OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

Market Transformation Programme on Energy Efficiency in GHG-intensive Industries in Russia

Project Preparation Support for the Development of Industrial Energy Efficiency Markets in Russia

FINAL REPORT

27 July 2010

Contract No. 16001926

Project No. GF/RUS/08/004

ICF INTERNATIONAL

Market Transformation Programme on Energy Efficiency in GHG-intensive Industries in Russia

Project Preparation Support for the Development of Industrial Energy Efficiency Markets in Russia

FINAL REPORT

27 July 2010

Contract No. 16001926

Project No. GF/RUS/08/004

Submitted by:

ICF

Sardinia House

52 Lincoln's Inn Fields

London

WC2A 3LZ

United Kingdom

Table of Contents

Introduction

The typical energy efficiency of Russian industry is significantly below the global average. There are a number of reasons for this disadvantage: an ageing capital equipment stock, traditionally low energy prices and abundant national energy resources, in combination with low government and management interest.

This situation is changing rapidly. Government has set an ambitious target of a 40% improvement of the energy intensity until 2020. National gas prices are increasing steadily, to the level of export prices and electricity sector reforms created a liberalized electricity market leading to market-based prices for electricity. This development raises the interest for energy efficiency significantly. In fact many options could be implemented that are cost-effective today.

However the uptake rate for these efficiency options is slow. There are still serious barriers that stand in the way of financing and implementing energy efficiency options. The knowledge in enterprises about the real energy efficiency opportunities needs improvement as well as the capacity in government to develop and implement effective energy efficiency policies.

Energy Management Systems (EMS) have proven to be an effective tool for enterprises in other countries. Typically they raise the annual efficiency improvement by 1-2 percentage points over a period of many years. This represents an increase by a factor two to three compared to the structural effect (replacing obsolete equipment by new more efficient ones). Such improvements have been observed for large companies and small and medium sized enterprises (SMEs). However experience shows that the EMS requirements for SMEs cannot be as demanding and detailed as for large enterprises. Both groups of enterprises need a differentiated approach.

Two types of efficiency options exist. The first group consists of replacement of existing equipment with more efficient equipment. The second group is more complex. It consists of options where entire systems are optimized. This requires a good understanding of the functioning and functionality of combinations of pieces of equipment. The level of understanding that is needed for systems optimization is much more demanding, but in many cases it will show much greater efficiency potentials. For example, the efficiency potential for a motor may be five percentage points, while the potential for a motor system may be twenty to fifty percent. Typically more than half of the total industrial energy use can be optimized using a systems approach. Therefore systems approaches can help to raise efficiency potentials substantially on a national and global scale. In many cases potentials in Russia are expected to be greater than elsewhere because many plants operate with outdated equipment and processes.

Attention for systems approaches is growing in Russia. There have been some efforts in optimization of water supply systems that show efficiencies for existing pumping systems of less than ten percent, revealing potentials to double or triple efficiencies. The key issue for deployment is to broaden the understanding and deployment of this type of systems approach. This requires capacity building for industry in EMS and Systems Optimisation.

The Government has passed an ambitious new energy efficiency law, which poses a considerable burden on the policy making capacity in particular of the Ministry of Energy. It is reorganizing its structure to raise the effectiveness of implementation of the law. For example, it is transforming one of its associated bodies that had some research tasks into a new Russian Energy Agency with a much broader set of responsibilities. Clearly a new range of skills and experts will be needed to further develop, implement and monitor policy measures. This new agency as well as other government bodies needs capacity building in order to adequately meet the demands set by the new energy efficiency law.

Therefore, the project focuses on a number of large energy-intensive industries and Small and medium Enterprises. Ten large enterprises receive intensive training and support as well as fifty SMEs. At the end of the project, they will have implemented a full scale EMS. They will serve as lighthouse projects, showing the cost effectiveness and competitive advantages of such a company effort. A few hundred more companies will have been exposed to EMS, possibly resulting in significant uptake. The understanding of the energy efficiency situation in different industry sectors in Russia will have improved markedly. These developments can be the basis for the introduction of a national energy management standard and future voluntary agreements. One thousand national experts, facility staff and government officials will have received training. This core of experts can serve as a basis for Russian implementation of modern energy efficiency policies on a national scale.

Combining the energy efficiency capacity building efforts with concrete financing opportunities for energy efficiency investments will considerably increase the impact of the proposed GEF-programme. The associated synergy of this combination is realized by complementing the GEF proposal by significant EBRD financing tools, the RUSEFF and Sustainable Development financing lines as well as carbon finance and specialized loan or equity facilities. The additional capacity and software and hardware investments that result from this project will result in a more effective, more cost-efficient and accelerated use of these financing lines.

It is expected that in five years, the project will have resulted in an additional CO2 reduction based on 10-year equipment life-times, in the order of 3.8 Mt . Thus the project combines the financing expertise and network of contacts in Russia that EBRD has developed during the last two decades with the UNIDO international technology transfer and capacity development programme for energy management and systems optimization.

1. Current status of energy efficiency policy

Looking back at the past 15 years, the government has made many attempts to introduce a robust energy efficiency policy in Russia. A special law on energy efficiency was adopted in 1996 along with a few other laws pertaining to energy (electricity and heat supply) but their implementation and enforcement remained poor. Russia's energy policy was and still is focused on energy security, energy supply and somewhat on the related energy supply efficiency and not on end-use. The implementation of laws and regulations on energy efficiency has been accomplished via a series of federal 'target programs'. For example, the first federal program on "energy efficient economy" implemented since 2002 and planned till 2010 focused on limiting overall energy consumption but was not effective and was cancelled in 2006. The regional authorities had to 'fill' these programs with investment projects. However, their capacity to design and prepare adequate project proposals was limited resulting in only a very few projects being implemented. The absence of monitoring of the impact and effectiveness of program implementation also contributed to the ineffectiveness of these programs.

These past initiatives to establish a legal framework for energy efficiency and implement state programs have not been very effective to date for several reasons. The main ones are:

1. The overriding 'regulatory' approach' (no carrots, only sticks) combined with poor enforcement during the transition period;
2. The lack of knowledge on what elements constitute an effective energy efficiency policy in a market-oriented economy and
3. The lack of adequate data and statistics to formulate realistic targets and therefore poor monitoring.

Another characteristic of that period that affected the implementation of the legal and regulatory initiatives were frequent changes in responsibilities of different government bodies as well as energy-related ministries being merged (and again separated). This did not contribute to policy continuity.

In recent years, however the approach shifted in favour of more market-based mechanisms. The Energy Strategy for Russia, adopted in 2003 and later revised is now emphasizing in general terms the importance of energy efficiency of both energy supply and end use in manufacturing and other sectors and the need to develop viable energy business cases. The strategy also recognizes the need to attract investments in improving energy efficiency but the functionality of this strategy is not completely clear. However, on the positive side, the recent power generation sector reform resulted in the liberalization of the electricity sector and managed to attract major foreign investors.

The real impetus for the energy efficiency policy process came from a presidential decree in 2008. In May 2008, the Government of Russia assigned the Ministry of Economic Development and other ministries the task to prepare, a concept of a national energy conservation programme to stimulate energy resource conservation in Russia. In particular, the planned policies and measures could include mandatory minimum energy-efficiency standards, expedited introduction of energy-efficiency markets (e.g., via ESCOs), and state-private partnerships for developing and introducing new energy savings technologies. Apart from other decrees aimed at stimulating energy efficiency, the governmental Coordination Council was created in order to solve problems with respect to energy saving and energy efficiency issues and for coordination of federal, regional authorities and businesses to implement energy saving policy and increase the energy-efficiency of the Russian economy. This includes development of the regulatory framework, target programmes and energy-efficiency projects. This new Coordination Council aims to (i) design the measures required by the energy efficiency Decree of June

4, 2008; (ii) recommend new regulatory support for energy efficiency in Russia; and (iii) prepare proposals for energy efficiency programmes.

Moreover, since March 2009, a revision of the Federal Law "About energy saving and increasing of energy efficiency" has been approved by Parliament in November 2009. Different federal Ministries prepared the revision in order to replace the existing Federal law "About energy efficiency" (№ 28 –FZ from 03 April 1996). The Ministry of Economic Development of the Russian Federation coordinates the energy efficiency activities of various government institutions and leads the discussion on the necessary amendments of related legislation and regulations.

The newly adopted law includes several elements relevant to the development and implementation of the planned industrial market transformation programme and includes provisions for regular energy audits and energy passports for legal entities. Audits are to be mandatory for organizations that receive significant government funding and that consume significant amounts of energy. Energy passports, to be based on audit results, are to include energy balances, improvement plans and indicators as well as some basic elements of an energy management standard. In addition, the Government issued an important document on 27 June 2009 (Decree № 884-p) pertaining to a Green Investment Scheme for energy efficiency and climate change mitigation. It appointed Sberbank as the authorised representative of the Government in implementing this scheme. It needs to develop the methodology and procedures for a new financing scheme for energy saving projects in all sectors of the economy including public buildings. This scheme will complement a number of targeted credit lines launched by various IFIs such as EBRD, KfW and IFC implemented through Russian banks playing the role of operators of credit lines.

On July 2nd 2009, an extended meeting of the Bureau of the RF State Council on energy efficiency took place in Arkhangelsk. President Medvedev ordered the Government to develop an integrated system of energy efficiency management at national, regional and municipal level by 1 October 2009. The essential question here relates to the creation of a national energy efficiency agency from an existing department/body under the ministry of energy. The implementation details were not yet clear in December 2009, but a substantial capacity building effort will be needed in order to make such an agency operational.

This all means that the government has a huge task to implement the new law and to create an effective organisational structure for energy efficiency policy at both the federal and regional level. While analysing the current mandates and functions of the main federal ministries and organisations involved in energy efficiency policy, it shows that although many are engaged in (aspects of) energy efficiency policy, none has an explicit mandate. Even the ministry of energy that has a prerogative for the fuel and energy complex and associated technical regulations, has not shown a consistent lead in the energy efficiency policy making process. In the current dynamic process, the ministry of economy is the main coordinator while the ministry of energy deals with the new state programme on energy efficiency projects. Other ministries and organisations are also involved in the (long) list of amendments to laws and regulations.

The main government bodies involved in this policy making process are the following (for more details on the functions and role of the main government organisations, see appendix 1).

Ministry of Economic Development is among others responsible for the coordination and/or preparation of draft legal acts in the following areas:

- Establish the powers of federal executive authorities in the field of energy saving and improving energy efficiency

- Approve of the Action plan to implement the Federal Law "On energy saving and improving energy efficiency"
- Set up requirements for regional, inter-municipal and municipal programs of energy saving and improving energy efficiency
- Set up the order for establishment and functioning of public information management system in energy saving and improving energy efficiency.
- Set up the order of providing intergovernmental transfers for the budgets of RF subjects from the federal budget for the implementation of certain measures on energy saving and energy efficiency.
- Sign up long-term energy service contracts for the needs of Russia.
- Determine certain requirements for the programs on energy and improving energy efficiency for the regulated organizations
- Approve standard forms of energy service agreements for the supply the goods, works/activities implementation of regulated organizations.
- Determine the detailed policy and regulatory requirements that will yield a reduction of the volume of energy consumption in absolute terms by 15% over a period of 5 years
- Determine indicators for the energy consumption by budget organizations.

Ministry of Energy is responsible for

- The preparation of a new energy efficiency program for different end-use sectors.
- The preparation of draft regulatory acts related to energy passports.

Ministry of Regional Development is responsible for preparing drafts of legal acts on energy efficiency in the building sector, including labeling and norms and standards.

Ministry of Industry and Trade is responsible for preparing drafts of regulated and legal acts in the following parts:

- Determining the requirements for the identification of energy efficiency classes for household appliances, and methodology for a labeling system.
- Establishment of a list of efficient energy devices that can apply for an accelerated depreciation rate.

Ministry of Finance is responsible for preparing drafts of legal and regulated acts in the following parts:

- Introduction of modifications in the departmental legal acts that regulate the financing of budget organizations related to the savings of energy efficiency measures.
- Approval of guidance on potential conservation by the budgetary institutions of savings obtained by implementing energy efficiency measures and its use to finance other articles.

Federal Tariff Service of Russia is responsible for preparing drafts of legal and regulated acts in the following parts:

- Preparation of proposals on pricing for electrical and heat power in the RF
- Preparation of proposals for state regulation of gas prices and tariffs for services to for its transportation on the territory of Russia

- Preparation of proposals concerning the rules of mutual approval of investment programs for the Subjects of natural monopolies in the electrical power industry.
- Application of the method of the price indexation in the regulation of tariffs for thermal energy.
- Making proposals for approval of tariffs using the method of return on the invested capital

Rostekhnadzor RF is responsible for the preparation of draft regulations on the definition of energy efficiency classes in houses.

The ministry of economic development and ministry of energy are the most involved in the drafting of regulations necessary to implement the Federal Law "On energy saving and improving energy efficiency". Therefore, the two ministries established jointly in January 2009 the interdepartmental working group on energy saving and improvement of energy efficiency of Russia's economy.

In addition, the ministry of energy is planning to reform one of its organizations into a national energy efficiency agency. This agency aims to function as a basis for energy efficiency policy in the future and therefore need to collect and analyse relevant data and statistics, prepare action programs for the development and implementation of energy efficiency sector programs, develop energy efficiency indicators and set-up a monitoring system, and design and implement information campaigns for different target groups.

The new law is a good step forward and it is expected that the political will to implement the law continues. The success of the new policy hinges however on the ability to design and implement the right mix of policy instruments in the different sector, but past experience has shown that the institutional capacity and organization needs to be strengthened in order to develop the necessary knowledge and skills for consistent and comprehensive energy efficiency policies.

Conclusions

- The current coordination effort of the ministries (in particular by the ministries of economic development and energy) has proved successful. Creating an energy efficiency agency as a future focal point for energy efficiency policies from which all government organizations and ministries - within their competence for energy - can benefit will result in a more structural approach for increasing the energy efficiency in the economic sectors.
- It is necessary to increase the institutional capacity within government organizations in order to design effective energy efficiency policies in the current economic environment. Targeted training programs for officials and technical staff focusing on the best practices and effective policies that are developed in other countries are a good method to create qualified staff.

With respect to the design of the GEF-market transformation program, it is recommended to include a capacity building program for selected staff of government organizations focused on increasing the knowledge and skills of officials.

This component should include the following main activities:

1. Based on the results of the GEF-program on industrial energy efficiency, develop and present to the Government a comprehensive proposal for a future industrial energy efficiency policy.
2. Develop a training program for government organizations in order to support the implementation of the new law on energy efficiency.
3. Develop a training program for capacity development of the energy efficiency agency.

2. Assessment of EE-potential in different energy-intensive industrial sectors

Evaluating detailed energy efficiency potentials in industrial sectors is complicated by the wide diversity of plants and processes. In addition, lack of available Russian statistics as well as inconsistency of reported specific energy consumption in Russian and foreign literature is an additional constraint for analysis. Nevertheless, attempts have been made to evaluate the EE-potential in industrial sectors, using available Russian statistics and data, supplemented by foreign data as well as consultant's estimates. This section shows a detailed analysis concerning the Russian energy-intensive manufacturing sectors and will be used as a basis for further assessments relevant to the design of the GEF-programme.

Estimating EE-potentials in the different manufacturing sectors is wrought with problems. In Russia, several studies were made in the past to estimate the overall energy efficiency potential of the country and certain sectors but they generally lacked sufficient detail.

More recent attempts were made by a CENEf[1] report prepared for the World Bank, which was also used in the latest IFC/World Bank report on energy efficiency in Russia[2].

Russia's energy efficiency potential was assessed in these reports based on international comparisons of energy intensities of specific industries, if available, and processes and equipment used in those industries. In addition, investment plans in certain sectors have been used in the evaluation where possible. However, some major constraints exist in analysing the EE-potentials.

First, the large diversity of industrial plants and processes makes it very difficult to evaluate energy efficiency potential in the industrial sectors in much detail. Evaluations usually focus on several relatively homogenous products such as: ferrous and non-ferrous metals, pulp and paper, cement, large-scale production of chemical and petrochemical products. Less data is generally available for light industry, such as: textiles, food processing and machine building.

Secondly, specific energy consumption reported by Russian statistical forms do not always cover those that are available in foreign literature making comparisons difficult. Also, all statistics often contain inconsistencies adding another constraint to analyses. These factors prevented for example a detailed evaluation of the energy efficiency potential in chemical and petrochemical production in Russia.

Thirdly, the data used in this section do not include industrial electricity and heat generation, CHPs, transmission and distribution, or energy resources extraction because they cannot be separated from the general electricity and heat supply data.

The major energy-intensive sectors are responsible for only half of the global industrial energy end-use, with the remainder is consumed by industries with very diverse outputs. Most of their energy is consumed by so-called crosscutting industrial technologies, such as motor systems (including compressors, pumps, fans etc.), steam systems, oxygen production, and HVAC systems (Heating, Ventilation and Air Conditioning), which are widely used throughout the industrial sector.

Based on data from the mentioned reports, Russia could cut its total final energy consumption by roughly 5 percent through investments in energy efficiency in manufacturing[2] alone. With a total

[1] CENEf: "Resource of energy efficiency in Russia: scale, costs and benefits", 2008

[2] IFC/World Bank: "Energy efficiency in Russia: Untapped reserves", 2009

consumption of 1.58 mGWh (Russian Integrated Fuel and Energy Balance 2005 – CENEf), manufacturing is the largest energy end-user in Russia, representing roughly 25 percent of total final energy consumption. The total energy efficiency potential of Russia's manufacturing sector is estimated at 0.56 million GWh per year.

Energy efficiency potential in manufacturing is concentrated in some activities, and widely distributed in others. On the one hand, the three most energy intensive industries – the ferrous metals, pulp and paper, and cement industries – represent 53 percent of energy saving potential, with 39 percent concentrated in ferrous metals. On the other hand, non-energy intensive industries such as bakeries, meat processing, machine building and other represent 47 percent of the potential, and cannot be neglected. The efficiency of electricity and heat use at Russia's manufacturing facilities must be considered. The efficiency of heat supply, including co-generation, also deserves attention.

According to the IFC/World Bank report, most of the investments required to improve energy efficiency in manufacturing are economically and financially viable based on 2007 gas prices.

The sections below describe the estimated EE-potentials for different energy-intensive industrial sectors.

Ferrous metals

Russia produced 70.8 Mt of steel in 2006. Around 62% was produced with Blast Oxygen Furnaces (BOF), 18 % by Electric Arc Furnaces (EAF) and the remaining 20% by Open Hearth Furnaces (OHF)[3].

Russia's ferrous metals sector consumed 36.1 mtoe in 2005. The energy efficiency of Russian ferrous metal production is well below levels achieved by other major international producers.

Russia can save as much as 16.4 mtoe through energy efficiency investments in the ferrous metals sector – equal to 45% of the sector's energy consumption in 2005.

The table below compares the actual efficiency of Russian plants for different processes to the efficiency of producers abroad.

[3] IEA: Energy technology Transitions for Industry, 2009

Process	Average Russian Energy Intensity	International Typical Value	Investments/Improvements
	(GJ final energy/t process output)		
Ore production and enrichment	0.34	0.289	
Sintering	1.83	1.49	Improving plant heat recovery, reduction of compressed air leaks, improved process control, and the use of waste fuels in sinter plants
Pellet production	1.28	0.7	Same as for sintering
Coke production (excluding Coke batteries heating)	1.39	0.92	Pulverized coal injection technologies in blast furnaces
Pig iron production	16.9	11.2	Top pressure recovery turbines, blast furnace gas recovery, hot blast furnace automation, and improved blast furnace controls
Electric arc furnaces	3.2	1.6	Scrap preheating and increase oxygen use
Open hearth furnaces	5	0.38	Switching to oxygen furnaces
Rolled steel production	4.01	0.4 for cold rolled steel; 0.9-1.6 for hot rolled steel	Transition to continuous, near-net shape and thin strips casting, which eliminates slabs heating and cooling stages and reduces rolling cycles

Source: IFC/World Bank: "Energy efficiency in Russia: Untapped reserves", 2009

Most of the savings comes from blast furnace improvements, such as

- the use of pulverized coal injection technologies which allows replacing coke with coal and thus avoid the need for coke making,
- increased BOF gas recovery,
- modern control systems and
- more efficient power generation from BF gas

Other energy efficiency improvements can be made from switching OHFs to BOFs.

Pulp and paper

Russian pulp and paper mills could cut their energy use by roughly 50 percent. In 2005, energy use in pulp and paper production totalled 6.9 mtoe. The technical potential for energy efficiency improvements in pulp and paper making is 3.7 mtoe.

The average energy intensity of Russian pulp and paper production is shown on the table below compared to international energy intensity based on best available technologies.

	Average Russian energy intensity	International energy intensity
Pulp production	18.1 GJ/t	11-14.3 GJ/t
Paper production	12-13 GJ/t	9GJ/t
Paper board production	11.77 GJ/t	7.8 GJ/t

Source: CENEf: "Resource of energy efficiency in Russia: scale, costs and benefits", 2008

All but one Russian paper producing plants have energy intensities far above their peers abroad, leaving a large potential for improvement. The breakdown of the age distribution of pulp mills also show that all Russian pulp mills are between 15 and 29 years old. For Russian paper mills 28% falls between 0-14 years, 40% between 15-29 years and 32% are over 30 years old.

Most of the technical energy efficiency potential can be realised through investments that are economically and financially viable. Technologies that would improve the energy efficiency of pulp making[4] include:

- batch and continuous digester modifications,
- heat recovery in thermo-mechanical pulping.
- more efficient black liquor boilers and gasifiers.

Technologies that would improve the energy efficiency of paper making include:

- extented nip press;
- high consistency forming;
- dry sheet forming;
- heat recovery and steam systems optimisation;
- optimised motor systems;
- efficient cogeneration units.

Cement

The cement industry worldwide is a fairly mature industry with well-defined technologies that are approaching the limit of practical efficiency. The thermal energy consumption of the cement industry is strongly linked to the type of kiln used.

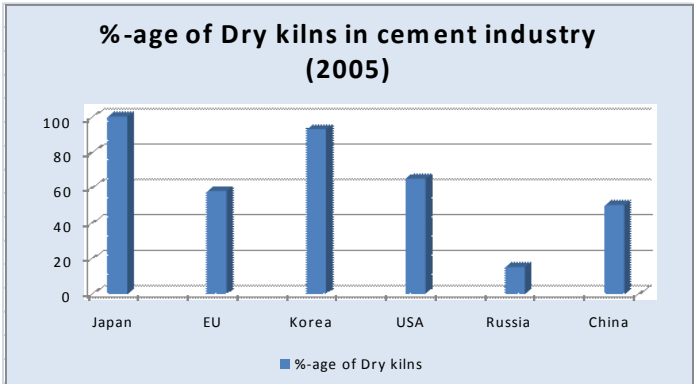
[4] IEA: Energy technology Transitions for Industry, 2009

Heat consumption of different cement kiln technologies	
Process	Fuel consumption
	(GJ/t clinker)
Vertical shaft kilns	~5.0
Wet process	5.9 – 6.7
Long dry process:	4.6
One stage cyclone pre-heater	4.2
Two stage cyclone pre-heater	3.8
Four stage cyclone pre-heater	3.3
Four stage pre-heater + pre-calciner	3.1
Five stage pre-heater + pre-calciner	3.0 – 3.1
Six stage pre-heater + pre-calciner	2.9

Source: IEA: Energy technology Transitions for Industry, 2009

The more efficient dry process with pre-heaters and pre-calciners is the technology of choice for new plants and since 1990; dry technologies have exhibited a marked increase in all the regions. However, at a country level, the share of the more energy-efficient dry process can vary significantly (see table below).

The increasing share of dry-process kilns with pre-heaters and pre-calciners has had a clear impact on energy consumption in clinker production. In the European Union, the average energy consumption per tonne of Portland cement is currently about 3.7 GJ/t clinker (CEMBUREAU). China continues to invest in dry kilns and currently consumes around 4.1 GJ/t clinker, while Canada and the United States both require around 4.5 GJ/t clinker. Together, these three countries account for just over half of total cement production. The average energy intensity of Russia's cement and clinker producers was 4.9 GJ/t in 2005, while for clinker production the average was 8.8 GJ/t.



Russian cement and clinker producers consumed 5.7 mtoe in 2005 and could cut its energy use by around 40%. The overall technical potential in the Russian cement industry is estimated at 2.5 mtoe, of which two-thirds of the potential lies in improving the energy efficiency of clinker production.

All of the technical potential for energy efficiency improvement in cement and clinker production is economically viable, and most of it is financially viable. However, shifting to BAT is usually only possible when a new cement plant is constructed at the end of a plant's technical lifetime, which can last up to 50years.

In addition to shifting to BAT for all new plants or major refurbishments, a range of energy efficiency options can be retrofitted, either at the end of the economic life of a component of the cement plant or when major refurbishment is required. Some of the retrofit options are listed below:

- using grate coolers instead of planetary or rotary coolers;
- adding pre-heater stages if process design allows and/or a pre-calciner if one is not already installed;
- installing waste-heat recovery for electrical power generation (although this is less viable the more efficient the plant is);
- upgrading the automation/control systems of older plants;
- using improved refractories for the kiln lining; and
- using variable speed motors in all practical applications.

Another important option is to decrease the clinker-to-cement ratio by blending with fly ash and slag from coal-fired power plants and steel production. In addition, cement plants can increase the use of alternative fuels and waste in the clinker production stage.

Chemicals

It is difficult to measure the physical production of the organic chemical industry given the large number of intermediate products that are traded at all levels of production. Polymer production represents both the largest and the fastest-growing segment of the chemical and petrochemical sector, representing approximately 75% of the total physical production, and growing at nearly 6% a year to approximately 300 million tonnes in 2006 (PlasticsEurope, 2007; SRI Consulting, 2008).

Fossil fuels are used in the sector both for energy production and as feedstock for the production of organic chemicals and a number of inorganic chemicals including ammonia.

Processes that result in several products are common in the chemical and petrochemical sector. They represent a particular challenge when modelling energy use and emissions. This is especially the case for steam cracking which is by far the largest multi-product process in this sector.

Given the quality of the data, figures on actual energy saving potentials are no more than an indication. They are not robust enough to provide a basis either for target setting or for country comparisons. They can, however, provide valuable information on trends in industry's efforts to improve energy efficiency.

In Russian statistics, the statistical form "11-TER" reports SECs for only 12 chemical products: sulphur, synthetic ammonia, soda ash, sodium hydrate, potassium, phosphate fertilizer; carbamide (urea), ammonium nitrate, chemical fibres, polymers, synthetic rubber, butyl and isobutyl alcohols. The 2005 energy consumption for the production of the above chemical products totalled 8 mtoe.

Application of SECs from other countries is hampered by the mismatching of SECs for chemical products reported by Russian and foreign statistics and lack of comparable data on SECs for similar chemical products manufactured abroad. In foreign literature, attempts have been made to estimate SECs for example for the following chemical products: petrochemical products – ethylene, propylene, butadiene, aromatics, PVC and others while these are not covered by Russian statistics. Even when

there are statistics in Russia on chemicals that can be compared to foreign statistics, the result is often not comparable because of definition problems, inconsistencies etc.

Therefore, the energy efficiency potential for the chemical industry was estimated by comparing the Russian average with the Russian best SECs. The result was an energy efficiency potential in the chemical industry of up to 2.85 mtoe.

An alternative approach to the evaluation of the potential is based on the investment plans analysis of different plants. It gives a potential of 1.85 mtoe that is an indication of the economic EE-potential.

A modern refinery is a complex integrated system producing a variety of oil fractions and products depending both on the quality of crude oil and production processes used. Form "11-TER" reports SECs for several refinery processes. SECs much depend on the process used to produce refinery outputs. Major trend in advanced technologies is driven by increasing share of lighter products in the output mix, but these cracking and reforming technologies are more energy intense, than atmospheric or vacuum distillation.

Basic measures to improve energy efficiency and refineries include: improvement of energy management; steam distribution and heat recovery; process heaters; flare gas recovery; distillation; hydrogen management; and efficient motors. To assess the energy efficiency potential, only two most energy consuming processes were used: atmospheric distillation and hydro-treatment. The total estimated potential to improve energy efficiency in oil refineries is assessed in the range 2.5-4.2 mtoe, or 31-54% of energy use in these two processes. Assuming the possibility to reduce energy consumption in other petroleum refining processes by 20%, the potential totals 4.0-5.6 mtoe, or 26-37% of overall petroleum refinery energy use.

Non-ferrous metals

Russian economic and energy statistics do not provide data on non-ferrous metallurgy physical outputs, or on total or specific energy consumption. So only data published by foreign sources are used in this section along with SEC estimates reported in Russian professional literature[5].

According to the IEA energy balances, Russian non-ferrous metallurgy annually consumes about 19 mtoe, of which, by CENEf' estimate, about 10-11 mtoe can be allocated to aluminium production. In 2000, production of alumina was assessed at 2.46 million t, production of primary aluminium at 3.25 million t, and overall aluminium production at 3.4 million t. Aluminium production in 2006 is estimated at 3.72 million t. Specific electricity consumption to produce 1 t of primary aluminium in Russia is assessed in the range of 14,500-18,300 kWh/t with 16,000 kWh/t average. This is not too far from the global average (15,268 kWh/t) and 15,180 kWh/t in the U.S., but much above the practical minimum for the best foreign producers (12,000-13,000 kWh/t).

Approaching the practical minimum level, the technical energy efficiency potential (electricity savings) of the Russian primary aluminium smelting is estimated at 0.85 mtoe.

Energy consumption in aluminium smelting is about two thirds of overall energy consumption in primary aluminium industry. The second most energy intense process is alumina refining from bauxite, followed by the use of carbon anodes and ingot casting. Production of 1 t of secondary aluminium from scrap requires only 5% (1% of electricity and 18% of natural gas) of energy needed for primary aluminium production. In the U.S., secondary production from scrap in 2006 was 30% of overall production and

[5] CENEf: "Resource of energy efficiency in Russia: scale, costs and benefits", 2008

fluctuated in the range of 30 to 37%, while in Japan the corresponding range was 90-97%, and in OECD Europe 30-33%. Direct data are not available for Russia, the large export of primary aluminium limits the recycling potential significantly. Only 20% of domestically produced aluminium is used in Russia. If the U.S. scrap to annual consumption ratio is applied to Russia, there is no, or very little, room to expand secondary aluminium production.

Several technologies allow for energy consumption reduction in the aluminium industry: transition from Soderberg to Hall-Heroult smelting process and gradual improvement of both technologies (notably point feeders and improved bath control).

Several marginally important technologies exist to improve energy efficiency of continuous casting and rolling, and a certain contribution may be made by detecting and removing aluminium cans from municipal solid waste, by recovering aluminium in wheel production, etc.

Based on estimates of primary and secondary copper production in Russia and on data for SEC in Russia versus practical minimum and actual use abroad, the technical potential for the copper industry was assessed at 0.1 mtoe. No cost data are available to assess, which part of the technical potential in non-ferrous metallurgy is economically viable.

Non-energy intensive industries

Non-energy intensive industries represent 42 percent of energy efficiency potential in manufacturing and account for 20 percent of all electricity saving potential in final consumption.

Products, for which SECs are statistically reported in Russia, include: textile products (cotton, flax, wool, and silk), leather footwear, meat products, sugar and bread.

Providing SECs for light and food industries is a quite difficult task, for the products manufactured are very diverse and the variation in production cycles is big. So, the potential was estimates based on the comparison of Russian average SECs with the average for several Russian best regions.

In 2005 non-energy intensive industries consumed 53 mtoe. They have the potential to reduce their energy consumption by around 30 percent, that is by 17 mtoe. The underlying reason for existing inefficiencies in non-energy intensive industries is outdated equipment and management practices. More than a quarter of companies use equipment for more than 25 years.

Existing practices among Russian mid-sized companies in improving energy efficiency indicate that almost half of energy efficiency improvements are being made in production line improvements while the rest are being made in generic energy equipment.

Summary

The table below shows a summary of the estimated energy efficiency potentials in Russian industry.

These figures cannot be interpreted absolutely due to the fact that 1) international statistics and definitions are often not comparable with Russian statistical, and 2) inconsistencies and lack of sufficient sectoral/process data. However, they do give an indication of the technical energy efficiency potential that can be used as a basis for industrial EE-policies in future.

Technical energy efficiency potential evaluation for manufacturing (2005)			
Sectors:	EE-potential (mtoe)	Final energy consumption (mtoe)	EE-potential (%)
Ferrous Metals	16.40	36.1	45
Chemicals, including refineries	7.35	15.4	48
Pulp and Paper	3.69	6.9	53
Cement and clinker	2.47	5.7	43
Non-ferrous metals	0.95	19.0	5
Light industry	17.00	53.0	32
TOTAL	47.86	136.1	35

For some companies, for example in the chemical sector, insight in their investment plans were obtained (mainly for verification purposes or absence of relevant data)[1]. These investment plans focus mainly on production technology improvements, confirming the current bias for production and less so for cost reduction (through energy efficiency improvements). Neither energy management (systems) nor specific system optimalisation projects figured in these investment plans.

Conclusions

- With respect to the GEF-programme, the focus of the pilot programme should be on the metals, chemicals, pulp & paper and the light industry. Increasing the efficiency of the cement and clinker sector also offers opportunities besides changing from the wet to the dry kiln process
- Energy management practices, in particular in energy-intensive industries can be greatly improved in order to better realise their EE-potential. Introduction of an energy management system, including systems optimisation based on international experience offers good possibilities.
- Given the diversity of products and processes in the light industry, the focus should be on technology solutions and systems optimisation tools.

3. Introduction of industrial energy efficiency policies in Russia

3.1 Barriers

Barriers for energy efficiency investments have been extensively analysed over the past decade in different reports, among which the recently published study of the WB/IFC. In this section, the barriers pertaining specifically to the industrial sector will be assessed and the potential of the GEF-programme to overcome these barriers.

Individual companies in general suffer from a lack of awareness/knowledge about energy efficiency that can be divided in different aspects:

- Company managers often do not know the real EE-potential of their company or are underestimating this potential;
- Metering and monitoring of (specific) energy consumption is not widespread, particularly at intermediate process stages;
- Knowledge about which EE-measures and technologies are beneficial for the company is often insufficient;
- Although financing is commercially available, managers often lack the knowledge of concrete financing opportunities for EE-investments;
- In particular for SMEs, the capacity to develop and implement EE-projects is often insufficient;
- Energy efficiency is not a core interest mission for most industries and company strategies tend to focus on output growth rather than cost management.
- Industrial markets focus on components, not on systems. When processes change over time, inefficiencies compound and reoccur.

These barriers are a consequence of the absence of an ‘energy efficiency culture’ among government and end-users and of (macro-) economic conditions (among others the ‘legacy of the past’: low energy prices and prevailing attitude determined by an abundance of energy). Only recently, the government has started the development of a new energy efficiency law and initiatives for implementation of an energy efficiency policy. However, this is not primarily directed towards industrial companies yet.

Compared to the situation in OECD countries that have developed effective EE-policies during the last decades and created an accepted culture of energy efficiency in governments, end-users as well as technology providers, the Russian start position is much more basic and requires a careful approach to industrial energy efficiency. The differences lie mainly in the following factors:

- As stated, Russia lacks a pervasive ‘energy efficiency’ culture;
- The pricing mechanism as a driver for more energy efficiency is still distorted and therefore not yet as effective as in developed countries;
- The industrial production processes are relatively obsolete and to date the main efficiency gains come from replacement of old equipment and processes for newer more efficient ones (the structural effect);
- There is still a lack of energy service providers with sufficiently trained professionals;

However, international experience has also shown that even when active EE-policies are implemented, the energy efficiency potential in industry still remains (far) from being realized. There are two main reasons for this.

1. Energy efficiency gains often decrease over time resulting in 'disappointments' and therefore less (management) attention.
2. In most cases, the management focus is solely on production as the core activity and energy efficiency is not part of the management practices.

Until recently, both markets and policy makers in developed countries have tended to focus more on energy efficiency of individual system components, such as motors or pumps rather than on optimizing the system. System optimization seeks to design and operate industrial systems (i.e. motor/drive, pumping, compressed air, fan and steam systems) to provide excellent support to production processes using the least amount of energy that can be cost-effectively achieved. The process of optimising existing systems includes:

- Evaluating work requirements
- Matching system supply to these requirements
- Eliminating or reconfiguring inefficient uses and practices (throttling, open blowing, etc)
- Changing out or supplementing existing equipment (motors, fans, pumps, compressors) to better match work requirements and increase operating efficiency
- Applying sophisticated control strategies and variable speed drives that allow greater flexibility to match supply with demand
- Identifying and correcting maintenance problems
- Upgrading ongoing maintenance practices

Experience in other countries shows on average motor system potentials in the range of 20-30% (pumps, fans), 40-50% for compressed air systems, 10-20% for steam systems. Anecdotal evidence for Russia suggests significantly greater potentials. Part of this stems from systems that were originally designed for much greater throughput, and poor maintenance.

Energy use in industry is affected by operational practices, which can change significantly over the lifetime of a factory as new product lines are introduced and when production volumes and schedules change. At the same time, cost-effective energy savings remain largely unrealized primarily due to a failure to manage energy as effectively as other resources such as labour and materials.

An industrial system encompasses everything from the supply of energy into the system to the production end uses, for example a variable speed drive, motor, a transmission, a pump and a pipeline system for fluid transportation is not a complete industrial system because it only covers the supply side and excludes the distribution and end use. The mismatch between supply and end use is the most fertile ground for improving energy efficiency.

Standards for the efficient energy performance of equipment, while important, provide no assurance that an industrial system will be energy-efficient. Evidence shows that, while efficient components may bring about gains in the range of 2 to 5 percent, systems optimization measures can attain average efficiency gains of 20 to 30 percent. Too often, energy efficient equipment becomes a solution in search of a problem. Management dissatisfaction arising from the misapplication of expensive energy-efficient equipment in industrial systems can serve to diminish rather than support energy efficiency efforts.

At the same time system optimisation provides also non-energy benefits, such as maintenance savings and reliability improvements, which are typically inherent to energy efficiency projects and further increase the total savings amounts.

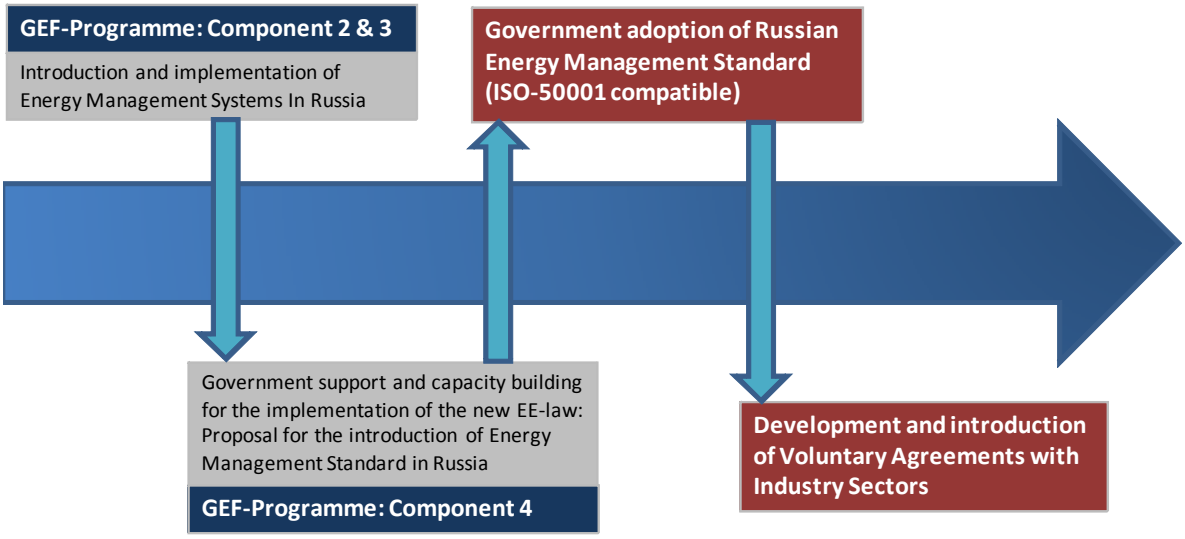
Industrial systems are ubiquitous in the manufacturing environment, but their applications are highly varied. System optimization cannot only be achieved through component standards or labeling or "one size fits all" approaches. Even when plant engineering and operations staff recognize the importance of optimizing a system and identify system optimization projects, they frequently experience difficulty in achieving management support and as a consequence sufficient financial support.

Given these challenges to systems optimisation, structural corporate commitment and processes, along with access to know-how are necessary for sustainable energy efficiency gains from systems optimisation. Energy management in the long term requires an articulated approach that is deeply related and embedded in industrial operational and management practices. Comparison of efficiency gains in the Netherlands and Ireland of companies with and without energy management system suggests an average incremental improvement of the yearly efficiency gains by 1.4 to 2 percentage points, in some instances even more.

The international response has been for countries to develop (guidelines for) national energy management systems. So far, seven countries and the European Union have established such standards. About sixteen countries have formulated guidelines for energy systems management practice. This plethora of initiatives resulted recently in the development of an international standard for energy management under the auspices of the ISO (ISO 50001). This standard will be compatible with ISO 9000/ 14000 quality and environmental management systems, which also require regular, independent audits to maintain ISO certification, an attractive value for international trade. The ISO 50 001 standard is expected to come into operation in late 2010 or early 2011.

Innovative government policies designed to influence corporate energy management practices are essential for achieving sustainable energy efficiency in industry. These include energy management standards. Russia can benefit from these developments abroad by developing a national energy management system that is ISO-compatible as a viable policy tool and market-based mechanism for encouraging and effecting energy efficiency in industrial facilities in a sustainable way. Past experience with environmental management standards shows that the ISO standards have provided a stimulus and a framework for the development of national environmental standards, regulation and laws. An ISO-compatible energy management system would also address harmonization problems stemming from earlier national energy management standards. In so doing an international energy management standard would remove barriers to and facilitate international trade.

Before the instrument of Long-term Voluntary Agreements with industrial sectors can be introduced, Russia should gain experience with the introduction of energy management systems and a national energy management standard. The proposed GEF-programme (see next section) provides the basis for the policy development by demonstrating that energy management systems are beneficial for industry and lead to increased investments in energy efficiency (components 2 and 3). Component 4 (Government support) will develop a full proposal to the government for the introduction of a national energy management standard, including the necessary institutional and legal actions to be taken. Adoption of the standard will then pave the way for the development of long-term agreements with industry sectors, including the associated requirements, such as benchmarking etc. These steps in time are schematically shown in the chart below.



This project will provide the foundations for target-setting agreements by building up necessary know-how, establishing a data collection and Monitoring and verification framework and developing a baseline set etc.

3.2 GEF-Programme design

Based on the actual situation with respect to industrial energy efficiency in Russia, and the significant opportunity given by the recent adoption of a Russian Energy Efficiency law, the overall objective of this GEF Programme is to reduce greenhouse gas emissions in the Russian Federation by transforming the market for Industrial Energy Efficiency in GHG-intensive industries.The programme will achieve this market transformation through activities that will:

i. structurally improve industrial energy efficiency in heavy and light industries through increased energy efficiency investments,

ii. have a wider direct positive effect on rational energy use with related environmental benefits, and

iii. improve the capacity of the government to develop effective (industrial) energy efficiency policies.

The project will build on a recently established energy efficiency credit line facility “RUSEFF”. This USD 300 million (EUR 230 million equivalent) framework provides credit for Russian banks to “on-lend” for medium-sized (up to USD 6.5 million) energy efficiency projects. RUSEFF is complemented with grant funding from the EBRD Shareholders Special Fund and the German government to finance technical assistance to help participating banks and their sub-borrowers to develop and finance bankable projects. The consultant providing the technical assistance was contracted on 17 April 2009. The objectives of their work is to support the implementation of the facility through marketing of the facility, capacity building and training of loan officers in participating banks, and the preparation of sub-projects.

The cost-efficiency and effectiveness of energy efficiency projects in industry can vary widely. A structured approach based on systems optimisation and Energy Management Systems is initially resource intensive, but evidence shows that is generates more cost-effective projects and projects with greater emissions reduction. These activities targeting national experts, service providers and industry experts will be tied to and support legislative developments in the Ministry of Energy and the new Russian Energy Agency providing a basis for sustained benefits long after the end of GEF funding.

Therefore the main goal of this GEF project is 1) to enhance the effectiveness and efficiency of the project portfolio funded through the credit lines and 2) to build local capacity in government and industry (including training of trainers) to achieve results in replication and sustainability far beyond the project life span and contribute significantly to market transformation.

Based on the previous considerations and Russian barriers, a programme for industrial energy efficiency will be based on the following components :

1) Preparatory activities for capacity building under (2), and (3);

2) A capacity building program to introduce energy management systems and systems optimization tools to large energy-intensive industries;

3) A capacity building program to introduce energy management systems in Small and Medium enterprises (SMEs);

4) A government support programme, which is crucial to the long-term sustainability of the project activities.

3.2.1 Baseline and impact of the programme

A number of baseline estimates can be applied, such as:

- Base year efficiencies
- Historical annual efficiency gain trends
- A projected Baseline for business as usual. This can be based on comparison of samples of companies within and outside the programme or extrapolated historical gain trends for participating companies,, with and without the EBRD investment programme

There is no “truth” in this choice. Therefore different approaches will be applied, yielding a range of programme impacts.

As for investments, initial estimates from an EBRD market demand study and model for Russia indicate that a dedicated financing facilities of over 120 million USD, assuming 80% debt financing for projects, could generate energy savings of 5600 MW per annum and emission reductions of up to 20 million tonnes CO2eq per annum.

The GEF programme will accelerate the uptake of these funds. Moreover, it will help that these funds are used in an effective and efficient way. Experience from other countries shows that Energy management Systems result in a considerable acceleration of the energy efficiency uptake, by a factor two to three compared to the structural effect (replacing old for new equipment). Over the period of the project this should generate additional CO2 reductions of more than 0.5 Mt CO2 per year in large companies. At the same time, Energy Management Systems and benchmarking for over 50 small and medium sized enterprises should result in more than 0.25 Mt CO2 reduction per year. The second key component of the GEF programme is systems optimisation. The EBRD loan programme as-is has no specific component to identify systems optimisation options. Experience elsewhere shows that a systems approach can yield five to ten times as high savings as an equipment component efficiency programme. Typically half of total energy use can be attributed to systems, and the savings potential is around 20-30%. 1 Mtoe of energy use systems optimisation can therefore yield 0.5-0.8 Mt of CO2 reductions.

The energy savings achieved at the participating companies depend on how many of them will actually invest in an energy management system and/or system optimisation projects. The target is that 10 large companies with a total energy use of more than 5 Mtoe will invest in energy management systems.

The impact of these savings can then be estimated by comparing them with the final energy consumption of the company without the investments. There are figures from program results in different countries that show the effect of the implementation of energy management systems. However, these are average figures. This method would not be correct to apply to individual companies because of the (big) fluctuations.

Therefore, the impact of the GEF-program can best be estimated by adding up the final energy consumption of all participating companies who invested in energy management systems and corrected for the autonomous effect with the total energy savings achieved by the investments in the energy management systems.

$$\text{Average impact} = \frac{\sum_{I=1}^{10} \text{energy savings}}{\sum_{I=1}^{10} \text{Baseline Final Energy Consumption}}$$

The Dutch program on Long-Term Agreements with industrial sectors shows that on average the energy efficiency increased by 2.4% annually due to the implementation of energy management systems. The autonomous effect (that is mainly replacement of old with new equipment) is estimated at 0.7% annually, leaving a net effect of 1.7%.

In addition, there is the effect of investments in systems optimisation projects. Assuming that 5 of the 10 companies will invest in systems optimisation projects during the programme period, an average additional effect of 0.3% annually is expected on top of Baseline efficiency gains.

Thus the baseline is the total final energy consumption of the large companies and SMEs participating in the programme, estimated at 5-10mtoe. The total achieved energy savings of the programme are estimated at an average of 2% annually, which yields 1-2 Mt CO2 reduction per year.

This is the direct impact assumed for the duration of the programme. Since the program is linked to the availability of sufficient financing options, such as the credit lines of the EBRD, and capacity building within Russia to sustain this effort, it is expected that the increased demand for investments will actually lead to further (accelerated) investment in energy efficiency after the program has finished.

3.2.2 Value-added and cost effectiveness of the GEF-program

Value-added of the GEF-program

The proposed GEF project will constitute the main source of industrial EE investments in Russia. More specifically, it is intended to provide the foundation for the Federal Government to implement its industrial energy efficiency programme in Russia. While any quantitative estimate of the promulgation of energy efficiency in Russia, with or without the proposed GEF project, is clearly highly subjective, what can be said with certainty is that the Gef-programme is a significant contribution to building energy efficiency capacity and therefore that the implementation of the programme, if carried out correctly, should have a positive impact on the energy efficiency market in Russia. Moreover, the GEF-programme is linked to major financial mechanisms of the EBRD dedicated to energy efficiency investments.

The GEF-program addresses several of the barriers to energy efficiency mentioned in section 3.1. In particular, the GEF-program will

- Increase the awareness and knowledge of energy efficiency potential and financing opportunities of corporate managers as well as operators in companies through a capacity building program industry;
- Implement energy management systems and system optimisation projects in selected large companies and SMEs;
- Increase the policy making capacity within the government. Support to the implementation of the new Law on energy efficiency and expert training of the Energy Efficiency Agency are essential elements in the program.

Investments in change-out of industrial plant and equipment leading to increased energy end-use efficiency will continue to proceed at the current slow pace of capital stock turnover. Energy efficiency improvement arising from such investment will be incidental to the primary purpose of increased production. This can be attributed to:

- Absence of an energy efficiency culture in companies and a bias in favour of production considerations;
- Lack of knowledge in companies at all levels about its energy efficiency's cost savings potential.
- Lack of demonstration projects
- Fragmented organisational structure and lack of capacity for the design and implementation of effective energy efficiency policies.

GEF involvement will address these barriers having the effect of accelerating the improvement of industrial energy efficiency in the Russian Federation. Experience in both Europe and the US have demonstrated that the introduction of an effective energy management program in industry results in major improvements in overall energy efficiency on the order of 20% or more, even for companies that are otherwise well-managed.

Without the proposed project it is likely that, in the wider market, the promulgation of minimum energy performance standards for equipment and appliances in the country will continue which may lead only to limited energy efficiency improvements. This is primarily because equipment standards have their origin in the residential and commercial sectors and are usually applied to the industrial sector by following the same principle. The GEF project will add value by providing assistance in establishing an energy management standard in the country, the creation of a basis for future target-setting agreements with industry and building capacity of enterprises and institutions to comply with the standard. Furthermore, it will share international experiences from other countries where target-setting agreements and energy management systems have successfully been implemented. The GEF will play a catalytic role in the project by transforming the industrial energy efficiency market through the activities on standards and capacity building.

Cost-effectiveness of the GEF-program

The introduction of energy management systems (as a precursor for a national Energy Management Standard (EMS) in Russia is one of the most cost effective ways to improve energy efficiency and address global climate change. The promulgation and promotion of energy management systems and the preparation of an energy management standard along with capacity building of enterprises and institutions will be very cost effective in transforming the industrial energy efficiency markets. This

combination of supply and demand side activities will be sustainable in the long run. The use of an energy management system (within target-setting agreements) has been demonstrated to be cost-effective- for example, a program in the Netherlands, including substantial technical and financial assistance, cost the government from $10-20/tCO2 saved.

This cost estimate gives a government perspective, it does not include the fuel saving benefits for the companies. For example UNIDO experience in China showed pay-back times for systems optimisation investments in the range of a few months to two years, so these measures are highly cost-effective with negative full lifecycle cost, even at commercial interest rates. The increased efficiency and effectiveness of the EBRD loans that is achieved through the GEF programme is expected to reduce pay-back times from two years to one year. Given a 10% discount rate and a USD 120 million investment programme this will yield financial benefits in the order of USD 12 million per year for Russian companies and the Russian federation, once fully deployed. As a consequence the overall cost of CO2 reduction will be negative. This does not include the indirect savings effects as the activities continue to expand beyond the programme ending after four years.

The proposed GEF project will take a strategic approach to addressing awareness, attitudes and behaviour in private sector industrial facilities and government through four targeted actions:

- Preparation of the introduction of an energy management standard (ISO-compatible) in Russia
- Capacity building for energy management, including systems optimization, in industry and the supply chain
- Capacity building and support program for government
- Stimulation of market demand for energy efficiency goods and services

The provided training, tools, and support to the implementation of energy management systems in selected industries are the means for realizing ongoing energy savings in the country. Strengthening the government capacity of developing and implementing effective energy efficiency policies is a sustainable way to ensure realisation of energy savings in the longer term. On basis of the carbon intensity of the grid the CO2 reductions can be estimated and subsequently the cost per ton per year calculated. This methodology can estimate the $/ton of CO2 on a yearly basis and therefore provides an outlook on future cost-effectiveness of the project.

Through these actions the project will address market barriers including lack of information, high transaction costs, perception of risk, lack of access to finance, price distortions, split incentives and bias, organizational cultures, capital stock turnover (timing issues), and policy and regulation. The project will also lay the foundations for similar projects in the Commonwealth of Independent States (CIS).

According to Russia's Ministry of Industry and Energy, the country could save approximately 35 - 40% of its current annual energy consumption through improved efficiency, saving 4-5 million GWh. Based on a rapid assessment of the technical energy saving potential of the energy-intensive and light industry sectors, they have a baseline consumption of 1.58 million GWh with an energy saving potential of around 0.56 million GWh..

3.2.3 Monitoring and Evaluation

Monitoring and verification of the results is key to determine the success of the program. Participating companies need to agree to provide the required information as part of the Memorandum of Understanding that will be signed prior to the start of the capacity building program. In addition the usual confidentiality arrangements must be agreed upon.

The energy audits to be conducted in the participating companies provide information on the base year energy consumption of the companies. For the Baseline, two approaches will be used: first, comparison of annual improvements in companies that participate in the programme and such that do not participate. Second, where possible, the trend of annual efficiency gains will be compared for participating companies, before and after participation.

Given the confidentiality of internal figures, a distinction must be made between internal and external monitoring and evaluation (M&E). Internal progress reports, audit results offer a first point of evaluation because initial assumptions can be verified. Once the energy management system is implemented, the official company reports give a second possibility for evaluation because it shows among others, the prepared optimisation projects etc. Finally, the number of projects that receive concrete financing show the program's direct impact.

The external M&E will take place with summarised reports showing the overall progress and projects that receive financing and can be used officially.

UNIDO has an official evaluation and monitoring process for its major projects and programmes. M&E takes place half-way and three to four years after completion of the project.

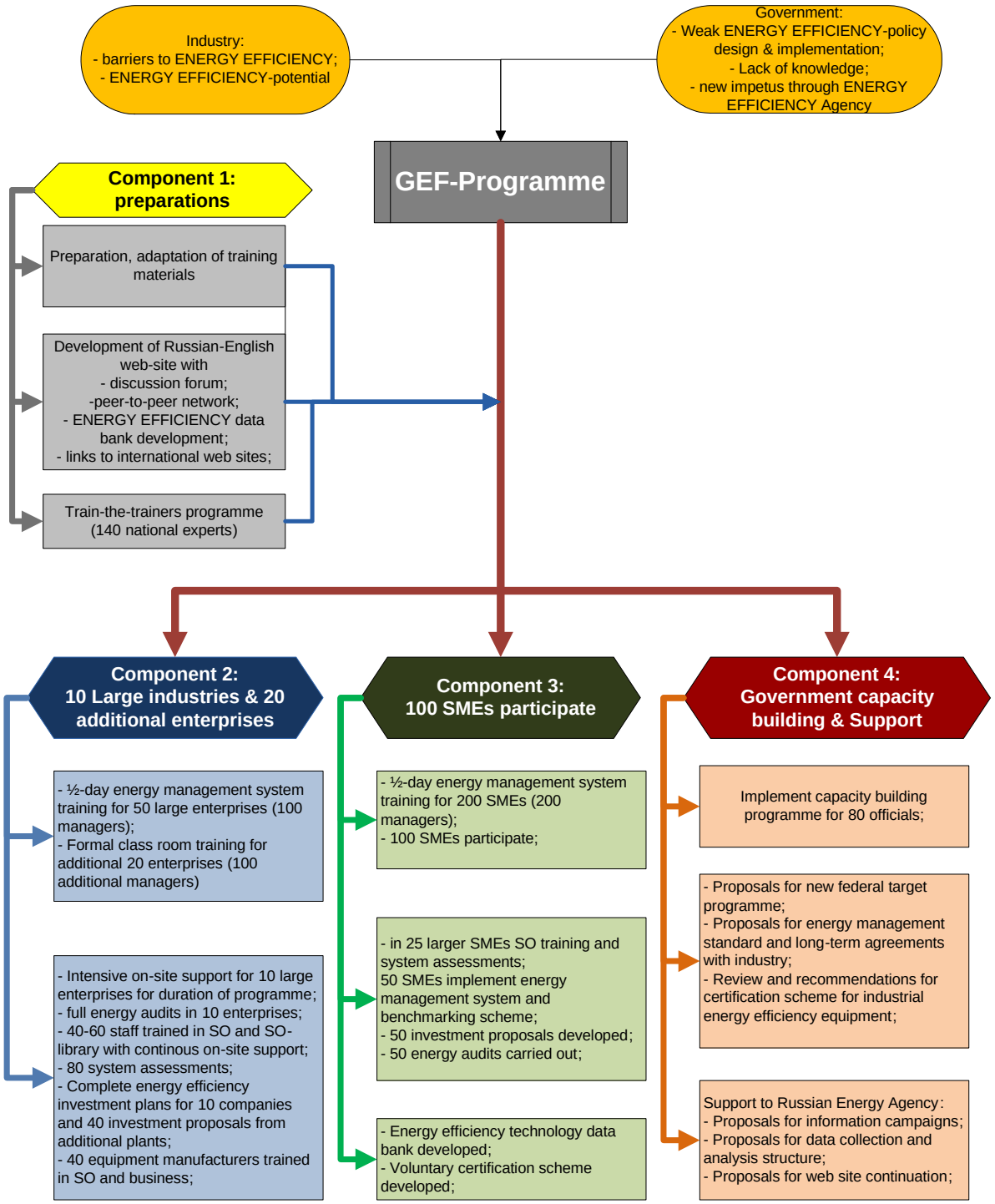
The project manager is responsible for regular progress reports (for example every -6-month period) with full support of and in agreement with the participating companies. The reports also need to be discussed with the two main federal counterparts (Ministry of Economic Development and Ministry of Energy) who have to sign off on these reports.

3.2.4 Replicability and sustainability

Through the GEF-program's capacity building activities for the new energy efficiency agency as well as with selected government officials, the institutional framework will be strengthened considerable resulting in more effective energy efficiency policy initiatives from the government. The government with its trained cadre of experts can then easily replicate and even expand the programs activities to other companies and sectors ultimately resulting in an energy management standard for Russia. The involvement of the different government organisations as well as relevant industry associations provides a sustainable basis for future energy efficiency policies not only for industry but also for other sectors.

3.3 GEF-Programme elements

3.3.1 Chart1: GEF-programme components



The next sections describe the different program components in more detail.

3.3.2 Component (1) Development of training materials, website & train-the-trainers program

The following activities are necessary pre-requisites to the other programme components. They are necessary for the implementation and support the project activities.

1.1 Development and translation of training materials and tools.

Training materials include a trainer manual, an extensive set of slides and a manual for trainees for classroom training and practical hands-on factory training. UNDIO has such materials available for motors, pump systems, fan systems, compressed air systems. These materials need updating and translation into Russian. For steam systems, background documentation is available from past courses, but so far no comprehensive training course materials. This material needs to be developed and translated into Russian. Process heat systems optimization is a new topic. All materials need to be developed and translated into Russian.

For Energy management Systems the training can be split into an extensive week-long classroom training, factory training and training for managers. Existing materials need to be adjusted for the Russian situation and the specific sectors that participate in the programme.

Finally three kits of measurement equipment will be bought. This equipment covers all types of systems that are considered in the project. The equipment can be used for the trainings and will be available for the auditors that participate in the project.

It is essential to adapt all documentation that will be used for training to the Russian situation, including web-based tools and the development of a Russian systems optimisation library needed to train the experts.

Outputs:	➢ Fully developed set of training materials for energy management system implementation and systems optimisation training, including build-up of initial systems optimisation library;

1.2 Information campaign and development of a project web site.

Information campaign

Development and implementation of an information campaign on the benefits of energy management systems and participation in the project using a range of media. The input and potential of specific business and government organisations should be taken into account. This information campaign will also serve the purpose of expanding the number of companies that are willing to participate in the project. The campaign will be designed and adapted to Russian customs in order to maximise exposure. Target groups are industry sectors and SMEs.

Web site

The Russian-English language web site will provide companies with specific information on a range of energy efficiency practices and technologies and what support is available in Russia (i.e. targeted funding, energy audit services etc.). Similar programmes in other countries (e.g. the Carbon Trust web site in the UK) need to be reviewed and positive and negative experience from such programmes summarised. The main types of information will be determined needed to populate the site taking into account other energy efficiency support facilities that are available in Russia. Available material in

Russian needs to be reviewed and arrange for appropriate content to be made available and adapted as necessary. Non-Russian material will be adapted and useful content made available for the Russian web-site.

The design and content will need to be thoroughly discussed by EBRD/UNIDO and Russian industry, business associations and experts and the site needs to be tested to verify technical integrity and user acceptance (beta testing). This should include feedback from representative industry users via industry associations as well as energy efficiency specialists and the EBRD/UNIDO. Partnership between the web systems and those of industry associations to maximise awareness will be sought.

The web site is pivotal to the support of the programme activities. Companies, government and other stakeholders need to be supplied with quality information and specific features need to be built in that support the energy management system activities. Some main elements that need to be included in the web site are the following:

- A discussion forum for managers and technical professionals of participating companies and organisations. If proven successful this can be developed into a peer-to-peer network which allows more in-depth exchange of information between company experts and managers. This can also include the development of knowledge networks (for example on pumps, air compressors, production intensification etc.) that deal with ongoing discussions on technology development with research and university professionals, equipment manufacturers and industry experts.
- Energy efficiency data banks that provide information on energy efficiency equipment as well as international policy measures (example is the Odyssee network in the EU).
- Web-based tools for energy management systems in SMEs. A special portal is warranted for SMEs. This can be based on international projects (for example the EU-BESS project) and adapted for Russia.
- Links to other web sites that can be helpful, for example the EU's www.managenergy.net, RUSEFF web site, access to credit lines form IFI's and local banks etc.

Once completed, a marketing campaign including TV and press exposure, specific seminars will promote the web site.

It is essential that the web site remains fully operational and updated as required. This implies regular maintenance, organisation of continuous feedback from customers and maintaining site records of attendants.

Outputs:	➢ Information campaign in a range of media implemented ➢ Fully functional Russian-English language web site, including maintenance; ➢ Discussion forum and Peer-to-Peer network established and operational;

1.3 Training of national experts on energy management systems and systems optimization.

The international team is to deliver intensive training up to 120 Russian experts to a level such that they can train others. They will be identified by the contractor based on EBRD/UNIDO's criteria and will receive training in energy management and systems optimization from international experts and subsequently become a source of national energy management expertise and serve as multipliers for project impacts.

The target is to train 20 Russian experts in energy management systems and 100 for systems optimisation (20 each for pump, fan and motor drive systems, steam, compressed air and process heat systems). The experts will be recruited from energy businesses/energy consultants, regional energy efficiency centres, national energy efficiency agency and equipment manufacturers/suppliers. These in-depth trainings will be complemented by less intensive knowledge building for a larger group. This larger group will be trained by the initial pool of trainees, supported by international experts.

In selecting the experts, two issues need to be taken into account:

- Regional spread of the experts;
- Difference in requirements for energy management system' training and systems optimisation training.

Russia is a large country in which industrial enterprises are clustered in different regions. It makes sense therefore to recruit experts from Moscow (central Russia), St. Petersburg (North-West Russia), Ekaterinburg (the Urals) and Kazan for example.

Energy management system training is quite different in scope and content from the system optimisation training. Each area of expertise requires very different skills. Candidates seeking to become energy management experts are more likely to be drawn from the ranks of consultants, government officials, and energy centres that are already skilled in the implementation of management systems such as ISO 9001 or 14001. A central requirement for successful energy management candidates will be the ability to work with factory managers to establish a management system.

In contrast, system optimisation experts will require solid engineering skills and specific expertise in the energy use of their chosen system or systems (compressed air, pumping, motors/fans, or steam). They will not be expected to have any background in management systems and will most likely be facility engineers, engineering consultants, or service/equipment providers.

Energy management training

The 20 national energy management experts will be trained through a mentoring and on-the-job process by the international team to an intermediate level of expertise ("Training the trainers"), including study tour(s) and capable of:

- Conducting short (one-half day) workshops for managers from holding companies and plant managers on the benefits of implementing an energy management system and showcasing the technical and financial assistance available to participating companies.
- Conducting training sessions for energy managers on implementation of an energy management system (compatible with ISO 50001), including information on internal auditing techniques
- Coaching facility personnel (in-person, phone, email) on energy management system implementation

Preparatory activities are completed over periods of 2 to 3 months in advance of the initial training courses. This involves the compilation of training materials by the international team, translation, the

identification of additional enterprises for the on-site training, identification of classroom facilities, provision of accommodation for trainees etc. The international team will offer intensive training for each energy management expert over a three-year period, with most of this training within the first 20 months of the project. The national experts will receive both classroom training and on-site interactive training involving participating industrial facilities.

A series of 3 workshops will be given to allow the international team to prepare the national experts. The international team will train national experts on the use of both the ½ day workshop and other one-week training sessions curricula that include practical implementation of energy management systems.

The international teams then work with their trainees on plant assessment and project development skills. In addition, the international teams prepare and observe trained national experts conducting training of local personnel in "factory training sessions".

System optimisation training

After completion of the preparatory activities (the compilation of training materials by international teams, translation, the identification of appropriate factories for the in-plant training with requisite motor/steam systems, and securing approval of site visits), the 100 experts will be trained by international system optimisation experts in classroom, study tour(s) and plant settings. On-site training can be implemented by combining this aspect of the training with the energy audit teams that go out to the participating plants.

At each plant the national experts in their specific field of expertise will be trained "on-the-job" in the use of measuring instrumentation, data collection and analysis etc. Training also covers system design, operation and installation, measurement of fluid flows, pressures, energy consumption, and application of analytical software.

The national systems optimisation experts will also be trained by the international team in the use of UNIDO web-based tools (a basic system optimization library) designed to assist national experts and their industrial customers in developing and documenting sustainable projects.

To ensure success of the project, selection of trainees will be rigorous and based on technical and training capabilities. Upon completion of their training these individuals will be capable of:

- Conducting system assessments and preparing professional technical/financial reports.
- Delivering training on systems optimisation to factory personnel.
- Using UNIDO web-based tools to develop sustainable projects (system optimisation library);
- Delivering consulting services to factories to enable them to implement systems optimisation projects.

The national experts trained will form the core 'pool of experts' that implement and support the programme activities. These core-experts will continue to receive training and support for the duration of the programme.

The initial systems training will take place in three one-week sessions, for each type of the five selected systems. The first session will be given by the international experts, in the second and third session there will be an increasing role for the national experts applying the learned expertise under supervision of the international experts. The trainings will take place in close proximity of selected industrial facilities as to enable hands-on application of learned theory. Two international trainers will participate per system training. The goal is to have 20 trainees per session.

Outputs:	➢ Up to 120 national experts fully trained in energy management systems and systems optimisation curricula;

1.4 Training of loan officers in local banks and technical assistance

This project activity, entirely funded through co-funding from the EBRD will provide training for banks which are participating in the RUSEFF credit lines (Participating Banks): These banks will receive training and assistance in energy efficiency project appraisal processes, with which they are unfamiliar. Additionally, a marketing and outreach campaign through the banks will help to increase the demand for energy efficiency loans among different categories of clients to the participating banks. The emphasis will be on building future capacity at the participating banks to initiate a self-sustaining market for financing sustainable energy projects. Technical assistance will also to the participating banks in capacity building for carbon financing.

The banks will build expertise in assessing the risk and creditworthiness of clients for energy efficiency loans. The approach taken is one of "on-the-job training", and training seminars.

Outputs:	➢ Promotion of energy efficiency lending through the transfer of knowledge and technical skills aimed at building local expertise

3.3.3 Component (2): Energy management system capacity building programme for large energy –intensive industries

In Russia, energy management systems have not been widely developed and/or introduced. As the EE-infrastructure for the introduction of a standard by the government is not present, the GEF-programme can be used to make a start and promoting EM's on a wider scale first and preparing introduction of ISO-energy management standard in the medium term. Some large enterprises and/or holding companies have already expressed their willingness to participate in the GEF-sponsored pilot programme, but this number needs to be increased. A wider information campaign among industry sectors on the benefits of energy management systems while at the same time emphasising the benefits of participating in the project will raise the awareness in industry. This will be followed by a series of short training workshops targeted at a large number of managers of large enterprises to introduce energy management systems and achieve a bigger participation. The pool of experts will implement the series of workshops on energy management systems and systems optimisation.

The aim is to select a core of 10 large enterprises that will receive continuous support throughout the programme. The implementation of an energy management system at large enterprises is not easy. Experience has shown that a gradual approach facilitates the implementation. The Dutch programme on long-term agreements comprises a basic energy management system as a requirement for the first years and a full energy management system after three years. The basic energy management system concerns the management commitment, the planning, resource roles and responsibilities, monitoring, basic energy management system documentation and performance review. The full energy management system comprises extensive communication and training, energy management audits, extensive reviews and monitoring by process, energy performance indicators, targets etc.

Applying this approach to the participating companies requires a full commitment not only from the large enterprises but also full support for the duration of the programme addressing all the issues that need to be addressed during the implementation. The pool of experts basically consists of a number of

teams (energy management system expert and system experts) that are available to deliver the support as required to the large enterprises s.

In addition to the core of 10 enterprises that receive full support for the duration of the programme, it is expected that as a result of the introductory training, more enterprises are interested in implementing energy management systems. These can be supported by several formal training sessions in energy management system and systems optimisation.

The specific objectives of this component are:

- To increase the awareness among industry on the benefits of participation in the project and the implementation of an energy management system;
- To train company staff in energy management systems development and implementation and systems optimisation;
- Increase investments for energy efficiency in the participating companies.

The results of this component are:

1) 10 large enterprises implement an energy management system.
2) In the 10 participating large enterprises up to 40 systems optimisation projects are developed.
3) Investment plans with a value of US$ 150M submitted to EBRD credit lines and/or local banks for financing;
4) An additional 20 enterprises received formal training on energy management systems and systems optimisation;
5) An information campaign has resulted in an increased awareness among industry, government and energy businesses on the benefits of energy management systems implementation.

Selection of industrial companies

Following the analysis of the technical energy efficiency potentials in industry, it is recommended to focus the selection of companies primarily from the following sectors:

- Ferrous metals;
- Chemicals;
- Pulp and Paper
- Cement
- Machine building.

However, a flexible approach should be maintained towards companies from other sectors that show a real interest in participating in the programme. Cooperating with 'flagship' companies will increase the exposure of the programme.

<u>Investments</u>

Since western experience shows that even when energy efficiency investments are economically justified, companies are not always willing to invest for various reasons. This effect may be more pronounced in Russia than elsewhere because of existing barriers. In order to overcome this potential barrier, participating companies could be offered a subsidy on the procurement and installation of the

necessary energy management system software and hardware on condition that the company decides to make the investment. A subsidy rate of 25% could be considered in this case. This will be linked to the submission of the company energy efficiency investment plans developed during the implementation of energy management system and system optimisation projects to available credit lines of the EBRD, local banks and others.

2.1. General enterprise training on energy management systems

Together, the international team with trained national experts conduct energy management training sessions of ½ day duration for enterprise staff, including designated energy managers, targeting 50 large enterprises from different sectors across Russia.

The ½ day high-level workshop (with guest speakers, case studies) is designed as an introduction to the benefits of energy management to as many managers as possible (2 of each enterprise, for example the general director and chief-engineer) and as a networking opportunity. It also serves to expand the number of participating large enterprises (for the approach to SMEs: see component 3).

A core number of 10 large enterprises will then be selected that agree on full participation in the programme. In order to have the complete benefits of the project, a (holding) company should be willing to sign an MoU with the EBRD/UNIDO that lays down the full project support the companies receive during the implementation and the obligations of the company (authorizing personnel for the training activities, on-site training facilities, cooperation with benchmarking activities, case studies and dissemination activities). When signing a MoU, it is also necessary to sign a confidentiality agreement in order to reassure the company that no commercial information will be used externally without their consent.

Designated staff at the core enterprises will first receive formal energy management system training through a one-week course. The target is approximately 50 staff to be trained.

Following the introductory training session to managers, it is expected that other large enterprises are interested in training on energy management systems and systems optimisation. These enterprises will receive formal classroom training on energy management system and systems optimisation and support through telephone and e-mail. They can also participate in the website's peer-to-peer network. It is assumed that 20 additional enterprises will participate in this formal training. With 5 company managers and operators participating, this will deliver the training to an additional 100 company staff.

Outputs:	➢ ½-day introductory training sessions to 100 managers in 50 large enterprises delivered; ➢ Formal classroom training in energy management systems and systems optimisation to 100 staff in 20 large enterprises delivered that are additional to the core 10 enterprises;

2.2. On-site energy management system training

The managers of the core of 10 large enterprises will designate company staff that will participate in the training sessions and will be responsible for the implementation of the energy management system.

A first two-day training session will guide participants through the Plan-Do-Check-Act cycle as it applies to the ISO compatible energy management system. Instruction will be given on how to establish an

effective energy policy, set improvement targets and objectives, establish energy performance indicators, energy manual, and identify significant energy uses and opportunities for improvement. At least ½ day will be dedicated to internal auditing and integrating the energy management system into existing ISO management systems such ISO 9001 and 14001.

The 10 large companies who send their energy management team representatives to the two-day training will further receive extensive on-site support from the national experts guided by the technical support of the international experts. The on-site support includes assistance to develop the procedures, energy manuals as well as investment preparation. Special emphasis will be put on the development and implementation of operational manuals, other necessary documentation/procedures, and management reviews and internal audits of the energy management system. International experience has shown that these points require strengthening in practice.

Each participating enterprise is expected to report annually on the implementation of the energy management system and prepare a full management review at the end of the programme period (including the results of system improvements).

Regular reporting on progress will be made via the website created to support the peer-to-peer network discussions. Each participant in the training sessions will also be registered for the peer-to-peer network.

Outputs:	➢ 2-day training sessions to participating large enterprises staff delivered; ➢ Extensive on-site EMS training for 10 large enterprises; ➢ Implementation of EMS in 10 large enterprises; ➢ Annual reports delivered; ➢ Management reviews of the energy management system delivered;

2.3. On-site systems optimisation training

The 10 participating large enterprises will receive intensive on-site training of dedicated enterprise staff in systems optimisation techniques and tools.

The 10 participating enterprises with each dedicating 4-6 staff for a total of 40-60 factory personnel receive a 2-day technical training on system optimisation for each system (approximately 320-480 training days total) from trained national experts with limited support of the international team. The 40-60 enterprise personnel also receive a 2-day training on the use of UNIDO's web-based tools (a basic systems optimisation library) that was developed for Russia under component 1. In total 30 four-day workshops will be delivered.

The national experts will continue providing intensive support in developing systems optimisation proposals. This support can include:

- Evaluating work requirements
- Matching system supply to these requirements
- Eliminating or reconfiguring inefficient uses and practices (throttling, open blowing, etc)
- Changing out or supplementing existing equipment (motors, fans, pumps, compressors) to better match work requirements and increase operating efficiency

- Applying sophisticated control strategies and variable speed drives that allow greater flexibility to match supply with demand
- Identifying and correcting maintenance problems
- Upgrading ongoing maintenance practices

The additional 20 companies will receive formal classroom training in systems optimisation through 6 three-day workshops for up to 100 additional staff. They will also receive further support in implementing systems optimisation assessments. Although this support is less intensive than for the core companies, the national experts will be able to complete 2 assessments in each large enterprise, giving a total of 40 assessments.

2.4. Energy audits

In each of the 10 participating large industrial company a full energy audit will be carried out that serves as a baseline for the energy management system implementation, including systems optimisation and further energy efficiency improvements.

The focus of the audit consultants retained for these activities will include production operations as well as auxiliary services, on-site generation opportunities and energy management practices. The consultants will: i) work with the technical staff of the plants to assess and review energy efficiency/carbon emission reduction opportunities; ii) evaluate and prioritise the potential investments; iii) appraise energy management practices

The consultants will analyse and assess the energy consumption of the selected operations based on existing facility data and/or additional measurements where required. Particular attention will be paid to areas where substantial savings can be made. These will include rehabilitation of existing assets, incremental investments and development of new energy sources. The output of the consultants' work will be a report analysing the energy usage within the operations, propose benchmarking indicators, elaborating and prioritise the potential energy saving investments.

In particular, each energy audit will require a site visit (indicatively, 3-5 days for each plant or more when additional measurements need to be conducted) and comprise the following elements:

A. *Energy Use Assessment*
   - Review of basic energy inputs
   - Review of supply arrangements, with indication of contractual terms, reliability of supply and main supply risks
   - Review of monitoring and measurement arrangements
   - Assessment of energy use with description of technical requirements relating to production and basic energy requirements (the consultants will assess both fixed and variable energy consumption and will indicate how relevant output or seasonal variations relate to energy consumption)
   - Conduct where necessary additional measurements
   - Preparation of energy balances of the various process flows
   - Assessment of the extent to which the implementation of new energy sources (such as on-site co-generation) is appropriate;
   - Assessment of the performance or practice in relation to current best practice in comparable leading international business and recommend improvements either by investments or through alternative operating practices.

- Recommendations for implementing and prioritising energy efficiency improvements, including no-cost and low-cost measures

B. *Energy Management Assessment*

- Assessment of the company's organisation in terms of energy management including the allocation of responsibilities and the ways information about energy usage is acquired, processed and used
- Analysis of the capability to handle energy-saving programmes and initiatives. For the purpose, the audit consultant will prepare a framework for training needs in connection with both energy management and energy efficiency development
- Recommendations on development and implementation of a measurement, monitoring and verification (MMV) system

C. *Carbon Credits Potential Assessment*

- Assessment of investments which can be eligible to generate carbon credits as per the rules defined by the UNFCC (United Nations Framework Convention on Climate Change)
- Assessment of the potential amount of carbon credits that could be generated.

Outputs:	➢ Full energy audits for the 10 large enterprises carried out;

2.5 Development of energy efficiency investment plans

The national experts together with enterprise staff will develop systems optimisation projects for each enterprise as part of the enterprise's energy efficiency investment plan. This includes a full technical, economic and financial analysis of each project, so that the investment plan can be approved by management and discussed with the EBRD and other financial institutions. The investment plan comprises the following elements:

- ➢ Preparation of prioritised investment plan of least cost alternatives whose implementation will improve the energy efficiency (including alternative sources of heat and power)
- ➢ Analysis of the impact of this programme on the company's forecast cost structure and fuel procurement contracts
- ➢ Assessment of physical energy savings anticipated as a result of the energy efficiency investment plan (the Consultant will also indicate and justify any arrangements involving fuel switching, e.g., use of combined heat and power)
- ➢ Assessment of financial savings resulting from the energy efficiency investment plan, indicating key assumptions relating to energy prices or other relevant data. (The analysis will make clear any incremental benefits such as sales of surplus electricity, which may be assumed in the cash flow analysis)
- ➢ Preparation of cash flow analysis over at least the life of proposed assets based on the proposed energy efficiency investment plan and resulting financial savings. The analysis will indicate returns and net present value for each component of the investment plan
- ➢ Establishment of financial and technical performance indicators to be monitored over the life of the energy efficiency project
- ➢ Implementation schedule including the timing and estimated cost of each component and basis of such cost estimates

It is expected that at the end of the programme 40 system assessments have been completed and that all participating companies have developed a comprehensive energy efficiency investment plan for which financing sources will be sought.

In addition, the 20 enterprises that received classroom training will with the assistance of the national experts develop 40 systems optimisation assessments.

2.6. Documented demonstration projects.

The foregoing training activities will deliver 40 completed system assessments at the core 10 companies, of which up to 25 will be fully documented as case studies illustrating financially attractive investments in energy efficiency improvement as a result of energy management system implementation and systems optimisation projects. From the additional 20 enterprises, 10 projects will be fully documented and serve as case studies.

The case studies will also document the energy and greenhouse gas emissions savings directly attributable to the project. They are also used in dissemination campaigns, distributed through industry associations, the project web site and training sessions.

2.7. Recognition and peer-to peer/knowledge networks

In Russia, hardly any networks are functioning to date. There are no fora or active associations that encourage professional contacts in a meaningful way. Industry engineers also have little opportunity to meet counterparts at other enterprises.

While training managers as well as engineers in the participating large enterprises, the GEF-programme will use the opportunity to establish peer-to-peer networks between the participants of the training workshops. This can be done through the web site that is regularly updated with content and information from the participating companies' progress and stimulates professional discussions and information exchange.

When functioning, this network can evolve into or start knowledge networks: networks that centre around information exchange concerning different state-of-the-art and future technologies and production processes, for example on pumps or compressors as well as on 'production intensification'. Participants will be from industry, equipment manufacturers, research institutes/universities and energy business professionals. Efforts will be made to link the peer-to-peer network into activities of the leading business associations to provide long-term foundations for networking.

Through the web site (developed under Component 1), a recognition program is available to industrial facilities that implement an energy management plan and report energy savings. Awards are given for outstanding performance at special (annual) events to be held together with leading business associations.

One of the outcomes of the Dublin ENERGY MANAGEMENT SYSTEM conference was the organisation by UNIDO of special Committee on International EMS good practice and experience, in which Russian experts will be invited to participate.

2.7. Participation of equipment manufacturers and suppliers

Involving equipment manufacturers where possible through industry associations is necessary in order to stimulate the provision of specific services to industries concerning energy management implementation and the systems optimisation concept. It will assist in the transformation of the market for industrial energy efficiency.

The international team will conduct 1 or 2-day training workshops (specific to system type) for 10 or more Russia-based manufacturers/vendors of each system (motor/ pump/ compressor/ fan/steam/process heat systems).

The international team will conduct training to introduce equipment vendors, manufacturers' representatives, and suppliers of pumping, fan, motor, compressed air, and steam system equipment to system optimisation techniques. Each training session will be up to 2 days, with a mix of theory and practical considerations. The purpose of this training is to prepare manufacturers, vendors and suppliers to 1) participate in reinforcing the system optimisation message with their customers, 2) assist them in identifying what will be required to reshape their commercial policies to reflect a system services approach and 3) to introduce a voluntary certification system for industrial equipment.

This training will cover 40 Russian companies and will be taught by instructors with equipment manufacture or sales experience.

Outputs:	➢ 40-60 enterprise staff trained in systems optimisation at the 10 core enterprises (a total of 30 four-day workshops); ➢ 40 system assessments prepared at the 10 core enterprises ; ➢ Up to 100 staff trained in formal classroom systems optimisation at the additional 20 enterprises; ➢ 40 system assessments prepared at the 20 additional enterprises; ➢ 35 full case studies developed; ➢ 10 full energy audits carried out at the core 10 participants; ➢ Recognition programme established and participants registered in the peer-to-peer network; ➢ 10 complete company energy efficiency investment plans developed; ➢ 40 Russian equipment suppliers trained in optimisation of six types of systems (12 three-day workshops);

3.3.4 Component (3): Introduction and implementation of an energy management system in selected SMEs

Small and medium industrial enterprises (SMEs) covering about 50% of the energy efficiency potential in Russia require a special approach. Not only to overcome the current barriers to energy efficiency but also because they usually lack the capacity for developing energy management systems. The focus will be on such sectors as small scale manufacturing, food processing, textile etc.

Sometimes, it is not always clear how to distinguish large enterprises and SMEs. There are medium enterprises that have the similar characteristics as the large ones. A possible criterion that can be used is the energy intensity of the production processes.

Depending on the actual size and production processes, ready-made solutions and limited capacity building (where appropriate) are effective approaches.

The specific objectives of this component are:

- To increase the awareness among SMEs on the benefits of participation in the project and the implementation of an energy management system;
- To train experts in energy management systems development and implementation and systems optimisation;

The results of this component are:

1) In 50 SMEs an energy management system and systems optimisation projects are implemented.
2) In 75 SMEs, investment plans with a value of US$ 150M are discussed with financing organisations;
3) An information campaign has resulted in an increased awareness among SMEs of the benefits of energy management systems implementation

3.1 Energy management training and system optimization training and implementation in SMEs

Together, the international team with trained national experts conduct additional energy management training sessions of ½ day duration for plant staff, including designated energy managers, targeting 100 SMEs from different sectors across Russia.

It is difficult to select the target sectors for the GEF-programme because the Russian statistics on the different light industry sectors do not indicate the final energy consymption by sector and are often also incomplete. By using and indirect method however, an indicative overview can be made of those sectors that can be targeted by the programme.

This method consists of taking the production volume of certain products and an average energy intensity based on international indicators that are - where possible -, corrected on the basis of Russian information and reports. This gives an approximation of the final energy consumption of different sectors. This is shown in the table below.

	Year	Production	Final energy intensity	Energy use	
		[Mt/yr]	[GJ/t]	[PJ/yr]	[mtoe/yr]
Meat	2008	6.8	5	34	0.8
Fish	2008	3.7	4	14.8	0.4
Vegetable oil	2008	2.5	3	7.5	0.2
Milk processing (milk equivalents)	2008	10.3	3	30.9	0.7
Bread	2008	7.5	3.6	27	0.6
Sugar	2008	5.9	8	47.2	1.1
Wodka and other alcoholic beverages	2008	1.6	25	40	1.0
Beer	2008	11.4	2	22.8	0.5
Non-alcoholic beverages	2008	5.71	0.5	2.855	0.1
Canned food	2008	12.7	2	25.4	0.6
Castings	2006	6.3	10	63	1.5
Total					**7.6**

Based on the results of the table, the following 5 (sub-) sectors can be targeted by the programme:

1. Castings;
2. Sugar processing;
3. Alcoholic beverages;
4. Meat processing;
5. Milk processing

There is a range of sector associations covering the above sectors. Several of them were approached and reacted positive to the contents of the programme. It is recommended using these associations in order to maximise the interest of companies in the GEF-programme.

In addition, there are several (sub-) sectors for which no detailed statistical information exists (usually gathered under the heading “rest of industry”), but that have considerable potential for energy savings. These sectors are machine building and tools and wood processing industry and should be included in the programme approach.

The GEF-programme can also benefit from results of several ongoing projects in Russia. The IFC for example has started a benchmarking study in the foundry sector and Senternovem is planning to start a similar exercise with two (large) metallurgical companies. These initiatives have been discussed with the organisers and the results will be made available to the GEF-programme.

The ½ day high-level workshop (with guest speakers, case studies) is designed as an introduction to the benefits of energy management to as many managers as possible (target 200) and as a networking opportunity. It also serves to expand the number of participating SMEs.

These workshops will target up to 200 managers from different SME sectors, such as machine building, textiles, food processing. It is expected that up to 100 SMEs will be willing to participate in the programme. They have access to the full support of the programme for SMEs including:

- Training in specially developed tools for SMEs on energy management systems and systems optimisation techniques;
- Energy audits;

- Access to investment preparation and a range of financing options for energy efficiency investments.

3.2 Systems optimisation training for SMEs

For medium sized or large SMEs that have a certain, although not sufficient capacity for energy management, 2-day training sessions in energy management system implementation and systems optimisation techniques will be conducted, followed by 1-day training on the basic UNIDO systems optimisation library developed for Russia.

It is expected that in 25 larger SMEs, this training will result in completed systems optimisation assessment reports that can be further discussed with financing sources.

For this training, preference will be given to SMEs committed to energy management but with either limited access to the services of a system optimization expert, or one on staff. The goal of the training is to prepare them to identify and implement system optimization projects with limited outside assistance.

3.3 Implementation of energy management and benchmarking to increase energy efficiency of SME's

For these SMEs as well as for the remainder of participating SMEs, a special tool will be developed for energy management schemes and benchmarking. There are different schemes being used in other countries. For example, in Europe, the BESS project has been developed and is functioning in many European countries: The BESS-project developed Benchmarking and Energy Management Schemes in SME's in order to increase energy efficiency in SMEs with good results.

To be able to implement energy management successfully a user-friendly web based e-learning scheme for implementing energy management and benchmarking has been developed. The handbook for the e-learning scheme describes the topic energy management, contains several supportive tools and describes why and how to work with them. Several practical tools to support the cycle of continuous improvement of energy efficiency in the company are supplied such as checklists, measure lists, templates for auditing and energy action plans. All these tools are downloadable. Furthermore, there is the possibility to anonymously benchmark your energy situation against others of the same sector.

BESS provides the energy management implementation model (EMIM) which shows the logic of the implementation process. It contains 19 actions and several tools and instruments which support the process.

For introduction in Russia, these tools will be developed taking into account the Russian conditions. Recently, in Russia several benchmark studies have been initiated and the results can provide valuable input for the GEF-program.

The national experts will provide on-site support for the participating SMEs in the practical use of these tools.

It is assumed that from the 100 participating SMEs, 50 will decide to implement the energy management system in their company and participate in the development of the (anonymous) benchmarking scheme aimed at covering 2-3 sectors. With the support of the pool of experts, 25 energy efficiency investment proposals will be developed that can be further discussed with financing organisations.

The results will be widely disseminated in order for future expansion of the scheme.

All participating enterprises will be part of the peer-to-peer network through the project web site.

3.4. Energy audits

In all participating enterprises an energy audit will be carried out. These audits are smaller in scope than for large industrial enterprises and can be performed by the national trainers pool (see also section 2.3).

3.5. Technology database and certification scheme

Besides the web site, a special energy efficiency technology data bank will be established (see also the web site under component 1). This will provide SMEs (and other industry) with information on modern energy efficiency technologies and equipment and can be based on other similar international data banks (for example the Odyssee site of the EU).

The technology data bank can also serve as a basis for developing a voluntary labelling and/or certification scheme for industrial energy efficiency equipment in cooperation with equipment manufacturers and vendors. This will provide easy accessible information for smaller companies who are taking decisions on energy efficiency investments. The approach to certification must be compatible with the existing GOST system (Russian standards) and may also provide input for the implementation of certification mentioned in the new law on energy efficiency (see also component 4).

3.6 Preparation of energy efficiency investment plans

It is expected to develop 50 investment proposals (based on systems optimisation projects in the participating SMEs) with a total value of US$ 150M, of which 25% is assumed to be realised during the programme period (value US$ 35M). The total energy savings will amount to 1.5-2.5 mtoe.

However, western experience shows that even when energy efficiency investments are economically justified, companies are not always willing to invest for various reasons. This effect may be more pronounced in Russia than elsewhere because of existing barriers, in particular SMEs may be reluctant to invest. In order to overcome this potential barrier, participating companies can be given a subsidy on the procurement and installation of the necessary energy management system software and hardware on condition that the company decides to make the investment. A subsidy rate of 25% could be considered in this case. This will be linked to the submission of the company's energy efficiency investment proposals developed during the implementation of energy management system and system optimisation projects to available credit lines of the EBRD (such as RUSEFF), local banks and others.

Outputs:	➢ 100 SMEs trained in energy management systems ➢ 25 large SMEs trained in systems optimisation; ➢ 25 systems optimisation assessments completed in large SMEs; ➢ Russian benchmarking developed and introduced in 2-3 SME-sectors and 50 SMEs; ➢ 50 quick audits carried out by national experts and audit companies; ➢ Data bank on energy efficiency technologies developed; ➢ Voluntary certification scheme prepared;

- 50 energy efficiency investment proposals prepared at participants;
- Energy efficiency technology data bank established;

3.3.5 Component (4): Government capacity building and support programme

Government energy efficiency policies in the past in Russia have not been effective and in general energy efficiency has not been given a high priority. The attempts made such as a law on energy efficiency showed a lack of knowledge and poor enforcement. Monitoring was virtually absent. In addition, the responsibility for energy efficiency policy does not fall on a dedicated ministry or other government body.

However, in November 2009, a revision of the Federal Law "About energy saving and increasing of energy efficiency" has been signed by the President that replaces the existing Federal law from 1996. The President and the government have put energy efficiency finally high on the agenda. It has also been recognised that a national energy agency should be established. Currently the ministry of energy is working on the implementation.

The new law - mainly directed towards the public sector -includes several elements relevant to the development and implementation of the planned industrial market transformation programme and includes provisions for regular energy audits, energy passports for large companies as well as long-term agreements and certification. Audits are to be mandatory for organizations that receive significant government funding and that consume significant amounts of energy. Energy passports, to be based on audit results, are to be developed by large companies.

The approach taken in the new law does not constitute a comprehensive industrial energy efficiency policy as has been developed in other countries and which would be based on realistic targets and measures to reach them. The main reasons for the absence of an effective approach to date are the following:

- To date, Russia in general has not been able to establish an "energy efficiency culture" in the country and therefore has to start 'from scratch' in building effective energy efficiency policies, including industry.
- There is generally a lack of knowledge about how best to address industrial energy efficiency at a government level.
- There are no incentives to encourage energy efficient behaviour in industries – neither carrots nor sticks. Although in the new law, the use of economic instruments is mentioned, these will mainly pertain to the budget sector.
- There is insufficient trust between government and industry. Measures taken by government are usually regarded more of a 'regulatory' nature rather than as an incentive.

The objectives of this component are:

1) To increase the capacity of the government to design and implement an effective industrial energy efficiency policy framework;
2) To support the implementation of the new law on energy efficiency, including support to the energy efficiency agency though a capacity building programme.

The expected results are:

- 80 officials of different relevant government bodies, including the energy efficiency agency are trained in developing an effective industrial energy efficiency policy (including Study Tours)
- Increased effectiveness of Russian (industrial) energy efficiency policy measures;

4.1 Organise training programme for officials on (industrial) energy efficiency policy

Selected officials of different ministries and organisations will be trained in the different policy options as implemented by the GEF Programme. Special emphasis will be given to the development of a scheme to introduce a Russian energy management standard that can be further developed into an ISO 50001 standard and later into (voluntary) agreements. Benchmarking is another scheme that is useful for the government as an instrument of energy efficiency policy. Another important element is the introduction of (voluntary) certification of industrial equipment and the use of economic instruments, (such as subsidies and the use of taxation measures) and further development of technology forecasting and scenario building tools.

The training program will also include program preparation for other end-use sectors, including target setting, monitoring system and indicators, data collection and analysis, and international and Russian best practices/technologies. The training may occur in classroom, on-the-job or study tour settings.

4.2 Support to the implementation of the new law on energy efficiency in Russia

In discussions with the Ministry of Energy on the implementation of the energy efficiency-law, several topics were mentioned. The implementation of the law requires that – besides the long list of legal amendments that need to be developed by a range of ministries - the ministry of energy provides proposals for the realisation of long-term agreements with industrial sectors and for a certification system on industrial energy efficiency equipment, both of which are mentioned in the law. These proposals are part of the new federal target programme on energy efficiency that also incorporates a range of measures directed at the public and housing sectors.

In order to facilitate these tasks, the ministry of energy is transforming an existing federal state unitary enterprise (FGUP) 'RusInformResurs' into a 'Russian Energy Agency' (REA). One of the reasons to use RusInformResurs is the fact that they have more than 60 branches and representations in the regions. Currently, the ministry is in the process of finalising the mandate and selection of new staff in order to start its activities. Two main directions are initially formulated for REA's responsibilities: 1) information provision on the fuel and energy complex as well as on energy efficiency and 2) concerning energy efficiency policy, REA is also planned to supervise and monitor the new federal target programme that is currently under the discussion by the government.

The timing of the GEF-programme is essential for delivering concrete support to REA. It has to conclude its reorganisation and staffing before March 2010 and start the development of its activities. It is expected that the results of the GEF-programme as well as the input of the experts will greatly benefit the development of effective energy efficiency policy measures as mentioned in the new law, provided the timing of the programme can be synchronised with the implementation of REA's activities.

Energy efficiency agency

a) Information provision

The newly formed agency will conduct information campaigns and organise, collect and analyse data on the fuel and energy complex and energy efficiency in other end-use sectors. The GEF-programme provides an opportunity for the new agency experts to work closely on with the programme's experts on the relevant GEF-activities, in particular on the GEF-programme information campaign(s), web site development and involvement in the capacity building programme for government officials.

The GEF-programme information campaign will be designed in close cooperation with the agency experts in order to create a transfer of knowledge and the GEF-experts will assist the agency experts in designing and implementing energy efficiency information campaigns.

The agency experts will also be involved in the development of the web site and its results. This will provide the creation of expertise within the agency and the possibility of taking over and maintaining the site after the GEF-programme has finished, thus creating a sustainable prolongation of the web site and its tools and networks.

Also linked to the capacity building activity, is the special attention on the energy efficiency data collection and analysis. Besides the training, the GEF-experts will assist the agency in setting up a data collection system, including energy efficiency indicators suitable for the Russian situation. It is important for the agency to develop a structure that includes the many regions of the Russian Federation in order to have a meaningful basis for analysis. International experience (IEA, EU, USA etc.) can provide valuable insight as to the development of a sustainable data collection and analysis structure for the country. This will result in concrete proposals for the agency to implement its tasks.

b) Development and implementation of the federal target programme on energy efficiency

REA has initially been tasked to supervise the implementation of the new energy efficiency programme and to monitor its impact. This is an important task and the GEF-programme experts together with the agency's experts will prepare proposals for the monitoring system and evaluation procedures.

Furthermore, the agency also plays a role in approving the regional energy efficiency programmes and projects that are submitted to the programme. Therefore, a realistic set of criteria to select submitted projects as well as a typology of energy efficiency projects suitable for (co-) financing from the programme – among others -need to be carefully developed. Relevant international experience in designing and implementing effective energy efficiency programmes while adapted to the Russian environment will form the basis for the development under the GEF-programme of concrete and ready proposals to the ministry for the implementation of the federal programme. These proposals are also linked to the training programme mentioned under 4.1.

Preparation of a road map for the introduction of market mechanisms for energy efficiency certificate trading

Energy efficiency policy in Russia is basically relying on *sticks* (state regulation), but lacks *carrots* (market incentives). To support market transformation the lack of these incentives should be addressed so that market mechanisms act as a key driver of energy efficiency in industry. With this regard the other components of this project i.e. energy management, energy audits, training etc., present a technical and procedural environment necessary to support the launch of other market mechanisms.

One of the tools for this in Russia is "Energy Certificate Trading" (White or Green Certificate Trading). This approach has been gaining popularity in the last 5-7 years. Several countries, notably Italy, France, Australia, and Sweden, have already acquired important experience in developing the related national policies, systems, procedures and other regulatory components for this mechanism. Energy Efficiency Certificates can provide important incentives to the private businesses in generating energy efficiency projects and marketing their results (measured out in tonnes of CO_2 emissions reductions). It needs however a sold basis for successful implementation.

To facilitate launching of this tool the project may include a number of training activities including:

- training of the business and regulatory stakeholders on the international experience in White Certificate trading and related policies and regulations;
- capacity building on White Certificate trading in Russia, including development of related trading platforms (incl. related software), of the linking provisions between the White Certificate trading system and voluntary sector-wise Agreements on energy saving, of the procedures of

selecting the eligible energy efficiency projects, monitoring and verification provisions, project approval rules, register management, White Certificate issuance provisions, etc,;

- development of recommendations for a White Certificates trading system timelines, including transition from a Pilot phase with a limited number of participants and strict rules to more comprehensive system embracing a number of GHG-intensive sectors with a great degree of transparency and free trade regime for the participants involved.

Long-term agreements with Russian industry sectors

In the new energy efficiency law, the ministry needs to develop agreements with Russian industrial sectors (usually through business associations). Since the necessary infrastructure for such agreements is not yet developed in Russia, the GEF-programme will provide through its activities with industrial companies results that can be used for the development of a suitable structure in Russia. The first phase of implementing energy management systems in large enterprises will deliver valuable information on the realistic possibilities in several energy-intensive sectors, including the possible use of benchmarking as an instrument. These results will be used by GEF-experts to develop proposals for the introduction of a Russian energy management standard (ISO 50001-compatible) based on the existing Russian legislation on standards (GOST). This will provide much of the requirements that need to be fulfilled in order to take the next step with the preparation of long-term agreements with realistic targets with relevant industrial sectors. The GEF-experts will develop a road-map for developing these agreements. This type of agreements is frequently being used in EU countries and this gives important insight in the conditions under which agreements can be a successful energy efficiency policy instrument in Russia.

Comparison of Russian and foreign standards for industrial equipment

The ministry needs to develop a scheme for the certification of industrial energy efficiency equipment. This is a complicated procedure given the existing system of standards (GOST) pertaining to energy efficiency equipment as well as the technical difficulties (types of equipment, operating conditions etc.). It is important to create a level playing field in this respect in order to avoid undue economic discrimination and market distortions. A review of existing government proposals and existing standards, and comparison with best practice from other countries will be made in order to develop recommendations for a certification scheme in Russia. International experience in labelling and certification, in particular with types and classes of industrial equipment will provide valuable input. The recommendations and proposals will be submitted to the government for further consideration.

Ad-hoc advice to Government

The ministry of Economic Development and the ministry of Energy have many tasks to fulfil for the development and implementation of the new energy efficiency policy ranging from developing new instruments such as escos (standardised performance contract) to developing the rules for self-regulatory associations for audit companies. At this point, many government decisions regarding legal and regulatory documents are not yet known. Therefore the GEF-programme through its international experts should support specific requests for assistance from the ministries.

Outputs:	➢ 80 government officials trained in (industrial) energy efficiency policy preparation; ➢ Proposals for selection and approval of projects submitted to the new federal target programme delivered;

- Monitoring and evaluation procedures for the federal target programme developed;
- Experts of the energy agency trained in information campaigns and the use of the web site and its tools;
- Proposals delivered to REA on data collection and analysis structure;
- Proposals delivered for the introduction of a Russian Energy Management Standard and road map for long-term agreements with industry;
- Recommendations prepared for certification scheme of industrial energy efficiency equipment;

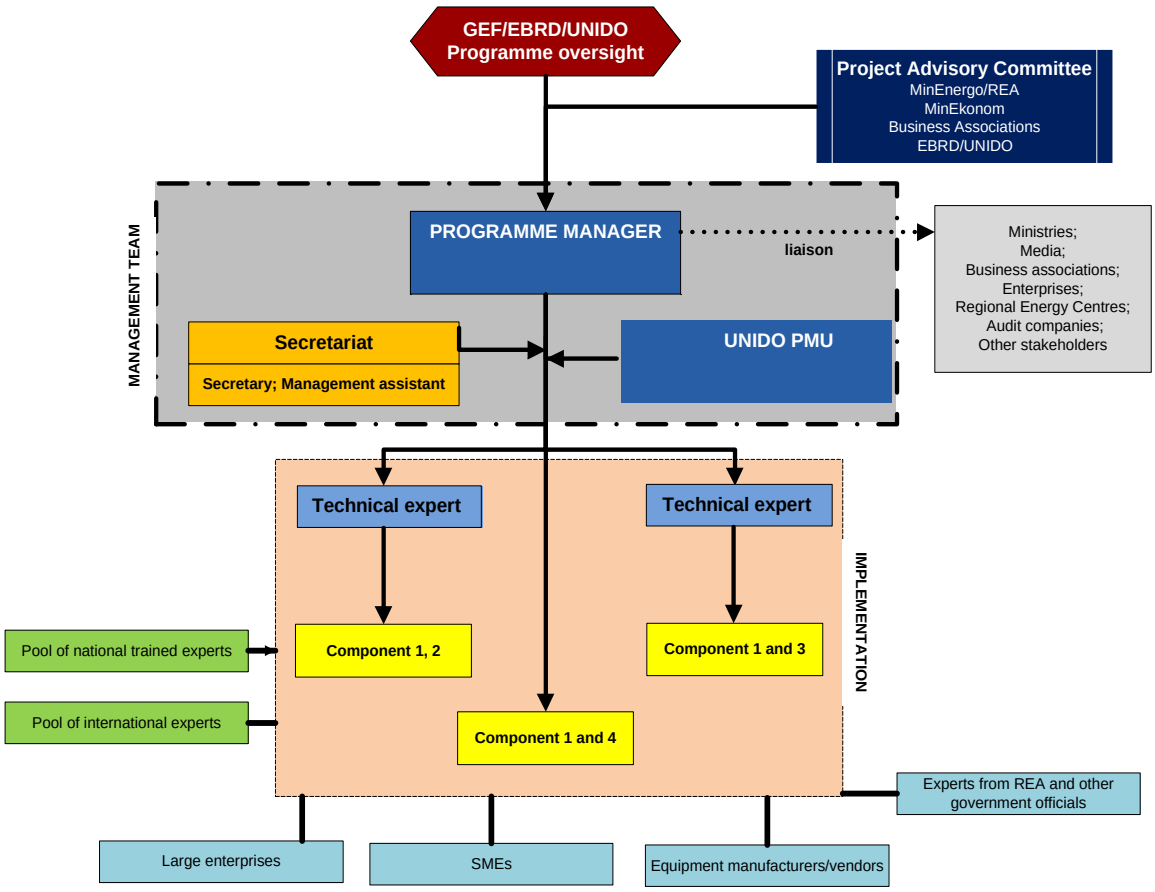
4. Project Management structure

The successful implementation of the programme depends to a high degree on the effective organisation of the following aspects:

A. Effective programme oversight and management;
B. Successful liaison with the Government, in particular the Ministry of Energy and the Ministry of Economic Development;
C. Develop good cooperation with management of participating enterprises and business associations;

Although the programme is complex and is divided into separate components, they are closely related. Therefore a central project management structure is proposed as depicted in the following chart.

The Programme Management Team (PMT) consists of a full-time international programme manager and two international Component Managers (CM). It is essential for the PMT to complement the international experts with Russian counterparts who will function as deputies of the international experts. The combined expertise and experience of the team will facilitate management and communication with the wide range of Russian organizations that are targeted by the programme. It also provides the transfer of knowledge of international practices to the Russian experts.



This structure allows for a strong integration of the implementation of the different components and provides a central focal point for the Russian Government.

Advisory committee

To secure a constructive stakeholder dialogue throughout the project an Advisory Committee will be formed consisting of the Ministry of Energy, Ministry of Economic Development and other representatives from relevant ministries, the Russian Energy Agency, and business associations with interest in industrial energy efficiency, project development and finance. The main role of the Advisory Committee will be to provide advice and feedback on the project design and support implementation during operations with policy support and by facilitating key partnerships across the market. The Advisory Committee also provides a forum for the advancement of sustainable energy finance in industry. The Advisory Committee members typically play important roles in promoting and sustaining a favourable policy environment for investments.

UNIDO and the EBRD project implementation team will convene the Advisory Committee semi annually to advise the project on operational issues and promote coordination with other national initiatives and policies. The first Advisory Committee meeting will be organized after launching the project. The purpose of the first meeting will be to announce that the project has started operation, present strategies for the first year and discuss the implementation plan. Other potentially interested government, FI and other partners would be invited to the meeting as observers.

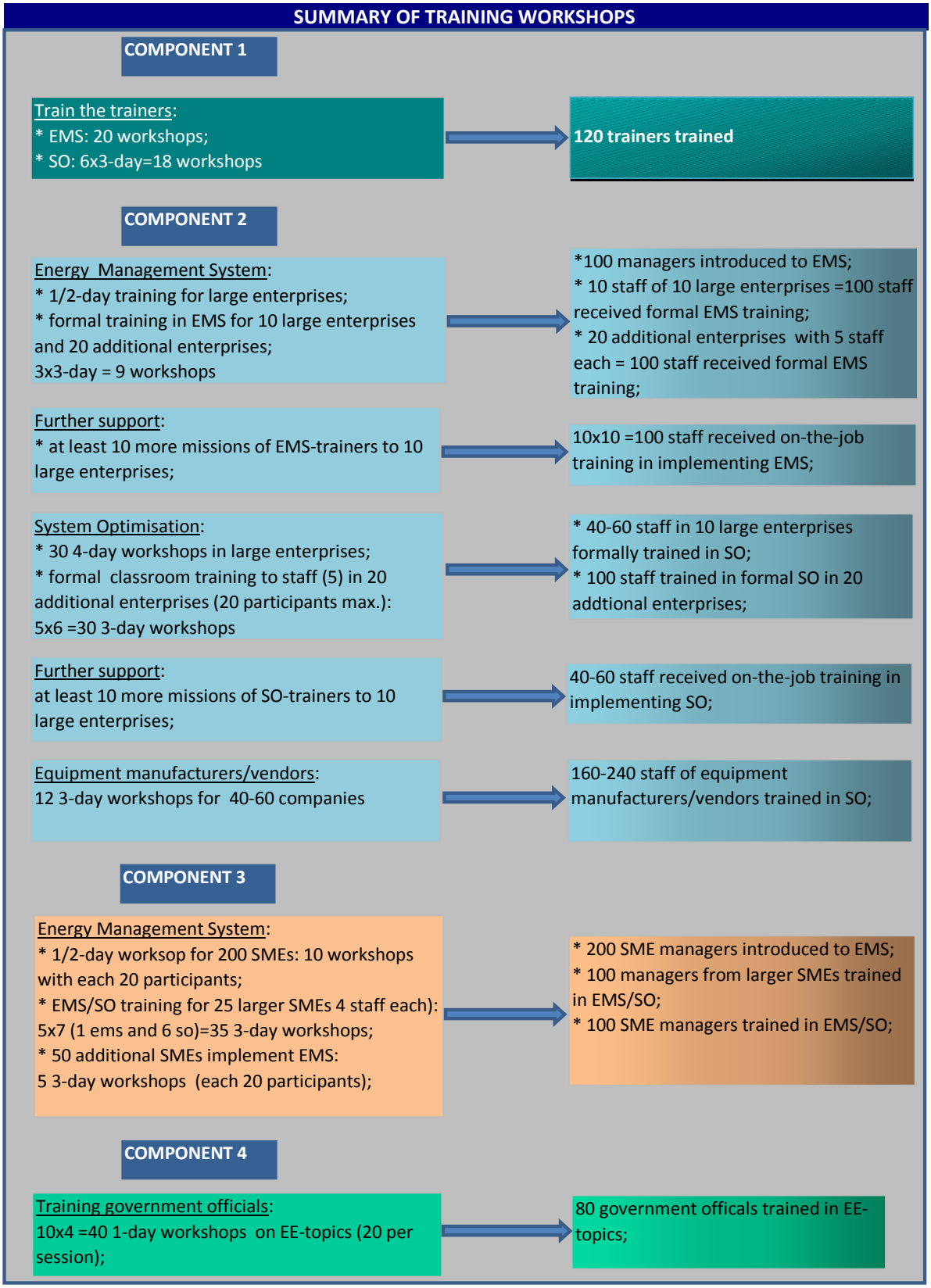
The purpose and the agenda of the following meetings will be to present project activities of previous year and strategy for the upcoming year. The Committee members may provide comments and advise the project implementation team on specific questions, and might provide information on policy, legal and government strategies related to industrial energy efficiency. The Advisory Committee can also serve as a lobbying body to support the project implementation by addressing critical business related policy and strategy issues at the government level. Beyond the semi-annual Advisory Committee meetings, project management and implementation team may contact the Advisory Committee members to seek advice on issues raised during day-to-day project operation.

Other stakeholder involvement

EBRD and UNIDO are engaging in extensive consultations with local stakeholders. Local stakeholder participation in the Program will be extensive in all components with representatives from government, developers, and financial institutions. This list is by no means exhaustive and simply serves to illustrate the profile of select interested parties.

Appendices

Appendix 1 Summary of Training activities



Appendix 2 List of contacted companies

List of distribution of companies invitations in GEF Programme

Based on a data base of large companies, invitations were sent out to the companies listed below. Several have expressed their interest in participation in the GEF-programme (indicated below).

Ferrous metals:

- Severstal – *ready to participate in GEF Programme, gave official answer*
- Evraz Group S.A – *interested in participation*
- Novolipetsk steel (NLMK) - *interested in participation*
- Magnitogorsk Iron and Steel Plant
- Mechel
- METALLOINVEST Holding
- TMK - *interested in participation*
- United Metallurgical Company
- Industrial Metallurgical Holding (KOKS)
- Chelyabinsk Tube Rolling Plant
- CJSC “Profit»
- Chelyabinsk Electro Metallurgical Integrated Plant
- Amurmettal Group
- Volgograd Metallurgical Plant “Krasnyj Oktyabr'»
- Serov Ferro-alloy Plant
- Ashinskiy Metallurgical Plant
- Metallurgic Plant named after A.K. Serov”
- Zlatoust Metallurgical Plant
- Kosogorskiy Metallurgical Plant
- Magnezit Group

Chemicals, including refineries:

- Group of companies PHOSAGRO - *ready to participate in GEF Programme, gave official answer (According to company support Russian Chemists Union)*
- Sibur Holding - *ready to participate in GEF Programme, gave official answer (According to company support Russian Chemists Union)*
- United Chemical Company URALCHEM - *ready to participate in GEF Programme, gave official answer (According to company support Russian Chemists Union)*

- Nizhnekamskneftekhim - *ready to participate in GEF Programme, gave official answer (According to company support Russian Chemists Union)*
- EuroChem Mineral and Chemical Company
- Uralchimplast

Pulp and paper:

- Ilimgroup
- International Paper Russia (Svetogorsk)
- Arkhangelsk Pulp and Paper Mill

Machine building:

- KAMAZ Inc.
- Transmashholding
- Objedinennye Mashinostroitelnye Zavody (Uralmash-Izhora Group)
- Holding Company «ELEKTROZAVOD»

Non-ferrous metals:

- United Company RUSAL
- Mining and Metallurgical Company "Norilsk Nickel" (Nornikel)
- VSMPO-AVISMA Corporation
- Russian Copper Company
- Uralelectromed
- Uchalinsky Mining and oncentrating Company
- Kamensk-Uralsky Metallurgical Works (KUMZ)

Light industry:

- Vostok-Service Group
- Group of companies BORODINO