CHP/DH Country Profile: Russia

Introduction

Russia uses combined-heat-and-power (CHP) generation extensively; it accounts for about a third of installed electricity generating capacity. In 2007 Russia had more than 700 electricity plants with a total generating capacity of 215 GW. Of this, thermal electricity plants and CHP represented 68% (145 GW) of installed capacity; hydroelectric plants 21% (46 GW); and nuclear 11% (24 GW). Russia has the largest and oldest district heating system in the world. More than 100 years old and comprising almost 500 combined heat and power stations, 200 000 kilometres of district heating (DH) pipeline network and more than 65 000 boiler houses, Russia's municipal district heating systems are a legacy of the Soviet era on which most of the country's urban population has come to depend during the long and cold winter season.

Although Russia's installed capacity of CHP stations is among the largest in the world, there is little reliable data on their efficiency of energy use. There is also a lack of any governmental definition of high efficiency CHP, unlike in other countries such as the UK and in the European Union (EU).[1] Furthermore, low investment and inadequate maintenance in Russia during the 1990s has severely decreased the reliability of heat supply in many systems. Below-cost pricing has also contributed to under-investment and poor maintenance, with an estimated 60% of the Russian network in need of major repair or replacement. More than half of the 200 000 km network of municipal heat distribution pipelines is estimated to have already passed its technical life expectancy. Some pipeline systems are 40-50 years old – way beyond their 16-20 year technical life expectancy. About 25-30% of the system is considered in critical condition. For this reason it is estimated that a minimum of 10-12% of pipes need to be changed every year. Yet each year only about 1% of pipes are changed on average across the whole Russian network. Raising the investments needed to replace, repair and maintain this immense network is the key challenge facing Russia's district heating system.

Another major challenge facing the development of CHP in Russia is the lack of an overall strategy and outlook for the heating sector. A draft *Law on the Heat Sector* was discussed in the Russian State Duma in 2002 but was not passed into law and has since been neglected. This is especially a problem given the restructuring and privatisation of the electricity sector during this time – which was completed in 2008 – to which the heat sector is so closely linked. Russian experts[2] also point to the lack of trained and qualified personnel in the sector for day to day operation. The lack of a long-term strategy for the sector is considered another major hurdle for its sustainable development. Heat tariffs in the residential sector are not cost-reflective. They are kept low for political reasons, given the inability of most of Russia's residential population to pay higher rates. However, these low rates reduce the sector's attraction to investors. Furthermore, heat tariffs based on norms, as opposed to actual use, hamper the effectiveness of measures to raise the efficiency of heat use and to reduce residential demand. The continued practice of cross-subsidising heat tariffs between industry and the residential sector has driven some industries away from large CHP heat sources to decentralised heat boilers or mini-CHP.

This report provides an overview of the Russian district heating sector and the role CHP plays. It discusses the challenges faced by CHP and the overall Russian heat sector, predominantly due to the lack of long term vision and policy focused on this key sector, despite the energy savings potential and the benefits this would have for enhancing energy security, environmental sustainability and quality of life for Russia's population.

1. For more information see the EU Cogeneration Directive (2004/8/EC) and the UK Government CHP Quality Assurance scheme (see www.defra.gov.uk/environment/climatechange/uk/energy/chp/) and IEA (2009), Cogeneration and District Energy: Sustainable Energy Technologies for Today and Tomorrow, at www.iea.org/files/CHPbrochure09.pdf.
2. Information portal of heating sector in Russian Federation www.rosteplo.ru.

Energy Overview

The Russian energy situation is influenced by three main features:

- the dominance of natural gas in its total primary energy supply;
- the need to move to cost-reflective domestic energy pricing; and
- the need to become more energy efficient.

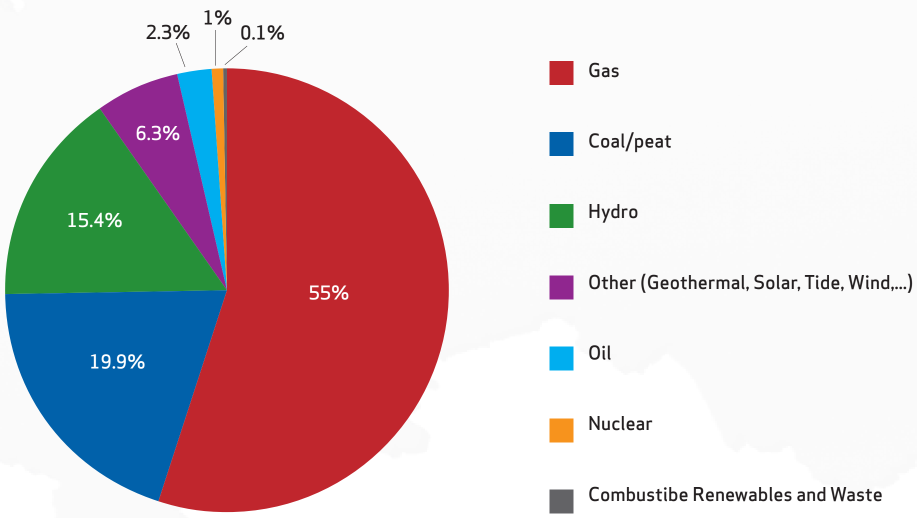
The dominance of natural gas and the need to get domestic energy prices right

The Russian *Energy Strategy to 2020*, adopted by the Russian Government in August 2003 projected a reduction in the use of natural gas in Russia's total primary energy supply (TPES) and a consequent increase in the share of coal. Instead, natural gas has remained stable as a share of TPES at around 53-55% over the period 2001 to 2007 while coal's share has actually dropped from 17% to 15%. As shown in Figure 1, in 2007 Russia's total primary energy supply continued to be dominated by natural gas with a 55% share. The share of oil was about 20% and coal just over 15%. Over the 2000-2006 period, gas prices have been about 20% cheaper than coal prices on a rouble per tonne of coal equivalent basis, making gas the fuel of choice in the Russian electricity and heat sector. This differs from elsewhere in the world, where natural gas attracts a significant price premium, because it is cleaner and easier to use. The 2003 Energy Strategy foresaw an adjustment in the gas: coal price ratio to 1.6:1. Although the Russian government aspires to raise domestic gas prices to parity with European prices by 2011[3], the impact of the global economic crisis may well extend the time it will take for domestic gas prices to increase and thus maintain the attractiveness of natural gas over its rival, coal.

Uncertainties currently abound in relation to formulating forward outlooks, given the context of the global economic crisis and the many unknowns this raises. As of the publication of this report, the new Russian Energy Strategy had not yet been released, but is expected in late 2009 or early 2010. This document, when released, will be especially interesting to assess how Russian energy policy makers have projected the demand for Russia's upstream energy resources, given the impact of the economic downturn both in terms of domestic and export-driven energy demand.

Figure 1: Total Primary Energy Supply (TPES) in Russia by source in 2007

Source: IEA Statistics



3. The commitment to raise domestic gas prices was institutionalized within the EU-Russia agreement signed in May 2004, where the EU gave its support for Russia's accession to the World Trade Organization. The Russian government decision of November 2006 to raise regulated wholesale industrial gas prices to reach export netback parity by 2011 originally planned industrial price increases of 15% from January 1, 2007, 25% from January 1, 2008, 13% from January 1, 2009, 13% from July 1, 2009, 13% from January 1, 2010, 13% from July 1, 2010, to reach parity with European levels (less transport costs) as of January 1, 2011. Given oil prices and exchange rates domestic gas prices will likely not reach their target before 2013.

The need to become more energy efficient

Over the last decade and a half, energy efficiency has been a key focus of the Russian energy policy thinking. Given the preponderance of natural gas in Russia's TPES, efficiency of natural gas production and consumption would be a logical focus for an efficiency effort. Greater gas efficiency would free up incremental gas for export, enhancing the security of export supply. However, to date the implementation of energy-efficiency policies in Russia has not been especially successful.

The Russian Energy Strategy 2003 estimated that Russia could reduce the consumption of energy per unit of output by 40-50% from 2000 levels, but cost-reflective energy pricing will be needed to create the incentives to stimulate reductions in energy intensity. The 2003 Strategy projects that Russia would consume over three times more energy if it were to maintain its year 2000 energy intensity and still meet its year 2020 GDP growth target. In other words, the Strategy estimates that potential energy savings represent nearly two thirds of the additional energy needed to support its economic growth to 2020. Statements made by the Russian President in 2009 reflect this continued belief that a 40% reduction in energy use is achievable and necessary for Russia to maintain its ability to fuel its economic growth and meet the demand in growing export markets to the east as well as to the west.

As reflected in the 2003 Energy Strategy, Russian energy policy thinkers understand that effective implementation of energy-efficiency measures would need to be supported by active economic reforms, including the rapid increase of energy prices to world levels and tariffs (including the elimination of the cross-sector subsidies in electricity and gas tariffs). More efficient energy use would offset to a large extent the impact of gradually increasing prices on consumers. In particular, such reforms would be essential to attract the necessary investments. Furthermore, efficiency and lower energy intensity generate environmental benefits through reduced GHG emissions and local air pollutants. To this extent, climate policy can play a key role in stimulating investments in this area.

Barriers to investment in energy efficiency which are more specific to Russia include low energy prices, monopolistic structures and lack of consumer control. Due to the lack of metering equipment in most of Russia's older building stock it is difficult to assess how much heat is consumed. Furthermore, the lack of heat regulators or thermostats makes it impossible for residents to control the heat in their apartments – apart from opening their windows. Even if residents had some control over their heat consumption, the system of billing for heat on a per resident basis provides no incentive whatsoever for efficient end-use behaviour. On a more macro-economic level, the major barriers which continue to hamper investment include the lack of contract enforcement and an unstable investment environment. Mechanisms are needed to provide investors with greater stability and reduce the fiscal and legal risks of investments. A mechanism to ensure the terms of investment are not changed or a framework such as the one provided by an Energy Savings Company (ESCO)[4], could help minimise the risks of investing in energy efficiency.

The Kyoto Protocol could enhance the attractiveness of some energy-efficiency investments through the use of its "flexible mechanisms".

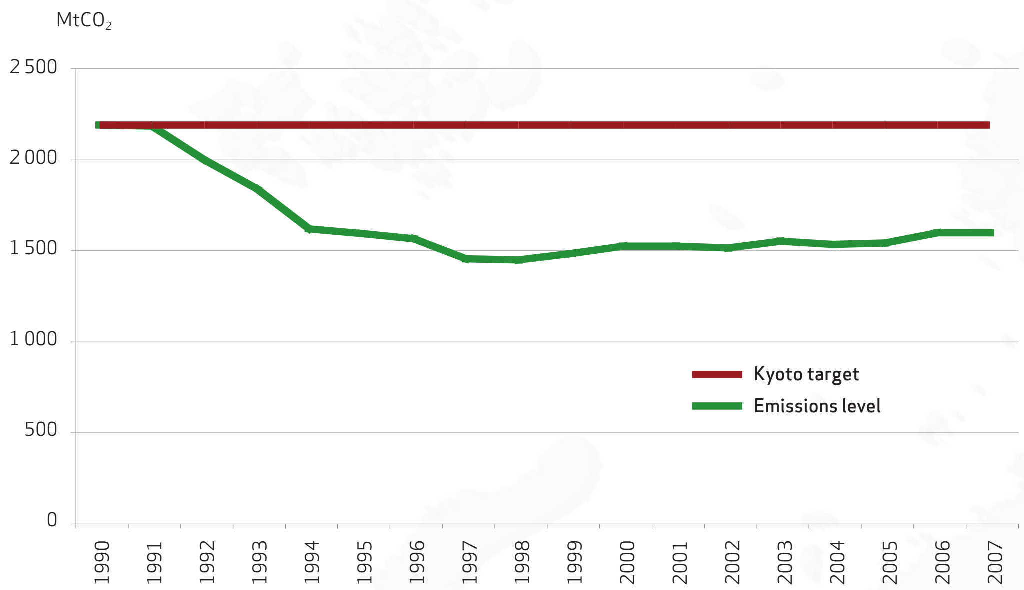
Climate Change Context

Russia's commitment under the Kyoto Protocol is to stabilise its emissions at 1990 level: its total greenhouse gas (GHG) emissions must not surpass this level during the five year period from 2008 to 2012. Russia's economy contracted sharply during 1990-1998 after the break-up of the Soviet Union causing carbon dioxide (CO_2) emissions to fall by 34% between 1990 and 1998. According to the latest preliminary IEA data, Russia's energy-related CO_2 emissions in 2007 represented over 1 500 $MtCO_2$, increasing by 10% from its lowest emission level in 1998. As reflected in Figure 2 below, Russia is expected to have a significant surplus of emission credits that it could either sell to other Kyoto Parties, or bank for future use. Even so, in 2007 Russia was still the world's third largest CO_2 emitter, after China and the United States.

4. An Energy Service Company or ESCO is a company that offers to reduce a client's energy costs, often by capitalizing the upfront expenditures and sharing the resulting future cost savings with the client.

FIGURE 2: ANNUAL RUSSIAN CO_2 EMISSION LEVELS

SOURCE: IEA STATISTICS



CHP Status

In Russia about 30% of heat is produced by combined-heat-and-power (CHP) plants.[5] Heat-only-boilers account for about 45% of total heat produced and decentralised sources (industrial or own-producers) account for the remaining share of heat produced. CHP is an integral part of Russia's district heating system, providing heat and hot water to most of Russia's urban population. Although there is a large share of heat produced by CHP in Russia, there is little available data on which to judge how efficient these plants are. Due to growing competition from decentralised sources of heat, many Russian CHP plants are run at only 40-45% of their capacity.[6]

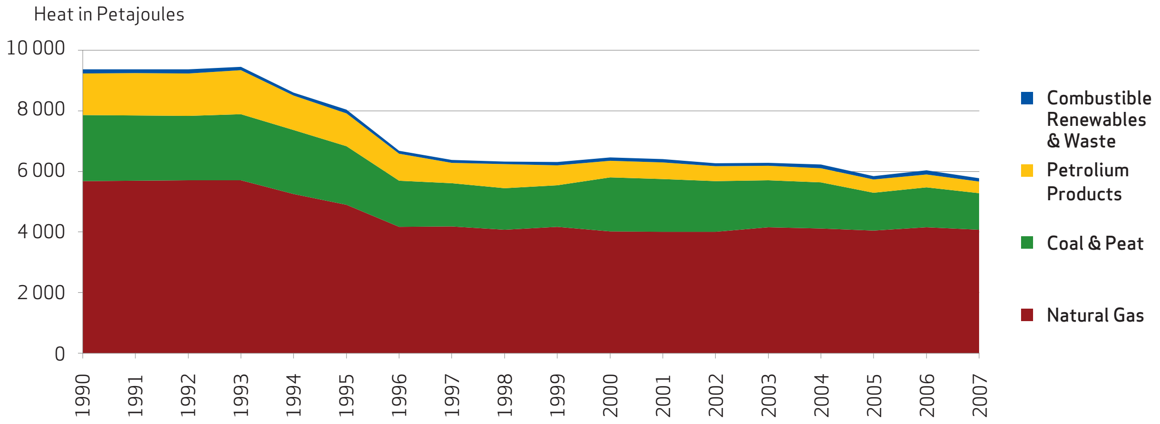
IEA data from 1990 to 2007 (in Figure 3 below), present the dramatic decrease in heat produced in Russia as a result of the decline in GDP growth over the market transition years of the 1990s. This lower output of heat has continued into this decade. This reflects an increasing use of decentralised heat systems as a more reliable source of heat or as a source of top-up heat when the DH system does not provide adequate supply. Generation from CHP plants over this time declined by more than 30%. In 2007, total final consumption of heat in Russia fell to 58% of its 1993 level. This was mainly due to a drop in heat consumption by the industrial sector by more than half, from 4 117 Petajoules in 1993 to 1 867 Petajoules in 2007. This fall occurred mainly over the 1990s when Russia's GDP almost halved during its transition to a market economy. Since 2000, the residential sector has seen its heat consumption drop by 38%. This is largely due to the lack of reliability of the DH systems and the fact that heat tariffs are calculated on a cost-plus basis. As the average cost of the heating system (operating and maintenance costs) increased, more clients found it economic to seek decentralised sources of heat.

Figure 3 also reflects the dominant share of natural gas as an input fuel to produce heat in Russia. CHP plants in the European part of Russia – where most of Russia's large urban population centres are located – are predominantly fuelled by natural gas (82-83%). In Siberia and the Far East, electricity and CHP plants are predominantly fuelled by coal (81-86%).

5. Igor Bashmakov (2008), *Analysis of Main Trends in the Development of Heating Systems in Russia*, Novosti Teplosnabzheniya, Vol. 2, pp.6-10, Vol. 3, pp. 12-24, Vol. 4, pp. 6-10.
6. Igor Bashmakov, presentation *Russian GDP Doubling, District Heating and Climate Change Mitigation* at the UNFCCC Workshop, Bonn, 2004.

FIGURE 3: FUEL USED TO PRODUCE HEAT IN RUSSIA, IN PETAJOULES, 1990-2007

SOURCE: IEA STATISTICS

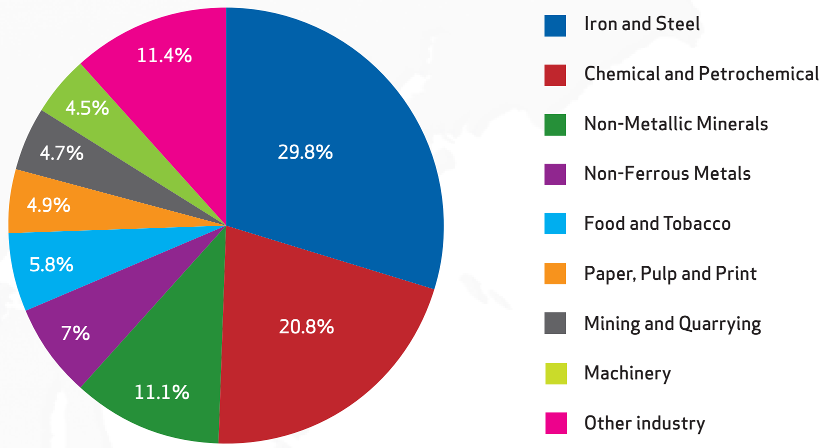


Industrial Applications

Russian industry is highly energy intensive. In 2007, the industrial sector accounted for 50% of total electricity demand, a higher share than most other countries. Given its suitability for energy intensive applications, just over half of Russia's 500 CHP plants are based within the industrial sector. Together, the iron and steel sector (30%) and the chemical and petrochemical sector (21%) accounted for over half the industrial heat consumption in Russia in 2007 (see Figure 4, below). A legacy of the central planning of the Soviet system is that many major cities in Russia were centred on a major industry and thus the heat from the CHP could supply heat to the DH system for the residential sector.

FIGURE 4: INDUSTRIAL ENERGY CONSUMPTION BY SECTOR IN RUSSIA IN 2007

SOURCE: IEA STATISTICS



District Heating Applications

Russia has the world's largest collection of district heating systems by far, with heat deliveries of about 1 700 TWh in 2007, almost 10 times more than the next largest system, Ukraine (with a level just under 200 TWh) and Poland (just under 100 TWh in 2007). Accurate information on end-use demand of Russia's district heating system does not exist due the lack of metering.

Over the period from 1998 to 2007, state CHP plants (part of the RAO UES state monopoly before the completion of the privatisation process) accounted for a declining share of heat produced in Russia, from a level of 35% to 31%. About 60% of all heat produced in Russia was consumed in the residential (about 45%) and commercial and public (about 15%) sectors. Just under three-quarters (74%) of heat supplied in Russia is through district heating networks with the other quarter of the heat supplied in Russia by decentralised / individual heat sources. District heating networks supply heat to about 80% of Russian residential buildings and about 63% of the hot water used by Russia's population.[7]

A large potential exists for energy savings in Russia's district heating systems[8], especially through the reduction of losses from the network and implementation of energy efficiency measures. Given an estimated 20-30% of heat is lost through the heat distribution network before it reaches the end consumer, focus on reducing these network losses will be an essential first step. Only after this stage is completed will the installation of meters and heat-regulating devices to allow for demand-side management be effective.

Case Study 1. Moscow Heat Supply System

Heat in Moscow is produced by 15 large combined-heat-and-power plants (CHPs), 70 district and local heating plants (DHPs and LHPs), and 100 local boilers (LBs). Table 17 shows their capacity and production.

THE MOSCOW HEAT-SUPPLY SYSTEM

Designation	Heat Capacity	Heat production	
	Gcal / h	Million Gcal	Percentage
Combined-heat-and-power plants	32 250	79.9	77%
District and local heat plants	13 700	22.7	22%
Local boilers	250	0.4	<1%
Total	46 200	103.0	100%

The primary heat / hot water network includes almost 2 300 km of pipes with an average diameter of 570 mm, and 21 booster pump stations. Inside city sub-districts, Mosgorteplo operates over 4 600 sub-stations and Mosteploenergo over 1 200. From the sub-stations, secondary networks transfer heating and domestic hot water to buildings. The secondary networks include some 4 400 km operated by Mosgorteplo and about 1 245 km operated by Mosteploenergo.

Equipment inside apartment houses includes a connection point in the basement; valves, filters, thermometers and manometers; pipes for heat and domestic hot water distribution; and radiators and/or convectors in individual apartments. Individual apartments generally have no meters, although the installation of building meters is beginning. Mosgorteplo recently completed installing meters in all the sub-stations it manages.

Source: www.mosgorteplo.ru and IEA (2002), Russia Energy Survey, OECD/IEA, Paris.

7. The rest of the population uses decentralized sources to heat water such as heat pumps, electrical means or in rural areas, coal or wood.
8. IEA (2004) *Coming in from the Cold: Improving District Heating Policy in Transition Economies*, OECD/IEA, Paris.

Small Commercial and Residential Applications

Since the early 2000s there has been increasing momentum in refurbishing existing boiler houses with gas turbines or smaller-scale industrial CHP units (capacity less than 25 MW). Most retrofitting to date used foreign technology. As of March 2007, about 120 of these units were operating across Russia. Bashkirenergo in Bashkortostan and Tatenergo in Tatarstan are the leaders in the use of micro or smaller-scale industrial CHP in Russia. These units have resulted not only in more efficient use of natural gas as an input fuel but also to a lower emissions and smaller impact on the environment. This trend to increasing use of smaller-scale, gas-fired CHP in Russia seems positive as efficiencies are likely to be over 80%. It is this level of efficiency that should be sought throughout Russia's installed CHP capacity.

Government CHP Promotion Policies

There has been limited government involvement in the development of CHP in Russia. A legacy of its Soviet past, CHP was an integral part of central planning and the vast DH network built to meet the heating and hot water needs of the Soviet people. Since the break-up of the Soviet Union and over the 1990s, lack of investment and government policy direction resulted in its deterioration. Despite this, very little government focus has been directed to the heat sector. The following sets out the related key laws and draft laws:

- *Draft Federal Law on Heat Supply* in the Russian Federation was developed in 2002 but has since not been passed by the Federal State Duma.

- *Draft Federal Law on the State Support of Mini-CHP stations* was developed in 2005 focusing on the regulations and support of small CHP stations in Russia. Consideration of this law was suspended due to lack of interest.

- Restructuring and privatisation of the electricity sector. The goals and objectives of the reform of the electricity sector were set out by the *Russian Federation Government Resolution No. 526 of July 11, 2001 on Restructuring the Electric Power Industry of the Russian Federation*. The conceptual implementation strategy (known as *The 5 + 5 Plan*) for the period 2003-2008 was adopted by RAO UES, the incumbent monopoly electricity company on May 29, 2003. On July 1, 2008 the reorganisation of RAO UES was completed and Russia's electricity sector was privatised. Throughout this process, the challenges faced by the heat sector were not addressed.

- *Draft Federal Law on Energy Efficiency* which has past 1st reading in the Duma and awaits its 2nd and 3rd reading in the Fall 2009 Session to be passed into law. The Russian President is calling for this law to be passed as quickly as possible.

CHP Barriers

Barriers to the future development of CHP in Russia are directly linked to the lack of focus by the Federal Government on the many challenges facing Russia's heat sector itself. These include the need for:

- refurbishment of the ageing district heat supply network to reduce system losses and enhance reliability;
- heat tariffs to cover the full cost of supply;
- promotion by government of high efficiency industrial CHP; and
- a coordinated and long term strategy and policy outlook for the heat sector.

The need to refurbish the ageing district heat supply network to reduce system losses and enhance reliability

With the evolution of federal, regional (Russia has 83 regions or Subjects of the Federation) and municipal governments undergoing major changes in responsibility and relationship over the 1990s, government services, including the responsibility "to provide heat for local residents," were transferred to most municipalities between 1993 and 1998. By 1998, these services were supposed to be fully covered by the municipal budgets. However, these were not large enough to finance all expenses. Given that municipalities were not allowed to create their own tax basis, they could not generate enough resources to modernise and maintain operation of urban networks.

Due to the lack of investment and maintenance over the 1990s, the key challenge facing Russia's heat sector today is to refurbish and modernise up to 70% of its system.[9] With a district heating supply network encompassing more than 200 000 km of pipelines, this is no easy task. Russian experts estimate that about 25% of the system is in critical condition and could lead to major blow-outs. It is estimated that at least 10-12 % of Russia's district heating pipeline network needs to be refurbished every year. In actual fact though only about 1 % of the system is refurbished annually. This low refurbishment rate has led to low reliability of the network and high frequency of failures ranging from 0.5 to 5 accidents per kilometre per year – a level an order of magnitude larger than heating systems in Western Europe.

Refurbishment of District Heating Systems in Russia: A Matter of Life and Death

On the morning of January 1, 2003, residents of Tihvin, the small town in the Northwestern part of Russia, woke up in deadly frozen apartments. A series of heat system disconnections were caused by the severe low outside temperature that dropped below – 40° Celsius (– 40° F) before New Year's Day. Around 75 000 people were left without hot water and heat. Even though the government took prompt actions to restore the city's heating networks and in-house pipes, the work was not completed until February 13, 2003.

IEA statistics[10] show losses along Russia's heat system ranging between 5 and 7%. However, this does not reflect the whole picture, as the methodology used in calculating transmission losses does not include losses of heat which are produced but not sold. Russian energy experts[11] estimate heat losses are in the range of 20% to 30% due to the heat lost in the heat distribution network. These losses are assigned to final consumption in many cases and due to the lack of meters there is no way to check what is actually consumed. This is reflected in Table 1 below.

TABLE 1:

RUSSIAN HEAT MARKET MAJOR INDICATORS IN THE 2005/2006 HEAT SUPPLY SEASON

Indicator	Units	Volume
Combined heat and power plants	Units	485
– Including CHP of RAO UES of Russia	Units	242
Large boilers	Units	>190 000
Individual heat generators and boilers	Units	>600 000
Central heating points	Units	>22 000
Heat generation	Million Gcal	2 300
Own use	Million Gcal	74
Distribution losses	Million Gcal	442
– through insulation	Million Gcal	400
– through leakage	Million Gcal	42
Distribution losses	%	20%
Heat networks	1 000km	183
Final heat consumption	Million Gcal	1 784
Fuel efficiency	%	71.5
Total energy inputs to heat generation	Million toe	323
Heat tariffs, average	USD/Gcal	20
Heat tariffs, range	USD/Gcal	5-100
Heat sales	USD billion/year	36
Potential savings from efficiency improvements	USD billion/year	10

Source: Urban Heating in Russia: Experience from the Transition and Future Directions, Alliance to Save Energy, Municipal Network for Energy Efficiency (MUNEE), 2007 available at http://ase.org/uploaded_files/munee/Russia_UH_Analysis.pdf

The need for heat tariffs to cover the full cost of supply

Heat costs and tariffs in Russia vary widely from USD 4 to 250 per Giga calorie (Gcal). The prices for heat provided by regional power utility companies are set by Federal Tariff Service, a government agency. Because residential and commercial customers do not have meters, they are typically charged by a formula based on floor space, with the charge frequently included in their rent. Heat prices are set for a two year period in the form of a minimum floor and a maximum cap. This provides some predictability of heat price evolution. The final price level is established by Regional Energy Commissions (RECs). These commissions also set prices for heat generated by industrial CHP and boilers. As a rule, municipalities are not responsible for setting heat prices any more. The heat tariff setting system was changed at the end of 2005 with the cap in the growth of heat tariffs established for each region by the Federal Tariff Service, to control the level of national inflation.

To ensure the long-run operation of the system, final consumers will need to pay tariffs that cover their full costs. Billing should eventually be based on actual consumption and not on size of dwelling, although the lack of individual metering and control systems will make this difficult in the foreseeable future. The cost of installing meters and heat regulators is yet another barrier to the process, especially given the low incomes of many Russian residents. In the meantime, existing tariffs based on floor space should be increased. Ideally, before heat tariffs are increased, priority should be given to installing meters and heat-regulating devices to allow consumers to regulate consumption. Financial support to heat consumers will be more efficient if provided directly to those most in need, rather than subsidising all heat prices.

The need for government to promote high efficiency industrial CHP

Russia's industrial CHP is largely a legacy of its Soviet past, given the strong system of central planning promoted the establishment of industrial cities fuelled by large CHP plants. Since the collapse of the Soviet Union there has been very little government focus on CHP development or any strategy or longer term perspective. Based on experiences across its member countries, the International Energy Agency concludes that governments need to do more to promote industrial CHP with overall efficiency thresholds of 70% or greater. This has been done in the US and more recently by the European Union through its CHP Directive (2004/08/EC). Another measure to promote industrial CHP is heat planning by putting industrial and DH customers near one another; this is being considered in countries like the United Kingdom (IEA UK CHP Scorecard, available at http://www.iea.org/G8/CHP/docs/UK.pdf).

The need for a coordinated and long term strategy and policy outlook for the heat sector

In Russia today, there is a mosaic of different institutional models and settings in Russian district heating markets/ municipal district heating systems across the country.[12] The share of the private sector in the district heating system (DHS) ranges from 100% to none, and declines as one goes along the heat supply chain from generation to distribution. Municipalities predominantly own DHS facilities, and are increasingly leasing them to private operators. In some cases they transferred ownership of some parts of DHS to private companies. Sometimes municipal DHS facilities are sold to cover debts for heat provided by public power utilities.

Government policy – both at the federal and municipal levels – plays an important role in the long-term sustainability of Russia's district heating system. Unfortunately, to date the focus in this sector has been on isolated investment and technology fixes without considering the broader need for market reform and policies to support the sector's sustainability. Focus has been on the electricity sector reform process with hardly any attention given to the heat sector. A draft Law on the Heat Sector was prepared in 2002 but was not considered in the Duma and has since been left aside. It attempted to resolve the problem of the insolvency of the heat sector, the issue of losses and to whom they should be attributed, the need to refurbish 100 000 km of old pipes and to raise tariffs to cost covering levels despite the population not being able to regulate their consumption of heat.

9. V.A. Rijenkov, presentation at IEA-FASI Workshop on Energy Efficiency in Buildings, June 2009 (see http://cert-energy.ru/catalog.aspx?CatalogId=798&d_no=1170).

10. According to IEA methodology, heat production represents all heat production from public CHP and heat plants as well as heat sold by autoproducer CHPs and heat plants to third parties. Fuels used to produce heat for sale are recorded in the transformation sector under CHP and heat plants. Fuels used to produce heat which is not sold is recorded under the sectors in which the fuel use occurs. The production of heat from boilers and heat pumps also reflectonly the quantities of heat that is sold. Therefore, transmission losses according to IEA methodology do not include losses of heat, for heat produced but not sold.

11. V.A. Rijenkov, presentation at IEA-FASI Workshop on Energy Efficiency in Buildings, June 2009 (see http://cert-energy.ru/catalog.aspx?CatalogId=798&d_no=1170).

12. Energy Saving Cooperation in the Baltic Sea Regions (2007), Energy System in Russia Report, available at www.esprojects.net/en/projects/escobalt/reports/nationalsystem/.

Stakeholders

Government

Despite the importance of the heat sector in Russia, there is not one federal government authority responsible for its effective and efficient management and development. Ministries and Services with general responsibilities touching on the heat sector include:

The Ministry of Energy is responsible for the development and implementation of national energy policy and regulations in the country's fuel and energy sector, including power, oil production and refinery, gas, coal, gas and oil pipelines and renewables. The Ministry delivers public services and manages state assets related to the production and use of energy resources.

The Ministry of Regional Development is the federal enforcement authority that develops state policy and regulations related to social and economic development of the regions of Russia including the municipalities, particular with respect to housing and communal services.

The Federal Tariff Service is an executive body authorised to exercise legal control in price and tariff regulation for goods and services in compliance with the Russian Federation legislative acts as well as the control over their implementation except price and tariff regulation that is within jurisdiction of other federal executive bodies. Also the Federal Tariff Service is a federal executive body that regulates natural monopolies in which case its functions encompass price (tariff) determination (setting) and control over issues related to price (tariff) determination (setting) and application in the business of natural monopoly agents.

The Federal Environmental, Industrial and Nuclear Supervision Service of the Russian Federation (RosTechNadzor) is a federal regulatory authority, which controls and supervises activities in different areas including industrial safety and environmental protection (mitigation of negative technology impact on the environment). It has the responsibility to keep a register of industrial enterprises based on their environmental impact and establish emission limits for them; to monitor how companies and individuals comply with environmental legislation and safety regulations and impose fines; and to carry out safety regulations reviews.

Non-Government Organizations

The Russian Heating Supply Partnership created in 2003 as a non-profit organisation. It represents over 100 non-governmental organisations in the residential sector such as the Russian Association of Energy Utilities, the Inter-regional Association of energy managers, companies focused on district heating, associations of engineers focused on heat and ventilation, regional associations and academic groups. The Partnership organises workshops and events to promote efficiency and reliability of central heating systems and to establish effective interaction between its members and the government and auditors responsible for upholding the quality of heat supply. (For more information see http://nprt.rosteplo.ru/).

The Integrated Energy Systems (IES) was established in 2008 as a non-profit organization by the Council of Electrical Energy Producers and Strategic Investors. IES-Holding is focused on creating a vertically integrated company to produce heat and power and to supply power, heat and gas. (For more information see http://www.ies-holding.com/eng).

CHP Potential and Benefits

Russia has the largest heat network in the world, a legacy of its Soviet past. Were it to use this to its advantage, through a long-term policy outlook to refurbish and maintain, effectively cost and price the heat and allow end-users to regulate and reduce their consumption through regulators and monitors, Russia's heat sector could flourish with all the related benefits this would bring in terms of energy savings, reduced impact on the environment, heightened energy security and comfort and quality of life of Russia's population.

Russia consumes the equivalent of about 150 bcm of natural gas a year in its district heating system. Raising the efficiency of its CHP plants and reducing the losses along its district heating network could save about 20-30% or 30-50 bcm a year. In 2004, an IEA Study *Coming in From the Cold* estimated that with a stronger policy framework, DHS in transition economies[13] could save in generation alone the equivalent of 80 bcm of natural gas a year – roughly the annual gas consumption in Germany. Raising heat tariffs and providing consumers a way to regulate their heat intake would generate additional savings, difficult to quantify given the lack of meters and statistics on end-use heat demand in the residential sector.

13. *Coming in From the Cold*, included the following countries as transitions economies: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Georgia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Kazakhstan, Kyrgyzstan, FYR Macedonia, Moldova, Montenegro, Poland, Romania, Russia, Serbia, Slovak Republic, Slovenia, Tajikistan, Turkmenistan, Ukraine and Uzbekistan).

Summary Policy Recommendations

Cost Reflective Tariffs

Heat tariffs should be cost-reflective. As with electricity, heat tariffs should cover full costs in order to maintain the longer-term viability of the system. Ideally, before heat tariffs are increased, priority should be given to installing meters and heat-regulating devices to allow consumers the ability to regulate their consumption. In Russia's older building stock there are no meters or thermostats. In most cases, installing heat meters and thermostats will be very costly with a long payback period. Financial support to heat consumers would be more efficient if provided directly to those most in need, rather than subsidising all heat prices.

Refurbishment of the Heat Supply Network

Higher heat tariffs would help to cover maintenance costs necessary to allow for adequate refurbishment of heat supply networks across Russia's district heating systems. As the maintenance of the systems improve, the overall efficiency of the system would improve with significant saving in heat losses. In 2009, the refurbishment of the heat network of the Mitish suburb of Moscow led to the reduction of heat losses from 30% to only 12%. Were this to be extrapolated across the whole of Russia, this would equal a savings of almost 20% in input fuel to the heat sector or 30 bcm of natural gas. During the transition period to cost-covering levels of heat tariffs, perhaps an ESCO-type arrangement could be established to provide incentives to municipal and private DHS operators to refurbish the network and be paid back through a share of the revenues from natural gas exports from the volumes saved through the refurbishment process.

Development of a Strategy

Russia would benefit from a long-term outlook of the heat sector with clear policy formulated to guide this sector's development over the next 20 years. The current policy experience characterised by isolated investment and technology fixes without considering the broader need for market reform and policies to support the sector's sustainability has led to a situation where Russia's heat supply is unreliable and inefficient. The IEA study, Coming in from the Cold (IEA, 2004) provides useful policy guidance on enhancing the viability of district heating systems using concrete examples of situations in countries with economies in transition. The book is available in English and Russian.

A coordinated strategy is needed in Russia to promote high-efficiency CHP both in terms of residential and industrial applications. The strategy should include widespread, stable financial and fiscal support for district heating system investments that reflect the full value of the long-term environmental and economic benefits. For example, grants, low-interest loans, accelerated depreciation, and tax exemptions can be used to assist potential investors in overcoming the additional up-front costs for district heating systems. Significant additional potential is likely to exist for industrial CHP in Russia, across a number of energy-intensive sectors. The Russian government should conduct a technical and economic assessment of CHP potential in key sectors, and publish the results to a wide audience. This assessment should identify market barriers (e.g., access to the electricity grid for selling power output) and financial challenges that may exist.

Capacity-building is another common element of long-term strategies. Outreach and education programmes towards potential users and implementers can highlight the benefits of additional investments. R&D with broad applicability across the mosaic of DHS systems in Russia can reduce implementation, maintenance, and training costs.

Identifying a Champion to Promote High Efficiency Industrial CHP

The IEA's assessment of policies and measures that have worked across its 28 member countries and other key partners in dialogue points to the need for governmental definition of high efficiency CHP. The experience in countries such as the UK and in the European Union (EU) reflects much benefit from a clear definition and target. In an effort to raise the efficiency of CHP plants, the EU Cogeneration Directive (2004/8/EC), Article 11 established a comprehensive legal framework for encouraging efficient CHP development across the EU. The Directive defines high efficiency CHP by the energy savings obtained by combined production instead of separate production of heat and electricity. Energy savings of more than 10% qualify for the term 'high-efficiency cogeneration'. To maximise the energy savings and to avoid energy savings being lost, the greatest attention must be paid to the functioning conditions of cogeneration units. In 2000, the UK Government CHP Quality Assurance scheme provided a methodology for assessing the quality of CHP schemes in terms of their energy efficiency and environmental performance. The IEA believes Russia would be well served to follow such examples – especially given its massive installed capacity of industrial CHP compared to many other countries.

Assigning the responsibility for CHP and DH to a federal agency would go a long way toward addressing coordination and implementation issues in Russia. This federal agency would:

- collect CHP/DH data;
- assess potential for efficiency improvements through refurbishments of existing plants and construction of new facilities;
- identify barriers to development; and
- set targets for "good quality" efficient CHP/DH.

This type of dedicated CHP/DH "champion" would make the above recommendations more likely to be successful. Further, given the diversity of current efforts in Russia, there appears to be a strong need for a CHP/DH champion to develop a long-term strategic framework for addressing these complex issues.

The International CHP/DHC Collaborative

The **International CHP/DHC Collaborative** was launched in March 2007 to help evaluate global lessons learned and guide the G8 leaders and other policy makers as they attempt to assess the potential of CHP as an energy technology solution.

The Collaborative includes the following activities:
- collecting global data on current CHP installations;
- assessing growth potentials for key markets;
- developing country scorecards with data and relevant policies;
- documenting best practice policies for CHP and DHC; and
- convening an international CHP/DHC network, to share experiences and ideas.

Participants in the Collaborative include public and private Partner organisations and other government, industry and non-governmental organizations that provide expertise and support. The Collaborative Network, the larger group that is informed about meetings, publications and outreach, has over 350 participants.

If you are interested in participating in the Collaborative, please visit www.iea.org/G8/CHP/chp.asp.

The **IEA District Heating and Cooling Programme** (IEA DHC) is the major international research and development programme for district heating and cooling. It functions within the IEA's Framework for International Energy Technology Co-operation. The programme conducts highly effective Research and Development as well as policy analysis of District Heating and Cooling systems with low environmental impact through international collaboration. Established in 1983, IEA DHC currently has nine participant countries: Canada, Denmark, Finland, Korea, Netherlands, Norway, Sweden, UK and USA. For more information, visit www.iea-dhc.org.

Acknowledgements

The principal authors of this report are Isabel Murray and Nataliia Denysenko of the IEA's Directorate of Global Energy Dialogue (GED), under the guidance of Tom Kerr (Directorate of Sustainable Energy Policy and Technology) and Ann Eggington (GED). The paper draws on technical input from a Russian expert consultant Vyacheslav Puzakov from OOO Izdatelstvo "Novosti Teplosnabgenija". Thanks are also due to Jerome Garcia of the IEA's Energy Statistics Division for his support and input. We also thank Luise Valentiner who prepared the layout of the report.

Questions and comments about this document should be sent to:

Tom Kerr
International Energy Agency
9, rue de la Fédération
75739 Paris Cedex 15
France

Email: tom.kerr@iea.org