EU-Russia energy dialogue and Russia's energy strategy – the vital role of energy efficiency

Bernard Laponche
26, rue Richer, 75009 Paris, France
blaponche@iceconsultants.com

Théodore Filimon
filimont@club-internet.fr

Bessarion Jghenti
bessarion@hotmail.com

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Abstract
The EU-Russia Energy Dialogue aims at establishing a permanent partnership in the energy sector in order to ensure that the exploitation of Russian energy resources would allow the economic development of Russia while providing sufficient energy exports to the EU.

Russia's Energy Strategy Outlook to 2020 is based on a 5% per year GDP growth, associated with strong structural changes in the economic activities and a vigorous energy efficiency policy, leading to a sharp decrease in energy intensity. The resulting low growth of domestic energy demand, combined with an increase in energy production and a decrease of the share of natural gas in power production, preserves a high potential for oil and natural gas exports in 2020, compatible with the future EU energy imports requirements and security of supply.

The IEA Russia Energy Outlook to 2020 is based on a much lower economic growth and a limited decrease of energy intensity. The share of natural gas in power production remains high. IEA underlines the financial effort necessary to increase oil and gas production in order to maintain a high level of energy exports.

Both outlooks are fundamentally different, by their assumptions and their results. Their analysis illustrates the challenge faced by the Energy Dialogue. One major issue of this comparative analysis is that the common conclusion of both forecasts is the necessity of a strong energy efficiency policy to reach the compatibility of economic development and energy export capacities for Russia in the future. Co-operation with Russia on energy efficiency should accordingly be a first priority in the EU strategy to ensure its future energy security.

A brief presentation of recent developments of energy efficiency in Russia and the EU-Russia co-operation in this field shows that the situation is far from satisfactory.

Introduction
The European Union, with its current fifteen member States, is the second largest energy consumer after the United States and the largest net energy-importing region in the world in absolute terms, importing half of its needs. In particular, EU imports around 40% of its natural gas production from Russia. At the opposite, Russia is the third largest oil producer in the world, after Saudi Arabia and the United States, and the second largest exporter of oil and oil products, as well as the largest producer and exporter of natural gas. Energy trade is then a major issue of the EU-Russia relationship.

The Energy Dialogue between the European Union and the Russia Federation was launched in October 2000. Its main objective consists in establishing a permanent partnership in the energy sector in order to ensure that the exploitation of Russian energy resources would allow the social and economic development of Russia while providing a sufficient level of energy exports in direction of the European Union, notably of natural gas.

Table 1. Energy consumption per capita and energy intensities (year 2000).

	EU	Russia
GDP (billion 1995 $, ppp)	8 241	1 086
Population (million)	377	145
GDP / c. (1000, 1995 $, ppp)	21.9	7.5
TPES (Total primary energy supply) - Mtoe	1 456	615
TPES / capita – toe	3.86	4.24
PEI (primary energy intensity) - toe/1000 $	0.177	0.566
TFEC (Total final energy consumption)* - Mtoe	957	370
TFEC/capita – toe	2.54	2.55
FEI (Final energy intensity) – toe/1000 $	0.116	0.341
EG (Electricity generation) - TWh	2 572	876
EG per capita – 1000 kWh	6.82	6.04
EGI (electricity generation intensity) – kWh/$	0.312	0.807

Source : IEA
** See detailed data in Appendix.*

The quality of the Energy Dialogue and the robustness of its output depend on the mutual agreements on the rules for energy investments and energy trade and also on a comprehensive knowledge and understanding of the perspectives of the Russian energy system (production and consumption) in the next few decades.

Russia's energy outlook was presented by the Russian Government in the document "Main elements of the energy strategy of Russia to 2020", and by the International Energy Agency in two recent publications: "Russia energy survey 2002" and "World energy outlook 2002". Both perspectives lead to the conclusion that a sufficient amount of oil and gas production in Russia should be available for export to the European Union during the next decades. However, the assumptions of the two exercises, and their results in terms of energy production and consumption differ considerably, while both forecasts recognise the necessity of a strong energy efficiency policy to ensure the compatibility of economic development and energy export capacities for the Russian Federation in the future.

After a brief presentation of the EU's and Russia's energy situations (section 1), this paper analyses the Russia Energy Strategy and the IEA Russia Energy Outlook (section 2). The discrepancies between the two projections and their potential influence on the EU-Russia co-operation in the energy sector are discussed in section 3.

Contrasted energy contexts

GLOBAL ENERGY DEMAND INDICATORS SHOW POOR ENERGY EFFICIENCY IN RUSSIA

Two indicators allow to compare globally the energy consumption of countries: energy consumption per capita and energy intensity, ratio of energy consumption over Gross Domestic Product (GDP). The GDP is measured in purchase power parity terms (here in 1995 $US at 1995 prices).

The values of these two indicators, for EU and Russia and for the year 2000 are presented in Table 1.

The difference between consumption systems is striking. With a GDP per capita three times lower than that of the EU, Russia's primary and final energy consumption per capita are slightly higher than the EU's and the electricity generation per capita is only 11% lower.

The high level of energy consumption per unit of GDP is confirmed by the values of the primary and final energy intensities, which are three times higher than the EU's; for electricity generation intensity, the factor is 2.6.

Part of this enormous difference in energy intensities is due to the climate, another part can be explained by the structure of the Russian economy, with a high proportion of heavy industries, but the bulk is due to the poor efficiency of energy production, transformation and end-use at consumer level, a fact which is confirmed by all sectoral analyses.

This situation is explained by the legacy of the former USSR system, by a continuous situation of low energy prices on the domestic market, and the low level of energy efficiency investments in both supply and demand.

THE CONSUMPTION PATTERN

Final energy consumption

Table 2 gives the shares of final energy consumption by sector and by products for the EU and Russia, for the year 2000.

The importance of "Heat" in Russia comes from the large development of district heating (mostly using natural gas and coal).

The largest gap is in "Transportation", which represents one third of total final energy consumption in the EU and only 14% in Russia[1].

Primary energy consumption

Table 3 gives the shares of primary energy consumption for the EU and Russia, for the year 2000.

Oil ranks first in the EU with a 40% share. In Russia, natural gas has a prominent position with 60% of the total primary energy consumption.

Electricity generation

Table 4 compares the sources for power generation.

In Russia, natural gas ranks first with 42% of power generation, followed by coal, hydro and nuclear (nuclear actually produces less electricity than hydro: Table 3 in Mtoe is misleading because of statistical conventions). In the EU, nuclear ranks first, followed by coal, gas and hydro.

ENERGY EXCHANGES

The EU produces almost 50% of the coal, 27% of the oil and 56% of the natural gas it consumes.

The origin of the main imports into the EU were, in 1999 :

- For oil : 36% from Middle East, 22% from Norway, 21% from Africa and 16% from Russia.
- For natural gas : 41% from Russia, 29% from Algeria, 25% from Norway.
- The main Russian energy exports were, in 2000, 188 Mtoe of oil and 165 Mtoe of natural gas.

The Russian Strategy and IEA Energy Outlooks

Russia's energy outlook is presented in the official document "Main Provisions of the Russian Energy Strategy to 2020" approved by the Russian government in November 2000 and published by the Russian Ministry of Energy in 2001. The data of the Russian Energy Strategy Outlook are those presented in the framework of the EU-Russia Energy Dialogue. The IEA Energy Outlook figures for Russia are those presented in the IEA document "World Energy Outlook 2002", published in 2002.

We present here the two Energy Outlook exercises in parallel, in order to show, step by step, their similarities or discrepancies.

ASSUMPTIONS ON ECONOMIC GROWTH

The Russian strategy is based on two scenarios:

- The "optimistic" scenario, where economic, fiscal and price reforms are undertaken effectively and efficiently and with no major disturbances on international energy markets. In this scenario, the average GDP growth over the period 2000-2020 is 5% per year.
- The "pessimistic" scenario, where problems arise on the domestic or international scene. In this scenario, the average GDP growth over the period 2000-2020 is 3.5% per year.

In the IEA outlook, GDP is assumed to grow 2.9% a year from 2000 to 2010 and 3.5% a year from 2010 to 2020.

Table 2. Final energy consumption – year 2000- Unit : Mtoe.

	EU	Russia
By Products		
Coal	3%	6%
Oil Products	47%	23%
Gas	24%	19%
Electricity	20%	14%
Heat	2%	37%
Renewables	4%	1%
TOTAL (Mtoe)	**957 Mtoe**	**370 Mtoe**
By sector		
Industry	27%	36%
Transportation	33%	14%
Other Sectors*	40%	50%

Source : IEA. See Appendix 1
**Residential, tertiary, agriculture.*

Table 3. Primary energy consumption – year 2000.

	EU	Russia
Coal	14.6%	18.0%
Oil	40.6%	21.1%
Natural Gas	23.3%	52.0%
Nuclear	15.5%	5.5%
Hydro	1.9%	2.3%
Other renewables	4.1%	1.1%
TOTAL (Mtoe)	**1 456 Mtoe**	**615 Mtoe**

Source : IEA

Table 4. Electricity generation – Year 2000.

	EU	Russia
Coal	27.4%	20.1%
Oil	6.3%	3.8%
Natural Gas	17.5%	42.1%
Nuclear	33.5%	14.0%
Hydro	12.4%	18.7%
Other renewables	2.9%	0.3%
TOTAL (TWh)	**2 572 TWh**	**876 TWh**

The IEA outlook goes up to 2030, with a 2.6% annual GDP growth during the last decade, but our comparison is limited to the 2000-2020 period since the Russian strategy does not look beyond 2020.

Table 5 gives the GDP values for the three scenarios, as well as the IEA Outlook values for the European Union for the same period (the assumptions on GDP annual growth are : 2.3% per year from 2000 to 2010; 2% from 2010 to 2020 and 1.6% from 2020 to 2030). For all scenarios, the GDP are measured in "purchase power parity" (ppp) terms, in 1995$US, at 1995 prices.

1. In the Russian and IEA statistics, the share of the "Transportation" sector is higher. This is due to the fact that the energy consumption of this sector includes natural gas consumption for transport of natural gas. In Table 2, this consumption is not included.

Table 5. GDP growth from 2000 to 2020.

		2000	2010	2020
Russian population* (million)		145	137	129
EU population* (million)		377	378	373
Russian Strategy				
Optimistic scenario	GDP billion $	1 086	1 740	2 793
	GDP/c. $	7 490	12 701	21 651
Pessimistic scenario	GDP billion $	1 086	1 540	2 161
	GDP/c.	7 490	11 241	16 752
Russia IEA				
	GDP billion $	1 086	1 445	2 039
	GDP/c.$	7 490	10 550	15 805
EU (IEA)				
	GDP billion $	8 241	10 345	12 610
	GDP/c. $	21 859	27 367	33 807

** IEA Outlook 2002 (– 0.6% over 2000-2030).*

In the Optimistic scenario, the GDP per capita of Russia in 2020, about 22 000 $US, would be equal to the GDP per capita of the EU in 2000 and two thirds of its value in 2020.

In the Pessimistic scenario, the GDP per capita of Russia in 2020, about 17 000 $US, would be lower by 25% than EU's GDP per capita in 2000.

The IEA Outlook GDP per capita of Russia in 2020, about 16 000 $US, would be lower than that of the Pessimistic scenario, and less than half the EU value at this date.

Since we can assume that the Optimistic scenario represents the political objective of the Russian Government, i.e. the scenario which corresponds to a true economic and social development of the country, we see that there is a deep discrepancy on GDP growth between the Russian Strategy and the IEA Outlook.

The first fundamental discrepancy between the Russian Strategy and the IEA Energy Outlook is the difference on the economic growth assumptions.

PRIMARY ENERGY CONSUMPTION

The results on primary energy consumption of the forecast exercises of the Russian Strategy, Optimistic scenario, the IEA Outlook for Russia and for the EU are shown in Table 6, with the corresponding energy intensities (ratio of the energy consumption over GDP).

The primary energy consumption in 2020 differs only by 4% between the Russian Strategy and the IEA Outlook, in spite of the 30% difference in GDP for the same year.

The Russian Strategy Outlook is based on the assumption that the energy intensity would decrease by a factor of 1.8 from 2000 to 2020, i.e. at an average rate of 3% per year.

With an energy intensity remaining at its 2000 level (0.57), the total primary energy consumption of Russia in 2020 would be 1 590 Mtoe, i.e. 710 Mtoe above the Russian Strategy value for the same year (880 Mtoe).

The Strategy considers that this "gain" in energy consumption would be obtained:

- About two thirds through structural changes of the Russian economy.
- About one third through energy efficiency policies, measures and investments, both in energy supply and demand.

The IEA Outlook is much less optimistic concerning the improvement of energy intensity: it assumes that it would decrease only at a rate of 1.4% per year on average, through structural changes in the economy and the energy sector.

The comparison with the EU's energy intensity presented also in Table 6 for 2000, 2010 and 2020, as forecast by the IEA ("World Energy Outlook 2002"), shows that the gap between Russia and the EU, of a factor 3.2 in 2000, remains at the same level in 2020 in the IEA Outlook, while it decreases to 2.3 in the Russian Strategy Outlook.

It is interesting to note that, in the IEA Outlook, the energy intensity of the region "United States and Canada" is 0.26 toe/1000 $ in 2000 and decreases to 0.23 in 2010 and 0.19 in 2020, far below Russia's level.

The second fundamental discrepancy between the Russian Strategy and the IEA Energy Outlook lies on the assumptions regarding energy intensity.[2]

Table 6. Primary Energy Consumption.

	2000	2010	2020
Russian Strategy (Optimistic)			
Total Primary Energy Consumption (Mtoe)	615	733	880
Energy Intensity (toe/1000$)	0.566	0.421	0.315
IEA Outlook for Russia			
Total Primary Energy Consumption (Mtoe)	615	737	844
Energy Intensity (toe/1000$)	0.566	0.510	0.414
IEA outlook for EU			
TPES (Mtoe)	1 456	1 625	1 729
Energy Intensity (toe/1000$)	0.177	0.157	0.137

2. And on electricity intensity, as is shown below.

Table 7. Electricity generation.

	2000		2010		2020	
	IEA	Strategy	IEA	Strategy	IEA	Strategy
Total generation (TWh)	876	876	1 052	1 065	1 405	1 375
Coal	19%	18%	20%	26%	15%	29%
Oil	4%	7%	3%	3%	2%	3%
Natural Gas	42%	42%	45%	39%	57%	34%
Nuclear	16%	15%	15%	15%	11%	21%
Hydro	19%	18%	16%	16%	14%	12%
Other renewables	0	0	1%	1%	1%	1%
GDP (billion $US)	1 086	1 086	1 445	1 740	2 039	2 793
KWh/$	0.80	0.80	0.73	0.61	0.69	0.49

ELECTRICITY GENERATION

Like primary energy consumption, the level of total electricity generation is not very different in the two Outlooks, but its structure is very different, with important consequences on the structure of the energy balance.

In the IEA Outlook, the share of natural gas increases from 42% in 2000 to 45% in 2010 and 57% in 2020. On the contrary, the part of natural gas in electricity generation decreases in the Russian Strategy from 42% in 2000 to 39% in 2010 and 34% in 2020.

The Strategy assumes a shift away from natural gas to coal (which increases from 18% to 29%) and, at a lesser degree, to nuclear (from 15% to 21%). The IEA Outlook considers both assumptions unrealistic.

The third fundamental discrepancy between the Russian Strategy and the IEA Energy Outlook resides in the evolution of the share of natural gas in electricity generation.

The difference in electricity intensity (ratio of total generation over GDP) is also striking. For the IEA, it decreases only from 0.80 in 200 to 0.69 in 2020 while in the Russian Strategy, it decreases to 0.49 in 2020.

IEA's projection that energy intensity would remain at such a high level in Russia raises questions since the same indicator is of the order of 0.32 in the EU in 2000 (and 0.27 in 2020 in the IEA Outlook). Here again, the gap between Russia and the EU remains very wide.

OIL AND GAS BALANCE

Russia is a large exporter of oil and gas, in particular in direction of the European Union.

One of the main outputs of both energy forecasts is the capacity of the Russian energy system to maintain the present level of oil and gas exports or even to increase it. Russia's future export capacities are the main issue of the EU – Russia Energy Dialogue.

In spite of the large discrepancies between the Russian Strategy and the IEA Outlook pointed out in the preceding chapters, the similarities of the two prospective exercises on Russia's export capacities for the next two decades are striking.

Natural gas exports

Table 8 compares the levels of Russia's domestic natural gas consumption, production and exportation in the Russian Strategy and the IEA Outlook.

The IEA Outlook foresees a high increase in natural gas production, from 472 Mtoe in 2000 to 709 Mtoe in 2020. In the Russian Strategy, the increase is much lower, from 471 Mtoe in 2000 to 564 Mtoe in 2020.

Domestic consumption is drastically different in the two projections, as we have seen above (in particular due to the electricity generation mix). However, natural gas exports, obtained by difference between production and domestic consumption, are much nearer in the two projections: they grow in both, from 157 to 188 Mtoe in the Strategy and from 153 to 238 Mtoe the IEA Outlook.

In both forecasts, Russian natural gas exports are expected to grow significantly and the European Union needs would be satisfied.

Oil exports

Table 9 compares the levels of Russia's domestic oil consumption, production and exportation.

The discrepancies between the two forecasts are less important for oil than for natural gas, they are nevertheless significant.

On oil consumption, the increase from 2000 to 2020 is by a factor of 1.7 in the Russian Strategy and 1.4 in the IEA Outlook. This can be explained by the difference in the economic growth rate but the IEA oil consumption increase seems to be small compared to the probable growth of energy consumption in the transport sector.

Since the oil production level in 2020 is higher in the IEA Outlook than in the Russian Strategy by 31 Mtoe, the resulting export capacity is significantly higher in the IEA's forecast: 281 Mtoe compared to 208 Mtoe in the Russian Strategy. For the IEA, the increase of oil exports between 2010 and 2020 is significant (a factor of 1.4), while the export level remains relatively stable in the Russian Strategy (a factor of 1.08).

CARBON DIOXIDE EMISSIONS

The carbon dioxide level, which constitutes the major part of greenhouse gas emissions, is an important issue since, under the Kyoto Protocol, Russia made a commitment to limit its average annual greenhouse gas emissions in the "performance period", 2008-2012, to their 1990 level.

While economic decline in the 1990s brought about a steep drop in CO_2 emissions, the Russian economy is still very carbon-intensive. The IEA values for CO_2 emissions was about 1 500 Mt of CO_2 in 2000 compared to about 2 200 Mt in 1990 (-30%). The IEA Outlook foresees that

Table 8. Natural gas exports in Mtoe.

	2000	2010	2020
Domestic consumption			
IEA	319	392	471
Strategy	314	344	376
Production			
IEA	472	574	709
Strategy	471	524	564
Exportation			
IEA	153	182	238
Strategy	157	180	188

Table 9. Oil exports in Mtoe.

	2000	2010	2020
Domestic consumption			
IEA	130	150	180
Strategy	132	176	222
Production			
IEA	329	435	461
Strategy	324	380	430
Exportation			
IEA	199	285	281
Strategy	192	204	208

Russia's energy related emissions would be about 1 830 Mt of CO_2 in 2010, i.e. 17% below 1990, despite a projected increase of 2.1% per year between 2000 and 2010. The CO_2 emission level would reach 2 060 Mt in 2020, still about 6% below the 1990 level.

The Russian Strategy level starts from a higher level of CO_2 emissions in 1990 (about 2 300 Mt) and gives a value of about 1 900 Mt in 2010 (17% below the 1990 value) and 2 200 Mt in 2020 (about 4% below 1990). The conclusion of both projections is that the emission level in 2008-2012 would still be significantly lower than the 1990 level. This would provide for Russia to host Joint Implementation projects or to sell surplus emissions as part of the emission trading system envisaged in the Protocol.

What if?

WHAT THE ENERGY FORECASTS SAY

The purpose of energy forecasts is to show us how, subject to a foreseeable economic evolution, the equation **"Production = Domestic Consumption + Net Exportations"** can be resolved in a satisfactory manner.

For both the Russian Energy Strategy and the IEA Outlook, maintaining or even increasing the level of oil and natural gas exports is an explicit objective and so is, for Russia, economic and social development. Although both the Russian Strategy and the IEA Outlook meet the first objective, because of the profound differences between the two, we are compelled to question their pertinence and plausibility.

The outcome of the Russian Strategy, in the "optimistic" scenario with a relatively high economic growth rate (+5% per year in average over the 2000-2020 period), which satisfies the objective of development, lies upon three main elements:

- a strong decrease in energy intensity (almost halved) due to the evolution of the economic structure (structure of the GDP, price adjustments, etc.) and to a vigorous energy efficiency policy, both demand- and supply-side, placed as a top priority of the Strategy;
- a modification of the structure of primary energy consumption through a strong shift from natural gas to coal, and to a lesser extent nuclear energy, for electricity generation;
- a relative increase in natural gas production capacities.

The conjunction of these three factors would ensure the satisfaction of domestic demand and a higher level of oil and gas exports in 2020 than in 2000 (for gas, around 190 Mtoe compared to 160; for oil, around 210 Mtoe compared to 190).

The IEA Outlook presents a quite different future:

- The economic growth rate is considerably lower: around 3% per year on average over the period.
- The energy intensity is only slightly modified (approximately a 20% decrease), essentially due to the structural evolution of the economy and the energy sector. No particular and voluntary effort to increase the efficiency of energy consumption is envisaged. The increase in energy demand is curbed due to a low economic growth but remains close to the level in the Strategy because of the poor improvement in energy intensity. Despite a lower economic growth rate, electricity consumption in the IEA Outlook is higher than in the Russian Strategy.
- Essentially for economic reasons, the IEA does not consider a shift from gas to coal and nuclear energy for power generation credible. As the level of electricity consumption in the forecast is high, the result is a level of domestic gas consumption much higher than that of the Russian Strategy (471 Mtoe compared to 376 Mtoe).

- The IEA projects a strong increase in Russian natural gas production, from 470 Mtoe in 2000 to 570 Mtoe in 2010 and 730 Mtoe (around 900 billion m^3) in 2020.

Thus, while domestic demand is higher, the exportation capacities are increased from 150 to 240 Mtoe for natural gas, and from 200 to 280 Mtoe for oil.

The export increase is higher in the IEA Outlook than in the Russian Strategy but the general tendency is the same: the essential is preserved.

DISCUSSION AND APPRECIATION OF THE HYPOTHESES

On economic growth

The high level of growth in the Strategy seems to be a legitimate hypothesis given the need for development in Russia and its capacities, if only in terms of energy and raw material resources. Moreover, the growth rate selected still places Russia's GDP per capita in 2020 far below that of the European Union.

IEA's Outlook chooses a lower growth rate which reflects a certain economic standing-still (and the perpetuation of difficult living conditions). On the contrary, one can certainly expect that to implement the significant investments needed to maintain the energy production sector afloat, and even to increase its capacities, as forecasted by the IEA, would have some impact on economic growth. This considerable financial effort for domestic or foreign investors implies that energy products can be sold on the domestic market at price levels that permit such levels of investment: for Russia, contrarily to certain energy-producing countries (oil producers, notably), the domestic market remains the main client for Russian production.

The investments that underlie the production perspectives adopted by the IEA Outlook are thus more plausible in the framework of a sustained economic growth.

On energy intensity

The strong decrease in energy intensity projected in the Russian Strategy has to be questioned. The Strategy supposes a 44% reduction, of which two thirds would be obtained through structural evolution and one third through energy efficiency. The IEA forecasts that structural evolution reduces the energy intensity by 20%. We could admit that a 25 to 30% decrease can be justified given the stronger economic growth rate used in the Strategy. The rest should be achieved by specific energy efficiency measures and investment.

The Strategy presents, in a detailed manner, the energy efficiency potential for energy consumption and production for each activity sector and energy product. The Strategy is accompanied by a Federal Programme, "An economy of high energy efficiency", for the period 2002-2005 and at the horizon 2010. The objective of this Programme is to implement the main elements of the Russian Strategy: to decrease the energy intensity of the Russian economy and to ensure the durable satisfaction of the country's energy needs.

The Programme is composed of three components: energy efficiency in the energy production sector, security and development of nuclear industry and efficiency of energy consumption. A detailed analysis of the third component shows that the financial efforts that the Federal Government intends to devote to end-use energy efficiency are quite low (3% of the total estimated budget) and that the main efforts are ascribed to the regions and cities (14%) and, moreover, to sources outside the public budget. Although the importance given to local and regional authorities is a legitimate objective, it is far from being an established fact and the allocation of sufficient public funds to a vigorous energy efficiency policy is even less certain.

The Programme is presented in more detail in the following section of this paper : "Elements on energy efficiency in the Russian Federation".

In the present situation, one cannot take for granted the implementation of an end-use energy efficiency policy: the indispensable elements of such a policy are yet lacking.

On natural gas

The second strong hypothesis of the Strategy is the reduced contribution of natural gas to power generation. One must surely agree with the IEA on the advantage of combined cycle natural gas turbines and thus seriously doubt, for economic and environmental reasons, the resurgence of coal and nuclear power plants projected in the Russian Strategy. However, one also has to question the considerable – and inexplicable – rise in electricity consumption forecast by the IEA.

THE WARNING SCENARIO

What would happen if we combined the hypotheses that seem the most plausible? The aim of this exercise is not to create another forecast, but to highlight the uncertainties linked to the two energy forecasts that we have just analysed.

Let us thus associate:

- the economic growth of the Strategy's "optimistic scenario", vital for Russia's economic and social development;
- IEA's hypotheses on energy intensity, which are likely given the poor energy efficiency policy;
- the evolution of gas production capacities developed in the Russian Strategy (many experts doubt the possibility to greatly increase Russia's production capacity due to the large investments required);
- IEA's forecasts on the structure of electricity production, and therefore on the part of natural gas in primary energy consumption.

Combining these hypotheses gives the results shown in Table 10.

The result is catastrophic: natural gas exports diminish and Russia becomes a natural gas importer at the horizon 2020.

Furthermore, with an energy mix like that of IEA's forecast, the primary energy consumption in 2010 (890 Mtoe) would lead to around 2 200 millions of tonnes of carbon dioxide emissions, i.e. the 1990 level: the "hot air" would have evaporated.

Table 10. The Warning scenario.

	2000	2020	2020
GDP (billion $)	1 086	1 740	2 792
Energy intensity (toe/1000 $)	0.566	0.510	0.432
Total primary energy supply - TPES (Mtoe)	615	890	1 200
Share of natural gas in TPES	52%	53%	56%
Natural gas domestic consumption	320	472	672
Natural gas production	471	524	564
Natural gas exports	**151**	**52**	**(-108)**

Such a scenario is obviously not conceivable in the medium term: how can one imagine that Russia could sustain a strong economic growth without energy exports? Nevertheless, this scenario has strong value as a warning beacon on a certain number of fundamental points for the European Union / Russian Federation energy dialogue:

It highlights the importance of the contradictions between the Russian Strategy and the IEA Outlook that we have underlined. A series of different but relatively plausible hypotheses knocks the results of both outlooks about. In the case of a forecast, this signals that the uncertainties are considerable.

At short-term, we could well imagine, in the absence of an energy efficiency policy, that Russia's economic growth is "pulled" by oil exports (the benefits of which are amplified by the current level of international crude oil prices) and results in a strong increase in energy consumption. The energy consumption in 2010 would then be higher than that envisaged in both the Russian Strategy and the IEA Outlook. In this case, the quantity of CO_2 emissions "free" to be used in the Kyoto mechanisms would be much lower than that currently forecast by both the Russians and the Western experts.

The current strategy of maximising natural gas exports is directly linked to the Russian domestic market situation (low prices, non-payments), which makes exports the only reliable source of revenue. As the Russian economy would evolve towards true prices, this strategy could be modified.

The Warning scenario brings to light an alternative of risks:

- If Russia wants to maintain its natural gas export capacities at all costs, domestic demand could be subject to strong tension, with grave social consequences.
- If domestic demand is the priority, the export capacity would diminish, which would curb economic growth, at least while the latter rests closely linked to energy exports.
- Then the global objective of the Russia / European Union dialogue, i.e. economic and social development and preservation (or increase) in exportations, would not be reached.

Elements on energy efficiency in the Russian Federation

The large discrepancy between Russia and EU energy intensities is explained by the Russian experts by:

- The difference in climate conditions.
- The difference in the structure of industry (a past focus on heavy, and military, industry); recent market incentives for export to heavy industry sectors (energy, metallurgy); the limited development of low energy intensive industrial sectors (machine production, electronic, food industry, etc.); the limited development of the tertiary sector.
- Waste in the use of energy: energy and heat loss, poor loading of power stations, low level of management.
- The low efficiency of industrial facilities, buildings, equipment and appliances; a large part of equipment, technologies, management practices are old and obsolete.

MAIN ENERGY EFFICIENCY POLICY DECISIONS

To improve the situation, a first step was taken with the 1996 Law "On energy saving". It established the background of State regulation and energy efficiency incentives. According to the Government's order of January 1998, all Subjects of the Federation (Regions) have to develop and adopt their programme of energy saving. These programmes are particularly important for the organisations funded by the federal or regional budgets. As a consequence, at the end of 2000, thirty seven (almost 40%) regions had adopted energy saving regulations and energy saving programmes were adopted in twenty regions.

A Federal Energy Saving Programme was adopted in January 1998. It is linked to the Russian municipal housing reform and deals with the installation of metering of energy (heat, gas, electricity) and water in dwellings. The meter production issue has been solved but the number of installed meters is estimated at only 25% of the total amount required.

Another step was taken with the development of energy audits in the energy sector, in particular at municipal level. A first survey of the results shows an energy saving potential of about 30% for heat and 15 to 17% for electricity.

After approval of the "Energy Strategy of Russia to 2020" in November 2020, which is analysed in the present paper, the Government adopted in November 2001 a Federal Programme entitled: "A highly energy efficient economy", to 2005 and 2010.

THE PROGRAMME: "A HIGHLY EFFICIENT ECONOMY"

This Programme presents the efforts which are necessary to reach the global objectives of the Strategy: to decrease the energy intensity of the Russian economy while fulfilling the energy needs of the country.

The Programme is divided into three sub-programmes on: Energy efficiency of the energy sector; Security and development of the nuclear industry; Efficiency of energy consumption.

The first sub-programme is in fact devoted to the development of the energy supply industry (oil, natural gas and, at a lesser degree, coal), while the energy efficiency (in the common sense) sub-programme covers both supply and demand.

The total cost of the Programme over the period 2002-2010 is estimated at 274.5 billion Euro, of which 250 for energy supply, 17 billion for nuclear energy and 7.5 billion for energy efficiency. Investment represents about 93% of the cost and 4% is related to research and development. This total cost would be split between the Federal budget (0.7%), the regional and local budgets (7.6%) and non-budgetary sources (91.7%). This means that the main sources of financing should be the enterprises (and in particular those of the energy sector), the financing institutions and households. The share of the regional and local budgets is relatively important, which reflects the high degree of decentralisation in Russia but, at present, it is difficult to know if these figures correspond to a reality or reflect only the expectations of the federal authorities and in particular those of the ministry in charge of energy.

The third sub-programme address energy efficiency in six sectors: energy intensive industries, agriculture, residential and commercial, transports, public buildings, energy sector.

The energy savings in 2010 expected from the implementation of the sub-programme are of the order of 80 Mtoe, of which 34% in energy intensive industries, 27% in the energy sector, 24% in the residential and commercial sector and 15% in the other sectors. The global result of the sub-programme implementation would be to decrease the energy intensity by 13% in 2005 and 26% in 2010.

The share of the federal budget in this sub-programme, at 3%, is higher than in the whole programme, but remains low, while the share of the regional and local budgets is about 14%, which is important and indicates the importance of the role of the regional and local authorities for the development of energy efficiency.

Our estimates on the cost of the programme per unit of energy is about 180 Euro per toe of crude oil or natural gas produced (by the first sub-programme) and a figure of about 96 Euro per toe saved (by the third sub-programme, for the demand side actions). The economic advantage of actions on the demand side should lead the Russian authorities to increase their efforts in this field of action.

ENERGY EFFICIENCY IN THE EU – RUSSIA ENERGY DIALOGUE

The importance of energy efficiency in Russia has been stressed by the expert group of the energy dialogue and confirmed by the declarations of the parties at the common summits, on the basis of the convergence, on this issue, of the conclusions of the European Commission Green paper on energy security and the Russian energy strategy.

This led to a common decision, at the summit meeting of October 2001, to develop in co-operation between the parties, pilot programmes for energy efficiency in the Russian regions of Archangels, Astrakhan and Kaliningrad. In winter 2003, these projects were not yet launched.

Conclusion

The danger that the dialogue on energy between the European Union and Russia faces is that the protagonists of this dialogue, respectively referring to the Russian Strategy or to the IEA Outlook, only consider, in the equation "Production = Domestic Consumption + Exportation", the terms "Production" and "Exportation", i.e. energy supply and exchanges. This is a general tendency in high-level energy negotiations, notably due to the very large financial interests at stake. "Domestic consumption" is then considered as a fatality upon which one cannot act or as an variable of adjustment.

On the contrary, we have seen that it is a central variable. If we take the case of natural gas, Russian production was 583 billion m^3 in 2000, exports towards CIS countries reached 48 billion m^3 and those towards Europe (accession countries and Western Europe) reached 130 billion m^3. We can see how closely the export capacity to Europe is linked to the level of domestic consumption. In turn, the latter depends on economic growth and, very strongly, on the degree of energy efficiency policies that could bring the very high energy intensity of Russia down to the level of Western industrialised countries.

The priority accorded energy efficiency by the Russian Strategy is thus a necessity for Russia and for Europe also. The IEA agrees on this: the Russia Energy Survey 2002, after exposing the financial difficulties of increasing natural gas production, states that:

> *"Energy efficiency projects should be considered and evaluated as an alternative to additional supply. Serious thought should be given to demand-side management and improved efficiency of gas use as an alternative to additional supply."*

Up until now, this message may have been heard, but has not been followed by efforts at the measure of the stakes, as is shown by the present state of the development of the Russian energy efficiency policy, as well as the progress of the EU – Russia co-operation in this field.

ANNEX 1 – Final energy consumption (year 2000) – Unit: Mtoe.

Energy Source	Coal		Oil Products		Gas		Electricity		Heat		Renewables[1]		Total		Share	
Region	**EU**	**Russia**	**EU**	**Russia**	**EU**	**Russia**	**EU**	**Russia**	**EU**	**Russia**	**EU**	**Russia**	**EU**	**Russia**	**EU**	**Russia**
Industry	26	10	41	21	92	25	83	27	4	50	14	-	260	133	27.2%	35.9%
Transportation[2]	1	2	311	47	-	-	4	4	-	-	-	-	316	53	33.0%	14.3%
Other Sectors[3]	5	9	92	18	138	47	105	20	17	87	24	3	381	184	39.8%	49.7%
TOTAL	32	21	444	86	230	72	192	51	21	137	38	3	957	370	100%	100%
Share	3.3%	5.7%	46.4%	23.2%	24.0%	19.5%	20.1%	13.8%	2.2%	37.0%	4.0%	0.8%	100%	100%		
Non energy use			85	8	10[4]	15[4]							95	23		

(1) Renewables: essentially biomass

Source IEA

(2) The transportation sector includes the transportation of goods and passengers but not the transport of natural gas (as it is the case in the IEA statistics)

(3) Residential, tertiary sector, agriculture

(4) In the industry sector in IEA statistics