

Energy Security in Russia: The case for Energy Efficiency

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The late January 2006 cold wave in Russia and Eastern Europe has shown that severe weather conditions could disrupt Russian exports of Natural Gas. Even if a very temporary problem (it lasted 48 hours) it emphasizes the Energy Security issue both for Russia and for foreign customers of Russian energy.

Nobody would deny that Russia has a unique position on the Eurasian landmass as far as energy production and export are considered. Russia is the only one country able to produce energy in all its different form, from hydrocarbon-based fossil fuels to nuclear generated electric power. Russia too benefits from huge reserves, mostly for Natural Gas (60% of World reserves) but also for oil and coal. There is then no doubt that Russia is to be a major player in the energy market and is central a partner for most European countries. However, this position implies that Russia could achieve a fair level of Energy Security or its credibility would be durably weakened.

Energy Security has many dimensions. Secure transit of energy is just one of these. This is normally the field of the Energy Charter Treaty², which was signed in July 2005 by 51 countries including most of Former Soviet Union countries, European ones, Japan, Australia and Mongolia. Russia and Belarus so far have not ratified the ECT because of minor technicalities but have publicly stated that they are committed to apply it till it could be ratified by their Parliaments.

However, if in a supplier country production is non-sustainable, or if internal consumption is progressively "eating" the export margin, there is no Energy Security for customer countries. This is another important Energy Security dimension and one particularly relevant for Russia and its European partners.

This paper focuses then not on "legal" dimensions of Energy Security but on the sustainability dimension of Russian energy exports, an issue relevant for European countries but for Russia too as energy exports are now major a part of its Foreign trade. The ability of Russia to export is the cornerstone of its credibility on the world energy market.

It shows that Russian economic development in the 10 years to come will depend on an effective strategy aiming at significantly improving energy efficiency. This has been already described as a national goal under the Russian G-8 presidency framework. Improving energy efficiency is a key of national security and long-term political stability and sustainability. However, improving energy efficiency implies defining a strategy and creating specific tools. Post-WWII experiences in most of Western European countries show that a nation-wide financial institution, with a direct access to household savings, is a key condition for the implementation an energy efficiency strategy.

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² For relevant document see: <http://www.encharter.org/>

0. Energy Security in a dynamic perspective.

Energy security can be defined as the ability to have at disposal energy in quantity and quality needed to cover the nation economic and social needs, including its international commitments.

Because energy consumption has usually a low elasticity to prices, at least in the short term, and because energy uses are the result of technical choices embedded in industrial processes, the notion of Energy Security is a dynamic and just not static one. Another important aspect here is the fact that if there are many potential energy sources, there can't be complete or fast substitution. If nuclear power can be used for electric power generation, this is not a solution for car and truck engines. If coal can be to some extent substituted to Oil and Natural Gaz, its impact on the Hot-House Effect is much stronger, and it adds frequently the acid-rain problem. If in the long run much is to be expected from "new" and "clean" energy sources (Windmill effect, Solar Energy) it is also quite obvious that some major technical breakthrough are needed. They would imply time and money.

What then matters is not only the fact that instant supply could be guaranteed, but that constant supply could be forecasted by potential users with reasonable a degree of certainty. It is to be understood that major uncertainty on quantity, quality or price would effectively destroy economic computation. Potential users would then try to achieve substitution of less uncertain energy sources to more uncertain ones, even if these sources are economically inefficient or even destructive on the natural environment. Potential users would also modify their investment planning to have energy-specific assets substituted by non-energy specific ones.

The impact of energy supply uncertainty on economic and technical choices is deep and wide ranging. As adaptation is slow and elasticity is low, prices movements are able to induce cost-push inflation phenomena and can lead to severe wealth crunch.

0.1. The EU-15 position as an energy importer.

European countries are major energy importers. At their 2003 levels the EU-15 group was importing 79,8% of its Oil consumption, 50,4% of its Natural Gaz consumption and 59,9% of its coal consumption³. Renewable energy sources, including "old" ones (hydro-electricity, ethanol and biomass) were accounting to 5% of EU-15 Energy Consumption. There were of course sensible differences from one country to another, Sweden reaching 31% and Germany 2%. Still, even moving from 5% to 10% till 2015 would be major an achievement.

Nuclear power amounted to 13% of all energy sources for EU-15 countries, and here again differences were large between France where 38% of the energy is generated by nuclear station (and 78% of electric power) and Netherlands, with just 1%.

Russian contribution to the European energy balance is important, mostly for Gas. The EU-15 imports 240.6 billions m³ of Natural Gas, of which 76 billions are coming from Russia, or 31,6%. As Netherlands Gas field are exhausted, the share of Russian gas is to increase in the next ten years.

But, if the EU-15 is to some extent dependent to Russian Gas, Russia is dependent to European money. At 230 USD for 1000m³, yearly exports to the EU-15 amount to 17.48 billion USD. This is equal to 12% of export revenues from non-CIS countries and to 20% of the Russian trade surplus. As Russia has not developed infrastructures for transforming

³ BP Statistical Review of World Energy, June 2004.

Natural Gas into Liquid Gas, the country is too highly dependent to ground-based transportation systems running to Western Europe.

It is to be added that European countries have massively improved their energy efficiency since 1973. More efficiency gains are obviously possible, but they will be costly, as the most obvious sources of energy wastage have already been addressed. The energy-saving return for 1 Euro of investment is clearly decreasing.

Other energy sources can be developed as European countries have a wealthy share of advanced technologies. However, some renewable energy sources are far to be mature, and some others are raising strong political opposition.

There is then no alternative to European countries. They have to import a significant share of their internal energy consumption, and Russia is to be an important supplier in years to come.

0.2. Russia's growth and energy exports.

President Vladimir Putin has set by spring 2003 very ambitious growth targets. His aim of doubling in the ten years to come the Russian GDP does not look an impossible mission when one carefully assesses the Russian industry growth potential. Nevertheless, achieving these targets will not be easy an undertaking.

One of the most valid lessons from the last past 5 years is that a strategy is needed, if only to create the coherent context making a sustainable average 7% a year growth possible. To let an inertial scenario to develop in Russia is certainly the best recipe to end with unsustainable and unbalanced growth. The more so if social and targets set recently by President Putin are to be met. Here again the four "national priorities" which have been presented in October 2005 are making much sense. However they would imply an increase of budget expenditures and, to some extent, could seriously increase Russia internal energy consumption. This could have adverse implications if these priorities are not to be integrated into a fully consistent strategy.

A growth-oriented strategy will imply a clever use of current energy resources and development of Russian industry global competitiveness. If both aims are not met the current "inertial" growth pattern will lead to a severe hydrocarbon export crunch by 2010/2012. Such a situation will have obvious fiscal and budget consequences. Such consequences, coupled to fast rising internal production prices, would make the Russian industry non-competitive and unable to find resources for its modernisation. Most available data point to the fact that the current "inertial" development scenario is not sustainable in the medium-term⁴. What is more this scenario is to be directly contradictory to Russian international commitments, be they on a bilateral basis (energy-based relations with China, Japan and EU countries) or on a multilateral basis (the "Kyoto Protocol" Russia ratified in 2004).

The "business as usual" attitude could lead by 2010 to a serious economic and political crisis, with the country unable to reach targets aimed for, unable to meet its international commitments and facing a strong gap between internal expectations and the government ability to deliver. Energy Security implies for Russia the ability and the willingness to effectively address its "energy dilemma".

⁴ V.Ivanter et alii, "Budushchee Rossii: inercionnoe razvitie ili innovacionnyj proryv" in *Problemy Prognozirovaniya*, n°5/2005, pp. 17-63.

I. The Russian energy dilemma

Energy and fuel exports seem to have played a strong direct and indirect role in fostering Russian growth at the macroeconomic level. The situation is more however complex once the Russian industry diversity is acknowledged.

There is no doubt that internal energy prices have played significant a role in industrial growth. To some extent the impact of low internal energy prices has been as significant as the 1998 devaluation one in repairing the industrial competitiveness. By tradition, Russian industry is divided among heavy industries and household consumption oriented industries. Such a divide is not without merit of its own. It allows delineating a possible household consumption induced demand effect from an investment induced demand effect. However, such a typology is probably not precise enough to reckon with structural heterogeneity inside the Russian industrial sector.

1.1 Russian internal dependence to Energy.

The energy end use of various economic sectors and of industrial branches is here of specific interest. Data are available for the 1998 industrial and economic structure. Even if now dating a little this study is the most comprehensive to date and its results can be relied upon as a benchmark for the current situation. This study then enables us to draw precise enough a picture (tables 1 and 2).

**Table 1:
Russian energy balance for 1998**

Balance computed in million Ton Oil Equivalent (TOE)	Solid fuels	Oil and gas condensates	Oil products	Natural gas	Electric power	Heating	Total
Total end use, of which	35,3	1,8	64,6	90,9	48,2	126,3	367,1
Industry, of which	21,9	0	20,8	38,1	24,4	46,9	152,1
Ferrous metal	20,1	0	4,7	17,1	4,7	5,7	52,3
Chemicals	0	0	3,9	3,9	3,4	11,2	22,4
Non-ferrous metal	0,5	0	2,5	2,8	8	4	17,8
MBMW	0,2	0	1	5,1	3,5	10	19,8
Food industry	0,2	0	0,7	1,8	0,9	4,8	8,4
Wood & papers	0,1	0	1,6	1,8	1,5	4,5	9,5
Construction materials	0,7	0	5	5	1,7	3,9	16,3
Light industry	0,1	0	0,1	0,2	0,3	1,2	1,9
Other branches	0	0	1,3	0,4	0,4	1,6	3,7
Transportation	0,3	0	12,5	1,3	3,6	2,8	20,5
Agriculture	1,5	0	9,6	4,1	3,3	4,7	23,2
Social housing and communal sector	7,6	0,3	2,1	17,6	2,8	15,3	45,7
Population	3,8	0	11,2	25,5	8,8	48,4	97,7
Others	0	0,1	5,5	1,5	5,3	8,2	20,6
Non-energy use of energy	0,2	1,4	2,9	2,8			7,3

Source: I.N. Borisova, S.A. Voronina, Ju.S. Kretinina, A.S. Nekrasov, "Stoimostnaya otsenka energeticheskogo balansa Rossii", in *Problemy Prognozirovaniya*, n°4/2002, pp. 65-74, table 1, p. 67.

The above table makes clear "where the power goes". Industry amounts actually for 41,4% of all energy end-use consumption, which makes the industrial sector the first user by a short head compared to the population (if one adds direct population end-use and indirect through the Social and communal sector), which consumes 39%. Agriculture and transportation have a total combined use of nearly 12%.

As figures of table 1 are for a year where economic activity was particularly depressed, one can reasonably assume that the industry share in the energy balance is probably now greater, possibly around 45%

The Russian population is quite logically major an end-user for natural gas and heating. Industry share is the greatest for solid fuels and electric power, but is closely competing with population for natural gas end use. As it would have been logically deduced, the transportation sector is major an end-user of oil products. However, agriculture share is here also to be acknowledged. Quite obviously, because of the extensive nature of Russian agriculture its sensitivity to fuel prices is certainly high.

**Table 2:
End-users and energy sources, in % of end-use consumption in 1998.**

<i>Energy source</i>	Solid fuels	Oil and gas condensates	Oil products	Natural gas	Electric power	Heating
<i>Using sector</i>						
Industry	62,0%	0,0%	32,2%	41,9%	50,6%	37,1%
Transportation	0,8%	0,0%	19,3%	1,4%	7,5%	2,2%
Agriculture	4,2%	0,0%	14,9%	4,5%	6,8%	3,7%
Population (including social and communal sector)	32,3%	16,7%	20,6%	47,4%	24,1%	50,4%

Source: idem as Table 1.

One has to add that the energy intensity of the Russian Economy is particularly high, something, which is more, related to industrial uses of energy than to household uses (table 3).

**Table 3:
Cross-country comparison of energy efficiency**

	USA	Europe	France	Germany	Russia	Rest of the world
Primary energy consumption in million tonnes, oil equivalent (mtoe)	2281	1495	266	351	621	5631
Primary energy consumption per capita (toe)	8,0	3,9	4,4	4,4	4,4	1,1
Primary energy consumption per capita unit (toe for 1000USD at 1995 ppp)	254	177	190	183	666	234

Source: International Energy Agency.

It is of particular interest to note that the energy per capita ratio in Russia is on a par with developed European country. This is not so surprising when one knows the urban structure of Russia even if average actual income is much lower in Russia than in France and Germany. It is to be remembered that since the first 1973 "Oil-Shock" both countries have massively invested in energy efficiency. Special financial institutions have been set-up to channel savings toward energy-effectiveness enhancing investments. In both countries, Public

Authorities gave some guarantees to strengthen these institutions. The energy-saving program was then the result of public and private actions combined into a State-led strategy.

Houses and flats thermal isolation is now much better than it was in the early 70's and the energy consumption for heating purposes has dramatically fallen in both countries without actual changes in living conditions. It also has to be added that industrial sectors, which were – and still are – big energy users made a strong effort to reduce their energy consumption through technological innovation. Industrial processes in industrial branches like metallurgy, chemicals, and construction materials dramatically improved their use of energy during the last 25 years.

However, the energy consumption per GDP unit, whatever could be misgivings about using PPP data, is so much higher that there is no doubt that the Russian industry is a main factor in non effective energy use.

The most disquieting data is the huge difference between Russia and the USA when comparing either the Primary energy consumption per capita (where Russia is significantly under US levels) and the energy consumption per capita unit. Even if US households are hugely most wasteful for energy than European ones, the primary energy consumption per GDP unit is much better in the USA than in Russia. this is a good benchmark of Russian industry non-effective energy use.

A more recent estimate is putting Russian energy use per capita in 2002 at 6,30 ton oil equivalent (toe) against 4,34 for France and 4,20 for Germany. However, when it comes to energy end-use for 1000 USD of GDP, we obtain 0,415 toe for Russia against 0,117 for France and 0,124 for Germany⁵. The very fact that Russia looks less ineffective in energy per capita use than in energy per GDP unit use is a good indication that the problem doesn't is in household consumption but in industrial use.

I.II. Industrial branches and energy consumption.

Comparing results given by sensibility to actual change rate and energy consumption is then needed to form precise a picture of Russian industry dynamics. The Energy balance for 1998 (table 4) gives a good understanding of what are the worst "energy guzzlers" in Russia. Not surprisingly, the Ferrous Metal industry is here topping the list, followed by the Construction materials branch and chemicals. On the other hand, the light industry is a very small energy consumer, and so is the food industry when compared to its share of total industrial production.

One relevant issue here, when one looks at Russian economy dynamic trends, is the impact of the construction materials branch on energy consumption. The current "National Priority" for house construction, which is certainly needed in Russia now, would imply a strong impetus on one of the less energy efficient Russian industry.

When branch energy consumption is compared to the industry total, it is possible to rank industrial branches by their relative sensitivity to domestic fuel prices.

Quite obviously industrial branches with a relatively high technological value are not the worst energy consumers. Still, the Russian economy can't be composed only of high-technology sectors.

⁵ V.A. Volkonskij and A.I. Kuzovkin, "Analiz i prognoz Energomkosti i Ergoeffektivnosti Ekonomiki Rossii" in *Problemy Prognozirovaniya*, n°1/2006, pp. 53-60, table 5, p56.

Table 4:
Energy balance for Russian industry, 1998

	End use of fuel-type energy in industry, million TOE	End use of all type of energy, million TOE	Fuel-type in % of total Industry consumption	All energy sources in % of total industry consumption
Ferrous metal	41,9	52,3	51,9%	34,4%
Construction materials	10,7	16,3	13,2%	10,7%
Chemicals	7,8	22,4	9,7%	14,7%
MBMW	6,3	19,8	7,8%	13,0%
Non-ferrous metal	5,8	17,8	7,2%	11,7%
Wood & papers	3,5	9,5	4,3%	6,3%
Food industry	2,7	8,4	3,3%	5,5%
Other branches	1,7	3,7	2,1%	2,4%
Light industry	0,4	1,9	0,5%	1,3%

Source: Idem Table 1.

Table 5:
Price balance of energy end-use by utilisation

	Volume in million TOE	Expenditures in billion RR	TOE price, in RR
End use consumption	192,6	128,7	668,2
Industry, of which	80,8	27,9	345,3
<i>Ferrous metal</i>	<i>41,9</i>	<i>14,5</i>	
<i>Construction materials</i>	<i>7,8</i>	<i>2,7</i>	
<i>Chemicals</i>	<i>5,8</i>	<i>2,0</i>	
<i>MBMW</i>	<i>6,3</i>	<i>2,2</i>	
<i>Non-ferrous metal</i>	<i>2,7</i>	<i>0,9</i>	
<i>Wood & papers</i>	<i>3,5</i>	<i>1,2</i>	
<i>Food industry</i>	<i>10,7</i>	<i>3,7</i>	
<i>Other branches</i>	<i>0,4</i>	<i>0,1</i>	
<i>Light industry</i>	<i>1,7</i>	<i>0,6</i>	
Transportation	14,1	21,9	1553,2
Agriculture	15,2	16,8	1105,3
Social and housing sector	27,6	13,8	500,0
Population	40,5	35,5	876,5
Others	7,1	9,7	1366,2
Non-energy use of energy products	7,3	3,2	438,4

TOE: Ton, oil equivalent.

Source: I.N. Borisova, S.A. Voronina, Ju.S. Kretinina, A.S. Nekrasov, "Stoimostnaya otsenka energeticheskogo balansa Rossii", op.cit., p. 69.

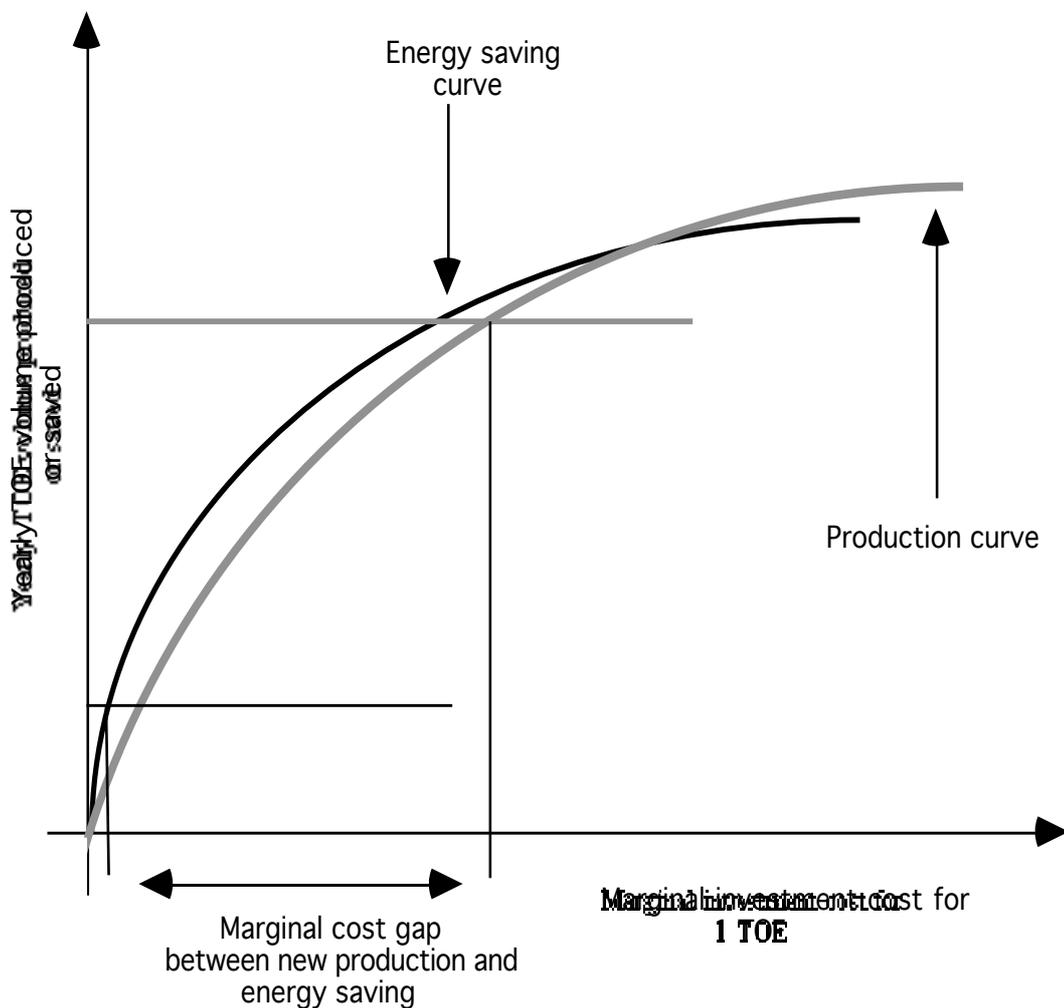
All available data point to the fact that Russia, which is a major energy producer, is wasting a lot of energy. This is of particular relevance in a world where energy is to become a scarce resource.

For an energy-exporter country like Russia there is a deeper significance than for other countries. Wasting an energy ton oil equivalent (toe) means one toe less to be exported, and then a reduction in the potential export revenue, but also in taxes, which are attached to export revenues. The higher the energy prices, the worst the loss both for the country and for the state budget.

I.III. The investment marginal effectiveness issue.

Expanding energy production means investing into new oil and gas fields. Because the most available resources have been exploited since the late XIXth century, this means exploiting more and more difficult to reach resources. The production cost and the investment cost for any additional toe is then to significantly rise. Russia is quite deep in a diminishing return curve. This was already obvious in the 70's and would become more and more a problem. By year 2025 the Eastern Siberia and Far-East region is to produce 10% and 5% of all Russian oil and gas against 0,6% for both in 1995.

Graph. 1



Not only would extraction costs raise significantly, but transportation costs are also to increase significantly. Combining the move to East to the fact that oil and gas sources in western Russia would be harder to exploit, the average cost for oil is to rise by 40% between 2005 and 2015 and again further in 2025. For natural gas it is to rise for 32 USD for 1000m³ in 2005 to 50-5 USD in 2015 and to possibly 75 USD in 2025. These data are not "market prices" but production costs, and are setting the bottom line for the hydrocarbon producing industry.

On the other hand, because Russia (and before 1992, Soviet Union) has made so few investments in energy efficiency (and energy saving), the country is at the very beginning of the efficiency curve. This is a major difference when comparing possible returns for such a policy in Russia and in Western Europe. It is then highly probable that the amount of energy saved for 1 Euro would be much greater in Russia than in France or Germany. This is an important point if investment decisions are to be coordinated. If investment are decided on a single-nation basis, then some opportunities will be missed by all involved countries. Investment coordination could significantly improve investment effectiveness and then increase global wealth.

This could be an important factor to redirect part of French and German energy-saving investments toward Russia.

This however would imply some institutional mechanisms to guarantee that energy hence saved would be available for France and Germany. To invest means transforming some financial "liquid" assets into fixed and specific ones. Investment implies then some kind of risk-taking. Ownership rights are a rationale answer to uncertainty about who would control the wealth flow induced by investments. But ownership rights are themselves liable to be contested in any international system. Ownership rights "hardness" depends to a large extent to a common institutional basis. As institutions are generated through history-dependent processes at a Nation-State level, actual "hardness" is difficult to assess in a multi-national context.

There is then a need to devise a specific system of guarantees if one wants to have investment coordination. This is certainly one of the most difficult issues to be addressed under the frame of the Russian-European Partnership.

Even if not going so far to describe what could be a multinational system of guarantees, one can then assumes that the current marginal cost gap between new energy production and energy saving favours to a considerable extent the latter. The investment-efficiency argument then strongly favours an energy-efficiency approach. This however is not the only argument to be raised.

II. The strategic relevance for Russia of improving energy use efficiency

Energy is a considerable factor in Russian Economic development for many reasons. As an exported resource it generates revenues. However as an internally consumed resource, it is also an important factor of industrial effectiveness.

There is then no doubt that Russia can't reject the current two-prices policy whatever its political cost during negotiations with the EU. With productive infrastructures still largely of Soviet-vintage, and facing a stronger rouble and a weaker US dollar, low internal energy prices are as important for the industry they are for households. However, one has to look at this issue not just in the short term, but in a longer-term perspective. Then, improving energy efficiency would become a strategic cornerstone for any Russian development policy.

II.I. Low internal energy prices and long-term sustainability.

The current policy of maintaining internal energy prices at a level under world prices has strong arguments favouring it. However, what is good policy in the short-run, because the

capital structure is relatively inflexible then, is not necessarily a good policy, or even a sustainable one in the longer run. This policy could be politically and economically unsustainable in the future and could impede efforts to achieve and effective Economic integration between Russia and the EU, its major trade partner (more than 44% after the 2004 integration wave).

One can criticise easily the way the European Commission is handling this issue and particularly its lack of dynamic flexibility on this point. Asking Russia to raise at once internal energy prices would amount to ask a large part of the Russian industry to commit suicide. But this is not to say that current internal energy prices are to be let unchanged forever. Even from a Russian point of view too low internal energy prices are hampering the ability of the energy sector to invest and modernise.

There is then a second contradiction, between short-term conditions for growth and long-term conditions of sustainability in the energy sector. Raising internal energy prices is probably unavoidable if the energy sector is to replace capital accumulated during the Soviet period. However, at the current consumption level for industrial production output unit, any attempt to quickly raise internal prices toward world prices would:

- (i) Destroy enterprise profitability in the core of the Russian industry, preventing enterprise to invest and catch-up productivity levels making them competitive in world market. This would prevent Russia to diversify its productive system and would make the country even more dependent to raw-material exports it already is.
- (ii) Severely harden the household budget constraint, reducing internal consumption and internal market, inducing then a new slump in consumption-oriented industries, at a time when household consumption is a major growth prime-mover in Russia.

If combined to the current trend of Rouble actual change rate re-evaluation, raising internal energy prices would push back the country in the pre-1998 situation. Political consequences could be significant.

With a new wave of economic depression, budget tax revenues would plummet and the government would be facing a dramatic choice of either curtailing public expenditures, with obvious social and demographic consequences, or running a high budget deficit, also with obvious financial consequences.

II.II. Will Russia still be major an energy exporter by 2010?

There is another dimension to the energy issue. At the current energy efficiency level, Russia will not be able to maintain its position as a major energy exporter in years to come.

As it can be seen in table 6, if Russia would sustain a 6% yearly growth till 2010, and if the energy index would not improve, then even in the best-case estimates for energy production (1133 mtoe) the national energy surplus is to shrink from 381 mtoe to 83 mtoe, that is 21,8% of the 2001 level.

This is a particularly serious issue when one looks at the energy export contribution to the State budget. Such a situation would also cripple most long-term development scenario now being drafted in Russia.

This is important too if one thinks about the possibility of capturing part of export revenues to fund investments in the Russian economy. There is no point of discussing how to use the raw-material rent if this rent is to disappear soon.

**Table 6:
GDP growth and energy use**

	<i>Russia, 2001</i>	<i>Russia 2010 (a)</i>	<i>Russia 2010 (b)</i>	<i>Russia 2010 (c)</i>
GDP in USD billion at 1995 ppp	933	1576	1576	1576
Production, primary energy (mtoe)	1002	1133	1133	1133
Consumption, primary, (mtoe)	621	1049,8	400,4	299,5
Energy surplus (mtoe)	381	83,2	732,6	833,5
Energy efficiency index: 1 ktoe for GDP 1000 USD at 1995 ppp)	666	666	254	190

Ppp : purchasing power parity.

(a): inertial scenario, (b) energy efficiency at the current US level, (c) energy efficiency at the current French level.

Source: Russian government and IEA.

On the other hand, would Russia to improve its energy efficiency index to the US level (254 ktoe) or even better to the French level (190 ktoe), the energy surplus would jump to 192% or 219% of the 2001 level. An energy efficiency index of just 477 ktoe for 1000 USD (1995 ppp) GDP unit in 2010 - a level that is not particularly efficient and could be reached without undue efforts - would be enough to maintain the energy surplus at the 2001 level *without having to invest heavily into new oil and gas fields but also into new and longer pipelines and gaselines*.

Reducing internal energy consumption is then a necessary condition to maintain a stable energy export flow, at least during the rebuilding period for the Russian industry. This would decisively contribute to Energy Security. Improving energy efficiency could well be a necessary condition for a stable growth in years to come as it would also improve investment effectiveness and then decrease structural inflationary pressures. Such a strategy would make Russia better able to answer its international commitments. Energy saving, to the contrary of what has been said in the recent Russian debate and specifically by Andrei Illarionov is not constraining growth but enhancing growth.

Investments in energy saving would also boost more effective and technologically up-to-date industrial processes. They could be important a prime mover for Russian industry modernisation. They certainly would be a major upturn toward global competitiveness. It can be added that such investments would open an important market for Russian high-technology companies, which have specific competencies in thermal detection, automatic control systems, and thermal isolation. This market would also have a significant incentive effect on FDI, attracting specialised Western companies.

III. The Economic impact of improving energy efficiency

Increasing energy efficiency is just not a necessary strategy to maintain Russia's position as an energy exporter and enable Russian industry integration in the world market in favourable a competitiveness situation. It is also a potentially highly valuable activity.

III.I. What is to be aimed for in a national strategy for improving energy efficiency.

Production processes in energy dependent branches show a huge amount of waste by comparison with European industries. The same can be said in the housing-communal sector where the amount of energy currently expended is much higher than the amount that actually reaches the consumer.

In both case the poor state of infrastructures, the use of obsolete technologies, and the lack of proper attention to efficiency in the design of technical systems explain the greatest part of what is wasted. Consumer behaviour is here a minor issue.

If one assumes that energy end-use could be reduced by a factor of 1/3rd for oil products, natural gas and electric power in the 6 industrial branches which are the most fuel-dependent or related (that is Ferrous metal, Chemicals, Non-ferrous metal, MBMW, Wood and papers, and Construction materials) the net gain would be on the basis of the 1998 industrial structure 25,78 millions TOE of which 18,17 millions TOE for fuel-type energy sources. This would allow for a 29% price increase without changing the energy bill.

A similar saving of 1/4th in Heating and Natural gas for the population and the housing-communal sector would generate a 26,7 millions TOE gain, of which 10,7 millions TOE for fuel type energy sources.

The very saving magnitude order assumed here is quite conservative and would be compatible with a short to mid-term program. By comparison with 1998, the Russian energy balance would be reduced by 14%. By the way, would Russia reach the same level of energy efficiency than USA (which are not particularly efficient by the way), Russian GDP could be increased by a factor of 2,6 times for the same amount of energy used.

Improving efficiency in energy use could decrease to a significant extent the energy consumed for a product unit. Energy prices could then be progressively increased without increasing the whole bill for the end-use consumer, up to the point where selling energy to internal users could become profitable a business. One can even easily compute what profit an energy saving program could make. The Russian federal program on “ a high energy efficient economy” adopted by November 17th, 2001 has clearly established goals and costs⁶. If one takes seriously the relation between energy saving targets in some sectors and investment costs, then a yearly cost can be derived in Euro.

Now, the already quoted paper on the Russian energy balance enables us to derive the internal price for energy (in Mtoe)⁷. By using the RR/Euro change rate used in B. Laponche and B. Jghenti paper, Russian internal energy prices can be made compatible with investment cost evaluations. A comparison between the estimated cost of the saving program and what would have cost the saved consumption at the Russian internal price enables us to compute the profit margin of the operation.

III.II. How much is it to be gained through an energy efficiency strategy.

⁶ See B. Laponche and B. Jghenti, deuxième rapport intermédiaire : LE PROGRAMME FEDERAL “ UNE ECONOMIE DE HAUTE EFFICACITE ENERGETIQUE ”, Etude pour le Ministère des Affaires Etrangères, Direction générale de la coopération internationale et du développement, Paris, September 2002.

⁷ Source: I.N. Borisova, S.A. Voronina, Ju.S. Kretinina, A.S. Nekrasov, "Stoimostnaya otsenka energeticheskogo balansa Rossii", in *Problemy Prognozirovaniya*, n°4/2002, pp. 65-74, table 1, p. 67.

This was applied to 2 sectors, Industry and Housing & communal. Of course, data in table 7 and 8 are no more than indications as the Russian program has not still kicked off. However, even if one takes 2002 as Year “T” one can quickly see that energy saving will be profitable an activity by the fourth year. Of course, one can harbour some doubts about costs as they have been computed in the Russian strategy. Still, there are few doubts that energy saving programs could become self-sustainable once the initial investment in sectors where wastage are the most obvious. It is to be added too that any increase of energy efficiency would translate into a reduced internal consumption, freeing then greater volumes to be exported. The same reasoning can apply to household energy consumption. Here again, improving energy use efficiency could allow for higher prices without putting too heavy a burden on Russian consumers and would free more energy to be exported.

In the computation done in table 7 & 8, a limited energy saving program would have reduced fuel-type energy consumption by 28,9 millions TOE. It is to be added that both tables have been computed with a low world energy price level. Would world oil prices stabilise over 65 USD a barrel, gains could be increased by a factor of 55%.

Compared to what was exported in similar energy sources, the volume gain hence freed would have been of 8,2% (and 7,9% compared to all energy exports). As all energy exports were valued for 1998 as 27,938 USD billions, and assuming a return to investment period of 3 years (which is short), this energy program could have reached 6,6 USD billions and still be covered by extra-exports (assuming stable energy world prices on the 3 years period).

Actually, for the limited program here envisioned it is quite clear that it could have been implemented for just a fraction of this money.

Hence, an industrial strategy focusing on improving energy efficiency would not only make industrial growth more sustainable and compatible with international commitments (be they at the EU or WTO level) but would be equivalent to an increase of raw energy production.

Table 7:
Net gain of the energy saving program in Industry

	Millions Ton oil equivalent		Millions Euro				
	Cumulated energy savings in Mtoe, low range of Russian estimates	Cumulated energy savings in Mtoe, high range of Russian estimates	Savings expressed in million Euro, at current energy prices, low range of Russian estimates	Savings expressed in million Euro, at current energy prices, high range of Russian estimates	Cost of the energy saving program, as forecasted by the Russian government, in million Euro	Gain, low range	Gain, high range
2006	3,40	3,60	41,89	44,35	309,75	-267,86	-265,40
2007	10,20	10,80	125,66	133,06	309,75	-184,09	-176,69
2008	20,40	21,60	251,33	266,11	309,75	-58,42	-43,64
2009	34,00	36,00	418,88	443,52	309,75	109,13	133,77
2010	36,33	38,53	447,63	474,73	238,6	209,03	236,13
2011	41,00	43,60	505,12	537,15	238,6	266,52	298,55
2012	48,00	51,20	591,36	630,78	238,6	352,76	392,18
2013	57,33	61,33	706,35	755,63	238,6	467,75	517,03
2014	69,00	74,00	850,08	911,68	238,6	611,48	673,08
			3938,29	4197,01	2432	1506,29	1765,01

Estimates done from the National Strategy for Energy, Russian government, December 2001, through Laponche and Jghenti. Price estimates coming from I.N. Borisova, S.A. Voronina, Ju.S. Kretinina, A.S. Nekrasov, quoted in table 4.

Table 8:
Net gain of the energy saving program in the Communal and Housing sector

	Millions Ton Oil Equivalent		Millions Euro				
	Cumulated energy savings in Mtoe, low range of Russian estimates	Cumulated energy savings in Mtoe, high range of Russian estimates	Savings expressed in million Euro, at current energy prices, low range of Russian estimates	Savings expressed in million Euro, at current energy prices, high range of Russian estimates	Cost of the energy saving program, as forecasted by the Russian government, in million Euro	Gain, low range	Gain, high range
2006	2,40	2,60	42,86	46,44	224	-181,14	-177,56
2007	7,20	7,80	128,59	139,31	224	-95,41	-84,69
2008	14,40	15,60	257,18	278,62	224	33,18	54,62
2009	24,00	26,00	428,64	464,36	224	204,64	240,36
2010	25,73	27,73	459,60	495,32	171,8	287,80	323,52
2011	29,20	31,20	521,51	557,23	171,8	349,71	385,43
2012	34,40	36,40	614,38	650,10	171,8	442,58	478,30
2013	41,33	43,33	738,21	773,93	171,8	566,41	602,13
2014	50,00	52,00	893,00	928,72	171,8	721,20	756,92
			4083,99	4334,03	1755	2328,99	2579,03

Estimates done from the National Strategy for Energy, Russian government, December 2001, through Laponche and Jghenti. Price estimates coming from I.N. Borisova, S.A. Voronina, Ju.S. Kretinina, A.S. Nekrasov, quoted in table 4.

When one looks at the marginal cost in hydrocarbon production, there is no doubt that such a strategy would be cost effective. The Laponche-Jghenti paper gives cost estimates, which are around 89 Euro to 126 Euro for one saved Mtoe. By comparison, investment costs in exploration, drilling and production are around 180 Euro for a newly produced Mtoe of gaz or oil

There is then no doubt that a marginal cost analysis would support an energy-saving program in industry and other sectors. If the amount of saved energy was to be allocated to fund the program, and then there are no doubts that such a program could be quickly, after an initial push, financially self-sustainable.

A last important point here is the fact that significant gains in energy efficiency would make ratifying the *Kyoto Protocol* effective from a Russian point of view. If the current gap between the Kyoto defined ceiling for Russia and current emissions level is not to close, then carbon rights could be sold in a sustainable way. This could help raising fund for the energy efficiency program, which then could become in a way self-sufficient.

A recent study commissioned by a MIT sponsored task-force has estimated possible gains for Russia for the 2010-2040 period as ranging between 389 billions USD to 411 billions USD (or between 12,9 to 13,7 billions USD a year) depending of the chosen strategy⁸. This however implies a careful management of the Russian position on the Carbon-Rights market. So far, Russia doesn't have a financial institution with the required expertise. Channelling Carbon Rights revenues into the State budget would be grossly inefficient. Here is a strong argument for a State-Based but definitely open Financial Institution acting as an Investment Agency specialised in energy efficiency improving projects.

What a Russian national energy efficiency strategy would then propose could significantly improve the energy balance and make Russian fast growth for decades highly

⁸ A. Bernard, S. Paltsev, J.M. Reilly, M. Vielle and L. Viguiet, "Russia's role in Kyoto Protocol", MIT joint program on Global Change report n°98, MIT, Cambridge (Mass.), June 2003.

compatible with *Kyoto Protocol* requirements. This strategy is anyway needed to make the current Russian growth sustainable in the long run and to maintain Russia's position as a major player on the worldwide energy market. A direct spillover would be a powerful boost to some high-technology Russian industries.

To the very contrary of what is sometimes said in the Russian debate, implementing the *Kyoto Protocol* would not harm Russian growth and could even be used to channel funds toward modernisation projects.