The Economic Rewards of 'No Regrets' Climate Policies

Conference on
Strengthening the Russian Economy Through
Climate Change Policies

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Introduction

At the recent White House Conference on Climate Change, President Clinton warned a group of scientists and business leaders that it would be a "grave mistake "to ignore the dangers of global warming.[1] He emphasized, however, that the United States must cut greenhouse gas emissions without harming its economy. Russia, having suffered profound economic shock over the last decade, will undoubtedly want to do the same.

This paper suggests that cooperation between Russia and developed nations such as the United States to reduce greenhouse gas emissions would benefit both parties. Russia possesses the world's largest and cheapest greenhouse gas emissions mitigation options. This fact could enhance Russia's position at the December meeting of the Framework Convention on Climate Change in Kyoto, Japan. Policies for international greenhouse gas emissions trading, offsets, or joint implementation could provide financial and economic benefits for the Russian economy, as well as make the cost of curbing emissions cheaper for countries like the United States. The White House conference demonstrated support for such cooperative, market-based mechanisms, and President Clinton himself advocated financial assistance for emissions reduction in nations such as Russia. Whether the Kyoto meeting produces such measures may depend on the strength of Russian leadership.

The Russian Economy and Greenhouse Gas Emissions

Economic collapse has been the overwhelming reality in Russia after 1989. Russian GDP fell by one-third to one-half, depending on how one values uncounted aspects of the market. (See Figure 1.) Energy demand collapsed along with central planning. (See Figure 2.) However, energy still plays an extraordinary role in the Russian economy, accounting fully for one-seventh of GDP. The energy sector has not completed reforms, however, and the burgeoning non-payments problem betrays the need for hard budget constraints. Competition in key utilities also remains weak. Continuing reform in this sector would benefit both the national economy and the global environment.

The Soviet Union and Eastern Europe at the start of this decade accounted for more than one-quarter of global carbon dioxide emissions. By 1996, successor states' share had fallen to one-eighth of the world total. In physical units, carbon emissions in the formerly planned economies fell from 1.6 billion tons of carbon in 1990 to under 0.9 billion tons of carbon in 1996. (See Figure 3.) The magnitude of this reduction is striking: it totals 2.5 times the emissions of the African continent, and amounts to half the emissions of the United States.[2]

Russia signed the Framework Convention on Climate Change in 1994, and belongs to the group of so-called Annex I countries, the developed nations pledged to early mitigation efforts.[3] Ironically, Russia has three key advantages with respect to cutting emissions. First, Russia still ranks among the world's most energy-inefficient economies. Many studies have documented the large opportunities in Russia for saving money by saving energy. Capturing these savings would dramatically reduce greenhouse gas emissions. Second, Russia possesses over half the world's natural gas reserves. Because natural gas emits about half as much carbon per unit of energy as coal, increasing reliance on gas makes meeting emissions targets easier. Third, Russia's high level of technical sophistication could enable it to utilize advanced energy technology, which could also provide economic and climate benefits for Russia and the world.

Russian energy use per dollar of GDP remains two to three times that of the United States. To be sure, American energy use per capita is higher, but American economic output per capita is several times higher. Russia continues to suffer from economic inefficiency, the legacy of central planning. Market reform lags the general economy in the energy sector, and modern technology is lacking on both the supply and demand sides of the energy equation. Structural reform has been underway as unnecessary and antiquated industry shuts down, but Russia has not finished this painful aspect of reform.[4] The overhang of industrial production remains, as does the effect of what Hungarian economist Janos Kornai called "soft budget constraints", meaning that prices were not rational and that prices did not matter. Technical inefficiencies in steel, aluminum, chemical, cement, and paper are legendary and have been well-documented.

Prospects for A Russian No-Regrets Strategy

No aspect of global economic development will have more impact on greenhouse gas emissions than the manner in which transition economy energy use evolves over the next two decades. Russia represents half the emissions of these nations (see Table 1), but has at its disposal a number of tools to reduce emissions growth. Available mitigation options in Russia include:

- Energy efficiency
- Switching to natural gas
- Nuclear power
- Renewable energy
- Afforestation

The Russian economy presents significant opportunities as well as difficulties in energy-related carbon dioxide emissions mitigation. The nation is fortunate in possessing the world's largest natural gas resource. Natural gas produces just over half as much carbon per unit of energy as coal. (See Table 2.)

Table 1: Carbon Emissions in Post-Planned Economies, 1996

(million tons of carbon)

Russian Federation	434
Poland	99
Ukraine	91
Kazakhstan	46
Romania	36
Czech Republic	36
Uzbekistan	32
Belarus	18
Hungary	16
Bulgaria	16
Other Former Soviet Union	16
Slovakia	13
Azerbaijan	12
Turkmenistan	8
TOTAL	**872**

Source: Estimated from British Petroleum, *Annual Statistical Review*

The debate over the cost of greenhouse gas emissions mitigation has been clouded by the inadequacy of economic tools. The economics of transition is a poorly developed field. But more fundamentally, economic literature has been--and remains--divided between macro- and micro-economic approaches. Much of the economic research on the cost of cutting greenhouse gas emissions has been based in conventional macroeconomics and has treated planned economies as if their economic behavior approximated that of market economies.[5] This approach has led some analysts to conclude that future energy use and greenhouse gas emissions in the planned economies will rise on steep growth curves. But that view does not take into account the need to restructure the planned economies. Surprisingly, the macroeconomic models also do not account for the technical inefficiency of planned and post-planned economies. By their nature, the models assume that Russia, for example, is in economic equilibrium, an assumption many Russians would undoubtedly dispute.

The field has evolved slowly over the last decade. In the early 1990s, Manne and Richels[6] and Manne[7] treated the former Soviet Union as a separate region in their Global 2100 model and estimated the costs of reducing energy-related carbon emissions. Global 2100, a top-down model, was used to produce a set of regional results for a base case and for significant emissions reductions relative to the base line. The results suggested that the cost of emissions reduction would total three percent of regional Gross National Product (GNP) in the first half of the next century. The Green model is also global in scope and addresses the Former Soviet Union and Central and Eastern Europe as one of 12 regions. For year 2050 emissions reductions (relative to a base case) of 70 percent, the Burniaux effort suggests a GNP loss of 2.3 percent. Martins suggests that a similar reduction in 2020 (compared to a baseline) would cost 3.7 percent of regional economic output. A global trade model utilized by Rutherford estimated much higher costs--almost 6 percent of GNP for the year 2050.

Russian academician and economist Alexei Makarov early on provided a contrasting view based on much more knowledge of the economy.[8] His team, using a dynamic optimization model developed specifically for the former Soviet Union, projected the year 2025 suggested that a 44 percent emissions reduction, compared to a baseline, would cost less than 1 percent of GNP.[9]

Across these studies, the one major difference in cost estimates in the studies reviewed appears to be that of methodology, specifically the choice of top-down versus bottom-up models. This result is not surprising given the special nature of planned and post-planned economies.

Table 2: Carbon Intensity of Fossil Fuels

	kg-C/GJ
Coal	~25
Oil	~20
Gas	~14

The debate regarding the value of top-down versus bottom-up modeling is perhaps most clearly focussed in application to the transition economies. The key issue is the explicit assumption in top-down models that energy supply and demand are in competitive equilibrium in the planned economies. Equilibrium models assume that planned economies mimic the behavior of market economies, and therefore are optimized. This assumption is not consistent with western economic theory, and is difficult to accept empirically, particularly with regard to energy use. This problem manifests itself in the work of the Intergovernmental Panel on Climate Change (IPCC), which did not account for the demise of central planning or the economic collapse in the region during the nineties. As a result, a key scenario of the IPCC (IS-92a) overestimates current emissions in the transition economies by over one-half billion tons of carbon. That error drives up all estimates of the cost of reducing emissions because it is the baseline from which cost estimates are usually derived. (See Figure 4.)

For context, the IPCC projected global energy use to increase from 385 EJ in 1990 (it was an estimated 368 EJ in 1996, according to BP) to 1,000 by the year 2050, a growth rate of 1.6 percent. Carbon emissions would increase from 6 billion tons (they were 6.4 billion tons in 1996, according to bc calculations using BP data) to 12, perhaps even 18 billion tons, depending on the scenario.

Exploring the future of transition economies such as Russia's, however, is much more difficult. The transition to markets means that changes to allocation based on market pricing rather than on central governmental goals and quotas will change just about everything, including not only energy-using behavior but the very structure of the economy. For example, heavy industry will almost certainly decline in importance--but by how much? Who can estimate how much of the steel industry is competitive on world markets, or the chemical industry? One can set models to adjust steel output to western norms, but that may be inherently wrong--the region could become the world's steel maker, though this is unlikely without major new investments in technology. However, most of the models do not have such mechanisms, and one has to "trick" the models into performing structural change in the crudest possible ways. For example, most top down models have an exogenous parameter for technological change, and so one can estimate the rate

of energy-intensity reduction required to match, say, U.S. intensity (which is not as low as Europe's) in Russia by the year 2020. This method is crude, but short of having experts examine sector-by-sector the potential for the technologies to be competitive on world markets, and to estimate those markets, and to make predictions about trade barriers, it is the best one can do.

Reviewing the scenarios in the context of reality is useful for Russian policy makers. The IPCC scenario represents more or less business as usual. Some scenarios show a reduction in emissions in the early years compared to the IPCC.[10] These analysts assume enough energy-intensity reduction to enable the transition economies to become as energy-efficient, if you will, as the United States by the year 2020. Some analysts may question how the Eastern European and Former Soviet economies can compete unless they become as efficient--in the general, economic sense--as Western Europe. Doing so would drive the scenarios even lower for the near team--that is, out to 2020. The findings from the energy intensity case that allowed energy intensity levels in EUSSR countries to converge with those of the United States by 2020 indicated that this lower intensity level would save up to $1.5 billion per year between 2005 and 2020. *This translates into a total of nearly $37 billion worth of potential savings that would result if energy intensity end-use improvement improved by an additional percentage point annually until 2020.* (See Figure 5.)

Economic recovery for the region has been projected by World Bank experts who expect Russia and Ukraine to follow along the path of recovery of Poland and the Czech Republic. Neither country's economy fell so hard or so far, but then neither has the resource advantages of Russia. Ukraine, of course, is a different matter. But if Russia continues on its path of reform, economic growth should rebound and follow a sustainable growth rate of 3-6 percent for the next decade. Prices of energy should nearly reflect those in the west, minus transportation costs, because the markets will set the opportunity costs of using fuels at home at the value of exporting them. Price elasticities of demand, however, are a controversial issue.

Transition economies, including Russia, will reform, restructure, and rationalize their economies if they are to grow.[11] Reform would have the effect of reducing energy intensity. Yet, the macroeconomic models have ignored this simple logic and based future energy use in this region on continued high energy intensity and high economic growth. The results are startling when one realizes that they indicate that the formerly planned economies would be twice as energy intensive in the year 2050 as Japan is today. This outcome is highly unlikely without the restructuring and efficiency improvements necessary to enable formerly planned economies to compete internationally.

Regional experts have evaluated these technical and micro-economic measures in extensive detail. The Ministry of Fuels and Energy has adopted these estimates as an indication of the potential for carbon emissions in Russia (see Table 3). Note that the year 2010 projection totals about one-sixth of Russia's current carbon emissions. Such estimates, however, assume that barriers to energy efficiency can be overcome. These barriers are well-known, and include market distortions such as price controls and market imperfections such as lack of information and lack of credit. Financing is widely regarded as a very serious barrier to efficiency throughout the transition economies. (See Table 5.)

Table 3: Cost-Effective Carbon Emissions Reduction Potential in Russia, 2010

Measure	*Reduction (MT-C per year)*
Power Turbines	40
Heat pipelines	22
Gas transmission lines	14
Refineries	10
Total (all options)	90-110

Source: Energy Strategy of Russian Federation, Ministry of Fuels and Energy, 1995. Projected for OECD/IEA Review for the Year 2010.

A case study from Russia suggests that Russian industry will reduce its energy intensity as reform progresses. The case study involved a private Russian manufacturer, Moscabelmet, which manufactures aluminum and copper cables and wires. The firm employs 1,500 and is one of Russia's largest producers of these products. Economic reforms have increased the share of energy costs from 5 percent of total production costs in 1993 to 15 percent in 1995. To save energy and money, Moscabelmet has taken the following steps:

1. Conducted an energy audit
2. Established an energy monitoring system;
3. Changed operating practices;
4. Installed steam traps, heat recuperators, and insulation.
5. Installed automated energy control systems.

A review by a CENEf team noted that the firm had benefitted from these measures, along with good management in all its operations. Despite the general turmoil in Russia, the firm has been able to stay up-to-date on tax payments as well as energy and utility bills. Production levels have been maintained, wages paid on time, and staff levels maintained over a two-year period.

The official Russian climate policy country study team found much potential for carbon emissions reduction in the energy supply sector. Through a variety of measures such as upgrading the compressors on gas transmission pipelines, better turbines for power generation, reducing losses in district heating, and installing catalytic cracking and better distillation columns in refineries--all items that the energy industry must eventually adopt--about 100 million tons of carbon per year

could be saved. That is equal to one-fifth of Russia's total emissions in the late nineties. Studies from across the planned economies suggest that energy savings measures are highly cost effective. (See Table 4.)

Issues for Joint Implementation

Russia would have strong advantages in an international regime of tradeable emissions permits or some equivalent system. If, for example, Russia were limited to 1990 levels of emissions, it would probably have excess emissions rights to sell for two decades. Even if a much lower ceiling were placed on Russia, it would still be able to sell emissions for many years to come. Because these opportunities appear to be very inexpensive, the global cost of emissions mitigation would be reduced. Russia could possibly benefit by obtaining capital or favorable financing for emissions reductions.

Joint implementation (JI) in the formal sense means that companies from foreign countries could share emissions reduction credits with local firms under a future greenhouse gas emissions convention. While this approach has significant potential for helping capture emissions reduction potential in the region, it is a relatively new idea and can for the present only be used in a demonstration mode.[12]

Table 4: Typical Energy Savings Options

Measure	*Cost ($/GJ)*
Electric motor efficiency	- $0.85
Steam management	- $0.82
Electronic energy controls	- $0.81
Steel plant modernization	- $0.71
Heat recovery	- $0.56
Dry process cement production	- $0.43

Source: Polish Foundation for Energy Efficiency

The Czech government, for example, has expressed doubts about rapid growth of JI projects without clear resolution who would obtain the benefits and who would receive allocated of credits.

In each of the transition economies, a number of issues stands in the way of developing an effective climate policy. These include:

- Lack of priority for climate change in the governmental decision-making process;
- Strong competition for the time policy makers have available to deal with other problems;
- Short-term political perspective;
- Lack of available financial resources, particularly for longer-term repayment.

Financing for energy efficiency remains very difficult to obtain in virtually every post-planned economy, regardless of the level of effort in price and structural reform. The multilateral development banks have not made significant financing available for demand-side management, which is where the largest and most cost-effective energy-efficiency options are found.[13] Commercial institutions have also been discouraged from financing efficiency, but mainly due to credit risks inherent in transition economies. The combination of these problems has presented a formidable barrier to the implementation of efficiency in Russia, as elsewhere. (See Table 5.)

Both Russia and the United States might want to propose in Kyoto the creation of financial facilities for joint implementation of energy-efficiency projects. Such facilities would provide key services currently missing from both public and private financial markets. These include means for supporting due diligence work in small projects, partial credit guarantees, credit enhancement, credit lines, and debt and equity participation. The main function would be to reduce risk, risk that is caused both by the lack of maturity of the transition economies and the unfamiliarity of markets with efficiency projects. Examples of key services that could be provided are the creation of escrow accounts, loan insurance, and pooled risk for climate mitigation projects.

Table 5: Financial Issues in Efficiency Projects

- Project size
- Transactions costs
- Lack of credit history in transition economies
- Absence of guarantees

SOURCE: Econergy International Corporation and Battelle, Pacific Northwest National Laboratory, Overcoming Barriers in Financing Renewable Energy and Energy Efficiency Projects, Washington, D.C., draft, July 1997.

Conclusion

Russian historian Nicholas Riasanovksy observed that in democracies, ideas quickly give way to interests. The idea of a no regrets approach to carbon emissions reduction is very appealing, but its success will depend on the ability to harness market forces and private interests. Emissions trading would, theoretically, provide the most efficient means of allowing the world to cooperate to cut greenhouse gas emissions. However, the complexity of the world's energy system and our inability to know precisely how energy used and saved may impair our ability to make such a system work. Doing nothing just as clearly is not in the interest of Russia or the other developed nations. A set of measures to share the burden of emissions reduction and to share resources for achieving those reductions may be the best one can expect in a less-than-perfect world. That means that joint implementation, offsets, and financing of projects would be desirable. A system of monitoring and verification would be necessary, but should be practicable.

None of these proactive options is likely to come to reality, however, unless nations such as Russia show leadership in the negotiations. The upcoming discussions at Kyoto are likely to be the best opportunity in years for Russia to improve its economic situation through climate cooperation.

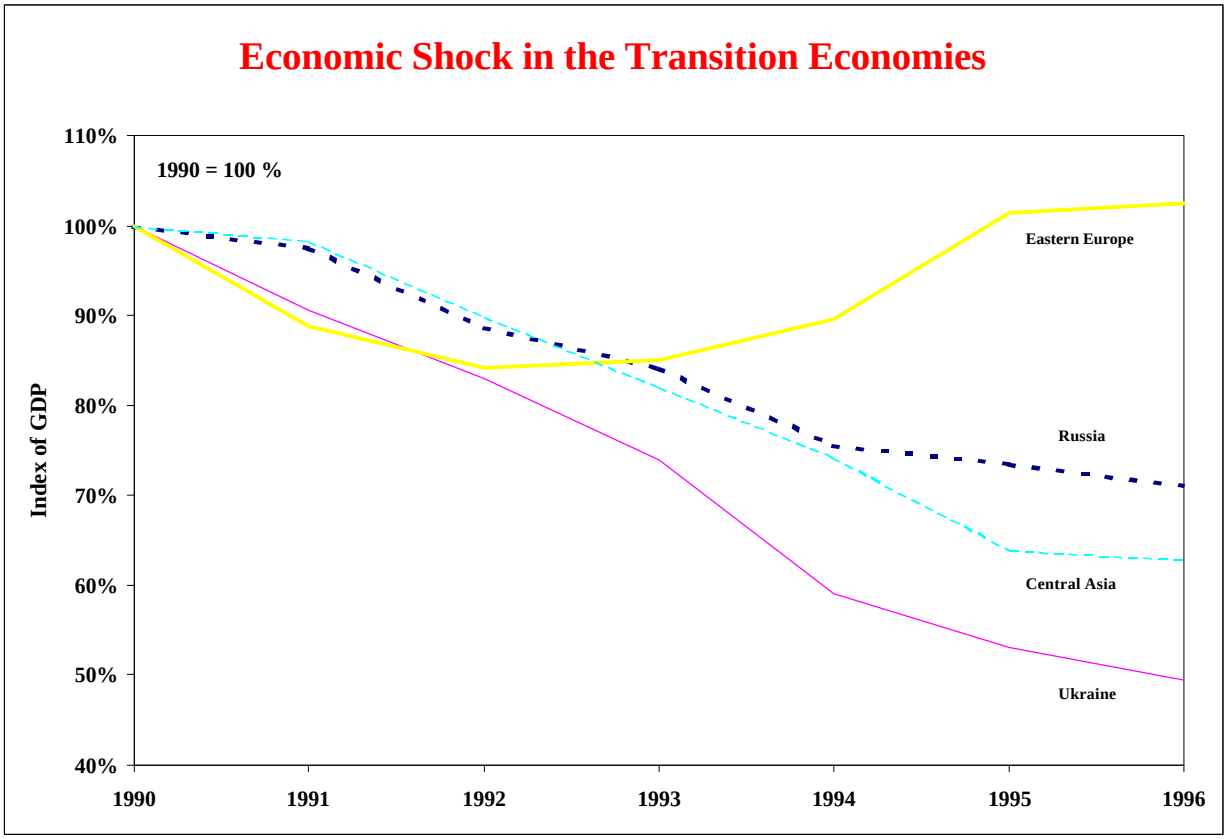
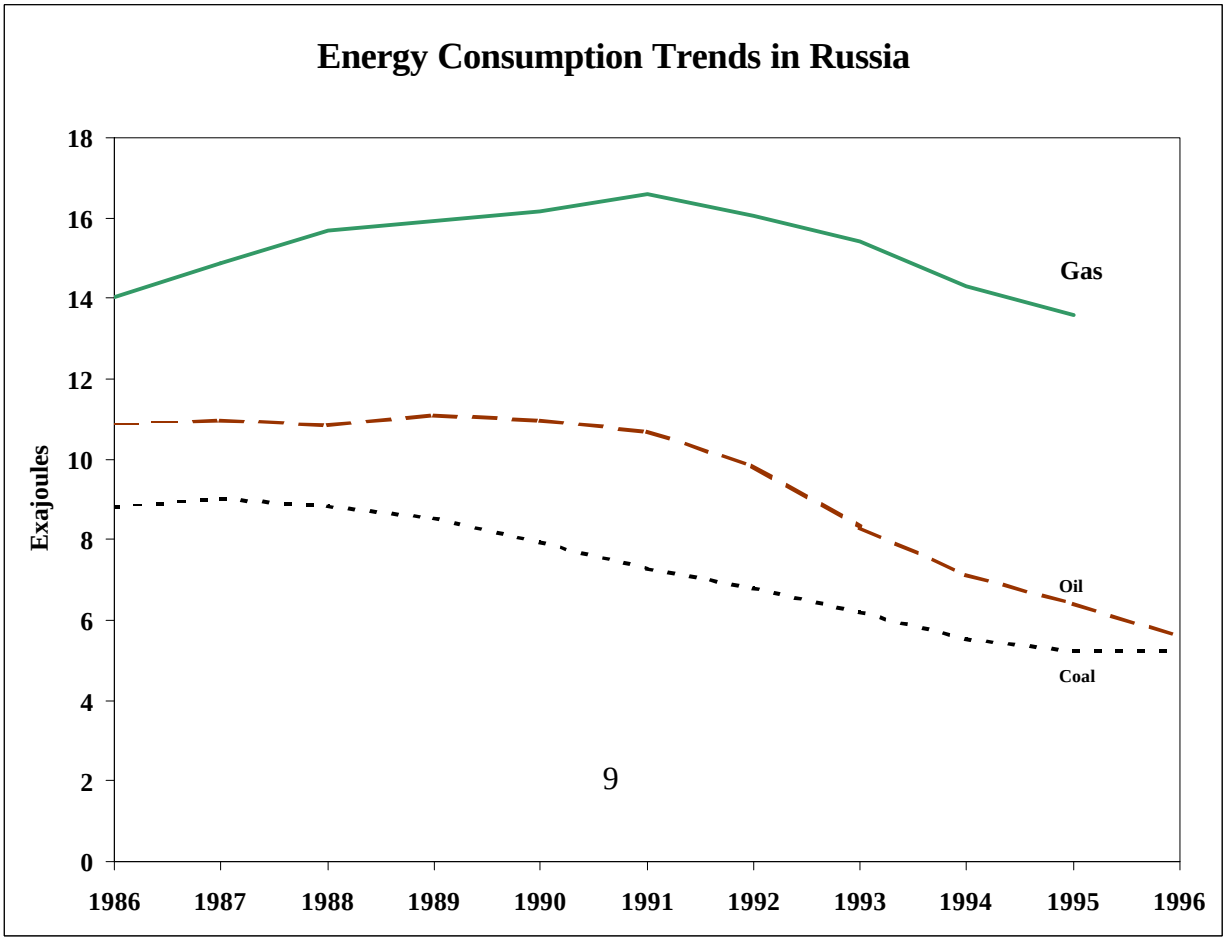


Figure 1: Economic Shock in the Transition Economies
Figure 2: Energy Consumption Trends in Russia



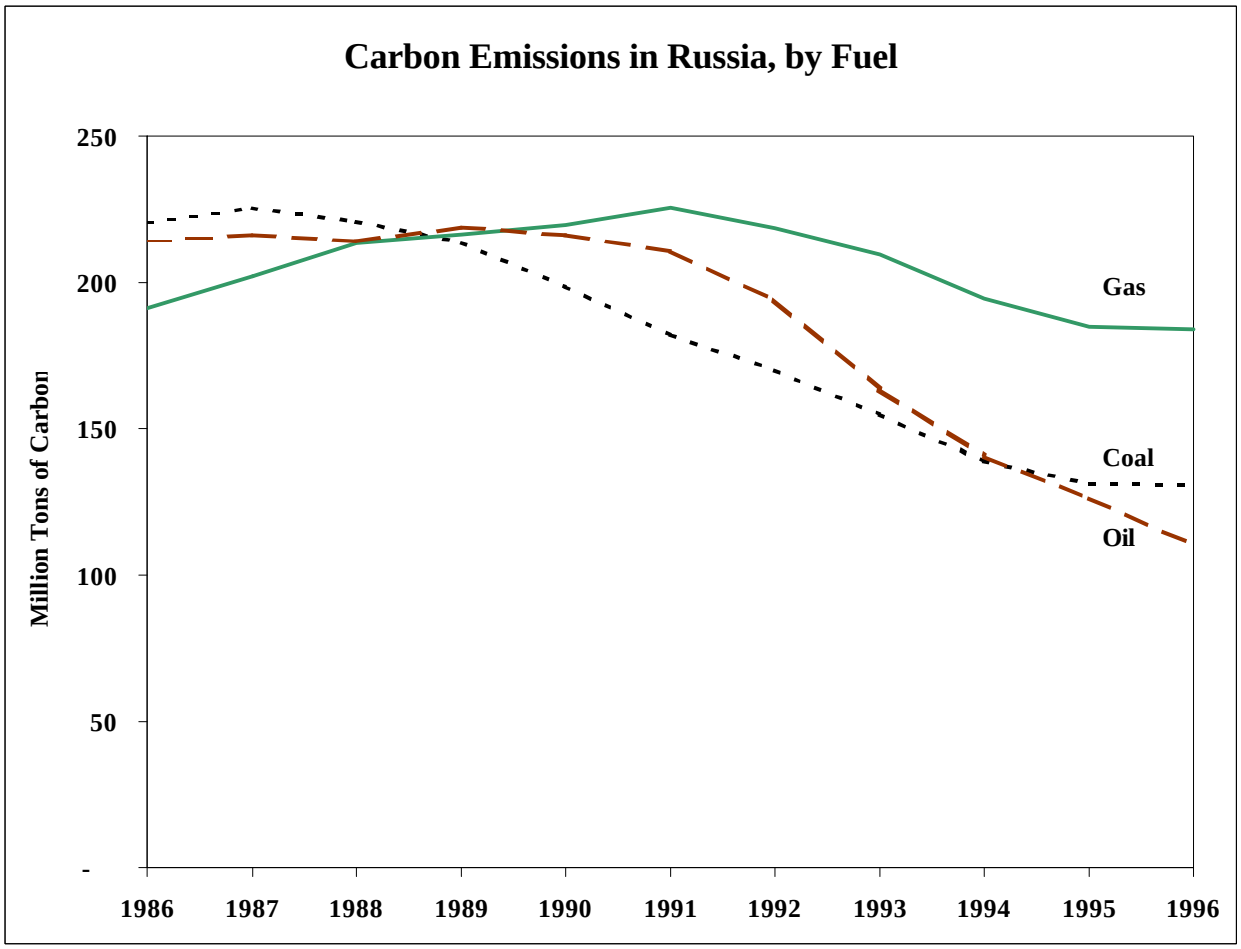
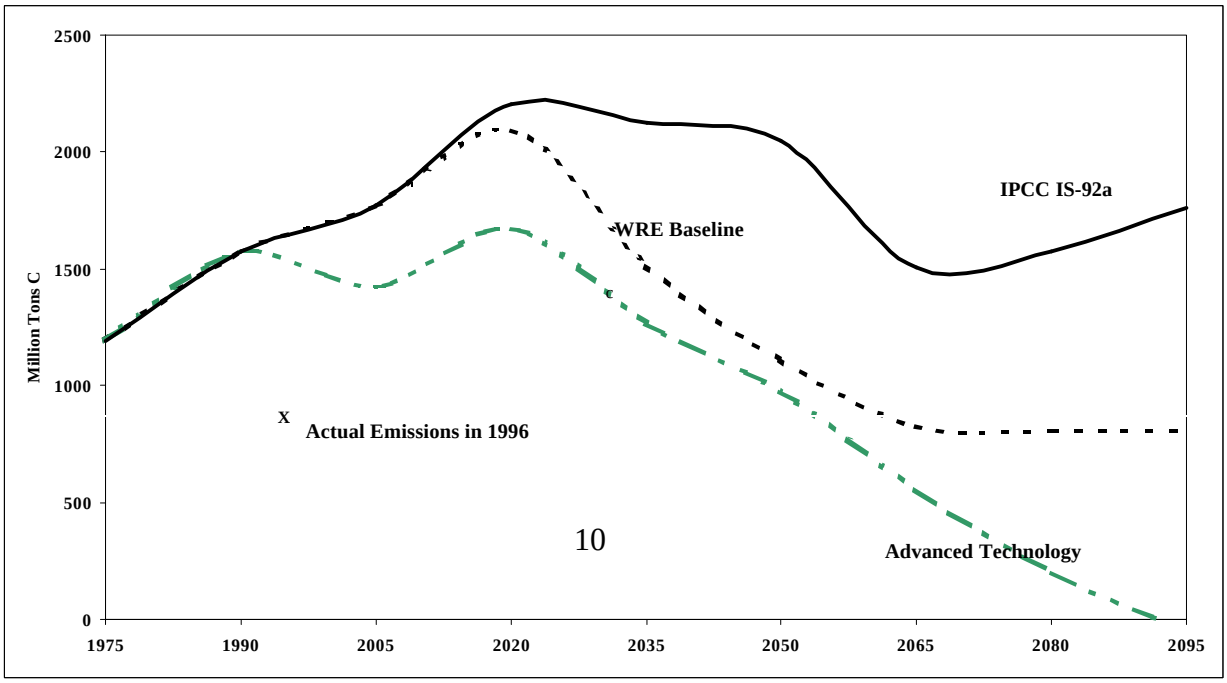


Figure 3: Carbon Emissions in Russia, By Fuel
Figure 4: Benefit of Advanced Technologies



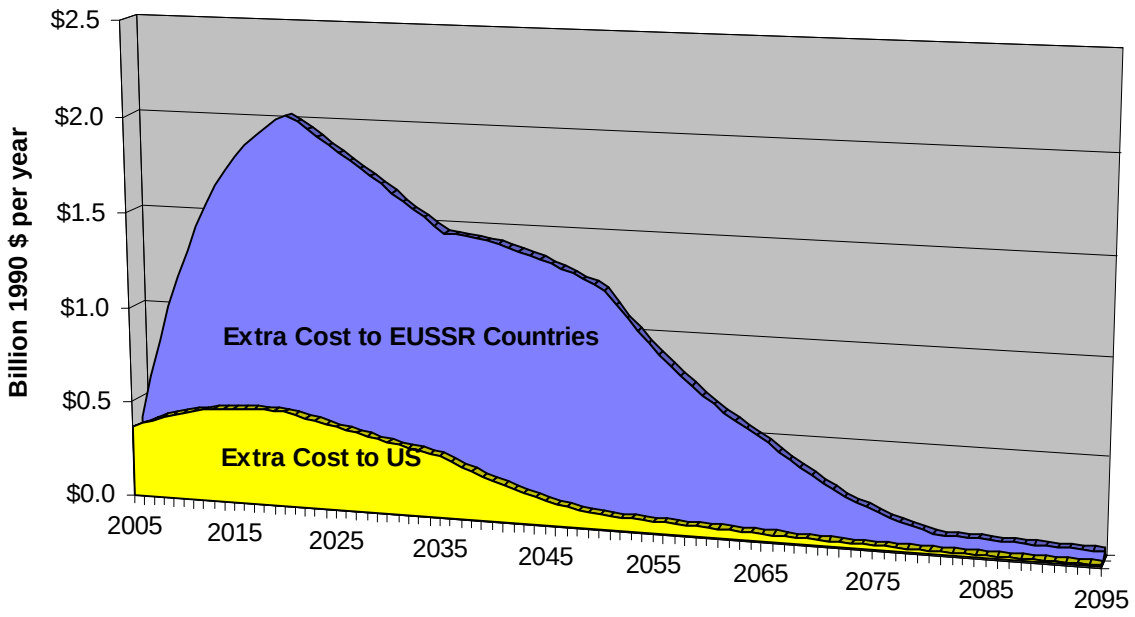


Figure 5: The Cost of Inaction is High

Notes and References

1. President William Clinton, comments before the White House Conference on Climate Change, Gaston Hall, Georgetown University, 6 October 1997. The author was an invited participant in this meeting. See also, Gwen Robinson, Bruce Clark, and Leyla Boulton, Clinton Warning to Developing Nations Over Climate Change, *Financial Times*, 7 October 1997, p. 1.

2. British Petroleum, Annual Statistical Review 1996, Internet, 1997.

3. By ratifying the FCCC, these nations accepted the same obligations as the other Annex I countries. The most important of these obligations is "... returning by the end of the present decade to earlier levels of anthropogenic emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol ..." (Art. 4 paragraph 2a). The year 1990 was generally indicated as the reference year for emissions stabilization (Art. 4 paragraph 2b). The Countries with Economies in Transition were allowed by the Convention to apply "... a certain degree of flexibility ... with regard to the historical level of anthropogenic emission of greenhouse gases ..." (Art. 4 paragraph 6). Poland, for example, adopted 1988 as its reference year.

4. World Bank, *From Plan to Market* (Washington, D.C., World Bank, 1996).

5. A.S. Manne and R.G. Richels, *Buying Greenhouse Insurance: The Economic Costs of CO2 Emission Limits* (Cambridge: MIT Press, 1992).

6. *Ibid*.

7. A.S. Manne, *Global 2100: Alternative Scenarios for Reducing Emissions* (Paris: OECD Working Paper 111).

8. William Chandler, Alexei Makarov, and Zhou Dadi, Energy for the Soviet Union, Eastern Europe, *Scientific American*, October 1990. See also William Chandler, Meredydd Evans, and Alexander Kolesov, 'Climate Change Mitigation: A review of cost estimates and methodologies for the post-planned economies.' *Energy Policy*, Vol. 24, No. 10, 1996.

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10. T.M. Wigley, R. Richels, and J.A. Edmonds, Economic and environmental choices in the stabilization of atmospheric C02 concentrations, *Nature* 379: 240-243, 1996.

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12. Meredydd Evans, "The Status of Joint Implementation Programs in the Countries of Central and Eastern Europe and the Former Soviet Union," Battelle, Pacific Northwest Laboratories, June 1994.

13. Janusz Michalik, Sławomir Pasierb, Jerzy Piszczek, Michał Pyka, and Jan Surówka, "Evaluation of the Feasibility and Profitability of Implementing New Energy Conservation Technologies in Poland," Polish Foundation for Energy Efficiency, October 1992.