Restructuring, liberalisation and EU accession: are transition economies moving towards more sustainable electricity markets?

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Abstract
Electricity markets in Central and Eastern Europe (CEE) are in dynamic change. Restructuring of the economies from planned to market-based ones, privatisation, liberalisation, EU accession, and the Kyoto process all shape market structures and therefore electricity supply and demand. Is it for the better or for the worse?

At the same time, energy intensities are still much higher in CEE countries than those in OECD due to the socialist legacy. Therefore, the improvement of energy efficiency is still a top priority in this region for improving energy security and foreign trade balances, for compensating for the burden of increasing energy tariffs due to the lifting of subsidies, for freeing up capital for other badly needed investments in the economy, and for a general improvement of economic efficiency. Have these changes reduced the energy efficiency gap between CEE and OECD?

The paper surveys the status of electricity sector reforms in CEE, and to what extent the factors shaping the present landscape have contributed to delivering more sustainable electricity services. The author identifies the legacies from the centrally planned economy affecting energy efficiency; reviews the progress of the reforms in overcoming these legacies and the development of energy intensities since the fall of the Berlin wall. The paper analyses the present landscape in the electricity sectors of four selected countries (Hungary, Czech Republic, Poland and Russia), and how the recent reforms, including EU accession and market opening, are influencing the sustainability of the electricity market.

The paper concludes that, while previously largely expected, market reforms alone are not sufficient for closing the energy efficiency gap, but concerted efforts are needed towards the improvement of energy efficiency from regulators, businesses, utilities and the non-governmental sector.

Introduction
As Frank Carter, a lecturer in Geography at the University of London stated, the communists had a cynical approach to pollution. "They monitored air and water pollution faithfully, but did little to curb it […]. State-run factories, the biggest polluters, found it far cheaper to pay the fines than to introduce control measures" (Hinrichsen 1998). This is why in the 90's, life expectancies in the so-called "Black Triangle", the areas of heavy industry and coal mining of Poland, then Czechoslovakia and East Germany, were 3 to 6 years below the average for Europe (Moldan and Schnoor 1992), while levels of particulates and sulphur dioxide were exceeding two to three times the WHO air quality guidelines (Hofmarcher 1998). Carbon emissions per unit of economic output also ranked among the highest in the world. In the months and years following the fall of the Berlin Wall, Western media has turned its attention to CEE – but much of this attention was focused on the grave environmental conditions the centrally planned era has left this region in.

While almost all aspects of industrial and agricultural production contributed their share to a highly polluted environment, the single largest polluter in this region was the energy sector: from mining through production to end-use.

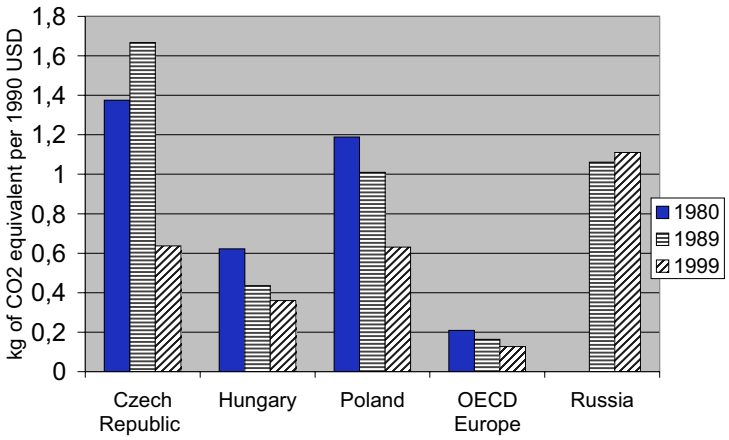

Figure 1. *CO_2 emissions per unit of economic output in selected countries and OECD in 1980, 1989 and 1999. (source: EIA 1999).*

Beyond the general socialist disregard for the environment and emission control, there were other important factors contributing to the energy sector's giant contribution to poor environmental conditions. While industrial output and living standards were far behind those in OECD countries, the level of energy consumption, and therefore energy-related environmental emissions, were comparable to those in "the West". Energy and carbon intensities – the primary energy necessary for and carbon emitted per unit of economic output – thus, were several times higher than those in OECD countries. In fact, the energy and carbon intensities of most Central European countries and Former Soviet Republics were, and for some still are, among the highest in the world[1]. This represented a massive economic inefficiency, which also translated into unsustainable environmental consequences.

The authors of this paper argue that this inefficiency represented by the world-record energy intensities is at the core of the majority of energy-related environmental problems in the region. Thus, beyond the general environmental clean-up tasks and increasing the environmental performance of industry (incl. the energy industry), the most important policy goal for improving the sustainability of energy in the region is to reduce energy intensities.

The purpose of this paper, hence, is to overview how the first decade of the transition from a centrally planned economy has affected energy intensities, and therefore the sustainability of the energy sector. First, we describe the major characteristics of the energy sectors in Central Europe at the fall of the communism, and compare the key energy and carbon indicators to those of OECD countries. Then, we look beyond the curtains and analyse the reasons to the massive rates of inefficiencies in the energy sector. After identifying the legacies of the centrally planned economy affecting energy intensities, we design a policy agenda which could address these legacies. We follow by a chronicle of the first decade of energy restructuring in three selected CEE countries (Czech Republic, Poland and Hungary), and analyse how much of the described policy agenda has been implemented. Then, we examine the situation today: how much the sustainability of the CEE energy sectors has changed, especially how energy intensities have developed. We conclude by identifying the remaining policy agenda items which need to be implemented to complete the transitions in the energy sector. While achieving even these policy targets will not convert CEE energy sectors into fundamentally sustainable ones, at least they will complete the process of transforming energy sectors from a centrally planned mechanism to a market-based one, and to ones which are mature for a European integration. In addition to discussing the negative legacies of the centrally planned economy, we also attempt to identify opportunities for potential "leapfrogging", or some "positive" legacies of the centrally planned economy which may need to be preserved instead of copying the "Western", and, in this case, less sustainable models.

Energy in CEE at the fall of communism

Energy was the single largest polluter in the CEE region at the end of the socialist era. In the so-called "Black Triangle", the areas of heavy industry and coal mining of Poland, Czechoslovakia and East Germany, acid rain has turned square miles of forests into a moonscape. Carbon emissions per unit of economic output were among the highest in the world; several times higher than those in OECD countries (see Figure 1). That is why in the 90's life expectancies in the region were 3 to 6 years below the average for Europe (Moldan and Schnoor 1992) while levels of particulates and sulphur dioxide were exceeding two to three times the WHO air quality guidelines (Hofmarcher 1998).

At the root of all environmental damages related to the energy sector was one key phenomenon: the wasteful production and use of energy in the CEE region. While life quality was much behind that in OECD countries, levels of per capita energy consumption was well comparable to those in the most developed economies. In 1989 a Russian citizen "consumed"[2] more energy than the citizen of any EC country, while he enjoyed only a fraction of the wealth of an EU citizen. As a result, per capita and per GDP environmental emissions were also very high, compared to the low living standards. Thus, at the root of the heavy energy-related environmental damages was the inefficiency of the energy chain, which is often characterised by the indicator energy intensity (TPES/GDP). While this is an indicator which is subject to discussion in the literature, the scale of the differences it points to in CEE definitely reveals real and serious problems.

Figure 2 compares energy intensities in four CEE countries with OECD and EU 15 in the year 1989. While energy intensity figures need to be interpreted with caution, as discussed below under the section "Chronicle of energy intensity developments", the order of magnitude of the differences in this Figure leads us to the key sustainable energy

1. For more detailed figures, see below.
2. Certainly the citizens have not directly consumed all this energy, but their per capita share of the national primary energy consumption was very high.

policy goal of the economic transitions: the reduction of the high energy intensities. Since per capita energy consumptions in the CEE countries and Russia were high enough to support a lifestyle of the most developed economies, there was no need to increase ultimate supply, but to rationalise the generation and use of the supply. Improving the efficiency of energy consumption and production would not only deliver improvement in the environmental conditions, but would enhance national wealth by increasing economic efficiency and productivity and by cutting waste. A significant increase of energy efficiency would also bring other key benefits including the reduction of the need for energy imports therefore increasing national sovereignty, the reduction of foreign debt to which energy imports contributed to a large extent, the freeing up of badly needed capital to other sectors of the economy, and the easing of the social burden of increasing energy bills as a result of tariff hikes.

But to understand how to most effectively reduce energy waste, we need to understand the reasons for these world-record energy intensities. The following chapter explores the legacies of central planning which resulted in these wasteful energy practices.

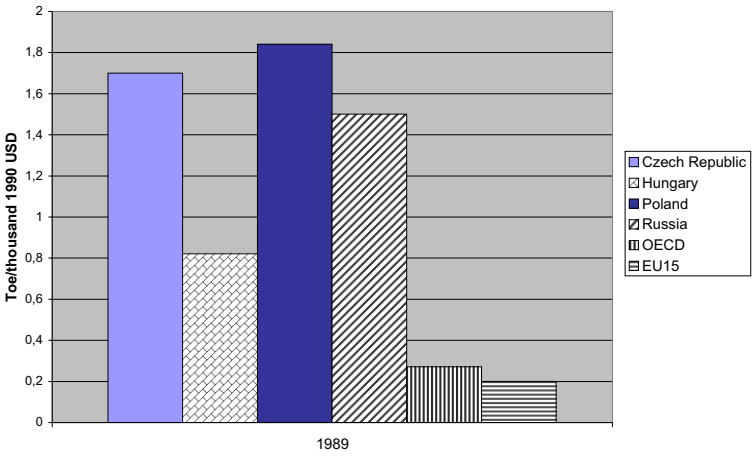

Figure 2. *Energy intensities in selected countries and country groups in 1989 (source IEA 2001).*

Legacies from the centrally planned economy

The reasons of the high energy intensities are embedded in the nature of the socialist economy. Several features of the centrally planned economy contributed to the wasteful practices and energy intensive structures, leaving legacies behind for the economies in transition which need to be addressed.

NEGATIVE LEGACIES

First of all, the planned economy itself does not reward efficiency. In fact, sometimes it encouraged inefficiency: an enterprise obtained energy resource allocations for the next planning period based on its consumption in the previous 5-year plan. This practice not only encouraged waste, but sometimes companies reported higher use than actual to obtain higher allocations. Actually production processes themselves were inefficient too: for example Polish cement required twice as much energy per ton as French cement; in the 80s Soviet steel mills used 1.5 tons of coal to produce a ton of steel, while Japanese used half as much (Chandler 2000).

On an individual level, the communist paradigm of "each to work according to his capabilities, and to be rewarded according to his needs" entirely decouples consumption from production, therefore again encouraging waste. This paradigm has manifested itself in several features of the economy: highly subsidised energy prices (since obtaining the basic utilities was considered an elementary right), flat rates charged independently of actual consumption, and the lack of metering. For the industry, the additional rationale for the subsidization of energy prices was that it served as a means of promoting industrial products' competitiveness in world markets. Furthermore, prices to the residential consumers were typically lower than those charged for the industrial consumers.

With regard to the consumption of natural resources, Marxist economics also detached consumption from resource availability and other features of nature by providing no price signals. In Marx's labour theory of value, natural resources (or rather "raw materials" as he preferred referring to them) had no intrinsic value; the value of a commodity was determined only by the amount of labour which went into producing it (Papp 1977). Thus, the market had no route to signal resource scarcity, market shortages or environmental damages associated with the use of the resource. For instance, oil prices were calculated based on the so-called "Bucharest formula", which was based on the rolling average of the oil prices in the last past five years (US Congress Office of Technology Assessment 1993). This has, for instance, isolated the socialist world from the impacts of the oil crisis in the 70s, and in general resulted in oil prices detached from world prices and market signals.

In addition to resource pricing and the economy not penalising inefficiency, the oversized scale of economies also discouraged efficiency. Instead of local demands driving production, a socialist system-wide "division of labour" resulted in giant industrial establishments producing typically not only for one country, but for several of them. Some industries were assigned to certain countries, for instance Hungary supplied socialist countries with buses, and much of the socialist bloc with canned agricultural products. This division of labour, the purpose of which was also to keep the member countries of the bloc dependent on each other, resulted in inefficient, large production structures, and an unnecessary need for shipping resources and goods.

However, beyond the wasting of energy, high comparative energy intensities resulted also from the structure of the economy. Heavy industry, being a highly energy intensive sector, comprised the lion's share of socialist economies. The deliberate development of heavy industry even in countries lacking the resource basis for it, such as Hungary, was ideologically founded: communism, after all, was founded by and on the pillars of industrial labour. In addition, the strong militarisation during the cold war also required an extensive heavy industry basis.

Even when there was an intention to increase energy efficiency such as in the late 80s and early 90s, it was hard to start: there was a lack of information and detailed data about real energy consumption; there was a lack of awareness of

energy wasting practices and how to improve efficiency. Corruption, widespread in the former socialist bloc, is also a factor contributing to economic and energy inefficiency. Firstly, corruption contributes to general economic inefficiency, further increasing energy intensities. Secondly, corruption related to energy payments eliminates the incentives for conserving energy and efficient energy management (Popiashvili 2000). Corruption in the energy sector in CEE has been shown to be present at all levels, from the level of households to large companies (Lovei et al. 2000). A milder version of corruption prevalent in even the three examined, most developed, CEE countries, is energy theft. Utility officials estimate that as high as 20% of revenues are lost in Hungary in some electric utility areas due to non-payment and electricity theft. Interestingly, an important portion of the theft occurs not for the purposes of meeting elementary human needs, but for heating indoor swimming pools or for eliminating the need to shovel snow in the winter by heating driveways. This, consequently, leads to large energy waste or at least highly energy-intensive consumption practices for luxury services ultimately paid for by the taxpayer.

POSITIVE LEGACIES

However, in addition to the negative legacies of the centrally planned economy, usually well known and often blamed for today's poor economic performances, there were a number of "positive" legacies left to the economies in transition as well. These positive "by-products" of socialist planning are also important to acknowledge, since they could result in leap-frogging in certain aspects of the economy compared to the most developed countries in the world.

One of the few features former socialist countries were leading the world at the fall of the communism was the high share of the organised modes of transport, i.e. urban public transport, and rail passenger and freight transport. For instance, in Warsaw, 80% of all trips were made by public transport in 1985, and it was similarly high in Budapest as well (Vorsatz 1996). In 1988, only approximately one-third of the average 6 000 km travelled per person happened by car in examined CEE countries (IEA 1997), including Poland, Estonia and the USSR, while this share was around 80% in European OECD countries[3]. In 1989, over 90% of freight ton-kilometers were shipped by rail in Romania, while this figure was less than 20% in the UK, and less than 50% in other West European countries (IEA 1997). This was partially the result of a policy artificially keeping people's mobility reliant on organised ways of transport; therefore, people's movements were controllable by the state. This was achieved by a number of means: for instance, citizens had to wait several years for the delivery of their purchased automobile.

As a result of the high load factors and the high share of trips made by public transport, specific energy consumption by transport (expressed by energy per passenger-kilometer) was much lower than in OECD countries, even that of Japan (Vorsatz 1994). For instance, while a Polish citizen travelled only about 40% less in 1988 than West Europeans, he consumed less than a quarter of the energy for travel than did a European (IEA 1997). This was just the opposite of general energy intensity comparisons described above.

One of the reasons CEE settlements were easily serviceable by public transport was the concentrated socialist land use planning. High-rise buildings and concentrated settlements provided not only ideal ground and economic rationale for public transport networks, but also for district heating networks. The high share of district heating among heating modes also results in a "positive" legacy from an energy perspective. Most district heating is in multi-storey apartment buildings in urban areas: for instance 80 % of the apartments in urban areas in Poland were served by district heating in 1995 (IEA 1997, p.119). Large-scale heating systems, especially if provided from a "waste" heat source of industrial units or from other cogeneration sources, are more energy-efficient than individual heating systems. As a result of integrated settlement planning, it was often possible to utilise the waste heat of power plants or industrial plants as district heating or other heat needs. Thus, cogeneration is not a new invention in the former socialist world, but a rather common practice in several CEE countries.

Policy agenda for energy market transitions in CEE

In the first section we concluded that the single most important policy goal of a sustainable energy policy for the economic transitions in CEE is the reduction of energy intensities, thus the improvement of the energy efficiency of the economies in transition. The concrete policy agenda which should follow this goal can be elaborated from the discussion above on the key reasons contributing to the high energy intensities. In this section, we review the policy responses to the legacies from a planned economy identified above. The following sections discuss how much progress has been made during the first decade of transitions of implementing this policy agenda.

When reviewing the list of factors which resulted in the high energy intensities, it can be concluded that a transition from the planned economy to a market economy is expected to address many of these causes. A market economy, ideally, introduces incentives to cut waste, rewards efficiency and penalises inefficiency, introduces economic activity on smaller scales more tailored to local conditions and demand, and provides price signals for excessive use of resources.

However, there are some painful aspects of a market-based energy sector which need to be introduced as part of the transition process. One of the socially most problematic aspects of the transition to a market economy in the energy sector is the lifting of energy subsidies, and thus increasing energy prices. The mechanism of energy pricing is a cornerstone of energy market structures and sustainable energy consumption, and thus we discuss below the pathways different countries have taken in lifting energy subsidies and energy price regulation vs. liberalisation. The social concerns can be addressed through specific and closely targeted subsidies which can help the disadvantaged without distorting the effective price (Grubb 1991).

3. Based on data from Italy, France, United Kingdom and Germany.

Table 1. Policy agenda to reduce high energy intensities and unsustainable energy practices in CEE.

Feature of centrally planned economy contributing to high energy intensity and unsustainable energy practices	Policy response to address feature
No competition, no penalty for inefficiency	Transition to a market economy Privatisation
Unrealistic resource valuation	Introduction of market prices
Subsidised energy prices	Lifting subsidies Liberalisation of energy prices
Flat rates	Consumption based billing Introduction of metering
Dominance of heavy industry	Transition to a market economy Restructuring
Large-scale economies:oversized enterprises	Transition to a market economy, Privatisation
Lack of expertise and awareness	Education, technology transfer
Insufficient data and understanding related to energy use	Data collection on end-use practices Establishment of energy related state institutional background Open access to information Public awareness raising campaigns on efficient energy use practices
Lack of pollution control	Harmonising environmental legislation with EU; improvement of enforcement; privatisation

In addition to the raising of prices, it is important that consumers pay for their real consumption instead of flat rates. Thus, metering of energy consumption need to be introduced to end-users where this was not the practice during socialism. However, consumption based billing alone is not enough for cutting waste: tenants need to be able to control their energy consumption. This often needs system changes, for instance, in district heating, where in most cases thermostats, control valves and bypass pipelines need to be installed for the users to allow individual consumption control.

The dominance of heavy industry was also identified as a key factor contributing to the high energy intensities. With a transition to a market economy, it is expected that economically inefficient, obsolete industrial operations will go out of business, and heavy industries will stay in operation only where the availability of the resources justifies this, or where demand supports it. In general, the economies will likely shift towards a more service oriented structures, thus reducing energy intensities.

Table 1 summarises the key legacies from the centrally planned economy contributing to the high energy intensities, and the policy responses to address them.

With regard to the "positive" legacies identified in the previous section, it is an important question whether any of them should or could be preserved. It is clear that a large part of these positive features cannot be sustained in a market economy, such as the artificially low rate of individual transport and the very concentrated settlement patterns integrated with industrial areas. However, preserving as much of the more sustainable positive legacies into the market economy as possible could certainly result in leapfrogging in certain aspects of the economy. For instance, while a transition to a higher share of individual mobility is inevitable, if careful attention is paid to keeping a high portion of the regular public transport passengers, certainly a more sustainable transport system could be developed in CEE countries than in OECD countries. As shown by the painful attempts in developed countries to increase the share of public transport, if a regular public transport passenger is lost from the system to individual transport (automobile), it is a trend that is extremely hard to reverse due to behavioural reasons.

Hence, preservation of as much of these positive trends as realistic in market conditions is key to a sustainable energy consumption. These countries should pay careful attention to how to sustain the high ridership of public transport, the high utilisation of rail for freight shipping, how to improve district heating so that it is an economically attractive heating option, and what aspects of the low consumption culture could be preserved or promoted. Obviously these goals need "policy leapfrogging": in these aspects there are no examples (or very limited) from the developed market economies to follow in the process of transitions.

A decade of transition: energy landscape in CEE at the turn of the millennium

In this section we review how much of the policy agenda outlined above has been implemented in CEE countries, and what was the result: what is the energy landscape at the turn of the millennium in the CEE. Since covering the entire energy sector and the entire CEE and FSU region would be well beyond the scope of this paper, here we constrain our discussion to one fuel: electricity, and focus it on four selected countries. We discuss developments in the three CEE countries with the most ambitios economic reform agenda completed: Hungary, Poland and the Czech Republic; and as a contrast, Russia, where developments went often in very different directions.

A CHRONICLE OF THE FIRST DECADE OF ENERGY TRANSITIONS

Formally all CEE and FSU economies have declared to assume the basics of market economies instead of socialist structures during the first decade of transitions. This, in theory, should have addressed most legacies left behind by the centrally planned economy contributing to the high energy intensities, as summarised in Table 1. However, a transition to market structures is a gradual one, and the different countries of the region have assumed different pathways for re-

structuring their economies. This section aims to chart how much the selected countries progressed in the key policy agenda items in their electricity sectors: restructuring, privatisation, liberalisation and price reform.

Electricity industry reforms in CEE and Russia

Most countries in Central and Eastern Europe and the Commonwealth of Independent States now pursue similar policies to increase the role of the market in the provision of electricity services.

Before 1990, electricity industries in the CEE countries and the FSU were organized in vertically integrated state enterprises that encompassed all stages of production: generation, transmission and distribution of electricity. In the Czech Republic and Hungary, the domestic electricity industry consisted of a single utility, while Poland's and Russia's electricity industries were made up of a number of regional utilities (five and seventy-two, respectively). In the socialist economies, electric utilities operated under close control of the central authorities of the state. This meant that electric utilities, similar to other state enterprises, had their investments approved and financed by the state (Stern and Davis 1997, p. 6). Following 1989, the re-establishment of financial separation between utilities and the state was set as policy objective in all newly emerged market economies. Corporatisation of electric utilities served as a first step toward making utilities operate on commercial terms. It aimed to create hard budget constraints on electricity enterprises and to abolish the funding of investments from the state budget (Stern and Davis 1997, p. 6).

All the three countries from CEE and also Russia undertook the task of utility corporatisation early in the '90s. Corporatisation usually occurred in combination with various measures of restructuring. Russia and the Czech Republic – the only countries pursuing voucher-based privatization scheme in our sample – also carried out partial privatization early in the process of their electricity industry reform.

As a first step, in the early '90s, governments divided their electric utilities into smaller parts and corporatised them separately. While restructuring in the Czech Republic's and Russia's electricity industry was limited to the unbundling of the distribution part of the industry from the transmission and generation parts, Hungary and Poland also undertook unbundling between generation and transmission. These steps served both to increase the transparency of utilities' operation and to set the stage for further liberalization measures such as privatization and deregulation.

The subsequent histories of the electricity industry reform in the four countries show a rather mixed picture. Poland and Hungary have made significant steps toward liberalizing their electricity industries. Both countries have as well established a separate regulatory body responsible for administering regulation. Poland has also introduced a partial liberalization of the retail market, with full liberalization scheduled for 2005. It is interesting, however, that, despite Poland's strong commitment to deregulation, so far it has been proceeding quite slowly with privatization – so far only 6-7 energy companies have been privatised. In contrast, Hungary embarked on a large-scale privatization program in the mid '90s, selling all distribution companies and six power companies (out of the country's eight) to strategic investors, mostly foreigners. In terms of deregulating the electricity market, however, Hungary is lagging far behind Poland. Hungary's new electricity law, setting the framework conditions for introducing competition, was passed in late 2001, and the first step in electricity market opening was taken in January 2003.

Compared to Poland and Hungary, the Czech Republic and Russia have made rather less progress in restructuring their electricity industries over the last decade. Though both countries privatized parts of their electricty industries quite early, during the first half of the '90s, their governments even now continue to retain the controlling right in the great majority of the privatized enterprices. Furthermore, in both countries, generation and transmission activities remain largely integrated, presenting a major impediment to creating competition. Little progress has been made in establishing an effective and transparent regulatory framework, too.

Despite Russia's considerable efforts to reform its electricity sector, a monopolistic structure of the industry remains. A major obstacle to introducing competition is that one company controls over half the country's total generation capacity. Lack of cost-based prices presents another major obstacle to further progress in Russia. Until tariffs are not allowed to reflect the relative costs of supplying different groups of consumers, regional utilities will not obey federal rules permitting third party access (TPA) for industrial consumers. Finally, in Russia, the electricity reform has been hampered by general economic conditions as well. Operation of the economy has been paralyzed by non-payment and arrears problems all over the '90s. In the electricity sector, sizeable part of total bills remains unpaid and power theft occurs on large scale. It is very unlikely that the role of markets will increase in the provision of electricity in Russia until the basic institutional pillars of the market economy are not reinforced.

Chronicle of electricity price reforms

As mentioned above, during the socialist era energy prices were generally kept well below cost in the CEE economies and the Soviet Union, and industrial tariffs cross-subsidised lower residential ones. Following 1989, the newly elected governments in CEE and CIS all have been facing the challenge of both raising absolute prices toward economic cost and rebalancing relative prices between major groups of consumers. The dynamic of price rebalancing varies significantly from one country to another even in the CEE group.

Poland increased relative prices throughout the first half of the '90s, raised households prices above prices to industrial consumers already in 1992, and, by 1995, achieved a price ratio of 1.5, which is comparable to those in OECD countries. Since then electricity prices have stabilized at the 1995 level. Hungary carried out a significant increase in households prices over the 1994-97 period, and achieved a price ratio of around 1.35 between residential and non-residential consumers by 2000. The Czechs increased relative prices sharply between 1990 and 1992, but then made almost no progress for several years. It was not until 1999 that household prices became finally higher than prices to industrial consumers. In 2000, households prices were 15 per cent above those charged for industry.

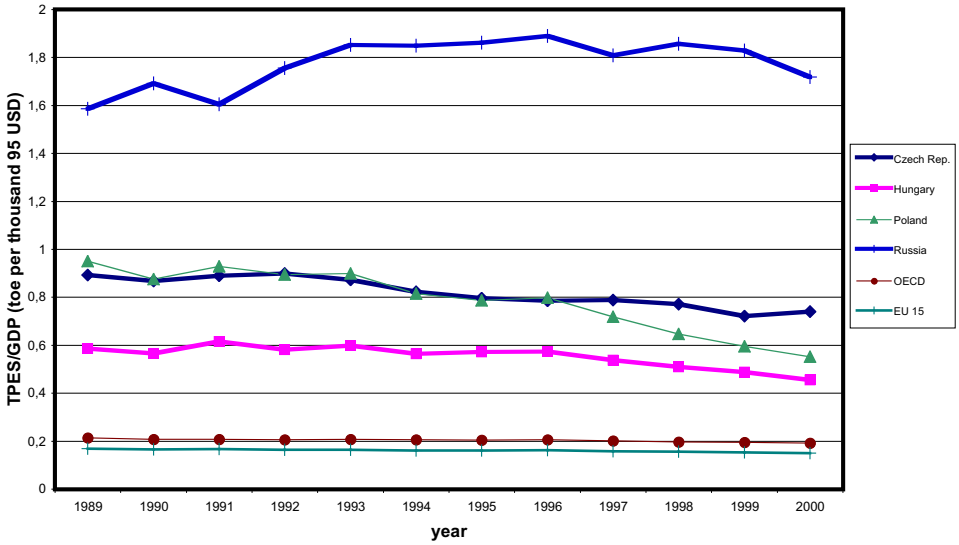

Figure 3. The development of energy intensities in the selected countries and other country groups 1989-2000 *(in toe per thousand 95 US $ exchange rates) (sources: IEA 1998b, 1999b, 2000, 2002 (Until 1992 the data is for the former USSR and are recalculated to 1995 US $ values using deflator obtained from the comparison of IEA 1998b and IEA 2002 sources.)).*

In Russia, energy prices, especially for gas and electricity, remain well below cost. According to recent IEA estimates, Russia's gas and electricity prices reflect rates of subsidy of 46 per cent and 42 per cent, respectively[4] (IEA 2000, p.122).

Furthermore, these prices are often not the effective price paid for energy resources. Non-payment, late payment and payment by barter have become widespread in the Russian economy since the beginning of the '90s. Payment and arrears problems have had harmful effect on the energy sectors, too. In 1997, the collection rate in the gas sector was around 60 per cent. Moreover, cash payment was estimated at only 17 per cent of total bills paid. Similar to the gas sector, electricity and coal industries also had poor collection rates[5] (IEA 2000, p. 124).

CHRONICLE OF ENERGY INTENSITY DEVELOPMENTS

Revisiting our policy agenda outlined in Table 1, we can now conclude that the majority of the policy priorities influencing energy intensities in CEE were implemented in the three selected CEE countries. Energy subsidies have been lifted and cross-subsidisation ceased, and payments are based on consumption in most cases. A significant share of the economy has been privatised, and the energy industry has either largely been privatised, or privatisation and transformation into a market based system at least have been started (in the case of Poland). Most inefficient, obsolete industrial operations have gone out of business. The new economic enterprises are usually less capital intensive, more energy efficient, and typically represent much less energy intensive branches of the economy than the heavy industry. Therefore, after addressing the reasons for inefficiency, it can be expected that energy intensities dropped to levels close to those in OECD countries. Let us thus review the developments in energy intensities over the last decade.

Poland has achieved a total improvement of 41 per cent in its energy intensity over the 1989-2000 period. In the Czech Republic and Hungary, the gain has been in the range between 19 and 22 per cent (Figure 3).

As shown in Figure 3, despite the recent trend, the energy intensities in the CEE economies remain high as compared to those in developed countries. In 1997, Hungary's energy intensity, measured by using 1990 exchange rate, was 3.5 times higher than the corresponding figure for the European Union. In Poland and the Czech Republic, the energy intensity was about twice as high as in Hungary.

However, these ratios should be interpreted with caution. The figures for energy intensity can vary greatly because of the different approaches to estimating GDP. The above figures, based on exchange rates, lie on the higher boundary of estimates and, hence, indicate a large discrepancy between transition economies and developed economies in terms of energy intensity. Other estimates, based on purchasing power parities (PPP), yield less difference in GDP and, hence, in energy intensity between the two groups of countries and within the group of the three CEE economies. For example, in 1999 Hungary's energy intensity at PPP rates was just 10 per cent above the OECD average and only 20 per cent below the corresponding figures for the Czech Republic and Poland (IEA 2001).

Economic restructuring, combined with the lasting recession, has so far worsened the situation in Russia and led to even higher energy intensity of output than in the Soviet era. Energy intensity in Russia *increased* by about 16 per cent between 1989 and 1998 and only started to decline in 1998. There are a number of factors that must have contributed to this development. In the industrial sector, the rise may have happened as many inefficient enterprises have not shut down after 1989, but continued to operate at a lower level of activity. As result, the ratios of fixed energy demand to

4. In both cases, price subsidies are considerably higher for the residential sector than for the industrial sector.
5. *World Energy Outlook* reports that non-payment of energy bills totaled US$85 billion in 1997 in the Russian Federation (IEA 2000, p115).

variable energy demand have increased for these firms. This led to lower energy efficiencies for some key industries of the economy, and contributed thereby to higher energy intensity for the country as a whole (Directorate General, 1998, p. 122). The lack of pricing incentives has also played a significant role. Energy prices, especially for gas and electricity, remain well below cost. Payment and arrears problems have had harmful effect on the energy sectors, too. Due to low energy prices and a limited payment, industrial enterprises have not had any incentive to reduce energy consumption or to invest in more efficient technologies. Thus, low effective prices of energy resources have been a major cause of the high energy intensity of the Russian economy[6] (Directorate General 1998, p. 123).

The remaining agenda of transitions towards a more sustainable energy system

We analysed above the reasons for the high levels of energy intensities in former communist countries by identifying the related legacies from the centrally planned economy. In the following section we outlined a policy agenda to address these legacies. Consequently we examined how much progress has been achieved in the reduction of high energy intensities. We concluded that the energy intensity gap has only worsened in Russia, and has not yet been closed in the CEE countries, and we analysed the reasons for this.

Table 2 summarises the progress made in the policy goals outlined in Table 1. The trends shown in this table underline our justification to energy intensity developments. Energy intensities have decreased in countries which have progressed substantially in economic reforms and energy sector restructuring (CEE countries), therefore addressing most of the legacies of communism affecting energy efficiency. As a contrast, Russia, where the transition to a market economy is incomplete and energy sector reforms have not been radical, energy intensities grew further instead of decreasing.

Thus, we can reinforce that the first key step towards decreasing the world-record energy intensities of former socialist countries is the general transition to a market economy, including the restructuring of the energy sector. *However, a competitive economy and a market-based energy sector alone are not sufficient for closing the energy intensity gap in the short term*. As illustrated by the second half of Table 2, progress in more direct energy efficiency policies beyond the general economic restructuring has been much more limited. While most counties have identified the improvement of energy efficiency as one of the key national energy policy goals, concrete steps have been limited in this direction. Hence, if former communist countries are to reach the levels of energy efficiency in the current EU, energy efficiency needs to be more directly and consistently targeted by policies, institutional and educational reforms. A highlight of specific policy goals to be pursued include, but are certainly not limited to:

- Beyond the harmonisation of legislation with the EU *acquis communitaire*, adaptation of more progressive energy efficiency policy practices from EU and specific member states. This includes performance standards, building codes and certification, and labelling schemes;
- the introduction of voluntary market transformation programs aimed at industries and businesses;
- the incorporation of the energy efficiency understanding into the curriculum of all educational levels (elementary to graduate level);
- expert training and retraining of the elder generation of relevant experts and skilled labour;
- institutional and financial commitment from the government by:
  - the establishment (or reinforcement) and empowerment of the institutional structures for energy efficiency policy, and by
  - commitment of financial and human resources for the purpose;
- the rational, openly advertised and *transparent* distribution of energy efficiency and renewable energy funds;
- consistent end-user data collection and reporting; and free and easy access to such data for research purposes;
- establishing or strengthening the relevant research and development capacities;
- and policies reinforcing the high share of public transport and rail freight in the modal split.

In the three selected CEE countries, moderate progress has been made in some of the points above. Unfortunately it is beyond the scope of this paper to go into details over the specifics of this progress by countries. The list above shows that funding for energy efficiency and renewable energy is, while important, not the only essential element of improving energy efficiency. While almost all items above require some level of funding, some measures, such as energy efficiency performance standards and labelling, education, etc., are associated with minimal costs. Thus, the limited availability of state financing alone is not a legitimate excuse for not pursuing more ambitious energy efficiency policies. On the contrary, it is typically easier to establish the legislative and policy framework before the economic transitions so that the new economy can already be based in calculable financial and legal environment. When the business sector and industrial production are established, it is much more difficult to introduce restrictive legislation such as performance or environmental emissions standards.

However, even if all policies suggested above are pursued, a dramatic change will not come overnight. Some aspects of the economy, such as corruption, non-payment, electricity theft, weak enforcement, and the grey or black economy, all affecting economic and therefore energy effi-

6. World Energy Outlook provides empirical evidence on the interrelationship between electricity prices and electricity intensity. It compares electricity intensity of GDP and households electricity prices across countries. The graphical analysis, based on data of 27 OECD countries and 22 non-OECD countries, reveals a strong inverse relationship between the two, which is difficult to explain solely by structural factors (such as climate and geography.) This suggests that prices, through their impact on energy demand and efficiency, are one of the fundamental variables to determine energy intensity (IEA 2000, p. 40-41).

Table 2. The status of the implementation of the policy agenda outlined in Table 1 in the three discussed CEE countries.

Policy goal to address factor contributing to high energy intensities (see Table 1)	Status of the implementation of policy goal (with a focus on the electricity sector)			
	Poland	Hungary	Czech Republic	Russia
Transition to a market economy	Largely completed	Completed	Completed	Started; further progress needed
Privatisation of the economy (as a percentage of private sector in GDP[1])	Partially completed (67% of GDP is from the private sector)	Largely completed (87% of GDP is from the private sector)	Largely completed (80% of GDP is from the private sector)	Partially completed (about 70% of GDP is from the private sector)
Privatisation of the electricity industry	Started	Largely completed	Partially completed	Partially completed
Liberalisation of the electricity industry	Started	Started in 2003	Started in 2002	Not started
Lifting electricity price subsidies[2]	Completed	Completed	Completed	Not completed
Consumption based billing	Mostly completed	Mostly completed	Mostly completed	Partially completed
Introduction of metering[3]	In process	In process	In process	In process
Increasing energy efficiency awareness	Limited progress	Limited progress	Limited progress	Limited/no progress
Energy efficiency education of experts	Limited/no progress	Limited/no progress	Limited/no progress	Limited/no progress
Data collection on end-use practices	Progress needed	Worsened during the 90s	Worsened during the 90s	Worsened during the 90s
Establishment of energy efficiency related state institutional background	Further progress needed	Much progress made in 2000; further progress needed	Further progress needed	Situation worsened during Putin administration
Open access to information	Improvement needed	Improvement needed	Improvement needed	Improvement needed
Harmonising environmental legislation with EU	Largely completed	Largely completed	Largely completed	Not applicable
Improvement of enforcement	Progress needed	Progress needed	Progress needed	Much progress needed

1) The data for the share of private sector in GDP of the Czech Republic and Poland is for 2000 and is from European Commission 2001a and 2001b. The data for the share of private sector in Hungary is for 2001 and is from Dresdner bank 2001. The data for Russia is from EBRD n.d.
2) In the majority of countries of the world, some form of subsidies exist in energy pricing. Therefore in this row we consider the lifting of price subsidies "completed" if energy subsudies remain within levels prevalent in OECD countries.
3) The most important impediment to consumption based billing is the lack of meters. The installation of meters, and therefore metering, is in process where appropriate.

ciency, will likely take a long time to disappear, since these have become culturally rooted over decades of communist rule. The cultural and behavioural legacies of communism, present in the working attitudes, organisational behaviour and all other levels of operation, have a strong momentum and thus are very difficult to be transformed. Even with the most advanced economic and legislative reforms, these are likely to persist for at least half a generation, slowing progress in economic and energy efficiency improvements. For instance, although the state may devote funds for energy efficiency, if the implementing agency is forced to distribute the money within a few weeks due to administrative reasons, the funds may result in a very limited value per Euro invested.

Conclusion

The goal of this paper was to identify the most important policy agenda towards a sustainable restructuring of the energy sector in Central and East European countries. First, we have demonstrated that the key to a more sustainable energy sector in these countries is the reduction of world-record energy intensities. We have identified the legacies of the centrally planned economy which contributed to these world-record energy intensities. We have outlined a policy agenda which could overcome these legacies as a part of the economic restructuring process. We have pointed out that at the dawn of transitions a unique window of opportunity existed for creating the basics of an economy which is more energy-efficient in some aspects, such as transport, than in the most developed economies. We have, then, summarised the progress which has been made over the first decade of transitions in the relevant economic reforms and energy sector restructuring. We have also examined the developments of energy intensities over the past decade, and shown that the energy efficiency gap between EU and CEE has only broadened in Russia, and has not improved significantly in Central European countries. We have analysed the reasons for this slow or lack of progress. We have demonstrated that radical economic reforms and energy sector restructuring are a key to the improvement of energy intensities, however, they are not sufficient alone.

If CEE countries seriously aim at bringing down their energy intensities to levels close to those in the EU, they need to implement major energy efficiency policies and establish or reinforce the relevant institutional background. It has been pointed out that it is ideal to pursue these reforms at the beginning of the transition process so that the new business and industrial sector is already based in a sustainable and calculable legislative and policy framework. We have drawn the attention to the window of opportunity in the reinforcement of high public transport ridership as a way to leap-frog towards a potentially more sustainable transport system than in the EU. Unfortunately, many of the windows of opportunity for leap-frogging have already closed down for CEE countries, but they still often exist in the slowly

transforming economies such as Russia and other former Soviet Republics. However, such leap-frogging requires not only inventive and dedicated policy-makers who dare not to copy "Western" policies but tailor new ones to local conditions; but also the "West", especially multilateral financial institutions, to acknowledge and promote different, new pathways of development. Finally, we have pointed out that even if the most radical policy, legislative and institutional reforms are implemented, the energy efficiency gap will take time to close due to the slower process of cultural and behavioural change.

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