ELSEVIER

Energy Policy 34 (2006) 2279–2297

ENERGY POLICY

www.elsevier.com/locate/enpol

Energy in transition: From the iron curtain to the European Union

Diana Ürge-Vorsatz[a,*], Gergana Miladinova[b], László Paizs[c]

[a]*Department of Environmental Sciences and Policy, Central European University, and Center for Policy Studies, Nádor utca 9, 1051 Budapest, Hungary*
[b]*Department of Environmental Sciences and Policy, Central European University, Nádor utca 9, 1051 Budapest, Hungary*
[c]*Institute of Economics, Hungarian Academy of Sciences, Budaőrsi út 45. H-1112 Budapest, Hungary*

Available online 17 May 2005

Abstract

The fall of communism left some of the most polluting and wasteful energy sectors of the World in Central and Eastern Europe (CEE). After 15 years of restructuring, eight of these countries have joined the European Union (EU), closing an era of economic transitions. What progress has been made in these countries in the field of energy from the perspective of sustainability? Has the transition agenda been completed, or do any of the socialist energy sector legacies prevail?

The purpose of this paper is to review the period of economic transition in the energy sector, focusing on sustainability, in three selected CEE countries, and to use Russia as a comparison. First, the paper argues that at the core of the unsustainability of energy sectors at the end of the communist era were among the highest energy intensities in the world. Then, we identify the legacies of the centrally planned economy that contributed to these high-energy intensities. We outline a policy agenda for the transitions which addresses the identified legacies. Next, we look at the energy landscape at the end of the restructuring, and review the developments in energy intensities during the period of economic transitions. We conclude that, while energy and economic restructuring is very important to bring down the high-energy intensities of former communist countries, a sizeable gap remains in intensity levels between CEE countries and the old EU states. Therefore, economic and energy system reforms alone will not close the gap, and targeted policies and measures are needed to improve energy efficiency levels. Beyond a more serious governmental commitment, a concerted effort is needed from regulators, corporations, utilities, consumer organisations and the civil sector to catalyse the remaining progress to be made in combating the socialist legacy in the field of energy efficiency.

Keywords: Energy intensity; Communist legacies; Economies in transition

1. Introduction

When the formerly socialist countries of Central and Eastern Europe (CEE) and the Soviet Union shed communist rule in 1989, they exhibited some of the highest energy intensities in the world, signalling serious problems with their energy sectors and economies. Once pollution levels in the communist bloc were internationally, they frequently made headlines in world media, especially those related to energy production. A decade and a half later, on May 1, 2004, eight former communist Central European countries joined the European Union, with which their economic transitions can be considered completed. The decade-and-a-half-long journey from the centrally planned economy to the club of leading market economies has taken these countries through a painful restructuring process. All fields of the economy have witnessed radical changes, including the energy sector. How much progress has been made in their energy sectors from the perspective of sustainability during the transitions? Do the legacies of the centrally planned economy still leave their footprint on the energy sectors of the new member states of the European Union? Has the transition agenda been completed from the perspective of energy sustainability?

The paper first argues that the foundation of the unsustainability of formerly communist energy sectors

*Corresponding author. Tel.: +36 1 327 3021; fax: +36 1 327 3031.
E-mail address: vorsatzd@ceu.hu (D. Ürge-Vorsatz).

0301-4215/$ - see front matter © 2005 Elsevier Ltd. All rights reserved.
doi:10.1016/j.enpol.2005.03.007

was rooted in their high energy intensities. The purpose of this paper hence is to review how the energy intensities and therefore the sustainability of the energy sectors have evolved in Central European countries during the transition period since the fall of Communism. First, we describe the major characteristics of the energy sectors in Central Europe at the fall of communism, and compare the key energy and carbon indicators to those of OECD countries. Then, we look beyond the curtains and analyse the reasons for the massive rates of inefficiencies in the energy sector. After identifying the legacies of the centrally planned economy affecting energy and carbon intensities, we design a policy agenda which could address these legacies. We follow by a review of the "energy history" of the first decade and a half of economic transitions in three selected CEE countries—the Czech Republic, Hungary and Poland—and analyse how much of the described policy agenda has been implemented. To illustrate the different nature of the trends in energy sector restructuring we use Russia as a comparison throughout the paper.[1] Then, we examine the situation today, to see how much the sustainability of the CEE energy sectors has changed, and 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 transform CEE energy sectors into fundamentally sustainable ones, at least they would complete the process of transforming energy sectors from a centrally planned mechanism to a market-based one, and to ones which are mature for participation in the pan-European effort towards climate change mitigation and sustainable development. 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.

2. Energy in CEE at the fall of communism

Energy in Central and Eastern Europe was supplied by some of the most monolithic fuel mixes in Europe during the socialist era. For instance, Poland relied on coal for about 62% of its primary energy and 97% of its electricity supply in 2000 (IEA, 2002; Europrog, 2001). Lithuania, Bulgaria, Slovakia and Hungary ranked among the top ten in the world to rely most on nuclear energy for their electricity supply: in 2002 Lithuania produced 82.7%, Bulgaria 51.5%, Slovakia 55.5% and Hungary 39.7% of their electricity from nuclear energy (Bassan, 2003). Another key characteristic of the energy supply of Central European countries and Soviet Republics was that they relied heavily on energy imports from Russia: energy was one of the leashes through which Russia kept its republics and the satellite countries of CEE dependent, in accordance with the provisions of the Yalta Treaty of 1945. Large imports of natural gas, electricity, oil, nuclear fuel and other primary energy carriers comprised the basis of CEE energy supply.

One of the few positive legacies of the Soviet era for most of the countries in the CEE region is the consequence of this politics: the high share of natural gas in the fuel mix, and the relatively well-developed infrastructure for natural gas. Since Russia is endowed with the lion's share of the world's natural gas reserves, it relies heavily on this fuel as a primary energy source. Furthermore, the USSR and now Russia through the giant natural gas monopoly Gasprom have developed an extensive pipeline network to provide the Baltic states most of the Central Europe with natural gas (see Table 1). This has resulted in a relatively high dependence on natural gas in these countries. For example, Gasprom is the only supplier of natural gas to Estonia, Latvia, Lithuania and Slovakia, and is responsible for 91% of Hungary's natural gas imports, 79% of Poland and about 70% of the Czech Republic's (Dempsey, 2004). Since natural gas is the least polluting of the fossil fuels, and emits approximately half as much carbon to the atmosphere per unit energy as coal does, this had a small positive impact on the overall environmental performance of the energy sectors of these economies.

While this high reliance on natural gas was desirable from an environmental perspective in the short-term (when it replaces poor quality coal or nuclear fuel), after the fall of the Soviet era, it raised concerns of national sovereignty in several CEE countries and former Soviet republics. Since diversifying the import sources of natural gas is burdensome due to the costly and time-consuming pipeline construction, fuel diversification emerged instead at the top of the energy policy (politics) agenda of several CEE countries as a tool to promote energy security. Natural gas, however, remains an important fuel in the CEE region.

Energy was the single largest polluter of 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. About 80 million tons of lignite coal were burnt annually in this region, resulting in 3 million tons

[1]Please note that it is not the purpose of this paper to analyze Russian issues. Trends and processes in Russia are used to highlight the similarities and differences in Russian and Central European socialist legacies and economic transition pathways.

Table 1
Share of natural gas in the total primary energy supply in the CEE countries in 2001

Country	Hungary	Slovakia	Latvia	Lithuania	Czech Republic	Estonia	Slovenia	Poland
Share of natural gas in the TPES (%)	42.3%	32.9%	29.6%	27.1%	19.4%	15.1%	13.1%	11.5%

Source: IEA (2004a, b).

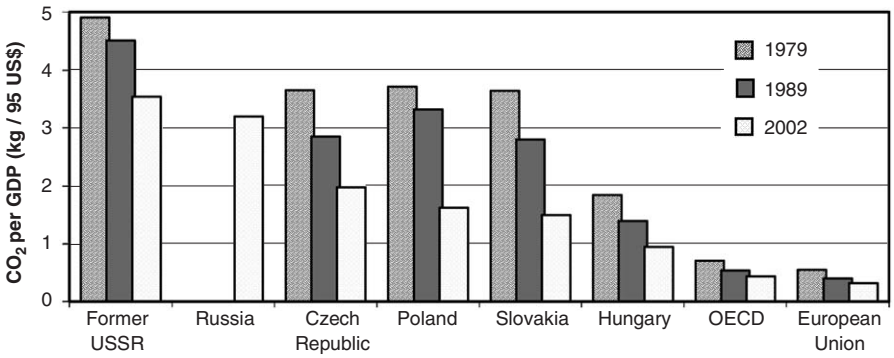

Fig. 1. CO_2 emissions per GDP at real exchange rates in selected countries and countries' groups in 1979, 1989 and 2002 (sources: IEA, 2001b, 2004a, b).

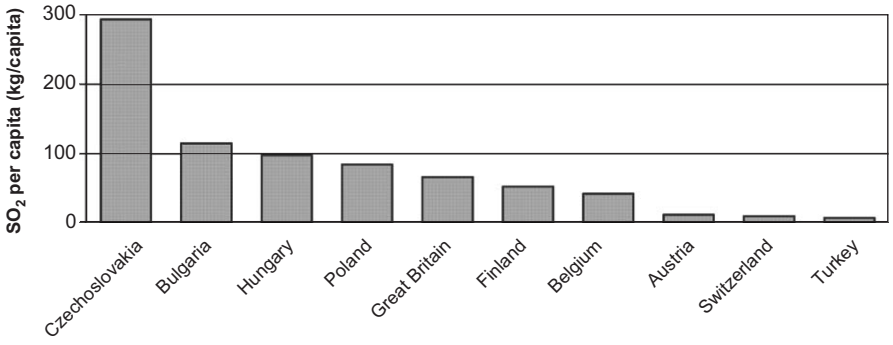

Fig. 2. Per capita SO_2 emissions in selected countries in 1990 (source: FFU database, 2003).

of SO_2 and 1 million ton on NO_2 emissions (Manczyk, 1999). Carbon emissions per unit of economic output were among the highest in the world; several times higher than those in OECD countries (see Fig. 1). In the 90's life expectancies in the region were 3–6 years below the average for Europe (Moldan and Schnoor, 1992), while levels of particulates and sulphur dioxide exceeded by two to three times the WHO air quality guidelines (Hofmarcher, 1998).

One of the reasons for high environmental emissions was the relatively poor quality of the fossil fuels, especially concerning their sulphur content, the lack of or limited environmental pollution control, and the fact that energy facilities were old by the turn of the 90s and equipped with obsolete, inefficient technologies (Fig. 2).

However, at the root of all environmental damages related to the energy sector was one single phenomenon: the wasteful production and use of energy in the CEE region. While life quality was much lower than that in OECD countries, levels of per capita energy consumption were comparable to those in the most developed economies. For instance, in 1989 a citizen of the USSR "consumed"[2] slightly more energy than the average EU citizen (Fig. 3), 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, despite the low living standards. Thus, at the root of the grave energy-related environmental damages was the inefficiency of the energy chain, which is often characterised by the reference to energy intensity or the total primary energy supply (TPES) per unit of gross domestic product (GDP) measured at real exchange

[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.

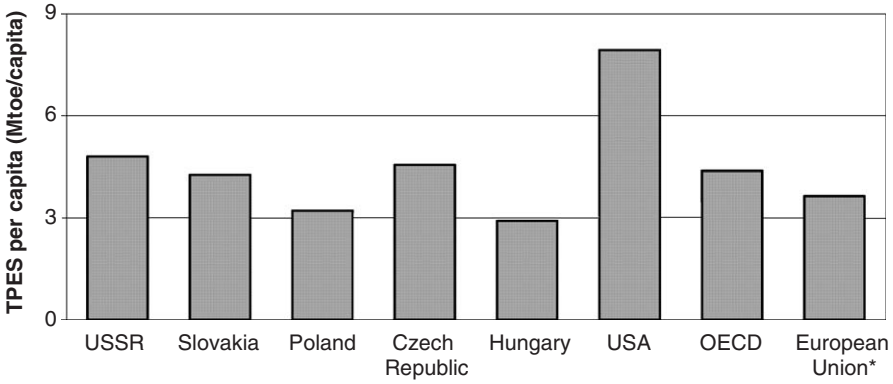

Fig. 3. Total Primary energy supply (TPES) per capita in selected countries and countries' groups in 1989 (sources: IEA, 2004a, b). *Data refer as of EU-15.

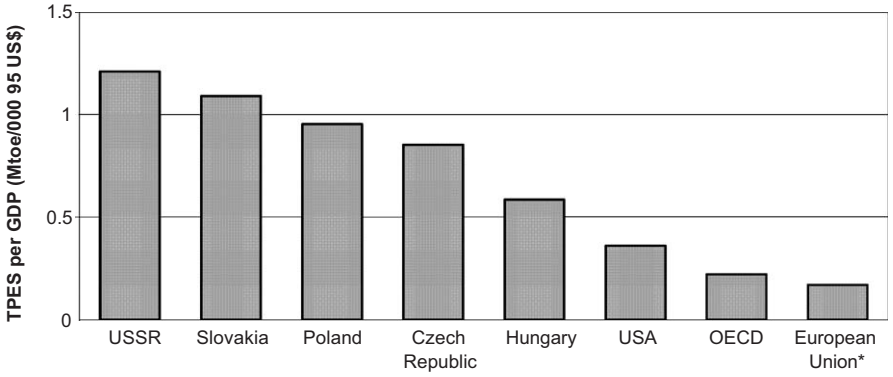

Fig. 4. Total Primary energy supply (TPES) per unit of economic output (GDP) measured at real exchange rates in selected countries and countries' groups in 1989 (sources: IEA, 2004a, b). *Data refer as of EU-15.

rates or at purchasing power parities (TPES/GDP or TPES/pppGDP).[3,4]

Fig. 4 illustrates that while per capita primary energy consumption levels were comparable as presented in Fig. 3, the economies of the four countries were between 3 and 7 times more energy intensive in 1989 than countries in the European Union. For instance, the USSR needed about 7 times more primary energy per unit of economic output than the average OECD country.

The above-mentioned facts about energy intensities lead us to the formulation of the key sustainable energy policy goal of the economic transitions: the reduction of the high-energy intensities. Since per capita energy consumption in the CEE countries and Russia was high enough to support the lifestyle of the most developed economies, there was no need to increase ultimate supply, but to rationalise production and the use of the supply. While the benefits of improving resource efficiency are widely celebrated (Weizsacher et al., 1997; Lovins et al., 1989; Hawken et al., 1999), the potential gains from increased levels of energy efficiency in the region were especially desirable. For instance, 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. Raising levels of energy efficiency would also bring other key macroeconomic benefits including the reduction of the need for energy imports (therefore increasing national security), the reduction of foreign debt to which energy imports contributed to a large extent, and the freeing up of badly needed capital to other sectors of the economy. Last, but

[3]One of the main sources of data for this paper is the database of the International Energy Agency (IEA) which as a creation of the Organization for Economic Cooperation and Development (OECD) shares the same macroeconomic statistics as the OECD. The authors are aware that in some cases the data for some countries have been questioned by some experts but still it is one of the few comprehensive sources that provides 'common ground' data for international comparison.

[4]It is considered that because of the wide fluctuations of currency exchange rates, GDP at real exchange rates undervalues the purchasing power of the different currencies and to reflect this the GDP at purchasing power parities measure has been developed which (IEA, 2004a), however, might overestimate the purchasing power. That is why different authors use either one or the other parameter, or both, as is the case in this publication.

not least, improved efficiency could ease the social burden of increasing energy bills as a result of tariff hikes while subsidies are lifted.

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

3. Legacies of the centrally planned economy

The reasons for the high-energy intensities in the CEE countries 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 transitioning economies which need to be addressed. Apart from the negative legacies it also needs to be recognised that there are some positive aspects in their energy consumption which are also discussed below.

3.1. 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 than actual use to achieve higher allocations. 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 those in Japan 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, a lack of metering. For industry, an additional rationale for the subsidisation of energy prices was that it served as a means of promoting industrial products' competitiveness in world markets. Furthermore, prices to residential consumers were typically lower than those charged for 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 to refer 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, there was no market mechanism to signal resource scarcity, market shortages or environmental damage associated with the use of a resource. For instance, since 1958 oil prices were fixed every year based on the so-called "Bucharest formula", which was based on the rolling average of the world oil prices in the last 5 years and from 1975 in the last 3 years (US Congress, 1993). This 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 Czechoslovakia supplied socialist countries with trams, Hungary with buses. 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 and inflexible 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 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 and McKechnie, 2000). A milder version of corruption

prevalent in even the three examined, most developed, CEE countries, is energy theft. Utility officials estimate that as much as 20% of revenues were lost in Hungary in some electric utility areas due to non-payment and electricity theft in the mid-1990s. Interestingly, an important portion of the theft occurs not for the purposes of meeting elementary human needs, but for heating indoor swimming pools. This, consequently, leads to large energy waste or at least highly energy-intensive consumption practices for luxury services ultimately paid for by the taxpayer or other consumers.

3.2. 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 transitioning economies 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 in which former socialist countries were leading the world at the fall of communism was the high share of 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, 1997). In 1988, only approximately one-third of the average 6000 km travelled per person happened by car in all countries examined by the IEA (IEA, 1997), including Poland, Estonia and the USSR, while this share was around 80% in European OECD countries.[5] This was partially the result of a policy artificially keeping people's mobility reliant on organised ways of transport (that way, people's movements were controllable by the state). This was achieved by a number of means: for one thing, citizens had to wait several years for the delivery of their purchased automobile. For instance, in the former East Germany, waiting periods for a Wartburg were as high as 14 years. In addition to the long waiting times, cars and driving were difficult to afford from the uniformly low wages, especially when compared to the costs of subsidised public transport.

But in addition to the artificial control of individual mobility, efficient public transport systems also provided a positive incentive for the use of public transport. Although this was not uniform, in several CEE cities the public transport network density was very high, providing easy access to transport lines. Frequent services also made public transport an attractive alternative to the automobile. Passenger rail transport possessed similar features: the railway connected also low-population villages to the network. At the same time, buses, trains and other public transport vehicles were often congested and not clean, leaving space for improvement in a market economy to make them more desirable.

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-kilometre) was much lower than in OECD countries, even that of Japan (Vorsatz, 1994). For instance, while Polish citizens travelled only about 40% less in 1988 than West Europeans, they consumed less than a quarter of the energy for travel than did Europeans (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 ideal ground and economic rationale not only 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. In general district heating is considered to be more beneficial than the individual heating because it is associated with lower capital, energy, operating and maintenance costs, and is more reliable and environmentally friendly as concluded by Euroheat and Power (2003). It also reduces the 'number of chimneys' in the cities and the need for fuel to be delivered to homes (Euroheat and Power, 2003). District heating has a significant market share in most of the CEE countries and the Russian Federation reaching more than 50% of the households in 1999 in Latvia, the Russian Federation, Lithuania, Poland and Estonia (Cherubin, 2003). In Latvia and the Russian Federation it is the dominant way of heating, with a 70% share. Among the EU countries the figures are much lower, with the highest percentage (51%), achieved in Denmark (Constantinescu, 2002). District heating was utilised mainly in the cities, providing, for instance, heat for 70% of the urban households in Poland (IEA, 1995) and 80% in the Slovak Republic (ECB, 2002).

However, district heating is a double-edged sword: while the general concept is desirable, as often in socialism, the implementation was poor: today systems are leaky, inefficient, obsolete and have high losses, and are thus often uneconomic, expensive and unreliable, a fact which has been acknowledged in several reports (Brendow, 2003; ESD et al., 2001; Gochenour, 2001). In the winter in CEE cities, lines of melted snow on the ground are a common sight, marking the underground district heating pipes. In some countries where coal is the predominant fuel it is also used by district heating utilities , thereby reducing significantly the quality of air in the cities (as was the case of Poland where about 80%

[5]Based on data from Italy, France, United Kingdom and Germany.

of district heating installations were coal-fuelled) (Euroheat and Power, 2001).

Another positive legacy from the Communist past was that, 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. For example, data shows in 2000 the electrical output of CHPs accounted for 19% of the total electricity production in the ten CEE countries, while this figure for the EU is only 12% (the EU goal is 18% but only by 2010) (ESD et al., 2001). Still, it should be mentioned that in recent years the share of combined heat and power (CHP) production in district heating has been lower than in the present EU member states (Constantinescu, 2002).

Another issue to consider is the initial intention to ensure energy efficiency through building multifamily apartments, which should have been more energy-sparing than single-family houses. The assumption was that as multifamily housing had less external building envelope than individual houses with the same floor space, the energy losses per unit of living space should be smaller (Chandler, 2000). However, this planned effect was many times offset by the lack of basic energy efficiency requirements in apartments, built of cemented blocks or concrete panels–Polish homes still use twice as much energy per square meter per degree-day as Western European ones (Chandler, 2000).

Another positive legacy of the planned economy, largely disappearing by the turn of the millennium, was the low rate of individual consumerism. For instance, the rate of packaging was very limited during the socialist era, and reusable packaging was common. This has resulted in a common and efficient bottle deposit system for drinks, and in some cases certain other products, such as honey in Kiev (Watt, 2004, pers. comm.), were only purchasable if the buyer took a container with him/her. In addition to packaging, reusing materials and components on a household level was common, shown by the relatively low volume of household waste.

This high level of reusing and recycling materials was not only the result of the low spending power of salaries, but also of the supply limited economy of socialism. In most countries long queues were common for even everyday goods such as bread and milk; some countries (e.g. Poland) even adopted voucher systems for basic foods, such as meat and sugar, on an individual quota basis. In such a supply limited environment, residents had the incentive to take the greatest possible advantage of all products by re-using packaging, are mending faulty products instead of replacing them. Even though imposed by constraints, such behaviour resulted in decrease of waste and an increase of economic efficiency on a household level.

It is clear that, while much of this is desirable strictly from a sustainability perspective, it would be unrealistic to expect that all of these positive legacies could be conserved. Since many of these evolved in response to constraints imposed by the supply limited economy, such as the low levels of individual mobility, their levels were artificial and could not be sustained under the conditions of a free market. However, behavioural change has a large momentum, and consumption patterns evolve historically and are determined by a large number of factors, therefore this situation offered an important window of opportunity for leapfrogging. If some of these positive aspects of the economy and individual behaviour could be conserved, certain fields of the economy could be kept at more sustainable levels than in the present market economies.

4. Policy agenda for energy market transitions in CEE

In the section above 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 transitioning economies. What concrete policy agenda follows from this policy 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 years of transition of implementing this policy agenda.

First of all, the key energy policy priority of most CEE countries and former Soviet Republics is the diversification of energy importers and fuels, to increase national sovereignty and energy security. A large step in this direction has been taken since most of the CEE countries have joined the Union for the Co-ordination of Transmission of Electricity (UCTE) and are now part of the European interconnected electric system (the last to join it from the CEE countries in May 2003 were Bulgaria and Romania) (UCTE, 2003). Yet most of the countries continue to be dependent on the Russian Federation for their gas and oil needs. While significant further efforts are needed in this direction, this discussion is not within the scope of the paper.

Beyond diversification, most CEE countries identify the increasing of energy efficiency and renewable energy sources as a national energy policy priority. However, results have been mixed in this direction (Urge-Vorsatz et al., 2003).

When reviewing the list of factors which resulted in the high energy intensities (Table 2), it can be concluded

Table 2
Policy agenda to reduce high energy intensities and unsustainable energy practices in CEE

Negative legacies from the centrally planned economy	Policy response to address the legacies
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 (mainly for district heating)	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 Independent evaluation and monitoring
Lack of pollution control	Harmonising environmental legislation with EU; improvement of enforcement; privatisation

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 a smaller scale 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. Since this process results in significant social stress, social and financial buffers need to be introduced. One approach is the offering of specific and closely targeted subsidies—cold weather payments for low income consumers, and an energy supplement or free minimum fuel allowance for domestic consumers (Grubb, 1991). However, a more sustainable solution is to use the subsidies to invest in improving the efficiency of energy consumption of poor households which could lead to long-term utility bill reductions.

Table 2 summarises the key legacies from the centrally planned economy contributing to the high energy intensities, and the policy responses to address them. Comments on the efforts that are needed to be undertaken by governments to complete the reform are included in Section 6.

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, and if yes, to what extent. It is clear that a large part of these positive features cannot be sustained in a market economy, as suggested above, 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 in 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 most OECD countries. Unfortunately, there are concerns that such a cautious approach is not observable in the CEE countries. For example, two thirds of the transport loans (which were 7.7 billion Euro in total) provided by the European Investment Bank in the period 1998–2003 to the CEE countries were for investments in roads compared to 17.5% in rail and 7.5% in urban transport (CEE Bank Watch, 2004).

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, it is a trend that is extremely hard to reverse later due to behavioural reasons.

Hence, preservation of as much of these positive trends as is realistic in market conditions is key to sustainable energy consumption in former communist countries. These countries should pay careful attention to how to sustain high ridership of public transport, 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 (or very limited) examples

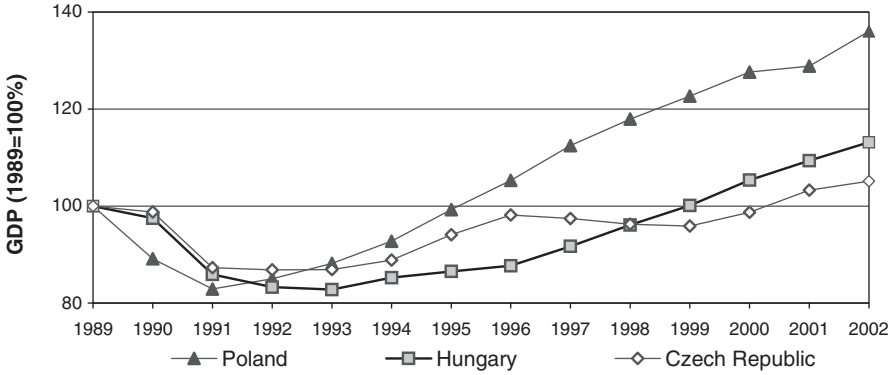

Fig. 5. The development of gross domestic product in the selected CEE countries and Russia, 1989–2002, as a percent of 1989 values (sources: IEA, 2004a, b).

from the developed market economies to follow in the process of transitions.

5. A decade and half of transition: energy in CEE at the doorstep of the European Union

In this paper first we showed that the high-energy intensities were at the core of unsustainable energy systems in the former communist bloc. Then, we identified the legacies from the centrally planned economy which contributed to these high energy intensities, and outlined an energy policy agenda for the transitions that follows from these legacies and which can lead these countries towards more energy-efficient economies. In this section we review the decade and a half of economic transitions: what is the energy landscape at the time of European integration? How much of the policy agenda outlined above has been implemented? What is the result? Have the socialist legacies disappeared and the energy intensity gap closed?

5.1. The energy landscape at the end of economic transitions[6]

It is well known that all post-communist economies of Central and East Europe (CEE) and the Commonwealth of Independent States (CIS) experienced deep structural crises after 1989. The Czech Republic, Hungary and Poland had an average contraction of around 18–20% in real GDP[7] between 1989 and 1993 (Fig. 5).

Since then, GDP figures have been rebounding and the three countries enjoyed significant economic growth, with the 1989 levels recovered in the second half of the '90 s. In contrast with the CEE countries, the Russian economy has been undergoing a much deeper recession. Over ten years, from 1992[8] to 1998, real GDP dropped by about 44% of its value and although for the period 1998–2002 there was a 30% increase, Russian GDP in 2002 was still 9% lower than in 1992 (IEA, 2004b).

The economic crisis resulted in a significant drop in the demand for energy in all of the socialist bloc countries. In 1993, total primary energy supply (TPES) in the three chosen countries in CEE was on average 18% below the 1989 level (Fig. 6). Energy demand followed a similar trend in all three CEE countries discussed until 1998, while in 2002 the picture is different for the four countries (Fig. 6). TPES growth resumed in 1998 in all the countries except for Poland. However, if longer term trends are observed, Hungary, the Czech Republic and Russia have roughly maintained total primary energy demand levels between 1993 and 2002, while Poland has decreased its energy consumption. Thus, despite the economic recovery since 1993, energy consumption in the three CEE economies has stabilised at or dropped below the 1993 levels. This demonstrates a decoupling of growth and energy demand, and indicates a continuous improvement of energy intensity, to be discussed in the following section.

As a direct consequence of the continuing economic recession, Russia's energy demand has declined sharply throughout the '90s. Between 1992 and 1998, TPES fell by about 25% (Fig. 6), since when it has resumed a moderate growth. This evolution of energy consumption in Russia has also resulted in a significant reduction of

[6]This section describes the trends in the sector during the entire decade and a half of economic transitions. However, at the time of the writing of this paper (2004) the latest data were typically from 2001–2002, thus the data span less than the entire discussed period.

[7]In this paper, the terms "real GDP" and "GDP" are used interchangeably.

[8]This is the first year after the reforms from which data for the Russian Federation is available in the statistics used for the paper, which is why Russia is not included in all figures.

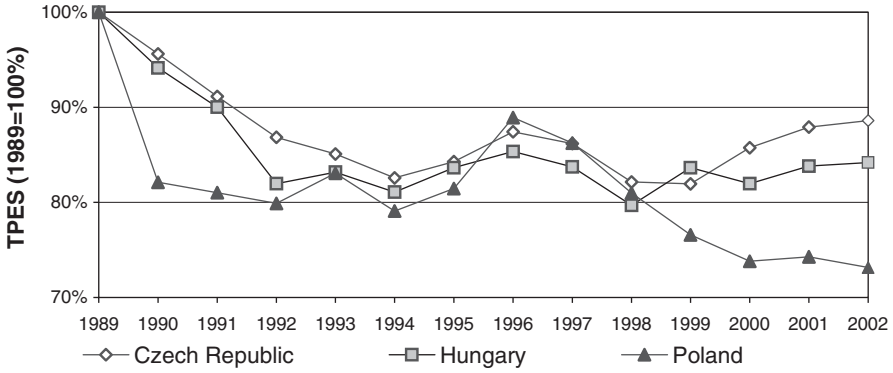

Fig. 6. The development of primary energy supply in the selected CEE countries, 1989–2002, as a percent of 1989 values (sources: IEA, 2004a, b).

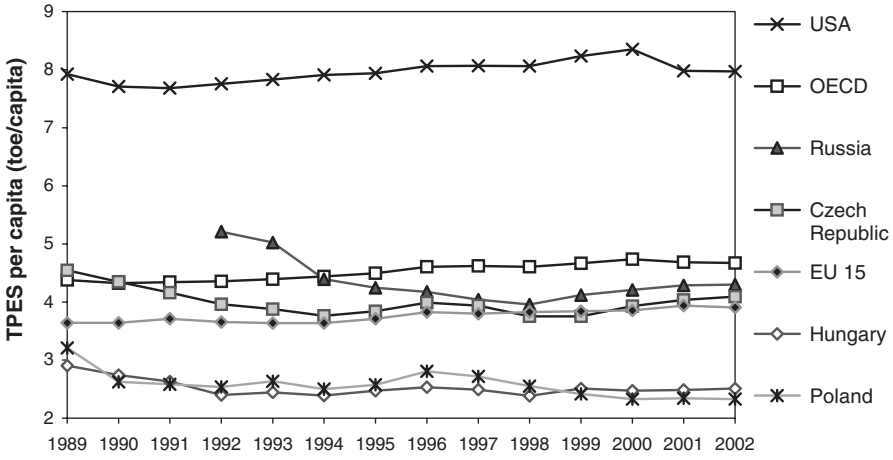

Fig. 7. The development of total primary energy supply per capita in selected countries and country groups for the period 1989–2002 (sources: IEA, 2004a, b).

energy supply per capita which almost reached the figures for the European Union and the Czech Republic. In the case of Hungary and Poland, the energy supply per capita is about 60% of the average energy supply per capita in the EU-15 (Fig. 7).

5.2. Chronicle of energy intensity developments

Revisiting our policy agenda outlined in Table 2 above, now we can 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 has largely 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. 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, most legacies which contributed to the high energy intensities should have disappeared. EU market structures and environmental legislation, including directives aimed at improving energy efficiency, have been adopted. It can therefore be expected that energy intensities will have dropped to levels close to those in other EU countries. Let us thus review the developments in energy intensities over the period of economic transition.

Poland has achieved a remarkable improvement of about 46% in its energy intensity over the 1989–2002 period. In the Czech Republic and Hungary, the gain has been between 15% and 25% (Fig. 8). While the Polish progress is considerable, the improvement for Hungary and the Czech Republic is only slightly better than for the EU-15.

As shown in Fig. 9, despite the progress, energy intensities in the CEE countries remain high as compared to those in the old market economies. In 2002, energy intensity in Hungary and Poland (in terms of real GDP, measured in 95US$), was about three

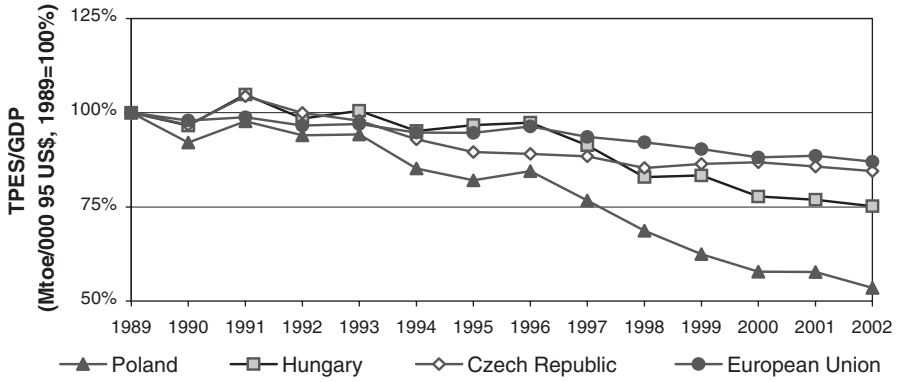

Fig. 8. The development of energy intensities (measured at real exchange rates) in selected countries and EU for the period 1989–2002, as a percent of 1989 values (sources: IEA, 2004a, b).

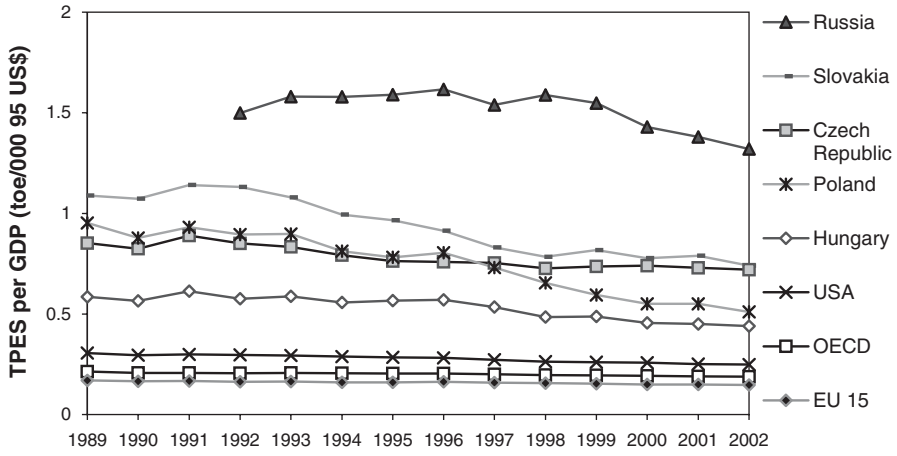

Fig. 9. The development of energy intensities (measured in real exchange rates) in the selected countries and countries' groups for the period 1989–2002 (sources: IEA, 2004a, b).

times higher than the corresponding figure for the EU-15, while intensities for Slovakia and the Czech Republic were about five times higher, and the Russian Federation's energy intensity was about nine times higher.

However, the figures for energy intensity can vary greatly due to the different approaches to estimating GDP. The above figures, based on real exchange rates, lie on the higher boundary of estimates and, hence, indicate a large discrepancy between transitional 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 (Fig. 10). For example, in 2002 Hungary's energy intensity at PPP rates was similar to the OECD average—although the intensity gap was not significant in 1989 either, and only 29% higher than that of the EU. Poland has achieved a 46% energy intensity reduction in PPP terms for the 1989–2001 period, coming down to a 41% higher value than the EU-15 in 2002. The Czech Republic is still over 76% more energy intensive than the EU, and the Russian value has climbed to three and a half times of the EU rates.

Examining Figs. 9 and 10, it is clear that in general there is some degree of convergence between energy intensities of the developed world and transition economies. However, while a strong converging trend is clear for Poland and Hungary, the Czech Republic shows only limited convergence and there is actually divergence in the case of Russia.

These trends support our hypothesis that in countries where reforms to overcome the socialist legacies identified above have been implemented, energy intensities are also on the decline and are converging to levels of the old market economies, while Russia, where many of the reforms have been lagging behind, has not experienced a reduction in its energy intensity gap with the developed world.

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

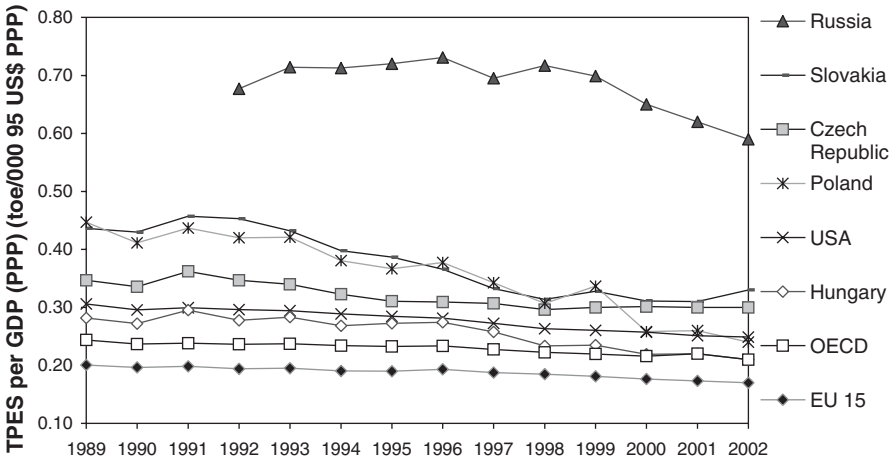

Fig. 10. The development of energy intensities in the selected countries and countries' groups and OECD (measured in purchasing power parities) for the period 1989–2002 (sources: IEA, 2004a, b).

the Soviet era. Russia's energy intensity still remained high and there has been limited progress with only a 13% decrease in the TPES measured at purchasing power parities over the period 1992–2002 (Fig. 10). There are a number of factors that have contributed to this development. In the industrial sector many inefficient enterprises have not shut down after 1989, but continued to operate at a lower level of activity. Energy prices, especially for gas and electricity, remain well below cost. Payment and arrears problems have had a harmful effect on the energy sectors, too. Due to low energy prices and limited payments, industrial enterprises have not had 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[9] (Directorate-General For Energy, 1998).

While it is clear why the level of energy efficiency has not improved considerably in Russia, it is interesting to examine why energy intensities have not dropped more dynamically in CEE countries despite the advanced stage of economic reforms, and why the three selected CEE countries have followed relatively different patterns of development in this area. The question emerges what the reasons are for these different rates of change among the three CEE countries. First, it is important to understand the differences in the 'baseline' conditions: Hungary executed many economic reforms already in the 80s, thus its energy intensity at the end of that decade was already lower than that of the other two countries. Thus, Hungary started already from a lower baseline than Poland at the fall of the iron curtain.

There are also a number of studies in this area decomposing energy intensity changes in these countries (Cornillie and Frankhauser, 2002; Energy Charter Secretariat, 2003; Elek and Nagy, 2004; Olshanskaya, 2004, Wnuk and Berent-Kowalska, 2004; Kononov et al., 1992). In some instances their results are not similar, or even contradict one another, which shows how difficult it is to obtain a comprehensive picture on the impact of the changes in the region. Some of the main problems that according to the authors cause these differences in the findings are the lack of reliable and comprehensive statistical data, and the differences in the level of analysis (macro vs. micro), in the chosen approach and in the time span under analysis. The European Bank for Reconstruction and Development (EBRD) has conducted an analysis (Cornillie and Frankhauser, 2002) aimed at the identification of the main factors that have driven the changes in energy intensity in CEE at macroeconomic level, former Soviet Union and Yugoslavia and Albania for the period 1992–1998. Energy intensity changes were broken down into four components: changes in industry, transport, the rest of the economy (agriculture, services and domestic), and structural changes. One of their important findings which is probably contrary to typical expectations is that *structural changes although having positive impact in most of the countries in transition have not contributed in a significant way to the reduction of energy intensity*. Given the major shift in economic structure, this seems hard to believe. Although similar

[9]World Energy Outlook provides empirical evidence on the interrelationship between electricity prices and energy intensity. It compares electricity intensity of GDP and household 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).

research with conclusions for all countries in transition has not been identified, other publications show that although the data at the microeconomic level is different it still could result in generalised conclusions like those of Cornillie and Frankhauser. For example, the study of Olshanskaya (2004) on the impact of the structural changes in Russia within the industrial sector for the period 1994–2002 showed that from 1994 until 1997 within the Russian industrial sector there were changes towards more energy intensive branches, a tendency which was offset by the positive effect of the structural changes after the downturn in 1998, and until 2002 the aggregated contribution of the structural changes was insignificant.

In Hungary a decoupling was observed for energy consumption in industry as compared to economic growth, leading to a decline of 15% in industrial energy intensity during the 1992–1998 period, while that of the rest of the economy remained constant or increased slightly (Cornillie and Frankhauser, 2002). The authors of a study of the Energy Charter Secretariat (2003) came to slightly different conclusions regarding the decline of energy intensity of industry which over the period 1994–2000 was calculated to be about 7%, while the impact of the changes of the intensity of the residential sector were calculated to be about 4%. In the Hungarian report to a project on energy efficiency indicators in CEE countries, supported by the SAVE programme of the European Commission, ADEME and the Danish Energy Authority, Elek and Nagy (2004) made an analysis of the final energy intensity of the whole economy (calculated for the 2000 GDP structure) and concluded that in the period 1991–1995 the economy moved towards higher energy intensity, while there was a decrease in the total intensity due to the industrial collapse. After 1995 this trend was reversed towards lower energy intensity which is explained by the completion of privatisation, the increase in foreign direct investment and successful 'large green field investments'. The impact of the structural changes is regarded to be towards an increase of intensity or positive (37.1%) for the period 1991–1995 and negative (−38.8%) for the period 1995–2001.

As demonstrated in Figs. 8–10, Poland has experienced the largest progress in the reduction of energy intensities among the CEE countries during the transition period. While no factor can be singled out as the reason for this unique improvement, a number of trends can be identified which have played a role in it. First, the primary energy fuel mix has been shifting away from coal towards other fuels, associated with less energy-intensive technologies (see Fig. 11), although coal still fuels the lion's share of Poland's economy. Second, one of the essential characteristics of the Polish transition process was a rapid structural change, taking the form of a large shift of resources from state owned enterprises to *de novo* private firms (Rostowski, 1998). *De novo* private firms contributed strongly to the successful transition and growth of the Polish economy. The private sector created from ground up played a decisive part in the rapid changes (Winiecki, 1996). Such private firms, characterised by new organisational patterns, responded much better to the increased energy prices and other economic reforms. In contrast to the other transitional economies, in which the privatisation process just altered the ownership structure of the economy, changes in Poland brought both new ownership and new organisation. Instead of inheriting the previous systems' organisational legacies, Poland created new organisational structures, being more entrepreneurial (Rostowski, 1998). The more flexible private sector responded sooner to the economic and energy sector reforms, and thus the impact of the economic restructuring came more rapidly than in the other investigated countries. These changes led to improvements in energy efficiency of the industrial sector of about 9% for the period 1993–2002 (from which the energy intensity of the steel industry decreased most sharply) as was calculated by Wnuk and Berent–Kowalska (2004). Their study also found that the structural

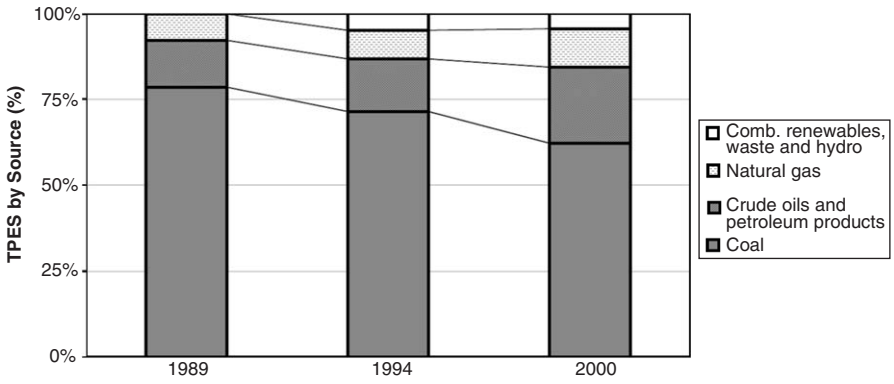

Fig. 11. Development of the structure of TPES in Poland for the period 1989–2000 (sources: IEA, 1999, 2001a, 2002).

changes contributed insignificantly to the decline of industrial energy intensity for the whole period of research (1993–2002). There has also been significant decrease in the intensity of the residential sector: when climatic corrections are added there has been a 4.7% annual decrease of the unit consumption per dwelling in the period 1993–2002 leading to a 30% decrease over the period (Wnuk and Berent-Kowalska, 2004).

It is possible that this large improvement in residential sector energy intensity showed by Wnuk and Berent-Kowalska, unique among the transition economies, can be partially attributed to the Polish government's efforts to improve energy efficiency. Poland has introduced several programs aimed at improving energy efficiency, including various subsidised schemes for enhancing the thermal efficiency in buildings and space heating and provisions in the legislation on stricter standards for space heating. While Poland was not the only country to introduce such measures, they appear to have been more effective than those of other CEE countries. The increased electricity prices were the other factor that drove changes in electricity use by households and led to behavioural changes among consumers. Its effect was very prominent for the period 1990–1995 in which electricity consumption fell by 25% (Wnuk and Berent-Kowalska, 2004). Afterwards with the recovery of the economy an increasing trend in electricity consumption by households was observed again and in 2002 consumption was almost the same as it had been in 1990.

Let us now examine why the energy intensity gap in CEE countries has not been closing more rapidly with other EU countries despite the advanced stage of economic and energy sector reforms.

An important reason for this lies in the issue of transport energy use trends, raised above under the positive legacies of socialism. Since there is a strong shifting trend in the modal split of passenger travel from public transport to car transport, this is resulting in an increase in energy consumption per passenger -kilometre travelled. For example in Poland for 1990–2000 passenger rail transport decreased by a factor of two, as measured in passenger-kilometre travelled, and bus transport decreased by 30%, while for the same period the number of passenger cars in Poland doubled (EC DG TREN and Eurostat, 2003). In parallel, the share of rail freight shipping is contracting in favour of road haulage, also a form of transport with higher specific energy consumption values. For example, in Poland the road transport of goods (measured in tonnes/kilometre) almost doubled while freight transport of goods declined by about 40% (EC DG TREN and Eurostat, 2003). In Hungary road-based shipping increased by 25% for the 1990–2000 period while the rail freight transport declined by a factor of two. In the Czech Republic for the 1994–2000 period there was also a trend towards an increase of the road transport of goods (by 65%) and decrease of rail haulage (by 40%) (EC DG TREN and Eurostat, 2003). These trends, consequently, increase the specific energy consumption for travel, slowing the decline of national level energy intensity.

Another important factor contributing to the moderate decrease in energy intensities in the discussed CEE countries is the behavioural and organisational momentum. Changes in the pattern of consumer behaviour demand not only time, but also financial resources. Despite climbing energy prices, most consumers were not aware how to improve the efficiency of their energy use besides purchasing more expensive appliances that they often could not afford.

While the degree of and trends in energy intensity developments are diverse among the CEE countries, a few general conclusions can be drawn. First, the level of energy intensities among the examined three countries, along with the other five post-communist new EU member states (see Figs. 9 and 10), is converging. Second, while it is converging, there is still a gap between levels in the EU and CEE: the average for the eight CEE countries is still about 60% higher in PPP terms than for the EU (Urge-Vorsatz et al., 2003). This difference suggests that, as the EBRD also points out, 'substantial inefficiencies remain, whatever the differences in socio-economic conditions there may be (Cornillie and Frankhauser, 2002). Third, it is clear that economic and energy sector reforms alone are not sufficient for closing the energy efficiency gap between CEE and the EU. Energy intensities have decreased in the 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. By contrast, Russia, where the transition to a market economy is incomplete and energy sector reforms have not been radical, energy intensities have grown further instead of decreasing. Finally, we can conclude that after 15 years of economic and energy sector reforms, it is today clear that *the transition to a market economy and energy sector restructuring alone will NOT close the energy intensity gap between CEE and EU*.

6. The remaining agenda of transitions towards a more sustainable energy system

In Section 3, we have analysed the reasons for the high levels of energy intensities in former communist countries by identifying the related legacies from the centrally planned economy. In Section 4, we have outlined a policy agenda to address these legacies. In Section 5.1 we have examined how much progress has been achieved in the reduction of high-energy intensities.

We have concluded that the energy intensity gap has worsened only in Russia, and has not yet been closed in the CEE countries. In Section 5.2 we have analysed the reasons for this. In the present section we will review the progress made in achieving the policy goals which were outlined in Table 2 and suggest measures to strengthen this process.

As presented in Table 3 the three CEE countries in focus have made the first key step towards decreasing their high energy intensities, which is the general transition to a market economy, including the restructuring of the energy sector. The authors concluded in the previous section, *the closing of the energy intensity gap with the EU undoubtedly requires further, substantial targeted efforts towards the improvement of energy efficiency*. The progress in this aspect is reviewed in the second half of Table 3, which shows that 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 EU-15, energy efficiency needs to

Table 3
The status of the implementation of the policy agenda outlined in Table 2 in the three discussed CEE countries and Russia[a]

Policy goal to address factor contributing to high energy intensities	Status of the implementation of policy goal			
	Poland	Hungary	Czech Republic	Russia
Transition to a market economy	Largely completed but need more progress in the agriculture sector	Completed	Completed	Further progress needed
Privatisation of the economy	Partially completed but slow progress	Largely completed	Largely completed	Limited progress with little FDI
Privatisation of the energy industry (electricity here)	Started but slow progress	Largely completed	Partially completed	Detailed plan for asset restructuring with privatisation during the period to 2008
Liberalisation of the energy industry	Started but still very limitted	Started and good progress (already 20% effectively open)	Started but still very limitted	Started but no progress in gas, transport and some progress in electricity
Lifting energy price subsidies[b]	Completed	Completed[c]	Completed	Not completed
Consumption based billing in electricity and natural gas	Mostly completed	Partially completed	Mostly completed	Partially completed
Introduction of metering[d]	In process	In process	In process	In process
Increasing energy efficiency awareness	Very limited progress	Limited progress	Limited progress	Very limited/no progress
Energy efficiency education of experts organised by the state	Limited/no progress	Limited/no progress	Limited/no progress	Limited/no progress
Data collection on end-use practices	Progress needed (some information available but not freely disseminated)	Worsened during the 90 s	Worsened during the 90 s	Worsened during the 90 s
Establishment of energy efficiency related state institutional background	Lack of progress	Much progress made in 2000; further progress needed	Insufficient progress	Little progress
Open access to information	Improvement needed	Improvement needed	Improvement needed	Improvement needed
Harmonising environmental legislation with EU	Harmonised but a number of derogations allowed	Harmonised but a number of derogations allowed	Harmonised but a number of derogations allowed	Not applicable
Improvement of enforcement	Much progress needed	Much progress needed	Much progress needed	Much progress needed
Independent evaluation and monitoring	Not existing	Not existing	Not existing	Not existing

[a]The evaluations in this table are in relative qualitative terms and present the opinion of the authors, experts in the area (Bergasse, pers. comm.; Mnatsakanian, pers. comm.) and literature sources (OECD, 2004; Paszyc, 2002; DOE, 2003a–c.).

[b]In the majority of countries, some form of subsidies exist in energy pricing. Therefore in this row we consider the lifting of price subsidies "completed" if energy subsides remain within levels prevalent in OECD countries.

[c]Hungary is still cross-subsidising natural gas.

[d]The most important impediment to consumption based billing is the lack of meters (especially in the district heating sector and for centrally supplied hot water). The installation of meters, and therefore metering, is in process where appropriate.

be more directly and consistently targeted by policies, institutional and educational reforms. Specific policy goals to be pursued include, but are certainly not limited to:

- Creating a comprehensive legislative framework, with appropriate secondary legislation and action programs for the improvement of energy efficiency which ensure that achieving their goals is a long-term governmental priority.
- Integration of energy-efficiency priorities into the strategies and policies of all relevant economic sectors.
- Strengthening the enforcement of related legislation and policies.
- Institutional and financial commitment from government through the establishment (or reinforcement) and empowerment of the institutional structures for energy efficiency policy, including providing sufficient resources and capacity for the energy efficiency agencies (for example Polish Kape has a staff of 20 to cover 39 million inhabitants compared to 500 at the Dutch Novem for 16 million inhabitants) (Bergasse, pers. comm.).
- Introduction of voluntary market transformation programs aimed at industries and businesses (this can be especially important for the many newly established enterprises).
- The incorporation of the energy efficiency understanding into the curriculum of all educational levels (elementary to graduate level).
- The rational, openly advertised and *transparent* distribution of energy efficiency and renewable energy funds.
- Detailed end-user data collection and reporting; open access to the information that is not treated as confidential.
- Establishing or strengthening the relevant research and development capacities.
- Developing policies for reinforcing the high share of public transport and rail freight in the modal split.
- Completing the introduction of the metering of energy consumption to end-users.
- Creating a targeted at the poorest social network for decreasing the effects of increasing energy prices.
- Creating mechanisms for Independent evaluation and monitoring of the progress.

In the three selected CEE countries, moderate progress has been made in some of the points above. The list shows that funding for energy efficiency is, while important, not the only essential element in improving energy efficiency. While almost all items above require some level of funding, certain 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 failing to pursue more radical energy efficiency policies. On the contrary, it is typically easier to establish the legislative and policy framework at the start of economic transitions so that the new economy can already be based in a 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. In addition to political commitment by governments, a concerted effort is needed towards the improvement of energy efficiency from regulators, businesses, utilities and the non-governmental sector.

With regard to the positive legacies above, unfortunately, much of the window of opportunity for leapfrogging has been closed. For instance, many passengers have been lost from the public transport system due to the depreciation of the infrastructure and services. Ageing GDR[10] rail cars due for retirement, less frequent services, discontinued lines in less frequented and thus unprofitable areas, a lack of new lines in freshly developing urban areas–all contribute to the loss of the last passengers who have an alternative to individual transport modes. A new and perhaps last chance to preserve what has remained of this positive socialist legacy is offered by the structural funds provided for the new member states of the European Union. Much of these are and will be devoted to infrastructure development, and thus if the importance of public transport, rail freight shipping, DH and CHP are recognised which is not the case at present, their reinforcement and development should be balanced with the construction of alternatives such as highways.

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 efficiency, 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, as described above, are very difficult to transform. 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, the state will in vain devote funds for energy efficiency, if the implementing agency is forced due to administrative reasons to distribute the money within a few weeks; in such cases the funds will produce very limited value per invested Euro.

[10]German Democratic Republic.

7. 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 their high energy intensities. We have identified the legacies of the centrally planned economy which contributed to the soaring energy intensities. We have outlined a policy agenda which could overcome these legacies as a part of the economic restructuring process. We have also 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 most developed economies. We have, then, summarised the progress which has been made during the decade and a half of transitions in the relevant economic reforms and energy sector restructuring. We have also examined the developments of energy intensities over this period, and shown that the energy efficiency gap between the EU-15 and CEE has only broadened in Russia, and has not improved significantly in Central European countries. We have analysed the reasons for this slow progress or complete lack of progress. We have demonstrated that radical economic reforms and energy sector restructuring are a key but are not sufficient in themselves for the improvement of energy intensities.

If CEE countries seriously aim at bringing down their energy intensities to levels close to those in the EU-15, they need to implement major, targeted energy efficiency policies and establish or reinforce the relevant institutional background. Beyond a more serious governmental commitment, a concerted effort is needed towards the improvement of energy efficiency from regulators, businesses, utilities the non-governmental sector, consumer organisations and other stakeholders. 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 on a sustainable and calculable legislative and policy framework. We have drawn 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 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 agencies, 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.

Acknowledgements

The authors of this paper would like to thank those who contributed their time, effort and expertise: Radmilo Pesic, Szilard Asztalos, Andrzej Baniak, Emmanuel Bergasse, Anna Loguinova, Jan Raczka, Silvia Rezessy and Alan Watt. The main author is grateful for the financial support received for the research for this paper from the Central European University and the Center for Policy Studies.

References

Bassan, M., 2003. Statistics in Focus. Environment and Energy. Theme 8–4/2003. Electricity Statistics. European Communities, Luxembourg.

Bergasse, E. Administrator for Central and South East Europe, International Energy Agency. Pers. comm., November, 2003 and February 2005.

Brendow, K., 2003. Restructuring DH/CHP in central and Eastern Europe: analysis and action. In: World Energy Council (WEC), (Ed.), Towards Local Energy Systems: Revitalising District Heating and Co-Generation in CENTRAL and Eastern Europe. WEC, London, pp. 63—91.

CEE Bankwatch Network, 2004. Heading Down Dead Ends Transport Sector Financing in Central and Eastern Europe. CEE Bankwatch Network, Praha.

Chandler, W., 2000. Energy and Environment in the Transition Economies. Between Cold War and Global Warming. Westview Press, Oxford.

Cherubin, W., 2003. Present situation and current trends in restructuring the district heating sector in Poland and other CEE countries. In: (WEC), World Energy Council (Ed.), Towards Local Energy Systems: Revitalising District Heating and Co-Generation in Central and Eastern Europe. WEC, London, pp. 19–41.

Constantinescu, N., 2002. Euroheat & Power. Report presented on the Roundtable on District Heating in Transition Economies. Priorities and Best Policy Practices, December 2002. IEA, Paris.

Cornillie, J., Frankhauser, S., 2002. The Energy Intensity of Transition Countries. EBRD, London.

Dempsey, J., 2004. Russia casts energy web over East Europe [on-line]. International Herald Tribune, October 1, 2004. Cited at http://www.iht.com/articles/541461.html.

Directorate-General For Energy, 1998. 1997—Annual energy review [on-line]. Cited 20 June 2001 at http://europa.eu.int/comm/energy/en/etf_1_en.html.

DOE, US Department of Energy, Office of Fossil Energy, 2003a. An energy overview the Republic of Hungary [on-line]. US Department of Energy, Office of Fossil Energy, October 20, 2003. Cited July 5, 2004 at http://fossil.energy.gov/international/hungover.html.

DOE, US Department of Energy, Office of Fossil Energy, 2003b. An energy overview the Republic of the Republic of Poland [on-line]. US Department of Energy, Office of Fossil Energy, October 20,

2003. Cited July 5, 2004 at http://fossil.energy.gov/international/plndover.html.

DOE, US Department of Energy, Office of Fossil Energy, 2003c. An energy overview the Republic of the Czech Republic [on-line]. US Department of Energy, Office of Fossil Energy, October 17, 2003. Cited July 5 2004 at http://fossil.energy.gov/international/czekover.html.

EC DG TREN, (European Commission, Directorate-General for Energy and Transport) and Eurostat, 2003. EU energy and Transport in figures: Statistical Pocketbook 2003. Eur-OP, Luxembourg.

Energy Charter Secretariat, 2003. The road towards an energy efficient future. Report to the Ministerial Conference "Environment for Europe" Kiev, Ukraine, May 21–23 2003. Energy Charter Secretariat, Brussels.

ESD, Energy for Sustainable Development, Ltd, Europe, Cogen, Cogeneration, The European Association for the Promotion of, ETSU -AEA Technology plc, S.A., KAPE, VTT and Elektroteknisk., Sigma, 2001. The future of CHP in the European market. 'Future cogen' project No 4.1031/P/99-169, financed under the SAVE program. [on-line]. Cited April 23 2003 at http://tecs.energyprojects.net/links/final_publishable_report.pdf.

Euroheat, Power, 2001. District Heat in Europe. Country by Country—2001 Survey. Euroheat & Power, Brussels.

Euroheat & Power, 2003. 8 reasons why you should utilise district heating and cooling for your building [on-line]. Information published on the official website of Euroheat & Power. [on-line]. Cited 20 June 2003 at http://www.euroheat.org/redirects/redirect_benefits.htm.

Europrog, Network of Experts, 2001. Statistics and Prospects for the European Electricity Sector (1980–1999, 2000–2020). Union of the Electricity Industry—Eurelectric, Brussels.

Elek, L., Nagy, P., 2004. Energy Efficiency in Hungary. Final Report of the Project "Energy Efficiency Indicators for Central and Eastern European Countries" with the Support of SAVE, Ademe and DEA.

FFU database, 2003. Database on the SO_2, No_x, particulates and CO_2 emissions of the Free University (FFU), Berlin (unpublished). FFU, Berlin.

Gochenour, Carolyn., 2001. District Energy Trends, Issues, and Opportunities, The role of the World Bank. The World Bank.

Grubb, M., 1991. Energy Policies and the Greenhouse Effect. Policy appraisal. Hants, Dartmouth.

Hawken, P., Lovins, A., Lovins, L.H., 1999. Natural Capitalism. Creating the Next Industrial Revolution. Little, Brown and Company, Boston.

Hofmarcher, M., 1998. Is public health between East and West? Analysis of wealth, health and mortality in Austria, Central and Eastern European countries, and Croatia relative to the European Union. Croatian Medical Journal 39 (3) [on-line]. Cited at http://www.mefst.hr/cmj/1998/3903/390303.htm.

IEA, 1995. Energy policies of Poland: 1994 survey.

IEA, 1997. Energy Efficiency Initiative. IEA/OECD, Paris.

IEA, 1999. Energy Balances of Non-OECD Countries: 1996–1997. OECD, Paris.

IEA, 2000. World Energy Outlook. Looking at Energy Subsidies: Getting the Prices Right. OECD/IEA, Paris.

IEA, 2001a. Energy Balances of OECD Countries, 1998–1999. OECD, Paris.

IEA, 2001b. CO_2 emissions from fuel combustion. OECD, Paris.

IEA, 2002. Energy Balances of OECD Countries, 1999–2000, 2002 ed. OECD, Paris.

IEA, 2004a. Energy Balances of OECD Countries, 2001–2002, 2004 ed. OECD, Paris (online data services).

IEA, 2004b. Energy Balances of non—OECD Countries, 2001–2002, 2004 ed. OECD, Paris (online data services).

Kononov, Y., Huntington, H., Medvedeva, E., Boyd, G., 1992. The effects of changes in the economic structure on energy demand in the Soviet Union and the United States of America. In: Sterner, T. (Ed.), International Energy Economics. Chapman & Hall, London, pp. 47–65.

Lovei, L., McKechnie, A., 2000. The cost of corruption for the poor-the energy sector. Public Policy for the Private Sector 207, 1–8.

Lovins, A., Lovins, L., Hunter, Krause, F., Bach, W., 1989. Least-Cost Energy. Solving the CO_2 problem. Rocky Mountain Institute, Snowmass, Colorado.

Manczyk, H., 1999. The Black Triangle: reducing air pollution in Central Europe. Report presented on the International District Heating Association 90th Annual Conference, June 1999. Boston: International District Heating Association. [on-line]. Cited April 2 2003 at www.energy.rochester.edu/pl/blacktriangle/.

Mnatsakanian, R., 2004. Head of Department of Environmental Sciences and Policy, Central European University. pers. comm., June, 2004.

Moldan, B., Schnoor, J., 1992. Czechoslovakia: examining a Critically Ill Environment. Environmental science technology 26 (1), 14–21.

OECD, 2004. OECD Economic Surveys: Russian Federation. OECD, Paris.

Olshanskaya, M., 2004. Comparative analysis of energy intensity in Russia and Slovakia during economic transition of the 1990s. Thesis, Department of Environmental Sciences and Policy, Central European University, Budapest.

Papp, D.S., 1977. Marxism-Leninism and natural resources: the Soviet outlook. Resources Policy, June 1977.

Paszyc, E., 2002. The Russian power industry shortly before reforms. CES (Centre for Eastern Studies) Studies 5, 58–69.

Popiashvili, K., 2000. Barriers to energy efficiency in Georgia. M.Sc. Thesis, Environmental Sciences and Policy, Central European University, Budapest.

Rostowski, J., 1998. Macroeconomic INSTABILITY in post-Communist Countries. Clarendon Press, Oxford.

UCTE, Union for the Co-ordination of Transmission of Electricity, 2003. UCTE and System Development (enlargement of the UCTE synchronous area). Official webpage of the UCTE [on-line]. December 22, 2003. Cited February 13 2003 at http://ucte.org/ourworld/System-Development/e_default.asp.

Urge-Vorsatz, D., Mez, L., Miladinova, G., Antypas, A., Bursik, M., Baniak, A., Janossy, J., Beranek, J., Nezamoutinova, D., Drucker, G., 2003. The impact of structural changes in the energy sector of CEE countries on the creation of a sustainable energy path. Special focus on investment in environmentally friendly energy and the impact of such a sustainable energy path on employment and access conditions for low income consumers. Project No IV/2002/07/03 for the European Parliament.

US Congress Office of Technology Assessment, 1993. Energy Efficiency Technologies for Central and Eastern Europe. US Government Printing Office, Washington, DC.

Vorsatz, D., 1994. Assessing the efficiency versus the inefficiency of the energy sectors in formerly centrally planned economies. In: Benson, S., et al. (Eds.), Energy and Environment: Transitions in East Central Europe. Energy and Environmental Research Center/EGU Praha, a.s., Prague, pp. 713–717.

Vorsatz, D., 1997. (Un)sustainability in transition in CEE: Opportunities foregone? In: Sors, A., Liberatore, A., Funtowitz, S., Hourcade, J.C., Fellous, J.L. (Eds.), Prospects for Integrated Environmental Assessment: Lessons Learnt from the Case of Climate Change. Meteo France, Toulouse, pp. 139–144.

Watt, A., 2004. Department of Environmental Sciences and Policy, Central European University, pers. comm., July 2004.

Weizsacher, E., Lovins, A., Lovins, L.Hunter., 1997. Factor Four: Doubling Wealth, Halving Resource use. Earthscan Publications Ltd., London.

Winiecki, J. (Ed.), 1996. The Sources of Economic Success: Eliminating Barriers to Human Entrepreneurship—A Hayekian Lesson in Spontaneous Development' in Five Years After June: The Polish Transformation, 1989–1994. Centre for Research into Post-Communist Economies, London.

Wnuk, R., Berent-Kowalska, G., 2004. Energy Efficiency in Poland. Final Report of the Project "Energy Efficiency Indicators for Central and Eastern European Countries" with the Support of SAVE, Ademe and DEA.