ENERGY EFFICIENCY IN THE BALTIC SEA REGION

An IEA-report to the Baltic Energy Efficiency Group (BEEG)
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EXECUTIVE SUMMARY

Dynamic economic development, increasing integration and international co-operation characterise the Baltic Sea Region (BSR). This report shows how these developments can be harnessed to strengthen energy co-operation to improve energy efficiency and move towards a sustainable energy system. It explores the on-going trends and activities, compares them to goals and scenarios and outlines the opportunities for the region.

The aim is to achieve wide implementation and dissemination of energy efficiency in the market. Policies need to be strengthened to deliver more energy efficiency. There also needs to be better coherence between policy areas such as energy and transport. Policy-makers must address the challenge of designing policies fully compatible with free markets to achieve goals that may not be attained by markets alone, such as energy security and environmental sustainability.

The potential for energy efficiency gains is substantial throughout the region. As the countries in the eastern part are moving to market-based economies, there are special opportunities to instil energy efficiency elements in policy frameworks, public and private decision-making related to energy use, and to take advantage of capital stock turnover during redevelopment. The markets are developing and so is co-operation between the actors throughout the region. Networks for energy end-use actors need to be strengthened to enhance business opportunities for wide implementation of energy efficiency. The BSR can be considered an “open air laboratory” for activities to improve energy market functions and deliver efficient solutions.

Energy efficiency and climate issues are mutually dependent since more than 80% of greenhouse gas (GHG) emissions are energy related. Energy efficiency policies, technologies, and programmes provide a large potential for low-cost emission GHG reductions. Climate-related policies and measures are also beneficial for energy efficiency, because such measures are likely to provide direct funding for efficiency programmes, as well as incentives for third-party investment. This report discusses the possibilities to exploit the climate-friendly potential of energy efficiency and combined heat and power, and to stimulate investment in these areas also through the emerging “flexibility mechanisms” of the Kyoto Protocol, and related tools such as carbon funds and clearinghouses.

This report calls for the establishment of a project-finance “clearinghouse” in the BSR. Given that the region has the largest number of Activities Implemented Jointly projects in the world, it could build on this asset to extract experience and to develop and improve methods to implement clean energy technologies. Capacity can be developed effectively in “learning by doing” and in active experience transfer.

Drawing on the Baltic 21 Energy Report, European Commission strategies for energy efficiency, the Energy Charter Protocol on Energy Efficiency, The Energy Efficiency Initiative and other IEA documents, this report reviews how the proposed actions fit to give substance for an effective energy efficiency policy. The ten actions to promote energy efficiency and to pave the way for a sustainable energy system in the Baltic 21 agenda are the cornerstones. Yet these actions need to be re-evaluated and made more specific in light of recent proposals such as the EC communication and action plan.

The keys to an effective energy efficiency policy for the BSR are to develop an effective market framework; build on consumer needs; improve routines and rules; and develop and disseminate energy efficient technology. Measures and suggested projects in these areas are highlighted in chapter 6.

ENERGY EFFICIENCY IN THE BALTIC SEA REGION

CHAPTER 1
OVERVIEW AND PROFILE

The vision for the Baltic Sea Region, as laid down in the Stavanger Communiqué, is expressed as being a region "... of dynamic economic development, increasing integration and international co-operation.... (where).. energy co-operation may serve as a model for other areas." This report shows how that vision can relate to energy efficiency (including district heating and combined heat and power), a component of energy policy that has the potential to provide many benefits to all countries in the region. The analysis explores the on-going trends and activities, compares them to goals and scenarios and outlines the opportunities for the region to function according to the vision.

This report describes and discusses the potential for energy efficiency improvements (chapter 2), the converging market development (chapter 3), impact of the climate issues and their interdependence with energy efficiency improvements (chapter 4), specific country and sector challenges (chapter 5). Finally an analysis of recommendations made in different forums is derived into some practical recommendations and suggestions (chapter 6).

The Baltic Sea Region (BSR) comprises Denmark, Estonia, Finland, Germany (northern Länder), Latvia, Lithuania, Norway, Poland, western Russia and Sweden. (Figure 1.1) The material (especially statistics) used for this analysis is, with a few exceptions, organised to include this region. Due to a lack of availability or fully comparable data, some conclusions are based on indicators and trends.

Figure 1.1
Baltic Sea Region
(Map from Baltic 21)

Some 86 million people live the Baltic Sea Region. Total energy supply is 3 500 TWh. Energy consumption is 2 600 TWh of which about 83% is used in industry, residential, service and agriculture sectors while 17% goes into transport. [1] Electricity production is about 1 100 TWh.[2] Diversification of generation resources in the region is high: hydro accounts for 35%, nuclear 20%, combined heat and power (CHP) 20% and condensing power 25%.[3]

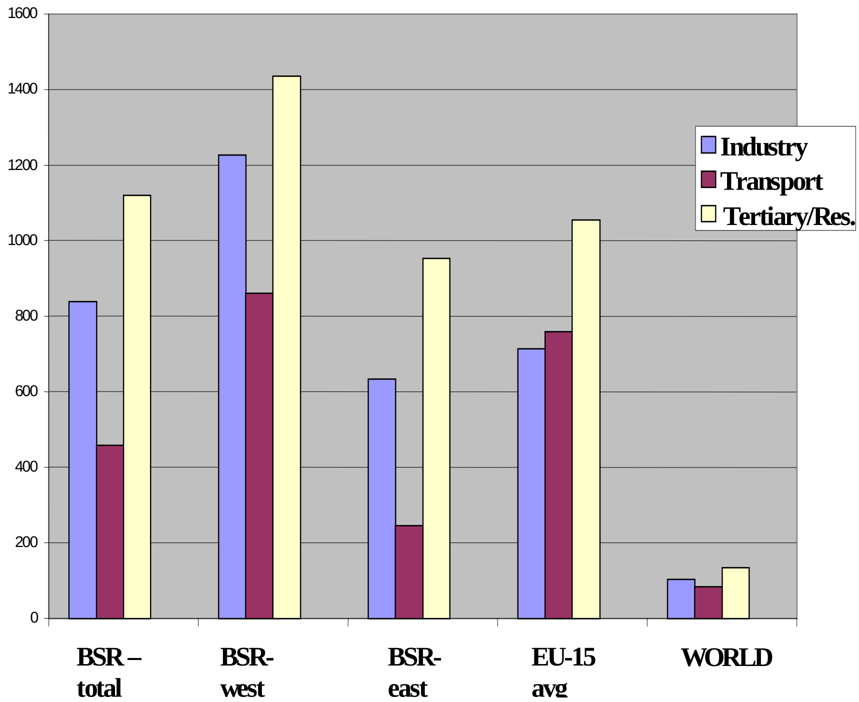
The energy situation in the BSR is characterised by huge differences between the countries in terms of:

- fuel supply for power generation, e.g. coal is dominate in Poland and hydro provides almost all of the electricity in Norway;
- per capita use of energy, ranging from 15 MWh (Estonia, Latvia and Lithuania) to 50 MWH (Finland, Norway and Sweden);
- per capita use of electricity, ranging from 2 MWh (Latvia and Lithuania) to Norway 25 MWh. The European Union (EU) average is 5.5 MWh, Germany and Denmark are close to the average and Finland and Sweden are more than double;
- the ratio of consumer's energy bills compared to GDP is 5-10 times higher in the BSR-east than in the west, or 2-4 times higher on a PPP basis;
- share of district heating from 5% in Germany, and even less in Norway, up to 50% (Estonia, Lithuania and Russia) with other countries in the range of 30-40%.[4]

The BSR has a high use of energy per capita, though there are great differences between the eastern and the western part of the region (figure 1.2). In the east, consumption is close to the average in EU-15 for the industrial and tertiary-domestic sectors, though far below for transport. Energy use in the western BSR is well above the EU-15 average in all sectors.

[1] Baltic 21, *Sustainable Energy Development in the Baltic Sea Region*, Baltic 21 Series Publication No. 3/98**,** (Stockholm) 1998
[2] Swedish Energy Administration*, Elmarknaderna runt Östersjön 1997*, STEM R 1997:81, Stockholm, 1997.
[3] *Baltic 21* Series No. 3/98
[4] Ibid.

Figure 1.2
Energy Use in BSR, EU-15 and the World
(kgoe/capita)



Source: European Commission, Energy in Europe 1998 Annual Review.

These patterns reflect variances in natural resources as well as differences in the development of the economic and political systems. A look at the recent situation suggests significant potential for increased energy efficiency in the region.

The economic activity in the region is high. Collaboration between governments, organisations and companies has increased significantly in the 1990s. The markets are becoming more integrated and more open. It is an evolving process as structures are amended and experience is gained in the social process.

Energy policies can be shaped to enhance the efficient use of energy for reasons of economy, environment and employment. Yet energy efficiency policies, in many cases, have not achieved a big impact. Most government policies that affect energy use have primary aims related to societal welfare, e.g. housing, industry, research, trade, taxation, transport, regional development etc. Many traditional efficiency measures, however, focus on the energy end-users to optimise resources or to maximise return. Frequently this fails because the actors get inconsistent and variable signals. An additional complication is that policies related to energy, or affecting energy, are set on many levels, e.g. international, national, regional, municipal and company.

Furthermore, many key public and private actors have little interest today in saving energy, because energy is cheap and it generally represents a small fraction of total costs. While these actors may know well how to improve efficiency in conjunction with new equipment design, purchase or overhaul, their motivation is not primarily energy considerations . Reaching out to them is a key step in accelerating actions to improve energy use.

This has two implications for policy making:

- Policies must be coherent to avoid being contradictory between sectors or levels of policymaking;

- The ability of the market to disseminate technologies according to customer preferences must be enhanced.

The markets in the BSR are under development from several aspects. There are markets in transition from planned economies to market based economies. There is an ongoing liberalisation of the old energy-markets following the EC-directives and the agreed time schedule. There is an ongoing integration of trade between countries and development of relations with the European Union. There is a newly agreed Protocol on Energy Efficiency within the Energy Charter that aims to facilitate trade of energy and energy-related products. There are envisaged new mechanisms in the Kyoto Climate Change Protocol for trading, related to environmental and climate change issues.

The changes in the BSR will take time to complete. Since energy is embedded in the whole structure of the economy, it will require some time to adapt to new conditions. Institutions have to evolve towards the new conditions and the social structure to adapt accordingly. A process not unique to the BSR, but accentuated due to the many simultaneous changes. Markets and market functions have to be developed and progressively be used to their full capacity. The BSR is a natural “open-air laboratory” for activities to improve market functions to improve energy efficiency based on economic, energy and environmental factors and the existing established networks and co-operation on all levels of societal activity.

CHAPTER 2
ENERGY SUPPLY & DEMAND AND EFFICIENCY POTENTIAL

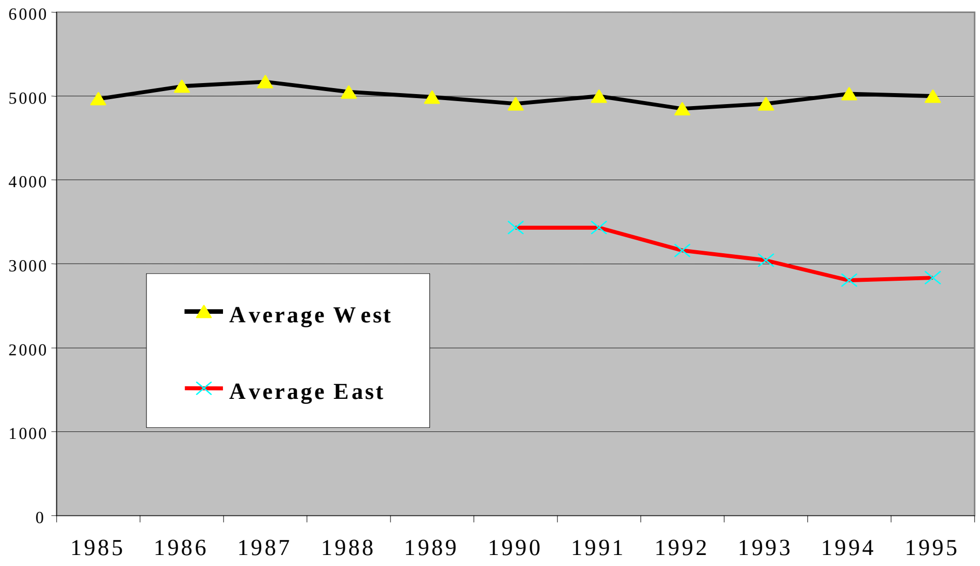
This chapter provides a broad picture of energy supply and demand trends in the Baltic Sea Region and considers potential for energy efficiency improvements in various sectors and areas of opportunity to achieve them. When examining avenues to achieve efficiency goals it is important to keep in mind that the demand is not the energy itself that the user desires, but rather the services that energy provides, e.g. heating/cooling, mobility, light, motor power, etc.

2.1 ENERGY SUPPLY AND USE INDICATORS

Often the first considerations in government's energy policy formation are economic development and energy security in terms of import dependency and diversification. These critical parameters have been undergoing significant change in some parts of the BSR in the last decade in step with political changes.

In the eastern part of the region, (Estonia, Latvia, Lithuania, Poland and Russia), per capita energy use dropped 18% from 1990 to 1995. (Figure 2.1) In the western countries, (Denmark, Finland, Germany Norway and Sweden), energy use per capita was roughly stable over the same period and has been so for ten years. Per capita use in the east is approximately 55% of that in the west. Since the eastern portion is home to two-thirds of the BSR's population, total energy use is higher than in the west.

Figure 2.1
Energy Use in the Baltic Sea Region
(kgoe/capita)



Source: European Commission, *Energy in Europe 1998 Annual Review*, (Brussels, 1999).

Economic activity is a fundamental driver of energy demand. In the BSR-east, GDP declined 30% from 1990 to 1995. While in the west of the region, GDP increased by 10% in the same period. Since 1985 the GDP growth in the west has been 20%. GDP increases in the BSR-west have not been commensurate with energy demand growth while declining wealth in the east has been sharper than that of energy use.

Energy policies in the Baltic states have been motivated by a strive towards increased security by lowering supply dependencies of imports, certain fuels, suppliers or technologies depending on the country's geopolitics and economic situation. One focus has been to lower the oil dependency. In more recent years, the focus also includes a lowering of dependency of fossil fuels to reduce CO_2 emissions. Diversification approaches and improved fuel use efficiency have been applied which has promoted wider trade and improved technologies. In addition, there is now more distinct emphasis on end-use energy efficiency. This approach can exploit greater freedom in fuel and technology choice since the energy supply could be sustained on a lower level.

Fossil fuels, (coal, lignite, shale, petrol and natural gas) still dominate in the BSR, accounting for 75% of the energy supply. A number of the BSR countries have vast reserves of fossil fuels and are net exporters. Table 2.1 shows the energy supply situation for the Baltic countries.

Table 2.1
Total Energy Supply in the Baltic Sea Region 1995
(ktoe)

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Country	**Fossil**	**Nuclear**	**Peat, Waste**	**Biomass**	**Hydro, wind, solar**	**TOTAL**
Denmark	18794	0	167	693	96	19 749
Estonia	5063	0	96	287	0	5 445
Finland	16 692	5 015	1 767	4 728	1 098	29 301
Germany (border region)*	18 555	4 943	24	96	96	23 713
Latvia	3 630	0	119	501	263	4 513
Lithuania	5 349	3 081	0	191	24	8 645
Norway	9 170	0	0	1 027	10 555	20 752
Poland	88 284	0	1 098	5 731	143	95 257
Russia (border region)*	43 772	4 513	0	1 027	525	49 838
Sweden	18 698	16 453	310	6 782	5 755	47 999
Sum	228 006	34 005	3 582	21 062	18 555	305 210

* Note that Germany and Russia are accounted for as the border regions defined in Baltic 21.
Source: Baltic 21 Series No. 3/98.

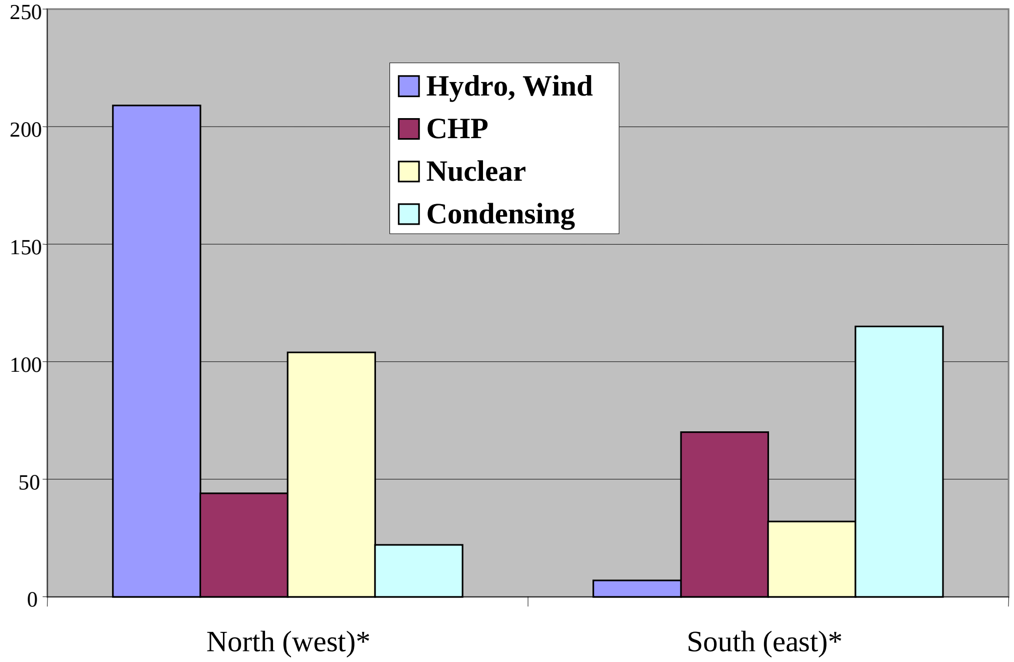
All countries in the BSR, except Norway, Poland, and the whole of Russia, are net importers of energy. On average, import dependency has been stable or declining in recent years.

Key question: Does the trend of less dependency and the prospects for higher diversification change the concept of each of the country's security policies and make closer co-operation more advantageous?

Regional differences in the use of fuel, as well as a variety of technologies, have prompted proposals for the formation of a "Baltic Ring" to use the existing electricity grids in cross-border trade to make optimal use of the thermal power generation in the south and east with hydropower in the north and west[5]. These differences represent opportunities in terms of trade and responses to climate change issues. (Figure 2.2) illustrates the electricity generation mix in the BSR subdivided in two regions.

[5] Baltic 21, *Sustainable Energy Development in the Baltic Sea Region*, Baltic 21 Series Publication No 3/98**,** (Stockholm) 1998.

Figure 2.2
Electricity Generation Mix in the BSR



*north (west) = Norway, Sweden, Finland and Russia
*south (east) = Denmark, Germany, Poland, Lithuania, Latvia and Estonia
Source: Baltic 21 series No. 3/98.

A key question is whether liberalisation of the electricity markets will accommodate an optimal region-wide pooling of resources.

2.2 WHAT IS ENERGY EFFICIENCY POTENTIAL?

Estimates of energy efficiency improvements and their impact on energy demand are based on assumptions about technical factors, equipment costs, expected rates of market penetration, consumer behaviour and policy measures. When considering potential for improvement, it is essential to distinguish between the realm of technological achievements and the real world of consumers. (See discussion of the "pay-back gap" in Appendix A.)

Definitions of cost-effective or economic potential usually assume an ideal world where producers and consumers act in an economically rational way and adopt energy-efficient technology as soon as it becomes "cost-effective". Many studies base their estimates of energy saving investments on a comparison between the cost of energy saved and that of energy produced using the same discount rate. Where the cost of conserved energy is lower than the supply costs, the energy efficiency investment is considered cost-effective and it is assumed that the investment will be made by the consumer or by the producer.

The evaluation of the cost-effectiveness of an energy efficiency improvement depends largely on the discount rate used, though there is no agreement on what represents an appropriate discount rate. In some cases the discount rates applied to energy efficiency improvements are the same as those used by utilities for energy supply investments; in other cases, premiums are included to take into account resource depletion, energy security and environmental considerations in order to create "societal cost-effectiveness" measures. Most individual consumers make investment decisions without direct reference to discount rates and discounted capital flows. Even in business or industry, where investments are more likely to be evaluated in terms of rates of return or payback time, energy users may apply more stringent investment criteria to energy efficiency investments than to equipment investments and those that increase their market share.

Even when the apparent costs of energy efficiency are much less than those of new energy supply, investments in efficiency are often more difficult to finance. Suppliers and users of energy are two different groups with vastly different investment priorities and access to capital. Many efficiency measures that would pay for themselves in two years or less do not appear financially beneficial to the energy end-users.

As energy efficiency is often a minor consideration in the choice of equipment, its costs have to be paid back at a rapid rate. Product characteristics are usually more important for individual consumers, as are productivity considerations for industrial consumers. In addition, investments in energy efficiency, which are subject to fluctuations of energy prices, add uncertainty to the investment. Information on the performance of energy efficiency investments is often difficult to acquire. Such investments are perceived as having a higher risk than many other business operations. These issues contribute to the problem of identifying a single, absolute or cost-effective potential.

Consumers do not base their choices on only formal economic calculations, but also on considerations of comfort, quality and availability of a product. Nevertheless a calculation of cost-effectiveness gives valuable information about how well resources are used. The cost-effectiveness of an efficiency measure depends on which costs and benefits are considered. For example, from a business perspective, the relevant costs and benefits are those borne by the energy user. These include the expenditures for equipment, engineering and installation as well as charges for production downtime. The benefits include energy cost savings, plus enhanced labour productivity, environmental compliance or product quality. These are the traditional accounting costs and benefits that directly affect the firm's bottom line.

From a societal viewpoint, there is a wider range of relevant costs and benefits. These include monetary, health, and ecological costs and benefits that accrue to society. Certain societal benefits, such as reduced local air pollution or diminished global warming are external to the market and are difficult to quantify. Moreover, they accrue to society at large, not to the particular party implementing the efficiency measure. This wider definition of cost-effectiveness is the more important measure for policy aimed at energy security and environmental quality.[6]

The idea of cost-effectiveness, energy cost savings, higher purchase prices, and sometimes other less explicit cost considerations provide a framework for describing the potential energy savings and CO_2 reductions in a society.(Figure 2.3) Different estimates of potential are:[7]

Market potential is the saving that can be expected to be realised in practice. It reflects what is seen to be technically and financially viable by individuals and organisations. (Note, this potential is often encompassed in the *baseline* in many energy demand and CO_2 emissions forecasts.)

Economic potential is the saving that can be achieved by optimising costs relative to best practice. It reflects the viewpoint of individuals and organisations.

Social potential is the saving that can be achieved at a net positive economic effect to society as a whole. Here, multiple economic actors are included. An example would be societal investment in energy efficiency to reduce electricity demand growth. This might be less expensive than building a new power plant.

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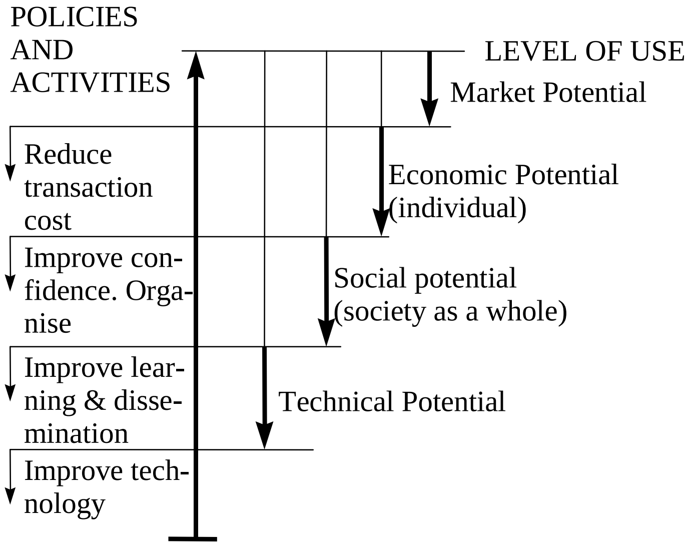
[6] U.S. Congress, Office of Technology Assessment, *Industrial Energy Efficiency*, OTA-E-560 (Washington, D.C.) 1993.
[7] Mark Storey, *Demand Side Efficiency: Voluntary Agreements with Industry, Policies and Measures for Common Action* Working Paper 8, (OECD, Paris) 1996.

T*echnical potential* is the achievable savings resulting from the maximum energy efficiency improvement available at a given time, regardless of cost considerations.

These definitions point out the importance of market actors in determining potential energy savings. There are many things that individuals or organisations (as single economic actors) can do to become more energy efficient. There are still more options, involving trade-offs among multiple economic entities, available at the level of the whole society.

Figure 2.3
Energy Efficiency: Different Types of Potentials and Policies for Improvements



Source: Lena Neij, adapted from *Dynamics of Energy Systems*, Lund University, (Lund, Sweden 1999).

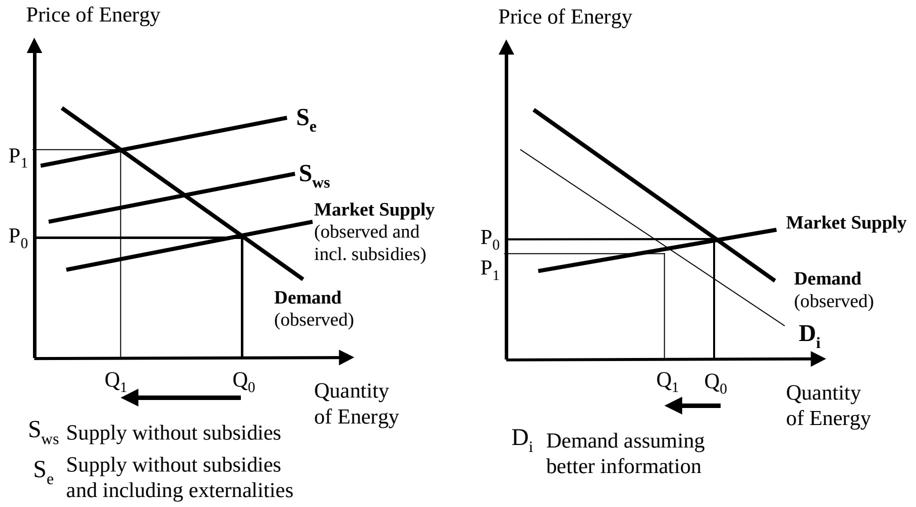
Nearly all devices and systems are less energy efficient than their theoretical maximum efficiency; there is always potential for improvement. Thus, few things are truly "energy efficient". A device or system can only be more or less energy efficient than the alternatives at a given time, in a given situation. But conditions change: innovation produces improved devices and systems; deployment patterns shift resulting in different economies of scale; energy sources and prices change; government policies and programmes change; etc. Thus today's efficient device is rarely tomorrow's.

2.3 HOW IMPORTANT IS PRICE?

The price of energy is fundamental. It is a major criterion on which consumers assess whether energy-saving measures are worthwhile. Another factor is that investing in efficient energy end-use technology can require major capital expenditures; efficient systems and equipment are usually, though not always, more expensive than the technology they replace. Among the many comparisons consumers have to consider when buying appliance or equipment is whether or not the energy cost savings of more efficient models are worth the higher purchase price of those models. Obviously, the higher the price of energy, the more attractive is the investment in the more efficient model.

When prices are distorted by subsidies, the individual benefit is lower. The more energy prices reflect the full costs of producing energy and mitigating the environmental damage it incurs (externalities), the more potential there is for energy savings. It also gives better information to customers thereby enabling them to make more energy efficient choices.

Figure 2.4
Energy Efficiency Potential Related to Price



2.4 WHAT IS THE ENERGY EFFICIENCY POTENTIAL IN THE BSR?

A crucial question is how much energy efficiency potential is there in the BSR and in what timeframe can gains be made. To respond, one needs to take into account factors such as economic conditions, political and market developments, energy prices, rates of uptake and other elements that are not known with precision. The fact that many of the countries in the eastern part of the region are in various stages of transition to market economies and have distorted energy prices further complicates the assessment of energy efficiency potential. The benchmarks used here are scenarios developed in the Baltic 21 – Energy assessment[8] and potentials calculated in the European Commission's communications and strategies.[9] Data for the BSR is presented largely in comparative form because fully reliable and consistent sources are scarce and many of the considerations made are subjective rather than absolute.

The Baltic 21 project consists of a cross-sectoral study that sets goals for energy efficiency and the environment. Its vision foresees that economic differences in the region should be reduced, basic energy services should be affordable for all and long-term security of supply should be maintained by resource management.[10] Modelling results indicate that:

- purchasing power could be changed from being 4 times larger per capita in the BSR-west today compared to the BSR-east to 1.5 times larger in 2030;
- net energy demand could grow while losses and primary energy supply decline;
- use of renewable resources could grow by 70% and natural gas by 100% whereas fossils decline;
- CO_2 emissions decline by 30%.

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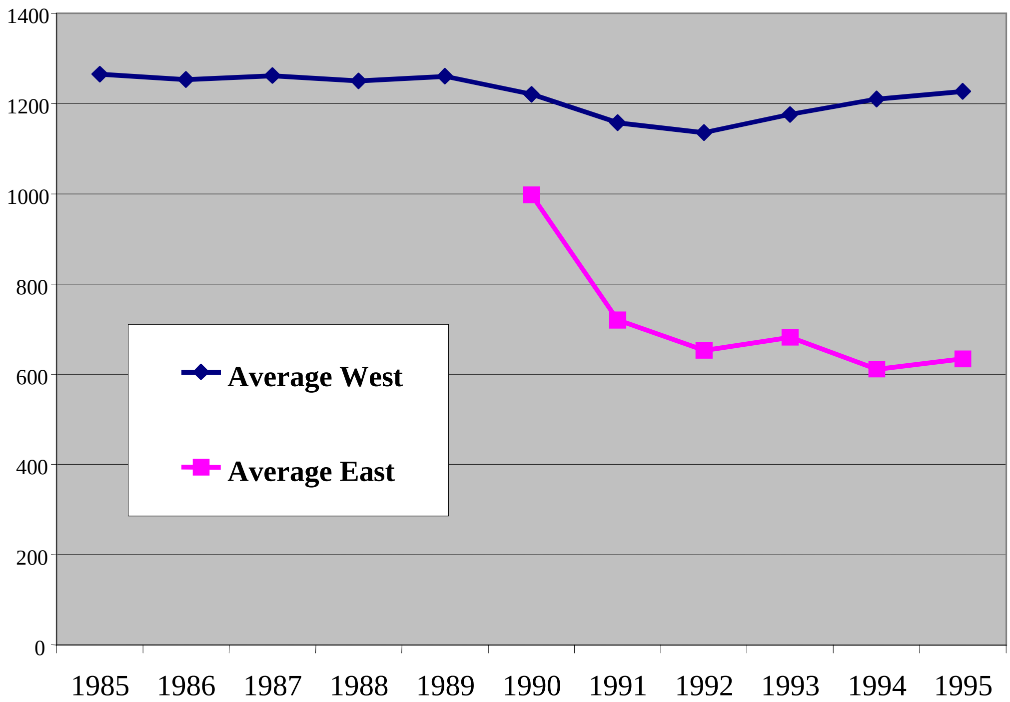
[8] Baltic 21, *Sustainable Energy Development in the Baltic Sea Region*, Baltic 21 Series Publication No. 3/98**,** (Stockholm) 1998
[9] European Commission, "Energy Efficiency in the European Community -- Towards a Strategy for the Rational Use of Energy", Communication (1998)246 Final, 29.04.1998.
[10] Baltic 21 Series No. 3/98.

The following sections review the trends in energy use by end-use sector and in district heating and combined heat and power (CHP). They also review the outlook for change and identify areas of opportunity.

2.4.1 Industry

Industrial energy use in the BSR-east dropped 60% from 1990 to 1995, but the decline has now levelled off. In the west, the energy use in industry remains, with some fluctuations, on a high level. An analysis of levels and trends must be conscious of the structure of the industrial base to be able to make good judgements about their significance and to identify opportunities for improved efficiency. (See Appendix B on energy indicators.)

Figure 2.5
Industrial Energy Use in the BSR
(kgoe/capita)

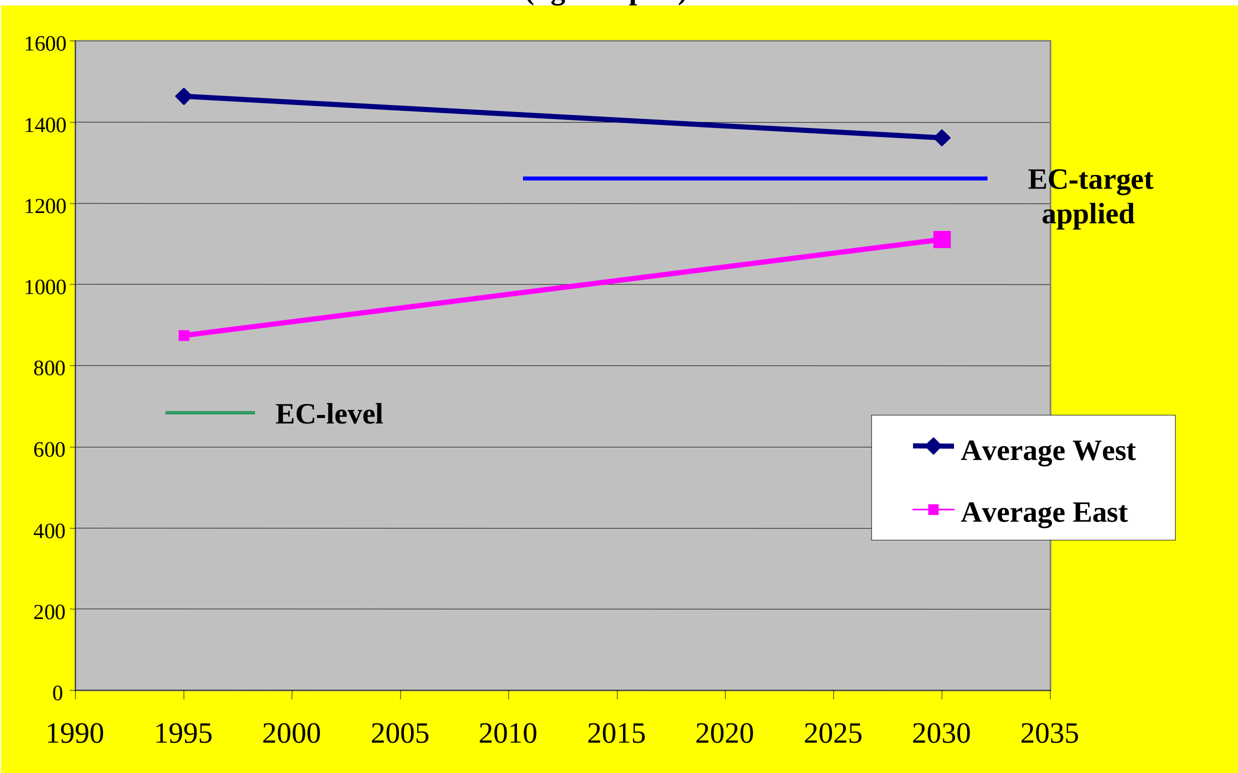


Source: European Commission, *Energy in Europe 1998 Annual Review*, (Brussels 1999).

The closure of many industrial facilities in the east was partly due to their economic inefficiency, including energy, which is reflected in the Figure 2.5. This very sharp decline in industrial activity over a short period of time has had significant economic and social consequences. It can be assumed that industrial restructuring and increased trade will lead to higher energy use in the east. During this restructuring there is an opportunity to direct attention and investment into improved practices and energy efficient technologies in traditional industries as well as new industries.

The Baltic 21 outlook shows a closing of the gap in energy use per capita between east and west by 2030. The EC Communication estimates, according to the concept of “social potential” that takes externalities into account, energy efficiency improvement potential of 17% for Europe. Since industrial energy use on average is remarkably lower in the BSR-east, it would not be reasonable to apply this target. Instead the target of 17% has been calculated (applied) on the average level of use in the BSR-west. Both these outlooks are shown in Figure 2.6.

Figure 2.6
Industry Energy Use in the BSR
Outlook and Target Levels
(kgoe/capita)



Sources: Baltic 21 and EC Communication on Energy Efficiency.

The outlook in the Baltic 21 scenario seems reasonable considering that industrial changes normally follow the capital stock turnover, which is slow, and that there is a reluctance to invest in changes that are only for energy efficiency purposes. It is, however, reasonable to assume that the capital stock turnover in the east will be faster because of the need for industrial and infrastructure renewal and that there will be a stronger component of structural change, if financing can be made available.

Table 2.2
Industrial Energy Use: Comparative Outlook

Region	**Level of use, relative to EU use per capita 1995**	**TENDENCY**	**Target relative EU use 1995**	**Remarks**
BSR-West	2.0	Levelling	EC, 2010: 1.7 B21, 2030: 1.9	The Baltic 21 target seems achievable and the EC target a bit optimistic.
BSR-East	1.2	Levelling	EC, 2010: na B21, 2030: 1.5	There are prospects to lower energy use per capita rather than seeing it increase.

Industry: Opportunity Areas

There are many energy efficient technologies and practices — both currently available and under development — that could save energy if adopted by industry in the BSR:

- general housekeeping and maintenance programmes;
- energy management and accounting systems;
- improved equipment and procedures for existing production methods;
- new and better production methods.

Most of the equipment and process enhancements in the third category, and nearly all the improved production methods in the fourth category, are specific to particular industries, but several (heat recovery technologies, high-efficiency motors and variable-speed drives, sensors and controls, and co-generation) have applications in many industries. These generic technologies are particularly attractive targets for promotion by government energy efficiency policies.

The costs and benefits of energy efficiency improvements vary widely. Minor operational changes, such as housekeeping and maintenance, are the cheapest, easiest to implement and least risky. But usually, though not always, they yield the smallest energy and cost savings. Production equipment changes and energy conservation add-on technologies involve larger investments and may or may not be justified by reduced energy costs alone. Major process changes often require building a new facility, and are usually justified only by strategic, market development concerns. Energy savings are rarely sufficient to justify investments of this magnitude.

In the BSR-east the general trend has been a sharp decline in energy use in industry due to closing of processes and factories with outdated technology. Through technology refurbishment and replacement, it is predicted that production can grow without substantial increases in energy use.[11]

It is likely that the biggest increases in efficiency will not come from direct efforts to reduce energy consumption, but rather from pursuing other economic goals, e.g. improved product quality, lower capital and operating costs, or specialised product markets. Many projects undertaken for non-energy reasons yield energy efficiency gains as a secondary consequence. Flexibility, productivity, product quality and reduced maintenance costs are often more persuasive arguments than just energy efficiency. They can, however, go hand-in-hand with efficiency improvements. Energy management systems applied in conjunction with quality management (ISO 9000) and environmental management (ISO 14000) have proven to be very effective tools to achieve several objectives and have substantial impacts.[12]

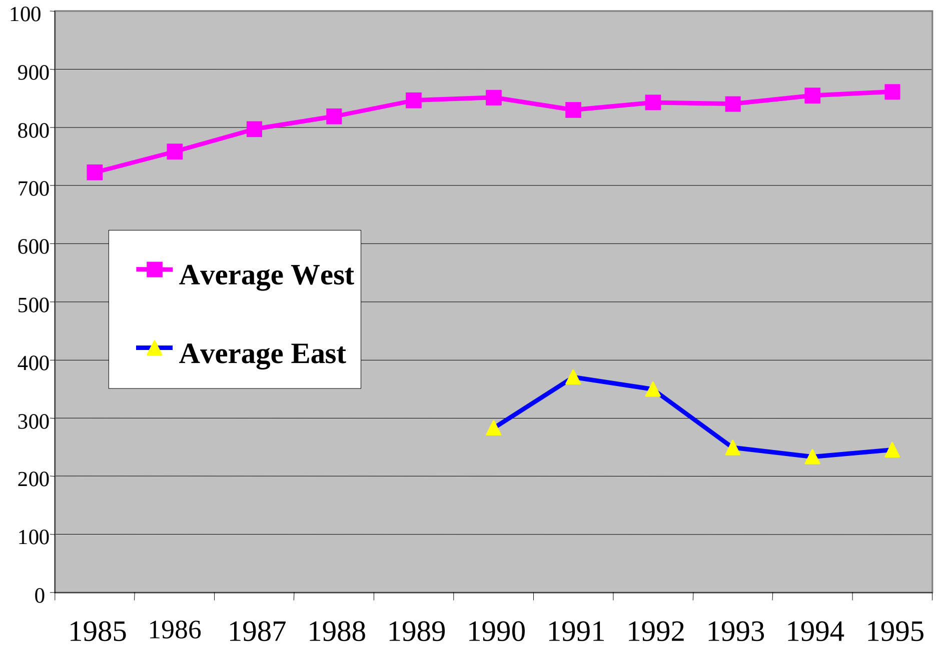
Key question: Would a best practice programme for industry be applicable in the BSR because of the speed of the technology shift?

2.4.2 Transport

Transport energy use in the eastern part of the BSR is only about 25% of that in west. Recent data show an increasing trend. The pattern for transport shows a growing trend in the BSR-west from an already high level.

[11] Vytautas Martinaitis *Energy Efficiency Aspects in Lithuania (Buildings and Industry)*. Paper presented at Workshop in Copenhagen September 2-3 1999.
[12] Energiledelse I erhversvirksomheder. Energistyrelsens koncept. (Energy Management in Industry)

Figure 2.7
Transport Energy Use in the BSR
(kgoe/capita)



Source: European Commission, *Energy in Europe 1998 Annual Review,* (Brussels, 1999).

Transportation consists of several components; the principal ones being travel (passenger transport) and freight (goods transport). Ideally, analysis should separate out travel and freight, for several reasons. First, while travel and freight are both closely associated with GDP, the observed rates of change in activity relative to the rate of change in GDP are different: travel and freight have different GDP elasticities. Second, distribution of activity across modes (and the rates of change of that distribution) is also noticeably different between travel and freight. Third, the potential for energy efficiency improvements is different for cars and trucks. Finally, the economic and other forces that influence transport decisions, as well as the actors who actually make transportation decisions are quite different. Nonetheless, inadequacies in data availability, for example in fuel consumption breakdowns, often limits the ability of analysts to separate passenger travel and freight.

Passenger travel activity is strongly correlated with personal income. In most countries, as income rises, non-motorised and short-distance collective motorised travel (bus, tram, and metro) gives way increasingly to the use of private cars, inter-city rail, and air travel. In the short run, road fuel prices have only a small impact on the level of travel, but may have more of an impact on car use. In the medium term, road fuel prices can have a profound impact on the efficiency of vehicles. Road fuel prices may have secondary impacts on overall levels of travel in the long run. Vehicle taxation as well — both at time of sale and yearly registration — affect automobile ownership and characteristics. The sector is sensitive to many economic forces.

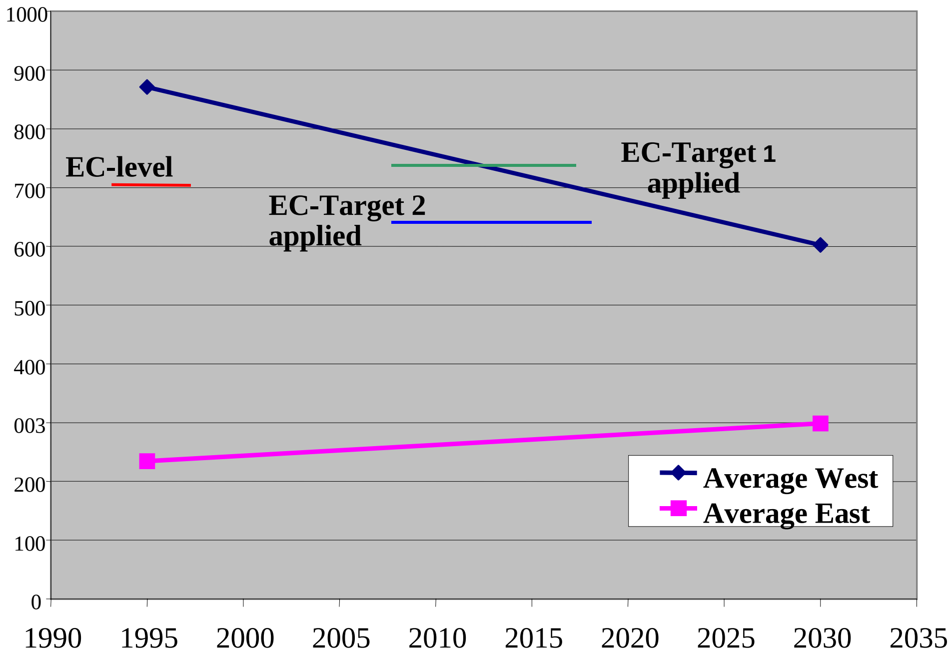
Car ownership in economies in transition countries exploded with reform, as millions of second-hand cars found their way into these countries. Meanwhile, rail and urban mass transport systems lost market share, because of disinvestment, changes in urban transport patterns resulting from economic restructuring, and changes in consumer preferences. This shift has been and will continue to be so important that changes in modal structure alone are a good indicator of overall energy use in the travel sector.

Freight activity levels per GDP in economies in transition countries are generally much higher than in western Europe. The old industrial structure strongly favoured rail transport. The collapse in industrial production and subsequent rapid changes in structure are mirrored by the strong decline of freight activity and a change in modal mix. Traffic, measured in tonne-km, decreased significantly in the economies in transition. The bulk of the decline was for rail transport.

Transportation modes changed as freight movement picked up in the mid 1990s. Trucking began to take a larger share, as rail and inland waterway traffic fell off. Modal shares for the more quickly recovering economies are approaching western Europe patterns. In addition, for many eastern countries, the European Union has supplanted the countries of the former Soviet Union as the most important trading partner. This re-orientation has also favoured trucks at the expense of rail.

The relevance of *modal mix, load factor and vehicle fuel efficiency* to the overall freight energy intensity is similar to the situation in passenger travel. Data on load factors and size of vehicles are difficult to obtain. In addition, the underlying causes are complex and difficult for transport or energy policy-makers to get a handle on or to influence. Vehicle fleet mixes, and how they are used, are the result of myriad decisions made by various actors in a logistics chain. In the western region, these decisions are made increasingly by commercial transportation firms, and less by internal transport managers. They are also made increasingly by specialist firms who target particular types of goods or transportation services. It is not clear that such trends are yet underway in economies in transition countries.

Figure 2.8
Transport Energy Use in the BSR
Outlook and Target Levels
(kgoe/capita)



Sources: Baltic 21 and EC Communication on Energy Efficiency.

The EC Communication provides two scenarios for the transport energy outlook for the BSR: one with improvements in technical efficiency and another that also incorporates modal shifts. Over the medium to long-term, such as considered in the Baltic 21 study scenario, it is reasonable to consider modal shifts particularly since the BSR has special opportunities for sea transport.

Table 2.3
Transport Energy Use: Comparative Outlook

Region	**Level of use, relative to EU use per capita 1995**	**TENDENCY**	**Target relative EU use 1995**	**Remarks**
BSR-West	1.2	Growing	EC,2010: 0.9-1.05 B 21,2030: 0.85	The trend is for increased transport energy use. Targets are not likely to be achieved without a significant change in technologies and infrastructure.
BSR-East	0.3	Levelling-Growing	EC 2010: na B 21 2030: 0.4	There is evidence that use can grow considerably faster unless actions are taken to develop existing basic infrastructure.

Transport: Opportunity Areas

Reductions in trucking energy intensity are likely in the next several years. Truck operators tend to be more sensitive to fuel costs than car owners, so cost becomes an incentive for efficiency in an increasingly competitive market. Furthermore, as truck fleets are increasingly called on to cross borders to the west, these vehicles will need to be in compliance with more stringent emissions and other standards. The conditions are ripe, therefore, for a fair degree of fleet turnover in the short run, and better vehicle maintenance in the medium term. Whether the current fleet of vehicles will be scrapped or recycled into other markets remains to be seen. Nevertheless, it is clear that the level of activity growth will statistically swamp reductions in truck energy intensity.

Trucking consumes more than four times as much energy as rail or inland shipping on a per tonne-kilometre of goods carried. In principle, energy policy should try to shift the mix of freight transport more towards rail and shipping. The room for manoeuvre in this respect, may be limited in some countries in the near term. In the longer term, however, energy and transport policy-makers should keep these considerations in mind.

There are four principal ways to influence transport system efficiency and energy consumption:

- urban and land-use planning;
- modal mix (cars, trucks, rail, air, etc.);
- price, behavioural and operational aspects (occupancy of vehicles, driver behaviour, system characteristics);
- vehicle efficiency and fuel choice.

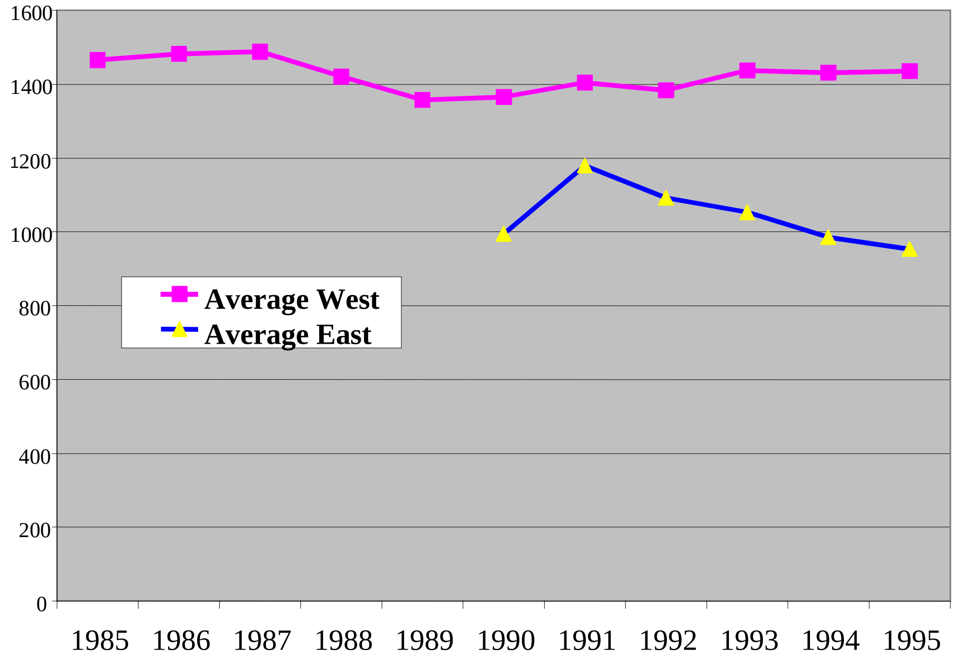
Key question: How can forces be co-ordinated to maintain existing energy-efficient infrastructures (rail-transport) in the east and act for modal changes and fuel shifts in the entire region? Can financing and purchasing power be harnessed to provide incentives to change the trend? Would regional stakeholder’s forums be useful?

2.4.3 Commercial and Residential

In the BSR-west, energy use in the tertiary (commercial and service) and residential sector shows a weak decline from the late 1980s and a levelling trend in recent years. (Figure 2.9) A sharp decline in the east, in part, reflects that energy is gradually being priced closer to costs, and subsidies are being removed. Growth in the commercial sector in the BSR-west has partly offset energy conservation in the residential sector. The commercial sector in the east is far less dominant and has had lower energy intensity.

Figure 2.9

Commercial and Residential Energy Use in the BSR (kgoe/capita)



Source: European Commission, *Energy in Europe 1998 Annual Review*, (Brussels, 1999).

The key energy-uses in households are space heating, water heating, electric appliances, lighting, and cooking. In lower income countries, cooking and lighting tend to dominate residential energy use, except in cold climates where space heating is important. Developments in residential energy use in the BSR-west are likely to differ markedly from those in countries with economies in transition in the coming years. This is due in part to more existing energy efficient equipment and because penetration levels are closer to saturation in the west for some equipment. Economies in transition countries, therefore, will probably see significant efficiency improvements as incomes rise and new appliances and household equipment are acquired. This trend will be offset to some extent by growth in home size, and demand for more comfort and convenience.

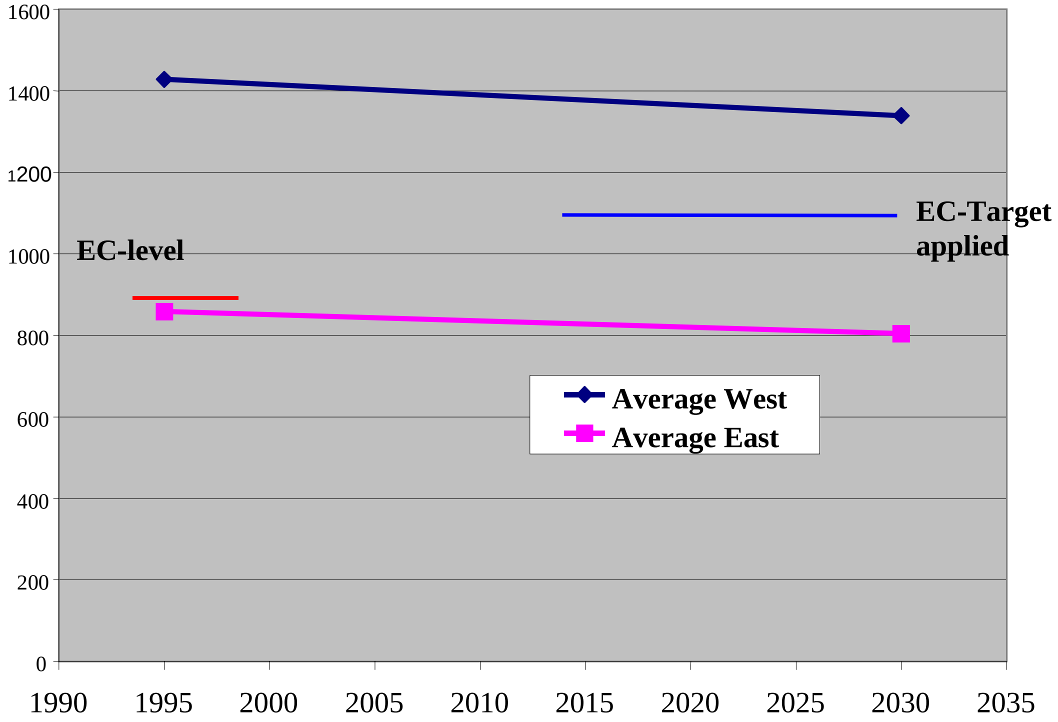
Experience in member countries of the International Energy Agency (IEA) suggests that energy prices have had a profound impact on energy use for space and water heating. Relative prices have affected the choice of fuel, as well as the share of electricity used for applications for which other fuels can be readily substituted (e.g. space and water heating), but the end-use price of electricity has generally been less variable than that of other fuels in IEA countries.

Another lesson from IEA experience is that efficiency standards for appliances and thermal standards for new residential units (with electric heat) have also had a demonstrable effect in restraining electricity use. Electricity prices have also had an effect on the intensity of uses which are not conducive to fuel substitution, e.g. lighting and appliances. Careful examination of the evolution of both fuel and electricity use in western countries shows little rebound effect, either when prices fell or efficiency improved significantly, or both.[13]

[13] International Energy Agency, *Indicators of Energy Use and Efficiency*, (OECD, Paris) 1997.

The Baltic 21 and EC outlooks indicate that growing wealth in the BSR-east may have two outcomes for energy use. Bigger homes and more equipment that requires more energy, and better quality in refurbished buildings that require less energy. The projection that both east and west will decline in energy intensity per capita, and at an almost equal rate, does not appear likely.

Figure 2.10
Commercial and Residential Energy Use in the BSR
Outlook and Target Levels
(kgoe/capita)



Sources: Baltic 21 and EC Communication on Energy Efficiency.

Table 2.4
Commercial and Residential Energy Use: Comparative Outlook

Region	**Level of use, relative to EU use per capita 1995**	**TENDENCY**	**Target relative EU use 1995**	**Remarks**
BSR-West	1.5	Levelling	EC,2010: 1.15 B 21,2030: 1.4	A lot of improvements have been made. Still new technology can be used for heating, insulation, lighting, ventilation and appliances.
BSR-East	0.9	Levelling-Growing	EC 2010: na B 21 2030: 0.8	Specific actions need to be taken to ensure that refurbishment also includes energy efficiency.

Key question: When and how will energy prices be reformed to reflect full cost pricing and energy subsidies be phased out? How can society and authorities constructively move in this direction? Can the capital stock turnover in buildings and the requirements for comfort and quality be used to encourage energy efficiency improvement and thus become partly self-financing?

2.5 A SPECIAL OPPORTUNITY: DISTRICT HEATING AND COMBINED HEAT AND POWER

In the Baltic region in particular, it appears that combined heat and power (CHP, or co-generation) have great potential. CHP can be implemented in either industrial facilities or in district heating systems, and it can be fuelled by biomass or natural gas. Although CHP is already a principal energy source in the region, there appear to be many opportunities for system rehabilitation and capacity expansion to improve efficiency and to reduce emissions. Even when fuelled by heavy fuel oil or coal, the inherent energy efficiency of CHP can provide net emission reductions.

As shown in Table 2.4, district heating provides 45-60% of total heat consumption in the BSR except for Germany (13%) and Norway (1%). CHP now serves up to 45% of total electricity consumption. In addition, the Baltic region today has a 40 % surplus of power capacity, though a large part of this capacity is old and of questionable environmental and economic quality.

Table 2.4

Existing District Heating, CHP Production, and CHP Potential Using All Existing District Heating for CHP - Compared to Electricity Production in 1994-1995

Country	District heating share of total heat	CHP share of total power production	Potential CHP share with existing district heating
Denmark	51 %	50 %	50 %
Estonia	52 %	33 %	161 %
Finland	48 %	35 %	40 %
Germany	13 %	10 %	30 %
Latvia	50 %	26 %	191 %
Lithuania	53 %	17 %	185 %
Norway	1 %	n.a.	n.a.
Poland	47 %	15 %	130 %
Russian Federation	46 %	25 %	198 %
Sweden	50 %	6 %	19 %

Source: Hammar, Ture, "*Identifying and Implementing Energy Efficiency Policies - The Baltic Sea Region as a Case*," Proceedings of the 4th ECEEE Conference, Mandelieu, France, 1999.

The countries in the Baltic region are particularly well-suited to advancing CHP as energy efficiency and emission reduction measures for several reasons:

- The BSR-east has a heavy concentration of industry with large thermal needs, as well as district heating systems, both of which are compatible with CHP.
- CHP projects are generally more cost-effective than renewable energy sources, with the exception of biomass, which is a promising fuel for CHP.
- CHP projects are larger in scale than energy-efficiency projects, making them more compatible with commercial financing criteria.
- Financial institutions have already carried out due diligence assessments in many of the host industries, reducing the transaction costs to develop CHP projects.

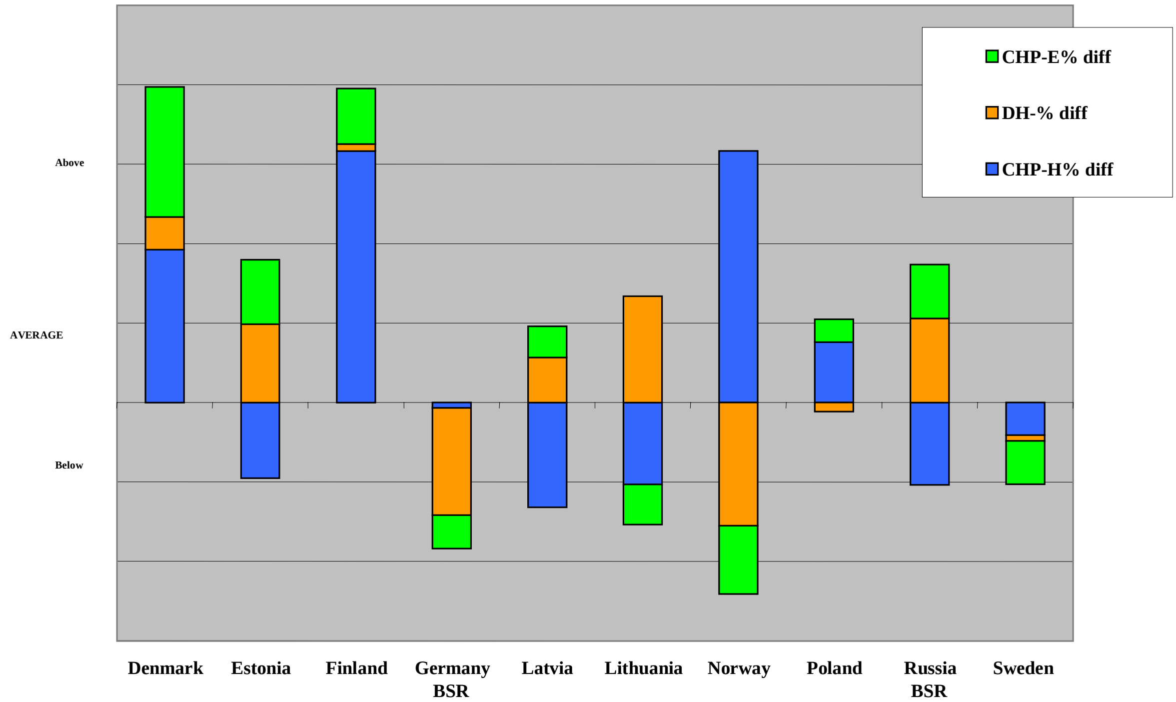
2.5.1 Country Comparisons

This study looks at three indicators of utilisation and potential:

- coverage of heating for residential and service sectors from district heating (DH%);
- coverage of district heating from CHP (CHP-H%);
- coverage of electricity from CHP (CHP-E%)

Taking the three indications together provides a rough idea of where the potential is for more dissemination and deployment of CHP technology. The comparison is based on the average of all the BSR countries that are shown as the baseline in Figure 2.11.

Figure 2.11
BSR Country Comparisons of Combined Heat and Power and District Heating



Source: Baltic 21-Energy., Series No. 3/98.

The figure indicates potentials, e.g. Denmark is above average in all three indices and it might be concluded that the opportunities for further development are limited. Yet it also represents that there is wide acceptance of CHP and DH reduces the “marketing” efforts.

Along these lines, it could be assumed that Estonia might have interesting potential as the coverage of CHP for heating is low. On the other hand, the chances to expand existing DH-systems are not as high and the need for electricity from CHP is lower than the BSR average. Germany and Sweden show potential in all indicators, which could be of particular interest if these countries proceed to phase out nuclear power.

A first approach to increase the use of CHP in the short-term would be to target areas with a low CHP heat-percentage, particularly those with extensive municipal DH-grids. A second step could look at industry and a third is extension of DH-grids in countries with high heat demand.

2.6 CONCLUSIONS

The analysis in this chapter builds on comparisons between the BSR countries. It is clear that the lack of reliable and consistent data hampers detailed study. Establishment of such material and a consistent methodology to use it is important. Appendix B outlines how such a system of indicators can be developed.

Nevertheless it appears that the projections, scenarios and goals set out in Baltic 21 and in the EC communications for improving energy efficiency in end-use and electricity generation are reasonable. The trends and tendencies towards energy efficiency improvements in the sectors, however, need to be reinforced if the goals are to be attained. The question is what measures can be implemented and what forces are needed to achieve sustainable development in the region. Can the power of market forces be harnessed to reach the goals and ensure that no regrets will have to be paid later?

CHAPTER 3
ENERGY EFFICIENCY AND MARKET DEVELOPMENT

Energy markets in the BSR are evolving on a number of different fronts: from centrally planned to market based economies in the east; ongoing liberalisation of electricity and natural gas monopolies in the west partly as a result of the EC-directive; increasing trade between countries and, for some, changes related to membership application or closer association with the European Union. In 1998, the Protocol on Energy Efficiency of the Energy Charter that requires contracting parties to establish appropriate policies to improve the functioning of the market was adopted. As well, the climate change flexibility mechanisms for trading and financing GHG emissions reductions are being discussed which may influence energy efficiency opportunities.

This is a dynamic process. It does take time, however, to put all the pieces in place and to adjust structures as experience is gained. The BSR is a particularly interesting region given its state of development and the changes underway. It can be considered an "open-air laboratory" for activities to improve energy market functions.

Energy ministers of IEA countries have highlighted the necessity of developing the interrelations between actors and improving market functions. In "*Harnessing the Power of Markets", Ministers emphasised that free and competitive energy markets, appropriately regulated, together with liberalised international trade and investment provide an essential foundation for sustained economic growth. At the same time, Ministers noted the challenge involved in designing policies fully compatible with free markets to achieve goals that may not be attained by markets alone, such as energy security and environmental sustainability….."*[14]

3.1 THE MARKET FRAMEWORK

A fully functioning energy market where resources are used in a sustainable way will have a number of characteristics: prices will reflect costs and will not be subsidised, ownership can be secured, participants have the freedom to enter and exit markets, information is accessible by market actors in a manner they are able to use their resources economically. However, as no market can be "perfect" in reality, there will likely be some market imperfections as described in the "pay-back gap"(see Appendix A).

This section focuses on market issues as they relate to energy efficiency and rationale use of resources for a more sustainable economy.

3.1.1 Transition Issues

The European Bank for Reconstruction and Development (EBRD) indicators show progress in the transition of energy markets in all BSR-east countries. (Table 3.1) Although the objective is recognised and accepted by these countries, much progress is still needed. Pricing of electricity and gas remains a problem. Subsidies prevail for social reasons. Pricing does not properly account costs for depreciated equipment. Consequently energy suppliers cannot build new generating capacity when existing plants need refurbishment or replacement.

The uneven pricing for different systems skews competition, e.g. fully priced district heating (DH) can not compete with under-priced electricity for heating of homes. This unbalance can create technology lock-in that might be regretted later.[15]

[14] International Energy Agency, Ministerial Communiqué, IEA/GB (99)28, May 1999.
[15] Accounting and Accreditation of Activities Implemented Jointly. Report for EC DG XII 1999. (Contract No. ENV4-CT96-0210).

Table 3.1
Status of Price Liberalisation in the BSR-East

Country	**Observation by EBRD 1997**
Estonia	Few formal price controls remain except for public utilities and oil shale. It is, however, being reviewed in the context of privatisation of Eesti Energia.
Latvia	Electricity prices are moving towards cost-recovery levels and full economic cost is envisaged by 2005.
Lithuania	DH prices do not yet reflect full costs, but cover operating costs and a margin. Electricity prices cover operating cost but do not cover long-term investment. An Energy Pricing Commission for gas, heat and electricity was established in 1996.
Poland	Prices for DH, gas and electricity are still administered*. Price of electricity is estimated to be about 80% of long run marginal costs.
Russia	Prices for electricity and natural gas monopolies are administered*. Cross-subsidies are significant. A programme has been launched to achieve cost-recovery for e.g. communal services by 2003.

* i.e. prices are not necessarily market driven
Source: European Bank for Reconstruction and Development, *Transition Report 1997.*

The Energy Charter Treaty provides a list of transition issues related to the market framework, including:[16]

- functioning market mechanisms (prices reflect environmental costs and benefits);
- reduction of barriers to energy efficiency to stimulate investments;
- mechanisms for financing energy efficiency initiatives;
- education and awareness;
- dissemination and transfer of technologies;
- transparency of legal and regulatory framework.

Key question: Support to the transition economies needs to be strengthened to establish an adequate market framework. The current unbalance creates problems, e.g. for the DH systems and other infrastructure investments. Improve experience transfer related to price reform. Seek to eliminate subsidies and use that money to support energy efficiency investments.

3.1.2 Liberalisation Issues

The roles for energy companies become more distinct in a restructured electricity market. Generation and distribution are unbundled. Generators sell into a pool or through contracts to a supplier who delivers via the separated transmission and distribution systems. Consumers can choose their supplier.

In a restructured electricity market, focus on demand-side management (DSM) diminishes because priority is given to reducing overall generation costs in order to be more competitive. However, energy companies may pursue DSM activities for several reasons, including:

- need to use energy efficiency to gain market share. (This will be more important as price competition reaches its limits.[17])
- need to maximise wire capacity as transmission and distribution companies will have an interest to flatten the load curve and to postpone investments.

Opening of electricity markets has led to lower prices for many consumers.[18] This can reduce the

[16] Energy Charter Treaty, Protocol on Energy Efficiency and Related Environmental Aspects, Article 3 -Basic Principles.
[17] Brita Olerup, "*Energy Services a Smoke Screen*", Energy Policy vol. 26 No 9., 1998.
[18] European Commission, "*Opening Up to Choice. The Single Electricity Market*", brochure on homepage of DG XVII.

incentive for consumers to undertake energy efficiency improvements. Overall, experience indicates that energy efficiency initiatives decline in restructured electricity, at least in the short term.

Market liberalisation also changes the investment and pricing perspectives for electricity companies.

- In a monopoly system, costs are distributed across the customer base, though not always equitably, and investments are made when forecasted demand calls for new supply.
- In a restructured system, prices are a function of supply and demand and usually with some regulatory oversight. Investment may be made if the revenue stream covers the cost of a new plant. As well, there will be new investors entering the market as independent power producers and new approaches such as "distributed (small scale) generation".

Effect of liberalisation issue	**In utilities own activities**	**In customer activities**
Unbundling of services	Less incentive for DSM	The variable part of the cost is often reduced and the fixed part is increasing. This gives the user less incentive to save energy.
Competition	Change in investment behaviour	Lower prices reduce the incentive for energy efficiency.

The Baltic Ring study calculates two scenarios with low and high economic change.[19] Both of them project that heat and electricity demand to 2010 will be reduced in the BSR-east compared to the early 1990s due to efficiency improvements. The study further indicates a surplus in capacity.[20] Given current trends, estimated over-capacity in 2005 is 40%.

Nevertheless new investments, guided by economic considerations, are envisaged for the following reasons:

- existing capacity needs replacement;
- growth may wipe out over-capacity in a not so distant future;
- environmental challenges will demand better efficiency;
- CHP capacity may have to be maintained due to heat demand and environmental objectives.

Key question: Will these trends have a positive or a negative impact on the use of CHP? Will the new interest for smaller CHP outweigh the disinterest for large systems? What will be the outcome for DH-systems? Is there a need for a co-ordinated sustainable technology programme with international financial institutions?

3.2 INSTITUTIONAL ISSUES

In addition to economic issues, institutional aspects are important since they help build actors' confidence for actions.

- "The transition process is eminently a process of institutional change".[21]
- "It needs to be stressed that when talking about institutions we mean …. laws, social rules, cultural norms, routines, habits, technical standards, etc. Institutions are not organisations. Rather, institutions are the rules of the game".[22]

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19 www.BalticRing.com
20 The system has an installed capacity of 190 GW and a peak of 136 GW in the BSR the year 1995.
21 Martin Raiser, "*Informal Institutions, Social Capital and Economic Transition: Reflections on a Neglected Dimension*", EBRD Transition Working Paper 25.
22 Charles Edquist et al., "*The ISE Policy Statement*", Innovation Systems and European Integration (ISE), Linkoeping, Sweden, May 1998.

Concentration only on technical and formal institutional issues to create an investment climate may overlook the equally important factors of mindset, experience and habits. How experience is used and transferred among people is important and highly dependent on traditions and habits. To learn from mistakes and to repeat successes is fundamental to capacity building.

Policy makers and other market actors will have a significant impact on the type of energy systems that will be used to provide energy services. It will be important that policy makers integrate well the existing forces in the market and enact policies that will encourage better energy systems and better energy use. Consistent policies at all levels is key to achieving sustainable energy systems.

Governments (national and local)

- Establish the legal, institutional and market parameters.
- Improve energy efficiency in government activities, thus acting as an example.
- Develop organisational routines so that energy efficiency is fully considered, including in other sectors such as transportation, housing, etc.
- Establish methodologies to evaluate technical and economic performance of energy services and products using least-cost principles.
- Conduct and provide transparent evaluations.
- Support effective agency and administration efforts to enhance energy efficiency.

Energy Efficiency Agencies

- Gather and disseminate information about activities (technology, programmes, operations etc.).
- Develop and implement energy efficiency programmes.
- Evaluate activities and disseminate results in a targeted manner to support the learning process.
- Co-operate with peers to establish common projects to ensure a larger market response.
- Be pro-active to find and transfer experiences, programmes and projects.

Business Associations and Municipal Associations

- Provide support to members to apply energy efficient technology and operations, particularly in changing routines and adopting certification schemes.
- Communicate the results based on sound evaluation techniques.
- Participate in agreements with branch, government or international concerns to achieve targeted results.

Utilities

- Improve the efficiency of energy supply, transmission and distribution.
- Take part in dissemination of technology to improve energy service.
- Provide information on energy service and energy efficient options to consumers.
- Develop tariff structures that encourage energy efficient consumption patterns.

Equipment manufacturers

- Act together with governments and large buyers to develop new, more efficient technology.

Big buyers[23] (public authorities, business chains etc.)

- Identify opportunities for efficiency within their sphere of influence.
- Examine purchasing routines and ensure that energy efficiency is adequately incorporated.
- Consolidate purchasing power to establish a dialogue with manufacturers and with those who provide energy services or energy-using devices.

[23] The public sector in its role as provider of services controls a substantial building stock, vehicle fleet, workshop facilities etc. Supply for such activities represents a huge purchasing power that can move the benchmark for products on the market.

Non-Governmental Organisations

- Publicise good examples to maintain energy efficiency in the community's focus.
- Network to make use of the latest experiences in research both in technology and applications.

International organisations

- Develop supporting instruments for monitoring and evaluation.
- Serve as a forum to disseminate results.
- Act as a clearinghouse to establish collaborative actions among countries in the region.

3.3 DECISION-MAKING AND COHERENCE

Policies are shaped at many levels, for numerous purposes and by many actors. Energy policies interact with other policies, e.g. industry, environment, transport, agriculture. Sometimes there are conflicts of interest. These need to be resolved. Policies need to be coherent. For example, energy efficiency should be an integral part of housing policy, i.e. providing favourable financing or tax credits for energy improvements undertaken when buildings are refurbished.

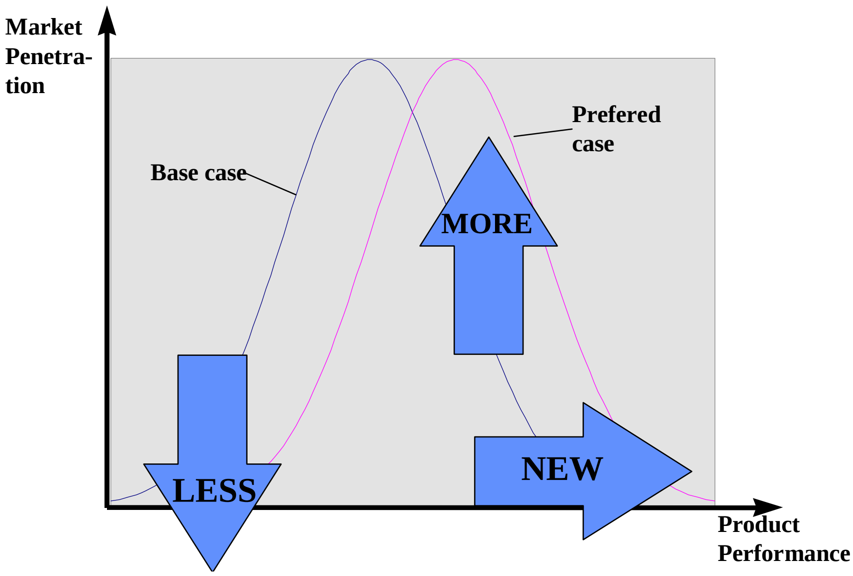
Individuals, companies and organisations also have a multitude of interests to satisfy when making choices that affect energy use. Interests other than energy efficiency often dominate. Decisions are generally based on economic interest as it is assumed in policy making, but this is not always the case.

Policies must account for individuals acceptance and access to resources. Failure can occur when a policy relies on technology improvements without taking into account user acceptance or when subsidies or grants are used to build an artificial motivation, which is not reinforced by technology improvements. User acceptance is a matter of general preferences, habits and skills and is not dependent on energy efficiency.[24] An effective energy efficiency policy incorporates three essential elements:

- potential for cost-effective energy savings;
- acceptance on the part of energy users of improved technology and/or modified patterns of behaviour;
- access of consumers to resources, products and skilled assistance to help them make informed decisions.

[24] Vattenfall, "*From Possibility to Market*", Report on Uppdrag 2000 (Sweden) 1992, ISSN 110-5130.

Figure 3.1
Market Transformation



Coherent policies, where sector interests are harmonised, and customer preferences are addressed, can help transform the market into a more energy efficient one. But the focus should not be only on energy efficiency. Energy efficiency should be combined with other aspects that will encourage consumers to choose the more efficient solutions.

Some important combined qualities for consumers include:

- housing comfort (low noise appliances, less fire risk with less overheating in appliances);
- industry production (higher reliability in processes with high quality equipment, better productivity and fewer rejects with efficient lighting);
- transport efficiency (logistic instruments that increases pay-load and reduces empty return, alternative fuels that reduces hazards for drivers);
- office environment (daylighting that reduces discomfort and stress, equipment that reduces overheating and thereby requires cooling).

Learning is crucial for the market to develop. Improved deployment (greater volume of the products) will result in reduced technology costs due to learning effects on the production side. Governments need to take bold measures to accelerate deployment and learning. These measures should use the interest of particular groups of users/actors (niches) to co-ordinate and amplify the resources spent on RD&D and market deployment.

Niche markets provide leverage for RD&D money. It is a well-known fact that creation of niche-markets and conscious use of market learning effects can form bases for new and improved products with better performance and lower prices.[25] To ensure that market actors make the large scale investments, *one needs to find and use niche markets* for the new technologies based on credible and stable policy measures. Long-range financing is needed to foster cost-efficient technologies. Policies also need to include more co-ordinated instruments that address innovation and dissemination through a multitude of channels to the market.[26]

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[25] IEA, Energy Technology Price Trends and Learning, IEA/CERT(98)24 and forthcoming publication.
[26] Forschungsstelle fur Umweltpolitik (FFU), "*Innovation and Diffusion through Environmental Regulation: The Case of Danish Refrigerators*", FFU-report 98-3, freie Universität Berlin, 1998.

CHAPTER 4
ENERGY EFFICIENCY AND CLIMATE CHANGE ISSUES

Energy efficiency and climate issues are mutually dependent since more than 80% of greenhouse gas (GHG) emissions come from energy production, conversion and end-use. Energy efficiency policies, technologies, and programmes provide a large potential for low-cost emission GHG reductions. Climate-related policies and measures are also beneficial for energy efficiency, because such measures are likely to provide direct funding for efficiency programmes, as well as incentives for third-party investment. This chapter explores the possibilities to exploit the climate-friendly potential of energy efficiency and CHP, and to stimulate investment in these areas through the so-called “flexibility mechanisms” of the Kyoto Protocol, and related tools such as carbon funds and clearinghouses, and the process of carbon performance contracting.

4.1 OPPORTUNITIES IN THE BSR

The carbon dioxide and methane emissions of the countries in the Baltic Sea Region (BSR) region are shown in Table 4.1. Not surprisingly, Russia, Germany and Poland have the highest rates of emissions. It is important to note that emissions from the BSR eastern countries have decreased since 1990, as a result of the economic restructuring that is still underway. The large reduction in Germany’s emissions is almost entirely the result of restructuring in the former East Germany.

Table 4.1

Summary of CO_2 and CH_4 Emissions in the BSR

	CO_2 Emissions			CH_4 Emissions		
	1990 (Gg)	1994 (Gg)	1995 (Gg)	1990 (Gg)	1994 (Gg)	1995 (Gg)
Denmark	52 025	63 132		407	401	
Norway	35 544		37 880	432		469
Finland	53 800		56 050	246		341
Germany	1 014 155		894 500	5 682		4 788
Sweden	55 445		58 108	324		296
Estonia	37 797	21 628		323	188	
Latvia	22 976		11 267	159		103
Lithuania	22 969			159		
Poland (1988)	381 482	372 293		2 801	2467	
Russian Federation	2 375 591	1 633 517		26 690	23 880	

Source: World Bank, “Review of Russian and International Studies on GHG Emission, Regulation, Initiatives, Commitments, and Prognoses of the Different Countries,” Final Report on Task 1, 1998. Data for Poland and Lithuania are from the National Communication to the UN FCCC Secretariat.

With the exception of Denmark and Germany, which get a substantial share of their energy from fossil fuels, the BSR-west countries derive a majority of their energy needs from low-carbon sources. Norway has abundant hydropower, and Finland and Sweden use a mix of hydro and nuclear electricity, biofuels, and wind energy. Therefore these three countries expect that additional opportunities for CO_2 reductions in the electricity supply sector will be limited and expensive.

The BSR countries' strategies for GHG emission reductions are summarised in Table 4.2. The GHG-mitigation strategies in most of the BSR-west stem from their existing energy policies, which developed from efforts to improve security of energy supply after oil price shocks.

Table 4.2.
GHG Mitigation Strategies of the Countries in the Baltic Region

	Dk	**Nor**	**Fin**	**Ger**	**Swe**	**Est**	**Lat**	**Lit**	**Pol**	**Rus**
ENERGY SUPPLY										
District Heat Infrastructure Improvements				P	P	P	P	P	P	P
Renewable Sources	P	P,A	P,A	S	P,A		S	P	S	P
Generation Efficiency	P	S		P	P	P	P	P	S	P
CHP	P		S	P						P
Other*						P			P	
ENERGY END USE										
Building Envelope Insulation			S,A	P		P	P	P	P	P
Industrial efficiency		S,A		P				P	P	P
Energy Standards, Bldg Codes	P,A		P							
Labelling and Certification	S				P				S	
Training and Education	S	P,A		P	P,A	S			P,A	
Recycling/Waste Minimisation	P,A	P							P	
Other			S		P					
TRANSPORTATION										
Infrastructure Improvements	S	S			P	S	S	S	P	
Public Transport	S	P		S	P		S		S	
Fuel Economy	S			S					S	P
Emission Standards									P	
POLICY MEASURES										
Carbon tax	P,A	P, A	P,A		P,A	S	S		S	
Energy tax	P,A		P,A		P,A					
Tax Incentives/Subsidies				P	P				P	
Financial Assistance		P		P					P	
Domestic emission trading	C(P)	C	C(P)		C					C

P – primary mitigation strategy

S – secondary mitigation strategy
A – advanced stage of development
C- considered
* Includes use of heat meters in energy production (Estonia) and less carbon-intensive fuels Poland)
** Includes energy monitoring and auditing (Finland), and efficient technology procurement (Sweden)

Source: Based on the most recent national communications to the Secretariat for the UN Framework Convention on Climate Change (FCCC).

The energy policies of the 1990s in the BSR-west focus more on environmental protection and sustainable development objectives than they do in the BSR-east. In general, carbon and energy taxes remain the primary policy instruments in these countries, although recently more incentives have been applied to stimulate renewable energy sources. Relatively little direct regulation has been used to reduce energy-sector emissions.

In the BSR-east, a large portion of energy consumption is derived from carbon-intensive fossil fuels, such as fuel oil and coal for heat boilers, oil shale for power generation, and a small portion from natural gas. Lithuania, however, has RBMK-type nuclear capacity that provides 93% of its electricity generation, much of which is exported. The eastern BSR countries such as Poland, Lithuania, Estonia, and Latvia are currently undergoing economic, industrial, and power sector restructuring and privatisation. Their main strategy in the industrial and energy supply sectors is modernisation of equipment and processes that leads to increased energy efficiency. Poland in particular considers energy efficiency a means to enhance the competitiveness of its industries.

Carbon reduction strategies for these countries focus on fuel switching to less carbon-intensive fuels and the incorporation of a greater number of high-efficiency combined-cycle gas turbines for electricity and heat generation (see table 4.2).

The BSR-east countries are also concerned with improvements to their energy and transportation infrastructures as part of their economic development. These countries recognise the significant potential for improving the efficiency of their extensive network of district heating systems and the quality of their transportation infrastructure that will improve standards of living while reducing CO_2 emissions by reducing total fuel consumption. These countries plan to use the limited funding available to implement the most financially attractive projects first. Improving the thermal efficiency of buildings is also in this category.

The two principal categories of carbon emission reduction measures are energy and land-use measures. The bulk of the greenhouse gas reduction potential of the BSR is likely to be found in the energy sector, even if forestry, landfill gas and agriculture could make a contribution. Energy measures include switching from fossil fuel to renewable sources to generate electricity and improving the end-use energy efficiency in buildings, factories and vehicles.

Energy efficiency and emission reduction measures must be targeted to both the long term and short-term perspectives in terms of capital stock turnover, technology availability and endurance to avoid lock-in. (See Appendix C). The primary technical options generally include energy-efficiency, combined heat and power (CHP), fuel-switching and renewable energy sources. In general, both end-use and supply-side technology improvements have to be pursued in order to achieve the desired CO_2 emission reductions.

No single measure will achieve the desired result alone. Sound strategies will comprise a mix of approaches. The following typology illustrates that some measures will have to be prioritised in the short term while the long-term options mature, e.g. while waiting for a natural change in capital stock such as major refurbishment of buildings or retooling of industrial plants (see table 4.3).

- Energy efficient equipment (EE); improvements for a given output of an energy end use. Less input of energy ensures that the energy system will be able to operate with a wider range of choices for fuel supply. Thus, a more sustainable system can be created, as it will more easily allow supply from renewable sources.
- Energy management (EM); more conscious use of resources including energy is often both technically feasible and cost-efficient though it might call for a change in organisation and routines, as well as training of staff.
- Fuel switching (FS) to non-fossil fuels (FSN), such as renewable biomass, wind, hydro and solar, can be made in some existing co-generating facilities and in existing systems, fulfilling both short and long-term needs. A shift to low-carbon fuels (FSL) such as natural gas can be quicker, but might have lock-in effects for the long term.

- Generation efficiency (GE) with improvement of output from existing generating facilities can be made very quickly and with good economy. Improved use of CHP by use of low-carbon sources (especially biomass) can be one such option.
- Structural changes (SC), such as new systems or new infrastructures for transportation and decentralised power, will take longer to achieve but will probably be necessary to shape sustainable energy systems.

Table 4.3

Prioritisation of Time Scale for Generic Emission Reduction Measures

	SHORT TERM	LONG TERM
Energy Efficient Equipment for End-Use (EE)	B	**A**
Energy Management (EM)	**A**	B
Fuel Switching to Non-Carbon (FSN)	B	**A**
Fuel Switching to Low-Carbon (FSL)	**A**	B
Generation Efficiency (GE)	**A**	B
Structural changes (SC)	**-**	**A**

A= Highly applicable; B= Suitable

4.2 THE UN FRAMEWORK CONVENTION ON CLIMATE CHANGE AND JOINT IMPLEMENTATION (JI)

A key element of the United Nations Framework Convention on Climate Change (FCCC) is Article 4.2 This Article commits the Annex I (industrialised) countries to adopt policies to mitigate global climate change by reducing GHG emissions and enhancing sinks, and to communicate their policies and measures with respect to the aim of returning emissions to 1990 levels.[27] All of the BSR countries are included in Annex I.

Article 4.2 also allows for the joint implementation (JI) of measures to reduce the GHG emissions. JI refers to the implementation of such measures in one country with financial and/or technical support from another country, potentially fulfilling some of the supporting country's emission-reduction commitment.

In 1995, the Conference of the Parties (COP) to the UNFCCC agreed to a pilot phase for JI to be reviewed by the end of the decade. The purpose of the pilot phase, known as "activities implemented jointly" (AIJ), was to gain experience with the concept, to better define methodological and implementation issues, and to identify institutions to manage JI. During the pilot phase, Annex I Parties cannot credit reductions achieved through AIJ against national commitments.[28]

The Kyoto Protocol, agreed at COP 3 in December 1997, includes quantified emission limitation and reduction commitments (QELROs), i.e. emission caps for the Annex I countries over the 2008-2012 commitment period (see table 4.4).

Table 4.4

Quantified Commitments on Limitation and Reduction of Greenhouse Gas Emissions*

	Kyoto Protocol QELRO: 2008-2012 emissions	Projected excess GHG emissions in 2010 (million mt	Adjusted QELRO based on EU burden-sharing agreement (%	Projected excess GHG emissions in 2010 (million mt

[27] UNEP, United Nations Framework Convention on Climate Change, UNEP, Geneva, 1993.

[28] Conference of the Parties (COP),. "Decision 5/CP.1 on Activities Implemented Jointly," 6 April 1995, First Session of the COP, Berlin, Germany, 1995.

	as % of 1990	CO_2)	of 1990)	CO_2)
Denmark	92	-4	**79**	3
Norway	101	2	101	2
Finland	92	23	**100**	16
Germany	92	-8	**79**	120
Sweden	92	14	**104**	7
Estonia	92	-9	92	-9
Latvia	92	-1	92	-1
Lithuania	92	-5	92	-5
Poland	94	87	94	87
Russia	100	-532	100	-532

* Note that the western countries' original Kyoto QELROs have been redistributed under the EU burden sharing agreement.
Sources: Conference of the Parties (COP), 1997. "Kyoto Protocol to the UN Framework Convention on Climate Change," FCCC/CP/1997/L.7/Add.1, 1997, Third Session of the COP, Kyoto, Japan; Baron, R., M. Bosi, A. Lanza, J. Pershing,"A Preliminary Analysis of the EU Proposals on the Kyoto Mechanisms," IEA, Paris, 1999. J. Swisher calculations for eastern Baltic countries, based on projections from *IEA World Energy Outlook*, (IEA, Paris) 1998.

The redistribution of efforts among EU countries achieved through the "burden-sharing agreement" has some striking implications for the BSR-west countries: Denmark and Germany shift from being able to meet their Kyoto QELRO without specific reduction measures to having to make significant additional reductions (or acquire reductions from other Parties). Finland and Sweden, on the other hand, are relieved of some of their reduction commitment.

It also appears that Poland will have to reduce emissions during the 2008-2012 commitment period in order to comply with its Kyoto objective. Russia and the Baltic States (Estonia, Latvia and Lithuania), on the other hand, are expected to have a surplus of emission allowances.

An important element of the Kyoto Protocol is that Parties agreed to three so-called flexibility mechanisms by which reductions achieved in one Party can be credited to another Party to meet its emission objectives. These mechanisms are referred to as joint implementation (JI, in Art. 6), the clean development mechanism (CDM, in Art. 12) and emissions trading (Art. 17)[29]. Both JI and emissions trading apply to Annex I Parties with emission commitments: reductions achieved by one Party beyond its emission objective in 2008-2012 could be transferred to another Party, using one or the other mechanism. JI is based on project-specific "emission reduction units" (ERUs) that must be agreed as additional from what would otherwise occur. Emissions trading would allow transfers of so-called "assigned amount units" (AAUs) based on Parties' overall inventories. In theory, both mechanisms could be used to support "crediting" based on specific projects. In either case, the governments of both Parties to the transaction must agree to it, as they are solely responsible for meeting their emission goals under the Kyoto Protocol.

4.3 POTENTIAL FOR JI TO STIMULATE ENERGY EFFICIENCY IN THE BSR

As shown in Chapter 2, the technical and economic potential to improve energy efficiency in the Baltic region is substantial. Realising a large share of this potential can reduce GHG emissions and improve the local environment at low cost. There is clearly significant potential for use of the JI mechanism to stimulate energy efficiency investments in the BSR.

4.3.1 JI and Access to Financing

Energy efficiency investments usually represent technical modifications to existing or new projects. The resulting energy savings and emission reductions can add to the benefit of the project both in

[29] Each of the three mechanisms has a different unit for trading emission offsets or credits. The unit for Annex I JI is emission reduction units (ERUs); the unit for the CDM is certified emission reductions (CERs); and the unit for Annex I emission trading is assigned amount units (AAUs) based on the Parties' overall emission inventories.

terms of reduced costs for energy and in performance (such as comfort, productivity, convenience, etc.). Joint implementation offers the potential to accelerate such investments, as the sale of the generated emission reduction units may nudge previously uneconomical or risky investments, or increase access to capital.

Emission reduction units can only be generated in the commitment period of the Kyoto Protocol (2008 to 2012), which may lower the attractiveness of such projects for the moment. Until the offset market for emission reduction units is mature enough, it may be more practical to seek co-financing from companies and institutions that are interested in acquiring such units in advance of a full-fledged market regime. The motivations for such purchases could include:

- satisfying internal environmental objectives (especially public and multilateral institutions);
- obtaining low-cost ERUs in anticipation of higher prices later;
- self-education from gaining early experience with carbon trading;
- enhancing the sponsors' public image (especially private firms).

One promising option for financing energy-efficiency projects generally, and JI projects specifically, is performance contracting via ESCOs. There have already been some efforts to establish ESCOs in the BSR, although their financial contracting is based more on conventional fee-for-service arrangements than true performance contracting.

4.3.2 Requirements For Securing Emission Reduction Units

The types of transactions that are expected under the JI provisions of the Kyoto Protocol are project-based emission reduction units. In an international offset transaction, the participants must:[30]

- demonstrate additionality of measures taken in energy systems or land-use practices;
- document the resulting net emission reductions from the project;
- obtain local agreements and host-country approval;
- monitor and verify that the reductions have been achieved.

Some observers suggest that the verification of emission reduction units from JI projects may require some degree of standardisation in baselines as well as emission monitoring. Whatever final decisions may be on baselines, monitoring, verification and reporting for projects, most of these procedures can be built into the design and operation of a project, once it has been selected as a JI project. Again, the key element in project selection is its environmental additionality, which is whether the project's emissions are lower than would have happened otherwise (i.e. lower than baseline emissions). Thus, the establishment of a credible baseline is the key step in determining the extent to which a project would be eligible as a JI project.

4.3.3 Identifying Projects with JI Potential

The most promising JI projects will generally be energy-efficiency, CHP, fuel-switching and renewable energy projects, in which an existing (baseline) pipeline project can be further upgraded, expanded or modernised to reduce fossil-fuel use and GHG emissions. While all industrial-sector projects may have some energy and emission saving potential, the larger and more cost-effective projects generally are found in the more energy-intensive industries, and those with direct GHG emissions. These industries include metal production and finishing, chemicals and fertilisers, pulp and paper, glass and cement, textiles and food processing.

In evaluating projects, the essential criteria that determine the extent to which emission reduction units can successfully be developed and traded via the JI mechanism include the following:

- reliable emission reduction potential;

[30] See Swisher, J.N., *"Joint Implementation under the U.N. Framework Convention on Climate Change: Technical and Institutional Challenges,"* Mitigation and Adaptation Strategies for Global Change, vol. 2, 1997.

- clear additionality compared to a credible baseline;
- practicality of monitoring, verification and certification;
- institutional capacity for host-country approval and other support.

The size of the emission reduction potential depends on the intensity of energy use in the baseline case and on the availability of proven technology to improve performance and reduce emissions. The additionality of the project depends on the credibility of the baseline. Monitoring, verification and certification needs are project-specific, but energy and industrial projects can generally be designed to satisfy reasonable standards of precision without excessive costs.

Host-country institutional capacity can be a severe constraint to JI project development. Even in potential host countries where there has been a significant amount of JI project development activity, such as the Czech Republic, little progress has been made in devising institutional arrangements needed for carbon trading. A dedicated agency to oversee day-to-day operations in the host country, to disseminate information and to engage in international policy and methodological developments is a necessary first step. Also, local institutions to perform independent verification of GHG reductions achieved via JI are yet to be built.[31] It should be recognised that the fact that activities implemented jointly could not generate credits, and that the Kyoto commitment period is now eight years away are two important barriers to the development of such institutions.

Other barriers related to expertise, awareness and networking in the host countries include:

- insufficient local-language information on climate change and flexibility mechanisms;
- insufficient dissemination of available information;
- lack of dialog between those negotiating policy at the international level and those with the technical expertise to implement projects;
- low awareness among general public, enterprises and non-environment government decision-makers and therefore low interest in the issue;
- insufficient capacities and skills in project identification, preparation and management;
- insufficient expertise in financial and economic analysis related to environmental projects;
- insufficient expertise regarding methodologies and tools to evaluate offset markets and the role of a given country in the international markets;
- infrastructure and know-how to conduct quantitative modelling studies.

A number of simple and low-cost solutions could help address many of these barriers. They include: improved and broad dissemination of information, e.g. websites; translation of key material into local language; seminars with industry and government agencies.

Other JI policy-related issues that need further consideration involve questions regarding ownership and sharing of the burdens and benefits of participating in JI. These issue include ownership of installations and emission reduction units, credit sharing, potential producer surplus and its sharing between the parties involved.

4.4 EXPERIENCE IN THE BALTIC REGION

The BSR has the largest number of energy related AIJ projects in the world (Figure 4.1). They represent an asset that can be used to extract experience, but even more to develop and improve methods to implement energy efficiency and CHP, and to assemble strong instruments for financing energy-efficiency improvements. The work has clearly shown that there are many small-scale projects, which are affordable and profitable even without any climate-related credit if they can be identified, managed and financed.[32]

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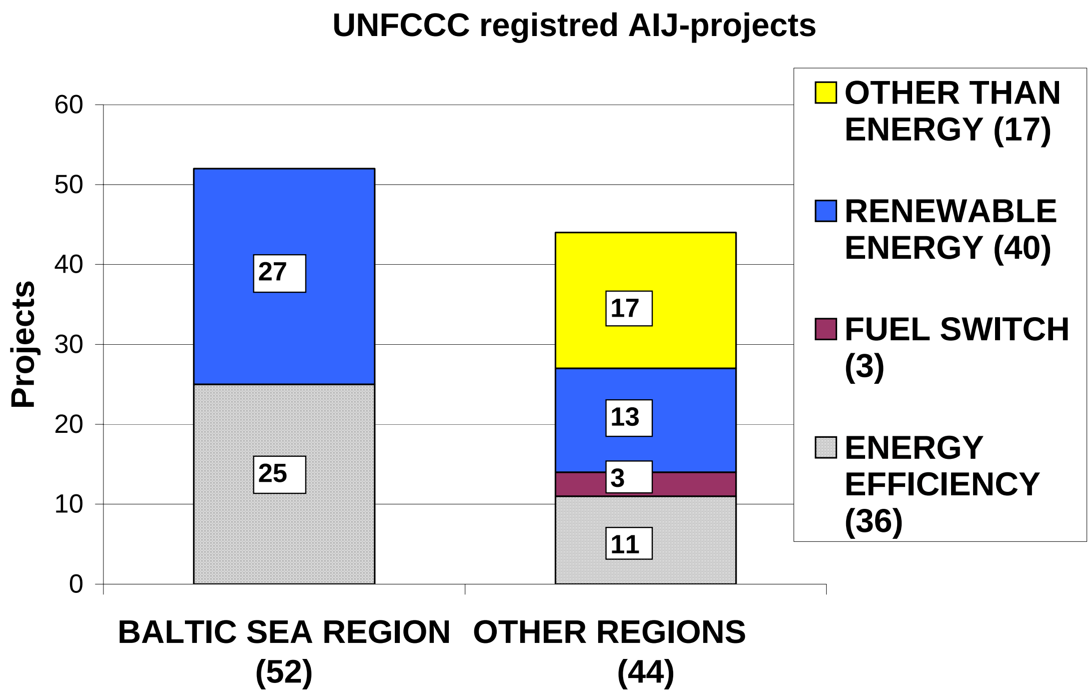
31 The World Bank, "*Synthesis Study of the National Strategy Studies Programme in the Czech Republic, Slovak Republic, Russian Federation and Uzbekistan*", 1998.

32 International Energy Agency, *Activities Implemented Jointly.: Partnership for Climate and Development*, (IEA, Paris) 1997.

Figure 4.1



Distribution of AIJ Projects

Source: IEA calculations from UNFCCC material, April 1999.

The majority of AIJ projects in the region are those from the Swedish Environmentally Adapted Energy System (EAES) programme, which covers boiler conversions, district heating renovation and renovation of buildings. These projects have been tailored with the guiding principle that they should be:

- quick in implementation, with standard financial and purchasing solutions;
- affordable investments on favourable, but commercial, terms;
- reliable, proven and sustainable technology.

To date, the EAES programme has sponsored some 70 projects in the Baltic region, with a total investment of more than ECU 30 million.[33] In addition, nearly ECU 10 million have been spent on technical and institutional support, or about 30% of the investment costs. The total carbon emission reductions are estimated at about 100 000 metric tons of carbon-equivalent (mtC) per year, together with substantial reductions of sulphur dioxide emissions and other local pollution. The EAES programme represents more than half of the total AIJ projects reported to the UN FCCC Secretariat, although these projects tend to be relatively small in terms of the amount of emission reductions.

Both the financing and the technical assistance components are provided by the Swedish agency NUTEK (now STEM). The financial terms involve ten-year loans at the Stockholm inter-bank interest rate with a two-year grace period. The Swedish sponsors accept most of the project risks, although the loans are secured by collateral from the local municipalities. The financial risks include, among others, currency risk, fuel and heat price risks, and consumer non-payment. By assuming these risks, the sponsors improve the financial terms for the participating municipalities and also lower investment costs, as vendors tend to add up to 40% to cover the risk that they will not receive payment from direct

[33] Some of the earlier projects are not registered as AIJ-projects

customers in this region.[34] In addition, the sponsors use competitive procurement to obtain equipment for multiple projects, further reducing costs.

While the financial terms are commercial in nature, they must be regarded as highly favourable compared to true commercial terms for projects of this size, type and location. The risk premium for projects in the Baltic region is substantial, as evidenced by the fact that such projects are not being financed by commercial investors. In addition, the size of the projects would normally drive the transaction costs to intolerable levels, while also concentrating the highly risky pre-investment development costs, to the point where commercial investors would lose interest. Even the 30% transaction costs achieved by the relatively efficient project aggregation in the EAES programme would be excessive for commercial finance. Nevertheless, the EAES programme has achieved a great deal of success in reducing costs by aggregating projects, standardising the financing and pooling the equipment procurement. Unlike many schemes in other regions, the EAES programme has had little problem with loan defaults.

This simple, practical approach has naturally moved the projects toward the use of local labour and hence development of local business. One goal of the EAES-project has been that a growing share of project deliveries should come from host-country companies, although it has also fostered joint ventures between foreign and local partners.

The challenge in applying the AIJ experience is to build on the experience of, for example, the EAES programme in bundling small projects, streamlining finance and procurement, and reducing transaction costs and risks. These lessons need to be applied to a wider range of increasingly ambitious projects that can be supported in part by future sales of emission reduction units (ERUs). The numerous successful boiler conversions implemented in the EAES programme are excellent examples of the "learning-by-doing" that was expected in the AIJ phase.

One lesson from existing AIJ projects is that there are many small projects that will have to be identified and clustered to attract financing and limit transaction costs. Experience in project development demonstrates that pre-investment development costs and other transaction costs are relatively inelastic. This means that, for small projects, development costs comprise a larger share of the total project cost than for larger conventional projects. This difference typically does not contribute greatly to the project's total cost. However, because these pre-investment costs are entirely at risk in the early stages of the process, their contribution to the project risk is magnified considerably. Reduction in costs, through aggregated procurement and streamlined financing, and to mitigation of risks, through bundling of projects and resulting diversification; and the establishment of a commercial basis for these activities have been the main drivers of the concept of a clearinghouse for energy efficiency projects in the BSR

Key question: In addition to climate issues, the important lessons learned from the BSR experience with AIJ projects are project management, financing, networking, capacity building and operations. Can this experience be effectively collected, analysed and transferred to form a basis for regional co-operation to further energy efficiency gains?

Ministers of the 4th Pan-European Conference on Environment for Europe recognised these issues and recommended:
"… supporting international co-operation in the continuous development of a "clearinghouse" for new small-scale energy efficiency projects in order to make them bankable; and by encouraging the development of an energy efficiency service industry." [35]

[34] Salay, J., "*Energy Use, Efficiency Gains and Emission Abatement in Transitional Industrialised Economies: Poland and the Baltic States*", PhD dissertation, Lund Univ., Sweden, 1999.
[35] ECE/CEP/47 item 3e.

A clearinghouse with such a role is now under development with assistance from the EC INTERREG 2C-Programme and involves all the countries around the Baltic Sea.

4.5 EXISTING MODELS OF CLEARINGHOUSES OR CARBON FUNDS

There are several instruments already in place such as the World Bank's Prototype Carbon Fund, the Global Environment Facility (GEF), the European Bank for Reconstruction and Development (EBRD) and other regional initiatives. Ideally, a Baltic energy-efficiency clearinghouse should be able to harness funding and technical assistance from these multilateral institutions in order to leverage and position greater amounts of private-sector financing.

The future emission reduction units provide a new revenue source from an environmental perspective on top of the existing business-related sources.

Thus, to capture the most benefit, the development of a Baltic clearinghouse should emphasise: first, identifying and financing projects; and second, developing and harmonising guidelines and procedures for certifying performance and make use of climate related credits. Some of the existing and emerging instruments sponsored by multilateral institutions in the nascent carbon market are described in more detail below. Other private sector models and regional efforts are described in Appendix D.

4.5.1 The World Bank Prototype Carbon Fund

The World Bank Prototype Carbon Fund (PCF) is designed to create and pool emission reduction units into a fund that is attractive to buyers and sellers. It is also a vehicle for furthering internationally accepted guidelines, and for creating confidence in the market. The PCF intends to introduce a high-quality, reliable product into an untested market for buying and trading ERU among countries. The World Bank has received commitments for approximately US$100 million from a mix of governments and corporations.

Being a new instrument in an embryonic market, an ERU lacks homogeneous characteristics and an associated existing market price. Unlike conventional funds, the PCF does not directly offer an expected return on investment in monetary terms, but rather, provides high quality certificates. Participants will be able to either use their certificates to meet their own carbon reduction obligations or sell the certificates to other companies or governments.

Many companies, even those without emission obligations, expect that the cost differential of emission reduction between countries, combined with the reductions required by the Kyoto Protocol, will form a basis for a substantial market in ERU, perhaps on the order of US$ 8-10 billion per year. These companies are interested in learning about the carbon-offset market and its opportunities. They view an investment in the PCF as a low-cost opportunity to learn about the market's niches, about how to position themselves in the market as buyers, brokers or sellers, how to design their own funds and trades, and what services can be exchanged in the short and longer term.

Observers of the nascent carbon-offset market realise that the public information on JI deals is very sparse. Developers of JI projects face practical questions regarding legal contracts, baseline assessment, verification and certification, and questions of judgement such as what constitutes an internationally acceptable carbon offset. Participants in the PCF would share in the experience of 10-15 JI and CDM projects, and receive access to proprietary information, legal contracts, verification protocols, and reports on lessons learned. The PCF can help participants to strategically align themselves in the carbon-offset market, assess their future role, and begin to implement their strategy.

4.5.2 GEF/IFC Project Support And Investment Funds

Over the last five years, the IFC and GEF have forged a partnership that has resulted in several innovative programs to overcome the barriers to financing renewable and efficient energy projects in emerging economies. They have been able to leverage small amounts of funding into larger amounts of private-sector investment. These funds help to catalyse market development years ahead of their normal development by the more risk-averse private sector alone.

One approach has been the incremental “buy-down” of the higher costs and risks often associated with business development in clean energy technologies. This can be achieved through concessional grants or loans, where either the lack of credit or the high cost of credit impairs a project’s economics. Another mechanism is credit guarantees to catalyse private capital flows to perceived high-risk projects or technologies. Also, the IFC has engaged in equity investments in regions or sectors that lack venture capital, and has contributed grants and technical assistance to offset start-up costs.

Several projects engage the private sector in one or more components. More than twelve GHG-reduction projects funded by the GEF involve participation of energy service companies (ESCOs) for the delivery and maintenance of electricity in both grid and non-grid systems. There are seven rural energy projects that make use of local electricity co-operatives, many of which are owned and managed by small-scale entrepreneurs.

The delivery mechanisms for GEF funds range from project-specific grant funding and risk buy-down to investment in equity and debt funds, loans, lines of credit and loan-guarantees with financial intermediaries. In addition, the GEF has recently concluded a major study of the expanded use of contingent finance using non-grant mechanisms.

The GEF has supported several projects with private sector participants directly, with both loans and grants. A newly formed demand-side management (DSM) organisation is using GEF funding to encourage local private companies to manufacture more energy-efficient lighting, refrigerators, motors and other key energy-consuming devices.

Investment fund support is also a critical component of the IFC and GEF effort to leverage private-sector resources. The Small and Medium-Scale Enterprise (SME) Program, is designed to overcome the scarcity of long-term financing for smaller firms in emerging economies. Six experienced SME institutions (e.g., banks, venture capital companies, or NGOs) were selected by IFC to act as intermediaries for the program and receive low interest loans. The intermediaries in turn will provide debt or equity financing of about US$20,000-200,000 to SMEs for GEF-eligible projects.

IFC and GEF also support direct loans, lines of credit and loan guarantees with financial intermediaries in order to support the development of SME environmental projects. The rationale behind working through financial intermediaries is two-fold:

- to demonstrate that SME environmental projects can both benefit the environment and be commercially viable;
- to increase the involvement of intermediaries (both financial and non-financial) in the financing of SME projects, thereby expanding the market base.

In addition, financial intermediaries often have their own networks and market intelligence.

4.5.3 European Bank Activities

The European financial institutions that are active in the Baltic region include the EBRD, the European Investment Bank (EIB)and the Nordic Investment Bank (NIB) (see table 4.5). Also, the Nordic Environment Finance Corporation (NEFCO) provides financing for environmentally beneficial projects.

Table 4.5
International Financial Institutions Countries of Operation

	EBRD	NEFCO	NIB	EIB
Denmark			M	L
Estonia	SME	S	M	L
Finland			M	L
Germany				L
Latvia	SME	S	M	L
Lithuania	SME	S	M	L
Norway			M	L
Poland	SME	S	M	L
Russia	M,L	S	M	
Sweden			M	L

SME – special funding facilities available for financing small to medium sized enterprises (maximum ECU 2 million)
S – small sized loans available (ECU 125,000 – 3 million)
M – medium sized loans above ECU 3 million
L – large loans are ECU 20 million or more. For some banks such as the EIB, smaller loans are considered for Baltic states via global loans to national or regional level banks.

4.5.3.1 European Bank for Reconstruction and Development

The EBRD was established in 1991 to finance the transition toward market-oriented economies and to promote private and entrepreneurial initiative in Central and Eastern Europe and the Commonwealth of Independent States (CIS). The EBRD provides debt and equity financing for projects in both the private and public sectors. Its policy is to "promote in the full range of its activities environmentally sound and sustainable development."[36]

Over the last few years, the EBRD has increasingly supported operations that focus specifically on energy efficiency, renewable energy, and clean technology. The EBRD has pledged to actively support the concept of joint implementation to leverage additional investments in projects that reduce GHG emissions.

In 1999, EBRD launched an Energy Efficiency Equity Fund. This fund will finance small and medium-size projects with a return on investment of at least 20%. Loans will range from two million to ten million ECU. Private investment in this fund will supplement the 20% to 25% contribution from the EBRD.

The EBRD's Power and Energy Team provides funding for utility plant upgrades that often include fuel switching from coal and oil to natural gas, as well as transmission system improvements that improve efficiency by reducing transmission losses. The Energy Efficiency team funds efficiency investments, such as district heating, directly or via ESCOs that implement efficiency projects. The Efficiency Team uses bank-to-bank credit lines to finance small and medium-sized energy-saving projects.

The EBRD has a number of financial instruments for small- to medium-sized enterprises (SMEs), such as credit lines for financial intermediaries, co-financing and trade facilities, and equity participation in investment funds or banks (table 4.6). The EBRD has at least two SME investment funds specifically for the Baltic States, although these are not specific to energy efficiency or climate change. The Baltic Investment Fund invests in medium-sized companies and joint ventures with foreign partners in

[36] EBRD Charter, Article 2.1vii.

Estonia, Latvia, and Lithuania, and the Baltic Small Equity Fund invests in SMEs in Estonia, Latvia, and Lithuania with operations based upon a partnership between the Fund and the investee companies.

Table 4.6

EBRD Funding Facilities for Small and Medium-sized Enterprises in the Baltic States

Fund Name	Total Capitalisation	Loan/Equity Size	Status
Baltic Investment Fund	N/A	US$1 million – US$2 million	Active
Baltic Small Equity Fund	N/A	US$25,000 – US$400,000	Active
Direct Investment Facility	US$30 million	Equity only: US$500,000 – US$2.5 million	Active
EIF Group Central and Eastern European Power Fund, Regional	US$ 250 million	US$2 million minimum (approx.)- US$50 million	Under development
SME finance facility, Regional	ECU 125 million	Loans: up to ECU 250,000 Equity: Up to ECU 1 million	Under development

In addition, the EIF Group Central and Eastern European Power Fund, now in the final stages of development, is a closed-end venture-capital fund that will invest in small- to medium-sized projects and companies that provide generation and distribution of power and heat in Central and Eastern Europe and the Baltic states. The fund expects to have an initial capitalisation of up to US$250 million for equity investments of US$5 million to US$30 million. The EBRD-EU Regional Finance Facility for ten EU accession countries, also in the final stages of development, provides term loans to financial intermediaries to facilitate the expansion of lending to small and medium-sized enterprises, including micro enterprises. Funding in the form of loans and equity will be made available to a network of banks in Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic and Slovenia.

4.5.3.2 Nordic Environment Finance Corporation

The Nordic Environment Finance Corporation (NEFCO) was established in 1990 by Denmark, Finland, Iceland, Norway, and Sweden to facilitate the implementation of environmentally beneficial projects in Central and Eastern Europe, with priority given to the Baltic region. NEFCO provides on average 25%-35% of total financing in the form of equity investments, loans, and guarantees for projects based on long-term co-operation through investments in enterprises. In particular, NEFCO participates, via joint venture companies or corporate acquisitions, in projects that also involve a Nordic company or institution as business partner.

NEFCO gives priority to projects that reduce pollution in the Baltic Sea (and the Barents Sea) and/or that reduce transboundary airborne pollution, such as:

- modernising industrial and energy production processes;
- manufacture of equipment for pollution abatement, metering, and energy efficiency;
- environmental, consulting, and engineering services and firms.

In November 1995, NEFCO agreed with the Nordic Council of Ministers' ad hoc Group on Climate Strategies to conduct JI simulation studies of five of NEFCO's ongoing projects in Estonia, Lithuania, Poland, Russia, and Slovakia. The purpose of the study was to gain experience with JI on reference case criteria, technology transfer, transaction costs, crediting, monitoring, and other related issues. Three of the projects involved industrial energy efficiency in cement production, mineral wool production, and cellulose paper and packaging. One project involved conversion to geothermal electricity generation in Slovakia. Another project involved manufacturing of heating pipes in Russia.

4.5.3.3 Nordic Investment Bank

The Nordic Investment Bank (NIB) is owned by the five Nordic countries. It was established in 1975 to finance medium and long-term projects of mutual interest to the borrower and the Nordic countries. The NIB's first energy-efficiency loan was to the Turow power plant in Poland. For the Baltic States, the NIB has the Baltic Investment Loans, a special lending facility for small and medium-sized projects that promote private-sector development. Although this facility is not specific to energy or climate projects, it nevertheless is an additional source of funding that can be channelled for such purposes.

In 1997 the NIB created a new type of loan for environmental investments in the Nordic countries and neighbouring regions. The ECU 100 million "Environmental Loan Facility" was established in response to the Nordic Council of Ministers' decision to provide funds for projects that reduce the burden on the environment and transboundary pollution. The Loan Facility targets the Baltic region. The first environmental investment loans were granted to Latvia and Lithuania, in the form of credit lines of ECU 20 million to the finance ministries of both countries. The money is being applied to high priority environmental investments such as energy efficiency improvements.

4.5.3.4 European Investment Bank

The European Investment Bank (EIB) has been funding projects in Central and Eastern Europe since 1990. Its goal is to support capital investment projects that further European integration. While the EIB places a high priority on environmental and energy conservation projects, most projects funded under this criterion have been large infrastructure construction and improvement projects (table 4.7). In Central and Eastern Europe, the EIB concentrates its efforts on road and rail investment and telecommunications upgrades. Energy and environment projects include construction of gas pipelines and storage facilities in Lithuania, Poland, and Slovakia, and water or wastewater treatment facilities construction in Latvia and Poland.

Table 4.7

International Financial Institutions Types of Activities

	EBRD	**NEFCO**	**NIB**	**EIB**
Sectoral Studies	*	*	*	*
Project Lending (Private)	SME	S	M	L
Project Lending (Public)	SME	S	M	L
Technical Assistance Projects	S	S		
Guarantees and Equity	SME	S	M	L
Project Preparation Facilities	M	S	M	*
Focus on energy efficiency	M	S	*	*
Focus on climate change	M	S	*	

* indicates minor area of activity

SME – special funding facilities available for financing small to medium sized enterprises (maximum ECU 2 million)

S – small sized loans available (ECU 125,000 – 3 million)

M – medium-sized loans above ECU 3 million

L – large loans are ECU 20 million or more. For some banks such as the EIB, smaller loans are considered for Baltic states via global loans to national or regional level banks.

Key question: Should a project-financing clearinghouse be established to bundle small projects and provide portfolio management to reduce risk and attract investors such as international financial institutions and commercial banks?

4.6 DISCUSSION OF DIFFERENT FUNDS OR CLEARINGHOUSE TYPES

The three principal functions of the sustainable energy or GHG-reducing funds or clearinghouses discussed above are informational networks, financial mechanisms, and provisional carbon trading systems. All of the funds provide informational networks. However, given the presence of private-sector brokers and promoters, as well as the efficiency of electronic communications via the Internet, this function alone does not justify the establishment of a clearinghouse mechanism.

The financial function is the essential component. Despite the appearance of overall negative or low life-cycle costs, investments in energy-efficiency, CHP and renewable energy projects are limited by high transaction costs, small project scale, weaknesses in domestic capital markets, perceived credit risks and a lack of guarantees.[37] Because of these pervasive barriers to financing energy projects, there is an urgent need for innovative financial mechanisms that can successfully channel investment into technically sound and financially viable clean energy projects.

Thus, the major potential benefit of the funds discussed in section 4.6 is their ability to streamline the process of project finance, bundle similar projects and customers, reduce transaction costs, and mitigate investor risk. These functions can be delivered in new and innovative ways using variations on the traditional project-finance model, including performance contracting via ESCOs and leveraging using various forms of concessional finance.[38]

At present, the ability of these funds to produce and sell emission reduction units should be viewed as one component of an innovative project-finance package. The growing international interest in emission trading will eventually provide a new source of project revenues that can help the repayment of the project financing.

The carbon trading function of sustainable energy or GHG-reducing funds or a clearinghouse is not by itself sufficient to accelerate investment in efficiency and renewable energy projects. However, risk management strategies such as carbon options and carbon performance contracts are likely to gain momentum as different players continue to refine their carbon strategy in the market.

There is a need for innovative financial mechanisms that can channel investors' resources into small energy projects. The IFC, in partnership with the GEF, has made the most progress toward establishing such mechanisms and targeting small projects. In the BSR, NEFCO may be an especially promising partner for a potential Baltic clearinghouse, due to its emphasis on environmental criteria and on relatively small projects.

The EBRD, EIB and NIB could be investment partners on specific projects, particularly as these institutions activate investment funds targeted at distributed power, energy efficiency and environmental projects. Finally, the World Bank PCF, as the most mature mechanism developed specifically to trade offsets in greenhouse gas emissions, will be useful in the development of market activities.

Efficiency improvements can be implemented through a wide range of mechanisms, including direct contracting, equipment purchases, public procurement, utility programs, performance standards, technological progress, and behavioural response to price increases. Projects are traditionally implemented primarily by end-users, with vendors and banks playing the roles of equipment suppliers and financiers.

One of the fundamental barriers to reducing both energy costs and carbon emissions in commercial and industrial facilities is the inability of companies and public institutions to borrow against future

[37] International Energy Agency, *Activities Implemented Jointly: Partnership for Climate and Development*, (IEA, Paris) 1997.
[38] Econergy International Corp. (EIC) and Pacific Northwest National Laboratory (PNNL), "*Financing Mechanisms for Renewable Energy and Energy Efficiency in Emerging Markets*", PNNL, Washington, 1997.

energy savings to finance capital improvements. A common alternative is to out-source work as much as possible and to seek private capital. To the extent that third-party financing can be used, commercial and industrial facilities can potentially contract to implement energy and emission saving projects that they could not otherwise finance.

To date, most third-party financing of energy-efficiency projects has been carried out by energy service companies (ESCOs) using a performance contract model. The ESCO model appears to be a promising approach to implementing energy efficiency with private finance, especially if it can be complemented by climate-related measures derived from the energy saved by ESCO projects. Private investment is needed to realise the potential for energy efficiency and emission reductions in the Baltic region, and it appears that the ESCO model is a promising method for channelling such investment. Building on the competitive procurement methods that were used in the EAES programme, a Baltic clearinghouse could combine ESCO financing and collective procurement to reduce project implementation costs.

4.7 CONCLUSIONS

The establishment of a project-finance "clearinghouse" in the Baltic region could be instrumental in the transition from AIJ to JI. Given that the region has largest number of AIJ projects in the world, they represent an asset that can be used to extract experience and to develop and improve methods to implement clean energy technologies.

Because great potential for such projects exists in the Baltic region, a two-phase strategy for implementation of projects is recommended, concentrating on small energy-efficiency and combined district heat and power projects. The initial phase would focus on clearly profitable projects using proven and commercial technologies, and the later phase would use the value of emission reduction units, when they can be generated.

By emphasising clearly cost-effective projects in the early phases, a smooth transition can be made from AIJ to JI, and positive experience in the early phases can be applied to later JI phases. Meanwhile, development and testing of methods and procedures for baseline definition, carbon accounting, monitoring and verification can progress in the course of project development and implementation.

Public agencies and multilateral institutions can support energy efficiency projects that reduce carbon emissions through guarantee mechanisms, which foster investments in clean energy projects without excessive distortion of capital markets. Such financing arrangements could include, for example, municipal bond financing for infrastructure projects or guarantees of tariff payments by publicly-owned utilities for energy projects. Risk guarantees and reserve funds also have the ability to leverage private capital in greater amounts than the original contribution from the concessional source.

Performance contracting via ESCOs appears to be a promising option for financing energy efficiency projects, if this process can be successfully adapted to local conditions. Performance contracting provides a way for private businesses or public agencies to borrow against future energy savings to finance the purchase of energy-saving equipment, installation, and maintenance services. The nascent international carbon market already includes several funds, clearinghouses or consortia of buyers that might become important players in the near future. These include multilateral funds such as the World Bank PCF, regional funds, and private-sector consortia. European institutions such as the EBRD and NEFCO are also beginning to provide financing specifically for GHG-reducing investments. In the mean time, development and testing of procedures for baseline definition, emission inventories, monitoring and verification can occur naturally in the course of project development and implementation.

CHAPTER 5
COUNTRY CHALLENGES AND OPPORTUNITIES[39]

The countries in the BSR each face different challenges but some of the opportunities to meet the challenges are common. This chapter looks at the challenges and possible approaches to improve energy efficiency and reduce GHG emissions in the various countries and to what extent these can be more easily achieved with co-operative activities.

The first section looks at country specific objectives and selected actions, and highlights trends in the economies in transition countries of the BSR. These country descriptions provide a flavour and are not comprehensive. The second section considers areas for common action. The results of cross checking between the referenced policy documents and their main messages are presented in Chapter 6.

In previous years, economic growth in eastern Europe was driven by strong industrial output performance. [40][41] Much of the production was from basic and energy-intensive industries such as metals and chemicals. Since 1996, however, the trend in most BSR-east countries has seen GDP growth largely based on recovery and expansion of the service sector. In contrast, the largest economy, the Russian Federation has not made a recovery and remains in economic turmoil.

A main factor for economic growth in most of the transition countries is an increase in domestic demand, both private consumption and investment. Nominal incomes have grown accompanied by a decline of actual inflation rates. Domestic consumers are becoming more demanding and diversified in their tastes. This has increased competition as domestic producers struggle to catch up in terms of modernisation and restructuring to be able to compete with the more powerful and technologically advanced multinationals or foreign suppliers within their countries.[42] Modernisation will be essential for the success of economic transformation, i.e. rising productivity, production efficiency, better allocation of resources. Strong income inequity in different segments of society is a general feature.

5.1 COUNTRY SPECIFIC IMPLEMENTATION PRIORITIES

Based on country communications to the UNFCCC[43], country profiles in the Energy Efficiency Initiative[44] and the Baltic Energy Database, country specific energy and climate-change related priorities and measures are reviewed below.

DENMARK

Denmark is one of the leading countries in promoting renewable energy. It is the world leader in exports wind energy technologies. Denmark has traditionally taken a very systematic, planning approach to energy policy. Energy policy is significantly influenced by environmental issues, particularly climate change. This is reflected in the merger of the energy and environment authorities into one ministry in 1994.

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[39] This chapter brings together information from the following sources:

- Baltic 21 Energy Report; http://www.ee/baltic21/
- Baltic Energy Strategy; http://www.bcom-coe.org/
- Energy Charter Protocol on Energy Efficiency; http://www.encharter.org
- Countries climate change national communications to the UNFCCC; http://www.unfccc.de/
- EC "Communication on Energy Efficiency - Towards a Strategy for the Rational Use of Energy" and "A community Strategy to Promote Combined Heat and Power and to Dismantle Barriers to its Development"; http://europa.eu.int/en/comm/dg17/dg17home.htm
- Proposal for a Policy Statement on Energy Efficiency in Europe prepared for the Pan European Conference "Environment for Europe" Aarhus, Denmark in June 1998. http://www.mem.dk/aarhus-conference/
- The Energy Efficiency Initiative, background material for the Aarhus conference produced by the IEA; http://www.iea.org/eneffic.htm

[40] There are two general problems in analysing economic data for the transition economies: first is the significance of the shadow economy, estimated for example in Estonia to account for 12 to 40% of GDP; second is conflicting opinions about the country's economic performance by different national sources. See the Economist Intelligence Unit, *Country Profile Estonia, Latvia, Lithuania,* (London) 1997/98.

[41] United Nations Economic Survey of Europe in 1996-1997. New York, Geneva, 1997.

[42] ibid.

[43] UNFCCC reports on the in-depth reviews of national communications of each country.

[44] International Energy Agency, *Energy Efficiency Initiative*,(IEA, Paris) 1998.

Denmark has one of the lowest levels of energy intensity in the IEA, though in the past few years there has been little progress in lowering it.

Since 1973, Denmark reduced its dependence on oil from 89% of TPES to approximately 44% in 1995. This has been offset by a significant increase in the use of coal, from 9.8% to 38% over the same period. Denmark is now focusing on reduction of coal use through natural gas which accounts for 13% of TPES, since its introduction in the 1980s, renewable energy and energy efficiency.

Denmark agreed to reduce carbon dioxide emissions by 20% between 1988 and 2005. The target applies to national emissions adjusted for climate and electricity imports and exports. Denmark agreed to cut carbon dioxide emissions by 10% between 1990 and 2010 in the recently announced targets for the EU countries.

General Energy Policy: Action Plan for Energy "Energi 21" published in 1996; contribution to sustainable development of Danish society; objective to achieve 20% improvement in energy intensity between 1994 and 2005 (55% between 1994 and 2030).

Residential/building: Large number of activities and measures, including energy-labelling scheme for buildings, mandatory consumption-based billing, ban on electric heating, grants in different sectors.

Industry: Fuel combustion is the dominant source of CO_2 emissions, mainly from energy and transformation industries.
Energy audit grant programme, subsidy scheme to promote energy saving in industry; energy audit for reduction in CO_2 tax, voluntary agreements with sectors and groups of companies (with 10% of industry to be covered by 2005).

Transport: The number of private cars is increasing. Action plan for Transport stresses increasing fuel taxes, and strengthening the public transport systems. Measures include: energy labelling of new cars; promotion of bicycle transport; RD&D, e.g. electric vehicles; increased registration fees on medium-sized trucks; promotion of biofuels for busses; car tax based on energy and weight; tax on private use of pickups and vans.

Prices/Taxation: Tax reform where revenues from "green" taxes are used to lower taxes on labour costs; CO_2 tax in industry, households and public service; excise taxes on oil products, electricity and natural gas; exemptions/lower rates for energy-intensive industry based on competitiveness issues.

CHP/DH: These have been a long-standing priority in Denmark's energy policy. Initiatives include "Energi 21" to reform the legal and economic framework; grant schemes (1993 – 2002) to increase connection to DH systems supplied from CHP; expansion programme for small-scale co-generation (grants and exemptions from energy tax); promotion of biomass use in DH.

Procurement/labelling: There are several projects for joint procurement and labelling schemes. (see transport and buildings).

Institutional capacities: Primary responsibility for energy and energy efficiency is with the Ministry of Energy and Environment. Danish Energy Agency (DEA), as part of this Ministry, drafts strategies and implements programmes. There are interdepartmental and parliamentary committees for co-ordination and a new committee on electricity issues. There is a Council of Environmentally-Related Energy issues, with DEA as the secretariat, which advises the government and Parliament.

ESTONIA

Estonia has adhered to disciplined fiscal and financial policies and has led the former Soviet Union countries in pursuing economic reform.[45] There has been a dramatic growth in the service sector. In the industrial sector, timber and wood production have rebounded.

Estonia signed the Association Agreement with the European Union in 1995, and unlike similar agreements signed by Latvia and Lithuania, no transition period is expressed.

Privatisation within the country is nearly complete: most houses are now privately owned; the large strategic enterprises have been privatised or at least partly privatised (e.g. Estonian Energy, Estonian Telecom etc.).[46]

Industry: Prior to the early 1990s, Estonia's industry was dominated by energy-intensive manufacturing such as machinery, electrical and electronic goods, textiles and food-processing which were energy inefficient and environmentally damaging.[47] Following the break-up of the Soviet Union, industrial production collapsed by 36% in 1992 due to energy shortages and loss of traditional markets. Since 1995 industrial activity has recovered aided by foreign investments and the opening of new export markets in the west, mainly textiles and timber industry, but also chemicals, plastics, glass, rubber and metal industries. The industrial sector accounts for about 28% of total employment.[48] Investment in energy efficiency will depend partly on the price of energy. The state has already started to promote energy efficiency measures in industry supported by various programmes. In general, industry contributes about 7% of Estonia's CO_2 emissions.[49] Energy demand is expected to grow with economic recovery. Considerable modernisation of the industrial sector is needed.

Transport: Passenger car ownership has increased dramatically in recent years, as in most transition countries. The number of cars rose from 240 900 in 1990 to 383,400 in 1995.[50] Low petrol prices fuelled this development, contributing to traffic congestion. One of Estonia's main investment projects in the transport sector is the Tallin-Parnu section of Via Baltica (estimated cost of US$ 56 million) which will link Estonia to western Europe through Poland.

Four major ports handle about 75% of the Estonia's total trade: Tallin City, Muuga, Kopli and Paldiski, which since 1996 have come under a single administration called Tallin Port. Goods travelling from east to west tend to arrive by rail and are forwarded on by sea. Goods travelling on the north-south route, however, tend to be transported by road. Taking into account that the railroad network has remained largely unchanged in recent years (about 1 020 km of track, 132 km electrified) and that the Via Baltica will inevitably contribute to increasing traffic (passengers and goods), transport certainly will be an area requiring action.

Road investment in other parts of the country, however, has not been substantial. Air passenger traffic at present is not a very popular mode of transport with just over 6% of cross-border movements. The share of transport as a percentage of total fuel consumption is currently under 10%. The transport sector contributes 7 % to Estonia's CO_2 emissions.[51]

Construction: The construction sector recovered after 1992 with the overall economic revival. Encouraging factors are the increasing availability of long-term credits for private and commercial developments. Related to the growth in the service sector, there is also growing demand for office space in key locations such as Tallin and Tartu. Investment in the first quarter of 1997 totalled about US$ 33.6 million.[52]

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[45] [author or institution] Energy Efficiency Country Studies: Estonia, 1998.
[46] The Economist Intelligence Unit, *Country Profile Estonia, Latvia, Lithuania,* (London) 1997/98.
[47] ibid.
[48] Agenda 2000 Commission opinion on Estonia's application for membership of the European Union, Section B.3.4.
[49] UNFCCC, Report of the In-depth Review of the National Communication of Estonia, 1997.
[50] The Economist Intelligence Unit, *Country Profile Estonia, Latvia, Lithuania,* (London) 1997/98.
[51] UNFCCC, Report of the In-depth Review of the National Communication of Estonia, 1997.
[52] The Economist Intelligence Unit, *Country Profile Estonia, Latvia, Lithuania,* (London) 1997/98.

General: Estonia's energy balance and greenhouse gas emissions are dominated by oil-shale (95% of electricity generation, 25% of heat requirements) which contributes to environmental damage. Other factors, mainly low prices, further increase dependency. Estonia is drawing up legislation and regulations to correspond to EU requirements. There is a focus on future measures to improve end-use energy efficiency.

Residential/building sector: There has been a gradual introduction of EU directives on building standards. There are materials, methods, insulation and thermal performance standards. Estimates of technical potential show savings of more than 25% of energy used in residential buildings with improved insulation and other energy efficiency measures.

Industry: There are no specific measures to reduce GHG emissions and to increase energy efficiency in industry; however, there are pollution charges that go into the country's Environmental Fund.

Transport: Energy use for transport is rising for private passenger cars and goods transport.
Imported old cars have higher taxes and there are emission standards for new passenger cars. There is a proposal to implement differentiated fuel taxes to provide incentives for the use of cleaner fuels.

CHP/DH: Production from DH contributes a high share of emissions. The portion of DH delivered from CHP plants is fairly small (about 10%).

Financing/investments: Financing of energy efficiency measures has been largely done by allocation of state funds and by programmes financed by other countries (mainly Nordic) and loans from World Bank, EBRD and EIB.

Promotion of technology: Economic instruments, e.g. charges on SO_2, NO_x and CO emissions are expected to stimulate introduction of clean technology.

Institutional capacities: The Energy Department within the Ministry of Economics is responsible for energy policy issues, including energy efficiency. The Ministry of the Environment is responsible for implementing the Framework Convention on Climate Change, and co-operation from regional environmental departments in 15 counties and in institutes in Tallin and Narva.

FINLAND

The energy supply was closely linked with the former Soviet Union. Since 1989, Finland has diversified supply sources and opened up its energy sectors, particularly electricity, with vigour. It became a member of the European Union in January 1995. Environmental issues are of high importance. Finland is one of several IEA countries to adopt environment-based energy taxation. The negotiating target in the EU context is to stabilise CO_2, CH_4 and N_2O emissions together at the 1990 level by 2010.

Finland's energy intensity is significantly higher than the OECD-Europe average, but at about the overall OECD average. Energy intensity has decreased only marginally in the past few years. Finland is one of the most electricity-intensive countries in the OECD.

Renewables represent about 20% of Finland's TPES. The share of electricity from renewable sources is about 30%. The dominant renewable energy source is biomass, which accounts for about 80% of the total production from renewable energy sources. The use of peat is also quite extensive with production of 2 Mtoe compared with biomass production of 4.5 Mtoe in 1994.

District heating and CHP have an important role in Finland's energy system in providing an efficient use of fuel. Renewables, primarily biomass, are used to a large extent in the production of both heat and power.

General Energy Policy: Finland's Energy Strategy (1997) aims to reduce specific energy consumption by 10-15% by 2010. Measures include: fuel switching and renewable energy, efficiency measures, e.g. information, incentives, voluntary agreements, regulations and R&D. Decisions on future expansion of nuclear power are pending.

Residential/building sector: Being a cold country, Finland has a long history of strict building codes concerning energy efficiency as about 75% of total final heating energy is used in residential and office buildings. About 46% of the building stock is supplied by DH, mostly from CHP. There are special certificates for energy audits with direct market value (80% of buildings are to be audited by 2010).

Industry: Industry accounts for about 47% of total primary energy and 53% of total electricity demand. Industrial measures include: energy audits and voluntary agreements. As of 1998 companies representing 70% of industrial energy use and more than 70% of power production, 40% of electricity distribution and 30% of district heating are covered by voluntary agreements with monitoring schemes.

Transport: Transport in Finland contributes about 20% to total CO_2 emissions and the trend is on the increase. There is high passenger car use due to sparsely distributed population. However, the use of public transport, which is subsidised, is higher than the EU average. The railway system is likely to be privatised from 2000.

Prices/Taxation: A CO_2/energy tax was introduced in Finland quite early. There have been substantive changes in its structure and it is now applied at the level of consumption rather than at electricity production. Economic considerations have led to exemptions for a number of sectors, which has lessened the tax's environmental impact.

CHP/DH: 30% of electricity production is from CHP based on wide use of district heating and the large number of forestry industry installations. The prospects for further extending the use of DH, CHP and hydropower are said to be limited.

Procurement/labelling: There are activities to speed up entry of efficient and competitive technologies on the market with joint procurement.

Promotion of technology: Two of eight national technology development programmes address energy efficiency in the paper and base metals industries.

Programmes at the local level: "Cities for Climate Protection Finland Campaign" run by Association of Finnish Local and Regional authorities in collaboration with the International Council for Local Environmental Initiatives (ICLEI); 21 cities members; promotion of energy conservation in municipalities.

Institutional capacities: The Energy Department of Ministry of Trade and Industry (MTI) is responsible for policies and programmes in energy efficiency. MOTIVA (Information Centre for Energy Efficiency) is its executive agency. Their programmes include: collection, processing and distribution of information on energy efficiency; development of auditing methods, training programmes for auditors with certification.

There is a co-operation agreement between the MTI and Confederation of Finnish Industry and Employers to promote energy efficiency and reduce specific energy consumption. Also there is a co-operation agreement between MTI and Association of Finnish Local and Regional Authorities to promote of energy efficiency in local authorities, including Helsinki.

GERMANY (D)

Germany has ambitious plans to reduce GHG emissions with energy efficiency. It has agreed to reduce the weighted total of CO_2, CH_4 and NO_x by 25% by 2010 compared to 1990 as part of the new EU targets.

Energy intensity, which has shown improvement through the 1990s, is at the OECD-Europe average. In 1995, TPES increased in Germany for the first time since 1988. Germany supplies only 42% of its energy needs. It has large supplies of coal, although production is dropping because of the high cost of exploitation and the gradual removal of state subsidies. In early 1997, the Federal Government agreed to reduce subsidies to the coal sector over the next nine years. By 2005, the coal industry will be cut in half from 1996 levels. Imports account for more than 95% of Germany's oil requirements. Domestic gas provides 22% of demand.

General: The main strategy for reducing GHG emissions is improved energy efficiency on both supply and demand sides (more than 80% of measures described in the national communication). About one third of Germany's electricity production is based on nuclear power. The new government has proposed to phase out the use of nuclear power; framework conditions are currently under negotiation with energy suppliers.

Residential/building sector: This sector is targeted as the major contributor to achieving the country's CO_2 reductions with a goal of reducing energy use in buildings by 25-30% in 2000. Measures include an amended thermal insulation ordinance (1995) to improve energy performance of new buildings by 30%. A further strengthening is being developed to improve performance by another 30%. A number of programmes at the federal, länder and local levels are under way to support modernisation of buildings.

Industry: Industries and associations accounting for more than 70% of industrial final energy consumption have signed voluntary agreements with an aim to reduce CO_2 emissions by 20% by 2005 relative to 1990. A system of independent monitoring has been agreed. (Note should be taken in measuring progress as significant reductions of CO_2 emissions stem from restructuring and modernisation of the former GDR economy.

Transport: A major challenge is abatement of GHG emissions from the transport sector, especially road haulage. Measures to improve energy efficiency and to reduce traffic include: "green" taxes on fuel; support for combined rail-road transport.

Prices/Taxation: "Green" taxes on fuels and energy came into effect on 1 April 1999. As energy prices in general are decreasing due to restructuring of the market, the increase in the price of energy/fuel consumption is not strongly felt by consumers.

Coal prices are subsidised by the federal government and the länder. Coal imports, however, are by now fully liberalised.

CHP/DH: There are two joint federal/länder programmes to modernise district heating systems and to encourage the use of CHP in both the old and new länder. CHP is a key measure to improve energy efficiency on supply side. However, the CHP portion of the new "Stromeinspeisungsgesetz" (electricity law) has not yet been implemented. In addition, demarcation and concession agreements allow utilities to act as barriers to competition and provide little incentive for expanded use of CHP. Under current circumstances , CHP is more expensive than other generation sources.

Financing/investments: Investment support programmes exist in different areas to increase energy efficiency and to support more use of renewables.

Information: There is a high level of public awareness of environmental issues, including climate change, due a long tradition of public involvement in environmental policies, and information campaigns by the public authorities and NGOs.

Procurement/labelling: Germany has the eco-label "Blue Angel" for energy efficient appliances. There are also other energy efficiency labels.

Programmes at the local level: Local authorities have an important role in initiating activities for energy efficiency and climate change mitigation measures.

Institutional capacities: Germany has a federal system of government with many responsibilities in the area of energy and environment resting with the länder. The Ministry of Economics is responsible for federal energy policy. The Ministry of the Environment is responsible for nuclear safety. Both Ministries issue strategies and develop policies in the field of energy. There is no national energy efficiency agency

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An Inter-ministerial working group on Climate Protection is co-ordinated by Ministry of the Environment, Nature Conservation and Nuclear Safety.

Individual Länder have considerable responsibilities in energy efficiency. Energy agencies in a number of länder support information programmes.

LATVIA

Latvia is also among the fastest reforming countries of the former Soviet Union. Industry plays a major role in the economy making up between 25 and 30% of GDP in 1995. As in the other Baltic States, the service sector has dramatically increased its share in recent years, close to 60% in 1995.[53]

Privatisation is in progress. By 1996, most small companies were in private hands. The government has sold stakes in all the utilities and some large concerns (post, railway, etc.). In the housing sector, however, privatisation is progressing very slowly. In 1996 only 6% of residential housing was privatised, so little investment in energy efficiency is expected.

Industry: Latvia's industrial sector, specialising in heavy industry and defence, was mainly focused on the Soviet Union market. Large parts of industry were closed in the early 1990s due to fuel shortages and a rise in fuel prices from Russian suppliers. Influenced also by a number of other factors, output fell by 49% in 1992 and 33% in 1993.[54] Since 1996, manufacturing's share of GDP has increased to 22%. The main manufacturing industries are food-processing, timber-related products such as paper, machinery and equipment, and chemicals. These tend to be low value-added, labour intensive sectors. Some branches are very competitive in international comparisons; Latvia's paper industry increased output in 1996 by about one third. In general, though, Latvia's industrial sector is still in decline and a certain de-industrialisation, coupled with a growing service sector is likely.[55]

Transport: Cars play an important role. There has been a 19% increase in registered car ownership since 1992.[56] Here too, the Via Baltica, the big road project, is Latvia's main investment in the transport sector. The railways lost 75% of the traffic level between 1990 and 1995.[57] Railways are only partly electrified (271 km out of a total of 2 406 km). The east-west rail network in particular needs urgent improvements.[58] Shipping is also a major way of trading goods. Air travel is becoming

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[53] International Energy Agency, *Energy Efficiency Initiative*, vol 2 (IEA, Paris) 1998.
[54] The Economist Intelligence Unit, *Country Profile Estonia, Latvia, Lithuania,* (London) 1997/98.
[55] Agenda 2000 Commission opinion on Estonia's application for membership of the European Union, Section B.3.4.
[56] The Economist Intelligence Unit, *Country Profile Estonia, Latvia, Lithuania,* (London) 1997/98.
[57] Agenda 2000 Commission opinion on Latvia's application for membership of the European Union, Section B.3.4.
[58] ibid.

more and more popular with almost half a million passengers in 1996, a 27% increase from 1994. Goods air transport is expected to increase, but is not expected to reach 1990 levels by 2000.[59]

Construction: This sector has recovered since 1994. Growth in the construction sector is mainly concentrated in Riga and the larger towns, driven by bank developments, supermarkets and department stores. As mentioned, only a fraction of housing has been privatised so far (mainly to legal deficits concerning financial issues) and municipalities still own to most of the buildings. This hampers private investment in efficiency measures in the housing sector.

Residential/building sector: This sector accounts for 24% of energy end-use (1994) and has large potential for energy savings. Standards for thermal insulation have been in place since 1991. Gas meters are now installed in most apartments with installation of heat meters proceeding.

Prices/Taxation: There are no direct energy subsidies, nor cross-subsidies for residential consumers of electricity and heat. Non-payment of electricity bills remains a problem. Natural resource and excise taxes on fuel are planned.

CHP/DH: CHP plants are used to generate district heat (one fourth of total energy consumption, fuelled by gas, oil, peat, coal) with about 70% of households connected to DH systems. Few have been replaced or refurbished so far. Repair seems more likely given limited financing availability.

Financing/investments: Lack of investment, combined with institutional and economic problems make it unlikely that many of the measures will be implemented before 2000.

Institutional capacities: The Ministry of Economy is responsible for energy policy.
The Latvian Energy Agency, created in 1994 under Ministry of the Economy, was integrated in 1997 with the Latvian Development Agency. It has a specific orientation towards energy efficiency.

LITHUANIA
Following the break-up of the former Soviet Union, GDP in 1992 contracted by 38% in Lithuania.[60] A national banking crisis in 1996 slowed economic recovery, but now consumer demand has recovered, and the economy is growing. The private sector, especially retail, contributes to 65% of GDP, and to 70% of total employment in Lithuania.

Privatisation is underway in the residential sector with about 90% of housing units now in private hands. Strategic companies were initially shielded from privatisation until 2000; this decision, however, was repealed. The national government has been preparing sales strategies for e.g. the national airline, state railways.

Industry: During the transition period, the industrial sector collapsed by more than half (51.6% in 1992) as a consequence of a Russian fuel blockade, and the loss of traditional Soviet markets. The energy inefficiency of Lithuanian industry was exposed by consequent rises in fuel prices to world market levels.

The main industries are food-processing, light industry, machine-building and metal-working. Other branches include textiles, clothing, chemicals, motor vehicles, and radio/ television equipment, which are mainly export-oriented. The majority (88%) of industrial enterprises have less than 250 employees.[61] The energy industry, however, is the biggest single branch. More than half of the country's electricity production is exported.

[59] UNFCCC, Report of the In-depth Review of the National Communication of Latvia, 1997.
[60] The Economist Intelligence Unit, *Country Profile Estonia, Latvia, Lithuania*, (London) 1997/98.
[61] Agenda 2000 Commission opinion on Lithuania's application for membership of the European Union, Section B.3.4.

Lithuania has the highest energy intensity of all EU applicant countries. It also appears that Lithuania has preserved a larger part of the energy intensive industries inherited from the former regime than the other Baltic States.[62] The Agenda 2000 Commission opinion states that "a restructuring towards less energy and more labour intensive sectors ... appears overdue".[63]

Lack of long-term finance to continue progress towards full privatisation and restructuring is regarded as the main difficulty faced by industry. One of the problems is an inadequate framework and administrative system for foreign direct investment.[64]

Transport : The number of passenger cars grew by 35 % from 1991 to 1996.[65] Lithuania is the furthest advanced in building its portion of the Via Baltica (investment US$ 70.5 million). It has 2 007 km of railway lines, with 122 km electrified.

Klaipeda is the country's main port and transit point with road and rail connections to Russia, Ukraine and Belarus, and container line connections to Germany, Poland, the Netherlands and the United Kingdom. Cargo turnover increased 17% in 1996 compared to the previous year.

Goods transport has been shifting from railway to road, with railways loosing two-thirds of their traffic between 1990 and 1995. This is because most of Lithuania's railway is handicapped by poor track conditions and that most parts of the rail network are operating at Russian track gauge.[66]

Construction: Much of the construction work has been concentrated on infrastructure projects such as the Via Baltica and the modernisation of Klaipeda port. Construction of residential buildings is going on but has less impact compared to the infrastructure projects. The residential sector is a target area for energy efficiency action.[67]

General: The National Energy Strategy was approved by Parliament in 1994 with aims to diversify sources of primary energy, increase energy efficiency, and eliminate consumer price subsidies.
Dating back to the Soviet era, Lithuania's energy industry was supposed to supply energy for export. About half of all electricity produced in 1995 came from the Ignalina nuclear power station (Chernobyl type). An EBRD study on Ignalina in 1997 suggested continued use with improved safety measures, but to phase out two reactors by 2005 and 2010. The European Commission in November 1998 pointed out that the country still has not presented a satisfactory energy strategy with particular attention on Ignalina. Exports of electricity are a major source of foreign currency.

Residential/building sector: The main areas of activity have been development, procurement and installation of systems for water, gas, heat and power metering and regulation. Measures also include:
insulation of existing and new buildings, development of technical guidelines for installing exterior insulation walls.

Industry: a programme for energy efficiency in construction material industry has been developed.

CHP/DH: Projects to use indigenous fuels and waste in district heating in 5 major cities are under consideration.

Promotion of technology: Innovative technologies have been applied in some branches of industry (e.g. glass manufacturing, rockwool manufacturing).

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[62] ibid.
[63] ibid.
[64] Ibid.
[65] The Economist Intelligence Unit, *Country Profile Estonia, Latvia, Lithuania,* (London) 1997/98.
[66] Agenda 2000 Commission opinion on Lithuania's application for membership of the European Union, Section B.3.4.
[67] Ministry of the Economy, "Energy in Lithuania", 1996.

Institutional capacities: Energy policy is the responsibility of the Ministry of Energy and its implementing body, the Energy Agency. The Centre for Energy Conservation, Consulting, Information and Research was established under the energy agency in 1995. The Energy Efficiency Research and Information centre in Kaunas deals with R&D and transfer of results.

NORWAY

Norway is a major oil and gas producer and has huge hydropower resources. Combined with a small population, energy exports of oil, gas and electricity represent an important element of the Norwegian economy that significantly influences energy policy. Norway also gives high priority to environmental issues.

Norway has restructured its electricity sector to introduce competition. In 1996 electricity trade with Sweden started through the Nordic power exchange pool (Nordpool). Quantitative restrictions on electricity trade and duty on cross-border trade were eliminated.

Energy intensity is below the OECD-Europe average and Norway has made good progress in reducing intensity since the first oil crisis. Its energy consumption per capita, on the other hand, is well above the OECD-Europe average and the IEA average as a whole. It is only topped in Europe by Sweden and Finland. Its electricity intensity (production plus net imports divided by GDP) is about double the IEA average. While Norway is a unitary state, local authorities are active in electricity supply.

The target for carbon dioxide emissions is to ensure that the emissions in 2000 do not exceed those of 1989. Norway has stated that the target was preliminary and would be reviewed depending on technological advances, developments in the international energy markets and international negotiations and agreements. In support of its climate change strategy, Norway is one of several IEA member countries to have a specific carbon dioxide tax.

General: Norway is the second largest oil exporter in the world with increasing exports of natural gas. Its electricity is supplied hydropower. An increase of CO_2 emissions by 16% is expected until 2000; 50% of increase coming from extraction and transportation of natural gas in the offshore sector.

Residential/building sector: New building codes in 1997 strengthen insulation requirements for new construction to achieve a 25% reduction of energy consumption.

Industry: There is a focus on voluntary programmes: Industrial Energy Efficiency Network, reduction of specific energy use; energy saving goals; improved communication between industry and authorities; information given is confidential.

Transport: The sector contributes 40% to CO_2 emissions, half of it coming from road traffic.
The government supports the four largest cities in building public transport and land-use planning guidelines. There are high purchase taxes on private cars (value and weight-related).

Prices/Taxation: The principal instrument in climate policies is the CO_2 tax on different fuels for households and industry (covering about 60% of total anthropogenic CO_2 emissions). There are exemptions or reductions for fuel-intensive sectors based on international competitiveness concerns.
Electricity prices have dropped since deregulation of the market in 1991.

Financing/investments: Loans for energy investments in municipal buildings.

Procurement/labelling: Implementation of the EU energy labelling initiative (refrigerators and freezers); Nordic Swan eco-label for all Scandinavian countries.

Institutional capacities: Royal Ministry of Petroleum and Energy is responsible for energy policy. Two technical agencies handle regulation: Norwegian Petroleum Directorate (day to day supervision of oil and gas activities) and Norwegian Water Resources and Energy Administration (supervision of electricity industry).

POLAND

Poland is the leader among the transition countries in terms of economic growth. Its success is based on both sound and consistently improving macroeconomic fundamentals and a coherent pattern of structural reform. Most of the growth has come from a booming private sector, mainly new private firms, which accounts for about 60% of GDP.[68] Industrial output was strong in 1996/97, as was the construction sector.[69] The service sector is above 50 % of GDP.

In spite of progress with structural reforms, several industrial branches have not been privatised. Among these, are the large and inefficient coal mining and steel production enterprises that are likely to remain a problem in the medium term.[70] As in some other countries, political and social concerns limit the speed of potential restructuring of "difficult" sectors.

Privatisation: Small-scale privatisation in the economy has been quite successful: more than 98% of the retail and wholesale businesses and 95% of small companies have been privatised.[71] However, there are still a number of large and inefficient industrial sectors that are state owned. Housing has been privatised.

Industry: Poland is a heavily industrialised country, with industry contributing more than 40% of GDP. The main sectors are engineering, metallurgy and chemicals, which are energy intensive. These branches are still dominated by large state-owned enterprises and restructuring is slow. In this context, the EU Agenda 2000 states that the "Polish government has so far been less willing than others to address the serious regional and social problems that restructuring will cause".[72]

Other areas such as construction, building materials, furniture, agro-food, pharmaceutical and automobile manufacturing have been privatised (often with foreign investment) and consequently modernised and restructured.

The distinguishing feature of Polish industry is the importance of new firms which are regarded as being able to compete within the European market in the medium term.[73]

Transport: The volume of road traffic in Poland is expected to almost double by the end of 2000 compared to the level in 1988.[74] Until 1990 Poland did not have any major highways, so activity is focusing to a large degree on road building. It is expected, as in the other transition countries, that modal split will shift increasingly to road traffic for personal and even more for freight transport.[75] Being a transit country between western Europe and the CIS as well as between northern and southern Europe, substantial increases in road traffic increase have been noted since 1990.[76]

In contrast, inland waterways lost more than a third of traffic, and railways more than half between 1990 and 1995. Air traffic has increased slightly since the early 1990s.[77] In the Commission's opinion on Poland's application for EU membership, "it is recommended that the country puts an effort on the use of railways and inland waterways in response to the steady rise in road transport".[78]

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[68] EEI country survey, 1998
[69] ibid.
[70] UNFCCC, Report of the In-depth Review of the National Communication of Poland, 1998.
[71] Agenda 2000, Commission opinion on Poland's application for membership of the European Union, Section B.3.4
[72] Agenda 2000, Commission opinion on Poland's application for membership of the European Union, Section B.3.4
[73] ibid.
[74] UNFCCC, Report of the In-depth Review of the National Communication of Poland, 1998.
[75] ibid.
[76] Agenda 2000, Commission opinion on Poland's application for membership of the European Union, Section B.3.4
[77] ibid.
[78] ibid.

Construction: Since 1997 the private sector accounts for 93% of activity and the state sector for just 7%. There is intense construction demand in the leading urban centres. In Warsaw, Poznan and Gdansk, there is significant construction of new hotels, offices and housing developments. Outside of these centres, however, construction numbers have dropped (completions falling from 190 000 in 1985 to 62 130 in 1996). There has been some recovery since 1997. Enormous demand for new housing exists, fuelled by growing incomes of the population in the major cities and by large numbers of young people entering the labour force.[79]

General: New energy and environment policies and legislation are under consideration. Measures have been implemented in industry, transport and municipal development, mainly to encourage economic efficiency and rational use of energy. Electricity generation is the major source of CO_2 emissions. Measures include: introduction of natural gas in power, industrial and residential sectors (provided completion of new supply line from Russia); renewable-derived power can be purchased by distribution companies, though this is expected to play a small role.

Residential/building sector: Buildings are characterised by a poor state of building insulation and inefficient heating devices. Measures include: a new programme on thermal insulation and innovative third-party financing.

Industry: Structural changes are contributing to energy efficiency. Companies are encouraged to seek international co-operation to support cleaner production/technologies.

Transport: Modernisation and reconstruction of the whole transport system is under way. It is expected to lead to large increases in road traffic for personal and freight transport. Ecological infrastructure fee is to be introduced for traffic. 2 600 km of highways and 3 600 km of expressway are to be constructed. EU regulations on car emissions will be applied.

Prices/Taxation: There are tax credits for efficiency investments in industry and credit guarantees.

CHP/DH: Existing DH systems are targeted for expansion.

Information: Children's' education includes courses on ecology. There is a strong environment NGO movement in Poland.

Institutional capacities: The Ministry of Industry is responsible for energy policy with a specific a Department of Energy and Environment. The Energy Regulatory Office (URE) issues operating licences, monitoring of developments in prices and tariffs.

The Ministry of State Treasury handles relationships with state-owned enterprises. Coal is handled by the Agency for Restructuring of Hard Coal Mining in Katowice. The Ministry of Environmental Protection, Natural Resources and Forestry is responsible for licensing exploration and development of oil and gas resources.

The Polish National Energy Conservation Agency (KAPE) in Warsaw is the main national body for energy efficiency. It is a senior partner in the EC FEMOPET (Fellow Member of Organisation for Promotion of Energy Technologies) energy efficiency project for Poland. Several NGOs are active in promotion of energy efficiency.

RUSSIAN FEDERATION

The Russian Federation has experienced the greatest difficulties in moving from a centrally-planned to a market economy. Since 1990 output in Russia has dropped significantly and about one-fourth of the population lives below the official poverty line. Expectations for modest economic growth have not been realised.

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[79] The Economist Intelligence Unit, *Country Profile Poland,* (London) 1997/98.

Privatisation: Large parts of the economy are still state-owned, as is the housing sector.

Industry: With some 35% of world gas reserves and considerable oil production, the fuel and energy sector is the mainstay of the country's economy. Other important branches like raw material processing, heavy machinery building and building material manufacturing contribute to high energy consumption in the industrial sector. Energy prices are highly subsidised. Russia's energy intensity is more than nine times the average for European countries of the OECD.[80] Industrial demand makes up 60% of electricity use compared to much lower demand levels in the residential and service sectors.[81]

Transport [82]*:* The transport infrastructure is underdeveloped. Not all places (especially villages in permafrost regions) can be reached via surfaced roads. There are no western-style motorways, although a motorway linking St. Petersburg, Moscow, Minsk and Rostov is planned. Clearer rules are needed for private-sector involvement in capital projects.

Buses are the leading mode of passenger transport and account for more than railways, due to rising charges for long-distance passenger rail travel. Six cities have subway networks including Moscow and St. Petersburg. The number of private cars has dramatically risen in the bigger cities in recent years.

Total freight haulage fell by 43% between 1990 and 1996. Railways moved 1 129 billion ton-km in 1996 (55.3% less than in 1990). Railways remain the dominant mode of cargo transport. There has been a lack of investment in railways, where the technical state is very poor. Electrification of railways is quite high (44%).

St. Petersburg and Kaliningrad are the large ports on the Baltic Sea. The major port, however, is Novorossiisk on the Black Sea which is a main export route for Russian oil to the west. River transport accounted for only 2% of haulage in ton-km in 1996. Most major rivers run north-south which limits potential for river transport development as transport flows are mainly east- west.

Air transport plays a comparatively large role in the country's internal transport, although it is too expensive for the average Russian and operational safety of civil aircraft may be doubted.

Construction: Until recently, the construction sector was almost completely state-owned. Only a few dwellings were built privately by house-building co-operatives. Since 1996 the sector has been restructured. Private and co-operative housing activity has increased.

Construction under central planning suffered from inefficiency, long lead-times, and high rates of labour turnover. The sector had been expected to recover slowly with lower inflation rates and rising incomes assisting the launch of mortgage lending. However, the economic crisis has stymied progress.

General: Based on the report from the UNFCCC 's review of Russia's national communication (1997) the following measures have been identified:

Residential/building sector: Energy conservation programmes are planned by a number of cities and regions.

Industry: Major potential is foreseen in the Russian economy for energy saving, yet, very limited information is available on status of energy saving measures. Also, a drop in GHG emissions since 1990 due to restructuring of the economy seems to be regarded as sufficient for achieving commitments. No specific national measures are underway, or at least not documented. The Energy

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[80] UNFCCC Report on the In-depth Review of the National Communication of the Russian Federation, 1997
[81] ibid.
[82] The Economist Intelligence Unit, *Country Profile Russia,* (London) 1998/99.

Strategy, approved in May 1995, however, gives priority to energy efficiency and promotion of energy conservation.

Information: Climate change and environmental issues do not seem to be matters of priority to the general public.

Programmes at the local level: A distinction needs to be made between federal and local level programmes, i.e. a number of energy efficiency activities are under way in larger cities according to local circumstances and conditions; competition with Moscow and federal policies can also influence more progressive policies.

Institutional capacities: The Ministry of Fuel and Energy (Mintopenergo) is the federal authority in that elaborates and implements energy policy in the oil, gas, coal and non-nuclear electricity sectors as well as of energy efficiency and renewables. Nuclear is the responsibility of the Ministry of Nuclear Energy (Minatom). The Federal Energy Regulatory Commission and Regional Energy Regulatory Commissions are increasingly involved in tariff policy.

Federal energy efficiency programmes are in the Department of the Federal Programme on Energy Conservation and Energy Policy. Several other governmental and non-governmental organisations are involved in the promotion of energy efficiency, e.g. Ministry of Science and Technology; Russian Energy Efficiency Union; Centre for Energy Policy; Centre for Energy Efficiency; institutes linked with the Ministry of Energy.

SWEDEN

Major changes have occurred in the Swedish energy system during the last 20 years. The most important of these that the proportion of the country's energy supplied by oil has fallen substantially from 77% in 1970 to 43% in 1995. At the same time, electricity production from hydro power and nuclear has doubled. Nuclear represents about 38% of TPES, with 12 nuclear plants at four sites Over the period, the proportion of the country's total energy supply accounted for by electricity leaped from 14% to 30%.

The relative proportions of final energy use accounted for by industry and the residential/service sectors remained more or less stable between 1970 and 1995. These sectors' proportions have each decreased somewhat, while the transport sector has increased. Industry's proportion fell from 41% to 37% and the residential/service sector from 44% to 41%, while the domestic transport share of the total energy use grew from 15% to 22%.

Energy intensity is above the OECD-Europe average. While there were some good gains after the first oil crisis, energy intensity has increased since the early 1980s. Electricity intensity, however, is one of the highest in the OECD and has grown since the 1970s. It showed a small decline in the past couple of years.

In January 1996, the electricity market was restructured. The distribution system is separate from both the supply and the sale of electricity. The electricity grid is international, or at least Nordic, requiring regional co-operation. This has complicated and limited domestic taxing regimes on electricity production.

Sweden takes environmental concerns very seriously and it is one of several IEA member countries to employ CO_2 taxes. Furthermore, Sweden also has a tax on emissions of NOx and a tax on SO_2 emissions. The target is to stabilise CO_2 emissions from fossil fuels at 1990 levels by 2000. Sweden also has a target to reduce methane emissions from refuse disposal by 30% from their 1990 levels by 2000.

While Sweden is a unitary state, local authorities are very active in the energy field. Many municipalities are involved in electricity and heat distribution.

General: There is a Parliament decision to phase out nuclear power. Though no date is set for closing the last nuclear plant, two nuclear reactors in Barsebäck are to be taken out of service. Legal challenges have delayed the initial deadline, but it appears that the first reactor will taken out of service by late 1999.The second reactor is due to be closed by July 2000. Closure of second reactor is conditional upon compensation of electricity production and/or reduced electricity consumption.

Industry: Energy efficiency measures in the industrial sector are environmental taxation and information exchange. An important focus is technology procurement, involving competition for manufacturers for more energy efficient products.

Transport: Transport accounts for about one third of CO_2 emissions in Sweden. A sales tax favours low-emission vehicles. There are voluntary agreements with Swedish car producers to reduce average fuel consumption of vehicles (25% by 2005 compared to 1990 level). There are "green fleet" programmes in Stockholm. Regional efforts promote biogas and alternative fuels.

The Transport Policy Proposal for Sustainable Development (1998) has long-term objectives with view on accessibility, quality, safety and environment and targets emission reductions. As most goods are transported over distances of less than 100 km, rail is not considered as an alternative to road transport for goods. However, a new track charging system for railways should reduce costs for operators (rail network still state-financed). A reduction of rail costs for freight users is planned.

Prices/Taxation: There are environmental taxes, e.g. energy, $CO_{2,}$ sulphur. The tax scheme provides conflicting signals to CHP related to the use of fossil fuels for electricity production and biomass for the heat component. The CO_2 tax has not had much effect in the existing housing sector due to the high costs for replacing heating systems.

CHP/DH: As biofuels have not been subject to the energy tax, number of coal-fired CHP and DH plants have changed to burning biomass. The amount of biomass used in heating plants almost doubled between 1990 and 1995 (25% to 42% of total district heating supplied). Demand for DH has increased.

Information: Awareness of climate change issues is very high, especially among young people, partly due to government programmes.

Procurement/labelling: There are a number of initiatives for joint procurement in Sweden, at the national and local levels. Nordic Swan labels are used.

Promotion of technology: Government funds specifically target clean technology development and dissemination.

Programmes at the local level: Local authorities are very active in the energy field. Municipalities are major distributors of electricity and heat. Since 1977 municipalities are legally obliged to promote energy efficiency in planning. There are government grants for municipalities for sustainable development activities and specific measures. A number of cities are ICLEI [spell out]climate protection campaign members.

Institutional capacities: The Ministry of Industry and Trade is responsible for energy policy. Energy efficiency programmes are administered by the Swedish National Energy Agency (formerly NUTEK, National Board for Industrial and Technical Development). Other agencies involved in energy efficiency issues include: Swedish Council for Building Research; National Board for Housing, Building and Planning; National Road Administration; the Transport and Communication Research Board and the National Board for Consumer Policies.

5.2 COMMON GROUND AND CHALLENGES

Building Sector
The EU Communication on Energy Efficiency identifies the building sector as having a large potential for energy efficiency gains. It is highlighted as an area for priority action. Within the European Union, the building sector accounts for 40% of the energy demand and similar patterns characterise the BSR-east countries.

Reduction of heat loss in existing buildings is listed among the action priorities in a number of the policy documents. Recommendations include improving energy efficiency through tightening thermal insulation standards and a call for countries to review their national building standards for energy efficiency to identify areas for improvements.

Further suggested measures include the development of tools to help installers to design appropriate systems, as well as training and certification in their use. The development of a standard for products used in construction is in progress in the EU.

Areas for possible co-operation include thermal insulation standards, passive solar design, ventilation, heating and air conditioning systems, high efficiency low NOx burners, metering technologies, and market transformation activities for equipment, lighting and appliances.

Combined Heat and Power (CHP) and District Heating
CHP and district heat are identified as particularly important fields of action. The Energy Efficiency Protocol emphasises the necessity to support the promotion of CHP and measures to increase the efficiency of district heating. The role of municipalities and local community services is important in this context and there is ground for co-operation and transfer of experience here.

Particularly in the economies in transition, the future of district heating networks is uncertain due to lack of investment capital for refurbishment, efficiency improvements and expansion, and due to non-payment problems. District heating systems also face aggressive marketing of individual heating technologies (electricity, oil, gas) to consumers within the network. In the BSR-west the use of CHP in district heating faces new competition from often-cheaper sources of electricity available in liberalised markets.

An important barrier to an increased development of CHP is the nature of the relationship between co-generators and electricity suppliers. They include obstacles to access the grid, inadequate payments for sales of surplus capacity to the grid, and high tariffs for stand-by and top-up supplies. These barriers to the penetration of CHP hold even in a partly liberalised European electricity market.

The EU encourages Member States to change these conditions and regulations in favour of CHP and DH, including the internalisation of external costs and benefits in the energy sector through tax incentives. Furthermore, concerted action and information exchange among countries is called for, including evaluations of the impact of a liberalised market on CHP. Voluntary agreements with industry to increase CHP are encouraged.

Third-party financing and stronger involvement of ESCOs can be employed to further CHP and DH objectives as they relate to increased efficiency and sustainable development. The Baltic 21 Energy Report underscores that support from international financing institutions is crucial and refers to past and future commitment of the European Investment Bank.

Baltic Sea Region cities and towns can increase co-operation to ensure existing district heating markets and modernisation of district heating systems. The Energy Efficiency Protocol suggests “twinning” of towns or other relevant territorial entities. Co-operation could include definition of guidelines for the rehabilitation of distribution systems, customer contact, investment attraction and protection of the interests of the heat consumers. The possibility of defining district heating investments as infrastructure investments in a liberalised market should also be discussed. Draft guidelines must take into consideration consumer, legal, financial technical and spatial planning aspects of district heating in a market framework.

Developments of an international centre for CHP, international workshops and a purchaser's forum have also been suggested for co-operative action.

Industry

In manufacturing, the EU Communication on Energy Efficiency suggests removal of technical barriers through minimum efficiency requirements or equivalent negotiated agreements establishing minimum requirements for manufactured goods.

Co-operation to establish and promote Best Practice Programmes in industry can be stimulated through industry associations.

Changing practices to incorporate life-cycle cost analysis in industry and public procurement together with business associations is another promising area.

Transport

The EU Communication on Energy Efficiency warns that without appropriate policy action, emissions from transport will increase by about 40% between 1990 and 2010. It proposes measures concerning four principal elements: further action on vehicle fuel economy, fair and efficient pricing in transport, completion of the internal market in rail transport, measures for better integrating the various modes of transport. In addition, the EC wants to concentrate on the large-scale introduction of new technologies such as hybrid cars, fuels cells etc. beyond 2010.

The Baltic 21 Energy Report suggests increased co-operation at the regional, state and local levels to better integrate transport and energy policies. Measures mentioned in a number of policy statements call for improved motor vehicle performance standards and the development of efficient transport infrastructures.

Taxation

A key measure to improve energy efficiency is for energy prices to reflect economic costs and incorporate externalities. There is a need for the development of a methodology for inclusion of external costs and calls for an international forum to develop and exchange experience on taxation models.

The EU Communication on Energy Efficiency explicitly lists taxation and fees as feasible instruments and encourages Member States to examine possible tax incentives for energy-saving. The Energy Efficiency Protocol stays one step behind in suggesting a general evaluation of economic instruments for improving energy efficiency and environmental objectives.

Support of Local Authorities

Municipalities are key-actors both in carrying out policies and in their role as large purchasers who can influence the market. They need to be supported by the central governments in delivering energy efficient and environmental solutions. As well, they can work together in procurement activities to increase demand for energy efficient products.

Information and Awareness Promotion

The is much common ground for co-operation on international, regional, national and local levels to increase information and awareness on cost-effective energy efficiency opportunities, new technologies and behavioural aspects through a variety of dissemination networks.

Key question: Are the shared challenges sufficient ground for common or collaborative programmes to be a vehicle for effective transfer of experience and capacity building?

CHAPTER 6
POLICIES, MEASURES AND COLLABORATIVE ISSUES

Evidence shows that energy could be used more efficiently in the BSR. It also underscores that more effective and targeted policy actions are needed to release the potential. The Intergovernmental Panel on Climate Change (IPCC) estimates of cost-effective energy efficiency potential in the world, indicate savings potential of 20 to 30% in the next two or threes decades.[83] These estimates are verified in the European Commission's Communication.[84] In some sectors the potential is even bigger.[85] Evidence points to the fact that energy efficiency potential in the BSR is even greater than the estimates mentioned.

To obtain these efficiency gains, directed and conscious policy actions are required. Energy efficiency experiences from many countries show that some policies can make a more positive difference than others. The variety of situations (economic, social, etc.) makes it difficult to transfer a success directly from one country to another. It is possible, however, to point out some elements necessary for a working policy and collaborative development.

The *Energy Efficiency Initiative* contains a number of recommendations for an effective energy efficiency policy (see executive summary of EEI).[86] As well, ten concrete actions to promote energy efficiency and to pave the way for a sustainable energy system are outlined in the Baltic Agenda 21. In addition, the Energy Charter Protocol on Energy Efficiency enumerates the elements needed for a consistent policy for the participating countries. Further, the EC's Energy Efficiency Communication pinpoints areas for action to release energy efficiency potential.

Comparing these documents provides a useful view on how the proposed actions fit to give substance to the policies needed.[87] The major findings are:

- Development of market mechanisms to reflect full cost and unsubsidised energy pricing requires more concrete actions. The transition of the pricing systems in the east merits increased attention.
- The often-stated necessity of creating advisory services and independent bodies for energy efficiency has little support in the legal and institutional framework and little or no financing. Such bodies are needed to build capacities and exchange experiences. The creation of a BSR wide efficiency network might strengthen local bodies.
- Establishment of common codes, standards and labels should be considered.
- Specific and concrete suggestions for collaborative programs are needed to develop and use niche markets as a pulling mechanism for technology development and dissemination. Market transformation approaches should be explored.
- The Baltic 21 proposed actions should be re-evaluated and made more specific to reflect the new obligations and proposals in the Energy Charter Energy Efficiency Protocol and in the Communiqué from the European Commission on Energy Efficiency and to suit the multitude of purposes expressed in those policy documents. Many of the initiatives proposed are such that the primary "stakeholders" should have been identified by now. It is time to take steps to formulate commitments, e.g. voluntary agreements.

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[83] International Energy Agency, *Energy and Climate Change. An IEA Source-book for Kyoto and Beyond*, (IEA, Paris) 1997. European Commission, *Energy Technology, Report from the ATLAS project*. (EC DG XVII, Brussels) 1997.
[84] European Commission, Energy Efficiency in the European Community -- Towards A Strategy for the Rational Use of Energy Communication 246 Final, (Brussels) 1998.
[85] Intergovernmental Panel on Climate Change, *Technologies, Policies and Measures for Mitigating Climate Change*, IPCC Technical Paper Nov. 1996.
[86] International Energy Agency and Danish Energy Agency, *Energy Efficiency Initiative*, (IEA, Paris) 1998.
[87] The action list of Baltic 21 has been checked against the policy documents from the Energy Charter Agreements and from the European Commission.

Table 6.1

"Scorecard" of Comparisons between Baltic 21 Actions,
Energy Charter Protocol and EC Communication

No.	BALTIC 21 PROPOSALS FOR ACTIONS	Energy Charter: Basic Principles	Energy Charter: Domestic Programme Activities	European Commission Communication on Energy Efficiency	TOTAL SCORE	REMARKS
		%	%	%	%	
1	Strengthen co-operation between authorities.	50	50	40	45	Actions should be more specific and defined for several types of co-operation (level, purpose). A time-schedule should be considered.
2	Kyoto follow-up and flexible instruments (support development of mechanisms).	15	30	12	20	Define what is BSR-specific.Target the most important areas/sectors.
3	Promote increased energy efficiency and energy savings by regional competition.	50	20	25	30	Select areas and implement a market transformation programme. Reinforce network capacity with special focus on energy efficiency.
4	Develop a system for regional competition in the renewable energy market (study).	15	20	25	25	Identify the "stakeholders" in government, financing institutes and business and form a development programme.
5	Convene a workshop on energy statistics and regional model building for 'sustainability' scenarios.	30	20	25	25	Define the expected outcome and a time-schedule.
6	Foster co-operation between cities on district heating, etc.	30	20	40	30	Define a form for the experience transfer and secure commitments from the participants.
7	Evaluate donor and IFI investments in a regional sustainable development context.	30	30	12	25	Establish a clearinghouse for small-scale investments and define terms for large-scale infrastructure investments.
8	Co-operate on information regarding renewable energy potentials	15	20	25	20	See comment to No 4.
9	Co-ordinate sectors with special relevance for energy development.	15	0	40	15	Define and visualise coherency aspects. Promote creation of energy efficiency network in the BSR.
10	Co-operate on research, development and dissemination of efficient technologies.	15	20	25	20	Could be a strong market transformation component. A study to prioritise technology areas and niche-markets should be considered.

POLICY ISSUES

Actions proposed in the Baltic 21 initiative are grouped together according to the prerequisites for sustainable development.[88] This aggregation shows strong similarity to that used in the Energy Efficiency Initiative.[89] Recommendations in the following sections are presented in these categories.

Policy Issue	**Baltic 21 Action No.**
Market framework	1,2,3,4
Consumer needs	5,6,8,9,10
Technology	5,6,10
Institutions (habits, routines, established practices)	3,4,7
Continuity	1,2,5

6.1 MARKET FRAMEWORK

Coherent policies that have a reinforcing effect on energy efficiency are essential. Energy efficiency needs to be an important component of policies affecting industry, trade, buildings, agriculture, etc. Promotion of energy efficiency often will strengthen the other policy goals.

The Energy Charter Treaty's Protocol on Energy Efficiency lists elements needed for a market framework. The ongoing changes in the BSR-east are moving in the direction of establishing a fair trade environment. The current risk seems to be that the changes are unbalanced: some sectors operate on full cost pricing (such as district heating) whereas others retain pricing that does not allow capital recovery (electricity and gas). This could lead some countries or some sectors to lag behind others. In the east BSR, it is essential for a well functioning market that the objective of full cost pricing be achieved at a sustainable pace.

Where subsidies exist to pay for energy consumption, it may be advantageous to redirect the funds to make investments in energy efficiency so the consumer can get a lower sustainable cost for consumption, which will allow re-payment of the infrastructure investments.[90]

Economies in transition should consider closer co-operation and transfer of experiences to help solve their problems. Special training and staff exchange programmes should be set up in co-operation with international financial institutions and bodies working to enhance trade in energy efficiency equipment and services.

Some technologies dealing with infrastructure development in heating, distribution, generation, transport, etc. may have long-term benefits but have low attraction for investors. Infrastructure investments typically have a long-term scope, but yield low annual profits. These investments may need special arrangements for loan security, guarantees, etc. and may be able to take advantage of innovative financing schemes related to climate change actions.

There are many energy efficiency projects that are cost-effective and that can reduce greenhouse gas emissions. Some may be quite small. In some cases, there is a lack of project management experience to identify projects, define them well enough to attract investors, and to monitor results. Making effective use of some of the evolving climate change related mechanisms, such as emissions trading, will require improved methods for monitoring and verifying results.

[88] Baltic 21 Energy. Baltic 21 Series No.3/98 p 60

[89] International Energy Agency and Danish Energy Agency, *Energy Efficiency Initiative*, (IEA, Paris) 1998.

[90] This applies when the subsidies are real transfer of money. There are cases, however, when business is based upon use of under-utilised and depreciated capital stock. Here prices might be correct but too low to generate reinvestment funds. Then the need for a least-cost assessment is pressing to ensure that the new supply will be dimensioned to meet historical high demand.

Organisations with expertise in technology development should focus more effort on "clustering" projects to attract financial institutions. This could help to lower the risks. It could be done by way of a "clearinghouse" that gathers projects and serves as a broker between investors and project participants.

Enhanced co-operation to build capacity between administration and businesses, particularly to transfer experience to markets in transition, could include the creation of Super-ESCOs.[91] Super-ESCOs should be considered as a way to assist capacity building in areas with weak business structures. For example, they could target development and improvement of energy transmission, transport and other infrastructure.

Table 6.2

Market Framework Measures

Sector	Policy/Measures
Utility	• Energy price reform to full cost recovery and preferably including externalities. • Enhance experience transfer related to pricing issues. • Promote fair competition between "fuels" and unbundling of services. • Preserve and enhance infrastructure assets such as DH-systems. • Develop and use innovative financing mechanisms for smaller efficiency projects.
Industry	• Develop BSR-wide Best Practice Programmes for industrial housekeeping activities.
Transport	• Preserve and enhance infrastructure assets such as efficient transport-systems. • Take advantage of rapid changes in the growing transport sector, especially in BSR-east, as a demand pull for alternative fuels. • Develop and use innovative financing mechanisms especially related to climate change actions.
Tertiary and Domestic	• Develop and use innovative financing mechanisms for small projects and take advantage of new opportunities related to climate change actions.
Administration	• Consider "Super-ESCO" as a framework to develop markets and societal framework at the same time • Promote energy efficiency networks region-wide to enhance experience transfer and capacity building for organisations and companies.

6.2 CONSUMER NEEDS

Taking consumer needs into account is critical to enhance the acceptance of energy efficiency measures. Most consumers know that more efficient options are available, but they do not find it worthwhile to search for them. Demand-side measures need to focus on the service rather than the equipment itself. Consumers must be confident that the new products will deliver something at least as good and preferably better than before. For business to meet this challenge, development of staff and business practices are required.

The pace of technology advances makes it difficult to keep abreast. Training is important for staff engaged in selling energy and services, as well as staff engaged in equipment operation. To make energy efficiency the preferred choice requires that staffs adopt new routines and have improved opportunities to keep up with new technology. This should be met with comprehensive training programmes for consultants, operation and maintenance staff, installation companies, etc.

Energy service companies (ESCOs) can play a big role as an intermediary resource to arrange financing and deliver results. They need to ensure that the products they propose are quality products

[91] The expression "Super-ESCO" is sometimes used to describe a situation where administrative and legal capacity is developed in bilateral contacts between countries at the same time and in harmony with business development activities.

and that they provide not only better efficiency but they also satisfy customer's needs. Traditional energy or equipment supply companies will need to re-define their business to take advantage of these new approaches. Enhanced collaboration between existing ESCOs and the manufacturing industry in the building sector would be useful. As would targeting of consumer groups where lack of financing and expertise is the barrier, e.g. municipal administrations. Meanwhile, financial institutions will need to adapt to the ESCO's model.

Voluntary agreements are used in many countries to stimulate efficiency gains and emissions reductions. They are likely to become even more widespread. These agreements take many different forms. Their success is very much linked to credible monitoring process. Verification methods include independent certification, self-monitoring within a group such as an industry association, or in conjunction with a public organisation.

Consumer desires and good business opportunities have led some insurance companies to offer special rates for "green" approaches that lower risks, e.g. fire risk in buildings. They are also training staff in these areas.

As business is getting more global, some efficiency related issues could be addressed on a broad scale. Transfer of experience between different business cultures on achievements can be made both in informal conferences and workshops. They can also be made more formal by establishing verification systems, e.g. linked to the environment certification programmes EMAS and ISO 14000. Market actors involved in equipment specification and procurement and other energy related decision-making, both public and private (and particularly in the transition economies where capital stock turnover rates are higher), should be encouraged to adopt the relevant standards.

Table 6.3
Consumer Focussed Measures

Sector	Policy/Measure
Utility	• Transfer the utility role as provider of efficiency information in the unbundling process and make it in their business interest to provide energy efficiency service to customers.
Industry	• Develop and train operations staff. Employ and use their priorities both for product development and selection to get "micro-level" coherence. • Develop auditing and self-monitoring schemes to assist interested parties and networking among them. • Find niches for ESCOs. • Use the environment certification programmes.
Transport	• Develop purchasers participation for transport that suits the primary interest of users, e.g. alternative fuels, car-share etc.
Tertiary and Domestic	• Develop and train sales and installation staff employ them as a feedback source on customer preferences. • Find niches for ESCOs.

6.3 TECHNOLOGY

Ample technology to have a significant impact on energy efficiency is already known, but not sufficiently disseminated.[92] In every market some actors are prepared to act earlier and lead the way. For all markets and all products there are some lead users who can articulate needs for an improved product. Finding them, bringing them to together, assisting them with expertise, means for testing and purchasing is a task for an operating agent who is not associated with special interests on the market

[92] IEA, *Enhancing the Market Deployment of Energy Technology*, (OECD, Paris 1997).

and can act objectively. This can help to maximise scarce technology development funding by targeting specific features where customer interest is proven.

A large-scale shift also requires a sharpening of the traditional tools used. R&D activities need to be more tailored to observe and use the learning processes related to the market. R&D projects have to pool resources better to get quicker response and feedback before entering into the next phase of development. Efforts need to be oriented towards early improvement of performance. Information and training programmes need to be more targeted. Experience from measures, projects and policy applications have to be better exchanged between countries, administrations and companies. This does diminish the need, however, for long-term R&D. There will always be a need for long-term technology solutions to improve the way energy is used through better technologies.

The technology development process as portrayed in the learning curves needs to be better understood and applied.[93] It should be employed as a policy tool and used for organisations to pool their resources. Public and private procurement processes should be employed as a market pull mechanism - both for improving technology and for its wider dissemination. Developing instruments and institutions along these lines will enable societies to maximise use of the normal capital turnover to offset old technology with improved technology. It will stimulate trade and industry to take up the challenge of supplying emerging markets at home and abroad. It will enable policies to target support towards outstanding performance and to avoid using scarce funds for insignificant technology. It facilitates funding for early performance achievement above a standard target whereas late achievement or lower performance gets less support.

In some technology areas it can be predicted that quick volume growth will lead to lower production costs which in turn will make the technology even more attractive. For some technologies "nursing of markets", by providing incentives to award early performance achievements, have been successfully applied.[94] Co-operative studies and pooling of resources for such purposes in the BSR should be considered.

Public purchasing power should be directed towards energy efficient installations in a strategic manner thereby building the foundation for bigger markets and subsequently lower costs for many consumers. Such a strategy would also be important for small and medium-sized business involved in installation and operation of equipment. Purchasing for public needs and for building of infrastructure can be pooled to form projects where governments and companies can jointly design and evaluate improved structures. Getting a big operation to change the benchmark for performance of products can be very costly to companies. They need time to adjust and prepare not only production facilities, but also training of staff for design, sales, maintenance, etc. Intentions to target certain technologies for market pull activities need to be advertised early.

Some market actors have a subordinate role in technology shifts. Yet their ability to cope is essential to successful outcomes since they deal with installation, operation, and maintenance. Some of these companies might be small and need special attention. Support might be needed for training, marketing, etc., to ensure that new technology smoothly finds its place in the market.

District heating systems can be an efficient resource when working properly. Some older systems, however, need to be refurbished to reduce losses and operate optimally. When replacing generation units, it is worthwhile to evaluate the use of small high-efficient CHP and a reconfiguration of the distribution. Co-operation between cities could be of interest to modernise DH-systems and to get improved technology at lower cost.

[93] The learning curve basically shows that doubling the volume of any technology improves it performance by 15-20%. Building up volume is thus one activity that can be used. The other is to observe where the most valuable support can be given in a focussed learning process.

[94] Similar methods have been used in the Swedish "Teknikupphandling", and can be traced in the Japanese programme for Photovoltaics. Such processes are "nursing the learning curves".

Establishment of CHP is recommended as a prime consideration. Though this can be cumbersome in some cases where many business interests have to be met and the risks related to different markets have to be assessed simultaneously. Financing institutions should give higher consideration to such projects and the organisations to make them succeed.

District heating systems and transport networks are specific examples of infrastructure that have required huge initial investments. In many countries these investments have already been made. Now, however, many need substantial upgrades to be more efficient and cost-effective, as well as to move towards sustainable energy systems. This calls for careful planning with close co-operation between authorities on many levels and with consumers and businesses.

The IEA is prepared, through its Implementing Agreements, to improve instruments for market transformation related to deployment of both improved new technology and existing efficient technology.[95] Essential instruments include networking within the existing IEA groups for collaborative R&D, improved collaboration with other networks, and convening relevant market players to facilitate deployment.

Combining markets in the east and in the west can be fruitful. The need for infrastructure renewal is high in some countries and constitutes a historic opportunity to make use of new technology rather than getting locked into old patterns of high demand and second rate performance in material and processes. Special surveys should be made to target sectors where changes are eminent.

Minimum efficiency standards have been proven in many countries. Enforced standards with a long - term view will have a definite impact, at low cost, on market transformation. Together with labelling systems they reinforce each other.

Table 6.4
Technology Measures

Sector	Policy/Measure
Utility	• Develop and implement experience transfer and joint activities (twinning) for DH/CHP development and refurbishment. • Undertake country surveys using least-cost planning methods to ensure that the infrastructure shift is not based on outdated data in terms of demand level and/or technology.
Industry	• Train small and medium sized enterprises and service providers in the use and distribution of energy efficient technology. • Investigate how market pull in the east and west can be joined for development of technologies in terms of costs and performance.
Transport	• Develop provisions for alternative fuel infrastructure and find niche markets (lead users) for fleets using alternative fuels.
Tertiary and Domestic	• Organise public purchasing power and target to energy efficiency. • Investigate how the capital stock turnover can be a pulling force for technology development and dissemination, develop mechanisms for use of these niche market opportunities (financing, procurements, training, etc.).

6.4 INSTITUTIONS (HABITS, ROUTINES, ESTABLISHED PRACTICES)

For energy efficiency to be widespread, the millions of everyday decisions to buy and operate energy-using equipment need to be made with energy efficiency as the preferred choice. Everyday routines and habits form much of the future society. Energy policies and measures have to take this into account and try to reshape them to be more rational to support energy efficient choices.

[95] The IEA DSM-Agreement Annex III, Technology procurement and in a new Annex on Market Transformation. Also in the IEA Agreement on Photovoltaics.

Consumers must have the opportunity to recognise energy efficient equipment. Measures include:

- equipment labels with a comparative element, e.g. the EU-label;
- customer information that makes it easy to calculate the economic costs and benefits;
- customer information about other important functional aspects of the product;
- consumer awareness through promotional campaigns and energy audits;
- information and labelling in a fashion that suits the purchasing habits of the customer.

Existing labelling schemes should be made part of the trading practices and trade agreements in order to ensure that inferior products are not trickling out to markets with low purchasing power.

Professional procurement routines for industry, commerce, buildings and services should encompass life-cycle cost (LCC) criteria in public and private purchasing. Routine evaluation techniques and training of staff will be needed. Trade associations should be encouraged to develop purchasing routines that favour LCC criteria.

Information dissemination and training are more important as the speed of technology shift increases. It needs to be part of business evolution, for example where associations involve themselves to keep abreast with new solutions and disseminate the knowledge.

Financing institutions and relevant organisations should establish evaluation procedures that account for energy efficient equipment as a way of lowering risks by securing performance of the products and identifying clusters of projects suitable for financing under the climate related mechanisms (clearinghouses/project portfolio). Instruments should be developed for securing the positive effects and verifying results of AIJ activities, e.g. the "IEA barrier removal method".[96]

Partnerships between municipalities and regional bodies responsible for land use planning and development should be reinforced to give priority to technological co-operation and to focus on customer needs for transportation, logistics and communication.

Table 6.5
Institutional Measures

Sector	Policy/Measures
Utility	• Training in administration of fair pricing and for business practice as well as to adapt to a future liberalised market. • Develop skills to make business plans, work with project management, handle financing instruments and adapt to future GHG-crediting.
Industry	• Establish LCC-criteria for equipment. • Develop purchasing routines and train staff to identify options for energy efficiency. • Develop methods to work with, monitor and verify activities related to voluntary agreements.
Transport	• Develop land-use and regional planning to facilitate energy efficiency. • Develop technologies for logistics and communication to support customer needs and societal necessities.
Tertiary and Domestic	• Adopt and reinforce labelling schemes. • Develop purchasing routines and train staff to identify energy efficiency options.

[96] International Energy Agency, *Activities Implemented Jointly, Partnership for Climate and Development,* (IEA, Paris) 1998. (IEA, Paris) 1997.

6.5 CONTINUITY

Customers are given many signals from governments. It should be a general rule that other policy aspects do not discourage choice of an energy efficient solution.

Networking between administrations and between business associations is important to develop capacities and strengthen co-operation among those fostering new applications. This can either be regular or ad-hoc depending on the issues. Also NGOs and academia have important roles. There are also numerous international bodies promoting energy efficiency policy and measures, and in some cases they could benefit from a more co-operative and targeted perspective. All of these actors have opportunities to build supporting relationships in the challenging task of enhancing and monitoring energy efficiency and its contributions to a better environment.

Models for monitoring programmes and business activities to evaluate and develop measures should have high priority. Statistics and indicators on both physical results and on qualitative aspects are needed. (See Appendix B.) Special attention should be paid to the necessity of independent instruments and regular data sampling to be used for the purposes of emission baselines and trade of energy-related products. An annual review of sustainability indicators should be produced with special emphasis on energy.

Table 6.6
Continuity Measures

Sector	Policy/Measures
Utility	• Need clear long-term conditions in terms of their business roles on the market and of their obligations to serve as ESCO or to give customer service including energy efficiency. • Serve under predictable schemes for fuel taxes and other conditions that affect decisions and competitive position.
Industry	• Receive input and provide networking opportunities to develop behaviour and routines to improve energy efficiency.
Transport	• Pay special attention to conditions to avoid lock-out of long-term and energy efficient technologies.
Tertiary and Domestic	• Have access to impartial advice from independent organisations charged specifically to support energy efficiency.
Administration	• Establish monitoring systems based on reliable and verifiable statistics that enables detailed analysis of sustainable development.

6.6 PROJECT SUGGESTIONS

Proposals

1. There should be a stronger network for energy demand issues in order to assist the market actors by transferring experience and help build capacity to absorb new more efficient technologies in the market.

2. Monitoring progress is part of the process. Once a year a BSR energy efficiency week, with seminars, exhibitions and ”benchmark test” on sustainability progress should be organised. These events should allow all involved actors to share experiences and thereby improve measures.

3. A monitoring system based on reliable and verifiable statistics and indicators that enables detailed analysis of development needs to be established for the benchmarking.

4. Procurement for more energy efficient products specific to the needs of the region should be organised. Parties, prepared to take the lead and make commitments in development and dissemination of new technology, should be identified and their efforts encouraged.

5. Full use should be made of the BSR experience with AIJ-projects for energy efficiency improvements, e.g. how small scale energy efficiency projects can be realised and financed (clearinghouse facility), the future climate-related mechanisms could be employed, trade experience can be improved and transferred (c.f. The Energy Charter), technology learning and dissemination of sustainable technology can be promoted and lock-ins will be avoided.

6. Transfer experiences of successful applications of institutional adjustments, such as pricing reforms and legislation, transferred between the countries concerned in the BSR-east.

7. Establish concrete development plans for DH/CHP evolution as a priority item and encourage industry to participate. Provide adequate long-term signals to the market for the investments.

8. Form a BSR technology development experience project to promote “capacity building” in “learning by doing” and to form a link for R&D resources towards implementation and technology deployment,

9. Develop Baltic 21 activities further to BSR-wide sector programmes, both to ensure that the experiences are better utilised between countries and to build a joint demand for energy efficiency products and services. Some areas for such programmes:

   - Best Practice Programmes for industry;
   - Zero-Emission urban transport system to promote alternative fuels, infrastructure for fuels and vehicle-maintenance and demand for alternative transport/vehicles;
   - Refurbishment of buildings for the residential and commercial sectors (procurement programmes);
   - Development of standards, codes and labelling.

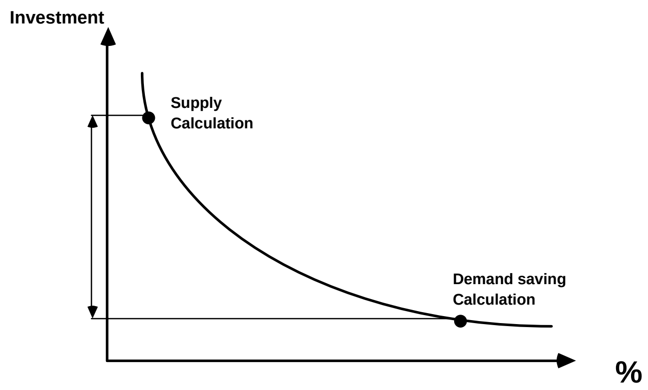
APPENDIX A
THE "PAY-BACK GAP"

It is often said that the energy price, set on a competitive market, is the necessary instrument to strike the balance between supply and demand. The correct price is important and essential, but not always the only condition. The reason is that actors on the both sides, supply and demand, do not value their opportunities equally and that the demand side systematically gives the lower value.

Energy supply enterprises have more opportunity to obtain and treat information and to spread risks. Supply of energy is generally their core business. In their calculation they know that their installations will be used for a long time and have a high degree of flexibility to meet different demand patterns. In some cases they even have a dominating position on the market. They are prepared for big investments in new supply.

End-users of energy have less information and fewer opportunities to treat it. Energy use is just one part of a consumer's activities. When assessing the cost-effectiveness of an energy efficient investment, the user may not know if the equipment will be used for its full life, or if the investment will provide a return. Most consumers elect to invest only smaller amounts if the purpose is only to lower the energy bill. The difference between the two perspectives and modes of operation is called "the pay-back gap".

Figure A.1
"Pay-back Gap" between Supply and Demand Savings



The consumers' "implicit discount rate", i.e. the rate which should have been used if the choice have been made using a formal calculation has been thoroughly documented.[97.] It is noted that the level of the (implicit) discount rate greatly exceeds the "social discount rate". The level depends on types of products and ranges from 20 to 300%. Industry applies rules of thumbs for investments. Common required pay-back criterion is in the range of 2-5 years. Households are reluctant to invest in improved efficiency due to general scepticism to new technology, high first-costs, difficulty to verify results, difficulty to get the products, and possibilities that they might require a change in behaviour, etc.[98.]

The discount rates for supply side calculations are generally in the range of 4-8% (real value). The experience from countries that are restructuring markets is that there are great possibilities to achieve higher economic efficiency on the supply side. This is often pursued after restructuring to improve

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97 Cambridge Sytematics Inc., *Implicit Discount Rates in Residential Customer Choices*, Investments in Conservation Measures,. EPRI EM-5587, vol.1, Project 2547, 1988.

98 Electric Power Research Institute, *Efficiency: A Hard Sell*, EPRI Journal, 1994; and *Overcoming Barriers to the Diffusion of Efficient Technologies*, EPRI TR 103527, 1994.

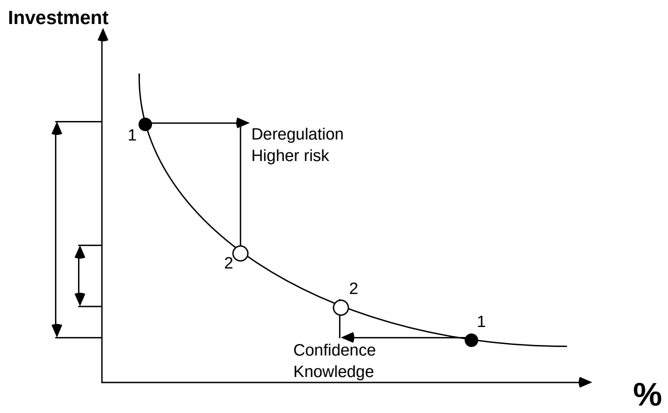
competitive position. It is important in restructuring that fundamental prerequisites for competition are met to get a well functioning market, e.g. information, company size and access to the market.

The European Union (EU) has estimated an efficiency potential gain of 10-20% in the European use of electricity. Achieving this potential would save 10-20 billion ECU per year in use of fossil fuels, reduce power capacity some 40 000-80 000 MW saving 80-160 billion ECU in capital, and cut CO_2-emissions by more than 100 million tonnes.

The deregulation of monopolies in energy supply often reduces the incentive of suppliers to participate in end-use energy efficiency improvements. On the other hand, restructuring can have a positive impact on the "pay-back gap". The supplying companies have to face higher risk in their investments, which makes them less prone to build extra capacity.

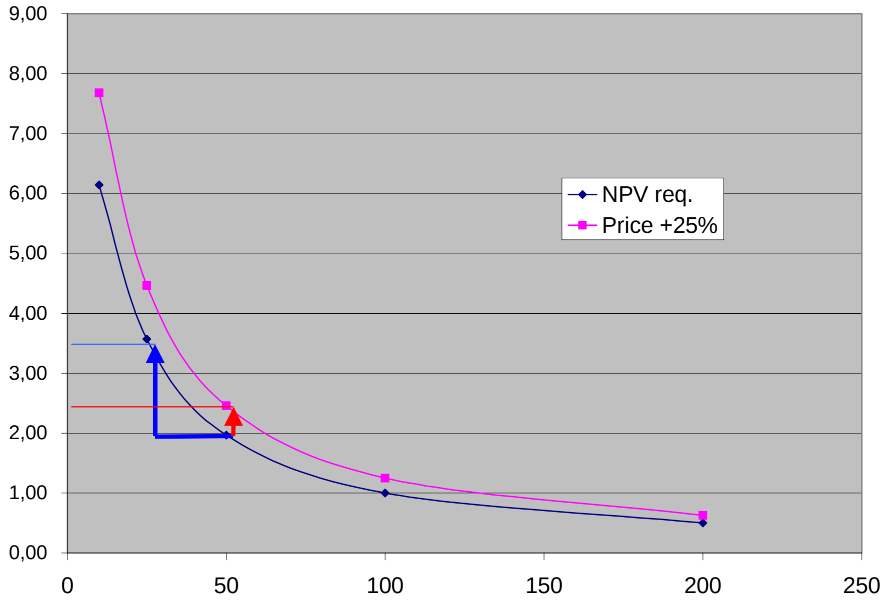
At the same time it is sensible to improve end-users confidence in energy efficiency thereby reducing the "pay-back gap" from both directions.

Figure A.2
Reduced pay-back gap (1-1 to 2-2) from Both Sides



The importance of customer confidence and knowledge about the performance of their energy efficiency alternatives is illustrated in the following:

Figure A.3
Net Present Value (NPV) required from an investment (of 1 currency unit) as function of the discount rate.



If the customer in this example requires a two-year payback (50% rate of return), the inclination is to invest twice the annual savings. If consumer confidence is doubled and the payback time is extended to four years (25% rate of return), the investment will be 3.5 of the yearly savings. A rise in the price by 25 % would increase interest in investing to the level of 2.5 of the annual savings.

APPENDIX B
THE NEED FOR A DISAGGREGATED APPROACH TO EXAMINE ENERGY USE

In most cases people and businesses are not concerned with energy itself, but rather with the service that the energy can provide. Energy demand is driven by a variety of factors. The most important are economic output and structure, technological progress, personal income, energy prices, lifestyles, and the impact of energy and environmental policies. The links among the factors are complex, and the way energy demand responds to changes in any of them depends on the type of energy service, stage of economic development, existing infrastructure, political system, availability of energy resources, climate and geographic conditions, and culture. Hence, in assessing energy use today and how it may evolve in the future, it is very important to examine the various activities in a society that influence energy use.

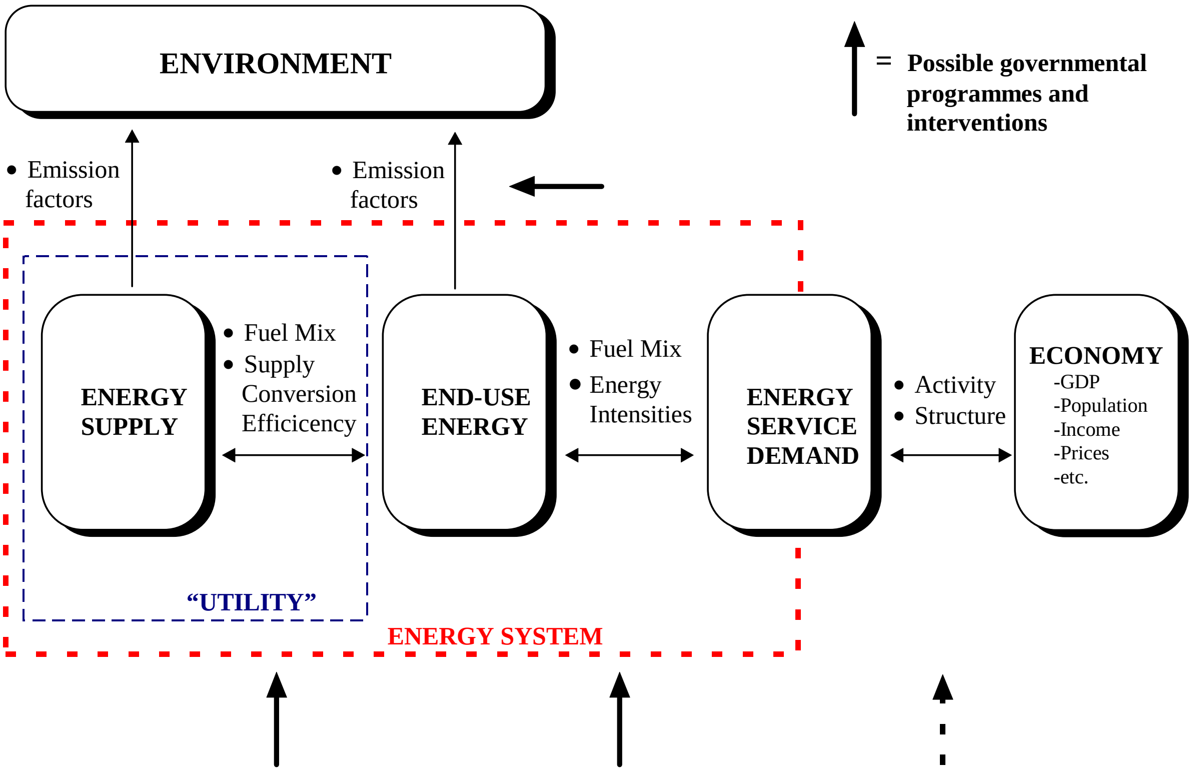
How these activities change as economies expand and how much more, and what kind of, energy will be demanded is certainly dependent on the rate of growth of the economy, but also on its stage of development. For example, even relative to income, the rate of increase in the number of cars or amount of car use is much lower in richer countries than in poorer ones where fewer people have had personal automobiles. Similarly, residential electricity demand is likely to grow at a much higher rate in countries with current low ownership of household appliances compared with countries where families already own two refrigerators and three televisions. In many of the economy in transition countries ownership of key energy-using household, transportation, and commercial sector equipment is likely to grow rapidly as income rises.

On the other hand, as economies grow they usually use energy more efficiently. They may buy more efficient boilers and machines, more efficient trucks, insulate their homes more, etc. Distinguishing between the factors driving up energy demand with those factors making it more efficient is key to relating past changes in energy use to future ones. More efficient energy use relates to using less energy to satisfy demand for the service energy provides, e.g. less fuel needed to heat a building to a certain temperature, or less electricity input to produce one tonne of aluminium. Growth in energy use, however, can also be reduced from changes in economic structure, like shifts in the manufacturing base towards producing goods that require less energy, e.g. electronics instead of steel. These reductions should *not* be mistaken as results of improved energy efficiency.

To identify the elements that make energy use more efficient, changes in past energy use resulting from changes in structure and economic activity need to be separated from those related to improved energy efficiency. Hence, many countries and the IEA are increasingly using a disaggregated perspective when examining energy use. A method often applied is the *indicator approach.* Indicators relate energy consumption to the driving factors behind the activities that require energy input in the main sectors of the economy.

The approach is illustrated in Figure B.1. It pictures the links between the general economy and its agents' (individuals and companies) demand for energy service, the energy system to supply these services, and the related environmental impacts. Demand for energy services is generated from sectoral activity and the structure within each sector. The driving factors of activity and structure development are *inter alia* GDP, population, income distribution and prices. Measured at the end-use level, *energy intensity represents the final energy needed per unit of activity*. Including supply-side losses for each energy carrier indicates the primary energy requirements per unit of activity. In addition, multiplying fuels by emission factors makes possible estimation of the emissions resulting from each activity in the various sectors.

Figure B.1
A Model of Energy/Environmental Indicators



By applying the indicator approach, changes in energy use and emissions can be decomposed among each of the factors[99] (indicated by bullet points in Figure B.1):

Changes in delivered energy are decomposed into changes in:

- activity (value-added, population, floor area, tonne-km, person-km);
- structure (industry mix, mix of transport modes, appliances ownership);
- energy intensity.

Changes in primary energy supply are decomposed into changes in:

- fuel mix;
- supply conversion efficiency.

Changes in emissions can be decomposed into all the above factors, plus:

- pollutant content of each fuel.

Separating the impacts on energy use and emissions of each of these factors is important since they change for different reasons and in response to different stimuli. They also have different sensitivities to energy prices and other factors. Policy-makers need to see the impacts of policies and technologies on the energy use affected by them. They need to observe these changes separately from changes in other factors. The disaggregated view allows for a better understanding of how the various components have shaped and will shape energy and emission developments. This, can help determine

99. There are interactions and feedback between the factors, e.g. decreasing energy intensities may encourage more activity for a given end-use. For example, most observers find that if fuel use per kilometre driven falls 10%, car use increases 1-2%, (Johansson and Schipper, 1997, and Greene, 1997). For economy in transition countries where demand for some end-uses has been suppressed, these feedbacks may be more significant than in IEA countries. For example, to the extent that urban residents in some economy in transition countries experienced insufficient heating in the early 1990s, it could be expected that efficiency improvements will be primarily translated into increased indoor temperatures, and therefore not reflected as reductions in energy intensity (energy use per dwelling area).

where policies can be most effective. In Figure B.1 the arrows indicate where government programmes are most likely to be implemented when designing policies for energy savings and/or emission abatement. This includes programmes directed towards:

- more efficient end-use of energy;
- supply side (improvement of supply conversion efficiency, and moves to renewable energy and less polluting fuels);
- emissions reductions through "end-of-pipe" technologies (scrubbers, CO_2 removal, etc.);
- reduced activity levels (e.g. closing of steel mills);
- changes in the structure of energy use (e.g. improving public transportation).

The first three policy areas relate to changes in the energy system, and thus are the primary targets for energy efficiency and emission abatement programs. Policies affecting activity and structure are generally more macroeconomic in nature and not the prime responsibility of energy and environment authorities.

Figure B.2 illustrates the indicator approach by using data for energy use in the United States. It shows average percentage change in the factors illustrated with bullet points in Figure B.1[100] The average change in GDP and the resulting CO_2 emissions per GDP are shown for illustration[101]. The figure shows that the driving forces behind the approximately 1% annual increase in CO_2 emissions from 1990-94, were rising activity levels and a more energy-intensive structure of the various sectors of the US economy (mainly from an increased share of trucks in freight transport and more heated household area per capita). Factors working in the other direction were reduced emissions per unit of electricity on the supply-side and total reduction of energy intensities in the various end-use sectors. Few changes took place in the fuel mix at end-use level during this four-year period.

Reducing the growth of activity levels is seldom a target for policy-makers. The same is true for the structure, where factors like more energy intensive travel and freight per capita, more home area per capita, will move emissions upwards. Thus this illustrates that if the growth in US emissions is to be reduced, the emissions reductions have primarily to be effected by altering factors in the energy system. Within the energy system, improving end-use intensities stands out as the most effective factor, at least in the short term.

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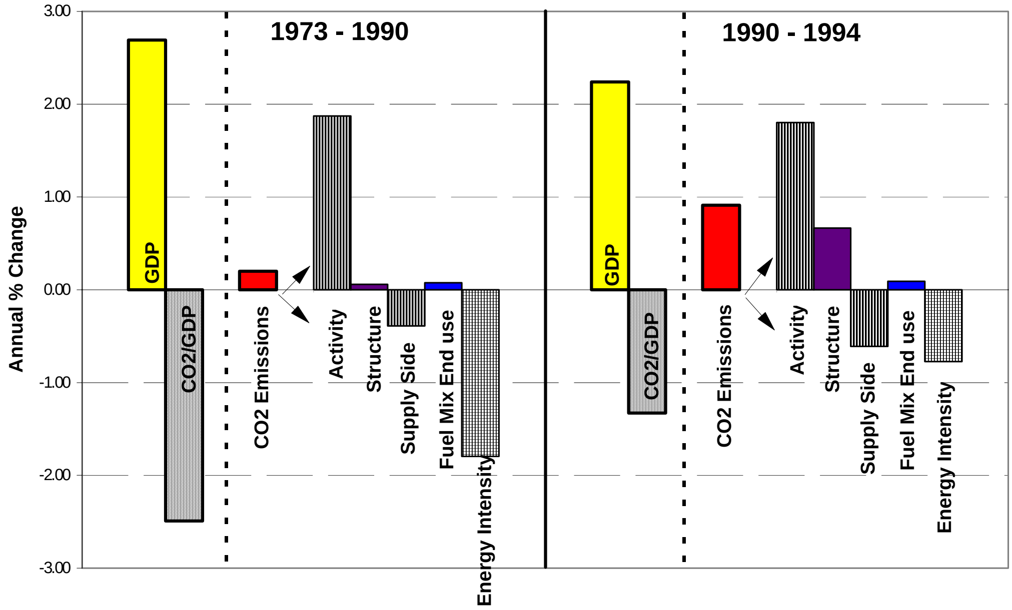
[100] Emission factors are not shown, since the carbon content of each fuel is assumed constant and no technology for CO_2 removal has been applied.

[101] Activity differs from GDP in that it is defined by more "physical" indicators such as person/km, amount of heated area, population. An economic activity indicator is used only for manufacturing; value-added in each subsector.

Figure B.2

Decomposition of US CO_2 Emissions 1973-1990 and 1990-1994



Source: IEA and Lawrence Berkeley National Laboratory (LBNL) energy indicator databases[102]

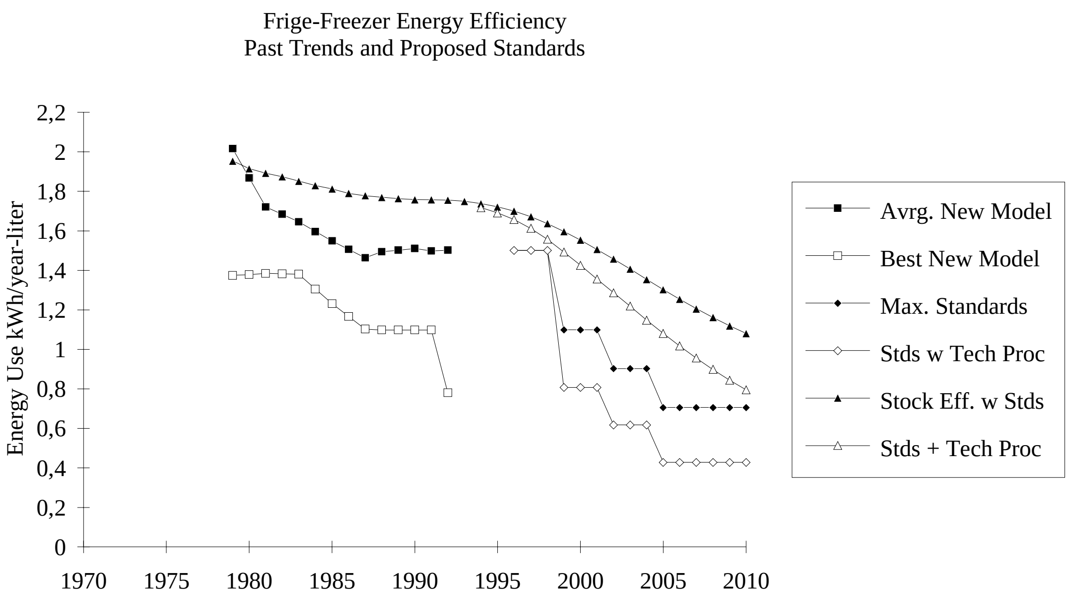
[102]. IEA, *Indicators of Energy Use and Efficiency: Understanding the Link Between Energy and Human Activity* (OECD, Paris) 1997 (updated by Lawrence Berkeley National Laboratory (LBNL) and the IEA secretariat).

APPENDIX C
ENERGY-EFFICIENCY MEASURES AND THE TIME PERSPECTIVE

Technology that improves energy efficiency can provide low-cost reductions in carbon emissions, given enough time to develop and commercialise the technologies, and given enough time for capital stock turnover to allow the new technology to make up a large share of the energy economy. Although currently-available energy-efficiency performance levels represent a dramatic improvement over much of the equipment in service today, the average energy consumption of the equipment stock cannot be reduced to such efficient levels until after about 2010, because many less efficient models would still be in service in the meantime (see Figure C.1, for example). The rate of energy-efficiency improvement is limited by the rate of turnover of existing equipment. It is also subject to constraints on market penetration rates, as there is little incentive for equipment producers to develop and introduce new models with efficiencies greater than required by current practice.

Figure C.1

Historical Trends and Energy-Efficiency Standards for Fridge-Freezers in Sweden*



*Annual energy use is normalised per adjusted litre of refrigerator space. Past trends show best-available, average new model, and average stock efficiency. Average stock efficiency is projected into the future based on two sets of standards: with and without technology procurement.

Source: Swisher, J., "*Dynamics of Appliance Energy Efficiency in Sweden*," Energy: the International Journal, vol. 19, no. 11, 1994.

Thus, the time frame of the emission-reduction commitments under the Kyoto Protocol will probably be too short for many technologies to provide a significant contribution to emissions reduction even if they hold the promise for very large long-term emission reductions. In the short term, action is required to make the technology available and shift investment decisions towards the employment of low-carbon technology but *focusing on short-range measures may lock out promising long-range mitigation technologies.*

The increasingly efficient *combined cycle technology* is capturing a growing share of the worldwide power-generation market, and this technology can significantly reduce CO_2 emissions from the electricity sector, compared to conventional fossil fuel-fired technology. However, it also raises the spectre of fossil technology lock-in *leading to lock-out of renewable electric technologies or indeed any non-fossil electric technology in the long term*[103].

This observation emphasises a very important aspect of technology learning: focusing only on the short-to-medium term remedies may foreclose long-term options, because future opportunities are strongly coupled to present actions. Analysis and policy measures must have a time horizon beyond 2010.[104] It is not enough to act locally, and think globally, one must also *act now, but think 2020*.

As noted above, the lifetime and operational characteristics of equipment that uses energy will set the pace for the changes in energy use and emission profiles. Some types of equipment (e.g., heating systems) have long lifetimes but can still be gradually changed in their function when maintained and overhauled. On the other hand, some types (e.g., lighting equipment) have shorter lifetimes and can be replaced by more energy-efficient equipment.

In the short term (until 2010) the reduction of GHG emissions will have to come from readily available, established technologies and simple measures such as operational practices, which will have to be accordingly adapted to the local context and stimulated by policy measures, fiscal incentives, etc. In general, new advanced technologies would only marginally contribute to reach the Kyoto targets.

Table C.1 and Figure C.2 illustrate how much improvement can be made when changing equipment (stock aspect) and how much from can be made in operations and maintenance. The table only applies to energy efficiency improvements and not to fuel switching or other supply-side measures. The improvement rate from a shift of equipment (IR) or from changes in operations (OIR) is given as a percentage of the original (baseline) energy used for the function that the equipment provides. These figures are rough estimates, but taken from actual cases. The main idea is to show that there is always room for improvement.

Packages of policy instruments and measures will be needed to bring about the accelerated deployment of existing, more efficient technologies that can contribute most to reaching near-term reduction goals. Even when the Best Available Technology (BAT) is known it might still not be *established*. Institutional barriers for such establishment are often normal frictions in a market economy, but such friction can be reduced and the *economic* efficiency thereby improved.[105] The technologies that can make a change for the coming decades, even if mostly known, have to be better *adapted to*:

- fit the multitude of consumer situations and be affordable;
- production in large volumes to lower the unit cost and consumer price;
- fit the interest of market intermediaries and provide them incentives.

[103] Clas-Otto Wene, *Experience Curves for Energy Technology Policies*. Forthcoming publication from IEA.
[104] 2010 is used to represent the time frame 2008-2012 mentioned in the Kyoto Agreement.
[105] Information, transaction costs, risk, financing systems, market organisation etc. can be changed to support a faster response of supply to need, of costs to prices, of price to volume, and all other relations that affects the dissemination of the more efficient equipment.

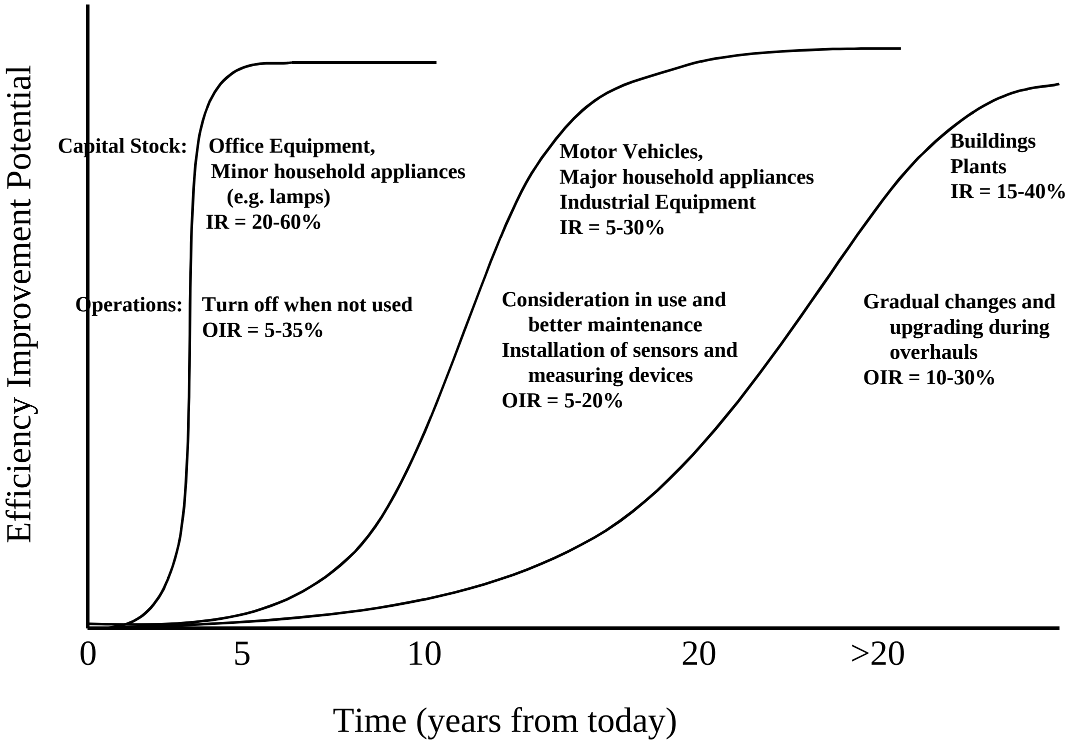
Table C.1

Time Perspective on Energy-Efficiency Improvement Potential

	Short life (<5 years)	Medium (10-20 years)	Long (>20 years)
Stock aspect *Improvement rate (IR): Best Available Technology compared to Average Installed (BAT/AVI)*[106]	Office equipment. Minor appliances in households (e.g. lamps) IR : 20-60%	• Motor vehicles, • Major appliances in households, • Industrial eq. IR : 5-30%	• Buildings • Plants IR : 15-40%
Operational aspect *Operational Improvement Rate (OIR)*[107]*:*	Turn off when not used. OIR : 5-35%	• Consideration in use and better maintenance. • Installation of sensors and measuring devices OIR : 5-20 %	Gradual changes and upgrading when overhauled OIR : 10-30%

Figure C.2

Time Perspective on Energy Efficiency Improvement Potential



[106] An evaluation of some 20 procurements made in 1990-95 show an improvement in performance of 17-43% measured against best available products, 20-75% measured against the average available on the market and 20-80% measured against the average installed. Suvilhto and Oefverrholm, *Swedish Procurement and Market Activities*, ACEEE, 1998.

[107] Calculated from the Energy Efficiency Initiative Vol. 1 Chapter 6 "Sectoral Policies and Programmes, and from Vol. 2 Cases (ID 44 Energy Audit Services in Finland, ID 16 Green Light Programme in the US and ID 33 Federal Energy Management Programe in the US). International Energy Agency and Danish Energy Agency, *Energy Efficiency Initiative,* (IEA, Paris) 1998.

APPENDIX D
ADDITIONAL MODELS OF CLEARINGHOUSES OR CARBON FUNDS

PRIVATE SECTOR MODELS

Costa Rican Certifiable Tradable Offset Program

The Costa Rican Office for Joint Implementation (OCIC) has developed a program of Certifiable Tradable Offsets (CTO), assisted by a financial markets broker, Centre Financial Products Limited (CFP) of Chicago, Illinois. In late 1997, the Government of Norway purchased US$ 2 million worth of CTOs at a price of $10/mtC. CFP has been marketing and attempting to broker the Costa Rican CTOs for more than one year, but the Norwegian Government purchase is the only sale of CTOs known to date. However, anecdotal evidence suggests that since the Kyoto conference of December 1997, CFP has received a number of inquiries to broker CTOs and may be executing other trades.

CTO issues are backed by the Costa Rican government's Protected Area Project (PAP), which covers up to 20% of Costa Rica's total surface area. A second land-use carbon capture project, the Private Forestry Project (PFP), will promote the expansion of privately-held conservation areas through expanded and longer-term use of the state's forestry incentives.[108]

The CTOs consist of a specific volume of greenhouse gases (GHG) expressed, in carbon equivalent units, resulting from a portfolio of carbon emission reduction or sequestration activities, mostly the latter. The projects are undertaken as part of a comprehensive JI/AIJ program that began in 1994. In the case of the initial offering, the carbon offsets will come from the forest conservation programs of the PAP.

Each CTO carries a guarantee by the Ministry of Environment and Energy (MINAE) for a period of 20 years. During that period, any CTO that is declared invalid by third-party monitoring and verification organisations will be replaced. According to personal communication with the OCIC, this feature "means that CTOs contain all the approval requirements of domestic and international law for them to count against national GHG-reduction commitments if such crediting is permitted for the post-pilot phase under the UN FCCC."

The basis for the MINAE guarantee is two-fold. First, Societé Generale de Surveillance (SGS), a Swiss auditing concern, has performed extensive field verification of the emissions base for the PAP program on behalf of the government. Second, MINAE will not certify all carbon offsets generated by the programs, but it will hold a specified volume of CTOs (about 15%) in reserve in case CTOs that have been issued are invalidated.[109]

Validated CTOs will be sold to investors by a special GHG Fund administered by OCIC in collaboration with the National Forest Financing Fund (FONAFIFO), which manages the finances of the government's national forestry initiatives. For tax purposes, FONAFIFO is incorporated as a "fideicomiso" or trust fund under the laws of Costa Rica and it is managed by MINAE. FONAFIFO, and thus the Government of Costa Rica, therefore own the rights to the carbon credits, providing the financial basis for the CTO program.

The Costa Rican CTO program activities are relevant to the design of other GHG funds and clearinghouse efforts, as this is an important precedent in the nascent carbon market. The CTO could serve as a model for determination of price indicators and transaction costs associated with carbon

[108] Oficina Costarricense de Implementación Conjunta (OCIC), 1998. *Second Joint Report to the Conference of the Parties on Activities Implemented Jointly*, OCIC, San José.

[109] Oficina Costarricense de Implementación Conjunta (OCIC), 1998. *Second Joint Report to the Conference of the Parties on Activities Implemented Jointly*, OCIC, San José.

trading activity. The Costa Rican CTO system is not a direct competitor with energy-sector activities in Annex-I countries, because it is restricted to Costa Rica (a non-Annex I country) and focuses on land-use credits. On the other hand, it has established significant credibility and has a high market perception.

Greenhouse Emissions Management Consortium

Several Canadian energy companies, which had already been loosely collaborating on GHG issues, established the Greenhouse Emissions Management Consortium (GEMCo) in 1996. GEMCo member-firms are considering investments in carbon offsets through emission reductions or carbon sequestration activities as part of a corporate environmental management strategy. They are interested in investments that typically take place outside their normal operations. GEMCo's membership incorporates both potential buyers and suppliers of projects with high emission mitigation potential. The organisation currently includes British Columbia Hydro, Canadian Utilities Ltd., EPCOR, Nova Gas Transmission, Nova Scotia Power, Ontario Hydro, SaskPower, TransAlta Corporation, and Westcoast Energy. GEMCo is focusing on:

- Demonstrating the role of offset investments and credit-trading as least-cost GHG management solutions;
- Establishing formal mechanisms for offset certification and credit-banking in Canada;
- Identifying and engaging in the development of carbon-offset projects;
- Representing its members in the development of Canadian carbon-offset investment, credit-banking and trading policies;
- Assisting members to develop their internal capacity to identify and secure emissions reductions and offsets for their own use.

Each offset project is a profit-oriented commercial venture, where the development costs are initially born by GEMCo. Members will achieve offset benefits through direct participation in contracts, service agreements, partnerships or joint ventures established to capitalise on potential commercial opportunities. Any business or investment risk from participation will be born by the participants rather than by GEMCo. The mechanisms for transferring ownership of emissions benefits or credits from one party to another will likely depend on the project design and may be unique to each business deal. Costs incurred by GEMCo to develop an offset project into an "investment-ready" state will be recovered from members' dues. This structure provides all members the incentive to participate in the new ventures.

Within the consortium framework, members commit CDN$50,000 per year when they join. Before joining the membership, they have to demonstrate that they are committed to reducing GHG emissions, both in their own operations and through investment outside their normal operations. New members must also commit to investing in at least one GEMCo-presented deal within 24 months of joining GEMCo. Most members work with the consortium to develop strategic deals, or deals that require a consortium approach. In late 1997, GEMCo and Northeast Utilities of the United States signed an agreement under which GEMCo would purchase reductions from a landfill-gas project operated by the utility.

Perhaps the most sophisticated transaction recorded recently involves GEMCo and a no-till farm project in the U.S. GEMCo is working through a broker in New York, Cantor Fitzgerald, to buy options on future carbon credits, which will be structured as performance contracts with the Iowa farmers for no-till practices on their land. Details of this transaction are not available. The buy or "call" option is one of the preferred risk management techniques in order for the buyer to shift the risk onto the seller and in order to lock in future carbon prices at a forward price today.

International Utility Efficiency Partnership GHG Offset Facility

The International Utility Efficiency Partnership (IUEP) is a program of the Edison Electric Institute (EEI), which is an association of mostly private electric utilities in the United States. EEI's international members include Electricité de France (EdF) and ENDESA of Spain.

The IUEP is a non-profit organisation whose subsidiary, IUEP GHG Offset Facility, LLC, ("the Facility") acts as both a broker and a co-developer for offset suppliers. A number of its projects are certified by the USIJI, totalling some 2.7 million mtC of certified but not verified offsets, which the IUEP intends to sell in the market.

The Facility represents a well-developed private sector initiative. At present, it is unclear whether the Facility has received any substantial capital commitments from potential investors for its own working capital or whether there have been significant expressions of interest in their credits from interested buyers. The IUEP estimates its monitoring costs to total approximately US$10,000 per year per 30 MW project.

Environmental Resources Trust

The Environmental Resources Trust (ERT) is a non-profit trust fund founded by the Environmental Defense Fund (EDF) in order to broker carbon. ERT intends to act as a clearinghouse for interested buyers. At present, it is uncertain whether the ERT will pursue a strategy of accumulating capital to initiate market operations as a buyer of reductions.

However, in 1998, the ERT announced that it would be the account holder for a significant carbon trade between the Canadian integrated energy company Suncor Energy and the US utility Niagara Mohawk. Suncor agreed to make an initial purchase of 100,000 mtC of reductions from Niagara Mohawk. Essentially, carbon credits were purchased from Niagara Mohawk's biomass energy projects in New York state, and the proceeds of the sale were donated to ERT, therefore giving Niagara Mohawk an additional tax benefit (donations to non-profit NGOs are tax-deductible under US law).

REGIONAL FUNDS AND CLEARINGHOUSES

Costa Rica Carbon Renewable Energy Fund

The Costa Rica Carbon Renewable Energy Fund (CREF) is a regional clearinghouse for energy-sector GHG reduction projects in Central America. It is being established in association with the World Bank Prototype Carbon Fund (PCF), described above, as a "baby PCF." The PCF serves as the trustee over an initial trust fund amount of US$10 million.

The purpose of the CREF is to support development of projects using renewable and efficient energy technologies through carbon offset payments. The initial trust fund amount will be invested in a portfolio of 5-15 "carbon certified" renewable energy projects. The initial project pipeline consists of hydro and wind power projects, although the fund will also be open to end-use energy-efficiency projects as well.

The CREF will be set up as a Trust Fund under Costa Rican law and will be managed financially by a local Costa Rican bank, to be selected under a competitive bid, and a management fee will be incurred of no more than 1%.

The executing agency will be the Costa Rican Office for Joint Implementation (OCIC), described above, which already has successful experience implementing Costa Rica's CTO program for carbon offsets from land-use projects. The OCIC will conduct all contracting of certification and verification services on behalf of the PCF, using proceeds from the CREF, upon approval of these by Fund Management Unit of the PCF. All OCIC services will be reimbursed by the CREF.

Applications for carbon payments will be received from individual energy projects on a rolling basis, reviewed by OCIC staff and submitted to their Carbon Committee for a quarterly review. Once a project has received Carbon Committee approval, certification of baseline and accounting methodologies will occur with accredited third-party service providers. These will determine the appropriate amount and price of the carbon to be set out in the future Carbon Contract with the energy project owners.

Upon satisfactory determination of these price and quantity issues, OCIC will retain legal services for drafting the Carbon Contract, and this will be reviewed and negotiated with the energy project owners. All certification and annual verification services will be deducted from eventual carbon payments. The final Carbon Contract will stipulate the schedule of delivery and ownership of credits, which will pass through to the PCF.

The OCIC will provide instructions to the local financial intermediary to disburse on an annual schedule for the life of the contract, and bi-annual verification services will be required by the OCIC in their supervisory role. The PCF will require annual reporting on CREF activities to be reviewed and approved by its Board.

The baseline energy supply, against which the carbon emission reductions from CREF projects will be measured, can be credibly assumed to the thermal power plants burning fossil fuel. A 230-kV electric transmission interconnection project spanning the Central American isthmus is being implemented to improve the reliability and economic performance of electricity supply in the region. The interconnection is designed to decrease need for reserve generation capacity, given the complementary resources of hydro and thermal systems throughout the region.

To support this plan, the generating resources that are to provide new electricity supply at the margin are thermal power stations, including a 50 MW diesel plant in Nicaragua and a 150 MW coal-fired plant in Guatemala. Based on these baseline resources, the emission savings from CREF projects are expected to be about 0.25 mtC/MWh.

Another example of the use of trust funds as financial mechanisms for GHG-reducing projects is the Costa Rican National Carbon Fund (NCF), which was used in the Norwegian CTO transaction in 1997. For tax purposes, the NCF is registered offshore by CNFL, a government-owned electric utility. Part of the funds from the government of Norway and a Norwegian corporate consortium is distributed as carbon offset payments (circa US$20/ha per year) to land-holders upstream of a CNFL hydroelectric project. This allows the CNFL to protect the watershed and ensure the hydrology for the plant’s operation. The Norwegian corporate consortium was also awarded the turnkey construction contract for the hydroelectric plant.

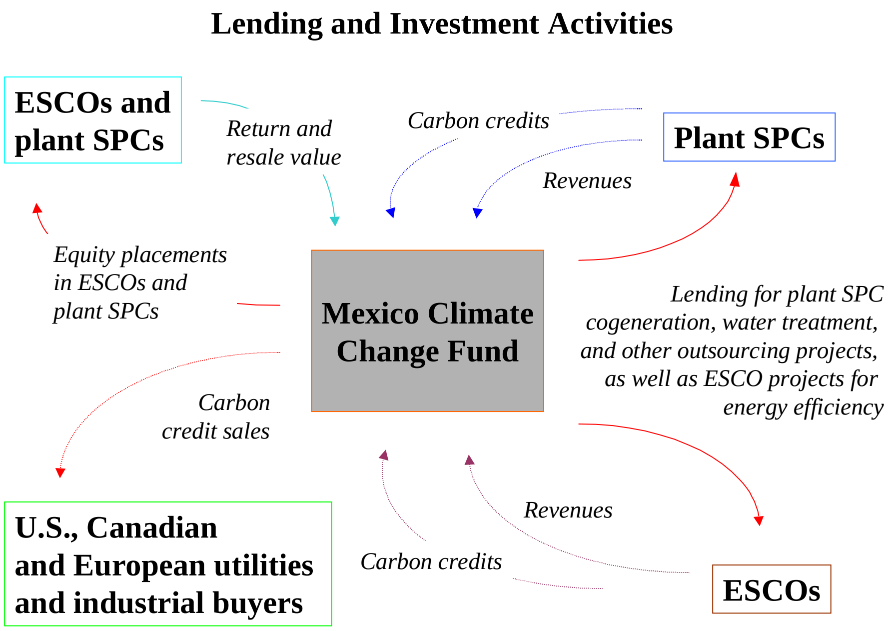
Mexican Climate Change Fund

Still in the formative stage, the Mexican Climate Change Fund is a collaboration of the IFC and the Multilateral Investment Fund, which is the private-sector investment arm of the IDB. This trust fund is raising equity from GHG-producing companies such as electric utilities to match the IFC/MIF equity share, which will then be complemented with debt financing from U.S. and Mexican banks, as well as the IDB and the World Bank group (see Figure 3C.1).

The purpose of the Fund is to finance environmentally sound energy and other infrastructure projects, many of which are expected to produce carbon offsets. The Fund will make loans to Mexican ESCOs to implement energy-efficiency projects. It will also make both debt and equity investments in plant-level special-purpose companies (SPCs), which will finance CHP, renewable energy, water treatment, methane recovery, and other GHG-reducing projects.

The carbon offsets that the project investments generate will be marketed to utilities and other industrial GHG emitters in North America and Europe. Revenues from these offset sales will supplement the debt service and potential resale of the SPCs. These revenues will improve the economic performance of the Fund and provide additional resources for new investments.

Figure D.1
Structure of Mexican Climate Change Fund



Source: Econergy International Corp., 1998.