ESMAP

Energy Sector Management Assistance Programme

Poland

Energy Sector Restructuring Program
Volume 5: The District Heating Subsector

Report No. 153/93

JOINT UNDP / WORLD BANK
ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)

PURPOSE

The Joint UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP) was launched in 1983 to complement the Energy Assessment Programme, established three years earlier. ESMAP's original purpose was to implement key recommendations of the Energy Assessment reports and ensure that proposed investments in the energy sector represented the most efficient use of scarce domestic and external resources. In 1990, an international Commission addressed ESMAP's role for the 1990s and, noting the vital role of adequate and affordable energy in economic growth, concluded that the Programme should intensify its efforts to assist developing countries to manage their energy sectors more effectively. The Commission also recommended that ESMAP concentrate on making long-term efforts in a smaller number of countries. The Commission's report was endorsed at ESMAP's November 1990 Annual Meeting and prompted an extensive reorganization and reorientation of the Programme. Today, ESMAP is conducting Energy Assessments, performing preinvestment and prefeasibility work, and providing institutional and policy advice in selected developing countries. Through these efforts, ESMAP aims to assist governments, donors, and potential investors in identifying, funding, and implementing economically and environmentally sound energy strategies.

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FUNDING

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ENERGY SECTOR RESTRUCTURING PROGRAM

Volume 5

The District Heating Subsector

January 1993

Power Development, Efficiency
and Household Fuels Division
Industry and Energy Department
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PREFACE

This report —the fifth of a five-volume series of studies of restructuring in the Polish energy sector— is based on work completed during 1990. The results of the study were examined in a seminar that included representatives of the district heating enterprises and the Ministry of Industry and Trade as well as the Bank of Poland and Ministry of Finance, Ministry of Privatization, trade unions, Polish experts, consultants, the World Bank, and *ESMAP*. This report provides an opportunity to bring the analysis of the restructuring issues and lessons learned in Poland into a wider perspective, allowing other countries pursuing similar goals to benefit from this work.

The variety of situations which exist in district heating in Poland means an ad hoc approach is needed for a proper restructuring of the subsector, an approach tailored to the specific characteristics and circumstances. Technical arrangements, ownership and management vary considerably, making it necessary some degree of decentralization, leaving some of the decisions on restructuring to local bodies. The main emphasis of the restructuring work, therefore, will be to provide model charter and statutes for the future enterprises in the subsector, and to ensure that these are well understood and applied skillfully. The nature of the regulatory arrangements also poses special questions, particularly in view of the need to separate regulation from policy, ownership and management. A careful balance between local and national roles will need to be struck. With the establishment of the Energy Restructuring Group (ERG), these and other restructuring issues will need to be tackled for timely advise and proper policy choices.

Work on energy restructuring is the responsibility of the Ministry of Industry and Trade (MoI). Given the complexities of sector restructuring and the importance of the energy sector in the economy, an Assistance Program for Energy Sector Restructuring has been designed to support MoI in this activity. This Program relies on four groups (see Annex C in Volume 1 of this report): The ERG, the counterpart group, the coordinating group and *ESMAP*.

The ERG consists of a team of international and Polish experts—that began work in December 1992 in Warsaw and will have a continuous presence there for approximately eighteen months. This Group, funded jointly by the European Community, the USAID and the UK Know-How Fund, will be closely supported by *ESMAP*. To carry out rehabilitation and restructuring proposals, a coordinating group in each subsector headed by higher management has been established. To assist MoI and the ERG, a Counterpart Group has also been established, staffed by secondees from the energy industries themselves. This group will assist the ERG in the collection and understanding of data, gaining access to industry executives as appropriate and offering comment on the implementation options. The Counterpart Group will assist the Ministry of Industry and Trade by identifying important matters for consideration and by ensuring that consequential actions which involve the coordinating groups and other parts of Government are also pursued in a timely manner. *ESMAP* will support the work of the ERG through (a) the proposed activities to be carried under the *ESMAP* program, and (b) the active involvement in ERG activities.

The Energy Restructuring Group (ERG) should be instrumental in clarifying any doubts and achieving good results in the restructuring process. Most issues will necessarily have to be addressed on a case-by-case basis because of the different local circumstances. However, three interrelated matters will need special attention to strike proper balance:

- the expressed intention to encourage privatization of district heating enterprises wherever possible;
- the need for substantial new investment to upgrade existing infrastructure; and
- the need to steadily reduce and finally eliminate subsidies, achieving levels of cost and prices which enable the new companies to become financially viable and strong.

In particular, the ERG should identify any need to improve the way in which additional investment is evaluated in view of the likely significant changes.

Several World Bank and *ESMAP* staff participated in the preparation of this report. Jayme Porto-Carreiro (*ESMAP*) was the task manager for the study, assisted by a Bank core team consisting of David Craig, Henk Busz (EC3IE) and Christopher Brierly (*ESMAP*). Luis E. Gutiérrez (*ESMAP*), current Task Manager for restructuring activities in Poland, was responsible for consolidating and drafting this report. The report benefited considerably from the comments and suggestions of Finn Lauritsen (ERG Energy Saving & Efficiency Specialist).

Funding for the work was provided by the United Kingdom's Know-How Fund and by UNDP through bilateral contributions to *ESMAP*. The United States has also provided funding for the follow-up work since 1991.

ESMAP wishes to express its appreciation to the government of Poland and the many enterprises and organizations in the energy sector for the cooperation and assistance rendered to *ESMAP* staff and the various consultants during the preparation of the studies.

CURRENCY EQUIVALENTS

Currency Unit= Zloty (Zl)

Calendar 1991 US$1 = Zl 10,559 (Average)

Weights and Measures

Gcal	Giga calorie (one million kilo calories)
GJ	Giga Joule
GW	Giga Watt (1,000,000 kW)
GWh	Giga Watt hour (1,000,000 kWh)
kcal	kilo calorie (4,187 Joule)
kW	kilo Watt
kWh	kilo Watt hour
Mt	Million tons
Mtce	Million tons of coal equivalent
Mtoe	Million tons of oil equivalent
Mtpa	Million tons per annum
MW	Mega Watt (1,000 kW)
MWh	Mega Watt hour (1,000 kWh)
PJ	Peta Joule (34,129 tons of oil equivalent)
TJ	Tera Joule
TW	Tera Watt (1,000 GW)
TWh	Tera Watt hour (1,000 GWh)

Acronyms

BST	Bulk Supply Tariff
CMEA	Council for Mutual Economic Assistance
CHP	Combined Heat and Power
DH	District Heating
DHE	District Heating Enterprise
FGD	Fire Gas Desulphurisation
GDP	Gross Domestic Product
Gmina	Polish Local Government (municipality)
GUS	Central Statistical Office
HOB	Heat Only Boiler
HV	High Voltage
IAS	International Accounting Standards
IBRD	International Bank for Reconstruction and Development

IRB	Intercommunal Regulatory Bodies
ITB	Invitation To Bid
LV	Low Voltage
MV	Medium Voltage
NERB	National Energy Regulatory Body
NHAB	National Heating Advisory Board
PDM	National Load Dispatch Center
PGNG	Polish Oil and Gas Company
PPA	Power Purchasing Agreement
PSE	Joint Stock Polish Grid Company
PSENN	Polish Grid Company
Voivodship	Prefecture, Regional Administrative Body of Central Government
WEWB	Power and Lignite Board
WWK	Hard Coal Board
ZE	Zalad Energetyczne (electricity distribution companies)

Polish Fiscal Year

January 1 to December 31

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EXECUTIVE SUMMARY

Introduction

1. Like other parts of Poland's energy sector, district heating is a candidate for significant restructuring. As the central government hands off power and responsibility to lower-level bodies and seeks to promote economic reforms, the reorganization of the supply of heat and hot water to urban consumers and, to a lesser extent, of processed steam to industry raises a number of political, legal and economic issues. Already decentralized, the district heating sector requires a stable framework in which to fill its role, price and deliver its products, invest for the future and address environmental protection concerns. While the subsector cannot easily be fully privatized, the government role in it can be significantly redirected away from a past of subsidized ownership and management to a future of more orderly financial support and more localized regulation.

2. This report discusses the options and preferred solution for the restructuring of the Polish district heating subsector. Chapter 1 describes the characteristics of the sector. Chapter 2 outlines the objectives for restructuring and the criteria used to evaluate the different options, and Chapter 3 goes on to apply these criteria to different options. Chapter 4 discusses the preferred structural solutions in more detail while in Chapter 5 a regulatory framework is described. Chapter 6 looks at investment priorities and the scope for operational improvement. In Chapter 7 guidelines for pricing and the metering of heat are developed. In Chapter 8 employment and financial issues are addressed. Finally, in Chapter 9, the conclusions are drawn together for an outline program for restructuring the subsector.

Background

3. In Poland the district heating subsector is the main supplier of heat and hot water to urban areas and, to a lesser extent, of process steam to industry. The sector is completely decentralized and comprises some 50 district heating enterprises (DHE), which for the most part operate as state enterprises under the supervision of the voivods. Of the 50 DHEs in 1989, the five largest produced 45 percent of the heat and, with 15 others, accounted for 80% of all production. Thirty-three of the 50 operate at the voivod level, while 11 supply districts within voivods, and the remaining six are municipal providers. The enterprises, many of them proprietors of several separate systems, can be divided into three categories depending on the scope of their distribution networks. The largest, often connecting several different heat sources along bulk heat transmission mains, may acquire their supplies both from combined heat and power (CHP) plants and heat only boilers (HOBs), some of which are part of the electricity subsector. Medium-size DHEs, each managing its own transmission network, tend to use a single CHP/HOB complex as their source, while the small enterprises rely on a single HOB plant. Although the large and medium-size firms fill most of the year-round demand for hot water and of the seasonal, seven-month demand for heat, small local boilers are very numerous.

4. On the larger systems, heat is produced by combined heat and power (CHP) plant and heat only boilers (HOB) operated by enterprises within the electricity subsector and sold to the DHEs; the balance of heat is produced in small local HOBs, owned by the DHEs, and in industrial, CHP plant and boilers which have surplus heat for sale.

5. In contrast to other subsectors, district heating is already substantially decentralized, reflecting the local nature of the district heating networks. Loose supervisory control of the whole subsector is

exercised by the Ministry of Physical Planning and Construction. The Government has already initiated a restructuring program for the energy sector, this has entailed in the district heating subsector removal of subsidies and a consequent rise in heat prices to consumers. The organization of district heating is also affected by recent legislative changes in the area of local government which involve a devolution of power from central government, acting through the voivods, to the communes.

6. The inefficiencies and deficiencies in the subsector range from the maintenance liabilities on the many small boilers that supply individual buildings to the network water losses that are sometimes three times as high as those for comparable Western European systems. Reported heat losses vary from the theoretical heat loss in the transmission and distribution system of 10% up to 45%, a range that reflects the shortfall in metering equipment that would enable distributors to identify corroded and poorly insulated mains that leak heat and water. Government subsidies to housing cooperatives mean that even after 1990 price increases, domestic consumers who pay flat-rate charges for their heat actually cover only 15% of the cost. In 1992 these figures have changed. Consumer charges for heat cover around 55% of the supply cost.

7. The district heating subsector is a significant contributor to Poland's environmental problems, especially air pollution. The DHEs use coal as their primary energy source, consuming 24 million tons of coal products —13% of the country's output— in 1989 and creating 11% of national sulfur dioxide emissions, 10% of particulate fallout and 8% of nitrous oxide emissions. Because so many of the sources of that pollution are low-stack, small boilers in urban areas, the subsector has a disproportionate impact on local air quality.

Restructuring Patterns

8. While no single formula for reorganization can accommodate the diversity of Poland's DHEs, the absence of private capital and the predominance of monopoly/monopsony conditions in the market make it clear that public control and even forms of public ownership will have to continue in the subsector for some time to come. Within those limitations, however, efficiency can be encouraged —especially among the larger firms— by shifting away from ownership patterns that integrate heat production with its transmission and distribution toward the creation of more, smaller enterprises performing those functions separately but under the oversight of intercommunal agencies. Such authorities could license joint-stock companies to own the DHEs and, where privatization is not feasible in the short-term, could encourage management contracts with the private sector.

9. For the major entities that own and operate large CHP/HOB or HOB plants, the best organizational structure is likely to depend on the size of each DHE's assets and on other local factors. In the many instances where dependence on a single heat or heat-and-power generator reduces the likelihood of financial viability, the stations will probably have to remain under the ownership of a larger entity. As much as possible, however, the generating plants should be held by joint stock or other companies separate from the transmission and distribution enterprises so as to avoid the danger of cross-subsidization.

Issues of Finance and Regulation

10. Although the existing DHEs are not heavily burdened by long-term commercial debt, their restricted cash flow —at least until heating prices rise— weakens their potential as future borrowers from any source other than government. As they are transformed into joint stock companies, it will be neces-

sary to revalue their assets, including the often inflated status of the separate funds that reflect the state's past contribution to the enterprise, on one hand, and the enterprises' internally generated reserves on the other.

11. The DHEs will need to raise funds for major investments in new power generation and/or to extend their transmission networks. New policies to allow accelerated depreciation might ease the way toward financing such projects, but for a period of several years government will probably have to be either the guarantor or direct source for DHE borrowing, especially to finance the conversion of heating networks to more efficient variable volume operation, the installation of much-needed controls on heat flow and urgent rehabilitation of leaky mains.

12. The central government can, however, devolve many of its former responsibilities as regulator of this utility subsector to the new intercommunal bodies foreshadowed in 1990 legislation on local government. While a national advisory agency should assist the new lower-level regulators with data collection, analysis and a pool of skilled specialists, the intercommunal regulators would be the ones to issue licenses, reviewable after ten years, and to oversee operations of DHEs. The regulators would act as price setters for their jurisdictions and as financial auditors and performance monitors.

13. Badly distorted by various subsidies and a pattern of cost-plus contracts, heat prices in Poland do not reflect the actual costs of supply. Since competition in the subsector is not likely to provide an effective stimulus for accurate pricing, regulators will need to establish a long-run marginal cost tabulation as the basis for the prices they set in the first few years of restructuring.

14. A good deal of the success of any transition will depend on the effective metering of all stages of heat generation and transmission from bulk sales to retail consumption. All distribution companies should embark on a program of heat meter installation as soon as possible, starting with major customers but moving quickly as well toward the individual apartment buildings where low prices have encouraged the use of inferior internal systems and discouraged their sound maintenance.

Environmental Issues

15. While intercommunal regulatory bodies can oversee these improvements in DHE performance, the stimulus for anti-pollution action will continue to come from the Polish Ministry of Environmental Protection and Natural Resources and voivod-level offices, both of which are pressing for significant emission restrictions. The new standards will require DHEs to take significant abatement measures.

16. For the many local boilers a shift to greater use of washed coal can help reduce particulate and sulfur dioxide emissions, but large and small plants alike will either have to change the way they burn fuel or install costly equipment to scrub their exhausts or both. The economics of environmental compliance may work over time to reduce the number of local boilers or, at least, impel them to shift their fuel source from coal to natural gas.

I. THE HEAT SECTOR IN POLAND

1.1 In 1989 the 50 enterprises, which comprise the heating subsector, sent out (heat purchased plus heat produced) 313 PJ of heat; of this more than 45% was produced by the 5 largest enterprises, and 80% by the largest 20. The largest enterprise sent out more than 50 PJ and the smallest less than 1 PJ.

Area of Operation

1.2 Most of the enterprises (33) operate at the voivod level, some (11) at the level of districts within voivods, while 6 operate at the municipal level.

Types of Systems

1.3 Within its operational area each enterprise may control a number of separate district heating systems of various sizes and types. Broadly there are three categories of enterprise:

- *Category A* which have a large main distribution network, often with several different heat sources connected by bulk heat transmission mains, though at present each heat source supplies a separate part of the network, which is isolated from other sections by valves.

- *Category B* enterprises operate a single medium sized main network which is supplied with the majority of its heat by a single CHP/HOB complex. The network is split into separate chapters and the heat sources are operated independently. The enterprise will often operate a number of smaller networks and a large number of local boilers supplying individual buildings with little or no network.

- *Category C* enterprises are small with a compact main network supplied from its own HOB plant. In addition it may operate a number of smaller isolated networks, supplied from enterprise owned HOBs, and numerous local boilers.

In all categories, the main network accounts for the majority of the heat supplied, but isolated networks, local schemes and local boilers are very numerous.

- *Condensing Power Stations with limited heat production.*
- *CHP power stations (i.e. co-generation).*
- *Large HOBs at power stations and on separate sites.*
- *CHP plant in industry.*
- *Industrial waste heat.*
- *Small HOBs in networks.*
- *Local HOBs.*

Box I-1: There are various sources of heat used

Products

1.4 The principal product of the DHEs is hot water for space and domestic water heating for dwellings and industrial and commercial space. Space heating is required for about 7 months of the year and hot water for the whole year. Some enterprises also produce and distribute steam.

Heat Sources

1.5 Box I-1 presents the various sources of heat. The first five categories are purchased heat while the last two are own production. It is important to distinguish between true CHP and large HOBs even when they are operated by the same enterprise on the same site —although this is often not done so by the electricity subsector enterprises. The CHP plants offer a highly efficient method of producing electricity and heat simultaneously. For the subsector as a whole, the contribution of each heat source for 1989 is shown in Table I-1.

Table I-1: Heat Production in Electricity Subsector

Sources	*PJ*
Condensing plants	*35.9*
Co-generation in CHP/HOB plants	*123.6*
HOBs in CHP/HOB plants	*49.0*
Separate HOBs	*29.0*
	237.5
Less: direct sales by plants	*47.5*
Heat purchased by DHEs from electricity	*190.0*
Heat purchased by DHEs from industry	*30.7*
DHEs own heat production:	
Networks	*81.6*
Local boilers	*2.4*
Total Heat sent out by DHEs	*304.7*

Fuels

1.6 The major fuel source is coal, irrespective of the type of production. A few large HOBs are oil fired and all CHP/HOB plant use fuel oil for starting and flame stabilization at low load levels. Local boilers also use coal products (briquettes, coke and half-coke) and a limited number burn gas or oil.

Transmission and Distribution

1.7 Heat sources can often be some distance from the distribution pipework (particularly if they are large CHP plants). Under these circumstances heat is delivered in bulk through transmission mains, which frequently run above ground. For smaller networks the heat sources are closer to the points of consumption and are connected directly to the distribution system.

1.8 The systems are constant volume, full flow (i.e. the same volume of water is pumper irrespective of the heat load). The flow temperature of the major heat sources is adjusted according to weather conditions by the heat dispatcher.

1.9 In many DH systems in Poland water losses are significant. It is necessary to add "make-up water" into the system frequently. The water losses from some networks are sometimes more than three times those of comparable networks in Western Europe.

1.10 Water losses are caused by:

- Losses at the production plant
- Leakages from components in the DH network
- Leakages from corrosion of the DH network
- Leakages at the consumers installation

- Illegal tapping by consumers
- Tapping in connection with renovation of pipes.

1.11 Network analysis shows that the water loss is in the range of 100-150 m^3 per TJ of heat production. Figures for networks in Western Europe are in the range of 20 to 50 m^3/TJ, approximately 25% of the water losses in Poland. In the Polish DH system the "make-up water" is normally not demineralized. The data received from the "make-up" show a varying level of water quality. Often the water is not completely demineralized and deoxygenated. In some systems the water losses are even higher than the capacity of water treatment system. In these systems it is necessary to replenish with non-treated water to maintain system pressure. At the plants, the return water is filtered by coarse strainers installed upstream of the pumps (no filtration by fine strainers was observed). This means that small particles, sludge, magnetite etc. are not completely removed from the system and that the total amount will increase gradually. Further, oxygen in the water causes corrosion, which results in more and more magnetite.

Network Heat

1.12 Nationally, 93% of the heat sent out by the DHEs is supplied to consumers via networks, with the rest supplied by local boilers feeding individual buildings. This latter source, although small in volume, represents a large number of small plants which are a major maintenance liability.

Heat Losses

1.13 Comparison of heat sales with heat sent out gives a measure of heat losses in distribution. These range from the theoretical heat loss of 10% to 45% and the wide range of figures suggest that better metering equipment is required so that cost effective system refurbishment can be properly identified

Investment

1.14 Major new plant and extensions to networks are currently funded from the central government through the voivods. The DHEs do not normally have complete control of system extension investment —the voivod can insist that an enterprise connect any new development to its distribution system. Lack of co-ordination between heat load development (largely controlled by the voivod) and investment in heat generating capacity (controlled largely by the central authorities) has led to capacity falling short of actual load in many enterprises.

Heat Tariffs

1.15 Each enterprise sets its own tariffs which are based on a cost plus formula. Tariffs are usually revised annually although more recently changes in coal and transport costs have necessitated more frequent revision.

Domestic Tariffs

1.16 The DHEs have very few supply agreements with individual domestic consumers. Most of their contracts in the domestic sector are with the housing co-operatives who are charged cost plus prices by the DHEs. The tenants pay the co-operatives a nationally set flat rate charge for space and water heating related to floor area. The flat rate charges have been much more frequently changed where these have been metered. The shortfall between receipts from tenants and the cost of heat purchased from the DHEs is made up by subsidy payments from the state.

1.17 Despite recent increases in prices in 1990 domestic consumers were paying only 15% of the cost of the heat they consumed. The state plans to remove this domestic subsidy through a series of increases in the national tariff. The tariff will also apply to volume rather than area.

Industrial and Commercial Tariffs

1.18 These consumers are charged on a one or two part tariff. The one part tariff is an energy charge and in most cases the heat consumed is estimated by the DHE as only a few consumers are metered.

1.19 The two part tariff consists of a fixed capacity component, related to the calculated maximum heat demand and is calculated to cover the DHE's fixed costs plus profit, and an energy component to cover variable costs. Again meters are rare so that heat consumed has to be estimated.

Legislative Framework

1.20 Under laws passed in 1990 responsibility for meeting communal requirements was passed to the communes (gminas). These locally elected bodies, of which there are more than 2000, are to be responsible for, inter alia, the provision of district heating. The gminas are allowed to establish "structural units" and intercommunal bodies for the joint performance of certain activities, where such activities cross gmina borders. The activities of the gminas are supervised by the voivod administration and by the local offices of the Ministry of Finance.

1.21 Ownership of property belonging to state enterprises, including the DHEs, can be transferred to the gminas or groups of gminas, at their request. They can appoint joint stock companies to assume the function presently discharged by the DHEs. It is possible that some gminas will not adopt this solution and instead will prefer to run their own heating system. Given the large number of gminas, a wide range of views is likely to emerge unless regulations or guidelines are issued by central government.

II. OBJECTIVES AND EVALUATION CRITERIA

Objectives of Energy Sector Restructuring

2.1 The proposed restructuring of the DHEs must be seen in the wider context of the Government's policies to move Poland towards a more market based mechanism. A rapid process of structural change has been initiated, including price liberalization, wage controls, exchange rate liberalization and the abandonment of output planning and controls.

2.2 The energy sector has a crucial role to play is this process. The Government is committed to ensuring energy is produced and sold at efficient price and output levels and allowing restructuring of the constituent enterprises within the sector in pursuit of the goal.

2.3 It is recognized that where markets are likely to fail to reflect fully the cost and benefits of economic activity, then explicit public intervention will be required. In the energy sector this means that environmental costs of burning fossil fuels should be brought within the decision making framework.

2.4 The linkages between the macroeconomic policies and the energy sector are shown in Table II-1. Efficient resource allocation in the economy at large will be crucially dependent on achieving efficient supplies of energy, with different sources priced to reflect their relative opportunity costs. However, achieving these price levels for energy must be done considering the Government's anti-inflation policy —the migration to "border prices" for energy must be carefully managed.

Table II-1: Macroeconomic and Energy Sector Linkages in Restructuring

MACROECONOMIC OBJECTIVES	ENERGY SECTOR OBJECTIVES
Promote an efficient resource allocation in the economy based on competitive prices and competitive behavior.	*Achieve an economic and reliable energy supply.* *Establish and sustain competitive markets wherever possible.*
Reduce price distortions while reducing inflation.	*Achieve investment and operation efficiency by aligning input prices (particularly fuel and capital goods prices) with border prices.* *Achieve efficient energy use through fuel pricing based on opportunity costs with full pass through of input price adjustments.*
Mobilize internal and external financial resources.	*Promote corporate autonomy and financial sufficiency.* *Promote private sector participation and competition.* *Prevent investment shortages and non-economic investments.* *Reduce public sector management and ownership.*
Recognize external costs.	*Ensure that environmental and social costs of power production are reflected in economic decisions.*

2.5 Efficient production and delivery of energy requires a market environment in which enterprises respond to price signals concerning the relative costs of inputs. However external costs must be reflected in pricing and output decisions through some application of the "polluter pays" principle.

2.6 A further issue is that allowing complete financial freedom to enterprises would be incompatible with the protection of consumers from the abuse of natural monopolies, which are a particular feature of the "networks" in the system.

Objectives for the Heating Subsector

2.7 The objectives for restructuring the district heating subsector must reflect the wider goals discussed above. It is also important that they should be consistent with proposals for the restructuring of the electricity sector. These two sectors are closely linked: the heat produced in electricity generation would generally not be used without district heating systems, while the DHEs rely on CHP plant, and the large HOBs located at power station sites, for the bulk of their heat requirements. Thee result is that in the majority of cases there exist single buyer/seller relationships between enterprises in the two subsectors.

2.8 For both subsectors the aims of restructuring are to create a structure, such as to ensure that:

- Enterprises are able to establish prices for their inputs (labor, capital, fuel and bulk heat) and are obliged to set prices for their outputs (heat and electricity) which are efficient in economic terms.
- Existing and potential enterprises are able to attract new sources of capital to augment the resources available from government.
- Consumers are protected from exploitation of the natural monopoly characteristics of networks.
- Enterprises are able to meet environmental standards imposed by the relevant authorities.
- The structures established are capable of further evolution as the enterprises grow and as the energy sector becomes more commercial.

2.9 In addition, there are a number of objectives that are specific to the district heating subsector:

- Production and distribution costs should be minimized where heat is cost competitive with alternative sources of space and water heating.
- The structures must achieve economies of co-ordination between the district heating and electricity subsectors. These may arise both in terms of heat despatch (at peak electricity demand incremental heat production from CHP may have a substantial opportunity cost as compared with heat from HOBs) and in terms of investment.

2.10 For the electricity subsector, where there are relatively few opportunities for alternative fuels, the minimization of costs is also important. The non-storable nature of electricity leads to substantial economies from coordinating generation and from the planning of capacity. These economies lead to the need for a high degree of horizontal co-ordination (e.g. merit order of despatch) and vertical co-ordination (the matching of generating and transmission capacity).

2.11 From the above points it is evident that restructuring the district heating subsector cannot consist merely of establishing a suitable framework for the unfettered operation of competitive forces. There are inherent structural sources of market failure, which have lead to the imposition of public control in various forms in market economies where district heating is used. In addition, in Poland some crucial market forces have yet to develop —notably in the area of capital markets. Divestiture of the entire industry from public ownership at an early stage is not a practical proposition since sufficient private capital has not yet been mobilized, while the enforcement of hard budget constraints through bankruptcy would be unduly disruptive to important elements in the subsector without special continuity provisions.

2.12 Indeed, even if the capital markets were operating effectively, at this stage the DHEs would not offer the prospect of a sound return, given the steps still needed to place the sector on a sound commercial footing. Hence the sale value of DHE assets would be likely to remain below depreciated replacement costs for some time to come.

Evaluation Criteria

2.13 Table II-2 presents the evaluation criteria for the district heating and electricity. Some criteria are common to both while others are specific.

Table II-2: Evaluation Criteria for Restructuring

District Heating Specific	Common	Electricity Specific
Ease of ensuring optimum extension of network	*Effectiveness of hard budget disciplines*	*Preservation of merit order dispatch*
Effectiveness of mechanism for electricity and heat coordination	*Ease of establishing efficient input and output prices*	*Ease of minimizing total system expansion cost*
Flexibility with respect to local circumstances	*Attractiveness of enterprises to lenders*	*Ability to maintain adequate reserve margin*
	Ability to attract new entrants	
	Extent of regulation required	
	Environmental investment capability	

III. STRUCTURAL OPTIONS AND THEIR EVALUATION

3.1 In this Chapter the functions undertaken within the subsector are reviewed and the extent to which these are vertically and horizontally integrated is examined. Four structural models applicable to the subsector are identified and evaluated.

Components of Industry Structure

3.2 As for the electricity sector it is possible to group the specific functions of the DH subsector under the four general headings as shown in Table III-1

Table III-1: Functions of District Heating Subsector

Economic Stages	*Functions*
Production	• *purchase of fuel from a number of sources in competition with other sectors;* • *planning, operating and maintaining the heat production plant;* • *sale of heat to transmission and distribution enterprises in parallel with other producers;* • *for CHP plant, the sale of power to the electricity grid.*
Transmission	• *purchase of heat from a number of sources;* • *planning, operating and maintaining an integrated bulk heat supply system (assuming the regulation and control equipment is installed which makes open network operation possible);* • *sale of heat to a limited number of distributors and large customers;*
Distribution	• *purchase of heat from the transmission grid and other sources;* • *planning, operating and maintaining the extensive network for heat supply;* • *sale of heat to a large number of consumers.*
Consumption	• *purchase of heat from a distributor;* • *operating and maintaining the consumer sub-station;* • *operating the hot water distribution network within a building;* • *operating radiators and associated control equipment.*

3.3 Although these four activities can be separate they often overlap. Transmission and distribution may also produce heat from their own HOB plants, which may be embedded within the distribution system and operated as peaking plants. Producers may also carry out distribution functions, either by "wheeling" heat through the transmission and distribution networks or by supplying them via their own distribution system.

3.4 The most efficient, lowest costs, heating systems require the coordinated development, operation and control of all elements of the system. This co-ordination can be achieved through common ownership or through appropriate price mechanisms and contractual arrangements.

3.5 Before going on to discuss possible models of structure it is useful to describe the existing situation:

Extent of Vertical Integration

3.6 At present all the enterprises operate a number of isolated networks for which all the functions are vertically integrated within the DHE. However, the degree of vertical integration for the DHE's main network is primarily determined by the size of the DHE. With large or medium sized networks the heat production is separated from transmission, while transmission is often integrated with distribution. For smaller networks the three stages are usually integrated.

Extent of Horizontal Integration

3.7 Within their geographical area of operation, DHEs exhibit a high degree of horizontal integration, controlling a number of separate networks. While this can provide some economies of scale (e.g. workshops, laboratories) it can disguise network inefficiency and encourage cross-subsidization.

3.8 Four broad structural models are considered. These are intended to apply at the system level, i.e. they are local in character rather than national. Horizontal integration of separate systems is discussed in Chapter 4.

Model DH1

3.9 This is a fully vertically integrated (production, transmission and distribution within a single company). This model is used in West Germany, in Sweden and Finland, and it represents the most common model for the smaller DHEs in Poland.

Model DH2

3.10 This has vertical integration between production and transmission, but with separate distribution companies. This is relevant if the heat production unit wants to connect more plants (e.g. CHP units) to one common carrier to obtain better plant utilization.

Model DH3

3.11 This has vertical integration between transmission and distribution but with separate production companies. This model is used in the large district heating scheme at Aarhus in Denmark. It is also the model which applies most often to the main networks of the Polish DHEs.

Model DH4

3.12 This is the fully disaggregated model. It is used by the large district heating scheme in the greater Copenhagen area.

3.13 Models DH2, DH3 and DH4 presuppose a hydraulically integrated heat transmission system which permits the dispatch of the heat load from the lowest cost source. Such open networks at present exist only in Poznan and Lublin. Investment would be required on other DHE systems to remove the technical constraints to open network operation where economically justified and where implementation of one of the disaggregated models appears justified.

3.14 The wide diversity of DHEs in Poland does not lend itself to the adoption of a single structural model and with this in mind the four models have been evaluated on the nine criteria given in 3.13, for each of the three categories of enterprise discussed in 2.3. Points on a scale 0, 1 or 2 have been assigned in each case. Although this simple ranking procedure does not attempt to balance the evaluation criteria on anything but a scale of equal importance, the separate evaluation for the three categories of plant does allow the relative weights to vary by circumstance. The sum of the points over the nine criteria are shown for each model structure and by category in Table III-2 (18 points being the maximum).

Table III-2: Summary Evaluation of Models by Category Type

	Cat. A	*Cat. B*	*Cat. C*
Model DH1	*5*	*6*	*10*
Model DH2	*10*	*11*	*8*
Model DH3	*10*	*12*	*8*
Model DH4	*16*	*13*	*5*

Category A Enterprises

3.15 For large systems (i.e. those in Katowice, Warsaw and Krakow) a fully vertically disaggregated structure scores highest. The formation of a transmission company purchasing from a variety of sources and selling to a single distribution company or to several smaller companies has the following advantages over more aggregated structures:

- Hard budget disciplines are more effective when production, transmission and distribution are linked commercially, pricing is transparent and no single company is very large.
- Separation leads to a desire to minimize the costs of purchasing inputs, thereby promoting merit order dispatch of heat plant.
- The transmission company can be given control of capacity planning and so can minimize the cost of new capacity by inviting competitive bids and by optimizing the use of CHP and heat storage.

3.16 While this model is most appropriate for the large systems it does have some important disadvantages, liked primarily to the problems of implementation:

- Extensive investment would be required for most systems to establish an open, hydraulically integrated transmission network, heat dispatching system and metering facilities.
- Disaggregation of large DHEs into separate companies would create additional demands for scarce management skills.

Category B Enterprises

3.17 Model DH4 has a slightly better score than for models DH2 and DH3, and could be favored in the long term. However it does not appear to be the most appropriate structure initially for the following reasons:

- The extent of the transmission network for these enterprises is limited and any transmission company would have a narrow asset base making it difficult to raise capital for refurbishment;

- Many medium sized enterprises are dependent on a single producer with little scope for competition in production.

3.18 Accordingly the most favored structure is DH3, which is in fact the commonest structure at present for this category. The enterprise is sufficiently large to negotiate efficient prices and to raise capital, and should the system expand in the future then transmission and distribution could be disaggregated.

Category C Enterprises

3.19 The more integrated models, DH1 and DH2, score highest for small systems. Given the size of these enterprises more disaggregated structures would limit their ability to attract capital and to negotiate efficient input prices. Enterprises operating small networks are currently fully integrated. Whilst some competition in production would be desirable, the scope for new entrants is very limited.

3.20 Selection of the appropriate structural model for and particular enterprise cannot be undertaken without a more detailed assessment which looks at local issues and technical constraints.

IV. DEVELOPMENT OF RECOMMENDED STRUCTURE

4.1 The broad structural options have been addressed in Chapter 3, but a number of more detailed issues remain to be discussed in this Chapter. Figure IV-1 presents the recommended structure of the district heating subsector.

The Number of DHEs and the Scope of Activities

4.2 The operational area of a DHE may be either a voivod, a district (several gminas) or a municipality. Most of the larger DHEs have a main network, often connected to a CHP/HOB plant, and several smaller networks supplied by the DHEs own HOB plant. These considerations raise the issue of the number and size of DHEs in a restructured industry.

4.3 There are two important reasons for DHEs not to become too small:

- Enterprises need to become sufficiently large to capture economies of scale —these may arise in terms of workshop facilities, network repair and maintenance, fuel procurement and access to expertise. Small networks with sales less than (say) one million GJ/pa may lose economies of scale, although such losses could be partially offset by sub-contracting.

- Enterprises need to be of sufficient size to be financially viable in a "hard budget" environment. This means having a reasonably diversified market and avoiding heavy dependence on a narrow asset base.

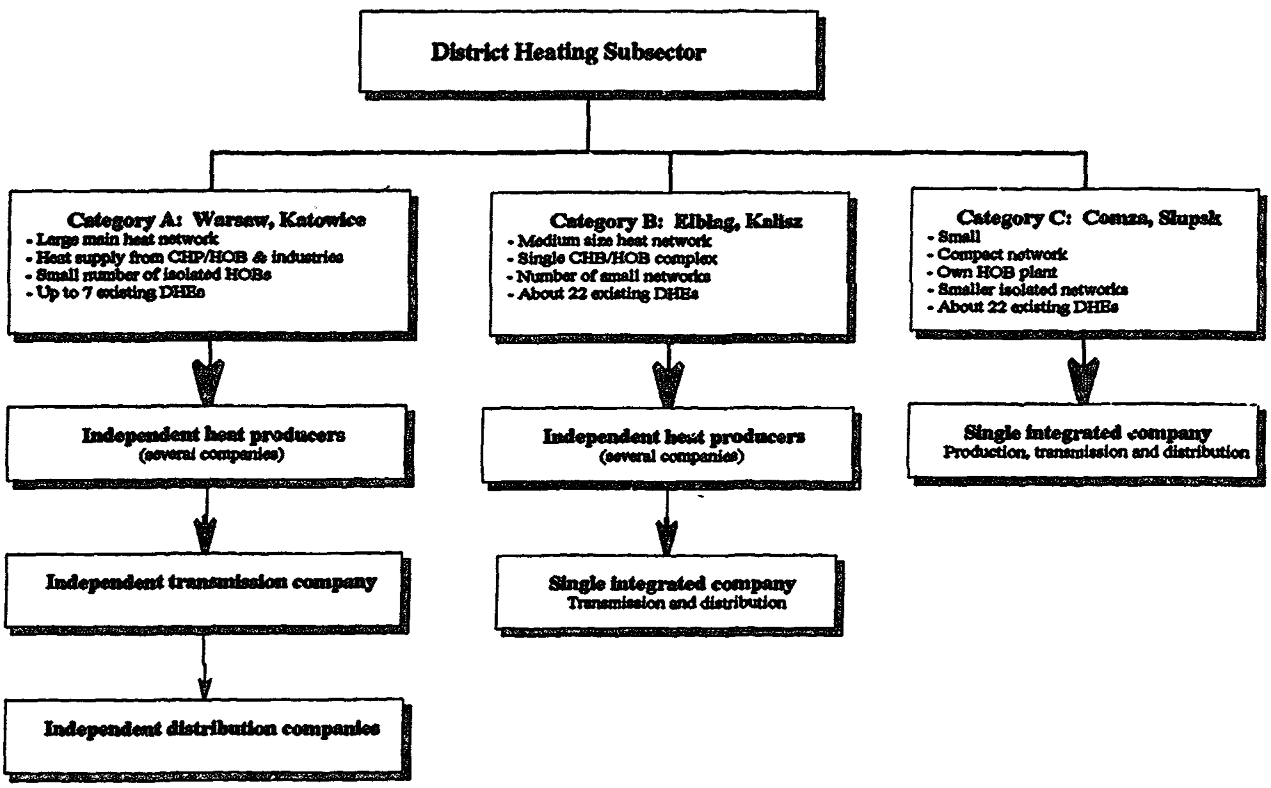

Figure IV-1: Recommended Structure of District Heating

4.4 There are also important reasons for not allowing DHEs to become to large and for giving each substantial network a corporate identity:

- smaller DHEs are likely to be more responsive to local needs:
- there will be less danger of cross-subsidization;
- smaller DHEs will be more exposed to hard budget disciplines and will be less likely to become bureaucratic.

On balance the arguments appear to favor relatively small DHEs —it does not appear necessary that a DHE must cover a whole voivod in order to capture economies of scale and to be financially viable.

4.5 The scope of activities for an individual DHE will depend on which of the broad structural models is adopted. However, in addition to responsibilities for their heat networks, most DHEs also own and operate local boilers dedicated to the supply of small groups or single consumers. It is possible that local boilers of this sort could be run more efficiently by those responsible for the management of the buildings they supply. They would be assisted by independent boiler maintenance companies, thus allowing the DHEs to focus their resources on their main business.

Role of the National District Heating Organizations

4.6 In the past the similarity of technical and administrative problems facing the DHEs has led to the formation of national bodies serving the whole or a large part of the subsector:

- the National Board of District Heating —a small subscription funded body, to which all DHEs belong, which advises the MGPiB, gives technical assistance to its members and acts as a focal point for international relations;
- the District Heating Research Organization —a general research and development organization funded primarily by the Warsaw SPEC;
- the District Heating Union —a subscription funded body, to which 20 small DHEs belong, which carries out specific research projects.

It appears that the organization of the subsector at national level is too weak, primarily because of lack of resources.

4.7 A national district heating association could perform a number of important functions for its members:

- development and harmonization of technical standards;
- technical research and dissemination of information;
- compilation of statistics for the whole subsector;
- provision of a single point of contact for relations with the central government;

- co-ordination of international relationships.

The association could be controlled by a board elected by its members and staffed primarily by people seconded from DHEs for a limited number of years. Given the initial shortage of resources it might be necessary for the government to inject some funds into the establishment of any such organization.

Legal Status and Ownership of the DHEs

4.8 The recent laws on local government transfer responsibility for the provision of heat from the voivods to the gminas, once this is requested by the gminas concerned. The law does allow the gminas considerable discretion over how these responsibilities should be discharged. From experience in Poland and in other European states with similar systems (notably Belgium) it appears that there are several ownership options for the assets currently held for the state by the voivods:

- retaining the status quo;
- transferring the assets to individual gminas;
- forming intercommunal bodies to own and operate the DHE assets;
- sale (under privatization law) of the assets to joint stock companies with the shares held either by the gminas singly or together with other investors.

4.9 The first option is suitable only for a temporary period until there is a transfer of ownership from the central government, while the second option will be suitable only where the network lies wholly within the boundary of a single gmina (which is rare). In addition direct ownership carries the risk of cross-subsidization between district heating and other local community activities. The corporate form of the third ownership has considerable advantages over the intercommunal form (fourth option), which suffers from similar problems to the second option.

4.10 Although the intercommunal bodies envisaged by the legislation on local government should not own or operate the DHE assets, they will have formal responsibility for the provision of heating and hot water in the member gminas. This can be done by the intercommunal bodies licensing the joint stock companies to supply the required services and then regulating their activities.

4.11 Assuming that option (d) is carried out, it will be essential to provide the correct financial incentives by the implementation of "hard budgets" and the rewards for the effective use of capital resources. This implies:

- reflecting the true costs of the capital employed in the value placed on assets;
- ensuring the DHEs provide market based returns to this capital;
- subjecting the companies to the normal disciplines of the Commercial Code;
- subject to license conditions, allowing the owners to determine corporate policy

The supervisory boards of the DH companies would be responsible to the shareholders, who would judge performance primarily in terms of reported financial results. Funding should be secured solely on the companies' asset base and cash flow and without explicit government guarantees.

4.12 The final aspect to be decided is that of share-ownership. Experience in other countries suggests that, although public sector ownership can attain corporate efficiency, private sector ownership makes the imposition of financial disciplines more certain and reduces the risk of political intervention.

4.13 With limited funds available from private investors only the largest DHEs are likely to be able to attract private shareholders in the initial stages and so the majority are likely to remain in public sector ownership in the short term. However, if the responsible gminas so decided, it would be possible to entrust the running of the district heating system to the private sector under a management contract (as is the case in the UK and France for boiler plant owned by local government).

Legal Status and Ownership of Major CHP/HOB Plant

4.14 All major CHP/HOB and large HOB plant is owned and operated by enterprises which were formerly part of WEWB. The CHP/HOB stations comprise both cogeneration plant producing heat and power, and heat only boilers. The HOBs are used to meet peak load which cannot be met by CHP plant. Heat is sold to the local DHE and, in some cases, direct to industrial consumers. The plants are typically the primary source of heat on each DHE's main district heating plant. The 16 major HOBs are owned by power sector enterprises and sell heat to local DHEs.

4.15 The bulk of the plant is owned by CHP generating enterprises which each own several CHP/HOB stations and one or more large HOB stations. A few are owned by generating enterprises whose major assets are large power stations producing electricity, and a somewhat larger number by distribution enterprises (ZEs). There appear to be four main ownership options for these stations:

- remaining within separate enterprises specializing in the operation of this type of plant;
- becoming part of generating enterprises whose main role is to produce electricity;
- becoming part of the electricity distribution companies;
- becoming part of the DHEs.

4.16 As with the district heating subsector itself, no single solution appears to be best for all circumstances. The best solution is likely to depend on the size of the assets and on other local factors. However, it does appear that no company dependent on a single asset, such as a CHP/HOB or HOB station, is likely to be financially viable, and therefore it follows that each station should belong to a larger entity of some sort.

4.17 For those systems where the disaggregated district heating model (DH4) is likely to be appropriate the CHP/HOB and HOB stations should remain separate from the heat transmission and distribution companies —they would be held within separate companies selling their output to heat and power subsectors but not belonging wholly to either of them.

4.18 For smaller DH systems where retention of a vertically integrated structure is indicated, the independent CHP/HOB enterprises should be owned either by the DHE or by a local generating company, depending largely on the relative importance of its heat and power outputs. Vertically integrated DHEs could also acquire CHP/HOB stations from local distribution companies (ZEs), but where a more disaggregated DHE structure persists then the ZEs could hold on to the heating/power plant.

4.19 As regards the legal status of enterprises operating CHP/HOB plant, the arguments run parallel to those for DHEs. Joint stock companies should be formed, and where CHP/HOB plant is transferred to DHEs there should be a separate company formed in order to avoid the dangers of cross subsidization. The options for ultimate share ownership would also be similar to those for the DHEs.

Implications for the Financial Structure of DHEs

4.20 Historically, individual enterprises have had little input to the determination of the financial structures under which they operated. With the exception of commercial debt, all key financing decisions were taken by the central government or by the voivod.

4.21 The accounting information which has hitherto been compiled is in a form designed to ensure systematic and accurate data collection rather than to facilitate their use as a management tool. However the financial structure for two DHEs has been analyzed on Western lines. Even allowing for the fact that asset values are not correctly reflected in the data certain conclusions can be drawn:

- The enterprises had sound long term funding and liquidity positions, although this may have been in part due to the method of financing.
- There is a substantial variation in profitability caused by the substantial diversity in cost bases, including variations in heat sources, conditions of the network and variations in customer densities.
- Despite established procedures for debt recovery, working capital control could be much improved, and the credit effectively given to customers is to a substantial extent funded by delayed payment to creditors.
- Gearing is likely to be negligible, so that operating in a commercial environment they would have substantial unutilized borrowing capacity.

Equity and Equity Reserves

4.22 For state enterprises, the equivalent of capital and reserves are the "capital funds", which are shown as sources of finance in the balance sheet. Formerly, there were a large number of such funds, but since 1989 most state enterprises have reduced the types of fund in the balance sheet to the following:

- statutory fund — intended to represent the state's contribution to the enterprise;
- enterprise fund — intended to represent the internally generated reserves;
- fund for social obligations — to pay for housing and other staff benefits;

- reserves — retained profits not transferred to any other reserve.

Should a joint stock company be created from a state enterprise, then these funds would be transferred to the new company.

Financing, Investments and Working Capital

4.23 To date, capital expenditure has been financed in three ways:

- Major investment, particularly in CHP, has been largely financed by central government. Asset values were credited to the statutory fund on completion.
- Other large investment in DHEs (such as network extension) were funded by the voivods, with asset values credited to the enterprise fund.
- More minor expenditures (refurbishment and repair) were internally financed, with asset values credited to the enterprise fund.

It has rarely been necessary to resort to commercial borrowing and so there is little long term debt outstanding. Operational expenditures and working capital are also largely internally funded although some commercial "operational" loans have been taken to cover short term cash deficits.

Revaluation

4.24 Periodic asset revaluations have been made in order to maintain asset values in the inflationary environment. Contrary to International Accounting Standards (IAS) practice (which specifies that revaluation surpluses should be credited to a separate revaluation reserve), surpluses on fixed asset and stock revaluations have been added to the existing statutory and enterprise funds. This has significantly increased the value of these funds.

Subsidies

4.25 The cost of district heating to domestic premises is directly and heavily subsidized. The subsidies are channeled from Government to the housing corporations, who are the DHEs' main customers for heat. In addition, the DHEs also receive direct subsidies for small quantities of heat provided directly to domestic premises. In addition there are a number of indirect subsidies:

- income tax holidays granted to enterprises in the past;
- DHEs have not paid a "dividend" or other direct return to the central government or voivod for funds;
- revaluations have not kept pace with inflation, so that depreciation costs have been based on undervalued assets.

Financial Structures for New Companies

4.26 On the creation of the joint stock company, the various funds of the state enterprise would be combined to form the equity capital. This would be split between share capital and reserves in a proportion appropriate to the case. Shares would thus be created for potential sale out of the equity capital. It would be necessary to revalue the assets prior to the formation of the company. Also, since debt represents a very small fraction of total capital, the Government has the option of injecting new debt into the enterprises. Before deciding on this it would be essential to prepare financial projections to demonstrate whether a company could service both debt and equity, as well as finance a reasonable proportion of its investment from internal funds.

Sources of Finance for Companies

4.27 Securing adequate investment funds will be one of the greatest challenges for the new companies. Without Government guarantees, commercial banks may be willing to lend for periods of up to 10 years but at present the cash flow of most enterprises in the heating subsector is not strong enough to service significant debt over a relatively short period compared with the life of the investment. This position should improve as heat prices rise. Measures such as accelerated depreciation allowances (not at present used in Poland) would help with the financing of such projects.

Financial Objectives

4.28 The key objectives are those which relate to the profitability of the firms. These include:

- adequate margins of revenue over costs at different levels of the business;
- adequate returns on capital employed;
- an adequate generation of internal cash flow to permit some self-financed investment.

4.29 While restructuring is taking place, over (say) a 4 year period, it would not be expected that the DHES would necessarily pay dividends. However, if privatization is to be pursued, DHEs will need to offer a competitive dividend yield on their equity and to ensure that dividend growth offers full protection against inflation. As a low risk utility investment, the dividend yield would be expected to offer only a small premium on real free market interest rates (allowing for differences in tax treatment).

4.30 In addition to profitability objectives, the DHEs will need to establish separate financial targets for the management of working capital, especially for debtor days (average collection period), for debt service cover and for gearing.

V. REGULATORY FRAMEWORK

5.1 The district heating subsector in Poland possesses a number of features which make the effective operation of market forces unlikely and hence necessitate appropriate regulation of some aspects of commercial activity. These features include:

- the natural monopoly characteristics of the heating networks and the monopoly/monopsony relationships which exist between the DHEs and the CHP and HOB stations;
- the high costs of heat storage which leads to the economies of transmission and distribution networks;
- the external costs imposed on the environment particularly by coal fired CHP and HOB plant.

The limited competition envisaged in the restructuring envisaged implies the preservation of a series of local monopolies so that a degree of regulation would be needed.

5.2 Given the present and likely future large number of DHEs organized at local level and the specific assignment of responsibility for the subsector to the gminas under Local Government legislation, it is likely that decentralized regulation is appropriate. However local regulation does have certain dangers:

- potential adoption of local policies at variance with policies at the national level or elsewhere in the subsector;
- politization of regulatory policy, leading to uneconomic practices such as cross-subsidization of particular consumers.

There will also be a need to pool scarce specialist technical and economic skills required to facilitate regulation and to capture the benefits of co-operation between the various local regulatory bodies. This suggests that there will be a need for a complementary, coordinating entity at national level.

5.3 The primary regulatory authorities could be elements of the new intercommunal bodies foreshadowed in the Local Government legislation of 1990. Each would be delegated regulatory power and responsibility for its area by the gminas which comprise the group. The bodies would have a small number of permanent professional staff.

5.4 Gminas would be separately represented as shareholders of the joint stock heating companies at these companies' general meetings. Hence gminas could buy and sell shares in the local heating companies.

5.5 The intercommunal regulatory bodies would need the support of a national body of expertise to discharge their functions properly. This expertise would be operational/technical and economic in nature. The central advisory entity could discharge the following functions:

- it would act as the focus for the collection, analysis and dissemination of information relating to the performance of companies in the subsector. This would provide a basis from which intercommunal regulators could administer "yardstick competition" by comparing the performance of the companies under their supervision with those of similar companies in the subsector.

- It would provide a pool of specialist skills available to local regulators. These centrally based specialists could, for example, prepare and monitor standard forms of license for heating companies and advise on prices, performance criteria and other specific provisions for individual licenses.

5.6 This advisory body would best function as a unit of a regulatory agency responsible for monitoring the national electricity and gas networks, for which it has also been recommended that there should be similar agencies. Such a central body would not have enforcement powers, which would be exercised solely at a local level. It would instead maintain a central role in promulgating the principles of regulation.

5.7 The main instruments of regulation in the subsector would be the licenses issued by the Intercommunal Regulatory Bodies to the joint stock companies operating in the subsector. These would convey the right to undertake specific operations (e.g. transmission, heat production, distribution, customer supply) in a defined area for specified period of time (probably at least ten to fifteen years) subject to conditions. The regulator's primary activity would be to establish these conditions and to ensure compliance. License terms would be varied depending on the type of activity.

5.8 The Ministry of Environmental Protection and Natural Resources would have a distinct and separate role to play in the environmental regulation of the subsector. The Ministry would continue to set environmental standards (notably for emissions) and the rate of fees/penalties at a national level, with the administration of these standards, the collection of fees/penalties and adjustments to reflect particular conditions delegated to the local level.

5.9 The structure proposed, which separates the gminas' roles as owners and regulators, could best be reinforced by the Intercommunal Regulatory Bodies (IRB) not owning heating company or CHP assets directly, and by ensuring that there is different effective control of the IRB than of the companies. For example, a two thirds majority voting provision in the intercommunal assembly of gminas covered by the IRB, compared to simple majority voting in the shareholders' meetings for heating companies, could provide a check on a dominant gmina applying pressure (as a shareholder) on a heating company to cross-subsidize consumers in its own area.

Regulation of Heating Companies

5.10 The primary instrument of regulation would be the license required by network operators. Companies producing and selling heating heat to particular customers via specific infrastructure (e.g. adjoining factories) would not require a license. . Heat sales to the network by producers with capacity below a predetermined level (e.g. 10 or 20 MW) could also be exempt from license arrangements.

5.11 The license would confer on the network operator the sole right to operate a heat distribution network within a specific operational area for a defined period of time —at least ten to fifteen years. In the longer term the license would probably need to be valid for a comparable period to the average lives of network assets (say twenty five years) in order to avoid unnecessary distortions in investments. However, given the significant changes anticipated in the subsector within the more immediate future, initial licenses could be subject to review after ten years in order to allow for the opportunity for re-licensing to reflect structural changes in the industry (e.g. merger or disaggregation of networks).

Integrated Heating Companies

5.12 Other than the key provisions for the regulation of price levels, the conditions would include:

- a requirement to keep separate accounts for heat production, trading, transmission/ distribution and supply —cross subsidies would be prohibited;
- a requirement to furnish operational and financial data at periodic intervals and on request;
- an economic supply obligation, requiring the company to purchase/produce and distribute at least cost; prices for external sources of heat would be related to the avoided costs of internal production; the company would be obliged to contract for external supplies if this implied a cost reduction;
- an obligation to ensure the security and adequacy of supplies within the franchise area, by contracting for sufficient production capacity and by providing sufficient distribution capacity, except for customers with abnormal connection or supply requirements;
- an obligation to draw up and maintain (in consultation with the IRB) a technical code governing connections to, and operation of, the company's network;
- an obligation to prepare and publish (following IRB approval) a code of practice governing supply relationships with customers;
- the preparation and publication of tariffs which should be non-discriminatory, cost based and should identify the separate cost components; and
- a requirement to make a financial contribution to the funding of the IRB and the National Heat Advisory Board.

It may also be appropriate to include a provision requiring IRB approval for major changes to network or service coverage.

5.13 The IRB is expected to monitor the heating companies' operational and financial performance. The criteria, which could be established in the license, might include:

- number and duration of service interruptions;
- supply pressures and temperatures in relation to ambient temperatures, including maximum return temperatures to CHP plant;
- elapsed time between the reporting of faults and visits to premises by staff;
- levels of accuracy for metering;

- adherence to times for regular servicing;
- unit costs of purchased heat, produced heat, losses and distribution.

5.14 Since there is likely to be little scope for competitive supplies of heat using common carriage over a single distribution network, the bulk heat cost and distribution elements of the final heating tariffs should be regulated directly. For the case of district heating in Poland, a price based regulatory mechanism is likely to be the most appropriate form for several reasons:

- intrusive regulation, with detailed price formulation by the IRB, would run counter to the prevailing market based philosophy of economic management;
- the new companies should have the discipline of regulated revenues, rather than a cost plus environment; and
- for simplicity of operation and of administration by the IRB.

For major items of capital expenditure, which can be "lumpy" and unpredictable, rather than allow for these in setting the price control formula, it may be better to charge for them on a conventional rate of return basis. The categories of such expenditure could be specified in the license.

5.15 Because of the separate regulation of bulk heat and network components, the price control formulae in each license should recognize:

- The initial costs of different companies will not be comparable because of the wide variation in network characteristics and heat sources. The starting price levels in the formulae would thus be company specific.
- The factors affecting heat production and distribution costs are quite different, implying that for integrated companies ere would need to be two distinct components.
- In each case, the price control formula would make reference to external cost factors to achieve efficiency.

For the distribution/supply element, a simple reference to an external index of price inflation is likely to suffice, with the inclusion of an "X" factor to reflect anticipated real savings in costs over time. The bulk heating element is likely to require separate treatment since the movements in relevant costs (coal, rail transport etc.) may not be related to general inflation. A weighted average of these factors could be used, but allowing for the uniqueness of some companies' heat supply arrangements may mean that some direct pass through of the companies' own costs has to be permitted in the regulatory formula.

Transmission Companies

5.16 The licenses issued to the transmission companies for the large cities will need to differ in several respects because of the nature of the business:

- As the transmission company should function in a neutral 'broker' role in purchasing bulk heat, it should be limited as to the extent to which it can own boiler capacity; such capacity should be held in a subsidiary with separate accounts;

- There should be separate accounts for the heat trading business and for the ownership and operation of the transmission network: separate accounts would be submitted to the local IRB.

Other conditions would be similar to those for integrated companies. Operational data would be reported to the IRB for monitoring purposes. The performance criteria would reflect the nature of the business and would place greater reliance on system reliability and less on response to individual customer requests. There would be obligations to maintain secure supplies and to procure heat at least cost, as with the integrated companies.

5.17 As discussed in more detail below, transmission companies should be required to sell bulk heat to all consumers at a single, published Bulk Supply Tariff (BST), which pools the costs of heat production in the area and passes benefits on equally to all consumers in the area. The level of the BST should be subject to the same method of price control as that suggested for the integrated companies.

Heat Distribution Companies

5.18 Heat distribution companies purchasing bulk heat at a BST from a transmission company in a large city would, in terms of economic regulation, be very similar to integrated companies purchasing heat from external sources such as CHP enterprises. In both cases the regulatory environment should permit the network operator to own and operate its own production capacity when this was cost effective (with the BST as the applicable reference point for a distribution company). The licenses of the distribution companies would thus be very similar to those for the integrated companies. The main differences would relate to the technical interfaces between the transmission and distribution networks and the impact of the distribution company on the system capacity requirements. Licenses might require submission of demand forecasts (say up to 10 years ahead) to transmission companies, which would complement the commercial mechanisms of long term contracts.

VI. OPERATIONAL EFFICIENCY AND INVESTMENT

6.1 There are a number of issues which relate to the operational efficiency of network operation and the investment requirements of the DHEs.

Operating Procedures and Heat Despatchability

6.2 Polish DH networks are designed to operate at constant volume. In some cases the flow is regulated twice a year, namely at the start of the heating season and at the end. Water flow during the summer is approximately 80% of the winter flow. Variations in heat load are met by temperature adjustments of the supply pipe out of the heating plant based on outdoor temperatures. The supply temperature is normally varied between 80 to 130°C. The return temperature is generally between 55 and 70°C. Such a system operates satisfactorily provided that the hydraulic characteristics of the network remain constant.

6.3 The present design of the DH system, with one heating plant located on the center of the DH network, is typical for small scale systems. The major advantages of this structure are its simple operation and the fact that it can be operated from one location by simple means. However, this simple system has also some disadvantages:

- Lack of supply safety (vulnerable to pipeline breakdown);
- Large pipe diameters (hydraulic capacity of each pipeline correspond to maximum heat capacity demand in the area through the pipe);
- High power consumption for the circulation of DH water.

These disadvantages grow with the increase in size of the DH system and, therefore, large DH systems often have a number of different heat production units located throughout the network. Because it is impractical to alter the characteristic when an HOB plant (for example) is brought in line to supplement CHP output, most large networks are operated as separate islands supplied with heat from dedicated CHP and HOB plants.

6.4 The inflexibility of network operation and the consequent need to associate each local network with specific plants, results in sub-optimal use of co-generation facilities by CHP enterprises and hence higher heat purchase costs for DHEs. With the present system for pumping electricity consumption in a system designed and operated at constant flow is significantly higher than for a system based on variable flow.

6.5 Changing from constant flow to variable flow will lead to considerable savings in the main pumps. From DH projects carried from the World Bank in poland, calculations show that a 60% reduction can be obtained, in case the pumps are operated according to the lowest differential pressure giving sufficient heat supply at all substations. It is possible to convert the Polish DH network to variable volume operation, bringing significant benefits to the DHEs:

- it would enable CHP enterprises to maximize co-generated electricity production;
- it could improve the efficiency of co-generation turbines through the lower return water temperatures;

- it would reduce DH pumping power requirements (an auxiliary load) which would release electricity for sale; and

- it would reduce heat losses in the distribution network.

6.6 The direct financial benefits to the DHEs would be relatively small as compared to those accruing to the operator of the CHP plants. It would, therefore, be necessary to ensure that contractual arrangements are such that the DH operator will receive a return sufficient to cover the investment required to convert to variable volume operation.

6.7 Conversion would require considerable investment in new controls throughout the network from consumer sub-stations to DH circulation pumps. Investment could take place in the following steps:

- providing sub-stations with control valves to shut off supply when demand is satisfied;

- installing valves at sub-stations and other network flow control points to ensure that pressure differentials across control valves remain constant under all flow conditions;

- installing variable speed drives on DH pumps (where networks are supplied by CHP/HOB plant, it is the latter enterprise which owns the pumps and which would be responsible for the new investment); and

- integrate hydraulically the converted heat islands to form a true heat network able to be supplied from a number of sources.

For some systems it may be more appropriate to link separate heat islands with transmission mains as a first step, leaving the islands as constant volume systems.

6.8 In a DH system, based on variable flow with a changed supply strategy, the consumer installation can be operated at a lower differential pressure in the network. In other words it is possible to connect more consumers to the system without interrupting the heat supply and the operation of other consumer installations. These changes also make it possible to operate various heat sources in the system at peak hours, when and where needed. These could be situated at strategic points in the network in order to increase the total system capacity. The possibility of choosing different heat sources —load dispatching— means that the total cost of heat production will decrease.

Network Rehabilitation

6.9 The district heating networks are in urgent need of rehabilitation related to:

- external corrosion of the heat mains;

- high heat losses due to increased water losses and poor mains insulation;

- internal make-up water requirements which lead to a level where treatment is impractical, leading to internal corrosion and further reduction in reliability.

In Poland, heat distribution mains are laid in underground concrete ducts where they are insulated in-situ. This system, which has been superseded in Western Europe, is expensive to install and requires heavy maintenance expenditure.

6.10 In the West the solution to poor reliability has been to develop a piping system which incorporates an insulating layer bonded to the steel carrier pipe, which is protected by an outer plastic pipe. Such a construction can be buried directly in the ground and is known as a pre-insulated piping system. The reliability of such systems is dependent on the quality of the insulation but service lives in excess of 25 years and with very low failure rates per km can be obtained. The greater reliability and reduction in heat and water losses may justify investment in new pre-insulated mains ahead of their replacement time due to failure.

6.11 The poor reliability of the heat mains causes excessive water losses. As the DHEs pay for make-up water and its treatment as part of their heat purchase agreements with CHP enterprises, it is in their interest to reduce water losses to a minimum.

6.12 Internal corrosion is caused by inadequate treatment of system and make-up water. Treatment consists of base exchange to reduce hardness, de-aeration and pH correction. Water returned below the contracted quality is treated as not returned and the DHE is charged for the extra make-up water. In general the large volumes of make-up water required make it impractical to dose with corrosion inhibiting chemicals. Chemical dosing will be practical only when make-up volumes are reduced by cutting down on leakage. This can be achieved by utilizing pre-insulated pipes and replacing fittings with modern (imported) equivalents.

Improvements on Consumer Premises

6.13 The heating system downstream of the sub-station, comprising the internal heat distribution pipework, pumps, heat emitters and controls, is usually the property of the building owner, although it is often maintained by the DHE. Individual control of heat consumption is generally limited to the use of manual radiator valves. Radiator valves, pumps and pipe joints are all sources of leaks which add to the problems of internal corrosion. The life of the heating systems are as low as 5-6 years in some DHEs —whereas the typical life in the West would be at least 15 years.

6.14 Since the DHE does not own the heating system inside the building it has little incentive to invest in improving its operational efficiency. In this situation, installing heat meters and setting cost reflective heat tariffs is likely to be the best way of persuading building owners and their tenants to improve their heating systems.

Bulk Heat Metering

6.15 The metering of heat transactions on Polish networks is very limited. Only a small proportion of consumers, have heat meters. Thus, although heat transactions and prices are quoted in terms of heat units, the actual quantity of heat delivered is in most circumstances an estimate.

6.16 It would not be cost effective to install true heat metering in individual domestic premises, particularly as the ability of consumers to control their heat consumption is at present very limited. All heat transactions between producers, transmission/distribution companies and large consumers should be metered since accurate accounting is a pre-requisite for improving operational efficiency. The costs of installing the metering could be recovered by levying a standing charge to recover costs over the meter's lifetime.

Transfer of Local Boilers

6.17 Most DHEs own and operate a number of small, local boilers supplying individual buildings which are not connected to a major network. The majority of local boilers are fired with coal or coal products and their operational and maintenance costs are high compared with either large coal fired plants (HOBs) or small boilers fired with oil or gas, which have higher combustion efficiencies.

6.18 The operation and maintenance of local boilers diverts resources from the core activity of the DHEs. In consequence, where possible, many DHEs extend their networks to incorporate local boiler loads. Where this has not happened it appears sensible that ownership and responsibility for maintenance should be transferred to the relevant housing co-operative or building owner.

Environmental Impact

6.19 The discussion focuses on atmospheric pollution as it is in this area that action by the DHEs can have most effect —the direct effect of DHE activities on water pollution is considered to be relatively unimportant.

6.20 Coal is the predominant energy source used for district heating. The subsector consumes 24 million tones of coal products, equivalent to some 13% of the country's hard coal production of 1989. Only 3% of the fuel used is oil or gas.

6.21 Given the subsector fuel mix and knowledge of the grades of coal used, total emissions can be estimated as in Table VI-1. These emissions are of even greater significance that the shares in the total would suggest, since many of the plants responsible for them are small, low stack boiler houses located in urban areas where emissions have a disproportionate effect on local air quality.

Table VI-1: Emissions by the District Heating Subsector (Kte p.a.)

	SO_2	NOx	Particulates
Hard coal & briquettes	*404*	*98*	*199*
Lignites and briquettes	*7*	*1*	*2*
Coke	*4*	*2*	
Oil (HFO)	*15*	*3*	
Gas (natural)		*0.1*	
Total	*430*	*104*	*201*
% of total National Emissions	*11%*	*8%*	*10%*

6.22 The Ministry of Environmental Protection and Natural Resources has set targets for air quality improvement that require the reduction of SO_2 emissions by 30%, NOx emissions by 10% and particulates by 50% for the year 2000 relative to 1980. As part of this process, the Environmental Protection Offices of the voivods have revised their emission permits for large plant to provide for the introduction of stricter emission limits for existing and new plant from 1998 —these limits are applicable to co-generation plant and large HOBs. Fees and prices are also to be increased to provide a greater incentive for compliance.

6.23 Abatement measures differ by type of plant so that the main plant types are reviewed separately.

Pulverized Fuel Boilers

6.24 Most modern large CHP and HOB plant are fired with pulverized fuel, which in the case of Poland is generally of poor quality —high sulfur, high ash with a low calorific value. Many boilers of this type will have difficulty in meeting the post-1997 emissions limits. Where particulates are a problem then it is possible to improve the efficiency of the electrostatic precipitators. To reduce SO_2, various flue gas desulphurisation processes can be used, depending on the individual situation. To reduce NOx, low NOx burners could be fitted.

Moving Grate Stokers

6.25 Older, large HOBs are coal fired and have moving grate stokers. Although coal quality is generally better than for pulverized fuel boilers, abatement measures will still be needed. Particulates can again by retrofitting pre-filters upstream of the precipitators, but sulfur removal is likely to be more difficult. Only when the boiler has substantial life left would it be economical to replace the stoker with a fluidized bed combustor while leaving the boiler intact.

Local Boilers

6.26 Emissions from the DHEs local boilers also come under the control of voivod Environmental Protection Offices. The major problems associated with these low stack boilers are particulates and SO_2. Emissions of particulates can readily be reduced by dust collection equipment and it is anticipated that improved maintenance and upgrading of particulates control equipment could produce a reduction in emissions at a modest cost. Where such equipment is not fitted, the greater use of washed coal is likely to be the most efficient method of reducing both particulates and SO_2 emissions. If more significant reductions in emissions are required then the only economic option for the DHEs would be to convert the boilers to run on gas or low sulfur fuel oil, or to connect the building supplied by the boiler to the district heating network.

VII. PRICING AND METERING OF HEAT

7.1 The diverse and disaggregated structure of the heating subsector has led to a number of specific pricing relationships. However, a number of general observations can be made:

- relationships have been generally determined on a cost-plus basis, with the DHEs heat tariffs set to cover only their operating expenses plus a small margin

- explicit and implicit subsidies have been pervasive and distort the basic cost-plus structure. The final price of residential heat has been fixed nationally, with housing co-operatives or DHEs receiving subsidies to cover the difference between this and the calculated prices. Consequently there has been little incentive to minimize calculated residential tariffs;

- as a result the DHEs have reduced incentives to cut supply costs, thus allowing heat producers to negotiate relatively high prices and offering little incentive for efficiency in heat production;

- the prices set by the DHEs have been distorted by the other subsidies affecting the subsector:

    - the subsidized cost of coal,
    - the undervaluation of CHP and HOB assets, implying a subsidy on the capital costs of heat production;
    - the undervaluation of heat transmission and distribution networks and their grant funding, implying the need to make only minimal returns;
    - the uniform cost plus pricing structures have led to significant cross-subsidies between different types of consumer.

7.2 The pricing structures have had some general features common to most localities:

- Prices paid by DHEs for heat typically consist of an energy tariff, although sometimes a two part tariff is negotiated, involving a variable component (covering the energy cost) and a fixed payment (capacity cost) per MW of load. Purchases are generally metered on a volumetric basis.

- DHE tariffs to industrial and commercial customers have generally been estimated.

- DHE "calculated" tariffs for the residential sector have typically involved separate fixed monthly rates per cubic meter of space heated (seven months) and hot water (all year) with occasionally some additional elements. Due to the absence of meters, most consumption is again estimated.

Hence, price structures have tended not to reflect the costs of heat supply, which vary through the year. As most supplies have not been metered, there are few direct price incentives for customers to economize on consumption.

7.3 In general the price systems should:

- provide signals for the efficient use of resources by making prices higher at times of day when heat is more valuable and by rewarding those who cut costs;
- be non-discriminatory;
- provide sufficient revenue to allow companies to be financially viable; and
- meet macro-objectives which cannot be satisfied by other means.

7.4 As regards efficient resource allocation, appropriate signals are provided by prices which reflect the costs imposed by an additional marginal sale. There is a marginal cost associated with the heat consumed and a marginal cost associated with extra production, transmission and distribution capacity needed to meet demand when the system is capacity constrained. In a balanced system this latter cost should equate to the short run costs associated with foregone heat consumption due to system overloading and additional heat losses. The combined energy and capacity impact of a sustained increment in consumption is the long run marginal cost (LRMC).

7.5 Within a competitive environment, the forces of competition will ensure companies set prices at these levels. However, the heating subsector possesses a number of characteristics which necessitate the use of regulated proxies to competitive mechanisms to achieve marginal cost related price levels. Two broad alternatives exist:

- to establish the opportunity costs associated with competing sources to district heat and set prices close to these levels; and
- to build up LRMC from its constituent components.

The two approaches would be equivalent if heat sources had been developed optimally over time. This is not the case in Poland; due to historic price distortions, district heating appears to have developed sub-optimally.

7.6 It appears that the most satisfactory approach will be to use direct measures of LRMC to regulate district heat price levels for the next few year, until networks have adjusted to a more balanced coverage. Where gas, the main rival, appears to be a viable alternative, the LRMC level would have to be "capped" at the cost of the alternative source

7.7 Within this framework, the prices at each commercial interface should reflect the marginal costs at that interface. Thus:

- prices at which heat is purchased should reflect the marginal costs of heat production and of additions to capacity;
- the bulk supply tariff (BST), at which transmission companies sell heat, should reflect for the system as a whole the marginal costs of heat purchase and production and of transmission capacity; and

- retail tariffs to consumers should reflect the BST plus the marginal costs of distribution capacity.

Some adjustments may be required where a clash with financial objectives arises. Prices set to marginal costs might be too low to service debt on past investment or may place a socially unacceptable burden on specific customer categories. In such a case prices should, as far as possible, reflect the structure of marginal costs, although their level may need to be adjusted to meet financial targets.

Heat Purchases

7.8 The structure and levels of heat purchase prices should in principle reflect marginal energy costs at different times of the year and the capacity costs of replacement HOB plant.

7.9 A key regulatory function for the IRBs would be to ensure that their companies operating heating networks did not abuse their monopoly position. To achieve this, it was recommended that under the terms of the license the heating companies would satisfy the IRBs that the prices were indeed cost-reflective. In order to assess this, IRBs would need access to external reference data on standard heat supply costs in various situations. The derivation of these standard cost reference points is discussed in the following paragraphs.

7.10 The appropriate indicators of marginal energy costs will vary according to the specific regime of each network operator. At present the DHEs obtain most of their heat from external producers; much of the heat produced by the DHEs is used to serve isolated networks from small boilers. The remaining production, in small HOBs, is primarily for peaking and network stabilization. It is recommended, however, that heating companies acquire more significant HOB capacity and at the same time divest most of the non-network boilers to the consumers concerned. For the main networks, this will lead to greater choice over whether to produce or purchase their HOB heating requirements. CHP/HOB heat, will continue to be the major source for base load. since the economics of district heating depend crucially on such supplies being made available at lower cost than peaking heat from separate HOB units.

7.11 Against this background, the simple use of a large HOB unit to act as reference point for estimating appropriate LRMC levels for heat purchases is potentially incorrect, in that prices for base load energy which reflected HOB costs would encourage the perpetuation of existing excess dedicated HOB capacity, in preference to more economic CHP. It will be important for the IRB to identify marginal heat producing plant feeding the network at different times of the year.

7.12 The widely different regimes will imply a variety of results —in a minority of cases large dedicated HOB units may be the marginal source of heat at all times. In many other networks, cheaper sources of base-load energy will be already operating at the margin at certain times of the year. Typically these will be CHP/HOB complexes —in such networks, a standard payment rate, based on the marginal costs of CHP production, should be used. Such rates would vary throughout Poland depending on coal transport costs and other plant characteristics.

7.13 These standard "base load" rates would be set at levels designed to encourage efficient CHP operation. The economic purchase obligation placed on heating companies would compel them to contract to purchase and despatch heat in merit preference to more expensive HOB plant. Over time, this should encourage adjustments towards an optimum mix of base load and HOB plant operations in each network.

7.14 These arrangements should be precursors to more direct competitive bidding for heat supplies. This would entail the heat company inviting tenders for heating capacity of a particular type. This should certainly be a preferable arrangement for the larger networks. However, at the present most networks have dominant CHP/HOB suppliers, creating monopoly/monopsony trading relationships which will be eroded only gradually. Indeed, in many smaller networks, the economies of scale of CHP plant may dictate that such bilateral relationships will continue to be appropriate. Thus competitive bidding and standard cost based arrangements will need to be administered in parallel.

7.15 It is also important to encourage the efficient use of heat by the purchasing company. As return water temperatures should be minimized in order to maximize the efficiency of heat production, heat producers could be paid supplements to their energy rates if they received return water at temperature differentials smaller than standard levels —such obligations would be included in the license conditions. Heat producers will need to be equipped with meters at the interface with the network.

Bulk Heat Sales

7.16 Bulk sales by transmission companies should be made on a published bulk supply tariff (BST), which should be differentiated by season to reflect variations in marginal supply costs. As well as the costs of heat production, the BST would need to recover the costs of the transmission network.

7.17 The BST would then comprise:

- capacity elements relating to the marginal capacity costs of heat production and the transmission network —peak energy rate premia may provide the simplest and most appropriate pricing signals for these costs;
- energy elements relating to the marginal costs of heat production and transmission losses (differentiated by season); and
- fixed charges representing the costs associated with specific capacity to service a particular bulk customer (e.g. transmission spurs) and the customer specific cost of metering and administration, and a contribution to any non-marginal financial costs incurred.

The latter costs could include capital charges and overheads incurred by the transmission company in excess of LRMC based costs recovered in capacity charges, but such charges would be closely scrutinized by the regulatory body.

7.18 The existing and likely future LRMC levels for a network should be considered by the IRB when setting the price limit formulae. When there was expected to be increasing excess capacity on a network, as gas supplies replaced district heating, the formulae could include adjustment factors providing for accelerated real reductions in unit prices over the license period.

7.19 The metering arrangements necessary to administer the BST would be quite straightforward, in that thermal meters read at monthly intervals would suffice for energy-only tariffs.

Retail Heat Sales

7.20 For both integrated companies and distribution companies, retail heat tariffs should recover the marginal costs of the distribution network and consumer supply in addition to heat production and transmission costs.

7.21 Efficient retail tariffs would reflect distribution costs in a similar way to transmission costs. Marginal capacity costs of the network would appear as a supplemental energy charge in the periods when sustained incremental heat demand on the network was likely to create additional expenditures. The avoidable costs associated with customer service, plus any allocated non-marginal costs which financial constraints dictated needed to be recovered, would normally appear as a fixed monthly charge.

7.22 However, the effectiveness of retail tariffs lies in their ability to signal costs to the consumers concerned. Metering costs typically preclude complex, disaggregated tariffs and instead simpler proxies must be used to convey the required cost signals. For district heating this difficulty is compounded by the fact that the final consumers of heat (tenants) are not those with whom the heating company has a commercial relationship (landlords and housing co-operatives).

7.23 Against this background it appears that all distribution companies should embark on a program of heat meter installation as soon as possible, commencing with major customers.

7.24 Detailed retail tariff structures would be the responsibility of the distribution companies. There are some points of general applicability:

- tariffs should be published for all consumer types, such that bilaterally negotiated rates above published levels would not be allowed without regulatory approval;
- their form would generally involve monthly differentiated energy rates reflecting differential costs over the year: regular meter readings would then be taken during the year;
- in addition, there would be fixed monthly charges, to recover customer and non-marginal costs.

7.25 Energy tariffs would be common to industrial, commercial and residential users provided they were supplied from a similar distribution network. Differences in sub-station maintenance costs could be reflected in differences in fixed charges.

7.26 Connection charges to new users should be published separately and should be fixed for standard connections.

Transitional Arrangements

7.27 At present there are two types of subsidy to the subsector:

- the direct subsidy of residential tariffs;
- the production and distribution cost subsidies associated with the major inputs of coal and capital.

These subsidies are presently being phased out —the removal of the former does not affect the financial position of the heating companies but is likely to result in a reduction in demand as housing co-operatives respond to the increase in their costs. Only when the input subsidies have been fully removed can prices be properly linked to long run marginal costs. This adds weight to the argument for maintaining price control over this sector until the subsidies have been fully phased out.

VIII. ISSUES ASSOCIATED WITH RESTRUCTURING

8.1 There are certain issues for the internal management of the DHEs:

- employment conditions for senior management, including selection, remuneration, performance appraisal, training and procedures for dismissal;

- the system available for financial management of the DHEs.

Employment Conditions for Senior Management

8.2 The general manager is selected by the responsible voivod in a competition. However, this competition is normally just between nominated persons, and it is expect that the selected person will come from within the subsector. The general manager is appointed for a fixed term, after which a new competition is held. The general manager appoints his own senior managers, subject to approval by the employees council. Appointments from outside the industry are rare, with the most common case being that of accountants.

8.3 The financial rewards for senior management are not significantly greater than those from lower level jobs. Typically the ratio between the highest and lowest salary in an enterprise is about 3.5 to 1. Although formal procedures for dismissal exist, there is general reluctance to effect dismissal. Formal job descriptions exist but focus on activities rather than accountability, targets and responsibility. Performance appraisal takes place every two years but very little action is related to this assessment.

8.4 A number of possibilities exist to improve the quality of the senior management in the DHEs:

- clear statements of corporate and departmental objectives, roles and responsibilities;

- job descriptions and qualifications should be drawn up for all senior management positions. Selection, through advertisement, should be based on these criteria;

- individual targets should be set for managers —measurement of achievement against objectives should be linked to a more differentiated reward structure;

- contracts should contain a balance of incentive and security; and

- a training need analysis should be carried out for all jobs within the DHEs and training then be provided accordingly.

Financial Management Systems

8.5 The existing systems for financial management in the DHEs reflect the centrally planned environment in which they have hitherto operated. These systems will not be appropriate for management within a commercial environment.

8.6 The main characteristics of the existing systems are:

- there is no business or financial planning activity within the enterprises (this being undertaken by the voivod or the central government);

- annual budgeting is well established;
- cash management and short-term financial planning is undeveloped —DHEs have used short term debt or delayed payments to finance cash shortfalls;
- arrangements for debt recovery from personal and individual customers work well —housing co-operatives pay only when they receive the consumer subsidy and cannot be disconnected for late payment;
- accounting practices to not conform to international standards;
- accounting systems are generally manual and do not readily produce information that management can use to control the business; and
- financial reporting is based primarily on formats laid down by the Central Statistical Office —these formats are difficult to interpret and provide no provision for comparison with budget.

8.7 The main requirements for change in order to obtain a regular flow of appropriate financial information are therefore:

- the agreement of corporate objectives and the preparation of a business plan, looking a minimum of five years ahead;
- annual budgets broken down by department or division, and performance overall monitored on a monthly basis;
- more careful attention to cash management so that short term debt is minimized;
- a change to the new national accounting standards when these are agreed and published;
- a clear distinction to be made between financial reports for external users and reports intended to help management run the business.

8.8 Computerized systems will be needed in many DHEs for a range of applications. It will take time to develop these —the high priorities will be the general ledger, accounts receivable, billing/invoicing and the payroll. Lower priorities will be the accounts payable fixed assets and stock. The similarity of business between DHEs suggest that joint specification and development of systems is likely to be advantageous.

8.9 To comply with the regulatory system, companies will probably need to report separately on a number of different activities. The accounting systems will need to be developed so as to allow separate allocation of identifiable costs and apportionment of others to heat production, heat purchase and supply, heat distribution and other separate unregulated activities.

IX. IMPLEMENTATION PROGRAM

9.1 This Chapter draws together actions needed to be taken for restructuring the Polish DHE subsector. It is not possible to give detailed structures for each location —these should instead be developed at local level. Instead a broad framework, within which the central Government can ensure local initiatives proceed in a coordinated fashion, is described.

Sequence of Events

9.2 The most important first step will be for the Government to agree the proposals for a new institutional structure. If this is done then activity will be required in three key areas:

- Legislation will be required to establish the legal framework within which the DH subsector would be required to operate. This would establish the National Heating Advisory Board (NHAB), the other national regulatory bodies involved in the energy sector, and the IRBs at the local level;

- The gminas would need to establish intercommunal bodies and, within these, IRBs to administer the subsector;

- The enterprises within the subsector will need to be restructured, by transferring ownership to the gminas, and by forming joint stock companies.

9.3 Restructuring must also take account of other changes anticipated within the energy sector:

- Initially some Government control over tariffs will remain, while tariffs are re-balanced to reflect the relative costs of supply to different groups and also increased to appropriate levels relative to other sources of energy. Once this transition is complete, the new heating companies will set tariffs on a commercial basis within the regulatory framework;

- The transition to a market economy will lead to considerable uncertainty in the outlook for demand and hence for the financial prospects of the companies in the short term;

- The resources available to manage the restructuring will be limited at both national and local levels.

9.4 These factors suggest that the most appropriate broad sequence of events for the government might be to:

- agree and publish a short paper setting out the restructuring plans for all components of the energy sector;

- strengthen the interministerial committee who would drive the restructuring process and control the detailed work;

- draft the enabling legislation to establish the NHAB;

- prepare and publish model statutes for the intercommunal bodies. These would be circulated to the gminas who would be invited to submit proposals to the government for the formation of these bodies; and

- initiate the preparatory work for restructuring the enterprises within the subsector while deferring the necessary mergers and asset transfers until responsibilities had passed to the new intercommunal bodies.

9.5 The reasons for this proposed sequence of events are that, with tariffs likely to be held below Western European levels for two or three years, there is little chance of immediately establishing financially viable heat companies buying at commercial rates. Hence the restructuring itself should be deferred, but all the regulatory and institutional changes would be prepared so that once full conversion to the market occurs it can be in a coordinated fashion. In the meantime the most urgent investments could be undertaken in order to improve operational efficiency.

Joint UNDP/World Bank
ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)

LIST OF REPORTS ON COMPLETED ACTIVITIES

Region/Country	*Activity/Report Title*	*Date*	*Number*
	SUB-SAHARAN AFRICA (AFR)		
Africa Regional	Anglophone Africa Household Energy Workshop (English)	07/88	085/88
	Regional Power Seminar on Reducing Electric Power System Losses in Africa (English)	08/88	087/88
	Institutional Evaluation of EGL (English)	02/89	098/89
	Biomass Mapping Regional Workshops (English - Out of Print)	05/89	--
	Francophone Household Energy Workshop (French)	08/89	103/89
	Interafrican Electrical Engineering College: Proposals for Short- and Long-Term Development (English)	03/90	112/90
	Biomass Assessment and Mapping (English - Out of Print)	03/90	--
Angola	Energy Assessment (English and Portuguese)	05/89	4708-ANG
	Power Rehabilitation and Technical Assistance (English)	10/91	142/91
Benin	Energy Assessment (English and French)	06/85	5222-BEN
Botswana	Energy Assessment (English)	09/84	4998-BT
	Pump Electrification Prefeasibility Study (English)	01/86	047/86
	Review of Electricity Service Connection Policy (English)	07/87	071/87
	Tuli Block Farms Electrification Study (English)	07/87	072/87
	Household Energy Issues Study (English - Out of Print)	02/88	--
	Urban Household Energy Strategy Study (English)	05/91	132/91
Burkina Faso	Energy Assessment (English and French)	01/86	5730-BUR
	Technical Assistance Program (English)	03/86	052/86
	Urban Household Energy Strategy Study (English and French)	06/91	134/91
Burundi	Energy Assessment (English)	06/82	3778-BU
	Petroleum Supply Management (English)	01/84	012/84
	Status Report (English and French)	02/84	011/84
	Presentation of Energy Projects for the Fourth Five-Year Plan (1983-1987) (English and French)	05/85	036/85
	Improved Charcoal Cookstove Strategy (English and French)	09/85	042/85
	Peat Utilization Project (English)	11/85	046/85
	Energy Assessment (English and French)	01/92	9215-BU
Cape Verde	Energy Assessment (English and Portuguese)	08/84	5073-CV
	Household Energy Strategy Study (English)	02/90	110/90
Central African Republic	Energy Assessement (French)	08/92	9898-CAR
Comoros	Energy Assessment (English and French)	01/88	7104-COM
Congo	Energy Assessment (English)	01/88	6420-COB
	Power Development Plan (English and French)	03/90	106/90
Côte d'Ivoire	Energy Assessment (English and French)	04/85	5250-IVC
	Improved Biomass Utilization (English and French)	04/87	069/87
	Power System Efficiency Study (Out of Print)	12/87	--
	Power Sector Efficiency Study (French)	02/92	140/91
Ethiopia	Energy Assessment (English)	07/84	4741-ET
	Power System Efficiency Study (English)	10/85	045/85

Region/Country	Activity/Report Title	Date	Number
Ethiopia	Agricultural Residue Briquetting Pilot Project (English)	12/86	062/86
	Bagasse Study (English)	12/86	063/86
	Cooking Efficiency Project (English)	12/87	--
Gabon	Energy Assessment (English)	07/88	6915-GA
The Gambia	Energy Assessment (English)	11/83	4743-GM
	Solar Water Heating Retrofit Project (English)	02/85	030/85
	Solar Photovoltaic Applications (English)	03/85	032/85
	Petroleum Supply Management Assistance (English)	04/85	035/85
Ghana	Energy Assessment (English)	11/86	6234-GH
	Energy Rationalization in the Industrial Sector (English)	06/88	084/88
	Sawmill Residues Utilization Study (English)	11/88	074/87
Guinea	Energy Assessment (Out of Print)	11/86	6137-GUI
Guinea-Bissau	Energy Assessment (English and Portuguese)	08/84	5083-GUB
	Recommended Technical Assistance Projects (English & Portuguese)	04/85	033/85
	Management Options for the Electric Power and Water Supply Subsectors (English)	02/90	100/90
	Power and Water Institutional Restructuring (French)	04/91	118/91
Kenya	Energy Assessment (English)	05/82	3800-KE
	Power System Efficiency Study (English)	03/84	014/84
	Status Report (English)	05/84	016/84
	Coal Conversion Action Plan (English - Out of Print)	02/87	--
	Solar Water Heating Study (English)	02/87	066/87
	Peri-Urban Woodfuel Development (English)	10/87	076/87
	Power Master Plan (English - Out of Print)	11/87	--
Lesotho	Energy Assessment (English)	01/84	4676-LSO
Liberia	Energy Assessment (English)	12/84	5279-LBR
	Recommended Technical Assistance Projects (English)	06/85	038/85
	Power System Efficiency Study (English)	12/87	081/87
Madagascar	Energy Assessment (English)	01/87	5700-MAG
	Power System Efficiency Study (English and French)	12/87	075/87
Malawi	Energy Assessment (English)	08/82	3903-MAL
	Technical Assistance to Improve the Efficiency of Fuelwood Use in the Tobacco Industry (English)	11/83	009/83
	Status Report (English)	01/84	013/84
Mali	Energy Assessment (English and French)	11/91	8423-MLI
	Household Energy Strategy (English and French)	03/92	147/92
Islamic Republic of Mauritania	Energy Assessment (English and French)	04/85	5224-MAU
	Household Energy Strategy Study (English and French)	07/90	123/90
Mauritius	Energy Assessment (English)	12/81	3510-MAS
	Status Report (English)	10/83	008/83
	Power System Efficiency Audit (English)	05/87	070/87
	Bagasse Power Potential (English)	10/87	077/87
Mozambique	Energy Assessment (English)	01/87	6128-MOZ
	Household Electricity Utilization Study (English)	03/90	113/90
Niger	Energy Assessment (French)	05/84	4642-NIR
	Status Report (English and French)	02/86	051/86
	Improved Stoves Project (English and French)	12/87	080/87

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Niger	Household Energy Conservation and Substitution (English and French)	01/88	082/88
Nigeria	Energy Assessment (English)	08/83	4440-UNI
Rwanda	Energy Assessment (English)	06/82	3779-RW
	Energy Assessment (English and French)	07/91	8017-RW
	Status Report (English and French)	05/84	017/84
	Improved Charcoal Cookstove Strategy (English and French)	08/86	059/86
	Improved Charcoal Production Techniques (English and French)	02/87	065/87
	Commercialization of Improved Charcoal Stoves and Carbonization Techniques Mid-Term Progress Report (English and French)	12/91	141/91
SADCC	SADCC Regional Sector: Regional Capacity-Building Program for Energy Surveys and Policy Analysis (English)	11/91	--
Sao Tome and Principe	Energy Assessment (English)	10/85	5803-STP
Senegal	Energy Assessment (English)	07/83	4182-SE
	Status Report (English and French)	10/84	025/84
	Industrial Energy Conservation Study (English)	05/85	037/85
	Preparatory Assistance for Donor Meeting (English and French)	04/86	056/86
	Urban Household Energy Strategy (English)	02/89	096/89
Seychelles	Energy Assessment (English)	01/84	4693-SEY
	Electric Power System Efficiency Study (English)	08/84	021/84
Sierra Leone	Energy Assessment (English)	10/87	6597-SL
Somalia	Energy Assessment (English)	12/85	5796-SO
Sudan	Management Assistance to the Ministry of Energy and Mining	05/83	003/83
	Energy Assessment (English)	07/83	4511-SU
	Power System Efficiency Study (English)	06/84	018/84
	Status Report (English)	11/84	026/84
	Wood Energy/Forestry Feasibility (English - Out of Print)	07/87	073/87
Swaziland	Energy Assessment (English)	02/87	6262-SW
Tanzania	Energy Assessment (English)	11/84	4969-TA
	Peri-Urban Woodfuels Feasibility Study (English)	08/88	086/88
	Tobacco Curing Efficiency Study (English)	05/89	102/89
	Remote Sensing and Mapping of Woodlands (English)	06/90	--
	Industrial Energy Efficiency Technical Assistance (English - Out of Print)	08/90	122/90
Togo	Energy Assessment (English)	06/85	5221-TO
	Wood Recovery in the Nangbeto Lake (English and French)	04/86	055/86
	Power Efficiency Improvement (English and French)	12/87	078/87
Uganda	Energy Assessment (English)	07/83	4453-UG
	Status Report (English)	08/84	020/84
	Institutional Review of the Energy Sector (English)	01/85	029/85
	Energy Efficiency in Tobacco Curing Industry (English)	02/86	049/86
	Fuelwood/Forestry Feasibility Study (English)	03/86	053/86
	Power System Efficiency Study (English)	12/88	092/88
	Energy Efficiency Improvement in the Brick and Tile Industry (English)	02/89	097/89
	Tobacco Curing Pilot Project (English - Out of Print)	03/89	UNDP Terminal Report

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Zaire	Energy Assessment (English)	05/86	5837-ZR
Zambia	Energy Assessment (English)	01/83	4110-ZA
	Status Report (English)	08/85	039/85
	Energy Sector Institutional Review (English)	11/86	060/86
Zambia	Power Subsector Efficiency Study (English)	02/89	093/88
	Energy Strategy Study (English)	02/89	094/88
	Urban Household Energy Strategy Study (English)	08/90	121/90
Zimbabwe	Energy Assessment (English)	06/82	3765-ZIM
	Power System Efficiency Study (English)	06/83	005/83
	Status Report (English)	08/84	019/84
	Power Sector Management Assistance Project (English)	04/85	034/85
	Petroleum Management Assistance (English)	12/89	109/89
	Power Sector Management Institution Building (English - Out of Print)	09/89	--
	Charcoal Utilization Prefeasibility Study (English)	06/90	119/90
	Integrated Energy Strategy Evaluation (English)	01/92	8768-ZIM

EAST ASIA AND PACIFIC (EAP)

Asia Regional	Pacific Household and Rural Energy Seminar (English)	11/90	--
China	County-Level Rural Energy Assessments (English)	05/89	101/89
	Fuelwood Forestry Preinvestment Study (English)	12/89	105/89
Fiji	Energy Assessment (English)	06/83	4462-FIJ
Indonesia	Energy Assessment (English)	11/81	3543-IND
	Status Report (English)	09/84	022/84
	Power Generation Efficiency Study (English)	02/86	050/86
	Energy Efficiency in the Brick, Tile and Lime Industries (English)	04/87	067/87
	Diesel Generating Plant Efficiency Study (English)	12/88	095/88
	Urban Household Energy Strategy Study (English)	02/90	107/90
	Biomass Gasifier Preinvestment Study Vols. I & II (English)	12/90	124/90
Malaysia	Sabah Power System Efficiency Study (English)	03/87	068/87
	Gas Utilization Study (English)	09/91	9645-MA
Myanmar	Energy Assessment (English)	06/85	5416-BA
Papua New Guinea	Energy Assessment (English)	06/82	3882-PNG
	Status Report (English)	07/83	006/83
	Energy Strategy Paper (English - Out of Print)	--	--
	Institutional Review in the Energy Sector (English)	10/84	023/84
	Power Tariff Study (English)	10/84	024/84
Solomon Islands	Energy Assessment (English)	06/83	4404-SOL
	Energy Assessment (English)	01/92	979/SOL
South Pacific	Petroleum Transport in the South Pacific (English-Out of Print)	05/86	--
Thailand	Energy Assessment (English)	09/85	5793-TH
	Rurel Energy Issues and Options (English - Out of Print)	09/85	044/85
	Accelerated Dissemination of Improved Stoves and Charcoal Kilns (English - Out of Print)	09/87	079/87

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Thailand	Northeast Region Village Forestry and Woodfuels Preinvestment Study (English)	02/88	083/88
	Impact of Lower Oil Prices (English)	08/88	--
	Coal Development and Utilization Study (English)	10/89	--
Tonga	Energy Assessment (English)	06/85	5498-TON
Vanuatu	Energy Assessment (English)	06/85	5577-VA
Western Samoa	Energy Assessment (English)	06/85	5497-WSO
	SOUTH ASIA (SAS)		
Bangladesh	Energy Assessment (English)	10/82	3873-BD
	Priority Investment Program	05/83	002/83
	Status Report (English)	04/84	015/84
	Power System Efficiency Study (English)	02/85	031/85
	Small Scale Uses of Gas Prefeasibility Study (English - (Out of Print)	12/88	--
India	Opportunities for Commercialization of Nonconventional Energy Systems (English)	11/88	091/88
	Maharashtra Bagasse Energy Efficiency Project (English)	05/91	120/91
	Mini-Hydro Development on Irrigation Dams and Canal Drops Vols. I, II and III (English)	07/91	139/91
	WindFarm Pre-Investment Study (English)	12/92	150/92
Nepal	Energy Assessment (English)	08/83	4474-NEP
	Status Report (English)	01/85	028/84
Pakistan	Household Energy Assessment (English - Out of Print)	05/88	--
	Assessment of Photovoltaic Programs, Applications, and Markets (English)	10/89	103/89
Sri Lanka	Energy Assessment (English)	05/82	3792-CE
	Power System Loss Reduction Study (English)	07/83	007/83
	Status Report (English)	01/84	010/84
	Industrial Energy Conservation Study (English)	03/86	054/86
	EUROPE AND CENTRAL ASIA (ECA)		
Eastern Europe	The Future of Natural Gas in Eastern Europe (English)	08/92	149/92
Poland	Energy Sector Restructuring Vols. I-V (English)	01/93	153/93
Portugal	Energy Assessment (English)	04/84	4824-PO
Turkey	Energy Assessment (English)	03/83	3877-TU
	MIDDLE EAST AND NORTH AFRICA (MNA)		
Morocco	Energy Assessment (English and French)	03/84	4157-MOR
	Status Report (English and French)	01/86	048/86
Syria	Energy Assessment (English)	05/86	5822-SYR
	Electric Power Efficiency Study (English)	09/88	089/88
	Energy Efficiency Improvement in the Cement Sector (English)	04/89	099/89

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Syria	Energy Efficiency Improvement in the Fertilizer Sector(English)	06/90	115/90
Tunisia	Fuel Substitution (English and French)	03/90	--
	Power Efficiency Study (English and French)	02/92	136/91
	Energy Management Strategy in the Residential and Tertiary Sectors (English)	04/92	146/92
Yemen	Energy Assessment (English)	12/84	4892-YAR
	Energy Investment Priorities (English - Out of Print)	02/87	6376-YAR
	Household Energy Strategy Study Phase I (English)	03/91	126/91

LATIN AMERICA AND THE CARIBBEAN (LAC)

LAC Regional	Regional Seminar on Electric Power System Loss Reduction in the Caribbean (English)	07/89	--
Bolivia	Energy Assessment (English)	04/83	4213-BO
	National Energy Plan (English)	12/87	--
	National Energy Plan (Spanish)	08/91	131/91
	La Paz Private Power Technical Assistance (English)	11/90	111/90
	Natural Gas Distribution: Economics and Regulation (English)	03/92	125/92
	Prefeasibility Evaluation Rural Electrification and Demand Assessment (English and Spanish)	04/91	129/91
	Private Power Generation and Transmission (English)	01/92	137/91
Chile	Energy Sector Review (English - Out of Print)	08/88	7129-CH
Colombia	Energy Strategy Paper (English)	12/86	--
Costa Rica	Energy Assessment (English and Spanish)	01/84	4655-CR
	Recommended Technical Assistance Projects (English)	11/84	027/84
	Forest Residues Utilization Study (English and Spanish)	02/90	108/90
Dominican Republic	Energy Assessment (English)	05/91	8234-DO
Ecuador	Energy Assessment (Spanish)	12/85	5865-EC
	Energy Strategy Phase I (Spanish)	07/88	--
	Energy Strategy (English)	04/91	--
	Private Minihydropower Development Study (English)	11/92	--
Haiti	Energy Assessment (English and French)	06/82	3672-HA
	Status Report (English and French)	08/85	041/85
	Household Energy Strategy (English and French)	12/91	143/91
Honduras	Energy Assessment (English)	08/87	6476-HO
	Petroleum Supply Management (English)	03/91	128/91
Jamaica	Energy Assessment (English)	04/85	5466-JM
	Petroleum Procurement, Refining, and Distribution Study (English)	11/86	061/86
	Energy Efficiency Building Code Phase I (English-Out of Print)	03/88	--
	Energy Efficiency Standards and Labels Phase I (English - Out of Print)	03/88	--
	Management Information System Phase I (English - Out of PRint)	03/88	--
	Charcoal Production Project (English)	09/88	090/88
	FIDCO Sawmill Residues Utilization Study (English)	09/88	088/88

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Jamaica	Energy Sector Strategy and Investment Planning Study (English)	07/92	135/92
Mexico	Improved Charcoal Production Within Forest Management for the State of Veracruz (English and Spanish)	08/91	138/91
Panama	Power System Efficiency Study (English - Out of Print)	06/83	004/83
Paraguay	Energy Assessment (English)	10/84	5145-PA
	Recommended Technical Assistance Projects (English- (Out of Print)	09/85	--
	Status Report (English and Spanish)	09/85	043/85
Peru	Energy Assessment (English)	01/84	4677-PE
	Status Report (English - Out of Print)	08/85	040/85
	Proposal for a Stove Dissemination Program in the Sierra (English and Spanish)	02/87	064/87
	Energy Strategy (Spanish)	12/90	--
Saint Lucia	Energy Assessment (English)	09/84	5111-SLU
St. Vincent and the Grenadines	Energy Assessment (English)	09/84	5103-STV
Trinidad and Tobago	Energy Assessment (English - Out of Print)	12/85	5930-TR

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	Energy End Use Efficiency: Research and Strategy (English - Out of Print)	11/89	--
	Guidelines for Utility Customer Management and Metering (English and Spanish)	07/91	--
	Women and Energy--A Resource Guide The International Network: Policies and Experience (English)	04/90	--
	Assessment of Personal Computer Models for Energy Planning in Developing Countries (English)	10/91	--
	Long-Term Gas Contracts Principles and Applications (English)	12/92	152/92

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