

# **DSM Opportunities Within the Future Competitive Polish Electricity System**

Ewaryst Hille, Polish Foundation for Energy Efficiency, Poland  
Wallace R. Gibson, Northwest Power Planning Council, USA

## **1. SYNOPSIS**

New arrangement of the electricity sub-system could create more equity situation for competitive DSM, IPP and Supply options.

## **2. ABSTRACT**

In general, the Polish electricity system is being restructured based on the UK concept. A dozen independent generating companies will be competing in the pool to provide energy and power to the transmission system, from which independent distribution companies will buy. After the time needed to accommodate the actors to the new system structure and technical development, retail wheeling will be allowed.

During more than 40 years of socialism in Poland, a huge energy efficiency potential has accumulated. Many of the measures making up this potential are more economically attractive than supply options. According to the latest version (November 1994) of the proposed national Energy Law, it should be possible for distribution companies to make investments for improvements in consumers' energy efficiency. The version opened the way for creation of rates based on recovery of those investment costs.

With special rules for DSM financial arrangements and rates, at the beginning stated by the regulator and after some transition time based on the negotiation process, it should be profitable for the distribution companies to provide DSM proposals to the pool to compete with marginal supply options. These profitable projects will not be available in the near future outside of the distribution companies, because of lack of experienced energy service companies (ESCOs), lack of capital and the much higher risk without reimbursement from rates. To launch DSM activity, distribution companies have to learn how to define and realize projects in the market and how to organize finance for them.

## **3. INTRODUCTION**

### **3.1. Country background**

The Polish government undertook the political decision to direct the economy to a market shape. The big challenge for us is how to reorganize the electricity economy under this requirement. This is, of course, also a more general, worldwide question: how should electricity economies be structured, to what extent should they operate under free market rules and to what extent should they be regulated. In Poland there is a unique opportunity to arrange a very modern economy, where society has decided to undertake efforts and sacrifice some welfare to rebuild almost everything in the country and where there are no explicit private owners of the energy enterprises which, if in opposition, could be an obstacle to restructuring. So we should to try answer these very difficult questions: (1) how should the electricity subsystem be restructured? (2) who should the owners be? (3) where should markets be located? (4) how should these markets be regulated? and (5) when, if ever, should regulation disappear?

A good starting point for the future decision is the most recent Energy Law proposal dated Nov. 10, 1994 and recommended by the Economic Committee of the Board of Ministries for approval. This document established the division of political, ownership and regulatory authorities among different governmental agencies. Energy policy preparation will be the responsibility of the Ministry of Industry and Trade when the law is approved by Parliament, ownership of the State part of the energy enterprises will be the responsibility of the State Treasury, regulatory aspects of the energy economy will be the responsibility of the Central Regulatory Office under Prime Minister and district heat issues will be under the Voievodship's Offices (regional governmental authorities). What is worth underlining is that this new act opens DSM options to equality with supply options for energy enterprises. The proposed Energy Law requires DSM options to be introduced to the plan of distribution and transmission companies and allows them to create tariffs on the basis of the costs of DSM when they represent economically sound alternatives to new energy sources. Simultaneously, energy enterprises are obligated to secure customers against unreasonable price increases under regulation.

### 3.2 Electricity subsystem background

In the past the reason for building extended networks of electricity systems has been the expectation of increased efficiency of production from very large producing units, due to the effects of scale. Huge generators substantially exceeding the demand of individual customers are characterized by efficiencies higher than small units. However, big blocks have also been the reason for higher risk during breakdowns when many customers could be short of power. The solution was to join blocks together and organize a system for mutual insurance (since the probability of simultaneous breakdown reduces with the increase in the number of linked units) This also created the next opportunity to improve efficiency through the possibility of better management of the system. This has been the reason for the efficiency, reliability and cost improvement (Fig.1.) of the system.

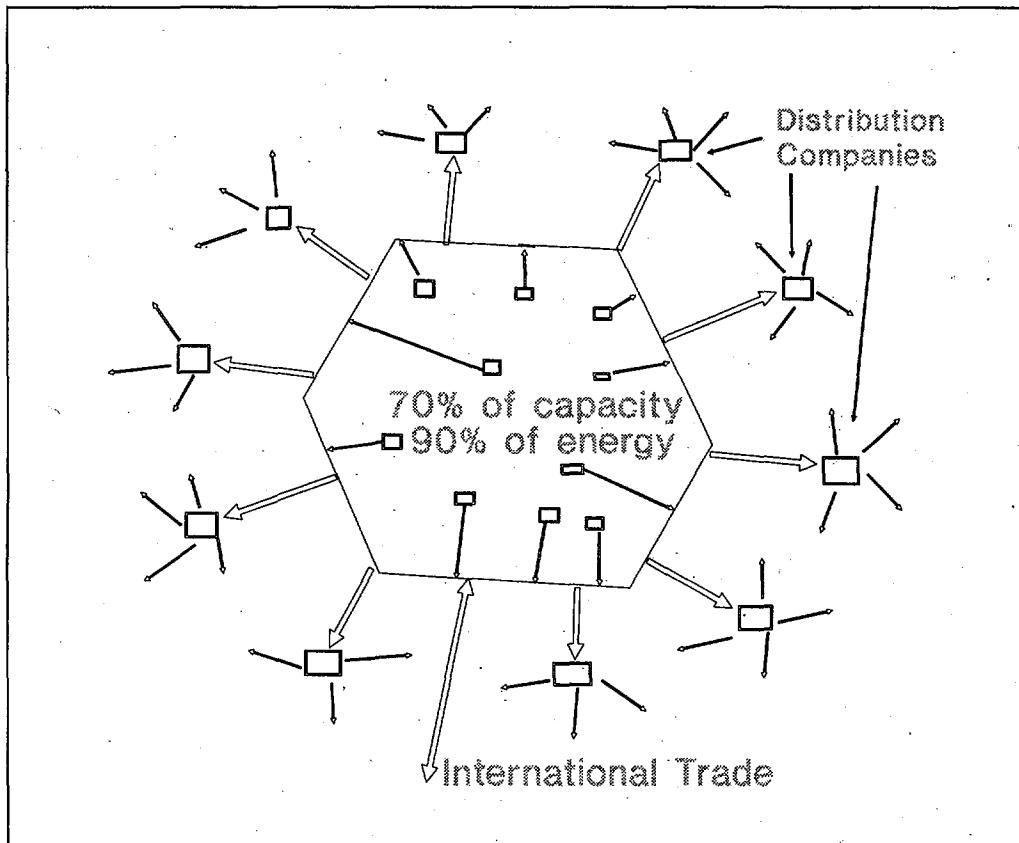


Figure 1. Current structure of the electricity sub-system

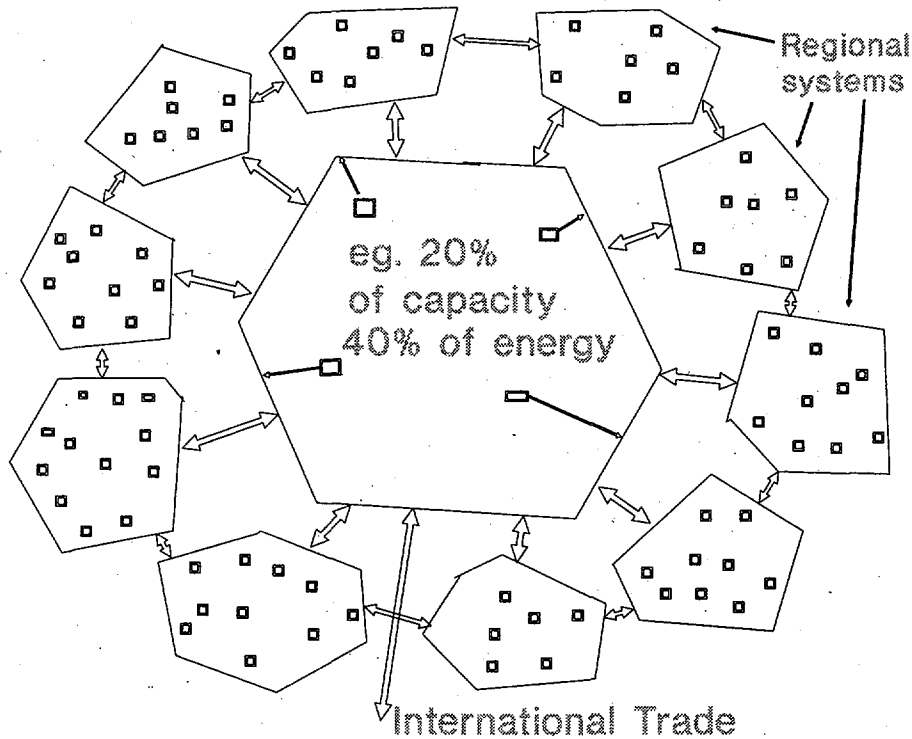
### 4. FUTURE OPTIONS FOR ELECTRICITY SYSTEM

Currently, it is possible to observe essential changes in the efficiency of production. As a result of persistent technical progress, differences have decreased between the efficiency of bigger and smaller facilities. Moreover, one can expect that due to rapid development of electronic devices, quick synchronization of separate units with the system as well as reduction of disturbances during the connection process will be very likely achievable. This creates (to the extent available currently) the technical basis for revision of the most recent concept of supply service in the most economically reasonable manner.

This issue is especially important for the Polish electricity subsystem during the period of creation of a new concept of the system as today's decisions will influence the energy economy for many years ahead.

It seems that the above described changes in the technical area let us build the future system in a manner at least partially free of the disadvantages of natural monopoly. At the end of the process one can imagine a situation in which explicit changes of roles of every system actor will have happened. A very limited number of generators will

be strictly connected within the common country-wide network mainly as a security reserve (likely as spinning or partially loaded reserve) for a set of small and medium size regional sub-networks and even independent generators. The regional sub-networks would be dispatched independently during normal situations, while taking account of opportunities for trade. Simultaneously, they will be an alternative source of power and energy for customers, both competing with the local generators and also acting as a source of information about other producers' marginal costs of production. The country-wide network will also have capacity to import energy and power from abroad. (Fig.2).



*Figure 2. Future (?) structure of the electricity industry.*

The above-mentioned concept assumed that, under optimal conditions, there will be operating many small, independent electric and heat subsystems, working in locally-organized natural gas and liquid fuels markets. These systems could have reserves provided by heat-only boilers for heat and, for electricity, by the system of local links (a local wholesale market administered by e.g., the licensed local distribution company) and by connections with the country-wide wholesale market (administered by the Polish Power Grid Company).

Such the system would have the following advantages:

- (1) a substantial increase in the rate of cogeneration of heat and power and in the average efficiency of energy conversion;
- (2) an increased share of small, local sources, especially for peak and near-peak needs, placed close to consumers, that will improve the flexibility of the system's response to demand changes (e.g., during rapid outdoor temperature changes), reduce transmission needs and simultaneously enhance the ability to evaluate specific local DSM options against new local and external supply options;
- (3) increased attractiveness of production based on renewable fuels and energy;
- (4) increased interest in co-financing of investment in alternative energy subsystems in the case where local demand uncertainty has been reduced through DSM programs (for instance, common investment with a heat distribution company for better heat insulation of buildings or common investment with a gas company for heat-only boilers, both done to avoid additional electricity space heating during peak demand time);
- (5) reductions in transmission and distribution losses;

- (6) increased energy security of the whole system through three levels of mutual insurance - "vicinity" connections, regional networks, and the country-wide network (plus international exchange);
- (7) increased security of the system during emergency situations;
- (8) decreased required reserve margin for the whole system;
- (9) diminished risk of negative effects of wrong investment decisions because of dispersion of investments which are dependent on development of local demand; making investment processes shorter, diminishing costs of investments through higher utilization of domestic financial resources which are better available for small activities in Poland;
- (10) increased interest of local authorities due to the possibility of making integrated local decisions favouring a more benign energy economy for the local environment, the incentives for the local economy and the improved local labour market.

The above outlined structure of the electricity subsystem defines new positions and relationships among the distribution and transmission companies. The domain of the transmission company is tied to the system producers because together on the one hand they provide security and reliability for regional subsystems and on the other hand the share of the transmission business for the whole electricity economy diminishes. Simultaneously the transmission enterprise is a tool for delivering information about marginal costs available around all the system, which will secure economically sound behaviours inside the regional subsystems. Distribution companies play a similar role to that of the transmission company but on a regional scale and between independent local producers and customers. The above described structure creates many new opportunities based on trade connections.

One issue that is especially important is the long-term path for this development. One could imagine this path in the following manner:

- (1) Diminishing economic cost of system development by reduction of electricity demand and shaping capacity demand (this would require DSM options conceived and supported by electricity enterprises because of the existence of the many market barriers, which effectively hide DSM options at the beginning of structural changes). This would lead to rejection of marginal expensive supply options currently creating economic costs to the system.
- (2) Diminishing uncertainty of the demand forecast with relatively lower prices and increased acceptance of price rises by customers (lower costs although with higher prices for customers are an effect of DSM). The first profits appear from the partially modernized system.
- (3) Increasing demand as prices remain relatively low, depletion of simple DSM resources (DSM will start to be dominated by market transformation), and an apparent increase of profits from electricity production.
- (4) Rapid growth of interest in independent production with available very low marginal costs (currently about 3-3.5 cents/kWh in much of the USA) due to much shorter power station construction time. Repeated division of roles as companies concentrate on supply-side or demand-side measures. Utility DSM starts to play a minor role. Decisions to reduce and shape demand are undertaken by customers on the basis of relevant market price signals as barriers disappear.

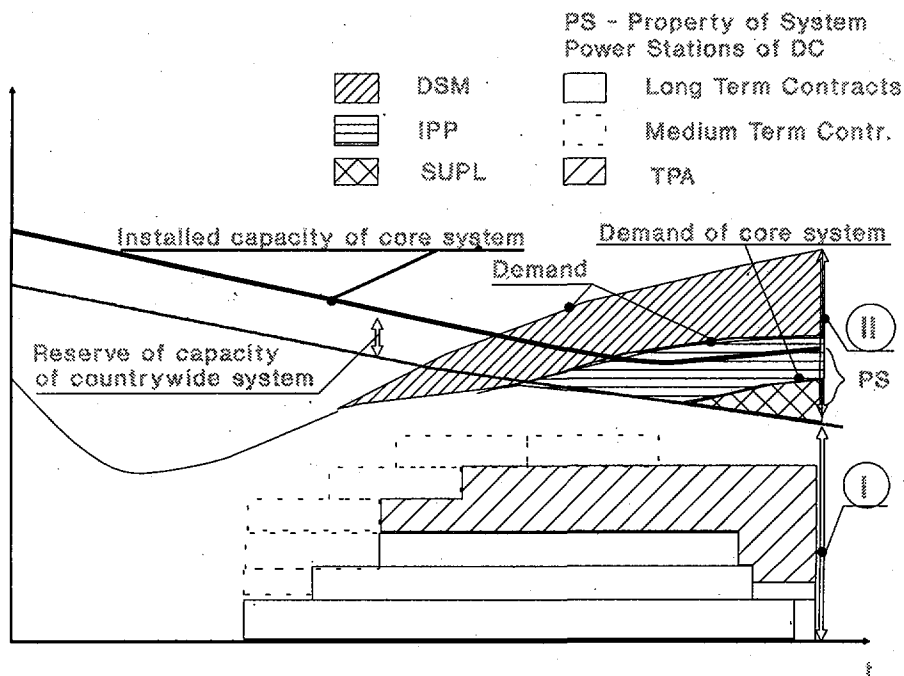
It seems that recently introduced changes as well as those planned for the Polish electricity system are not in conflict with such a concept but are even favourable to it. The previously vertically-integrated Polish electricity system has been divided and now producers, transmitters and distributors are organized into a set of independent companies. Producing and distributing enterprises have been commercialized and will be privatized. The transmission company - The Polish Power Grid Co. (PPGC) will be under state control and should play a crucial role in advancing competition and in wholesale market administration. According to its internal strategy, PPGC will be divided into the following five business parts by the end of 1995: (1) power dispatching, (2) transmission, (3) bulk electricity sales, (4) system services, and (5) integrated resource planning. Cash flows from bulk electricity sales and associated with PPGC's revenues and expenditures will be separated from another one by the end of 1994. PPGC foresees introducing, as part of the developing competitive market: (1) negotiable prices for generators, a wholesale tariff schedule for distributors, negotiable prices for large industrial consumers and varying tariffs by regions, (2) open tenders for new capacity, (3) starting to play an active role in the market as pool administrator. As a result, the competitiveness of the market for electricity should rise and according to PPGC's plan, in 1995 the competitive market should have 25% of the total electricity trade, through spot contracts; in 2002-2003, about 40% due to the expiration of current medium-term contracts; and at the end by 2007-2010, about 60% due to the expiration of current long-term contracts.

## 5. DIVISION OF THE RESPONSIBILITY FOR SUPPLY

According to the current understanding, the distribution and transmission companies should be responsible for secure supply today and in the future. But one important question is to what extent they should be responsible for it and what is a reasonable relation between the security level and the costs of it. Currently in Poland, the forecast of demand for

energy and power, assumed target LOLP and the likely value of unserved energy and power are the basis for assessment of the required system security efforts. All of these are long-term problems and very uncertain ones, especially during the period of transition of the economy. When, due to the general decision to introduce a market economy and to new technical opportunities, more competitive choices become possible, a benign market environment should be created to break down the natural monopoly situation and answer the above question in a way based on trade and negotiation.

These are the reasons to allow for independent distribution companies to have an interest in investigating and creating their own integrated resource plans. They could trade with a wide range of potential suppliers (e.g., PPGC, independent power producers, neighbouring distribution companies) and customers (through DSM) as well as develop their own resources (production from their own plants, savings of losses) according to a least-cost planning methodology with an economically reasonable risk of failure to deliver energy and power. As part of the negotiations with consumers the distribution company should define a reasonable level of internal and external costs for delivery of service with the reliability required by customers. The external costs should comprise costs arising from the part of reliability of supply for consumers that is delivered by the country-wide system (central power stations, long distance distribution companies, international trade) through the transmission grid. As a result one can imagine the situation presented in Fig. 3 where due to competition between options, economically sound relations appear between DSM, independent power producers, and central power stations.



According to this idea, the distribution company should present a wholesale market proposal for an amount of energy and power to be purchased by PPGC, an acceptable price, the required reserve and so forth. Of course, it could be the starting point for negotiations and reassessment of the distribution company's position, but behind that proposal a full internal analysis using integrated resource planning should be done, with different alternatives for trade with PPGC and other partners as well. One very important issue for Polish reforms seems to us the possibility to define better the economic arguments for efforts of distribution companies to finance investment in supply capacity development. Distribution companies, on the basis of local changes in demand, due to local economic development and DSM activities, could assess needs for additional generation with lower uncertainty and could guarantee purchase of new energy and capacity. If it could be profitable for distribution companies, they could co-invest in new generators and start to be owners (to some extent) of both local and country system power stations. Such a more reliable forecast of

demand for new power should encourage additional external sources of finance such as the local budget and foreign capital. After some time this mechanism could have the effect of smoothing ownership changes of generating and transmission companies to the direction of higher shares for distribution companies, local authorities and private domestic and foreign investors in place of the State share.

## **6. DSM AND INDEPENDENT POWER PRODUCTION'S PLACE IN THE DISTRIBUTION COMPANY**

During the centralized economy period, a huge potential for energy efficiency improvements has developed. According to many analysts, the efficacy of energy use in Poland is 2-3 times lower than in well-developed countries. This means that the economy could develop without substantial growth of energy demand for many years. But situation differs depending on the part of the economy, the geographical region, the kind of equipment or technology and the economic condition of the customers. This is why DSM activities can be reasonably defined only on the local level. When, according to the new Energy Law, energy enterprises could make a profit due to choosing DSM and embodying the avoided costs of purchasing supply in the rates, one could anticipate an increase of interest in doing this. Because of diminishing risk, one can also expect attempts to diversity efforts through different DSM options and customers as well as to divide risk with other actors. At the end, one can expect that for its bid the distribution company would prepare a mixture of DSM options resulting in a proposal to purchase energy and power on a reasonable level. The majority of the responsibility for maintaining demand in the required range would be the distribution company's and should be clearly presented in the conditions of the contract between the distribution company and the suppliers.

As mentioned above, in Poland energy efficiency should play an important role in achieving energy balance. This is the reason for stressing to enterprises that they should develop these activities to the economically and financially reasonable level. The best method to do this within a free market economy seems to us to promote competition. With the possibility of making profits with DSM, and the potential to trade with the effects of DSM programs against purchasing of supply on the wholesale market, positive internal incentives for distribution companies to be concerned about energy efficiency were introduced. Nevertheless, it would be very desirable to provide external incentives for distribution companies by competition between them and ESCOs. During the first stages of rebuilding of the electricity subsystem these companies could cooperate with distribution companies to diminish risk and the costs of DSM. After some time, when more experienced and financially strong ESCOs have developed, they can be expected to compete with the distribution companies for DSM opportunities.

The next source of dispersion of resources and increased competition is independent power producers (IPPs). More reliable demand and higher prices would be the signals for less risky business for private investors. In the Polish situation, domestic finance sources should be more easily available for small and medium size investments than for very big power stations. When supported (financially and institutionally) by local authorities and distribution companies as well as operating in a more-benign environment created by the Energy Law and other centrally established acts, independent power producers could develop quickly very competitive plants - relatively cheap and flexible options against big system power stations. It should be a way to avoid stranded investment for development of supply capacity as a result of very high uncertainty of a whole-country demand forecast and long process of investment in big power station construction.

## **7. THIRD PARTY ACCESS TO THE GRID**

Third party access (TPA) or retail wheeling mechanisms appear very promising to overcome some natural monopoly barriers. Some disadvantages could, however, hamper introducing this idea. The main doubt is inequity in the positions of big, medium and small customers. Efforts and costs of preparation of direct contracts with producers would be similar for every customer while the benefits differ significantly. The proposed structure of the electricity system and the assumed position of the actors in the market will create a sufficiently equitable situation for third party access if the distribution companies and/or the ESCOs, with the incentive of avoiding the marginal cost of purchasing new supply, will represent small and medium size customers. Big and medium size customers would utilize TPA independently. This situation, one anticipates, should happen when competition between supply and demand cost will start and simultaneously different enterprises start competing to serve the potential customers.

Third party access mechanisms will change the structure of contracts for electricity and power supply from the national system power stations as well as will make possible trading with resources arising from DSM, between distribution companies located far away from one another. After the currently negotiated medium- and long-term

contracts expire, third party access should cover majority of the trade in electricity and power from central power stations (Fig. 3).

## 8. NEGOTIATIONS

To realize the above-mentioned concept, the crucial issue is to start negotiations between actors. The very first problem is to define the new business positions of the distribution companies and potential ESCOs when PPGC has to shrink its activity and divide its business according to the five areas described earlier. The attitude of PPGC is very important, because currently almost all the capacity for integrated resource planning and DSM, as well as formal tools for economic and financial assessments of the system are concentrated in this company.

What is very needed is therefore to start to educate management of distribution companies and to start negotiations. According to the concept presented here, the baseline for PPGC could be a level of responsibility for supply no higher than what arises from the current level of installed capacity. This should be a strong incentive for distribution companies to do independent IRP investigations and define their own positions for future negotiations and tenders with the goal of supplying the rest of the predicted demand.

## 9. EXTERNALITIES

The concept presented above should be very friendly to the natural environment because of the development of many DSM options and of concern of reducing the costs of energy production. Additionally, due to a better fit of capacity and costs of production to the economic and technical capability of customers, one can expect room for additional costs imposed for environment protection by the Ministry of Environment, such as taxes, fees and fines, without substantial growth of risk to lost competitiveness of electricity producers and economic recession.

When labour markets expand because of requirements for energy services, energy production from independent power producers, and many additional activities such as energy audits or finance and market service, it could also be a partial remedy for unemployment problems.

## 10. CONCLUSIONS

The decision to restructure the Polish electricity sub-system toward a free market has recently been taken. Currently, we need to determine this market shape during successive stages of the transition. The market would start as a very controlled one at the beginning, with strong supervision of the central regulator, competition allowed only among big system producers, wholesale tariffs for distribution companies and a big share of long-term and medium-term contracts under the management of the transmission company. It would develop to a very competitive market in the future with competition of the supply options against DSM options. This future market should make possible the division of risk and profits on the basis of trade rules among all partners active in the electricity sub-system as well as securing equitable access to the transmission grid. One should obtain an economically sound level of the electricity economy from a comparison, on the wholesale market level, of the marginal cost of production and transmission of energy and capacity on one side and the marginal costs of the undelivered energy and capacity and distribution costs on the other side. This evolution will strongly depend on the readiness of the energy distribution companies and the ESCOs and IPPs to strive effectively to compete for their customers' benefits.

When the Polish economy is in transition, it is very difficult to determine one perfect market (or quasi-market) structure for a long time. This is why the Polish government will have to observe the dynamic progresses of the situation and react flexibly. It seems clear that the crucial issues will be to introduce reasonable tariff rules, a regulatory office obligation, some specific obligations for enterprises and requirements which will match the ongoing changes in the situation, while simultaneously promoting the next changes in the desired direction. This solution has to take into consideration the requirements of improving the economy, any technical barriers, the capacity of Polish electricity institutions to accommodate and to adapt to changes, and their capacity in the future to start to be initiators of the next steps of reform on the basis of its expected benefits. These have to emerge first under the more regulated phase of the processes.

The most important aspect of the transition to the new system is to divide the interest of energy enterprises and to educate managers how to strive for their firm's own interest while maintain enough reliability of electricity supply to

satisfy consumers. This should take place on behalf of the customers and should be an issue of very careful observation of the government.

## 11.ACKNOWLEDGMENTS

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