RECENT REGULATION ON THE DISBURSEMENT OF ELECTRICITY REVENUE IN UKRAINE: PUBLIC INTEREST OR REGULATORY CAPTURE?

by

Kira Grozava

A thesis submitted in partial
fulfillment of the requirements for the
degree of

Master of Arts in Economics

National University of "Kyiv-Mohila
Academy"

2002

Approved by _____
Chairperson of Supervisory Committee

_____

_____

_____

Program Authorized
to Offer Degree _____

Date _____

National University of "Kyiv-Mohila Academy"

Abstract

RECENT REGULATION ON THE DISBURSEMENT OF ELECTRICITY REVENUE IN UKRAINE: PUBLIC INTEREST OR REGULATORY CAPTURE?

by Kira Grozava

Chairperson of the Supervisory Committee: Professor Serhiy Korablin, Institute for Economic Forecasting at the National Academy of Sciences of Ukraine.

In June 2000, barter operations were prohibited by an enactment of Cabinet of Ministers, and shortly, Amendments to the Law of Ukraine "On Electricity" were introduced. The amendments entitle regulation authorities (government officials) to allocate customers' payments for electricity among electricity market participants. According to positive economic theory of regulation, either consumer or producer group gains from regulation of a particular industry. Yet another view is that a single-buyer model (mandatory pool) for electricity, such as the one currently operating in Ukraine, "encourages" government to intervene in the allocation of cash proceeds and to divert cash to illegal purposes, thus creating other group(s) of potential beneficiaries of regulation. Analysis of algorithm of payments' distribution introduced by the regulation policy of interest and negative profits of electricity generating companies indeed suggest that there is group(s) other than producers and consumers. This work offers a refined version of Peltzman model allowing for a tradeoff between three groups and analyses empirical evidence from Ukrainian electricity sector to evaluate how the presence of an additional group(s) distorts price-profit tradeoff discussed in the Peltzman model.

Econometric findings suggest that net cash flows of electricity generating companies decreased after July 2000. Thus, regulation did not achieve the intended goal.

TABLE OF CONTENTS

List of Figures……ii

List of Tables…….iii

Acknowledgments……..iv

Glossary……..v

Chapter 1. Introduction……...……1

Chapter 2. Literature Review……...…4

Chapter 3. Theory of economic regulation……..…….8

Chapter 4. Electricity sector regulation in Ukraine……..…..21

Chapter 5 Empirical Model and Discussion of Results:

Estimation of impact of regulation on profitability of generation companies……..35

Chapter 6. Concluding Remarks ……44

Bibliography……...…49

Appendix

LIST OF FIGURES

Number *Page*

1. Structure of the Wholesale Electricity Market in Ukraine ……51

2. Procedure of Payments for electricity according to the current legislation of Ukraine (2000-2001)……..52

3. The sequence of setting and changing WEM algorithm in years 2000-2001……53

4. State regulation of Ukrainian Energy Sector……..54

5. Accounts Payables and Accounts Receivables of Ukrainian Electricity Generation Sector in Relation to GDP……..18

6. Total vs Monetary Payments in Ukrainian Electricity Generation Sector ……34

LIST OF TABLES

1. Debts of electricity generating companies in Ukraine ……..19

2. Regression Results……...41

ACKNOWLEDGMENTS

I thank my advisor Professor Ghaffar Mughal for his insightful guidance and thoughtful critique during the process of writing. I owe a special gratitude to Professor Ron Johnson for his patience, support, inspiration and invaluable help. I also express my sincere appreciation to Professor Lutz for his advise in the initial stages of writing, for his careful revision of multiple drafts, and constructive comments and suggestions. Special thanks to Professor Iryna Lukyanenko for the fruitful ideas that helped me with econometric modelling. I am also very grateful to Professor Gardner for making valuable suggestions on the latest draft of the paper. And finally, I express my appreciation to my parents, my husband, and some of my colleagues for their very special help.

GLOSSARY

Bilateral contract. A commercial agreement between a selling entity and a buying entity to provide electricity service to meet the buyer's needs while providing certain economic benefits to both. (Cheng, 2001)

Electricity Losses. Physical losses of electricity measured as a difference between metering data on total electricity supply to the network and on consumption by users (Tsaplin, 2001)

HPS. Hydro Power Station.

Independent Suppliers. Suppliers of electricity by non-regulated tariff

Minpalyvenergo. Ministry of Fuel and Energy

NERC. National Electricity Regulation Committee.

NPS. Nuclear Power Station

Oblenergos. Local distribution companies in Ukraine.

TPS. Thermal Power Station

WEM. Wholesale Electricity Market

Chapter 1

INTRODUCTION

In June 2000, the Ukrainian government banned barter transactions, and within a few weeks of the ban adopted Amendments to the Law of Ukraine "On Electricity". According to the amendments regulatory authorities (government officials) became entitled to allocate customers' payments for electricity among electricity market participants. The purpose of this work is to evaluate the impact of regulation of June 2000 on net cash flow of electricity generation companies.

Price and rate-of-return regulation are among the most widely used forms of government regulation of public utilities in different countries throughout the world. Government intervention in allocation of revenues among energy market participants is unique to Ukraine, especially, keeping in mind that generation and distribution levels are viewed as competitive in this country. The justification for such an interference is that it is aimed at increasing the level of monetary payments in the industry and, thus, solving the current problems of the energy sector, namely constant debt accumulation, coal industry crises, systematic electricity disconnection and other widely discussed in Chapter 4 of this thesis.

According to Peltzman model (Peltzman 1976), used as a theoretical background of this thesis, either consumer or producer group gains from regulation of a particular industry. Laszlo Lovei (2000) believes that a single-buyer model (mandatory pool) for electricity, such as the one currently operating in Ukraine, "encourages" government to intervene in the allocation

of cash proceeds and to divert cash to illegal purposes (p.3). So, one may suggest that there is group(s), other than producers and consumers, which appropriates a part of the rent transfer created by regulation in electricity sector of Ukraine. Analysis of the algorithm of payments' distribution introduced by the regulation policy of interest and negative profits of electricity generating companies indeed suggest that there is group(s) other than producers and consumers. This work offers a refined version of Peltzman model allowing for a tradeoff between three groups, suggests in what way the presence of an additional group distorts price-profit trade-off discussed in the Peltzman model, and studies the impact of regulation policy of June 2000 (that introduced group(s) apart from consumer and producer groups) on net cash flows received by electricity generation companies.

During the period of 1999-2001 regulated electricity tariffs rose for residential and industrial consumers suggesting that regulation was not in their favor. Financial and economic state of electricity generation companies widely discussed in chapter 4 suggests that it is highly unlikely that producer group largely benefited from regulation of electric utilities in Ukraine. Empirical section goes into more detail estimating the impact of regulation on electricity producers. Therefore, Chapters 4 and 5 investigate whether electricity producers (generators) experienced an increase or a decrease in their profits[1] as a result of introduction of Amendments to the Law of Ukraine "On Electricity".

The work is organized in the following way. Chapter 2 provides literature review focusing on empirical studies evaluating effects of regulation of electric utilities; chapter 3 describes the Peltzman model of economic regulation, and offers a refined version of the model allowing for the presence of a third

[1] Traditionally, barter operations constitute large share of payments in Ukrainian economy. Regulation of interest banned barter operations because it was aimed at improving financial state of electricity sector through increasing the share of monetary payments. Therefore, in order to measure the success of the policy the impact of regulation on net cash flows (money actually received by the generators) is studied here.

group; chapter 4 gives detailed background information on electricity sector of Ukraine. Tough regulation policies aimed at stabilizing the situation in electricity industry are analyzed, as well as their consequences. In the light of the theory chapter outlining the potential beneficiaries of Ukrainian electricity sector regulation and evidence of real economic situation in Ukrainian electricity industry, the empirical model in Chapter 5 estimates impact of regulation, namely Amendments to the Law of Ukraine "On Electricity" introduced in June 2000, on net cash flow per KWh of electricity generation companies and evaluates empirical results. And Chapter 6 suggests some policy implications that promote deregulation of electricity market in order to improve economic performance of electricity sector and cease the possibilities for regulatory rent-seeking resulting from the temptation to manage cash proceeds.

Chapter 2

LITERATURE REVIEW

According to the "public interest" theory of regulation, government regulation aims at correcting market inefficiencies. A contrary view suggests that due to the information asymmetry or under the influence of interest-groups government regulation results in the creation of market inefficiencies. Electricity industry, like other public utilities, has been considered a natural monopoly subject to market regulation. Applied regulation of natural monopoly ranges from government ownership to various price or rate of return regulation. Regulation of electric utilities is supposed to either serve public interest, i.e. lower prices for consumers, or/and enhance efficiency of electricity generating companies. Albeit, empirical research in this area reveals that in many cases electric utility regulation fails to achieve these goals.

There are numerous empirical studies evaluating the impact of government regulation of electric utilities on different variables measuring economic performance of electricity companies. In "Regulation and Financial Condition of the Electric Power Companies in the 1970's", Paul Joskow (1975) studies the financial prospects of the US electric utility industry under the existing regulation. He suggests that due to the asymmetric information of the regulators, cost increases are not followed immediately by the electricity price increases causing the earned rate of return to fall below the cost of capital. He argues that regulatory decisions rely on historical accounting data instead of extensive projections of future test years, leading to revenue erosion of electricity companies.

Some researchers inspired by Averch-Johnson model (bias toward capital input) study the effect of regulation on the static costs of electric power

industry. Results are mixed. Spann (1974), Courville (1974), Petersen (1975), Atkinson and Halvorsen (1980) received both consistent and inconsistent with the Averch - Johnson effect results. Nelson and Wohar (1983) analyze the effect of regulation on productivity growth in the electric power industry. But Joskow (1989) points out their problem with identification of a meaningful regulatory effect.

The impact of regulation on the service quality evaluated by Joskow (1974), Carron and MacAvoy (1981) is destructive in the periods of inflation. Regulatory agencies usually resist price increase and electricity producers have to economize on capital investment leading to the poor quality of service. Many researchers of electric power regulation effectiveness focus on the question whether electricity prices charged by the regulated firms are lower than of deregulated. The evidence provided by Stigler and Friedland (1962) suggests that electricity prices do not differ significantly between regulated and unregulated states in the US. Moore (1975), Jarrell (1978), and Caudill et al. (1993) point out that electricity prices under regulation exceed unregulated. The researchers believe that the results are consistent with Stigler/Pelzman theory of economic regulation, namely, interest-groups influence regulatory decisions in their favor. The results of study by Mixon Jr., Raymond , and Upadhyaya (1996) based on modern econometric techniques add support to the earlier research. They rely on modern economic theory or regulation implying the endogeneity of regulation. Firms, as well as consumers seek regulation. The former are willing to protect themselves from entry and price reductions and the later - from the market power of monopolies. Thus, Mixon et al. studies the two-way causality in a simultaneous equation system. The estimation reveals that occurrence of regulation is positively related to the electricity price; however, regulation is ineffective in reducing the price of electricity.

Political economy models of regulation allow to analyze distributional effects of regulation, such as, profitability effects, factors' of production rent-sharing, transfers among producer groups, and transfers among consumer groups. Market values of regulatory assets is one of the approaches used to measure profitability effect. Simulation techniques are also widely applied to estimate regulatory effects on profitability. Usually regulation policies have been found to have important distributional effects either among special producer or consumer interest groups. Kalt (1981) extensively studies the distributional effects for the energy sector of the US over the period of 1970's. One of his important findings is that crude oil price controls created an enormous transfer of rents from oil producers to refineries by increasing their profit by roughly 60%.

The study by Gregg A. Jarrell (1978) focuses at determining the effects of state regulation on the price of electricity and the profits of electricity producers. Jarrell examines whether the industry is regulated to protect public interests or the producers' interests. From the point of view of public-interest theory and welfare economics, state regulation is aimed at correcting market imperfections caused by natural monopoly. In such a case competition is wasteful but a single firm may set monopolistically high price and low output. Thus, government role is to restrict entry, set price equal marginal cost and subsidize producers' losses. Jarrell also points out that Harold Demsetz challenges the natural monopolist's ability to set monopoly price. From the point of view of positive theory of regulation, government regulation promotes the interests of the regulated industry. Jarrell states that an important finding is that "the distribution of market surplus in the absence of regulation is an important determinant of the demand for regulation." If the unregulated profits are at maximum and producers are the most politically effective group, it is (politically) optimal not to regulate the industry because regulation would simply lead to opposition. A perfectly competitive market with a powerful consumer group would have the same

implication. Jarrell's regression results support the hypothesis that electric utility industry in US has benefited from a proproducer policy in the first half of the twentieth century.

Chapter 3

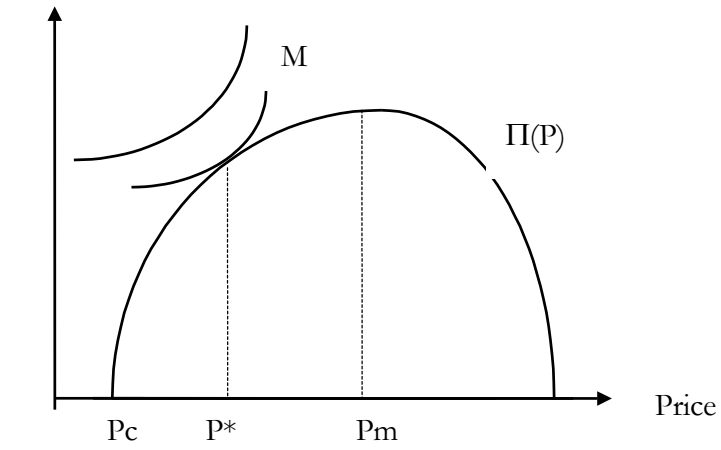
THEORY OF ECONOMIC REGULATION

Public interest has shown to be rather normative than positive theory of regulation. Thus, given the limitations of the public interest theory of regulation discussed in the literature review section and the specific context of Ukrainian electricity sector, a refined version of Peltzman model appears to be more appropriate for a theoretical insight of this study.

Let's look at the original Peltzman model. According to Kip Viscusi, Vernon and Harrington (2000), Peltzman emphasizes that regulation redistributes wealth, regulator is maximizing political support, and interest groups seek for favorable regulation in return for offered votes. As a result, regulatory decisions often favor small interest groups due to their superior organization and strongly felt preferences. Whereas large groups with weakly felt preferences are subject to a free-rider problem, members of small interest groups are willing to spend resources on acquiring beneficial regulation because they clearly realize the large expected gain and offer organized and effective political support.

Thus, legislators tend to introduce regulatory policies, which allow them to maximize political support. Political support is provided by the two groups: producers maximizing their profits and consumers who in turn benefit from low prices. To arrive at illustrate the optimal mix, Peltzman (Peltzman 1976)

suggests reviewing the following graph in order to provide a clear example of price regulation decisions.



Regulator's (politician's) objective function is

$$M = M(W1, W2), \text{ where}$$

$W_i > 0$ is wealth of group i. Thus, a regulator maximizes his objective function subject to constraint on total wealth:

$$V = W1 + W2 = V(W1, W2)$$

By assumption $V_1 > 0$, $V_2 < 0$ which means that total wealth must be distributed within the two groups, meaning that it is impossible to increase wealth of one group without decreasing wealth obtained by the other group.

As discussed earlier, the two interest groups are producers and consumers. Therefore, a function representing political support can be written as

$$M = M(P,\Pi),$$

where P is price and Π- profit earned by an industry, and $M'_P < 0$, $M'_\Pi > 0$. Profit as also a function of price, increasing for the values $Pc < P < Pm$ and decreasing for $P > Pm$. If a regulator raises the price in the range of Pc to Pm he is gaining votes of producers but losing the ones of consumers because M (P,Π) is decreasing in price but increasing in industry profit. Thus, political support increases in the northwest direction. The regulator's indifference curves reflecting price/profit combination resulting in M level of political support have a positive slope since an increase in price must be matched by an increase in profits in order to replace loss of consumer votes with the gain of producer votes. The point of tangency of Π(P) and M1 determines the optimal price P* and profit consistent with the maximization of political support subject to constraint that profit is also a function of price Π(P).

Thus, according to the Peltzman model, either consumer or producer group gains from regulation of a particular industry. This model in its original form, however, may not be suitable for the electricity industry in Ukraine. Laszlo Lovei (2000) believes that a single-buyer model (mandatory pool) for electricity, such as the one currently operating in Ukraine, "encourages" government to intervene in the allocation of cash proceeds and to divert cash to illegal purposes (p.3). Therefore, in countries with corrupt governments there is a possibility for other group(s) of potential beneficiaries from regulation policies allowing for government intervention in distribution of electricity payments. Amendments to the Law of Ukraine "On Electricity"

(adopted in June 2000) introduced an algorithm of payments' distribution according to which government authorities allocate payments for electricity among market participants, including generation and distribution companies, state transmission company, state enterprise "Energorynok". Evidence presented in Chapter 4 suggests that often government allocated electricity revenues to "other needs" determined by the regulation authorities. Thus, the analysis of an algorithm, as well as, negative profits of electricity generating companies indeed suggest that there is a third group(s)[2]. The purpose of this work is to investigate whether electricity producers (generators) experienced an increase or a decrease in profits as a result of introduction of Amendments to the Law of Ukraine "On Electricity". In other words, in what way the presence of an additional group distorts price-profit tradeoff discussed in the Peltzman model?

Let's introduce a third group into the Peltzman model. In Ukrainian context, this group acts as an intermediary between electricity consumers and producers, i.e. the group is allocating cash flows coming from consumers in a form of payments for electricity among electricity market participants and is entitled to divert the cash flows to "other needs" determined subjectively. This third group may be represented by electricity market participants other than generation companies, namely, state transmission company, distribution companies and state enterprise "Energorynok", as well as by "other needs"

[2] There may be more than one additional group, but for simplicity, let's name additional group(s) "a third group" and define it a broad sense, such that it may include electricity market participants other than

determined by a regulator, such as construction of wind power stations, nuclear and hydro power blocks, liquidation of natural disaster consequences, debt repayment, etc, and/or a regulator himself. As a result, a third group may leave a part of producers' profits for its own needs. Thus, a regulator faces a tradeoff between three competing groups, and a model is three-dimensional. But now a regulator himself may represent a third group, thus, in addition to political support he may also be interested in rents generated by his regulation policies.

In the context of Peltzman model, politician's objective function becomes:

$$U = U(M, G) = U(W1, W2), G),$$

where U is regulator's utility being a function of political support from producers and consumers (M) and cash flow he can extract from the producer group (G),

subject to constraint of total wealth:

$$V = \text{Producer Surplus} + \text{Consumer Surplus} + G.$$

Functional relation between price and profit Π is as in the original Peltzman model,

$$\Pi = \Pi(P). \quad (1.1)$$

Thus, regulator's utility function can be written as

$$U = U(\Pi^{\wedge}(P), P, G),$$

$$U'_{\Pi^{\wedge}(P)} > 0,\ U'_{P} < 0,\ U'_{G} > 0$$

---

producers and consumers, as well as, a regulator himself

where P is price paid by consumers, G is a gain of regulator (or a third group that in turn provides any kind of favorable treatment to a regulator) and $\Pi^{\wedge}$ is profit actually received by producer. Formally[3]:

$$\Pi^{\wedge} = \Pi - G. \quad (1.2)$$

Combining (1.1) and (1.2) we see that that profit actually received by producer is a function of two variables:

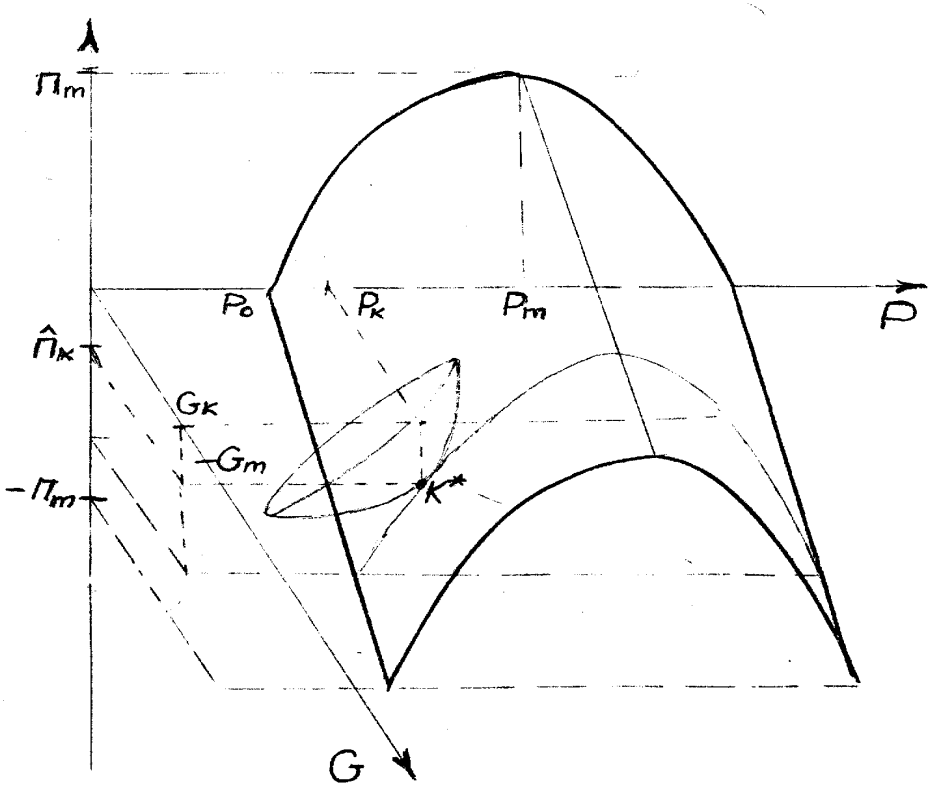
$$\Pi^{\wedge} = \Pi^{\wedge}(P, G) = \Pi(P) - G$$

$$\Pi^{\wedge}{}'_{P} > 0, \qquad \Pi^{\wedge}{}'_{G} < 0$$

Now it is clear that an increase in the third group's gain G leads to a decrease in producer's actual profit $\Pi^{\wedge}$, which may take on negative values as well.

Thus, a regulator now deals with a three-dimensional space, and an interaction between three groups is now represented by a concave down semi-cylindrical surface. Graphically:

[3] Assume G as a lump sum tax, such that the relationship between producers' actually received profit and gain of a regulator is linear.



P-axis shows price, G-axis shows gains of a third group, and Π^ -axis – producers' profit. The values of Πm, Pc, Pm, are as in the two dimensional model, and value of a maximum third group's gain, Gm equals Πm. Note that a part of a semi cylinder is located under the PG surface to allow for negative values of Π^. Regulator's objective is to maximize political support from all three groups (or political support from producers and consumers and regulator's own gain) by setting optimal values of P*, G*, and Π^*. As in the original model, consumers gain from price decrease; producers and a third group gain from price increase. And regulator's indifference curves increase in the direction of (-P, +G, + Π^).

Due to the assumption of a third group, the point of tangency does not necessarily lie on the original profit-price frontier but anywhere on the surface of Π^(P,G). For illustrative purposes, let K* (P*, G*, -Π^*) be an optimal point (the values of Πm, Pc, Pm, and P* are as in the two dimensional model). Point K* with a negative value of Π^* is chosen deliberately in order to demonstrate that current regulation of electricity market in Ukraine make generation companies operate at negative profits.

Because of the assumption of limited wealth, in order to get regulatory rents (or resources to give to a third group) a regulator must decrease wealth of either consumers or producers (or both). In other words, in the presence of the third group that gains from regulation policies, both producers and consumers may lose. Let's demonstrate some possible outcomes of interaction between the three groups in a two dimensional space.

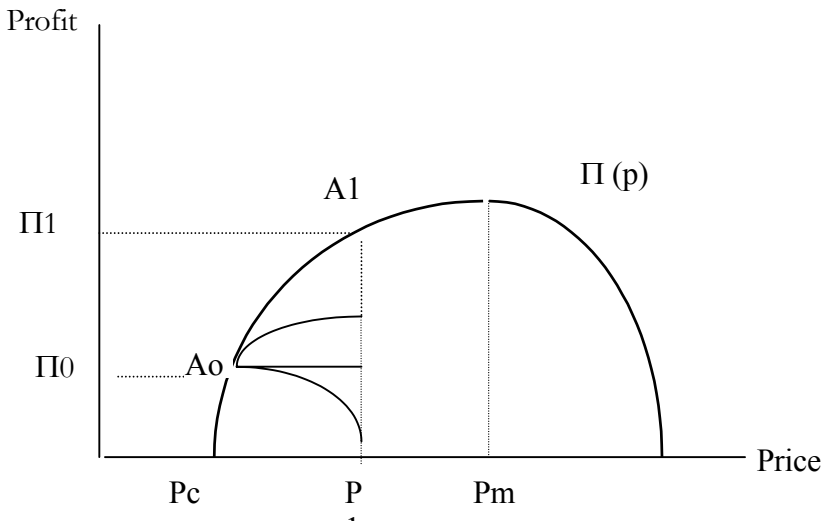
Assume demand for electricity is inelastic[4] and that prices for electricity increase.

First scenario: a third group's takes away a part of cash flow which is larger than additional producer's profit due to an increase in price.

Second scenario: a third group takes away entire additional profit associated with an increase in price.

Third scenario: a third group takes away only a fraction of an additional producer's profit.

Graphically:



Let Ao be a starting point. At this point price is Po and producer profit is Π0. If price increases to P1, and there is no third group, producer's profit should increase to Π1. However, in the presence of a third group there are 3 possible outcomes:

(1) Gain of a third group is G = Π1 – (Π1 - Π0)*k, k>1, where k is a coefficient determining a share of producer's profit taken away by a third group. Since k>1, the profit taken away is greater than an additional profit

[4] According to the study of my colleague, Olexander Polituha, demand for electricity is indeed inelastic for both residential and even industrial consumers in Ukraine .

(Π1 - Π0) resulting from an increase in price. Thus, in this case producer's profit decreased after a price increase: Π<Π0. Graphically, this outcome is represented by the lower line coming out of point Ao. Thus, consumer loses (P↑), producer also loses (Π ↓), and a third group gains (by assumption, with an introduction of a third group its gains are greater that zero). And its gain equals the difference between curve Π (P) and the lower curve measured on the vertical axis.

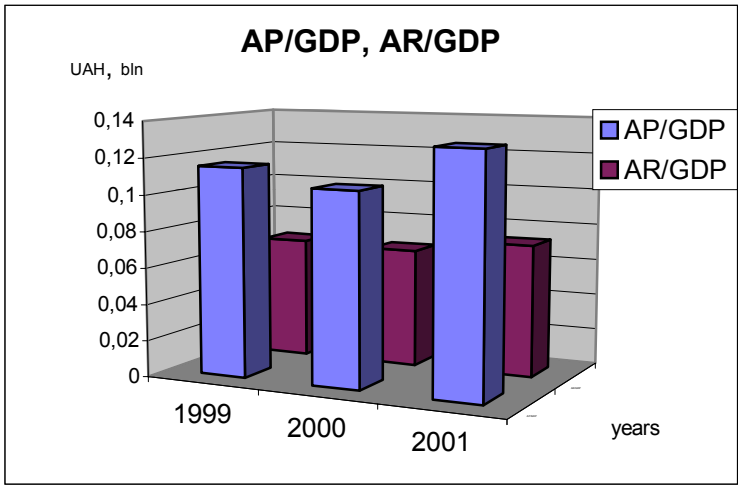
(2) Gain of a third group G = Π1 – (Π1 - Π0)*k, k=1. Meaning, that a third group takes away all additional profit (Π1 - Π0) resulting from a price increase. Graphically, this outcome is represented by the middle line coming out of point Ao. Thus, consumer loses (P↑), producer's profit remains the same (Π = const), third group gains the difference between curve Π (P) and the middle curve coming from the point Ao measured on the vertical axis.

(3) Gain of a third group G =Π1 – (Π1 - Π0)*k, 0<=k<=1. In this case, a third group takes away only a fraction of an additional profit resulting from price increase: Π>Π0. Graphically, the upper curve coming out of point Ao represents this outcome. Thus, consumer loses (P↑), producer gains (Π>Π0), and a third group gains. The gain is measured at a vertical axis as a difference between curve Π (P) and the upper curve coming out of point Ao.

The last outcome may fit Ukrainian electricity sector, since a stipulated goal of a policy that allowed regulation authorities to allocate cash flows (and "legalized" a third group) was to improve financial state of the sector via increasing the level of monetary payments in electricity industry. Assuming regulation authorities want to get reelected, they have to fulfill promises made to potential providers of political support. Thus, after justifying intervention in revenue allocation with the goal stated above, regulator had to allow for a slight increase in producers' profits.

But looking at the debt structure of the electricity generation sector, one can see that electricity sector debts in 2001 increased dramatically in comparison to the year 2000, therefore, it is very unlikely that producers benefited from the regulation of interest.

Figure 6: Accounts Payables and Accounts Receivables of Ukrainian Electricity Generation Sector in Relation to GDP



Source: NERC, own calculations

Unfortunately, difference between accounts payable and accounts receivable of generation sector continues to increase also.

Table 1: Debts of electricity generating companies, billions of UAH.

year	AP	AR	AP-AR
1999	14.978	8.704	6.274
2000	18.295	11.299	6.996
2001	26.243	14.651	11.592

Source: NERC, own calculations

The next chapter describes electricity market in Ukraine and shows that a suggested modified model is more adequate for the real situation in Ukrainian electricity sector because electricity generating companies make negative profits (losses) in Ukraine.

Here let's briefly look at the effect of regulation on consumer group. Electricity consumers may be roughly divided into two subgroups: residential and industrial users. Electricity tariffs for both subgroups are regulated. During the period of 1999 to 2001 tariffs for residential users increased from 11 to 15.6 kopeeks per kW*h, while only capital (Kyiv) residents enjoy day-round electricity supply. Industrial users also faced electricity tariff increase (ranging from 11 to 13 kopeeks per kW*hr for users with demanded capacity of more than 750 kW*h; and from 13 to 17 kopeeks per kW*h for users with demanded capacity of less than 750 kW*hr). Referring to Peltzman model, consumers gain from price decrease, which did not happen in Ukrainian electricity sector during the period of 1999 - 2001. Financial and economic state of electricity generation

companies, widely discussed in Chapter 4, suggests that it is highly unlikely that producer group largely benefited from regulation of electric utilities in Ukraine. But empirical section estimates the impact of regulation policy allowing government to allocate cash proceeds on cash flow per kWh of electricity producers. A modified theoretical model shows that in a presence of a third group producer profits may stay constant, slightly increase, or decrease after an increase in price (even provided inelastic demand). Thus, empirical section will suggest which of the three outcomes discussed above is applicable to Ukrainian electricity industry.

Chapter 4

ELECTRICITY SECTOR REGULATION IN UKRAINE

This chapter describes attempted regulation policies that have led to financial and technical crises in Ukrainian electricity sector, outlines vertical structure of electricity market, and analyses current procedure of payments for electricity in Ukraine.

Ukrainian energy sector belonged to the united energy system of the Soviet Union, which ensured electricity supply to all categories of consumers. The latter had a centralized dispatch and joint systems of electricity supply, transmission and distribution. Such organization allowed predicting technical ability to regulate technological indicators, such as electric current frequency and supply pressure, by varying electricity flows (meaning redistribution of capacity loads in accordance with planned peak periods in different time zones). This made possible for Ukrainian plants to consume electricity generated in Russia and vice versa. Therefore, when Ukraine became independent, it had to solve the technological and economic problems associated with the separation of its energy system.

Starting from 1994, Ukrainian government implemented a string of successive actions aimed at establishment of separate unified energy system (UES). Electricity production has been divided into generation, transmission, and supply. Thus, the following enterprises have been created in the generation capacity break-up process:

- in thermal energy sector: 4 electricity generating companies ("Dniproenergo", "Tsenterenergo", "Zahidenergo", "Donbasenergo") based upon the assets of former TPS (thermal power stations) (fuel: coal and gas); and "Kyivenergo" company, which due to its duty of supplying a city of Kyiv,

owns not only generation capacity (TPC: working using oil fuel) but also transmission lines;

- in hydro energy sector: 2 electricity generating companies ("Dniprohydroenergo", "Dnistrohydroenergo") based upon the assets of former HPS (hydro power stations);

- in nuclear energy sector: national nuclear energy company (NNEC) "Energoatom" that includes 5 nuclear power plants (with Chernobyl).

Beside that, 26 "fixed" territories of electricity supply were segregated in accordance with the administrative-territory organization of Ukraine. Any customer belonging to a specified territory has a fail-proof right for electricity supply by the regional company – electricity supplier – "oblenergo". Therefore, there are 26 "oblenergoes" that now own the corresponding technological complexes of transmission lines.

State enterprise "Ukrenergo" has been established to operate the centralized dispatch and to control the safety of electricity provision. It is subordinated to the Ministry of Fuel and Energy of Ukraine. During the period of 1995 – 1999, "Ukrenergo" carried out operational control over the payments for electricity. Yet another state enterprise "Ukrinterenergo" has been founded to export electricity generated in Ukraine to Eastern Europe countries, such as Slovakia and Hungary.

Some elements of POOL model (wholesale spot market for electricity, developed and approved in Great Britain in the beginning of 90's) were implemented in order to arrange electricity payments. Structure of the Wholesale Electricity Market (WEM) of Ukraine is schematically represented in table 1 of the Appendix. Therefore, electricity generating companies are obliged to sell generated electricity to the wholesale buyer – intermediary (state enterprise "Energorynok" created in the year 2000 and subordinated to

the Cabinet of Ministers). "Energorynok", in turn, became an exclusive seller of electricity to electricity supplying companies.

State monitoring and control over electricity has been divided between executive authority – Ministry of Fuel and Energy that comprise to the Cabinet of Ministers of Ukraine and National Electricity Regulation Commission (NERC). State regulation of Ukrainian electricity sector is schematically represented in table 4 of the Appendix.

Absolute majority of companies-participants of WEM is still controlled by the State. Thus, state owns not less than 75% of corresponding stocks in thermal generation companies and about 95% in hydro generation companies. In 15 (out 26) "oblenergoes", state block of shares ranges on average from 65 to 70% of total equity. "Energoatom" and "Ukrenergo" companies are state unitary enterprises whose status is identical to the subdivision of Ministry of Fuel and Energy (for example, the head of "Energoatom" holds an appointment of deputy minister of fuel and energy).

In October 1997, the Law of Ukraine "On Electricity" came into power. This law determined the main legal, economic, and organizational activity principles of electricity sector enterprises as well as the basis for the WEM operations. As was mentioned above, according to the Agreement among WEM participants, WEM became an exclusive buyer of electricity form generating companies and exclusive seller of electricity to supplying companies. The Agreement also designates rules for WEM operation, including electricity price formation. Formally, it was assumed that WEM Council would consist of representatives of all enterprises - wholesale market participants, and would become a self-regulated authority and would objectively set wholesale electricity prices for electricity suppliers. Tariff formation (cost of services) for electricity transmission and supply by "oblenergos" in the determined territories has been incumbent to NERC. Such tariffs are called regulated.

After analysis of a described WEM system and other provisions of the Law, it is obvious that there is not much scope for declared competition:

1.There is no basis for competition between "oblenergo" and "independent supplier" because distribution networks almost in all cases belong to "oblenegos" ("oblenergo" is a regional monopoly in each fixed territory). Therefore, it is clear that consumers contracting with "independent suppliers" face higher prices than "oblenergo's" customers initially due to rental price of distribution networks. This eliminates consumer's choice of supplier stipulated in the law, and dooms existence of "independent suppliers" to economic failure.

2. There are no direct business contacts between electricity generating and electricity supplying companies, which could "identify" a buyer – electricity supplier liable for payments for generated electricity. Assume the nonpayment for electricity at one fixed territory (caused by, say, technical accident in distribution network) took place. In order to compensate for the lack of money to pay generators for the amount of generated electricity, WEM (in order to pay generators wholesale price) has to increase electricity prices for final consumers located at other territories. Such increase may cause defaults in the whole WEM system due to inability of consumers to pay higher prices. Thus, WEM is only a multilateral agreement among its participants, and WEM Council is not a legal entity able to be in charge of loss with its assets. In such a case, generating companies do not have incentives to lower electricity costs and corresponding bids at the wholesale (spot) market.

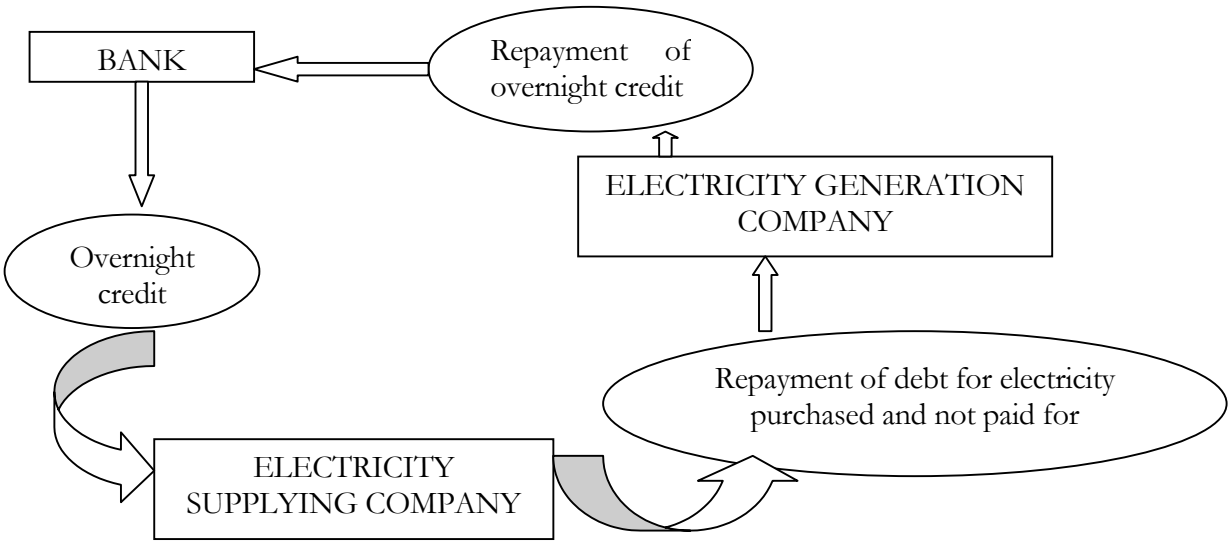
3. WEM is controlled by the state: absolute majority of companies -WEM participants are either state owned or the state has a cinch on them. This converts WEM Council into a "decorative" body, which formally executed decisions of government, NERC, Ministry of Fuel and Energy. For example,

during 1998-2000 electricity prices (paid to generating companies) were set in such a way that could help them pay their debts for imported natural gas and coal, pay back loans which were sometimes taken against state security. It is worth noting, that in Ukraine there is almost no internal market for natural gas and coal for generators (majority of coal mines are state owned, and almost all natural gas has been bought directly by generation companies or by state owned company "Naftogas Ukrainy" from an exclusive supplier of Russian gas to Ukraine – international corporation "ITERA"). Thus, prices for fuel were determined by the Russian partners or by the Ukrainian government in correspondence to its own commitments and liabilities. Besides, government programs of building nuclear reactors at Khmelnitskaya and Rivenskaya NPS and constructing stations for non-traditional sources of energy, as well as, liquidating the consequences of natural disasters (floods, etc) have repeatedly been financed using WEM funds (and not only investment component incorporated in electricity tariffs)). Also, delays with privatisation of enterprises – WEM participants (privatisation had been anticipated by the authors of the law) lead to the absence of strategic investors in the WEM Council, who would stand for objective mechanisms of electricity price formation. Thus, self-regulatory mechanism of WEM Council in the field of competitive market development has not been successful.

4. Average price for "commercial electricity" is formed by a "regulated tariff" because during 1997-2001 government (due to political and social reasons) prohibited suppliers to set a mark up, while other elements of electricity price were set by the government (NERC and Ministry of Fuel and Energy).

Above-mentioned "theoretical" contradictions in statutory provisions, which did not allow for the formation of competitive electricity market relations during 1998-1999 were accompanied by other influential factors that intensified crises in the sector:

1. Debt crises (low level of total payments) and extremely low level of monetary payments for electricity: this tendency has been caused by nonpayment (or dramatically low payments) for electricity by final consumers to electricity supplying companies. This fact (via "chain reaction" in the earlier described structural demerits of POOL model in Ukraine) forced generation companies to constantly accumulate debts and, therefore, worsen their financial state and technological state of equipment. According to German Advisory Group (Opitz 2000), total level of consumer payments for electricity in 1998 was 67% (while monetary payments accounted for only 10%) and in 1999 – 77.4% (with a share of monetary payments – 17.5%). Corresponding differences between total and monetary payments (57% and 59.9% for 1998 and 1999, respectively) was covered with barter transactions and offset payments, most of which were approved by decrees of the government. A mechanism of, so called, "overnight" credits has been among such payment schedules:



Source: Ministry of Fuel and Energy, unpublished materials

Thus, huge amount of offset payments authorised by the government allowed the majority of indebted consumers (60% of which are large

electricity consumers: metallurgy, chemical plants, coal industry, etc and utilities) to be subsidised by generating companies. Former did not pay for the supplied electricity waiting for the successive assent of the government to make offsets.

2. Multiplication of indebted consumers and frequent governmental bans to disconnect their electricity supply: according to German Advisory Group (Opitz 2000), at the beginning of the year 2000 there were 50,000 enterprises that had debts to electricity suppliers.

3. Sharp increase in electricity losses taking place in distribution networks caused by dramatic deterioration of technological state in electricity generation and supply: in 1996 electricity losses in distributional networks amounted to 12.95% while in 1999 they increased to 16.87%. These figures overshoot world standards in 3-4 times. In other words, because of the worn-down capacities, the average yearly losses were 10 billion kWh. This figure is equal to the average yearly electricity consumption by one oblast (region) of Ukraine. Approximately 97% of TPS inventory has worked over its predicted term of exploitation. Coefficient of efficiency of TPS is only 30%, while a similar figure in the developed industrialised countries is necessarily over 60%. Therefore, about 90% of TPS in Ukraine are worth shutting down (or else, constant accidents and breakdown will persist). It is predicted that after 2010, NPS will face alike dilemma. 50% of transmission lines has also depleted its working resources. Therefore, critical technical and technological state in electricity sector has been primarily caused by terrible financial state of electricity generating and supplying companies that does not allow for the necessary renovation of capital, reconstruction of power plants and replacement of transmission lines, not even mentioning introduction of new energy saving systems.

4. Actual bankruptcy of electricity generating and supplying companies caused by constant bad debt accumulation**:** accourding to Minpalyvenergo, at the beginning of 2000, bad debt of "oblenergo" to generators (including VAT)constituted 6 billion hryvnas, and consumers' debt to "oblenergos" – 4.9 billion hryvnas. Clearly, the described situation in electricity sector requires pivotal changes since further financial and technological degradation of the sector threatened electricity production safely in the country. In the beginning of 2000 government started implementation of an ambitious program of actions aimed at stabilization in the energy sector. It was declared that the most vital task was improvement of payment discipline in the sector, increase of monetary payments and elimination of barter transactions. This seemed a right thing to do. In January 2000 government passed a decree according to which, curtailed a list of indebted customers that were previously prohibited to be disconnected from electricity supply. It also allowed electricity suppliers to disconnect all customers (almost without exceptions) who exceeded a certain bad debt volume. Yet another positive aspect lied in an attempt to establish mechanisms for market price formation for fuel and oil products.

However, at the beginning of 2000 some negative tendencies in reforming the sector showed up. The then government officials were convinced that it was possible to eliminate barter transactions and increase the level of monetary payments by hard-handed administrative actions and without seriously altering the WEM model and price formation mechanism. Economic relations in Ukraine heavily relied on barter transactions (including relations between electricity generating and fuel supplying companies). Therefore, an attempt to "moneterise" (allow only monetary payments) all payments in the energy sector simply by a virtue of government prohibition of all other forms of payments and without restructuring the sector could lead to depletion of

existing working capital of customers and new debt accumulation on their part. This is a real result achieved by electricity sector enterprises judging from their financial statements at the end of 2000.

First step of "administrative" reform was taken in April 2000, it was establishment (as a branch of "Ukrenetgo") of state enterprise "Energorynok" subordinated to the government. "Energorynok" has been determined as an exclusive wholesale intermediary in electricity trade.

In June 2000 Verkhovna Rada adopted Amendments to the Law of Ukraine "On Electricity". These amendments introduce full state control over the electricity sector, which was called by press "hand regulation". Table 2 outlines a procedure of payments for electricity envisaged by the Amendments to the Law of Ukraine "On Electricity." A special "algorithm of wholesale electricity market" has been suggested in order to distribute funds of WEM members accumulated as payments for electricity. In other words, this algorithm can be described as a special procedure of allocation of payments from extra distribution accounts carried out by an authorized bank without payment orders. Such extra distribution accounts were opened by electricity supplying companies and wholesale intermediary "Energorynok" with the purpose of funds accumulation received as electricity payments from customers and for clearings with other WEM participants. After customers' payments reached distribution accounts of electricity supplying companies they went to distribution account of "Energorynok". The latter was to allocate funds in correspondence with proportions set by NERC in the algorithm. Hence, generation companies, electricity supplying companies, "Ukrenergo" (dispatch and transmission of electricity through the backbone network), and "Energorynok" itself were among the final funds recipients. But the funds also were to be transferred according to the "other needs" of electricity sector subjectively determined by the government and NERC. So, electricity-supplying companies did not have the right to manage funds on

their distribution accounts. Any other form of payment (but monetary payments necessarily going through the distribution accounts) was banned. Moreover, if a customer made a payment to a current account of the supplier, these funds had to be returned to a customer in three days period so that he could make the same payment to distribution account. In case of contempt, the relevant payment was transferred to the state budget of Ukraine. Besides, changes to the WEM algorithm (that was formally determined by NERC) could be made on the grounds of enactment, statutory orders, delegations of government, decisions of WEM Council, state of emergency proclaimed in WEM. Table 3 presents the sequence of setting and changing WEM algorithm in years 2000-2001. The "direction" and final recipients of cash flows had been changed approximately 120 times during one year.

Other important parameters of WEM, specified in the amendments to the Law of Ukraine "On Electricity", are the following:

Parameter	**Amendments to the Law of Ukraine "On Electricity" (June, 22, 2000)**	**Remarks**
Opening and servicing of distribution account	only in the authorized bank appointed by the government. In June 2000, according to the government decree, Oschadny bank Ukrainy (controlled by the state which owns 85% if its shares) was appointed as an authorized bank.	Supplying companies do not have a right to choose a bank to carry out electricity payments.
Procedure of allocation of WEM funds from distribution accounts	is established by NERC on the grounds of request of Minpalyvenergo (or the government)	The state determines the amount of funds (belonging to the market participants!) to give to each WEM participant and the order of allocation.

Control over the electricity payments	-Government and NERC (operational control). -Auditorial body of Verkhovna Rada – Rahunkova Palata (control over the payments on distribution accounts)	Control over the payments among market participants is conducted by the government and not by the independent audit firms.
Sanctions, including appointment of "temporary head officer" for privatized companies of WEM	Provided by the law	There is a possibility of state authority's interference into private property, including appointment of a new head officer of a joint stock company ignoring adequate statutory procedure (i.e. without holding shareholders' general meeting)
Payments for the services of electricity supplying companies	are possible only after the money reached distribution account of the state enterprise "Energorynok"	Supplying companies do not have the opportunity to manage their own revenues earned
Bilateral contracts	are banned (athwart the draft of the Law of Ukraine "On the Main Provisions of WEM Operation". The development and submission of this law to Verkhovna Rada was envisaged by the law "On Electricity" in force)	One of the most competitive form of electricity market relations does not exist.
A period of existence of distribution accounts	Is not specified	Enforcement of payment discipline was stipulated as only a first step in the development process of competitive environment in WEM

Source: Ministry of Fuel and Energy: unpublished materials, own analysis

Thus, with the help of legal provisions, the government gained an opportunity to dispose of funds of WEM participants and finance certain government programs. This legislation gave governments an opportunity to divert cash flows. For example, in 2000 the following has been financed out of WEM funds in addition to, so called, "investment components" of NERC tariffs:

- construction of nuclear reactors in Rivenskaya and Khmelnitskaya NES (nuclear electro stations);
- Ukrainian part of an international project "Rehabilitation of HES (hydro electro stations) and management in the system";
- "Ukrenergo's", "Donbasenergo's", "Dniproenergo's" and "Zenterenergo's" loans (and interest) repayment to IBRD and EBRD obtained with a purpose of capacity reconstruction in the previous years;
- program of building wind electro stations;
- payments for Russian imported natural gas to the international corporation "ITERA" and payments for the nuclear fuel.

None of the above mentioned problems has been solved. But, during the year 2000 NERC (mostly by government delegations) changed WEM algorithm 120 times (approximately 2 times in a calendar week) and proclaimed a state of emergency in WEM 8 times with an overall duration of about 100 days. During the state of emergency all WEM funds were either transferred to the international corporation "ITERA" as emergency payments for natural gas or aimed at liquidation of consequences of natural disasters (which in fall – winter period often led to electricity disconnection of some Ukrainian regions).

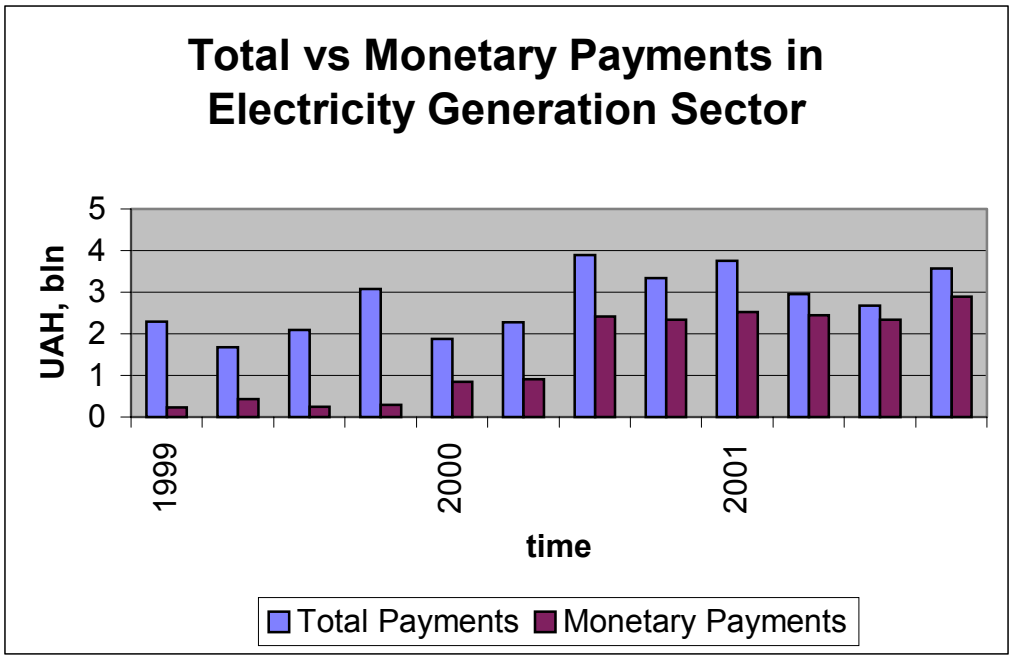
Nevertheless, it is also true that due to such tough administrative actions the level of monetary payments in the sector more than doubled and constituted 41-42% form the overall payments at the end of 2000. At the same time, government often disregarded its own concept of "monetary payments only" by passing the following decisions:

-allowance of the off-set payments through the overnight credits for budget organizations and certain industrial users;

-allowance for large industrial users to pay for the electricity to "Energoatom" up-front with a 20% discount on the wholesale price (on the grounds of a contract between large user and "Energoatom" approved by the government). According to German Advisory Group (Opitz 2000), such kind of agreement is in conflict with POOL model because in this model there should be a common wholesale price (for electricity with the same parameters at one point of time);

-delays with disconnection of heavily indebted industrial users. Resulting increase in wholesale electricity price (14% during the year) disabled other categories of electricity users (agricultural enterprises and utilities) to pay their bills. Besides, government often had to secure loans in order to buy coal for generation companies.

Figure 6: Total vs Monetary Payments in Ukrainian Electricity Generation Sector



Source: NERC, own calculations

The above described electricity sector model shows that in Ukraine there are no direct contacts of generation companies and electricity suppliers, instead government intervenes in allocation of cash flows belonging to the market participants. These facts suggest that Ukrainian electricity sector fits modified Peltzman model with three (or more) market participants described in the previous chapter.

Next chapter estimates impact of regulation that introduced a third group into the electricity market on profits of electricity generating companies in order to suggest which outcome of the three dimensional model described in theoretical chapter is suitable for electricity sector of Ukraine.

Chapter 5

EMPIRICAL MODEL AND DISCUSSION OF RESULTS

5.1 The Model

In this section, I estimate the impact of regulation, namely Amendments to the Law of Ukraine "On Electricity" introduced in June 2000, on net cash flow per KWh of electricity generation companies. According to the amendments regulation authorities (government officials) became entitled to allocate customers' payments for electricity among electricity market participants. Such regulation suggests the existence of an additional group (apart from producers and consumers) that might be a beneficiary of regulation policies. Judging from the financial reports of electricity generating companies, they have been operating at losses for many years. Harsh government regulations banned barter and took over control over cash flows in electricity market with the purpose of increasing monetary payments and therefore, improving financial state of generating companies. But this regulation also introduced an opportunity for distributing cash flows subjectively by diverting them from electricity generators. Sometimes decisions concerning final recipient of money may be based on political rather then economic considerations. Thus, often generators face a third outcome of the model described in the theory chapter, i.e., considerable increase in monetary payments leads to a very small increase in their net cash flow. But sometimes a third group may be able to take all the cash flow of generating companies in order to pay for gas to Russia or to help regions of Ukraine after natural disasters, thus acting according to the first scenario

of the refined model. It is also known that the funds belonging to electricity generators are often directed to such projects as construction of alternative power sources (e.g. wind power stations), however, many of such projects are never fulfilled. Electricity prices as well as the level of monetary payments have risen in Ukraine since 2000, but in the presence of the third group(s) that gains from regulation policies increase in prices may not necessarily lead to increase in producer net cash flow (even given inelastic demand for electricity). The theory chapter suggests three possible directions of movement in net cash flow received by generation companies: it may remain constant, fall, or slightly increase.

Thus, I will test the following hypothesis:

Ho: Net cash flows of generation companies *increased* after the regulation allowing government to allocate electricity payments.

Against the alternative:

H1: Net cash flows of generation companies *did not increase* after the regulation allowing government to allocate electricity payments.

For measuring the effects of regulation researchers use cross-sectional and time series analysis. Measure of companies' performance is a dependent variable modeled as a function of exogenous economic characteristics influencing performance, whereas regulation is represented by a dummy variable. The effects of regulation on performance measures are inferred from

the sign and the magnitude of regulation dummy variable coefficient (Joskow et al 1997). I will follow this common approach.

To estimate the impact of regulation on financial performance of electricity generating companies, I use panel data with 4 thermal, 2 hydro, and a nuclear power companies for the period of three years 1999-2001 (monthly data, 7 cross sections, 36 periods, 252 observations). Data source is National Electricity Regulation Committee (NERC). Twelve months of 1999 and first six months of 2000 reveal performance of generation companies prior to the implementation of Amendments to Electricity Law. On 1st of January, 1999, NERC introduced a new retail price formula. There were no other significant changes in regulation policies up to the second quarter of 2000. Regulation policy of interest was adopted in the last month of the second quarter of 2000. Thus, regulation is time dummy variable and equals 1 for the period of July 2000 – December 2001.

A model similar to Jarrell (1978) is suggested to evaluate impact of regulation policy on net cash flow per KWh of generation companies:

$$CFit = a0 + a1*Lt + a2*Dregulation + a3*CFit(-1) + a4*CFit(-2) + u_{it}$$

CFit - net cash flow per KWh ,UAH;

Lt -electricity losses, %;

Dregulation - dummy for regulation;

CFit(-1), CFit(-2) – net cash flow per KWh of the previous periods, UAH;

i stands for electricity generating company:;

t stands for time period.

Dependent Variable.

Net Cash Flow, CFit

Net cash flow as a dependent variable reveals the effectiveness of generating companies through the cost parameter, as well as the effectiveness of regulation policies that influence the revenue parameter. In order to capture the impact of third group(s) on profits actually received by generation companies, net cash flow per KWh is calculated by the formula:

CF/kWh = (Cash flows - cost of electricity generated)/amount of electricity generated.

Since the Amendment under consideration was aimed at increasing the level of monetary payments, cash flow (or actually received revenues in the form of monetary payments for electricity) will be used instead of gross revenues in the calculation of profit variable. It is worth mentioning that a large part of electricity cost consists of the cost of fuel imported from Russia and Tukmenistan and could be sensitive to exchange rate fluctuations. Fourtunately, for the period under consideration exchange rate was relatively stable. In order to control for the differences in generating capacity among electricity producers, net cash flow is estimated per unit of generated electricity.

Independent Variables.

1) Electricity Losses, Lt

Losses in electricity networks might influence net cash flow of electricity generating companies. Consumers are not supposed to pay for electricity lost in the transmission process. And due to poor technological state of wires, roughly 20% of generated electricity is lost in the networks (or stolen). The expected coefficient is negative because increase in electricity losses causes deterioration of net cash flow.

2) Lagged Net Cash Flow, CFit(-1); Cfit(-2)

Ukraine is known to be a wage arrears economy (Lukyanenko et al 2002). The payment ability of residential and industrial consumers is expected to depend on wage arrears, financial state of industrial customers, and alike. Remembering that electricity payments are made monthly, wage arrears and financial difficulties of enterprises in the previous periods lead to delays of electricity payments, i.e., cash inflows in the previous period influence cash inflows for the following period. This is one of the reasons for net cash flow per kWh of the previous periods to appear in the right hand side of the model.

3) Regulation dummy variable, Dreg

Amendment was adopted in the last month of the second quarter of 2000. Thus, regulation is time dummy variable and equals 1 for the period of July 2000 – December 2001.

In this model, current behavior of net cash flow depends on its past behavior, thus it is a dynamic panel data model. In such models, "within transformed lagged dependent variable is correlated with the within transformed error" because of inclusion of time invariant unobserved characteristics (Verbeek 2000; Green 2000; Hsiao 1999), and, random as well as fixed effects estimators are biased. Therefore, GMM (generalized method of moments) approach is suggested. I use the Arellano-Bond estimator incorporated in Stata 7.0. An excellent theoretic discussion of this estimation technique is provided in Baltagi (2001).

5.2 Discussion if Results

Table 2: Regression results:

Arellano-Bond dynamic panel data
Number of obs 231
F(4, 226) = 9.8

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
CF(-1)	-.076697	.0651897	-1.18	0.241
CF(-2)	.3564863	.0642208	5,55	0.000
LOS	-.00124566	.0007299	-1.72	0.087
DREG	**-.0304695**	.0130618	-2.33	0.021
constant	.0022266	.000689	3.23	0.001

Sargan test of over-identifying restrictions
chi2(241) = 245.84 Prob > chi2 = 0.4016
Arellano-Bond test that average autocovariance in residuals of order 2 is 0:
H0: no autocorrelation z = 2 Pr > z = 0.0459
Arellano-Bond test that average autocovariance in residuals of order 3 is
H0: no autocorrelation z = 0.67 Pr > z = 0.5056

All coefficients except coefficient of the first lag of the dependent variable are significant and have predicted signs. Coefficient of regulation dummy turned out to be negative. The estimation results show that Amendments to the Law "On Electricity" did influence net cash flow of electricity producers. After the regulation entitling government to distribute revenues from electricity payments, net cash flow of electricity generating companies decreased, being more precise, in the short run *losses* of generation sector increased by 3 kopiyka per kWh. Taking into account the dynamic structure of the model, one can predict that in the long run generation companies would incur even greater losses of net cash flow. Thus, the null hypothesis of positive relation between regulation and net cash flow of generating companies is rejected. Ukrainian electricity sector fits the first outcome of the model. After the

government became entitled to allocate electricity revenues to different recipients, generation companies get a smaller share of their money than before this regulation was introduced. According to the data, generating companies are still making losses and experiencing serious financial difficulties. And as has been mentioned earlier, the gap between accounts payable and accounts receivable of generation sector has been widening in absolute terms as well as in relative terms; in fact, it has almost doubled in the year 2001 relative to 2000 with accounts payables reaching UAH 14.5 billions.

After analysing government regulatory actions, one can conclude that these actions have not yielded the anticipated results, in other words, regulation failed its intent. Moreover, along with disabling payments from some categories of consumers, regulation policies in the sector turned WEM operations in a state mechanism of redistribution of deficit monetary funds and ceased development of competitive relations in the electricity sector. Dominance of subjective decision-making in policy of "hand regulation" of monetary flows enhanced possibilities for corruption as well (Lovei 1998). The observed decrease in the cash flow might have been a result of redistribution of funds to other market participants (e.g. oblenergos), albeit it is impossible to prove because the other main recipients of funds, the oblenergos did not report their profits to NERC before the introduction of the Amendments.

Obtained result could be easily predicted because it is counterintuitive to stimulate transparent market operations with proliferation of ad hoc

interventions. The next chapter is devoted to some policy implications based on international tendencies in building competitive markets for electricity.

Chapter 6

CONCLUDING REMARKS

Administrative authorities may be involved in distributional activities rather than in efficient regulation of the electricity sector. Absence of market forces influencing earning capacity discourages investment and lowers budget revenues from privatization. Although the following suggestions do not follow inexorably from the analysis, they are consistent with our findings and have proven to be efficient in many countries.

According to the world experience of reforming energy sector, financial recuperation and restructuring of the sector are closely linked with deregulation and formation of competitive markets for electricity and fuel.

An absolute competition stimulus in electricity markets of many countries is a two level trade model - wholesale (spot) market and a market for bilateral contracts between electricity generating companies, electricity suppliers, and/or large industrial users[5]. Such model allows for centralised WEM dispatch and a unified system of control over electricity payments by means of modern depository and information technologies to monitor "delivery vs. payment." A market for bilateral contracts allows for a turnover of financial derivatives (futures and options) with electricity viewed as an asset. Electricity generating companies are issuers of such financial contracts which guarantee stable electricity supply (with determined parameters) at a predetermined

[5] This was one of the highlights of the 18th World Energy Congress that the author had the privilege to attend.

agreed upon price. When an issuer offers a financial contract for sale, he receives money not only for the volume of electricity sold, but he also receives a fee for a transferred right to sell the contract. At the same time, there is a possibility of direct contracting between generator and a final user. Similar competitive financial instruments are used in markets for coal and natural gas. Therefore, it is easy to correlate prices for fuel and electricity without delays. State regulatory authorities determine a list of consumer categories purchasing electricity at regulated prices (tariffs), i.e. not at competitive market. Such categories are: residents, state military and other security entities, state education and health centers, etc. If other categories of consumers, such as industrial enterprises and businesses, do not go over a predetermined upper limit of electricity consumption, they are also allowed to purchase electricity at a regulated tariff.

Order of restructuring and privatisation in electricity section deserve careful attention. Restructuring of electricity companies (separation of non profitable assets, payments of debts accumulated in previous years, etc) and legislative foundation for competitive drives of electricity market must be provided prior to privatisation and investment. Restructuring is also helpful in optimisation of number of market participants. In the prior to privatisation stage some countries in transition effectively divided large electricity companies into a certain amount of independent economic units. Such strategy attracted investment, which was impossible to obtain before restructuring. In Argentina, for example, there are 40 companies with generation capacity.

Mergers or acquisitions may result only if market forces prove them to be efficient and desirable but not as a result of state regulation.

Improvement of hourly trade system and development of exchanges for electricity, should become important elements of reform. Taking into account varying cost structure of electricity generation in Ukraine, TES companies, "oblenergos" and independent electricity suppliers could become first participants of financial markets for electricity. It is also necessary :

-to determine categories of consumers that have a right to buy electricity at regulated tariff, calculated by NERC;

-to provide a qualification for commercial activities only to those who fulfil obligations on electricity supply according to the tariff on his fixed territory;

-to create a unified information accounting system of dispatch and control over payments for consumed electricity;

-to allow industrial electricity users with highly variable electricity consumption cycles to directly participate in electricity exchanges under the condition of a large share of monetary payments;

-to encourage electricity saving programs by providing some benefits to successful companies;

-to develop a strategy to convert state enterprise "Energorynok" into a non-profit legal entity consisting of electricity market participants or into a joint stock company with state being a shareholder.

A fist step towards developing a competitive market and market for bilateral contracts may be to allow trade of electricity generated with excess capacities, so that electricity price will be objectively determined by the interaction of generating and supplying companies (and maybe large users). This will allow electricity generation companies to discharge accumulated debts and vest them with real property rights for their product. The following would also be beneficial:

-to allow generating companies to make direct contracts with supplying companies and explicitly formulate terms of trade in such contracts: (form of payment: upfront, futures, respite, etc.);

-introduce direct property liabilities of supplying companies to generating companies for the electricity received. This will help decrease losses in distribution networks, eliminate artificial inequality between "oblenergos" and "independent suppliers, as well as, introduce competition among electricity suppliers for solvent clients;

State office in energy sector ought to be regulation and not distribution. The following activities may be included:

- efficient control over fulfillment of contractual obligations among energy sector companies;
- providing sanctions for unscrupulous consumers and electricity, gas, and coal markets' participants;

- modeling electricity generating capacities and demand along with forecasting electricity surplus or deficit and relevant activities to balance the two (planning refits and export/import volumes);

There is no ideal model of restructuring electricity sector that would account for all possible technological and economic peculiarities. Thus, Ukraine has to fit various models to its own environment. Hence, creation of appropriate legislative base with relevant provisions for market functioning is equally important.

The foregoing suggestions acquire urgency in the light of our findings and of unintended consequences of the Amendment of June 2000.

BIBLIOGRAPHY

Agreement between Members of WEM with the amendments dated by the year 2000.

Arizu, B., Dunn Jr., W.H., Tenenbaum, B. (2001); "Regulating Transmission. Why System Operators Must Be Truly Independent." Public Policy for the Private Sector, Note no.226, Washington, DC: World Bank.

Atkinson, S.E. and Halvorsen, R. (1980); "A test of Relative and Absolute Price Efficiency in Regulated Industries", *Review of Economics and Statistics,* 62:81-88.

Badaraco, E. P. (2001); "10 Years of Deregulation in the Argentine Electricity Market: What have we Learned? Pricing in the Wholesale Market and Financing of Operation and Expansion of Transportation." Inversora Dock SUD S.A., Argentina. Technical Paper presented at 18th World Energy Congress.

Baltagi, B. H. (2001); *Econometric Analysis of Panel Data.* 2nd edition. West Sussex, England: John Wiley & Sons, Ltd.

Bergman, L. (2001); "Regulation and Competition On the Nordic Power Market." Stockholm School of Economics, Stockholm, Sweeden. Technical Paper presented at 18th World Energy Congress.

Bohun, V., Terway, A., Chander, S. (2001); "ADB's Support for Power Sector Restructuring in the Asian and Pacific Region." Technical Paper presented at 18th World Energy Congress.

Cabinet of Ministers of Ukraine Enactment #1137 "On the Appointment of the Authorized Bank", 2000.

Cabinet of Ministers of Ukraine Enactment #1139 "On Sanctions for the Violation of the Law on Electricity", 2000.

Carron, A.S. and MacAvoy, P.W. (1981); *The decline of Service in the Regulated Industries.* Washington, D.C.: American Enterprise Institute

Conception of Restructuring RSC "UES of Russia." Draft, July 19 2000, Moscow.

Courville, L. (1974); "Regulation and Efficiency in the Electric Utility Industry." *Bell Journal of Economic and Management Science,* 5:38-52.

Doncel Jones, J. C., "Restructuring of the Public Sector – Privatization and Liberalization Problems with the Privatization and How They Could be Addressed." Conte-Grand,

Doncel Jones & Mazza, Argentina. Technical Paper presented at18th World Energy Congress.

Draft of the Law of Ukraine "On Principles of the Wholesale Electricity Markets Functioning in Ukraine" December 18, 2000, Kyiv.

Electricity Reform Abroad and U.S. Investment.(1997); Available from

http:/www.eia.doe.gov/emeu/pgem/electric/ch4.html; accessed 26 September 2001.

Energy News. Kyiv: All-Ukrainian Energy Committee World Energy Council, 2001. Special Edition #10

Garcia, H., Lalor, R.P., (1996); "Reshaping Power Markets – Lessons From Chile and Argentina." Public Policy for the Private Sector, Note no.85, Washington, DC: World Bank.

Greene, William H. (2000); *Econometric Analysis*. 4th ed. Upper Saddle River, New Jersey: Prentice-Hall, Inc.

Hsiao, C. (1999); *Analysis of Panel Data*. Cambridge University Press.

Jarrell, G.A. (1978); "The Demand for State Regulation of the Electric Utility Industry." *Journal of Law and Economics* 21, 269-295.

Joskow, P.L. (1974); "Inflation and Environmental Concern: Structural Change in the Process of the Public Utility Price Regulation." *Journal of Law and Economics*, 17:291-327.

----------. (1989); "Regulatory Failure, Regulatory Reform and Structural Change in Electric Power Industry," Brooking Papers on Economic Activity: Microeconomics, 125-99

Joskow, P.L., MacAvoy, P.W. (1975); "Regulation and the Financial Condition of the Electric Power Companies in the 1970's" *The American Economic Review*. Vol. 65:2, pp. 295-301.

Joskow, Paul L., Schmalensee, R. (1986); 'Incentive Regulation for Electric Utilities," *Yale Journal on Regulation*, 4:1, 1-49.

Joskow, P.L. in Shmelensee, R., Willing, R. D. (1989); *Handbook of Industrial Organization*. Amsterdam: Elsevier Science B. V. Vol.2, ch.25.

Juchniewicz, L. (2001); "Regulation of Energy Related Activities in Transition Economies - Polish Case." Polish Energy Regulatory Authority, Warsaw, Poland. Technical Paper presented at 18th World Energy Congress.

Kalt, J.P. (1981); *The Economics and Politics of Oil Price Regulation: Federal Policy in the Post Embargo Era*. Cambridge: MIT Press.

Kaserman, D. L., Mayo, J. W. (1991); "The Measurement of the Vertical Economies and the Efficient Structure of the Electric Utility Industry." Journal of Industrial Economics, 39;5, pp. 483-502.

Kennedy, D., (1999); "Competition in the Power Sector of Transition Economies." European Bank for Reconstruction and Development, Working Paper no. 41

Kip Viscusi, w, John M. Veron, Joseph E. Harrington, Jr. (2000); *Economics of Regulation and Antitrust*, Cambridge: MIT Press.

Law of Ukraine "On Energy". # 575/97-VR, October 16, 1997, Kyiv.

Law of Ukraine "On Natural Monopolies" , 1998

Law of Ukraine "On Amendments to the Law of Ukraine on Electricity" # 1821-III, 2000

Law 24065 "Electricity Generation, Transmission and Distribution." December 19, 1991, Argentina

Lovei, Laszlo. (1998); "Electricity Reform in Ukraine." Public Policy for the Private Sector, Note no.168, Washington, DC: World Bank.

_____. (2000); "The Single Buyer Model." Public Policy for the Pivate Sector, Note no.225 Washington, DC: World Bank.

Lukyanenko I, Gorodnichenko Y. (2002); *Contemporary Econometric Methods in Finance and Economics,* Kyiv, Ukraine: Litera (in print)

Ministry of Fuel and Energy: unpublished materials

Mixon Jr., F.G., Raymond, J.E., Upadhyaya, K.P. (1997); "The Economic Theory of Regulation Versus Alternative Theories for the Electric Utilities Industry :A simultaneous Probit Model." Resource and Energy Economics, Vol.19, Issue 3, pp. 191-202

Moore, C.G. (1975); Has Electric Regulation Resulted in Higher Prices? An Econometric evaluation utilizing calibrated regulatory input variable. *Economic Inquiry* 7, 207-220.

National Electricity Regulation Committee. Enactment # 1098 "On approval of WEM Council decision on changing the algorithm of distribution of payments for electricity." as of October 31, 2000.

Nelson, R.A. and Wohar, E. (1983); "Regulation, Scale Economics, and Productivity in Steam - electric generation.", *International Economic Review,* 24:57-78.

Newbery, D. M., Pollitt, M. G. (1997); "The Restructuring and privatization of UK Electricity Supply Was It Worth It?" Public Policy or the Private Sector,

Note no.124, Washington, DC: World Bank.

Ontario Power Generation. Available from www. opgdirect.com; accessed November 16th, 2001.

Opitz, P. (2000); "Payments in the electricity market: results of changes in state policy." German Advisory Group policy paper, Kyiv.

Pelzman S. (1976); "Towards a More General Theory of Regulation", *Journal of Law and Economics* 19: 211-240.

Pepermans, G., Proost, S. (2000); The Liberalization of the Energy Sector n the European Union. KULeven Center for Economic Studies Working paper no.2000-3

Petersen, H.C. (1975); "An Empirical Test of Regulatory Effects", *Bell Journal of Economics,* 6:111-126.

Ryding, Helene. (1998); "Electricity Restructuring in Ukraine: Illusions of ower in the Power Industry?" Centre for Economic Reform and Transformation, Hariot - Watt University, Edinburg.

Spann, R.M. (1974); "rate of Return Regulation and Efficiency in Production: An Empirical Test of Averch-Johnson thesis", *Bell Journal of Economic and Management Science,* 5:38-52.

Stigler, G.J. (1971); "The Theory of Economic Regulation." *The Bell Journal of Economics and Management Science* 2, 3-21.

Stigler, G.J., Friedland, C.(1962*);"* What can Regulators Regulate? The Case of Electricity, *The Journal of Law and Economics 5, 1-16.*

Verbeek, Marno. 2000. *A Guide to Modern Econometrics*. Chichester, West Sussex, England: John Wiley & Sons, Ltd.

Versii. Internet newspaper. "Argentinean Dream of Ukrainian Energy" by Olga Zav'yalova. May 2001.

www.imepower.com

Yates, Philip. (1988); "Improving Power System Efficiency in Developing Countries Through Performance Contracting." Energy Series Paper 4. World Bank, Industry and Energy Department, Washington, DC.

FIGURE 1. WHOLESALE ELECTRICITY MARKET IN UKRAINE

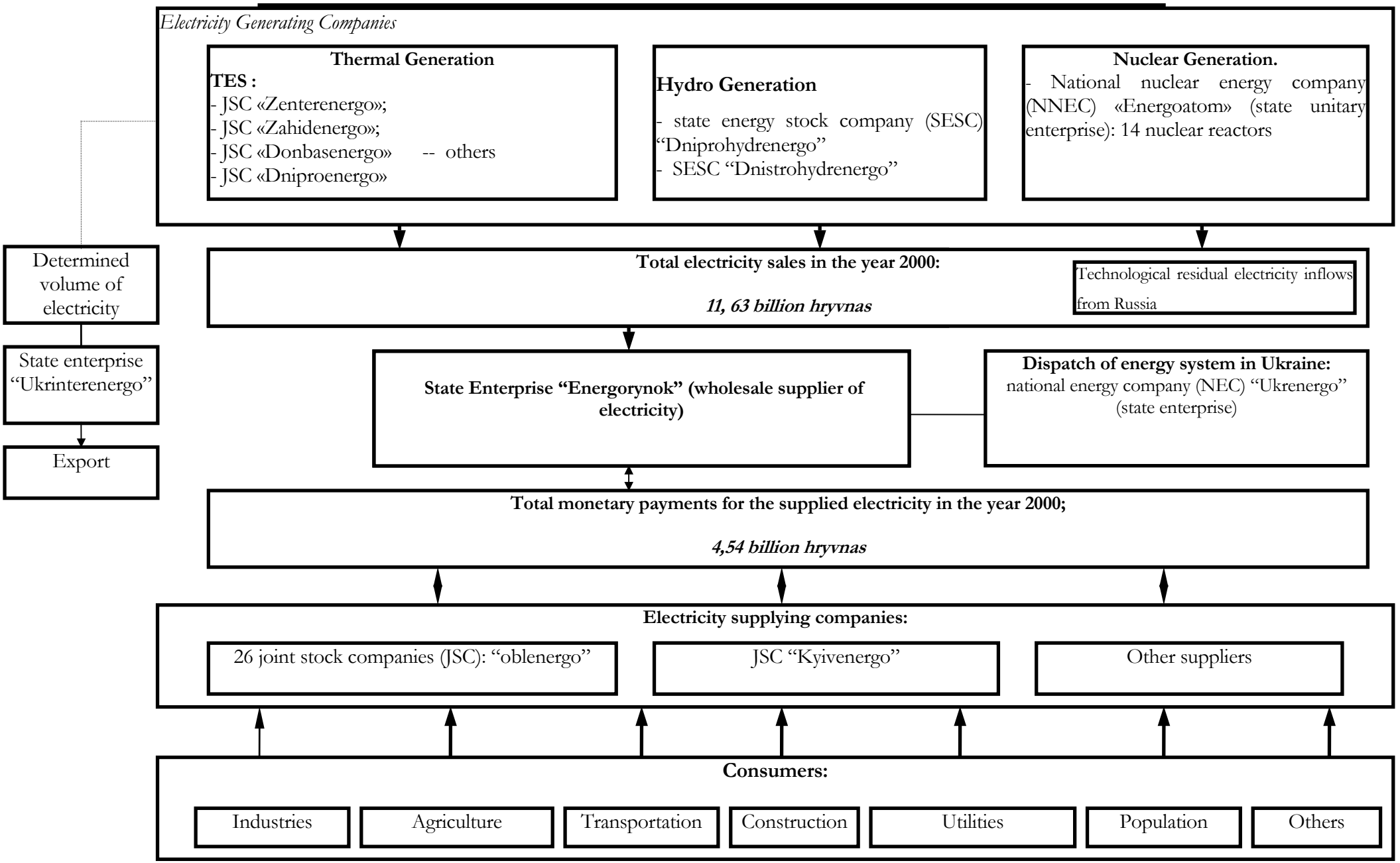


Figure 2. Procedure of payments for electricity according to the current legislation of Ukraine: (2000-2001)

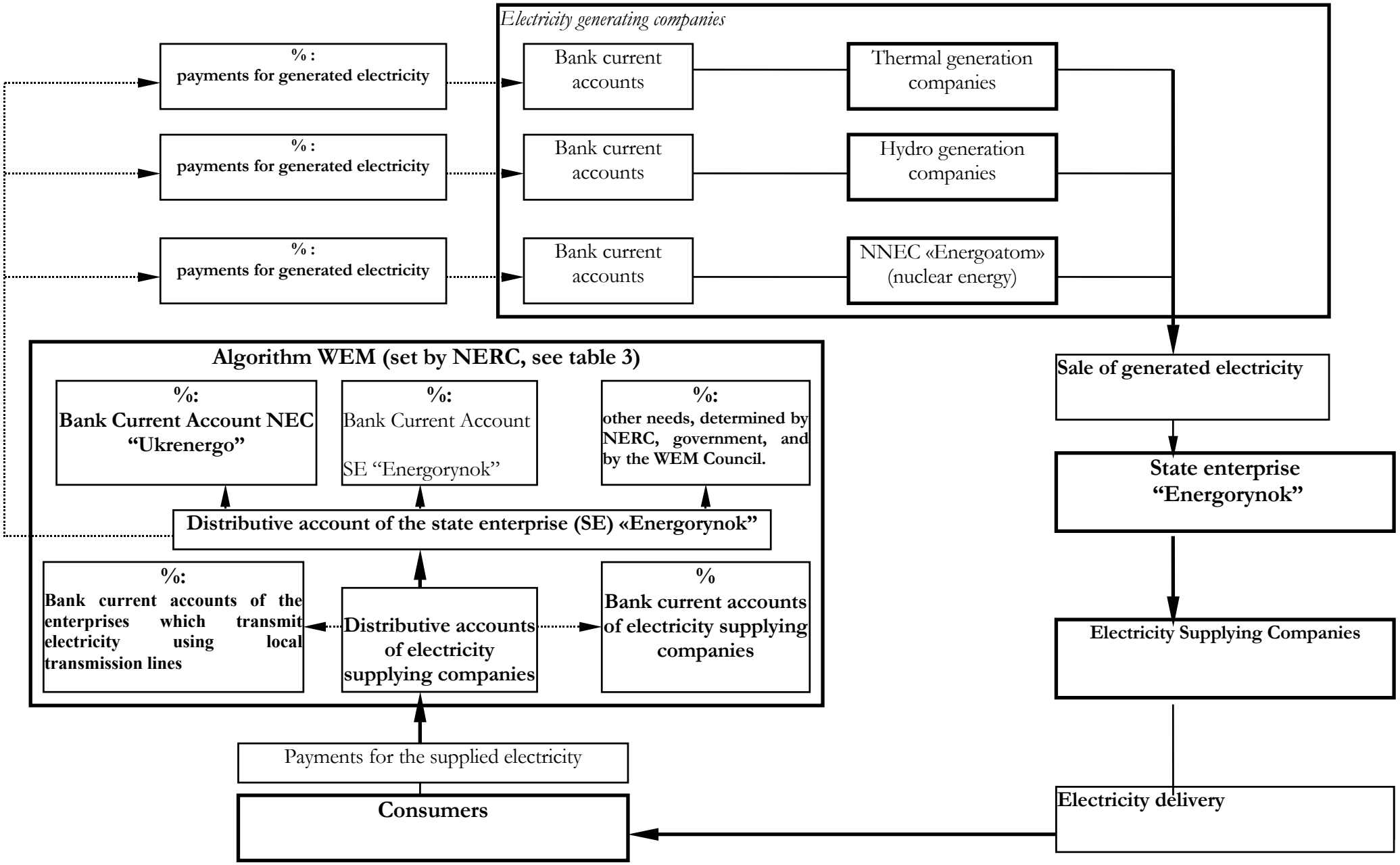


Figure 3. The sequence of setting and changing WEM algorithm in years 2000-2001.

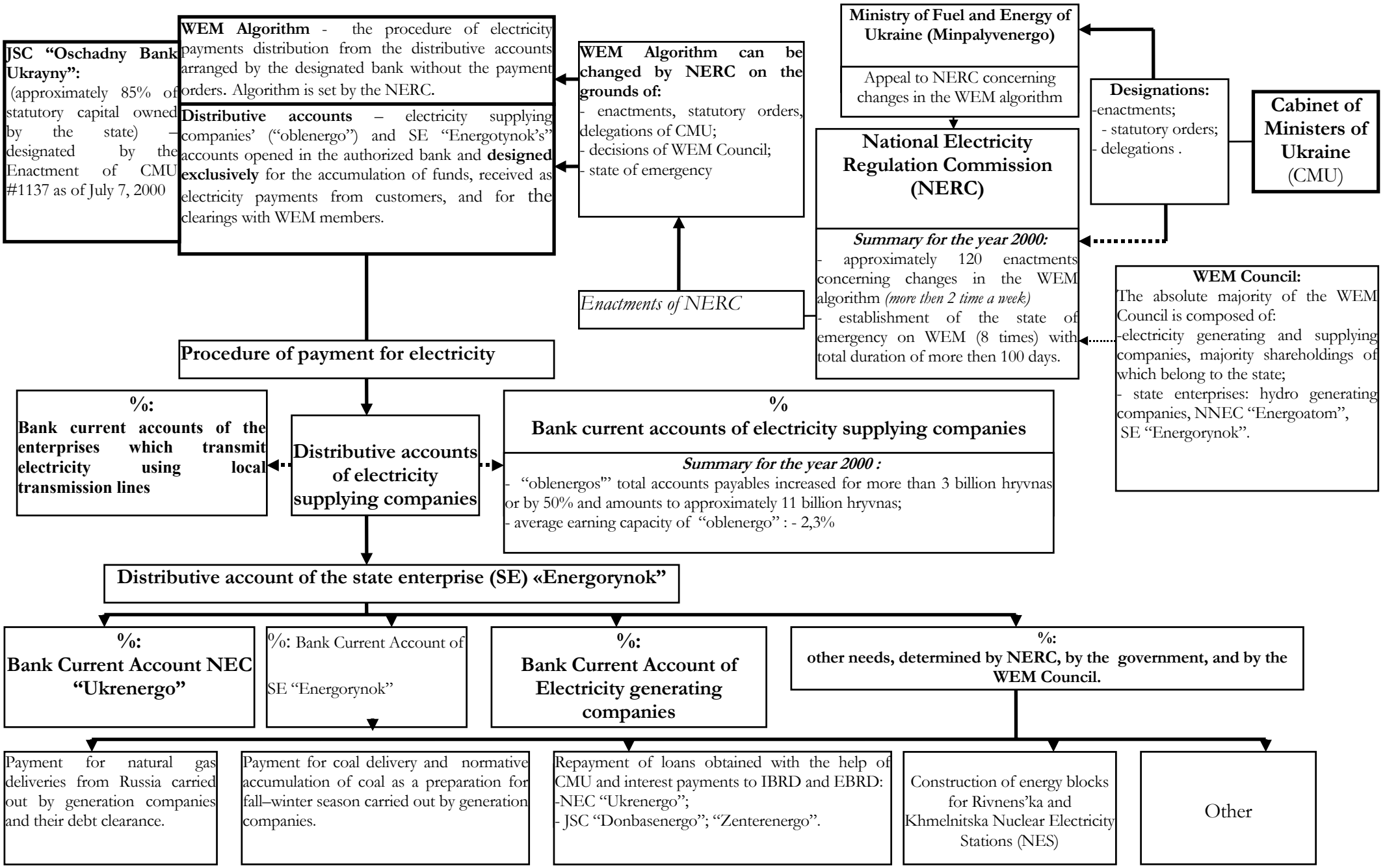


Figure 4. State Regulation of Ukrainian Energy Sector.