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# UKRAINE LOCAL ELECTRIC COMPANIES TARIFF FORMULATION AND METHODOLOGY (TASK B 1)

**NIS Institutional Based Services Under the Energy Efficiency and Market Reform Project**
**Contract No CCN-Q-00-93-00152-00**

**Ukraine Power Sector Reform**
**Delivery Order No 18**

*Final Report*

*Prepared for*

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*Prepared by*

Hagler Bailly
1530 Wilson Boulevard
Suite 400
Arlington, VA 22209-2406
(703) 351-0300

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# TABLE OF CONTENTS

**Executive Summary**

**Chapter 1 Tariffs**

**Chapter 2 Detailed Findings**

| | | |
|---|---|---|
| 2 1 | The Tariff Data Tables | 2-1 |
| 2 2 | Assessment of Transmission and Supply Costs | 2-2 |
| 2 3 | Regulation | 2-2 |
| 2 4 | Business and Tariff Separation | 2-3 |

**Chapter 3 Solutions and Recommendations**

| | | |
|---|---|---|
| 3 1 | The Spreadsheet | 3-1 |
| 3 2 | Cost Assessment | 3-2 |
| 3 3 | Business and Tariff Separation | 3-3 |
| 3 4 | Management of the Tariff process | 3-3 |
| 3 5 | Long Term Recommendations | 3-4 |

**Appendix A Spreadsheet printout**

# EXECUTIVE SUMMARY

This report deals with the work carried out in fulfilment of Task III B, which states

(1) Advise oblenergos on implementation of tariff methodology in licenses including periodic review of cost based license parameters

(2) Co-ordinate with NERC in implementing market based tariff structure and advise oblenergos on data needs and best approach for costs of LVNO, equipment rehabilitation, replacement costs and labour costs

The initial need was for the LECs to complete tariff formulations using a temporary tariff methodology at the instruction of NERC on a monthly basis This task was being undertaken manually and was therefore not being completed on time The Consultant was asked to help and developed a spreadsheet package, which would automate and speed up the required calculations

This process of assistance was used as a vehicle for discussion about the proposed methodologies for more sophisticated tariff formulation already published by ESBI Consultants to comply with the parameters set out in the licenses

One major cause of the suspension, in July 1997, of the World Bank loan to the industry was the failure to implement cost related tariffs The situation at the time of writing is that the loan is still suspended and although the Government of Ukraine has declared its intention to implement a cost based tariff structure at various dates in the Summer of 1998 it has still not taken place In these circumstances the staff in the companies were understandably finding it difficult to be enthusiastic about the theory and process of tariff formulation Advice was limited to explanation of the tariff calculation spreadsheets and discussion of the data collection and management processes that should be put in place to ensure a more accurate tariff once the company was free to set tariffs once more

There is a strong case for advice on tariffs and the management of the energy market process to be extended It will take several years for the system to develop into a fully working market and the LECs would benefit greatly from assistance on a "hand holding" basis for at least the initial two or three years of this development

# CHAPTER 1
# TARIFFS

1 1 A major part of the commercialisation of the industry is the need for the low voltage electricity supply and distribution businesses, within the Local Electricity Companies (LECs), to set commercial tariffs which reflect the true costs of production and distribution for the electricity that they deliver

1 2 As part of the process, the LECs are being asked by the National Electricity Regulation Council (NERC) to calculate, and return to NERC, complete cost and transmission details in data tables which NERC provide

1 3 The methodology being used for these calculations is called "Temporary methodology for the calculation of retail tariff for electricity consumed, tariff for electricity transmission by local networks and tariff for electricity supply" As the name implies, it is intended simply to start the idea and process of cost related tariffs in a situation where tariffs have always been decided by political command in the past

1 4 The methodology only looks at current costs with no regard for any return on past investment in network assets or the need to make provision in the tariff revenue for future replacement of network assets

1 5 The main intention of Task III B is to advise on the implementation of the generic tariff methodologies, developed and published by ESBI consultants, to meet the terms set out in the License parameters However it was obvious at "grass roots" level that the LEC's tariff staff needed direct assistance in the temporary method being applied at the time The Consultant therefore decided that giving assistance with their necessary tasks of tariff formulation, even by a method which did not meet the criteria of tariff formulation set out in the License, would be the best vehicle for discussing more correct principles of cost related tariff formulation

# CHAPTER 2
# DETAILED FINDINGS

## 2 1 The Tariff Data Tables

**Objective** To enable the LEC to complete the tariff data tables provided by NERC in an efficient and accurate manner

**The present process**

2 1 1 The tariff data tables supplied by NERC, with which each Oblenergo are expected to make their returns of costs and transmitted electricity, are already in MS Excel spreadsheet form

2 1 2 However Oblenergo staff were inserting the data into each cell of the spreadsheet by hand, following manual calculations

2 1 3 Data is being returned to the tariff staff, by various departments of the Oblenergo, as paper documents and then being transferred and combined by manual process

2 1 4 The calculations result in tariffs for two voltage levels The split in costs between voltage levels appeared to be based on very approximate personal judgement

2 1 5 Basically the original spreadsheet format was only being used as a method of printing the end result

**Weakness in the process**

2 1 6 The manual transfer of data from several sources and subsequent manual calculations provide many conditions for human error to affect the process

2 1 7 Automation of the calculations would allow for automatic testing for validity of data This is rarely possible with manual calculation

2 1 8 Automation of the calculations would also allow for modelling of the effects of change This is very labour intensive by manual means

## 2.2 Assessment of Transmission and Supply Costs

**Objective** To derive a method of assessing the true, fair and acceptable costs of the transmission and supply businesses

2 2 1 The costs included in the existing tariff calculations are not originally split between the Transmission and Supply businesses They are artificially split using an arbitrary proportion

2 2 2 The costs, which were being included, are only those paid during the relevant period and not the costs incurred or accrued during the period

2 2 3 Many of the costs listed as "Payment from profit" are not profit dependant and are therefore prime costs and should be treated as such Many taxes and fund payments are included which are not related to the amount of profit the company makes

2 2 4 Many "social" costs are included (e g costs of providing "pioneer" camps) These should be the responsibility of the local social service administration not a private company The costs of these services should not be borne either by electricity customers or shareholders

2 2 5 There is no provision in existing cost calculations for a financial return on past investment in network assets

2 2 6 No allowance is made in the current method for the need to replace distribution network assets in the future

## 2 3 Regulation

**Objective** To assist the LEC in negotiating the review of its Use of Network tariff calculations by NERC

2 3 1 Resulting tariffs indicated a need for considerably higher transmission tariffs than were consequently set by NERC, usually by a factor of 2 or 3

2 3 2 The Consultant urged the companies to discuss this problem with NERC The intention was that both the company and NERC would learn from the exercise of comparing their calculation processes When one LEC actually travelled to Kiev and met with NERC, it was admitted that NERC were not employing any calculation process and were simply using political judgement

2 3 3 Regulation is being based on costs not on permitted revenue This provides little incentive for financial efficiency within the LEC

2 3 4 No long term stability Revenue based regulation could be more stable over a longer period with an agreed system of indexation

2 3 5 At present the Supply Tariff is also subject to regulation

## 2 4 Business and Tariff separation

**Objective** To ensure that the Supply and Transmission businesses operate separately and formulate separate tariffs

2 4 1 There appears to be no clear segregation of Supply and Distribution either in the cost calculations or the minds of staff

2 4 2 There is also a lack of distinction between the way in which the tariffs associated with each business are treated by NERC

2 4 3 The Supply tariff should be entirely determined by market forces and therefore un-regulated

2 4 4 The Use of Network, usually called the Transmission tariff, provides income to the distribution business, which is a natural monopoly It must therefore rely on regulation to ensure that it is set in a manner, which is fair and reasonable to all parties



1

# CHAPTER 3
## SOLUTIONS AND RECOMMENDATIONS

### 3 1 The Spreadsheet

3 1 1 The spreadsheet is mostly based on the original tables in Ukrainian that were provided by NERC to each LEC The original spreadsheet has been altered in the following general ways

- There is a minimum input of data and then the process of replication and calculation is automated to reduce the possibility of human error

- The more complex calculations could be defined in complex formulae hidden in individual cells in the original tables However it makes the calculation process easier to follow if each step of the calculations is set out line by line and gives economists who are used to manual calculation a better feeling of control

- To assist Consultants to understand the calculations the Ukrainian/Russian worksheets are replicated in English The English worksheets are only mimics of the Ukrainian/Russian worksheets and can be deleted without affecting the operation of the calculations in any way

- A set of instructions for the sequence of use of the spreadsheet is included in English and Russian as part of the spreadsheet itself

3 1 2 A simple method of apportioning costs between voltage levels was needed The method used in the spreadsheet simply uses a count of the lengths of underground and overhead networks and the numbers of substations at each of four-voltage level It then automatically splits the appropriate costs into the current two voltage levels In order to compare lengths of network and numbers of substations the unit components were costed using normative costings provided by the Institute of Rural Electrification The actual cost figures used are not important but provide a readily available method of apportionment that can be used now During discussions , each LEC was advised to develop their own set of costs to apply to this table which reflect their own situation

**Recommendation** *Each company is urged to develop its own method of apportioning costs between voltage levels, which reflects its own network and financial situation*

3 1 3 A schematic illustration of the transmitted electricity together with the losses has been included to help to clarify the actual practical position indicated by the figures

3 1 4 The process of assessing technical electrical losses varies in each company Some seemed to have definite data apparently derived from actual meter readings Others relied on traditional estimates

3 1 5 The tariff requirements from NERC usually specified that they use the normative values set by NERC

3 1 6 Without exception the values used by LECs seemed to be approximately 20-30% lower than the Consultant would expect from the typical Ukrainian network and the normative values were even lower The actual figure can not be reliably calculated when there is a high level of commercial loss (theft) of electricity

**Recommendation** *Each LEC should attempt as soon as possible to verify its level of technical losses and endeavour to agree these figures with NERC*

## 3 2 Cost Assessment

3 2 1 The costs included in the existing tariff calculations must be split between the Distribution and Supply businesses at source rather than be communally accounted and then split artificially later

3 2 2 The "Payments from Profit" section of the cost data table includes items which are not in the least related to whether the company makes a profit or what size that profit may be This change would need to be negotiated with NERC

3 2 3 Accrued costs actually incurred during the tariff period must be included in the appropriate tariff formulation even if they were not actually paid within the period

3 2 4 The costs associated with provision of local social services should eventually be transferred to the local civic administration They are more properly funded from tax revenues rather than by electricity customers or company shareholders

## 3 3 Business and Tariff separation

There should be a much more clearly defined segregation of the Supply business and its market related supply tariff from the Distribution business and its regulated Use of Network tariff

3 3 1 The company structure, business activities and accountancy procedures should be separated between the Supply and Distribution businesses

3 3 2 The formulation of the Supply tariff should be completely separate from the Use of Network (Transmission) tariff

3 3 3 In the long term there should be a separate Supply business within the umbrella of the LEC

## 3 4 Management of the Tariff process

3 4 1 During discussion the value of good information was stressed Systems should be devised to ensure that data gathered from load control and metering should automatically feed into tariff formulation processes

3 4 2 Several of the district network organisations have detailed information provided by load metering systems and collated by telephone and computer data collection systems The data from this system would be of great value to tariff formulation staff, especially when improved metering system allow for more sophisticated tariff structure

3 4 3 Customers load demands should be modified by financial incentive rather than by disconnection The tariff should give clear signals to the customer about the benefits of using electricity efficiently and the financial penalties of exceeding agreed parameters This method can only be effective if the billing and collection process is efficient

3 4 4 Unless a return on the capital invested can be demonstrated to be included in the tariff revenues, this situation will discourage outside investment

3 4 5 Unless some allowance is made in formulation of tariffs and in the accounting procedures for the need to replace distribution network assets the company will not be able to meet its commitments to maintain an efficient distribution network in the future

## 3 5 Long Term Recommendations

3 5 1 There should be an ongoing process of negotiation with NERC to make the tariff formulation process more reasonable to all parties involved This would be better achieved by a Tariff Working Group from a trade association of Oblenergos

3 5 2 Such an association would be a great benefit to the companies It would also benefit the industry as a whole because the oblenergos need to be financially healthy and efficient as they provide the only point at which real revenues are collected for the whole industry

3 5 3 The Consultant feels that, especially in the field of tariff formulation and the developing energy market system, consideration should be given to funding a longer term "hand holding" advice programme These systems will continue to develop in major ways for several years to come This could be on a reduced level of activity but be available to assist in the negotiations for the development of the market and tariff systems



11

# APPENDIX A
# SPREADSHEET PRINTOUT

**Temporary Tariff Methodology**
**Spreadsheet Instructions**

**GENERAL**

a) The original Ukrainian Tables are the active worksheets The English Tables could be deleted without disturbing the operations

b) The calculations use only the Forecast columns of the relevant tables The Base Period is only for comparison

c) The major calculations are shown step-by-step so that they can be followed and checked

d) The calculation sheets have both Russian and English labels and either language can be hidden to aid viewing of the sheet in one language only

e) The Table 1 "Payments from Profit" could also be automated to suit a local company s method of assessment of these costs

**INPUT SEQUENCE**

**1 Intro**
Input Company Name, period of tariff calculations, normative technical loss factors and seasonal (quarterly) adjustment factors This will automatically generate headings for each sheet and include correct normative loss factors where needed

**2 Table 1**
Input costs for generation, transmission and supply The totals in each column and the Total Cost column will be completed automatically

**3 V Class%**
Input lengths of underground cables (km) overhead lines (km) and numbers of substations at each voltage level This data is then combined by using the normative costs to give a relative cost in each of 4 voltage levels The percentage in the 1st (35kV and above) Voltage Class is then automatically used to split the costs of transmission

**4 Table 2**
Total Transmission costs are auto transferred from Table 1 The 1st Voltage Class costs are automatically split as in 3 above

above

**5 Table 3**
Capital Expenditure is input (when permitted !)

**6 Table 4**
Input all known amounts of energy transmitted and sold Amount transformed from 1st to 2nd voltage level is calculated in HB Losses(see 7 below) and auto-inserted

**7 HB Losses.**
Amounts transmitted are auto-inserted from Table 4 Input losses in each voltage level % loss factor are auto-reported at foot of sheet (Note If Normative LF are needed use Goal Seek function to alter losses in each voltage level and make reported losses equal Normative values )

**8 Trans Diag**
Graphically illustrates the amounts being transmitted etc

**9 LTT(HB)**
Sets out the step by step calculation of the Local Transmission Tariff rates All figures used are auto inserted from tables The resulting tariff rates are reported in Table 6

**10 Supply(HB)**
Calculations for Supply Tariff The total amounts of energy sold in both voltage levels is report to this sheet The correct percentage of this total should then be allocated to each Customer Group The resulting rates are then reported to Table 7

**11 Retail Calcs.**
Input Average Purchase Price This will be adjusted for losses in each Voltage Class The Tariff rates are reported automatically and the Retail Tariff calculated in the 'Oblenergo" table If NERC rates are known then a comparable table will indicate the Retail Tariff that will derive from these rates

**12 Table 8**
Completed automatically from 11 above If amounts sold to each of these categories of customer are known they can be added to this table and the revenue calculated

Overall Costs (1) \A1

| Any Oblenergo | Jan 97 |
|---|---|

| No | Cost Components | Total costs CT Gr | | Generation Costs CG Gr | | Transmission Costs CL Gr | | Supply Costs CS Gr | |
|---|---|---|---|---|---|---|---|---|---|
| | | Base Period | Forecast Period | Base Period | Forecast Period | Base Period | Forecast Period | Base Period | Forecast Period |
| 1 | Costs which can be referred to as primary costs of the licensed activity | | | | | | | | |
| | - material costs | | 1 790 906 | | 1 294 000 | | 468 764 | | 28 142 |
| | - labour costs | | 1 069 000 | | 35 000 | | 833 714 | | 200,286 |
| | - payments or social measures | | 544,000 | | 17,000 | | 424,973 | | 102,027 |
| | - depreciation | | 2,055,000 | | 81,000 | | 1,966,499 | | 7,501 |
| | - cost of repairs | | 158 000 | | 43,000 | | 104 409 | | 10,592 |
| | - cost of electricity for internal needs | | 75 094 | | - | | 75 094 | | - |
| | - cost of using others' trans networks | | - | | - | | - | | - |
| | - other costs | | 387,000 | | 2,000 | | 298,144 | | 86,856 |
| | Total | | 6 079,000 | | 1 472 000 | | 4 171,596 | | 435,404 |
| | Indirect costs | | 369,000 | | 89,352 | | 253,219 | | 26,429 |
| | TOTAL - direct + indirect costs | - | 6 448 000 | - | 1 561 352 | - | 4,424 815 | - | 461 833 |
| 2 | Payments from Profit | | | | | | | | |
| | - for development & production base | | 77 040 | | 18 655 | | 52 867 | | 5,518 |
| | - for capital investment | | - | | - | | - | | - |
| | - for increasing turnover funds | | 51,584 | | 12,491 | | 35,399 | | 3,695 |
| | - for social measures | | 331,590 | | 80,293 | | 227 547 | | 23,750 |
| | - for incentives | | 73,571 | | 0 | | 73,571 | | - |
| | - other purposes (land + transport) | | 101,033 | | 7 933 | | 93,100 | | - |
| | - to investment fund | | 64,480 | | 15,614 | | 44,248 | | 4,618 |
| | - to reserve fund | | - | | - | | - | | - |
| | - dividends | | - | | - | | - | | - |
| | - taxes from profit | | 321 806 | | 63 204 | | 240,913 | | 17 689 |
| | - to centralised funds | | 51,584 | | 12,491 | | 35,399 | | 3,695 |
| | TOTAL - Payments from Profit | - | 1 072 688 | - | 210 680 | - | 803,043 | - | 58 965 |
| | GRAND TOTAL | - | 7,520,688 | - | 1,772,031 | - | 5,227,858 | - | 520,798 |

Intro

\A1

| | | | |
|---|---|---|---|
| Oblenergo | Ioıaouoa ıacaaıea Iaeyıa?aı | | Any |
| Period | Ioıaouoa ?an?aoıue ıa?eıa | 1 | ?ıaa?u |
| | ( o a 1 = ?ıaa?u eee 32 = 2 eaa?oae) | | Jan |
| Year | Aaaaeoa aıa | 97 | |

| | | eean | |
|---|---|---|---|
| | | 1 | 2 |
| Normative LF | Aaaaeoa ıı?ıaoeaıue eıyooeoeaıo eı??aeoee | 2 20% | 6 00% |
| LFA - 1st Qtr | Eıyooeoeaıo eı??aeoee - 1 eaa?oae | 1 5 | 1 2 |
| LFA - 2nd Qtr | Eıyooeoeaıo eı??aeoee - 2 eaa?oae | 0 6 | 0 8 |
| LFA - 3rd Qtr | Eıyooeoeaıo eı??aeoee - 3 eaa?oae | 0 5 | 0 5 |
| LFA - 4th Qtr | Eıyooeoeaıo eı??aeoee - 4 eaa?oae | 1 4 | 1 2 |
| | Eıyooeoeaıo eı??aeoee | 1 5 | 1 2 |
| | | 0 033 | 0 072 |

| | | | | |
|---|---|---|---|---|
| 1 | ?ıaa?u | Jan | 1 5 | 1 2 |
| 2 | Oaa?aeu | Feb | 1 5 | 1 2 |
| 3 | Ia?o | Mar | 1 5 | 1 2 |
| 4 | Aı?aeu | Apr | 0 6 | 0 8 |
| 5 | Iae | May | 0 6 | 0 8 |
| 6 | E?ıu | Jun | 0 6 | 0 8 |
| 7 | E?eu | Jul | 0 5 | 0 5 |
| 8 | Aaaono | Aug | 0 5 | 0 5 |
| 9 | Naıoya?u | Sep | 0 5 | 0 5 |
| 10 | Ieoya?u | Oct | 1 4 | 1 2 |
| 11 | Iıya?u | Nov | 1 4 | 1 2 |
| 12 | Aaeaa?u | Dec | 1 4 | 1 2 |
| 31 | 1 eaa?oae | 1st Qtr | 1 5 | 1 2 |
| 32 | 2 eaa?oae | 2nd Qtr | 0 6 | 0 8 |
| 33 | 3 eaa?oae | 3rd Qtr | 0 5 | 0 5 |
| 34 | 4 eaa?oae | 4th Qtr | 1 4 | 1 2 |
| 35 | Aıa | Annual | 1 | 0 925 |

| | |
|---|---|
| Eoaaıne | Lugansk |
| Aııaoe | Donetsk |
| E?uı | Krım |
| Naaanoıllıeu | Sevastopol |
| | Kharkov |
| | Poltava |
| | Sumy |
| | L'vıv |
| | Khmelnıtsky |
| | Vınıtsa |

V Class %

\A1

Underground Cables

| Voltage Level kV | UG Cables km | Normative Costs Gr /km | Voltage Class | Total Normative Costs |
|---|---|---|---|---|
| 110 | - | 4,446 70 | 1 | - |
| 35 | 15 | 1 845 90 | 1 | 27,689 |
| 6/10 | 1 873 | 537 50 | 2 | 1 006 523 |
| 0 38 | 1,378 | 461 10 | 2 | 635 257 |

**Any Oblenergo** **Jan 97**

verhead Lines

| Voltage Level kV | OH Lines km | Normative Costs Gr / km | Voltage Class | Total Normative Costs |
|---|---|---|---|---|
| 110 | 2,044 | 418 06 | 1 | 854,515 |
| 35 | 3,276 | 268 67 | 1 | 880 217 |
| 6/10 | 6,806 | 106 54 | 2 | 725 079 |
| 0 38 | 18,683 | 108 95 | 2 | 2,035,546 |

| Voltage Level kV | Existing Voltage Class | Total Normative Costs | % Costs 4 Voltage Classes | 2 Voltage Classes |
|---|---|---|---|---|
| 110 | 1 | 854 515 | 2 65% | 34 601% |
| 35 | 1 | 10 297 505 | 31 95% | |
| 6/10 | 2 | 15 698 602 | 48 71% | 65 399% |
| 0 38 | 2 | 5,379,883 | 16 69% | |

Total 32,230,505

Substations

| Transformer Voltages kV | Nos | Normative Costs Gr | Voltage Class | Total Normative Costs |
|---|---|---|---|---|
| 154/35/10 | - | 299 500 | 1 | - |
| 110/35/10 | 44 | 213 400 | 1 | 9 389 600 |
| 110/10 | 39 | 93,000 | 2 | 3 627 000 |
| 35/10 | 220 | 47,000 | 2 | 10,340 000 |
| 10/0 4 | 6,157 | 440 | 2 | 2,709,080 |

| | Any Oblenergo | Jan 97 | | | | | |
|---|---|---|---|---|---|---|---|
| No | Cost Components | Transmission Costs CL Mln Gr | | Costs allocated by Voltage Class CL1 Mln Gr | | CL2 Mln Gr | |
| | | Base Period | Forecast Period | Base Period | Forecast Period | Base Period | Forecast Period |
| 1 | Production Costs which can be referred to as primary costs of the licensed activity | | | | | | |
| | - material costs | | 468,764 | | 162 196 | | 306 568 |
| | - labour costs | | 833 714 | | 288 472 | | 545,242 |
| | - payments or social measures | | 424 973 | | 147,044 | | 277 929 |
| | - depreciation | | 1,966,499 | | 680 425 | | 1,286 074 |
| | - cost of repairs | | 104,409 | | 36 126 | | 68,282 |
| | - cost of electricity for internal needs | | 75 094 | | 25 983 | | 49,111 |
| | - cost of using others' trans networks | | - | | - | | - |
| | - other costs | | 298,144 | | 103,160 | | 194 984 |
| | Total | - | 4,171,596 | | 1 443 407 | - | 2,728,189 |
| | Indirect costs | | 253 219 | | 87 616 | | 165,603 |
| | TOTAL - direct + indirect costs | - | 4,424,815 | | 1,531 022 | - | 2,893,793 |
| 2 | Payments from Profit | | | | | | |
| | - for development & production base | | 52 867 | | 18 292 | | 34,575 |
| | - for capital investment | | - | | - | | - |
| | - for increasing turnover funds | | 35,399 | | 12,248 | | 23 150 |
| | - for social measures | | 227,547 | | 78 733 | | 148,814 |
| | - for incentives | | 73 571 | | 25,456 | | 48 115 |
| | - other purposes | | 93,100 | | 32,213 | | 60,887 |
| | - to investment fund | | 44,248 | | 15,310 | | 28 938 |
| | - to reserve fund | | - | | - | | - |
| | - dividends | | - | | - | | - |
| | - taxes from profit | | 240 913 | | 83,358 | | 157,555 |
| | - to centralised funds | | 35 399 | | 12,248 | | 23,150 |
| | TOTAL - Payments from Profit | - | 803 043 | | 277 860 | - | 525,184 |
| | GRAND TOTAL | - | 5,227 858 | | 1,808,882 | - | 3,418,976 |

Capital Inv (3) \A1

**Any Oblenergo** **Jan 97**

| | | Total for each Voltage Class | | | | Capital Investment not depending on Voltage Class | | Total | |
|---|---|---|---|---|---|---|---|---|---|
| | | Class 1 | | Class 2 | | | | | |
| | | Base Period | Forecast Period | Base Period | Forecast Period | Base Period | Forecast Period | Base Period | Forecast Period |
| 1 | Capital Investment s parameter | | | | | | | | |
| 2 | Financing of capital investments from | | - | | - | | - | | - |
| | - depreciation payments | | - | | - | | - | | - |
| | - profit | | - | | - | | - | | - |
| | - funds not used at the beginning of year | | - | | - | | - | | - |

Amount Trans (4) \A1

**Any Oblenergo** **Jan 97**

| No | | Notation Units | Voltage Class 1 Base Period | Voltage Class 1 Forecast Period | Voltage Class 2 Base Period | Voltage Class 2 Forecast Period |
|---|---|---|---|---|---|---|
| 1 | Amount of electricity consumed at each Voltage Class | ECj MWh | | 284,152 | | 656 748 |
| 2 | Amount of electricity delivered outside boundary of the Licensee to networks of other Transmission Licensees | ETj | | | | |
| | Licensee 1 | MWh | | 8,200 | | 0 |
| | Licensee 2 | | | 0 | | 0 |
| | Licensee 3 | | | 37 900 | | 0 |
| | Licensee 4 | | | 0 | | 0 |
| | Total | MWh | | 46 100 | 0 | 0 |
| 3 | Amount of electricity received from networks of other Transmission Licensees | Erj | | | | |
| | Licensee 1 | MWh | | 83,100 | | 500 |
| | Licensee 2 | | | 3,400 | | 0 |
| | Licensee 3 | | | 16 300 | | 5 800 |
| | Licensee 4 | | | 0 | | 0 |
| | Total | MWh | | 102,800 | 0 | 6,300 |
| 4 | Amount of electricity transformed to a lower Voltage Class | MWh | | 748,723 | | 0 |
| 5 | Amount of electricity coming from generators directly at the Voltage Class | Egj MWh | | 0 | | 0 |
| 6 | Amount of electricity consumed for internal needs | EIN MWh | | 0 | | 0 |
| 7 | Amount of electricity sales at each Voltage Class (7)=(1)+(2) | Ecj MWh | | 330,252 | 0 | 656 748 |
| 8 | Amount of electricity transmitted at Voltage Class (8)=(7)+(4) | Ej MWh | | 1 078 975 | 0 | 656,748 |
| | Calculated Loss Factors | | | 3 30% | | 12 28% |
| 9 | Factors of normative technical electricity loss for transmission | LFj | | 2 20% | | 6 00% |
| 10 | Factor of adjustment trans electricity loss | LFAj | | 1 50 | | 1 20 |

Losses (HB) \A1

**Any Oblenergo**

**Jan 97**

| | | | |
|---|---|---|---|
| **35-154** | | | |
| Deliveries | MWh | 330,252 | |
| Losses | MWh | 36 821 | |
| **Less than 35** | | | |
| Deliveries | MWh | 656,748 | |
| Losses | MWh | 91,975 | |
| **Total** | | | |
| Deliveries | MWh | 987 000 | |
| Losses | MWh | 128,796 | |
| | | | |
| **35-154** | | | |
| Transmitted in | MWh | 1 115 796 | |
| Deliveries within VC | MWh | 330,252 | |
| Transmitted below | MWh | 748,723 | |
| Losses | MWh | 36 821 | |
| Losses from deliveries within VC | MWh | 11 270 | |
| Losses from transmission to lower VC | MWh | 25,551 | |
| | | | |
| **Less than 35** | | | |
| Transmitted in | MWh | 748 723 | |
| Deliveries | MWh | 656 748 | |
| Transmitted below | MWh | 0 | |
| Losses | MWh | 91,975 | |
| Losses from VC above | MWh | 25,551 | |
| Cumulative losses | MWh | 117 526 | |
| Losses from deliveries within VC | MWh | 117,526 | |
| Losses from transmission to lower VC | MWh | 0 | |
| | | | |
| **Voltage Level Loss Percentages** | | | |
| 35-154 | % | 3 30% | 1 5000 |
| Less than 35 | % | 12 28% | 2 0474 |
| Total | % | 11 54% | |

21

Illustration of Table 4 transmissions

VA1

Any Oblenergo
Jan 97

Total Imported from EnergoMarket
1 115 796 kWh

Total Losses in VC1
36 821 kWh

**Voltage Class 1**
**35 154 kV**

Total Transmitted without losses (8.)
1 078 975 kWh

Consumed (1.)
284 152 kWh

Imported (3.)
102 800 kWh
(not included in totals ! )

Total Delivered in Voltage Class (7.)
330 252 kWh

Exported (2.)
46 100 kWh

Losses from Transformed
25 551 kWh

Losses from Deliveries
11 270 kWh

Transformed to lower Voltage Class (4.)
748 723 kWh

Losses
91 975 kWh

**Voltage Class 2**
**10 0 4 kV**

Consumed (1 )
656 748 kWh

Imported (3.)
6 300 kWh
(not included in totals ! )

Total Delivered in Voltage Class (7.)
656 748 kWh

Exported (2 )
kWh

Losses from Deliveries
117 526 kWh

22

Losses (5) \A1

| Any Oblenergo | Jan | 97 |
|---|---|---|

| Calculation of Factors of normative Technical Electricity Losses (TEL) for Transmission | Notations Units | 1st Quarter | | 2nd Quarter | | 3rd Quarter | | 4th Quarter | |
|---|---|---|---|---|---|---|---|---|---|
| | | Base Period | Forecast Period | Base Period | Forecast Period | Base Period | Forecast Period | Base Period | Forecast Period |
| 1 Delivery to networks of 154kV | E154 MWh | | | | | | | | |
| 2 Delivery to networks of 110kV | E110 MWh | | | | | | | | |
| 3 Delivery to networks of 35kV | E35 MWh | | | | | | | | |
| 4 Electricity Transformation from 154kV to 110kV | E154/110 MWh | | | | | | | | |
| 5 Electricity Transformation from 154kV to 35kV | E154/35 MWh | | | | | | | | |
| 6 Electricity Transformation from 110kV to 35kV | E110/35 MWh | | | | | | | | |
| 7 Delivery to networks of 10 - 0 4 kV | E10-0 4 MWh | | | | | | | | |
| 8 Normative TEL at the voltage level 154kV | LE154 MWh | | | | | | | | |
| 9 Normative TEL at the voltage level 110kV | LE110 MWh | | | | | | | | |
| 10 Normative TEL at the voltage level 35kV | LE35 MWh | | | | | | | | |
| 11 Normative TEL at the voltage level 10 - 0 4 kV | LE10-0 4 MWh | | | | | | | | |
| 12 Factor of normative TEL at the volyage level 1 | LF1 | | | | | | | | |
| 13 Factor of normative TEL at the volyage level 2 | LF2 | | | | | | | | |

LTT(HB) \A1

**Any Oblenergo** **Jan 97**

| | Unit | Total | |
|---|---|---|---|
| **Amount of electricity transmitted** | | | |
| Voltage Class 1 | MWh | 1,078,975 | |
| Voltage Class 2 | MWh | 656,748 | |
| Total | MWh | 1,735,723 | |
| **Costs of Transmission** | | | |
| Voltage Class 1 | Gr | 1,808,882 | |
| Voltage Class 2 | Gr | 3,418,976 | |
| Total | Gr | 5,227,858 | |
| **Price for 35-154 kV voltage class** | | | |
| for Group 1 customers | Gr /IWh | 1 68 | |
| for Group 2 customers | Gr /ÌWh | 1 91 | |
| **Price for <35 kV voltage class** | | | |
| for Group 2 customers | Gr /ÌWh | 5 21 | |
| **Prices by voltage class** | | | kop /kWh |
| for Group 1 customers | Gr /ÌWh | 1 68 | 0 168 |
| for Group 2 customers | Gr /IWh | 7 12 | 0 712 |

24

| Any Oblenergo | Jan 97 |
|---|---|

| No | Parameters | Notation Units | Base Period | Forecast Period |
|---|---|---|---|---|
| | Initial Data | | | |
| 1 | Amount of electricity transmitted at Voltage Class | MWh | | 1,078,975 |
| 2 | Amount of electricity transmitted at Voltage Class | MWh | | 656,748 |
| 3 | Costs of transmission at Voltage Class 1 | Gr | | 1 808 882 |
| 4 | Costs of transmission at Voltage Class 2 | Gr | | 3 418,976 |
| | Results of Calculations | | | |
| | Electricity Transmission Tariff for Consumers at | | | |
| 5 | Voltage Class 1 | kop /kWh | | 0 168 |
| 6 | Voltage Class 2 | kop /kWh | | 0 712 |

| Revenue | |
|---|---|
| Sales to consumers at Voltage Class 1 | 476 375 |
| Sales for transit at Voltage Class 1 | 77,286 |
| Sales to consumers at Voltage Class 2 | 4,674,197 |
| Sales for transit at Voltage Class 2 | - |
| | 5 227 858 |

Supply (HB) \A1

| Any Oblenergo | Jan 97 | |
|---|---|---|
| | | Total |
| | Unit | Eoıaı |
| **Costs** | | |
| Total LES costs | Gr | 520,798 |
| | | |
| **Amounts of Electricity Sold** | | |
| | | |
| Total LES sales (Items 7 in Table 4) | MWh | 987 000 |
| % sales in 1st Group (excl popln ) | | 87 84% |
| Customers except for population | MWh | 866,981 |
| Population | MWh | 120,019 |
| | | |
| Internal consumption | MWh | - |
| LES sales minus internal consumption | MWh | 987,000 |

| Price with account of internal consumption | | | kop./kWh |
|---|---|---|---|
| Excluding population | Gr /MWh | 0 35 | **0 035** |
| Population | Gr /MWh | 1 77 | **0 177** |

26

Supply Tariff (7) \A1

**Any Oblenergo** **Jan 97**

| No | Parameters | Notation Units | Base Period | Forecast Period |
|---|---|---|---|---|
| | Initial Data | | | |
| 1 | Amount of electricity sold to consumers of Group 1 | MWh | | 866,981 |
| 2 | Amount of electricity sold to consumers of Group 2 | MWh | | 120,019 |
| 3 | Costs of electricity supply | Gr | | 520,798 |
| 4 | Coefficient of difficulty | | | 5 |
| | Results of Calculations | | | |
| | Electricity Supply Tariff for Consumers of | | | |
| 5 | Group 1 | kop /kWh | | 0 035 |
| 6 | Group 2 | kop /kWh | | 0 177 |

| Revenue | | |
|---|---|---|
| Sales to consumers of Group 1 | Gr | 307 770 |
| Sales to consumers of Group 2 | Gr | 213 028 |
| | | 520,798 |

Retail Calcs

\A1

| Any Oblenergo | Jan 97 |
|---|---|

Average Purchase Price 65 00 Gr /MWh
6 5 kop/kWh

| Voltage Class 1 | | |
|---|---|---|
| | LF | 2 20% |
| | LFA | 1 5 |
| | Adj LF | 3 88% |
| | 1-LF | 0 9612 |
| Purchase component | | 6 762380358 kop/kWh |

| Voltage Class 2 | | |
|---|---|---|
| | LF | 6 00% |
| | LFA | 1 2 |
| | Adj LF | 7 92% |
| | 1-LF | 0 9208 |
| Purchase component | | 7 344027322 kop/kWh |

**NERC - Jan.'97**

| | 1 | 2 |
|---|---|---|
| LTT | 0 250 | 0 480 |
| Supply | 0 016 | 0 080 |

**Retail Tariffs**

| Oblenergo | VC1 | VC2 | |
|---|---|---|---|
| | Grp 1 | Grp 1 | Grp 2 |
| LTT | 0 168 | 0 712 | 0 712 |
| Supply | 0 035 | 0 035 | 0 177 |
| Purchase | 6 762 | 7 344 | 7 344 |
| Total | **6 966** | **8 091** | **8 233** |

| NERC | VC1 | VC2 | |
|---|---|---|---|
| | Grp 1 | Grp 1 | Grp 2 |
| LTT | 0 250 | 0 480 | 0 480 |
| Supply | 0 016 | 0 016 | 0 080 |
| Purchase | 6 762 | 7 344 | 7 344 |
| Total | **7 028** | **7 840** | **7 904** |

28

**Any Oblenergo** \A1 **Jan 97**

| | Consumer Category (k) | Group of consumers (I) | Voltage Class (J) | Proportion of priviledge discount (d) | Retail price of electricity Prij Hrb/kWh | Retail Tariff for electricity 1996 Hrb/kWh | 1st quarter 1997 Hrb/kWh | 2nd quarter 1997 Hrb/kWh |
|---|---|---|---|---|---|---|---|---|
| 1 | Industrial consumers and equivalent commercial consumers who are agricultural producers non-industrial consumers (other than residential) | 1 | 1 | 0 | 0 0697 | 0 0697 | 0 0697 | 0 0697 |
| 2 | Industrial consumers and equivalent commercial consumers who are agricultural producers non-industrial consumers (other than residential) | 1 | 2 | 0 | 0 0809 | 0 0809 | 0 0809 | 0 0809 |
| 3 | Urban residential consumers no discount | 2 | 2 | 0 00 | | 0 0830 | 0 0829 | 0 0823 |
| 4 | Urban residential consumers 50% discount | 2 | 2 | 0 50 | | 0 0415 | 0 0415 | 0 0412 |
| 5 | Urban residential consumers 75% discount | 2 | 2 | 0 75 | | 0 0208 | 0 0207 | 0 0206 |
| 6 | Urban residential consumers 100% discount | 2 | 2 | 1 00 | | 0 0000 | 0 0000 | 0 0000 |
| 7 | Urban residential consumers with electric stoves no discount | 2 | 2 | 0 00 | 0 0823 | 0 0530 | 0 0559 | 0 0823 |
| 8 | Urban residential consumers with electric stoves, 50% discount | 2 | 2 | 0 50 | | 0 0265 | 0 0280 | 0 0412 |
| 9 | Urban residential consumers with electric stoves 75% discount | 2 | 2 | 0 75 | | 0 0133 | 0 0140 | 0 0206 |
| 10 | Urban residential consumers with electric stoves 100% discount | 2 | 2 | 1 00 | | 0 0000 | 0 0000 | 0 0000 |
| 11 | Rural residential consumers no discount | 2 | 2 | 0 00 | | 0 0780 | 0 0784 | 0 0823 |
| 12 | Rural residential consumers 50% discount | 2 | 2 | 0 50 | | 0 0390 | 0 0392 | 0 0412 |
| 13 | Rural residential consumers 75% discount | 2 | 2 | 0 75 | | 0 0195 | 0 0196 | 0 0206 |
| 14 | Rural residential consumers 100% discount | 2 | 2 | 1 00 | | 0 0000 | 0 0000 | 0 0000 |
| | | | | | | 0% | 10% | 100% |

| | |
|---|---|
| Loss adjustment factor - Voltage Class 1 | 1 5 |
| Voltage Class 2 | 1 2 |
| Average purchase price | 65 00 |
| Wholesale Market Price | 65 00 |
| Amount of electricity purchased at the Wholesale Market Price | 1115796 |
| Amount of electricity purchased from independent generators | 0 |
| Price of electricity purchased from independent generators | 0 |

Effective tariffs for electricity

| | | |
|---|---|---|
| 1 | Urban residential consumers | 0 083 |
| 2 | Urban residential consumers with electric stoves | 0 053 |
| 3 | Rural residential consumers | 0 078 |