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Joint Latvian-Danish Project

DEMAND SIDE MANAGEMENT AND ENERGY SAVING

DSM ENERGY SAVING PILOT PROJECT REPORT

COMPANY LATVENERGO

LATVIA

AURORA

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Purpose and Background

This report is part of the Joint Latvian-Danish Project Demand Side Management and Energy Saving. The Joint project is a part of the Denmark and technology transfer to Latvia. It is the result of collaborative efforts between Latvian team, consisting of the specialists from LATVENERGO and Danish team, which was represented by Danish Power Consult company.

Joint DSM and energy saving project, which started in 1994 was divided into four phases.

Phase 1: Seminar and preliminary audits carried out by Danish and Latvian specialists in several companies.

Phase 2 : Latvian team training courses, organised by Danish Power Consult during two weeks in Copenhagen from 30 May till 11 June 1994.

During the phase 3 the team from LATVENERGO associated Emils Darzins, Janis Slisans, Alvis Ozolins, Juris Paberzs and Ilgvars Cimoška - carried out energy saving pilot project in the Sock factory "Aurora". Energy audit in the sock factory "Aurora" was performed during 6 months in 1995. LATVENERGO team had contacts with DPC specialists - Mr.Johom Moltke and Peter T.Mortensen and discussed various aspects of demand Side Management, energy audit and energy saving in Latvia.

Authors express great gratitude to above mentioned colleagues and to Danish specialists from DPC, NESA, SEAS and from other institutions with whom they worked during training courses in Denmark.

During the energy audit and performance of the pilot project the following equipment, supplied by Danish side, was available by the team:
- Laptop personal computer Olivetti,
- program packages LMS Comand KWFLOW",
- 4 traffic computers TACOM with infrared ray heads for reading results from Ferrari energy meters,
- 4 metering boxes with Ferrari meters, TACOMs and current clamps.

The ultrasonic leakage detector which is available by LATVENERGO team was used short time.

The purpose if this pilot project was not only to carry out energy audit in the sock factory "Aurora" and propose Demand Side Management and Energy saving measures.

Another task of the project was the application of DPC energy audit methods, measuring equipment and software in Latvian conditions and the promotion of energy saving programs in Latvia in this way. For this reason great attention is paid to energy mapping in order to demonstrate possibilities of the Danish methods.

Phases 1 and 2 of the joint project and activities of DPC experts, including the supply of the equipment, was financed by the Danish government. All activities in energy auditing and the pilot project were performed by LATVENERGO team without any payment, i.e. in the form of additional scientific work.

Conclusions and Summary

The present report describes four proposals for electricity and compressed air savings in the factory "Aurora". The main figures for the proposals are given in the table No.1. If all proposals are effected electricity savings will be 3,3 million kWh/year amounting to 40,7% of the factories consumption in 1994.

The biggest electricity and fuel savings will be achieved in proposal for changes in compressed air and lightning systems and fuel burner exchange.

All calculations performed are based on the data of energy audit which was carried out in May and June 1995.

Synopsis of Recommended Energy Saving Proposals

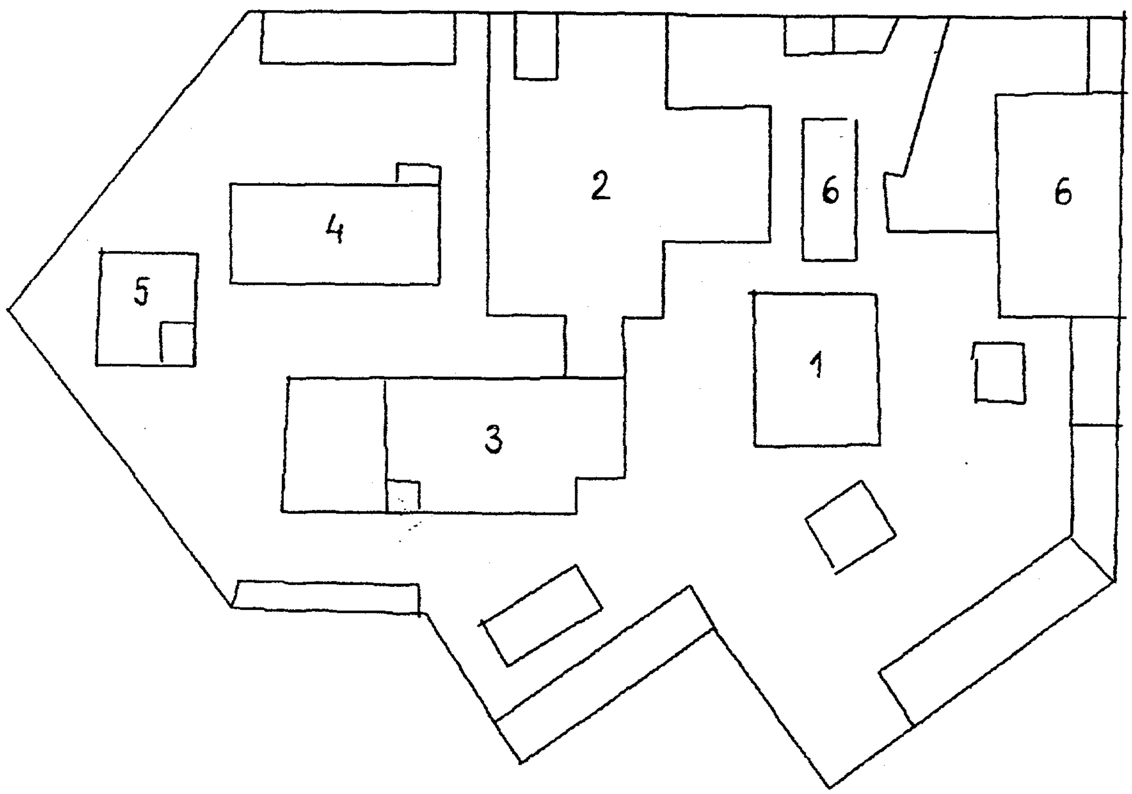
N°	Proposals	Total savings kWh/year	Ls	% from total consumption	Investment Ls	Payback period (year)	
1	Reconstruction of ventilation system	230400,0	5852,2	2,8	4160,00	0,81	
2	Looses of electricity in lighting system	38844,0	986,6	0,48			
3	Replacing of existing luminary's diffusers by X-tralux reflectors in the shops	1242675,2	31563,95	15,2	51446,30	1,58	1.6
4	Compressed air system leakage's reduction from 40% to 7%	939161,6	23600,7	11,5			
5	Change of the compressor	856960,0	21766,8	10,5	7012,00	1,93	1.9
6	Reconstruction of the boiler house kg/year	1660000,0	121180,0		82028,00	0,67	0.7

Table 1

Main Data About the Factory

The sock factory "Aurora" is Latvian state factory which was founded in 1947 by uniting small producing units into one bigger enterprise.

The factory is located in the left side of Riga near river Daugava. Plant of the factory is shown in the figures:



1 Boiler house
2 Production shop N°2
3 Production shop N°3
4 Production shop N°4
5 Compressors room
6 Administrative building

Fig. 1 Plant of the Factory "Aurora"

Production of the Factory

When the factory was founded it was projected to produce 14 millions pairs of socks per year. During this period 400 different kinds of equipment was installed and 1070 people were employed. First output of production was at 1948 - 3,9 million pairs of sock products. During next years factory was developing continuously, new modern equipment was installed.

Nowadays "Aurora" is a big specialised enterprise - the only one in Latvia producing sock production. The production of factory is sent to shops of previous Soviet Union republics and also it is exported to other countries.

In 1992 factory produced 56,0 million pairs of stock products. It was 231000 pairs per day. The factory produces 90 different kinds of sock products. The total retail trade amount in 1991 (and in prices of 1991) was approximately 189,6 million roubles.

The factory produces women stockings and tights, knee-length socks, men socks, children socks and tights. The assortment is renewed every year by 25 to 30%. The quality is increasing.

The are installed approximately 2600 pcs of different technological equipment, among them 2123 pcs of round knighting automates. They are modern and of high productivity for knighting, sewing, reeling, painting and finishing operations machines produced in previous Soviet Union, Czechoslovakia, Italy, Japan, Germany and France. In the production shops of factory the following machinery is installed: 03DR, 03DS, 03D, Gamma, 2ANK, 2AN, Platirovka, Modik-4, R-850, Zodiak-Ultra, Fantāzija, Assembler, POJS, Sabina, Beiby, D3BC, D3VUS, Motiv, DeraES, Verab, 10th class, Ange3B, Ange3C. The following sewing equipment is installed: Takitori-double, Spidomatic, oversewings from Remoldi, Textima, Ilorosso-Iloraizen, Fletlok, Mauzer 20K and soviet 208 class. The following painting equipment is installed: KT-100, KB-50, Kolormat-800, Aksimat. Raduga-125, Trikoset, UMOT, ČNO-86, Elio and also centrifuge fan and steam tables.

There are 4 main production shops in the factory, where all main technological processes of productions takes place - knighting, sewing, finishing, sorting, packing. Assisting production shops and services are occupied in the fields of repair of technological equipment, provide with electric energy, steam and do all repairmen and construction works.

There is a wide consumption production shop in the factory where the rests of main production shop capron production is re-heated into different parts for needs of factory and other enterprises.

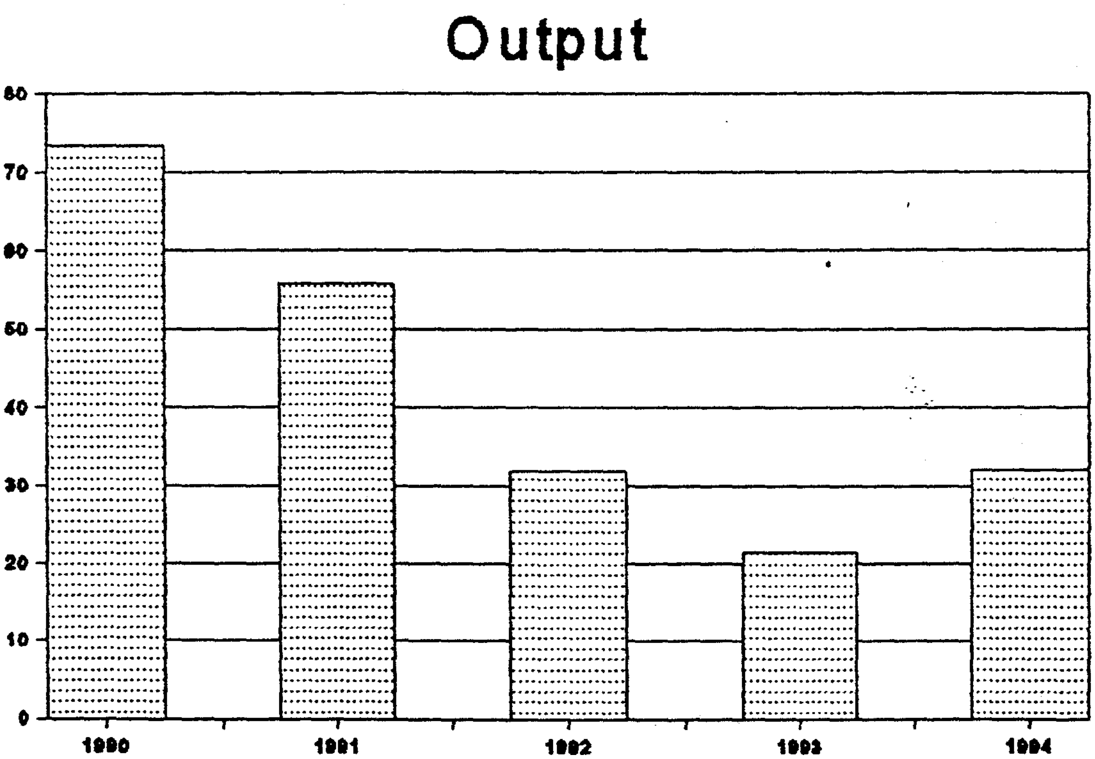


Fig. 2. Output of production (million pairs)

There is also a Computing centre in the factory, production shop of automatization and mechanisation, service of measurements, labour security and other structures.

For producing of sock production different raw materials are used - capron thread, textured thread, elastin, cotton, wool. The main suppliers of raw materials are factories of chemical fibre in Daugavpils, Chernigova, Kiev, Klin, Volzhsk and cotton production plant in Dedovka. Raw material from England, France, Italy , Japan and Egypt is also used.

The new technologies are involved - like one-process finishing, automatic thread chain cutting, the working in of poliuretan thread in the tights and sock edge, producing of ornamental socks without thermal process, automates for making boxes and plastic bags, pneumatic machine for sock turn round, etc..

Employees and Shifts

The number of employees is decreasing during last 4 years:

in 1992 worked 2399 employees,
in 1994 worked 1643 employees,
in May 1995 worked 1425 employees.

Factory is working 5 days during the week in two shifts. But sometimes some shops are working at weekends. In the first shifts are working 822 employees, but in the second shift are working 573 employees.

Main Data of Energetics

Year	Electricity; TkWh	Heat; Gcal	Water; T.cub.meters
1990	16.612	43.528	439
1991	13.856	13.856	376
1992	8.473	16.729	210
1993	7.286	19.073	135
1994	8.163	23.056	190

Table 2

Specific Consumption for 1 Million Production

Year	Electricity; T.kWh	Heat; T.Gcal	Water; T.cub.meters
1990	226	593	6
1991	248	248	6.7
1992	265	524	6.6
1993	338	887	6.3
1994	255	720	5.9

Table 3

The Measurements

The measurements in factory "Aurora" were carried out during 3 months (from March to May 1995). The goal of these measurements were to measure load curves for the electricity consumption mapping. For this purpose are used portable metering boxes (with energy meter, Tacom and current clamps). Two metering boxes with current clamps are in disposition of the audit.

On 11 and 12 April on the air compressing unit was installed TACOM BOX.

From 30 April till 8 May 1995 the total income power consumption in substation was measured. From 8 June till 12 June 1995 in the substation No.. 3 the power consumption of dawning production shop lightening and air conditioning were measured.

Electricity Supply of the Factory

The electricity supply is provided from Riga Electrical Network through two cables of 10kW - F-98A and F-101. The capacity of 10/0,4kW transformers in factory is 8260 kVA, for transformer substation - 5.

The general electricity supply scheme is shown in the Fig. 3.

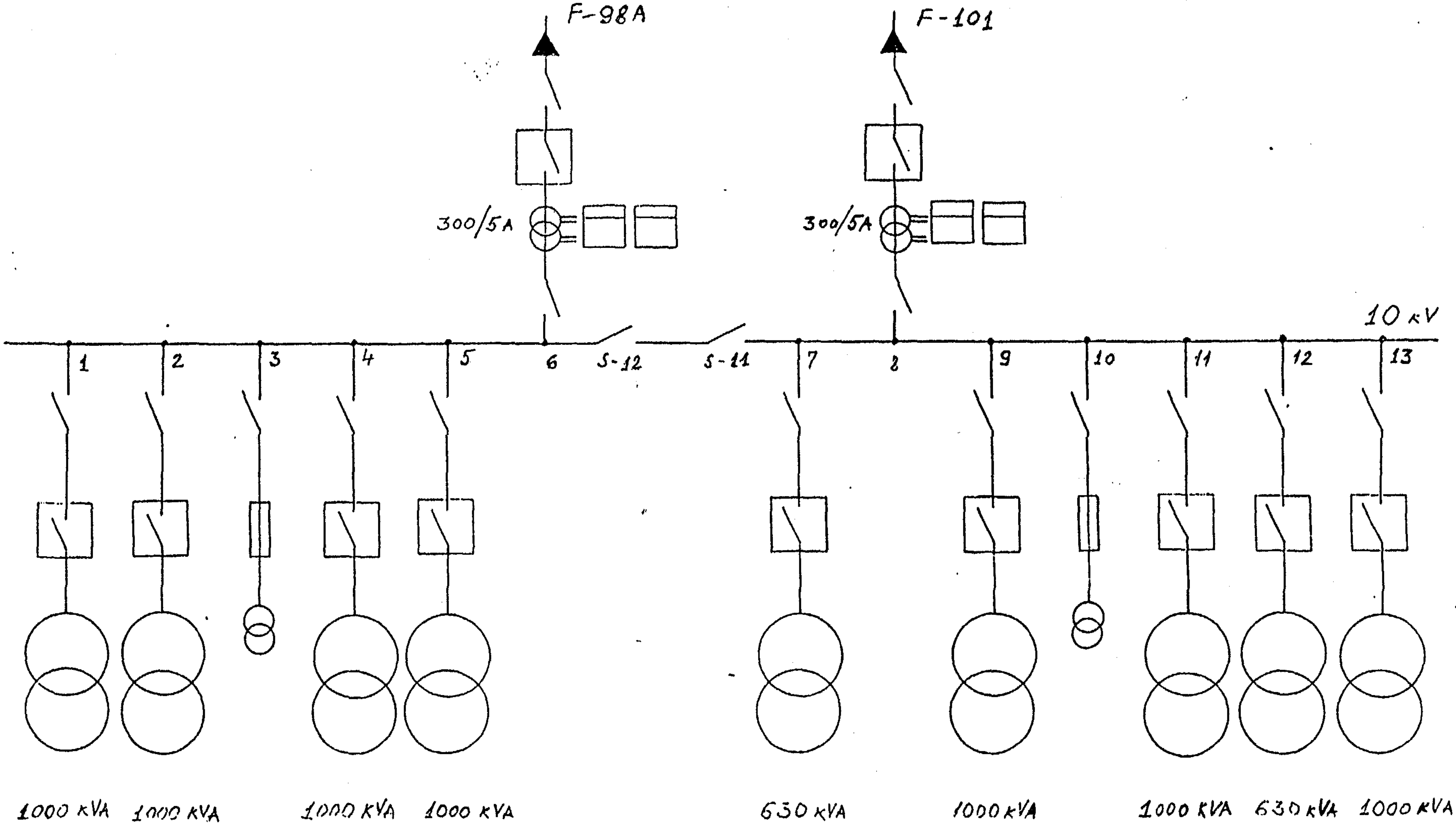


Fig. 3 Electric Power Supply Scheme of the "Aurora"

Heat Supply

The heat for factory "Aurora" is provided by its own boiler house where 4 boilers are installed: 2 DKVR-6,5/13 and 2 DKVR-20/13, heating with - gas or fuel oil.

Boilers produce steam, which is used for technological needs, heating, hot water supply.

Boiler house provides with heat the near residential complex including also Stradinsh Clinical Hospital.

The amount of energy used for own need changes between 19% in 1991 to 58% in 1990.

Settling account with end users is done by reading measurements from energy meters, which is on balance limit.

Heating mains are old and heat losses are up to 25%.

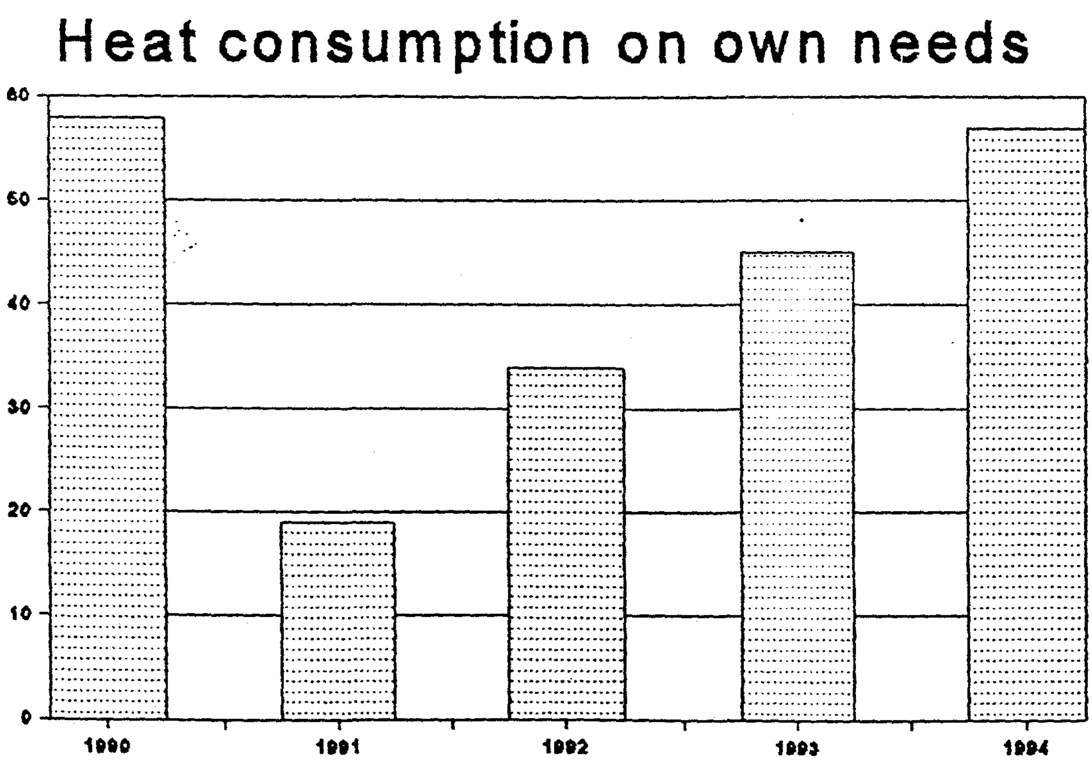


Fig. 4

Water Supply and Sewage System

In order to provide needs of factory in water the water for Riga city water pipeline and also factories artesian well (pump ECV-8-25-100). The productivity of pump is 25 m^3/h, which covers 50% of all needs.

Drain water is channelled to Riga city sewage collector after 3 stages of staying.

Payments in 1994:

water supply	12.500 Ls,
sewage	30.000 Ls.

Mapping of Electricity Consumption

Total Consumption of Electricity

To determine the total electricity consumption in the factory "Aurora" there were installed TACOM measuring units on two main income kWh meters. Measurements were made during on working week where Monday was a holiday.

Factory works in two shifts and maximum of the load is from 10 to 12 o'clock, and it is 1984 kW.

The average consumption during the working day in this period was 24,2 kWh. M

The maximum load in the 2nd shift is from 16 to 17 o'clock and it is 1360 kW.

The load measurement were made on two incoming lines and it divided correspondingly as 69,1% and 30,9%.

Electricity consumption distribution

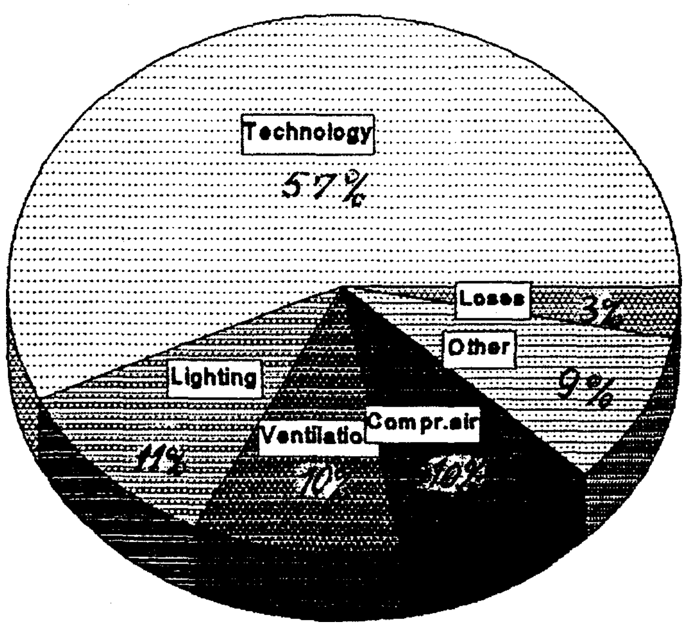


Fig. 5

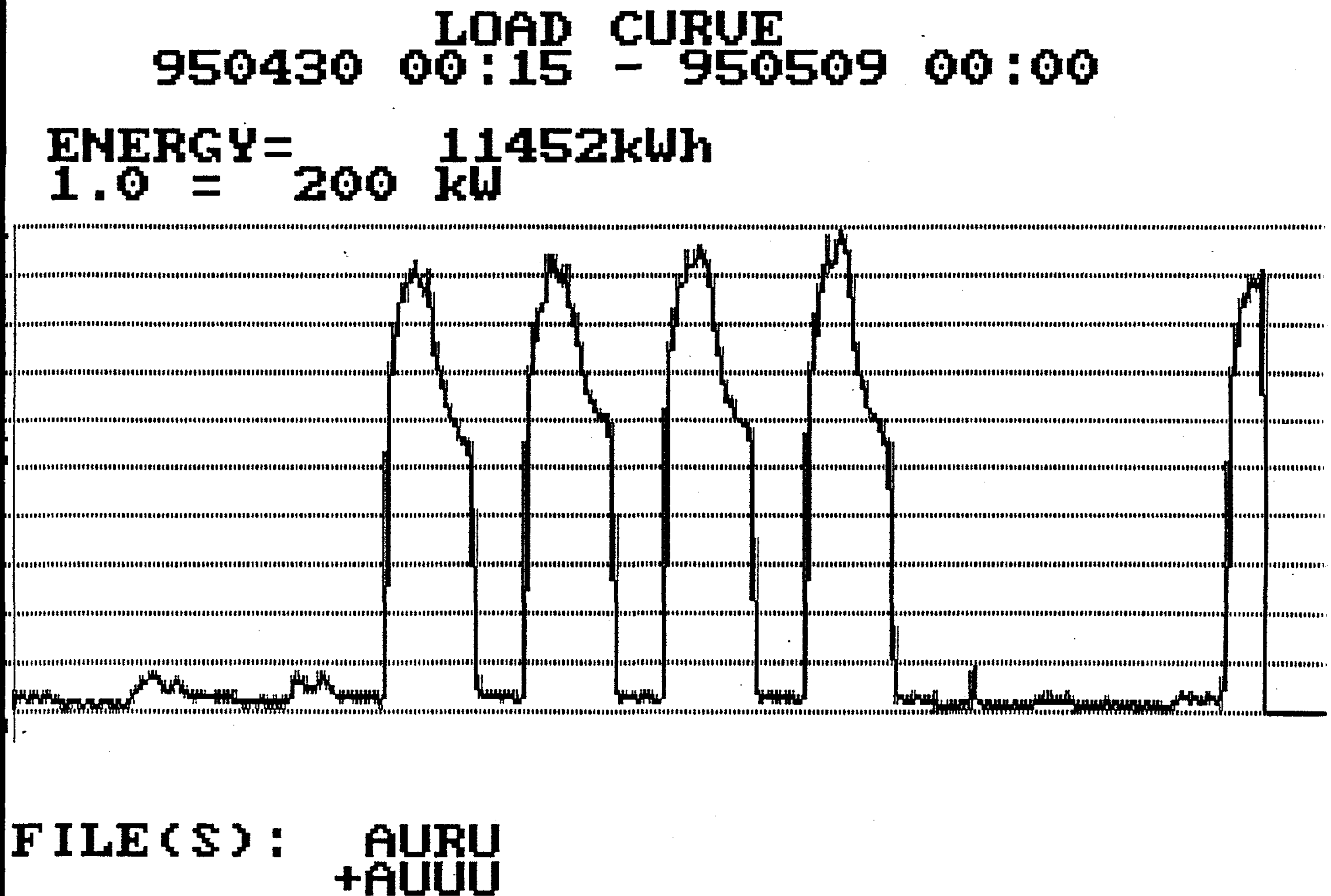


Fig. 6

Total Load of the Factory

Note: Fig. 6 - 9 and tables 4,5 have coefficient = 10

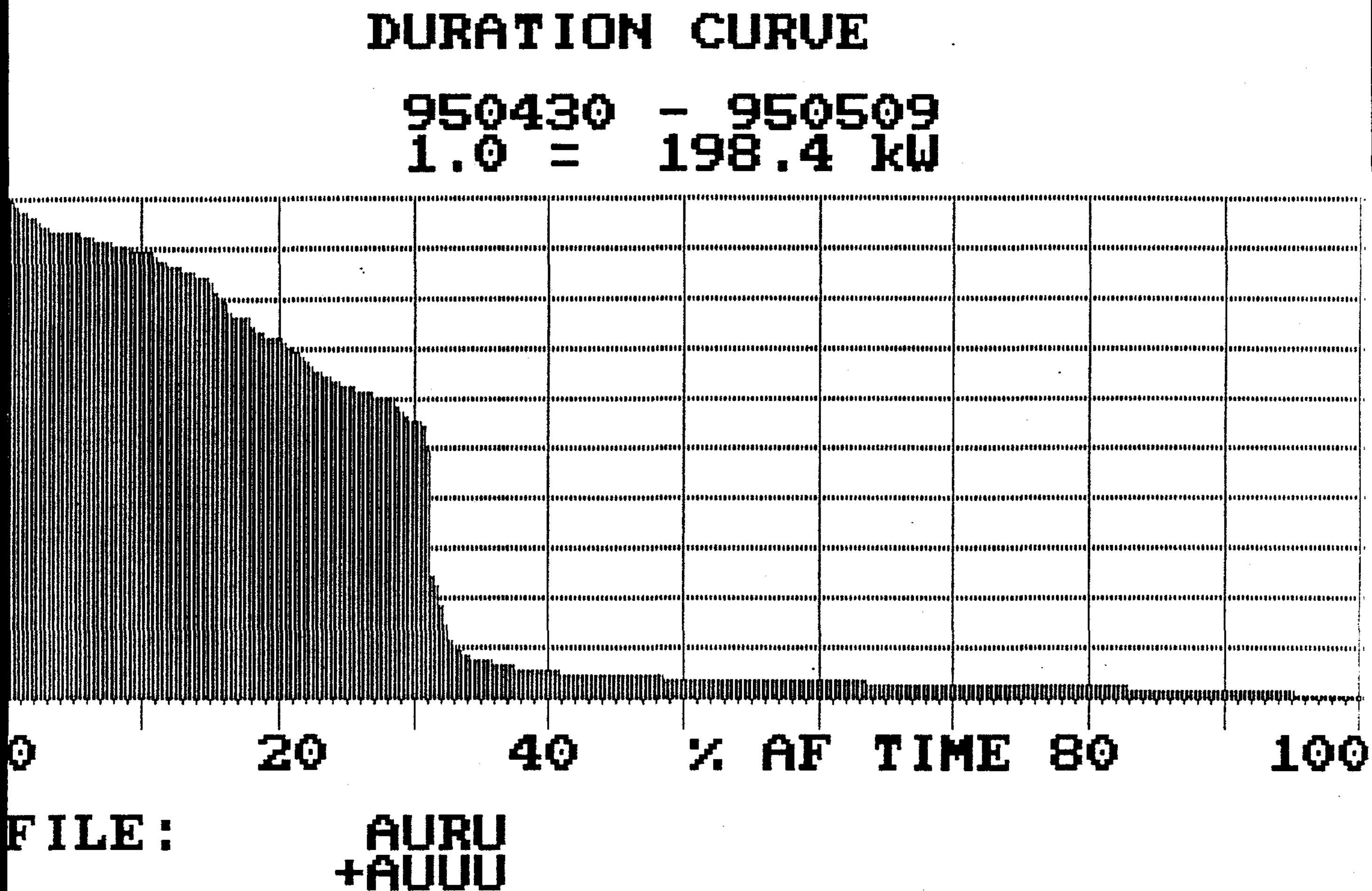


Fig. 7

Total Load of the Factory

ENERGY PER DAY

ILE: AURU + AUUU

AVERAGE ENERGY PER DAY

MONDAYS:	685.8 kWh
TUESDAYS:	2379.6 kWh
WEDNESDAYS:	2429.2 kWh
THURSDAYS:	2464.4 kWh
FRIDAYS:	2410.0 kWh
SATURDAYS:	118.4 kWh
SUNDAYS:	139.6 kWh
WORKINGDAYS:	1842.5 kWh

Table 4

Total Consumption of Electricity

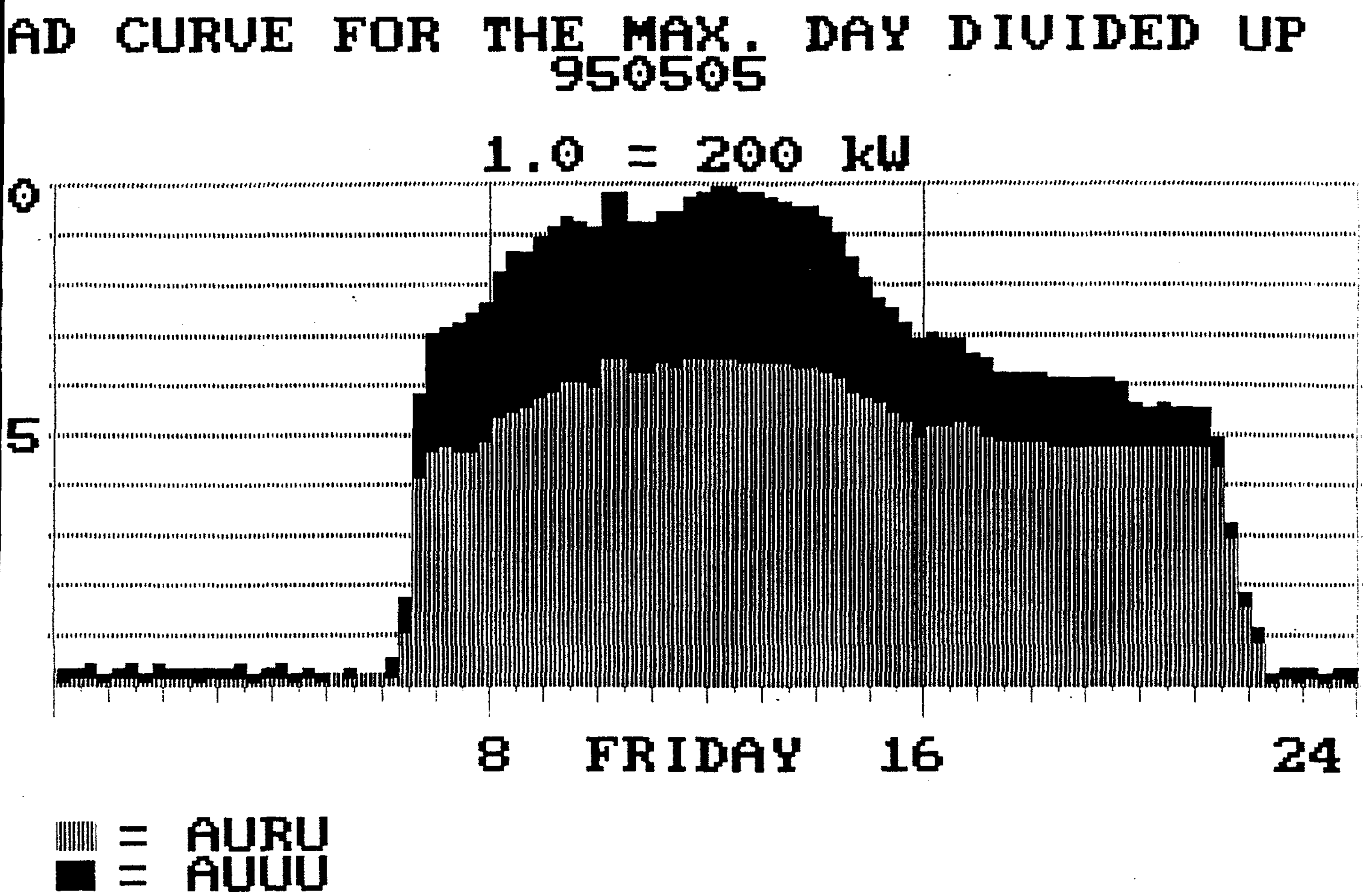
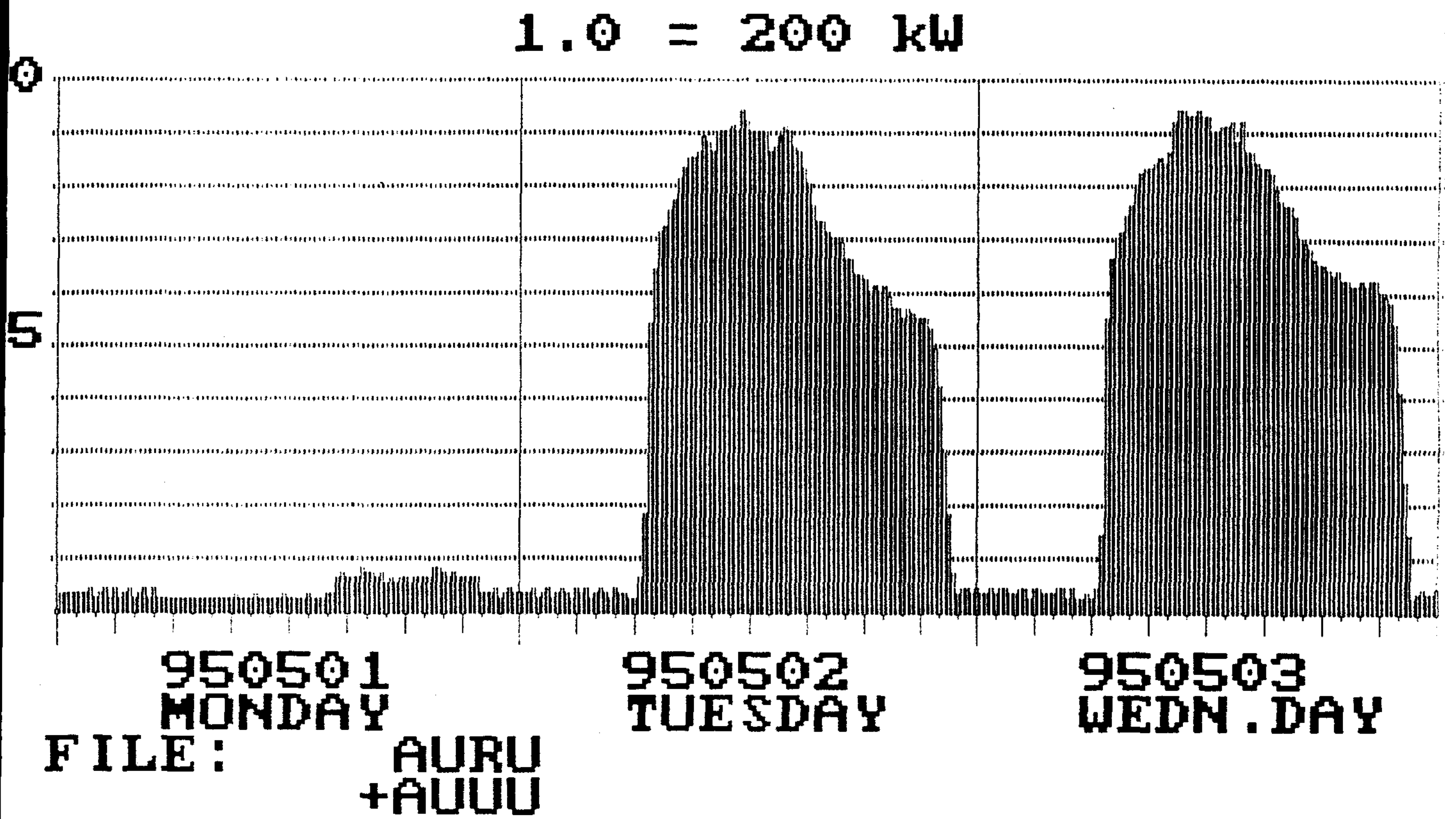


Fig. 8

Maximal Consumption of Electricity

TOTAL LOAD CURVE



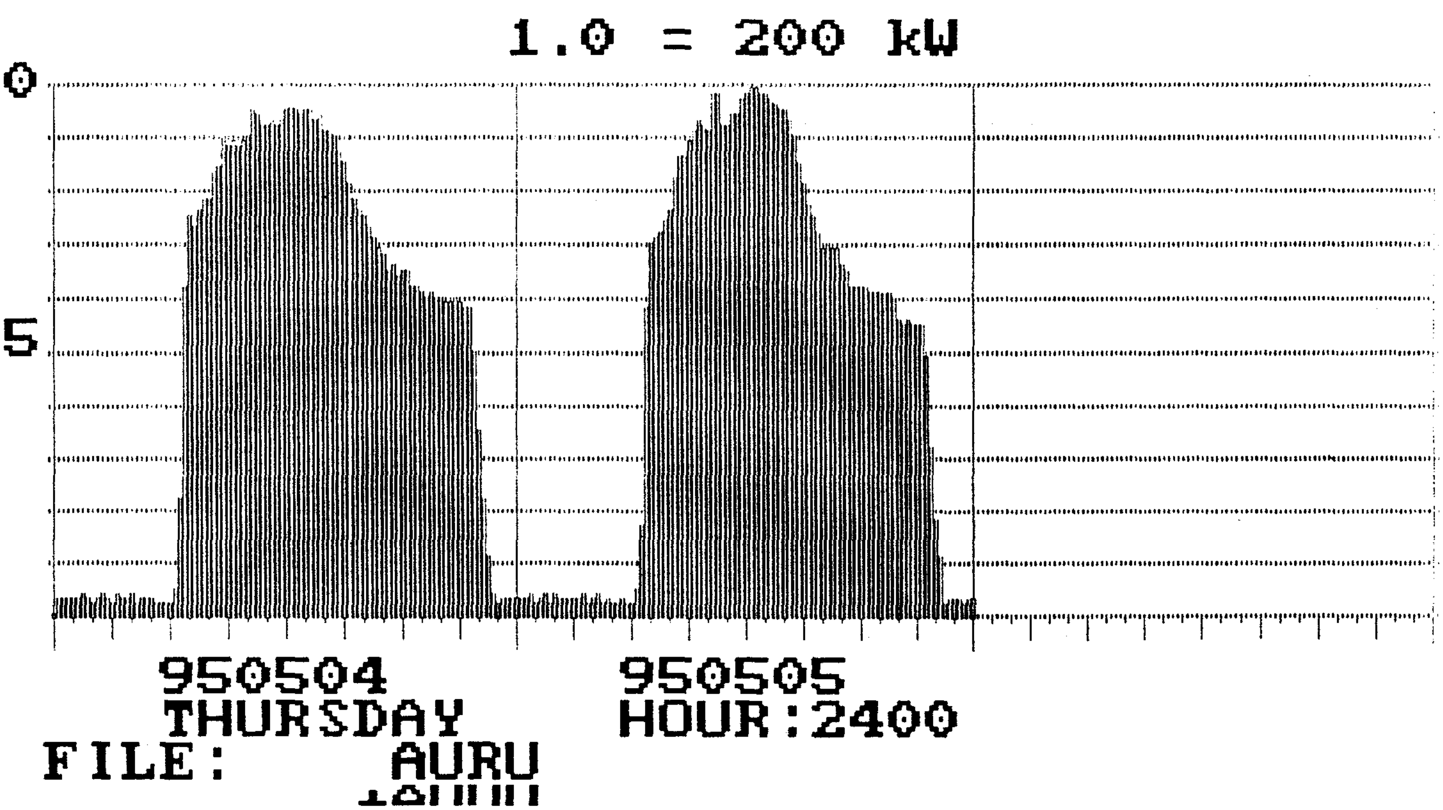
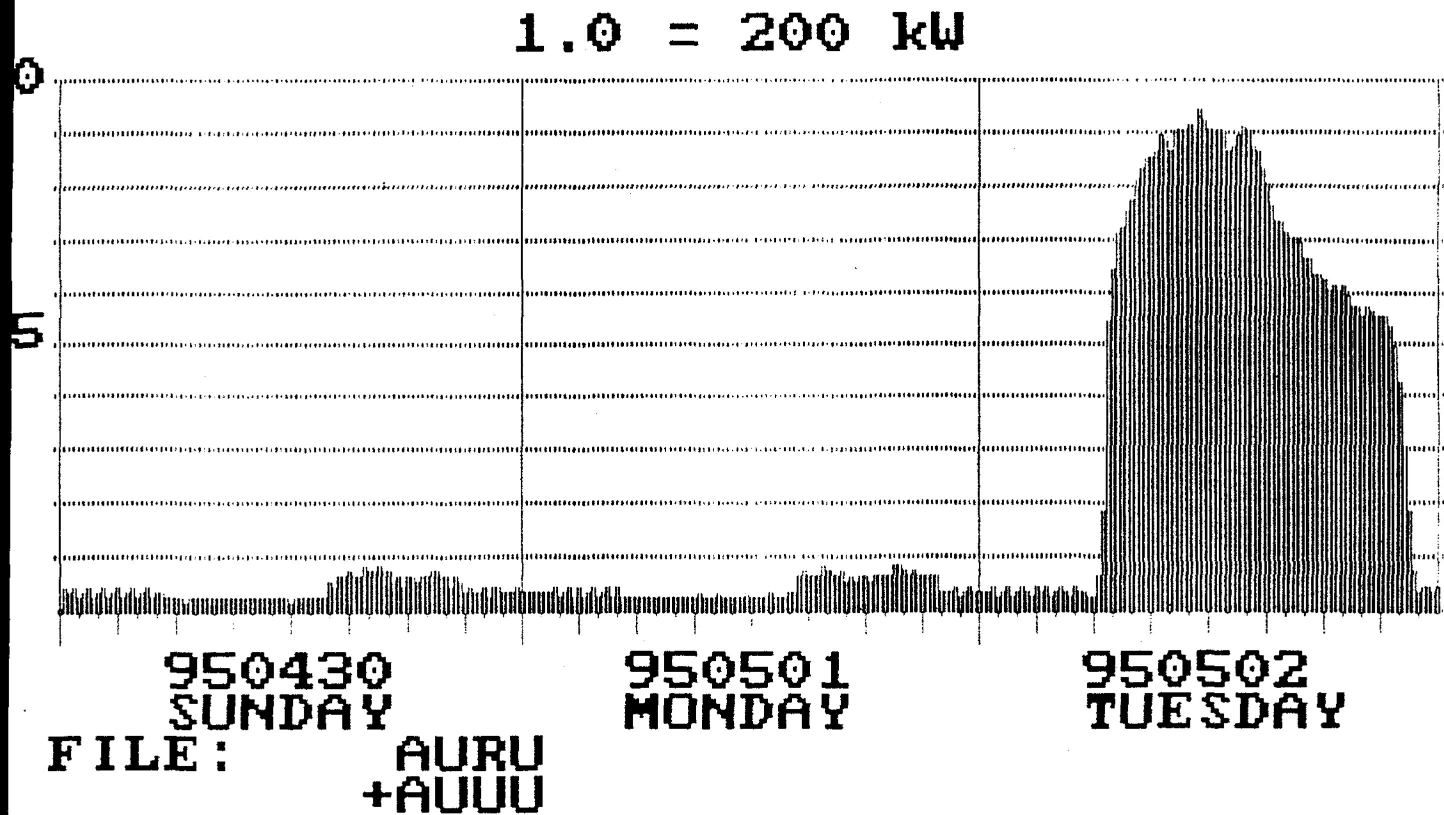


Fig. 9

TOTAL LOAD CURVE



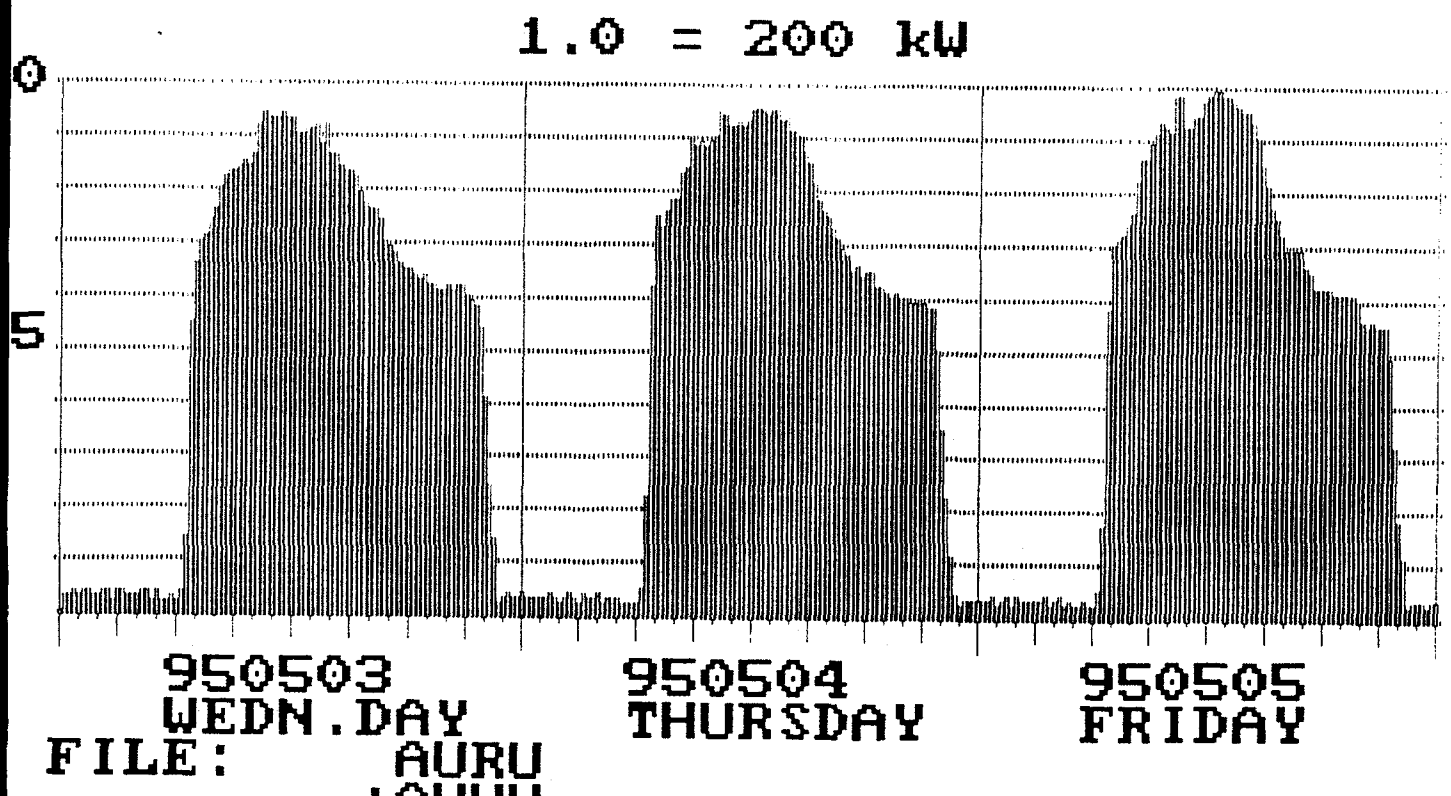


Fig. 9 (continuation)

KEY FACTORS

SUB LOADS PART OF THE TOTAL CONSUMPTION

INTEGRATION PERIOD: 15 MINUTES

DATAFILE	SUB LOADS PART OF THE TOTAL CONSUMPTION (%)
AURU	69.1
AUUU	30.9

Table 5

Electricity Consumption for Compressed Air Supply

One of the largest users of electricity is the compressed air supply system It consists fro 4 air compressing units with total power of 750 kW.

We can point out that the main fault is that automation is not working. The compressors are old one. The water cooling system is very irrational and water from city water supply was used. The re-circulation and secondary use of it is lacking.

In the project screw type compressors are recommended, so there will be no need in using water.

In the 1st shift one compressor is working with 250 kW power, in the 2nd shift often the compressor with 125 kW power is used.

The lack of automation do not allow to use measuring equipment to determine air losses in the system. Therefore the calculation method was used.

In practice according to the consumption of air, periodically the rest of it flow out through receiver.

The total daily electricity consumption is 3500 kWh.

Electricity Consumption for Ventilation

The total electricity supply for ventilation was determined similar as for lighting system.

It was carried out for the 2nd producing shop ventilation system using TACOM BOX.

During the measurements irrational consumption of 15 kW was found out.

The maximum of load - 294 kW. The load in the 2nd shift was obviously lower because the technological equipment was not used completely.

Electricity Consumption for Lighting

To carry out electricity consumption for lighting in the whole factory is very complicated. There are many objects and for many of them the electricity supply is connected with power supply.

For measurements we choose the 2nd producing shop which is the largest and works in two shifts.

TACOM BOX was used for measurements.

The results were used in estimation of energy saving because the lighting in this producing shop is from luminescent lamps and we know the amount of them.

In other cases the electricity consumption was calculated.

Compressed Air System

Change of Compressor VK-30

Compressed air system operates in working days 16 hours per day. It consists from 4 piston Russian compressors, 2 of them are type VK-20, which can produce compressed air 20 m^3/min, but 2 other are type VK-30, which can produce compressed air 30 m^3/min. Electrical load of VK-20 is 125,0 kW, but VK-30 - 250,0kW. The pressure of compressed air is 8,0 bar. Compressors are working without automatic control system. Normally is working one compressor type VK.30 and other VK-30 is as a reserve. Compressors type VK-20 worked in minimal regime of compressed air consumption.

So that present compressors are very old and they worked without automatic control systems it is very difficult to calculate efficiency of these compressors, approximately present efficiency of compressor type VK-30 may be 70% from original.

Load curve of compressor VK-30 is shown in the following figure.

Because compressors are antiquated, instead of compressor VK-30, factory installed new screw compressor type VLEA made in Germany. Main parameters for new compressor are:

pressure	8 bar
producing of compressed air	20 m^3/min
electrical load	132,0 kW

Average energy consumption for compressor VK-30 working time - two shifts or 16,0 hours or 1040000,0kWh/year. But energy consumption for cooling water system is 91520,0 kWh/year. Compressor VLEA have air cooling system. Price of compressor VLEA is 97390 DM. Energy consumption of compressor VLEA is 274560 kWh/year or 35060,4 Ls. Average price of one kWh in Latvia is

$$0{,}0215 \times 18\% = 0{,}0254 \text{ Ls.}$$

Real income of reducing energy consumption in this year was:

$$W_a = [\,(1040000{,}0 + 91520{,}0) - 274560{,}0] \times 0{,}0254 = 21766{,}78 \text{ Ls/year}$$

Cost of mounting new compressor from data of factory approximately is 7012,0 Ls.

Payback period is

$$T = \frac{I}{b} = \frac{35060{,}4 + 7012{,}0}{21766{,}78} = 1{,}93 \text{ years.}$$

The Losses of Compressed Air

As compressor VK-30 works in both shifts without automatic regulation the not useful consumption is 50% from whole amount.

The consumption of energy of compressor without automatic regulation of it's work is:

$A_1 = 250{,}0 \cdot 260 \cdot 16 = 1040000{,}0$ kWh/year.

The consumption of energy per year for cooling systems is:

$A_2 = (7{,}0 + 15{,}0) \cdot 260 \cdot 16 = 91520{,}0$ kWh/year.

The total consumption:

$A = A_1 + A_2 = 1040000{,}0 + 91520{,}0 = 1131520$ kWh/year.

Decrease of energy consumption using automatic regulation is 50% from whole consumption of the year:

$A = A \cdot 0{,}5 = 1131520 \cdot 0{,}5 = 565760$ kWh/year.

As compressor is working without automatics then the amount of energy used for compensation of losses for compressed air was determined by chronometer switching on compressor with hand while reaching working pressure.

Experiment longs for 1 hour. During this period compressor was switched on 6 times for 4 minutes each time and the losses of compressed air were compensated.

The total amount of energy for reducing air losses per year are:

$$AA_2 = 250 \cdot 16 \cdot 260 \cdot \frac{24}{60} = 416000{,}0 \text{ kWh/year.}$$

The energy consumption for cooling equipment during this time is:

$$AA_3 = (7 + 15) \cdot 16 \cdot 260 \cdot \frac{24}{60} = 36608 \text{ kWh/year.}$$

The consumption of energy for compensating compressed air losses is:

$$\frac{(416000,0 + 36608) \cdot 100}{1131520} = 40\% .$$

As in optimal regime compressed air losses are not lager than 7% , than irrationally used energy consumption for compressed air loss compensating is 33% which is 373401,6 kWh/year.

So useless consumption of energy in compressor department is:

565760,0 + 373401,6 = 939161,6 kWh/year

or

939161,6 · 0,0254 = 23600,7 Ls/year

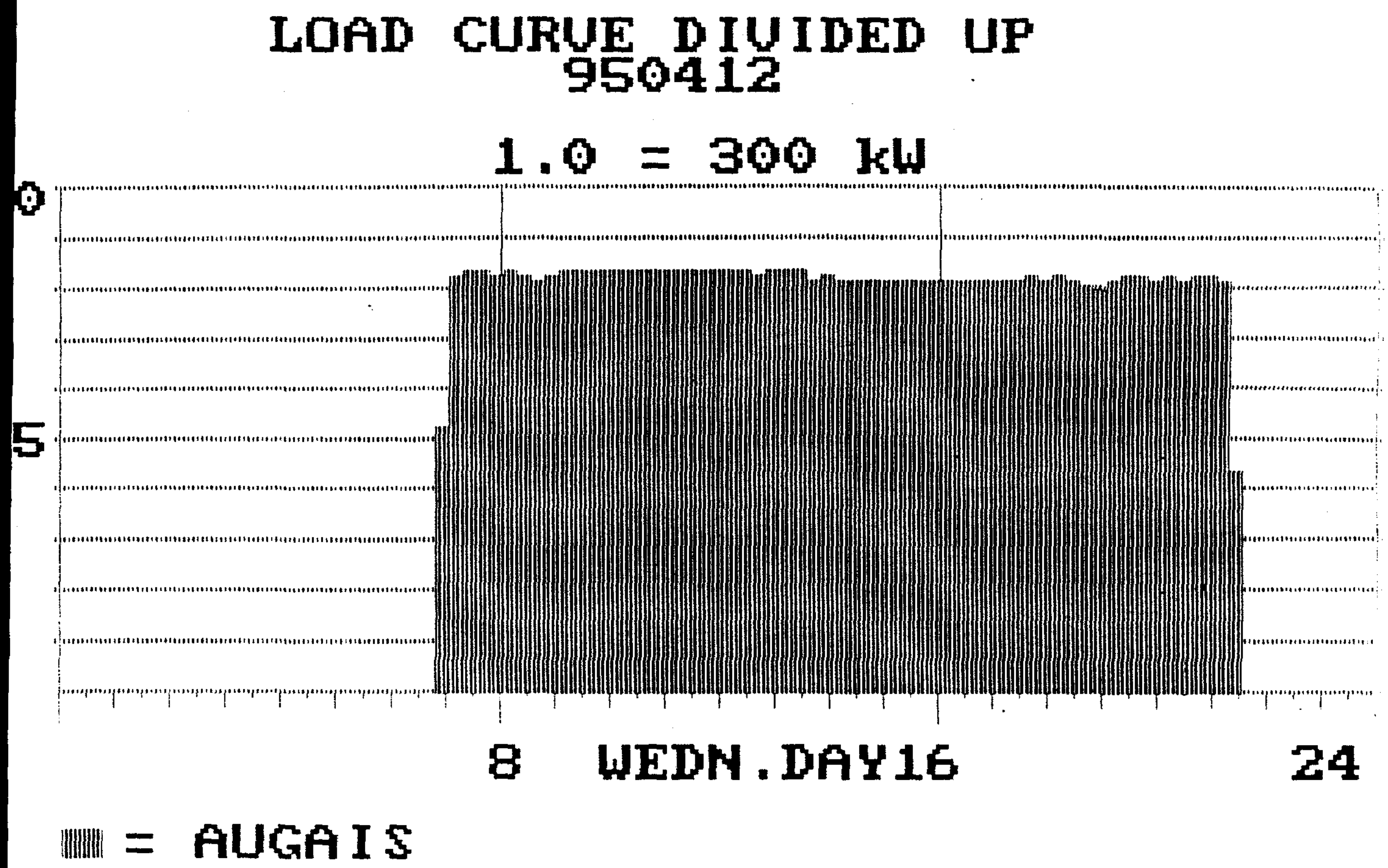


Fig. 10

Compressed Air Compressor Load

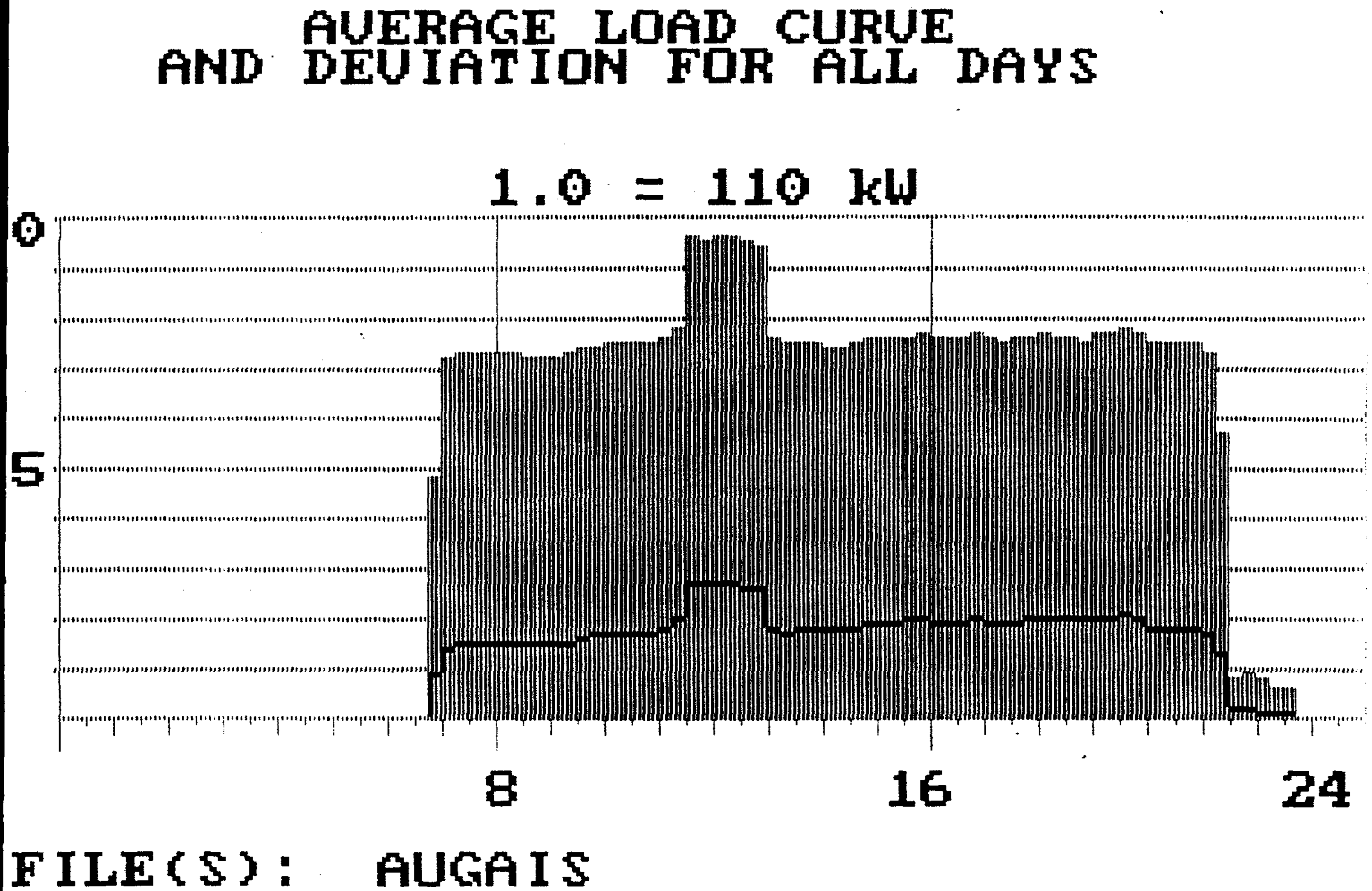


Fig. 11

Compressed Air Compressor Average Load

Electricity Consumption for Lighting

The total lighting power for lighting in factory "Aurora" is 597,44 kW. It divides following:

1st	production shop	1804 pcs of lightings OD-2x40,
2nd	production shop	1614 pcs of lightings OD-2x40,
3rd	production shop	662 pcs of lightings OD-2x40,
4th	production shop	1694 pcs of lightings OD-2x80.

At present only 4th production shop is working normally, in other parts work is organised only partly .

Carrying out light measuring in production shops was stated that in average lighting divides as follows:

	Lighting	
	quota	fact
1st production shop	750 lx	900 lx
2nd production shop	200 lx	200 lx
3rd production shop	2000 lx	1950 lx
4th production shop	750 lx	750 lx

As we see in table the lighting in general corresponds to quota, except the 3rd production shop, where the level of lighting is lower.

In order to save energy consumption for lightings OD-2x40 the X-Tralux type reflector are used. They increase the effectivity of light reflection for 50%. This allows to decrease the power of lightings using only one florescent lamp.

Reconstruction of lighting

Production shop	before reconstr.		after reconstruc tion			Amount of working hours
	lamps pcs	lighting pcs	lamps pcs	lighting pcs	power kW	
1st	2 x 40	1804	1 x 40	1804	72,2	16
2nd	2 x 40	6114	1 x 40	1614	64,6	16
3rd	2 x 40	662	1 x 40	662	26,5	16
4th	2 x 80	1694	1 x 80	1694	135,5	16
TOTAL		5774		5774	298,8	

The economy of electric energy working in two shifts and using X-Tralux type reflectors

Production shop	Decreased power	Lighting pcs	Economy of electric energy kWh/year
1st	0,04	1804	300185,6
2nd	0,04	1614	268569,6
3rd	0,04	662	110156,8
4th	0,08	1694	563763,2
TOTAL		5774	1242675,2

Switching off the lighting during lunch which is about 0,5 hours, the economy of electric energy will be:

$298{,}8 \cdot 0{,}5 \cdot 260 = 38844{,}0$ kWh/year.

Income from economy of electrical energy is:

$b = (1242675{,}2 + 38844{,}0) \cdot 0{,}0254 = \underline{32550{,}59 \text{ Ls}}$

The price of X-Tralux reflector is 8,91 Ls/pce.

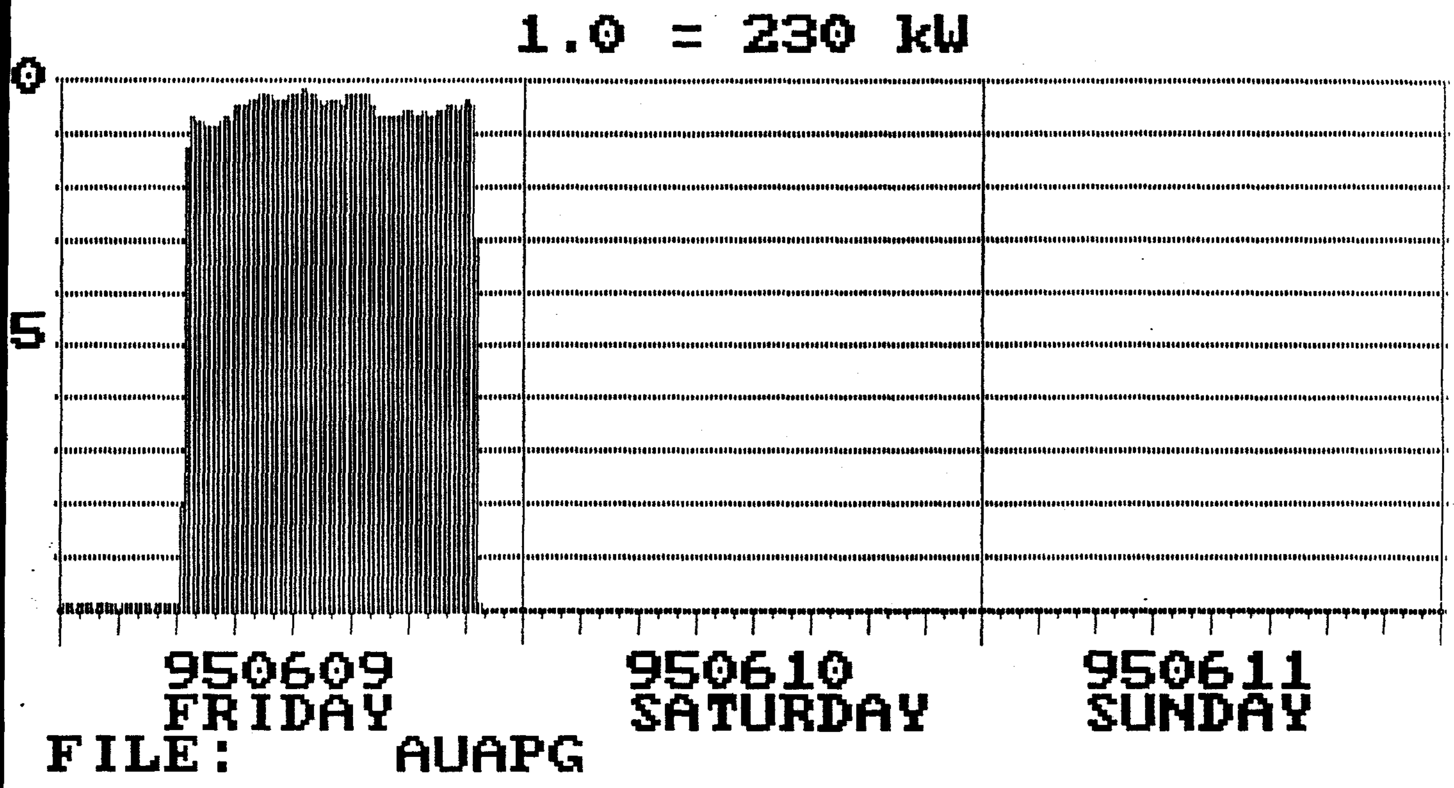
Expenses are:

$I = 5774 \cdot 8{,}91 = \underline{51446{,}30 \text{ Ls}}$

Payback period:

$$T = \frac{I}{b} = \frac{51446{,}3}{32550{,}59} = 1{,}58 \text{ year.}$$

TOTAL LOAD CURVE



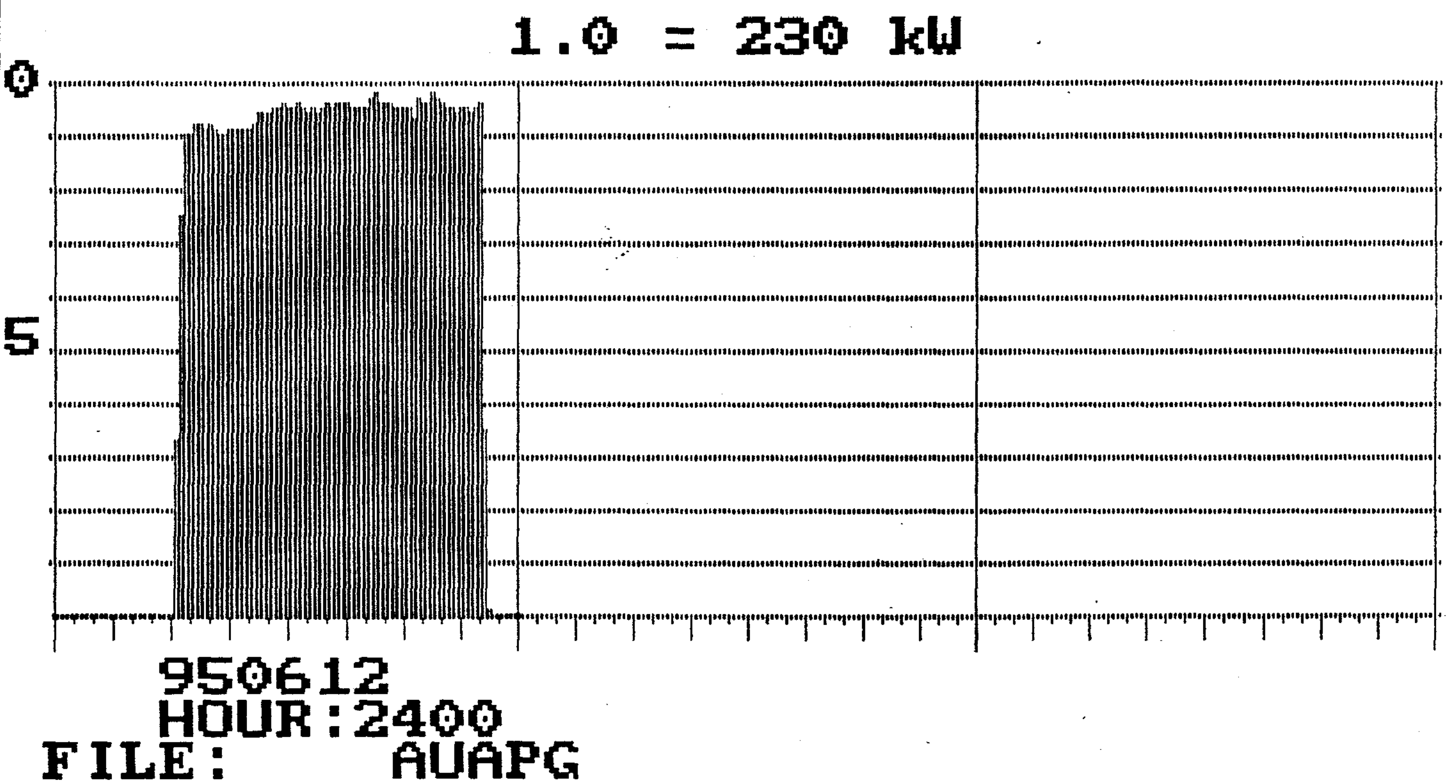


Fig. 12 Lightening Load of 2nd Production Shop

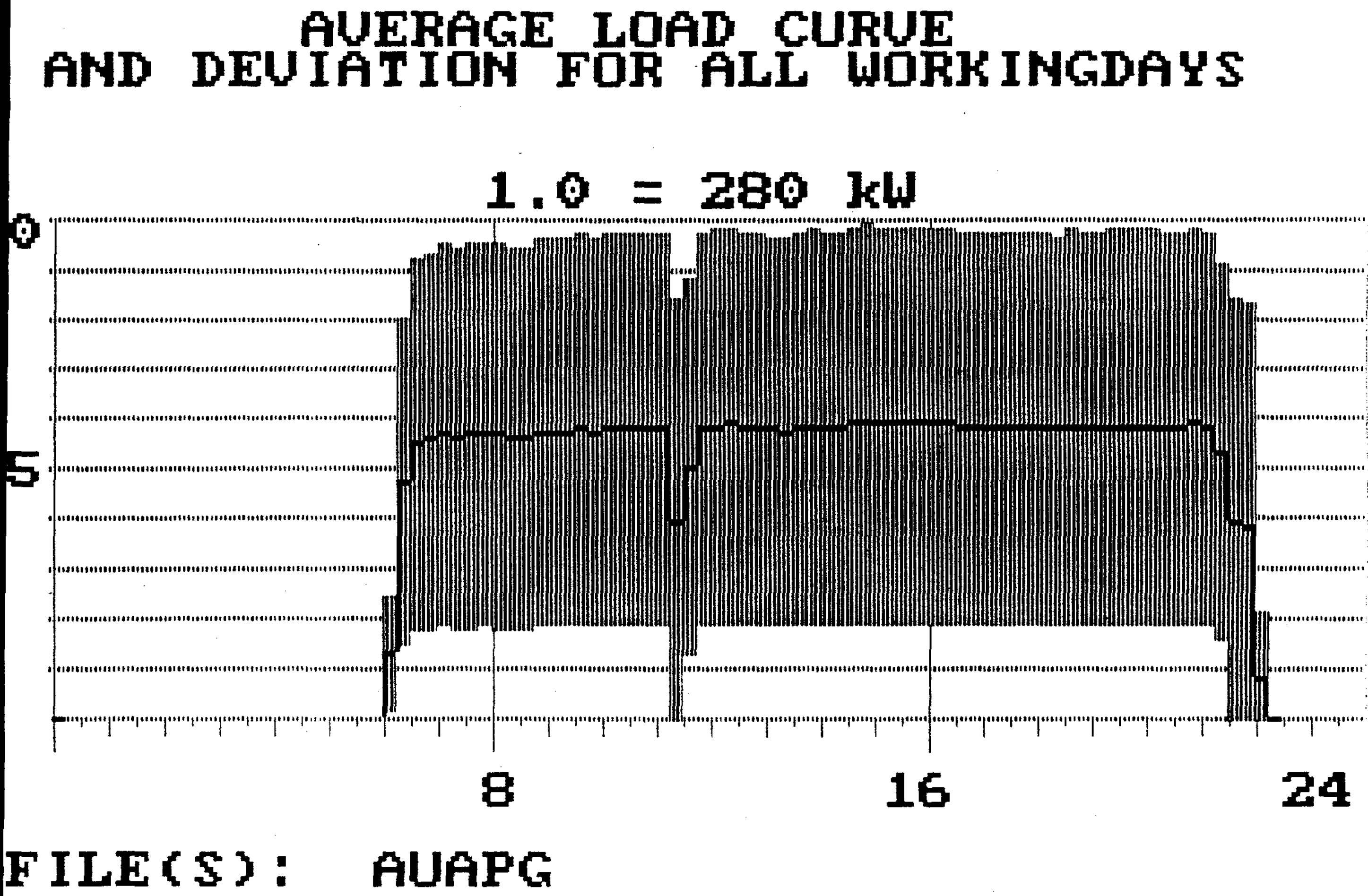


Fig. 13

Average Lightening Load of 2nd Production Shop

Ventilation

There are no special electric energy meters for registration of electric energy consumption of ventilation equipment.

The amount of energy used by ventilation equipment is calculated from total power used by ventilation equipment and air conditioning units and working hours.

The amount of electric energy consumption for ventilation is calculated as follows:

$$A = {}_{1}^{m} \text{ thousands kWh}$$

where P - power (kW) used by one ventilation unit generator;
$P = P_n \cdot k$ kW ;
P_n - ventilation unit generator nominal power (kW) as in passport;
k - coefficient of ventilation unit use, k = 0,6 - 0,8 ;
T - hours of work of one ventilation unit ;
m - amount of working units .

The amount of electric energy consumption in production shops during year:

	Production shop		thousand kWh
1	Production shop No.1	synthetic material knighting and sewing	83.0
2	Production shop No.2	synthetic material knighting and sewing	152.0
3	Production shop No.3	cotton and wool material knighting and sewing	282.0
4	Production shop No.4	knighting, not working now	31.0
5	Production shop No.5	colouring and forming	201.0
6	unit No.2	mechanical workshop (boiler house, carpenter works, electrical works, plumbing works, canteen, etc.)	71.0
	Total		820.0

A = 820 thousand kWh per year is 10,4% from factories total amount for year.

As for last years factory is not working regularly and amount of production has decreased also the time of using technological and ventilation unit has decreased as well as consumption of electric energy. During the test period many ventilation units were not working. The total amount of ventilation units is 354.

In factory there is installed the exhaust ventilation for sucking out wet, heat, dust and gases produced during the technological processes as well as fresh air supply ventilation. For warmed air supply ventilators with heaters with hot water are used.

Exhaust ventilation is made as total pumping away from upper zones of rooms as well as local pumping away from working places.

Fresh air supply is realised mainly by using axial fans but also belt driven fan are used.

The power of fan generator are different - from 0,6 to 55 kW. There are many ventilators with power 40 and 45 kW.

The ventilation units have been designed for the maximal possible work of technological equipment. During this period in production shops all workplaces and machines are not used. Therefore the amount of harmful outputs has decreased. Some working units and production shops are working half-time or staying for long period. Therefore to use the ventilation units with full capacity is not useful. After stabilisation of production there may be will be needed a reconstruction of ventilation equipment possibly decreasing the power consumption.

Now the exploitation of ventilation units has ineffective consumption of electric energy:

1) air conditioning units are without automatic or it does not work,
2) in production shops there are installed ventilation units with high generator power and they work even during the time when the greatest part of technological equipment and workers do not work,
3) The dampers of not working technological equipment are not shut therefore there is additional power needed for generator,
4) it will be useful to use multi-speed generators to change the speed depending of supplied air amount,
5) sometimes lock out ventilation units during breaks and after shift,
6) ventilation units with belts, have not all belts needed,
7) some exhausting ventilation unit air ducts are damaged,
8) air grills are not cleaned when needed ,
9) during winter period when air curtain is working the doors of workrooms are not closed,
10) there in no individual exhausting ventilation generator blocking with working machine,
11) there are old type fans with low actual efficiency of using.

Changing the old fan to new one we can achieve the following economy of electric energy:

where Q - fan generator power m³/min
h - pressure Pa
and - the actual efficiency of old and new fan
and - the actual efficiency of generator and electrical net

Example:

Instead of old type of fan VRS with = 0,63 we use new type C4-70 with =0,86

$h = 130\ kg/m^2 = 1300\ N/m^2 = 1300\ Pa$

$Q = 42000\ m^3/h = 700\ m^3/min = 11,7\ m^3/sec$

$P = 29\ kW$

= 0,87 and = 0,82 ; T = 28000 h

$$A = \frac{11,7 \cdot 1300 \cdot (0,86-0,63) \cdot 2800}{1000 \cdot 0,63 \cdot 0,86 \cdot 0,87 \cdot 0,82} = 28800\ (kWh)$$

So only change of one fan will give the economy of 288000 kWh/year.

Changing to money it will be:

28800 • 0,0254 = 731,5 Ls/year

If the price of new fan is 520 Ls and all expenses to install it will be approximately 70Ls, than the payback period is

$$T_p = \frac{520 + 70}{731,5} = 0,81\ year$$

It is possible to change 8 fans of such type- VRS to C4-70. So the total amount of saved energy per year will be

28800 • 8 = 230,4 thousand kWh or 5852,2 Ls.

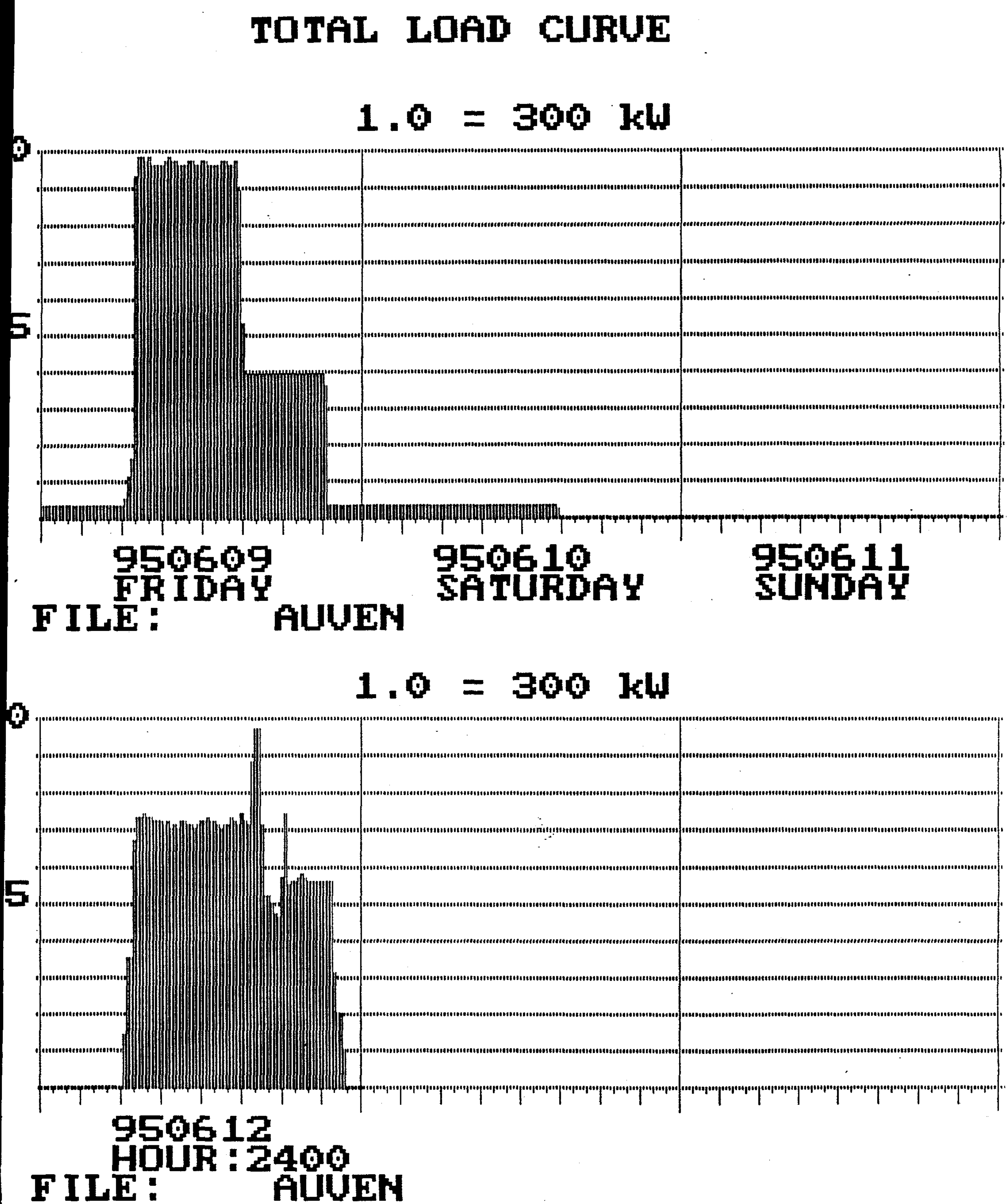


Fig. 14

Ventilation Load of 2nd Production Shop

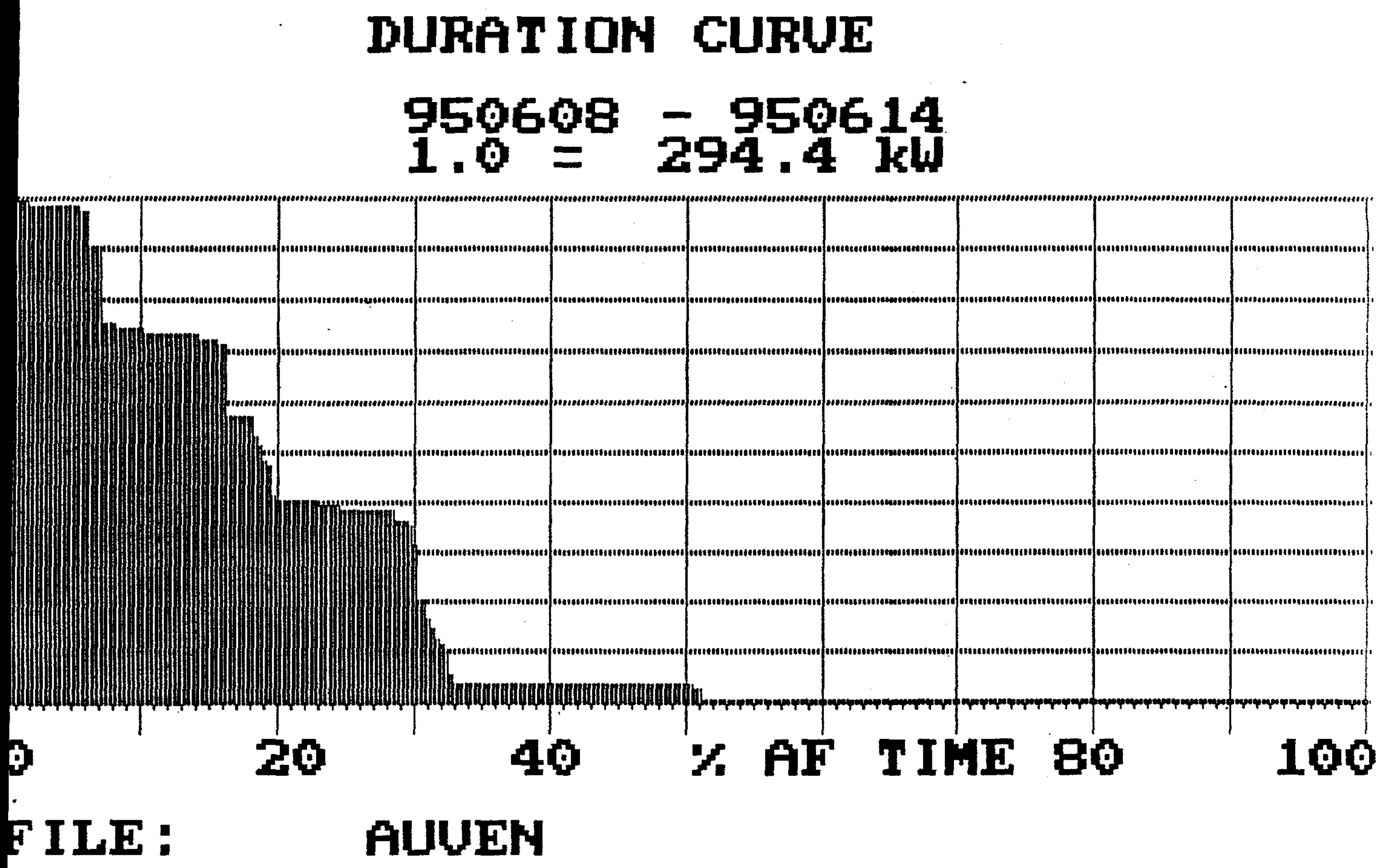


Fig. 15

Ventilation of 2nd Production Shop

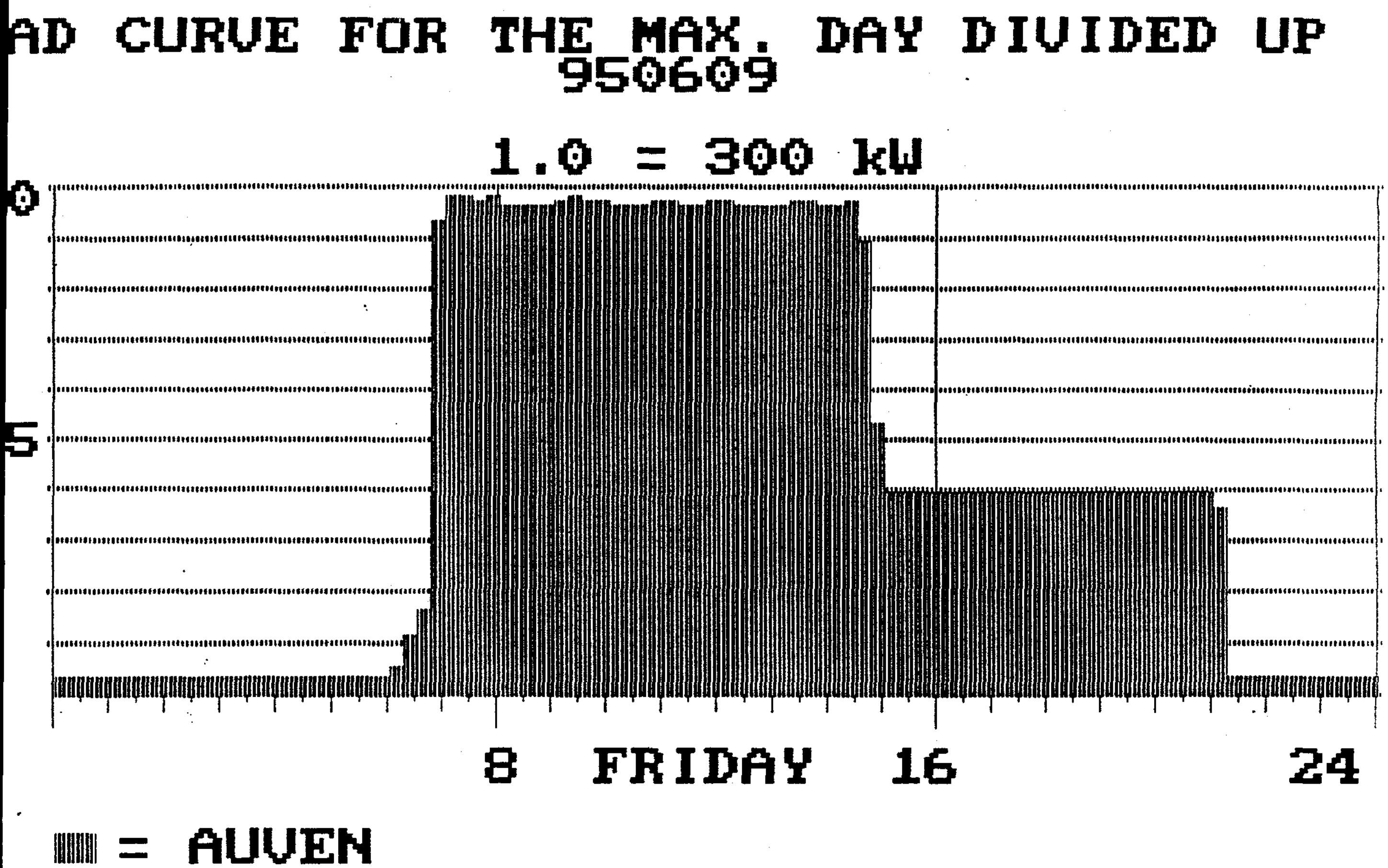


Fig. 16

Maximal Ventilation Load of 2nd Production Shop

Energy Saving in Heat Supply System

In factory's boiler house DKVR boilers use ineffective burners with hand regulation GMG-4 and GMG-5,5.

In comparison we choose Finnish company's OILON burners which are available in Latvia.

Boilers DKVR-6,5 need burners GRP-201 and boilers DKVR-20 need burners GRP-700.

Heat supply is provided by 1 boiler - in winter - DKVR-20, in summer - DKVR-6,5. In calculation we take in account that only one set of burners is changed on the burners of each type. The fuel oil is used in these burners, but also the gas can be used.

In 1994 23056 Gkal of heat energy was produced using 5360 tons of fuel oil.

To compare the OILON burners and GMG burners we can look at heat production in 1990, when it was the highest - 74982 Gcal, the fuel oil consumption was 10116 t/year. When using OILON burners the consumption of fuel oil was 7'722 t/year. It means that OILON burners are for 31% more effective. In 1994 if OILON burners used the fuel oil consumption could be 3700 t.

Economy - 1660 t/year or 121180 Ls if fuel oil price is 73 Ls/t.

The expenses of this enterprise:

1. project, installation, regulation		2500 Ls
2. prices of burners	9524 x 2 =	19048 Ls (GRP-210)
	26640 x 2 =	53280 Ls (GRP-700)
3. additional expenses of exploitation (heating of fuel oil before using in burner)		7200 Ls
TOTAL		82028 Ls

Other expenses in both cases are the same.

$$\text{Payback period} = \frac{82028}{121180} = 0{,}67 \text{ year.}$$

In order to increase the savings in the heat supply system we offer the following activities:

- one boiler DKVR-6,5 use in water regime which allows to increase its actual efficiency,

- to change the insulation of heating mains in the factory, which will decrease the losses by 20%,
- to install the heat exchanger in the exhausted gas channel to heat the air before boiler house.

Because of the lack of information these situations are not economically estimated.

Offer for Energy Saving Introduction

Energy saving realisation can be divided in 2 parts:
1 - without investments or with low investments:
- switch out the load when it is not necessary,
- to avert the exhausting in the air system;

2 - with investments:
- change of ventilation equipment,
- change of burners in the boiler house,
- change of air compressors.

APPENDIX

ENERGY PER DAY

FILE: AUGAIS

AVERAGE ENERGY PER DAY

MONDAYS:	323.5 kWh
TUESDAYS:	1416.3 kWh
WEDNESDAYS:	1887.6 kWh
THURSDAYS:	943.6 kWh
FRIDAYS:	314.5 kWh
SATURDAYS:	269.5 kWh
SUNDAYS:	147.1 kWh
WORKINGDAYS:	1137.7 kWh

KEY FACTORS

RECORDING PERIOD AND ENERGY

INTEGRATION PERIOD: 15 MINUTES

DATAFILE	PERIOD	ENERGY
AUVEN	95-06-08 H. 00:15 - 95-06-14 H. 00:00	9071 kWh

MAXIMUM DEMAND

DATAFILE	MAXIMUM DEMAND (kW)	TIME
AUVEN	294.40	95-06-09 HOUR 07:30

UTILIZATION TIME AND LOAD FACTOR

DATAFILE	UTILIZATION TIME (h)	LOAD FACTOR (%)	YEARLY UTILI. TIME (h)
AUVEN	31	21.4	1874

KEY FACTORS

RECORDING PERIOD AND ENERGY

INTEGRATION PERIOD: 15 MINUTES

DATAFILE	PERIOD	ENERGY
AUGAIS	95-04-11 H. 00:15 - 95-05-10 H. 00:00	9471 kWh

MAXIMUM DEMAND

DATAFILE	MAXIMUM DEMAND (kW)	TIME
AUGAIS	250.40	95-04-12 HOUR 07:30

UTILIZATION TIME AND LOAD FACTOR

DATAFILE	UTILIZATION TIME (h)	LOAD FACTOR (%)	YEARLY UTILI. TIME (h)
AUGAIS	38	5.4	476

KEY FACTORS

RECORDING PERIOD AND ENERGY

INTEGRATION PERIOD: 15 MINUTES

DATAFILE	PERIOD	ENERGY
AUAPG	95-06-08 H. 00:15 - 95-06-14 H. 00:00	10159 kWh

MAXIMUM DEMAND

DATAFILE	MAXIMUM DEMAND (kW)	TIME
AUAPG	226.40	95-06-08 HOUR 16:30

UTILIZATION TIME AND LOAD FACTOR

DATAFILE	UTILIZATION TIME (h)	LOAD FACTOR (%)	YEARLY UTILI. TIME (h)
AUAPG	45	31.2	2730

KEY FACTORS

RECORDING PERIOD AND ENERGY

INTEGRATION PERIOD: 15 MINUTES

DATAFILE	PERIOD	ENERGY
AURU	95-04-30 H. 00:15 - 95-05-09 H. 00:00	7916 kWh
AUUU	95-04-30 H. 00:15 - 95-05-09 H. 00:00	3537 kWh
SUM:		11452 kWh

SUMMATION OF ALL RECORDED DATA

MAXIMUM DEMAND

DATAFILE	MAXIMUM DEMAND (kW)	TIME
AURU	137.60	95-05-04 HOUR 12:15
AUUU	67.20	95-05-05 HOUR 12:15
SUM OF LOAD:	198.40	95-05-05 HOUR 12:15

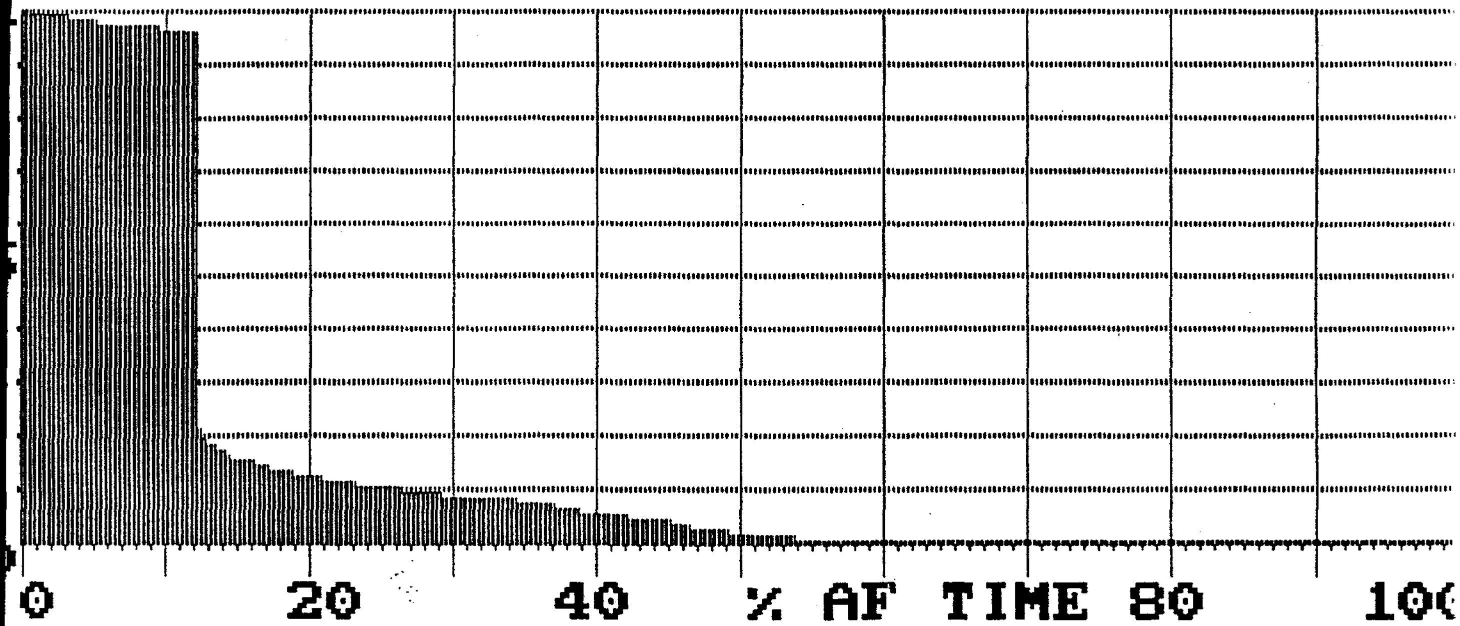
COINCIDENCE FACTOR: 0.969

UTILIZATION TIME AND LOAD FACTOR

DATAFILE	UTILIZATION TIME (h)	LOAD FACTOR (%)	YEARLY UTILI. TIME (h)
AURU	58	26.6	2333
AUUU	53	24.4	2134
SUM OF LOAD:	58	26.7	2341

DURATION CURVE

950411 - 950510
1.0 = 250.4 kW



FILE: AUGAIS