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Optimalan broj zaposlenih u elektrodistributivnoj delatnosti

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Apstrakt: U Javnim preduzećima kao i Javnim komunalnim preduzećima došlo je do pojave većeg broja zaposlenih radnika što po pravilu uzrokuje njihovo loše ekonomsko stanje. Namera ovog rada jeste da se pokuša dati odgovor koliko ima viška zaposlenih u elektrodistributivnoj delatnosti a na konkretnom primeru Elektrovojvodine. U radu je analizirano Javno preduzeće Elektroprivrede Srbije, i to samo njen elektrodistributivni deo. Do sada je u praksi primenjivan takav model da se napravi organizaciona šema preduzeća koja je po pravilu bila glomaznija pa se vremenom popunjavala sa novozaposlenim radnicima. Ovde primenjujemo model koji je sasvim drugačiji. Videćemo za analizirani konzum koliki je optimalan broj zaposlenih radnika, pa se na osnovu tog broja pravi organizacija preduzeća. Analiza rada se završava samo na optimizaciji broja zaposlenih radnika a organizaciona šema preduzeća može biti predmet istraživanja nekog budućeg rada. Rad se zasniva na korelaciji pondera mađarske elektrodistribucije koja je privatizovana i Elektrovojvodine. Mađarska elektrodistribucija je najbližnja Elektrovojvodini jer imaju: sličnu konfiguraciju zemljišta, kao i broj stanovnika po km² i kupaca po km² koji su samo za 20 % veći u Mađarskoj u odnosu na Vojvodinu. Analiza obuhvata četrnaest važnijih pondera koji većim delom obeležavaju elektrodistributivni konzum. Nakon iznalaženja pondera na praktičnom primeru Elektrovojvodine urađena je optimizacija broja zaposlenih radnika bez održavanja srednjenaponskog i niskonaponskog postrojenja a nakon toga i sa održavanjem.

Ključne reči: optimizacija, elektrodistribucija, ponderi, korelacija, javna preduzeća, uslovni radnik, zaposleni radnici i organizacija preduzeća

Optimal Number of Employees in Electric Power Distribution Companies

Abstract: In public companies, as well as in public utility companies, a recent common trend is a larger numbers of employees, which often causes their poor economic condition. The intention of this paper is to try to answer the question - what is the extent of overstaffing in the power distribution activities and this will be done through the case study of Elektrovojvodina. This paper analyses the situation in Elektrovojvodina public utility company, or more precisely - in its electric power-distribution sector. The previous model involved the design of an organisational scheme of the company, that was much larger, and then later - the employment of workers based on the requirements of the scheme. In this paper, a different model is used - an optimal number of workers is determined with regard to the consumption analysed and the organisational scheme of the company is subsequently designed based on this number. The aim of this paper is limited only to the optimisation of the number of employees, whereas structural organisation might be the subject of another research paper. This paper presents the correlation weights of Elektrovojvodina and the Hungarian power-distribution system that has been privatised. The Hungarian electric power-distribution system is similar to the system of Elektrovojvodina having the similar configuration of the land, the number of inhabitants per km² and the number of customers per km², which are only 20% higher in Hungary compared to Vojvodina. This analysis involves fourteen major weights that mark most of the electrical consumption. After the weight analysis in the example of Elektrovojvodina, the optimisation of employees is suggested.

Key words: optimisation, electro-distribution, weights, correlation, public companies, employees, company organization

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1. Introduction

In public companies, as well as in public utility companies, a recent common trend is a larger numbers of employees, which often causes their poor economic condition. Reasons for overstaffing are usually organisational or, quite often, political - having won the election, a ruling political party obtains a public company in redistribution and assigns itself rights to fully control it. If before the election, a company 'belonged' to another political option, the number of employees usually became even higher since the workers employed by a previous ruling party were not dismissed.

This paper analyses the situation in Elektrovojvodina public utility company, or more precisely - in its electric power-distribution sector. The model used before involved the design of an organisational scheme of the company, that was much larger, and then later - the employment of workers based on the requirements of the scheme. In this paper, a different model is used - an optimal number of workers is determed with regard to the consumption analysed and subsequently, based on this number, the organisational scheme of the company is projected containg not larger, but a smaller number of workers than it used to.

This analysis involves fourteen major weights that mark most of the electrical consumption. The case study of Elektrovojvodina is presentred.

The paper consists of eight parts:

- the design of the model of optimal number of employees;
- the definition of the most important physical parameters;
- the percentage of physical parametres in the model;
- the calculation of the weights of the analysed electro-distribution in relation to the number of employees (current situation);
- the choice of the most similar electro-distribution that has already been privatized;
- the calculation of the weights of the chosen electro-distribution in relation to their number of employees;
- the calculation of the optimal number of employees in Elektrovojvodina (future situation, without the maintainance of medium and low voltage);
- the correction of the weights of the chosen elctro-distribution (to a higher value owing to the difference in the supplies) and finally the calculation of the optimal number of employees in Elektrovojvodina (future situation with corrections that take into account the maintenance of medium and low voltage).

2. The Optimal Number of Employees

2.1. Human Resources

The model is done in such a way that it takes into account the experiences in some European privatized electric utilities, the long working experience of the author gained in the power distribution segments such as: development, energy, investment, data collection, the analysis of electrical power distribution and consumption as well as the experience in introducing and implementing a quality system according to ISO 9000 standards in Elektrovojvodina. The number of employees is directly related to the scope of work that has to be done so that the defined production processes and service delivery can be achieved. The tasks to be performed within the Company are the following: development, investment management, system maintenance, repairs on medium and low voltage facilities, activities related to the purchase and sale of electricity to customers, collection and monitoring of billing for electricity delivered.

The tasks that should be left to other companies engaged through agreements and contracts at transparent public procurement can be: keeping buildings, cleaning facilities, vehicle maintenance, design, construction of new facilities and reconstruction of existing facilities of all voltage levels, refurbishment of objects having 35 and 110 kV voltage level, calculation and distribution of electricity bills to customers as well as lawsuits and enforcement of payment for the delivered electricity. All objects that belong to Elektrovojvodina and deal with catering, recreation, hotel industry and other non-distributive activities should be excluded from the company scheme or left to the parts of the enterprise that are out of the distribution activities.

The public utility company Electric Power Industry of Serbia (EPS hereafter) should consist of the power distribution parts that will have approximately the same physical parameters. The assumption in this paper is that one of these parts might be the whole of Elektrovojvodina.

With such business structuring, we should identify the physical parameters that will be the object of our analysis and comparison with other electric utilities.

2.1.1. The model of optimal number of employees

The formula used for calculating the optimal number of workers is the sum of the fourteen physical parameters and the corresponding weights of the physical parameters. Since we want to calculate the optimal number of employees using the potential workers for each weight, the weights must have a unit of measure: number of employees divided by a number of customers, the total energy consumption, peak consumption and eventually the fourteenth weight – the length of 0.4 kV cable lines expressed in kilometers. When the weights of a privatized Hungarian electro-distribution company are included into this formula as well as the percentage of the physical parameters of the analyzed electro-distribution company (Elektrovojvodina), then the result expresses a required employee number (e.g. $0.2 \times 930,633 \times 0,00064 = 120$ required employees, where 0.2 is the share of this weight being 20%, 930,633 is the number of consumers of Elektrovojvodina and 0.00064 – the weight of electro-distribution of Hungary divided for the number of employees / number of customers). When, for each of the given weights, the number of required employees is calculated, their sum represents the optimal number of employees for the electro-distribution activity.

If the methodology described above is applied, the optimal number of employees can be calculated by using the following formula:

$$ONE = \sum_{i=1}^{14} \prod_{j,k=1}^{14} [a_i PP_j K_k] = a_1 PP_1 K_1 + a_2 PP_2 K_2 + a_3 PP_3 K_3 + a_4 PP_4 K_4 + a_5 PP_5 K_5 + a_6 PP_6 K_6 + a_7 PP_7 K_7 + a_8 PP_8 K_8 + a_9 PP_9 K_9 + a_{10} PP_{10} K_{10} + a_{11} PP_{11} K_{11} + a_{12} PP_{12} K_{12} + a_{13} PP_{13} K_{13} + a_{14} PP_{14} K_{14} \dots\dots\dots(1)$$

where:

ONE –optimal number of employees

a_i – the percentage of physical parametres

PP_j – physical parameters

K_k –weights of physical parameters

2.2. Physical Parametres and Their Percentage

2.2.1. Physical Parameters

The analysis of the electro-distributive part should include the following physical parameters:

• PP_1 = number of consumers	number of consumers
of the analyzed electro-distribution
• PP_2 = total of delivered energy	total of delivered electrical energy
per year, expressed in GWh
• PP_3 = total of peak consumption of electricity	peak load of consumption expressed
in MW
• PP_4 = consumption area	consumption area expressed in km ²
• PP_5 = density of the consumption	number of inhabitants
• PP_6 = configuration of the consumption	plain / mountainous
• PP_7 = number of transformer substations 110/35 and 110/20 kV/kV	number of TS 110/x items
• PP_8 = number of transformer substations 35/x kV/kV	number of TS 35/x items
• PP_9 = number of transformer substations 20/0,4 kV/kV	number of TS 20/0.4 items

- PP_{10} = number of transformer substations 10/0,4 kV/kV number of TS 10/0.4 items
- PP_{11} = length of 35 kV cables expressed in km
- PP_{12} = length of 20 kV cables expressed in km
- PP_{13} = length of 10 kV cables expressed in km
- PP_{14} = length of 0.4 kV cables expressed in km

2.2.2. The percentages:

Based on the experience gained in the electro-distribution activities and according to the priority levels, the following percentage of the physical parameters is determined:

- $a_1 = 20\%$ for PP_1
- $a_2 = 13\%$ for PP_2
- $a_3 = 5\%$ for PP_3
- $a_4 = 7\%$ for PP_4
- $a_5 = 3\%$ for PP_5
- $a_6 = 2\%$ for PP_6
- $a_7 = 10\%$ for PP_7
- $a_8 = 2\%$ for PP_8
- $a_9 = 9\%$ for PP_9
- $a_{10} = 4\%$ for PP_{10}
- $a_{11} = 2\%$ for PP_{11}
- $a_{12} = 9\%$ for PP_{12}
- $a_{13} = 4\%$ for PP_{13}
- $a_{14} = 10\%$ for PP_{14}

The share of physical parameters that represent energy values (the first six) is 50% , whereas the share of physical parameters that represent technical values (the remaining eight) is also 50%, which makes the total of 100 %.

2.3. Weights Derived from Physical Parameters

2.3.1. Weights of physical parameters

Since this model should result in the optimal number of employees, the weights of physical parameters must be: the number of employees divided by the physical values of the consumption analyzed.

- K_1 =number of employees/number of consumers of the employee/customer analyzed electro-distribution)
- K_2 = number of employees/ total of delivered electricity p.a. (employee/GWh)
- K_3 = number of employees /peak load of consumption (employee/MW)
- K_4 = number of employees /consumption area (employee/km²)
- K_5 = number of employees /number of inhabitants (employee/1,000 inhabitants)
- K_6 = configuration of the consumption (%plain/%mountainous)
- K_7 = number of employees /number of transformer substations 110/x kV/kV (employee/TS 110/x)
- K_8 = number of employees /number of transformer substations 35/x kV/kV (employee/TS 35/x)
- K_9 = number of employees /number of transformer substations 20/0.4 kV/kV (employee/TS 20/0.4)
- K_{10} = number of employees /number of transformer substations 10/0.4 kV/kV (employee/TS 10/0.4)
- K_{11} = number of employees /length of 35 kV cables (employee/km 35 cables)
- K_{12} = number of employees /length of 20 kV cables (employee/km 20 cables)
- K_{13} = number of employees /length of 10 kV cables (employee/km 10 cables)
- K_{14} = number of employees /length of 0.4 kV cable (employee/km 0-4 cables)

3. number of employees in the electro-distribution system, current situation

The analysis of the employed workers with the selected weights (Elektrovojvodina – current state) is presented here. Taking into account physical parameters and the total number of employees, the weights are calculated as well as the number of required employees for each physical parameter and it is presented in Table 1.

Table 1: Physical parameters, weights and the number of employees in Elektrovojvodina without Department for Design (current state)

Physical parameters	PP ₁	PP ₂	PP ₃	PP ₄	PP ₅	PP ₆	PP ₇	PP ₈	PP ₉	PP ₁₀	PP ₁₁	PP ₁₂	PP ₁₃	PP ₁₄	
Values of PP	930,63 custom	8,534 GWh	1,457 MW	21,506 km ²	1,917 /1,000 inl	80/20 %/%	61 TS110/x	75 TS35/x	9,588 TS20/x	1,477 TS10/x	1,359 DV35kV	9,212 DV20kV	952 DV10kV	14,433 DV04kV	
Weights	K ₁	K ₂	K ₃	K ₄	K ₅	K ₆	K ₇	K ₈	K ₉	K ₁₀	K ₁₁	K ₁₂	K ₁₃	K ₁₄	
Values of weights	0.0026	0.29	1.7	0.12	1.29	0.095/0.1	40.66	33	0.26	1.68	1.83	0.27	2.6	0.18	
Factor-required empl	a ₁	a ₂	a ₃	a ₄	a ₅	a ₆	a ₇	a ₈	a ₉	a ₁₀	a ₁₁	a ₁₂	a ₁₃	a ₁₄	
Share - per cent	20	13	5	7	3	2	10	2	9	4	2	9	4	10	
Number of required empl	483	321	124	181	74	43	248	49	225	99	50	224	99	260	
	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*	
Total of empl															2,480
															15*

Taken from: www.elektrovojvodina.rs/sl/.../energetski_pokazatelji_za_2013. 4. March 2015.

Figure 1: Total number of employees in Elektrovojvodina, current situation

Source: The authors listed below Table 1

4. Number of Employees in the Electro-Distribution System of Hungary, Current Situation (After Privatization)

Why was Hungarian electro-distribution chosen for this analysis? It is due to its similarity with Elektrovojvodina that can be observed after the analysis. The configuration of land is almost identical – these are two plain areas through which two rivers flow: the Danube and the Tisa. The population density per km² as well as the number of customers per km² is higher by 20% in Hungary. Elektrovojvodina is a part of the public utility company Electric Power Industry of Serbia (EPS), whereas the Hungarian electro-distribution has already been privatized and consists of six parts covering different regions: Budapest with the surrounding area (ELMU), North-West part (EADSZ), South-West part (DEDASZ), North-East part (EMASZ), East part (TITASZ) and South-East part (DEMASZ) of Hungary (Table 2).

Table 2: Hungarian regional electro-distributions and the companies providing supplies

Company	Region	The area in км²	Number of customers
ELMU	Budapest and the surrounding area	4,050	1,317,000
EADSZ	North-West	18,230	882,582
DEDASZ	South-West	18,414	675,500
EMASZ	North-East	15,505	695,100
DEMASZ	South-East	18,235	730,000
TITASZ	East	18,728	700,000
Total:		93,158	5,000,182

Taken from: www.oecd.org/regreform/2510584.pdf, 4. March 2015.

Both systems distribute electricity only, unlike some other companies that deal with the electricity and gas distribution or gas and water. The tasks they perform are similar except that Elektrovojvodina is engaged in designing facilities of the power system as well as maintenance and overhaul of facilities of medium and low voltage. This is the reason why from the total number of employees in Elektrovojvodina, a number of employees working in the Department for Design (around 34 workers) was subtracted so that the companies can be comparable and therefore 2,480 is taken as the total number of employees in Elektrovojvodina. At the end of this analysis, in its last step, the total required number of employees increases by the number of assemblers if maintenance and repair of medium and low voltage is still kept.

According to the physical parameters of the electric power distribution of Hungary, the weights are calculated and then, subsequently, the required number of employees. The calculated summation fits into the total number of employees. After processing and systematization, these parameters are presented in Table 3, while Figure 2 presents the number of required employees according to the physical parameters and the total number of employees of the electric power distribution of Hungary.

Table 3: Physical parameters, weights and the number of employees in the electric power distribution of Hungary – current situation

Physical parameter s	PP ₁	PP ₂	PP ₃	PP ₄	PP ₅	PP ₆	PP ₇	PP ₈	PP ₉	PP ₁₀	PP ₁₁	PP ₁₂	PP ₁₃	PP ₁₄
Values of PP	5,00 0,18 2 Cust omer s	36,2 69G Wh	6,30 7 MW	93,1 58 km ²	10,198 /1,000 inh	80/20 %/%	251 TS110/ x	231 TS35 /x	40,7 50 TS20 /x	5,902 TS10/x	8,655 DV35kV	62,3 15 DV2 0kV	6,924 DV10kV	95,204 DV04k V
Weights	K ₁	K ₂	K ₃	K ₄	K ₅	K ₆	K ₇	K ₈	K ₉	K ₁₀	K ₁₁	K ₁₂	K ₁₃	K ₁₄
Values of weights	0.00 0.04	0.09	0.51	0.03 5	0.32	0.095/0 .124	12.9	14	0.08	0.55	0.38	0.05 2	0.47	0.034
Factor – potential employee Share - Percentage %	a ₁	a ₂	a ₃	a ₄	a ₅	a ₆	a ₇	a ₈	a ₉	a ₁₀	a ₁₁	a ₁₂	a ₁₃	a ₁₄
Number of potential employees	20	13	5	7	3	2	10	2	9	4	2	9	4	10
Total number of employees	640	424	161	228	98	64	324	65	293	129	66	292	130	324
	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*
														15*

Taken from: www.oecd.org/regreform/2510584.pdf, 4.March 2015. for: PP₁ and PP₄
www.mekh.hu/adatok-statiszkak-2, 4.March 2015. for: PP₂, PP₃ and PP₆ and the total number of employees
: bs.wikipedia.org/wiki/Madarska, 4.March 2015. for PP₅
www.elmu.hu; www.eadsz.hu; www.dedasz.hu; www.emasz.hu; www.demasz.hu; www.titasz.hu, 04.March
2015. for: PP₇, PP₈, PP₉, PP₁₀; PP₁₁, PP₁₂, PP₁₃ and PP₁₄

Figure 2: Total number of employees in the electric power distribution of Hungary

Source: The authors listed below Table 3

If we compare the electric power distribution of Hungary (without the maintenance of medium and low voltage) and Elektrovojvodina (with the maintenance of medium and low voltage) in terms of: the number of customers, consumption area, number of inhabitants, total consumption of electricity per annum, achieved peak consumption, the total number of transformer substations, the total length of the distribution network and the total number of employees as well as their percentage ratio, we get data presented in Table 4.

Table 4: Percentage ratio of the physical parameters of electric power distribution of Hungary and Elektrovojvodina

		Number of customers	Area in km ²	Number of inhabitants	Energy consumed GWh	Peak consumption in MW	Number of TS	Lengths of cables	Number of employees
Electric power of Hungary		5,000,000	93,030	10,198,000	36,269	6,307	47,134	173,098	3,238
Elektrovojvodina		931,000	21,500	1,917,000	8,534	1,457	11,201	26,334	2,480
		1*	2*	3*	4*	5*	6*	7*	8*
Ratio: Hungary/Vojvodina		537%	432%	532%	425%	433%	427%	665%	31%

Source: Authors listed below Table 1 and Table 3

It can be observed in Table 4, that the distribution companies of Hungary (without the maintenance of medium and low voltage) compared to Elektrovojvodina (with the maintenance of medium and low voltage) have a larger number of customers by 537%, a larger area of consumption by 423%, that the number of inhabitants in these areas is higher by 532%, that the annual consumption of electricity is higher by 425%, with a peak consumption higher by 433% and with the use of the number of substations higher by 427%; finally – we see that the increase in the distribution network that is higher by 665% is achieved with the number of employees that is higher only by 31%. Figure 3 shows a diagram of the physical parameters of the electric power distribution of Hungary without the maintenance of medium and low voltage and Elektrovojvodina with the maintenance of medium and low voltage.

Figure 3: Comparative physical parameters of the electric power distribution of Hungary without the maintenance of low and medium voltage and Elektrovojvodina with the maintenance of low and medium voltage

Source: Authors listed below Table 4

5. Number of Employees in Elektrovojvodina Without the Maintenance of Low and Medium Voltage According to the Model of Hungarian Power Distribution (Future Projection)

After analyzing the electric power distribution system of Hungary and finding weights that are associated with the number of required employees, we can move on to the next stage which is calculating the number of required employees in Elektrovojvodina according to its physical parameters and with the use of the weights for the required number of employees in Hungarian companies; the last stage is – according to formula (1), calculating the optimal number of employees in Elektrovojvodina without the maintenance of medium and low voltage.

Table 5 presents these data.

Table 5: Physical parameters, weights, number of employees in Elektrovojvodina, with the maintenance of low and medium voltage, according to the Hungarian model (estimated situation)

Physical parameter s	PP ₁	PP ₂	PP ₃	PP ₄	PP ₅	PP ₆	PP ₇	PP ₈	PP ₉	PP ₁₀	PP ₁₁	PP ₁₂	PP ₁₃	PP ₁₄
Values of PP	30.63 customers	8,534 GWh	1,457 MW	21,506 km ²	1.917 /1.000 inh	80/20 %/%	61 TS11	75 TS35/x	9,588 TS20/x	1,477 TS10/x	1,359 DV35kV	9,212 DV20kV	952 DV10kV	14,433 DV04kV
Weights	K ₁	K ₂	K ₃	K ₄	K ₅	K ₆	K ₇	K ₈	K ₉	K ₁₀	K ₁₁	K ₁₂	K ₁₃	K ₁₄
Value of weights	0.00064	0.09	0.51	0.035	0.32	0.095/0.124	12.9	14	0.08	0.55	0.38	0.052	0.47	0.034
Factor – necessary employee	a ₁	a ₂	a ₃	a ₄	a ₅	a ₆	a ₇	a ₈	a ₉	a ₁₀	a ₁₁	a ₁₂	a ₁₃	a ₁₄
Share - percentage %	20	13	5	7	3	2	10	2	9	4	2	9	4	10
Number of necessary employees	120	100	38	53	19	43	79	21	69	33	11	43	18	50
Total number of employees	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*

15*

Taken from: www.elektrovojvodina.rs/sl/.../energetski_pokazatelji_za_2013. 4.March 2015.

Figure 4: Total number of employees without the maintenance of low and medium voltage, according to the Hungarian model (estimated situation)

Source: Authors listed below Table 5

6. Number Of Employees In Elektrovojvodina with the Mainatenance of Low and Medium Voltage, According to the Hungarian Model – Corrected

It can be seen that the number of employees needed for Elektrovojvodina, according to the Hungarian model, should be significantly smaller than it is currently. Certain redundancies seem to be inevitable and quite likely, particularly in privatization processes that might happen soon. The differences between the activities of Elektrovojvodina and the Hungarian electricity distribution are primarily in maintenance and repairs of medium and low voltage - in Elektrovojvodina, these tasks are performed within the company, while in Hungary, they are carried out exclusively out of the distribution company.

Due to the differences mentioned above, the Hungarian model will be corrected in the analysis of Elektrovojvodina and the weights will be increased by 30%. This increase applies only to assemblers who maintain the system of medium and low voltage. According to the official data, from the year 2007-2014,

Elektrovojvodina (on average) has had 636 employees that are highly qualified, skilled and semi-skilled workers - assemblers engaged in the maintenance and repair of medium and low voltage, which makes 25.3% in the structure of the company.

In this case, with such parameters, the following data of weights are obtained as well as the number of required employees and they are presented in Table 6.

Table 6: Physical parameters, weights, number of employees in Elektrovojvodina, with the maintenance of low and medium voltage, according to the Hungarian model (corrected situation)

Physical parameters	PP ₁	PP ₂	PP ₃	PP ₄	PP ₅	PP ₆	PP ₇	PP ₈	PP ₉	PP ₁₀	PP ₁₁	PP ₁₂	PP ₁₃	PP ₁₄	
Values of PP	930,633 customers	8,534 GWh	1,457 MW	21,506 km ²	1,917 /1.000 inh	80/20 %/%	61 TS11 0/x	75 TS35/x	9,588 TS20/x	1,477 TS10/x	1,359 DV3 5kV	9,212 DV20kV	952 DV10kV	14,433 DV04kV	
Weights	K ₁	K ₂	K ₃	K ₄	K ₅	K ₆	K ₇	K ₈	K ₉	K ₁₀	K ₁₁	K ₁₂	K ₁₃	K ₁₄	
Values of weights	0.00083	0.12	0.66	0.046	0.42	0.095/0.124	16.8	8.2	0.1	0.72	0.49	0.068	0.61	0.05	
Factor	a ₁	a ₂	a ₃	a ₄	a ₅	a ₆	a ₇	a ₈	a ₉	a ₁₀	a ₁₁	a ₁₂	a ₁₃	a ₁₄	
required employee Share	-	20	13	5	7	3	2	10	2	9	4	2	9	4	10
percentage %															
Number of required employees	154	133	49	70	24	57	103	27	86	43	14	56	23	72	
	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*	
Total number of employees														911	
														15*	

Taken from: www.elektrovojvodina.rs/sl/.../energetski_pokazatelji_za_2013 4.March 2015. and the value of weights according to Table 3

Figure 5: Total number of employees in Elektrovojvodina with the maintenance of low and medium voltage, based on the corrected model of the Hungarian distribution system

Source: Authors listed below Table 6

Table 7 presents comparative weights and the number of employees of Elektrovojvodina - current situation (with the maintenance of medium and low voltage), and the future, projected design (without the maintenance of medium and low voltage) according to the Hungarian model as well as the future corrected situation (with the

maintenance of medium and low voltage) and the number of workers of the Hungarian power distribution company after privatization.

Table 7: Comparative weights and number of workers in Elektrovojvodina and the Hungarian electric power distribution system

Weights	K ₁	K ₂	K ₃	K ₄	K ₅	K ₆	K ₇	K ₈	K ₉	K ₁₀	K ₁ ¹	K ₁₂	K ₁₃	K ₁₄
Vojvodina (now)	0.0026	0.9	1.7	0.12	1.29	0.095/0.124	40.6	33	0.26	1.68	1.8	0.27	2.6	0.18
Hungary (now)	0.00064	0.09	0.51	0.035	0.32	0.095/0.124	12.9	14	0.08	0.55	0.3	0.05	0.47	0.034
Vojvodina (future design)	0.00064	0.09	0.51	0.035	0.32	0.095/0.124	12.9	14	0.08	0.55	0.3	0.05	0.47	0.034
Vojvodina (corrected)	0.00083	0.12	0.66	0.046	0.42	0.095/0.124	16.8	18	0.1	0.72	0.4	0.06	0.61	0.05
Number of employees, Vojvodina (now, without projection)	483	321	124	181	74	43	248	49	225	99	50	224	99	260
Number of employees, Hungary (now)														2,480
Number of employees, Vojvodina (projected future design)	640	424	161	228	98	189	324	65	293	129	66	292	130	324
Number of employees, Vojvodina (corrected)	120	100	38	53	19	43	79	21	69	33	11	43	18	3,238
Total number of employees, Hungary														50
Total number of employees, Vojvodina, corrected	154	133	49	70	24	57	103	27	86	43	14	56	23	72
														3,238
														911

Source: Authors listed below Tables 1, 3, 5 and 6

How could Elektrovojvodina benefit from optimization of the number of employees based on the Hungarian model that would result in 1569 redundancies? An average net salary in EPS (after 10% reduction) is over 70,000 dinars. Gross costs, per worker, taking into account: salaries, cost of office space, air conditioning, heating, the cost of official vehicles, mobile phones, transportation to work and the similar amount to a minimum of 1.000 € / worker per month or € 1,569,000 for 1,569 workers, which is annually € 18,828,000.

The current number of employees in EPS is still the highest among public utility companies, reaching 31,147, even after reorganization and the formation of EMS Serbia (transmission of electricity from production to distribution) with 1,502 employees at the end of last year and PEU Resavica (coal mine) with 4,381. The analyzed model of optimization of employees applies only to the electric-distribution activities of EPS. If the redundancies reached 40%, this would mean a saving of 31.147 x 0.4 x 1.000 € x 12 months – i.e. around 150 million euros annually.

7. Structure of human resources

When it comes to human resources, it is not enough to determine only the required number of workers employed by these parameters, but also the structure of employees since there may be more than necessary workers in the electricity distribution companies and, on the other hand, fewer than necessary of those who are directly involved in production work processes - fitters, engineers and others technical staff. This is unfortunately what often happens. In this model, the number of employees who are not directly in the production process and maintenance of the distribution system during the continuous supply of electricity to the consumption observed (non-production workers) ranges from 15-20% of total employees. If the number of non-production workers in Elektrovojvodina were 18% of the total number of employees, according to the corrected Hungarian model, that would involve 164 non-production employees, while the production part would contain 747 workers.

Conclusion

In case of Elektrovojvodina, by taking weights that are applied in the Hungarian electricity distribution company, with a correction higher by 30% for maintenance and overhaul of medium and low voltage, it can be concluded that the objectives should be making the organization with the total of 911 employees, of which 747 should be production workers and 164 - non-production workers.

Elektrovojvodina is the best organized part of the distribution activity in EPS and yet there is such a discrepancy in the number of employees and the associated consumption. In other parts of EPS there are also significant issues related to the number of employees. For Elektrovojvodina, the redundancy of 1,569 employees means monthly reduction in the costs of € 1,569,000 and € 18,828,000 annually.

Even if, owing to the difference in their activities, primarily, the maintenance (although the question is whether it should be insisted on keeping the maintenance and repair of medium and low voltage) the Hungarian model were increased by 50% (which accounts for 33.3% of assemblers in total employment), then the total number of employees in Elektrovojvodina would be about 1,050, which is still significantly fewer than the current situation.

References

1. A MAGYAR VILLAMOSENERGIA-RENDSZER (VER) 2013. 19, 65 and 69. Taken on March 4, 2014 from: <http://www.mekh.hu/adatok-statisztikak-2/kiodvanyok/villamos-energia-rendszer-statisztikak.html>
2. Број запослених радника у ЕПС-у. Taken on March 4, 2014 from: energyobserver.com
3. Електровојводина, Одабрани електроенергетски подаци за 2013. годину. Taken on March 4, 2014 from: www.elektrovojvodina.rs/sl/privredno_drustvo/Energetski-pokazatelji
4. Електровојводина, Одабрани електроенергетски подаци за 2013. годину. Taken on March 4, 2014 from: www.elektrovojvodina.rs/sl/privredno_drustvo/Energetski-pokazatelji
5. Electricity Report on Hungary. Taken on March 4, 2014 from: gen.org/globalenergy/library/national_energy_grid/hungary/09_hun.htm
6. Површина и број становника Мађарске. Taken on March 4, 2014 from: bs.wikipedia.org/wiki/Mađarska