PARTICULARITIES REGARDING THE ELABORATION OF THE BUDGET OF UNITARY COST PER PRODUCT IN THE UNITS OF THE COAL3 MINING INDUSTRY UNDER THE CONDITIONS OF COSTS CALCULATION ACCORDING TO THE STANDARD – COST METHOD

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ABSTRACT: A basic demand of implementing an efficient strategy in the field of production costs is the appropriate sizing of unitary cost per product. With this in view, at the level of a coal mining unit one can also elaborate the budget of unitary cost per product employing the grouping of expenses according to calculation articles. By using the grouping of expenses according to calculation articles one provides an exact knowledge of the size of each calculation article as well as of the manner it takes part in elaborating the unitary cost of the product.

ОСОБЕНОСТИ ПРИ РАЗРАБОТВАНЕТО НА БЮДЖЕТА НА ЕДИНИЧНИТЕ РАЗХОДИ НА ПРОДУКЦИЯТА ВЪВ ВЪГЛИЩНИЯ МИННЕН ОТРАСЪЛ ПО СТАНДАРТЕН РАЗХОДЕН МЕТОД

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РЕЗЮМЕ: Основно изискване при осъществяването на ефективна стратегия в областта на производствените разходите е определянето на единичните разходи на продукцията. По този начин на ниво въглищен минен отрасъл може в перспектива да се разработи бюджет, използвайки групирането на разходите в зависимост от параметъра на изчисление.
При използване на групиране на разходите съгласно параметъра на изчисление, се осигурява определяне на размера на всеки параметър на изчисление, както и начина, по който той участва при формиране разходите на продукта.

The determination of the budget of unitary cost per coal ton is done according to the data registered in the partial expenses budgets that form the general budget of the production cost of the mining unit. The expenses registered in the already elaborated budgets are taken over by the budget of the unitary cost and re-grouped together according to the classification of calculation articles. For the calculation article entitled "raw materials and direct materials" the calculation of the unitary cost raise no problem as it is already known, being determined during the stage of budgeting the expenses with raw materials and direct materials (Table 1):

Accordingly, in the "Situation of expenses with raw materials and direct materials proper to specific consumptions provisioned for year N as compared with the achievements during the first ten months of year N-1" drawn out at the level of production field no.1, they determined unitary cost, its level being of 12616.85 lei/t. Mathematically, the calculation relation can be written as follows:

$$edm = \frac{\sum_{i=1}^{m} sc_i \times p_i}{1000} \qquad (1)$$

where: *edm* represents unitary expenses with raw materials and direct materials;

sc_i – specific consumption of *i* material (per 1000 t of extracted coal);

p_i - unitary price of supplying material *i*;

i - type of material;

1000 – changing 1000 kg into 1t.

Introducing the data in Table 1, one gets the following:
edm = (17cm/1000t x 121200 lei/cm + 2500 kg/1000 t x 310 lei/kg + 1300 kg/1000 t x 1265 lei/kg + 300 kg/1000 t x 4696 lei/kg + 750 p/1000 t x 2203 lei/p + 60 kg/1000 t x 1265 lei/kg)/1000 = 12616.85 lei /t

In order to determine unitary expenses with the direct salaries of the coal mining unit the following stages are to be noticed:

- determining the expenses with the direct salaries of the coal mining unit proper to N budget year:

$$EDS = \frac{efs \times Q}{q} \qquad (2)$$

Tabel 1

The situation of expenses with direct materials proper to specific consumptions provisioned for year N as compared with the achievements during the first ten months of year N-1

Production field no. 1

Materials nomination	Specific consumption			Acquisition prices			Standard expenses with materials Lei/t	
	M.U.	Cumulated achievements 10 months year N-1	Previsions N year	M.U.	Achievements Year N-1	Previsions Year N	Cumulated achievements 10 months year N-1	Previsions Year N
Mining	Cm/1000 t	17,70	17,00	Lei/cm	101000	121200	1787,70	2060,40
wood	Kg/1000 t	2559,00	2500,00	Lei/kg	1925	2310	4926,08	5775,00
Metal net	Kg/1000 t	1007,00	1300,00	Lei/kg	1054	1265	1061,38	1644,50
T.H. profile	Kg/1000 t	299,00	300,00	Lei/kg	3913	4696	1169,99	1408,80
Explosive	P/1000 t	749,00	750,00	Lei/p	1836	2203	1375,17	1652,25
Staples	Kg/1000 t	55,00	60,00	Lei/kg	1054	1265	57,97	75,90
Fittings								
Total standard expenses with materials							10378,29	12616,85

where: *EDS* represents the expenses with direct salaries of the mining unit during the budget year;

efs - expenses with direct provisioned salaries of production field no. 1 proper to the achieved physical coal production = 4620000 thousand lei;

Q - provisioned volume of physical production proper to the mining unit per budget year = 705600 t;

q - Provisioned volume of physical production of production field no. 1= 88760 t

$$EDS = \frac{4620000 \times 705600}{88760} = 36726813,88 \text{ thousand lei}$$

- calculation of unitary expenses with direct salaries of the coal mining unit proper to budget year N:

$$eds = \frac{EDS}{Q} \qquad (3)$$

where: *eds* represents unitary expenses with direct salaries of the mining unit proper to the budget year.

$$\text{eds} = \frac{36726813,88}{705600} = 52050,47 lei/t$$

In order to establish the level of production indirect expenses and of general administration expenses one should notice the financial norms drawn out with this in view.

Thus, in order to establish the expenses determined by the consumption of compressed air at the level of a mining unit one should take into account two factors: the price of a cm of compressed air and the consumption of compressed air.

The consumption of compressed air or the flow of compressed air (cm/24 h) is calculated according to the following formula:

$$Q_{ca}=K_1 \times K_2 \times \sum_{i=1}^{n} q_i \qquad (4)$$

where: Q_{ca} represents the consumption of compressed air of the coal mining unit;

K_1 – correction coefficient of compressed air losses within airing pipes;

K_2 – simultaneity coefficient of compressed air consumers that depends on the number of work points within the mining unit which are simultaneously connected;

q_i - consumption of compressed air during 24 hours per work point within the coal mining unit;

i = 1,n – number of work points within the coal mining unit (stoping, drift, etc.)

The size of simultaneity coefficient is exhibited in Table no. 2.

Table 2

Size of simultaneity coefficient

No. of work points simultaneously supplied	Simultaneity coefficient
1	1
2 – 3	0,9
4 – 6	0,83 – 0,80
7 -10	0,78 – 0,71
11 - 20	0,69 – 0,59

The size of the correction coefficient of pipes losses, as it is shown by standards, is estimated to be optimum in case of losses between 10% and 18%.

Compressed air consumption for a work point is established by standards at an average of 60 cm/ 24 h. The price of a cm of compressed air is estimated at 80000 lei.

Consequently, the size of compressed air consumption expenses within the coal mining unit that comprises 5 work points simultaneously supplied is the following:

$$E_{ca} = p_{ua} \times Q_{ca} = p_{ua} \times K_1 \times K_2 \times \sum_{i=1}^{5} q_i \quad (5)$$

where: E_{ca} represents compressed air expenses;
p_{ua} – Price of a cm of compressed air;
Q_{ca} – Consumption of compressed air.

Introducing the data in formula no. 5, one gets the following:
$E_{ca}^{\min}$ = 80000 x 0.80 x 0.1 x 5 x 60 = 1920000 lei/ 24 h (the variant of the smallest losses within the compressed air network)
$E_{ca}^{\max}$ = 80000 x 0.83 x 0.18 x 5 x 60 = 3456000 lei/ 24 h (the variant of the biggest losses within the compressed air network)

In order to determine compressed air expenses one should take into consideration their level which is the arithmetic mean of expenses, under the circumstances of the smallest losses, namely the largest losses within the compresses air network:

$$E_{ca}^{med} = \frac{1920000 + 3456000}{2} = 2688000\ lei/24h$$

Knowing the fact that for the year the budget has been elaborated a coal production of 705600 t is envisaged as well as the fact that the number of working days is 240, and then the level of unitary expenses with compressed air is going to be of 914.28 lei/t, calculated according to the following relation:

$$e_{air} = \frac{E_{ca}^{med} \times T}{Q_c} \quad (6)$$

where: e_{air} represents unitary expenses with compressed air proper to the budget year;
E_{ca}^{med} – Average expenses with compressed air (lei/ day);
T – Number of working days during the year the budget has been elaborated for;
Q_c – Envisaged coal production of the mining unit (t/ year).

$$e_{air} = \frac{2688000 \times 240}{705600} = 914,28 lei/t$$

The calculation of the expenses with electricity for lighting up includes the consumption for indoor lighting up as well as for outdoor lighting up depending on the number of lighting units and their unitary power, the simultaneity coefficients of the consumption of electricity for indoor and outdoor lighting up, the power factor, and the coefficient of the network losses. The calculation formula is the following:

$$Q_e = \frac{1,10}{\cos\phi} \times \left(K_1 \times P_i + K_2 \times P_o\right) \quad (7)$$

where: Q_e represents the consumption of electricity for lighting purposes (kWh);
1,10 – coefficient that considers power losses within the network;
$\cos \Phi$ - power factor of the network that depends on the number and type of charges (an average of 0.75);
P_i – Nominal power of indoor lighting equipment (kW);
P_o – Nominal power of outdoor lighting equipment (kW);
K_1, K_2 – Simultaneity coefficients of electricity consumption within the network that represent an average of: K1 = 0.70 for less than 100 lighting units used in order to light up inner space, K2 = 0.74 for less than 100 lighting units used in order to light up external space, and 0.68 for more than 100 lighting units.

The nominal power of the indoor and outdoor lighting equipments is calculated by taking into account the number of lighting units, the unitary power of a lighting unit as well as the number of functioning hours.

$$P_i, P_o = \frac{N_{i,O} \times Pu_{i,e} \times t}{1000}(kW) \quad (8)$$

where: $N_{i,o}$ represents the number of indoor and outdoor lighting up units;
$Pu_{i,o}$ – power of an indoor/outdoor lighting up unit (W);
t – inner/external functioning time of the lighting unit during a year (hours);
1000 – changing W into kW.

One might assume that the number of lighting units used for inner spaces is 75, each having a power of 75 W; the functioning time of each lighting unit per year is of 1900 hours; the number of lighting up units used for external space is 100, each having a power of 100 W; the functioning time of each lighting unit per year is of 3600 hours. Introducing the data in relation (8) one gets the following:

$$P_i = \frac{75 \times 75 \times 1900}{1000} = 10687,50 kW/year$$

$$P_o = \frac{100 \times 100 \times 3600}{1000} = 36000\, kW/year$$

The size of electric lightning expenses is the following:

$$E_{xe} = P \times Q_e = p_{eu} \times \frac{1,10}{\cos\phi} \times \left(K_1 \times P_i + K_2 \times P_o\right) \quad (9)$$

Knowing the fact that the estimated price of a kWh (p_{eu}) is 450 lei and introducing the data in relation (9), one gets the following:

E_{xe} = 450 x $\frac{1{,}10}{0{,}75}$ (0,70 x 10687,50 + 0,68 x 36000) =

$= \frac{15820818{,}75}{0{,}75}$ = 21094425 lei/year

Further one can determine unitary expenses with electricity for lightning during the budget year:

$$C_e = \frac{E_{xe}}{Q_c} \quad (10)$$

Introducing data in relation (10), one gets the following:

$$C_e = \frac{21094425}{705600} = 29{,}89 coal/ton$$

The establishing of the level of expenses determined by thermal energy consumption used in order to warm administrative spaces includes heat consumption to warm those spaces as well as the cost of a G calorie.

Heat consumption can be calculated by using the following formula:

$$Q_{te} = \left(\overline{t_i} - \overline{t_e}\right) \times V_i + L_i \quad (11)$$

where: Q_{te} represents thermal energy consumption for heating;

$\overline{t_i}$ - inner average temperature to be attained (Celsius degrees);

$\overline{t_e}$ - external average temperature taken into consideration (Celsius degrees);

V_i – inner volumes of the buildings that are to be heated (cm);

L_i - global heat loss in order to increase by one degree the temperature per cm of the inner volume taking into consideration the nature of the building (k cal/ cm degree).

The size of losses is determined by taking into account the type of the building and is exhibited in Table 3.

Table 3

The size of heat losses coefficient

Type of building	Value of coefficient Kcal/ cm
Brickwork or finished reinforced concrete buildings	40
Not finished closed brickwork or reinforced concrete buildings	45
Wooden provisional buildings	50

The level of expenses determined by the heating of administrative spaces will be the following:

$$Ex_{te} = p_{eu} \text{ x } Q_{te} = p_{teu} \times (\overline{t_i} - \overline{t_e}) \times V_i \times L_i \times T \quad (12)$$

where: p_{teu} represents the price of a k calorie;

T - the number of days, within a year, when space heating is provided.

Knowing that external average temperature is – 5 Celsius degrees, indoor average temperature is18 Celsius degrees, the inner space volume that is to be heated is 500 cm, the coefficient of heat losses is 40 kcal/cm, the estimated tariff of a kcal is 21,8 lei/kcal, and the number of the days when space heating is provided is 150 within a year, one can determine the level of the expenses determined by heating administrative spaces:

Ex_{te}= 21,8 x [18 – (-5)] x 500 x 40 x 150 = 1504200000 lei/ year

Afterwards, one can determine unitary expenses with thermal energy per budget year, employing the following relation:

$$E_{te} = \frac{Ex_{te}}{Q_c} \quad (13)$$

$$E_{te} = \frac{1504200000}{705600} = 2131{,}80 lei/t$$

The expenses determined by drinking water consumption as well as by that for special purposes have in view the existence of an irregularity of water consumption during working hours, the number of employees who consume water, water consumption per employee during a shift, water consumption for special purposes (cleaning, showers, etc), and the price of a cm of water.

Water consumption is calculated according to the following formula:

$$Q_{water} = K_1 \text{ x } (N_e \text{ x } A_e + A_{sp}) \quad (14)$$

where: Q_{water} represents the consumption of drinking water and of water for special purposes;

K_1 - irregularity coefficient of water consumption during a day (for coal mining industry = 1.4);

N_e - number of employees of the mining unit;

A_e - water consumption/ employee during a day;

A_{sp} - water consumption for special purposes (cleaning, showers) (l/ day).

The size of the expenses determined by water consumption will be the following:

$$Ex_{water} = p_{wu} \times Q_{water} = p_{wu} \times \frac{1}{1000} \times K_1 \left(N_e \times A_e + A_{sp}\right) \times T \quad (15)$$

where: Ex_{water} represents expenses determined by water consumption;

p_{wu} - tariff per 1 cm of water;
1000 - changing l into cm;
T - number of working days per year.

Knowing that the estimated tariff per 1 cm of water is 1100 lei, the number of employees of the mining unit is 3400, water consumption per employee during a day is 3 l of water, water consumption for special purposes is 90000l/ day, and the number of working days is 240 one can determine the level of the expenses determined by water consumption:

$$Ex_{water} = 1100 \times \times \frac{1}{1000} \times 1,4 \times (3400 \times 3 + 90000) \times 240 = 37033920 \text{lei/year}$$

For the budget year, unitary expenses are determined owing to the following formula:

$$E_{water} = \frac{Ex_{water}}{Q_c} \quad (16)$$

$$Ewater = \frac{37033920}{705600} = 52,48 lei/t$$

Employing similar procedures and using the existing financial norms, one can determine the level per product unit of the other categories of indirect expenses (cleaning stuff, buildings capital repairs, office stuff, etc)

The model of the budget of production unitary cost elaborated at the level of a mining unit for year N is exhibited in Table 4.

Table 4
The budget of unitary cost proper to the product "extracted coal"

Specification	Estimated year N-1		Provisioned year N	
	(thousand lei)	(lei/ t)	(thousand lei)	(lei/ t)
Quantity (t)	660,2		705,60	
Raw materials and direct materials	6856541,83	10378,29	8902449,36	12616,85
Direct salaries	32464930,68	49140,00	36726813,88	52050,47
Contributions to social insurance system, to unemployment fund proper to direct salaries	12985972,27	19655,99	14690676,00	20820,11
Electricity	7395701,48	11194,38	9438105,60	13376,00
Technological fuel	209317,54	316,83	304614,57	431,71
Amortizing fixed assets	982004,00	1486,39	995111,00	1410,30
Total direct expenses	60894467,80	92171,90	71057770,41	100705,46
Equipments maintaining and functioning expenses	1350000,00	2043,40	1350000,00	1913,26
Section's general expenses	1850000,00	2800,22	1850000,00	2621,88
Administration general expenses	3599350,00	5448,09	3781200,00	5358,84
Total complete cost	67693817,80	102463,62	78038970,41	110599,45

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