

Federal State Budgetary Educational Institution of Higher Professional Education  
Russian State Agrarian Correspondence University,  
Fuchik street, Balashiha, 143900,  
e-mail: nekasumov@yandex.ru

## THE USE OF TECHNICAL KNOWLEDGE IN LABOUR ECONOMICS

### WYKORZYSTANIE WIEDZY TECHNICZNEJ W EKONOMII PRACY

**Summary:** The results of labour intensity calculations for a specific employee with the use of normative documents are presented. The indicators of average energy consumption of labour, as calculated for all categories of workers, depending on sex, age, body weight and physical activity ratio are presented.

**Keywords:** labour consumption, physiological energy norms, physical activity indicator, average energy consumption of labour, cost, price

**Streszczenie:** W artykule przedstawiono wyniki obliczeń pracochłonności dla konkretnego pracownika z wykorzystaniem dokumentów normatywnych. Przedstawiono wskaźniki przeciętnej energochłonności pracy obliczone dla wszystkich kategorii pracowników w zależności od płci, wieku, masy ciała i wskaźnika aktywności fizycznej.

**Słowa kluczowe:** pracochłonność, fizjologiczne normy energetyczne, wskaźnik aktywności fizycznej, średnia energochłonność pracy, koszt, cena

#### Introduction

According to the universal Declaration of Human Rights (1948) [6] and the International Covenant on economic, social and cultural rights (1966) [4], "the ideal of free human beings enjoying freedom from fear and want can only be implemented if there is a conditions whereby everyone may enjoy his economic, social and cultural rights, as well as their civil and political rights". Their effective implementation is necessary to observe the principle of equal pay for equal labour. However, the average wage level in rural areas is much lower than in other sectors of the economy, although the quantity and quality of labor is the same. This negative fact results in discrimination on a sectoral basis. To eliminate it, the method of energy analysis was developed. The mentioned problems were partially addressed in [2] and [3].

In our opinion, the labour is a conscious energy to create goods; it is the basis of evaluating and pricing. On the basis of equality of people, the socially necessary equal work should be paid equally regardless of the industry sector worker. Therefore, the development of standards for the energy equivalent of 1 man-hour is an urgent task.

#### Material and methods

To determine the energy consumption (energy equivalent) of labour in various categories of workers, we used the "Norms of physiological needs for energy and nutrients for different groups of population of the Russian Federation. Guidelines" [5] and the obtained data were compared with materials GOST R 51750-2001. Method of determining energy consumption during the

production of goods and rendering of services in technological energy systems [1].

Total energy expenditure ( $\Sigma E_H$ ) per day according to intensity can be divided into three parts: during sleep ( $E_S$ ) (cost of energy at this time is equal to the value of basal metabolism ( $E_{VBM}$ ) [5]), during personal time ( $E_{PT}$ ) (very low physical activity, I group physical activity [6]) and to labor ( $E_L$ ):

$$\Sigma E_H = E_S + E_{PT} + E_L \quad (1)$$

$$E_S = E_{VBM} : 3 \quad (2)$$

$$E_{PT} = [(E_{VBM} \times 1.4) - E_S] : 2 \quad (3)$$

$$E_L = (E_{VBM} \times C_{PhA}) - E_S - E_{PT} \quad (4)$$

where:

$C_{PhA}$  is the coefficient of physical activity, [5].

Using the above mentioned formulas, we calculated the average values of the energy intensity of labor all categories of workers, depending on physical activity, body mass, gender and age. It is worthy to notice that the entire adult population, depending on the magnitude of energy expenditure was divided into 5 groups for men and 4 groups for women, taking into account the production of physical activity and other expenditure [5].

Results and discussion

When utilizing the results of the calculations according to the above discussed procedure, we obtained the following values of energy consumption or the energy equivalent of labour between the different types of workers according to the ratio of their physical activity. The employed unit is MJ/hour.

**Group I (a very low physical activity; men and women):** The workers mainly performing a mental work; physical activity coefficient of **1.4** (civil servants of administrative organs and institutions, researchers, teachers of universities, colleges, secondary

school teachers, students, medical professionals, psychologists, managers, operators including equipment maintenance of computers and computer software, programmers, employees of financial-economic, legal and administrative services, employees of design offices and divisions, advertising and information services, architects and engineers in industrial and civil construction, tax officers, employees of museums, archives, librarians, specialists, service, insurance, dealers, brokers, sales agents and procurement officials on social and pension funding, patent attorneys, graphic designers, Travel Desk, reference services and other related activities).

Table 1. The average values of the labour energy consumption of the adult population of Russia for group I of physical activity (MJ/h)

Men					Women				
Body weight, kg	18-29 years	30-39 years	40-59 years	Over 60 years	Body weight, kg	18-29 years	30-39 years	40-59 years	Over 60 years
50	0.405	0.382	0.357	0.329	40	0.302	0.293	0.285	0.268
55	0.424	0.399	0.377	0.346	45	0.321	0.313	0.301	0.287
60	0.444	0.419	0.394	0.363	50	0.343	0.332	0.324	0.307
65	0.466	0.438	0.413	0.380	55	0.363	0.352	0.341	0.324
70	0.488	0.461	0.432	0.399	60	0.385	0.374	0.363	0.343
75	0.511	0.480	0.452	0.419	65	0.405	0.394	0.382	0.360
80	0.536	0.505	0.475	0.438	70	0.427	0.416	0.402	0.380
85	0.561	0.530	0.497	0.458	75	0.447	0.433	0.422	0.399
90	0.589	0.555	0.522	0.480	80	0.469	0.455	0.441	0.419

**Group II (low physical activity; men and women)** – workers engaged in light labour, the physical activity coefficient is **1.6** (drivers of urban transport, workers of food processing, textile, garment, electronic industry, operators of pipelines, packers, drivers of railway transport, local doctors, surgeons, nurses, sales-

men, employees of enterprises of public catering, hairdressers, workers of housing and maintenance services, restorers of art products, guides, photographers, technicians and operators of radio and television broadcasting, customs inspectors, workers of police and highway patrol officers and other related activities).

Table 2. The average values of labour energy consumption of the adult population of Russia for group II of physical activity (MJ/h)

Men					Women				
Body weight, kg	18-29 years	30-39 years	40-59 years	Over 60 years	Body weight, kg	18-29 years	30-39 years	40-59 years	Over 60 years
50	0.556	0.526	0.491	0.453	40	0.414	0.403	0.391	0.368
55	0.583	0.549	0.518	0.476	45	0.441	0.430	0.414	0.395
60	0.610	0.576	0.541	0.499	50	0.472	0.457	0.445	0.422
65	0.641	0.602	0.568	0.522	55	0.499	0.484	0.468	0.445
70	0.672	0.633	0.595	0.549	60	0.530	0.514	0.499	0.472
75	0.702	0.660	0.622	0.576	65	0.556	0.541	0.526	0.495
80	0.737	0.695	0.652	0.603	70	0.587	0.572	0.553	0.522
85	0.771	0.729	0.683	0.629	75	0.614	0.595	0.580	0.549
90	0.810	0.764	0.718	0.660	80	0.645	0.626	0.606	0.576

**Group III (medium physical activity; men and women)** – workers engaged in average weight of labour; the physical activity coefficient is **1.9** (machinists, operators, machine operators,

drillers, drivers of electric vehicles, excavators, bulldozers and other heavy equipment; workers of greenhouses, growers, gardeners, fisheries and other related activities).

Table 3. The average values of labour energy consumption of the adult population of Russia for group III of physical activity (MJ/h)

Men					Women				
Body weight, kg	18-29 years	30-39 years	40-59 years	Over 60 years	Body weight, kg	18-29 years	30-39 years	40-59 years	Over 60 years
50	0.784	0.741	0.692	0.638	40	0.584	0.568	0.552	0.519
55	0.822	0.773	0.730	0.671	45	0.622	0.606	0.584	0.557
60	0.860	0.811	0.763	0.703	50	0.665	0.644	0.627	0.595
65	0.903	0.849	0.800	0.735	55	0.703	0.681	0.660	0.627
70	0.946	0.892	0.838	0.773	60	0.746	0.725	0.703	0.665
75	0.990	0.930	0.876	0.811	65	0.784	0.763	0.741	0.698
80	1.038	0.979	0.919	0.849	70	0.827	0.806	0.779	0.735
85	1.087	1.028	0.963	0.887	75	0.865	0.838	0.817	0.773
90	1.141	1.076	1.011	0.930	80	0.909	0.881	0.854	0.811

**Group IV (high physical activity; men and women)** – workers performing a heavy physical labour; the physical activity coefficient is **2.2** (construction workers, porters, those ones

working on maintenance of railway tracks and repair of roads, forestry, hunting and agriculture; woodworkers, athletes, blast furnace steelmakers-casters and other related activities)

Table 4. The average values of labour energy consumption of the adult population of Russia for group IV of physical activity (MJ/h)

Men					Women				
Body weight, kg	18-29 years	30-39 years	40-59 years	Over 60 years	Body weight, kg	18-29 years	30-39 years	40-59 years	Over 60 years
50	1.012	0.956	0.893	0.823	40	0.754	0.733	0.712	0.670
55	1.061	0.998	0.942	0.865	45	0.802	0.782	0.754	0.719
60	1.110	1.047	0.984	0.907	50	0.858	0.830	0.809	0.768
65	1.165	1.096	1.033	0.949	55	0.907	0.879	0.851	0.809
70	1.221	1.151	1.082	0.998	60	0.963	0.935	0.907	0.858
75	1.277	1.200	1.130	1.047	65	1.012	0.984	0.956	0.900
80	1.340	1.263	1.186	1.096	70	1.068	1.040	1.005	0.949
85	1.403	1.326	1.242	1.144	75	1.116	1.082	1.054	0.998
90	1.472	1.389	1.305	1.200	80	1.172	1.137	1.103	1.047

**Group V (a very high physical activity; men)** – workers particularly performing hard physical labour; the coefficient of physical activity – **2.5** (sportsmen of high qualification in the training period, machine operators and agricultural workers in

the sowing and the harvest period, the miners and the people working in underground tunnels, fellers, concrete workers, bricklayers, those performing non-mechanized labour, herders and other related activities)

Table 5. The average values of labour energy consumption of the adult population (men) of Russia for group V of physical activity (MJ/h)

Men				
Body weight, kg	18-29 years	30-39 years	40-59 years	Over 60 years
50	1.239	1.171	1.094	1.009
55	1.299	1.222	1.154	1.060
60	1.359	1.282	1.205	1.111
65	1.428	1.342	1.265	1.163
70	1.496	1.410	1.325	1.222
75	1.564	1.470	1.385	1.282
80	1.641	1.547	1.453	1.342
85	1.718	1.624	1.522	1.402
90	1.804	1.701	1.598	1.470

The indicators were calculated on the basis of the state of [2] and can be used in the development of federal and municipal rules and regulations as well as in the economic activity of enterprises, organizations and institutions of all forms of ownership.

In our opinion, the application of the average values of labour energy consumption by the workers may practically reduce a social tension in labour relations, bring the wages be aligned in line with the level of labour costs in the particular sectors of the economy and individual industries. It will also optimize the structure of the economy and will allow the proportional, dynamic development of the real sector economy.

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