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Calculation of the Specific Energy Consumption in Raw Silk Production

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ABSTRACT: Questions of development power - and resource-saving operating modes of the equipment at the enterprises of silk branch are given in article. Now management and regulation of operating modes the kokonomotalnykh of the enterprises are carried out on the basis of experience of experts together with employees of power services taking into account the actual indicators of work of the enterprise.

KEYWORDS*:* energy resources, production, modernization, power consumption.

I. INTRODUCTION

Progressive, science-based rules of power consumption allow to estimate the level of exploitation of power engineering, uncover and realize untapped reserves, to plan electricity supplies in perspective. However, there are no indications on the methods of electricity rationing in the technical literature and departmental materials concerning the production of raw silk [1].

We recommend a methodical calculation scheme based on probabilistic methods. The initial information are diurnal measurements: this is the minimum length of time for which operating data on conditions of production is present - output, energy consumption, information on quality indicators of raw materials and others.

Day period measurements selection (working day) necessitates averaging the energy consumption of data on days-off for the corresponding amendments to the per diem measurements [2].

According to the metering devices there is made a daily balance of electricity by consumer groups. Here are the following races electricity-moves: According to it the following consumption groups are distinguished

a) for supporting the needs (lighting, water, air and exhaust ventilation, etc.) - W^1;

b) for reeling machine - $W_{\sum a}$

c) for ventilation – W_v

In determining the value of W^1 we include the share of electricity consumption in the day, referred to the working day, i. e.

$$\Delta W_{out} = \frac{W_{out}}{m}, \tag{1}$$

whereW_{out} - consumption of electricity in the day, kWh; m - the number of working days per week. The result is:

$$W = W^1 + W_{\sum a} + W_v, \tag{2}$$

An analysis of annual and daily load curves of silk mill shows the presence of certain abnormalities in specific energy consumption depending on the ventilation operating mode which affected by the temperature and humidity of indoor and outdoor atmosphere. To facilitate the calculation and improve their accuracy, this factor is taken into account separately, and shall be based on power consumption without consumption for ventilation [3]:

$$W_1 = W^1 + W_{\sum a}, \tag{3}$$

Average values $\overline{W}^1$ и $\overline{W}_{\sum a}$ determined for the five business days according to the data with an average performance ($\overline{P}$). Standard error of the mean calculated from the formula:

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$$V = \frac{\sigma}{\bar{x}} \cdot 100, \quad (4)$$

Where V - the coefficient of variation, % ; σ - Dispersion; $\bar{x}$ - average value.
If we take the variable specific energy consumption per 1 kg of raw silk:

$$K = \frac{\overline{W_{\sum a}}}{\overline{\Pi}}, \quad (5)$$

then the equations of power characteristics $W_l = f(\overline{P})$ и $d_1 = f(\overline{P})$ excluding the ventilation energy consumption of the factory will take the following form:

$$W_1 = W^1 + \kappa P, \quad (6)$$

$$d_1 = \frac{W^1}{\Pi} + \kappa, \quad (7)$$

Determine the most probable limits of the average daily performance deviations ($\overline{P}$) and in accordance with the average value of the specific energy consumption and its standard deviation using the formula:

$$\sigma_{\bar{d}} = \sqrt{\frac{\left(\sum d_i - \bar{d}\right)^2 P_i}{(n-1)n\sum P_i}}, \quad (8)$$

Having values d1, we find a correction for the ventilation work. To do this, you must determine the total power consumption for ventilation on the counter or the actual data by calculation.

Assuming that the ventilation is switched on and off, provided the desired air parameters, and assuming a first approximation, therefore the factory productivity unchanged, the difference in the value of specific energy consumption will be only the electric power consumption.

Given that the number of hours of ventilation and number of included units are different for each period of the year, we introduce the time of switching-on, given to the full performance of the entire ventilation:

$$\tau^1 = \frac{W_v}{P_v}, \quad (9)$$

where P_v - total power consumption of all supply fans, kW.

Expected value x^1 can also be determined on the basis of the operating data and forecasts for the current period. Correction for ventilation operation will be:

$$\Delta d = \frac{P_{v^{\tau 1}}}{\Pi}, \quad (10)$$

and accordingly complete energy consumption per 1 kg of raw silk:

$$d_2 = d_1 + \Delta d, \quad (11)$$

Bearing in mind that the main factor affecting the value of the specific energy consumption is τ^1, we find the analytical dependence $d = f(\tau^1)$.

Taking output during operation without ventilation $(\tau_1)$and with it (τ^1), respectively equal to P_1 and P_2 and considering that $P_1 = A\tau_1$ и $P_2 = A\tau^1$ (where A - hour factory productivity) and и $\tau_1 + \tau^1 = T_{раб}$, after appropriate transformations we obtain:

$$d = \frac{d_1\tau_1 + d_2\tau^1}{\tau_1 + \tau^1}, \quad (12)$$

or

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$$d = d_1 + \Delta d \frac{\tau^1}{T_{work}}, \qquad (13)$$

where T_{work} - the monthly fund of working time.

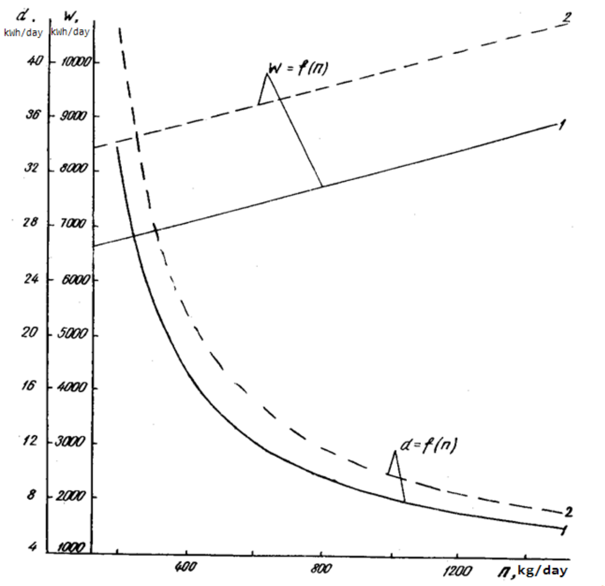
For Namangan filature SP «VerigrowIpagi» with technological machines such as Fy 2000 NT with average values of pF = 450 kg / day, W_{day} = 3380 kWh / day (without B) and P = 86 kW correction for ventilation will be 8.64 kWh / kg.

The average specific energy consumption without ventilation is d1 = 24 kWh / kg (standard error of ± 5%) (Fig. 1). A mathematical model of specific energy consumption for the existing equipment and the actual volume of production (PF = 450 550 kg / day) can be represented as follows:

$$d = 24 + 8{,}64 \frac{\tau^1}{T_{work}}, \quad kWh/kg$$

Fig. 1 Energy characteristics of filature absolute and specific electricity consumption
1 - unvented
2 – vented

The equation takes the following form depending on the reduced ventilation running time:



with $\tau^1 = T_{work}$ $d = d_1 + \Delta d = 24 + 8{,}64 = 32{,}6 \quad kWh/kg$

with $\tau^1 = 0$

$d = d_1 = 24 \quad kWh/kg$

with $0 < \tau^1 < T_{work}$

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$$d = d_i + \Delta d \frac{\tau^1}{T_{work}} = 24 + 8{,}64 \cdot \frac{\tau^1}{T_{work}}, \quad kWh/kg$$

The development of standards specific energy consumption for the planning period requires the following background information: the planned performance(Π_{pl}), reduced the number of hours of ventilation (τ^1_{pl}), the power consumption of auxiliary values are introduced into operation in the planning period (W_{aux}), the amount of energy savings from the implemented measures to conserve electricity according to plan organizational and technical measures (W_{sav}), energy characteristic *d=f(Π)*, based on actual data [4].

The value of the norm is found from the following ratio:

$$d_{pl}(\Pi_{pl}) = d_f(\Pi_f) \pm [d(\Pi_f) - d(\Pi_{pl})] + \Delta d \frac{\tau^1_{pl}}{T_{work}} + \frac{W_{sav} - W_{aux}}{\Pi_{pl}}, \qquad (18)$$

II. RELATED WORK

The carried-out literary review showed that during existence there was a number of schools of sciences which were engaged in development and improvement of technological processes of processing of natural silk and it receiving products. Unfortunately, there was a certain departmental dissociation which has an adverse effect on the general development of the industry. So in works: E.N Mikhaylova, V.V. Lind and P.A. Osipov, G.N. Kukin, V.A. Usenko, E.B. Rubinov, M.M. Mukhamedov, Alimova H. And, only the questions connected with properties, structure of cocoons as initial raw materials of preparatory operations, including the operations realized in field conditions at cultivation and cleaning of cocoons and also kokonomotaniye questions were considered.

III.CONCLUSION

Where $d_f(\Pi_f)$ - the average value of the specific energy consumption at the actual average daily performance, kWh / kg (without ventilation) (.. see fig. 1) is taken equal to the value of d1 from (7); $d(\Pi_f), d(\Pi_{pl})$ - specific consumption of electricity by the curve *d=f(Π)*, corresponding to the actual and planned performance, kWh/kg (without ventilation); τ^1 - - For long-term data for SP «VerigrowIpagi» Namangan filature is on average 3120 hours / year.

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