WASTE OF ELECTRICAL ENERGY IN LINES AND TRANSFORMERS

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Abstract; Consumers downloads day , year during changed standing because of power waste The value also changes stands In the transformer magnet of the conductor interest , magnet of the conductor free leaving , transformer oil , insulation of paper , varnish from work output wear and tear to account in the transformer energy a waste surface will come . This in the article downloads graph and in transformers electricity energy waste boasting and reduce measures given .

Key words : electricity energy , average square power , power waste of downloads yearly graph , voltage , magnet conductor , just work power wasteful , small connection [1].

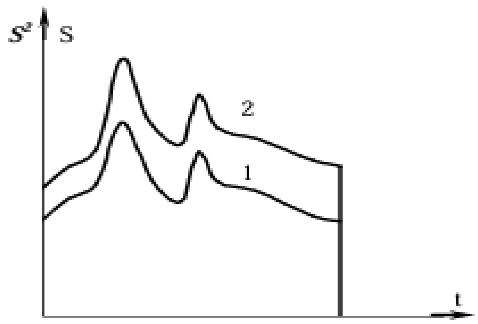
Main part

Power time in unity energy that it was because of in the network energy waste power waste network given in download worked on time by multiplying determination can :

$$\Delta W = 3I^2Rt = \Delta Pt \qquad (1)$$

if separate shown consumer of downloads yearly graph in Figure 1 (curve 1 line) as described if , then on the network energy a waste downloads square of the graph to the surface proportional will be (curve 2 line) and according to the tune expression can :

$$\Delta W = \int_0^1 \Delta P dt (2)$$



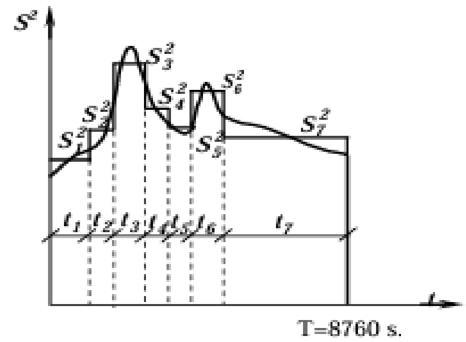


Figure 1. Separately shown of the consumer yearly upload graph for in tune expression harvest will be [2-3]:

Figure 2. Stepped yearly upload graph yes a waste

Power waste expression if we put , in that case energy a waste for the following expression harvest will be :

$$\Delta W = \int_0^T (\frac{P^2+Q^2}{U^2} r)dt = \frac{r}{U^2}\int_0^T (P^2+Q^2)dt = \frac{r}{U^2}\int_0^T S^2 dt(3)$$

Here T is the consumer connection time If the consumer one year during connecting standing if , i.e. T-8760 hours if , then yearly energy waste determination curve 2 for with limited surface determination is enough In practice downloads square yearly graph small , S1, S2, S3... (Fig. 3) loads in intervals 11 , 12, 13. to the value of belongs to has been paid approximate graph with replacement can In it yearly energy a waste according to the tune total in the form of defined as :

$$\Delta W = \frac{r}{U^2}(S_1^2 t + S_2^2 t_2 + S_3^2 t_3 + \ldots + S_n^2 t_n)(4)$$

On the network energy waste to determine next method average

square power to the values based on method (Fig. 3). Average square

power so power that it is the whole T time during immutable from the line

flowing while standing face giver energy a waste that's it time T on the line during upload to the graph according to power flowing when standing equal to will be From this come came out without coordinate arrows ,$S_{ur.kv}^2$ and with T limited right of the rectangle surface coordinate axes , of S² graph and with T bordered of the figure to the surface equal to will be [4-5].

$S_{ur.kv}$ of value determine the energy waste in tune from the expression to find can

$$\Delta W = \frac{r}{U^2} S_{ur.kv}^2 * T(5)$$

Above given energy waste determination methods one series to shortcomings have is only downloads graph just in case use can Widespread maximum wastes time to the concept based on method energy waste count much is simple .

Downloads yearly graph for (Fig. 4) so T $_{max}$ the time to find maybe it is time during consumer immutable S $_{max}$ upload with working , from the network acceptance doer energy is one year during upload according to the graph S(t). work from the network acceptance doer to energy equal to be [6-7].

$$W = P_{maks}T_{maks} = S_{maks}cos\varphi_{ur}T_{maks} = cos\varphi_{ur} * \int_0^{i=8760} Sdt(6)$$

Here the shadow Fur is the year during presumably accepted as immutable done power of the coefficient average value ; Tmax maximum in download work it 's time Hence, from (6).

$$T_{maks} = \frac{\int_0^{i=8760} Sdt}{S_{maks}}(7)$$

From the line being transmitted yearly energy the amount and maximum asset power knowing , from expression (6). maximum in power work the time determination can :

$$T_{maks} = \frac{W}{P_{maks}} = \frac{W}{S_{maks}cos\varphi_{ur}} \qquad (8)$$

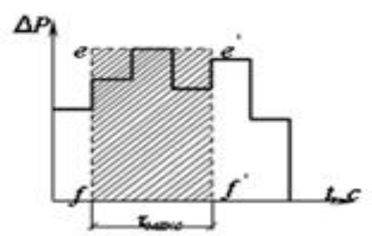
Any consumer his own maximum in download work time size with is characteristic . In calculations this size statistics to information basically acceptance to do possible [8-9].

To the above similar way such time t determination maybe it is time during on the line maximum power wasted DR max immutable has been without face giver energy a waste that's it line one year during upload to the graph according to without variable power a waste with worked in the case energy wasted equal to be (Fig. 5). Such a time t maximum wastes it is called time . DR. max and t is known when energy a waste sides this to quantities equal to has been right of the rectangle surface with is determined (Figure 5):

$$\Delta W = \Delta P_{maks}\tau = \frac{r}{U^2} S_{maks}^2\tau = \frac{r}{U^2}\int_0^{i=8760} Sdt(9)$$

From here maximum wasted work time defined as :

$$\tau = \frac{\Delta W}{\Delta P} = \frac{\int_0^{i=8760} Sdt}{S_{maks}^2}(10)$$



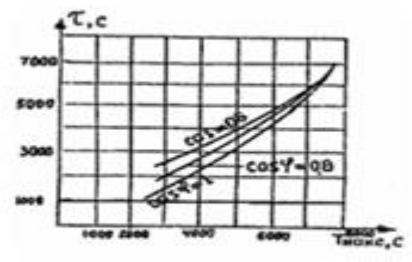


Figure 5. Maximum a waste the time determination

Figure 6. Maximum wastes time t maximum upload with work time Dependence on T $_{max}$ there is .

In practice τ the T $_{max}$ through determination because it is possible they are between certain dependence there is .

From formulas (1) and (10). apparently as T $_{max}$ downloads of the graph change to the character , that is this to the function S(t) under the integral in the expressions dependτ of that T depends on $_{max}$ determination for each character of consumers each character Tmax to sizes have has been one series downloads graphics and $S^2(t)$ curve the line determine that graphics Integrating , then expressions (7) and (10). using t that T depends on $_{max}$ sof of each character values for determination necessary [12-13].

It's a curve from the lines using , max wastes time method using energy waste determination can

Calculation order as follows . Active whose resistance was r being viewed

of the line asset power coefficient $cos\varphi = \frac{P_{maks}}{S_{maks}}$has been maximum download

$S_{maks} = \sqrt{P_{maks}^2 \ Q_{maks}^2}$ the and given categorical of the consumer

maximum in download work time T $_{max}$ the determined and given $cos\varphi$and

identified T is presented in Figure 6 for curve lines through maximum

a waste time τ the is found . of the line at a certain nominal voltage U $_{n}$

in it yearly electricity energy a waste ΔW is the formula (9). using

we find can :

$$\Delta W = \frac{r}{U^2} \ S_{maks}^2 \tau$$

Or

$$\Delta W = \frac{P_{maks}^2 \ Q_{maks}^2}{U_n^2} r * \tau (11)$$

Line during one how many downloads connected in case in it energy a waste xar one in the plot energy waste to add based on is determined .

if being viewed line plot through each hil R $_{1max}$, R $_{2max}$, R $_{3max}$ and to them suitable maximum in download work time T $_1$ T $_2$ T $_3$ has been to consumers power being transmitted if so , to him waste determination for being transmitted energy average value account received in case , (8) by formula defined maximum in power work of time average value get should [14-15]:

$$T_{maks} = \frac{W}{P_{maks}} = \frac{P_{1\,maks}T_{1maks}+P_{2\,maks}T_{2\,maks}...+P_{n\,maks}T_{n\,maks}}{K_{\rho}(P_{1maks}+P_{2maks}+...+P_{n\,maks}} = \frac{\sum_1^n P_{i.maks}T_{i\,maks}}{K_0\sum_1^n P_{i.maks}}$$

Here , K $_o$ is the loads of the group from the graph defined one timeliness coefficient of . Steel conductive on the lines energy waste in the calculation of current change because of to be asset resistance account get necessary

In the transformer energy a waste In the transformer energy a waste two from the part organize found :

1. to downloads depends has been a waste $\Delta R_k\tau$,
2. to downloads depends didn't happen a waste $\Delta R_S\tau$.

So, $\Delta W = \Delta P_s T + \Delta P_k \tau (13)$

Here is the T- transformer work time (if transformer year during connected if , then T=8760 s).

Hard work power a waste ΔR_s from the transformer flowing to power connection maybe not given of the transformer to the structure depends is the voltage and of power something in values immutable size organize reaches [16].

Short connection power waste , that is in my lap power a waste ΔR_k q iska connection to the nominal value of waste equal to without , from the transformer flowing to power depends without will change . So so that 's it a waste of powers per square is proportional , that is :

$$\frac{\Delta P_k}{\Delta P_{X.n}} = \frac{S_t^2}{S_{t.n}^2} (14)$$

Here - from the transformer flowing real power ; S $_{tn}$
nominal power of the transformer .

In it real short connection power according to the tune defined as :

$$\Delta P_k = \Delta P_{X.n}\frac{S_t^2}{S_{t.n}^2} \qquad (15)$$

ΔR_S and ΔR_kThe values of are given in the manual tables as catalog data of transformers. $\tau$the value of T $_{max}$ and $cos\varphi$ of values with will be identified .

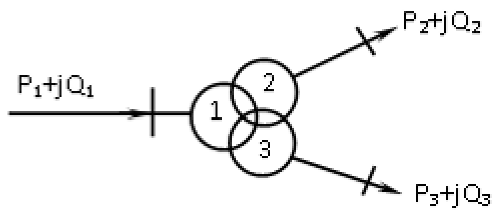
n transformers operate in parallel them a waste divisor common energy to (13) and (15). basically according to the tune found :

$$n\Delta W_1 = n\Delta P_s T + \Delta P_{k.n}\left(\frac{S_t^2}{S_{t.n}^2}\right)(16)$$

Here S $_t$ from transformers flowing powers sum ;$S_{t.n}$ each one some nominal power of the transformer .

Three chubby in transformers common power waste to find for (Fig. 7) eng 2 and 3 first wastes is determined , then this power waste both from the crucibles flowing to powers in addition to the 1st chulgam a waste is determined . Divided chubby power in transformers as well a waste each one my stomach for separately account is obtained [17-18].

7-picture. Scheme of a three-phase transformer



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