

M>D 621.165

А.Л. ШУБЕНКО, qe.-dhjj . G:GM ; BIFZr G:GM ,]. OZjvdh\
Н.В. ЛЫХВАР, dZg^ . l_og . gZml; BIFZr G:GM ,]. OZjvdh\
А.В. СЕНЕЦКИЙ, ZkibjZgl BIF Zr G:GM ,]. OZjvdh\
 <HAFH@ GHKLB IHURGBY WNNDLBGHKLB F:EUO
I:HLMBGGUO LWPA: KQL BO JKRBBY
=:AHLMBGGUF B G:KLHCD:F B

Jha|eyZ xlvk y fh èbh kl• i@s_ggy _n_dlbghkl• iZj hl nj [ggbo L?P ijhfbkeh ÷o i† jbfkl\ aZ jZonghd € jharbj _ggy]Zahmj] ggbfb gZ[mhZ fb . <bdhgZgh hp*gd m_n_dlbghkl• kdbm ÷o ehigbo]Za† =LM\ _g_j]_lbqgbc iZj h\bc dhl_e (?ID) IZ ^hZldh\ h]h kiZexZggy \ gbo iZebZ . >hke@ggy ÷dh gZgh aZ† ihf h]hx jh aj h[e_gh]h \ II FZr G:GM i jh] jZfg h]h dhfie_dkm , ydbc ÷a\ hey} i j hhðlv jh ajZongdh† ÷ ke@ggy _g_j]hmkIZghhd g_levdb \ aZe_ghkl• † ÷m iZebZ , Ze_•† ch]h kdeZ^m IZ a nj ZomZggyf mkø ah\gr gø IZ \gml jrgø nZdlhj† . GZ\ ^gh , ydbf qbghf afgxxlvk y i hdZagbdb I=M ij b gZygh kl• ÷ ^Z dh\h]h kiZexZ ggy iZebZ \ ?ID .

Possibility of increase of efficiency of steam-turbines HEC of industrial factories due to their expansion by gas-turbines buildings is examined. Estimation of expedience of add of exhausting gases of GTU in a power steam-boiler with the use of additional incineration of fuel. Researches are conducted with the bundled software developed in IPMash NANU. Bundled software allows to conduct calculations not only depending on the type of fuel, but also from his composition. This bundled software takes into account great number of external and internal influencing factors. The results of calculations showing changes the indexes of SGU at presence of additional incineration of fuel in PSB.

<\^gb_ . Ihur_gb_ klhbhfklb l_iehhc b we_dlj bq_kdhc wg_j]bb , Z IZd_ kgb`gb_ gZ^ghklb we_dljhl_iehkgZ[_g by ijbh†yl d m_`ebq_gbx m^ev gu o aZljZl gZ_`gbpm ÷i nkdZ_fhc ijhfure_gghc ijhm dpbb , Z ke_†Zl_e vgh , d kgb`gbx _ dhgdnj_glhkihkh[ghkl b [1]. IjbqbgZ wh]h – ijbfg_gb_ fZehwnn_dlbguo wg_j]haZljZlguo l_ogheh]bc , dZd ijb ijhba \hkl\ wg_j]hghkbl_e_c , IZd b ijb bo ihlj_e_gbb , \ qZklghklb , \ l_iewg_j]_lbd_ . <h k_f fbj_ ijh]j_kk \ l_iewg_j]_lbd_ kyauZxl kj_r_gb_f aZZq ih ihur_gbx wnn_dlbghklb , wdheh]bqghklb , kgb`gbx fZl_jbZeh - b dZiblZeh_fdhklb , ihur_gbx gZ^ghklb b wdkienZlZpbhgguo khckl\ wg_j]_lbq_kdbo mkZgh\hd l_ieh \uo we_dljhklZgpbc . Hgbf ba gZb[he__ ZdlmZevguo gZijZè_gbc ihur_gby wnn_dlbghklb wg_j]hijhba†klZ yeyxky bkke_†Zgb_ j_bfh\ b hilbfbaZpby jZ[hlu wg_j]hmkIZghhd k ijbfg_gb_f fZl_fZlbq_kdbo fh^e_c . < BIFZr G:GM ihkljh_gu fZl_fZlbq_kdb_ fh^eb wg_j]h nklZgh\ db (FFW) dhlhju_ ih aheyxl ijhðlv bkke_†Zgby j_bfh\ wg_j]hmkIZghhd , \ lh f qbke_ iZjh]Zah\uo (I=M) k mq_lhf nZdlbq_kdhc l_iehhc ko_fu , khklhygby h[hjm†Zgby b mkeh\bc]h wdkienZlZpbb [2, 3].

1. Ihurgb_ wnn_dlbghklb aZklj jkrbgy fZeuo izhlmgggu o LWP Zahlmggufb gZklh cdZfb . H[t_`bg_gb_ iZjhl nj]bgghc b]Zahlmj]bgghc mkZgh\hd h[sbf l_ogheh]b q_kdbf pbdeh f y\ey_lky , h^gbf ba gZb[he__ wnn_dlbguo kj_kl\ agZqbl_evgh]h ihur_gby wdghghfbqghklb we_dljhklZgpbc gZ hj]Zgbq_kdhf lhieb\ . Ijbfg_gb_ I=M ihehbl_evgh kdZauZ_lky gZ wdghghfbqghklb jZ[hlu mkZgh\db, DI> ([jmlh) emqr bo I=M khklZey_l 58–60 % . Ijbfg_gb_ ko_f I=M ZdlmZevgh gZ ij_†bylbyo obfbq_kdhc , g_nl_i_j_Z[ZluZxs_c , p_eexehagh - [mf Zghc , m]hevghc i jhfure_gghklb [4].

< gZklhys_c jZ[hlu jZkkfZl jBZ_lky hafhghklv ih\ ur_gby wnn_dlbghklb ijhba†klZ l_iehhc b we_dlj bq_kdhc wg_j]bb iZjhl nj]bgghc LWP, gZ dhlhjh

mkZgh\ e_gu iZjh\ dhleu =F -50-1 b iZjh\ _ lmj[bgu fh sg hklvx 6 F<1 , iml_f gZkljhcd b bo =LMfh sgh klvx 6 F<1 kh k[j khkf \ u oehiguo]Zah\ \ WID.

1.1 DZldh _ hibkZgb_ kmsklmsh hhmhZgby . JZkkfZljZ_lky dhlehZ]j_Zl =F -50-1 iZjhijhba\dl_evghklvx 50 l/q, k ghfbgZev gufb iZjZf_ljZfb : Z\gb_ 40 d]/kf², l_fi_jZl mj Z440 ° [5].

Lmj[bgu k l_iehnbdZpbhguf hl[hjhf iZjZ (L) r bjhdh ijbf_gyxlky gZ ijhfure_gguo ij_fjbylbyo ,]^ gZjyfm k ijhba\klhf we_dj_bq_kdhc wg_j]bb lj_[m_lky ihZqZ iZjZ hij^e_ggu o iZjZf_ljh\ \ ey ijhba^ kl_gguo b l_iehnbdZpbhgguo gm^ . GZjZkkfZljZ_fh f ij_fjby lbb mkZgh\ e_gZlmj[bGZ :L -6 (L-6-35), ghfbgZevghc fhsghklvx 6 F<1 [6].

Kns_kl\ nx s Zy klj ml nj Z l_iehwg_j]_lbq_kdh]h h[hjmhZgby g_ iha\ey_l ijhba\dlv we_dljhwg_j]bx \ g_hlhibl_evghc i_jbh^ ih dhgdnj_glghc klhbfbklb . M^evghc jZkoh^ l_iehlu gZ ijhba\klhf we_dljhwg_j]bb gZ lmj[h nklZgh\d_ :L -6 ijb ijh_dlguo agZq_gbyo iZjZf_ljh\ b l_ogbq_kdh]h khklhygby khklZey_l 3019 ddZ/(d<1 · q). Ijb ijh_dlguf agZq_gbb DI> dhleZ 91,42 % b l_iehlhjghc kihkh[ghkl b kb]Z_fh]h]ZaZ 8034 ddZ/f³ m^evghc jZkoh^ i j bjhg]h]ZaZ gZ ijhba\klhf we_dljhwg_j]bb khklZey_l 0,408 f³/(d<1 · q) [5].

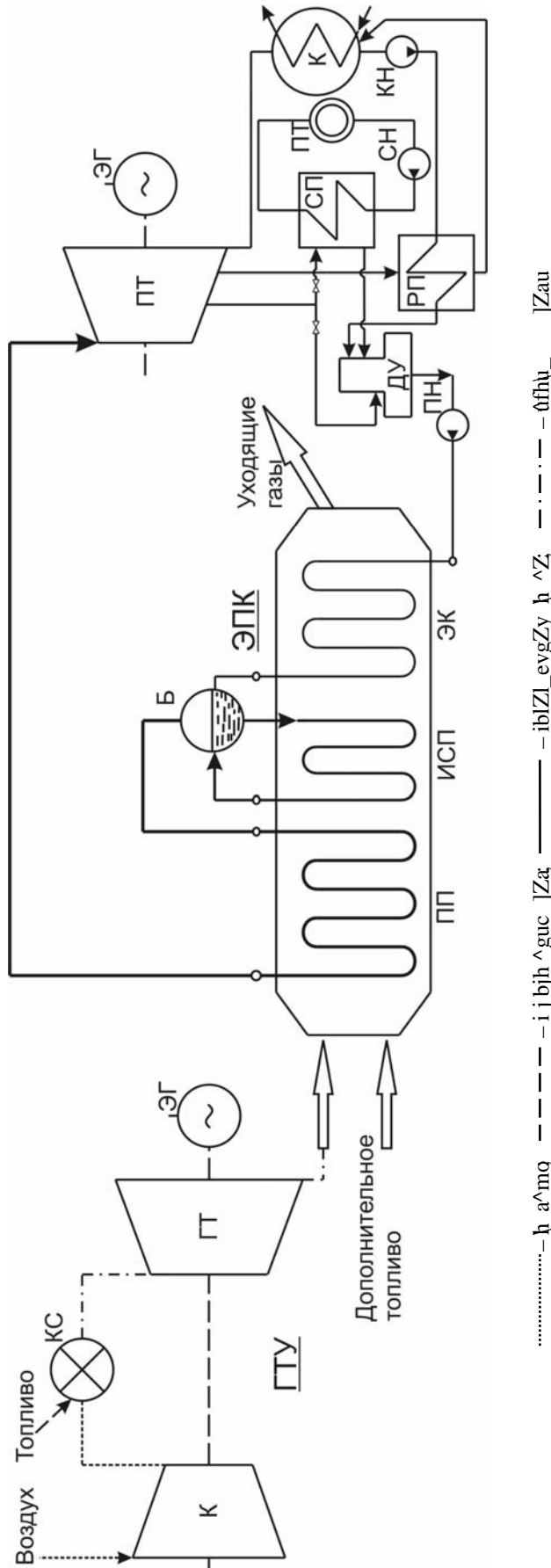
1.2 IqZfjh_ logbqdh_ jgb_ . Ba hafghuo ZjbZglh\ j_ZebaZpbb dhf[bgbjhZggh]h pbdeZ k bkihevahZgb_f bf_xs _jhky gZ LWP h[hjmhZgb y gZb[he__ wnn_db\guf ij_kl Zey_lky j_ZebaZpby k[jhkgbc ko_fu iZjh]Zahc mkZgh\db, ijb dhlhjhc \uohiguo_]Zau =LM k[jZkuZxlky \ WID. >ey j_ZebaZpbb iZjh]Zah]h pbdeZ [ueZ \jZgZ]Zahmj[bggZy mkZgh\dZ =LW-6 (ijhba\klZ =I GID «Ahjy-FZrijh_dl »,]. GbdheZ_\), fhsghklvx 6 F<1 kh k[jhkhf \uohiguo]Zah\ \ iZj hhc dhle =F -50-1, mkZgh\eguc gZ LWP. <u[hj =LMZggbc fhsghklb h[mkeh\g [ebahklvx jZkoh\ \uohiguo]Zah\ =LM b hafm oZ \ lhid_ WID gZ ghfbgZevguo j_bfZo . Ijb wlhf hliZZ_l g_h[oh\ f hklv \ hafm ohih]j_Zl_e dhleZ, l. d. \uohiguo_]Zau =LM bf_xl \khdm x l_fi_jZlmj m Ke_h \Zl_evgh, ihy\ey_lky hafghklv m_ebq_gby ih\joghklb gZ]j_Z wdghfZca_jZ aZ kq_l m^Ze_gby \hafm ohih]j_Zl_ey . >ufh\ _]Zau ihke_ =LM k[jZkuZxlky \ dhle =F -50-1 b ml bebajmxlky k h[Z\gb_f lhiebZ beb [_a.

JZkkfZljZ_lky ZjbZgl \ujZ[hldb hieghl_evghc we_dljhwg_j]bb iml_f j_dhgkljm dpbb LWP k mkZgh\dhc hgbc =LM fhsghklvx 6 F<1, jZ[hZxs_c gZ ijbjhghf]Za_kh k[jh khf \ufh\ u o]Zah\ \ kms_kl\ mxs bc WID.

QZklh I=M kh k[jhkhf \uohiguo]Zah\ =LM \ wg_j]_lbq_kdbc dhle gZauZ xl djZldh «k[jhkgufb »; ijbgbibZevgZy l_iehZy ko_fZ ij_klZ\egZ gZjbk . 1 [6].

Ij_bfm s_klh k[jhkguo I=M - hafghklv bkihevahZgby \ no bh\ lhiebZ : \khdhdZq_kl\ggh]h \]Zahf dhgl nj_ b gbadhdZq_kl\ggh]h \ iZjh\ dhglmj_ . MijZ\gb_ I=M k[j hkg]h lbiZ hj]ZgbahZgh lZd, qlh nf_gvr_gb_ fhsghklb hkn_s_kl\ey_lky aZ kq_l iZjh]h dhglmj_Z ijb g_baf_gghf j_bf_ jZ[hlu]Zah]h dhgl nj_Z [7]. GZb[he__ wdghfbqguf ijb wdkienZlZpbb WID, kqblZ_lky j_b f khf_klgh k]Zahc lmj[bghc . Ijb ihfhsb jZajZ[hZggh]h \ BIF Zr G:GM dhfie_dkZ ijh]Zff ihdZ_f , dZdbf h[jZahf baf_gyxlky ihd ZaZl_eb I=M ijb gZebqbb hieghl_evgh]h k[jhkZ lhiebZ \ WID [3].

2. Bkkeh Zgb_ jfh\ zhlu I=M . < BIFZr G:GM jZaj_Z hlZgZFFW b khhl\lklm x sbc ijh] jZffguc dhfie_dk (ID), h[_ki_qbZxsbc jZkq_l oZ]Zdl_jbklbd wg_j]hmklZghhd k\ khdhc (gZ mjhg_ ijh_dlguo jZkq_lh\ lmj[hkl jhbl_evguo aZh\) lhqghklvx . BkihevahZgb_ ijb jZajZ[hld_ FF ki_pbZevguo ijbgbih \ hj]ZgbaZpbb we_f_glh\ LKW b LKW \ p_ehf , h[_ki_qbZxsbo hklZlhqgh ijhkl nx



Ябк . 1. Ij bgp bibZevgZy l_iehZy ko_f Zl= Mkh k|jkhkf h oehi gu o |Zah\ =LM\ |hj_edb WID

gZkljhc d m ID gZ mkeh\by fh^ebjhZgby dhgdj_lghc wg_j]hmklZghdb b ohjhr mx mijZ\ey_fh klv __ gm lj_gg_c klj nml nj u, oZjZdl_j bam_l jZajZ[hZgg mx fh^ev , dZd mgb\jkZev gmx b ohjhrh ZZilbjm_fm x , f m]bfb kehZfb hij^ey_l __ dZd«]b[d mx » FFW . LZdZy fZl_fZlbq_kdZy fh^ev ihahey_l mqt u\Zlv fgh_klh g_r gbo b gm lj_ggbo nZdljh\ , ebyxsbo gZ ih dZaZl_eb wg_j]hmklZghhd (baf_g_gb_dhgkljmdlbguo b l_jfhbgZfbq_kdbo oZjZdl_jbklbd l_iehh [f_gguo ZiiZjZ lh\ , ijh lhqguo qZkl_c iZjh\ uo b]Zah\uo lmj[bg b f) [2, 7-9].

< ijhp_kk_ wdkienZlZpbw wg_j]hmklZghdb , __ ijhba\bl_evghklv , dZd ih l_iehhc , lZd b ih we_dljbq_kdhc fhsghklb fh_l baf_gylvky \ ij^eZo , hij^ey_fuo j_bfhf jZ[hlu ihlj_[bl_e_c . Fh]ml f_gylvky lZd_ l_fi_jZl mjZ iblZl_evghc h\ b k\^h iZjZ ,]Zahuc j_bf lhidb b dZf_ju k]hjZgby , b fm]b_ ihdZaZl_eb , oZjZdl_jbam_x sb_ wnn_dlbghk lv jZ[hlu mkVgh\db. DZhf m j_bfm jZ[hlu khhl\lklm xl hij^e_ggu_ agZq_gby iZjZf_ljh\ l_iehhkbl_e_c ih h\iZjh\fm b]Zahfm ljZdlZf , l_ieh\uo ihl_jv b DI> .

Bkke_hZg by ijh\debkv ijb mkeh\bb kb]Zgby ijbjhgh]h]ZaZ\ dZf_j_k]hjZgby]Zahc lmj[bgu b \ wg_j]_lbq_kdhf dhle_.

J_rZ_lky aZZqZ ihbkdZ jZpbhgZevgh]h jZkohZ lhiebZ \ wg_j]_lbq_kdbc dhl_e iZjh]Zahc mkVgh\db ey h[_ki_q_gby fZdkbfZ evghc wdghghfb lhiebZ b fbgbfZevgh]h jZkohZ m^evghc l_iehlu gZ ijhba\klh we_dljbq_kdhc wg_j]bb . < dZq_kl\ dj bl_jby wnn_dlbghklb bkihevahZeky m^evguc jZkoh^ l_iehlu gZ wg_j]hmklZghdm. Ihbkd gZbenqr]h j_r_gby hkns_kl\eyeky k bkihevahZgb_f f_lhZ ihdhhjbgZlgh]h ki nkdZ [10]. JZkoh^ lhiebZ \ WID h]jZgbq_g ba[uldhf hafm oZ\ \uoehiguo]ZaZo=LM; h]jZgbq_gb_f lZd_ kem bl fh sghklv lmj[bgu . JZkoh^ iZjZ gZ iZjh\ mx lmj[bgm aZbkl hl jZkohZ \uoehiguo]Zah\ =LM b dhebq_klZ hieghl_evgh]h lhie bZ kb]Z_fh]h \ dhle_ . =LM jZ[hZ_l \ ghfbgZevghf j_bf_ ijb jZaebqguo j_bfZo ILM. JZkq_l ihdZaZl_e_c wg_j]_lbq_kdhc mklZghdb gZqbgZ_lkyk\ebqbg_u h[Zhqgh]h lhiebZ \ WID 200 d]/q, l. d. ijb f_gvr_f jZkoh^ g_h[_ki_qbZxlky ghfbgZevgu_ iZjZf_lju iZjZ i_j^ iZjh\c lmj[bghc . JZkfhljbf jZ[h] mILM gZ l_iehnbdZpbhgghf j_bf_ ; j_amevlZlu bkke_hZgbc ij_klZeg_u \ lZ[e . 1 b gZjkb . 2.

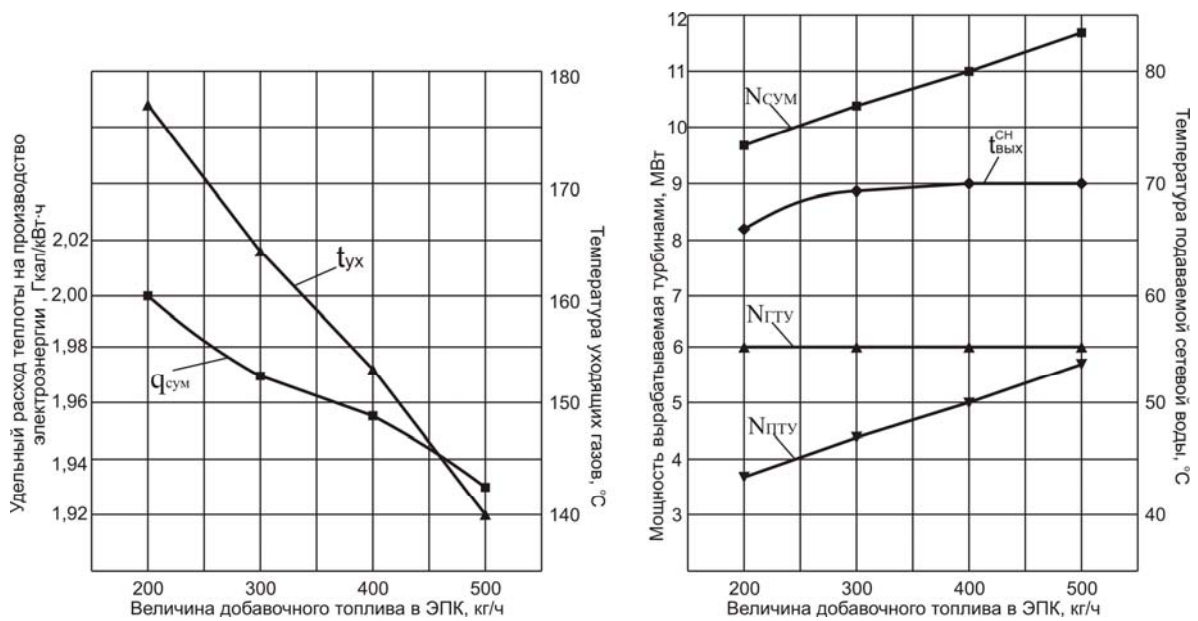
Ba lZ[e . 1 b]jZnbdh\ (jkb . 2) bgh , qlh h[ZdZ lhiebZ \ WID lj_[m_lky ey m\ebq_gby heb hl[bjZ_fh]h iZjZ ba ijhlhgghc qZklb lmj[bgu gZ h]j_Zgb_ k_l_hc h\ h g_h[ohdfhc l_fi_jZlmju (kh]eZkgh l_fi_j Zlnj gh]h]j ZnbdZ l_iehk_lb). Kb]Zgb_ hieghl_evgh]h lhie bZ \ dhle_ eby_l gZ ihdZaZl_eb wg_j]_lbq_kdhc mkVgh\db b \ebqbgm \jZ[hldb we_dljbq_kdhc wg_j]bb. Ijb kb]Zgbb hieghl_evgh]h lhiebZ wdghghfbqghklv mkVgh\db m\ebq_b_lky aZkq_l h[_ki_q_gby ghfbgZevguo iZjZf_l_jh\ iZjZ gZoh^ \ iZjh\ mx lmj[bgmb ihur_gby DI> WID, gh kdjhklv jhkl Z wdghghfbqghklb kgbZ_lky ijb m\ebq_gbb ljukdZ hoeZZxs_]h dhg^gkZlZ \ iZj ey g_hi ns_gby m\ebq_gby l_fi_jZlm ju iZjZ ur_ ghfbgZevghc .

GZ jZ[h] m wg_j]hmklZghdb hdZauZ_l kns_kl\ggh_ ebygb_ \ebqbgZ ih_joghklb gZ]j_Z wdghghfZca_jZ WID. JZkfhlj bf Ze__ ZjbZgl m\ebq_gby ih_joghklb gZ]j_Z wdghghfZca_jZ ijb ihklhyggc \ ebqbg_ h[Zhqgh]h lhiebZ , ijh\^f ZgZeba baf_g_gby ghkbfuo dhgkljmdlbguo baf_g_gbc gZ ihdZaZl_eb wg_j]hmklZghdb (dhg^gkZpbhgghc j_bf jZ[hlu ILM), j_amevlZlu k\^f \ lZ[e . 2.

Ih j_amevlZlZf jZkq_lh\ ij_klZeg_gguo \ lZ[e . 2 ihkl_jh_gu]jZnbdh (jkb . 3). LZdbf h]jZahf , m\ebq_gb_ ih_joghklb gZ]j_Z wdghghfZca_jZ WID, ihahey_l ih\ukblv fhsghklv iZjh\c lmj[bgu b wg_j]hmklZghdb \ p_ehf . Ijb wlhf l_fi_jZl mjZ nohysbo]Zah\ kgbZ_lky aZ kq_l m\ebq_gby ih_joghklb gZ]j_Z

IhdZaZlEb I= Mij b kb] Zgbb h ih egbl_evgh]h lhie bZ \ WID

OZjZdl_jbkl bdb	IhdZaZlEb			
<_ebqbgZ h [Zhqgh]h lhiebZ $G_{\Pi}, d]/q$	200	300	400	500
Ih_joghklv gZj_Z wdlghfZca_jZ $F_{wid} f^2$	978			
JZkoh^ lhiebZ \ =LMG_{\Pi M, d]/q	1613	1613	1613	1613
JZkoh^ \uoehiguo]Zah\ =LMG_{\Pi \u{o}, d]/k	30	30	30	30
L_fi_jZlm j Z\uoehiguo]Zah\ =LMt_{wid}, \u{o}	420	420	420	420
L_fi_jZlm j Z]Zah\ \ WID t_{wid}, \u{o}	491	528	560	596
KnffZjgh_ dhebq_klh izjZ gZiZjh\u{x l mj[bgm D_0, l/q	16,49	19,07	21,39	24,0
>Z\u{gb_ h\u{gh]h izjZ gZ\u{h^ \ iZjh\u{x l mj[bgm P_0, FIZ	3,43	3,43	3,43	3,43
L_fi_jZlm j Z h\u{gh]h izjZ gZ\u{h^ \ iZjh\u{x l mj[bgm t_0, \u{o}	426	435	435	435
>Z\u{gb_ hljZ[hZr_]h izjZ \ l mj[bg_ P_{omp}, FIZ	0,005	0,005	0,005	0,005
<_ebqbgZ l_jkdZ \u{y hoeZ^ \u{gby izjZ D_{\Pi}, l/q	0	0,6	1,2	2,2
JZkoh^ k_l_ \ hc h\u{t gZl_ iehnbDZpb x D_{kg}, l/q	10	10	10	10
Lj_lm_fuc l_fi_jZlm j guc ljZnbd k_l_ \ hc h\u{t t_{\u{o}^{kg}} / t_{\u{o}^{kg}}, \u{o}	45/70	45/70	45/70	45/70
NZdlbq_kdbc l_fi_jZlm j guc ljZnbd k_l_ \ hc h^ u t_{\u{o}^{kg}} / t_{\u{o}^{kg}}, \u{o}	45/66	45/69,3	45/70	45/70
Wnn_dlbgu c DI> =LM\u{, %	31,5	31,5	31,5	31,5
Wnn_dlbgu c DI> ILM \u{, %	28,01	28,58	29,06	29,41
L_fi_jZlm j Znoh\u{so]Zah\ t_{m\u{o}}^h K	177	164	153	140
Fhsghklv]Zah\ hc l mj[b gu N_{\Pi M, d}<l	6 000	6 000	6 000	6 000
Fhsghklv izjh\u{c l mj[bgu N_{ILM}, d<l	3 670	4 370	4 980	5 680
KnffZjgZy fhsghklv \no l mj[bg N_{knf}, d<l	9 670	10 370	10 980	11 680
L_iehhljgZy kihkh[ghklv bkihevam_fh]h lhiebZ Q_{kg}, ddZe/d]	10 670			
Ih^ggZy l_iehZ \ WID Q_{wid}, =dZe	2134	3201	4268	5335
Ih^ggZy l_iehZ \ DK Q_{DK}, =dZe	17210,71			
M^evguc jZkoh^ l_iehZ u gZijhba\u{klh we_dljhwg_j]bb q, =dZe/(d<l \cdot q)	2,0	1,968	1,956	1,930



Jbk . 2. <e bygb_ kb]Zgby h ih egbl_evgh]h lhiebZ \ WID gZih dZaZlEb I=M

IhdZaZl_eb I= Mij b baf_g_gbb i h\joghklb gZlj_Z wdghgf Zca_jZ WID

OZjZdl_jbkl bdb	IhdZaZl_eb			
Ih\joghklv gZlj_Z wdlghfZca_jZ $F_{wid} f^2$	521	673	826	978
<_ebqbgZ h [Zhqgh]h lhiebZ $G_{h\Gamma}, d]/q$	500	500	500	500
JZkoh^ uoehiguo]Zah\ =LM $G_{\Gamma o}, d]/k$	30	30	30	30
L_fi_jZlm jZ uoehiguo]Zah\ =LM $t_{wid}, ^\circ$	420	420	420	420
L_fi_jZlm jZ]Zah\ \ WID $t_{wid}, ^\circ$	596	596	596	596
KnffZjgh_ dhebq_klh iZjZ gZiZjh\m x lmj[bgm $D_0, l/q$	18,69	20,13	21,0	21,66
>Ze_gb_ h\ygh]h iZjZ gZoh^ \ iZjh\m x lmj[bgm P_0, FIZ	3,43	3,43	3,43	3,43
L_fi_jZlm jZ h\ygh]h iZjZ gZoh^ \ iZjh\m x lmj[bgm $t_0, ^\circ$	435	435	435	435
>Ze_gb_ hljZ[hLZ\]h iZjZ \ lmj[bg_ P_{omp}, FIZ	0,0039	0,0041	0,0042	0,0042
<_ebqbgZ ljukdZ ey hoeZ ^gby iZjZ $D_{\Gamma f}, l/q$	2,6	2,77	2,85	2,92
Wnn_dlbgu c DI> =LM $\eta, \%$	31,5	31,5	31,5	31,5
Wnn_dlbgu c DI> ILM $\eta, \%$	28,99	29,14	29,21	29,28
L_fi_jZlm jZ m\h\fsbo]Zah\ $t_{m\phi}, ^\circ$	237	213	198	187
Fhsgklv]Zah\ hc lmj[bg $N_{\Gamma M}, d<l$	6 000	6 000	6 000	6 000
Fhsgklv iZjh\c lmj[bg $N_{ILM}, d<l$	4 420	4 790	5 010	5 180
KnffZjgZy fhsghklv hno lmj[bg $N_{kf}, d<l$	10 420	10 790	11 010	11 180
L_ieh\hjgZy kihkh[ghklv bkihevam_fh]h lhiebZ $Q_{kg}, ddZe/d]$	10 670			
Ih^ggZy l_iehZ \ WID $Q_{wid}, =dZe$	5335			
Ih^ggZy l_iehZ \ DK $Q_{DK}, =dZe$	17210,71			
M^evguc jZkoh^ l_ieh u gZijhba\klh we_dljhwg_j]bb $q, =dZe/(d<l \cdot q)$	2,164	2,09	2,048	2,017
M^evguc jZkoh^ m\eh\gh]h lhiebZ ih \ujZ[hld_ we_dljhwg_j]bb =LM $b_m^{-LM}, d].ml/(d<l \cdot)$	0,390	0,390	0,390	0,390
M^evguc jZkoh^ m\eh\gh]h lhiebZ ih \ujZ[hld_ we_dljhwg_j]bb ILM $b_m^{ILM}, d].ml/(d<l \cdot)$	0,424	0,422	0,421	0,420
M^evguc jZkoh^ m\eh\gh]h lhiebZ ih \ujZ[hld_ we_dljhwg_j]bb I=M $b_m^{I=M}, d].ml/(d<l \cdot)$	0,2033	0,2028	0,2026	0,2024

wdghgfZca_jZ, qlh kb^l_evklm_l h [he__ iheghf bkihevahZgbb l_ieZ moh\fsbo]Zah\ . LZd_ kgbZ_lky m^evguc jZkoh^ m\eh\gh]h lhiebZ ih \ujZ[hld_ we_dljhwg_j]bb ILM .

Hlf_lbf , qlh ij_klZe_ggu_ jZkq_lu yeyxky ebrv ijb_fjZfb d ZgZeban ZjbZglh\ \ujZ we_f_glh\ b j_bfh\ jZ[hlu I=M . Bkke^hZgby lZd_ [ueb ijh^gu b ey j m\po ZjbZglh\ wdkienvIZpbb wg_j_lbq_kdhc m\kZgh\db k mq_hf jZaebqguo ha^ckl\m\fsbo nZdlhj\ b dhfihgh\ h[hjm^hZgby , dhlhju_ hdZauZxl kns_kl\ggh_ ebygb_ gZ wdghgf bq_kd mx p_e_khh[jZaghklv hij^e_gby j_bfZ jZ[hlu wg_j_lbq_kdhc m\kZgh\db .

<uh\ . Ijh^gggu_ bkke^hZgby ihdZaZeb hafhghklv ihur_gby wnn_dlbghklb iZjhlmj[bgghc LWP iml_f m\kZgh\db]Zahlmj[bgghc gZkljhcdb kh kljhkhf uoehiguo]Zah\ =LM \ WID .

JZkq_lu ihdZaZeb kgb_gb_ m^evguc jZkoh\ l_iehlu gZ ijhba\klh we_dljhwg_j]bb I=M k 2,0 h 1,93 =dZe/(d<l \cdot q), ijb m_ebq_gbb jZkohZ hieghl_evgh]h lhiebZ hl 200 h 500 d]/q \ WID .

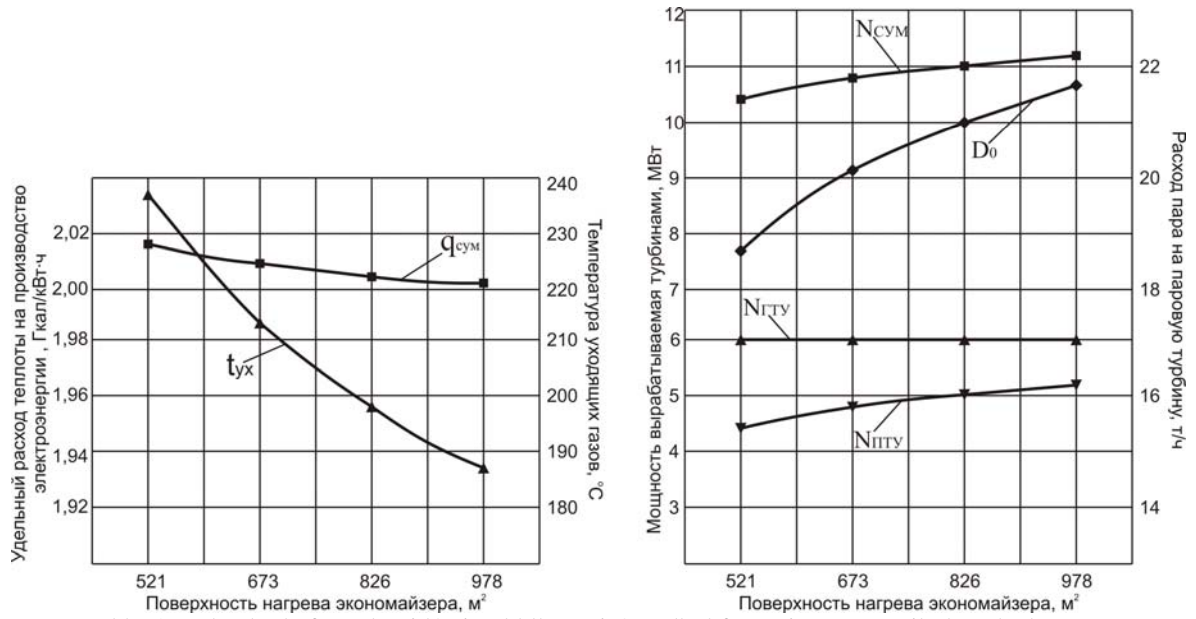


Рис. 3. Зависимость удельного расхода электроэнергии и температуры уходящих газов от площади поверхности нагрева экономайзера.

Моделирование процесса нагрева экономайзера при площади поверхности нагрева 521 и 978 м² показывает, что удельный расход электроэнергии на производство пара при площади нагрева 521 м² составляет 0,76 кВт·ч/т, а при площади нагрева 978 м² – 0,2033 и 0,2024 кВт·ч/т. Это свидетельствует о том, что при увеличении площади нагрева экономайзера удельный расход электроэнергии на производство пара уменьшается.

В процессе работы экономайзера наблюдается увеличение температуры уходящих газов при увеличении площади поверхности нагрева. Это связано с тем, что при увеличении площади нагрева экономайзера увеличивается количество пара, производимого турбинами, что приводит к увеличению расхода пара на паровую турбину.

Кибкхд ебл_жмжу : 1. Долинский А.А. Кн[кл]г гу_ wg_j]hj_kmjku ёу wg_j]_lбдб МdjZbgu / : . : .>hebгkdbc, X.B.<hehбд // I jhf . l_ieh_l_ogbdZ – 1996. – < 3. – К. 62-80. 2. Лыхвар Н.В. Klj nmlmj u Zgguo b yaud kбkl_fu fZrbggh]h ij h_dlbjh \Zgby b бкке^hZgbc l_iehù o ko_f iZj hl mj [bgguo mklZgh d // FZl_fZlbq_kdh_ h[ki_q_gb_kбkl_f Z[hfZlbabjh\ Zggh]h ijh _dlb hZgby h[t_dlh\ fZrbgh kljh_gby. – OZvdh\ . – 1981. – К. 45-62. 3. Лыхвар Н.В. бZghklbj hZgb kхklhygby h[hjm^hZg by lmj[hmkIzgh\hd LWK b :WK ih l_jfhбgZfbq_kdbf iZj Z_lj Zf gZ hkgh\ _fZl_fZlbq_kdh]h fh ^ebjh Zgby // : \ бZp. dhkf. l_ogbdZ b l_ogheh]by: K[. gZmq lj . – <ui . 5 (l_fZlbq_k dbc). – OZvdh\ : OZjvd. ZbZp. bg-l. – 1998. – К. 362-365. 4. Манушин Э.А. Dhf[bgbj hZgg_u wg_j]_lbq_kdb_ mklZgh d k iZjh ùfb b]Zahùfb lmj [bgZfb // Bl h]b gZmddb l_ogbdb. <BGB LB. K_j. Lmj[hk lj h_gb_ – 1990. – 4. – К. 135-146. 5. Александров В.Г. IZ j hù _ dhleu fZehc b kj_г_c fh s ghklb. Ba^ . 2_ . i_j_jZ[. b ñi . – E.: Wg_j]by. – 1972. – 200 к. 6. Рыжкин В.Я. L_iehù_ we_dljбq_kdb_ klZgpbb: mq_gbd ёу mah\ / ih ^ j_ . <.Y. =bjm_evZ . 3_ ba^ . i_j_jZ[. b ñi . – F.: Wg_j]hZlhfa ^Zl, 1987. – 309 к. 7. Лыхвар Н.В. F h^ ebjhZg b_l_ieh vg_j]_lbq_kdbo mklZgh d k bkih evahZgb_f bgl_jZdlbghc ko_fg hc lj Znбdb / G.<. Eu oZ j, X .G. =hhj ns_gdh, <.: . Ydh\e_\ // Ij h[e. FZrbgh kljh_gby. – 2003. – < 1. – К. 30-41. 8. Лыхвар Н.В. =b[db_fZl_fZlbq_kdb_ fh ^eb wg_j]hmkIzgh\hd ёу hi lbfaZpbb j_ bf h\ LWP // Kh\ jr_gklhZgb_ lmj[hmkIzgh\hd f_lhZf b fZl_fZlbq_kdh]h b nbabq_kdh]h fh ^eb j hZgby : K[. gZmq lj mh\ – OZjvdh\ : Bg-l ijh [e_f fZrb ghkljh_g by bf . : .G. Ih ñhj gh]h G:G MdjZbgu , 2003. – L. 2. – К. 413-419. 9. Лыхвар Н.В. FZl_fZlbq_kdh_ fh ^ebjh Zgb_ b hi lbfZevgh_ i_jh_dlb j hZg b_ iZj hl mj[bggh c mklZgh d / G.<. EuoZj , X .N. Dhkyd // L_ieh vg_j]_lбdZ. – 1986. – < 2. – К. 69-72. 10. Карманов В.Г. FZl_fZ lbq_kdh_i jh] jZf f bj hZg b_ . – F .: GZndZ, 1980. – 256 к.

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