

$$E_{\phi} = Q_e / A_{\phi} \tag{1}$$

$$E_{\phi} = \int_0^{T_2} N \cdot d\tau / A_{\phi} = \sum_{i=1}^n (N_i \cdot T_i \cdot h_i) / A_i \tag{2}$$

N, N_i^* – ;
 T_i – ();
 h_i – (,) i - ;
 h^* i -x ;
 A_i – () ;
 n – () ;
 m – () ;

$$dE_{\phi} = 2 \sum_{i=1}^n (N_i \cdot T_i \cdot h_i) dAA / [\sum_{i=1}^m (A_i)]^2 + \sum_{i=1}^n (dN_i \cdot T_i + dT_i \cdot N_i \cdot h_i + dh_i \cdot T_i \cdot N_i) / \sum_{i=1}^m A_i \tag{3}$$

[5],
 dE_{ϕ} .
 (3)
 (3)
 $dE_{\phi}, N_i, T_i, h_i, A_i$

[6].

$$\begin{aligned}
 & N_i, T_i, h_i, A_i, \\
 & O_{\alpha i} \quad i \in \overline{\{l, k\}}, \\
 & \Delta_{\alpha i} \quad i \in \overline{\{l, k\}}; \\
 & \Pi_{p j}, \quad i \in \overline{\{l, m\}}, \\
 & M_{\text{о6}} = M_{\text{о6}} + M_{\text{о6}}^*
 \end{aligned}$$

$$M_{\text{о6}} = M_{\text{о6}} + M_{\text{о6}}^* \tag{4}$$

$$\begin{aligned}
 M_{\text{о6}} &= \{N_1, N_2, \dots, N_k, h_1, h_2, \dots, h_k, O_{\alpha 1}, O_{\alpha 2}, \dots, O_{\alpha i}, B_{\alpha 1}, B_{\alpha 2}, \dots, B_{\alpha i}, \\
 & \Pi_{p 1}, \Pi_{p 2}, \dots, \Pi_{p m 1}\}; \\
 M_{\text{о6}}^* &= \{N_1^*, N_2^*, \dots, N_n^*, h_1^*, h_2^*, \dots, h_n^*, O_{\alpha 1}^*, O_{\alpha 2}^*, \dots, O_{\alpha n}^*, B_{\alpha 1}^*, B_{\alpha 2}^*, \dots, B_{\alpha n}^*, \\
 & \Pi_{p 1}^*, \Pi_{p 2}^*, \dots, \Pi_{p m 2}^*\}.
 \end{aligned} \tag{5}$$

$$\begin{aligned}
 & M_{\text{np}} = \{B_k, Z_M, C_M\} \\
 & M_{\text{np}}^* = \{D_o, Z_o, P_d\}
 \end{aligned} \tag{6}$$

$$\begin{aligned}
 & M_{\text{np}} = \{B_k, Z_M, C_M\} \\
 & M_{\text{np}}^* = \{D_o, Z_o, P_d\}
 \end{aligned} \tag{7}$$

$$(5) \quad (k = l = m = n = 1) \quad M_{\text{сн}}$$

$$M_{\text{сн}} = M_{\text{мр}} \times M_{\text{о6}} + M_{\text{мр}}^* \times M_{\text{о6}}^* = \{B_{\text{к}} \times N, \text{З}_{\text{м}} \times N, C_{\text{м}} \times N, B_{\text{к}} \times h, \text{З}_{\text{м}} \times h, C_{\text{м}} \times h, B_{\text{к}} \times O_{\text{д}}, \text{З}_{\text{м}} \times O_{\text{д}}, C_{\text{м}} \times O_{\text{д}}, B_{\text{к}} \times \Delta_{\text{д}}, \text{З}_{\text{м}} \times \Delta_{\text{д}}, C_{\text{м}} \times \Delta_{\text{д}}, B_{\text{к}} \times \Pi_{\text{р}}, \text{З}_{\text{м}} \times \Pi_{\text{р}}, C_{\text{м}} \times \Pi_{\text{р}}, \Delta_{\text{о}} \times N^*, \text{З}_{\text{6}} \times N^*, P_{\text{д}} \times N^*, \Delta_{\text{о}} \times N^*, \text{З}_{\text{6}} \times N^*, P_{\text{д}} \times N^*, \Delta_{\text{о}} \times h^*, \text{З}_{\text{6}} \times h^*, P_{\text{д}} \times h^*, \Delta_{\text{о}} \times O_{\text{д}}^*, \text{З}_{\text{6}} \times O_{\text{д}}^*, P_{\text{д}} \times O_{\text{д}}^*, \Delta_{\text{о}} \times \Delta_{\text{д}}^*, \text{З}_{\text{6}} \times \Delta_{\text{д}}^*, P_{\text{д}} \times \Delta_{\text{д}}^*, \Delta_{\text{о}} \times \Pi_{\text{р}}^*, \text{З}_{\text{6}} \times \Pi_{\text{р}}^*, P_{\text{д}} \times \Pi_{\text{р}}^*\}. \tag{8}$$

$$B_{\text{к}} \times O_{\text{д}}, \quad \Delta_{\text{о}} \times \Pi_{\text{р}}^* \quad \text{З}_{\text{6}} \times \Pi_{\text{р}}^*$$

$K_{\text{сн}}$

$$K_{\text{сн}} = |M_{\text{мр}}| \times |M_{\text{о6}}| + |M_{\text{мр}}^*| \times |M_{\text{о6}}^*| - 3 = 3 \times 5 + 3 \times 5 - 3 = 27. \tag{9}$$

(3),

(8)

2

1.

1.

1	2	3	4	5
			$B_{\text{к}} \times N$	1
	-		$B_{\text{к}} \times h$	2
			$B_{\text{к}} \times \Pi_{\text{р}}$	3
			$B_{\text{к}} \times \Delta_{\text{д}}$	4

1	2	3	4	5
			$З_{\text{н}} \times N$	5
	-		$З_{\text{н}} \times h$	6
			$З_{\text{н}} \times \Pi_{\text{p}}$	7
	-	(-)	$З_{\text{н}} \times O_{\text{д}}$	8 (8.1 + 8.2)
	-	(-)	$З_{\text{н}} \times D_{\text{д}}$	9 (9.1 + 9.2)
	-		$C_{\text{н}} \times N$	10
	-		$C_{\text{н}} \times h$	11
			$C_{\text{н}} \times \Pi_{\text{p}}$	12
	-		$C_{\text{н}} \times O_{\text{д}}$	13
	-		$C_{\text{н}} \times D_{\text{д}}$	14
			$D_{\text{o}} \times N^*$	15
			$D_{\text{o}} \times h^*$	16
	-	-	$D_{\text{o}} \times O_{\text{д}}^*$	17
	-	-	$D_{\text{o}} \times D_{\text{д}}^*$	18
	-		$З_{\text{б}} \times N^*$	19
	-		$З_{\text{б}} \times h^*$	20
	-	(-)	$З_{\text{б}} \times O_{\text{д}}^*$	21 (21.1 + 21.2)

	2	3	4	5
	-	(-)	$3_6 \times D_n^*$	22 (22.1+ 22.2)
	-		$P_n \times N^*$	23
			$P_n \times h^*$	24
	-		$P_n \times O_n^*$	25
	-		$P_n \times D_n^*$	26
			$P_n \times \Pi_p^*$	27

M_{cn}

() , $k > 1, l > 1, m > 1, n > 1$.
 (6) (7) , (5)

$i \in \{1, k\}, j \in \{1, m\}, q \in \{1, l\}, p \in \{1, n\}$.

2. ,

.	
1	2
1	,
2	
3	
4	,
5	
6	-
7	, ,
8.1	, , -
8.2	, ,
9.1	, , ,

1	2
9.2	,
10	
11	
12	
13	,
14	
15	
16	,
17	-
18	-
19	
20	
21.1	- (
21.2) -
22.1	- (
22.2) -
23	
24	
25	-
26	-
27	

$$\left(\begin{matrix} \cdot \\ \cdot \end{matrix} \right) E_{\Phi} \quad (1)$$

$O_{\alpha}, B_{\alpha}, \Pi_{\beta}$

1. ()/ – . : , 2009. – 260 .
2. – . : , 2011. – 272 . /
3. / – : , 2011. – 256 .
4. // . – 2007. – 1. – . 50-52. /
5. / , . . . // . – 2003. – 12. – . 7-9.
6. / . . . // . – , 2005. – 33. – . 205-209.

17.01.2014

G. Bilovol

MODELING A SET OF COMMON STRUCTURES OF MEANS TO IMPROVE ENERGY EFFICIENCY OF PRODUCTION SYSTEMS

The article provides an algorithm to identify the structural model of a set of ways to improve energy efficiency of production systems. The expediency of forming a part of this set in the most general way is shown. The examples of measures used to improve energy efficiency of production systems are given.

Keywords: production system, energy efficiency, modeling, array, a set of ways.