CHEMICAL ENGINEERING TRANSACTIONS Volume 18, 2009
Editor Jiří Klemeš
 ISBN 978-88-95608-04-4 ISSN 1974-9791
DOI: 10.3303/CET0918156

Energy-saving technology performance and efficiency indexes

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For analysis of functioning operating CHP it is necessary to use productivity and efficiency characteristics. Productivity (effect) – characterises set of demanded end results of the phenomenon, process or a kind of activity, functioning of CHP of oil-gas-chemical complex (OGCC) enterprises or economy as a whole.

Efficiency is a generalising characteristic of economic growth quality. Economic growth is a growth of real output of the economy in time which is usually measured as increase or a real Total National product (GNP) or a real Total Internal product (GIP), or the income per capita. Efficiency quantity indicators are defined by a parity between productivity (effect) indicators and expenses or consumed resources.

It is accepted to distinguish a technological, economic and social production efficiency, which completely correspond to three basic groups of progressive indexes (or indicators) of sustainable development (organizational, economic, social and ecological indicators). At definition of technological and economic efficiency size as a result are production volume or volume of the national income, the profit received in manufacture, production technical and economic indicators (TEI).

Technological production efficiency is the characteristic of manufacture which in natural expression defines an optimum combination of production factors at some set level of release.

Economic efficiency of manufacturing is one of the characteristics defining at the given volume of output such optimum combination of manufacturing factors which minimises expenses.

Technological progressiveness – one of characteristics of effectiveness of the market which shows degree of developing and use by the companies of innovative and advanced products, innovative resource and energy saving production technologies and production distribution in supply chains of end production. Technological progressiveness at macroeconomic level influences on economic growth rate.

Technological efficiency coefficients (EC) of separate CHP elements or chemical-technological processes (CTP) are values of various efficiency, values of intensity and productivity of these CTP.

Please cite this article as: Meshalkin V., (2009), Energy-saving technology performance and efficiency indexes, Chemical Engineering Transactions, 18, 953-958 DOI: 10.3303/CET0918156

The major technological EC of resource and energy saving CHP and CHEP functioning is the resource and energy efficiency indicator, or resource and energy efficiency criterion, which is equal to specific production resource-intensity, i.e. to account norms on raw materials and fuel and energy resources (FER) on release of a production unit.

The concept of resource and energy efficiency is closely interconnected with concept of “environmental efficiency”, or “ecoefficiency”, of the industrial enterprises and any kinds of enterprise activity.

Ecoefficiency is the generalised characteristic of influence level on surrounding environment (SE) of industrial manufacturing and production, and also degree of rational use of natural resources in the OGCC.

Productivity and efficiency indicators based on results from European refineries and Russian oil refineries.

The concept of resource and energy efficiency is closely interconnected with concept of «environmental efficiency», or «ecoefficiency», of industrial enterprises and any kinds of enterprise activity. The major organizational-administrative tool of realisation of strategy for transition to a sustainable development is activity of the World Business Council for Sustainable Development (WBCSD) which aspires to develop the positive corporate approach to questions of business development taking into account problems of surrounding environment protection — «through business and in interests of business». In 1997 members of Council WBCSD had been published the important statement made on the basis of passing in WBCSD discussions, named «Environmental efficiency», or «Ecoefficiency».

Ecoefficiency is the generalised characteristic of influence level on surrounding environment (SE) of industrial productions and production, and also degree of rational use of natural resources at the enterprise. «Ecoefficiency» it is defined as the complex characteristic representing set of six basic private indicators: specific material consumption of production and services; specific energy consumption of production and services; specific volumes of toxic substances and a firm waste emissions; specific indicators of secondary processing of materials (secondary material resources), including, use of secondary energy resources; use degree of renewed resources; prolongation of life and increase of use intensity of ecologically safe end-products.

Performance of these complex ecoefficiency indicators will allow OGCC companies to achieve competitive advantages in the conditions of globalisation but only in the event that to them will not concern as to any addition to usual forms of business dealing. Ecoefficiency demands entering of radical changes into the theory and practice of the organisation of principal views of activity and company business processes.

All above-stated ecoefficiency indicators finally are directed on achievement of “a zero waste” on the enterprises and to the whole supply chain. «A zero waste» is one of complex ecoefficiency indicators. It is obvious, that maintenance of maximum ecoefficiency is possible at achievement at enterprise «zero of failures», «a zero of a waste» and «a zero of emissions» on the basis of use innovative resource and energy saving technologies, scientific principles of management and the organisation of manufacture, probability-statistical methods of strategy of general quality management «6 sigma», and also logistical strategy of "lean" production and the "lean" supply chain of end production, creation of special system of resource and energy efficient waste

managements. For resource and energy efficiency and ecoefficiency management of the enterprises it is necessary to use the concept of Total Quality Management (TQM).

By the end 1990s ecoefficiency indicators became one of their recognised key tools of increase of the company competitiveness in the conditions of globalisation. "Ecologically pure" resource and energy saving, or "green" manufactures and "green" supply chains are one of the major organizational-structurally-business maintenance factors of high indicators resource and energy efficiency and ecoefficiency, and as growth of competitiveness of OGCC company.

Now development of the Stockholm Convention is the European Union legislation on «registration, to an estimation and check (permission) of chemicals» («Registration, Evaluation and Authorization of Chemicals», the REACH-legislation). REACH-legislation which has taken effect since June, 2007, demands, that all chemicals made and sold in EU in number of more than 1 t/year, were registered by the European Chemical Agency in Helsinki. Registration assumes giving of the detailed files containing among other obligatory an estimation of chemicals danger.

Realisation of a sustainable development concepts and ecoefficiency indicators should provide the complex decision of following global problems of mankind: population growth; raw materials sources, FER and new kinds of fuel; food and potable water; an exhaustion of natural resources; global changes of a climate (global warming and acid rains, a smog); pollution of soil, water systems and air; restrictions of manufacture and consumption of harmful products. It is necessary to underline especially, that at practical realisation of concepts of a sustainable development and working out of OGCC enterprises with high ecoefficiency indicators it is necessary to use principles of "green", or «resource and energy saving, ecologically pure», chemistry.

At designing resource and energy efficient ecologically safe CHP and CHEP of OGCC enterprises it is necessary to use along with the considered principles of "green" chemistry as ways of resource and energy saving on OGCC manufactures. Next basic physical and chemical, technological and organizational-administrative ways and methods of resource and energy saving on manufactures and OGCC enterprises are allocated: 1) a way of the best use of CHP motive power ; a way of the fullest processing of raw materials; a way of rational use of fuel and energy resources (FER); 2) a way of the best functional-structural use of devices and machines; a way of organization of the closed water supply and high-quality clearing of drains; 3) a way of maintenance and increase of reliability of manufacture; a way of optimum spatial manufacture configuration; methods of automation and a computerisation of manufactures and the enterprises; Logistics methods of resource and energy saving in OGCC.

One of the major scientific and technical factors of resource and energy saving maintenance in OGCC is wide use of mathematical methods, personal computers, computer networks, hybrid expert systems, and also the various computer-aided systems (CAS) of technological processes (CASTP) and manufactures (CASM) which are hardware realised with application of modern micro-controllers, computers and special instrumentations. (Meshalkin et al 2006, Sarkisov 2001, Puigjaner et al 2000) For situational resource and energy saving management on OGCC manufactures and enterprises are used corporate information systems (CIS) of Enterprise Resource

Planning (ERP), Supply Chain Management (SCM), Customer Synchronized Resource Planning (CSRP), etc. The major component of program-informational supply of ACSTP, ACSM and CIS for the decision of increase problems of resource and energy saving indicators at OGCC enterprises are modern databases, including intellectual databases of parametres of balance, physical and chemical and thermodynamic properties of substances and their mixes (Butusov et al, 2003, Gridel and Alleny, 2004).

It is necessary to underline especially, that working out problems of resource and energy saving CHP and CHEP represent a special class of intellectual creative problems, which carry the name "not numerical (weak numerical, or not computing) problems" (NNP). NNP have not computing purposefully-semantic character. To specified NNP class of the chemical technology, arising at various stages of research and technical activity of huge number of experts of chemists-technologists and designers, following problems concern, in particular: definition (identification) of structure of molecules of chemical compounds on experimental data; planning of chemical synthesis of molecules of difficult substances; a choice of an optimum chemical way of demanded products manufacture; working out a new materials with the set properties, including catalysts; forecasting of reactionary ability and physical properties of new substances; structurally-parametrical synthesis of resource and energy saving CHP and CHEP; optimum configuration of the manufactures equipment; technical diagnostics and situational management of difficult CHP in the conditions of the uncertain information, etc.

Now in Russia and in a number of industrially developed states are developed hybrid expert systems (ES) of the automated synthesis (generation or working out) technological schemes resource and energy saving, highly reliable OGCC manufactures, and also hybrid ES of workings out of rational logistical decisions (Meshalkin et al 2002, Meshalkin 2004, Nevskij et al 2004)).

For search of optimum decisions of a maintenance problem of resource and energy saving in the chemical, oil refining, petrochemical and biochemical industry it is necessary to use, except methods of the theory of synthesis resource and energy saving CHP, also methods of applied economy, the management theory, the organisation theory, strategy and logistics methods.

Acknowledgement: the report is prepared at support of the trans-European teaching-methodical project of CD-JEP № 26045-2005 of program «TEMPUS».

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