

SUBSTANTIATION OF CONDITIONS OF EFFECTIVE INTEGRATION OF COGENERATION HEAT PUMP TECHNOLOGIES IN THE CONCEPT OF SUSTAINABLE DEVELOPMENT

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Анотація

Проведений аналіз особливостей оцінювання ефективності застосування енерго- та ресурсозбе-рігаючих, екологічно безпечних та економічно ефективних інноваційних технологій у концепціях зеле-ної логістики та сталого розвитку на прикладі когенераційних теплонасосних технологій на основі результатів наших досліджень. Представлено обґрунтування умов ефективної інтеграції когенера-ційних теплонасосних технологій у концепції сталого розвитку.

Ключові слова: ефективна інтеграція, когенераційно-теплонасосна технологія, сталий розвиток

Abstract

The analysis of peculiarities of estimation of efficiency of application of energy- and resource-saving, environmentally safe and cost-effective innovative technologies, in the concepts of green logistics and sustainable development, on example of cogeneration heat pump technology, based on our research results, was carried out. The substantiation of conditions of effective integration of cogeneration heat pump technologies in the concept of sustainable development was presented.

Key words: effective integration, cogeneration heat pump technology, sustainable development

Introduction

Aim of the research is analysis of peculiarities of estimation of efficiency of application of energy- and resource-saving, environmentally safe and cost-effective innovative technologies, in the concepts of green logistics and sustainable development, on example of cogeneration heat pump technology, on the basis of our research results; the substantiation of conditions of effective integration of cogeneration heat pump technologies in the concept of sustainable development.

In our investigation the peculiarities of estimation of efficiency of application of energy- and resource-saving, environmentally safe and cost-effective innovative technologies, in the concepts of green logistics and sustainable development, on example of cogeneration heat pump technology, were analysed, on the base of our results of researches [1 – 10].

Research results

In the research [1] the justification of the application of the methods of green logistics and sustainable development for the analysis of perspectives of application of innovative technologies is presented.

In our study [1] we suggested to perform the comprehensive assessment of efficiency of application of energy- and resource-saving, environmentally safe and cost-effective innovative technologies, in the concepts of green logistics and sustainable development, with application complex generalized dimensionless criterion of energy-ecological-economic efficiency of innovative technologies:

$$K_{INN}^{compl.} = \beta \cdot K_{RES} + \Delta E + \Delta EC + K_{REC}, \quad (1)$$

where β – is share of replacement the traditional technology by innovative technology;

K_{RES} – is dimensionless criterion of relative energy- and resource-saving efficiency of innovative technology, which used for the determination of energy- and resource-saving operation modes; this criterion may be applied on condition that $K_{RES} > 0$;

ΔE – is relative economic efficiency of innovative technology, which used for the determination of economically valid operation modes on condition that $\Delta E > 0$,

ΔEC – is relative ecologic efficiency of innovative technology, that enables to determine ecologically safe operation modes of innovative technology on condition that $\Delta EC > 0$;

K_{REC} – is dimensionless criterion of relative recycling (and/or utilization of the waste) efficiency of innovative technology, which used for the determination of recycling or waste utilization possibilities of innovative technology; this criterion may be applied on condition that $K_{REC} > 0$ [1].

According to such approach [1], it is determined that: energy- and resource-saving, economically substantiated, ecologically safe and recycling (and/or utilization of the waste) efficient innovative technologies will be provided on conditions of: $K_{INN}^{compl.} > 0$ and $K_{RES} > 0$ and $\Delta E > 0$ and $\Delta EC > 0$ and $K_{REC} > 0$.

The greater is the value of $K_{INN}^{compl.}$ index, the more energy efficient, ecologically safe, economically efficient and competitive innovative technology will be.

Application of the suggested approaches [1 – 10], aimed at determination of the areas of efficiency of application of energy- and resource-saving, environmentally safe and cost-effective innovative cogeneration heat pump technology will be demonstrated on the specific example. Fig. 1 (from [1]) shows the results of comprehensive assessment of efficiency of application of energy- and resource-saving, environmentally safe and cost-effective innovative cogeneration heat pump technology, in the concepts of green logistics and sustainable development.

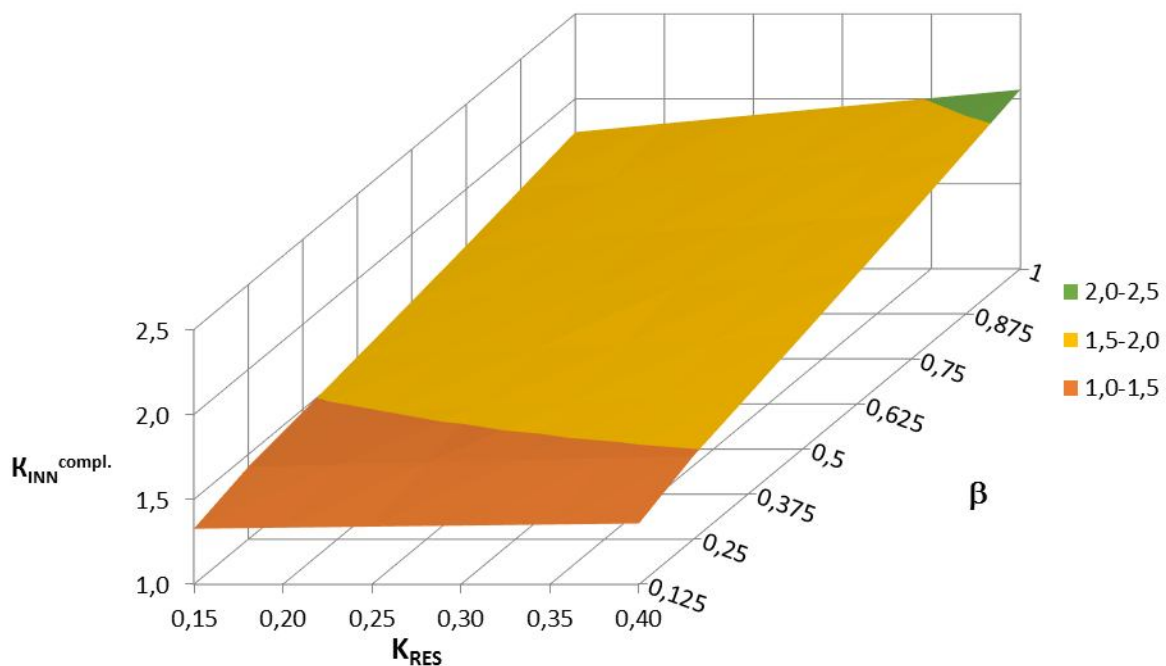


Fig. 1. Area of efficiency of application of innovative cogeneration heat pump technology of small power, using the heat of water recycling system (Source: author's research results from [1]).

Fig. 1 (from [1]) shows the area of efficiency of application of energy- and resource-saving, environmentally safe and cost-effective innovative cogeneration heat pump technology, using the heat of water recycling system with cogeneration heat pump installation of small power. This area in research [1] was determined by the complex generalized dimensionless criterion of energy-ecological-economic efficiency of innovative technologies from the formula (1). In our research [1] the values of complex generalized dimensionless criterion of energy-ecological-economic efficiency of innovative technologies from the formula (1) are deter-

mined on conditions of replacement share the traditional technology by innovative cogeneration heat pump technology, which change in the range of $\beta = 0,125 \dots 1,0$.

As it is seen from Fig. 1 [1], on conditions of $K_{INN}^{compl.} > 0$ and $K_{RES} > 0$ and $\Delta E > 0$ and $\Delta EC > 0$ and $K_{REC} > 0$, dependence, shown in Fig. 1, determine area of efficiency of application of energy- and resource-saving, environmentally safe and cost-effective innovative cogeneration heat pump technology, using the heat of water recycling system. On such conditions of effective integration, the cogeneration heat pump technology can be recommended as energy- and resource-saving, environmentally safe and cost-effective innovative technology.

Conclusions

In presented study, based on our research results [1 – 10], the analysis of peculiarities of estimation of efficiency of application of energy- and resource-saving, environmentally safe and cost-effective innovative technologies, in the concepts of green logistics and sustainable development, on example of cogeneration heat pump technology, was carried out. The substantiation of conditions of effective integration of cogeneration heat pump technologies in the concept of sustainable development was presented.

Research results from publications [1 – 10] allow to provide a reasonable definition of the conditions of effective integration of cogeneration heat pump technologies in the concept of sustainable development.

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