# INNOVATIVE IMPRESSIONABILITY AS A BASIS FOR STIMULATION OF AGENT'S BEHAVIOR REGARDING ENERGY SAVING

**Maryna Chorna, Kharkiv State University of Food Technology and Trade**
**Ganna Nord, Petro Mohyla Black Sea National University**
**Nina Avanesova, Kharkiv National University of Civil and Architecture**
**Oleksandra Stoian, Petro Mohyla Black Sea National University**

## ABSTRACT

*To build a staff incentive system regarding energy saving in a work, it is reasonable the use of the generalized index for staff incentive evaluation, what is like a total sectional integrated indexes of the appropriate mean of stimulation: material and social. The calculation of this index according to ten indexes allows finding the functional relations among the indexes. The use of the integrated index permits to evaluate effectively the incentive measures, which have a direct impact on the increasing of innovative impressionability as the basis for the active economic behavior of agents.*

**Keywords**: Innovative Impressionability, Staff Incentive, Integrated Index, Matrix of the Incentive Tools**.**

**JEL Classifications:** M5, Q2.

## INTRODUCTION

Modernization and innovative development of the methodological platform for the formation of the energy complex management system is quite a difficult process, during which it is constantly necessary to overcome the barriers of resistance. The communication barriers are connected ultimately with the problem of motivation formation of the active behavior of the energy system's end consumer. It is necessary to create a customer information system, a system for education of the customer with the newest values of energy saving, for reduction of the destructive behavior relative position of the relevant power equipment directly from the houses and etc. The stimulation of a consumer increases opportunities for consumption of the energy-saving technologies, promotes the formation of a positive image of innovative energy-saving technologies, opportunities for optimization of energy management, increasing of availability of network for distribution of generation equipment.

The significant role for the innovation development in the energy complex plays the formed human's life suggestions, behavioral models, which either promote diffusion of innovations or prevent. The impressionability or irresponsiveness of the civil society to the innovations in the sphere of energy saving at a modern stage of social development is determined mainly by social factors (among which the low level of life quality of a significant part of population does not contribute to the development of innovations) (Tetiana et al., 2018a: 2018b; Nakashydze & Gil'orme, 2015).

Various influences of the state on the formation of active behavior of energy saving agents

are distinguished in countries depending on the intervention or non-intervention of the state. Thus, the works (Ntanos et al., 2018a: 2018b: 2018c; Papageorgiou et al., 2015) study the influence of the European Union's policy on the economic behavior of alternative energy sources suppliers as a factor of economic growth of the country. The world's leader in using alternative energy sources in China has somewhat different mechanisms for studying the behavioral change of consumers of alternative types of energy sources. It is the use of Smart Technology that affects the innovative responsiveness of consumers (Zhou et al., 2016; Guo et al., 2016; Zhu & Ruth, 2015; Antoniucci et al., 2015; Xie, 2015).

## MATERIALS AND METHODS

The possibilities of application of the apparatus of economic and mathematical modeling, balanced indicators, and other methods for investigation for analysis of staff incentive with economic indicators are considered in the works of foreign scientists: Mathis & Personnel (1991), Torrington & Hall (2000), Tuyen (2010). Mathis & Personnel (1991), who offer to estimate the staff incentive with the system of balanced indicators, what includes 17 indicators of the material and social stimulation factors. Thagard (2010) developed, on the basis of the cognitive modeling, a cognitive model for agents coordination with energy saving, which consist of focusing on the specific conditions for situation development in the subject area.

The development of an analytical model of energy system is based on the heuristic identification parameters of the cognitive area, in which the modern conscious energy saving consumers closely cooperate.

The model development of the social behavior of economic agents is studied by Kalmykov (2015). The improved model of the agent’s social behavior is a base for the study of the information distribution processes regarding the social and economic problems, which arise in the society, when there exist the problems of energy dependence of business entities from the external traditional energy sources.

The basis for the methodological platform of our study is a calculation of the integrated index for estimation of the staff incentive regarding energy saving, which is based on the methods of applied statistics.

In particular, the work (Tetiana, 2018c) describes the calculation of the integral indicator of staff incentives taking into account three groups of factors: material, organizational and psychological. But in our study, for the first time, a system for evaluating the material incentives for energy saving of the personnel of the enterprise was developed and calculated on the basis of the economic-mathematical modeling of the integral indicator.

## RESULTS AND DISCUSSIONS

From the way in which the individuals perceive a certain innovation, it will largely depend on a speed (and sometimes the possibility itself) of transmission of all new. One of the important characteristics, which conduce to success of innovations, is an innovative perceptivity: openness to a new experience, critical thinking and the capacity to overcome stereotypes.

The main hypothesis of this study is that the innovative perceptivity as a special personality characteristic permits to clear the barriers of the energy complex modernization. The innovation phenomenology as a new, non-traditional situation of any human activity, ultimately in the professional sphere, leads to the changes and requires a person to change the usual actions. One of important characteristics of innovative person is a reasonable self-esteem. It is generally said, that self-esteem is a sole definition, however a lot of authors emphasize in it different

components: except situational also a global, individual and social, and also it is distinguished a situational and constantly lowered self-esteem. The other necessary characteristics for innovative activities, in our opinion, are: the readiness to activation of exploratory behavior in response to the stimulus novelty, the inherited aiming for depression or complete cessation of the leading activity and insistence. The individuals with the low novelty search don't want the changes of violations in the unhurried routine course of their lives and in every way they resist it.

The existence of a large number of factors influencing the economic behavior of the personnel on energy saving requires the separation of groups of factors of stimulating and disruptive nature. Thus (Bell et al., 2016) in order to form the innovative behavior of consumers regarding the need to use alternative sources of energy, it is required from the teenage age to form personal values of a social nature. Dolan & Metcalfe (2015) conducted a social experiment on the formation of collective behavior of neighboring consumers using solar energy technology and prevention of destructive conflicts. Suslov (2014) considered the influence of the institutional environment on the formation of population mentality on the need for energy conservation. There are also specific incentives to encourage employee behavior. Asensio & Delmas (2015) considered ways to influence behavior using social networks and other Internet tools.

People with the high *"loss prevention"*, as a rule, borrow a trouble a lot and they retard their activity with the overstated, and often groundless, anxieties even with the usual circumstances, they avoid new impressions because of the risk of the physical and psychological damage, they have a maladaptation to the changes and innovations.

The owners and top-management, in general, are not interested in the changes of processes and technologies of well-functioning energy system.

The absence of motivation system for the expenses increasing to the study and development with the total expenses of the energy companies leads to the industry's retardation. The enterprise's staff as an "*alfa-stakeholder"* of the energy saving system is an active agent, which must have an appropriate level of innovative perceptivity.

Estimation of a staff incentive of the energy-consuming enterprises can be carried out with different methods, but namely the calculation of integrated index allows taking into account the experience of experts-specialists with different competences.

Let's consider the stage of normalization of groups of promotional tools for energy saving.

The matrix of material incentive tools regarding energy saving in the formalized form (Mater):

$$Mater = \begin{pmatrix} corr(m1,m1)\ corr(m1,m2)\ corr(m1,m3)\ \ corr(m1,m4)\ corr(m1,m5) \\ corr(m2,m1)\ corr(m2,m2)\ corr(m2,m3)\ corr(m2,m4)\ corr(m2,m5) \\ corr(m3,m1)\ corr(m3,m2)\ corr(m3,m3)\ corr(m3,m4)\ corr(m3,m5) \\ corr(m4,m1)\ corr(m4,m2)\ corr(m4,m3)\ corr(m4,m4)\ corr(m4,m5) \\ corr(m5,m1),\ corr(m5,m2)\ corr(m5,m3)\ corr(m5,m4)\ corr(m5,m5) \end{pmatrix} (1)$$

Where,

m1-share of the amount of bonus payments for presented ideas, rationalization proposals, new decisions regarding energy saving to the total amount of bonus payments at the enterprise.

m2-share of the average salary of the staff, which is engaged in innovations related to energy saving at the enterprise, to the total amount of salary fund.

m3-share of the amount of bonus payments for energy-efficiency measures (saving of light, fuel etc.) to the total amount of bonus payments at the enterprise.

m4-share of the social development fund in the total expenses for the staff.

m5-a share of compensation expenses with the use of power-saving features in the total share of compensation expenses for the staff.

Matrix computation of the material incentive tools for the staff regarding energy saving (Mater) will be realized with the system "*Data Analysis"* MS Excel (Table 1).

**Table 1**
**NORMALIZED MATRIX OF MATERIAL INCENTIVE TOOLS FOR THE STAFF REGARDING ENERGY SAVING**

| | **m1** | **m2** | **m3** | **m4** | **m5** |
|---|---|---|---|---|---|
| **m1** | 1 | -0.213 | -0.089 | 0.557 | 0.142 |
| **m2** | -0.213 | 1 | -0.508 | 0.497 | 0.918 |
| **m3** | -0.089 | -0.508 | 1 | -0.762 | -0.673 |
| **m4** | 0.557 | 0.497 | -0.762 | 1 | 0.796 |
| **m5** | 0.142 | 0.918 | -0.673 | 0.796 | 1 |

In calculations, statistical reports of energy companies were used according to the electronic resource (https://smida.gov.ua). This resource reflects the reporting of more than 100 energy companies which allows the formation of a relevant data set to determine the integral indicator of personnel incentives for energy conservation.

According to the findings of matrix computation of material incentive tools it can be concluded: the most direct functional connection exists among indexes "*A share of the average salary of the staff, which is engaged in the innovations related to the energy saving at the enterprise to the total amount of salary fund*" (m2) and "*A share of compensation expenses with the use of power-saving features in the total share of compensation expenses for the staff*" (m5), the most inverse functional connection is among the indexes "*A share of the amount of bonus payments for energy-efficiency measures (saving of light, fuel etc.) to the total amount of bonus payments at the enterprise*" (m3) and "*A share of the average salary to the staff, which is engaged in the innovations related to the energy saving at the enterprise to the total amount of salary fund*" (m2).

The matrix of social incentive tools regarding energy saving of the staff in the formalized form (Social):

$$\text{Social} = \begin{pmatrix} corr(m6,m6)\ corr(m6,m7)\ corr(m6,m8)\ \ corr(m6,m9)\ corr(m6,m10) \\ corr(m7,m6)\ corr(m7,m7)\ corr(m7,m8)\ corr(m7,m9)\ corr(m7,m10) \\ corr(m8,m6)\ corr(m8,m7)\ corr(m8,m8)\ corr(m8,m9)\ corr(m8,m10) \\ corr(m9,m6)\ corr(m9,m7)\ corr(m9,m8)\ corr(m9,m9)\ corr(m9,m10) \\ corr(m10,m6)\ corr(m10,m7)\ corr(m10,m8)\ corr(m10,m9)\ corr(m10,m10) \end{pmatrix} \quad (2)$$

Where,

m6-share of expenses for performance of trainings, seminars regarding explanation of the necessity of activities on energy efficiency in general staff development expenses.

m7-share of expenses for increasing of qualification regarding the work on new energy-efficient equipment in the total expenses for staff development.

m8-share of expenses for conduction of activities among the personalia's family regarding the necessity to save energy in the total social expenses.

m9-share of expenses for conduction of activities among the personalia's family regarding the necessity to save energy in the total social expenses.

m10-share of top management that takes place regarding an active behavior regarding energy saving in the total share of top management.

Matrix computation of the social incentive tools (Social) will be realized with the system "*Data Analysis*" MS Excel (Table 2).

According to the findings of matrix computation of social incentive it can be concluded: the most direct functional connection exists among the indexes "*A share of expenses for performance of trainings, seminars regarding explanation of the necessity of activities on energy efficiency in general staff development expenses*" (m6) and "*A share of expenses for conduction of activities among the personalia's family regarding the necessity to save energy in the total social expenses*" (m9), the most inverse functional connection is among the indexes "*A share of expenses for increasing of qualification regarding the work on a new energy-efficient equipment in the total expenses for staff development*" (m7) and "*the share of top management, that takes place regarding an active behavior regarding energy saving in the total share of top management*" (m10).

**Table 2**
**NORMALIZED MATRIX OF MATERIAL INCENTIVE TOOLS FOR THE STAFF REGARDING ENERGY SAVING OF THE SOCIAL STAFF INCENTIVE REGARDING ENERGY SAVING**

| | **m6** | **m7** | **m8** | **m9** | **m10** |
|---|---|---|---|---|---|
| **m6** | 1 | 0.896 | 0.513 | 0.903 | -0.282 |
| **m7** | 0.896 | 1 | 0.390 | 0.657 | -0.596 |
| **m8** | 0.513 | 0.390 | 1 | 0.736 | 0.402 |
| **m9** | 0.903 | 0.657 | 0.736 | 1 | 0.145 |
| **m10** | -0.282 | -0.596 | 0.402 | 0.145 | 1 |

There were identified the relations between the staff incentive indexes regarding incitement allow to determinate directions of the staff development financing in the context of innovative perceptivity, active behavior of the consumer of the renewable energy sources. Herewith, the sectional interests of the agent of different levels of staff arise: managers, professionals, workers. Within the frame of the energy saving concept as a paradigm of the new information society, the development of a methodological platform for the study of the mechanism of adoption of energy-efficient technologies lies the consideration of the "*sectional interests*" of agents, who are engaged in the generation, transportation, energy consumption, who organize the legal, economic, social and other control for improving of the categorical apparatus of economic processes consideration of Pyster (2012).

## CONCLUSIONS

While analyzing and estimating of the sectional interests during adoption of energy-efficient technologies, the attention should be paid to such problems as the identification of the functions of the social and economic groups' interests' expression. Herewith the preconditions

for formation of needs and requirements of the individual people's unions are created. That is to say, that the up-to-date thing is detection of such functions of interacting groups, as the demonstration of interests, integrations, adaptations and other. The detection of such functions is necessary for elimination of destructive role in the demonstration of the sectional interests and decreasing of influence of one-sided advantage of only, for example, the corporate interests of energy generating companies, especially those, which form a direction for implementation of the energy-efficient technologies.

The innovative perceptivity of economic agents allows grading this destructive behavior, conflict management.

The developed evaluation model of the staff incentive regarding energy saving is used in formation of the communication support of the projects of innovative complex systems of energy saving and climatisation with the use of solar emission energy, heat pump, warmth of soil and air (including ventilating).

Prospects for further research are the construction of a strategic matrix of development and training of personnel in order to enhance innovative behavior in energy conservation, definition of methods and means of training (trainings, forums, etc.). Also, using the calculation of the integral indicator of stimulation, it is required to make changes in the compensation social package of energy distribution companies. Compensation packages vary considerably depends on the category of company's staff. Thus, the social package for top managers can be in two forms: fixed and variable. The fixed social package does not take into account the effective activity of the enterprise, its size depends on such factors as the scale of the enterprise, the risk of the manager in problematic territorial zones (the existence of discrimination, military conflict, terrorism, etc.), the traditions of transnational companies, the prospects for enterprise development. The variable part of the compensation package is the main material incentive for the actions of the top manager in the interests of the company for the purpose of energy saving. For example, owners employ a manager in the field of energy saving, who should, based on socio-professional competencies, build and implement a strategy to reduce energy costs. It should be noted that the existence of a social (compensation) package for senior management of the company is an integral part of the state of business transparency for stakeholders, especially business investors: existing and potential.

## REFERENCES

Antoniucci, V., D'Alpaos, C., & Marella, G. (2015). Energy saving in tall buildings: From urban planning regulation to smart grid building solutions. *International Journal for Housing Science & Its Applications, 39*(2).

Asensio, O. I., & Delmas, M. A. (2015). Nonprice incentives and energy conservation. *Proceedings of the National Academy of Sciences, 112*(6).

Bell, B. T., Toth, N., Little, L., & Smith, M. A. (2016). Planning to save the planet: Using an online intervention based on implementation intentions to change adolescent self-reported energy-saving behavior. *Environment and behavior, 48*(8), 1049-1072.

Dolan, P., & Metcalfe, R. (2015). Neighbors, knowledge, and nuggets: two natural field experiments on the role of incentives on energy conservation.

Guo, F., Kurdgelashvili, L., Bengtsson, M., & Akenji, L. (2016). Analysis of achievable residential energy-saving potential and its implications for effective policy interventions: A study of Xiamen city in southern China. *Renewable and Sustainable Energy Reviews, 62*, 507-520.

Hilorme, T., Chorna, M., Karpenko, L., Milyavskiy, M., & Drobyazko, S. (2018). Innovative model of enterprises personnel incentives evaluation. *Academy of Strategic Management Journal, 17*(3).

Hilorme, T., Nazarenko, I., Okulicz-Kozaryn, W., Getman, O., & Drobyazko, S. (2018). Innovative model of economic behavior of agents in the sphere of energy conservation. *Academy of Entrepreneurship Journal, 24*(3), 1-7.

Kalmykov, L. V., & Kalmykov, V. L. (2015). A solution to the biodiversity paradox by logical deterministic cellular automata. *Acta Biotheoretica*, *63*(2), 203-221.

Mathis, L., & Personnel, R. (1991). *Human resource management* .West Publishing Company, 45.

Nakashydze, L., & Gil'orme, T. (2015). Energy security assessment when introducing renewable energy technologies. *Eastern-European Journal of Enterprise Technologies*, *4/8* (76), 54-59.

Ntanos, S., Kyriakopoulos, G., Chalikias, M., Arabatzis, G. & Skordoulis, M. (2018c). Public Perceptions and Willingness to Pay for Renewable Energy: A Case Study from Greece. *Sustainability*, *10*(3), 687.

Ntanos, S., Kyriakopoulos, G., Chalikias, M., Arabatzis, G., Skordoulis, M., Galatsidas, S. & Drosos, D. (2018b). Social assessment of renewable energy sources usage and contribution to life quality: The case of an Attica urban area in Greece. *Sustainability*,*10*(5), 1414.

Ntanos, S., Skordoulis, M., Kyriakopoulos, G., Arabatzis, G., Chalikias, M., Galatsidas, S., Batzaios, A., & Katsarou, A. (2018). Renewable energy and economic growth: Evidence from European countries. *Sustainability*, *10*(8): 2626.

Papageorgiou, A., Skordoulis, M., Trichias, C., Georgakellos, D., & Koniordos, M. (2015, September). Emissions trading scheme: Evidence from the European Union countries. In *Communications in Computer and Information Science*, Proceedings of Creativity in Intelligent Technologies & Data Science Conference (222-233).

Pyster, A., Olwell, D., Hutchison, N., Enck, S., Anthony, J., Henry, D., & Squires, A. (2012). Guide to the systems engineering body of knowledge. Hoboken, NJ (Eds), *The Trustees of the Stevens Institute of Technology*.

Suslov, N. I. (2014). Energy saving incentives and institutional environment: a cross country analysis, (Part 1). *The World of Economics and Management*, *14*(2).

Tetiana, H., Karpenko, L., Fedoruk, O., Shevchenko, I., & Drobyazko, S. (2018). Innovative methods of performance evaluation of energy efficiency project. *Academy of strategic management journal*, *17*(2), 112-110.

Thagard, P. (2010). *The brain and the meaning of life*. Princeton: University Press.

Torrington, D., & Hall, L. (2000). *Human resource management*. Pearson Education.

Tuyen, T. N. (2010). *Knowledge economy and sustainable economic development: A critical review*. Log Access Mode. Retrieved from http://www.e-cademic. de/data/ebooks/extracts/9783598251818.pdf.

Xie, G. (2015). Modeling decision processes of a green supply chain with regulation on energy saving level. *Computers & Operations Research*, *54*, 266-273.

Zhou, B., Li, W., Chan, K. W., Cao, Y., Kuang, Y., Liu, X., & Wang, X. (2016). Smart home energy management systems: Concept, configurations, and scheduling strategies. *Renewable and Sustainable Energy Reviews*, *61*, 30-40.

Zhu, J., & Ruth, M. (2015). Relocation or reallocation: Impacts of differentiated energy saving regulation on manufacturing industries in China. *Ecological Economics*, *110*, 119-133.