

“Green” standards will ensure safe living environment

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Abstract. The paper introduces the concept of “green” standardization of living environment technologies and “green” innovative products to shape the most likely transition to a new nature-like technological paradigm, which will replace the existing energy-consuming equipment and technology paradigm leading to global ecological collapse in the future. “Green” standardization of the future is necessary to assess compliance and to examine safety and nature-likeness of the newest technologies being developed from among promising breakthrough technologies and to assess compliance of “innovative” products with the requirements of biopositivity, comfort and safety.

1 Problem statement

Modern technologies require a huge amount of energy, which theoretically cannot be generated by the existing alternative energy industry (wind, tidal, solar power engineering, etc.). The science, which makes it possible to create fundamentally new technologies of power generation and consumption similar to living nature already today – nature-like technologies and “living” systems – will help us to break the deadlock. The point of nature-like living environment creation is to restore natural self-consistent resource turnover disturbed by today’s nature decontextualized technologies. The tool for creating “green” living environment is convergent nano, bio, information, cognitive and socio-humanistic technologies integrated into the “green” living environment technologies [1], [2], [3].

Modern of production technologies is updated every 5-7 years on the average. Of course, it is not possible to foresee what future technologies will be or to train professionals in advance to handle them. Therefore, professional should be open minded and capable of quickly distinguishing the information among the new data streams which is directly related to breakthrough critical technologies [4], [5], [6], [7], to new beginnings of coming “green” technological paradigm. This is the reason of a worldwide trend when practitioners of all ranks - managers, financiers, engineers, technologists, teachers and others – strive for science, scientific research.

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2 Conceptual goal and research objectives

Nowadays, the main challenge for humanity is connected with energy consumption and consequently with depletion and complete extermination of all basic resources for people living by modern consumption standards. The world will have to switch to “green” technologies of a new technological paradigm. Advanced countries are gradually moving to natural-like existence without the use of hydrocarbon resources, without sufficient fresh water resources and without other exhaustible resources of the planet.

The strategic goal of “green” standardization is to include “green” technologies in the natural resource turnover based on development of “green” technologies standards for living environment and “green” innovative products.

At atomic level, biotechnologies eliminate the distinction between living and non-living things, between organic natural objects and technical objects. New nanotechnology-based materials and systems are already used in medicine, power engineering, environmental construction, transport and almost everywhere. The next stage is restoration of living nature systems and processes in the form of a synthetic cell, mass creation of artificial materials and components, both for living organisms and for technical objects. Already now additive technologies allow to create both bioorganic living objects and systems as well as bio-like materials and technical objects that use natural principle in their customized forming and growing following computer models [4], [5], [6], [7].

Humanity has moved up to a completely new post industrial era in its development. There is an abundance of food, goods and services, which has caused intense competition in the entire global economy. “Tectonic” shifts and deformations in scientific, educational, political, economical, social, cultural and other spheres have therefore begun in the world within a short space of time. Instability, dynamic political, economical, social, legal, technological and other situations have become the signs of new era. Everything in the world has started changing continuously and rapidly. Advanced standardization marked as “green” must consequently be constantly rebuilt to meet new conditions. Innovation and “green” standardization become attributes of the time.

Today’s global crisis cannot be solved with the use of past fundamental technological patterns of our civilization in its current development paradigm. We need a quantum leap, transition to other principles, first of all, in energy production and consumption, which will change the global living environment appearance [3], [8].

The concepts of nature-like living environment technologies and bio-positive innovative products has originated in the nineties [1], which personify technologies that are in harmony with nature rather than damage it, allowing to restore the balance between the biosphere and technosphere disturbed by humans [3].

The concept of “green” standards, which has appeared at the intersection of three concepts: “Greenpeace”, nature-like living environment technologies and bio-positive innovative products, can be insulcated in CALS-technology paradigm. Such a paradigm inculcation makes it possible to change the global appearance of living environment and to make a quantum leap in living environment technologies to other principles, primarily in terms of production and energy consumption [9], [10], [11].

The concept essence is that “green” living environment can meet criterion of safe equilibrium in natural and technological balance at a given time interval. This criterion is achieved through constructive and technological correspondence of ecological safety and ergonomics of “green” products at a certain stage of development, organizational and technological forms of “green”, i.e. nature-like, construction operations [12], [13], [14], [15].

3 Results and discussion

3.1 Terms and definitions of “Green” standardization

“Green” living environment (or “green” habitat) - a set of habitat objects and factors providing safe and favorable conditions for human life, as well as preservation and restoration of natural environment, rational use and restoration of natural resources, prevention of negative impact of economic and other activities on the environment and elimination of its consequences.

Note - the “green” living environment objects include buildings, structures, facilities and adjacent territory.

The “green” living environment factors include rational and planned zoning, design solutions, utilities and equipment of buildings, structures, facilities and premises.

“Green” innovative products - the products with new or significantly improved properties combining useful effect of their functional purpose with safe and favorable conditions for human life, as well as preservation and restoration of natural environment, rational use and restoration of natural resources, prevention of negative impact of economic and other activities on the environment and elimination of its consequences throughout its life cycle.

“Green” standard - a standardization document that establishes requirements, norms and rules for “green” living environment, “green” innovation products, “green” technologies approved in the established manner.

Set of “green” standards - a set of standardization documents that establish agreed requirements, norms and rules for interrelated standardization objects of “green” living environment and “green” innovative products and promote introduction of new import-substituting environmentally oriented materials and technologies.

“Green” building - building of real estate assets minimizing their negative impact on the environment, improving quality of environmental performance for real estate asset users, improving living standards, improving energy efficiency of the assets, reducing resources consumption and harmful emissions.

Designing assets in compliance with green building standard principles (Green Standards, LEED, BREEAM, DGNB, etc.) or in accordance with Customer’s goal, for example, only improving energy efficiency, environmental friendliness of an asset with no reference to certification systems, within certain budget.

“Green” technology - a set of methods, tools and knowledge used to make products and render services providing safe and favorable conditions for human life, as well as preservation and restoration of natural environment, rational use and restoration of natural resources, prevention of negative impact of economic and other activities on the environment and elimination of its consequences.

“Green” living environment technologies - a set of methods, tools and knowledge used in building and operation of structures and facilities providing safe and favorable conditions for human life, as well as preservation and restoration of natural environment, rational use and restoration of natural resources, prevention of negative impact of economic and other activities on the environment and elimination of its consequences.

“Green” products - the products combining useful effect of their functional purpose with safe and favorable conditions for human life, as well as preservation and restoration of natural environment, rational use and restoration of natural resources, prevention of negative impact of economic and other activities on the environment and elimination of its consequences throughout its life cycle.

3.2 Classification of “green” living environment technologies

“Green” living environment technologies are classified using hierarchical and faceted methods.

In terms of economy sectors, “green” living environment technologies are divided into:

- primary economy sector technologies (agricultural and fishing sector, natural raw materials extraction);
- secondary economy sector technologies (processing industry, construction, housing and public utilities);
- tertiary economy sector technologies (service industry, including information technologies).

“Green” living environment technologies are divided by type of process, where technology is applied, into the following types: unit process technology; standard process technology and group process technology.

Green living environment technologies are classified into the following categories:

- zero waste living environment technologies (total technological waste of all processes making up this technology is up to 1.5 %);
- low waste living environment technologies (total technological waste of all processes making up this technology ranges from 1.5 to 10 %).

Living environment technologies are classified by energy efficiency in accordance with energy efficiency factors defined in international and/or national standards, regulatory legal documents and other documents.

One or several factors characterizing energy efficiency of the living environment technology are determined from the list: heat capacity utilization; annual (monthly, daily, etc.) energy consumption and absolute or specific energy loss values (of energy carrier) in energy transfer system.

This list of factors is not exhaustive and, if necessary, other factors characterizing its energy efficiency can be determined for a specific living environment technology.

Living environment technologies are classified by characteristics of cost-effective use of resources in construction: resource content and resource intensity (material intensity and energy intensity).

This list of factors is not exhaustive and, if necessary, other factors characterizing its resource intensity can be determined for a specific living environment technology.

Living environment technologies are classified by degree of its ecological safety using the following classification criteria: by type of pollution and by territorial and geographical characteristic of living environment (specially protected area, city, village, etc.).

In terms of pollution, living environment technologies are classified depending on whether they introduce one (or several) types of pollution or not: mechanical; chemical (including greenhouse gases); biological (including microbiological pollution); physical (physical fields) (including thermal, light, noise, electromagnetic, radioactive pollution) and visual.

In terms of pollution, living environment technologies are classified depending on whether they pollute one (or several) geospheres or not: hydrosphere (including global ocean, continental surface waters and groundwater); lithosphere (land, subsoil, soil) and atmosphere (ozone layer, near-Earth space).

Living environment technologies are classified by their purpose depending on their characteristics aimed at preventing certain negative environmental impacts.

In terms of purpose, living environment technologies are classified by areas of the following environmental impacts: resource-saving (energy saving , material saving); environmental protection; reduction of harmful emissions; human health and safety and reduction of carbon footprint.

3.3 Criteria of classification as “green” living environment technologies

There are determined criteria for living environment technologies to be classified as “green”. Each criterion is determined by a set of characteristics, which, in turn, are characterized by a set of parameters. A criterion can also be directly characterized by a certain parameter.

When classifying living environment technologies as “green”, an expert method, which evaluates one of the parameters that most accurately represents a characteristic and/or criterion, is used. Such parameter is called a representative parameter. Parameter values that allow to classify living environment technology as “green” are established in “green” standards for living environment technology.

There are determined criteria for “green” living environment technologies to be classified as “green”. Each criterion is determined by a set of factors defined with a set of characteristics and parameters. A criterion can also be directly characterized by a certain parameter.

Living environment technology is classified as “green” through evaluation of one of a set of factors that most accurately represents characteristic and/or criterion of living environment technology. Such factor is called a representative factor. More than one representative factor can be established for criteria and/or characteristics of living environment technologies.

The list of living environment technologies factors, including representative ones, used as basis for classification of living environment technology as “green”, is established in “green” standards for living environment technologies.

The living environment technologies can be unconditionally classified as “green” ones. When classifying living environment technology as a “green” one, the following criteria are considered: nature-likeness; bio-positivity; comfort and safety.

Living environment technology is classified as a “green” one if the values of all the below criteria are unexceptionally equal to one:

N - value of the “Nature-likeness” criterion, equal to 0 or 1;

B_p - value of the “Bio-positivity” criterion, equal to 0 or 1;

C - value of the “Comfort” criterion, equal to 0 or 1;

S - value of the “Safety” criterion, equal to 0 or 1;

T - value of the living environment technology integral criterion obtained by multiplying all the above criteria.

If the T integral criterion value for living environment is equal to 1, then such living environment technology is classified as a “green” one.

Each of the criteria is characterized by a set of factors with singling out one representative factor among them.

If living environment technology is similar to a natural process and is characterized by at least one of the listed factors, then the value 1 is assigned to the “Nature-likeness” criterion, if not applicable - 0.

If living environment technology is similar to a natural process and is characterized by at least one of the listed factors, then the value 1 is assigned to the “Biopositivity” criterion, if not applicable - 0.

If living environment technology is similar to a natural process and is characterized by at least one of the listed factors, then the value 1 is assigned to the “Comfort” criterion, if not applicable - 0.

If living environment technology is similar to a natural process and is characterized by at least one of the listed factors, then the value 1 is assigned to the “Safety” criterion, if not applicable - 0.

3.4 Compliance assessment according to green standard requirements

The groups of indicators enabling to assess compliance of living environment technology with “green” standards are unified in eleven categories: Living environment management; Living environment comfort; Living environment energy efficiency; Living environment transport; Living environment water; Living environment air; Living environment materials; Living environment waste; Living environment land use; Living environment safety and Living environment innovations.

“Green” living environment technologies and “green” innovative products. Terms and definitions”:

- urban planning activities – development of territories, including cities and other settlements through spatial planning, urban development zoning, land planning, architectural and civil engineering, construction, overhaul, restoration of capital construction project, operation of buildings, structures;

- sustainable territory development – ensuring safety and favorable conditions for human life during urban planning, limiting negative impact of economic and other activities on the environment as well as protection and rational use of natural resources for present and future generations;

- environment quality – state of the environment characterized by physical, chemical, biological and other factors and/or set of them;

- favorable environment – environment which quality ensures sustainable functioning of natural ecological systems, natural and man-made objects;

- negative environmental impact – impact of economic and other activities, which leads to negative changes in environment quality;

- best available technology – technology for production of articles (goods), performance of work, rendering of services determined on the basis of modern scientific and technological achievements and the best combination of criteria for achieving environmental protection objectives, provided that it is technically possible to use it.

Newly developed living environment technologies and innovative products must necessarily be assessed for compliance with “green” standards. Compliance assessment methodology is under development.

“Green” nature-like living environment technologies and “green” innovative products give humanity a tempting chance to avoid resource collapse, but at the same time, they reveal fundamentally new global threats and challenges. These threats are related to the essence of nature-like technologies built on the possibility of wildlife systems and processes reproduction. This opportunity opens a prospect of targeted intervention in natural object vital functions, first of all those of human and, for the first time in history, in human evolution process.

In terms of the technological base and methods used, such intervention can be divided into two most important types: biogenetic type based on the use of nanobiotechnology methods and cognitive type based on the convergence of infocognitive and socio-humanistic sciences.

4 Conclusions and recommendations

New “green” living environment technologies concern not only material, but milestone production as well. “Green” living environment technologies become a leading form of activities along with “green” projects and “green” programs. Specifics of modern “green” living environment technologies lie in the fact that no theory, no profession can cover the entire process cycle of living environment or at least one production operation. Complex arrangement of large “green” living environment technologies leads to the fact that former

professions cover only one or two steps of large process cycles. To have successful work and career, it is important for a builder of the future to be not only a professional, but also be capable of recognizing “green” signs of the future, to actively and competently join the new “green” process cycles of future living environment formation.

At present, military colonization has been replaced with technological subjugation – leadership is ensured with direct support of military force, rather than with the help of it. Only thanks to achievements of Russian science in priority breakthrough “green” areas, Russia will be able to defend its independence, security and sovereignty. While having an umbrella of nuclear, missile and space shields, Russia must create a new “green” scientific and industrial landscape on its territory, and “green” economy throughout the post-Soviet space on the whole. With the help of scientific achievements, we should break through in the new area of “green” living environment technologies and “green” innovative products in a short space of time to make cities and settlements of the country attractive and competitive in terms of living standards.

City planners and architects needed “green” standards and new “green” style of thinking to competently arrange “green” projects and to implement new “green” technologies, “green” innovative models. “Green” style of thinking necessarily includes dialectic, systematic, logical, open minded approach to environmental problems and possible consequences of their solution. To study living environment, we needed scientific effort-based “green” standardization skills, first of all – ability to quickly respond to growing information flow. We needed skills to create “green” scientific hypotheses and pragmatic innovative “green” models of new environmentally oriented systems – economic, industrial, technological, educational and other systems.

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