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Microturbines application for touristy economic units

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Abstract. The article discloses touristy economic units' business modern technological innovation adaptation possible ways. Microturbines have advantages in compare with the usual gas piston devices (compression ignition engine): high efficiency factor, full light acoustic isolation, small size. Undeniable advantage of using them is their work with substandard gas, which touristy economic units can produce even from their garbage. Microturbine has maximum capacity of 12 kW. Modern microturbines have a reservoir for about 100000 hours, that means ten years, and with regular turbine catering once a year. Besides, it should be noted that vertical wind turbines and microturbines could be produced on 70 percent under additive technology with a 3D printer.

1. Introduction

It is up-to-date point of economy to find the alternative sources of energy for budget-forming economic entities. For the Southern Federal District one of these entities are resort and spa sector touristy sector economic units. The research's aim is to substantiate a technological innovation using possible way for touristy economic units' business sustainable ecological and economic development achievement.

2. Materials and methods

General scientific and special research methods were used to solve mentioned goal. There are content analysis, economic modeling, graphical analysis, system and process approaches, statistic, techno-economic, system and structural analyses, quality management system standards methodology ISO 9001:2015, environment management system requirements ISO 14004:2016, the theory of constraints by E. Goldratt; expert estimation method. These methods application helps to achieve technological innovation effective usage for sustainable ecological and economic development by touristy economic units' business.

3. The study of microturbines application in touristy economic units' business

At the figure 1 there are given the characteristics of Southern Federal District budget-forming economic units, which applied innovations (2000–2017 years). Basing on these data, we can resume that the less part of mentioned business entities provided innovative technologies.



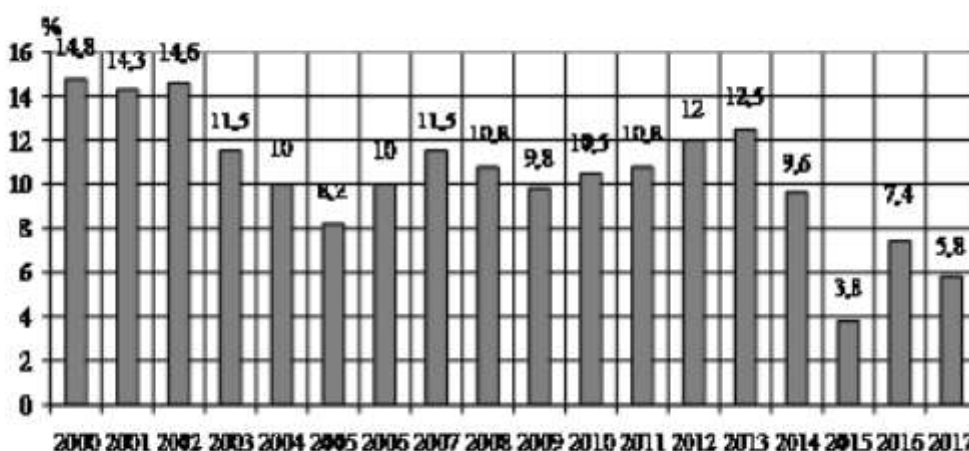


Figure 1. Southern Federal District budget-forming economic units, which applied innovations (2000–2017 years) (%) (the data was taken from the official statistical sources and authors researches).

In this article authors determine, that the main task for touristy economic units' business is application of technological innovation, which helps cost minimization and environmental pressure reducing. The way of such application can be:

- heat recovery from used preheated air;
- air recirculation;
- constrained air disproportionation throughout the height of the building;
- water recycling;
- thermal protection of mains with high temperature;
- nonsimultaneous work of energy-consuming devices and others.

Analysis of this problem illustrates, that at the second iteration it will be effective to use such technological innovations as microturbines for touristy economic units' business.

This research subject is suggestion of complex microturbines using for touristy economic units' business as one of factors of their sustainable ecological and economic development achievement.

There are theoretical researches of foreign and national authors that were made in the field of the importance of uninterrupted business, ecological and ergonomic safety of employees and customers. At the same time there is a problem in their praxis functioning that connected to electric power and heat supply of touristy economic units in business activity. Also it must be mentioned that besides ones listed above there is a negative influence at usability of labour, these factors impair a process of services quality and its supplying. The absence of electricity and heating influence either negatively employees' health, make impossible online tracking and monitoring of touristy economic unit's process when groups or individuals are at the rout.

We have suggested using of SMART-technology for business units in resort and spa sector, but if there are problems, described above, that innovations listed previously won't be able. So, a switch to energy self-supporting sources for production, supplying and accumulation is necessary. Horizontal sun and wind turbines are heavy and not cheap. Gas and diesel powered turbines are short-lived and can harm the environment in the case of fuel leakage.

Nowadays the worthiest means of power generation for touristy economic units' business can be

gas-operated microturbines that practically helps to turn these business entities into power self-supporting ones.

It is necessary to notice, that microturbines have a lot of advantages in compare with usual gas and diesel devices (compression ignition engines). There have ideal efficiency, full acoustic isolation, small size (weight – 2060 g, length – 324 mm, base diameter – 115 mm, width with poles – 128 mm). Undeniable advantage of using them is that they easy work with substandard gas, which touristy economic units can produce even from their garbage.

Microturbine has 12 kW maximum capacity. Modern microturbines can work about 100000 hours (ten years). In America are only a few microturbines producers now. Their conception is similar to these ones suggested at the article. The micro-turbine can become a «power heart» of families or economic units. It gives 200 Newton. It is the enough large power motor for its decent size. Now a standard apartment consumes 1,5-2 kW. So microturbine power will be enough for dozens of apartments in communal blocks or privat houses. These characteristics were estimated for micriturbine's speed about 100 thousand rounds per minute. But under force variant of the turbine use it can be reached 150 thousand rounds per minute.

Microturbines characteristics are:

- maximum thrust – 200 N;
- working traction – 160 N;
- firing rate (on maximum thrust) – 460.00 ml/min;
- using fuel – gas;
- highest rate of turn – 120 000 round/minute.

Besides, it should be noted that microturbines could be produced on 70 percent under additive technology. They can be produced with 3D printer, which makes at once a complete product from amorphous metal. All pieces are «printed» from metal except screws and spans. Few quantity of pieces are made by milling at five-access machines. This is also modern equipment.

A production possibility integration consists in industrial using and receiving a business effect from its realization. On the average, a total sum of investments on integration a set of 18 microturbines into a bunch of touristy economic units will run at about 50 million roubles (including adapter modules and converters of records and so on). Payback time of the scheme is 3,5 years.

At table 1 estimation economic methods of innovative suggestions are illustrated, proving its effectiveness.

Table 1. Estimation economic methods of innovative suggestions (in roub.).

Year	Cash-flow	NPV
2019	-4600000	–
2020	1500000	-3020408
2021	1500000	-1724652
2022	1500000	-490598
2023	1500000	684691
2024	1500000	1804014
2025	1500000	2870036
2026	1500000	3885295

During the research it was determined, that for the most effective solution of pointed tasks, forming a team, inventions and realization of suggestions it should be used a toolkit of the constraints theory, a concept of sustainable development, environment management, process management, standards of project management PMBOK 6.

Mentioned substantiation of possible direction of using technological innovation for achievement a sustainable ecological and economic development by touristy economic units proves its effectiveness.

So, a microturbine gives touristy economic units a chance to receive a reliable power and heat source, support of business continuity, and we can draw undermentioned conclusions.

4. Conclusion

Realization of authors' suggestions will have a following complex effect from integration of their implementation possible way:

- economic – operational efficiency increasing for touristy economic units owing to regular supply of business function;
- social – standardization of usability of labour in business, raising customer satisfaction and providing their better safety owing to SMART-technology support;
- ecological – environmental compatibility of microturbines that allows to reduce the workload of environment.

After a successful trialability the suggested scheme can be offered for the other branches and areas.

Information, written in this article, can be useful for regional government leaders resort and spa sector, office managers, compilers of tourism.

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