Vol. 1, No. 2, 2016

PROSPECTS OF USING METHODS EFFECTIVE USE OF ALTERNATIVE ENERGY

Svetlana Bukhkalo, Oksana Olkhovska

Department of National Technical University "KhPI", Kirpichovska St., 62002, Kharkov, Ukraine

Received: 30.05.2016

Abstracts: The article presents the possibility of the development of science-based concept of integrated processes complex enterprises energy mix (alternative energy and polymer wastes). A review of the literature and the necessary articles written on the subject: as technologies and economies develop and become more complex, energy needs increase greatly; types and methods of alternative energy, as well as the possibility of calculating the basic set of main economic indicators are classified; identified possible areas of work in obtaining the necessary information and results. The results of studies of complex innovative projects conducted as inter-university cooperation.

Key words: environmental safety, alternative energy, complex projects, polymer wastes, estimation criteria, scientifically grounded processes

Introduction

In this, we discusses phase of work in NTU "KhPI" – studies the possibility of increasing the economic efficiency of alternative energy sources. A review of the literature and the necessary articles written on the subject:

1. As technologies and economies develop and become more complex, energy needs increase greatly.
2. Types and methods of alternative energy, as well as the possibility of calculating the basic set of main economic indicators are classified.
3. Identified possible areas of work in obtaining the necessary information and results.

Energy is a fundamental input for economic systems. Current economic activity depends overwhelmingly on fossil fuels including oil, coal, and natural gas. Solar or wind energy stored in firewood or other biomass energy meets other basic needs for home heating and cooking.

A review of the literature alternative energy

Each stage of economic development has been accompanied by a characteristic energy transition from one major fuel source to another. Today, fossil fuels – coal, oil and natural gas –are by far the dominant energy source in industrial economies, and the main source of energy production growth in developing economies (see Fig. 1) [1]. But the twenty-first century is already seeing the start of the next great transition in energy sources – away from fossil fuels towards renewable energy sources. This transition is motivated by many factors, including concerns about environmental impacts (particularly climate change), limits on fossil fuel supplies, prices, and technological change. Solar energy comes in three basic forms [2]: low temperature solar thermal; solar electric or photovoltaic (PV); high-temperature solar thermal energy.

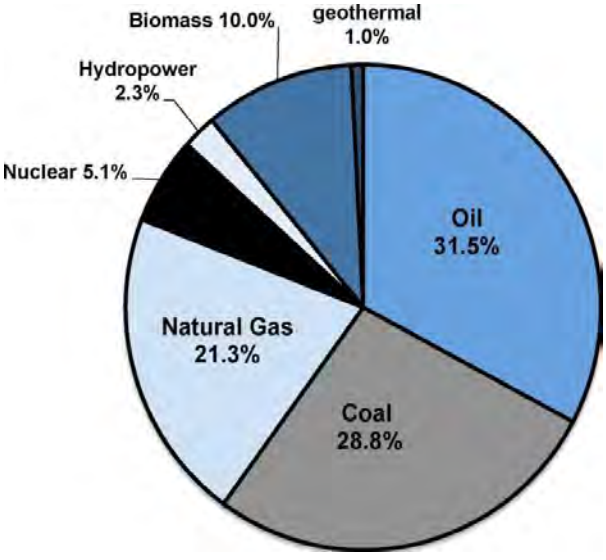

Fig. 1. Global Energy Consumption by Source, 2011 Source: International Energy Agency (IEA 2013)

Like biomass and hydropower, wind power has been used since ancient times. On the best sites, modern electricity production from wind is very close to cost parity with sources like coal and nuclear power. But there is a big difference between wind power cost on the best sites and on less suitable sites. Wind power is generated by the energy in moving air, and available energy varies with the cube of wind velocity [1–5].

The authors then estimate the infrastructure that would be necessary to supply all energy worldwide from WWS in 2030. Table 1 presents their results, based on the assumption that 90 % of global energy is supplied by wind and solar, and 10 % by other renewables. The efficiency of a solar collector depends on the ability to absorb heat and the reluctance to lose heat once absorbed. Fig. 2 presents principle of energy flows in a solar collector [3].

Table 1

Infrastructure Requirements for Supplying All Global Energy in 2030 from Renewable Sources

Energy Source	Percent of 2030 Global Power Supply	Number of Plants/Devices Needed Worldwide
Wind turbines	50	3,800,000
Wave power plants	1	720,000
Geothermal plants	4	5,350
Hydroelectric plants	4	900
Tidal turbines	1	490,000
Rooftop solar PV systems	6	1.7 billion
Solar PV power plants	14	40,000
Concentrated solar power plants	20	49,000
TOTAL	100	

Source: Jacobson and Delucchi (2011) [2].

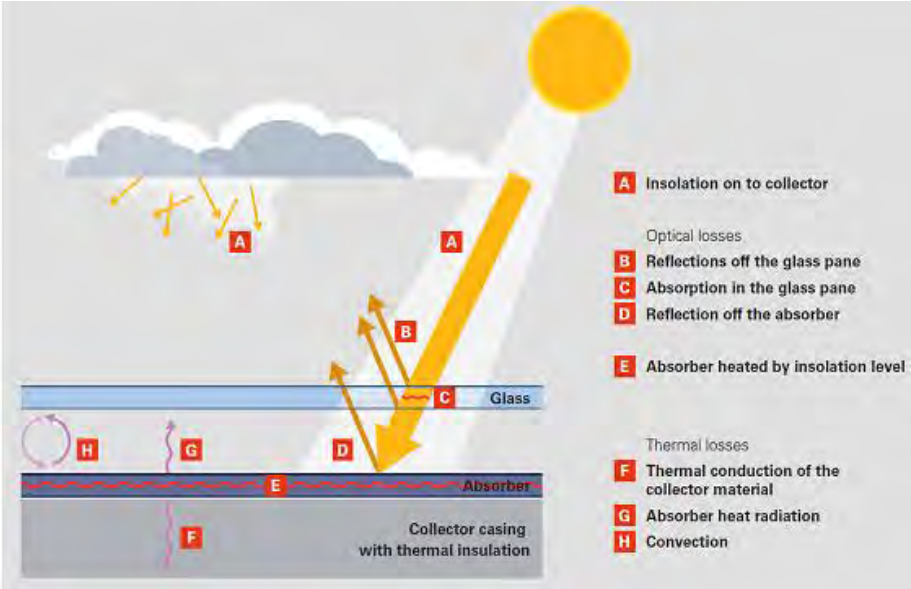

Fig. 2. Principle of energy flows in a solar collector [3]

A simple way to calculate the efficiency is to use equation 1 [4]:

$$h_c = h_0 - a_1 \frac{(T_m - T_a)}{G} - a_2 \frac{(T_m - T_a)^2}{G} \qquad (1)$$

where h_c – collector efficiency; G – total (global) irradience on the collector serface [W/m^2]; T_m – mean collector fluid temperature [°C]; T_a – temperature of the ambient air [°C].

A review of the experimental research alternative energy together with the students

Most renewables are less available and/or have higher costs than fossil fuels used in the recent past. The costs of renewable energy resources are attributable in part to inherent characteristics, particularly their low net energy ratios, intermittent availability, and capital intensity.

Development of new technology will reduce cost but may not make renewable energy cost competitive with market prices of fossil fuels in the near future unless fossil-fuel externalities are considered. The speed of the transition to renewable energy will be highly influenced by policy choices; potential policies include increasing energy research and development expenditures, feed-in tariffs, and renewable energy targets (Table 2).

These questions was designed together with the students, as complex and innovative projects in the student scientific society – is the third stage of the work in NTU “KhPI”. Attraction to address environmental problems in Ukraine public student organizations in the process of learning in higher education will allow them to prepare in the future society of Ukraine to the organized collection of various types of waste. Our work is focus on evidence-based choice of integrated energy

of different origin – alternative energy (AE) (Fig. 3, 4) and energy waste. This will reduce, primarily, the total amount of waste to be disposed of in landfills or polluting harmful emissions. This approach allows using the resource potential of these types of waste, and creating conditions for compliance with legal, health and environmental, economic and organizational aspects of the problem of waste management in general.

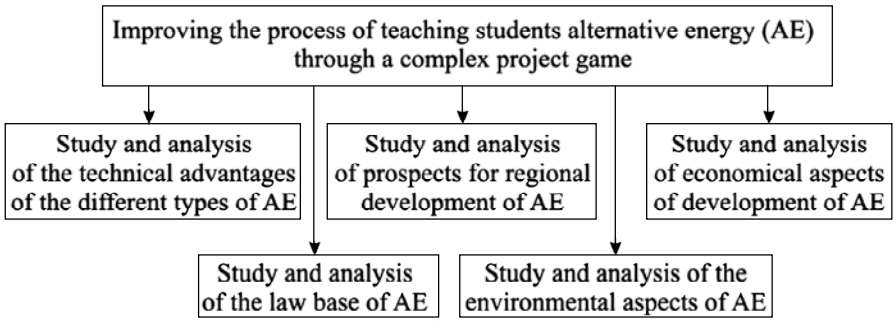

Fig. 3. Improving the process of teaching students

Table 2

Transparent materials in different areas of the solar spectrum-comparative characteristics of materials panels for solar collector

Materials for the pane	Wavelength, microns			
	0,295–0,400	0,400–0,750	0,750–2,000	5–15
Polyethylene film with stabilization	26	80	80	80
PVC film	22	88	88	10
Polyamide film	73	87	88	30
Fiberglass	4	80	85	2
Glass	46	83	83	0

While working to develop the principle of evaluating the effectiveness of the use of funds expended primarily for the construction of a particular object of alternative energy. For example, the methodology to calculate the allocation of public funds for the expansion of the subsequent reinvestigation innovation construction by depreciation and profits, which are formed in the process of the wind power plant (Fig. 3).

The total number of articles, papers in international and other conferences, study guide, tutorials, and guidelines for students – more than 30 are prepared and published.

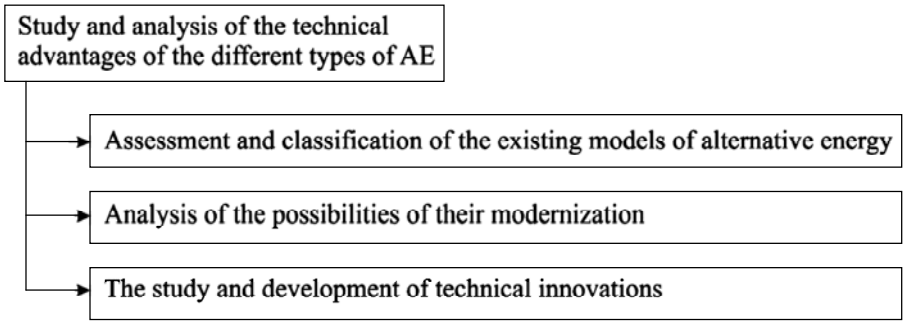

Fig. 4. Study and analysis the process of teaching students

The global system of education is in a state of crisis, which is cause by both internal and external to its factors. For Ukraine, this transition to a market economy, a high level of unemployment among university graduates, especially in the economic crisis, sharply exacerbated the problems and opportunities for young people to find their niche in the job market, highlighted lack of preparation of graduates for the real organizational and technical activities.

Description of the problem to be solved.

The problem of learning the practical skills of the students in higher education, even in the most modern of techniques, it is very difficult to solve. Creating the conditions for training students for the acquisition of the necessary competencies for life will contribute to the competitiveness of graduates in the labor market; the key competence can facilitate their participation in the development of the democratic principles of society.

Ways and means to the development of solar and wind energy and the environment are widely used in the EU. This is linked to the development effectiveness environmental management and legislation. Such experience is required at the stage of Ukraine training students in high school. University graduates, getting on

the company as experts will have a modern legal framework, national programs of the EU.

In order to integrate Ukraine into the EU and for the realization of our project to the following questions:

1) classification of wind power plants in terms of investment;

2) classification of wind power plants in terms of economic efficiency;

3) the classification of solar energy in terms of investment;

4) classification of solar sources energy in terms of economic efficiency

5) classification of types of polymer waste as an alternative energy source;

6) analysis of the experience of wind, solar and polymer waste systems for use in Ukraine.

The problem of wastes utilization and recycling is present as complex research and analysis of energy- and resource saving processes for treatment of polymer wastes of various origin [6–11].

Energy is a fundamental input for economic systems. Current economic activity depends overwhelmingly on fossil fuels including oil, coal, and natural gas. These fuels are non-renewable. Renewable sources such as hydroelectric, wind, and solar power currently provide less than 10 % of global energy.

Conclusions

Many sources of renewable energy are available, and have been used for centuries. Most renewables are less available and/or have higher costs than fossil fuels used in the recent past. The costs of renewable energy resources are attributable in part to inherent characteristics, particularly their low net energy ratios, intermittent availability, and capital intensity. Development of new technology will reduce cost but may not make renewable energy cost competitive with market prices of fossil fuels in the near future unless fossil-fuel externalities are considered.

The speed of the transition to renewable energy will be highly influenced by policy choices. Potential policies include increasing energy research and development expenditures, feed-in tariffs, and renewable energy targets. Public policy can also aid in providing capital for renewable energy projects, and in providing a robust electricity grid for moving energy long distances.

Discussion questions for students:

1. In general, how do renewable energy sources differ from fossil fuels, i.e. what are some common characteristics of renewable energy sources that are different from characteristics of fossil fuels used in the past?

2. Explain the renewable energy sources principle in your own words. How would this apply to developing a portfolio of renewable energy sources in your home region?

3. Is energy conservation likely to be more important in a renewable energy economy than it has been in the past? Explain.

4. Hydropower is currently the largest source of renewably generated electricity in the world, and there is potential for expansion. In some parts of the world, a renewable energy portfolio could be based on hydropower and energy conservation alone. Yet hydropower is also controversial, chiefly because of associated negative externalities. Describe some of these. Do you think more hydropower should be developed in the world?

5. How would you decide whether or not to develop a particular hydro project?

6. Why does public policy have such a prominent role in promoting renewable energy use, and in accelerating the transition to renewable energy?

7. What public policy approaches do you think will be most effective?

References

[1] Timmons D. The economics of renewable energy / D. Timmons, Jonathan M. Harris and Brian Roach // Global Development And Environment Institute, Tufts University. 2014. P. 52.

[2] Joshua Earnest, Tore Wizelius. Wind power plants and project development. 2011. P. 484.

[3] Technical guide – Solar thermal systems, Viessmann GmbH, 2009.

[4] Solar district heating guidelines. Fact sheet 7.1, p. 1 of 15, www.solar-district-heating.eu

[5] Buoyancy Effects on Thermal Behavior of a Flat-Plate Solar Collector, Jianhua Fan & Simon Furbo, Dep. of Civil Engineering – Technical University of Denmark, 2008, www.aseanenergy.info/Abstract/31029901.pdf

[6] Bukhkalo S. I. Zagal'na tehnologija harchovoï promislovosti u prikladah i zadachah (innovacijni zahodi) [tekst] pidruchnik / L. L. Tovazhnjans'kij, S. I. Bukhkalo, O. A. Severin, O. I. Olkhovs'ka, A. V. Serikov, M. M. Zipunnikov. K. : "Centr uchbovoï literaturi", 2013. 352 p.

[7] Bukhkalo S. I. Issledovanie metodov pererabotki othodov termoplastov i kompozicionnyh materialov na ih osnove. Otchet o NIR, NTU "KhPI", – Har'kov, N GR 01850021487, 1990, 103 p.

[8] Bukhkalo S. I. Izmenenie svojstv v processe jekspluatacii plenki i napravlennaja modifikacija vtorichnogo polijetilena; dis… kand. tehn. nauk. – M., 1988, 153 p.

[9] Bukhkalo S. I. Dejaki aspekti ekologichnoï bezpeki polimernoï tari ta pakuvannja harchovoï promislovosti / Naukovi praci ONAHT. Odesa, 2014. Vup. 45. Vol. 3. P. 76–79.

[10] Bukhkalo S. I. Zagal'na tehnologija harchovoï promislovosti u prikladah i zadachah (innovacijni prikladi) [tekst] pidruchnik / L. L. Tovazhnjans'kij, S. I. Bukhkalo, A. Є. Denisova, I. M. Demidov, P. O. Kapustenko, O. P. Arsen'єva, O. V. Bilous, O. I. Olkhovs'ka. K. : "Centr uchbovoï literaturi", 2015. 468 p.

[11] Bukhkalo S. I., Olkhovska O. I. Osnovni skladovi kompleksnih pidpriємstv energetichnogo miksu / Visnik NTU "KhPI". Serija: Innovacijni doslidzhennja u naukovih robotah studentiv. Har'kov: NTU "KhPI". No. 7 (1116). P. 103–108.