STANDPOINT

on dissertation "Evaluation of mixed installations with alternative energy sources", of Prof. Dr. Eng. Alexander Georgiev Georgiev for obtaining the scientific degree "Doctor of Science" Professional field: 4.4. "Chemical Sciences", specialty "Processes and apparatus in chemical and biochemical technology", by Assoc. Prof. Dr. Eng. Petar Nikolov Gerginov

1. Relevance of the problem developed in the dissertation

Increasingly expensive energy in industry and household imposes the need to increase efficiency in the use of available resources. Restrictions on the use of traditional energy sources due to their depletion or for environmental reasons necessitate their replacement and supplementation with alternative energy sources. As energy from alternative or renewable sources is volatile over time, combining different types of schemes allows for a more permanent and complete satisfaction of energy needs. The study of mixed installations with alternative energy sources is a necessary step towards a better understanding and improvement of the technology of using the current and new priority energy sources.

2. Main contributions of the dissertation

Scientific contributions include a detailed study of mixed installations with alternative energy sources, incl. research through theoretical formulations and mathematical modeling. Vacuum solar collector with heat pipe was studied; mixed water storage with stratification of the working fluid; industrial water storage with two separate coils; borehole heat exchangers in Bulgaria and Chile; latent storage using phase change materials.

Scientific and applied contributions are related to conducting experiments of different duration on a mixed system containing vacuum solar collectors; charging and discharging of underground storage with solar collectors in Chile; solar heating system combined with photovoltaic panels; ground-source heat pump system in five operation modes of the system; measuring the temperature field in a borehole heat exchanger during charging it with heat from a flat-plate solar collector; study of different modes of operation of ground-source heat pump; use of phase change materials in underground horizontal heat exchangers.

The applied contributions are related to improving the efficiency of the solar installation by implementing a heat pump unit; transfer of PV panel into PV / T panel; creation of a concentrating photovoltaic heating system (CPV / T); creation of a new construction of a mixed ground source heat pump system; proving the benefits of a micro-cogeneration system through the simultaneous operation of a Stirling engine and photovoltaic (PV) panels to produce electricity from a solid fuel central heating system.

The listed contributions are extremely important, as they prove the need for the use of mixed systems with alternative energy sources and fully meet the objectives of the dissertation. The main conclusions direct the future researchers and users of the presented results to the optimization of the known mixed systems, the more correct design of new installations, as well as the selection of new and more efficient materials and components.

3. Description and evaluation of the submitted materials

In connection with the implementation of the requirements of the competition the following materials were presented: Curriculum vitae (CV European model), Dissertation for the award of the degree "Doctor of Science", Abstract of the Dissertation for the award of the degree "Doctor of Science", List and copies of scientific publications, Information on the fulfillment of the minimum requirements of BAS with citations of the attached scientific publications, Copy of the diploma for the educational and scientific degree "Doctor".

The presented dissertation consists of the following sections: Introduction, Literary review, Aim and tasks, Components of mixed systems from alternative sources, Analysis of mixed systems, General conclusions, Main contributions, Bibliography and List of publications in full text of the dissertation. The dissertation contains 345 pages, including 201 figures and 29 tables. The bibliography covers 229 sources. The candidate has presented 36 articles on the topic.

The short version reflects all sections of the dissertation, consisting of 72 pages, incl. the author's publications on the dissertation.

Pursuant to the requirements of the Law, the following points have been collected:

A. Dissertation "Doctor" - Total 50 points (from min. 50 points):

B. Dissertation "Doctor of Science" - Total 100 points (from at least 100 points):

C. Monography - (not required)

D. Publications (WoS and Scopus) - Total 266 points (from min 100 points):

E. Citations (Web of Science): Total 258 points (from min 100 points):

F. Other - (not required)

Therefore, the submitted materials fully meet the requirements of the procedure.

4. Scientific publications of the candidate in Bulgarian and foreign literature

The list of author's publications in full text on the topic presents 36 articles. Of the total number of publications, 15 are in journals with impact factor for the respective year, 11 are published in specialized international journals or in full text in proceedings of international scientific forums. 15 of them were published from 2016 to 2020. The author of the dissertation is the first author in 17 of the publications. The presented 36 publications were cited a total of 244 times.

A sufficient number of publications and citations are presented in Web of Science and Scopus.

5. Personal impressions of the candidate

I have gained personal impressions from Prof. Dr. Eng. Alexander Georgiev Georgiev from my participation in the fourth international scientific conference AESMT'21, as well as from several contacts to discuss common topics. I can confirm his high professionalism, organizational skills and responsibility for the questions asked.

6. Recommendations and notes

The presented work is extremely complex in terms of methodology, analysis and testing of mixed systems with alternative energy sources, as well as in forecasting their operation in different experimental and operational conditions. The problems posed are probably future problems of multidisciplinary teams related to the construction of installations, their use in practice (in connection with their design and implementation), the inclusion of the geological environment as a collector of heat / cold and others.

In this regard, a future effort is probably needed to harmonize the terminology and abbreviations used in Bulgaria with the world accepted in terms of mixed systems, in which I hope that Prof. Georgiev could contribute with his high competence.

Conclusion

The dissertation "Evaluation of mixed installations with alternative energy sources" is an original work with scientific and practical significance. The presented mixed systems demonstrate the more efficient use of alternative energy sources and outline future directions in their design and operation.

The conducted procedure complies with the requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB) and the Regulations for its implementation at the Institute of Chemical Engineering at the Bulgarian Academy of Sciences.

In conclusion, I give my **positive assessment** of the study and propose to the esteemed scientific jury to award Prof. Dr. Alexander Georgiev Georgiev the degree of "**Doctor of Science**" in Scientific Field 4. "Natural Sciences, Mathematics and Informatics", Professional direction: 4.4. "Chemical Sciences" and specialty "Processes and Apparatus in Chemical and Biochemical Technology".

11.02.2022,
Sofia

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/ Assoc. Prof. Dr. Eng. Petar Gerginov /