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Editorial Special Issue on "Energetic Complementarity"

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Abstract

This editorial presents the motivations that were the focus of the papers that make up this Special Issue on energetic complementarity. The articles deal with the application of the concept of energetic complementarity in time under certain conditions and with the proposition of new means to evaluate complementarity in time between more than two renewable energy resources. An article further proposes a method for establishing energetic complementarity in space, a concept that is important and necessary for management and planning of energy resources but does not yet have tools that allow it to be quantified and handled appropriately. In addition, two letters to the editor discuss issues that still need to be matured for a better understanding and application of the concept of energetic complementarity, both in time and space.

Keywords

Component: Energetic Complementarity

The concept of complementarity is not new and has always been present in the work of engineers and managers who have dealt with the design and operation of energy systems over time. The growth of energy systems around the world, as a result of growing demand for energy supplies and rising expectations for better quality supplies, has resulted in the need to make better use of available energy resources. In this context, energetic complementarity deserves a formal and coherent treatment.

Complementary energy resources can be exploited with hybrid systems with components with lower installed power or with lower capacities for energy storage and yet present equivalent or even better performance when compared to systems based on not so complementary recourses. It is obvious that the coinci-

dence of minimums with maximum energy availabilities should lead to better performance.

This theme of "energetic complementarity" still has a lot to be understood, both regarding the determination of sites with complementary energy resources, and the effects of complementarity on the performance of hybrid systems based on complementary resources. It is necessary to determine maps of complementarity in time and space. It is necessary to relate complementarity with performance for the different types of hybrid systems that explore energetic complementarity.

This Special Issue presents six papers. Two of these papers explore concepts [1] that already exist in the literature for complementarity in time. An article presents a new method for the determination of complementarity in time, as a convolution, allowing the determination of complementarity between more than two energy resources. Another paper presents a completely new method for evaluating complementarity in space. Finally, there are two letters to the editor adding important notes to the continuation of research work related to the study of energetic complementarity.

The paper of Pianezzola, Krenzingerand Canales makes a fairly complete assessment of the complementarity between wind and solar energy along the territory of the State of Rio Grande do Sul, the southernmost State of Brazil, making small adjustments in the concept of complementarity presented by Beluco *et al.* [2]. The paper of Bagatini, Benevit, Beluco and Risso compares the wind and solar resources as well as the water resource, also for the State of Rio Grande do Sul, evaluating only the complementarity in time. These papers use different databases.

The paper of Borba and Britopresents a new and very convenient approach to evaluate complementarity over time, as a convolution of the functions that describe the energy availability of the resources considered in the analysis. This new method even allows the comparison of more than two energy resources. The content of this article is completely new and reinforces the role of the concept of complementarity as a tool for the management and planning of energy resources.

The paper of Risso and Beluco presents the basis for a method to evaluate complementarity in space. This topic is completely new and has not yet been addressed in the literature. Cantão *et al.* [3] do this with correlation maps, without presenting specific contributions about complementarity itself. The method proposed here contributes to the analysis of complementarity and in fact opens many new possibilities.

Finally, the letter of Livi and Beluco draw attention to the maturation process of the concept of complementarity as being able to elevate this concept from a complementary concept in the design process to a parameter with status to significantly alter the characteristics of components of energy systems. And Brito's letter reinforces this approach by pointing out the need to include the concept of

complementarity in the early stages of designing energy systems and also reinforcing their importance in energy systems with energy storage capacity, as is the case with the Brazilian system.

Concluding, I would like to thank the authors for their contributions that made it possible to complete this Special Issue and for their attention in the review phases of the papers. I would also like to thank the reviewers for their contribution to raising the quality of the final product obtained with this work. I still want to thank the Editor of Energy and Power Engineering, Dr. Fermin Mailor, for the opportunity given to me to propose the theme of this Special Issue and to contribute as a Guest Editor, and Mrs. Carrie Lu and colleagues, for the invaluable help and understanding in all stages of the work.

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