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Some Concerns Related to the Idea of Energetic Complementarity and Its Application

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Abstract

This letter to the editor presents some notes on energetic complementarity and a growing understanding of its role as a planning tool. This letter looks at the fact that an increasing number of works in recent years on this subject has promoted an increase in its level of importance in the design and operation of energy systems. The main change is the consideration of complementarity no longer as a consequence but as a design parameter. The continental dimension of Brazil, for example, should make it obvious that complementarities should be sought among the various energy resources available.

Keywords

Component: Energetic Complementarity, Complementary Energy Resources

Dear Editor,

The launching of the idea of COMPLEMENTARY ENERGY RESOURCES [1] [2] some years ago is an initiative that came in a very opportune time. Until the conception of this idea, complementarity was considered as an adjective. Now we have many evidences that it must be considered objective A shift from a supporting role for an increasing major role. This change in perspective might be simple, but it is essential taking into account the possible consequences.

Let's see: an alternative part has the function of substitution of a part in a system already complete. Complementary parts form themselves a one complete system. Alternative parts can be inserted over time, but complementary parts can only be complementary if they are defined from the outset as complementary. Components may not be equal? It may be, but the general view of the pro-

jects not. The factors taken into account can be very different, even complementing each other.

Many questions are involved and the complementarity may be characterized by many aspects: climatic, hydrologic, geographic, social, political and others that can be even intermingled. Due to these characteristics, when working in projects involving complementarity, a specialized knowledge in particular types of energy resources is not mandatory or even essential. The most important factor is a broad knowledge of the possibilities and necessities of the available renewable energy resources.

In a simple way, two or more energy resources can be complementary when their availabilities over time complement each other. A simple way to look for complementarity is to identify the time interval between availability minima. It is important to note that complementarity also needs to include the mean values of availability and the variations of availability around these means.

In general, the role of complementarity in the design and operation of power systems grows with the size of the system. In Brazil, for example, an interconnected system unites the major consumers and extends from south to north. The Brazilian system shows great dependence on water resources and a hydrological (and consequently energetic) complementarity [3] among the available resources along the Brazilian territory would contribute to reduce the probability of lack of energy in the system.

The continental extension of the Brazilian system also suggests the search for complementarity with other forms of energy, such as wind [4] and solar. Wind power is undergoing an expansion phase and the consequences of its low capacity factor can be mitigated by using it in conjunction with reversible power plants [5] [6] and other complementary resources. PV solar energy is also experiencing a phase of expansion, with decreasing costs and promising new applications emerging [7].

In other energy systems around the world, there are also growing concerns about the insertion of the concept of complementarity into the design of systems and their components. It is important to emphasize that the idea of complementarity must be present from the very beginning of the design process, both in situations of complementarity in time and complementarity in space [1].

Complementarity can be harnessed in small energy systems, isolated from the grid, and complementarity can also be used in large interconnected systems. A small and isolated system designed to take advantage of complementarity, when complementarity is configured, can allow operation with less powerful equipment or smaller batteries. In the same way, plants separated by hundreds of kilometers can operate on a complementary basis, optimizing for example the use of water stored in reservoirs and optimizing the cost of energy generated.

It is interesting to note that over the years the idea of complementarity has been matured with papers [8] [9] propose methods for analyzing systems based on complementary resources and papers [10] have already emerged suggesting

the optimization of components of hybrid systems based on complementary energy resources. It is the necessary step to consolidate the transformation from the concept of adjective to objective, as presented in the first paragraph of this letter.

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