



Multi-criteria sustainability assessment of water desalination and energy systems — Kuwait case

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ABSTRACT

The complexity expressed through the definition of sustainability notion and its application is a triple vision: preservation of energy resources and protection of environment, achievement of social values and justice within the present and for future generations, and as well as sustainable economic development. In order to reach this vision the multi-criteria assessment of water and energy systems is needed. Scarcity of water and energy resources implies the need for a new future strategy in the development of water and energy technologies. In particular the water desalination technology is important for regions with high shortage in natural water resources. Even in countries with abundant energy resources there is a need for evaluation of its use for the water production. Water desalination and power technologies have been closely related in the development of future energy strategy. Primary goal in this development was the economic validation of potential technologies. With new technologies in this field, it becomes of great interest to introduce multi-criteria evaluation in the assessment of different approaches. This implies the need to take into a consideration the environment, technological and social aspect of water and energy technologies. Demonstration of the multi-criteria evaluation of cogeneration electric power and desalting water plants is presented for the Kuwait case with attention to strategy development for the period 2010–2015. It is imminent to the development of new water and energy technologies to take into consideration different concepts of cogeneration systems. In this respect, we will focus the attention in this analysis to the following combined cycle's options: electricity and water production "as usual"; electricity and water production by natural gas; electricity and water production by nuclear energy; electricity and water production by solar energy. For each of these options different desalination technology is considered, including: multi stage flash (MSF), multi effect distillation (MED), and reverse osmosis (RO) desalting systems. The multi-criteria assessment method, based on the economic, environmental, technological and social criteria with respective indicators, is used in the evaluation of water and energy production options. It will comprise cases with economic, environmental, technological and social indicator priorities in comparison with others indicators. This aim of the analysis is to assist the decision makers in selecting appropriate option.

Keywords: Sustainability; Multi-criteria; Water desalination economic indicators; Environment indicators; Technological indicators; Social indicators; Electric power and water cogeneration

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