

Operation of desalination plants using renewable energies and hybrid control

Luis G. Palacin^{a*}, Fernando Tadeo^b, Cesar de Prada^b, Johanna Salazar^b

^a*Sugar Technology Centre*, ^b*Department of Systems Engineering and Automatic Control, University of Valladolid, 47011 Valladolid, Spain*

Tel. +34 (983) 423162; Fax +34 (983) 423161; email: palacin@cta.uva.es

Received 20 December 2009; Accepted in revised form 30 May 2010

ABSTRACT

This paper presents a control system for the operation of desalination plants powered by locally generated renewable energy. To cope with the variability of the water demands and the available energy, the amount of water produced must be manipulated optimally. This is carried out by regulating a variable speed pump, using hybrid predictive control, which takes into account the operational limits of both the pump and the process. The operation is complex because the scheduling of the cleaning operations and the optimization of the energy consumption must be performed simultaneously to the control of the plant, fulfilling a set of additional constraints. The paper uses a continuous reformulation of the problem in order to simplify the optimization process. Simulations of a specific plant show that an optimal operation reduces the extra energy consumption, and makes it possible to supply the variable water demand.

Keywords: Reverse osmosis; Desalination plants; Hybrid control; Dynamic optimization; Model predictive control; Balance of energy supply and demand

* Corresponding author.