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Pressure retarded osmosis as a controlling system for traditional renewables

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Pressure retarded osmosis (PRO) is a viable but still not diffused form of renewable energy (see Maisonneuve et al., 2015 for a recent literature review). In PRO, water from a low salinity feed solution permeates through a membrane into a pressurized, high salinity draw solution, giving rise to a positive pressure drop; then energy is obtained by depressurizing the permeate through a hydro-turbine and brackish water is discharged.
Many technological, environmental and economical aspects are obstacles in the diffusion of PRO, like the vulnerability of the membranes to fouling, the impact of the brackish water on the local marine environment, the high cost of membranes, etc.
We are interested in the use of PRO as a combined form of energy with other renewable energy source like solar, wind or mini hydro in water supply networks (WSN). For the wide diffusion of renewables one of the major concerns of commercial power companies is to obtain very stable form of energy to comply with prescriptions of electricity grid operators and with the instant energy demand curve. Renewables are generally very variable form of energy, for the influence of climatic conditions on available power, and of the fluctuation in water demand in WSN. PRO is a very flexible technology where with appropriate turbines and control system power can be varied continuously to compensate for variation of other source of energy. Therefore, PRO is suitable to be used as a balancing system for commercial power system.
We will present a simulation of the performance of a PRO used in combination with three different renewables. In the first two scenarios PRO compensate the difference between energy demand and energy production of a solar power plant and hydro power plant in a WSN. In the third scenario PRO is used to compensate daily variation of energy production in a wind power plant. Standard curves of energy production and energy demand for southern Italy are used.
In order to control PRO production an appropriate hydro turbine system is necessary. Therefore, pumps as turbine (PAT) are used in alternative to a classical hydraulic turbine (Carravetta et al., 2013). PAT can be easily regulated by hydraulic system, of by an inverter, granting the necessary flexibility of energy production with a sensible reduction of machinery cost.

Maisonneuve J, Pillay P, Laflamme C.B. Pressure-retarded osmotic power system model considering non-ideal effects. Renewable Energy. 2015; 75(3): 416-424.

Carravetta A, Del Giudice G, Fecarotta O, Ramos HM. Pump as Turbine (PAT) Design in Water Distribution Network by System Effectiveness. Water. 2013; 5(3):1211-1225.