Science for Environment Policy
DG Environment News Alert Service
European Commission

10 November 2011

Wind power reduces environmental impacts of desalination plants

Desalination plants, powered by wind energy, offer the potential to produce freshwater using a renewable source of energy. A recent study has explored some of the challenges of integrating wind energy with desalination units, and suggests combining wind with other forms of renewable energy, or constructing a system that operates with variable energy input would help overcome problems with wind powered desalination.

Water security is becoming an increasingly urgent problem as populations grow and the demand for freshwater increases. One solution is the desalination (desalting) of seawater or brackish water to produce freshwater. However, the process of desalination consumes large amounts of energy. If the energy comes from fossil fuels, environmental pollution will increase. Using renewable sources of energy, such as wind power, is seen as a viable energy alternative.

Worldwide, the use of renewable energy in desalination systems is not widespread and less than 1% of the capacities of desalination plants are powered by renewable energy. However, the development of small and medium-scale desalination plants using wind power is increasing. Since the early 1980s, wind-powered desalination plants or prototypes have been in operation, principally in Europe (Spain, France, Germany and the UK), Hawaii and Australia.

The study identifies two desalination processes as particularly suitable to being powered by renewable sources: mechanical vapour compression (MVC) (a thermal desalination unit), during which the feed water is heated; and reverse osmosis (RO) (a non-phase change process), where a membrane is used to separate salts from the feed water.

Wind energy can be used directly or indirectly to power these (and other) desalination technologies. RO plants are frequently found on the coast where it is often windy, and as RO is one of the most efficient desalination processes, it is one of the most suitable for integration with wind energy. MVC installations are more robust than RO plants and are better placed in remote locations with abundant wind power.

The study discusses technical problems associated with the intermittent nature of wind power, and issues with achieving the greatest energy efficiency from wind energy still need to be resolved. Two key strategies for addressing this are:

- Integrate wind and other types of renewable energy sources, such as photovoltaic energy, to even out the power variations and interruptions associated with wind power.
- Construct a flexible desalination system that can operate with a variable energy input. Backup storage or additional energy supplies would then be unnecessary.

The study recommends that future wind-powered desalination plants should be thermal desalination types, which produce high quality water with fewer polluting discharges. Two newer designs of thermal distillation plants (a humidification-dehumidification process and vacuum distillation) operate at lower temperatures compared with current MVC processes. Lower operating temperatures do not require as much wind energy to be turned into heat, as is currently the case, which would reduce the costs of desalination and increase the energy efficiency use from the wind power.

Wind energy has been demonstrated to be a suitable alternative to conventional energy for operating desalination plants, particularly on the coast.

Source: Ma, Q., Lu, L. (2011) Wind energy technologies integrated with desalination systems: Review and state-of-the-art. *Desalination.* 277: 274-280.
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Theme(s): Climate change and energy, Environmental technologies, Water