Osmotic power production utilises the osmotic pressure difference between fresh water and sea water.

Osmotic power has a great potential compared to other new renewable energy sources.

Energy production from osmotic power is stable and predictable.

Osmotic power is an environment-friendly energy source: CO₂-free, area efficient compared to other renewable energy sources, gentle environmental impact, and with a potential for green certificate.

When a river runs into the ocean and fresh water mixes with sea water, huge amounts of energy are unleashed. Unlike the violent torrents in a waterfall or in steaming hot geysers, the energy released when mixing water with different salinity cannot easily be seen from the banks of the estuary. Nevertheless, the energy is there.

**The process of osmotic power**

When the mixing of fresh water and sea water is carried out by controlling the pressure on the saltwater side, the process is called pressure retarded osmosis (PRO). A simplified PRO process diagram is shown below.

Fresh water is fed into the plant, where it enters the membranes. In the membrane modules the fresh water is transferred by osmosis through the membranes into the pressurized sea water. The osmotic process increases the volumetric flow of high pressure water and is the key energy transfer in the plant.

Sea water is pumped from the sea and fed into the membranes, where it is diluted by the fresh water entering through the membrane.

**Environmental aspects**

The mixing of sea water and fresh water is a process that occurs in all river outlets in the world, and because rivers often run into the ocean in cities or other industrialized areas, most of the osmotic power potential can be utilized in urban areas.

Osmotic power plants can be constructed partly or completely underground, thus allowing them to play a discreet role in the local environment. The water management processes associated with operation of the plant can be designed without affecting the biotopes of the river, river outlet and sea. In addition, osmotic power plants are very area efficient compared to other renewable energy sources.
Several plant designs have been developed for PRO power generation. The illustration shows a typical plant located at sea level. Fresh water is taken from a river close to its outlet. Sea water is fed into the plant by underground pipes. The diluted water is pumped back into the estuary thus maintaining the flow of water in the river.

Statkraft has been developing osmotic power since 1997, and most of the conceptual challenges have been identified. All the acquired technology is in use in the water treatment industry today. Statkraft has focused its efforts on membrane development and has achieved an increase in power generation from less than 0.1 W/m² to almost 3 W/m². Commercial operation requires a membrane performance of 5 W/m².

Plant designs

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