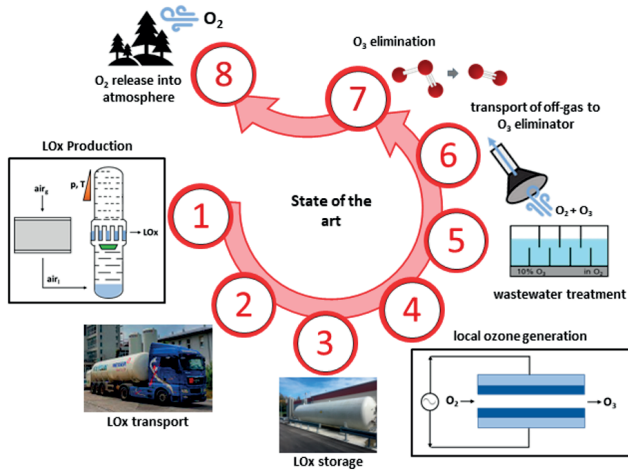
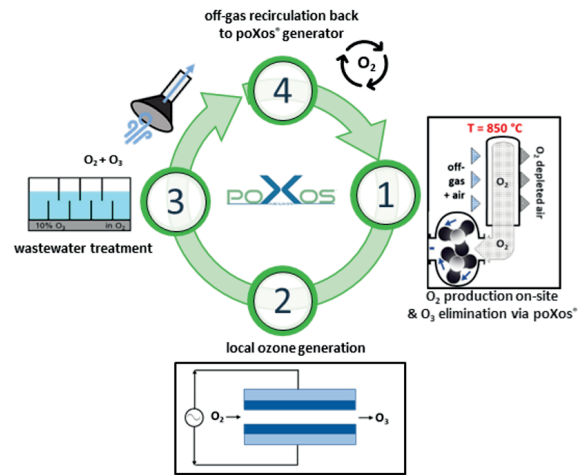


# Minimized O<sub>2</sub> costs for ozonation with POXOS®



State of the art in wastewater treatment.



Wastewater treatment with POXOS®.

A team of founders at Fraunhofer IKTS works on the commercialization of membrane plants for local oxygen production. In 2024, corresponding devices will be available under the trademark POXOS® (pure oxygen on site).

## POXOS® generators for ozonation

Wastewater treatment with ozone particularly benefits since delivery, storage and evaporation of LOx (cryogenic Liquid Oxygen) are not needed anymore. In addition, the oxygen rich off-gas is recirculated and fed into the POXOS® generator again. For the first time, the oxygen is completely utilized. Additionally, the ozone eliminator is unnecessary. If the POXOS® generator is operated with sustainably generated electricity, the oxygen supply is 100 % CO<sub>2</sub>-neutral.

## Lowest operating costs and CO<sub>2</sub> emissions

The electricity demand of the patented process is typically below 0.25 kWh per Nm<sup>3</sup> O<sub>2</sub> if gas (sewage gas) is burned for heating. Therefore, the operating costs are significantly lower than for a LOx supply. Furthermore, CO<sub>2</sub> emissions can be lowered by at least 50 %. Assuming an oxygen demand of 500,000 m<sup>3</sup> O<sub>2</sub> per year and an oxygen price of 0.25 €/m<sup>3</sup>, savings of approx. 100.000 € are achievable.

## Unique Selling Proposition (USP) of POXOS®

- Lowest energy costs due to sustainable heating using sewage gas
- High purity, sterile, dry O<sub>2</sub> as required
- Simplified process chain due to off-gas recycling and inherent O<sub>3</sub> elimination
- Scalability and recyclability

**POXOS®**  
PURE OXYGEN ON SITE

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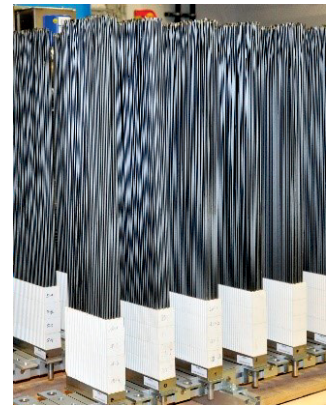




Heating chamber of POXOS® generator.



Prototype of a POXOS® generator.



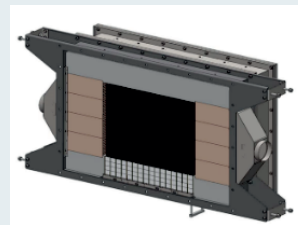
Ceramic membrane modules.

MIEC membranes (MIEC – Mixed Ionic Electronic Conductor) also called ITM (Ion Transport Membrane) or OTM (Oxygen Transport Membrane) have been developed at Fraunhofer IKTS for years. Their ability to separate oxygen is based on the combined conductivity for oxide ions and electronic charge carriers at sufficient high temperatures (> 700 °C). The driving force for the separation process is the gradient of the oxygen partial pressure across the membrane generated by vacuum.

## From raw material to MIEC membrane

The ceramic material is synthesized via solid state route at Fraunhofer IKTS. Membrane manufacturing is done by stiff-plastic extrusion of a plasticized mass followed by drying and firing. The finished membranes show outer diameters of ~3 mm and a wall thickness of ~0.3 mm at a length of ~70 cm. Currently, the production capacity at Fraunhofer IKTS amounts to approximately 10,000 membranes per year.

## Modular design – POXOS® generator



## From the MIEC membrane to POXOS® generator

The POXOS® devices are based on a smart modular design. One membrane module contains ~150 membranes and gets lined up with up to 15 other modules. Further increase of the oxygen throughput is achieved by combining several module lines. During operation, the produced oxygen amount is adjusted according to the operator's requirements by controlling the feed-air flow and the vacuum pressure on the membranes' permeate side. Currently, up to 60 Nm<sup>3</sup>/h O<sub>2</sub> can be produced during continuous operation of the POXOS® generators.

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