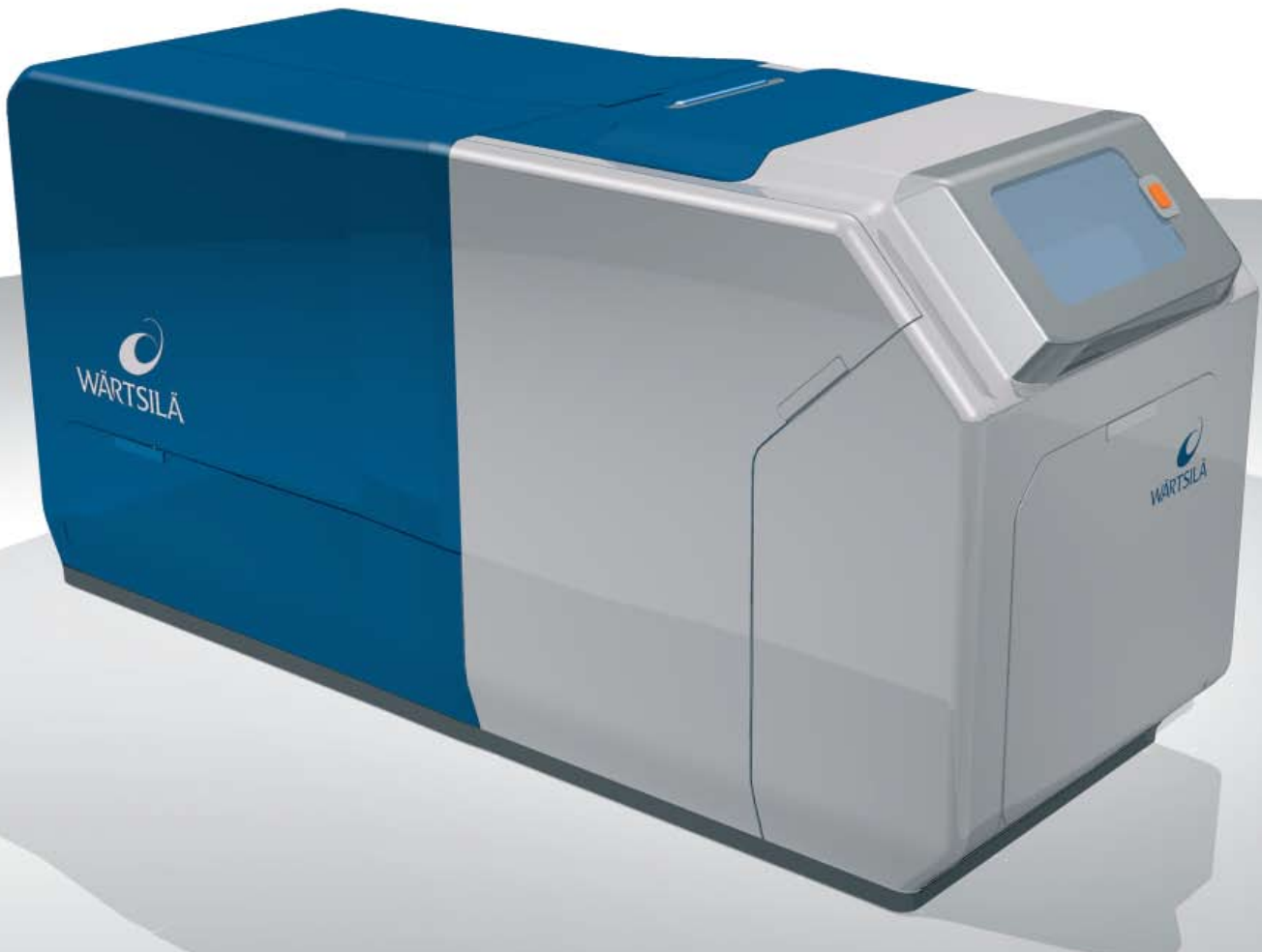


# WÄRTSILÄ SOLID OXIDE FUEL CELL UNITS



Since the year 2000, Wärtsilä has developed fuel cell technology for distributed power generation and marine markets. The present R&D work in Wärtsilä focuses on Solid Oxide Fuel Cell (SOFC) system development for commercial and industrial applications.

Wärtsilä is currently developing WFC20 alpha prototype, a 20 kW SOFC power unit. Wärtsilä plans to introduce its first commercial demonstration of WFC50 units in the 50 kW range in the next couple of years, looking into pre-commercial niche applications thereafter.

Wärtsilä plans to commercialize the units in a number of marine and stationary applications. The former includes marine

auxiliary power generation uses, and the latter commercial buildings like hotels, supermarkets, service stations, data centres, etc.

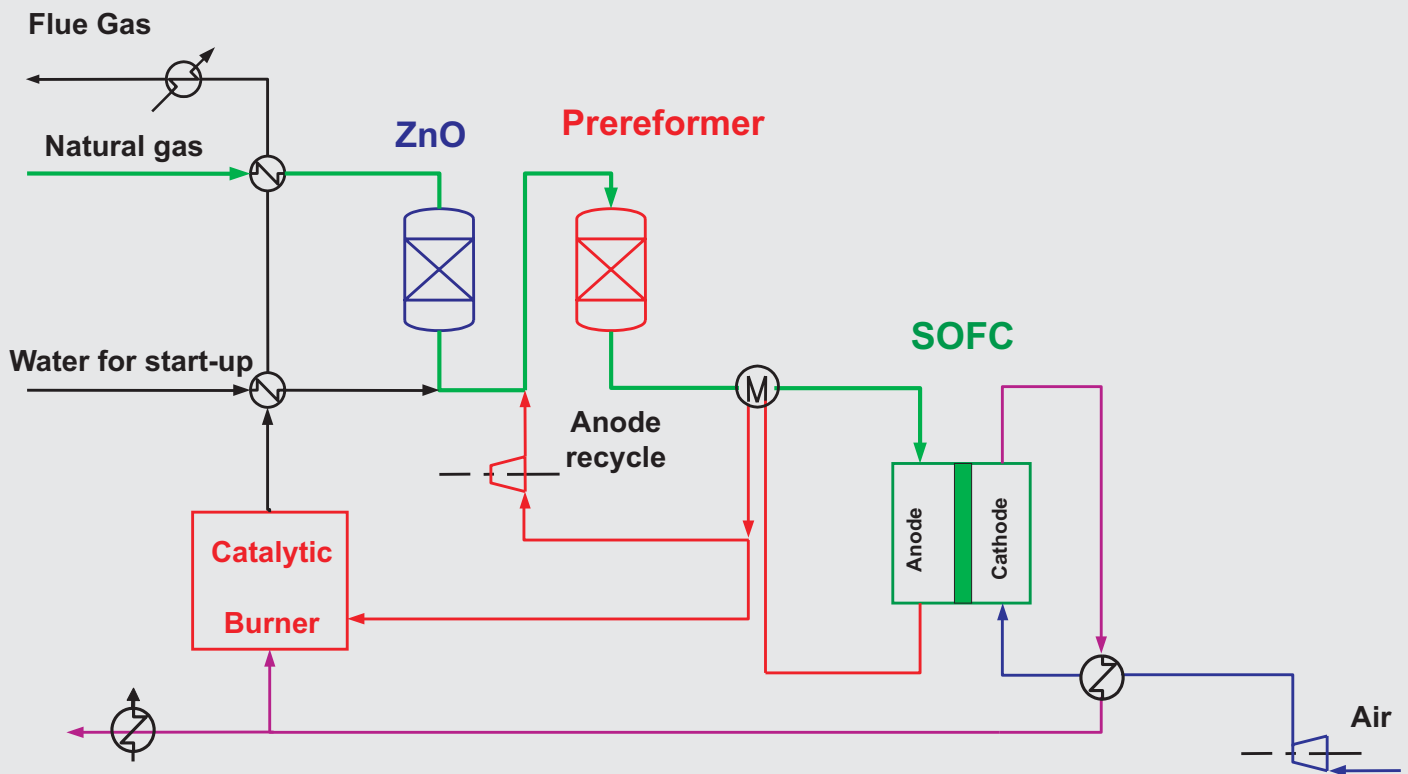
Wärtsilä is focusing on natural gas and methanol as the most potential fuels for the SOFC-units. However, there are also a number of other fuels suitable for SOFC-systems, such as diesel, biogases, landfill gas, coal bed methane and waste gases, as well as ethanol and other alcohols.

Given the outstanding benefits that fuel cells offer, in terms of clean, quiet and highly efficient power generation, fuel cells are a very attractive source of power for a number of commercial applications. Modularity is one of the advantages of fuel cell technology, as

it allows building large systems based on smaller units.

Wärtsilä is committed to providing its customers with highly efficient and environmentally sustainable power generation solutions and developing new energy generation technologies of the future, such as fuel cells. The fuel cell program supports Wärtsilä's long-term strategy for sustainable development.





### SOFC SYSTEM DESCRIPTION

The present Wärtsilä SOFC system is based on the use of natural gas or methanol, technology for other potential liquid fuel uses will be developed later. The basic system diagram is shown above.

The fuel is de-sulphurized and pre-reformed prior to the fuel cell stack. Residual gases are burned in a catalytic after-burner, after which high temperature heat will be recovered.

The benefits of the fuel cell technology include:

- Higher fuel efficiency
- Low running noise
- No vibrations
- Low NO<sub>x</sub> and no SO<sub>x</sub> emissions
- Clean and odourless exhaust



Some potential applications of our systems:

- Baseload applications
- Variable load applications
- Auxiliary power applications for ships
- Combined Heat and Power applications
- Electricity-only applications
- Grid independent applications
- Grid parallel applications