
EUROPE
ATMO
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CO_2 Heating Solution

ECONORDIC first multiservice heat pump using a natural refrigerant

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Summary

- SANDEN and FLEXIT
- Project Background
- ECONORDIC Product specifications
- Tests Results
- First Installations
- Conclusions

SANDEN Corporation

SANDEN
Delivering Excellence

Founded in 1943

17,000 associates
including joint-ventures

¥306,984 M €2.1 bn
annual sales

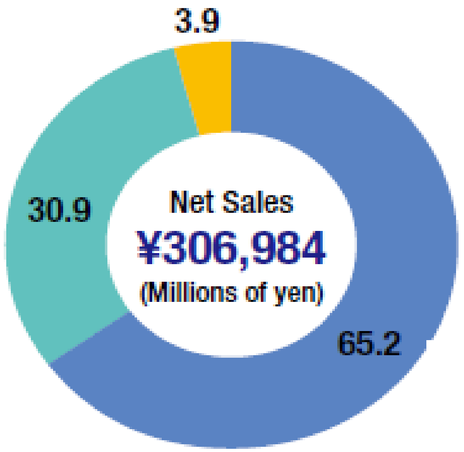
54 locations 23 countries

60%
share of sales outside of Japan

Global No 2 25% market share
automotive air-conditioning compressors

Global No 1 30% market share
in vending

1 out of 7
most sustainable plants in the world recognized by OECD



CO_2 condensing units and heat pumps

FLEXIT

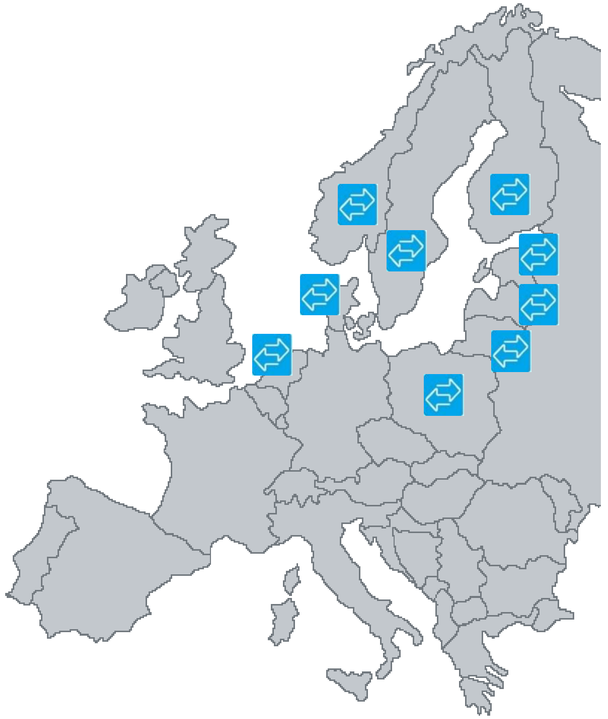
Founded in 1974 (Finn Martinsen AS) Family owned company

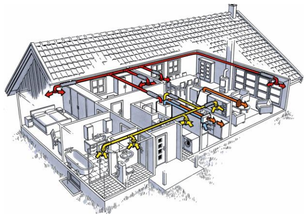
260 employees

Turnover 60 M€

<u>Head office in Örje, Norway:</u>
- Project design
- Product development
- Marketing
- Customer service NO
- Financial
- Warehouse (NO)
- Production (ducts)
- Technical service

<u>Töcksfors, Sweden:</u>
- Production
- Warehouse (SE + Exp.)
- Product development
- Purchase
- Laboratory
- Show room
- Conference rooms
- Customer service SE





- **Primary market:** Norway, Sweden, Finland and Denmark
- **Export** through distributors in Estonia, Latvia, Lithuania, Poland, Holland and Slovenia.

The70's

Simple wall valves and natural ventilation

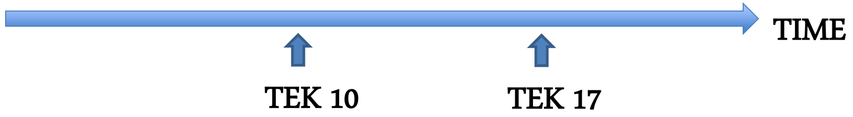
2020

NZE houses

Project Background

- More strict Thermal Regulations in Europe for high efficiency houses
- Space heating demand reduction in new building
- Domestic hot water becoming main energy consumer
- High Ventilation efficiency and heat recovery required
- Limitations of HFC refrigerants : F-Gas, Kigali, Taxes, etc.

Decreased SH needs



Example: Climate zone Oslo, 2-floor passive house, 200m^2. (Source Sintef)

Summed energy needs 1 yr [kWh]

Space heating (SH)	Ventilation heating (VH)	Domestic hot water (DHW)	Total
1902	413	8091	10406

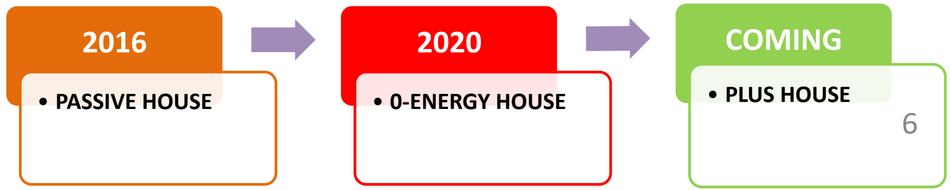
Simultaneity / operating modes [h]

	Space heating	Ventilation heating	Domestic hot water	
Standby				3302
SH	26			26
VH		963		963
DHW			1851	1851
SH+VH	1330	1330		1330
VH+DHW		352	352	352
SH+DHW	9		9	9
SH+VH+DHW	927	927	927	927
	2292	3572	3139	8760

Peak power [W]

Space heating	Ventilation heating	Domestic hot water
4275	477	3500

Future buildings will require lower energy need

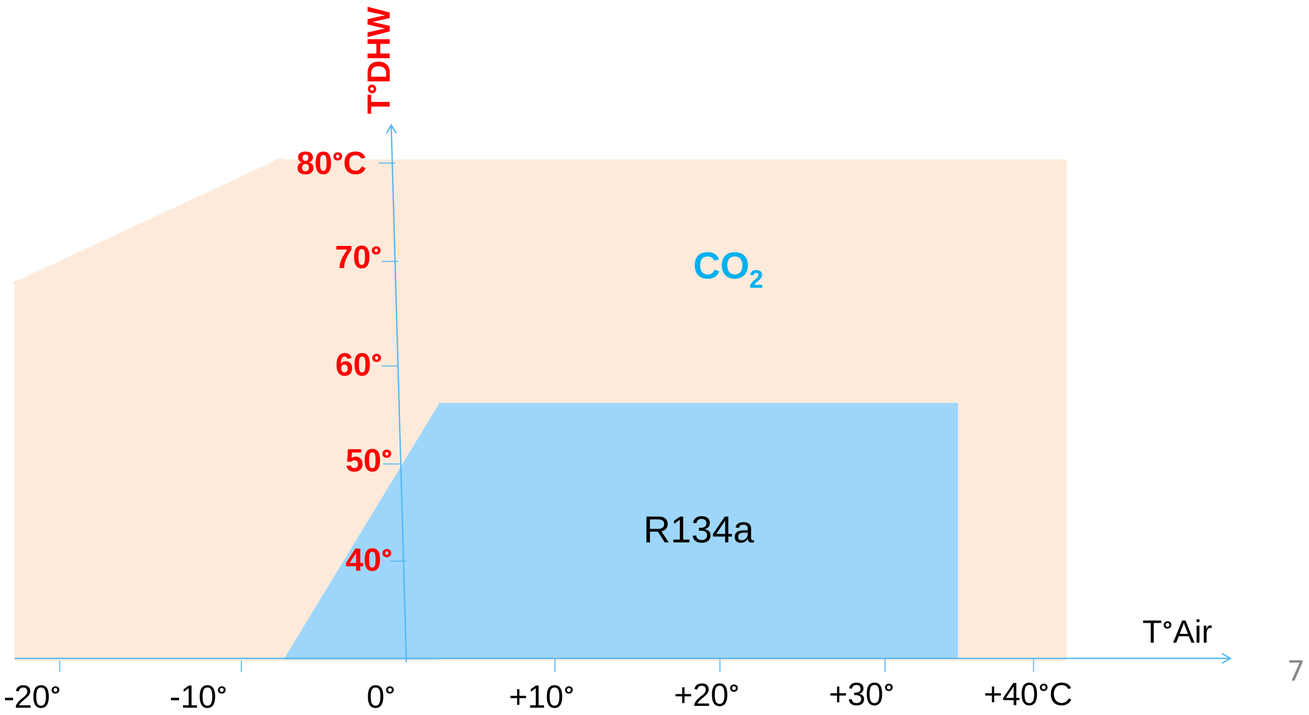


Project Background

- FLEXIT strategy : A new product with integrated ventilation, domestic hot water and space heating for domestic houses and villas
- The focus: passive & low energy domestic houses below 200m^2
- CO_2 Heat Pumps have the highest efficiency for DHW preparation in wide range of conditions
- Project partners: FLEXIT as a ventilation leader and SANDEN as CO_2 technology provider

Strong points of CO_2 in DHW production

- High water temperature
- Quick availability of DHW
- Large operating range without electrical heater
- Compactness (CO_2 has higher density enabling smaller size of components)
- Quick defrosting
- Impressive high COP for DHW



Project Background

Benefits of adopting CO_2 refrigerant

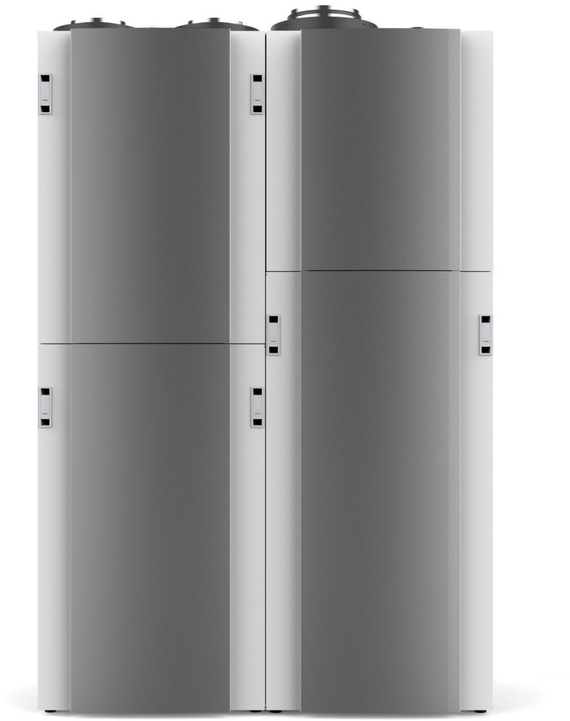
	R-410A	R-407C	Hydrocarbons (eg. R290)	CO_2 (R744)
Type	☹ **HFC** (synthetic)	☹ **HFC** (synthetic)	Natural	Natural
ODP Ozone depleting potential	0	0	0	0
GWP Global warming potential	☹ **2100**	☹ **1800**	3	1
Toxicity	Non toxic	Non toxic	Non toxic	Non toxic
Flammability	Non flammable	Non flammable	☹ **Flammable**	Non flammable
Regulation	☹ **Being phased-out** • Kigali agreement plans progressive phase-out • Europe F-Gas regulation		☹ **Safety restrictions** • Charge limit • Not accepted in some applications	Always compliant 

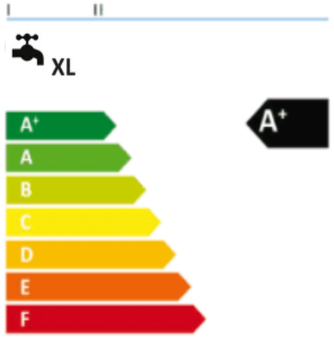
Reduce your carbon footprint with CO_2 technology and save energy.
Ensure safety of staff and customers.

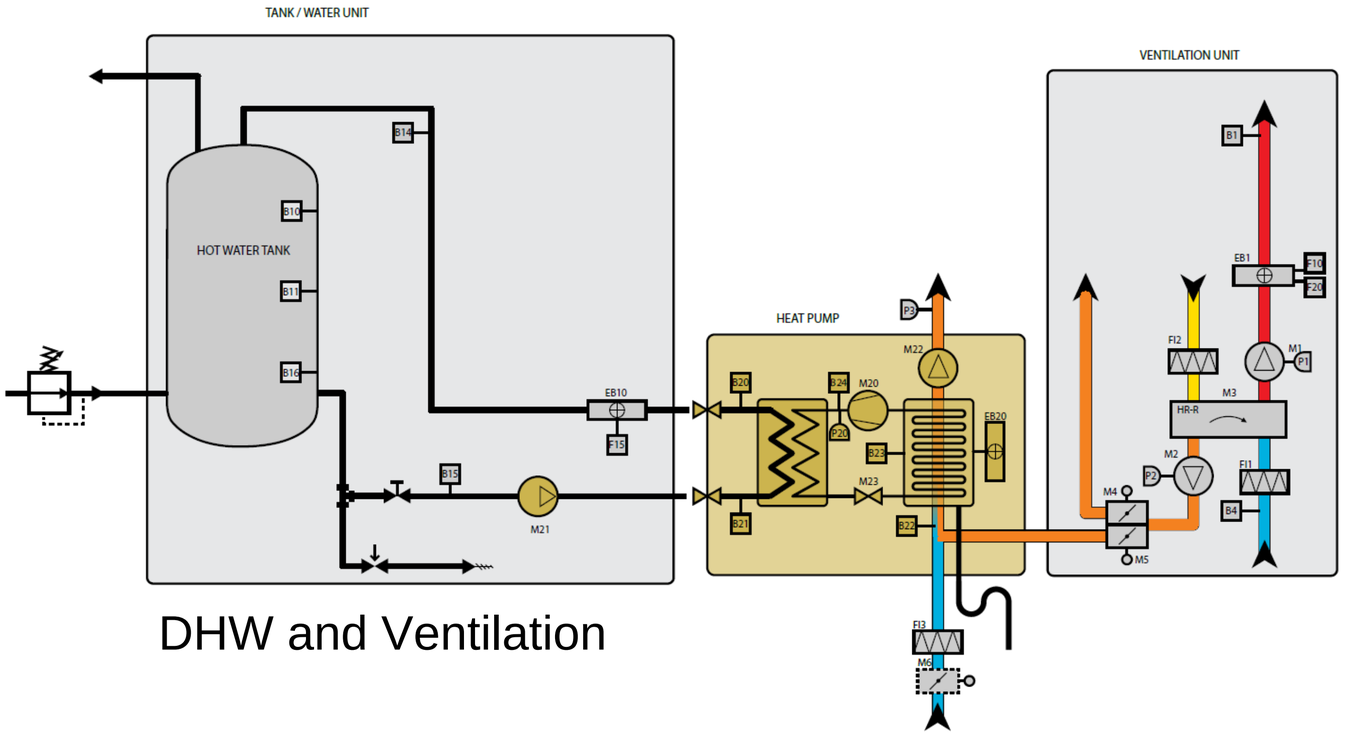
ECORNORDIC Product Specifications

COMPLETE ECONORDIC UNIT

- 60 cm standard width modules
- Modular for easier transport and installation
- Fully integrated control system
- Producing all needs simultaneously
- 2 different variants: DHW/Ventilation or DHW/SH/Ventilation
- Silent operation (below 50dBA)
- Short payback period 3 to 7 years in case of refurbishment







DHW and Ventilation

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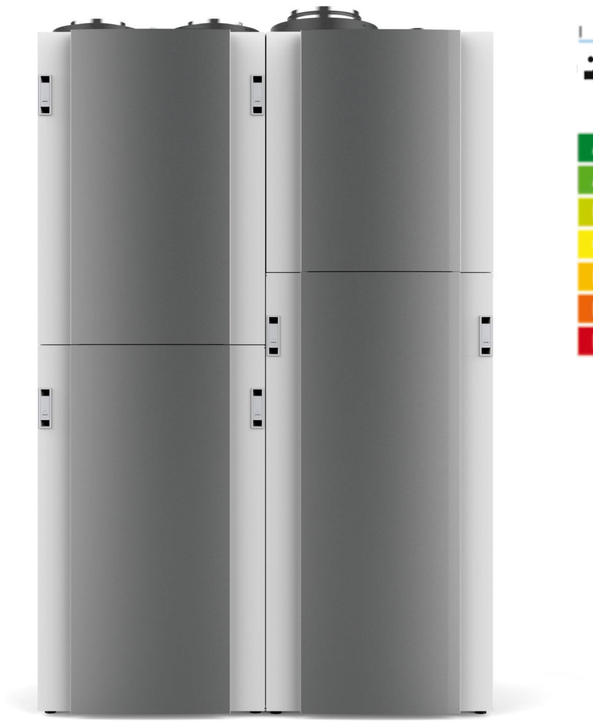
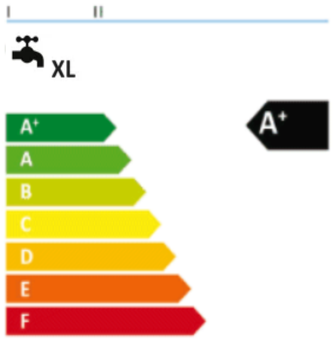
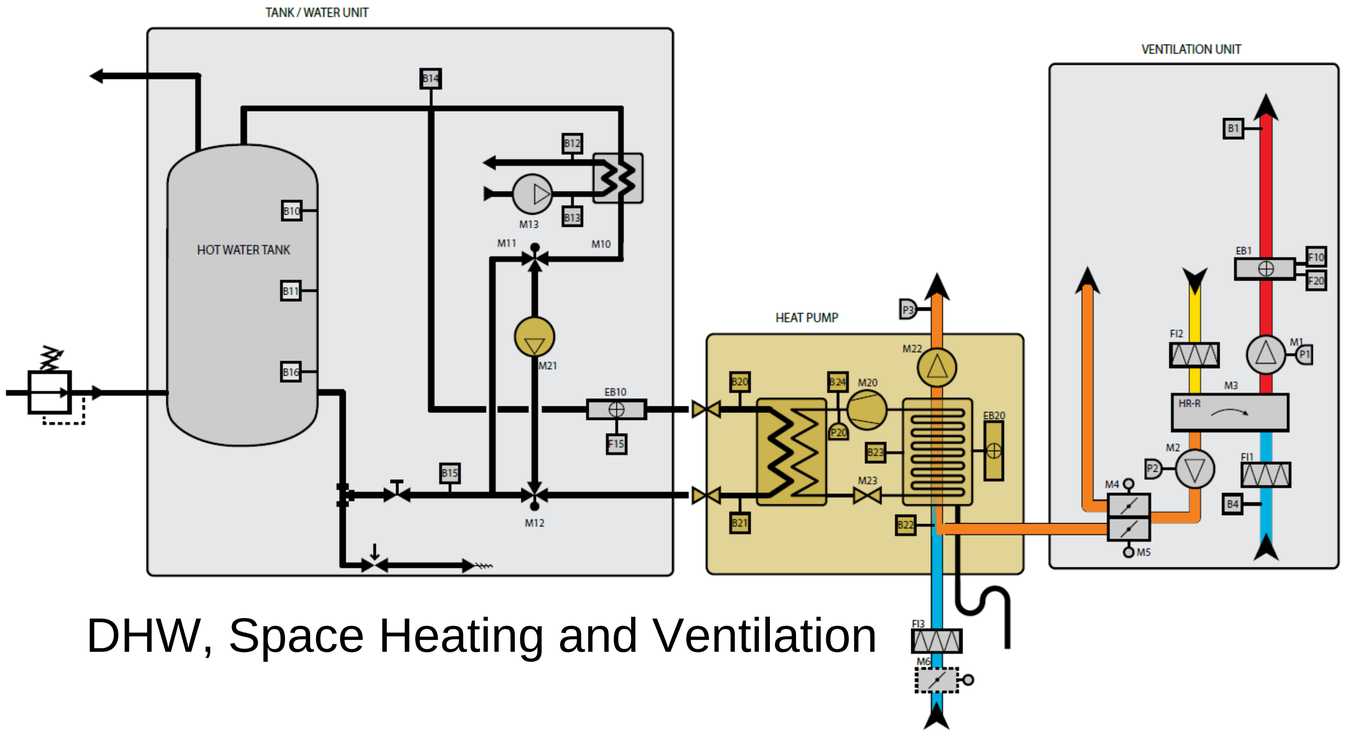






DHW, Space Heating and Ventilation

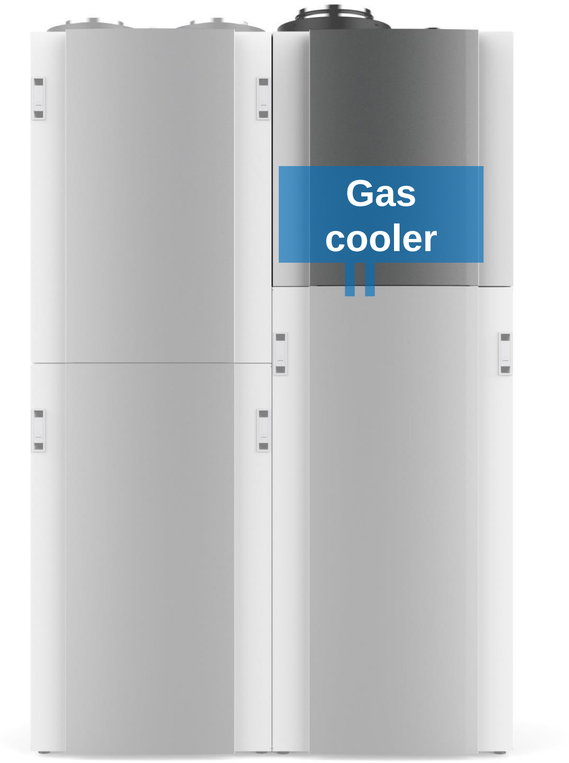
ECORNORDIC Product Specifications

VENTILATION MODULE

- Balanced ventilation up to 390 m^3/h (max)
- Rotor heat exchanger for Nordic climate
- SFP 1.2
- F7 filter in/ out

HEAT PUMP MODULE from SANDEN

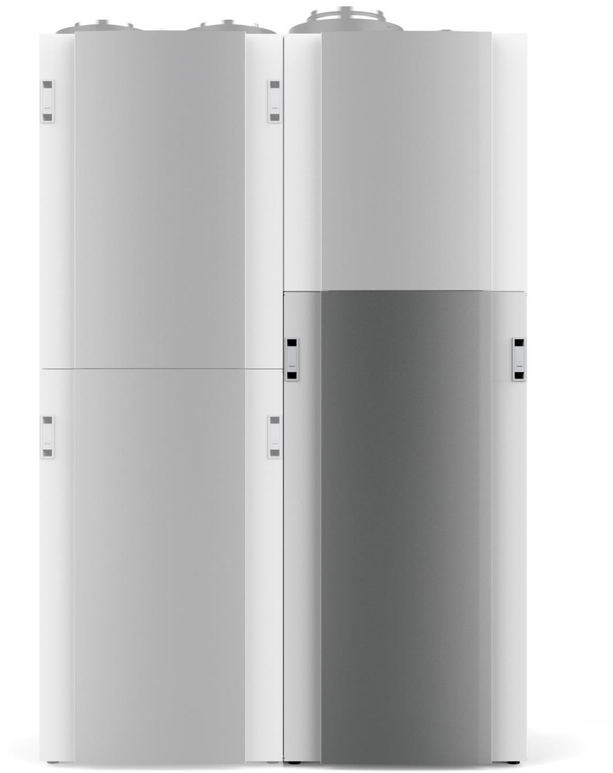
- Natural refrigerant CO_2
- Compressor – Inverter Scroll
- 65 °C without Electric backup
- Variable heat capacity: 2 to 4 kW
- Outdoor conditions for HP operation: -25°C to +43°C



ECORNORDIC Product Specifications

TANK MODULE

- Tank volume approx. 200 liters.
- Stainless steel
- Tap cycle XL
- Fresh water circuit
- Electric backup heater 3 kW
- Service friendly



INSTALLATION MODULE

Free space for installations

Ex.

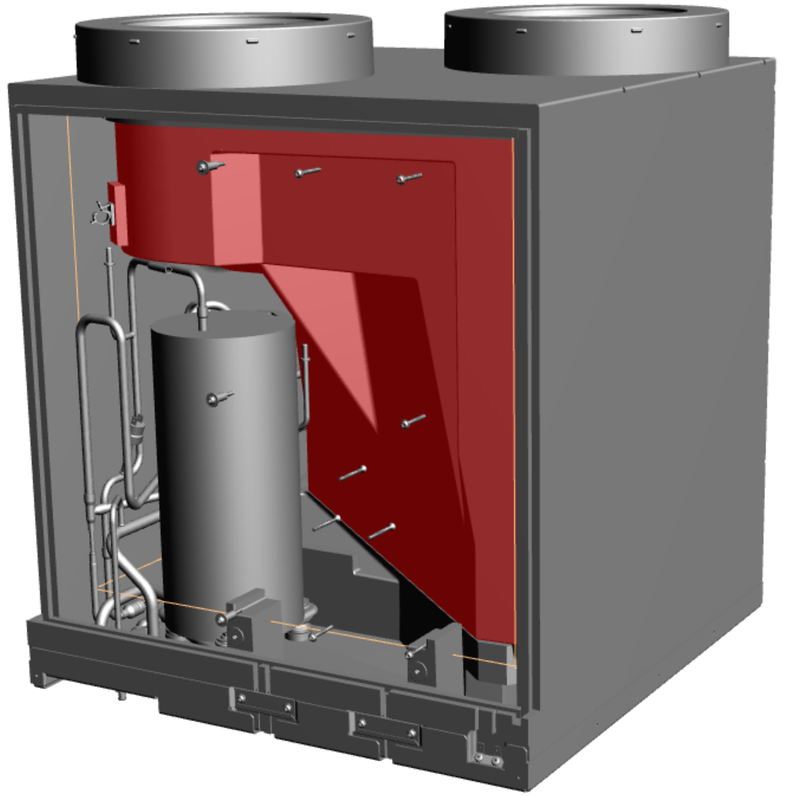
- Space heating distribution
- Expansion vessel
- Water inlet/oulet
- Accessories

ECORNORDIC Tests Results

Product Specifications main targets ☑

- COP DHW 10/65°C @ +7°C (air) > 3,4
- Total heat recovery over 90 % (reuse exhaust air from AHU to HP)

- Heating capacity=3kW@-25°C
- Heat capacity= 4kW@-7°C
- HP Noise @1m = 46 dBA
- Air tightness checked

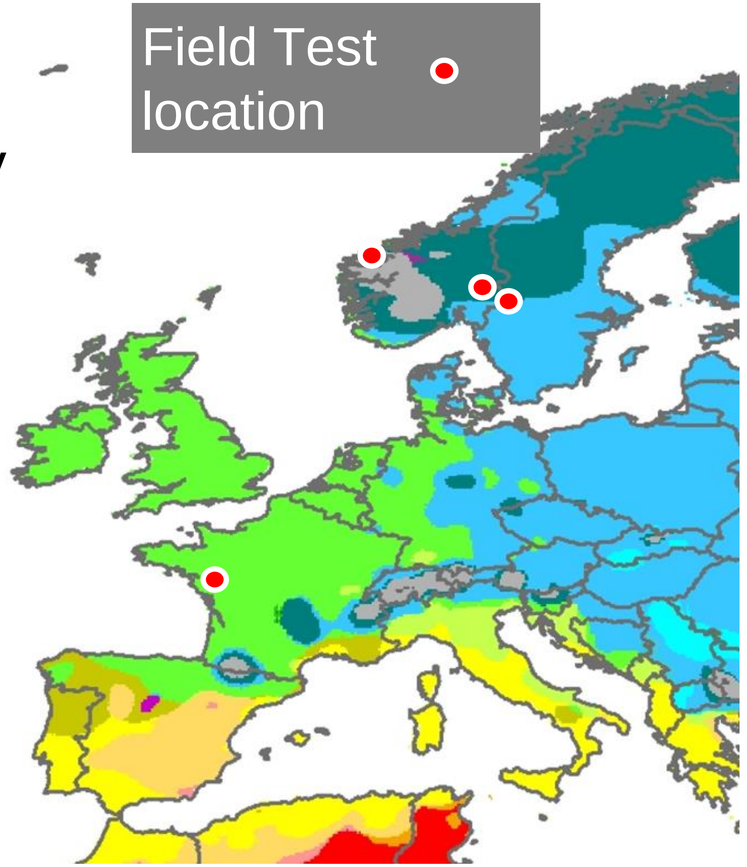


The Heat Pump unit

First Installations and Field Tests

FIELD TESTS

- Located in Norway, Sweden & France
- 3 units installed since 2014 (AquaEco 2) in Sweden and Norway
- 4 Econordic installed this year in field
- More Econordics will be installed in field during this year



Location	Min temp	Max temp	Average yearly temperature
Töcksfors (SE)	-19.0°C	26.1°C	6,5°C
Mysen (NO)	-24.7°C	27,6°C	5.9°C
Ålesund (NO)	-7°C	25.0°C	7.2°C
Nantes (FR)	2.3°C	27.0°C	11.7°C

Temperature data for years 2016/2017

First Installations and Field Tests

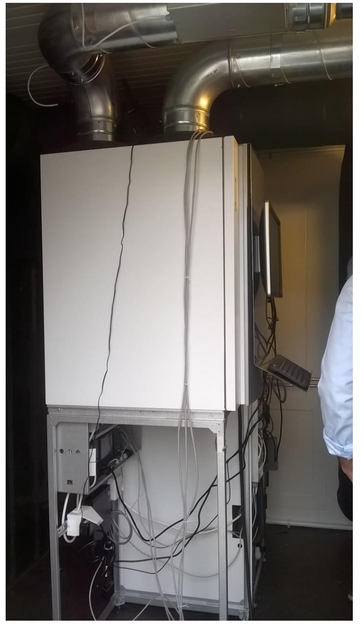
Example:

- Field Test installed in Mysen (Norway) since April 2017
- House 145m² (dual house)
- System installed in separated technical room (without frost)
- Flexit developed “Combi box“ option to manage simply air inlet & outlet for the HP

First Installations and Field Tests

Two containers installed to simulate extreme winter conditions

- Inside and outside temperatures
- Water pipes & air ducts network installed
- Outside temperature down to -30°C
- 2 Econordic installed inside



Conclusions

- ECONORDIC is a green solution with integrated ventilation, hot water and space heating
- It uses CO_2 which is the only A1 natural refrigerant for such application.
- CO_2 Heat Pump is adapted to new houses where DHW is the main Energy consumption
- Field tests and first installations showing positive feedback in Norway, Sweden and France: Air Quality, Thermal Comfort, Quiet & Simple Operation
- Development is at final validation step & Product to be launched early 2018 !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Thank you very much!