TEKNOTHERM

Company Presentation

PCM-Workshop
12.11.2021

Who are we?

Bjørn M. Holo

Senior technical advisor

M.Sc Mechanical Engineering (NTH)

Working with Marine HVAC since 1992.

Chris-André Larsen

Technical advisor

M.Sc Energy and Environmental Engineering (NTNU)

Started with Teknotherm in August

Company history

1926 — **Lehmkuhl Industry** establish in Oslo

1973 — Establish **Head office and production** in Halden (Norway)

1982 — Company sold. Name changes to **Teknotherm Marine**

1998 — Establish **Service office** In Ålesund (Norway)

2005 — Acquires Unitor Stettin, named **Teknotherm Marine HVAC**

2008 — Establish **Teknotherm Refrigeration** in Gothenburg (Sweden)

2013 — Establish **Service office** in Tromsø (Norway)

2015 — **Heinen & Hopman** acquires Teknotherm Marine

HEINEN & HOPMAN

2016 — Establish **Marine HVAC** In Bergen (Norway)

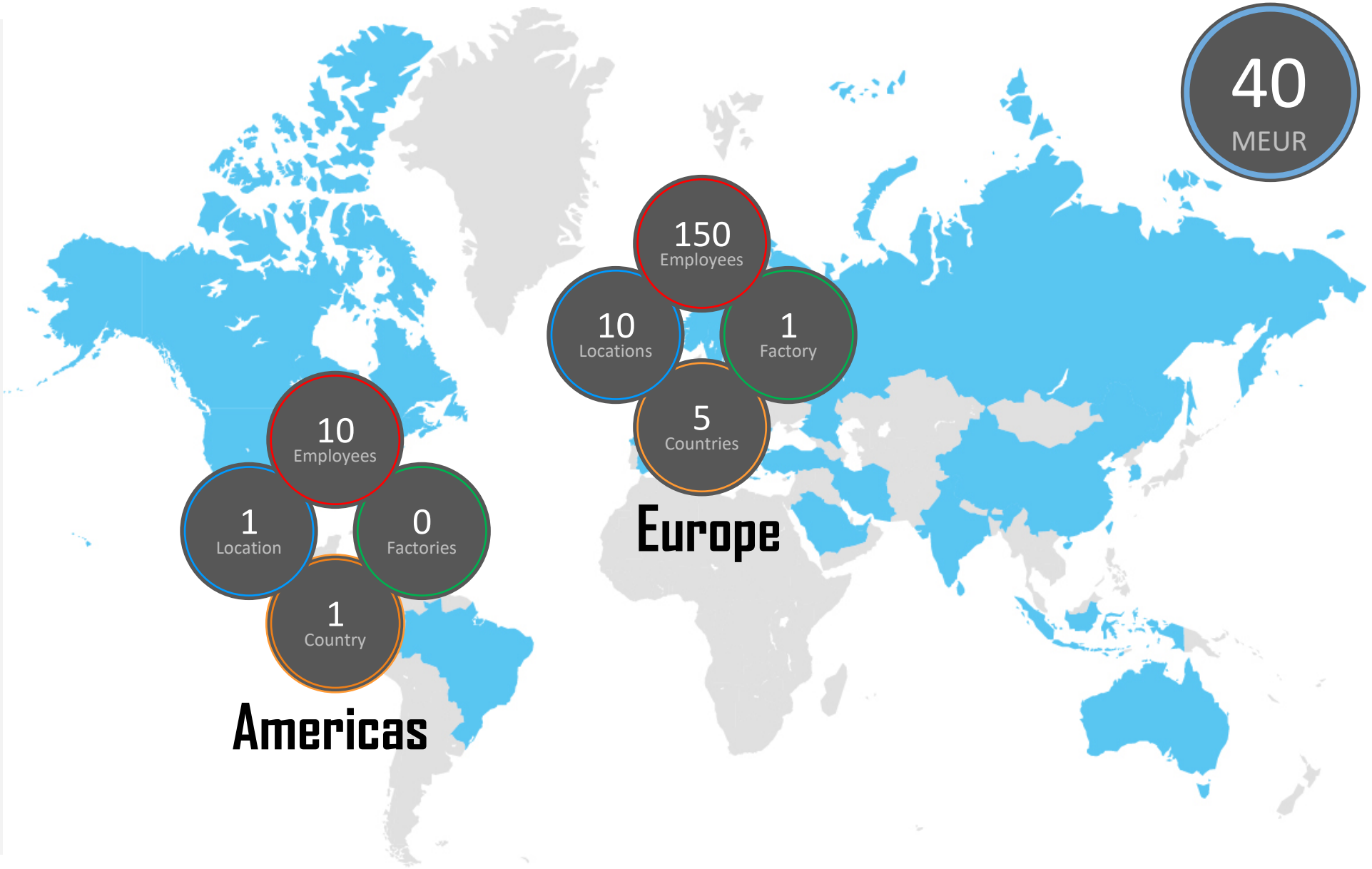
2016 — Acquires **Teknotherm Inc.** in Seattle (USA)

2018 — Establish **Offshore HVAC** in Oslo (Norway)

2020 — Establish **Teknotherm Marine España** in Vigo (Spain)

Locations

- Halden (Norway)
- Oslo (Norway)
- Bergen (Norway)
- Stettin (Poland)
- Vigo (Spain)
- Gothenburg (Sweden)
- Seattle (USA)
- St. Petersburg (Russia)
- Ålesund (Norway)
- Trondheim (Norway)
- Tromsø (Norway)



Heinen & Hopman Group

TEKNOTHERM

HEINEN & HOPMAN

TEKNOTHERM

BRONSWERK
ONBOARD CLIMATE ENGINEERING

1995 - 2015 CELEBRATING 20 YEARS
ALSCOTT

AERIUS
Marine HVAC since 1858

LeBlanc
& Associates, LLC

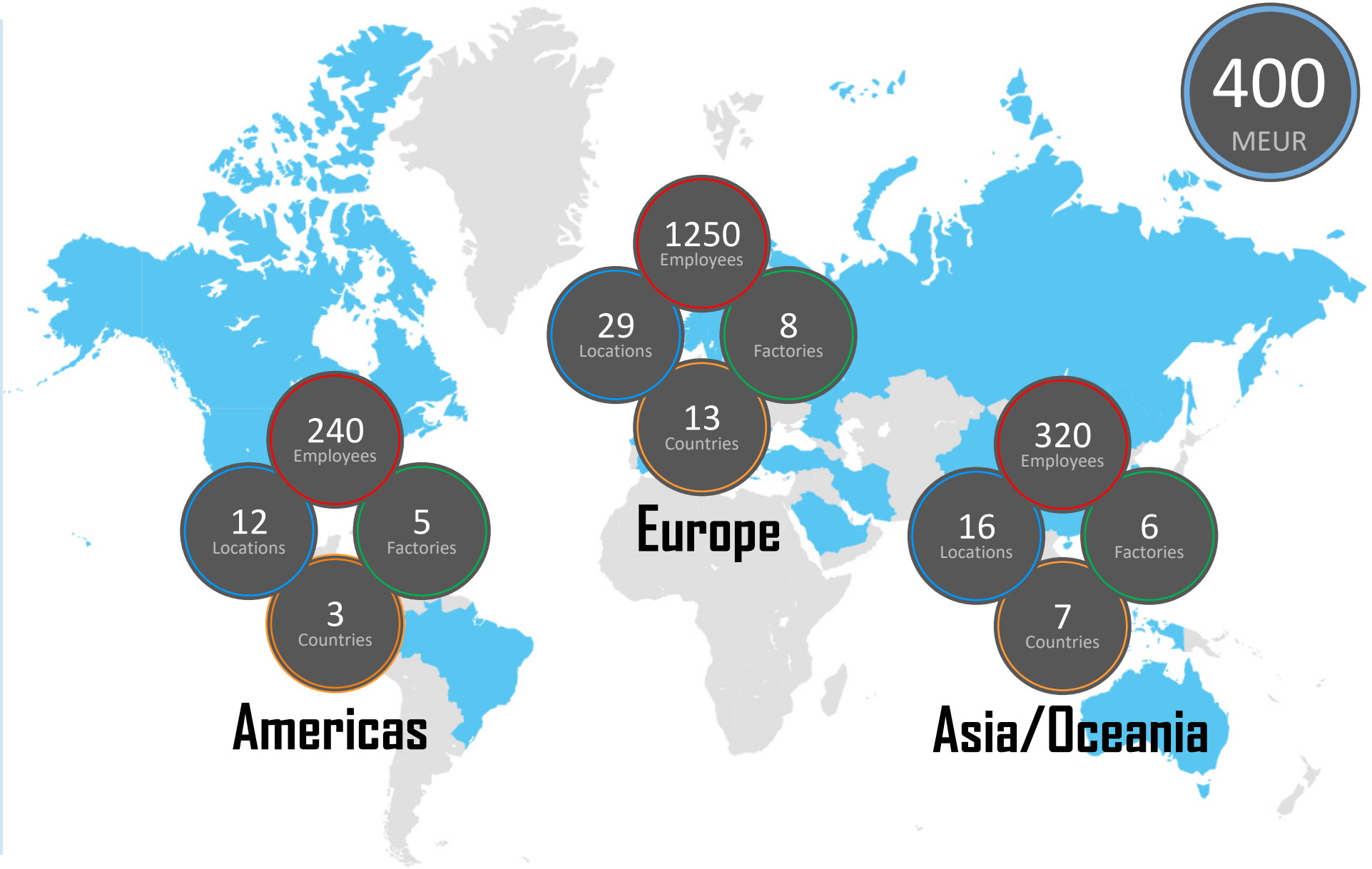
Drews
Marine GmbH

Möhring
Marine Service

SNORI

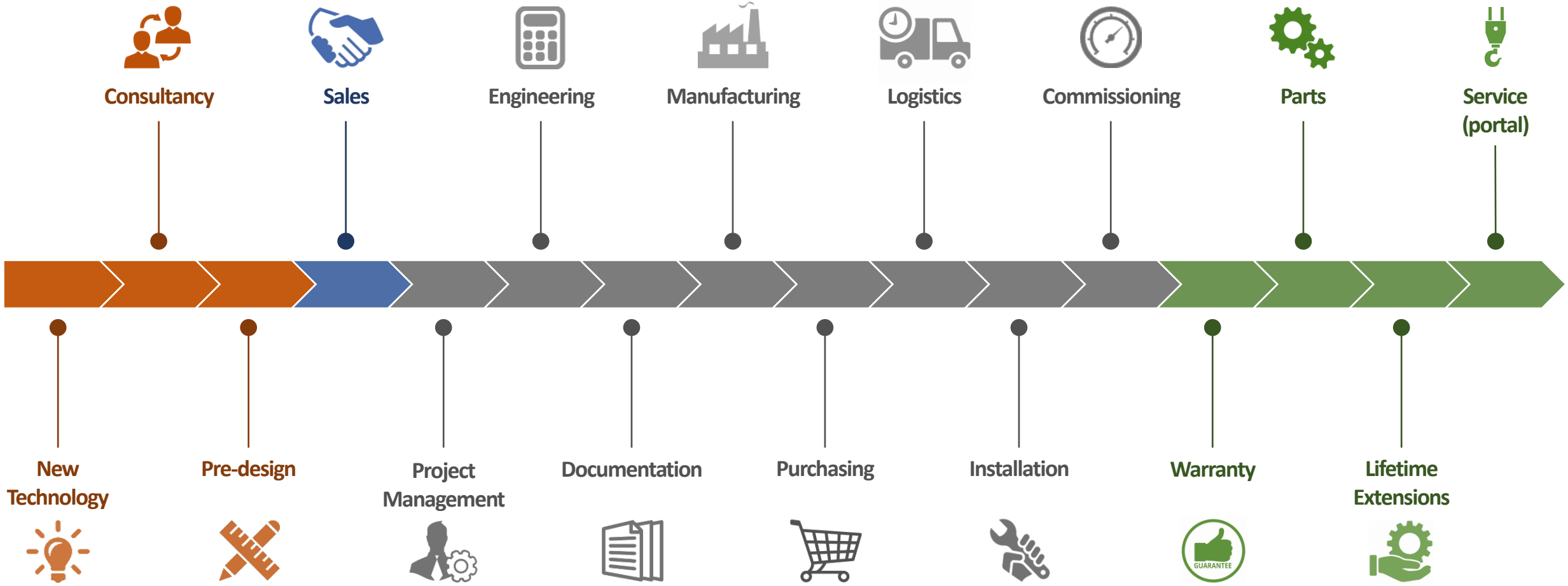
°C casp

oomiak MARINE



System responsibility A-Z

TEKNOTHERM



References

Cruise Vessels

Hurtigruten 140m / 650pax (2 ships)

Scenic Eclipse 165m / 228pax

Havila Coastal Route 123 m / 640 pax (4 ships)

AraMana 139m / 280pax

Viking River Cruises 135m

Celebrity Flora 101.5m / 100pax

Viking Mississippi 137 m / 386 pax

World Traveller 126 m / 196 pax

Silversea Origin 101.5m/100pax

References

RoPax & Ferries

E-Flexer 212 m / 1200 pax / 120 cars (8 ships)

Color Hybrid 160 m / 2000 pax / 500 cars

Algerie Ferries 200 m / 1800 pax / 600 cars

Staten Island Ferry 97.5 m / 4500 pax (3 ships)

Superstar 230 m / 1100 pax / 5100 lm

TT Line 230 m / 800 pax / 200 trucks

Dover-Calais 230 m / 1500 pax (2 ships)

Aranui 5 126 m / 150 pax

Honfleur 185 m / 1680 pax / 550 cars

References

Special Vessels & Navy

Coast Guard Vessels Norway (3 ships)

Pioneering Spirit 382 x 124 m

Arctic offshore patrol vessel 103.6 m (Canada)

Polar Research Vessel 160 m (Australia)

Windmill Vessels 88 m (6 ships)

Successor Class Submarines 152.9m (UK)

FPSO 200 m

Fishing Vessel 81 m

Battery Ferries 109 m / 399 pax (3 ships)

References

Yachts

Motor Yacht A 119 m

REV Ocean 182 m

Northern Star 107 m

Olivia O 86.5 m

Topaz 147 m

Lady S 93 m

Nord 142 m

Azzam 180 m

Viva 94 m

TEKNOTHERM

PCM

Phase changing materials

Opportunities

- Utilize waste heat
- Capacity equalization
- Reduce installed capacity
- Reduce energy consumption
- Emission free operation in harbours and fjords

Phase changing materials

Challenges

- Limited space
- Low ΔT
- No one fit all solution
- Efficient charging, discharging and utilization

Tustna/Grip

Vessels

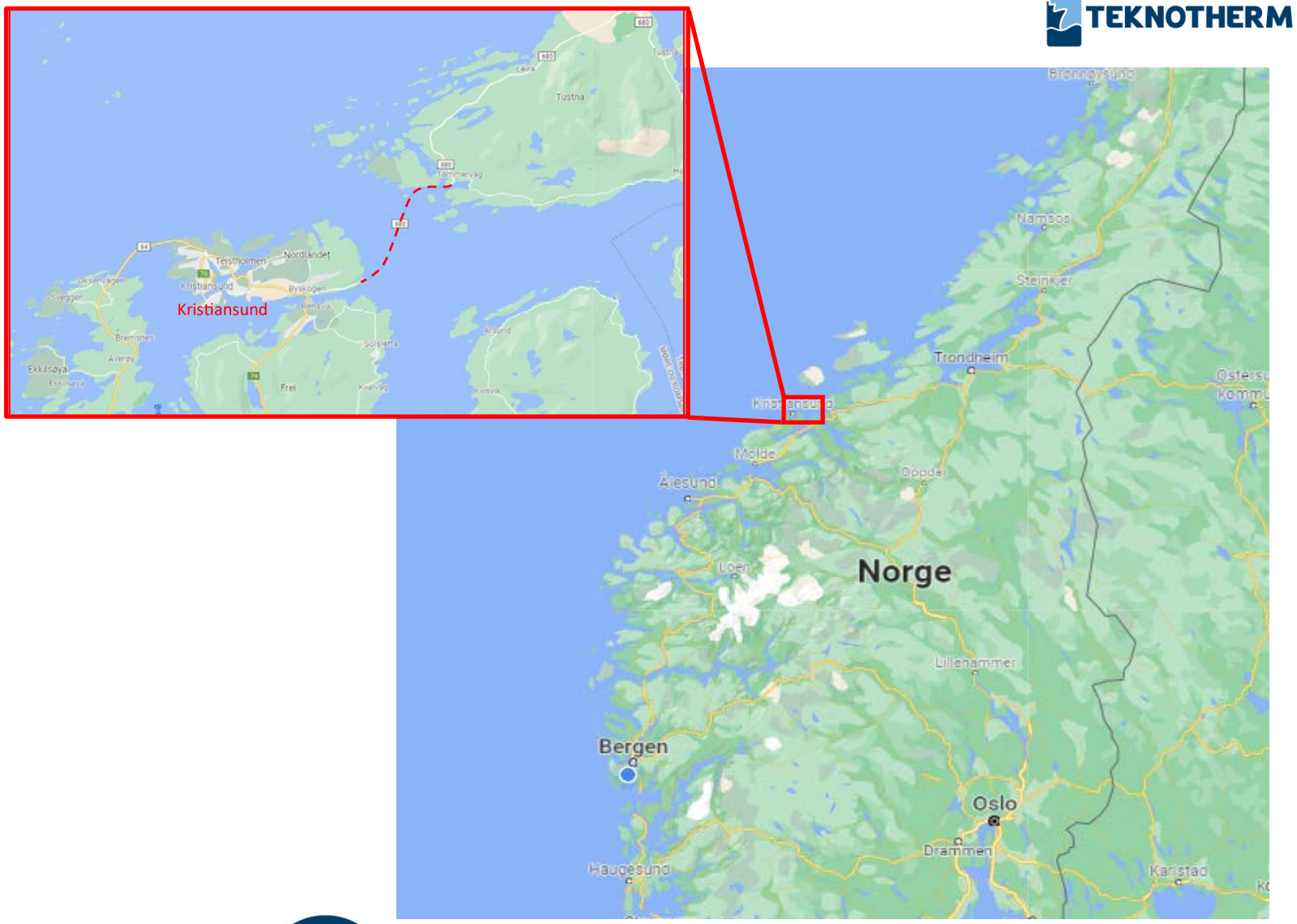
- Double ended ferries
- Battery propulsion
- Diesel back up
- 80 cars / 399 Passengers & Crew

Teknotherm Scope

- Ventilation system for accommodation and technical spaces
- Heating and cooling systems
- Control system for HVAC plant
- Engineering, equipment delivery, commissioning

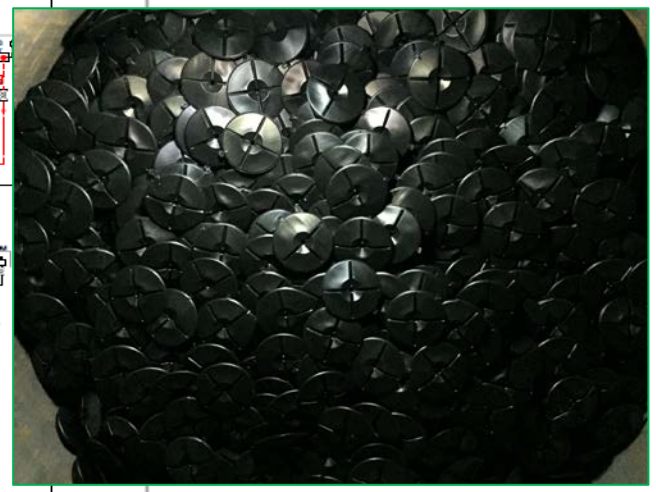
Tustna/Grip

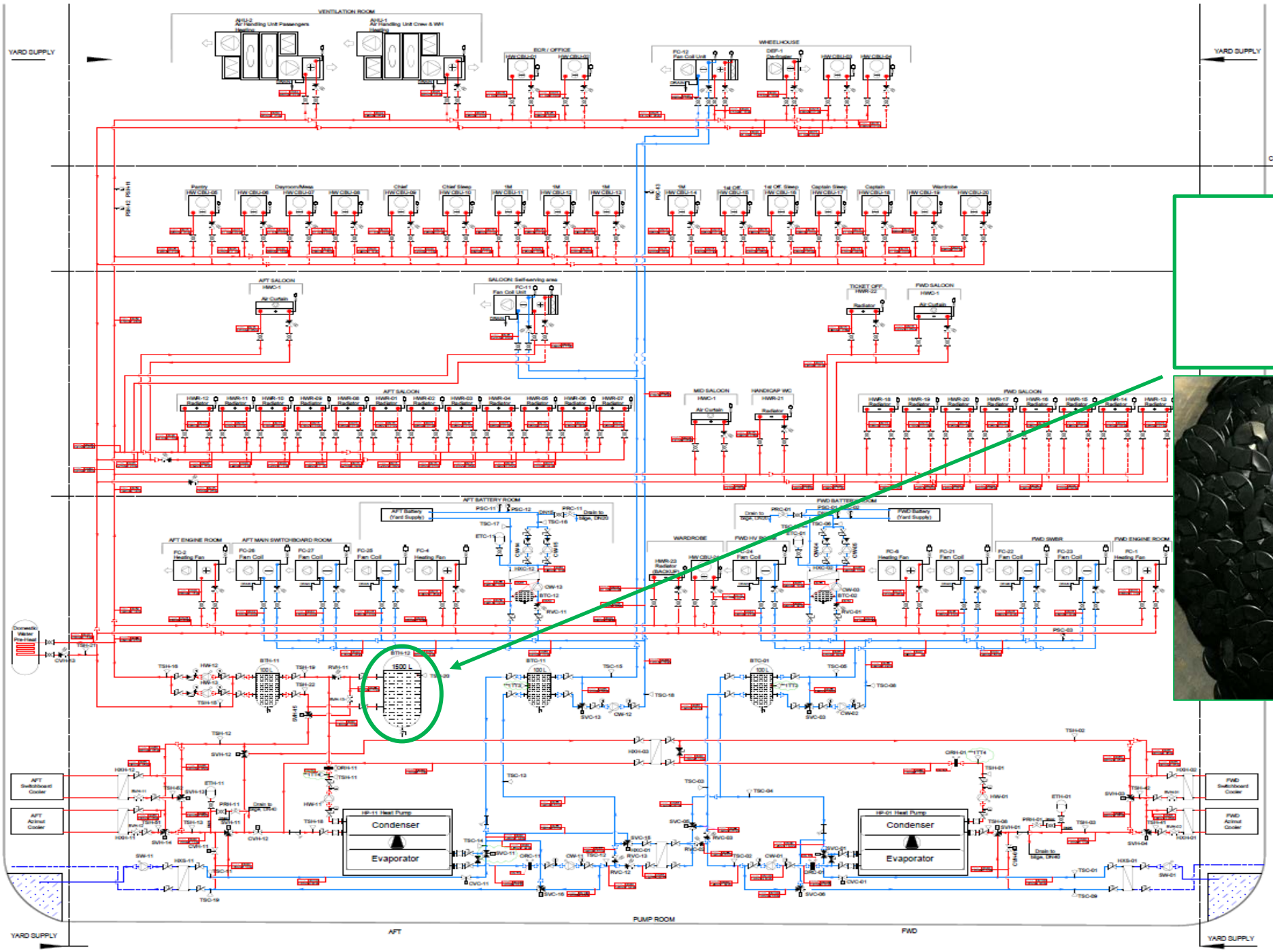
- 25 min crossing
- 4 min battery charging
- 12/18 h operation per day
- Operated by Fjord1
- ~80 electrical ferries in Norway last 8-10 years



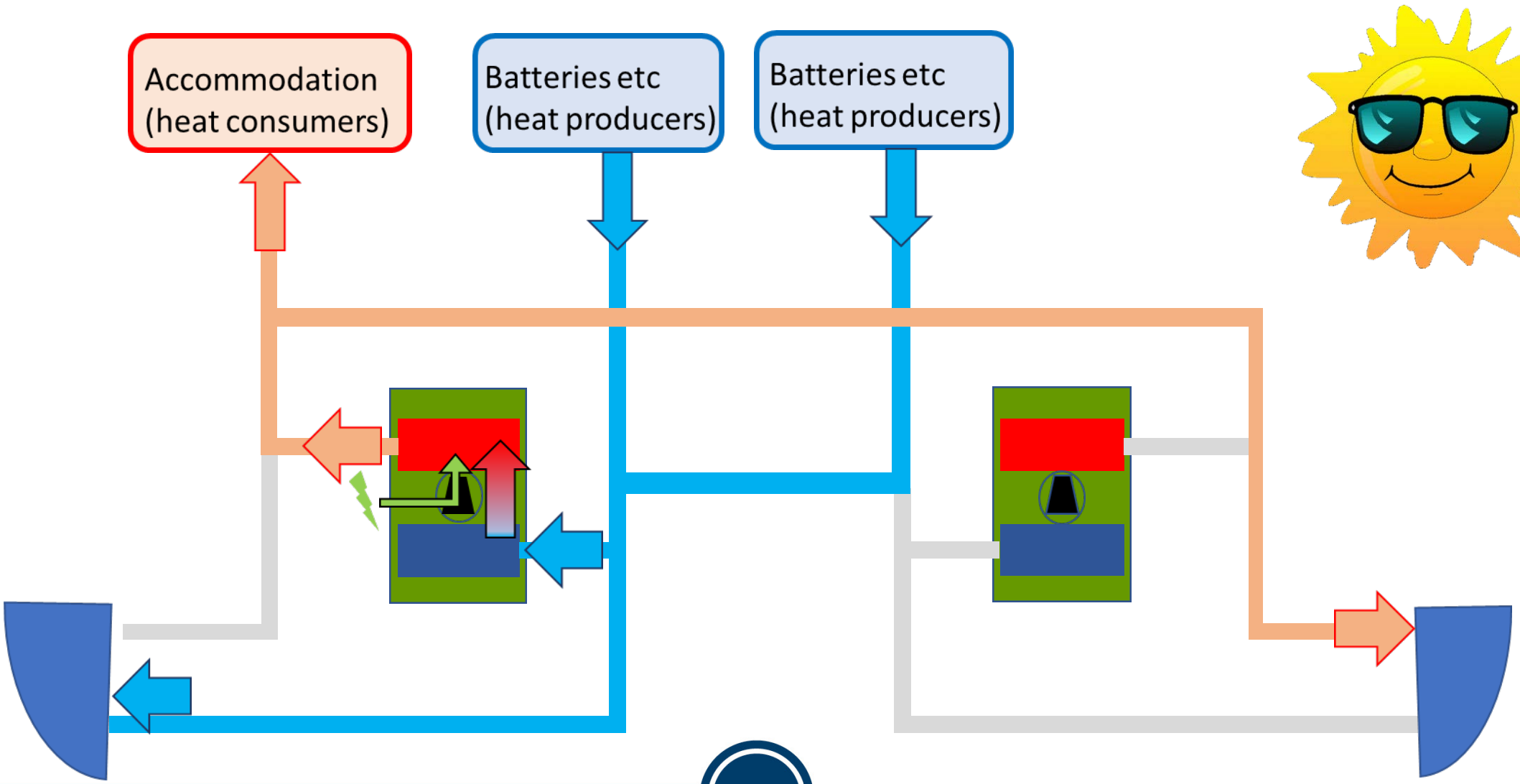
TEKNOTHERM

Tank with PCM
1500 liter
500 kg ATE36
~30 kWh

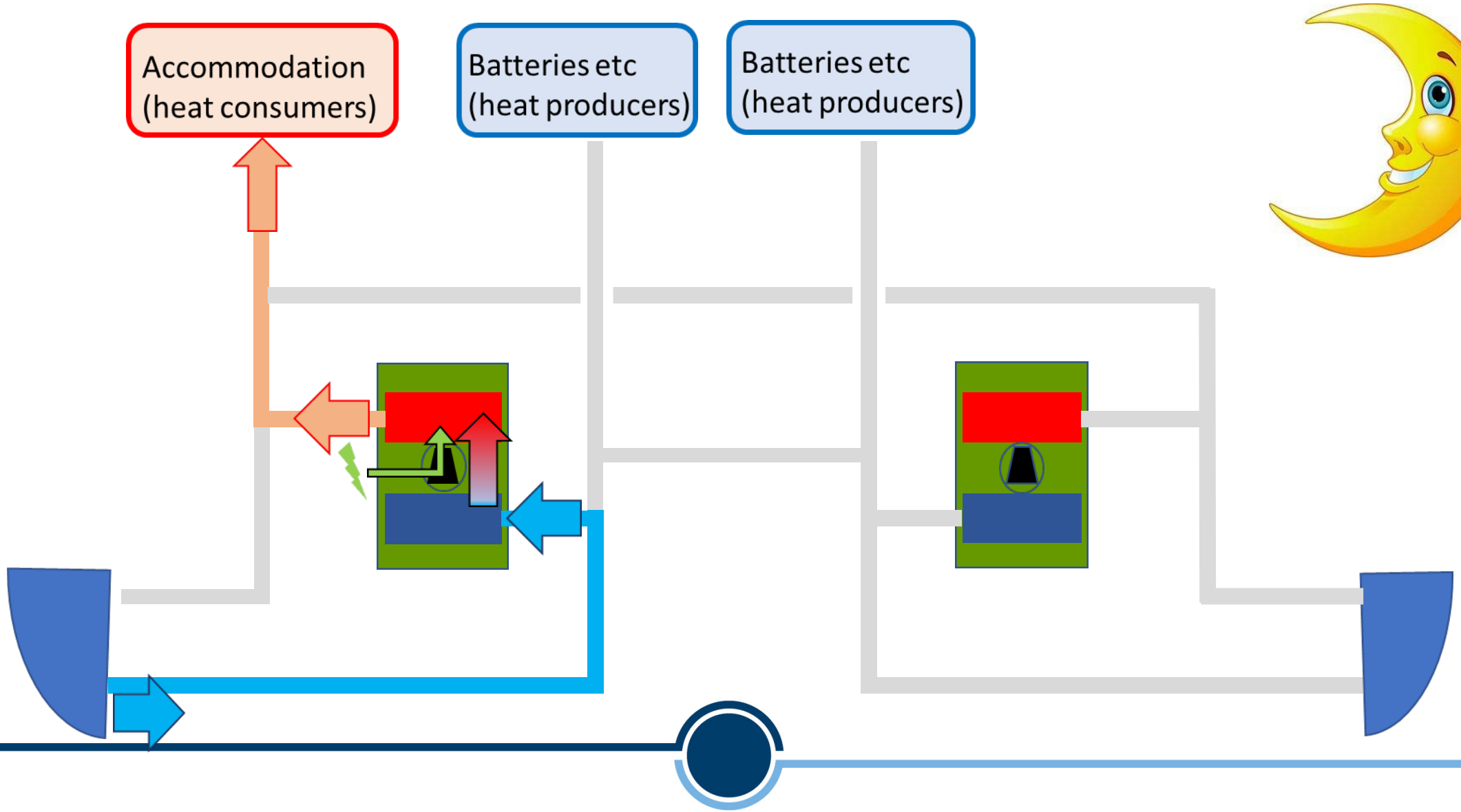


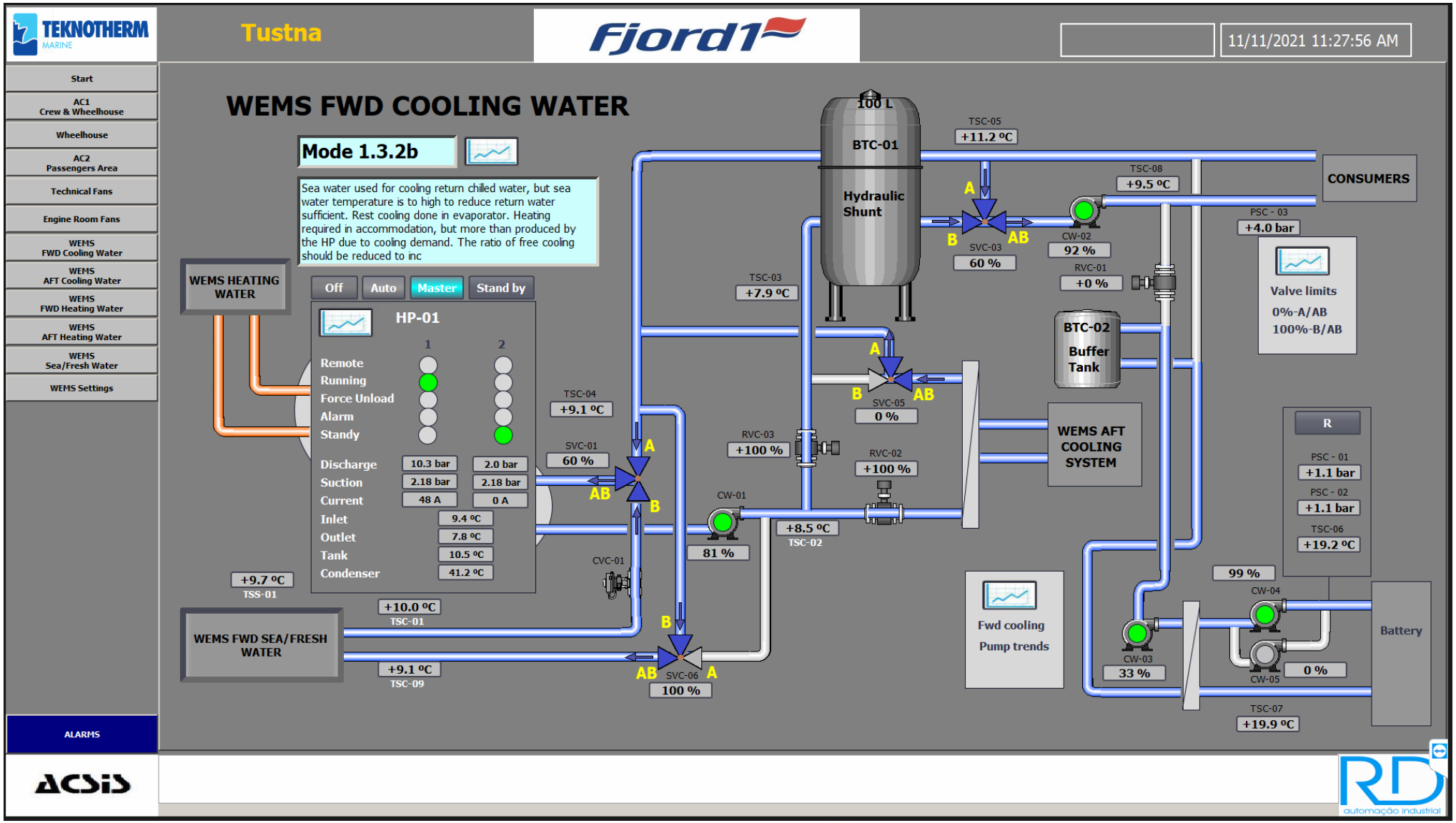


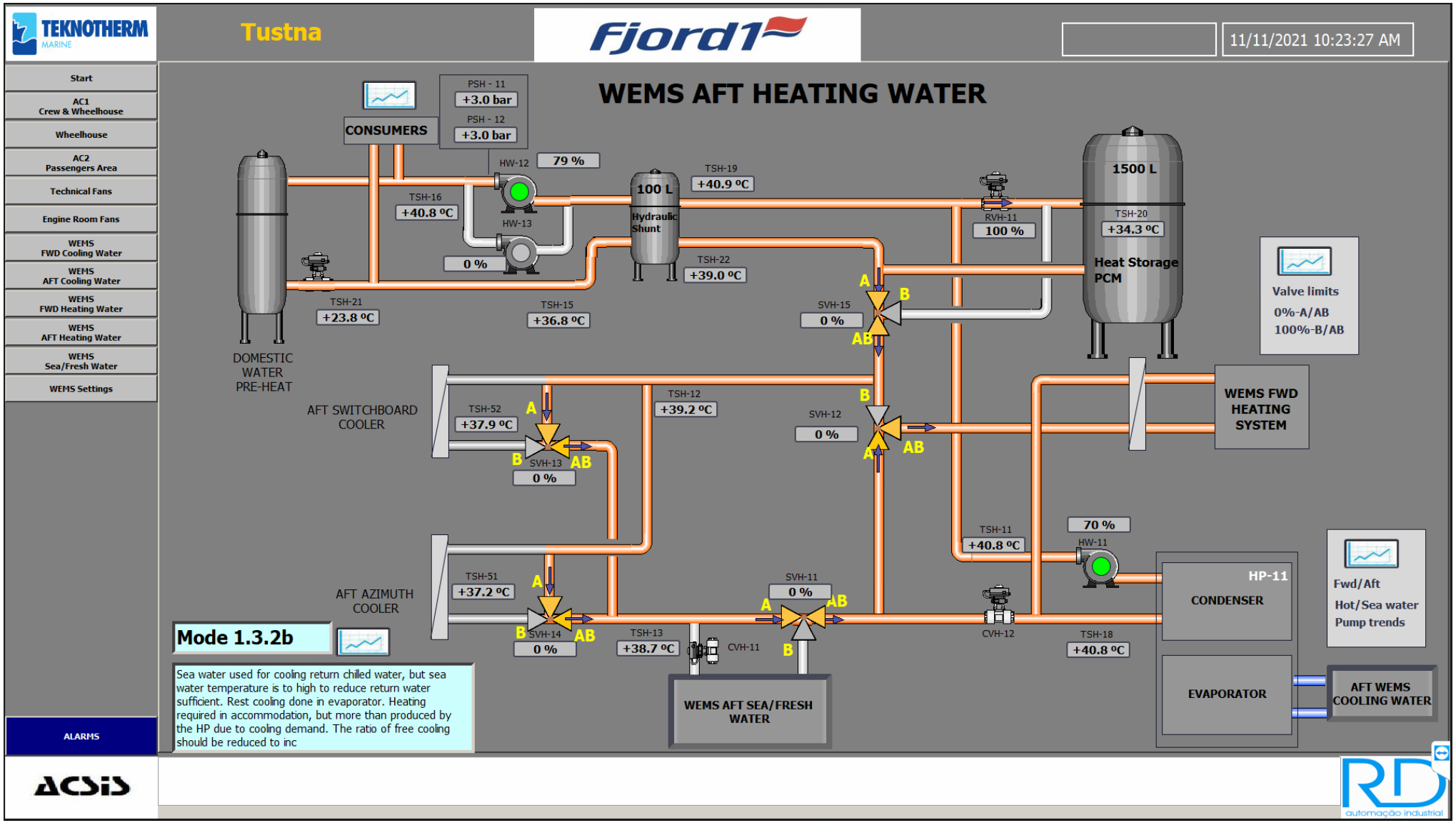
Energy flow – Day operation



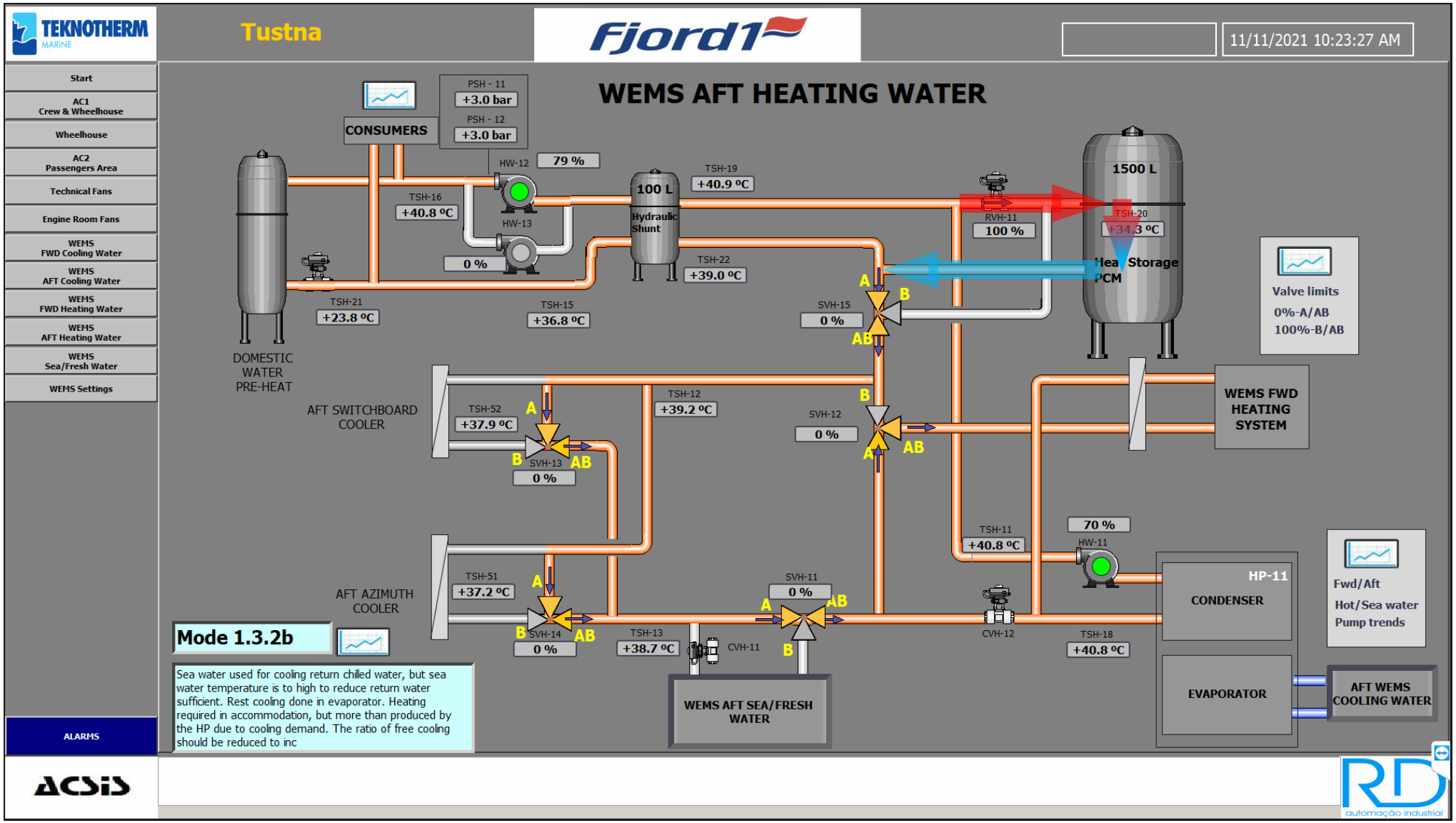
Energy flow – Night operation



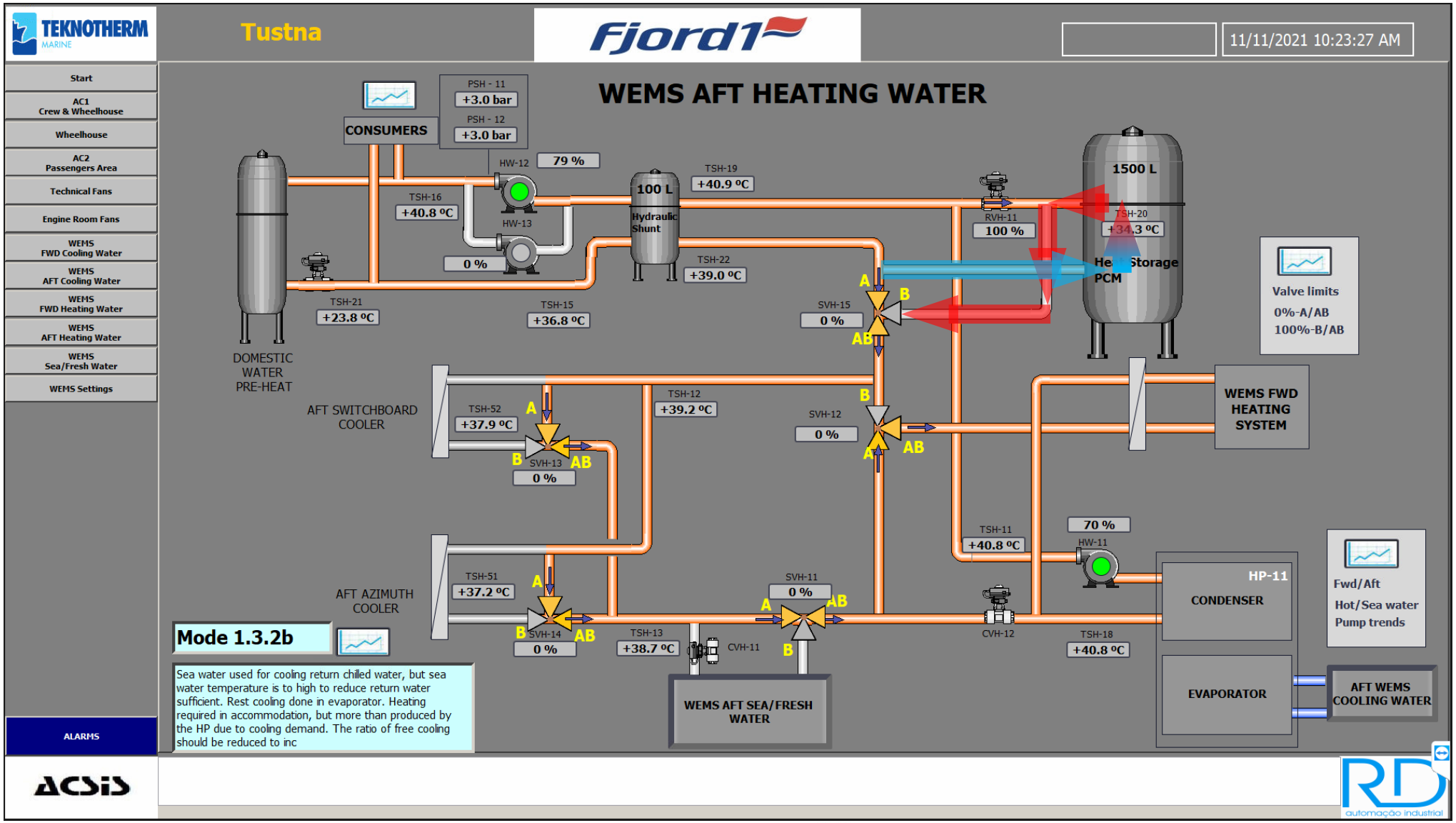

TEKNOTHERM MARINE
Tustna
Fjord1
11/11/2021 11:27:56 AM
Start
AC1 Crew & Wheelhouse
Wheelhouse
AC2 Passengers Area
Technical Fans
Engine Room Fans
WEMS FWD Cooling Water
WEMS AFT Cooling Water
WEMS FWD Heating Water
WEMS AFT Heating Water
WEMS Sea/Fresh Water
WEMS Settings
ALARMS
ACSiS
WEMS FWD COOLING WATER
Mode 1.3.2b
Sea water used for cooling return chilled water, but sea water temperature is to high to reduce return water sufficient. Rest cooling done in evaporator. Heating required in accommodation, but more than produced by the HP due to cooling demand. The ratio of free cooling should be reduced to inc
WEMS HEATING WATER
Off
Auto
Master
Stand by
HP-01
1
2
Remote
Running
Force Unload
Alarm
Standy
Discharge
Suction
Current
Inlet
Outlet
Tank
Condenser
10.3 bar
2.0 bar
2.18 bar
2.18 bar
48 A
0 A
9.4 ºC
7.8 ºC
10.5 ºC
41.2 ºC
100 L
BTC-01
Hydraulic Shunt
TSC-05
+11.2 ºC
TSC-08
+9.5 ºC
CONSUMERS
PSC - 03
+4.0 bar
SVC-03
60 %
CW-02
92 %
RVC-01
+0 %
TSC-03
+7.9 ºC
Valve limits
0%-A/AB
100%-B/AB
BTC-02
Buffer Tank
SVC-05
0 %
TSC-04
+9.1 ºC
SVC-01
60 %
RVC-03
+100 %
RVC-02
+100 %
WEMS AFT COOLING SYSTEM
R
PSC - 01
+1.1 bar
PSC - 02
+1.1 bar
TSC-06
+19.2 ºC
CW-01
81 %
+8.5 ºC
TSC-02
CVC-01
+9.7 ºC
TSS-01
+10.0 ºC
TSC-01
WEMS FWD SEA/FRESH WATER
+9.1 ºC
TSC-09
SVC-06
100 %
Fwd cooling Pump trends
99 %
CW-04
CW-03
33 %
CW-05
0 %
TSC-07
+19.9 ºC
Battery
RD automação industrial


TEKNOTHERM MARINE
Tustna
Fjord1
11/11/2021 10:23:27 AM
Start
AC1 Crew & Wheelhouse
Wheelhouse
AC2 Passengers Area
Technical Fans
Engine Room Fans
WEMS FWD Cooling Water
WEMS AFT Cooling Water
WEMS FWD Heating Water
WEMS AFT Heating Water
WEMS Sea/Fresh Water
WEMS Settings
ALARMS
ACSiS
WEMS AFT HEATING WATER
CONSUMERS
PSH - 11
+3.0 bar
PSH - 12
+3.0 bar
HW-12
79 %
HW-13
0 %
TSH-16
+40.8 ºC
TSH-19
+40.9 ºC
100 L
Hydraulic Shunt
TSH-22
+39.0 ºC
RVH-11
100 %
1500 L
TSH-20
+34.3 ºC
Heat Storage PCM
TSH-21
+23.8 ºC
TSH-15
+36.8 ºC
SVH-15
0 %
DOMESTIC WATER PRE-HEAT
Valve limits
0%-A/AB
100%-B/AB
AFT SWITCHBOARD COOLER
TSH-52
+37.9 ºC
SVH-13
0 %
TSH-12
+39.2 ºC
SVH-12
0 %
WEMS FWD HEATING SYSTEM
TSH-11
+40.8 ºC
70 %
HW-11
HP-11
CONDENSER
AFT AZIMUTH COOLER
TSH-51
+37.2 ºC
SVH-14
0 %
TSH-13
+38.7 ºC
CVH-11
SVH-11
0 %
CVH-12
TSH-18
+40.8 ºC
Fwd/Aft
Hot/Sea water
Pump trends
EVAPORATOR
AFT WEMS COOLING WATER
WEMS AFT SEA/FRESH WATER
Mode 1.3.2b
Sea water used for cooling return chilled water, but sea water temperature is to high to reduce return water sufficient. Rest cooling done in evaporator. Heating required in accommodation, but more than produced by the HP due to cooling demand. The ratio of free cooling should be reduced to inc
RD automação industrial

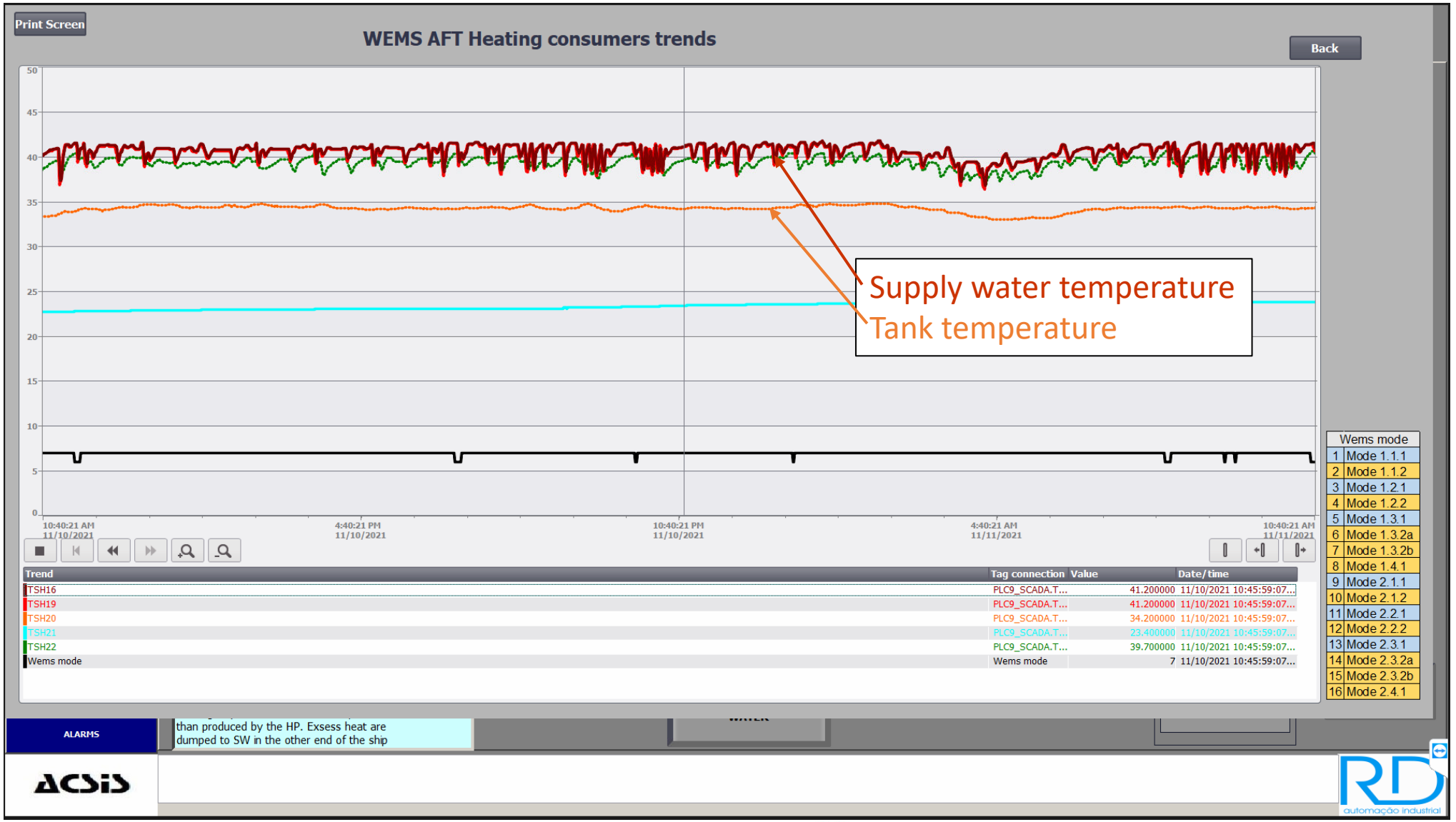
TEKNOTHERM


TEKNOTHERM MARINE
Tustna
Fjord1
11/11/2021 10:23:27 AM
Start
AC1 Crew & Wheelhouse
Wheelhouse
AC2 Passengers Area
Technical Fans
Engine Room Fans
WEMS FWD Cooling Water
WEMS AFT Cooling Water
WEMS FWD Heating Water
WEMS AFT Heating Water
WEMS Sea/Fresh Water
WEMS Settings
ALARMS
ACSiS
WEMS AFT HEATING WATER
CONSUMERS
PSH - 11
+3.0 bar
PSH - 12
+3.0 bar
HW-12
79 %
HW-13
0 %
TSH-16
+40.8 ºC
TSH-19
+40.9 ºC
100 L
Hydraulic Shunt
TSH-22
+39.0 ºC
TSH-21
+23.8 ºC
TSH-15
+36.8 ºC
DOMESTIC WATER PRE-HEAT
RVH-11
100 %
1500 L
TSH-20
+34.3 ºC
Heat Storage PCM
SVH-15
0 %
Valve limits
0%-A/AB
100%-B/AB
AFT SWITCHBOARD COOLER
TSH-52
+37.9 ºC
SVH-13
0 %
TSH-12
+39.2 ºC
SVH-12
0 %
WEMS FWD HEATING SYSTEM
AFT AZIMUTH COOLER
TSH-51
+37.2 ºC
SVH-14
0 %
TSH-13
+38.7 ºC
CVH-11
SVH-11
0 %
WEMS AFT SEA/FRESH WATER
TSH-11
+40.8 ºC
70 %
HW-11
CVH-12
TSH-18
+40.8 ºC
HP-11
CONDENSER
EVAPORATOR
Fwd/Aft
Hot/Sea water
Pump trends
AFT WEMS COOLING WATER
Mode 1.3.2b
Sea water used for cooling return chilled water, but sea water temperature is to high to reduce return water sufficient. Rest cooling done in evaporator. Heating required in accommodation, but more than produced by the HP due to cooling demand. The ratio of free cooling should be reduced to inc
RD automação industrial

TEKNOTHERM


TEKNOTHERM MARINE
Tustna
Fjord1
11/11/2021 10:23:27 AM
Start
AC1 Crew & Wheelhouse
Wheelhouse
AC2 Passengers Area
Technical Fans
Engine Room Fans
WEMS FWD Cooling Water
WEMS AFT Cooling Water
WEMS FWD Heating Water
WEMS AFT Heating Water
WEMS Sea/Fresh Water
WEMS Settings
ALARMS
ACSiS
WEMS AFT HEATING WATER
CONSUMERS
PSH - 11
+3.0 bar
PSH - 12
+3.0 bar
HW-12
79 %
HW-13
0 %
TSH-16
+40.8 ºC
TSH-19
+40.9 ºC
100 L
Hydraulic Shunt
TSH-22
+39.0 ºC
RVH-11
100 %
1500 L
TSH-20
+34.3 ºC
PCM
TSH-21
+23.8 ºC
TSH-15
+36.8 ºC
SVH-15
0 %
DOMESTIC WATER PRE-HEAT
AFT SWITCHBOARD COOLER
TSH-52
+37.9 ºC
SVH-13
0 %
TSH-12
+39.2 ºC
SVH-12
0 %
WEMS FWD HEATING SYSTEM
Valve limits
0%-A/AB
100%-B/AB
TSH-11
+40.8 ºC
70 %
HW-11
HP-11
CONDENSER
AFT AZIMUTH COOLER
TSH-51
+37.2 ºC
SVH-14
0 %
TSH-13
+38.7 ºC
CVH-11
SVH-11
0 %
CVH-12
TSH-18
+40.8 ºC
Fwd/Aft
Hot/Sea water
Pump trends
Mode 1.3.2b
Sea water used for cooling return chilled water, but sea water temperature is to high to reduce return water sufficient. Rest cooling done in evaporator. Heating required in accommodation, but more than produced by the HP due to cooling demand. The ratio of free cooling should be reduced to inc
EVAPORATOR
AFT WEMS COOLING WATER
WEMS AFT SEA/FRESH WATER
RD automação industrial

TEKNOTHERM


Print Screen
WEMS AFT Heating consumers trends
Back
Supply water temperature
Tank temperature
10:40:21 AM 11/10/2021
4:40:21 PM 11/10/2021
10:40:21 PM 11/10/2021
4:40:21 AM 11/11/2021
10:40:21 AM 11/11/2021
Trend
Tag connection
Value
Date/time
TSH16 PLC9_SCADA.T... 41.200000 11/10/2021 10:45:59:07...
TSH19 PLC9_SCADA.T... 41.200000 11/10/2021 10:45:59:07...
TSH20 PLC9_SCADA.T... 34.200000 11/10/2021 10:45:59:07...
TSH21 PLC9_SCADA.T... 23.400000 11/10/2021 10:45:59:07...
TSH22 PLC9_SCADA.T... 39.700000 11/10/2021 10:45:59:07...
Wems mode Wems mode 7 11/10/2021 10:45:59:07...
Wems mode
1 Mode 1.1.1
2 Mode 1.1.2
3 Mode 1.2.1
4 Mode 1.2.2
5 Mode 1.3.1
6 Mode 1.3.2a
7 Mode 1.3.2b
8 Mode 1.4.1
9 Mode 2.1.1
10 Mode 2.1.2
11 Mode 2.2.1
12 Mode 2.2.2
13 Mode 2.3.1
14 Mode 2.3.2a
15 Mode 2.3.2b
16 Mode 2.4.1
ALARMS
than produced by the HP. Exsess heat are
dumped to SW in the other end of the ship
ACSIS
RD automação industrial

Tustna/Grip

Challenges

- Delayed onshore infrastructure
- Heat load at night
- Sensor location
- Short circuits on sea water side
- No real test of unloading PCM

TEKNOTHERM