INTRESSEGRUPP PASSIVHUS
IG PH

www.igpassivhus.se

Centrum för Idrott och Kultur

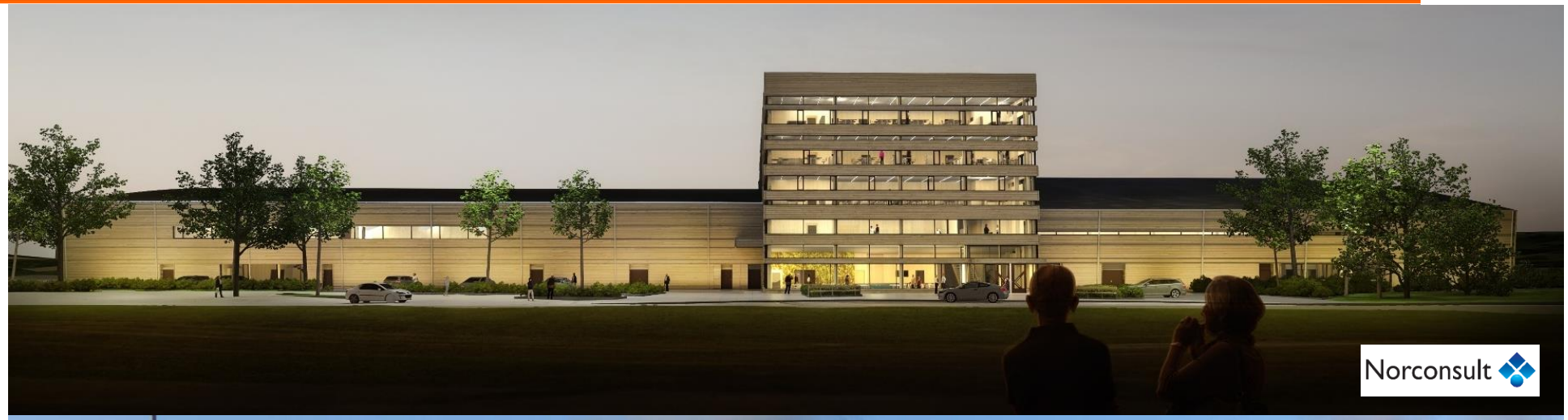
Passive Houses and CO_2 – A good combination!

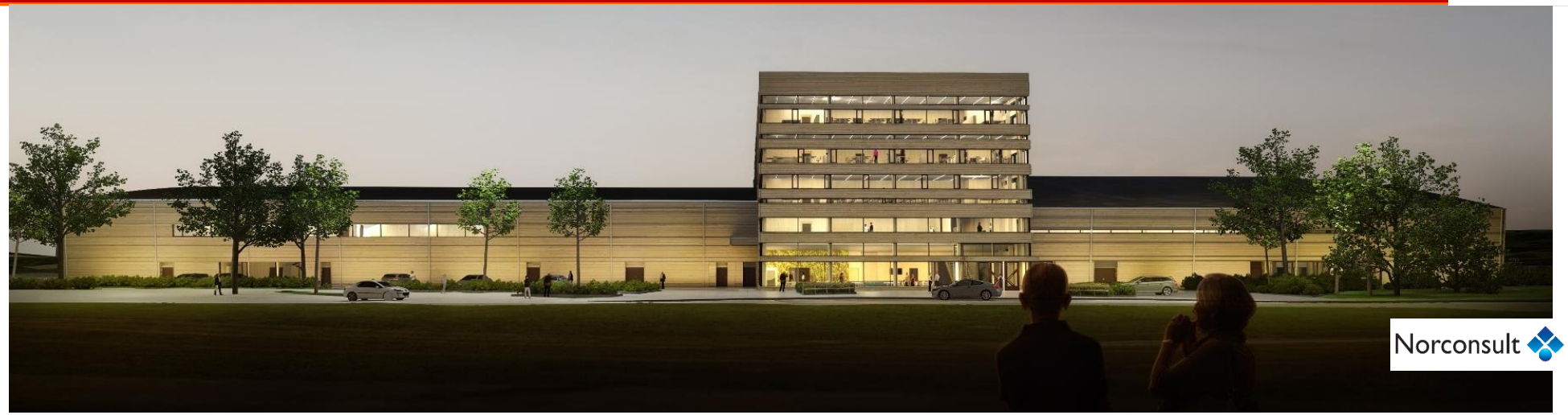
Tommy Wesslund

IG Passivhus Sverige

INTRESSEGRUPP PASSIVHUS

IG PH





Sporthalls, officies, restaurant, locker rooms, theatre, ice hall and more:

Demands:

Ice in the icehall

Hot water for making ice, melting snow, showers etc

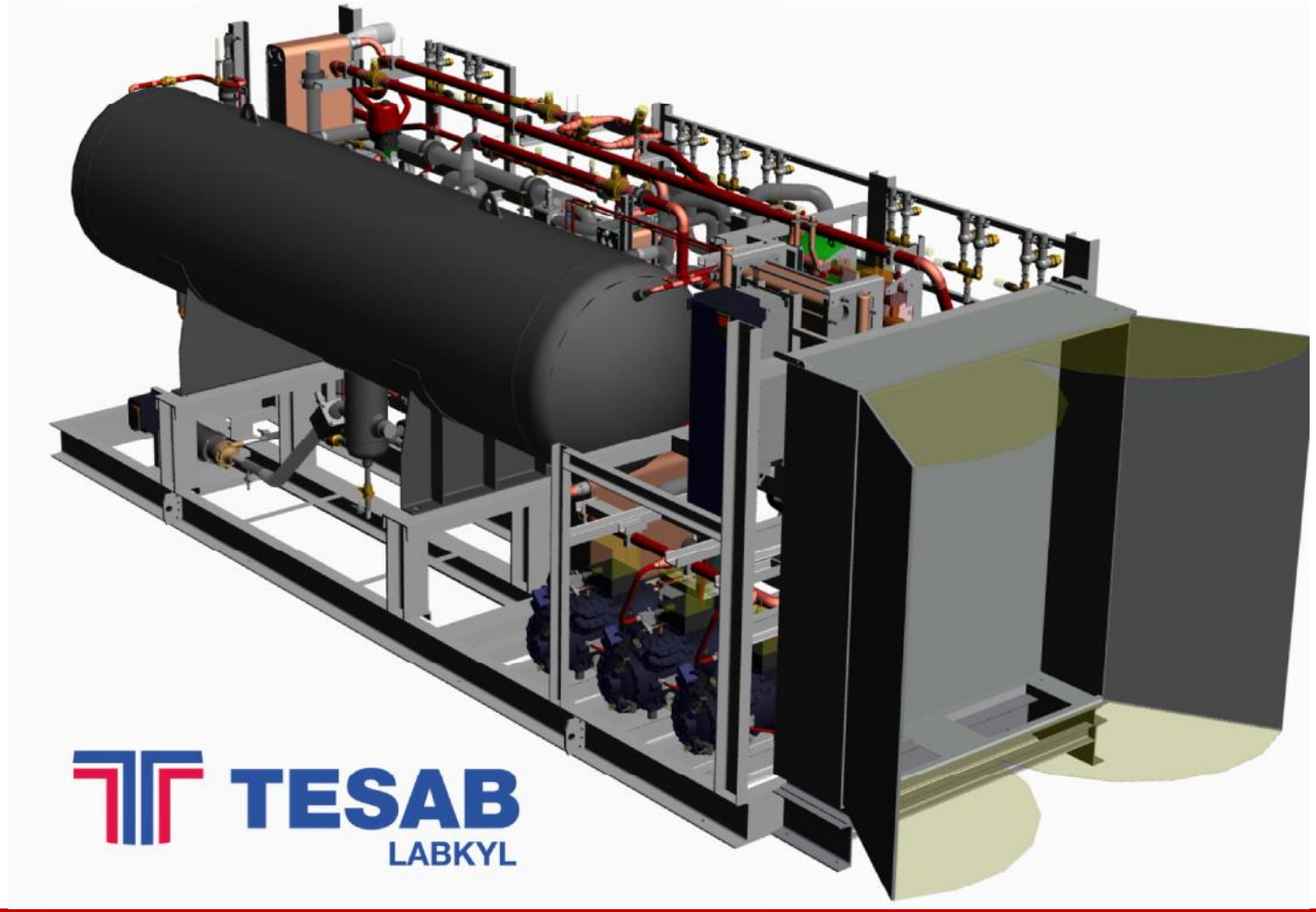
Ventilation

Heating

Cooling

INTRESSEGRUPP PASSIVHUS
IG PH

CO_2-UNIT



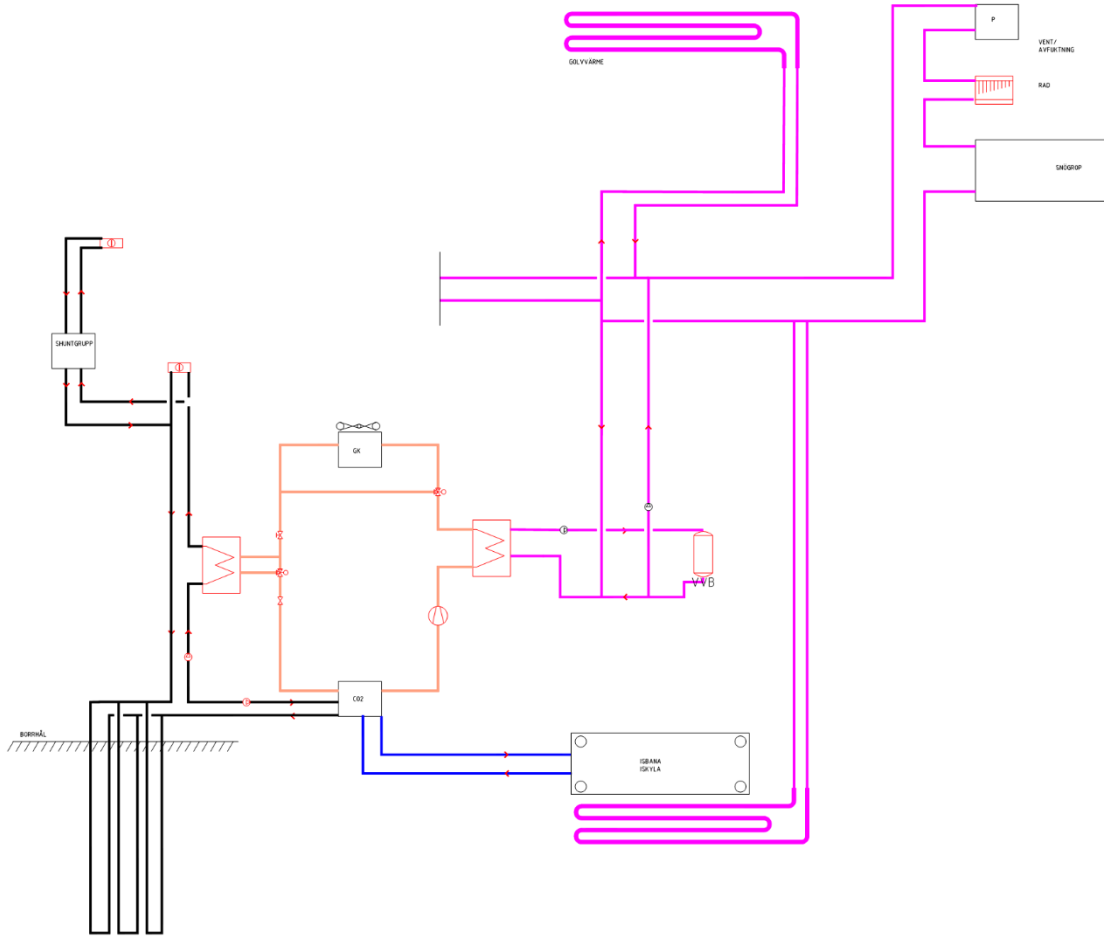
CO_2- unit:
Free cooling, Icehall, Heat recovery, Geothermal heating

Operating mode:

Autumn, Mild winter and Spring

Outdoor temperatur aboute -2°C and abowe

Autumn, Mild winter and spring
Cooling the icehall – producing heat and hot water

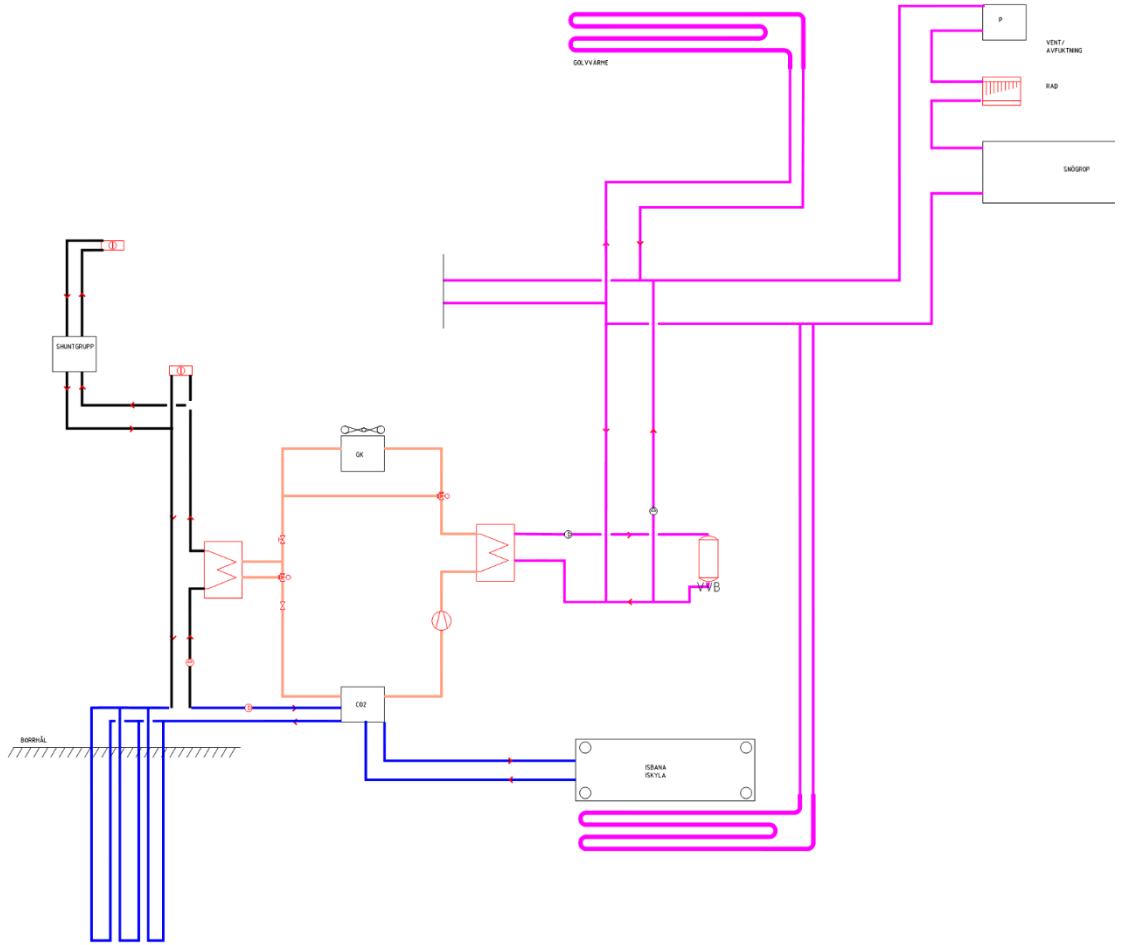


CO_2- unit:
Free cooling, Icehall, Heat recovery, Geothermal heating

Operation mode:

Winter: -3-4°C and colder

Cold Winter
Cooling the icehall and working as a ground heat-pump
Producing heat and hot water

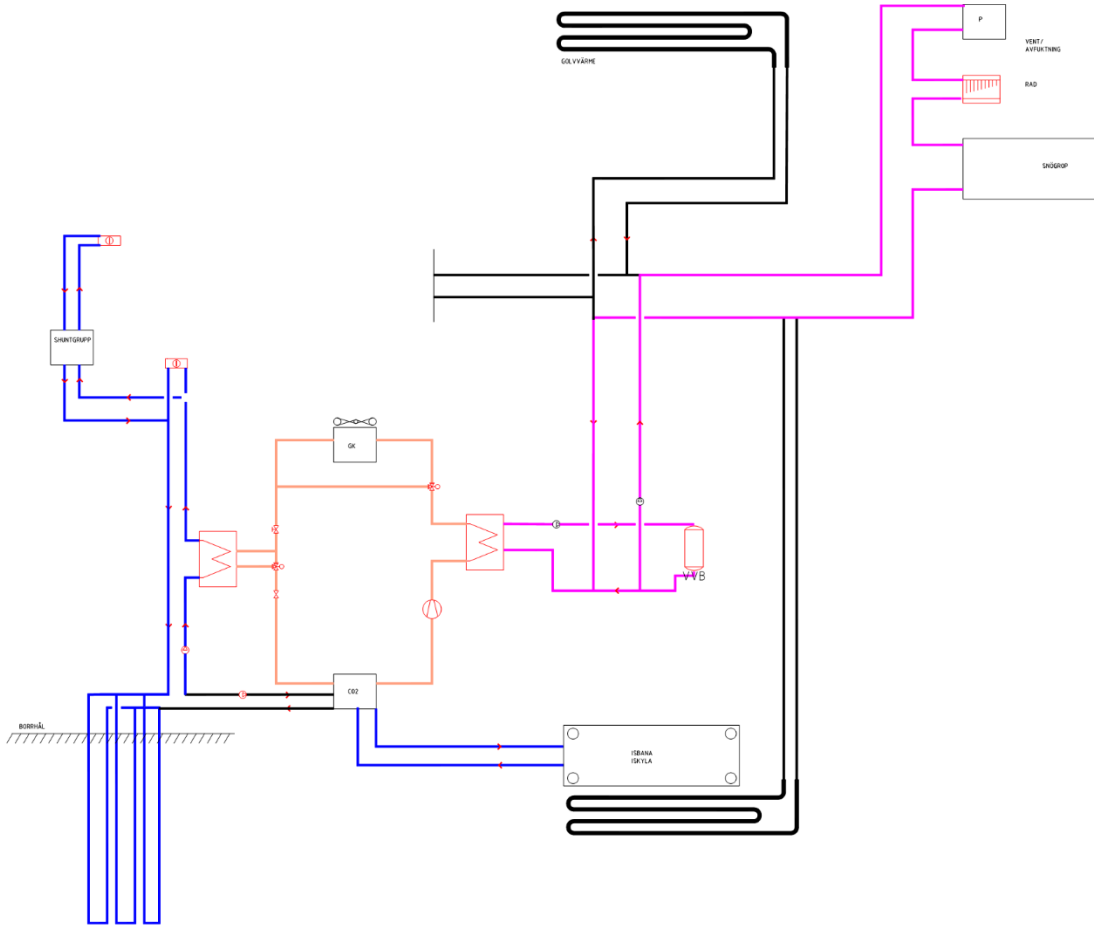


CO_2- unit:
Free cooling, Icehall, Heat recovery, Geothermal heating

Operation mode:

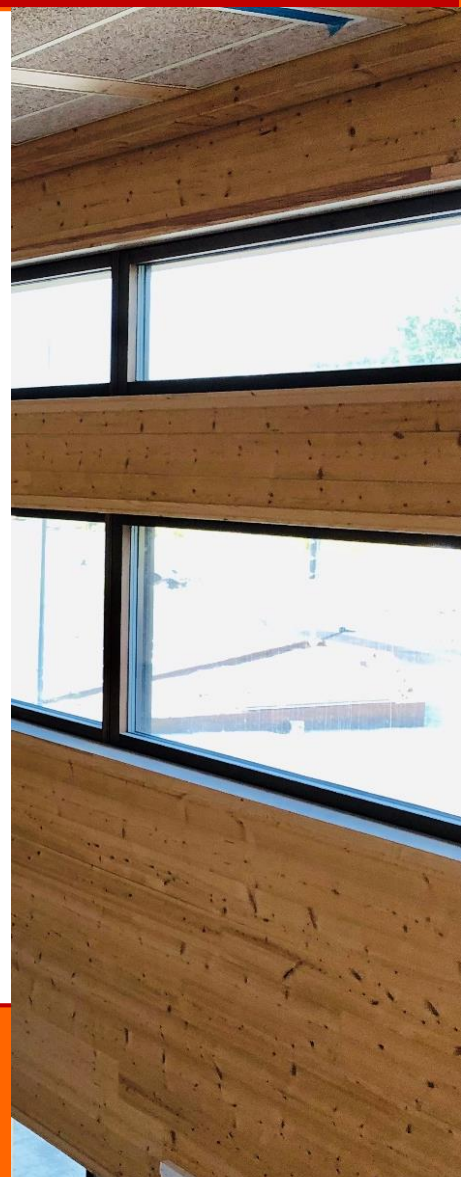
Summer: Free cooling

Summer
Cooling the icehall – producing heat and hot water
Cooling the building by Passive cooling

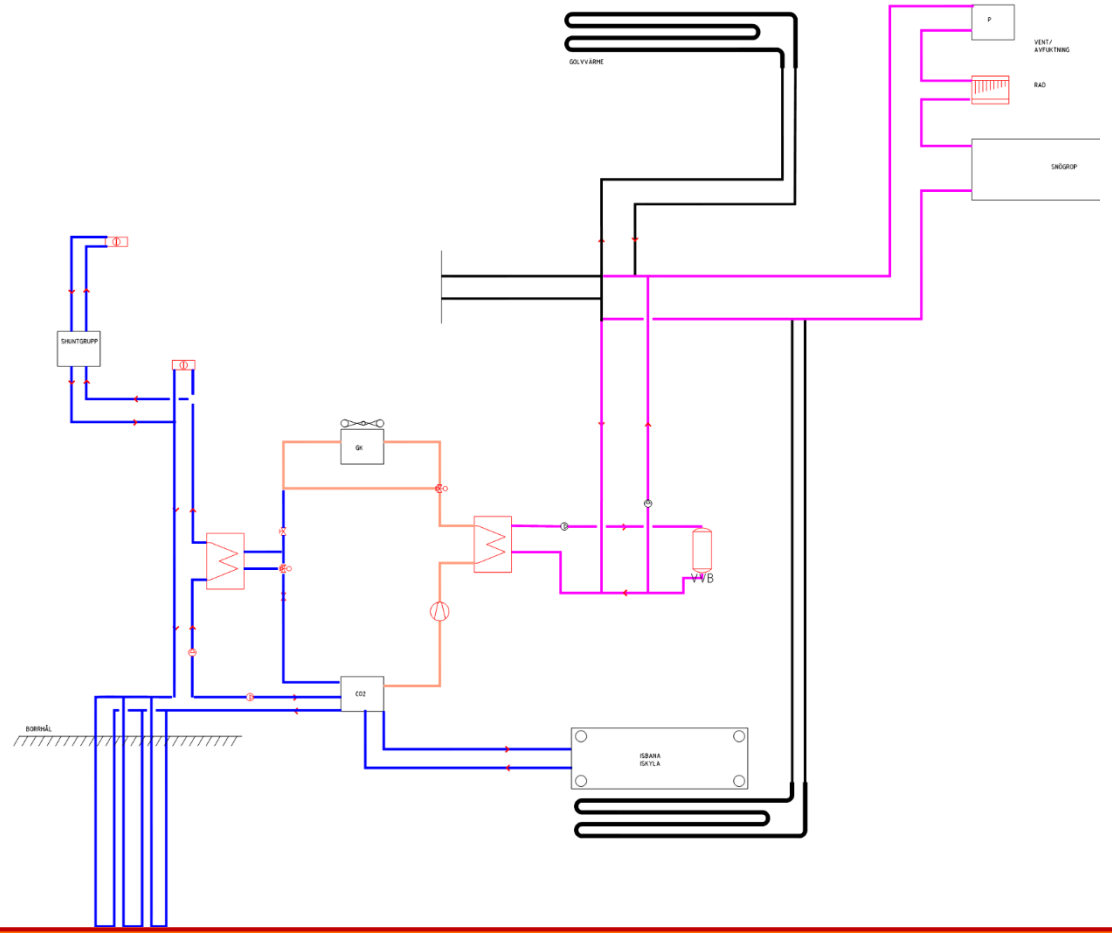


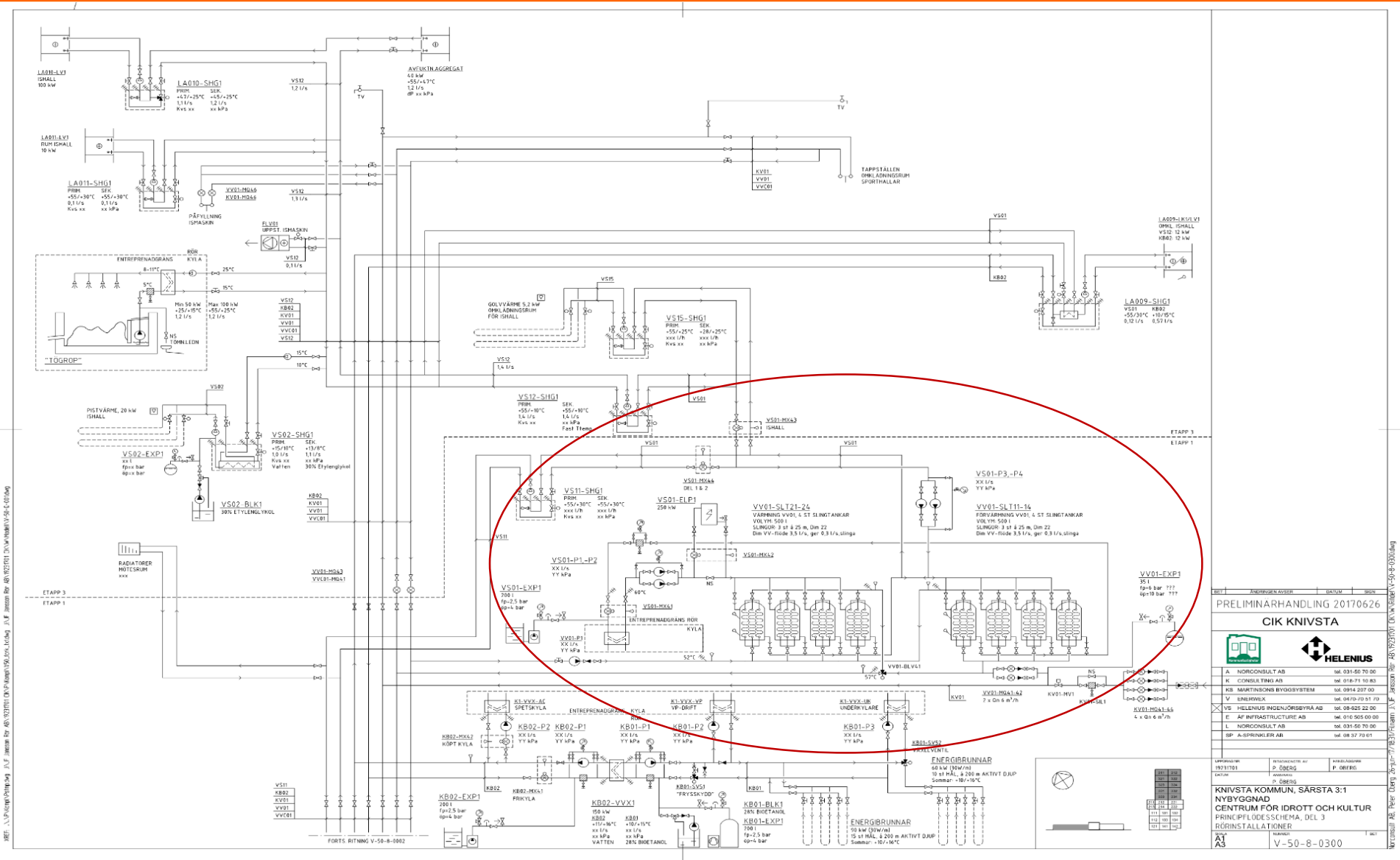
Operation mode:

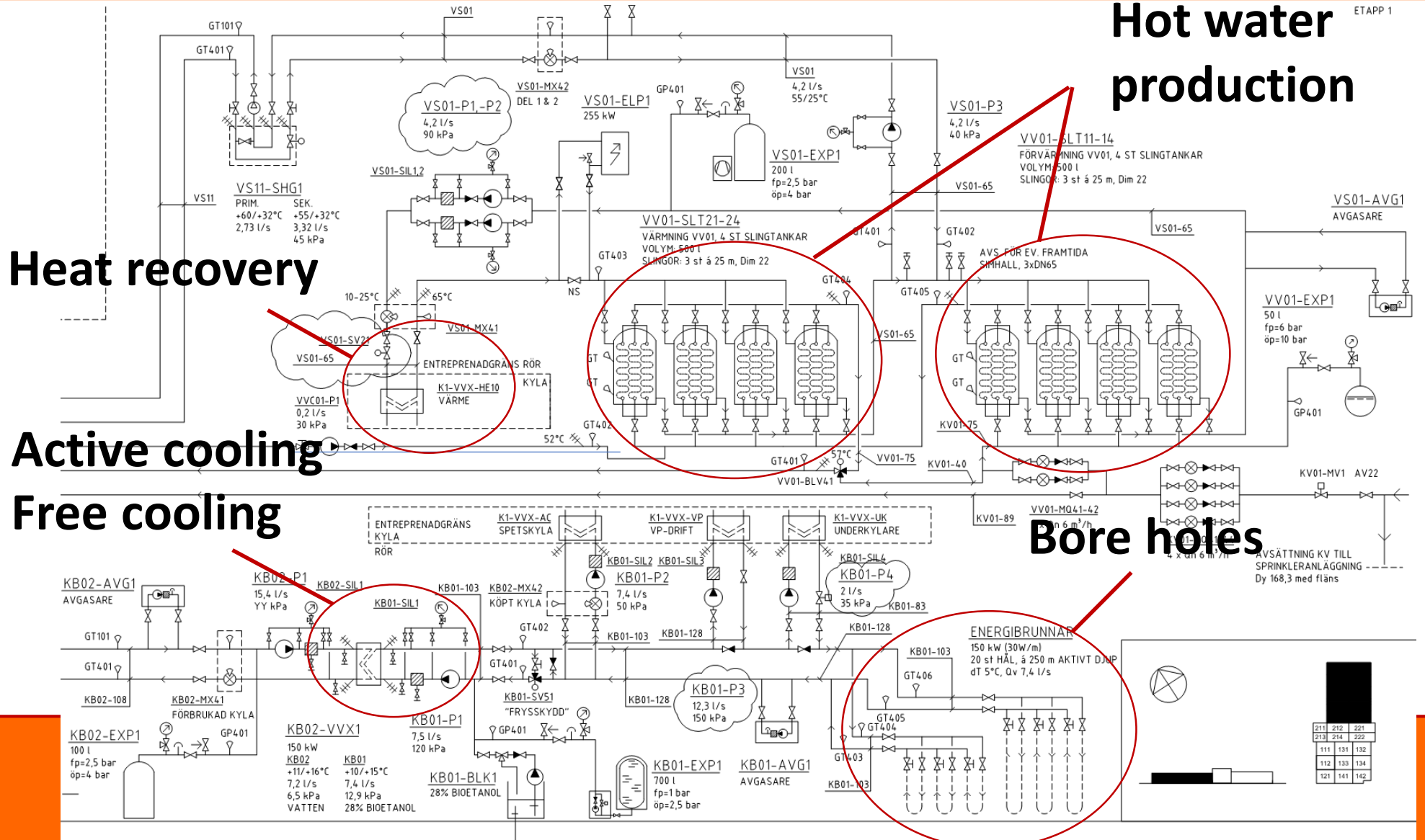
Summer:
Free cooling with active cooling using the CO_2-unit



Summer – very hot or high activities in the building
Cooling the icehall – producing heat and hot water
Cooling the building by Passive- and active cooling




PRELIMINARHANDLING 20170626
CIK KNIVSTA
KNIVSTA KOMMUN, SÄRSTA 3:1
NYBYGGNAD
CENTRUM FÖR IDROTT OCH KULTUR
PRINCIPFLÖDESSCHEMA, DEL 3
RÖRINSTALLATIONER
V-50-8-0300
ENERGIBRUNNAR
60 kW (30W/m)
15 st HÅL, à 200 m AKTIVT DJUP
Sommar: +10/-16°C
FORTS RITNING V-50-8-0002


Hot water production
Heat recovery
Active cooling
Free cooling
Bore holes
ETAPP 1
VS01
VS01-P1,-P2
4,2 l/s
90 kPa
VS01-MX42
DEL 1 & 2
VS01-ELP1
255 kW
VS01-EXP1
200 l
fp=2,5 bar
öp=4 bar
VS01-P3
4,2 l/s
40 kPa
VS01
4,2 l/s
55/25°C
VS11-SHG1
PRIM. +60/+32°C 2,73 l/s
SEK. +55/+32°C 3,32 l/s 45 kPa
VS01-SIL1,2
VV01-SLT21-24
VÄRMNING VV01, 4 ST SLINGTANKAR
VOLYM: 500 l
SLINGOR: 3 st á 25 m, Dim 22
VV01-SLT11-14
FÖRVÄRMNING VV01, 4 ST SLINGTANKAR
VOLYM: 500 l
SLINGOR: 3 st á 25 m, Dim 22
AVS FÖR EV. FRAMTIDA SIMHALL, 3xDN65
VS01-AVG1
AVGASARE
VV01-EXP1
50 l
fp=6 bar
öp=10 bar
10-25°C
65°C
VS01-MX41
VS01-SV21
ENTREPRENADGRÄNS RÖR
KYLA
K1-VVX-HE10
VÄRME
VVC01-P1
0,2 l/s
30 kPa
52°C
57°C
VV01-BLV41
KV01-75
KV01-40
KV01-89
KV01-MV1 AV22
VV01-MQ41-42
AVSÄTTNING KV TILL SPRINKLERANLÄGGNING
Dy 168,3 med fläns
ENTREPRENADGRÄNS KYLA RÖR
K1-VVX-AC SPETSKYLA
K1-VVX-VP VP-DRIFT
K1-VVX-UK UNDERKYLARE
KB02-AVG1
AVGASARE
KB02-P1
15,4 l/s
YY kPa
KB02-SIL1
KB01-SIL1
KB01-103
KB02-MX42
KÖPT KYLA
KB01-SIL2
KB01-SIL3
KB01-P2
7,4 l/s
50 kPa
KB01-SIL4
KB01-P4
2 l/s
35 kPa
KB01-83
KB01-128
KB02-108
KB02-MX41
FÖRBRUKAD KYLA
KB02-EXP1
100 l
fp=2,5 bar
öp=4 bar
KB02-VVX1
150 kW
KB02 +11/+16°C 7,2 l/s 6,5 kPa VATTEN
KB01 +10/+15°C 7,4 l/s 12,9 kPa 28% BIOETANOL
KB01-P1
7,5 l/s
120 kPa
KB01-SV51
"FRYSSKYDD"
KB01-BLK1
28% BIOETANOL
KB01-P3
12,3 l/s
150 kPa
KB01-EXP1
700 l
fp=1 bar
öp=2,5 bar
KB01-AVG1
AVGASARE
ENERGIBRUNNAR
150 kW (30W/m)
20 st HÅL, á 250 m AKTIVT DJUP
dT 5°C, Qv 7,4 l/s

Källa: Huurre AB

CO_2 as a refridgerant

CO_2 =

Natural, compared with other medias as R134a, R407c etc – low impact on the environment.

CO_2 – heat recovery: +60 -80°C.

Others – heat recovery: +42 -45°C

Energy effective
Warm heatrecovery.
Same technical system as in most normal groceries, well known.
Low operating costs.

Källa: Huurre AB

Result PHPP with the icehall

Resultat PHPP CIK med ishall

Kriterium	Krav	Resultat	Uppfyllda?
Årsvärmebehov (uppvärmning)	15 kWh/(m²år)	12,9 kWh/(m²år)	Ja
Värmeeffektbehov	10 W/m²	12,6 W/m²	Nej
Kylbehov	15 kWh/(m²år)	3,4 kWh/(m²år)	Ja
Övertemperaturfrekvens (>25°C)	< 10%	-	
PER-behov, totalt	115 kWh/(m²år)	61 kWh/(m²år)	Ja

*) Med genomförda åtgärder som t.ex. sommarventilation

Resultat BBR CIK med ishall

Krav för byggnaden:

Köpt Energi: 65,0 kWh/(m²år)
U_m: 0.6 W/(m²K)

Resultat:

Köpt Energi: 18,8 kWh/(m²år)
U_m: 0.17 W/(m²K)

Byggnaden uppfyller energikraven.
Byggnaden uppfyller kraven på värmeisolering.

Heat demands and gains

Heating load for CIK, -16°C outdoor:

Transmission	90 kW
Ventilation 50% airflow	140 kW
Hot water production	40 kW

Heating load CIK, 0°C outdoor:

Transmission	57 kW
Ventilation 50% airflow	70 kW
Hot water production	40 kW

Indoor
+ 8 °C

Internal heatgains:

Light 80% usage	(94 kW)
People 30% present	(30 kW)

Heat recovery from icehall

55 kW
(after reheating the icehall)

Daytime operation - CIK (the whole building, 12 300 m²), icehall in use:

Heat demand, -16°C outdoor temp.

Transmission	-34 kW (Excess)
Ventilation 50% airflow	140 kW
Hot water production	40 kW

CO_2 heatprod.demand

90 kW more than heat recovery produces.

COP 2,4 = about 37 kW electricity effect bought.

Cooling the ice and working as a ground heat-pump.

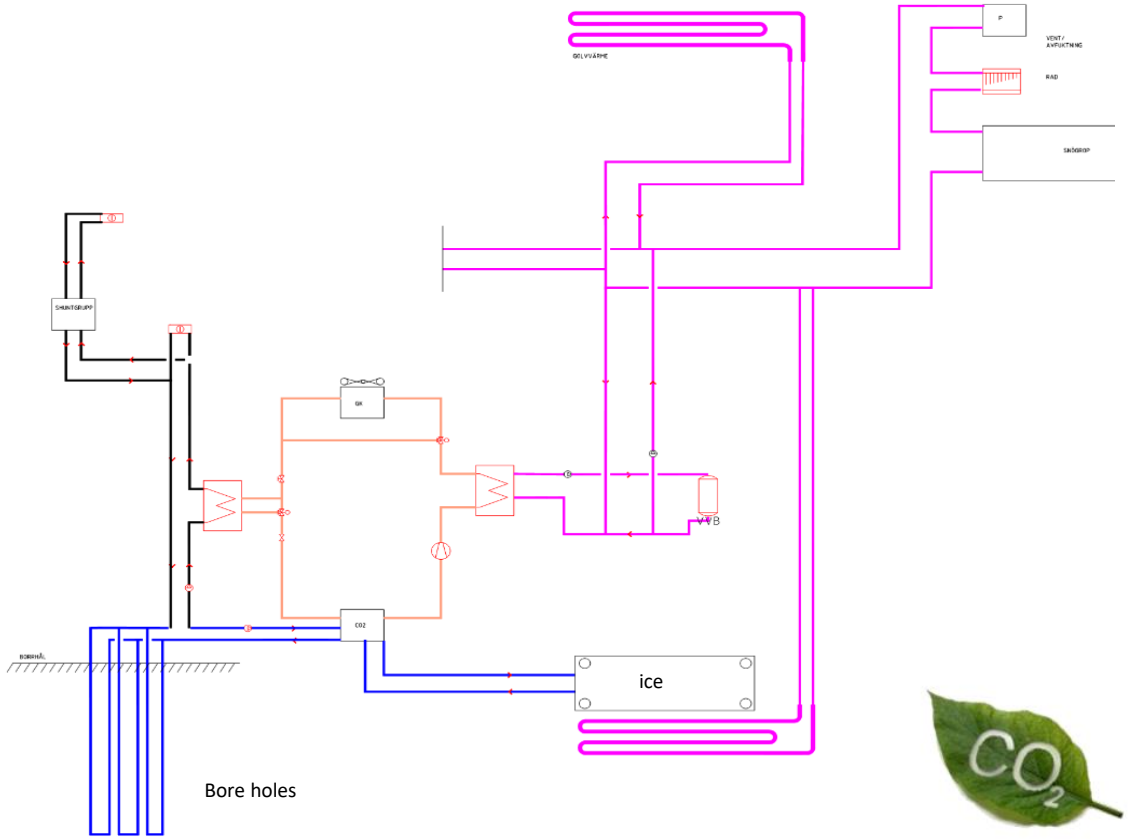
Heat demand, 0°C outdoor temp.

Transmission	-68 kW (Excess)
Ventilation 50% airflow	70 kW
Hot water production	40 kW

CO_2 heatprod.demand

0 kW more than heat recovery.

The heat recovery and internal gains covers the demand.

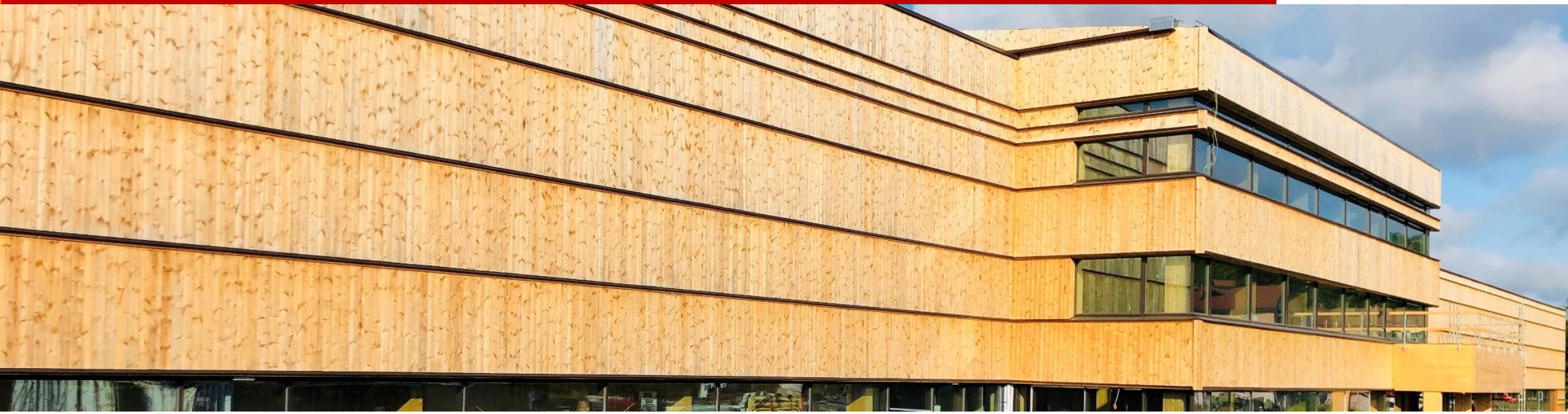


Temperatures in Knivsta 2012 - 2019

Heat demand covered by normal ice-hall operation

Ice-hall + bore holes

Summery



Normaly, the heat recovery from an icehall doesn´t even cover the heat demand of the icehall it self….

… but with a Passive House as a base, a ground collector (renewable energy) and, on top, an active CO_2-unit, installed for the activities in the icehall – we…

INTRESSEGRUPP PASSIVHUS
IG PH

… cover every comfort- and energy demand in the whole building!