H2020 - EEB - 2017 - 766464 – SCORES

Self Consumption Of Renewable Energy by hybrid Storage systems

D7.1 Characteristics of the existing building with district heating grid, using as the demo site A and C, and its climate conditions

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1. Background

"The SCORES project aim is to develop and demonstrate in the field a building energy system including new compact hybrid storage technologies, that optimize supply, storage and demand of electricity and heat in residential buildings, increasing self-consumption of local renewable energy in residential buildings at the lowest cost. The combination and optimization of multi-energy generation, storage and consumption of local renewable energy (electricity and heat) brings new sources of flexibility to the grid and gives options for tradability and economic benefits, enabling reliable operation with a positive business case in Europe's building stock. SCORES optimizes self-consumption of renewable energy and defers investments in the energy grid."

The aim of WP7 is on the one hand to integrated and demonstrate the system in the demonstration building an gain knowledge on operational issues. On the other hand a simulation of the future system (which is called SCORES future system or SFS) is planned for optimization and further calculations of KPI's to investigate the technical and economic performance of the system. The SFS is integrated in the future building. Hence, within WP7 there are two buildings and three systems defined for different purposes. Figure 1 gives an overview of the different types.

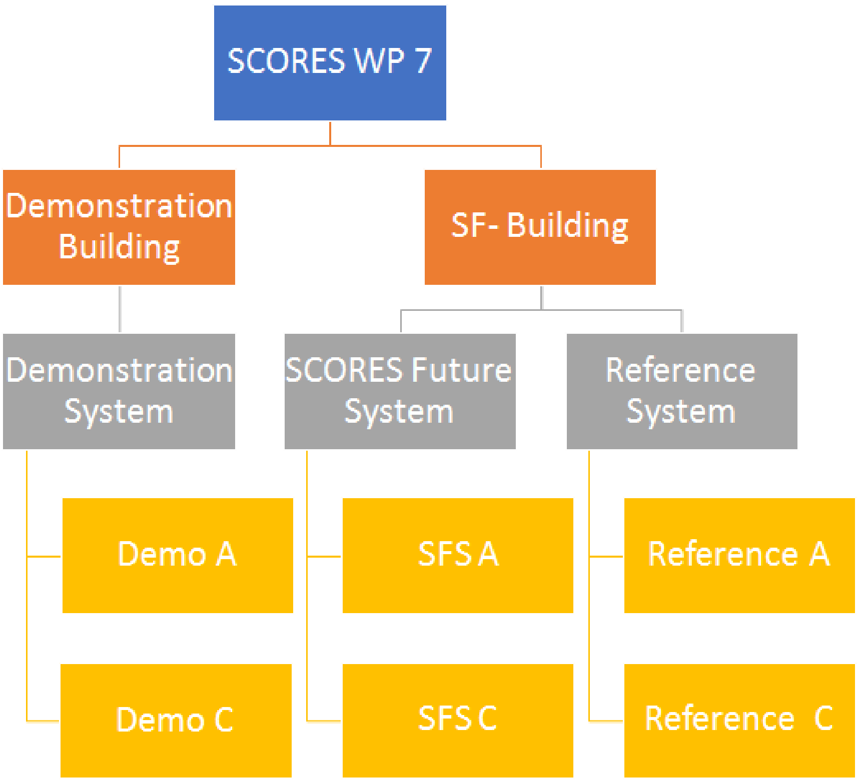


Figure 1: Structure and designation of WP 7 buildings and systems

The main difference between demonstration and future building/system is that for the demonstration we are bond to the existing building and space and budget limitations, whereas for the future system we can assume a house and optimal sized system representative for the future case. The latter will be used for simulation and the results will be compared to the reference system to calculate important KPI's.

This deliverable (D7.1) gives the main characteristics of the combined office and terraced houses complex, selected as demonstration building for Demo A and C of the SCORES project. Exchanges are coordinated with the technical partners of the consortium and with the owner of the demonstration site. It also includes an outlook for the preliminary system design and the SCORES future building.
The difference between the SCORES Demo A and SCORES Demo C is the connection to the heating grid. The SCORES Demo A will be connected to the micro-grid "Gleisdorf Schwimmbad" heating grid and SCORES Demo C will not be connected to a heating grid.

This document was compiled by Rebekka Köll (AEE) and has been reviewed by the partners within the SCORES program before publication.

2. References

2.1 Applicable Documents

	Document	Reference	Issue
AD-01	HEL-SCORES-RP-049_i1-D8.1 DemoB_building characteristics	HEL-SCORES-RP-049	
AD-02	SIE-SCORES-ECM-071-WP4 ESCS Operational principles	SIE-SCORES-ECM-071	

2.2 Reference Documents

	Document	Reference	
1	Oesterreichsenergie.at, Data & facts of electricty demand, https://oesterreichsenergie.at/daten-fakten-zum-stromverbrauch.html,	oesterreichsenergie, 2018	23.09.2018

3. Terms, definitions and abbreviated terms

RP Report
DHW Domestic hot water

DH	District Heating
SH	Space Heating
SFS	Scores Future System
CLC	Chemical Looping Combustion

4. Executive summary

This document presents the characteristics of the demonstration site located in Gleisdorf, Styria in Austria. There are actually two demonstrations (A & C) tested at the Austrian demo building. The demonstration building for both Demo A and Demo C is a building complex with combined usage of office and residential buildings and is described in detail in this document. Whereas, for Demo A the demonstration house and SCORES system is also connected to the district heating grid, Demo C is without connection to the heating grid. The district heating grid will be disconnected for the demonstration C period.

The total demonstration phase will take over a year. The first part of the demo phase will be tested without CLC storage, as it is tested at the French demo site at that time. For the second period the CLC is shipped and integrated to the demo system in Gleisdorf and tested together with the other system components.
The description of the building includes all necessary specification as its size, usage, location as well as all details of the building as the configuration, energy needs and technical equipment installed. Based on that a first concept of the system integration is shown and the location of the SCORES technologies in and outside of the building. Technical specifications related to the building, the integration of the SCORES system and the hydraulic scheme are also represented.
The demonstration system is different from the SCORES future system. The demonstration system is partly downsized due to limitations on site. For the SCORES future system a more representative house for Austria and optimal sized system will be considered. The document concentrates on the demonstration building but also gives an outlook on the SCORES future building.

5. General description

The selected building is located in the city of Gleisdorf in the south east of Austria. The building complex consists of an office building and 2 terraced houses, where one house is used as office as well. In the other two houses two families are living. The houses are connected to a low-temperature micro grid with a flow/return temperature of 45/35 °C.

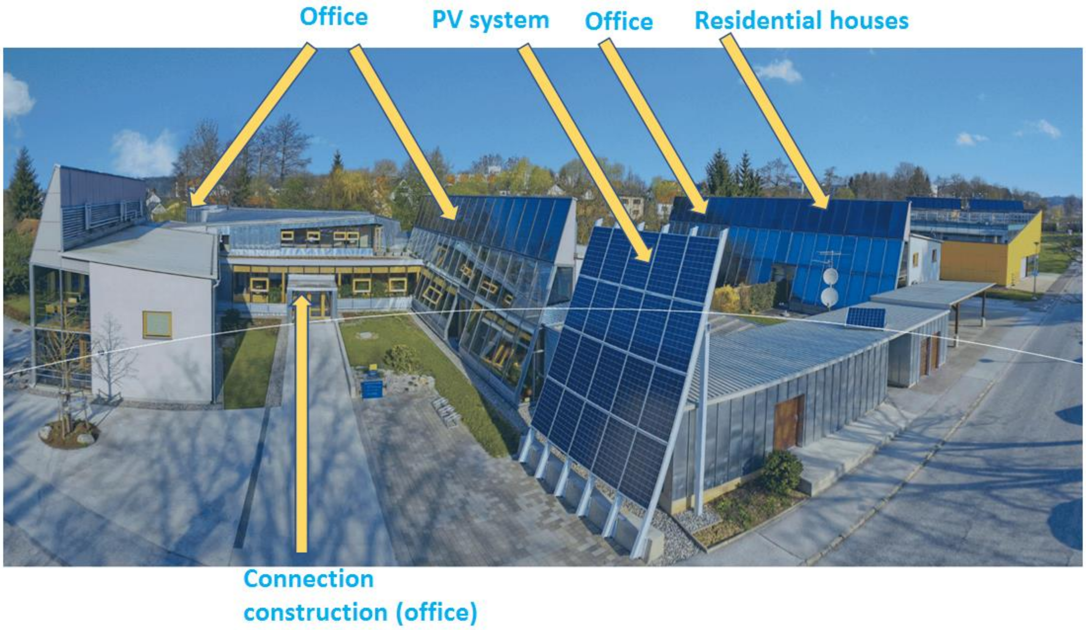


Figure 2: picture of the building used as demo site A and C

The prefabricated, low-energy buildings “SUNDAYS” was a pilot project finalized in 1998. The aim was to develop an optimized prefabricated house system which then can be used in different variants in modular construction mode. Through thermal zoning, high thermal insulation standards, use of daylight and controlled ventilation, the heating energy requirement of this building type is reduced to 32 kWh/m².a (energy label).
In order to make the solar energy radiated through the southern conservatory glazing usable and to balance the climate within the building, the south-facing inner wall of the office is designed as a storage wall consisting of 30 cm reinforced concrete. The heating system is a wall heating on the inner and partly outer walls. In 2011 the office was expanded via connection construction.

6. Location

The demo site is located in south-east of Austria in the city of Gleisdorf which is 25 km east from Graz and 150 km southwest of Vienna. The site is 5 minutes from the city center and next to the swimming pool and sport fields. The site is flat and without buildings which could influence the solar performance of the installation due to shading.
Construction part I (office building) main façade is oriented exactly to south to optimize the use of solar energy. Construction part II and III (terraced houses) are oriented 15 respectively 30 degree west

Geographical coordinates	47°06'33.1"N 15°42'33.6"E
Population (2017)	10 456 (2016)
Area	38.67 km²

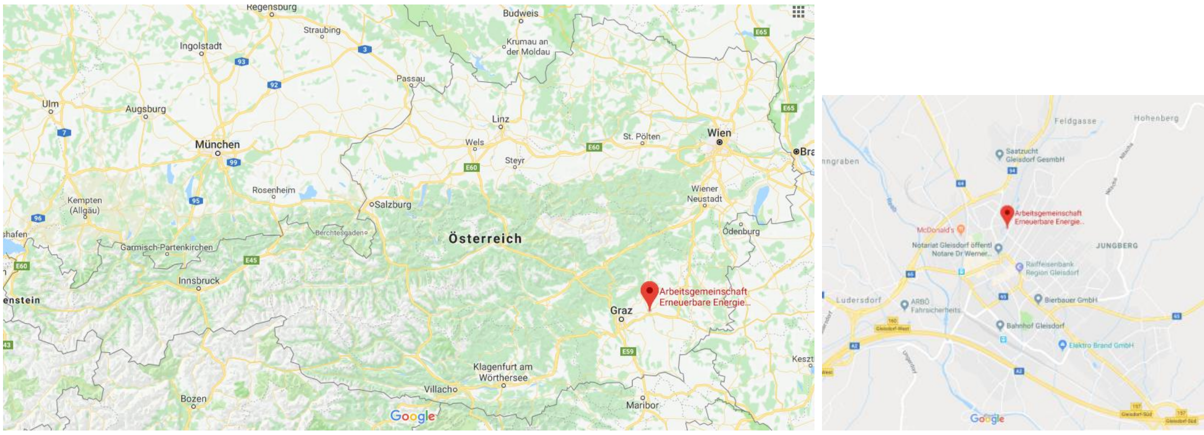


Figure 3: Location of the demo site in Austria (Source: Google maps)

7. Actors involved

Building owner	AEE INTEC + 2 families
Heating grid owner	Stadtwerke Gleisdorf
Electricity grid owner	Feistritzwerke Gleisdorf

8. Timeline of the building's SCORES construction

- December 2019 : All constructions on site finished
- Jan - Sept 2020 : Tests without CLC
- October 2020: Transfer and installation of CLC
- Nov 2020 – Apr 2021: Tests with CLC
- October 2021: End of project

9. Climate conditions

Gleisdorf features a continental climate (Cfb), in the Köppen climate classification with warm Summers and relatively cold Winters. Due to its position southeast of the Alps, Gleisdorf is shielded from the prevailing westerly winds that bring weather fronts in from the North Atlantic to northwestern and central Europe. The weather in Gleisdorf is thus influenced by the Mediterranean, and it has more hours of sunshine than regions in the north and west of Austria. Gleisdorf lies in a basin that is only open to the south, causing the climate to be warmer than would be expected at that latitude.

Climate data for Graz (1971–2000)													[hide]
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Record high °C (°F)	21.0 (69.8)	20.5 (68.9)	25.1 (77.2)	28.8 (83.8)	34.1 (93.4)	34.3 (93.7)	38.1 (100.6)	38.1 (100.6)	32.0 (89.6)	26.4 (79.5)	23.0 (73.4)	19.2 (66.6)	35.5 (95.9)
Average high °C (°F)	2.8 (37)	5.8 (42.4)	10.7 (51.3)	15.3 (59.5)	20.5 (68.9)	23.4 (74.1)	25.3 (77.5)	24.7 (76.5)	20.4 (68.7)	14.6 (58.3)	7.7 (45.9)	3.6 (38.5)	14.6 (58.3)
Daily mean °C (°F)	−1.0 (30.2)	1.0 (33.8)	5.1 (41.2)	9.6 (49.3)	14.6 (58.3)	17.7 (63.9)	19.5 (67.1)	18.9 (66)	14.7 (58.5)	9.4 (48.9)	3.7 (38.7)	0.1 (32.2)	9.4 (48.9)
Average low °C (°F)	−3.8 (25.2)	−2.9 (26.8)	1.0 (33.8)	4.9 (40.8)	9.5 (49.1)	12.7 (54.9)	14.7 (58.5)	14.3 (57.7)	10.6 (51.1)	5.9 (42.6)	0.9 (33.6)	−2.3 (27.9)	5.5 (41.9)
Record low °C (°F)	−20.2 (−4.4)	−19.3 (−2.7)	−17.2 (1)	−5.5 (22.1)	−1.3 (29.7)	3.6 (38.5)	6.3 (43.3)	4.9 (40.8)	0.8 (33.4)	−6.4 (20.5)	−12.7 (9.1)	−17.5 (0.5)	−19.3 (−2.7)
Average precipitation mm (inches)	23.9 (0.941)	30.4 (1.197)	44.1 (1.736)	49.0 (1.929)	86.0 (3.386)	117.8 (4.638)	125.1 (4.925)	113.0 (4.449)	81.1 (3.193)	61.7 (2.429)	51.9 (2.043)	34.9 (1.374)	818.9 (32.24)
Average snowfall cm (inches)	12.8 (5.04)	15.6 (6.14)	6.5 (2.56)	2.3 (0.91)	0.1 (0.04)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.2 (0.08)	9.1 (3.58)	15.5 (6.1)	62.1 (24.45)
Average precipitation days (≥ 1.0 mm)	4.8	4.8	6.6	7.9	10.6	11.5	10.7	9.7	7.5	6.3	6.5	5.2	92.1
Average snowy days (≥ 1.0 cm)	15.6	10.0	4.1	0.5	0.0	0.0	0.0	0.0	0.0	0.0	2.8	9.1	42.1
Mean monthly sunshine hours	90.4	117.8	145.7	166.4	210.0	213.0	234.4	226.9	174.0	139.6	93.0	78.8	1,890
Source: Central Institute for Meteorology and Geodynamics[12]													

Figure 4: Weather data for the nearby City of Graz (Source: Central Institute for Meteorology and Geodynamics)

Direct normal solar irradiation range: [1100; 1200] kWh/m²/year

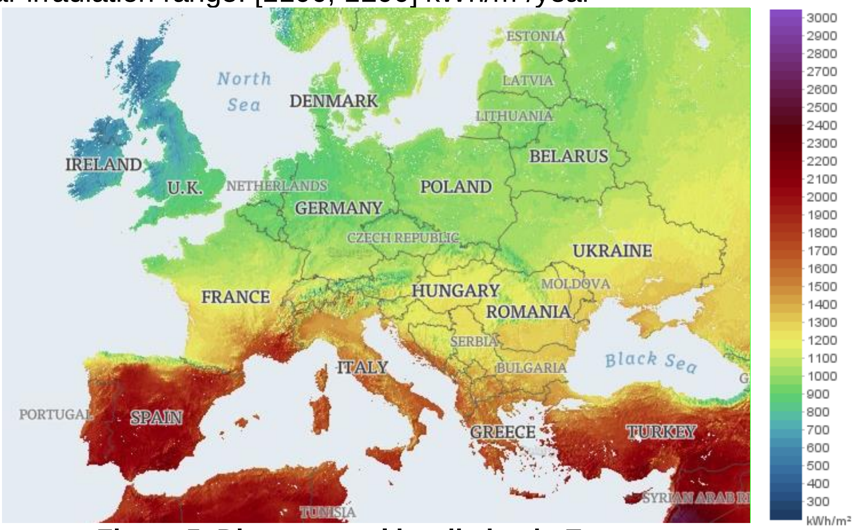


Figure 5: Direct normal irradiation in Europe
(Source: Global Solar Atlas by the World Bank Group)

10. Usage

In the original plan of the buildings built in 1998 was one office building (most southern one) and the two buildings in the back were designed as residential houses, with 3 residential buildings each (in total 2x3 = 6 residential buildings). All buildings are designed with winter gardens in the south, serving as shading zone and sun collection area. This area is not heated. Behind the winter garden the residential/office area is located and to the north are the access and supply facilities. The southern façade is completely glazed and equipped with a reflection foil to decrease the solar gains and overheating in summer. To increase the storage capacity of the building it is constructed with concrete floor and concrete walls (inner walls). The outer walls and roof elements are made of 10 cm of cross-laminated timber panels (λ = 0.14 W/mK) and are well insulated with 20 cm of wood-soft-fiber insulation boards (λ = 0.045 W/mK).

Due to the growth of the institute, AEE INTEC uses now 4 out of the 6 residential buildings also as offices and only 2 residential buildings are remaining.

10.1 Building complex "SUNDAYS" (Residential & office)

The residential building sizes are approx. 80 - 105 m² (including not heated area). Presently only two residential buildings are occupied by families the other units are used as office building of AEE INTEC.

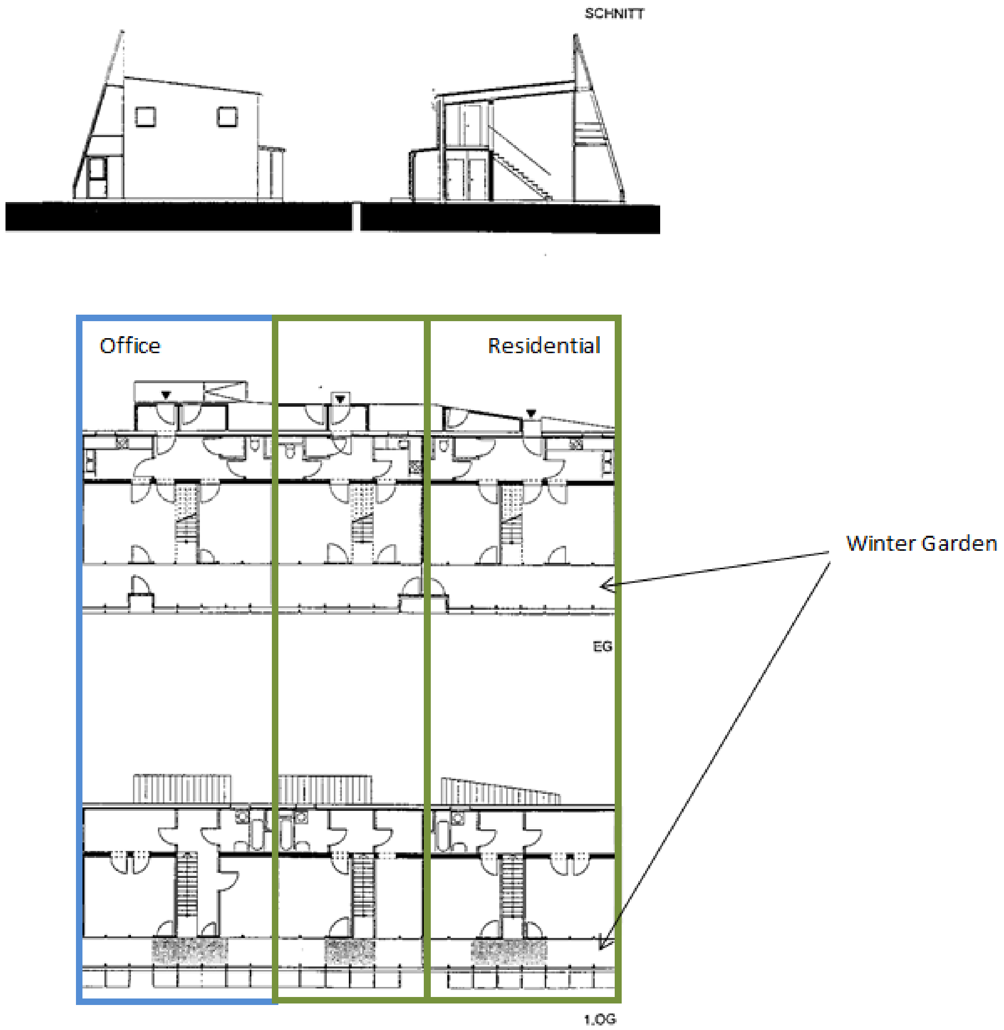
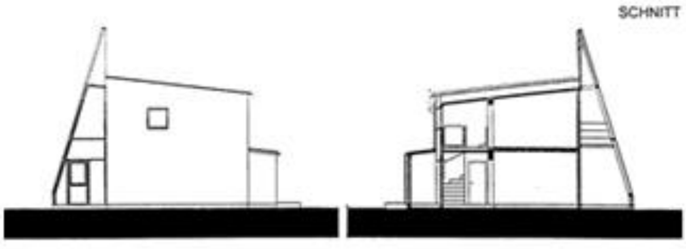


Figure 6: Terraced houses used as office (left unit) and residential applications (2 units on the right side) in the most northern building III.



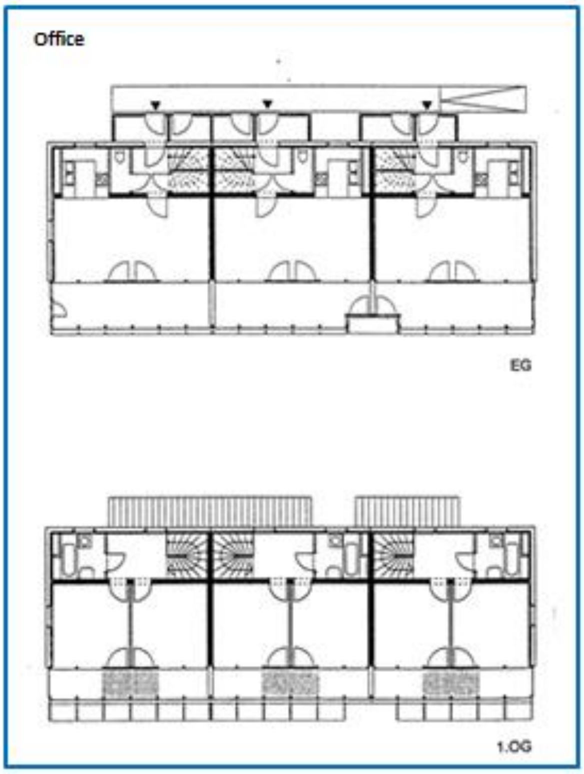


Figure 7: Terraced houses used as office for Demo A called “building II”

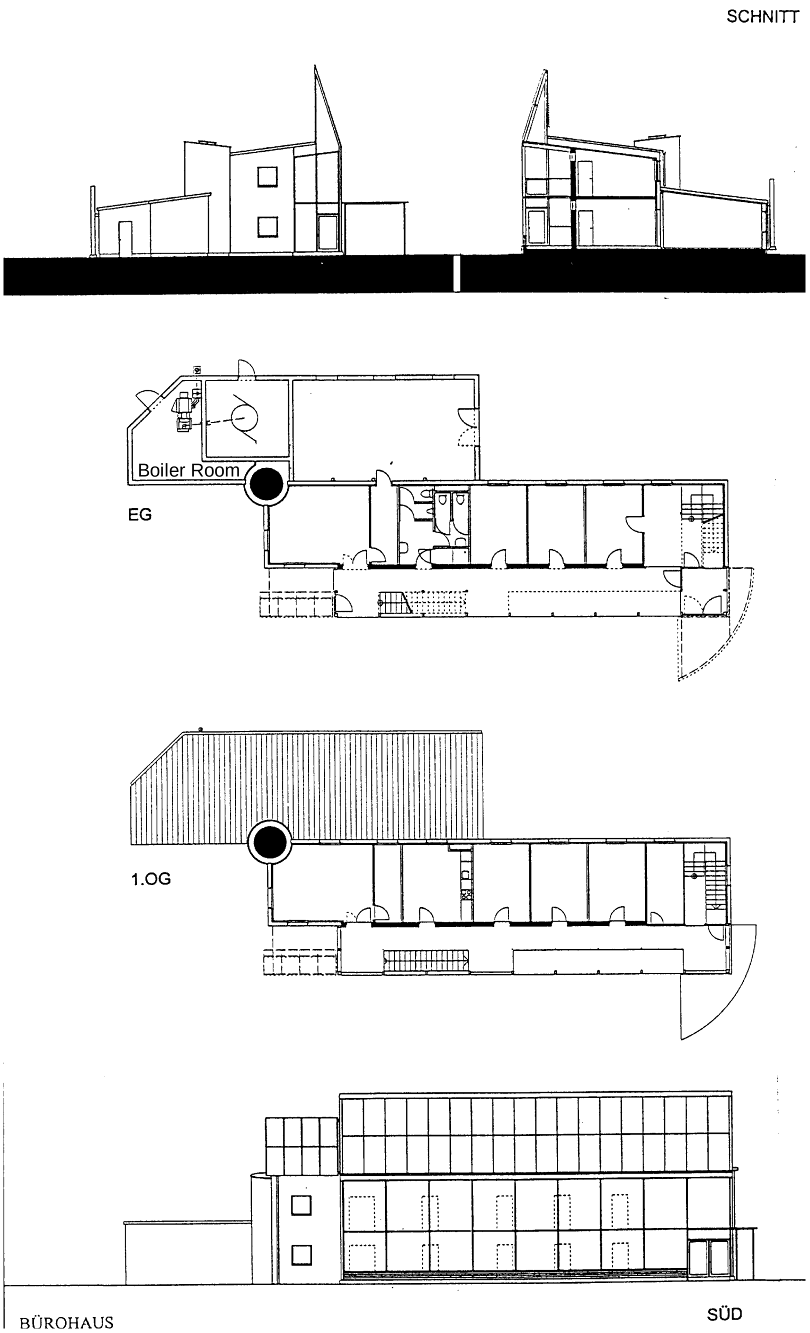


Figure 8: Office Building for Demo A & C called "building I"

SUNDAYS	
Heated area per residential building	75 m²
Outer Walls	Rc = 5.15 m²K/W
Windows winter garden	U = 0.7 W/m²K ,
Windows btw winter garden and living area	U = 1 W/m²K , 11 % window

Ventilation	Qmax = 2000 m³/h 60 % heat regain
Electricity	kWmax = 10 kW
Hot water (total)	Boiler: 150L x 4 Daily usage (total) = 600 L
Cooling	None

10.2 Connection building (office)

The office was expanded in the year 2011 and the two separate buildings I and II were connected via the connection building which contains another 420 m² of office area. The ground floor of the new building is used as reception and social area with a kitchen as well as two meeting rooms. On the north west side of the building a small terrace is located which can be used as social area as well. In the second floor new offices are installed and a transition between the buildings is enabled. The ground plan can be seen in Figure 9 and Figure 10.

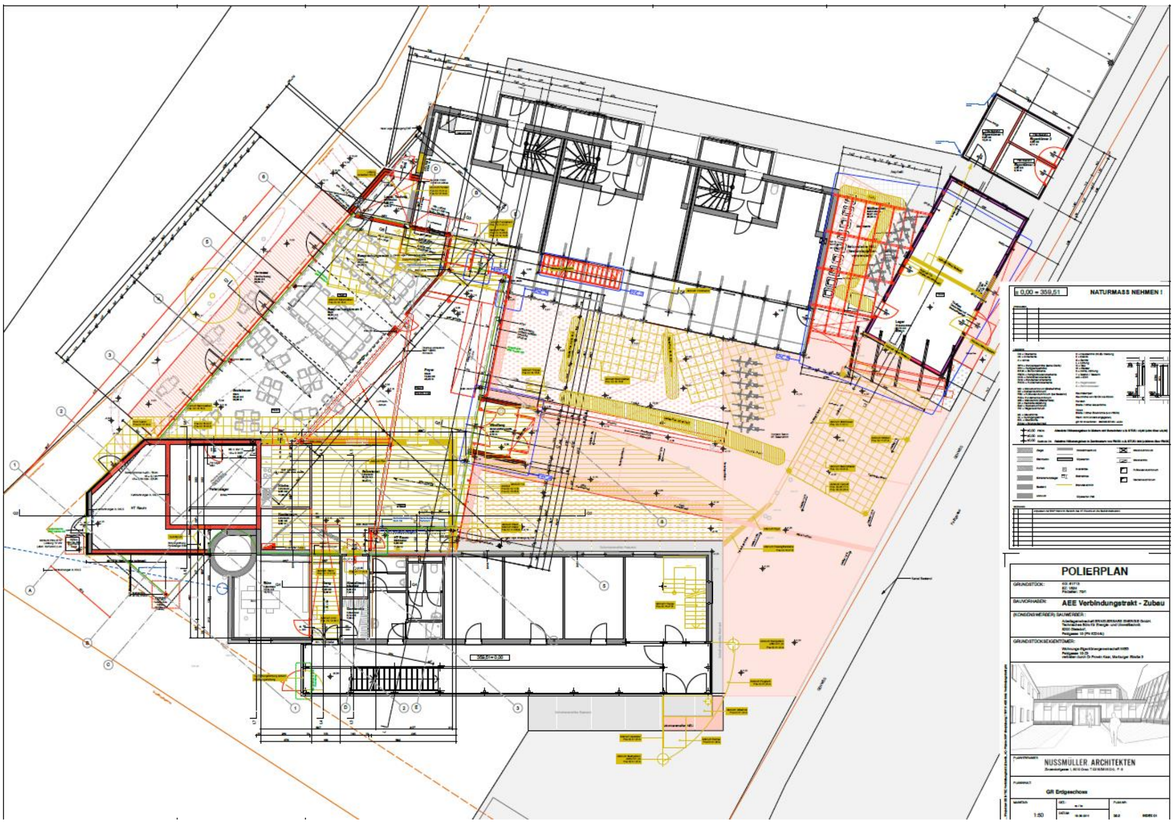


Figure 9: Ground floor of the connection building of office south and office north (Source: Nussmüller Architekten)

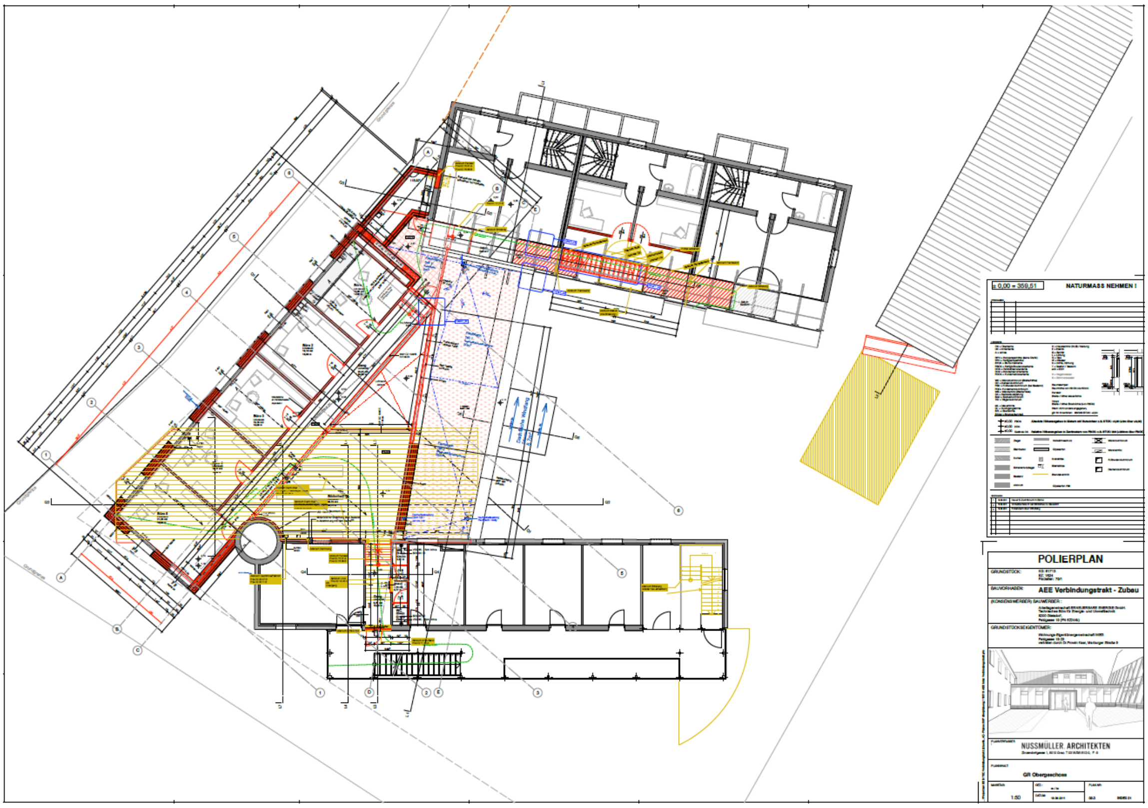


Figure 10: Second floor of the connection building of office south and office north (Source: Nussmüller Architekten)

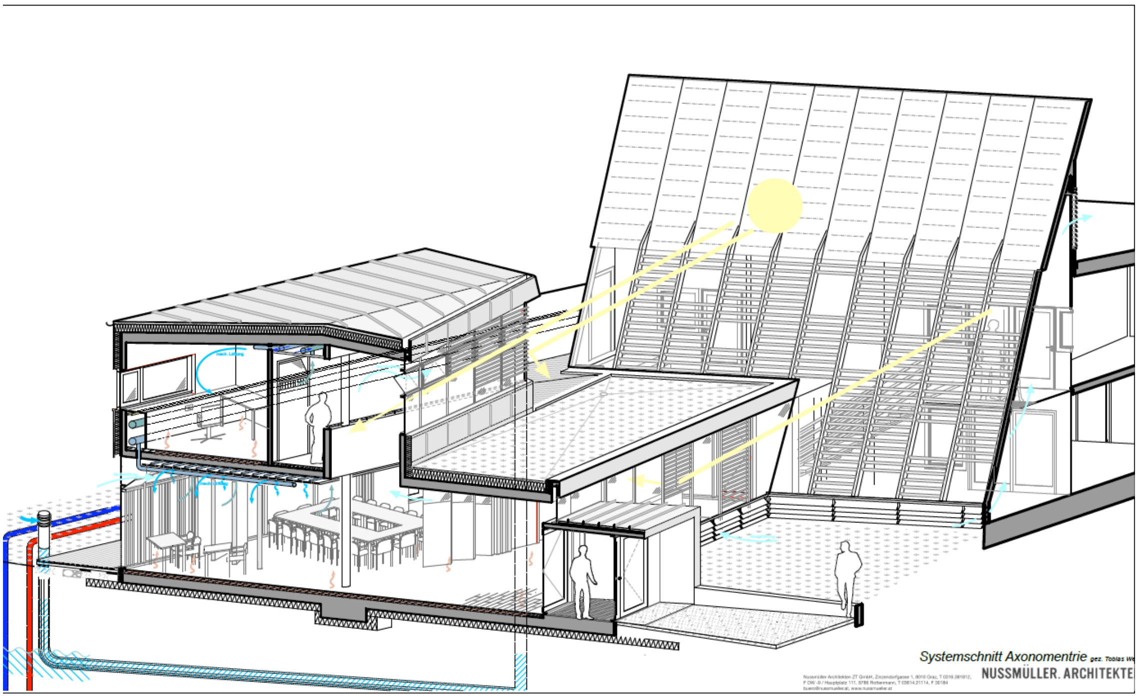


Figure 11: Cross section of connection building

Connection building	
Opening hours	7:00 – 18:00 weekdays Closed weekends
Area	420 m²
Walls	Rc = 9.36
Windows	U = 0.86, 14 % window
Ventilation	Qmax = 2000 m³/h 60 % heat regain
Electricity	kWmax = 10 kW
Hot water	none
Cooling	20 kW absorption chiller for meeting rooms

10.3 Total Building's dimensions

The building characteristics are summarized in the following table:

Table 1: Characteristics of the demonstration building

Characteristics	Value
total area	1,350 m²
total heated area	1,025 m²
residential area	150 m² (2 units)
average residents/apartment (2 units)	3 persons
office area	875 m²
average employees	70 persons
heat demand residential buildings (excl. losses)	39 kWh/m²a (150 m² heated area)
heat demand office (excl. losses)	50 kWh/m²a (875 m² heated area)
Total possible PV area	55 m²

The winter garden is not heated and therefore not considered for further calculations. The total possible PV area sums up by the area of currently installed solar thermal collectors + the already installed PV next to the building II. The heat demand is based on the consumption side and does not include the losses over the heating grid.

11 Cooling and Ventilation

An adsorption cooling machine with a capacity of 19 kW is providing partial cooling during summer. The meeting rooms in the ground floor of the connection building are equipped with chilled ceilings. The cooling machine is also used to pre-cool the fresh air of the ventilation system for the connection building and office north. Cooling will not be considered in the SCORES project.

All offices and residential houses are equipped with a controlled aeration and ventilation via earth to air heat exchangers. The fresh air is not directly fed into the house. It is sucked up by earth to air heat exchangers first and pre-warmed (winter operation) respectively pre-cooled (summer operation). Therefore, the air is flowing through a heat exchanger in the ground, which has the advantage that it can provide cooler temperatures than outside temperature in summer for precooling and higher temperatures than outside temperature in winter for preheating. The fresh air is supplied to the conservatory and is warmed further by the winter sun and forwarded into the rooms through the energy storage wall via corresponding ventilation flaps. From here the air consumed is drawn off via a central waste air ventilating fan.

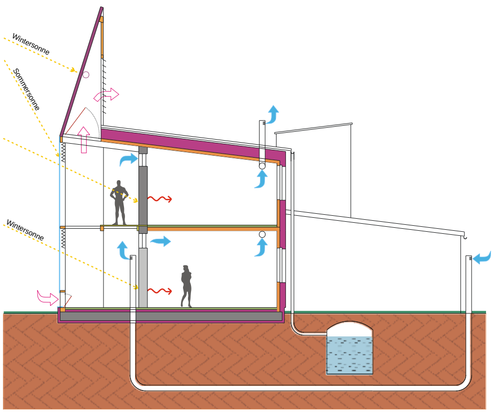


Figure 12: Section of office building – describing the air ventilation system

12 Energy consumption

12.1 Electricity demand

The electricity consumption is not monitored till now but monthly data is available for the office building. In total the yearly electricity consumption of the office is 35 MWh/a. Data from the residential buildings are not available but a typical value of 5.6 MWh/a for both families can be assumed [oesterreichsenergie.at, 2018]. Thus, the overall electricity consumption of the buildings results of about **40.6 MWh/a.**

12.2 Heat demand

The heat consumption of the buildings is measured by Stadtwerke Gleisdorf. The daily average values over an entire year can be seen in Figure 13. The numbers include the actual heat demand + thermal losses which also need to be covered by the heat supply system.

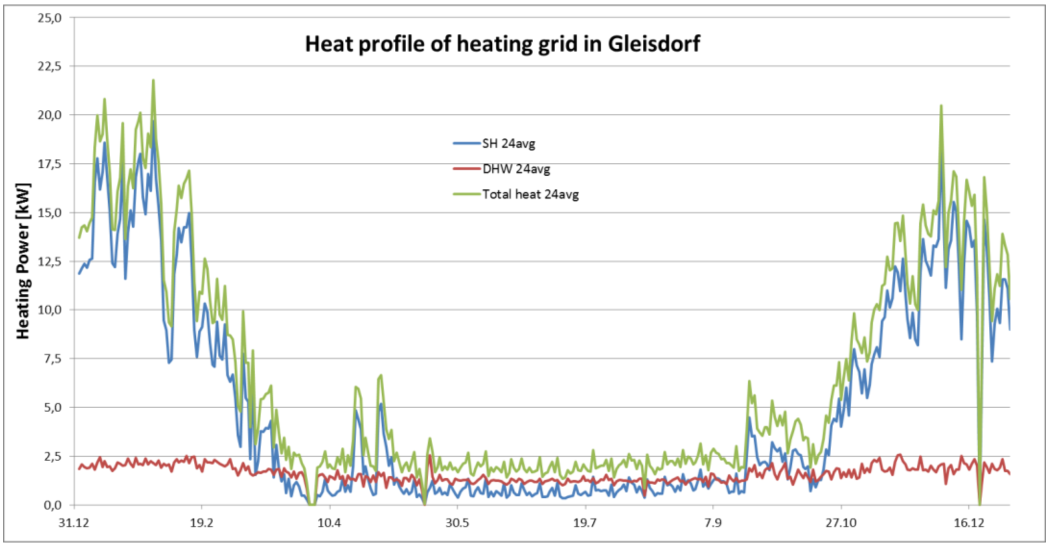


Figure 13: Heat demand profile of the Demo A building in Gleisdorf (daily average)

Figure 13 shows daily average power values, but the real peaks are higher. The total heat demand and peak power can be seen in Table 2.

Table 2: Overview of heat demand of Demo building in Gleisdorf (incl. losses)

	DHW	SH	Total	
Residential builings (2 units)	~8	~6	14	MWh/y
office	~ 8	~52	60	MWh/y
sum	16.1	58	74	MWh/y
max	52	49	52	kW
max heat/24 h	62	472	525	kWh/24h
max avg power/5h			45	kW/5 h

The values in Table 2 are the overall values including the office and residential area and also including the losses over the distribution loop. This is the amount of heat which needs to be provided by the SCORES system or district heating grid. At the moment no separate measurement between DHW and SH is integrated, but the values in the table give the order of magnitude. Detailed measurements will be realized during the project.

13 Existing energy distribution system and control

For the demo A and C the existing heating and DHW system in the demo building is used and the heat will be provided either by the heat pumps, the CLC-storage or for Demo A also by the district heating grid is possible. All individual buildings are connected via a central distribution loop to the SCORES system. The distribution loop has a hydraulic pump (Grundfoss Magna 40 – 100F) and a mixer which controls the temperature according to a defined heat curve calculated on basis of the outside temperature.

13.1 Heating System and control

The existing heating system of the buildings is a wall heating system for the "SUNDAYS" building on the inner and outer building walls. A prefabricated wall heating integrated in a gypsum concrete panel was used for this purpose (see Figure 14) for a maximum flow temperature of 50 °C. For the new connection building a floor heating is used.

The heat for space heating is provided over the distribution loop which is connected to a buffer storage and the district heating grid. The average flow temperature in the micro grid is 40 to maximum 50 °C.

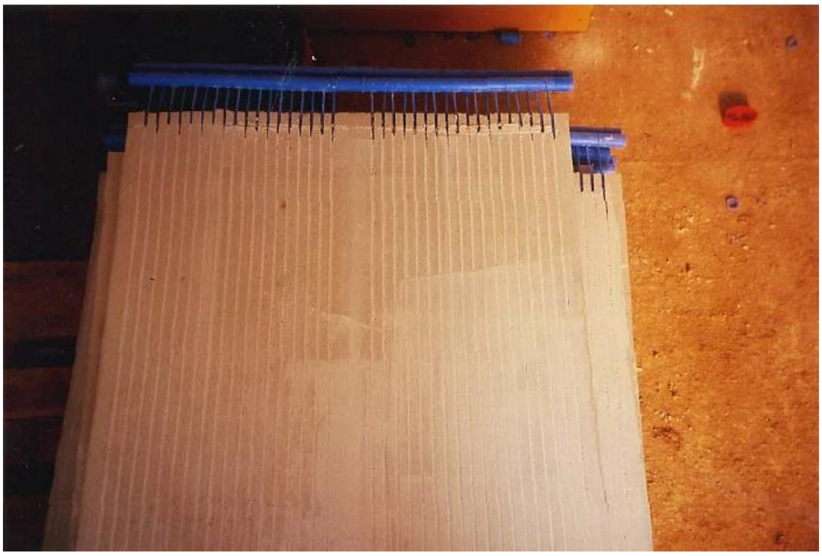


Figure 14 : Wall heating element integrated in gypsum concrete panel

The space heating and DHW loop of every user is connected to the same distribution loop. In the residential buildings an automatically controlled 3-way valve is switched to change from heating to DHW mode. This means that heating mode is off when DHW mode is on and the other way around. The target room temperature is set by every user via the central controller for the residential buildings and in the single rooms a variation of ±3 K from this set temperature can be set individually by a thermostat in every room. As soon as there is a heat demand the hydraulic pump in the heating loop turns on (constant flow) and the temperature in every room is controlled individually by the zone control valves. The actual room temperature is measured at every thermostat in every room and giving feedback to the zone control valves. The temperatures are not monitored at the moment.

13.2 DHW System and control

The distribution loop is generally on 40-45 °C for heating but is also used for DHW preparation in the houses. Therefore, the grid is on a higher temperature level of 70 °C to charge the DHW storages in the houses for a certain time period in the morning and noon to charge the individual 150 l DHW storage in the buildings. The 70 °C are necessary to prevent legionella in the local boilers. There are 7 boilers installed with a volume of 150 l each, but only 4 boilers are used, therefore the other 3 boilers are not considered for the demonstration.

The boiler charging period is from 03:00 -05:00 and 13:00 – 14:30. In this time period the 3-way valve is switched to DHW mode and no heating can take place. As soon as the temperature sensor in the boiler has reached the set temperature, the boiler pump is stopped. Even when the boilers are charged before the end of the DHW period, the 3-way valve is not changing the position and allowing to switch to the space heating mode earlier. After the time period the temperature in the distribution loop is going down again and used for heating purposes. The higher temperature for DHW can be either provided by CLC, heat pumps, electrical heaters or a combination of it. The time period of the DHW preparation can be changed in principle by the central controller, but need to be harmonized with the local controllers in the residential buildings and office.

At the moment, the only DHW demand is needed by the 2 family houses and a small amount is used for the offices.

14 Integration of the SCORES technologies in the Demo building

14.1 Thermal system

Existing distribution loop

The detailed hydraulic scheme of the existing thermal system is shown in Figure 15.

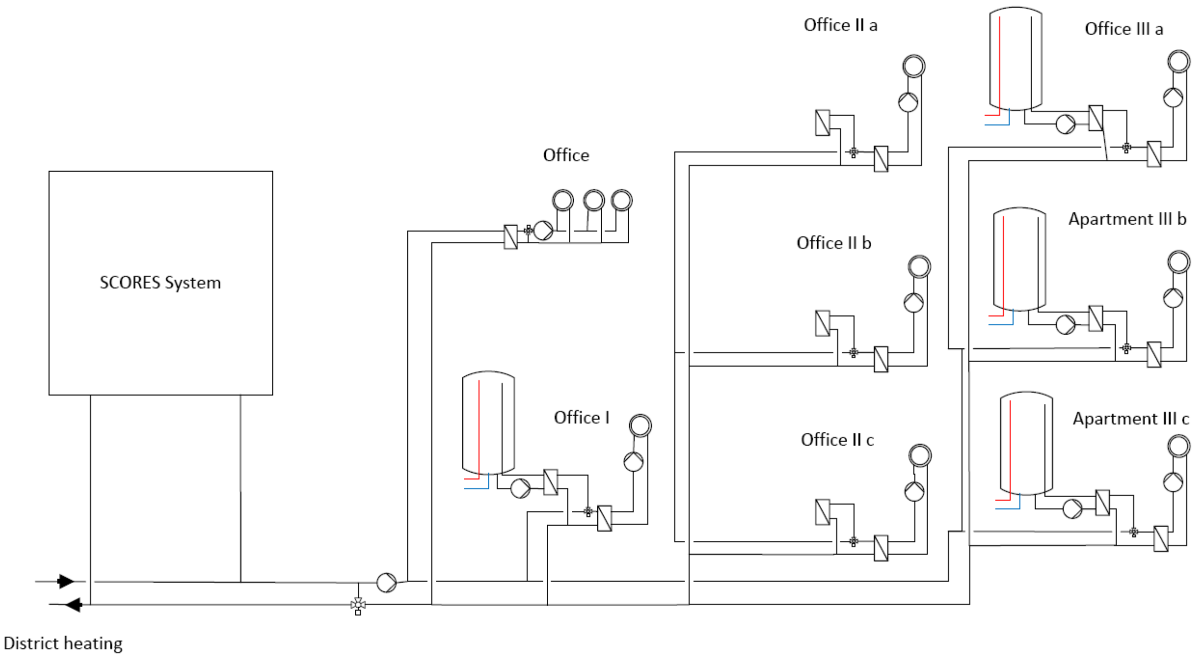


Figure 15: Detailed hydraulic scheme of the existing distribution loop of the demonstration site in Austria and integration point of SCORES System

The SCORES system will be integrated in the existing low-temperature distribution loop in Gleisdorf. The hydraulic scheme of the distribution loop is shown in Figure 15.

The consumers in the flats are two families, whereas the other consumers are used as offices. At the moment two boilers are in use in the offices and two in the flats. The other offices do not prepare hot water.

All the integrated SCORES components (PV modules, CLC container, batteries, heat pumps and buffer storage) are going to be decommissioned after the end of the project and the system will be the same as the current system.

Preliminary SCORES system

The SCORES System is integrated in the existing distribution loop to provide (part of) the heat and domestic hot water demand of the demonstration building. It is tested for a period of about 1.5 years in three different scenarios:

a) Demo A (connected to district heating grid) without CLC (but with heat pumps, PV, electrical batteries)
b) Demo C (disconnected to district heating grid) without CLC but with heat pumps, PV, electrical batteries)
c) Demo A with CLC +other equipment

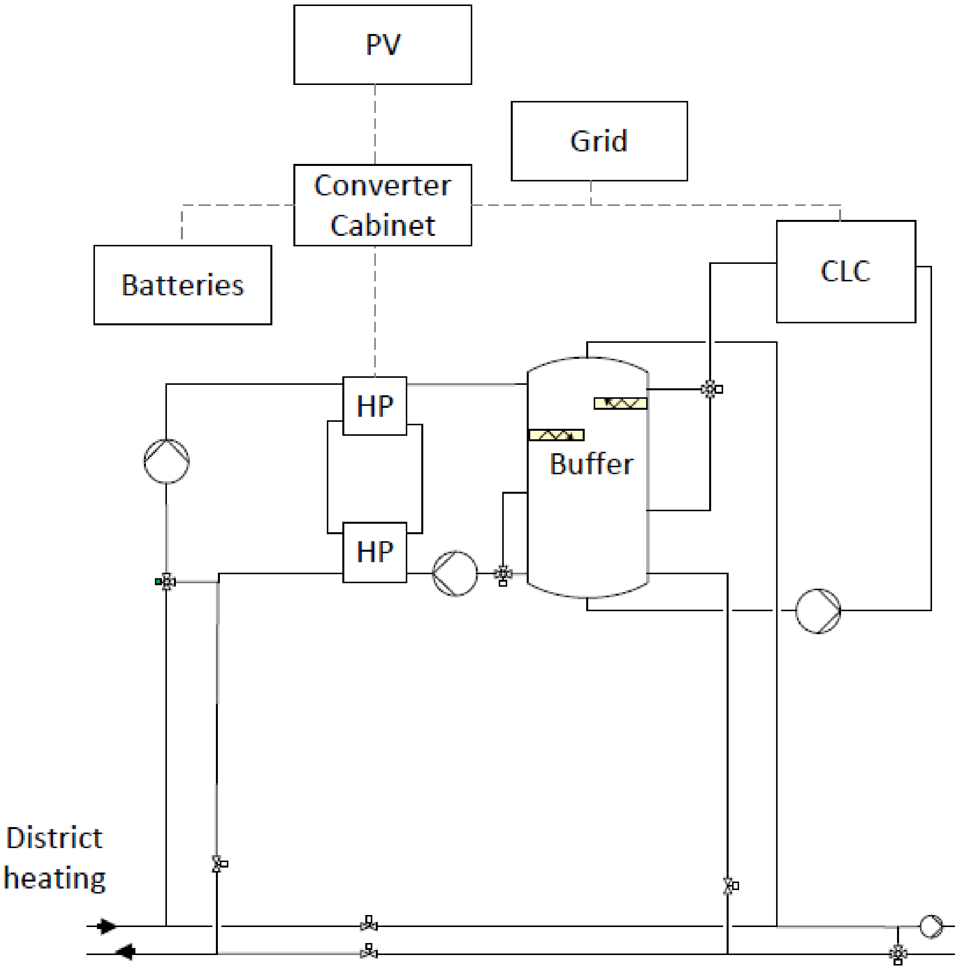


Figure 16: Hydraulic scheme of the integrated SCORES System for Demo A in Gleisdorf

The central component of the SCORES System is the buffer storage which is connected to the heat pumps and a CLC-storage. The heat pumps and the CLC storage are shifting heat to the buffer and from there it is extracted to cover the heat demand and deliver the required amount of heat at sufficient power to the distribution loop. The buffer will be equipped with electrical heaters to have a backup for the demonstration in case no sufficient temperature can be achieved.

The maximum power available by the heat pumps is 24 kW. If there is a higher power requested from the control the additional energy needs to be coved by the previously stored heat in the buffer. The maximum power (15 min average value) was 52 kW. In the coldest days in winter there was a peak demand of about 42 kW over 5 hours. The additional power needs to be provided by stored heat in the buffer or the district heating grid (only Demo A).

The CLC including a hydraulic pump and the heat exchanger is placed next to the building in a 20ft container and the pipings are connected to the boiler room of the building. Inside the boiler room they are connected to the buffer. With the controllable 3-way valve the return can be either shifted in the high temperature part or in the low temperature part of the buffer. This is necessary because before charging/discharging the CLC it must be cooled down to about 40 °C and this low temperature can cause mixing of different temperature levels in the buffer.

For the heat pump system two W2W heat pumps with a nominal capacity of 12 kW each will be installed in the central boiler room in the office building. The heat pumps can be used for charging the buffer for DHW and space heating purposes. They are connected in serial and with the remote controllable 3-way-valve it can be switched between preparing DHW or SH. On the extraction side there is also a 3-way –valve to switch between DHW and SH extraction (different temperature level).

Integration of SCORES System

The SCORES System will be integrated in the distribution loop as shown in Figure 17 for Demo A and Figure 18 for Demo C.

Since, there is no actual ground source (cold water well) available on the demo site the low temperature heat source for the heat pumps will be emulated with heat extracted from the district heating network. Therefore, heat is directly going to the heat pumps cold side, but the temperature needs to be mixed down by a mixer. The inlet temperature of the cold side of the heat pump will be controlled according to a typical annual temperature profile of a ground source around 10 °C. This connection is only for the demo, but not used for the future system where a ground source is used. In addition, the SCORES system or more precisely the buffer storage part of the SCORES system is connected to the distribution loop. The district heating grid and distribution loop can be separated by two 2-way valves.
The demo system will be used for the Demo A and Demo C system. Both cases are in principle the same but Demo C is not connected to the district heating network and the total heat demand has to be covered by the SCORES-System. To disconnect the heating grid the valves will be closed.

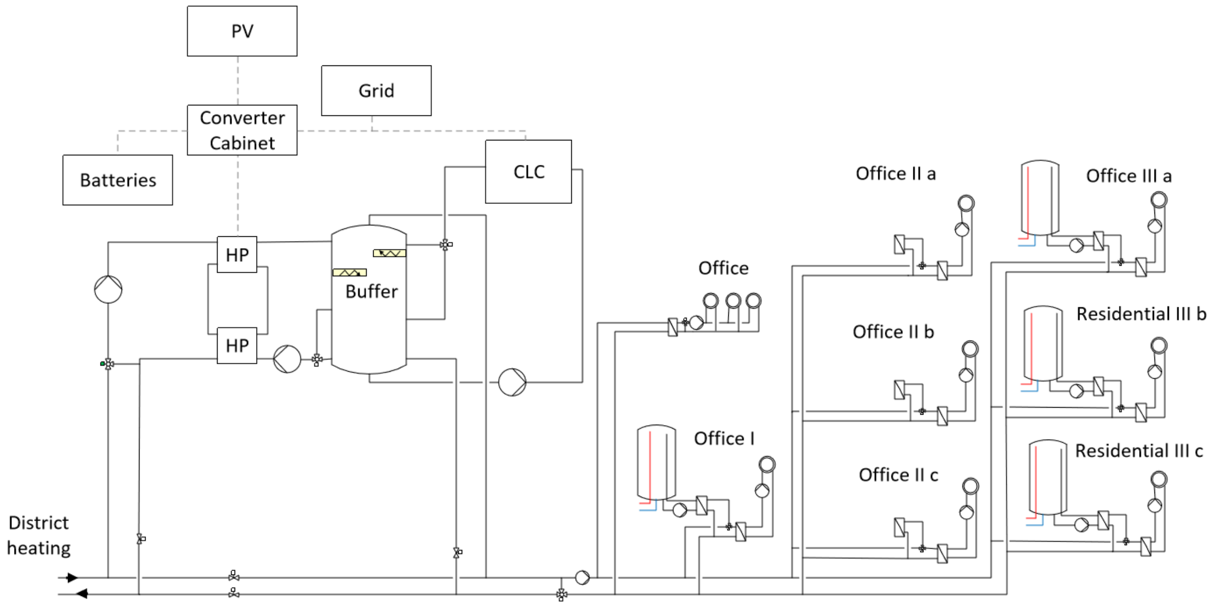


Figure 17: SCORES System integration in existing system for Demo A with connection to the heating grid

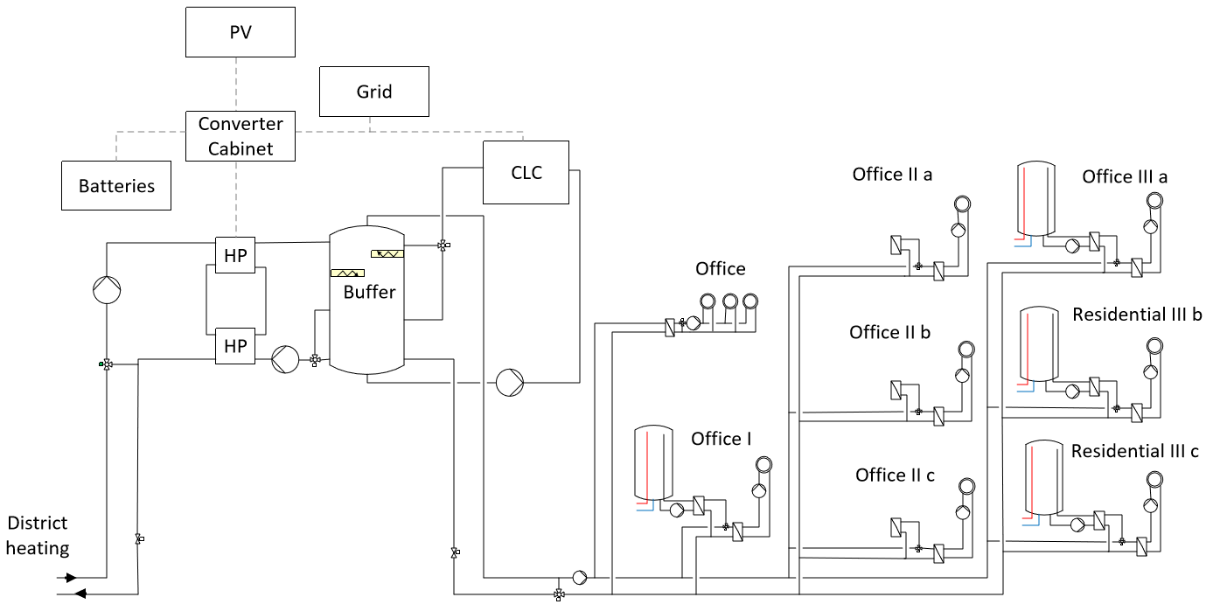


Figure 18: SCORES System integration in existing system for Demo C without connection to the heating grid

14.2 Electrical system

The main hardware components of the electrical system for Demo A and Demo C are the PV system, converter cabinet and second-life batteries.

The PV-area of 25 m² (~ 4.4 kWp) will be placed on a construction above the container. It will be placed on the site in a way that no shading is influencing the performance of the PV field. Since the CLC container is only installed part of the demonstration period, the PV system is mounted on the second container with the converter cabinet and electrical batteries. The PV electricity can be used for driving the heat pumps, charging the CLC, charging the electrical battery or fed into the grid and the BEMS controls when each mode is used.

The converter cabinet will be placed together with the electrical batteries in a second container. It cannot be placed in the boiler room since it has to be guaranteed that the cabinet and batteries are operated within a certain temperature range and the boiler rooms is too warm for that. In addition ventilation can be easily provided. The exact position of the container is shown in Figure 19. The detailed design of the electrical system is described in AD-02.

The container needs an electricity supply of 380 V / 32 A. (AD-01) Total available power for all equipment in the containers is 10 kW.

14.3 Area

The boiler room is in the southern building and in there the buffer tank and the heat pumps will be placed. The buffer tank is then connected to the CLC. The CLC container will be placed in front of the boiler room on the property of AEE INTEC. The temporary hydraulic connection from the CLC container to the boiler room will be a well-insulated tube-in-tube below-ground pipe to minimize losses.

The buffer is then connected to the district heating grid and to the heat distribution loop going to the buildings in the boiler room. In case of Demo C, the district heating grid is disconnected by two closing valves. Nevertheless, the district heating control will be always available on “stand-by” mode as backup energy source in case there are problems with the SCORES demonstration system.

The distribution loop is connecting the buffer with all building complexes and their space heating and DHW loops. In total there are 8 stations for heating and 4 of them also include DHW preparation. The cooling will not be considered for the SCORES project. The rough placement of the components can be seen in Figure 19. The detailed plan of the boiler room is shown in Figure 20.

The second life batteries together with the converter cabinet will be placed in an extra container which will be installed already before the CLC container. It will be a smaller container of 10 ft and above the container roof a construction will be built up to install a PV area of about 25 m². The container plan can be seen in Figure 21

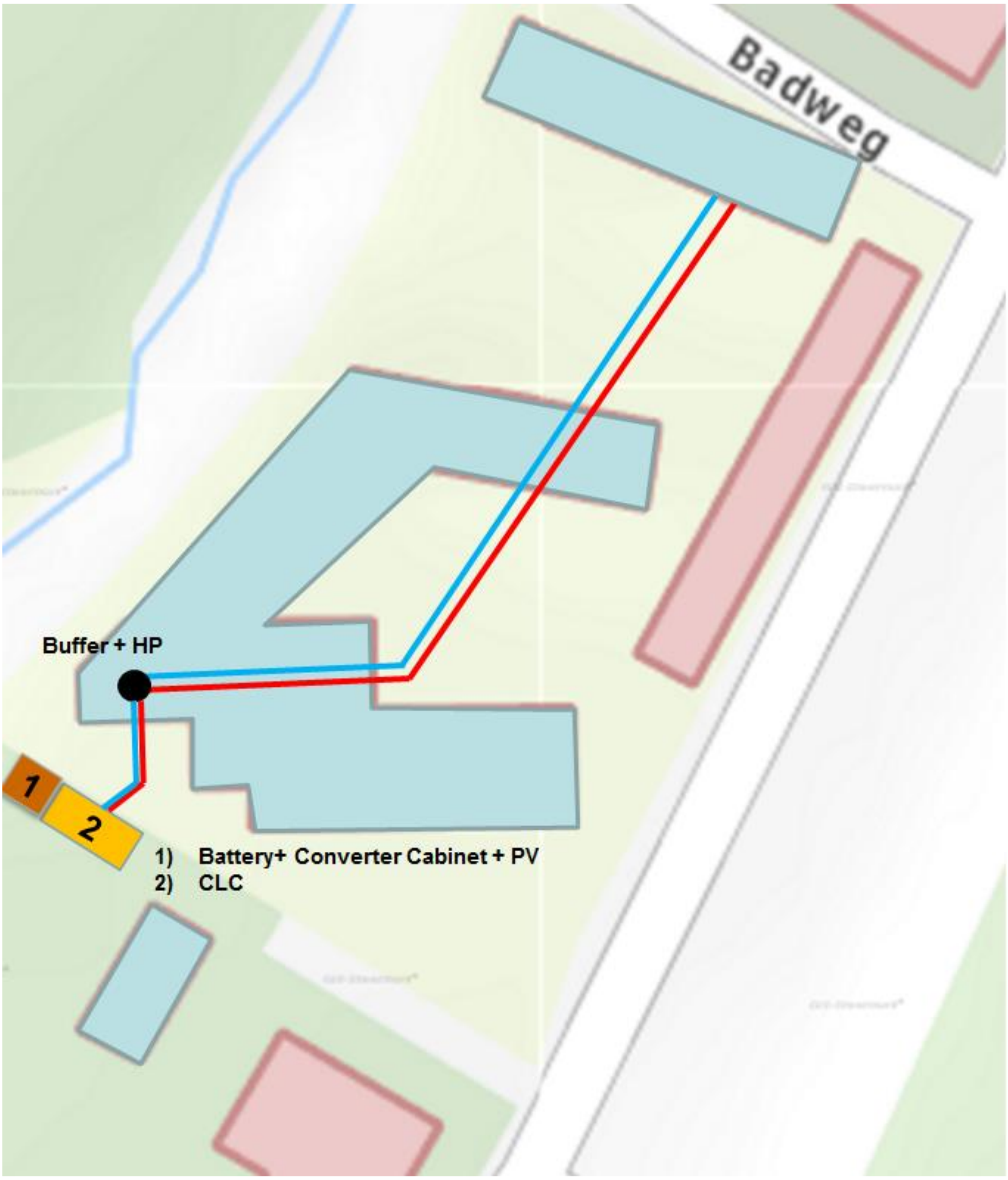


Figure 19: Site map of the SCORES technologies at Demo A and Demo C micro grid

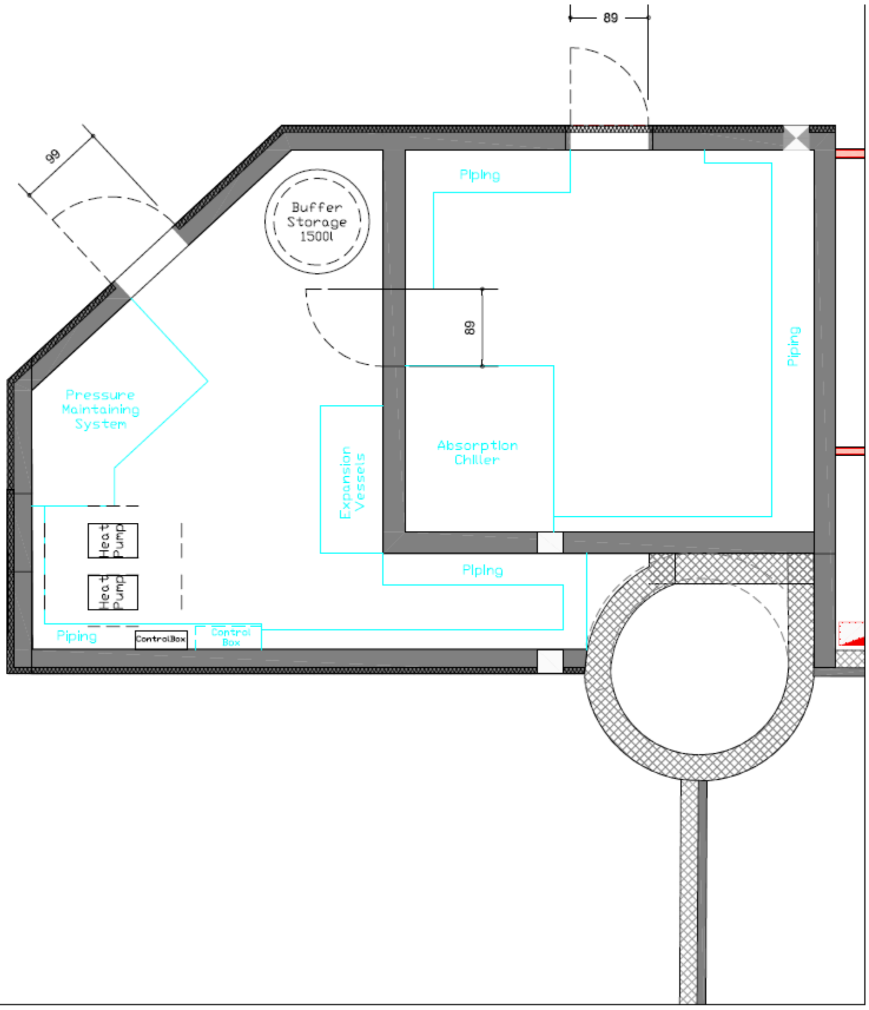


Figure 20: Location of the buffer storage and heat pumps in the boiler room

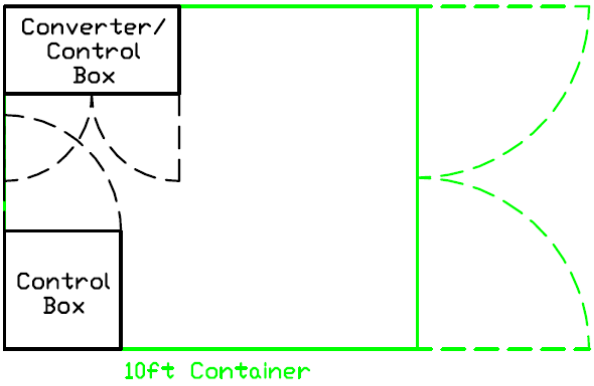


Figure 21: Separate Container with batteries and electrical converter cabinet

Outlook: SCORES future building

The SCORES future building is the basis for the simulation and the future system as well as the reference system calculations will be based on the defined building. The future building slightly differentiates to the current building to have a more representative building for Austria. The total area will stay the same for the SF – building, but the share between office and residential area will be different. For the futures system the buildings will be considered as they are originally designed for, which means that the office area is decreased and 6 buildings will be used for residential purposes instead of only two.
To fulfill the legal requirements the system has to meet certain regulations. Important for the DHW preparation is the ÖNORM B5019 („Hygienerelevante Planung, Ausführung, Betrieb, Überwachung und Sanierung von zentralen Trinkwasser-Erwärmungsanlagen”. Further legal requirements will be investigated in the project.

Table 3: Differences between demonstration building and SCORES future Building

	Demonstration Building	SCORES Future Building
Total heated area	1025 m²	1025 m²
Avg size of residential building (heated)	75 m²	75 m²
Number of residential buildings	2	6
Total residential area (heated)	150 m²	450 m²
Total office area(heated)	875 m²	575 m²
Possible PV area	55 m²	240 m²

In the following two figures the preliminary future system is shown. It is a first design and needs to optimized in the simulation for both Demo A (connected to DH grid) and Demo C (no connection to DH grid). The main difference is that the SCORES future system has a ground source instead of the connection to the district heating grid like it is used for the demonstration and that there are 6 residential buildings+ 1 office instead of only 2 residential buildings and the rest office area. The optimal sizes of the single components have to be determined by the simulation.
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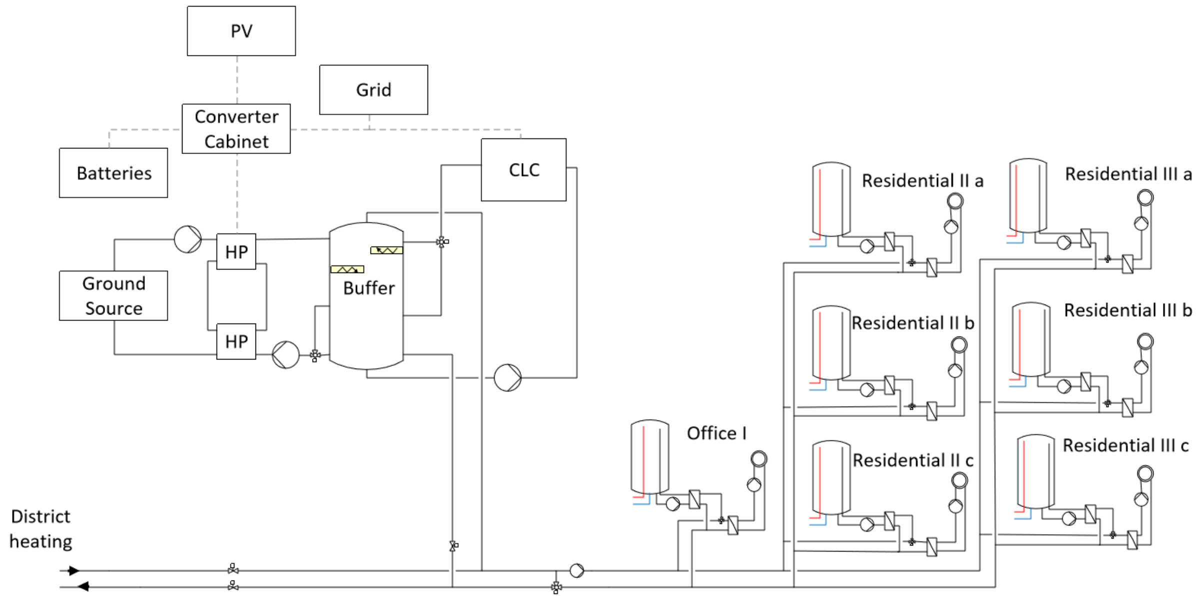

Figure 22: Preliminary system design for Case A

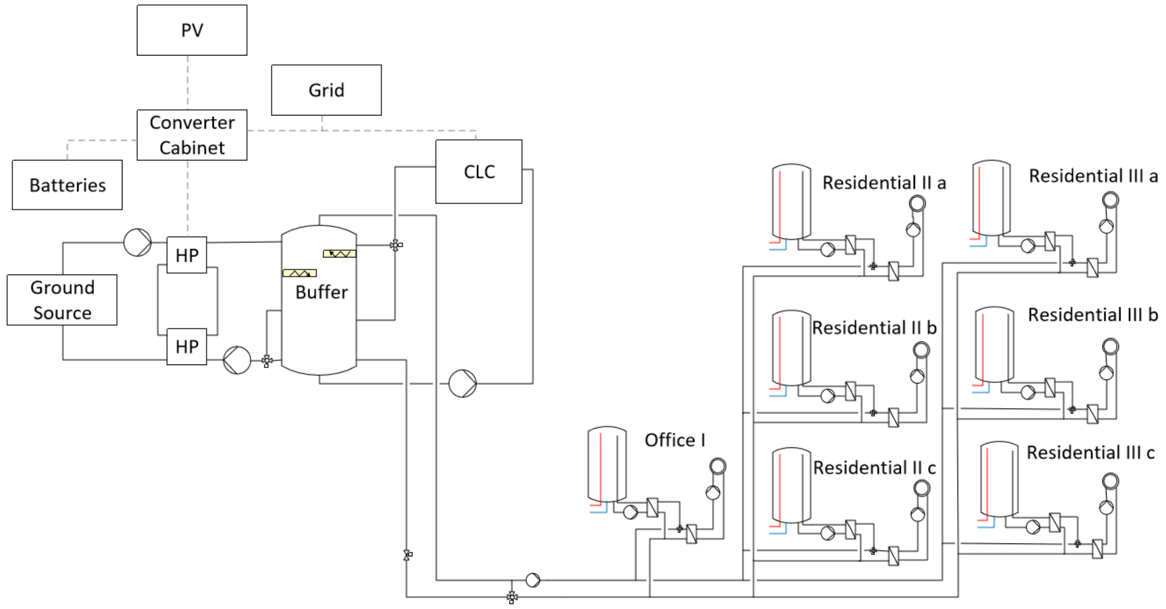

Figure 23: Preliminary system design for Case C