RVS HEAT

Catalogue of presentation

HEAT PUMPS

90°C

CO_2 ENVIRONMENT FRIENDLY

CE

www.rvsenergy.ro

Recommendation

"CO_2 heat pumps are highly energy efficient and have a low environmental impact. They use ambient air or water as a heat source and produce heat in the form of hot water at high temperatures up to 90 °C. They can be successfully used to heat new or existing buildings, but can also serve various technological processes. When powered by electricity from renewable sources, they operate without any emissions."

Professor Eng. Mugur Bălan, PhD

Technical University of Cluj-Napoca

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Why CO_2?

General considerations

In the context of current concerns about climate change and new European regulations on greenhouse refrigerants, it is also necessary to reconsider natural refrigerants such as NH_3 (R717) and CO_2 (R744), agents which compared to the freons currently used in the refrigeration industry, have virtually no impact on the environment. The Global Warming Potential (GWP) of NH3 is 0 and CO2 is 1, while the Ozone Depletion Potential (ODP) is 0 for both agents. The GWP of CO_2 can be neglected when used in technical applications as it is a by-product of many industrial processes.

The table below shows the ODP and GWP values for some refrigerants.

Refrigerant	ODP	GWP (100 years)
R12	1	2400
R22	0.05	1700
R134A	0	4300
R404A	0	3300
R407A	0	1600
R410A	0	2088
R32	0	650
R1234yf	0	4
R1233zd	0	1
R717 (NH3)	0	0
R718 (H20)	0	0.2
R744 (CO2)	0	1

Both NH_3 and CO_2 were among the first substances to be used as refrigerants, as early as the 1850s. In 2008 a classification of refrigerants into four generations was proposed:

1 First generation (whatever worked) (1830-1930): includes both NH_3 and CO2;

2 Second generation (safety and durability) (1931-1990): characterised by the switch to CFC refrigerants, but NH3 remains representative of this period;

3 Third generation (ozone protection) (1990-2010): proposes HCFC-type agents in a transitional period and HFC-type agents for long-term use, in the context of the first regulations on ozone layer protection. Natural agents, including NH_3 and CO_2 began to be reconsidered during this period;

4 Fourth generation (global warming) (after 2010): removal of environmentally harmful synthetic agents. In this current context, both NH_3 and CO_2 are considered among the most viable alternatives.

Refrigeration cycles that work with both agents are well known and new improvements are continuously implemented, especially for CO_2

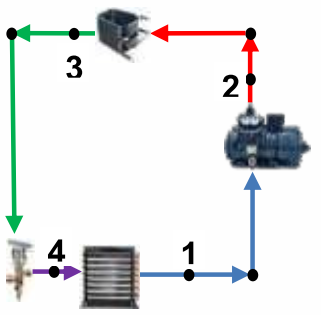
Why CO_2?

CO_2 is a well-known and long-established refrigerant, it is non-toxic, non-flammable, abundant (including in ambient air) and has a very low environmental impact compared to other refrigerants.
Co_2 is considered an excellent alternative to NH_3, especially in situations where toxicity and flammability are problems to be avoided. These reasons may explain the success of CO_2 in areas such as the automotive industry or household and commercial applications. Recently, CO_2 has become a competitive agent also in air conditioning.
The main dissadvantage of CO_2 is the low critical temperature value (tcr=31.06 °C), which causes transcritical, or supercritical, operation in many applications where condensation becomes impossible due to climatic conditions. Compared to NH_3 , the energy efficiency of CO_2 cycles is lower, especially in the supercritical mode.

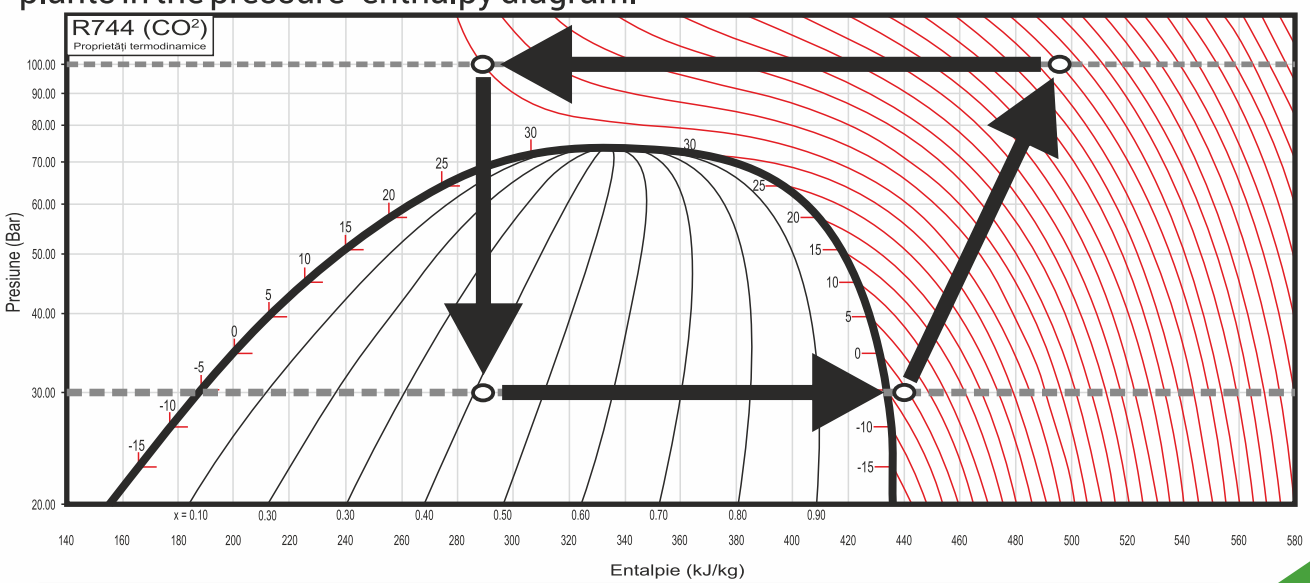
Although CO_2 was almost forgotten during the freon boom, it is being rediscovered and reconsidered in recent times because of its characteristics.

The CO_2 installation

In all cases where due to the too high temperature of the refrigerant (the hot source of the refrigeration cycle), it is not possible to condense CO_2, the operating cycles of installations with this refrigerant become supercritical, i.e. they operate at temperatures and pressures higher than those of the critical point (tcr = 31.06 °C; pcr = 73.834 bar). The maximum condensing temperature of CO2 is the critical temperature (≈ 31 °C). In the case of supercritical operation of refrigeration plants and heat pumps with CO_2 , since condensation no longer occurs, the heat exchanger that transfers heat energy to the hot source is no longer called a vapour cooler condenser.
In the figures below there are shown the schematics of the CO_2 plants with supercritical operation and the working cycle of these plants in the pressure-enthalpy diagram.



Schematic diagram of the classical CO_2 installation



Representation of the conventional (classical) supercritical cycle with CO2

Residential heat pumps

Készülj fel a jövőre egy jó ötlettel! Nagy teljesítményű CO2 levegő-víz hőszivattyúink

General

The RVS8 and RVS14 heat pumps are an efficient solution whatever regardless of the location. Their operation is climate neutral due to the refrigerant, which is CO_2 , having a value of 1 for global warming potential, while conventional Freon has values between 1600 and 4300. Heat pumps have low or even zero CO_2 emissions in combination with a renewable source of electricity.

About 40% of all CO_2 emissions are attributed to heat and hot water production. With heat pumps you reduce emissions compared to boilers that run on natural gas condensing. Heat pumps are therefore an environmentally friendly heating system.

Our heat pumps are unique in their ability to produce hot water continuously at temperatures up to 90 °C at ambient temperatures in the range -25...43°C, 24 hours a day. This means that the heat pumps can be connected to conventional heating circuits without any special modifications. This makes them quick and inexpensive to implement, as no boreholes or surface collectors are required as with ground-to-water heat pumps.

They are the perfect solution in regions where access to the gas network is limited or lacking. They are also the perfect solution when combined with photovoltaic systems, thus significantly or totally reducing operating costs, and correspondingly, CO_2 emissions.

They are the perfect solution for buildings where the heating system requires water temperatures above 55 °C, which other types of heat pumps cannot provide.

RVS-8

RVS-14

Model			RVS 8	RVS 14
Standard temperature mode	Nominal heating capacity	kW	7,8	13,6
	Hot water flow	l/h	149	259,8
	Electrical power consumption	kW	1,7	3
	COP	W/W	4,58	4,6
Low temperature mode	Nominal heating capacity	kW	7	12,1
	Hot water flow	l/h	118	203,9
	Electrical power consumption	kW	1,7	3
	COP	W/W	4,1	4,1
Very low temperature mode	Nominal heating capacity	kW	6,5	11,2
	Hot water flow	l/h	109	188,8
	Electrical power consumption	kW	1,71	2,9
	COP	W/W	3,8	3,9
Absorbed current intensity		A	8	13,6
Power supply	V / Ph / Hz		230–240V / 1Ph / 50/60Hz	
Nominal inlet water temperature		°C	45	
Maximum outlet water temperature		°C	90	
Ambient temperature		°C	-25...43	
Compressor			Panasonic	
Water recirculation pump	Brand		Yuanbaobao	
	Power	kW	0.08	
Type of defrosting			Bypass	
Size of hot water connection fittings			DN20	
Heat exchanger on the hot water side			Pipe-in-pipe type	
Air-side heat exchanger			Copper coils with aluminium connecting rods	
Refrigerant			R744 (CO_2)	
Quantity of refrigerant		kg	2	
Controller			CAREL Italy	
Dimensions	Length	mm	910	910
	Width	mm	430	430
	Height	mm	920	1000
Noise level		db	42	42
Net weight		kg	130	181
Inverter			DC	

Note:
1. Standard temperature mode: ambient temperature 20 °C, water temperature: inlet 15 °C, outlet 55 °C
2. Low temperature mode: ambient temperature 7 °C, water temperature: inlet 9 °C, outlet 55 °C
3. Very low temperature mode: ambient temperature -7 °C, water temperature: inlet 9 °C, outlet 55 °C

Industrial heat pumps

Vă prezentăm cele trei game de pompe de căldură, apă-apă, aer-apă și aer-aer.

Water-Water

RVSW – 40

RVSW – 75

RVSW – 120

Air-Water

RVS – 40

RVS – 75

RVS – 120

Air-Air

RVSA – 125

Overview

Our high temperature heat pumps, RVS brand, are the result of an industrial development and research process, started in 2012, which continues today.

RVS heat pumps are unique in their ability to produce hot water continuously up to 90 °C ambient temperatures in the range -25...43°C, 24 hours a day. This means that conventional heating circuits can be connected to heat pumps without any special modifications.

RVS heat pumps are designed for individual, district heating systems or for preparation of technological hot water for certain industrial processes, all year round. They can serve residential buildings of all sizes, commercial and industrial premises, administrative buildings, educational institutions, hospitals, etc.

Some models of water-to-water heat pumps can also provide cooling and air conditioning for various spaces.

Three types of heat pumps are available: air-to-water, water-to-water and air-to-air, which ensures a high flexibility in choosing the optimal technical solution, depending on the application and the particularities of the equipment:

- Reduced cost and installation time for air-to-water and air-to-air heat pumps;
- High efficiency and stable performance for water-to-water heat pumps.

Heat pumps can be interconnected in cascade in order to provide various, including very high, required heat outputs. Up to 256 heat pumps can be interconnected via ASC (APLS Smart Control). Individual units can be disconnected from the ASC system during maintenance without shutting down the system, ensuring continuity of heat supply.

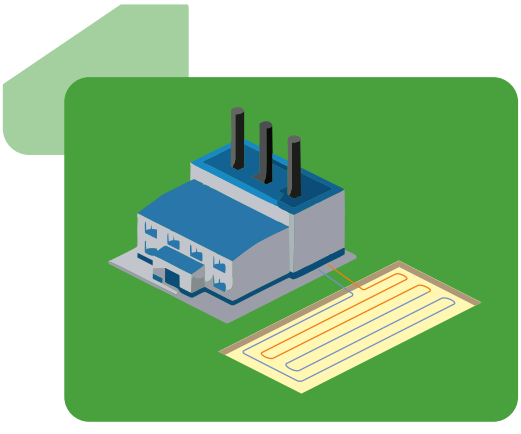
In the context of the current energy crisis and the European Union's short and medium-term directives and strategy, heat pumps in combination with photovoltaic systems are the most suitable solutions for providing heat energy under sustainable conditions.

Water-to-water industrial heat pumps

We would like to present the RVS water-to-water geothermal heat pumps range, water-to-water type, which are the most efficient source of "green" energy for producing hot water at high temperatures up to 90 °C.
Where there is sufficient space for the location of heat connection systems, RVS geothermal heat pumps offer high and consistent energy efficiency all year round.
Heat sources can be represented by:

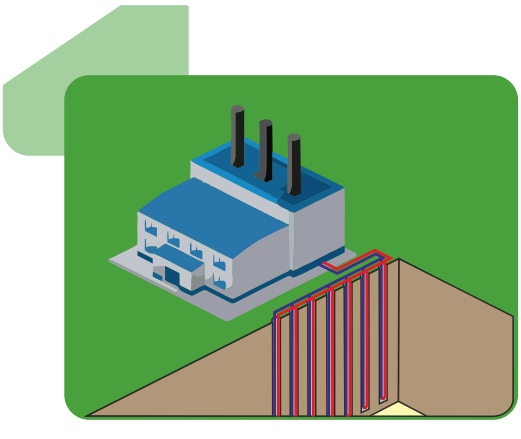
- Geothermal surface collectors;
- Vertical geothermal collectors (boreholes);
- Boreholes for groundwater;
- Connections to surface water sources (lake, river, stream, etc.);
- Sewerage system pipes, etc.

RVS geothermal heat pumps are the perfect choice both for the production of heat to supply any type of heating system (individual or central, low or high temperature) and for the production of domestic or technological hot water.



GEOTHERMAL SURFACE COLLECTORS

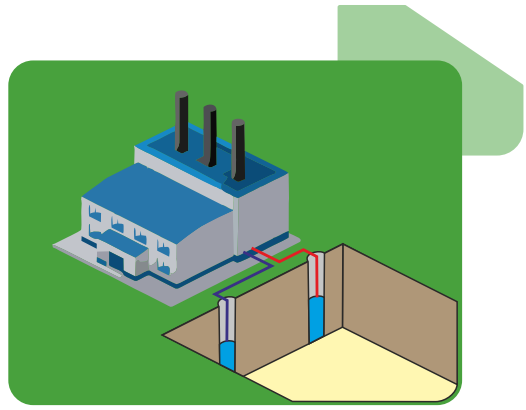
Heat is extracted from the ground through collectors made of polyethylene pipe. The collectors are buried in the ground and an antifreeze-type thermal agent circulates through them to provide frost protection. It is recommended that the soil is not covered with asphalt or concrete.



VERTICAL GEOTHERMAL COLLECTORS

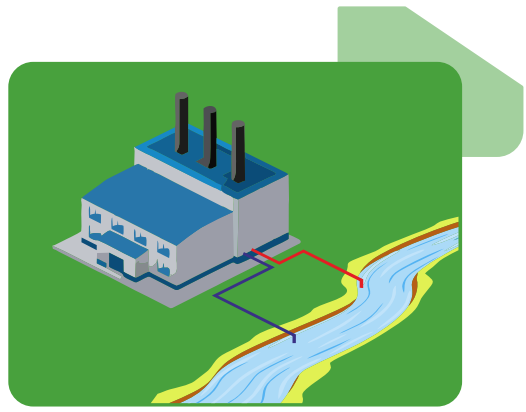
Heat is extracted from the ground at depth through collectors made of polyethylene pipe and mounted in vertical boreholes. At depths of more than 10 m, the ground temperature is constant at around. (10...12) °C, ensuring relatively constant energy efficiency throughout the year. An antifreeze-type thermal agent circulates through the collectors.

BOREHOLES FOR GROUNDWATER



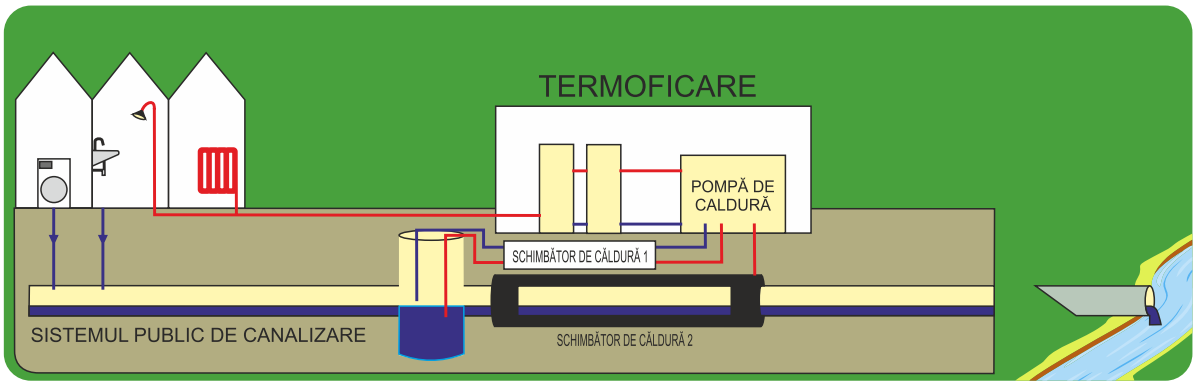
Groundwater has a relatively constant temperature of between (7...12)°C, which ensures a relatively constant energy efficiency throughout the year. A minimum distance must be maintained between the abstraction well and the discharge well. The direction of water flow must be taken into account when drilling boreholes.

CONNECTIONS TO SURFACE WATER SOURCES

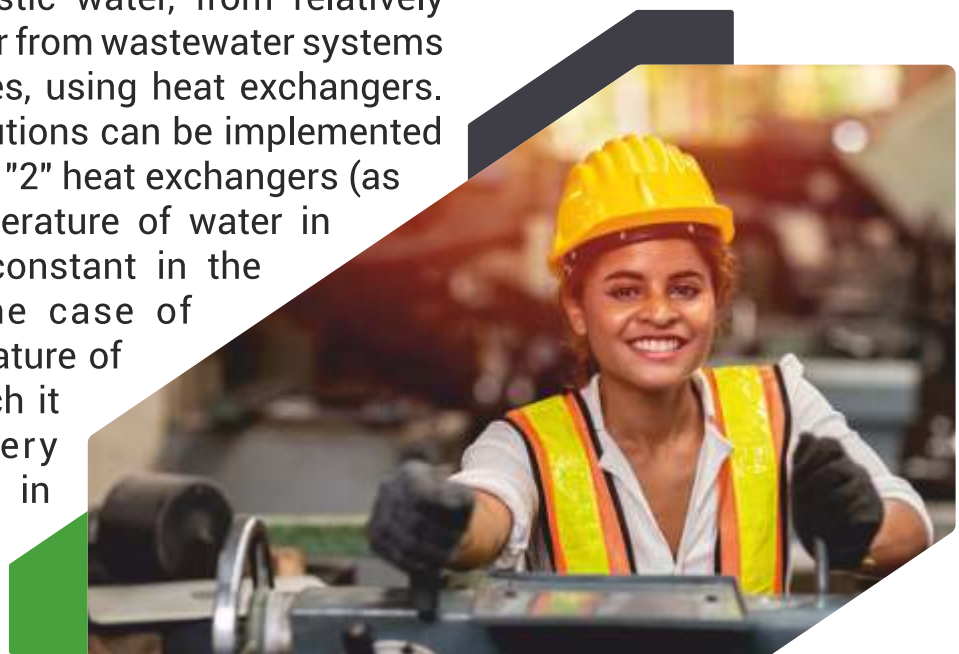


Heat is taken over (directly or via a heat exchanger) from a surface water source (lake, river, stream, sea, etc.). If there is a danger of the water source freezing, horizontal geothermal collectors can be installed in the water.

SEWERAGE SYSTEM PIPES



Heat is taken over from domestic water, from relatively constant flow sewage systems, or from wastewater systems from various industrial processes, using heat exchangers. From a design point of view, solutions can be implemented containing either type "1" or type "2" heat exchangers (as shown in the figure). The temperature of water in sewage systems is relatively constant in the range (10...20) °C, and in the case of wastewater, it depends on the nature of the industrial process from which it originates. This heat recovery solution is used in many cities in Europe.



Water-to-water industrial heat pumps

We would like to present the 3 available models of water-to-water industrial heat pumps

RVSW-40

water-to-water

Rated power:

- 40 kW

RVSW-75

water-to-water

Rated power:

- 75 kW

RVSW-120

water-to-water

Rated power:

- 120 kW

Model			RVSW40	RVSW75	RVSW120
Heating circuit	Nominal heating capacity	**kW**	39.3	76.3	118
	Hot water flow	**l/h**	750	1450	2256
	COP	**kW/kW**	4.85	4.62	4,72
Cooling circuit	Nominal cooling capacity	**kW**	31	59.8	86.2
	Cold water flow	**l/h**	6000	10000	14500
Electrical power consumption		**kW**	8.1	16.5	25
Power supply	V / Ph / Hz		380~440V/ 3PH/ 50~60Hz		
Absorbed current intensity (Max.)		**A**	24	45	75
Hot water inlet temperature		**°C**	5...50	5...50	5...50
Hot water outlet temperature		**°C**	45...90	45...90	45...90
Cold water inlet temperature		**°C**	10...30	10...30	10...30
Compressor			Dorin		
Water recirculation pump	Brand		Wilo		
	Power	**kW**	0,35	0,75	1,1
Size of hot water connection fittings			DN20	DN20	DN25
Size of cold water connection fittings			DN32	DN40	DN50
Heat exchanger on the hot water side			Pipe-in-pipe type		
Refrigerant			R744 (CO_2)		
Quantity of refrigerant		**kg**	9	15	22
Controller			CAREL		
Dimensions	Length	**mm**	1500	1740	2470
	Width	**mm**	900	995	1340
	Height	**mm**	1290	1540	1500
Noise level		**db**	49	50	54
Net weight		**kg**	450	890	1050
Inverter			AC		

Note:
Standard temperature modes:
Hot water temperature: inlet 15 °C, outlet: 60 °C
Cold water temperature: inlet 12 °C, outlet 7 °C

Air-to-water industrial heat pumps

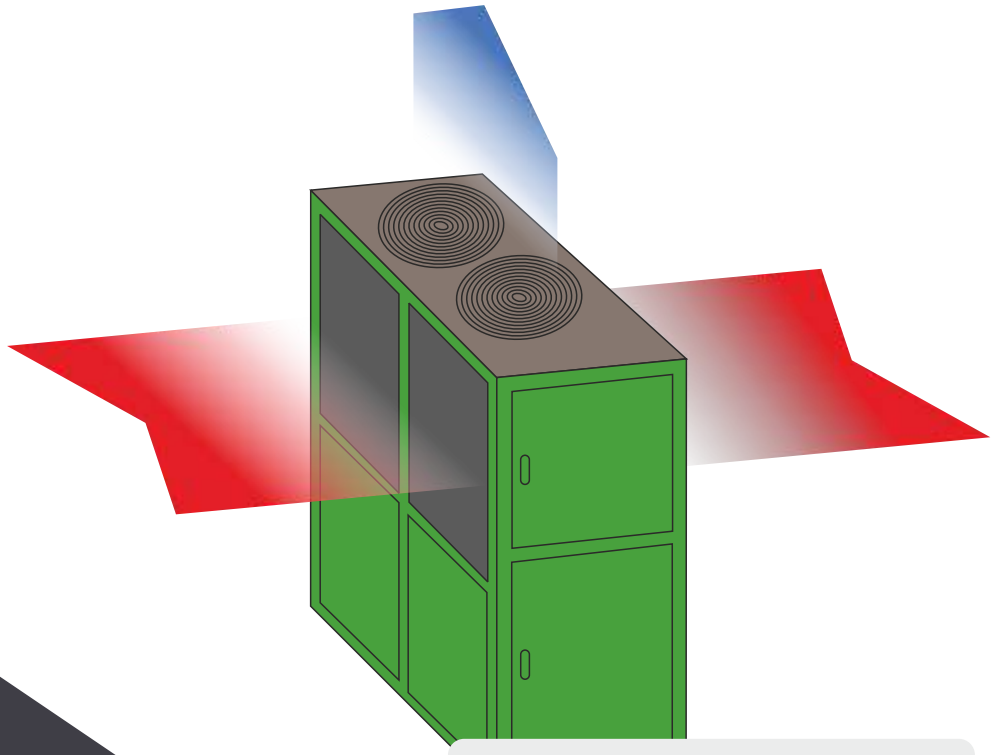
RVS air-to-water heat pumps are the optimal solution for heating and hot water preparation in many situations where it is not possible to use water-to-water heat pumps, e.g. if there is no space available for the location of collectors or boreholes or wells or pipes to collect groundwater or surface water. It is the perfect solution when there is no natural gas network in the area of the site served, or when access to the network is limited.

RVS heat pumps are the optimal solution to produce "green" heat. The CO2 emissions of this equipment are 0, if the absorbed electricity used comes from renewable sources.

The ASC monitoring and control system allows air-to-water or water-to-water heat pumps to be connected in cascade, both with each other and with other heat sources, including natural gas boilers. This allows the creation of complex systems with high and very high heat outputs, which can be used in many applications, for example in district heating systems. By cascade connection, RVS heat pumps can be easily integrated into existing heating systems with minimal adjustments.

For air-to-water heat pumps, installation costs are much lower than for water-to-water heat pumps and for this reason they are used in many applications.

The only disadvantage of air-to-water heat pumps compared to water-to-water heat pumps is that their performance is dependent on ambient temperature.



Inlet and outlet of ambient air at aer-to-water industrial heat pumps

Air-to-water industrial heat pumps

We would like to present the 3 available models:

RVS-40

Air-to-water

Rated power:

- 40 kW

RVS-75

Air-to-water

Rated power:

- 75 kW

RVS-120

Air-to-water

Rated power:

- 125 kW

Model			RVS 40	RVS 75	RVS 120
Standard temperature mode	Nominal heating capacity	kW	40	75.5	125.4
	Hot water flow	l/h	764	1.442	2.396
	Electrical power consumption	kW	9	16.7	26.6
	COP	W/W	4.4	4.5	4.7
Low temperature mode	Nominal heating capacity	kW	35	64	95
	Hot water flow	l/h	590	1.079	1.602
	Electrical power consumption	kW	9.4	16.8	24.3
	COP	W/W	3.7	3.8	3.9
Very low temperature mode	Nominal heating capacity	kW	28	49.1	78
	Hot water flow	l/h	472	826	1,315
	Electrical power consumption	kW	10.1	16.8	26
	COP	W/W	2.8	2.9	3
Absorbed current intensity		A	18	34	55
Power supply	V / Ph / Hz		400V / 3Ph / 50/60Hz		
Nominal inlet water temperature		°C	45		
Maximum outlet water temperature		°C	90		
Ambient temperature		°C	-25...43		
Compressor			Dorin (Italy)		
Water recirculation pump	Brand		Wilo		
	Power	kW	0.37	0,55	1,1
Type of defrosting			Bypass		
Size of hot water connection fittings			DN20		
Heat exchanger on the hot water side			Pipe-in-pipe type		
Air-side heat exchanger			Copper coils with aluminium ribs		
Refrigerant			R744 (CO_2)		
Quantity of refrigerant		kg	9	15	22
Controller			CAREL		
Dimensions	Length	mm	1.803	2.046	2.468
	Width	mm	830	1.106	1.368
	Height	mm	2.100	2.300	2.413
Noise level		db	49	54	65
Net weight		kg	525	980	1.350
Inverter			AC		

Note:

1. Standard temperature mode: ambient temperature 20 °C, water temperature: inlet 15 °C, outlet 55 °C
2. Low temperature mode: ambient temperature 7 °C, water temperature: inlet 9 °C, outlet 55 °C
3. Very low temperature mode: ambient temperature -7 °C, water temperature: inlet 9 °C, outlet 55 °C

Air-to-air industrial heat pump

Air-to-air heat pumps are equipment that absorbs heat from the ambient air and releases it to a space being served, either for comfort heating or for technological heating.

In order to increase the energy potential of the heat absorbed from the environment so that it can heat the air in the space served, this equipment uses absorbed electrical energy with exceptional energy efficiency.

The RVSA-125 air-to-air heat pump is the only model of all RVS heat pumps that consists of two units: an outdoor unit, which absorbs heat from the ambient environment, and an indoor unit, which releases heat to the environment. The equipment is available in a single version with a nominal heat output of 125 kW.

It is a modern heat pump with a special functionality, high energy efficiency and low CO2 emissions, and with the electricity it consumes coming from renewable sources, these emissions become zero.

The ASC control system allows regulation and control of the air temperature in the space served, as well as optimising safe operation, ensuring economical and energy-efficient operation.

The RVSA-125 air-to-air heat pump is the perfect solution for technological applications requiring air drying and for heating, where hot water heating circuits are to be avoided.

RVSA-125
Internal Unit

RVSA-125
External Unit

Model		m.u.	RVSA125
Nominal characteristics[1,2]	Actual heat output	kW	125
	Electrical power consumption	kW	25.5
	COP	kW/kW	4.9
Maximum hot air flow		m^3 /h	12000
Maximum cold air flow		m^3 /h	50000
Nominal hot air temperature		°C	60
Hot air temperature		°C	45...110
Ambient air temperature		°C	-43...+43
Refrigerant			R744/CO_2
Compressor			Dorin
Indoor unit dimensions	Length	mm	1820
	Width	mm	630
	Height	mm	2050
Outdoor unit dimensions	Length	mm	2470
	Width	mm	1370
	Height	mm	2415
Net weight of indoor unit		kg	550
Net weight of indoor unit		kg	1300
Noise level		db(A)	55

Note
Nominal temperature modes:
1Cold air temperature: inlet 7 °C
2Hot air temperature: inlet 27 °C , outlet: 60 °C

Steam generators

RVS steam generators with heat pump are a unique and remarkable technology that allows the production of dry saturated steam with the help of electric heat pumps in very energy efficient conditions and without natural gas consumption. This equipment is the only technological solution available on the market that allows the production of low CO2 emissions of process steam, which is needed in many industries: food production, food refining, meat processing, industrial washing processes, hospitals, etc.

Steam is a widely used thermal agent in engineering, in the production of mechanical work (e.g. in steam turbines and steam engines), for technological purposes (some applications are mentioned above), for heating, for the production of hydrogen, etc. Steam has the advantage that it allows significant heat storage. Conventional steam production requires imported natural gas, with associated CO2 emissions, or electricity if electric boilers are used.

Saturated steam contains not only water vapour but also drops of liquid water at the same temperature. Dry saturated steam is water vapour that no longer contains liquid moisture, i.e. water vapour at saturation or at the end of the vaporisation process.

The temperature and saturation pressure of the steam are interdependent, so that when the saturated steam pressure changes, the temperature also changes.

RVS steam generators, with heat pump, can produce saturated steam with a maximum temperature of 120 °C, respectively with an absolute pressure of 2 bars, respectively with a gauge pressure of 1 bar.

Optionally, RVS steam generators with heat pump can also produce superheated steam by compressing the saturated steam in an auxiliary compressor. The temperature of the steam produced can then reach a maximum temperature of 165 °C.

When using RVS heat pump steam generators, steam can be produced in the most energy efficient and environmentally friendly way possible. As the electricity they consume comes from renewable sources, the steam is produced with zero emissions, and they can make a decisive contribution to achieving the EU and company targets of a 55% reduction in emissions by 2030 and zero emissions by 2050.

RVS heat pump steam generators are available in two models, with nominal heat outputs of 150 kW and 400 kW respectively. The refrigerant is Freon R1233zd, which has an extremely low global warming potential (GWP = 1). By comparison R134a has GWP = 4300.

RVS steam generators with heat pump use waste water with a temperature in the range (40...75) °C as a cold source from which it absorbs heat. If the water source is not available, or is available in insufficient quantity, a high-temperature RVS heat pump with CO_2, either air-to-water or water-to-water, may be used to produce the hot water required to operate the steam generator.

The ASC control system enables safe regulation, control and optimisation of operation, ensuring economical and energy-efficient operation of RVS heat pump steam generators.

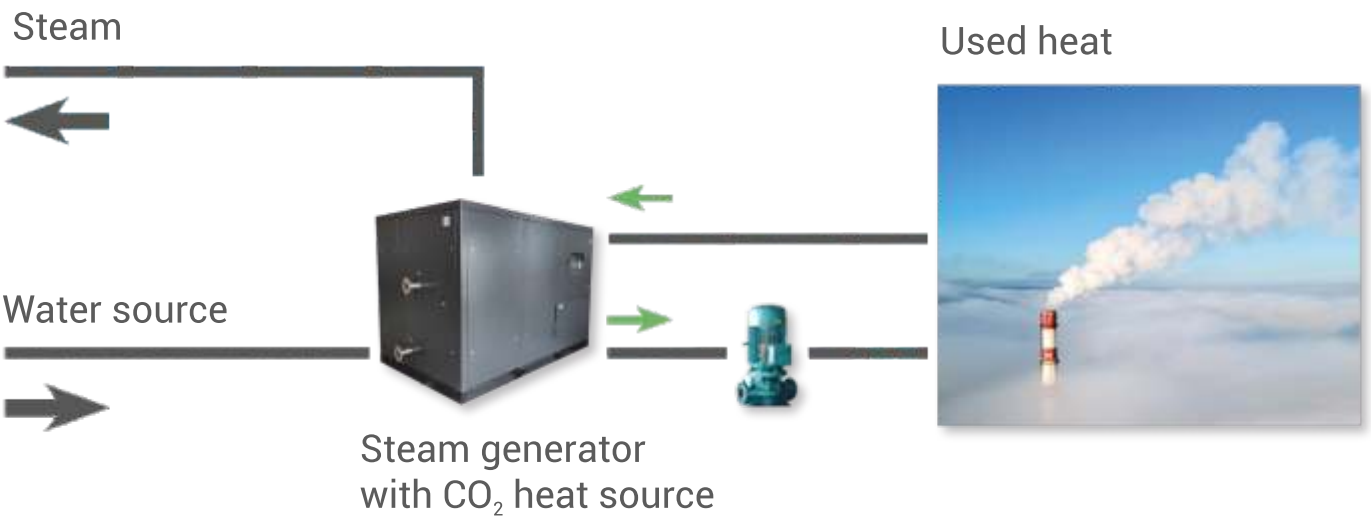
RVS steam generators with heat pump are the perfect solution for producing saturated steam at high energy efficiency and low CO2 emissions, or at zero CO2 emissions if electricity from renewable sources is used.

Steam generators

We would like to present you two of the products we developed, from the steam generators with heat pump category.

RVSGS-150

RVSGS-400



Modell		m.e.	RVSG150	RVSG400
Névleges jellemzők[1,2]	Hasznos hőteljesítmény	kW	151	395
	felvett villamos energia	kW	50.3	131.0
	felvett hőteljesítmény	kW	100.7	264.0
	COP	kW/kW	3.0	3.0
Gőzáramlás		t/h	0.21	0.50
Névleges gőzhőmérséklet		°C	120	120
Maximális gőzhőmérséklet (kiegészítő gőzkompresszorral / opcionális)		°C	165	165
Névleges gőznyomás		barg	1	1
		bara	2	2
Vízáramlás (hideg forrás)		m^3/h	19	45
Vízhőmérséklet (hideg forrás)		°C	40...75	40...75
Vízoldali csatlakozó méretei (hideg forrás)		mm	DN50/DN50	DN65/DN65
Gőzoldali csatlakozó méretei (forró forrás)		mm	DN32/DN32	DN65/DN65
Tápforrás		V/Hz	380~440 / 50~60	
Méretek	Hosszúság	mm	2200	2800
	Szélesség	mm	1200	1750
	Magasság	mm	1800	1900
Nettó súly		kg	1600	3000
Zajszint		db(A)	65	75

Note
Nominal temperature modes:
1Cold water temperature: inlet 60 °C , outlet: 55 °C
2Steam temperature:120 °C

APLS Smart Control (ASC)

The local smart control (ASC) and remote management solution provide, together, an integrated solution to be able to support the safe and optimal operation of the heat pump and the integrated systems.

Increasing heating systems' reliability

Heat pumps are very reliable, low-maintenance equipment and are sometimes considered to operate even without maintenance for very long periods of time. This is true and is proven by the technology itself. However, in a heating system, the heat pump itself is only one of the components of the system. There are also recirculation pumps, valves, intelligent command and control, etc. Each of these components is potentially at risk of failure.

In the design process, many risks can be mitigated, but not all. From the point of view of industrial users, the most important aspect is that when there is a certain heat demand (e.g. in a building, or in a technological process), the heating system can provide the required amount of heat. A system without a control unit cannot ensure continuous correlation between the heat output required at a given time and the heat output actually produced. For this reason, industrial heat pump systems are always designed with control modules. In the case of heat pump heating systems, it is usual to optimise heat production and electricity consumption, as the demands on these systems vary significantly. The main purpose of the ASC module is precisely to address this functionality.

The importance of an efficient control module increases with the variability of the heat demand and the complexity of the system. The ASC module is an optimised control system and has both the ability to issue alarms in the event of faults occurring and the ability to issue early warnings, which can prevent further outages or at worst reduce their duration.

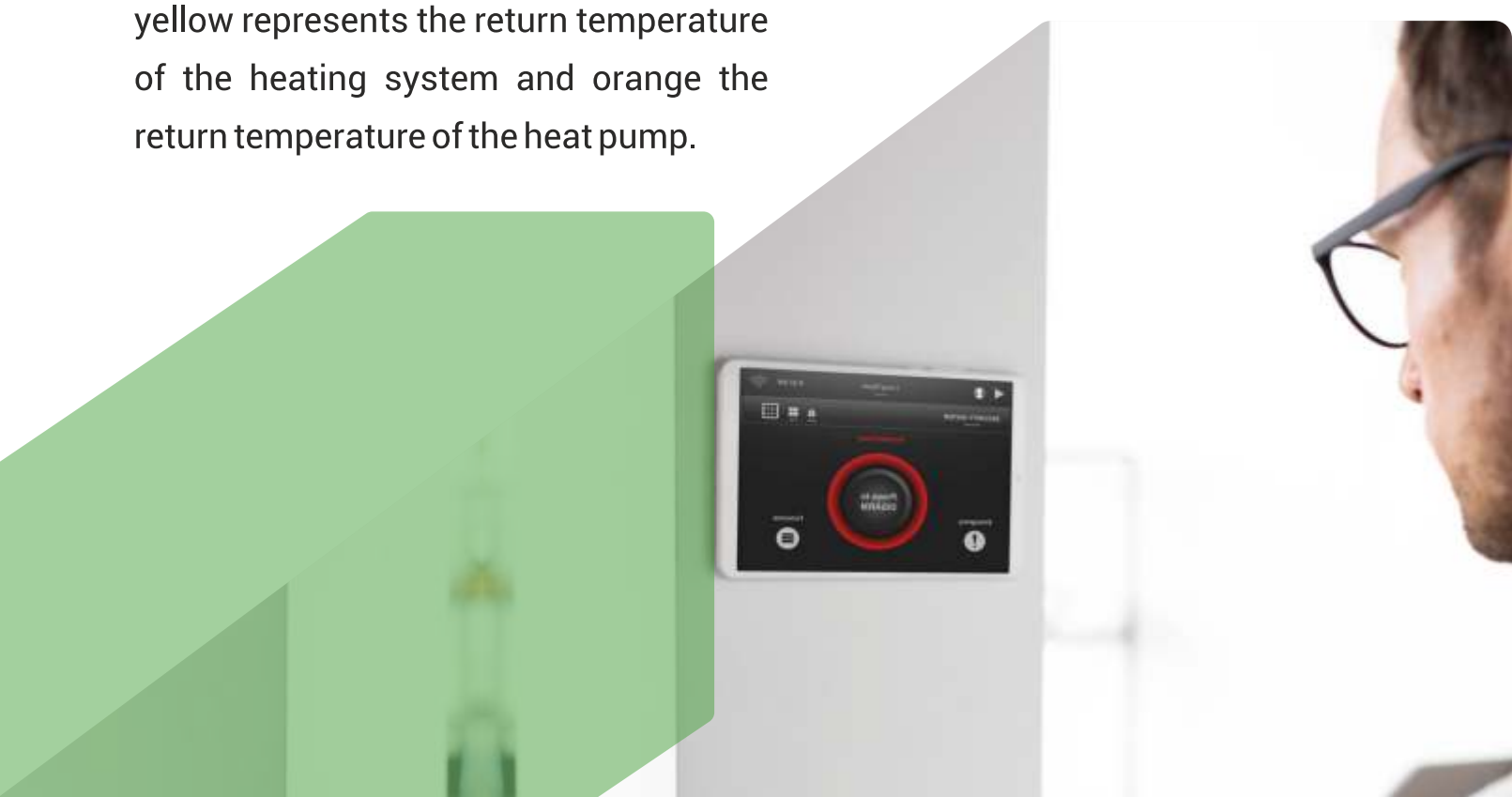
The ASC module functions as a data communication node, which centralises all data received from heat pumps and other heating system sensors. The ASC module can be configured for both low and high heat output systems and is constructed from standardised, industrial quality, highly reliable components.

The role of the communication system between the remote monitoring centre and the heating system, provided by the ASC module, is to collect and evaluate the available information from the controlled system and, in the event of exceptional situations, to inform the responsible persons of the need to initiate certain necessary preventive or remedial measures.

The purpose of the ASC module is to connect all heat sources and to transmit all necessary and important information to the technical operation and maintenance staff about the operation of the controlled equipment. In this way, the technical staff can easily and professionally carry out all tasks related to the controlled equipment.

The data and information transmitted can be consulted and evaluated accurately in real time. The equipment also allows remote setting and configuration of configurable equipment parameters, even during operation.

The figure below shows, as an example, how to select certain parameters and the time variation curves of these parameters. In the example considered, yellow represents the return temperature of the heating system and orange the return temperature of the heat pump.

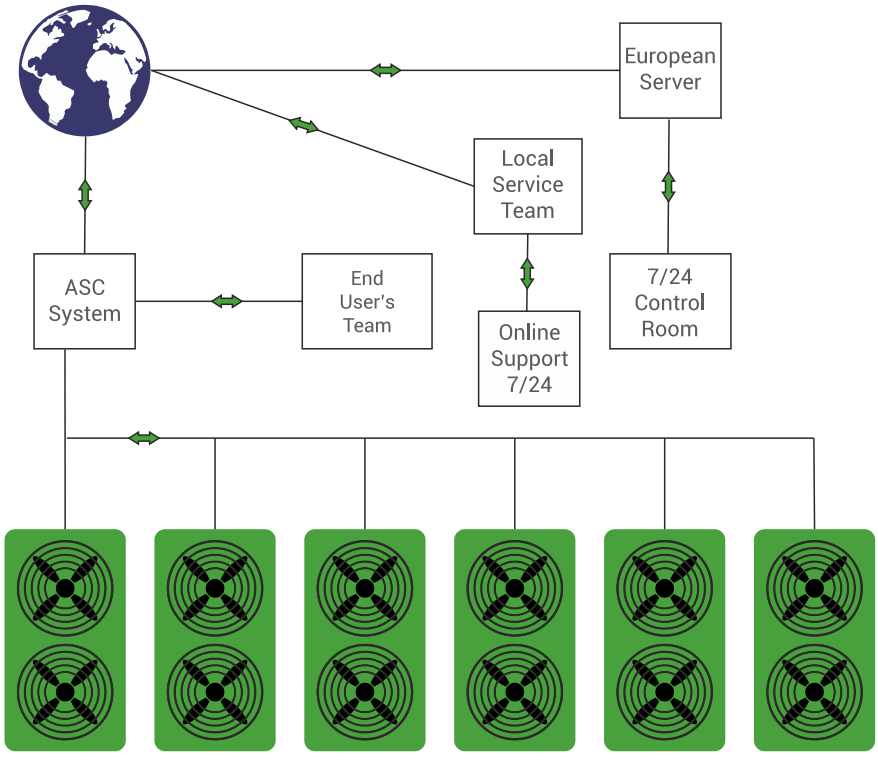


Efficiency of heat production and transport

Industrial heat pumps are intended exclusively for operation as technological heat sources. The ways in which the heat energy produced by heat pumps is transported to the place of use can be very different and the ASC module can have a beneficial influence on this process.

If the user requires a local control function of the ASC module, it will contain a programmable logic controller (PLC) that has implemented control software with configurable parameters. A large number of input/output interfaces are available to allow settings and configurations. The configuration of the ASC module with the necessary interfaces is carried out at the design stage of the heat pump heating system.

An example of an efficient and beneficial use of the ASC module is to provide cascading control of heat pumps and possibly other available heating sources. In the case of heating systems with more than one heat source, the heat demand can be provided by switching them on or off, depending on their energy efficiency and the heat output they can provide. This way of operating the heating system allows optimised regulation of the way the equipment operates. The algorithm for switching the heat sources on and off can take into account not only the energy efficiency of the equipment but also the operating costs at a given time, for example depending on the way in which the hourly or day/night tariffs for electricity or other fuels vary, and also on the correlation between the variable heat demand and the heat output of the available equipment. The combination of these parameters allows both optimised operation of the heating system and a balanced number of operating hours of equipment of the same type, in order to avoid the risk of equipment overload.



7/24 assistance

All RVS industrial heat pumps are backed by 7/24 technical support. Our partners who install RVS heat pumps also provide servicing and maintenance, as well as post-warranty services. The ASC system ensures real-time connection with the heat pump, making it possible to prevent any malfunction or breakdown. If physical intervention cannot be avoided, our partner teams will arrive as soon as possible. For the network of authorised partners, visit our website, www.rvsenergy.ro

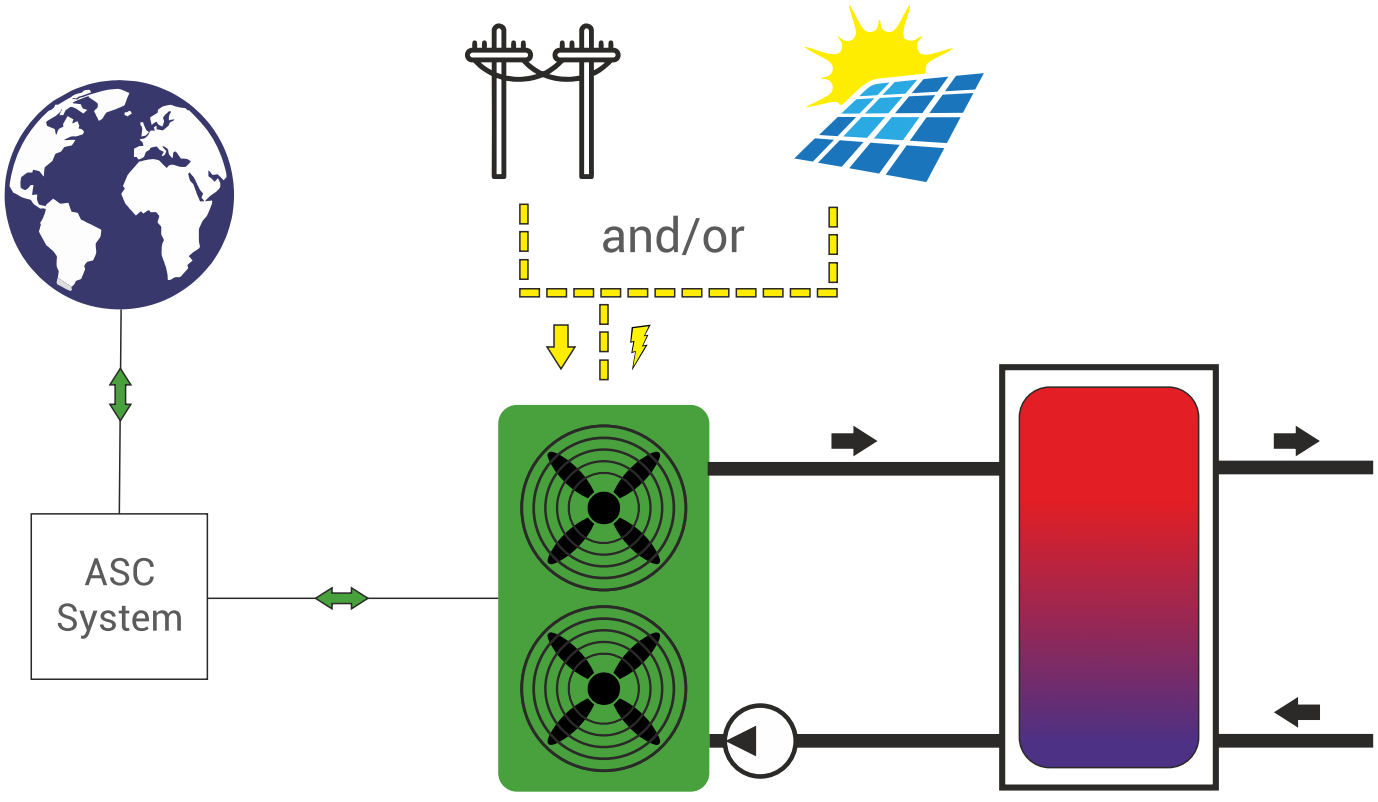
Warranties

All RVS heat pumps are designed to have a lifetime of at least 130,000 operating hours. This means 15 years of uninterrupted operation! As heat pumps do not run non-stop, this results in a lifetime of around 30 years or more. However, it can happen that a heat pump breaks down. That's why RVS offers a full 3-year warranty, and to keep servicing as short as possible, stocks of main components are provided in each country served.

Systems proposals

Main concept

The basic concept - one or more heat pumps linked in cascade, controlled by the ASC System, powered by the national electricity system and/or photovoltaic panels supply one or more hot water puffers.

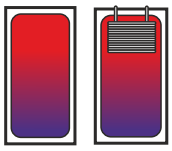


Legend of the diagrams used

RVS heat pump
It can be air-water or water-water. Can be connected in cascade, or individually. The air-to-water ones can be installed outdoors only, the water-to-water ones outdoors as well.

Photovoltaic panels
They represent an important part of a modern heating system.
They are a source of renewable electricity with zero emissions, and can significantly reduce electricity costs.

National electricity distribution network

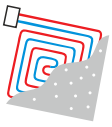


Puffers (or hot water tanks)
They are used for storing heat or for instant hot water production. Two heat exchanger puffer can be replaced by one heat exchanger heat exchanger.

Radiator type wall dryer for towels

Radiators for heating

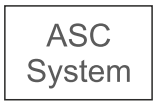
Distributor and collector for floor heating



Floor heating systems

Domestic hot water consumer

Internet



ASC System

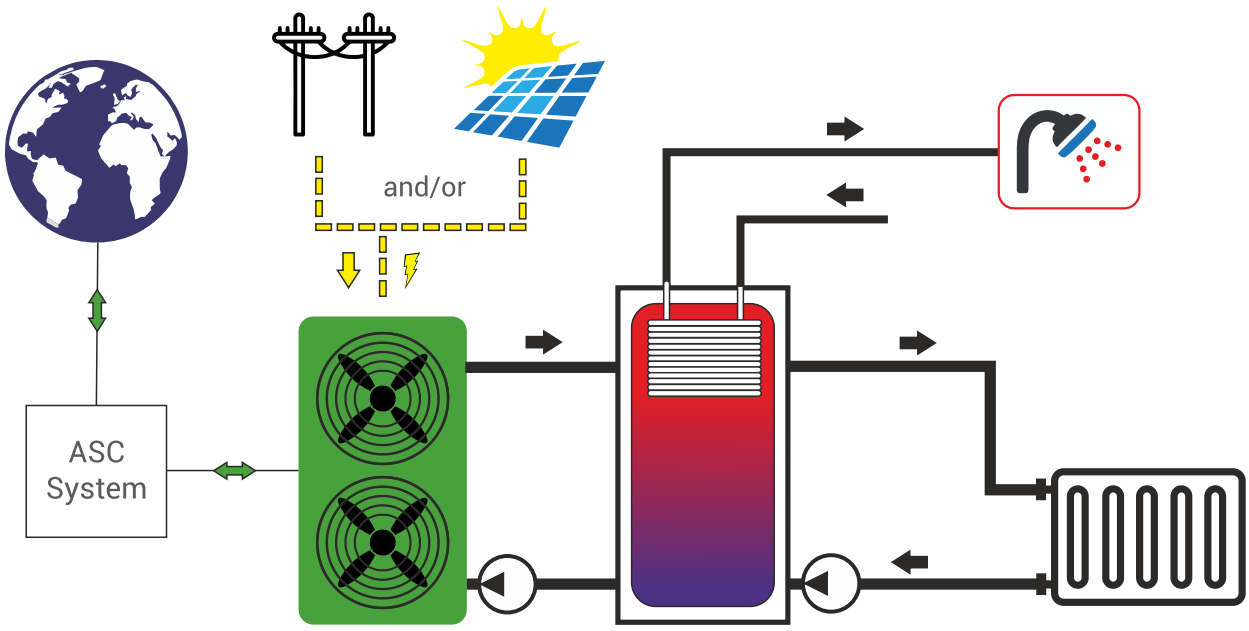
Recirculation pumps

Alternative heating or domestic hot water preparation systems, such as gas wall boilers, pellet or oil boilers, etc.
To be compatible with the ASC system, they must be electronically controlled.

Systems proposals

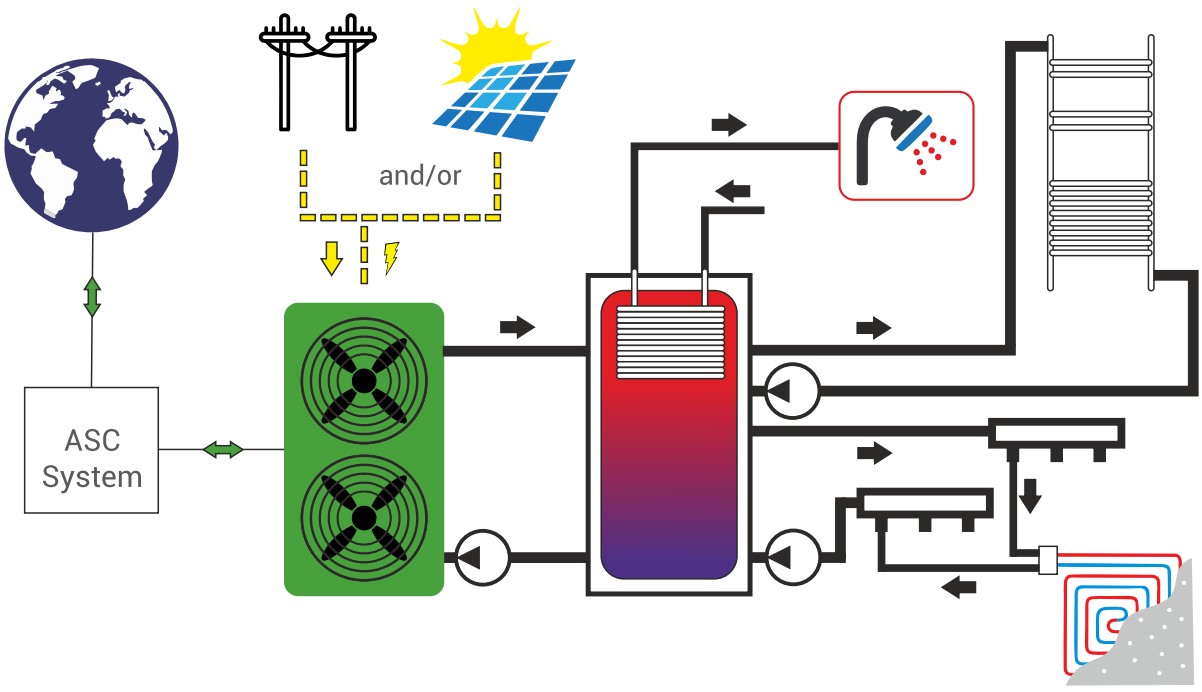
Option 1

The heat pump supplies hot water to the puffer serving the radiator heating system. Domestic hot water is prepared in instantaneous mode by means of the heat exchanger.



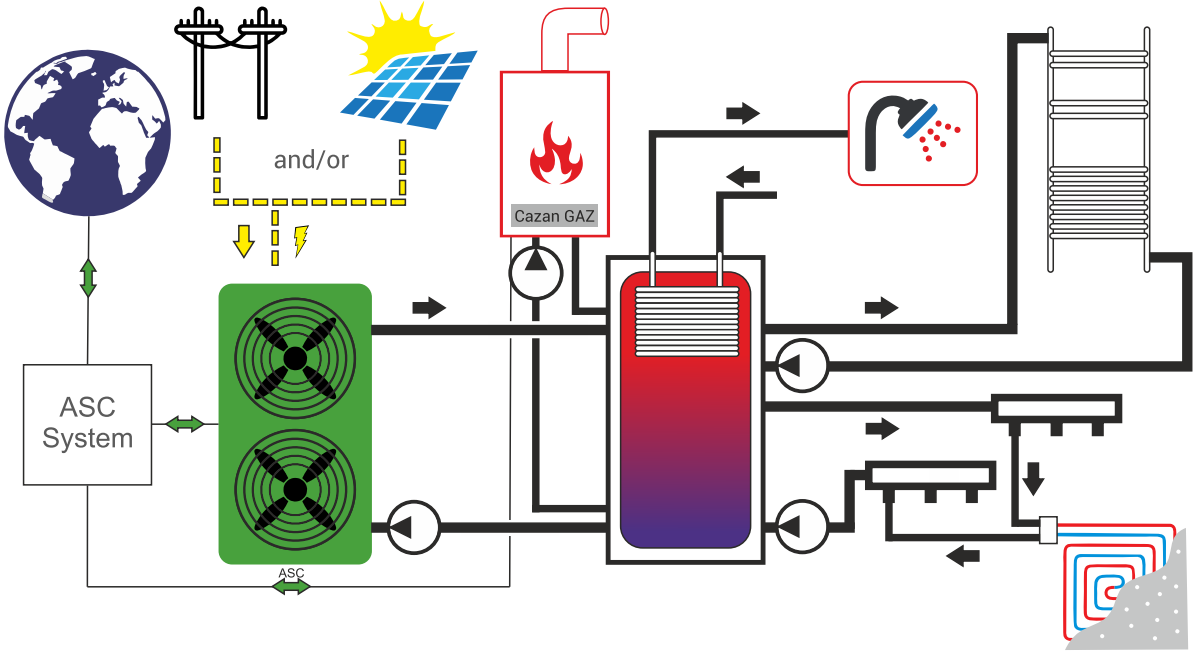
Option 2

The heat pump supplies hot water to the puffer serving the towel dryer radiator heating system and the floor heating system. Domestic hot water is prepared in instantaneous mode by means of the heat exchanger.



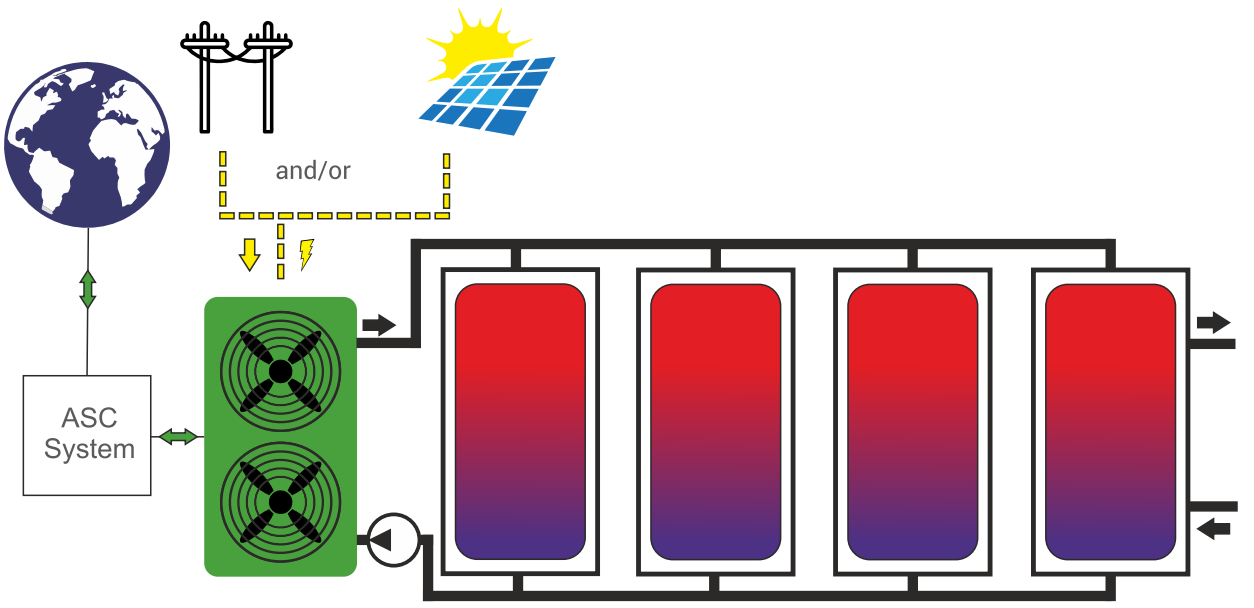
Option 3

The heat pump and the natural gas boiler together supply (as required) hot water to the puffer serving the towel dryer radiator heating system and the floor heating system. Domestic hot water is prepared in instantaneous mode by means of the heat exchanger. The heat pump and the natural gas boiler are connected to the ASC command and control system.



Option 4

Hot water storage in multiple tanks. The system allows heat storage in situations where production and consumption are lagged. An example of the use of this solution is to store heat produced with electricity from the photovoltaic system during periods of high solar power availability and then use the stored heat energy later, for example at night or on days when solar power is not available.



Calculation of CO_2 reduction

We offer, in collaboration with known and experienced specialists, the service of calculating the environmental impact, by reducing CO2 emissions, due to the implementation of technical solutions for heating with heat pumps, compared to the use of traditional technologies based on the combustion of fossil fuels, or the use of direct conversion of electricity.

The thermal behaviour of heating systems, hot water preparation systems or various other industrial applications can be simulated under real operating conditions and under the particular climatic conditions corresponding to the location where the system is located. Both the thermal behaviour of district heating systems (district heating) and the behaviour of buildings of any type, or various industrial applications, can be simulated.

Simulations can be carried out throughout the year, with time steps of up to one hour, taking into account the typical variation during the year of ambient temperature, solar radiation intensity, or other parameters, as well as the particularities of the heating system.

In order to carry out the simulations, it is necessary to know the energy consumption history (fuel, electricity, etc.) of the application to be investigated.

The mathematical modelling principles used for simulation have been validated and used in several studies on various applications: heating systems, deep rehabilitation, industrial applications, etc.

The effect of various equipment and technologies on CO2 reduction can be assessed: heat pumps, photovoltaic systems, solar thermal systems, geothermal systems, etc.

The technical documentation and simulation results, i.e. the amount of CO2 reduction, can be used as technical support in funding projects to argue the effects of implementing heat pumps, or various combinations of technologies, e.g. heat pumps and photovoltaic systems.

Note

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