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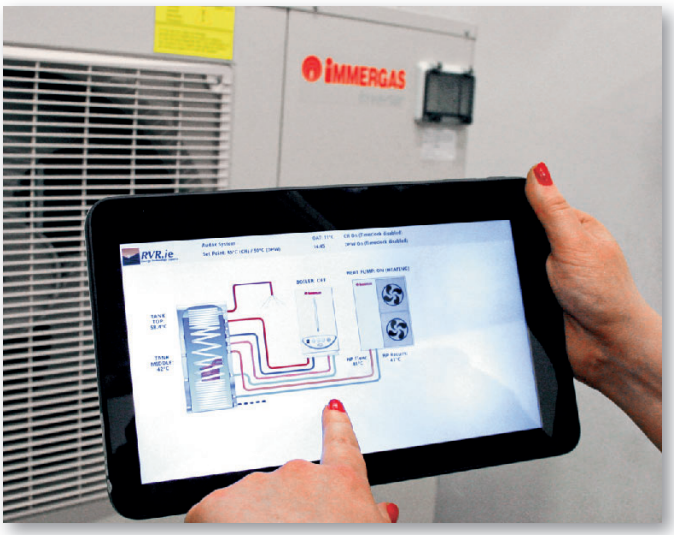
Energy Technology Experts

IMMERGAS

RVR HYBRID HEATING

Sustainable efficiency at your fingertips

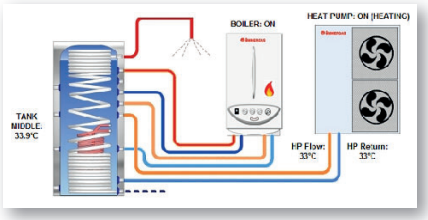


Something Unique and very special from RVR Energy Technology Ltd

We are delighted to introduce a unique new development from RVR Energy Technology Ltd. Our latest product range combines several advanced heating technologies from our partner Immergas, with new advanced on-line control and web enabled monitoring systems

We are very proud to introduce you to our latest development, the **RVR Hybrid Heating System.**

What is the RVR Hybrid Heating System?



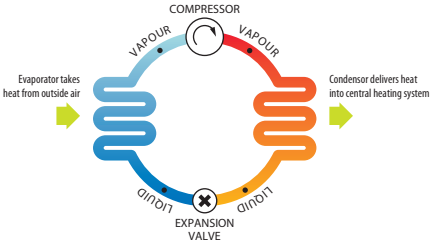
The RVR Hybrid Heating System is a unique combination of the modern high efficiency Audax heat pump, high efficiency Victrix condensing boiler and optional high efficiency solar heating in a single, purpose built, heat source supply package. The latest developments in these key areas have been combined with the most advanced and unique web enabled controls to provide the ultimate year round high efficiency heating solution for all types of heating and hot water applications. The system is designed to bring renewable heating solutions to a new level of performance and control.

How does the high efficiency Heat Pump work?

An Audax heat pump uses an electric motor to pump a refrigerant gas through an evaporator and condenser. The refrigerant gas acts as the heating medium.

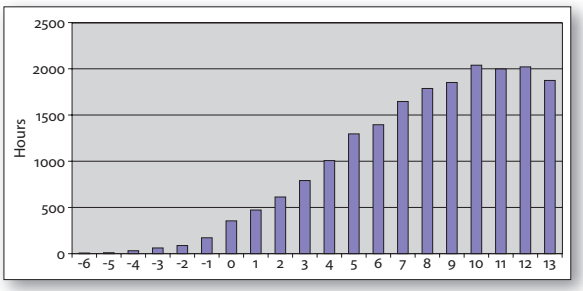
In the evaporator, the refrigerant liquid is turned into a gas. As it evaporates, it absorbs heat from the surrounding air. The refrigerant gas is then compressed under high pressure into high temperature gas. This hot gas passes through a heat exchanger (the condenser) where it condenses back into a liquid and as it does, it transfers the heat to the central heating system water. The high pressure liquid is then returned back to the evaporator through a special valve (called an expansion valve). As the refrigerant expands it again absorbs heat from the surrounding air. The cycle is repeated again and again.

In general, for every unit of electrical energy used for pumping, two to five units of heat energy will be produced by the Audax heat pump. The actual amount of heat delivered on any given day will depend on the temperature of the outside air and the temperature of the central heating system. It is the heat which is available in the outside air that provides the renewable heat source for the Audax.



When the outside air temperature is high, more heat will be delivered by the Audax than on a colder day. The ratio between the amount of electrical energy used for pumping and the amount of heat energy produced is called the 'Coefficient Of Performance' or 'COP' of the Audax.

Why does the efficiency (COP) of the Audax vary?



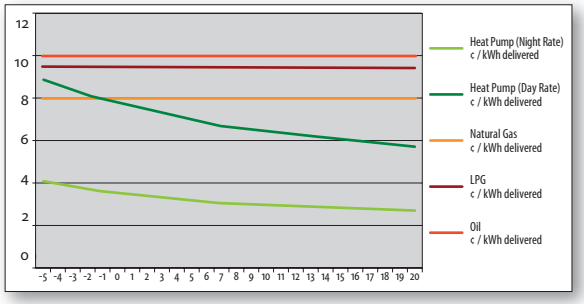
Temperature Frequency for Birr

An Audax heat pump uses the heat available in the outside air as its source of renewable energy.

An Audax heat pump system is inexpensive to install and will operate very efficiently for a large part of the year. This is particularly true in milder, temperate climates like Ireland.

When the temperature of the surrounding air is high the COP of the Audax will also be high. When the temperature of the surrounding air falls, then the COP of the Audax will also fall. The Audax heat pump will continue to operate efficiently once the air temperatures are above 2°C. Fortunately, our climate provides these conditions for most of the year, so the Audax is a very efficient and economical heating source for Ireland.

What happens in very cold weather



Energy Costs at Different Outdoor Air Temperature
Figures correct as of 30th January 2012

The Audax heat pump will operate very efficiently in most weather conditions. The COP of the Audax will vary from hour to hour throughout the day. The varying COP of the unit means that the cost per kW of delivered energy will also vary throughout the day. The following chart illustrates how the net cost of a kW of usable heat can vary depending on the outdoor air temperature.

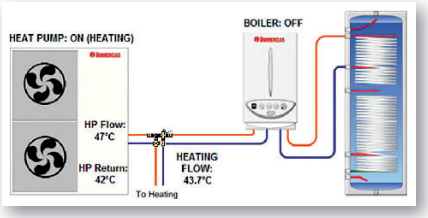
Because the efficiency of the Audax is lower in cold weather, it is essential to have a back up heating system to help cater for heat demand during the more extreme cold periods. In the majority of cases this back-up system will take the form of a high efficiency Victrix boiler.

Parallel and Combination Hybrid Systems

There are two system types of **RVR Hybrid System… The Parallel System and The Combination System**

A – The Parallel System (with manifold)

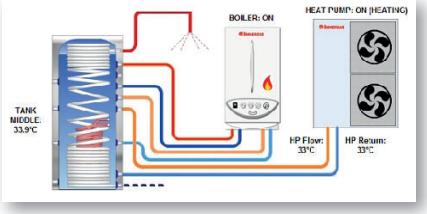
In this system type, the Audax and the boiler are directly connected to the heating system. A special manifold is installed to connect the Audax heat pump and the boiler. The Audax is the primary heat source and the boiler will operate only when it is not economic to run the heat pump, or when there is a very high heat demand in the system.



If a solar water heating system is installed, solar will be the primary heat source for the domestic hot water. The boiler is available to boost hot water production if required.

This type of system is the simplest way to connect an **RVR Hybrid System** into a traditional heating system with underfloor heating or radiators.

B – Combination System (with Tisun combination heat store / tank)



In this system type, the Audax and the boiler are both connected into a Tisun combination heat tank. Both the Audax and boiler may run independently or at the same time, depending on the demand for heat and on weather conditions.

This system also allows the use of a special "night rate heat boost" function. The night rate heat boost function allows heat, produced by the heat pump on low-cost night rate electricity, to be stored in the combination heat tank. The heat produced using night rate electricity can cost as little as 2 cents per kWh.

Typically, the additional cost of choosing a combination tank type system can be paid back in under two years when using the night rate heat boost function. We will look at how the heat boost function operates a little later on.

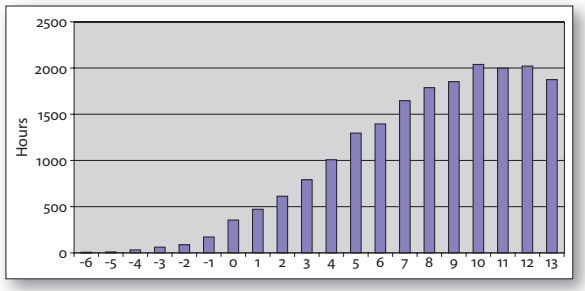
A second advantage of the combination tank system is that the heat pump contributes about 70% of water heating. In a typical family home, this will save an additional €200 per year when compared to oil.

Will Radiators or underfloor systems work more efficiently with an RVR Hybrid System?

The Audax will act as the primary heat source of the RVR Hybrid System. Although a heat pump may operate at higher temperatures, it is at its most efficient when operating at 45°C or below. For this reason, the Audax works very well with underfloor heating systems.

The hybrid heat pump / boiler system will also work very well with radiators:

Heating is usually needed when the outside temperature is less than about 13°C.



Temperature Frequency for Birr

According to MET Eireann figures collected over a three year period in Birr, Co. Offaly, the average number of hours per year where the temperature is 13°C or below is 19,630 hours.

The Audax will be at it's most efficient when the outside air temperature is above 2°C. The Met Eireann data shows that there are 18,389 hours per year when the outside air temperature is between 2 and 13°C. Therefore, the Audax is economically viable for 94% of the heating season.

In **underfloor** heating systems, the Audax will be able to run for most of these hours.

Radiators will sometimes need to operate at higher temperatures in order to provide enough heat output. If the temperature needed by the radiators is more than about 45°C, it is usually more economical to use the boiler.

The RVR Hybrid System Manager constantly monitors the outside weather conditions and adjusts the radiator temperatures to suit. This is called 'Weather Compensation'. It also calculates whether it is economic to use the heat pump or not.

Where radiators are used, they should be sized for lower operating temperatures. This will allow the system to operate at lower temperatures and extend the economically useful season of the Audax (i.e. where flow temperatures of 45°C or below are possible).

On a radiator based system designed for a flow temperature of 60°C, an Audax heat pump will be economical to run for 90% of the heating season.

	Hours	% of Heating Season
Heating Season Length	19,630	
Hours Audax is viable on Underfloor	18,389	94%
Hours Audax is viable on Radiators sized for 60°C	17,765	90%
Hours Audax is viable on Radiators sized for 80°C	11,608	59%

How do I know which fuel source is the most economical at a given time?

All fuels have become very expensive. A typical cost for oil during the winter of 2011 was €0.91 per litre. A litre of oil produces about 9 kW / hr of delivered heat energy when it is burned in a high efficiency condensing boiler. The cost per kWh of heat produced in this way is 10 ¢ / kWh.

In contrast, night rate electricity can be purchased for under 9 ¢ / kWh but can produce up to four kWh of 'delivered heat' – This means the cost of a kWh of heat produced in this way can be less than 2.5 ¢. Even with day rate electricity, the cost per kWh of delivered heat will typically be about 6 ¢ per kWh.

Gas price per kW is typically 8 ¢ / kWh (Natural gas - delivered energy) and 9.5 c / kWh (LPG - delivered energy).

Big savings are possible … but to achieve them it is necessary to constantly monitor weather conditions, cost of electricity and heating system temperatures in order to ensure that you get the maximum possible yield for every Euro spent.

A conventional control system cannot do this, it is essential to have a specially designed controller for this purpose.

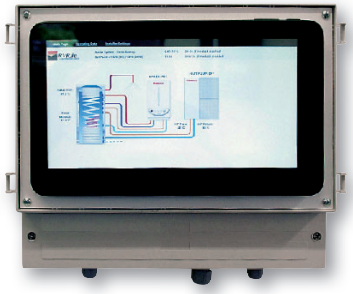
The RVR Hybrid System – Intelligent Controls!

The RVR Hybrid System Manager has been designed specifically to maximise the total efficiency of the heating system minute by minute throughout the year.

Hybrid System Manager

The RVR Hybrid System Manager constantly monitors its own performance and optimises heating costs at all times. It will automatically select either the Audax or the boiler. In some situations it will employ a combination of both to provide the ultimate performance.

Control Strategy


Hybrid System Manager with optional display

The RVR Hybrid System Manager incorporates a number of temperature sensors within the system. One of these sensors is located outside the building to constantly monitor external air temperatures. Another sensor is located within the building, either on the flow pipe to the heating system, or in the middle of the combination tank. A temperature sensor may also be added to the hot water cylinder or to the top of the combination tank (to control domestic hot water).

Additional information is also programmed into the RVR Hybrid System Manager. This information will include the current cost per kWh for each possible fuel source per unit of electricity for the heat pump and the unit cost per kW for the oil or gas boiler. A seven day time-clock is also programmed with the various on / off times if a heating timeclock is required.

The RVR Hybrid System Manager automatically monitors the performance of the Audax and constantly calculates the COP of the system. As the system already knows the cost of fuel at any given time, it can also calculate the cost of delivered energy based on the Audax COP.

For example, if the unit cost of electricity is 16 ¢ and the COP is 4 then the unit cost of delivered energy is 4 ¢ per kWh. The RVR Hybrid System Manager will compare this with (for example) 8 ¢ / kWh for Natural gas. In this situation, the system manager keeps the Audax running. Should the COP of the Audax fall below the point where it is economical to run, or the heat demand within the system increase beyond the ability of the Audax to meet the demand, the RVR Hybrid System Manager will automatically activate the boiler.

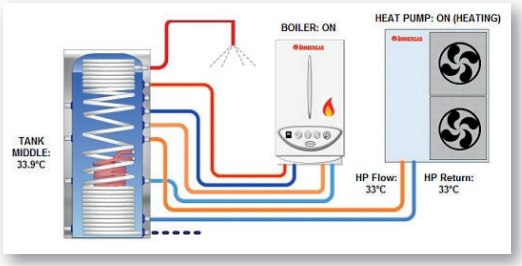
Heat boost

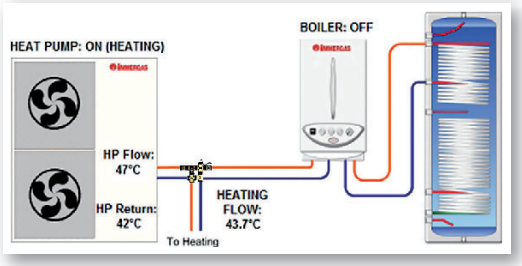
Where a combination tank is used, the system allows the use of a special "Heat Boost" function, which can store heat produced by the heat pump on low-cost night rate electricity. This offers much lower running costs. Typically, the additional cost of choosing a combination tank can be paid back in under two years when using the Heat Boost function.

The heat boost function works by reducing the combination tank set point by a small amount (e.g. 5°C) in the period before night rate electricity becomes active. Once night rate is available, the combination tank set point is raised to a higher level. The Audax "boosts" the tank to the higher temperature during night rate operation.

Studies (see page 7) have shown that the use of a combination tank together with the heat boost feature can reduce running costs by an additional 1.3 ¢ / kWh. This could be equivalent to a saving of €500 per annum in a typical home.

Internet Interface and web

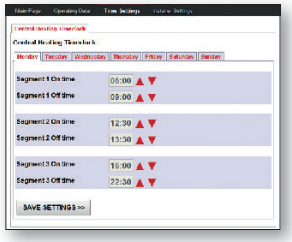




An outstanding feature of the RVR Hybrid System is that it is fully web connected and it can be monitored and controlled over the Internet. This gives unprecedented remote access to the user as the system can now be monitored and controlled from anywhere at any time, via PC, tablet or smartphone.

The user can log in at any time, from any internet connection in the world, to view system operation. The user will also be able to change the time clock settings and temperature settings for the system over the internet.

Built in Reliability, minimal maintainance costs... and complete customer care!

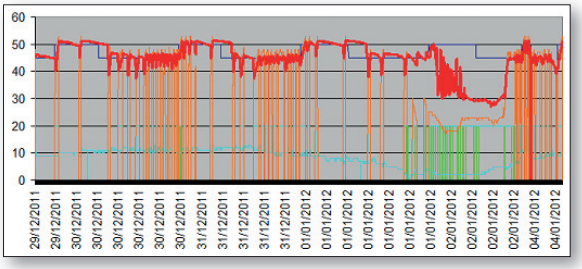


The RVR Hybrid System Manager constantly monitors the system status. If a fault develops, the system will send an email to a designated person. This could be the user, installer or the RVR service department.

The ***RVR Service Department*** can provide a monitoring service for the system and respond automatically to faults, if the user wishes. This service is provided free of charge for the first twelve months and on a service contract basis thereafter..

Logging and graphs

The user will also have access to continuously updated performance reports on line. These reports will show how the system is operating at any given time and also logs the past performance and running costs of the system.



Comparison and case studies

Combination system – comparison on cost savings

Large 450 m² modern home, well insulated, underfloor heating, using a combination cylinder with system set point of 45°C. Based on 1 month of data collected during December 2011 and January 2012. Average outdoor air temperature: 8°C. Min: 0°C. Max: 14°C

Central heating	Running Hours	kWh delivered	Running Cost (€)
Audax – Night Rate @ 8.76 ¢ / kWh electricity	130.00	1235.00	37.31
Audax – Daytime Rate @ 19.12 ¢ / kWh electricity	204.00	1938.00	112.29
24 kW Condensing Gas Boiler @ 11.65 ¢ / kWh delivered (LPG)	5.50	132.00	15.38
Totals	**339.50**	**3305.00**	**164.98**

Equivalent operation using boiler only:

Central heating	Running Hours	kWh delivered	Running Cost (€)
24 kW boiler @ 11.65 ¢ / kWh delivered	137.71	3305.00	**385.03**

Delivering an average of 118 kW per day, the running costs of the RVR Hybrid System for central heating were just 43% of the running costs of boiler only.

The savings in the period were €220.05*

Parallel system – comparison on cost savings

160 m² dormer bungalow in Co. Galway, underfloor heating, poor insulation, using a parallel connection directly to the heating with system set point of 45°C. Based on 1 month of data collected during December 2011 and January 2012. Average outdoor air temperature: 7°C. Min: 1°C. Max: 12°C

Central heating	Running Hours	kWh delivered	Running Cost (€)
Audax – Night Rate @ 8.76 ¢ / kWh electricity	48.50	460.09	11.80
Audax – Daytime Rate @ 19.12 ¢ / kWh electricity	203.50	1936.00	116.78
24 kW Condensing Gas Boiler @ 11.65 ¢ / kWh delivered (LPG)	15.60	374.40	43.62
Totals	**267.60**	**2770.40**	**172.20**

Equivalent operation using boiler only:

Central heating	Running Hours	kWh delivered	Running Cost (€)
24 kW boiler @ 11.65 ¢ / kWh delivered	115.43	2770.40	**322.75**

Delivering an average of 99 kW per day, the running costs of the RVR Hybrid System for central heating were just 53% of the runnning costs of boiler only.

The savings in the period were €150.55*

* ***Please note:*** *All savings shown above are for central heating operation only. Further comparisons on different fuel sources and costs are available by contacting RVR. LPG price shown may be subject to change. Additional savings are possible on domestic water heating when using the combination type system*

Please contact the sales team at RVR to discuss your specific requirements.

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