Birr Engineering Festival

Stephen Grant

1

Grant Engineering

Good morning, my name is Stephen Grant, Founder & Managing Director of Grant Engineering, and are based in Crinkle, Birr

We proudly employ over 450 people—300 in Ireland, 140 in the UK, and 10 in France.

Our company has a rich history of innovation and excellence in the heating industry.

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Grant Engineering

- Grant Ireland was established in 1978 in Birr
- Grant UK was first established in 1996 and is now based in Swindon
- Grant France was established in 2018 in Chambéry.

In addition to the countries above, Grant currently exports to Denmark, Greece, New Zealand, Finland, Lithuania, Greenland and more.

In 2020, we opened our €16m Training & Innovation Centre, with over 1000 professionals trained every year.

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Grant heating options

Our product range includes

- Grant Vortex boilers on kerosene or HVO biofuel
- Grant Aerona air source heat pumps
- Grant Spira condensing wood pellet boilers
- Grant Uflex underfloor heating
- Grant Afinia aluminium radiators
- Grant Wave hot water storage cylinders
- Grant heating controls
- Grant Sahara solar thermal panels

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HVO & Carbon reduction

- HVO is an abbreviation from Hydrotreated Vegetable Oil, and is a renewable alternative to kerosene that we use in boilers fitted in Ireland
- There are 1.2 million homes alone in Ireland (North & South) that use an oil-fired boilers
- Our standby generator is powered by HVO and are currently installing 700kW of PV panels on the factory.

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History of heating

Prehistoric era to Ancient Civilizations
- Fire
- Roman hypocausts

Middle Ages to Renaissance
- Franklin Stove

Industrial Revolution
- Steam heating systems

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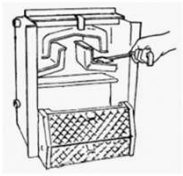
History of heating



20th century
- Coal/solid fuel, oil and gas heating systems

21st century
- Heat pumps
- Solar
- Geothermal
- Reducing carbon production
- Minimising energy consumption

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Coal, Peat, Oil & Gas

- Coal
- Peat
- Oil
- Natural Gas
- Gas to Liquid (GTL)

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Coal, Peat, Oil & Gas

Coal
Origan – Organic matter from millions of years ago
Usage – heating, electrical generation, industrial processes
Pros – Abundant, low cost, established infrastructure
Cons – High carbon & pollutants when burned, environmental damage from mining

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Coal, Peat, Oil & Gas

Peat
Origan – Organic matter from millions of years ago
Usage – heating and cooking , electrical generation
Pros – Abundant, low cost
Cons – High carbon & pollutants when burned, environmental damage to peatlands and habitats

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Coal, Peat, Oil & Gas

Oil

Origan – Organic matter from marine organisms from millions of years ago

Usage – energy for transport, heating, electrical generation, industrial processes, crucial for petrochemicals, plastics, fertilizers

Pros – Dominant energy resource worldwide, versatile, low cost, established infrastructure

Cons – Oil spills cause air and water pollution, greenhouse emissions, habitat destruction from excavation, geopolitical tensions with reserves

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Coal, Peat, Oil & Gas

Natural gas

Origan – Organic matter from marine organisms alongside oil from millions of years ago, mainly methane

Usage – heating and cooking , electrical generation, industrial process, vehicle fuel, feedstock for petrochemicals

Pros – Relatively abundant, lower emissions than oil or coal, existing infrastructure

Cons – High carbon emissions when burned, environmental damage from fracking and risk of gas leak

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12

Coal, Peat, Oil & Gas

Liquid to Gas (LTG)

GTL converts natural gas to liquid fuel like diesels and jet fuel.

This is from previously “flared off” gas on extraction that can now be used in similar fashion to diesel fuels.

12

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Heating today

Home heating systems today encompass a wide range of options designed to meet diverse energy needs and environmental considerations.

- Oil or gas central heating systems remain popular, but concerns about fuel reliance, greenhouse emissions
- Renewable energy sources like HVO will have a huge potential
- Heat pumps are brilliant for new homes and existing homes also, but only after high levels of retrofitting
- Biomass being timber, wood pellet for heating & electrical generation
- Solar PV and solar thermal

13

14

Refrigerant gases and their effects on the world

Refrigerant gases may not get much attention, but they're very important for maintaining the
comfort and convenience we enjoy every day.

These special gases are a key part of things like fridges, AC units, and heat pumps.

The refrigeration cycle can be used for both cooling (air-conditioning mode) & heating(heat pump mode).
In cooling mode, the cycle removes heat from indoors and releases it outdoors, while in heating mode, it absorbs heat from outdoors and transfers it indoors.

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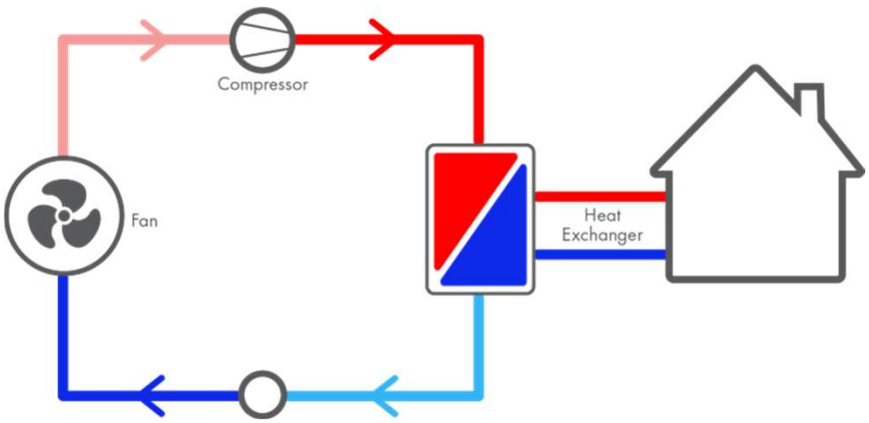
Refrigerant gases and their effects on the world

Common refrigerants used are R32 & R290 can give very high efficiency in compatible homes.



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Refrigerant gases and their effects on the world

Global warming potential (GWP) is a measure of the relative global warming effects of different gases. Carbon dioxide was chosen by an international panel (IPCC) as the reference gas and its GWP is taken as 1.

The higher the GWP value, the more that gas warms the Earth compared to carbon dioxide.

R32 is being replaced by R290 refrigerant in the heat pump industry, with the ability to generate higher temperatures whilst having a lower Global Warming Potential. R32 has a GWP of 675, with R290 having a GWP of 3.

If 0.5kg of R32 leaked into the atmosphere, it would be the equivalent of a car driving 1500 miles.
If 0.5kg of R290 leaked into the atmosphere, it would be the equivalent of a car driving 6 miles.

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Boiler efficiency

Boiler efficiency measures the relationship between the energy input and energy output of a boiler system. Condensing and non-condensing boilers both burn fuel, such as oil or gas.
The main difference is that the energy efficiency of condensing boilers is more than 90%, while non- condensing boilers are only up to 78% efficient.
This means that for every €100 you spend on heating, €90 of it will go towards heating your home and only 10% will be lost.

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Boiler efficiency

Wood pellet boilers have a similar level of efficiency to condensing gas and oil boilers. This means they achieve efficiencies of over 90%.

A great advantage to wood pellet boilers being they provide the same heat while not burning fossil fuels, meaning you will be helping the environment by cutting your carbon footprint.

The key difference that you must take into consideration is the cost. Biomass boilers are more expensive than your typical oil/gas boiler but if properly maintained, your biomass boiler will have a life expectancy of 15-20 years.

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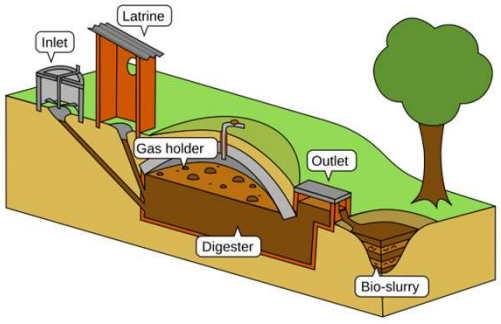
Biogas

Biogas is an environmentally friendly, renewable energy source produced by the breakdown of organic matter such as food scraps and animal waste.

The process of producing biogas is also largely cyclical and fits into an overall sustainable cycle of managing agricultural waste.

For example, animal waste produced on a farm can be used to produce biogas, which can then be used to fuel the farm machinery.



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HVO

Hydrotreated Vegetable Oil (HVO) is a diesel-like fuel that can be produced without fossil resources by processing renewable waste lipids.
Using Hydrogen as a catalyst, this is what differentiates between HVO and Biodiesel. HVO can be a direct replacement to kerosene as the properties are very similar.

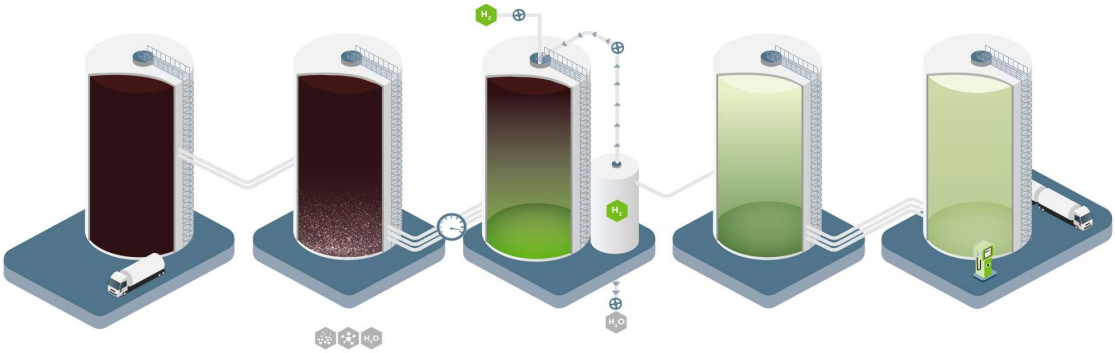
Some benefits of HVO include:

- Cuts greenhouse gas emissions by up to 90%
- Biodegradable and non-toxic
- Zero FAME, Sulphur and fossil content
- Sustainably produced
- Absence of smell

21

HVO introduction – How it's made

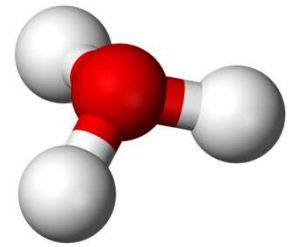
In the process, hydrogen is used to remove oxygen from, for example, triglyceride vegetable oil molecules and to split the triglyceride into three separate chains, thus creating hydrocarbons that are similar to existing diesel fuel components. This allows blending in any desired ratio without any concerns regarding fuel quality.



Waste Vegetable Oils and Residual Fats	Pretreatment	Hydrotreatment & Isomerization	Fractionation	Renewable Diesel
Waste and residues from food manufacturing and processes, or virgin sources	Feedstock is purified, removing salts, impurities, water and solid particles	Make up and recycled hydrogen are mixed with the oils and fats, modifying the chemical structure	Non-condensable gases are removed, the remaining liquid is distilled to separate the HVO	The HVO is ready for distribution and use.

22

Hydrogen



Hydrogen molecule

Hydrogen is a clean alternative to methane, also known as natural gas. It's the most abundant chemical element, estimated to contribute 75% of the mass of the universe.

While it's present in nearly all molecules in living things, it's very scarce as a gas.
One of the key advantages of hydrogen is its cleanliness. When used in fuel cells or burned in combustion engines, hydrogen produces only water vapor as a by-product, making it a zero-emission fuel.

Additionally, hydrogen can be produced from renewable sources such as wind, solar, and biomass, making it a sustainable energy carrier.

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Wind

Wind energy is a renewable and sustainable form of energy derived from the kinetic energy of wind. Wind turbines convert the kinetic energy of the wind into mechanical power through the rotation of turbine blades.
The rotating blades drive a generator, which produces electricity. Wind energy is clean and renewable, producing no greenhouse gas emissions or air pollutants during operation.
Wind is an abundant and inexhaustible resource, with vast potential for generating electricity in regions with favorable wind conditions.

Disadvantages include - reliability: wind isn't reliable.
Noise and Visual Pollution: turbine blades are often noisy.
Some people consider wind turbines an eyesore, ruining the natural landscape.

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Geothermal

Geothermal energy refers to energy stored in the form of heat beneath the surface of the Earth. In volcanic areas such as Iceland geothermal energy is a main source of energy.

In Iceland 90% of buildings obtain their heat requirements from geothermal sources. The hot rocks and hot springs from the active volcanic area heat water to produce steam which in turn drives large turbines to generate electricity.

25

Hydroelectric

Hydroelectric power uses energy from the movement of water to generate electricity. Water flows over a turbine and spins blades connected to a generator. Electricity is then fed to the electric grid, an individual consumer or a storage device.

The most common type of hydroelectric generating facility is a dam where water is stored until it is needed to produce electricity. Hydroelectric power is considered renewable, though some people have raised concerns over large hydroelectric dams due to their impacts on ecosystems, water quality, and natural river flow.

26

Tidal

Tidal power is like hydroelectric power as it makes use of moving water to spin a turbine to produce electricity. As tides rise and fall due to the gravitational pull of the sun and moon, water flows through the mouths of bays and other narrow points.

Tidal power facilities place turbines in these currents or trap water at high tide to release through turbines later. As the tides are generated by the ongoing movements of the planet, tidal power is considered renewable.

27

Solar

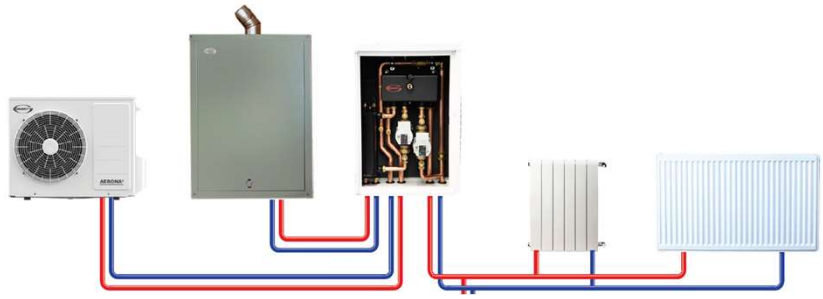
Solar power, also known as solar electricity, is the conversion of energy from sunlight into electricity, either directly using photovoltaics (PV) or indirectly using concentrated solar power. Solar panels use the photovoltaic effect to convert light into an electric current.

It's an inexhaustible resource with versatile, silent, efficient technologies. And its advantages will only increase in the future.

The energy the sun provides to the earth for one hour could meet the global energy needs for one year. Sunlight is an energy source that can be used anywhere on the planet and even gets to places with no infrastructure or connections

28

Hybrids



Hybrid heating is a combination of two or more technologies teaming up to generate heat, as a low carbon alternative for home heating.
These typically consist of a gas or oil boiler and an air to water heat pump.
The heat pump is expected to generate heat for 70-80% of the time and, during colder months, the boiler acts as a top-up, giving all year-round comfort.

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Closing remarks

In the last 12 months, there has been a significant drop in heat pump sales in Europe, ranging from 30% to 50%. For example, in Denmark, interest in heat pumps surged when gas prices were high but plummeted when prices dropped, causing many importers to go out of business.

It is crucial to introduce biofuels and hybrid heating systems to reduce carbon emissions in older buildings, combined with affordable insulation upgrades. All new buildings should be equipped with heat pumps and solar PV systems. Larger homes and listed buildings will likely require liquid fuel or biomass solutions.

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Closing remarks

The global warming potential (GWP) of refrigerants is an important consideration. For example, R410A has a GWP of 2088, R32 has a GWP of 675, and R290 (propane) has a GWP of 3. Homeowners are generally interested in CO2 reduction only if it is cost-neutral.

Finally, the potential for electricity production from ocean currents is promising. This source of power is constant, weather-independent, and has no visual impact, making it an attractive option for the future.

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