

easyPower

One technology, three solutions
for a brighter future

easyPower

part of the **easy**[®] family of brands



Our Planet is under Threat.

The world about us is changing fast and as far as our environment is concerned, it is not for the better.

It is now recognised that we are facing two separate but linked crises; Climate Change and ecological decline. The very systems that sustain life on earth are straining under the pressure of human activity and consumption. The science is clear... We must change how we live if we are to avoid catastrophic damage to our world.

We need to act fast and effect change across the whole spectrum of our lives. This is a daunting challenge and there is no silver bullet.

However, **easyPower** has a technology that can make a significant contribution to three of the most significant challenges of our time;

- **Carbon Capture,**
- **Renewable/Low Carbon Energy &**
- **Disposal of Our Waste.**

Our Planet Under Threat

Carbon Capture

The accumulated weight of human activity since the industrial revolution has upset our planet's natural carbon balance.

A combination of emissions from the burning of fossil fuels and the destruction of the natural world, have led to much higher concentrations of CO₂ and other greenhouse gases in the earth's atmosphere. Most scientists agree that this is causing our planet to warm with increasingly damaging consequences. The Paris Agreement reached in 2015, which has now been ratified by 190 countries, has a central aim to strengthen the global response to the threat of climate change. The collective declared aim "is to keep the global temperature rise this century, well below 2 degrees Celsius above pre-industrial levels; and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius".

Unfortunately, emissions reductions alone are no longer enough. The Intergovernmental Panel on Climate Change (IPCC) report that most 1.5°C and 2°C pathways are heavily reliant on achieving carbon dioxide removal at a speculatively large scale before the middle of this century. They estimate that anywhere between 100-1000 gigatons of CO₂ will need to be removed by 2100.

Renewable/Low Carbon Energy

To ensure that we continue to reduce carbon emissions, we need to remove the remaining fossil fuels from our energy supply as soon as possible.

Whilst there are encouraging trends in the growth of renewable energy, our current efforts are clearly not enough. The IEA reported that only 13.5% of the world's energy supply was from renewable resources in 2018. Full commitment to global transformation is required without delay.

There have been many headlines about the transformation of the UK's electricity supply, with record periods where we have generated electricity without the use of coal. As a result the carbon intensity (the amount of CO₂ per kW /hr) of our grid electricity has more than halved since 2007.

Despite this, in 2019 we still released 245g of CO₂ for every kWh of electricity we produced. There is still much to be done in order to effectively de-carbonise our electricity supply. Liquid fuels in both transport and domestic and industrial heating sectors are yet further behind on the curve.

A well-documented issue with renewables is that they are intermittent or unreliable, only providing energy when conditions permit. Costly energy storage has become a major additional overhead. Renewable power that is reliable and can meet baseload demand is clearly what is needed.

Disposal of Our Waste

We are producing vast quantities of waste, despoiling our countryside and clogging up our rivers and seas.

In 2016 the UK produced 221 million tonnes of waste, equivalent to over 3 tonnes for every person. We need to radically re-invent our systems, to design out waste wherever possible and increase the potential for re-use and re-cycling. In the interim we need to dispose of our unavoidable waste in the most sustainable manner possible. Our current practice of landfill or mass burn incineration is not sustainable and fails to get the most out of the latent resources contained within our waste streams. Atmospheric emissions from these practices impact both climate change and air quality; and are simply unacceptable

easyPower - The Technology

easyPower deploys an advanced pyrolysis process for the treatment of various material streams.

Pyrolysis is the chemical decomposition by heat of organic matter in the absence of air. There is no combustion. This produces a gas stream, a solid residual char and further carbon residues from the gas conditioning units.

The prepared material passes into the main process chamber where a combination of conditions, including high temperature and the absence of air, cause it to immediately release most of its energy in the form of gas. Any remaining energy is left behind as a solid, energy rich, carbon residue. Because the material is prevented from burning at any point, we have the ability to recapture more of the energy than any other process.

Process conditions can be varied in order to achieve the best possible results from whichever type of material is to be treated. Changes to temperature, residence time or moisture level, all affect the way each material reacts and can markedly influence both the calorific value and quantity of each of the end products.

In simple terms this is similar to the natural process of decay and decomposition that Planet Earth will carry out on her own, given a hundred million years or so, where organic matter is reduced to coal, oil and gas. The entire process is natural chemistry and it only works if there is no burning.

The **easyPower** process is unique in that we do not use any form of combustion to create the process heat. The technology is therefore completely free of airborne emissions.

The amount of solid and gas produced depends largely on the material being used and the combination of process characteristics applied during operation. The process is exceptional in that it operates at much higher temperatures than is normally used for similar processes, thereby shifting the emphasis to production of gas.

Another advantage of the process is its modular design.

The equipment is sized so that dependent upon feedstock, a single module will process up to 1 tonne per hr, with final throughput levels dependent upon a number of factors. This is equivalent to around 7,800 tonnes for a single module per annum, allowing time for maintenance. It is intended that a typical installation will consist of 6 modules, with a process capability of up to 46,800 tonnes of prepared material per year. In the UK that can be the equivalent of over 80,000 tonnes of raw unprocessed household waste per annum.

easyPower has multiple potential income opportunities which vary in terms of scale, dependent upon the nature of the source material and the specifics of the site and operation. This, combined with competitive capital costs, low running costs and an inherent flexibility, means that the commercial viability of the technology is considered as very attractive.

The opportunity for rapid deployment of the **easyPower** technology is greatly enhanced as a result of its wide ranging environmental credentials. The combination of small footprint and low profile helps to make the technology an easy fit within many of the existing waste treatment facilities already in operation around the UK. A range of factors, including a lack of emissions, reductions in transport movements, low noise and odour levels and no need for a tall flue or chimneys, all help to create a more receptive reaction from local communities, thereby helping us to achieve planning and regulatory approvals more quickly and smoothly than might generally apply to many other technologies.

easyPower - The Process Explained

The key principles of the process are simple and allow for a minimum amount of preparation and a minimum amount of manual intervention.

Efficient processing of large quantities of material, requires uncomplicated, straight forward preparation, combined with a system that is robust, stable and that can deliver the required results with the minimum of fuss. The following schematic diagram shows the principal phases and flows of the process.

Almost every part utilises known, proven technologies from across a broad range of highly specialised industries. We just apply the technologies in a different manner, allowing easyPower to deliver ground breaking technology, but with the benefit of time proven, reliable plant and equipment.

Stage 1

Incoming material, having been shredded down to smaller sized particles, is conveyed to the primary and secondary feed hoppers. Where necessary, automated metal recovery processes can be incorporated to remove metals. Drying can also be undertaken at this stage if required to reduce moisture content to the optimal level, dependent upon the feed material to be processed and the required outputs.

Stage 2

The prepared material is continuously fed into the main process chamber where a combination of conditions, including high temperature and the absence of air, cause the accelerated decomposition of all organic material. At no point is any of the material allowed to combust.

As the material enters into the main process chamber, the rapid change in conditions causes it to immediately release most of its energy in the form of gas. Any remaining energy is left behind as a solid, carbon rich, residue.

Process conditions can be varied in order to achieve the best possible results from each of the various types of material being treated.

Changes to temperature, residence time or moisture level, all affect the way the material reacts and can markedly influence composition, quality and quantity of the end products.

Stage 3

The vastly reduced remaining solid, typically representing 18% - 23% of the original feed material, now passes out of the main process chamber.

The extended exposure to high levels of heat, will completely destroy pretty much any type of organic contaminant, leaving behind an extremely good quality, carbon rich char. The carbon char is collected and stored in separate vessels ready for re-use. This is carbon capture in its purest form. If sequestered in the soil or stored within other long term facilities, this further enhances our environmental credentials, underlining our status as a carbon negative process.

Stage 4

The **easyPower** process produces large volumes of highly combustible, renewable gas. This high quality fuel gas is subjected to a series of further processes to condition and clean the gas ready for use in gas engines, for production of renewable electricity; or for further conversion processes in order to produce low carbon, liquid fuels. Surplus heat from the gas engines is also available for a range of applications, e.g. Local heat networks, refrigeration and cooling, all dependent upon local needs, thus ensuring the most appropriate use of this additional renewable resource

The process is virtually inaudible in operation and entirely odourless.

It creates no smoke as there is no burning and therefore does not produce any of the volatile airborne compounds normally associated with waste destruction processes. Furthermore, any biological contaminants that might have existed within the original material, are completely destroyed by the extreme temperatures combined with extended residence times.

easyPower - The Process Explained

The diagram below shows the basic process flow for any given waste stream. It is a generic depiction.

It must be recognised that differing streams of input material may produce different ratios of residual products, each requiring slightly different methods of separation, treatment and collection.

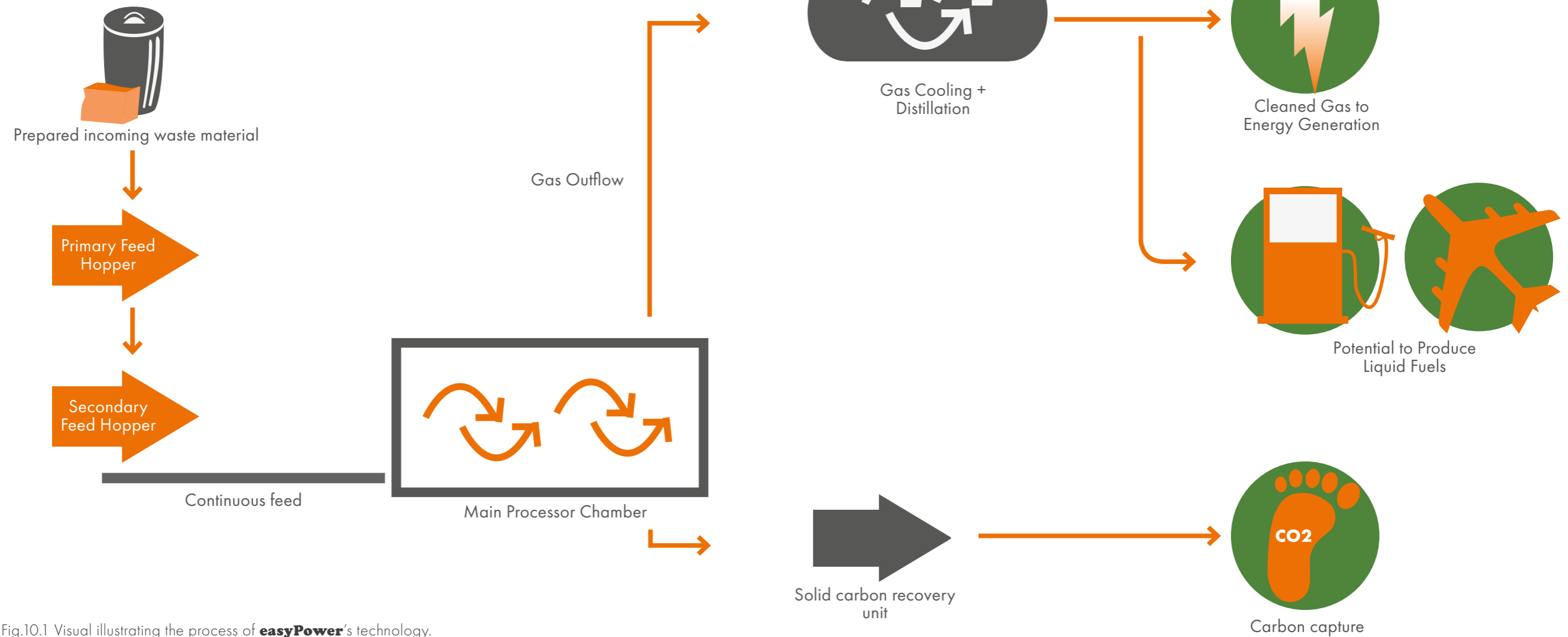


Fig.10.1 Visual illustrating the process of **easyPower**'s technology.

Material Streams & The Waste Hierarchy

What Materials Can We Process?

Any organic based material is suitable for the process and within certain bounds will produce similar results every time.

The process is very stable and robust. Any metals or minerals that might accidentally find their way into the process, will merely pass through the system unchanged.

We ideally look for materials to be provided to us with metals and minerals removed and moisture levels of 15% - 25%. We then apply a further degree of drying, in order to bring the material down to our optimum levels. Any heat requirement for pre-stage drying will be provided from the residual process heat produced by our gas engines and generators.

The following table sets out some examples of the material ranges that **easyPower** can treat. Plastics are worthy of special mention, as the issues surrounding plastic pollution have quite rightly become extremely high profile. **easyPower** takes the view that single use plastics and plastic waste overall should be reduced wherever possible. However, vast quantities of waste plastics already exist and need to be treated in the most sustainable way possible. We consider that **easyPower** delivers the best solution available.

- Mixed domestic or C&I waste
- Wood waste
- Construction & demolition waste
- Biomass & energy crops
- Agricultural residues
- Forestry residues
- Mixed plastics and rubber
- Clinical wastes*
- Sewage sludge*
- Meat & bone meal*
- Secure waste
- Landfill remediation

Proximity & Proportionate Solutions

The plant is tiny when compared to almost every other waste treatment process.

The plant is modular, allowing installations to be sized to meet local requirements at the right scale, even enabling modules to be relocated at a later date if required. Dependent upon feed a typical installation of 6 modules will process between 39,000 - 52,000 tonnes of prepared waste per annum and comfortably fit within a 3,000 m² standard industrial building, with a similar sized area required externally. This enables the technology to be located on existing waste sites, or other locations close to a material source. In planning parlance this is generally known as "The Proximity Principle". This provides the operators with an opportunity to reduce or completely remove the requirement to transport waste over distance, thereby reducing costs, noise, congestion and pollution associated with the movement of transport.

easyPower's ability to be flexible in terms of feed material combined with modular and adaptable process characteristics, means long term waste contracts are no longer essential. **easyPower**'s approach sits comfortably within the existing structure of The Waste Hierarchy. We are highly supportive of waste reduction, re-use and re-cycling. We do not advocate the construction of large scale, centralised waste plants that require diversion of huge quantities of waste from a wide area, over an extended period.

easyPower does not support the use of unsustainable forms of biomass as a substitute fuel for the production of energy. We share concerns with many environmental bodies that large scale deployment of forestry and other crops for biomass can be destructive for the natural environment and displace essential food production. However, we would emphasise that we also believe that well-considered and sensitively deployed biomass crops, can bring a wide range of environmental benefits when combined with **easyPower**'s pure pyrolysis.

easyPower; Delivering Three Separate Solutions

- **Carbon Capture** - a typical 6 module installation will capture some 35,000 tonnes of CO₂ each and every year.
- **Renewable Energy** - our process will produce between 5 & 10 times more energy than it consumes.
- **Waste Disposal** - we believe that **easyPower's** process is the "Best Available Technology" for dealing with any residual and unavoidable waste streams.

Delivering Three Separate Solutions

Carbon Capture

The key to carbon capture from the **easyPower** process is our production of carbon char. This is carbon capture in action.

A stable, solid material with multiple uses. No requirement for complex systems of gas capture or the challenge of finding a long-term storage solution. At the end of every day, each module will have produced around 20 tonnes of carbon rich char. On average, for every tonne of material input we will capture approximately 760 kg of CO₂ in our carbon char. This means that a typical 6 module installation, will capture some 35,000 tonnes of CO₂ each and every year.

If the material processed has come from biomass sources, it is often known as BECCS (Bioenergy with Carbon Capture and Storage). This is a widely recognised methodology for atmospheric carbon drawdown. Even if some of the input material originates from fossil fuels e.g. plastics, a proportion of that carbon is being still re-captured.

There are many uses for the char dependent upon the specific nature of the original material and whether the carbon itself is to be the subject of further modification.

Some of the uses for the char lead to further carbon storage and/or emissions reduction. When used in soils, it is commonly known as biochar and is recognised as a valuable soil amendment that can hold carbon, boost food security, increase soil biodiversity and discourage deforestation.

Importantly the carbon in biochar resists degradation and can hold carbon in soils for hundreds, if not thousands of years. See our Carbon Char Information Sheet for further details.

The capture of carbon is a natural part of the core **easyPower** process, but even further carbon capture is possible by the addition of further technologies, thereby increasing our atmospheric carbon drawdown capability even further.

Delivering Three Separate Solutions

Renewable/Low Carbon Energy

We are confident that **easyPower** has the most efficient technology for extracting the maximum amount of energy from the world's residual waste streams and from sustainably produced biomass. Our process will produce between 5 and 10 times more energy than the energy it consumes; and dependent upon feed material, a typical 6 module installation can produce up to 9 MW/hr of electrical energy and 9-12 MW/hr thermal... That's every hour.

In real terms, an average sized installation could provide enough renewable energy to supply the total electrical needs of over 23,000 UK homes.

In terms of potential energy recovery per kg of material processed, we are not aware of any other technology that can come close. **easyPower** is planning on development of small scale, stand alone units, for remote placement. These would process a prepared fuel and provide electrical power to over 800 typical UK homes.

Where the feed material is obtained from non-fossil fuel sources, the energy we produce will be entirely renewable and is therefore classed as carbon neutral energy. The **easyPower** process is continuous and can work 24 / 7 producing baseload power, providing a balance against the intermittent nature of energy produced by wind, tidal and solar.

Additional to the above, we have the option of converting our fuel gas to low carbon liquid fuels, helping yet further to meet the needs of some 'hard to de-carbonise' sectors. See our Energy Information Sheet for more information.

Waste Disposal

We believe that **easyPower**'s process is the "Best Available Technology" for dealing with any residual and unavoidable waste streams.

It extracts the most energy and captures high levels of carbon thereby making this a true carbon negative methodology for all but the highest fossil intensity waste streams. It can deal easily with a very wide range of wastes with simple, undemanding pre-treatment processes.

The technology is modular and scalable; and can therefore be located close to existing material sources, helping to reduce or remove the impacts of secondary transport movements. The core process itself does not produce odours and the noise levels are low. There are no tall chimneys or flues for emissions.

The **easyPower** process fits comfortably in the waste hierarchy below reduction, re-use and re-cycling; its inherent flexibility means that it does not demand the ongoing creation of endless amounts of unsustainable waste streams. **easyPower** can eradicate existing unrecyclable waste plastics and the more simple classes of medical waste which have seen dramatic increases recently, in the most sustainable way possible.

The introduction of this unique pure pyrolysis process should finally help bring a halt to the use of landfill and mass burn incineration, both of which are highly damaging to our environment and fail to maximise the recovery of either the energy or other resources from the waste streams they process.

easyPower The Key Benefits

Three Solutions for a brighter future

- **Carbon Capture** with multiple additional income streams and benefits. Provides a real option for achieving Net Zero targets
- **Renewable Energy** with high levels of efficiency, baseload power and multiple fuel choices.
- **Waste Disposal** across multiple material streams with no airborne emissions.

easyPower The Key Benefits

Benefits Include

- A nature-based process mimicking the Earth's natural process of producing fossil fuels, but in around 60 seconds.
- No combustion, no emissions from the core process.
- Almost inaudible in operation and entirely odourless.
- Small footprint and low-profile suits local application.
- Low capital cost, combined with minimal operational overhead, enables small scale operations to be commercially viable .
- Small, simple process assists in fast track Planning & Licensing Applications.

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