

ROFLOW PYROGEN

WELCOME TO ALL OUR GUESTS



ROFLOW PYROGEN

GREEN ENERGY

*“to preserve and renew
is almost as noble as to create”*

Voltaire 1694-1778



TODAYS AGENDA

INTRODUCTION

CLIMATE CHANGE AND THE CAUSES

WHY THERE IS AN ENERGY PROBLEM AND A GROWING WASTE PROBLEM

TO PROVIDE A GAME CHANGING SOLUTION TO 2 GLOBAL PROBLEMS - *WASTE AND ENERGY*

THE TECHNOLOGY AND HOW IT WORKS

OPEN FORUM



WHY THE NEED



*“A better waste solution---
---creating a better environment”*

- *Making a cleaner environment work. What do we mean?*
- *Minimising pollution AND generating revenue*



ROFLOW ENVIRONMENTAL ENGINEERING **PYROGEN**

GLOBAL ENVIRONMENTAL CRISIS

The ROFLOW PYROGEN Solution



- We live in a world of continuing **Environmental Crisis**, in particular man made waste and energy emission related climate issues
- UK waste exceeds 200 million tonnes per year. This waste can now be converted to power, heat or cooling using the **ROFLOW PYROGEN System** while resolving the nations Waste and Energy Crisis

- **ROFLOW PYROGEN Energy Systems** - a range of solutions from Waste Heat Recovery to Energy Generation utilizing a modular range of components with proven and patented technology.
- The **ROFLOW PYROGEN Solution** enables the world to manage Waste, to provide Renewable Energy while decreasing the Environmental Crisis

WHO ARE ROFLOW?

ROFLOW – Environmental Engineering



WHO ARE ROFLOW?

ROFLOW began trading in 1990. The company was created with the key objective to provide solutions for occupational and environmental problems delivered from a single engineering organisation. In this ROFLOW bring together the necessary components and service to produce turnkey custom designed schemes.



WHAT DO ROFLOW OFFER?

ROFLOW offer a comprehensive package of Environmental, Engineering Services and Energy Systems, predominantly involving the design, manufacture and installation of air movement equipment and systems as well as providing technical and diversified engineering solutions.



THE TEAM?

ROFLOW team has over 70 years of experience within 2 disciplines, The Physics of Air and Thermodynamics including Power Generation.

ROFLOW ENVIRONMENTAL DELIVERS

Recent Projects

Clean Air
Installation

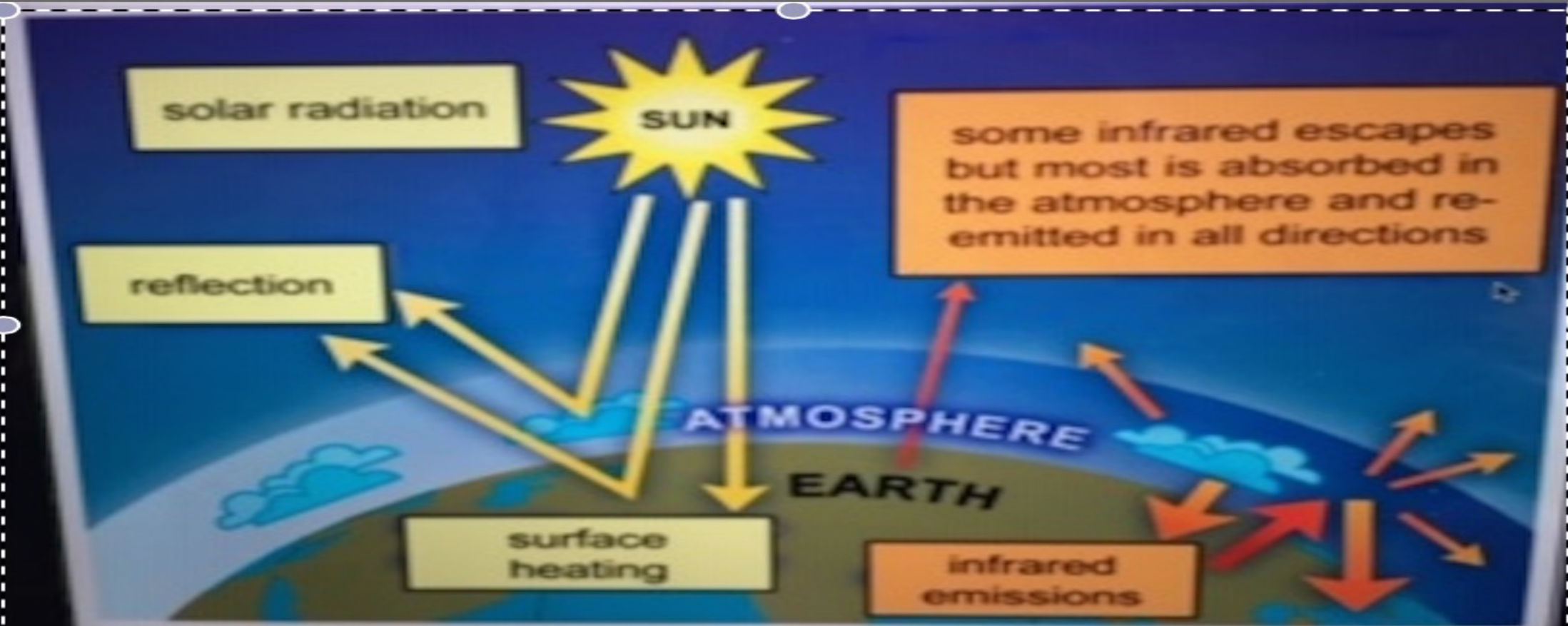
Bio- Mass
Filtration

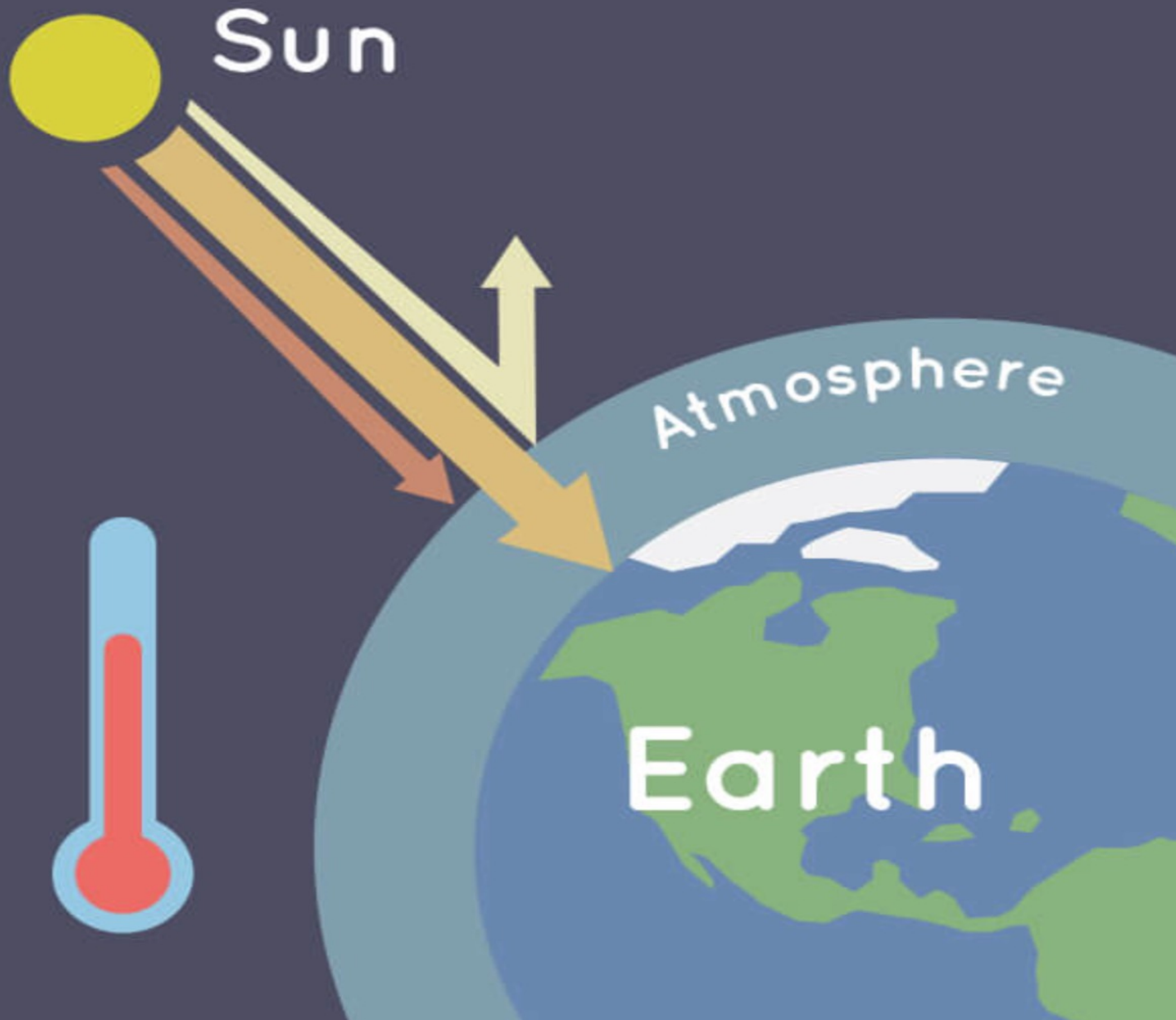
Lear Corporation
Dust Extraction



**CLIMATE CHANGE
WHY ITS HAPPENING
GLOBAL WARMING
THE GREENHOUSE EFFECT**

LETS LOOK AT SOME FACTS



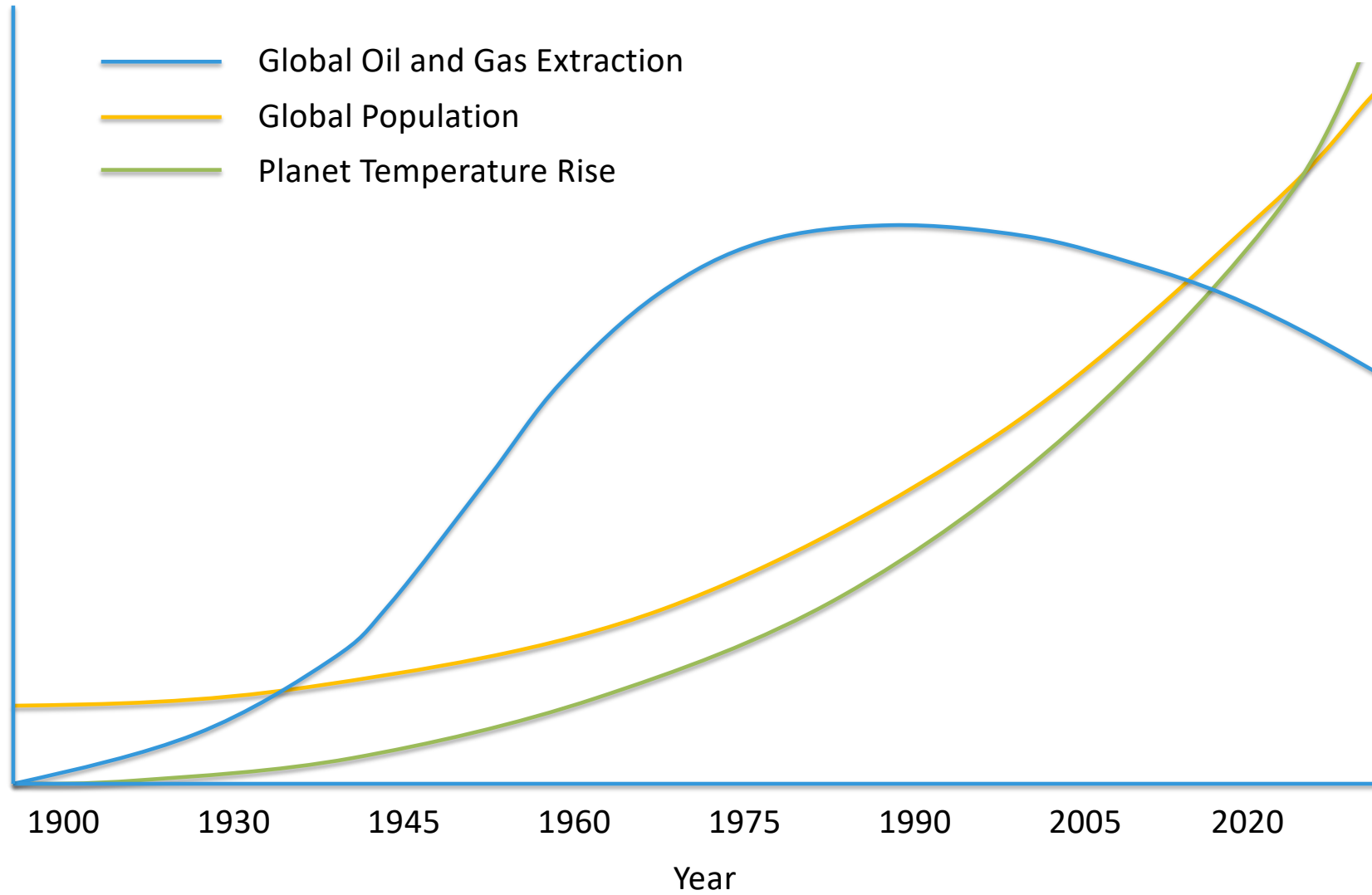


Greenhouse Effect the man-made causes

CO₂ - Methane – water vapour

The Results ;

**Temperature Extremes
More severe Hurricanes
Ice Caps melting
Flooding
Tipping points
Natural Disasters**



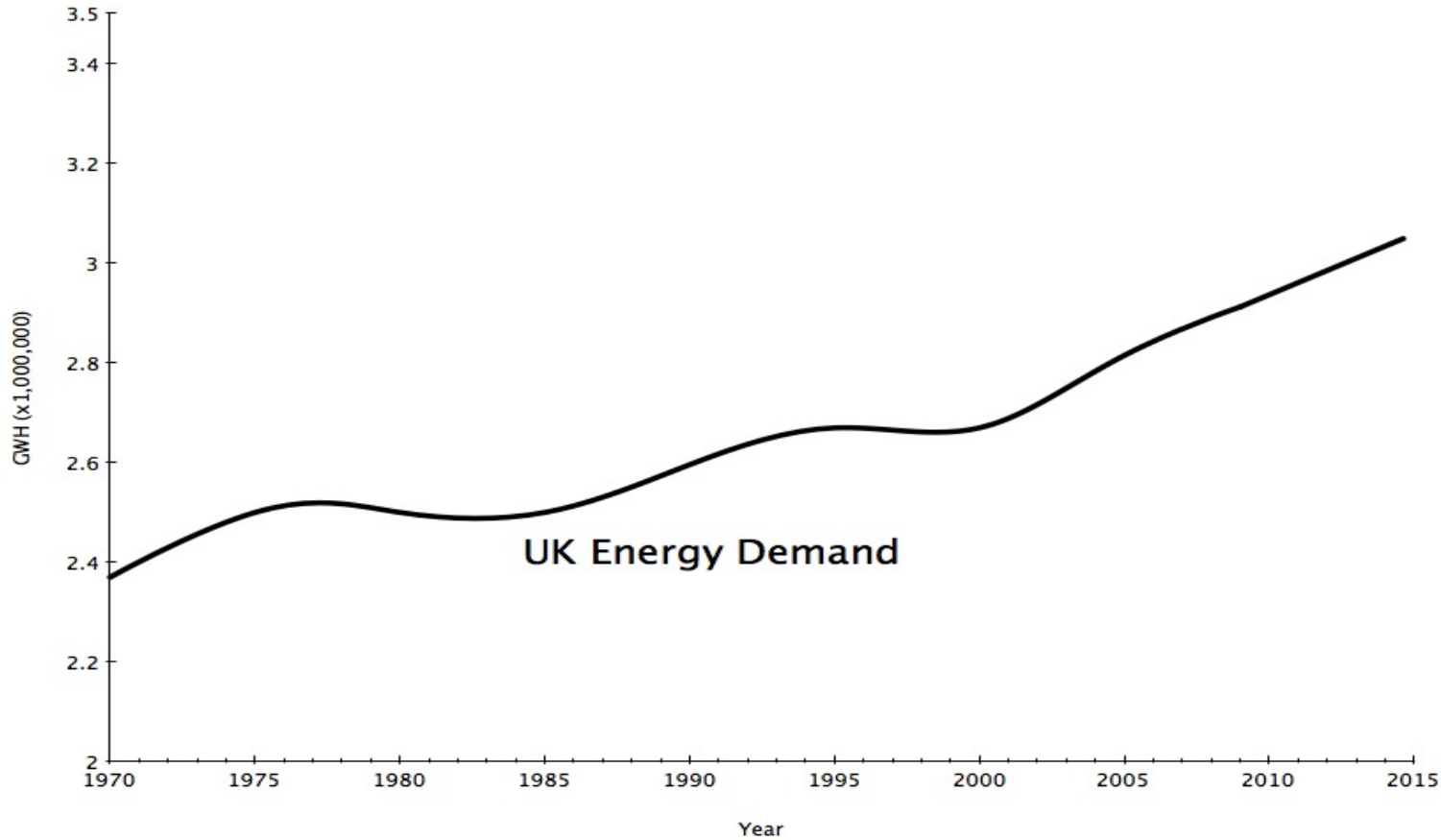
CLIMATE CHANGE – SOME FACTS



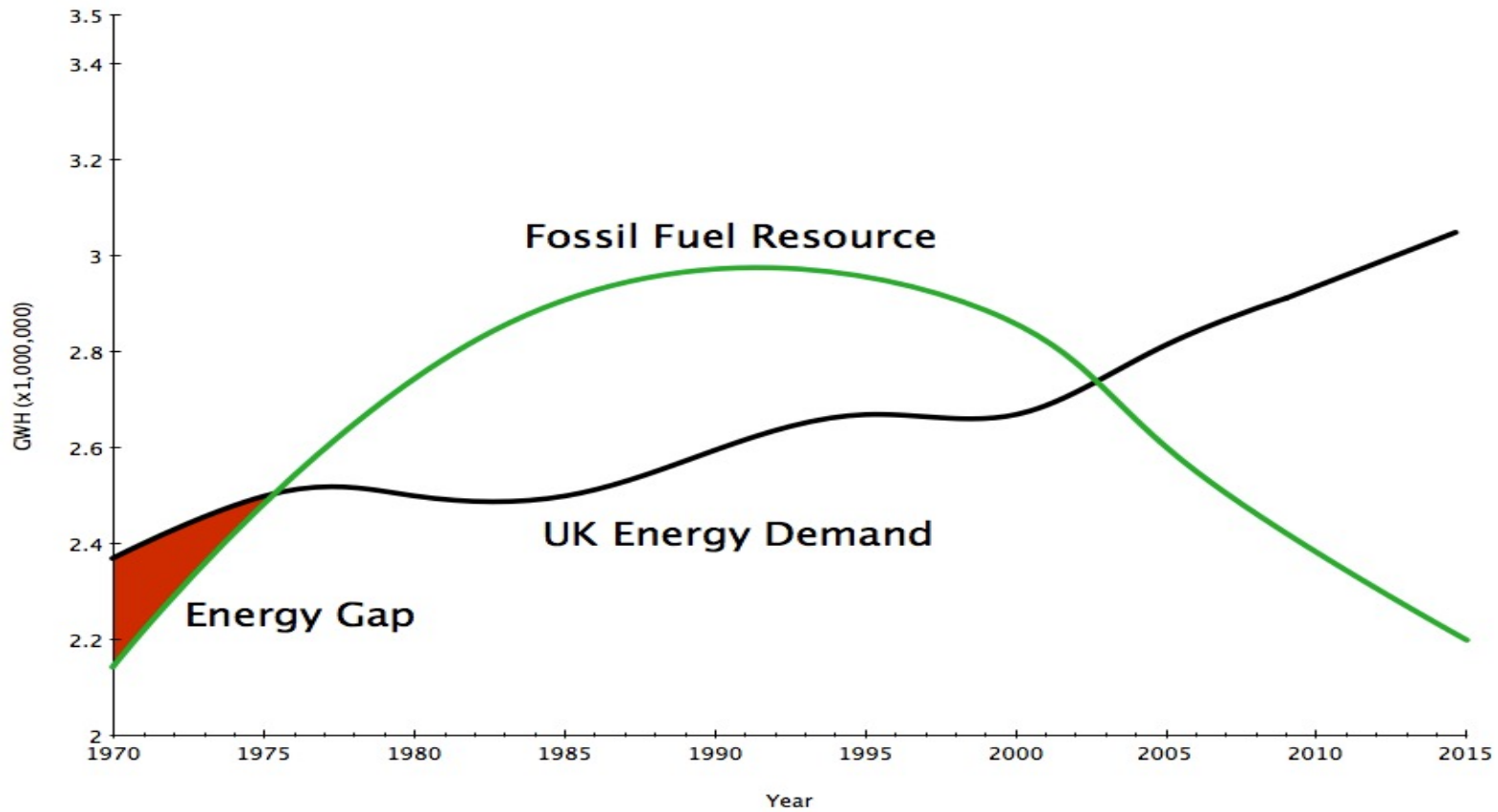
WHY AN ENERGY PROBLEM

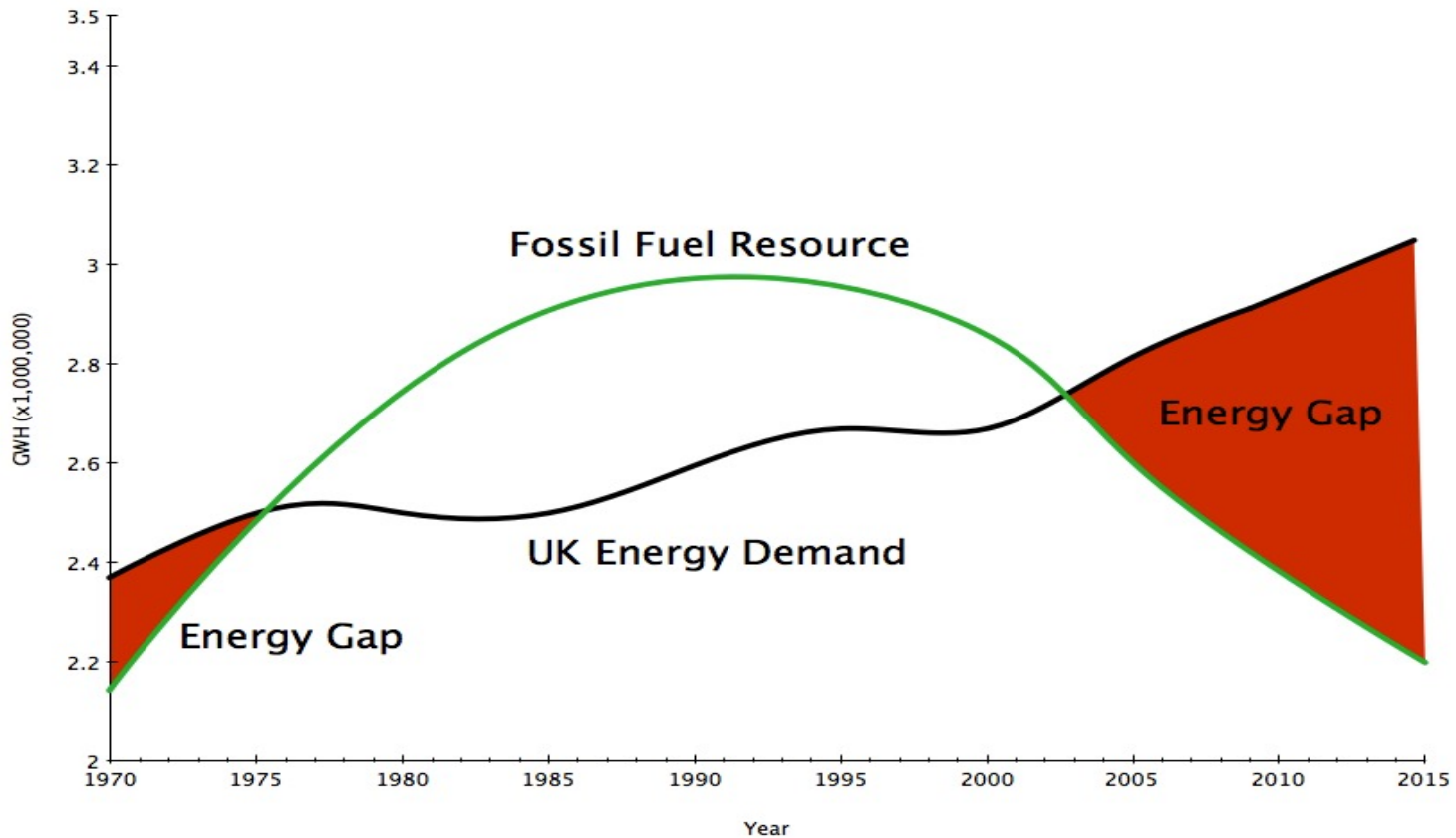
THE NEED FOR RENEWABLE ENERGY

RISING ENERGY DEMAND - UK

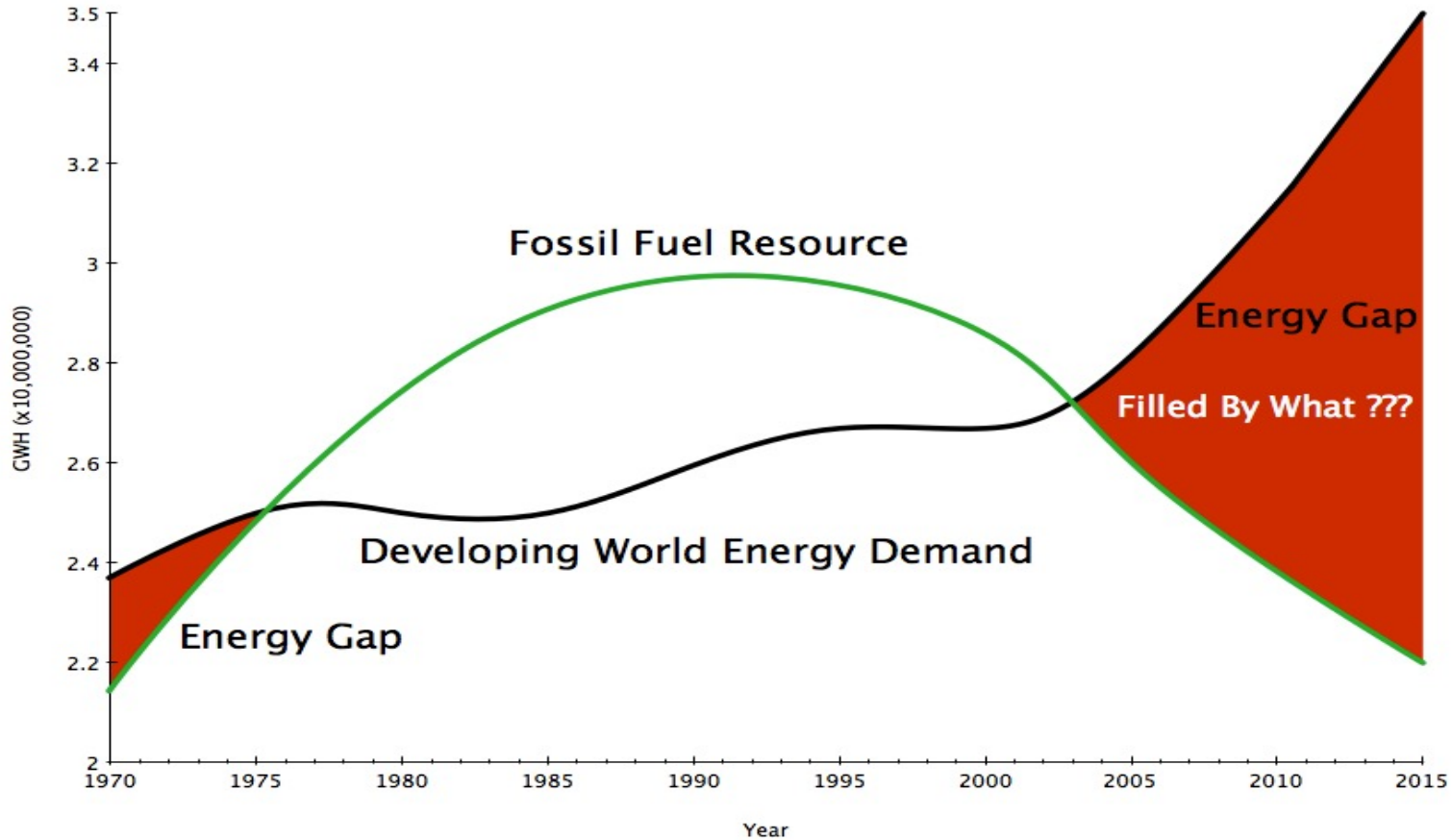


A year on year analysis of rising Energy Demand
The chart shows Energy Consumption rises regardless of Economic Statistics or Inflation Factors





INCREASING GLOBAL ENERGY GAP



The Developing World demand shows an alarming rise in demand due to the growth of China & India. Waste to Energy processes as a resource can help fill the Energy Gap.

UK ENERGY MARKET

As an Example

- 1 £54 billion UK Market Value for Electricity Generation per year
- 2 Overall Energy Efficiency for traditional Power Stations are circa 40%
- 3 Since 2003 Oil Imports have exceeded Oil Exports
- 4 The UK currently imports 1.5 million Barrels of Oil per day
- 5 Renewables are essential to the future of the Energy Sector



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PYROGEN

CARBON NEUTRAL ENERGY

Benefits of The ROFLOW PYROGEN Process

CARBON NEUTRAL

The ROFLOW process is 100% Carbon Neutral and therefore complies with all Government and Local Authority initiatives

ROFLOW PROCESS

The ROFLOW system has been designed to use 100% of all the bi-products generated in the process.



ENERGY GENERATION

A ROFLOW plant could provide enough Renewable Energy to supply the total electrical needs of up to 30,000 homes

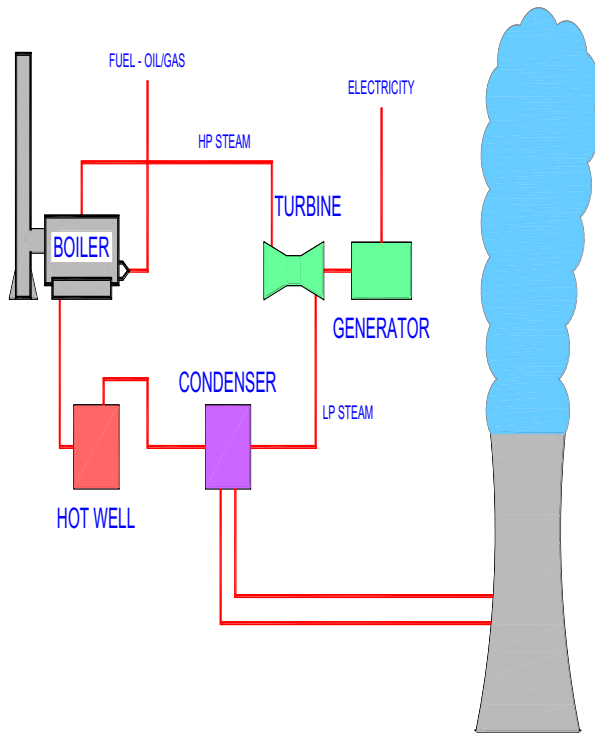
UNIQUENESS

There are no other known Generator Processes achieving the same levels of energy Output and Efficiency as the ROFLOW process

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ENVIRONMENTAL ENGINEERING **PYROGEN**

COMPARISON TO TRADITIONAL POWER GENERATION

Traditional Power Generation Methods



	Traditional Power Station (%)	Combined Heat and Power (CHP) (%)	Pyroge Reactor (%)
Fuel Input	100	100	100
Stack Losses	25	17	5
Condenser Losses	35	5	5
Electrical Output	40	37	60
Thermal Output	0	40	30
Total Output (efficiency)	40%	77%	90%

WASTE –

Some Facts

WASTE, A GLOBAL DISASTER...BUT AN OPPORTUNITY FOR CLEAN ENERGY

Mankind is exponentially using the planets precious resources for the ever increasing demand for energy and polluting the planet in the process

The UK alone produces more than 100 million tonnes of waste per annum (source :www.gov.uk)

Globally that figure is more than 2.2 billion tonnes (source: World bank)

300 million tonnes of plastic are produced each year. Sadly, 10% ends up in the sea.

Estimates now put the ratio of plastic to plankton at 1:2.

Waste plastic will outweigh marine life by 2050 if left unchecked.



UK WASTE PER ANNUM

◆ OVER 200 MILLION TONNES OF WASTE PER YEAR MWh

◆ 100 M/TONNES = CONSTRUCTION INDUSTRY 24,500

◆ 48 M/TONNES = INDUSTRY & COMMERCIAL 22,100

◆ 28M/TONNES = HOUSEHOLD WASTE 12,810

◆ 4M /TONNES = PLASTICS WASTE (To Landfill) 2041

◆ 4.3 M/TONNES = WOOD WASTE 2,640

◆ 0.44 M/TONNES= END OF LIFE TYRES 253



WHY A WASTE PROBLEM ?

WHAT IS THE ENERGY VALUE IN WASTE

MATERIAL	C.V	TONNES/ANNUM	TONNES/HOUR	ROFLOW ELEC CONVERSION
▪ RDF	18MJ/KG	28 MILLION	3329	12,810 MW/HR ELEC
▪ PLASTICS	36MJ/KG	3.2 MILLION	365	2041 MW/HR ELEC
▪ TYRES	39MJ/KG	0.4 MILLION	45	253 MW/HR ELEC
▪ WOOD	15MJ/KG	4.3 MILLION	490	2640 MW/HR ELEC
▪ TOTAL		35.9 MILLION	3788	15,368 MW/HR ELEC

NATIONAL UK DATA

UK ELEC DEMAND PER/HR

200 MILLION 23,000

37,000 MW/HR

WHAT IS THE ENERGY VALUE IN WASTE

MATERIAL	C.V	TONNES/ANNUM	TONNES/HOUR	Roflow Pyrogen ELEC CONVERSION
PLASTICS	36MJ/KG	4.0 MILLION	456	2041 MW/HR ELEC
RDF	18MJ/KG	28 MILLION	3329	12,810 MW/HR ELEC
TYRES	39MJ/KG	0.4 MILLION	45	253 MW/HR ELEC
WOOD	15MJ/KG	4.3 MILLION	490	2640 MW/HR ELEC
TOTAL		36.7 MILLION	4320	17,744 MW/HR ELEC

NATIONAL UK DATA

UK ELEC DEMAND PER/HR

200 MILLION

23,000

37,000 MW/HR



ROFLOW PYROGEN ENERGY GENERATION DELIVERS

Benefits of ROFLOW Energy Generation

- A Better Solution for Recycling Waste into Green Energy
- Creating a Better Environment
- Making a Cleaner Environment Work
- Minimises Pollution
- Generates Revenue
- Access to Power for Everyone
- Combined Heating Power Cooling (CHPC) – ROFLOW PYROGEN systems offer unrivalled levels of efficiency



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PYROGEN

THE ROFLOW PYROGEN HEAT EXCHANGER

A Demonstration of the Fastest Heat Transfer Device

“ The Heat Pipe “

A brief History and the link to where we are !!

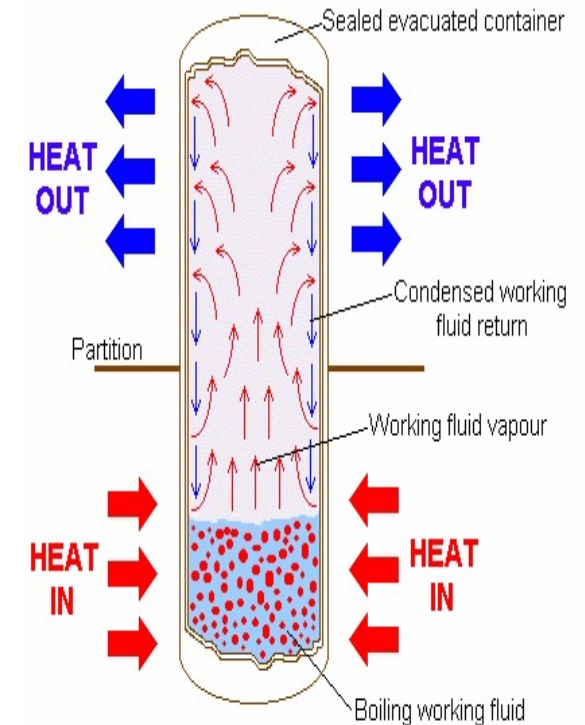
ROFLOW HEAT EXCHANGER

How It Works

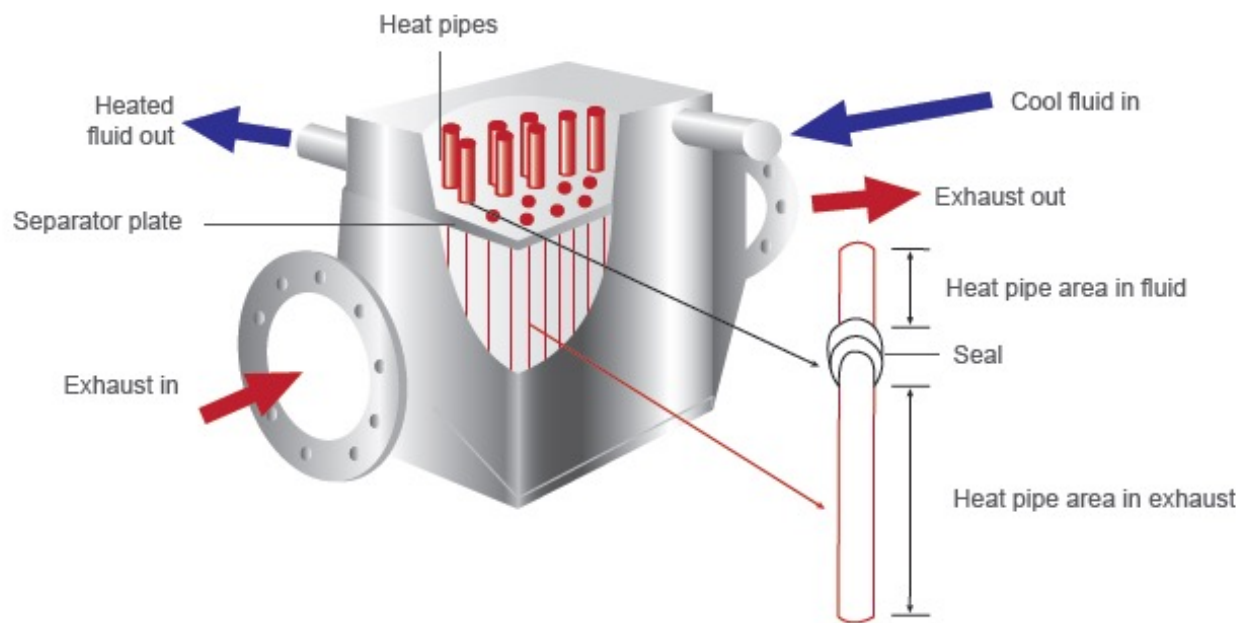
Can transfer up to 1000 times more thermal energy than copper

Can be used in traditionally difficult heat exchange environments

- High particulate exhaust
- Dirty liquids
- Corrosive environments
- Low temperature gradient

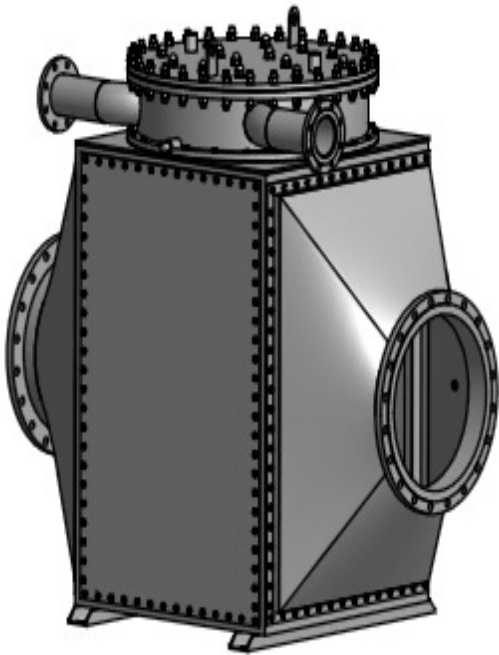


Schematic Representation of the Heat Pipe

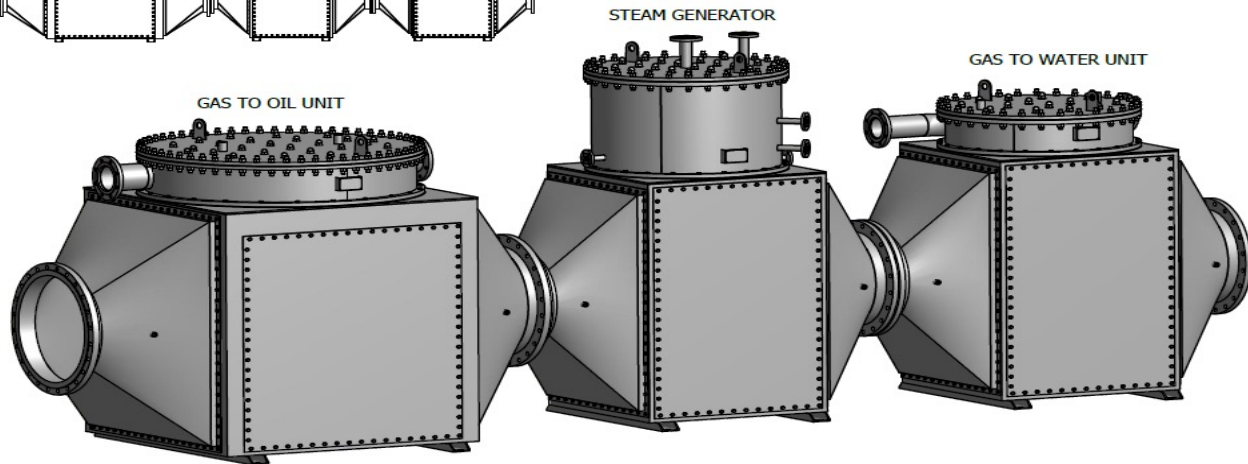
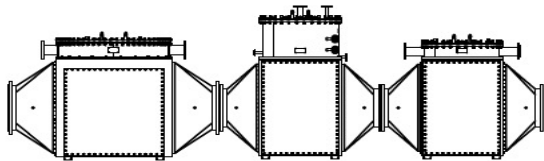


Heat pipe heat exchanger construction

Typical Gas to Steam Heat Exchanger



Multi-Heat Exchanger Configuration

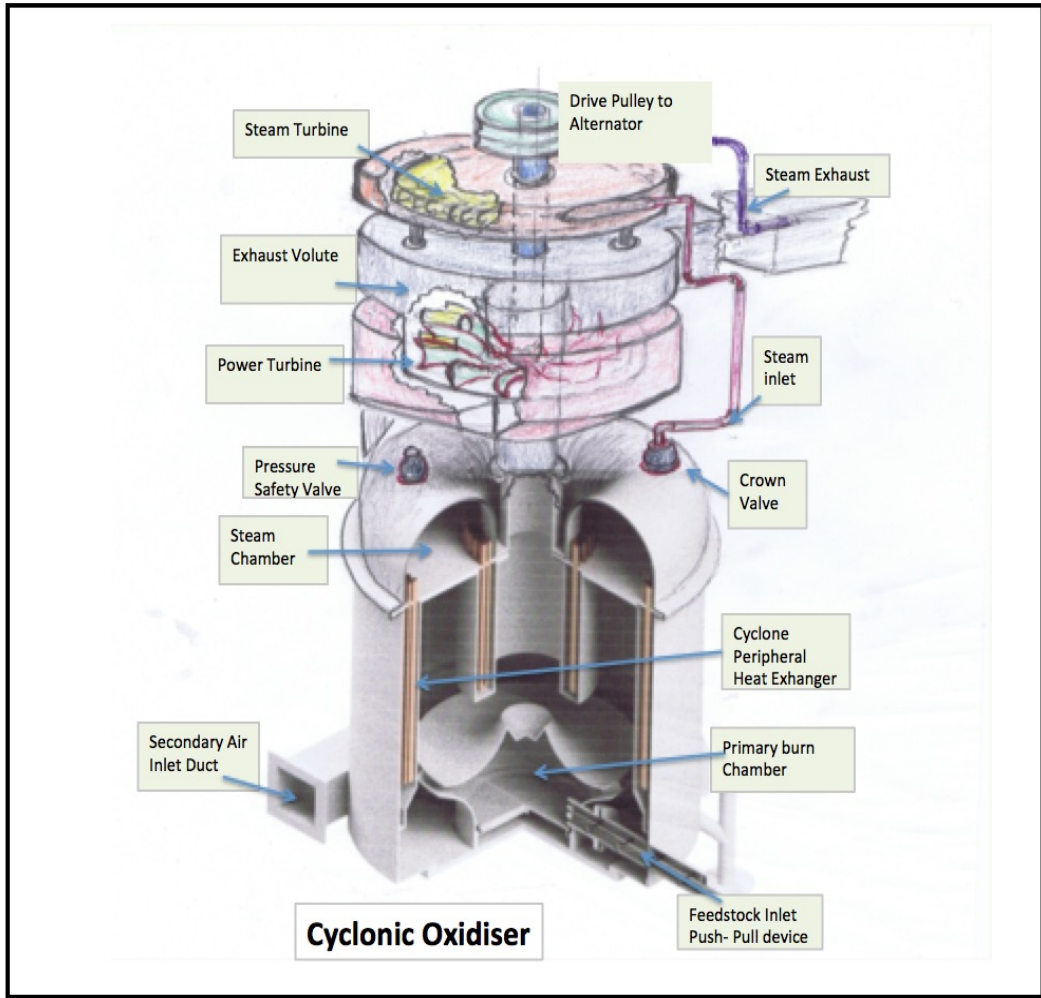


What are the Roflow Pyrogen Products

Cyclonox

Pyrolysis

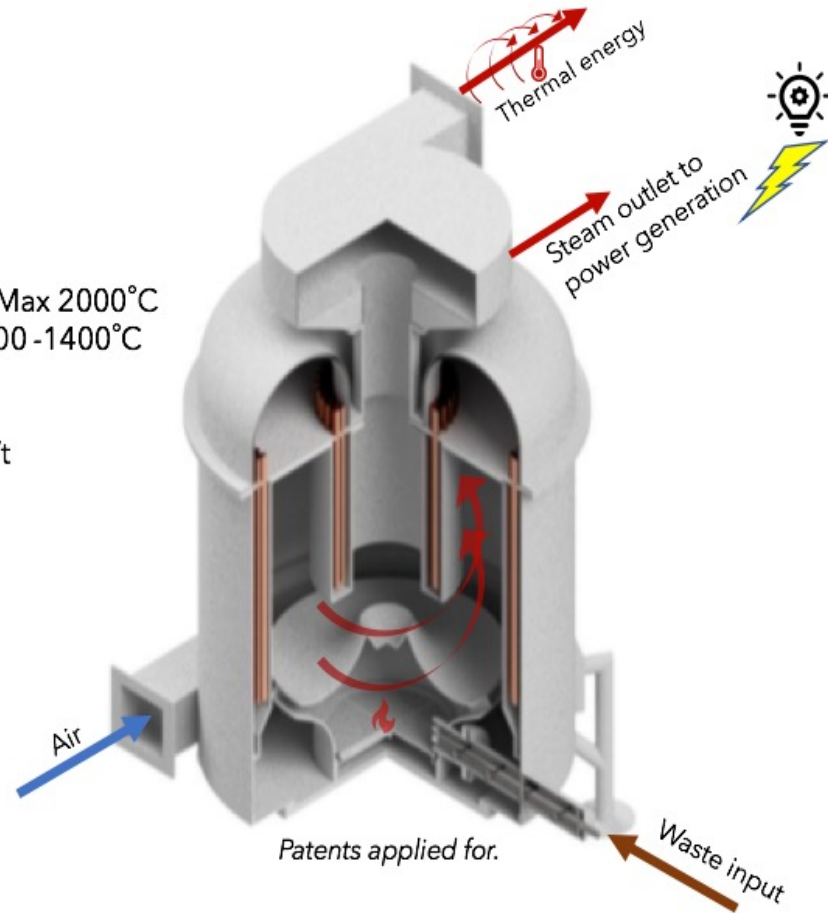
CYCLONOX

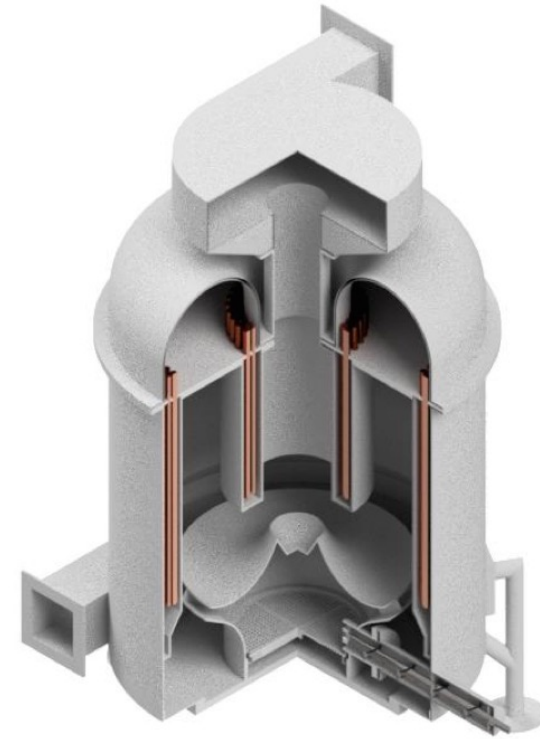
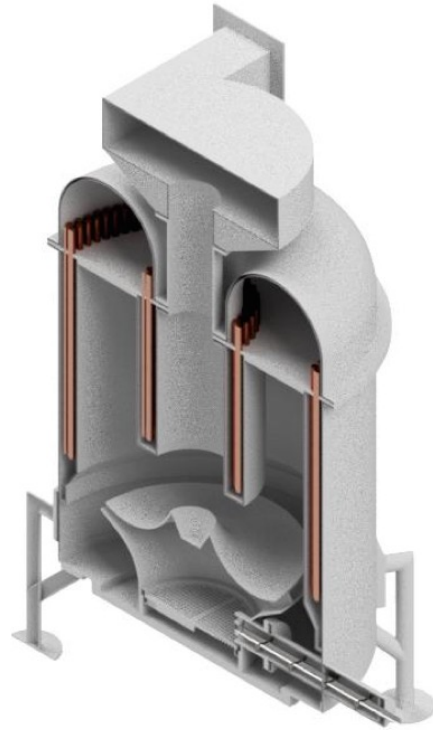
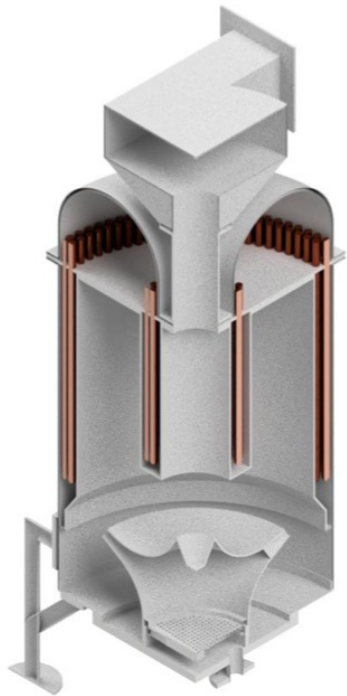


THE CYCLONOX

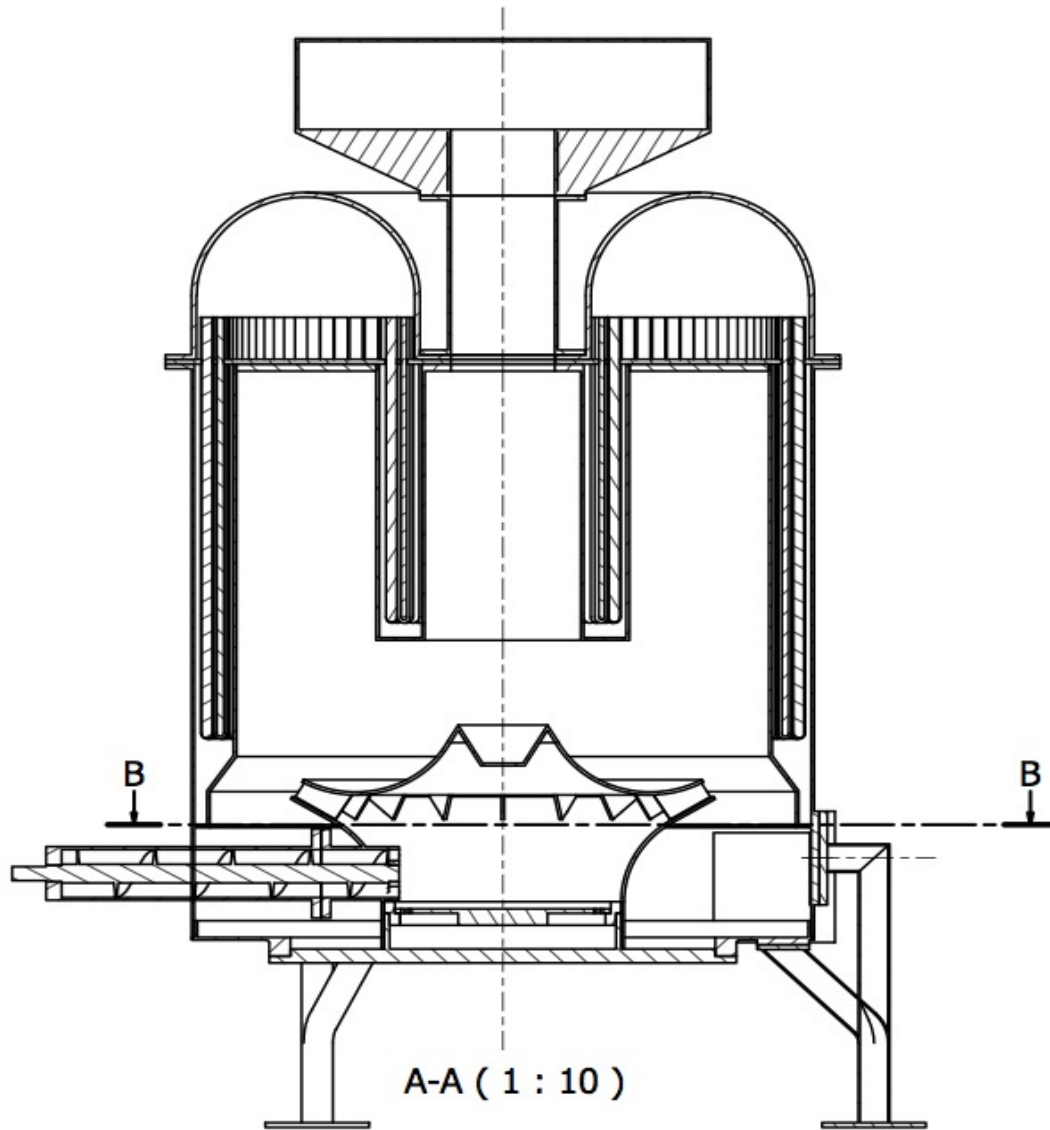
Technical data:

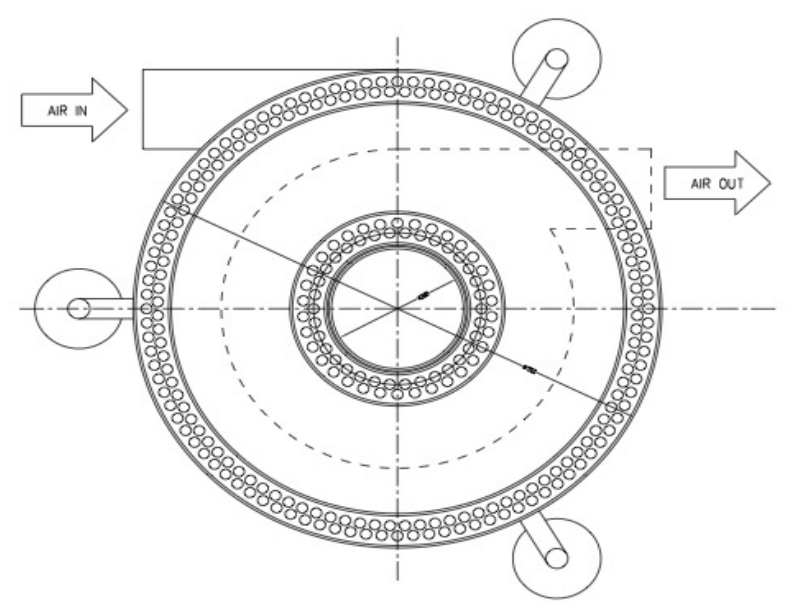
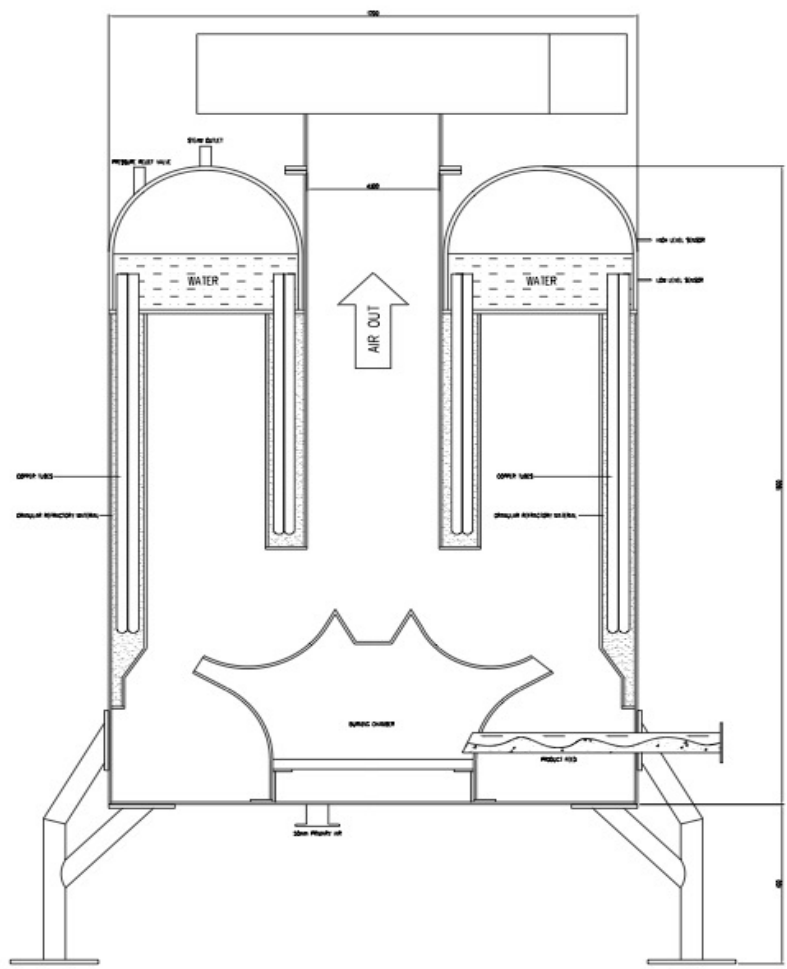
- Inner Temp Range: Min 800°C - Max 2000°C
Average 1100-1400°C
- Air Out Temp: 600-800°C
- Feedstock >20mm
- Feedstock Cal Value: 15-40+GJ/t
- Output: 5-6MWth





ROFLOW ENVIRONMENTAL ENGINEERING **PYROGEN**





IF IN DOUBT ASK

REV	DATE	DESCRIPTION	CHECKED	APPROVED

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ENVIRONMENTAL ENGINEERING

8 WALTON COURT
JARDON, ONTARIO
M2C 2M6

TEL: 905-477-4300
FAX: 905-477-4301

DESIGNER: STEVE MORGAN

PROJECT: PYROLYSIS UNIT

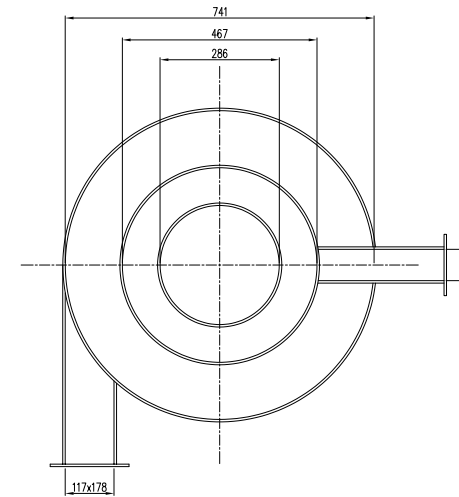
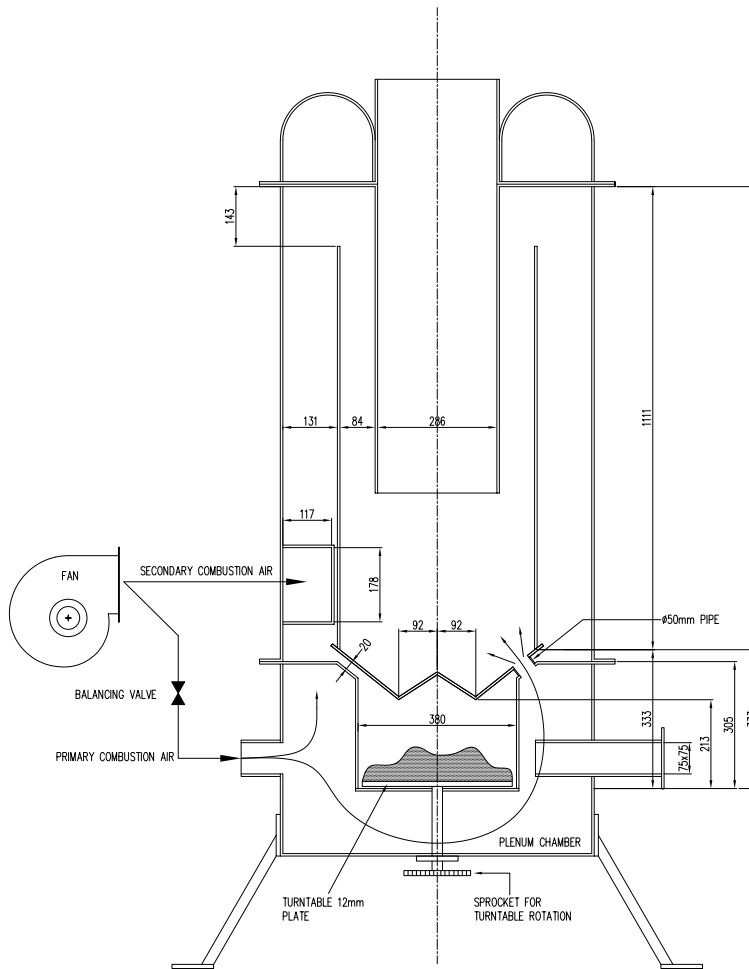
DRAWN: L.S. DATE: 27/07/19

CHECKED: DATE: 27/07/19

SCALE: 1:5 @ A1 SHEET NO: 002

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ROGEN



IF IN DOUBT ASK

REV.	DATE	DESCRIPTION	CHECKED	APPROVED

ROFLOW
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6 HANLON COURT TEL: 0191 428227
WEX 148 FAX: 0191 428211

CLIENT: STEVE MONGAN

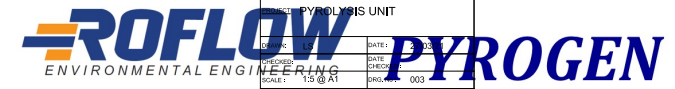
PROJECT: PYROLYSIS UNIT

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ROFLOW ENVIRONMENTAL ENGINEERING *PYROGEN*

- # PYROLYSIS

Tested Feedstock's



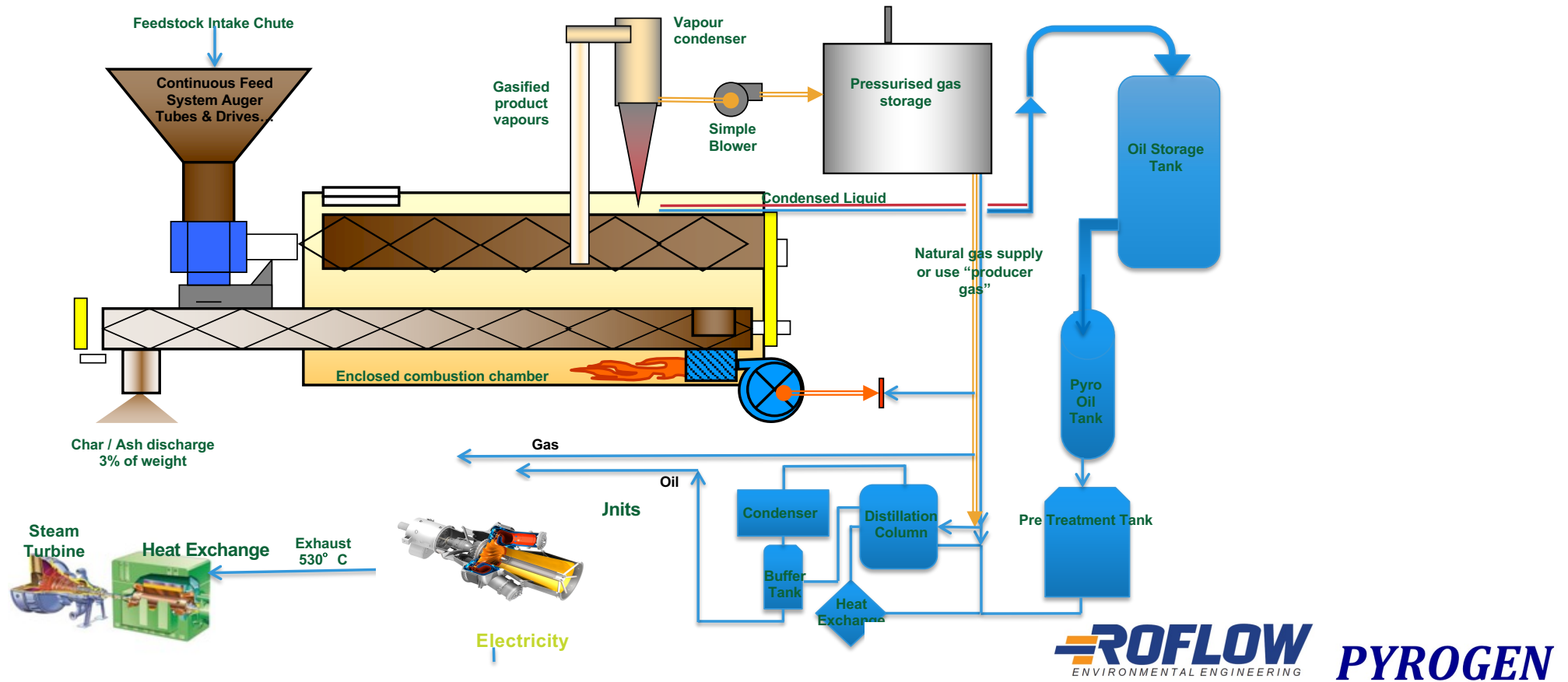
- Municipal Solid Waste (MSW) and (RDF)
- Biomass – Woodchips, Palm Kernel shells, Rice Husks, Walnut shells, Switch grasses, scrap lumber and saw dust, forest debris, bamboo, sugarcane
- Coal
- Tyres
- Plastics – (PE)

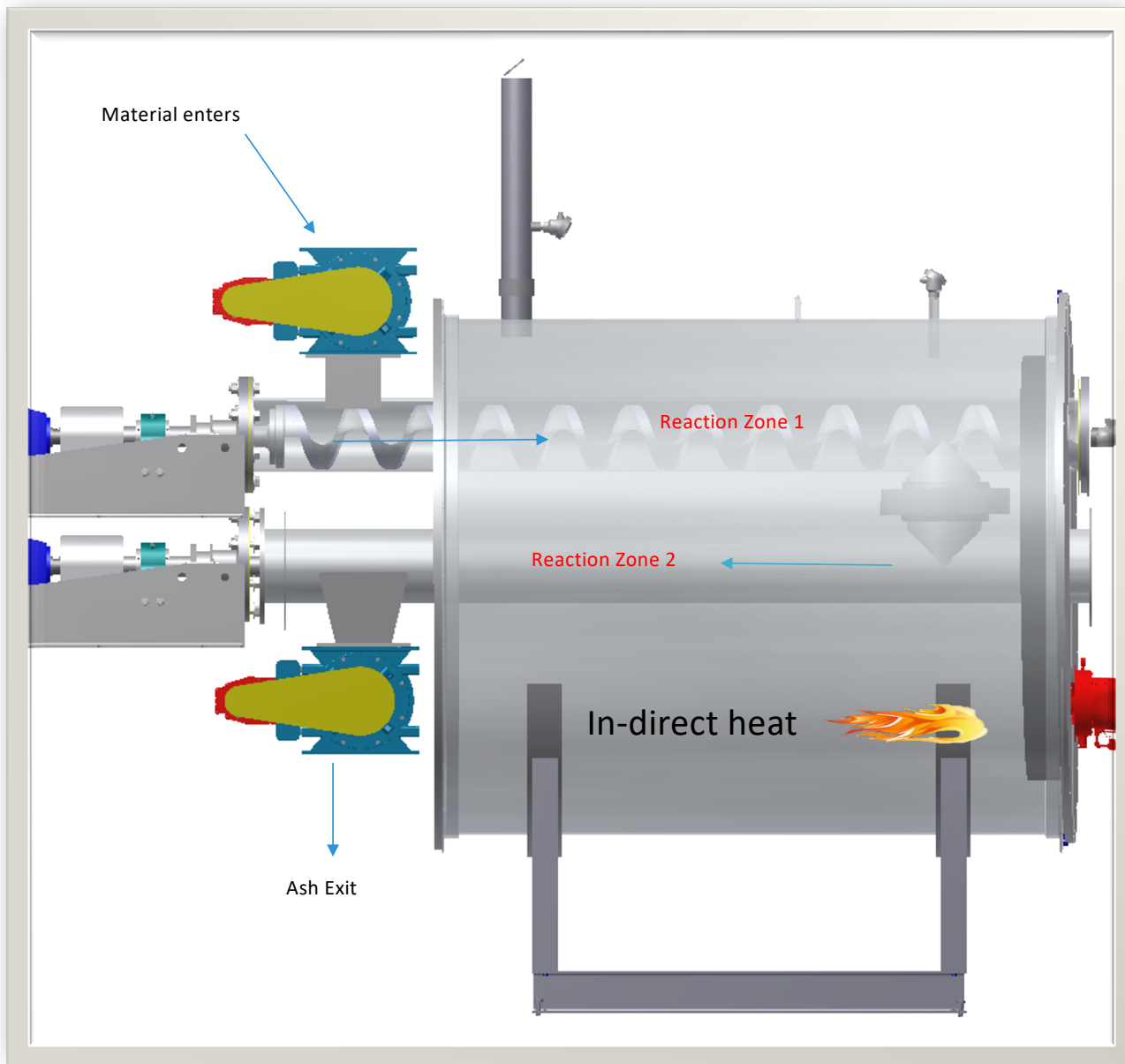


All of the above feedstock's have been tested within Fast Pyrolysis Reactor, each with different energy content and end products

PYROLYSIS

How It Works





Material enters the reactor through the top airlock, this device prevents unwanted air from entering the system. The material is then conveyed through pyrolysis Zone 1 where it undergoes a thermo-chemical reaction. By the time the material enters the Gravity drop, it has lost 70% of the original mass.

The remaining material then enters Zone 2, where a further reduction in mass occurs.

Unlike other Fast Pyrolysis Systems, the FPR is under a constant vacuum which remove the gases from the reactor in less than 2 seconds. They are Immediately condensed to prevent further reactions

INTERNATIONAL INSTALLATION

Dominican Republic

Reactor End Elevation



Reactor House



Control Room



Syngas Cleaning



2-Pyrolysis Reactors
Delivering up to
22MW Electricity
fully operational
since 2012

REACTOR KEY POINTS



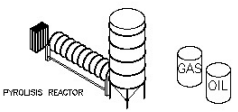


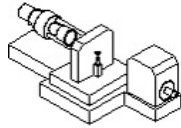
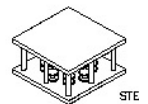
Omni-Reactor
operating on multi
fuel applications ie
Coal, Rice
Husks,RDF

Multi fuel applications ie Coal, Rice Husks,RDF

Gas cleaning and gas condensing section producing
both
Syngas and Bio-Oil

Operational Reactor
Condensing section
Producing Bio-Oil & Syngas

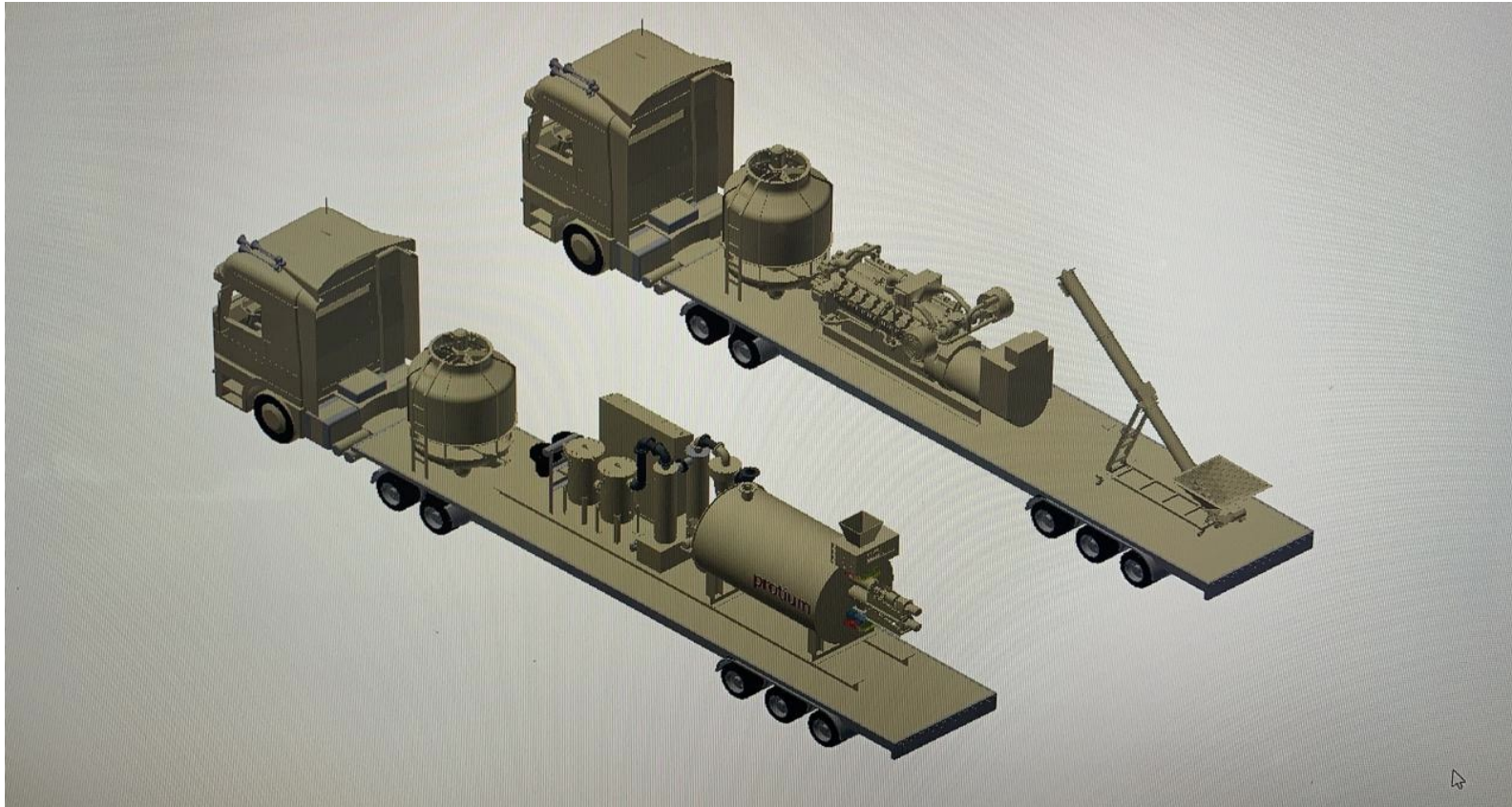
HOW IT WORKS AS A SYSTEM

PYROLYSIS	GAS TURBINE	HEAT EXCHANGER	STEAM TURBINE	STEAM ENGINE
 <p>Diagram showing a pyrolysis reactor (a series of vacuum retort tubes) and two containers labeled 'GAS' and 'OIL'.</p>	 <p>Diagram of a gas turbine engine.</p>	 <p>Diagram of a heat exchanger component.</p>	 <p>Diagram of a steam turbine engine.</p>	 <p>Diagram of a steam engine (piston engine).</p>
<p>PYROLYSIS IS A THERMAL REACTION PROCESS CONDUCTED THROUGH A SERIES OF VACUUM RETORT TUBES CONVERTING WASTE MATTER INTO A HIGH VALUE SYNTHESIS GAS</p>	<p>THE GAS TURBINE HANDLES ALL FORMS OF GAS & OIL PRODUCED FROM A PYROLYSIS PROCESS INDEPENDENTLY OR CONCURRENTLY</p>	<p>AN EFFICIENT HEAT EXCHANGER CONVERTS THE ENERGY FROM THE GAS TURBINE EXHAUST INTO STEAM WHICH DRIVES THE STEAM TURBINE</p>	<p>A STEAM TURBINE DRIVEN BY THE HEAT EXCHANGERS' HIGH PRESSURE OUTPUT, CONVERTING IT TO LOW PRESSURE AND POWERING THE STEAM ENGINE</p>	<p>THE PISTON STEAM ENGINE EXTRACTS AND CONVERTS THE LOW PRESSURE STEAM INTO ELECTRICITY, DELIVERING IT INTO THE GRID</p>
<p><i>EXCLUSIVE GLOBAL LICENSE INCLUDING MANUFACTURING LICENSE</i></p>	<p><i>PATENT GRANTED FOR THE APPLICATION OF THE PROCESS</i></p>	<p><i>PATENT GRANTED FOR THE APPLICATION OF THE PROCESS</i></p>	<p><i>PATENT GRANTED FOR THE APPLICATION OF THE PROCESS</i></p>	<p><i>PATENT GRANTED FOR THE APPLICATION OF THE PROCESS</i></p>

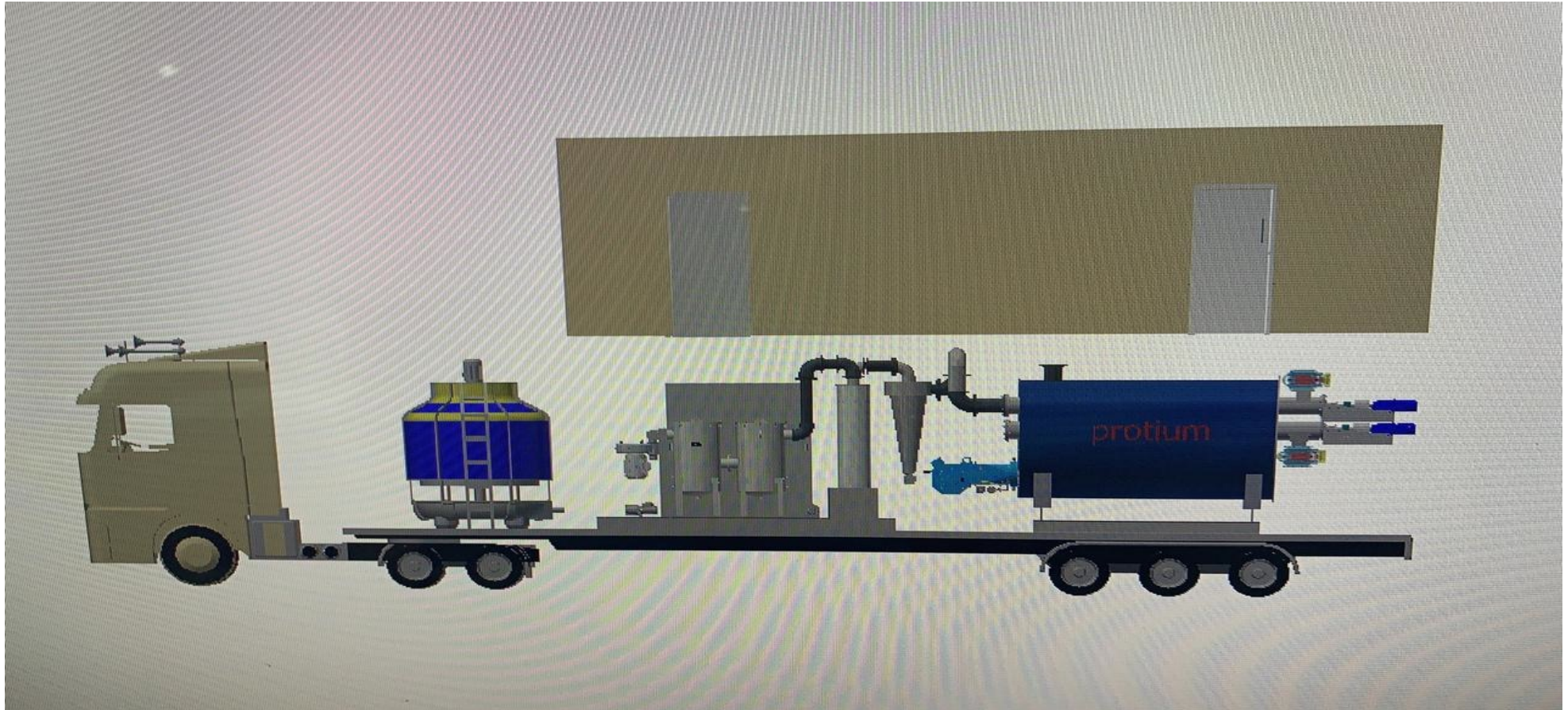


ROFLOW ENVIRONMENTAL ENGINEERING **PYROGEN**

REACTOR + GENERATOR MOBILE SCHEMATIC



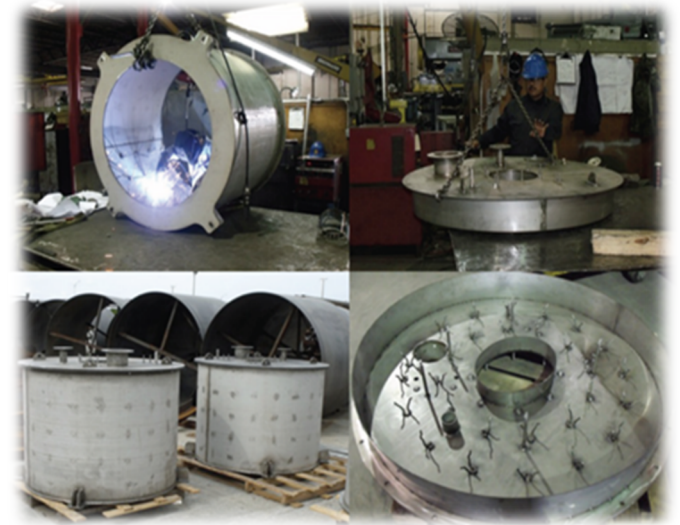
CONTAINERISED REACTOR



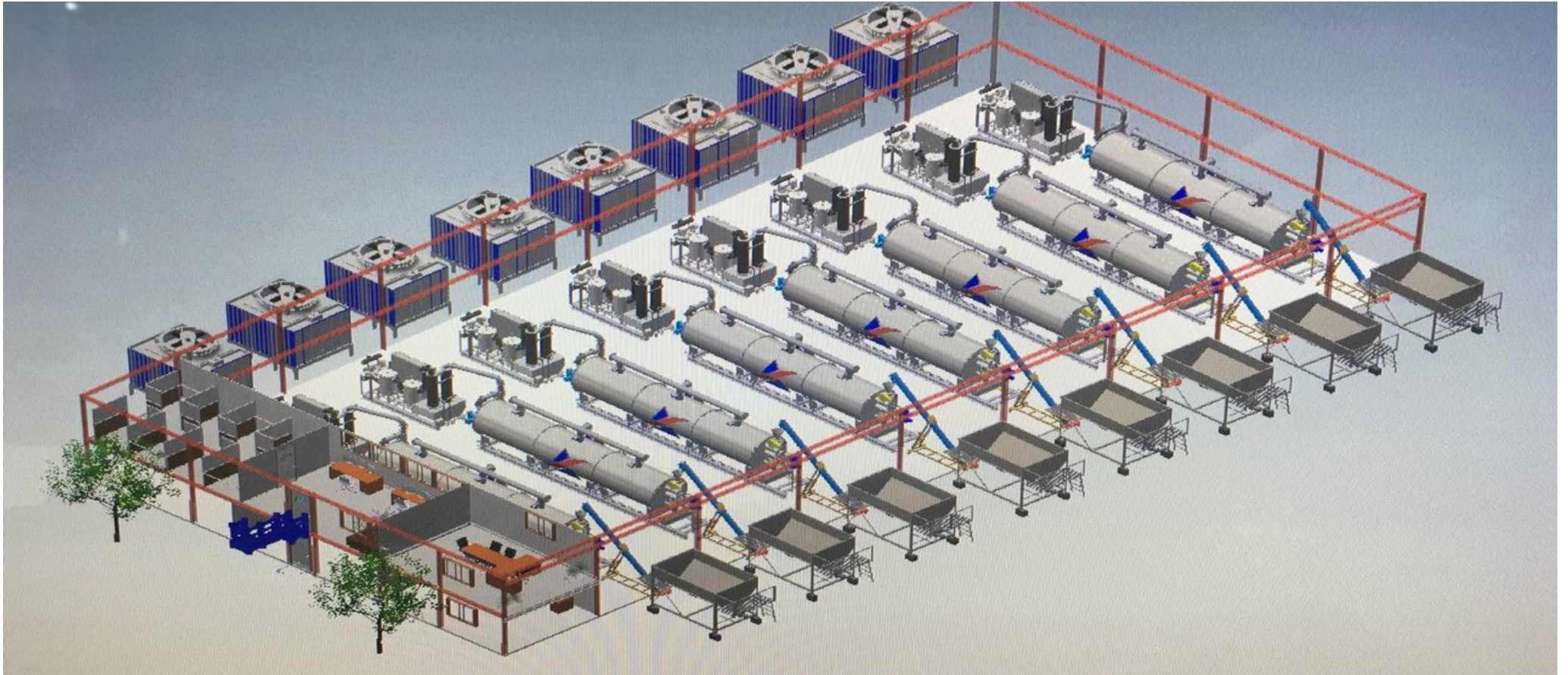
THE ROFLOW PYROGEN ENERGY GENERATION DELIVERS

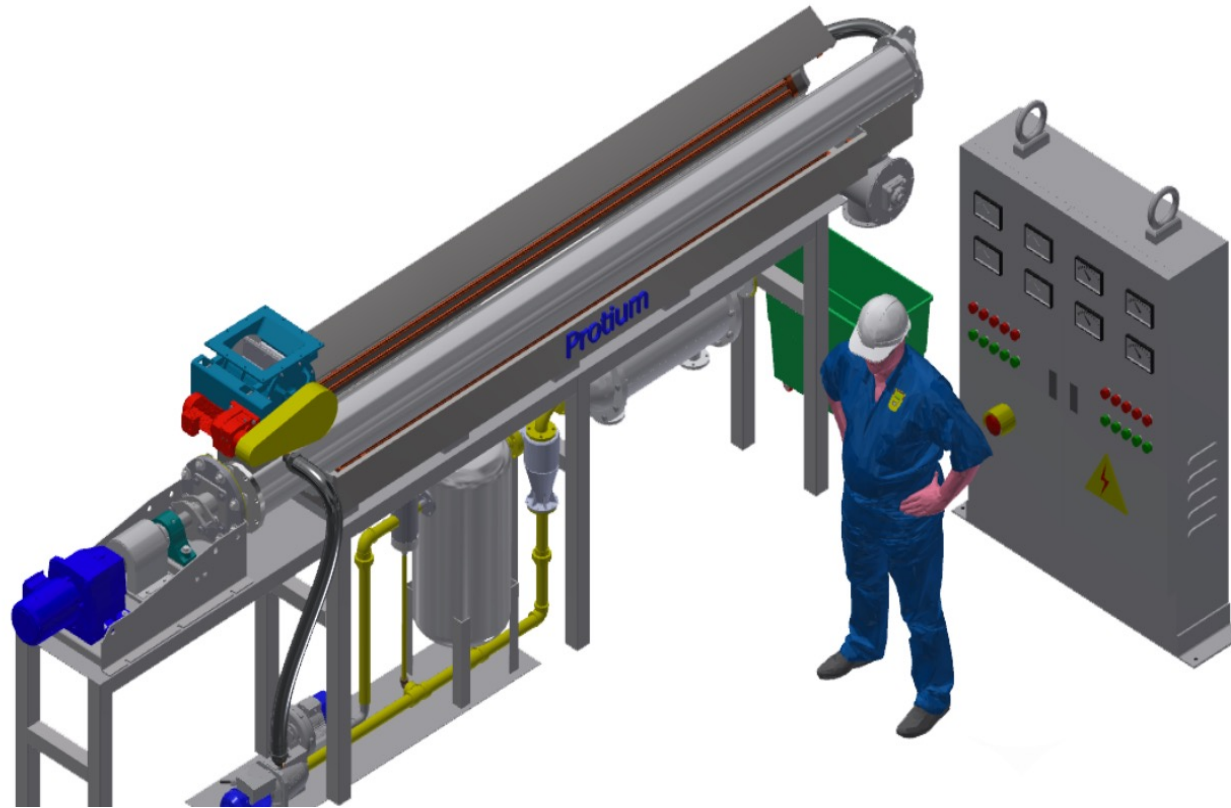
ROFLOW Energy Generation

- Change feedstock's with the push of a button – no equipment changes are necessary
- *24 hrs 7 days a week operational all year round*
- No harmful emissions from the system
- Reactor power's itself once gas is being produced
- Overall system efficiency above 90%
- Ease of operation and Maintenance
- Our housed – containerized units can be installed in 1 day
- System can produce gas and oil simultaneously for power generation
- Reactors are modular – Add units as your profits grow

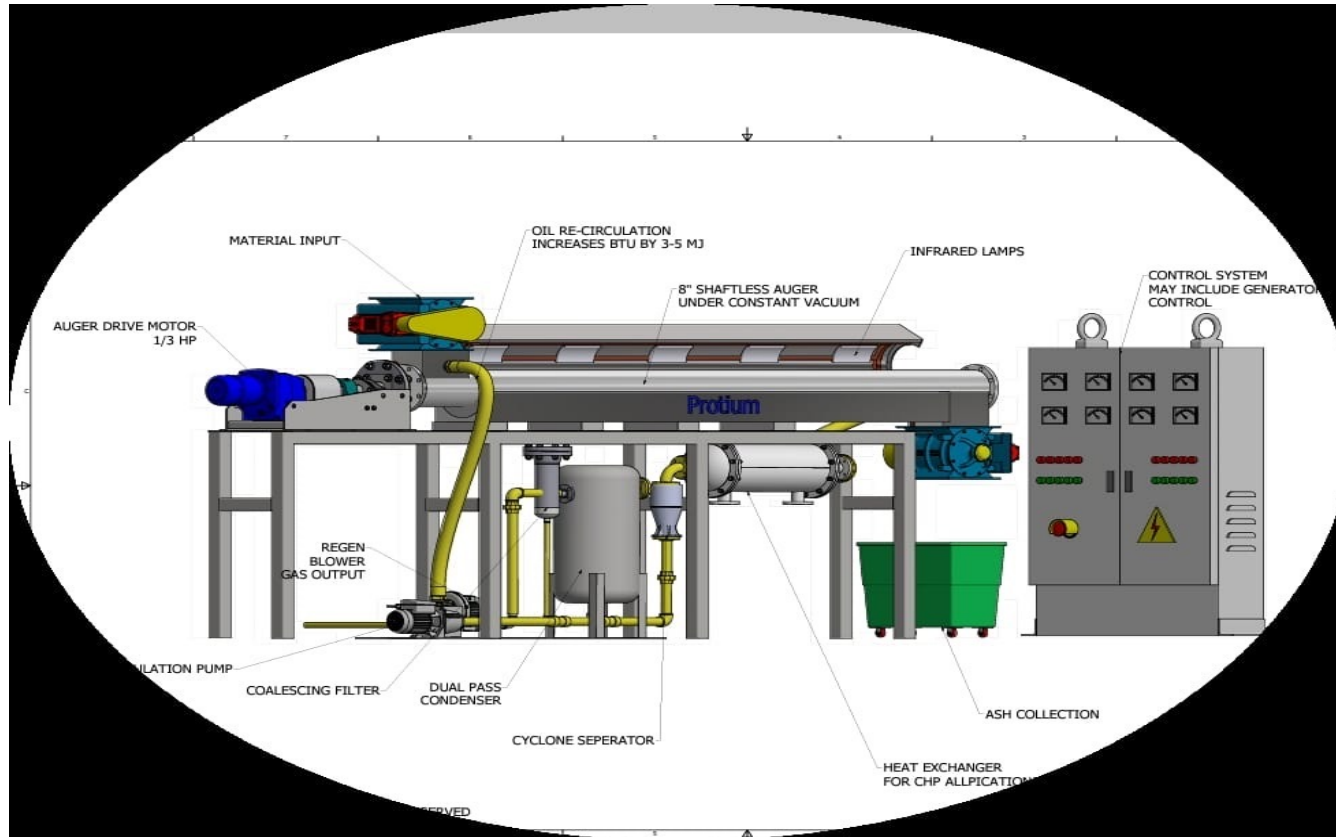


MULTI-CONFIGURATION REACTORS





ROFLOW ENVIRONMENTAL ENGINEERING **PYROGEN**



Carbon Neutral – What this really means...

The phrase carbon neutral simply means any activity that would normally consume energy provided by fossil fuels in one form or another which produces carbon dioxide. In turn this activity can be balanced out by other activities that produce renewable energy of a similar amount. The principle being that one activity balances out the other.

Our process will produce between 5 and 10 times more renewable energy than the energy it consumes. We may be about to invent a new terminology, but we would describe this as Carbon Negative 10. As we continue to improve our process efficiencies we would expect to improve upon this by some margin.

In real terms, an average sized plant could provide enough renewable energy to supply the total electrical needs of between 7,000 – 10,000 homes. We are unaware of any other technology that can even come close.

To do anything else with our waste ... now that would be a waste!

- **WHY POLITICS HASN'T HELPED**



INTELLECTUAL PROPERTY

WHAT DOES INTELLECTUAL PROPERTY COMPRISE OF ?

ESSENTIAL PATENTS –

Electricity Generation System

Pyrolysis Waste to Energy – Mini System

Cyclonox Waste Destruction & Energy Generation

ALL PATENTS HAVE THE MASTER LICENCE HELD EXCLUSIVELY INTO PYROGEN TECHNOLOGY LTD AND THEN LICENCED INTO ROFLOW PYROGEN LTD OPERATING COMPANY AND SUBSEQUENTLY INTO EACH PROPOSED SPV.



CONCLUSION

- What we have seen today isnt the whole solution , but if the science is adopted on a growing scale – we can make a difference.
- Perhaps one of the worlds leading public voices is Sir David Attenborough
- Here are two recent quotes of his;

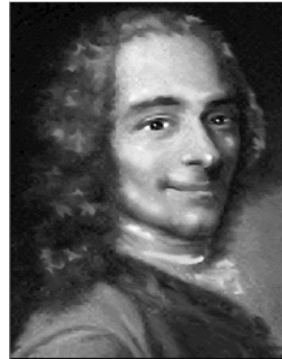
“ Climate Change is a looming disaster and time is running out-
but there is *Hope* “



“ Waste “

- Lets hope his best wishes for our success can be a springboard for moving forward

- “To preserve and renew ----
- ----- is almost as noble as to create”



Voltaire (Philosopher)
1694 - 1778

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PYROGEN