



Our Oceans. Our Planet. Our Future

Sustainable Solutions to Save Our Planet: Profitably. PowerHouse Energy Group: PHE



POWERHOUSE
ENERGY GROUP

The Leading Waste-to-Energy Solution
Distributed Modular Gasification®

The UK Pioneer in Waste-to-Hydrogen Solutions



INVESTOR PRESENTATION

Keith Allaun | CEO

A NEW ECONOMIC MODEL TO PRODUCE HYDROGEN FROM WASTE



In the US and UK
550 Million
Thrown Away Every Day

Worldwide, Over
500 Million
Plastic Bottles Used Every Year



Worldwide, Up To
1 Trillion

Plastic Bags Discarded Every Year



Over
300,000
Plastic Beads In A
Tube of Facewash

MISMANAGED WASTE

Our Planet in Peril

Since the 1950's plastic production has increased from 1.7 million tonnes to nearly 300 million tonnes every year **and roughly half of that is made for single use!**

It is likely that in the first ten years of this century we have used more plastic than we did during the whole of the last and event more staggering is that **there is more plastic in the open ocean than plankton**; plastic is being eaten by marine life. ^{1 4}



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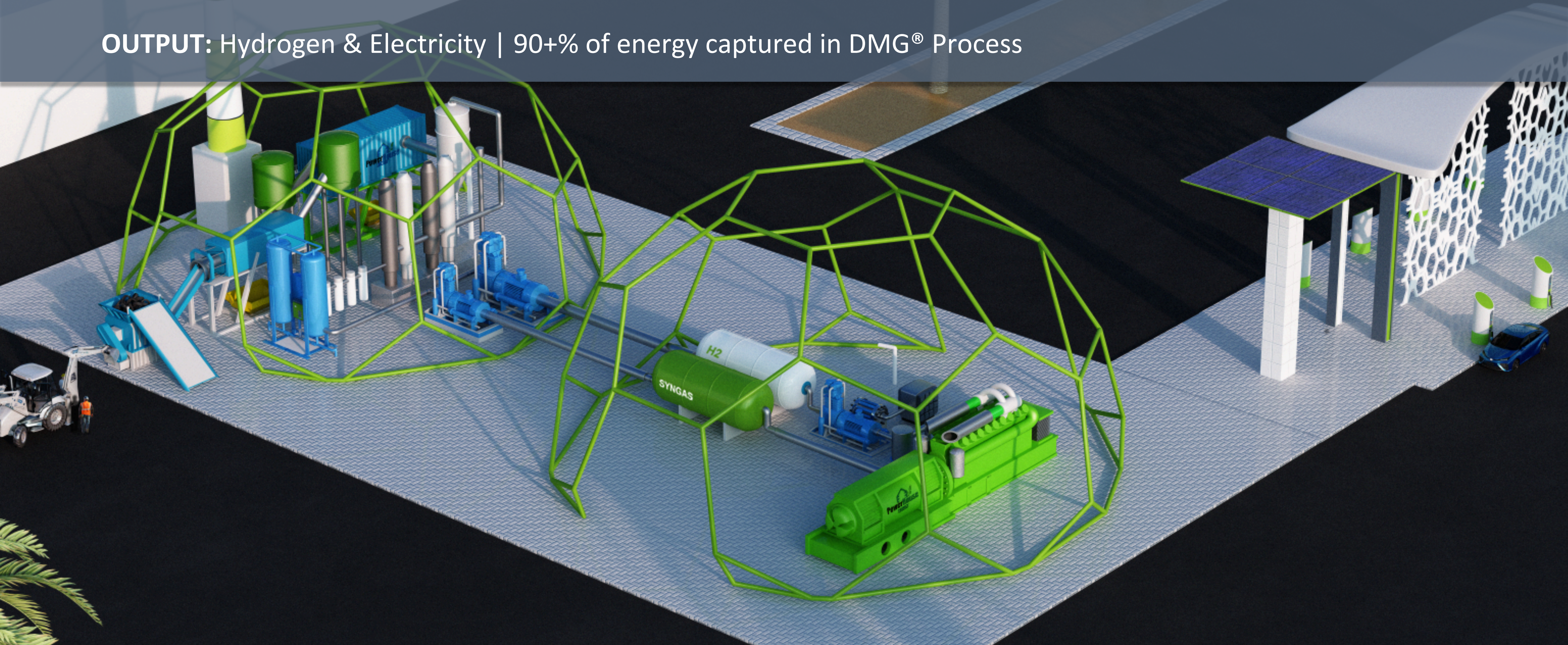
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Our Mission

ERADICATE WASTE PLASTIC, PROVIDE CLEAN ENERGY & HYDROGEN - PROFITABLY!

INPUT: Capable of gasifying difficult waste streams | 25 tonnes per day operation per module

OUTPUT: Hydrogen & Electricity | 90+% of energy captured in DMG® Process



Hydrogen Production Processes

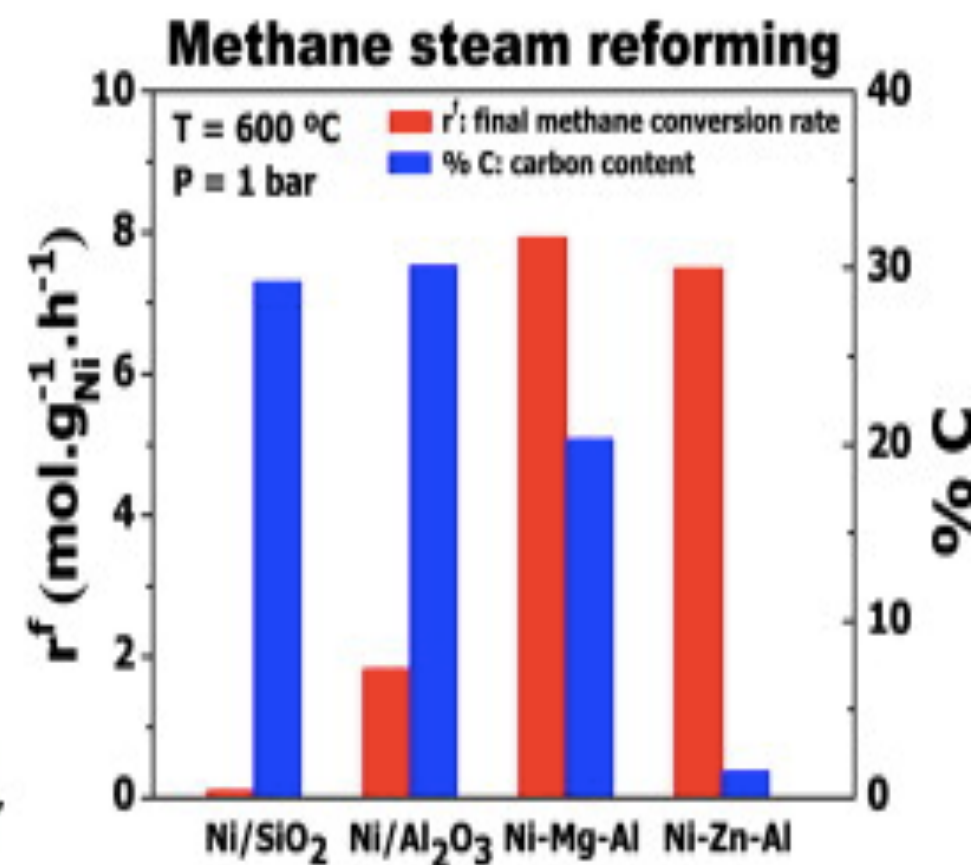
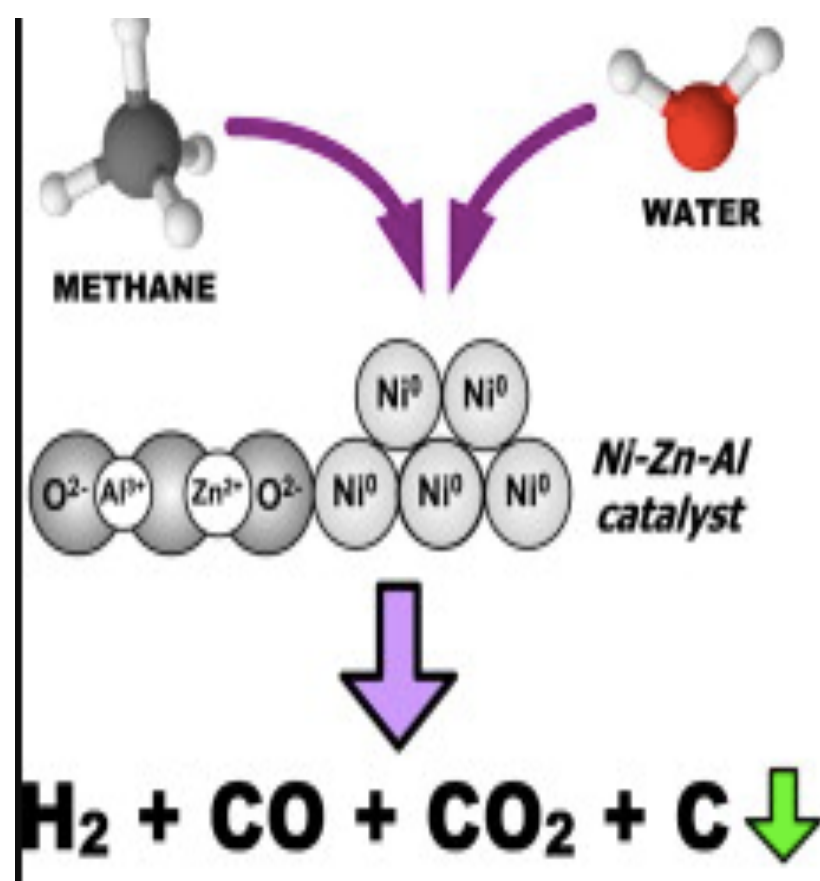
Dirty Secret behind 95% of H₂ produced today

Traditional Method

HYDROGEN PRODUCTION



CO₂ PRODUCTION



PHE Method

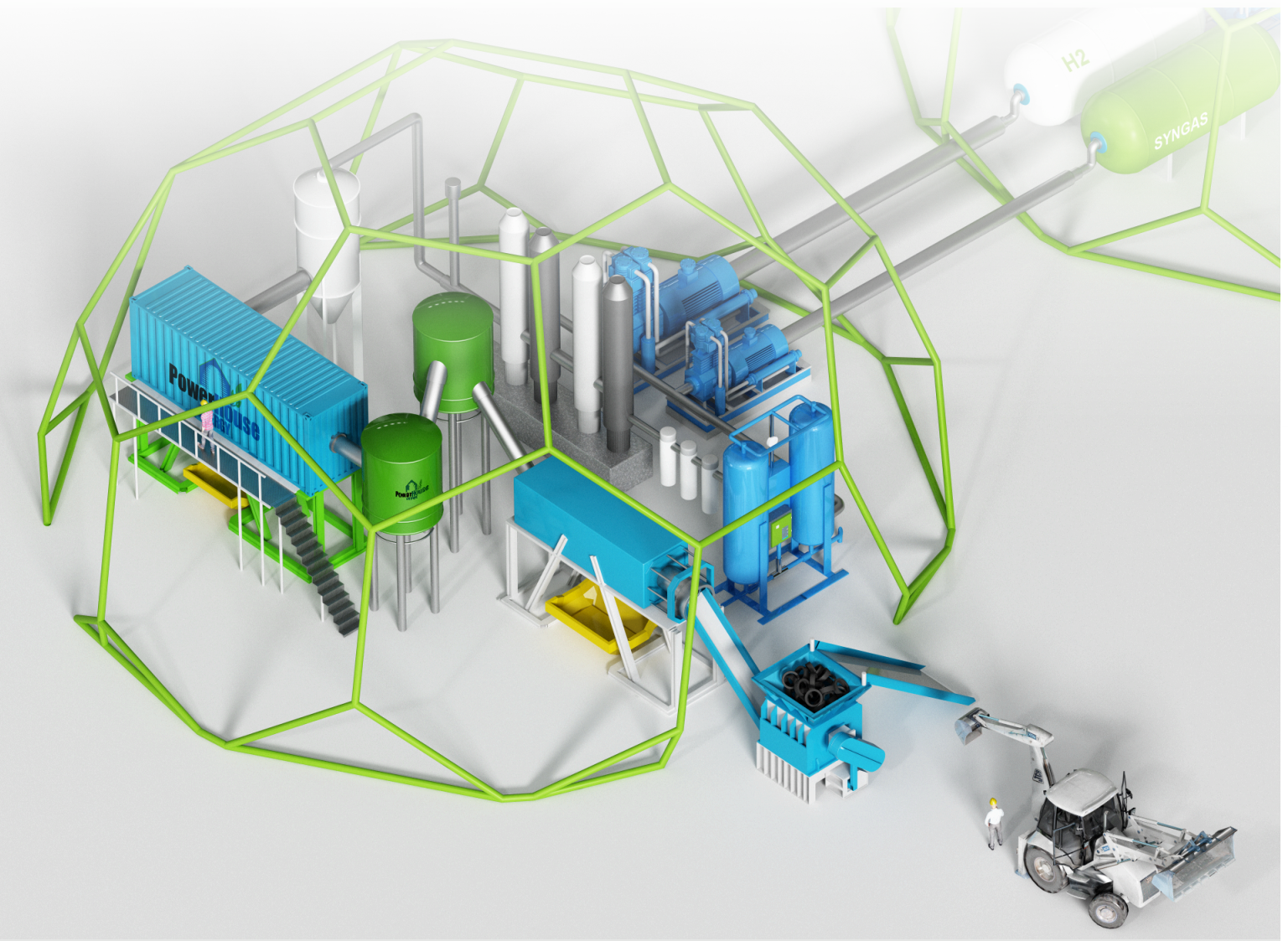
HYDROGEN PRODUCTION



CO₂ Production



MW ELECTRICITY





A Global Concern

PLASTICS

- About 4 percent of the petroleum consumed worldwide each year is used to make plastic, and another 4 percent is used to power plastic manufacturing processes
- In Europe, 26 percent, or 6.6 million tonnes, of the post-consumer plastic produced in 2012 was recycled, **while 36 percent was incinerated**. The remaining 38 percent of post-consumer plastics in Europe went to landfills
- In the United States, only 9 percent of post-consumer plastic (2.8 million tonnes) was recycled in 2012. The remaining 32 million tonnes was discarded

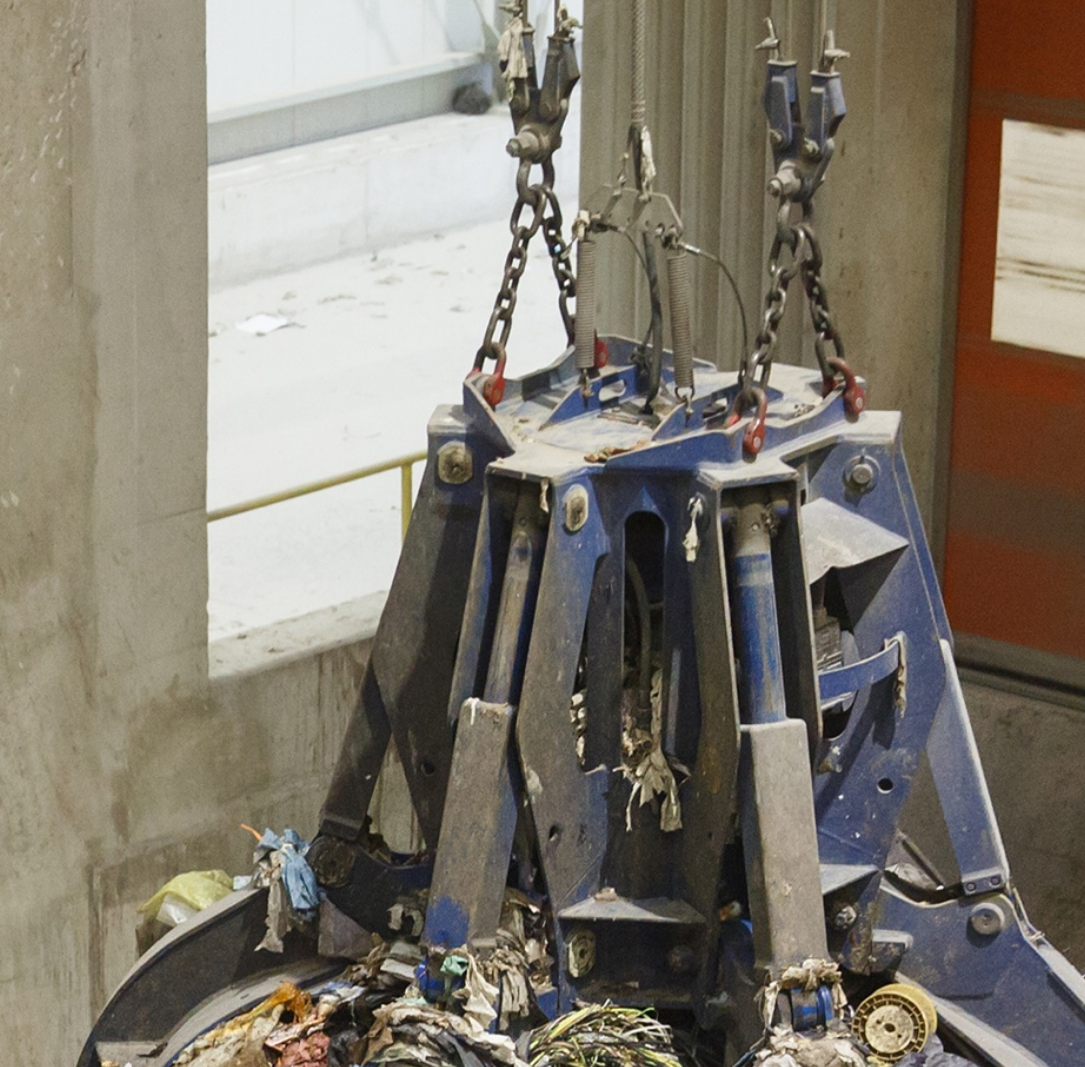
TYRES

- Total amount **of rubber recycled at its end-of-life: typically 3–15%**
- Amount of waste rubber re-used in some way (e.g., retreading, new products and so on): 5–23%
- Amount of waste rubber consumed for energy recovery: 25–40% **(Incinerated)**
- Amount of **waste rubber sent to landfill** or stockpiled: 20–30%



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There is a massive demand, globally, to deal with waste plastic – the *Environmental* and *Economic* costs are now completely, and inextricably , entwined



Feedstock Focus

Eliminate Plastic Waste & Used Tyres

DMG® Technology can utilize any waste for the feedstock, but PHE is focussing on the abundance of global tyre and plastic waste

Supply

- **800m** tonnes of waste plastic already exists
- **300m** tonnes of virgin plastic is produced each year.
- **Only 9%** is recycled world-wide.
- **8 MILLION TONNES END UP IN OUR OCEANS EACH YEAR**
- **70M** end-of-life tyres in UK p/a

Value

- Waste plastic and tyre crumb has a high calorific content which enables the **extremely effective** extraction of **hydrogen**
- Gate fees range from £70 - £220 per tonne



THE HYDROGEN ECONOMY

- The hydrogen produced by DMG[®] can support the acceleration of the burgeoning hydrogen economy
- Linde BOC independent analysis states that PowerHouse Energy's DMG[®] System can achieve 99.999% road-fuel-quality hydrogen
- The Hydrogen Council €10B Investment in Europe alone

Traditionally held back by cost and distribution

A lower cost will support the development of the hydrogen economy:

- £3/kg is comparable to the price of current hydrocarbon-based fuels
- Ability to mix with diesel or, even better, to power hydrogen & hydrogen fuel-cell powered vehicles
- Lower cost will enable participation from commercial transport corporations (bus operators, etc.)

Current cost of
hydrogen per kg

£10-£12

Anticipated cost of
hydrogen per kg using
PHE's DMG[®] system

£3



PowerHouse Energy's Market Focus

The Transport Sector



Electric Vehicles (EVs)

- ✓ Lithium ion battery
- ✓ Ability to recharge at home (hmmm)
- ✓ Zero tailpipe emissions
- ✗ Range anxiety
- ✗ Charging - availability and time
- ✗ Price
- ✗ **Transfer** of CO₂ footprint

VS.

Hydrogen Fuel Cell Vehicles (FCVs)



- ✓ Carbon negative footprint
- ✓ 10 year lifespan
- ✓ Extended range
- ✓ Co-firing H₂ with diesel
- ✓ Plug into home to power residence
- ✓ PHE H₂ SAME COST AS DIESEL

How PowerHouse Energy is Different

A NEW MODEL OF CLEAN, DISTRIBUTED HYDROGEN

01

FOCUS

PHE focuses on hydrogen for use in transport – a significant market with no dominant player.

Historical **FOCUS** on hydrogen has been for industrial uses.

02

CLEAN

PHE does not use steam methane reformation and the process produces 1/16th as much greenhouse gas as SMR.

H₂ demand in **transport** is growing tremendously.

03

DISTRIBUTED

PHE's modular units have a small footprint and the hydrogen and electricity is able to be used locally or fed into the grid.

PowerHouse Energy's DMG[®] is **CARBON NEGATIVE** with the **ABILITY TO SCALE**



Revenue Model

DISTRIBUTED MODULAR GASIFICATION: DMG®

- Requiring just a **half-acre** of land, PHE’s comparatively small scale Distributed Modular Gasification DMG® solutions can be **sited where they are needed**
- We **bring the solution** to where the problem lies
- A single site can process 25-100 tonnes of mixed plastics per day
- Each tonne of mixed plastic attracts a gate fee* of at least £80.
- Tyres command a gate fee of up to £220 per tonne

Gate Fee (per ton)	Tons Processed (per day)	Gate Fee (per day)	Gate Fee (per annum)
£80 (mixed plastic**)	25	£2,000	£700,000

*A gate fee is the charge levied upon a given quantity of waste received at a waste processing facility

**Indicative of average gate fees charged by landfills

Revenue Model

DISTRIBUTED MODULAR GASIFICATION: DMG®

- Distributed Modular Gasification implementations, and associated energy output, are dependent on the purity of synthetic gas (syngas) derived from the DMG® System.

*	Syngas Quality	Conversion Technology	Capex*	IRR	Electricity Output (MW per day)	Electricity Sale (£ per annum)**	Hydrogen Output (ton per day)	Hydrogen Sale (£ per annum)***
Level 1	Adequate	Steam Cycle	@£5m	@13%	1.2MW	£570,000	N/A	N/A
Level 2	High	Gas Engine	@£5m	@16%	1.6MW	£768,000	N/A	N/A
Level 3	Very High	Pressure Swing Adsorption	@£10m	@25% + ***	1.3MW	£624,000	1 tonne+	£1.75m

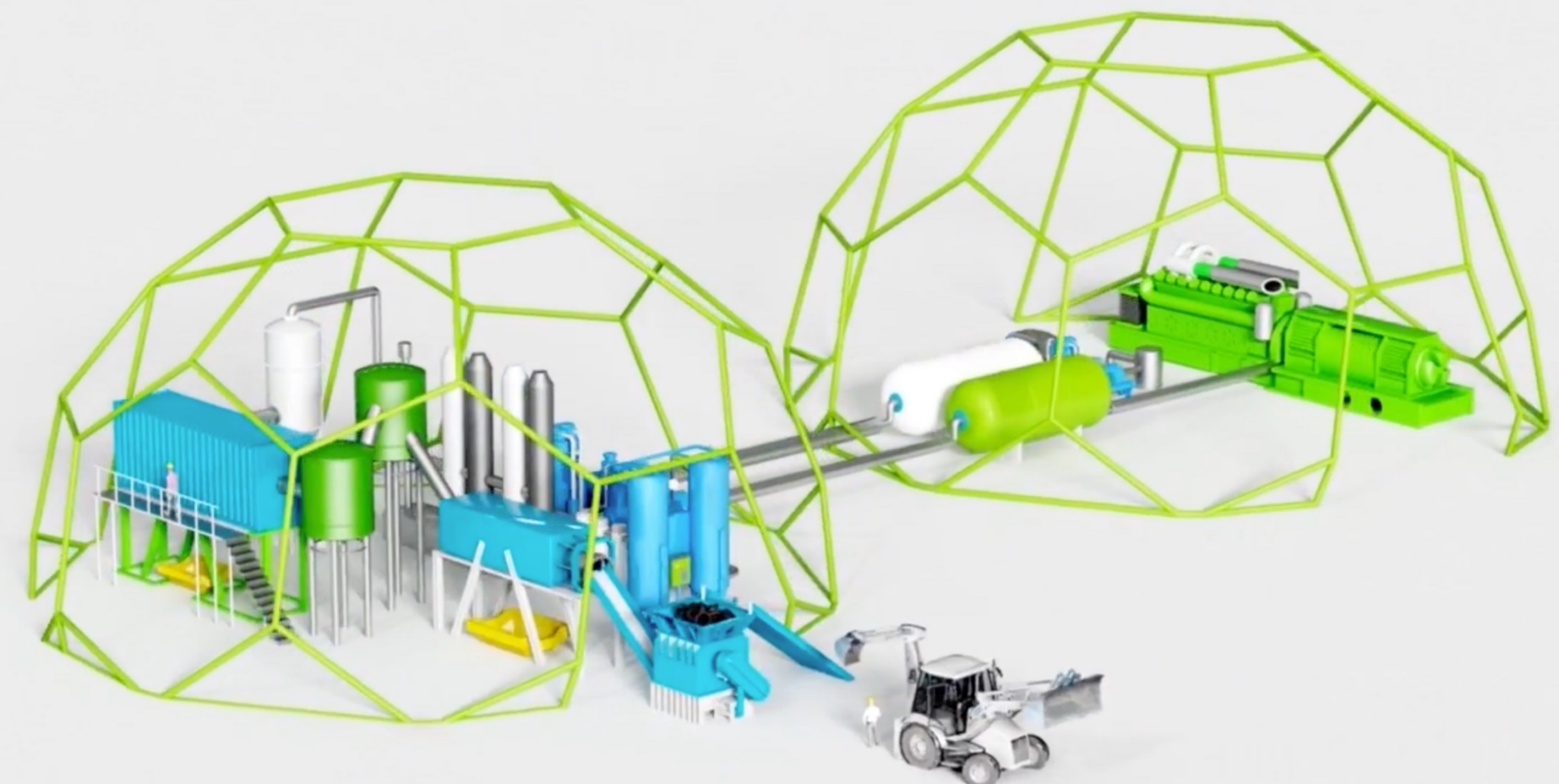
* Capex Numbers Indicative of long-term projections for multiple unit build-out
** Assumes £60 per MWh on private wire
*** Assumes £5,000 per ton. Current retail cost is £10-£13 per kilo or up to £13,000 per tonne.

ALL NUMBERS ARE INDICATIVE ONLY

Outlook

SIGNIFICANT PROGRESS MADE AND THE PATH AHEAD

- Continuing design work of the first commercial DMG® system
- Building, commissioning and full-scale operation of the first commercial DMG®
- Working with Peel Environmental **in advancing the planning and other permissions** for the first Cheshire site
- Signing agreements on the feedstock for the commercial G3-UHt system and on the ultimate use of the syngas and hydrogen
- Creating an **expansion plan for the further development of the Cheshire site**
- Continuing to explore **worldwide partnering and licensing** opportunities for the DMG® system, including the possibility of **DMG® networks in Qatar, East Asia, continental Europe and the USA**
- Seeking and agreeing strategic alliances, and pursuing other initiatives, in transport-related fuel cell applications: **industrial, consumer, marine**



BE PART OF THE HYDROGEN REVOLUTION

We have an earth-friendly technology that we believe will become the **GO-TO SOLUTION FOR HYDROGEN REFUELING STATIONS** globally. Our DMG® system is completely turnkey, converting waste to hydrogen for less than £3* per kilo.

1 SUSTAINABLE

Revenue Generation: Collect a tipping fee for gathered waste that is converted to green hydrogen	The DMG® can accept waste with high caloric value , e.g. tire crumb, vs. other waste treatment systems	Average thru-put: Approx. 25 tons of waste/per module /day, at an average rate of \$80/ton
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2 VIABLE

Green hydrogen produced from waste can be sold	Production cost: £3*/kilo—Markup: upwards of 300%	Compare to average price of hydrogen in UK:£12/kilo
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3 FUTURE

Unused hydrogen can be directed to stationary fuel cells	Generate green electricity at extremely high efficiency conversion (60%)
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DMG® is the FUTURE! (*indicative based on est. OpEx only and 1tpd H2 production)



PERSEVERANCE PAYS OFF

When Given The Chance

The Model T was built by the Ford Motor Company from **1908 until 1927- a two decade run of dominance!** Conceived by Henry Ford as practical, affordable transportation for the common man, it quickly became prized for its **low cost, durability, versatility, and ease of maintenance.**

Assembly-line production allowed the price of the touring car version to be **lowered from \$850 in 1908 to less than \$300 in 1925.**

The Cleanest Fuel

The Future of our Planet

UK Target of up to 200 sites in the next 10 years

EU Target of up to 500 sites in the next 10 years

- PHE will Build, Own, Operate the DMG® facilities
- May partner with “Big Brothers” in industrial and consumer transport
- Significant interest from FCV manufacturers
- Early adopters: councils, distribution centers, MRFs
- Potential franchise model – with co-investment with franchisees
- Active interest in licensing by multiple firms worldwide



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