Turquoise Hydrogen via Methane Pyrolysis

Decarbonizing Industry with Solid Carbon Co-Products

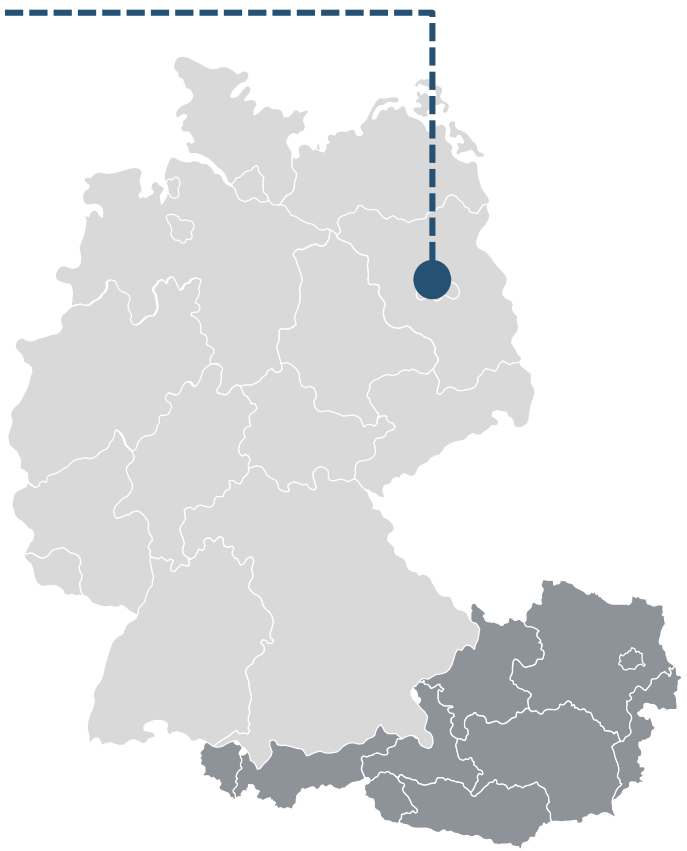
GRAFORCE

Headquarter and Production

Our office is located in Adlershof, in the heart of Germany's largest technology cluster called WISTA with over 1,200 technology companies and over 22,000 employees. Our strategic partner should provide production capacities when production ramps up.

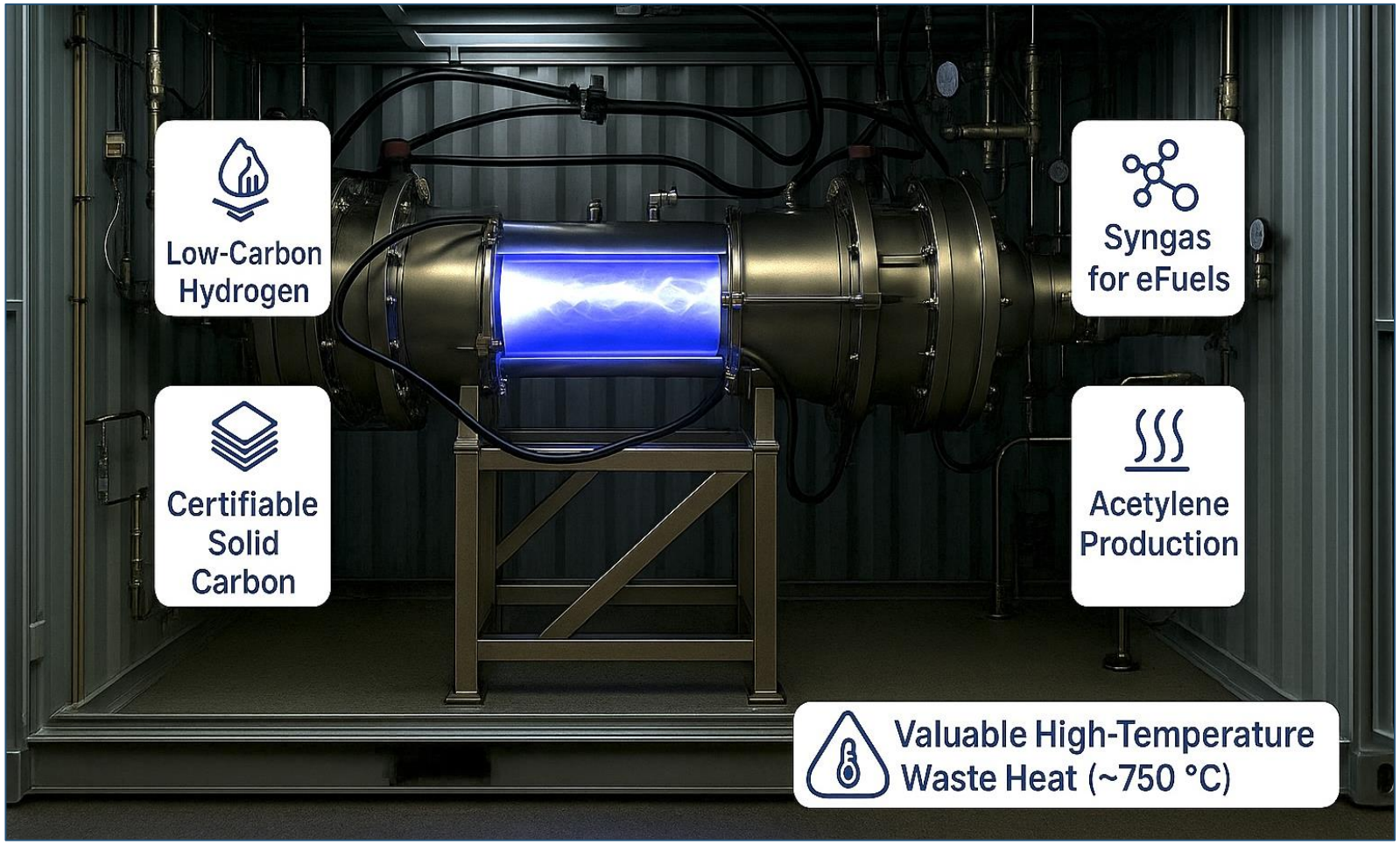
Berlin, Germany
Headquarters and R&D

Founded in	2012
Total size	c. 440 m²
Function	Office & laboratory
Headcount	25 FTE



Potential markets of Graforce Cross-Cutting Plasma technology

Graforce‘s Business is Driven by Global Megatrends - Perfectly Positioned



Plasmalysis technology offers:

- **Low-Carbon Hydrogen** – Clean energy carrier for industry, mobility, and storage.
- **Certifiable Solid Carbon** – High-purity carbon for industrial applications.
- **Syngas for eFuels** – Feedstock for sustainable synthetic fuels and chemicals.
- **Acetylene Production** – Valuable precursor for the chemical industry.
- **High-Temperature Waste Heat** (~750 °C) – Reusable thermal energy for industrial processes or power generation.

Source: Company information

Graforce Plasmalyse Technology Ready to Produce Low Carbon Hydrogen & Syngas on an Industrial Scale

Simplified Side By Side Methane Plasmalyse Solution for Turquoise Hydrogen & Syngas

I Hydrogen

Flare gas / natural gas
4 kg

(Renewable) electricity
10 kWh*

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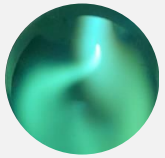
Plasmalyser



Turquoise Hydrogen
1 kg H_2

Carbon Black
3 kg C

Industrial-grade heat
3-5 kWh

II Syngas

Biogas CO2 / CH4
15 kg

(Renewable) electricity
18*- 26 kWh

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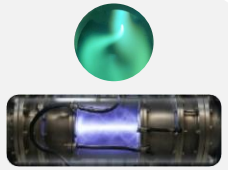
Plasmalyser



Syngas
1 kg H_2
14 kg CO

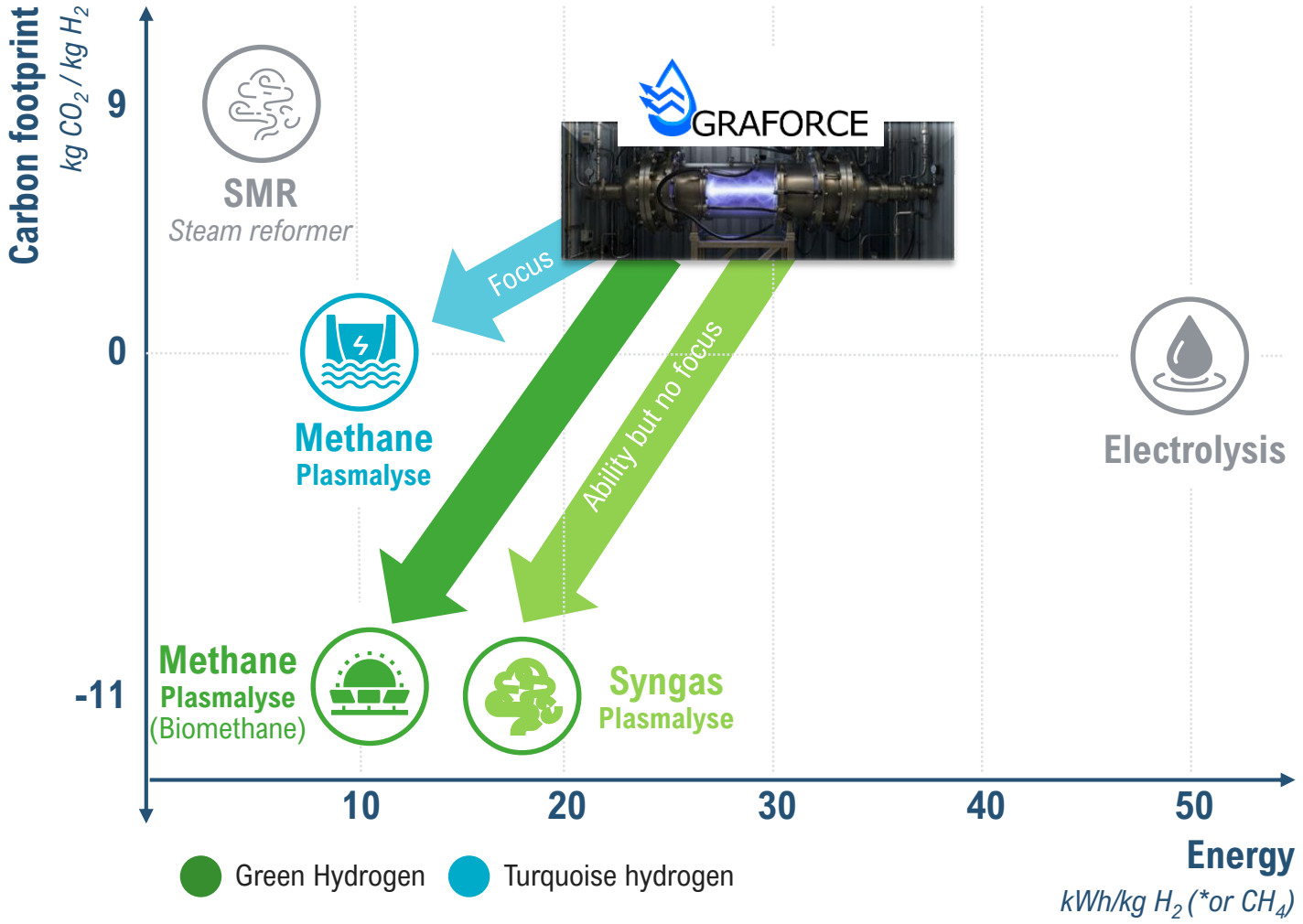
FT

Sustainable Aviation Fuel SAF

Industrial-grade heat
3-5 kWh

*** with waste heat utilization**

Methane Plasmalyse Technologies requires low energy & produces small carbon footprint



Affordable Turquoise Hydrogen & Syngas
Attractive cost levels of €2 - €3 per kg hydrogen* and cost levels of € 0.23–0.38/kg Syngas

CO_2 Capturing and Utilization
Capturing inside solid carbon , which can be sold at €450/t

High temperature waste
Waste heat up to 750°C for production processes or electricity production

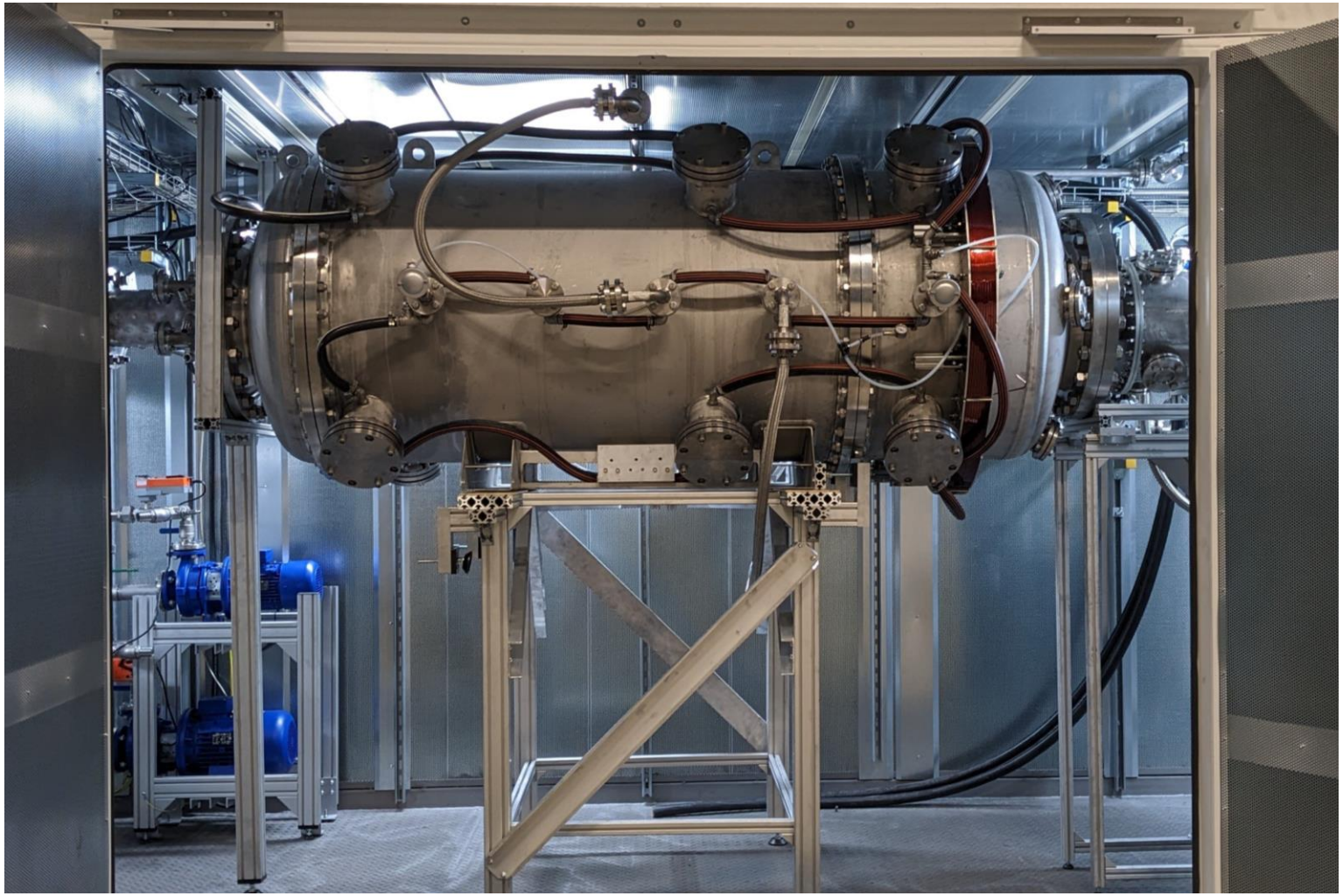
Significant CO_2 Reduction
70% reduction to alternative technologies

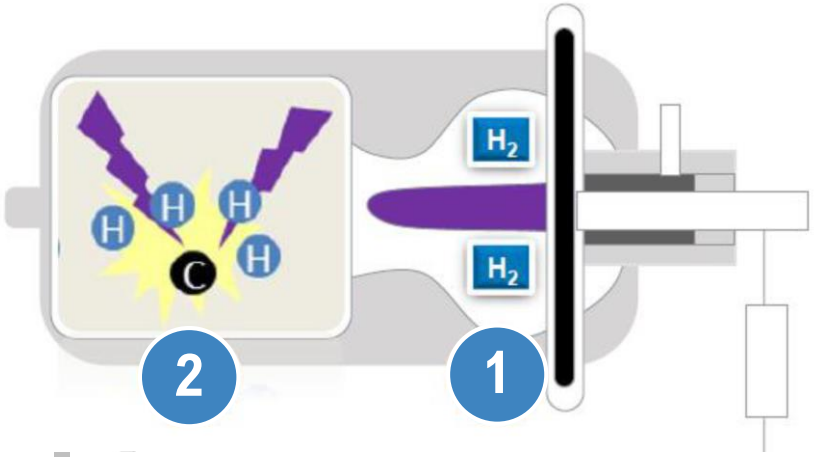
Significant lower energy need
80% lower electricity consumption compared to water electrolysis**

Note: *Target value achieved under laboratory conditions, considering heat utilization

Methane-Plasmalyse 0.2 MW - 0.5 MW Module

Plasmalyse decarbonizes methane to produce hydrogen (H_2) and solid carbon (C) and industrial grade heat or produce syngas from biogas





1. Plasma is created using two graphite elements. Feedstock used for plasma is either H_2, N_2 or a mixture of both
2. Hydrocarbons are dissociated into hydrogen and solid carbon through heat and plasma electrochemical processes

Turquoise & Green Hydrogen is Produced Through Methane Plasmalyse at Reduced Costs & With Low Carbon Footprint

Using the existing foundations to develop lucrative & ESG friendly opportunities in the hydrogen space

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Methane-Plasmalyse demonstration facility in Austria
Planned, developed and installed by Graforce

Note: * Only 10-15kWh needed / ** Based on European input prices. With US / MENA prices levels even lower results can be achieved

Methane Plasmalysis Plant for the Production of Green / Low-Carbon Hydrogen, Solid Carbon and Syngas

Standort: RAG Austria AG - Kremsmünster

1

Heat, cooling, gas piping systems and containers

2

Plasmalysis Module

3

Carbon separation

4

Synthetic carbon filling / storage / compaction and pelletizing

5

H_2-Compression and storage

6

Gas purification and treatment (H_2 5.0, H_2S, CO_2)

Site Plan for High-Temperature Generation Using H_2 Turbine and Methane Plasmalyse – Off-Grid Operation

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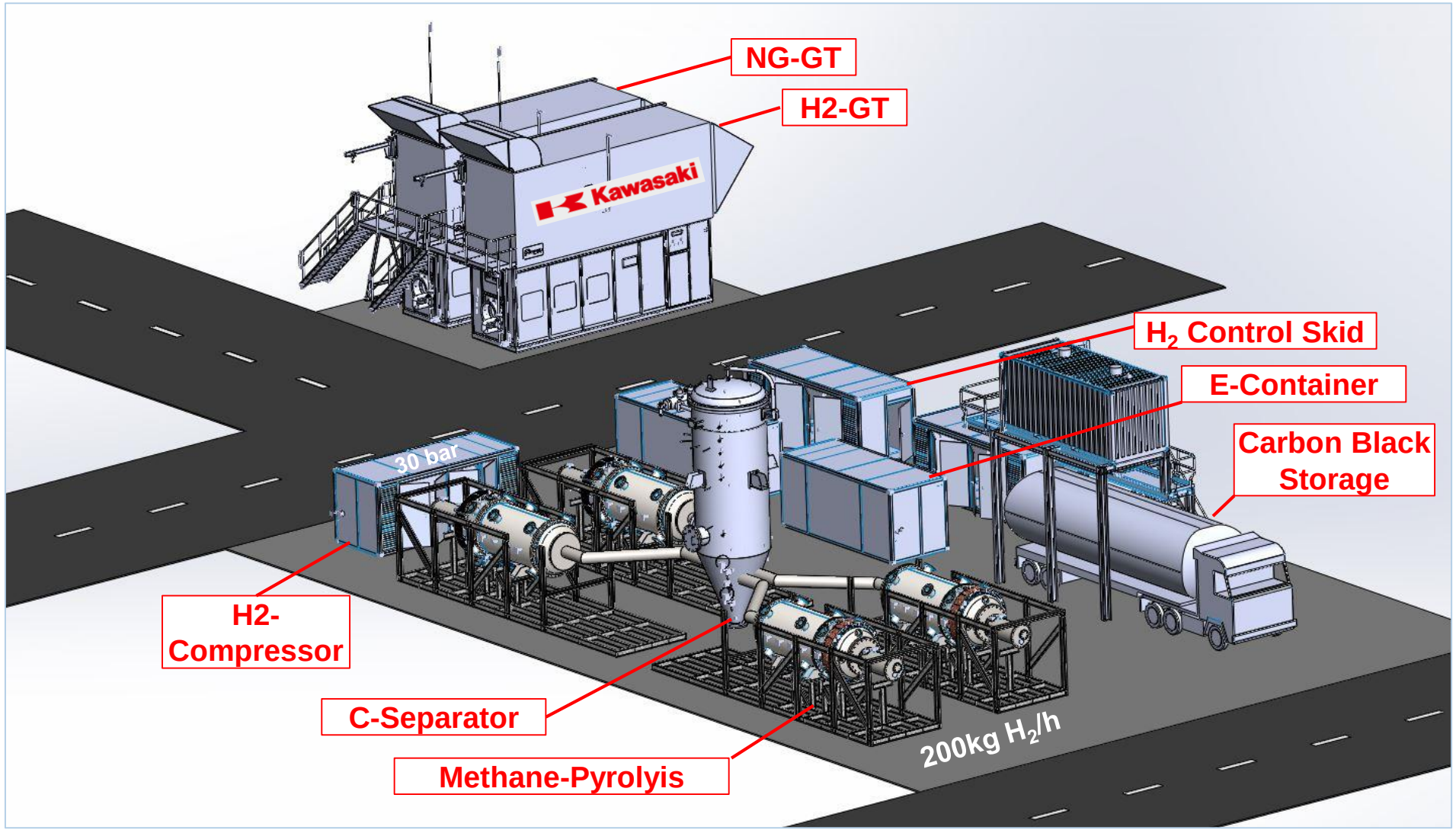
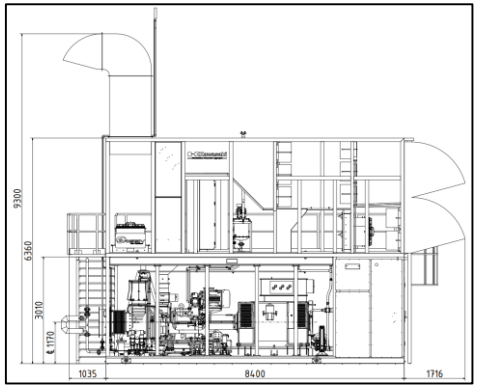
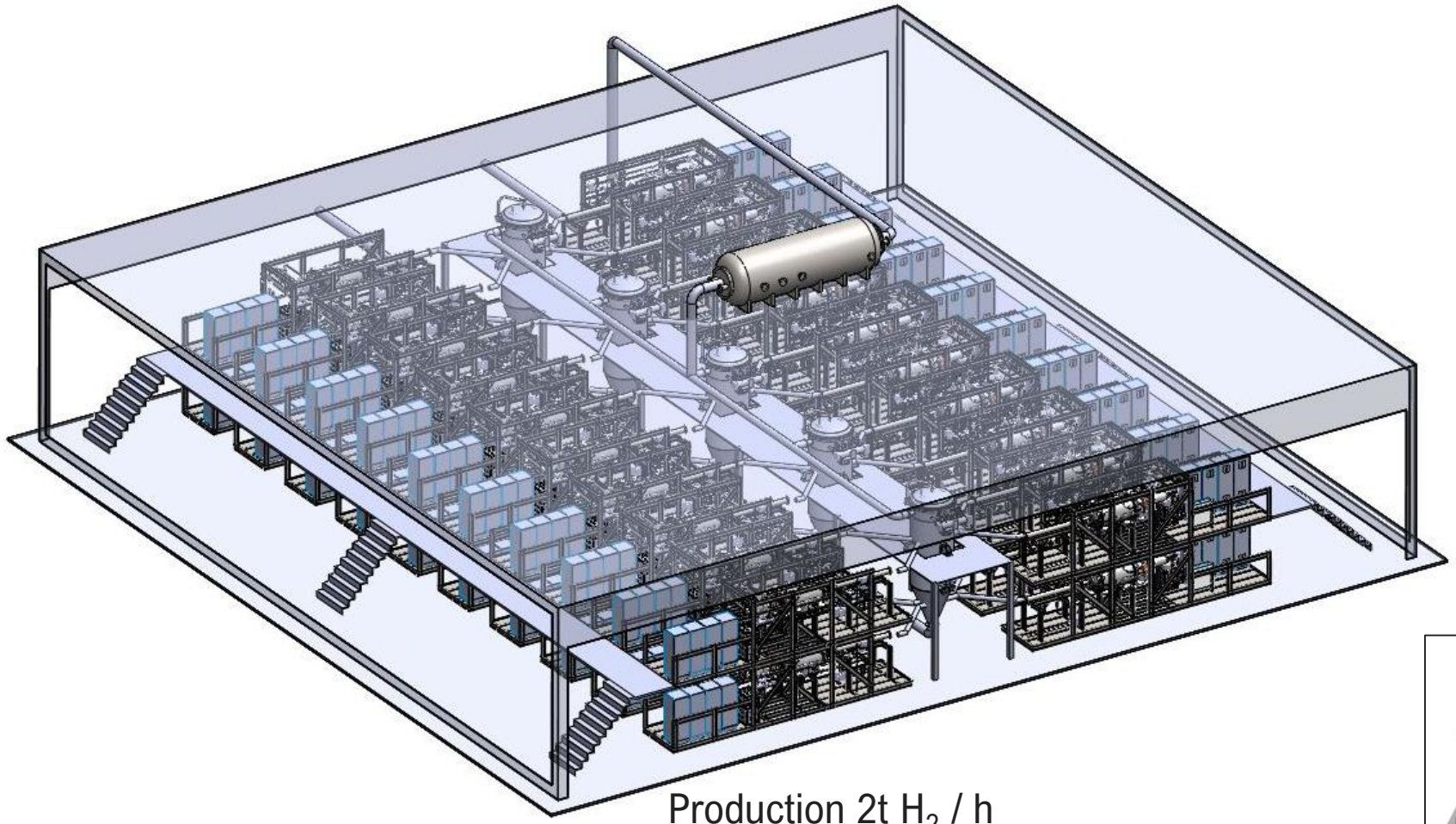




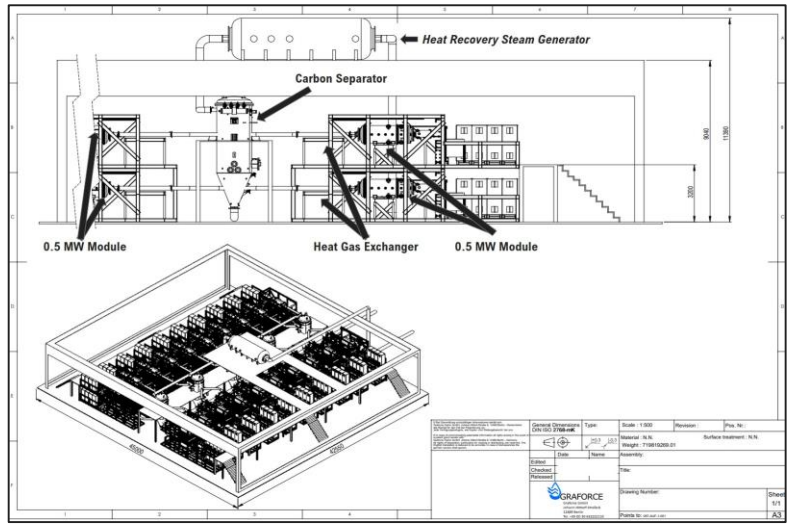
Kawasaki

20 MW Plasmalyse Methane Plant

Skid layout of a 40 x 0.5 MW modules

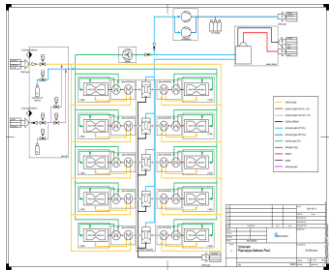


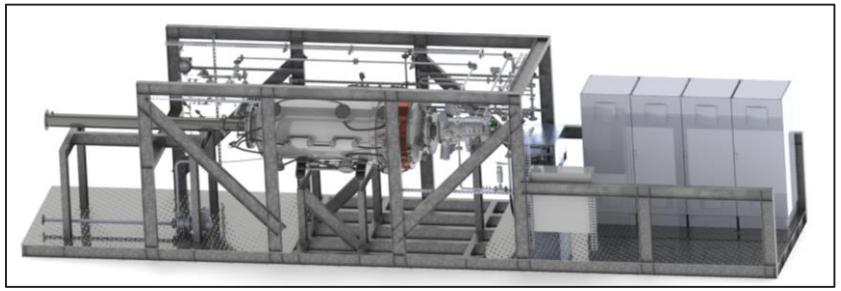
Production 2t H_2 / h



Heat and Material Balance: 20 MW Plasmalyzer with US-natural gas

	NG in	Plasmalyzer ou	Carbon out	Gas out	Sweep	Plasmalyzer	
	1	2.1	3	4.3	6.0	5.3	
Temperature	10.000	944.877	650.000	20.000	100.000	1661.460	C
Pressure	8.000	1.498	1.498	1.498	1.498	1.498	bar
Mass Flow	8238.160	9988.120	5604.640	2633.240	1750.276	9988.440	kg/h
Molar Flow	480.000	1992.332	466.664	965.972	642.000	1122.000	kmol/h
Volumetric Flow	1412.464	104119.200	17546.940	15716.600	13298.000	120464.800	m3/h
Molar Fraction (Vapor) / Hydrogen	0.000	0.749		0.968	0.968	0.554	mol%
Molar Fraction (Vapor) / Methane	0.950	0.014		0.012	0.012	0.413	mol%
Molar Fraction (Vapor) / Carbon monoxide	0.000	0.006		0.000	0.000	0.011	mol%
Molar Fraction (Vapor) / Carbon dioxide	0.000	0.005		0.000	0.000	0.009	mol%
Molar Fraction (Vapor) / Ethane	0.020	0.005		0.001	0.001	0.009	mol%
Molar Fraction (Vapor) / Propane	0.010	0.003		0.000	0.000	0.004	mol%
Molar Fraction (Solid) / Carbon	0.000	0.218	1.000	0.000	0.000	0.000	mol%
Mass Flow (Vapor) / Hydrogen	0.000	3006.696		1881.908	1252.208	1252.208	kg/h
Mass Flow (Vapor) / Methane	7315.360	453.980		180.198	119.774	7435.120	kg/h
Mass Flow (Vapor) / Carbon monoxide	0.000	357.464		537.796	357.465	357.464	kg/h
Mass Flow (Vapor) / Carbon dioxide	422.492	422.492		0.000	0.000	422.492	kg/h
Mass Flow (Vapor) / Ethane	288.663	300.668		18.062	12.005	300.668	kg/h
Mass Flow (Vapor) / Propane	211.699	220.462		13.243	8.809	220.462	kg/h





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Business Case & for a German industrial steel production site

Example calculation for a German industrial steel production site for a 20MW plant (40 x 0.5MW modules) or 8.400h per year.

Wensentliche Kennzahlen und Annahmen

CAPEX Plasmalyse	Plant Size	Operating Hours per Y
€ 66 Mio.	20,0 MW	8.400 h

Target H_2 Production Cost *	Target H_2 Sales Price *	Total / Equity Return
1,74 €/kg	2,35 €/kg	25% / 78%

CAPEX und Financing

CAPEX & Plasmalysis Performance			
Capacity	20,0 MW		
Max Operation	8.400 h	16.800 t H2	
Number of Modules	40		
Price 0.5 MW Module	1.250.000 €		
Total Power Consumption	28 MW		
Service Life	20 Jahre	*(Input max 30 Jahre)*	
40 x 0.5 MW Plasmalysis Moduls			50.000.000 €
5 x Carbon Separators			5.000.000 €
H2 Compressor, H2 Pipelines, Steam Generator, Steam Piping			3.400.000 €
Main Transformer, High Voltage Connection, Grounding, Lightning Protection, Capacitor Ban			4.200.000 €
4 x Loading Units			4.050.000 €
Subtotal			**66.650.000 €**
Freight	4,0%		2.666.000 €
Certifications	0,5%		333.250 €
Contractor Engineering	7,5%		4.998.750 €
Project Management	5,0%		3.332.500 €
CAPEX without Subsidy			**77.980.500 €**
Subsidy Adjustment	-15%		-11.697.075 €
Total CAPEX			**66.283.425 €**

Financing		
Equity	25%	16.570.856 €
Debt Capital	75%	49.712.569 €

Caution: Editable in blue

** Zielverkaufspreis zum Ende der Nutzungsdauer (siehe Reiter "Rendite")*

Calculation H_2 Production & Sales

Stromerzeugung				
PV	0 h	0 MWh	0,06 €/kWh	0 €
Wind	0 h	0 MWh	0,06 €/kWh	0 €
PPA	8.400 h	235.200 MWh	0,08 €/kWh	18.816.000 €
Total	8.400 h	235.200 MWh	0,08 €/kWh	18.816.000 €
Preisaufschlag Customer		0,0%	0,00 €/kWh	
Endpreis Betreiber			0,08 €/kWh	18.816.000 €

H_2 Production und Production Costs				
Capacity	20 MW	8.400 h	16.800 t H2	
Electricity Plasmalyse	0,080 €/kWh	10 kWh	0,80 € /kg H2	13.440.000 €
Electricity Infrastructure	0,080 €/kWh	4 kWh	0,32 € /kg H2	5.376.000 €
Nautral Gas	0,035 €/kWh	56 kWh	1,96 € /kg H2	32.928.000 €
Total Raw Material Cost			**3,08 € /kg H2**	**51.744.000 €**
Depreciation	20 Jahre		0,20 € /kg H2	3.314.171 €
Interest on Debt Capital	5,0%		0,15 € /kg H2	2.485.628 €
Inspection & Maintenance	3,0%		0,12 € /kg H2	1.999.500 €
Service personnel	1 FTE	108.000 €/p.a.	0,01 € /kg H2	108.000 €
Insurance	3%		0,12 € /kg H2	1.999.500 €
Handling H_2			0,20 € /kg H2	3.360.000 €
Total Production Cost			**3,87 € /kg H2**	**65.010.800 €**
Carbon Black (Sales)	450 €/t	50.400 t CB	1,35 € /kg H2	22.680.000 €
Carbon Black (Costs)	-20 €/t	50.400 t CB	-0,06 € /kg H2	-1.008.000 €
Hightemp. Heat	0,03 €/kWh	84.000 MWh	0,15 € /kg H2	2.520.000 €
Hightemp. Heat (Costs)	0,00 €/kWh	84.000 MWh	0,00 € /kg H2	0 €
Total By-Product Revenue			**1,44 € /kg H2**	**24.192.000 €**
Final Cost per kg H_2			**2,43 € /kg H2**	**40.818.800 €**

H_2 Sales & Profitability			
Sales Price (First Year)	*Sales Price: 2,35 €/kg **	3,00 € /kg H2	50.400.000 €
Production Cost (Year 1)	*Target Sales Price: 1,74 €/kg **	-2,43 € /kg H2	-40.818.800 €
Gross Margin		**0,57 € /kg H2**	**9.581.200 €**

Various Industries to Benefit Significantly From Graforce's Technology

Graforce technology can reshape entire industries while driving long-term positive impact, with a clear focus on affordable energy and CO_2 reduction

Regulatory Benefits of Methane Plasmalysis (Biomethane/Natural Gas)

- Complies with EU criteria for renewable & low-carbon hydrogen
- Exempt from CO_2 taxation (with biogenic methane)
- Eligible for EU funding programs (e.g. H2Global, RFNBO, IPCEI)
- Counts toward RED II / RED III targets (e.g. transport sector)
- Access to Carbon Contracts for Difference (CCfD)
- Helps reduce corporate CO_2 footprint under EU ETS
- Enables issuance of certificates/Guarantees of Origin (e.g. CertifHy)
- Potential for international H_2 partnerships (e.g. Middle East)

Steel Production

Glass/Lime Production

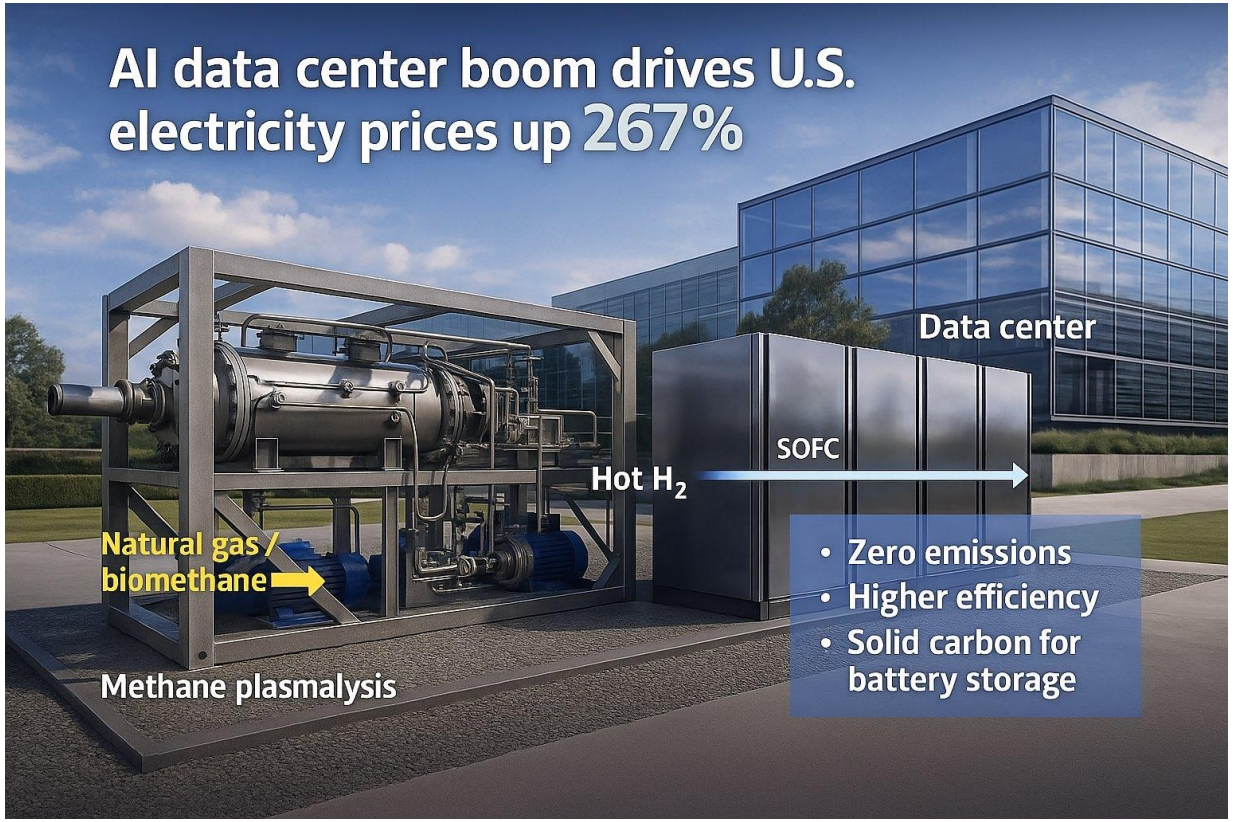
Flare Gas

Synthetic Aviation Fuel

Concrete Industry

Carbon / Graphite Industry

Plasmalysis for SOFC Data Center



Plasmalysis offers a total circular solution which would include:

- Supply of Natural Gas to Graforce System
- Operation of Graforce System to produce hydrogen as fuel for the SOFC bank of units.
- Production of carbon black as part of the Carbon Capture
- Use of Hydrogen on-site to fuel SOFC
- Sale of Carbon Black

Synthetic Carbon | Applications

Synthetic Carbon is expected to substitute for existing emission-heavy components in several industries like building materials and tire manufacturing

	Petroleum Coke	Building materials	Tire manufacturing	Agriculture	Specialty applications
					
Application areas	**Substitution** 100% substitution with synthetic carbon Significant reduction of CO_2	**Substitution** 20% of total concrete substituted with CO_2 neutral synthetic carbon Offering new conductivity and electricity storage in building materials.	**Substitution** Performance improvements Tire coloring	**Carbon soil enrichment** Increased water storage capacity Increased fertility New sales potential	**Substitution** Colored plastics Improved features such as conductivity

Properties Carbon & pot. customers

- 98% pure carbon (graphitic)
- Mesoporous structure, can be activated for adsorption
- Nanostructured particles, Ø 25–35 nm
- Electrically conductive, tunable via graphitization
- High surface area: 90–110 m²/g (BET)
- Thermally stable & chemically inert

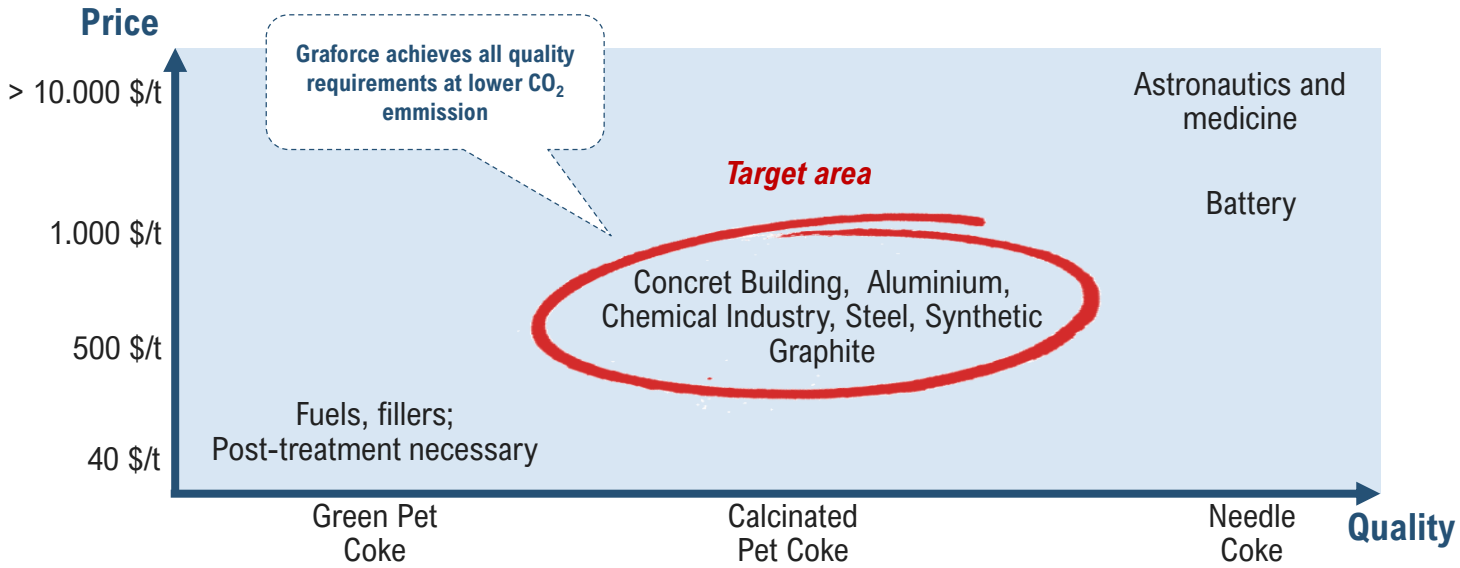
RHI MAGNESITA, EUROVIA VINCI, NIPPON STEEL, STRABAG, OMV, OVAKO, AUSTRIA AG

Synthetic Carbon use cases **differentiate by the quality of the material**. Emerging applications in building materials or agriculture expected to represent stable long-term off-take for users of Methane-Plasmalyse.

CO_2-neutral Carbon | Focus Market Petroleum Coke

Our CO_2-neutral Carbon can substitute existing Petroleum coke with high CO_2 emissions. The current markets offer attractive marketing opportunities and are expected to grow in the future

Petroleum coke | Price / quality



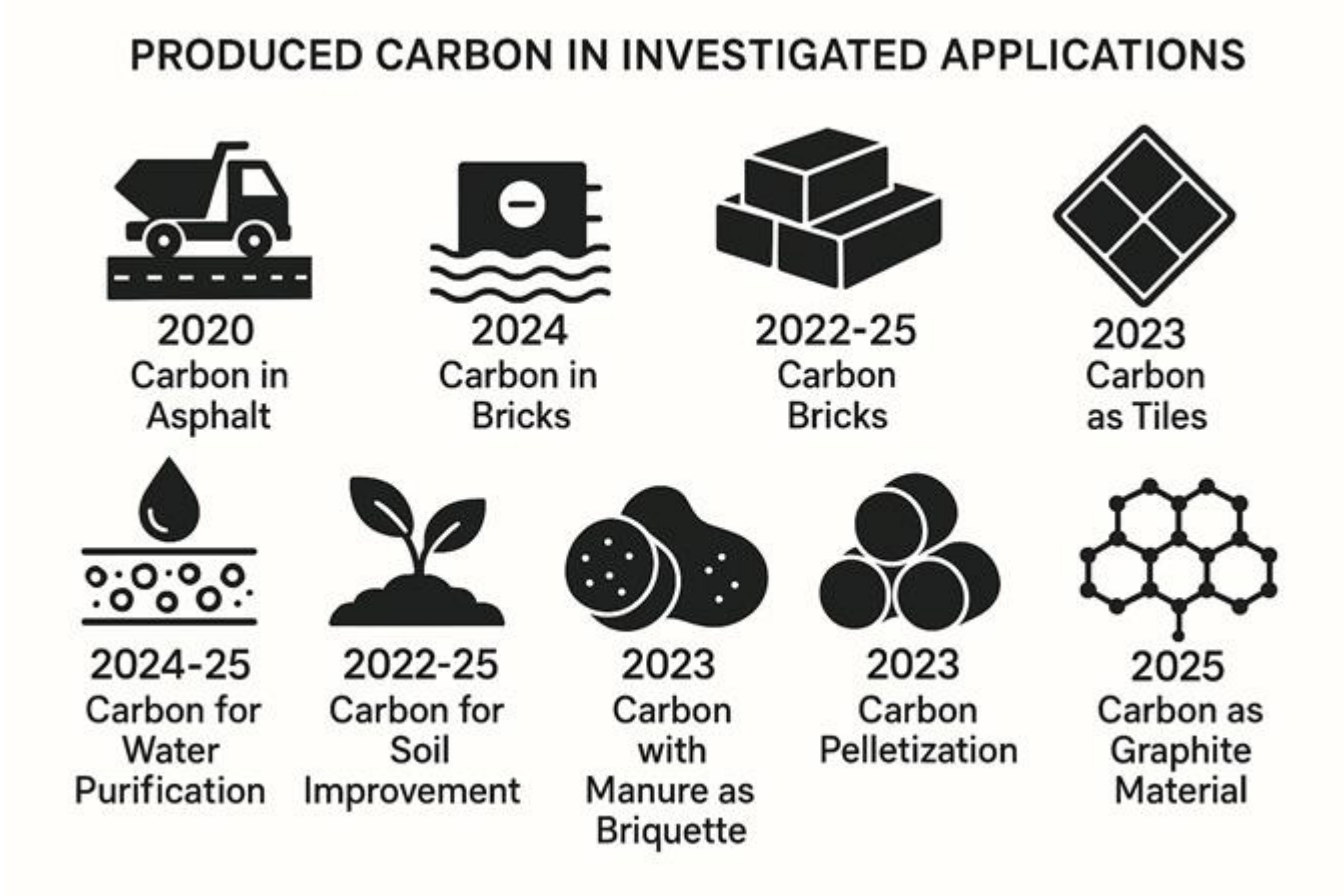
Quality Features	Target Quality	Graforce Quality
Particle size (mm)	0,2 - 4	0,2 – 8 Carbon granulated with a binder
Purity (wt% max)	Sulfur content < 0,5 Ash < 0,3	Sulfur content < 0,3 Ash < 0,3
Carbon (wt%)	98,0-99,0	99,0
CO_2 emission in production	0,85 t CO2 / t CPC	0,01 t CO2 / t CPC

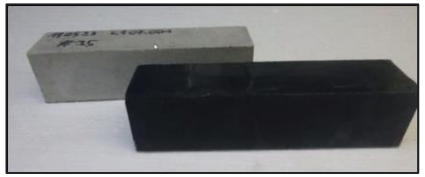
Petroleum coke | Market highlights

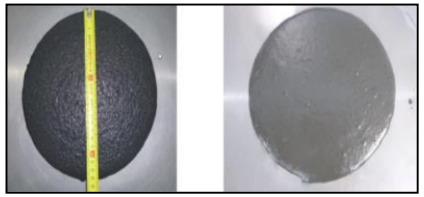
- The Carbon Black produced through Plasmalysis is highly suitable for substituting petroleum coke. Confirmed by analyses from potential customers
- The global petroleum coke market was valued at approximately $26.5 billion in 2022 and is projected to exceed **$43 billion by 2030**, growing at a CAGR of 6-7%
- Production volume is estimated at 170 million tons per year, with forecasts suggesting an increase to over **260 million tons by 2032**

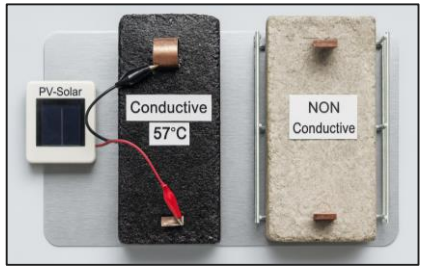
Source: Decode the Future of Petroleum Coke - Chemanalyst Sept. 2023, Petroleum Coke Market by Competitive Insights | Market Trends, Forecast, and Opportunities - EcoPulse Ventures 2025

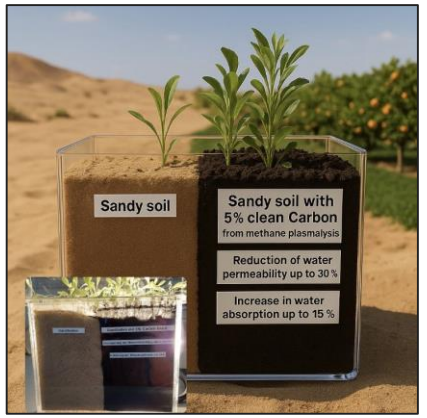
Grafroce Carbon Innovation Pathway: Tested Applications by Year







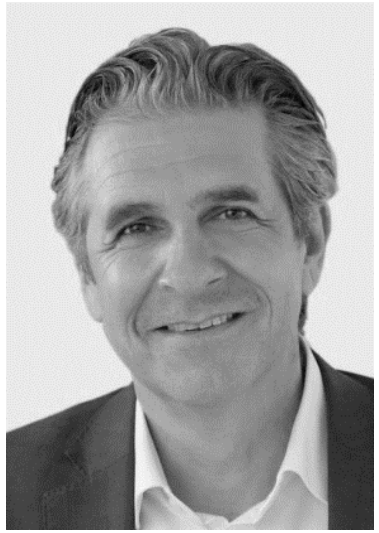




What are the unique features of Graforce's plasmalyse technology?

Criterion	Graforce	Competitors
Reactor Design	Fully graphite-based, no active cooling required, no catalyst needed	Metallic reactors, often require active cooling, material-intensive, catalyst clogging due to carbon
Plasma Generator / Energy Source	Efficient DC plasma source with >95% electrical efficiency	Often microwave or RF plasma with low wall-plug efficiency (55–70%)
Electrode Material / Wear	Graphite, very low wear, durable, automatic feed system	Metal electrodes, high wear, require cooling and frequent replacement
Electrode Replacement	Automated replacement system, <2 min downtime	Manual or not feasible, leads to extended downtimes
Energy Demand (incl. peripherals)	14 kWh/kg H_2 (proven in continuous operation)	20–40 kWh/kg H_2, mostly theoretical values
CH_4 Conversion Rate	Up to 98% (only 2% residual methane, no other gases that are hard to separate)	Typically 80–90%, often lower
Scalability	0.5 MW modules, linearly scalable, maintenance-friendly	Large-scale reactors, complex maintenance, not partial-load capable
Fouling Risk	Low thanks to controlled gas flow, compact reactor volume, and modular design	High in large reactors, uneven temperature distribution and carbon quality issues
Product Diversity	H_2, solid carbon, high-temperature waste heat, optional syngas	Mostly H_2 or syngas, by-products not utilized
Carbon Offtake & Market	Substitute for petcoke in TiO_2, electrodes, cement, steel, soil, batteries, etc.	Often no defined offtake, unclear monetization pathway
Certifiability	PFAS-free, membrane-free, LCDA-compliant	Complex materials, challenging certification
Feedstock Flexibility	NG, biogas, flare gas, CO_2 → syngas (proven)	Often methane only, no demonstration of CO_2 or flare gas usage
Decarbonization Potential	CO_2-free process with storable solid carbon (certifiable as CDR)	Partial CCS, not CO_2-free due to tailgas and low conversion
Technology Readiness Level (TRL)	TRL 7, continuous operation at industrial partner site	Mostly lab-scale, limited pilot data

Contacts at Graforce



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Carbon Black Diagram

Graforce´s current CB quality range