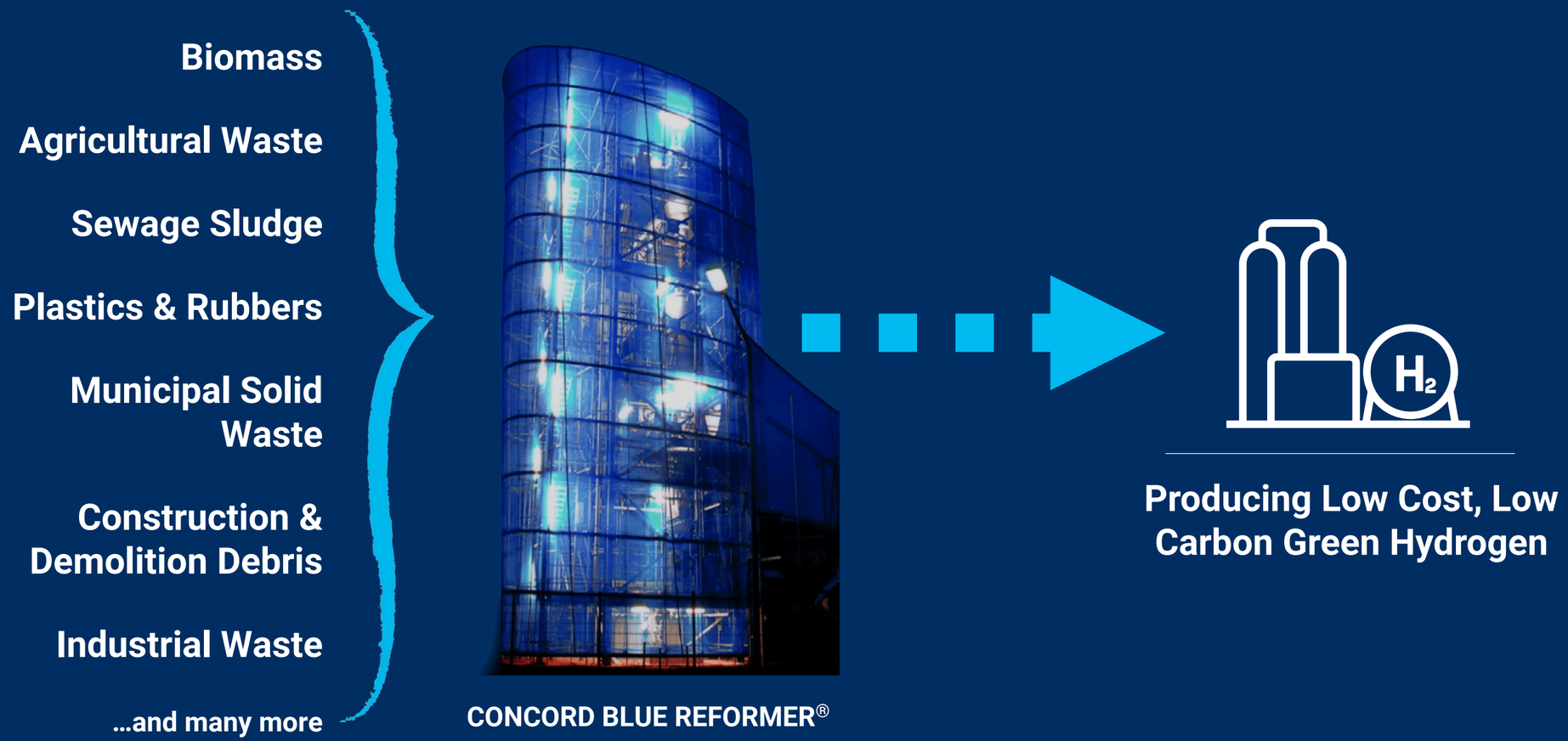


Concord Blue & CBR® Technology Overview
Reforming Waste into Hydrogen

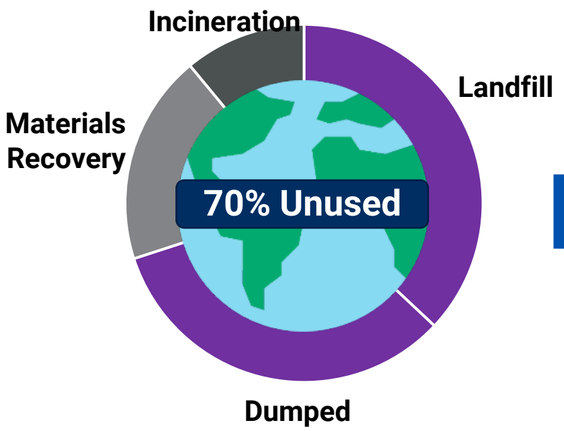
Industry Leading Waste to Energy Technology
Driving the Hydrogen & Clean Energy Transformation

THE CONCORD BLUE MISSION

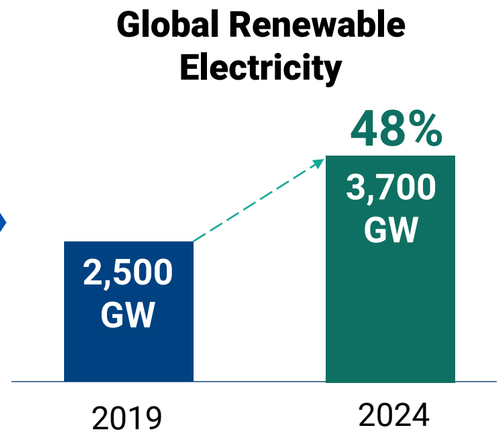
1. THE PROBLEM

Untapped Global Waste

Demand For Clean Renewable Energy

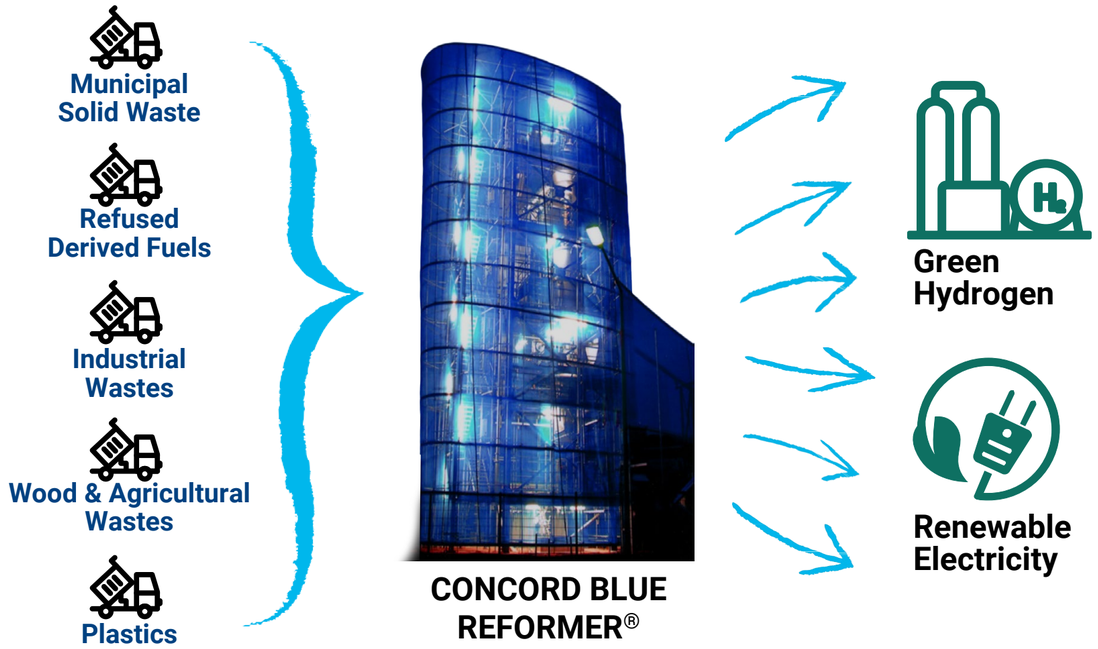


Source: World Bank, Fast-Company 2019



Source: IRENA Mar. 2020

2. THE SOLUTION



CONCORD BLUE ENERGY OVERVIEW

HISTORY
Waste to energy technology & development company began operations in 2002 upon completion of first demo facility in Herten, Germany

TECHNOLOGY
Patented, self-sustaining, non-combustion, industry leading thermolysis-based process produces highest conversion rate of waste to energy with maximum amount of hydrogen yield.

TRACK RECORD
Ten facilities have been built throughout the world including New York, Germany, India and Japan

STRATEGIC PARTNERS
World class firms including Air Liquide, Siemens, Steag Energy Services, Dresser Rand, EY, AON, Fraunhofer, German Waste Federation.

LOCATIONS
Headquarters in Los Angeles, California & engineering based in Herten, Germany

Concord Blue: Highlights

CBR® TECHNOLOGY: KEY ADVANTAGES

Concord Blue Reformer (CBR®) technology is the industry leading solution among all waste to hydrogen technologies

EFFECIENTLY ELIMINATES WASTE: 3-4x more energy over incineration with no additional ash, dioxins or furans

PRODUCES LOWCOST GREEN HYDROGEN: Less than 1/3rd cost of electrolysis while consuming 88% less electricity & no fossil fuels

MORE GHG EMISSION SAVINGS: +100,000 tons/year CO2 savings versus SMR* & incineration plus electrolysis (Herten W2H2 facility)

GREENER THAN ELECTROLYSIS: Produces hydrogen unlocking latent energy inside waste versus consuming large amounts of external electricity to produce less energy in the form of hydrogen

*SMR = Steam Methane Reforming

CONCORD BLUE: RECENT MILESTONES

Fueled by rise of green hydrogen—Last 12 months has been a breakout year

1. ***Passed Fichtner technical due diligence*** validating CBR® technology proven to work successfully in commercial operating environment
2. ***Upcoming Herten facility certified net negative CO2*** by RedCert auditors saving 100,000 tons CO2 per year generating revenues estimated at €12.8M
3. ***CBR® W2H2 technology certified "Green"*** by TÜV SÜD
4. ***CBR® technology qualified as chemical recycling*** allowing German waste management companies to meet quotas for plastic recycling
5. ***Awarded Top Ten Bioenergy Solutions of 2022*** by EnergyTech Review published May 2022 edition
6. ***Concord Blue & W2H2 now accepted by CertifHy***—EU's leading hydrogen consortium promoting sustainable hydrogen production
7. ***Selected by NEOM master planner*** as a core "waste to value" solution for the city
8. ***Selected by Advancements for documentary on how CBR® W2H2 technology can change the world***—award-winning educational TV series

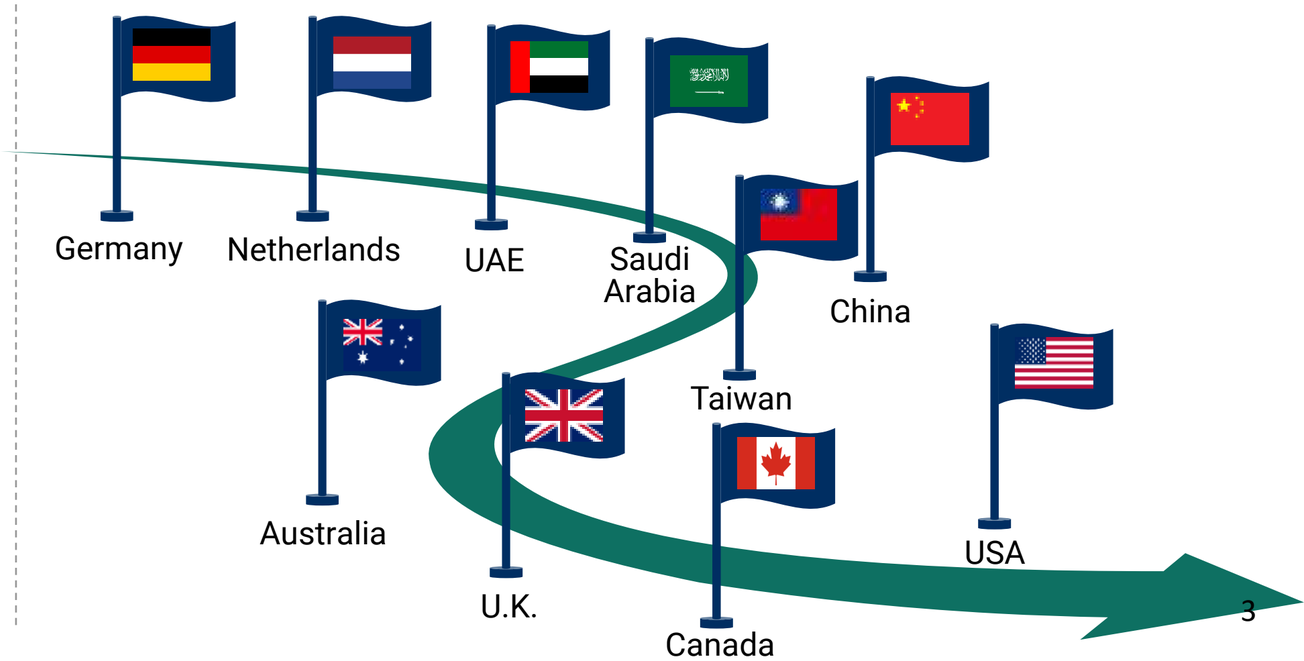
CONCORD BLUE SERVICES

Concord Blue provides a range of services to ensure projects are successful

	SERVICE	DESCRIPTION
1	CBRs®	Concord Blue's proprietary processing unit, which reforms waste into H2-rich syngas
2	PROJECT DEVELOPMENT	Develops construction ready projects for investors worldwide
3	PROJECT MANAGEMENT	Manages engineering, procurement & construction activities for balance of plant of CBR® projects ensuring costs are within budget & completed on time
4	OPERATIONS & MANAGEMENT	Partnered with Germany's largest O&M services firm (Steag) to provide best in class operations management

CBR® W2H2 PROJECTS EXPANDING WORLDWIDE

Concord Blue has begun developing CBR® W2H2 projects internationally partnering with leading local developers



History & Development of Concord Blue

Timeline of Key Corporate & Operational Milestones

Corporate event
Operating event

2002: Foundation & First demo plant

Corporate: Founded by Charlie Thannhäuser following completion of first demonstration facility in Herten, Germany

Operating: The first test plant in Herten, Germany starts operating

2005: Commercial W2H2 project in Izumo, Japan

Operating: CBR® technology is used for the first time on an industrial scale for H2 production

2009: JV with Rochem & demo location COD in Mumbai, India

Corporate: Concord Blue establishes a JV with Rochem Sep. Syst. India, a global leader in wastewater treatment and plant design

Operating: Concord Blue commissions a pilot plant in Mumbai, India

2011: Commercial W2E project in Mahad, India

Operating: Concord Blue begins operations of a CBR® processing industrial wastewater plant (sludge) in Mahad, India

2012: US HQ in Los Angeles

Corporate: Concord Blue establishes US headquarters in Los Angeles, California

2012: Commercial W2E project in Pune, India

Operating: In Pune, India, a plant for the processing and recycling of solid settlement wastes is commissioned to supply the local community with electricity

2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

2015: Agreement with Lockheed Martin

Corporate: Lockheed Martin signs teaming agreement with Concord Blue after completing three years of technical due diligence

2016: Secures first investment by institutional investor

Corporate: US pension fund executes first investment into Concord Blue

2016: Demonstration plant in North America

Operating: Concord Blue commissions the demonstration plant in Owego, New York

2021-22: Paving the way for further platforms

- CBR® technology qualified as chemical recycling allowing waste suppliers in Germany to meet quotas for plastic recycling and providing Concord Blue with access to 8m tons of qualified feedstock
- Formed strategic alliance and signed 20-year waste supply contract with Ecowest, which leads the German waste federation (ASA e.V.), an association representing 80 local waste facilities, providing access to waste feedstocks for platforms 2, 3 & 4
- Awarded 2022 Top Ten Bioenergy Solutions by EnergyTech Review published May 2022

2021-22: Progress on Platform One

- Pass Fichtner technical due diligence red-flag report validating CBR® technology on commercial scale
- Herten facility certified net negative CO2 by RedCert auditors saving 100,000 tons of CO2 per year
- CBR® W2H2 technology certified as producing "green hydrogen" by TÜV SÜD, accredited sustainability testing lab and certification body
- CertifHy„ EU's leading hydrogen trade group, endorsed CBR® technology as the preferred path to produce hydrogen from waste

Facility Utilizes Concord Blue's Patented Reforming Process

Self-powered, 3-stage reforming through three spatially separated vessels that use gravity and heated ceramic beads to separate clean, usable gas from inputs

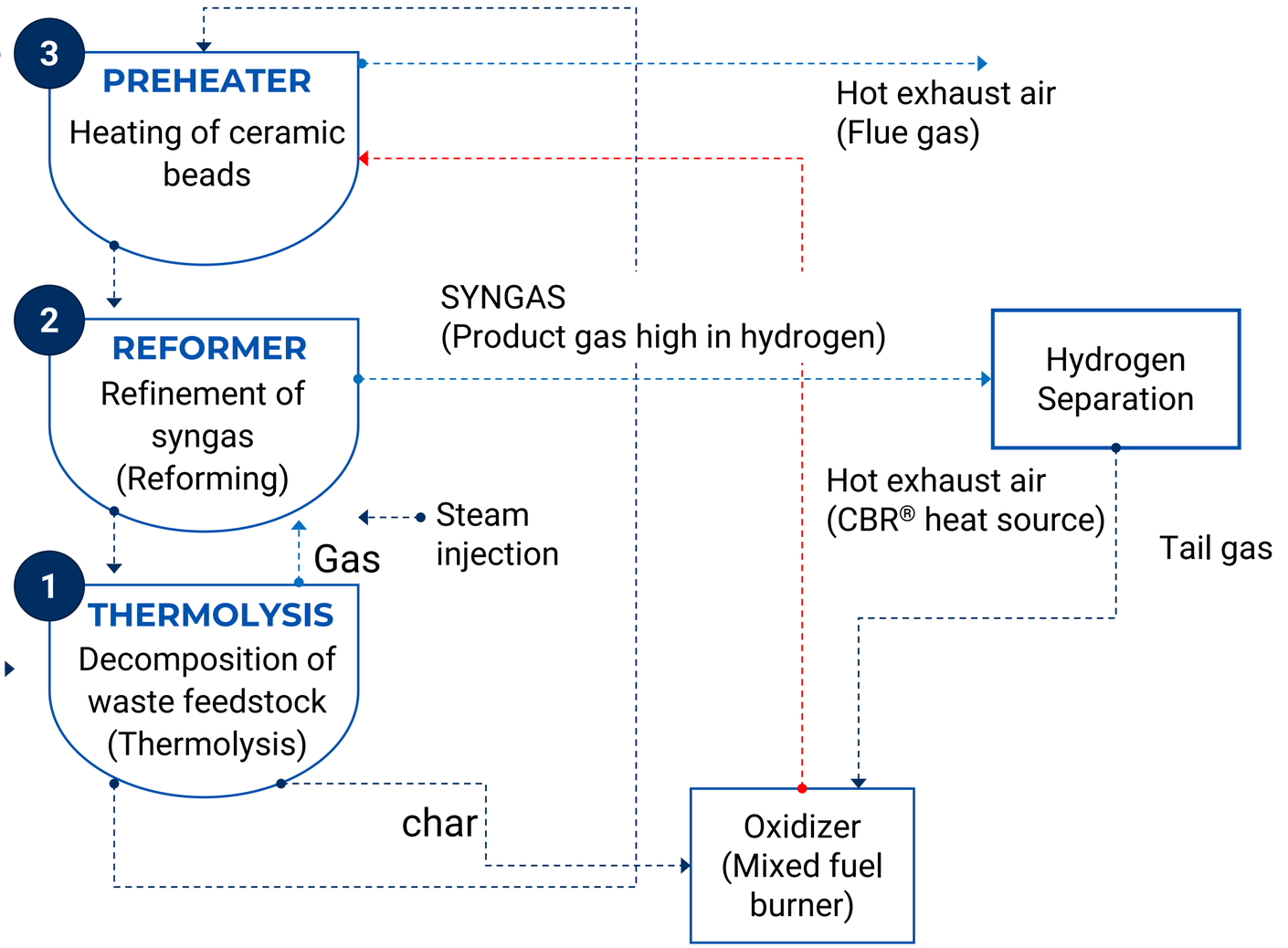
Ceramic bead cycle
Used as the indirect heat carrier: flow downward by gravity and return to the top by mechanical lift

MSW (Municipal Solid Waste)

Resource Garbage (incl. plastics)

Multiple Kitchen Wastes

Feedstock
A wide range of waste feedstocks can be processed including wood, refuse-derived fuel (RDF) made from Municipal Solid Waste (MSW), plastics, rubbers and sludge



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CBR® Technology Overview

Producing certified green hydrogen with net negative CO2 emissions

What is CBR®?

- Steam thermolysis-based waste reforming system, which recycles a wide range of waste feedstocks (including plastics) into certified "green" hydrogen / syngas

How is CBR® technology different?

- In PU2000, the Preheater Vessel contains **proprietary heat-carrying ceramic beads**, which are heated to over 1,000℃ and flow downwards due to gravity through the Reformer to the Thermolyzer Vessel. This vessel mixes the heated ceramic beads with the prepared feedstock received from PU1000 and is specially treated to ensure this high heat environment is free of oxygen (ensuring thermolysis, which limits pollutants)
- **Produces Biochar, which is oxidized in PU3000 to produce heat** for the Preheater Vessel, reducing the need for external energy sources post start-up
- Gas from the Thermolyzer naturally rises through **proprietary double clap (two-way flow) valves into the Reformer**, where steam is added to assist in the production of H2-rich Syngas

How does it compare to other similar technologies?

- In a net-zero economy, the closest low CO2 H2 production process comparable to CBR® is via incineration plus electrolysis
- The CBR® process is cheaper, consumes less electricity and does not produce incineration's high levels of bottom ash, air pollutants or GHGs
- Overall, CBR® is more scalable, can treat a greater feedstock range and has a smaller CO2 footprint (certified net negative)

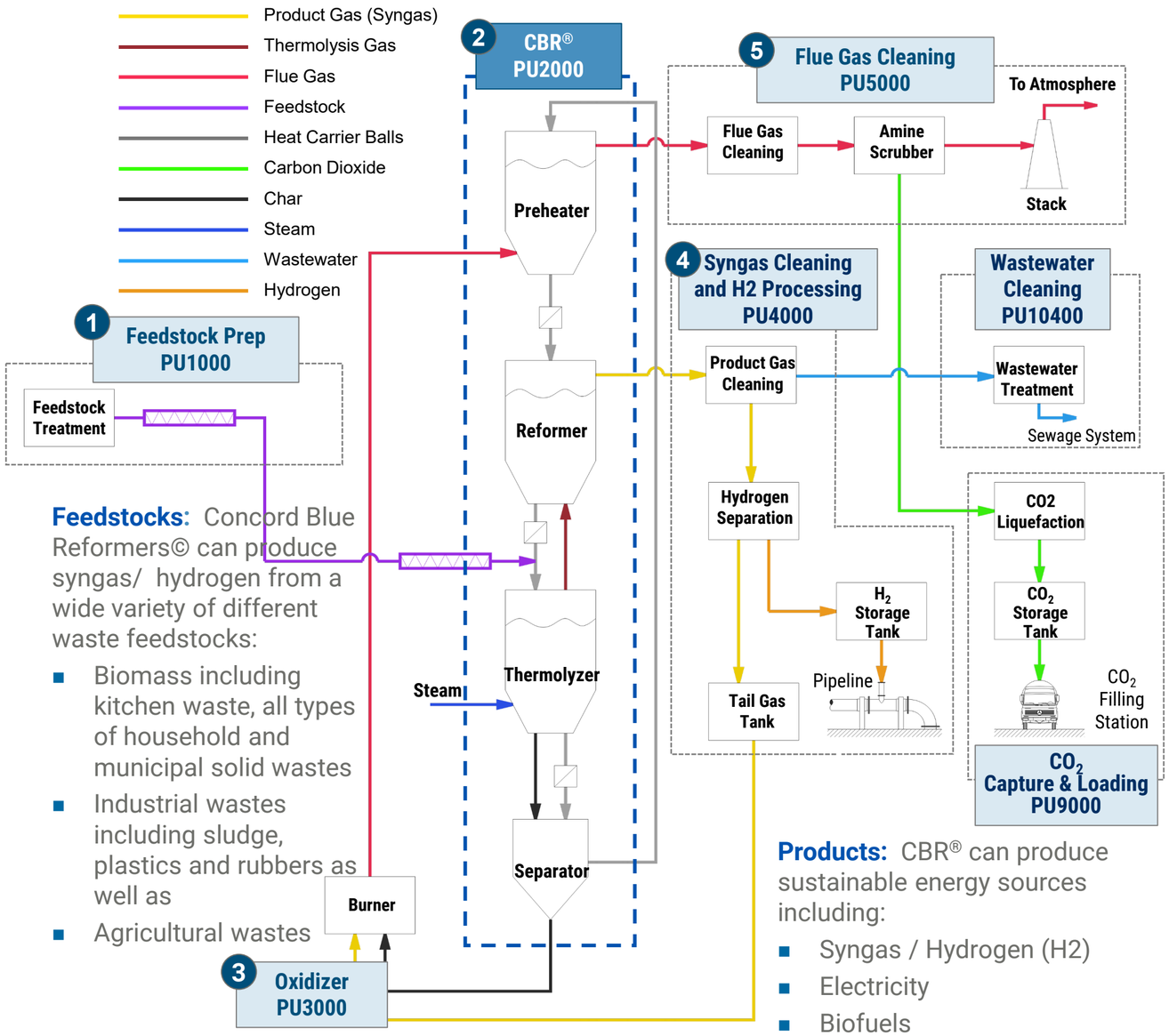
Verification/ Track Record

- Fichtner through its Red Flag report for the Meppen Project found that CBR® successfully operated in a commercial setting for power generation only (using 20 months of constant operating data from the Pune plant), concluding this was "relevant for hydrogen production" as refining the H2-rich Syngas into hydrogen uses well-established downstream technologies

Certification

- CBR® W2H2 technology certified "Green" by TÜV SÜD and net negative CO2 emissions by RedCert Auditor (in accordance with the EU's Red II Directive)

Process Unit ("PU") Block Diagram



Feedstocks: Concord Blue Reformers© can produce syngas/ hydrogen from a wide variety of different waste feedstocks:

- Biomass including kitchen waste, all types of household and municipal solid wastes
- Industrial wastes including sludge, plastics and rubbers as well as
- Agricultural wastes

Products: CBR® can produce sustainable energy sources including:

- Syngas / Hydrogen (H2)
- Electricity
- Biofuels

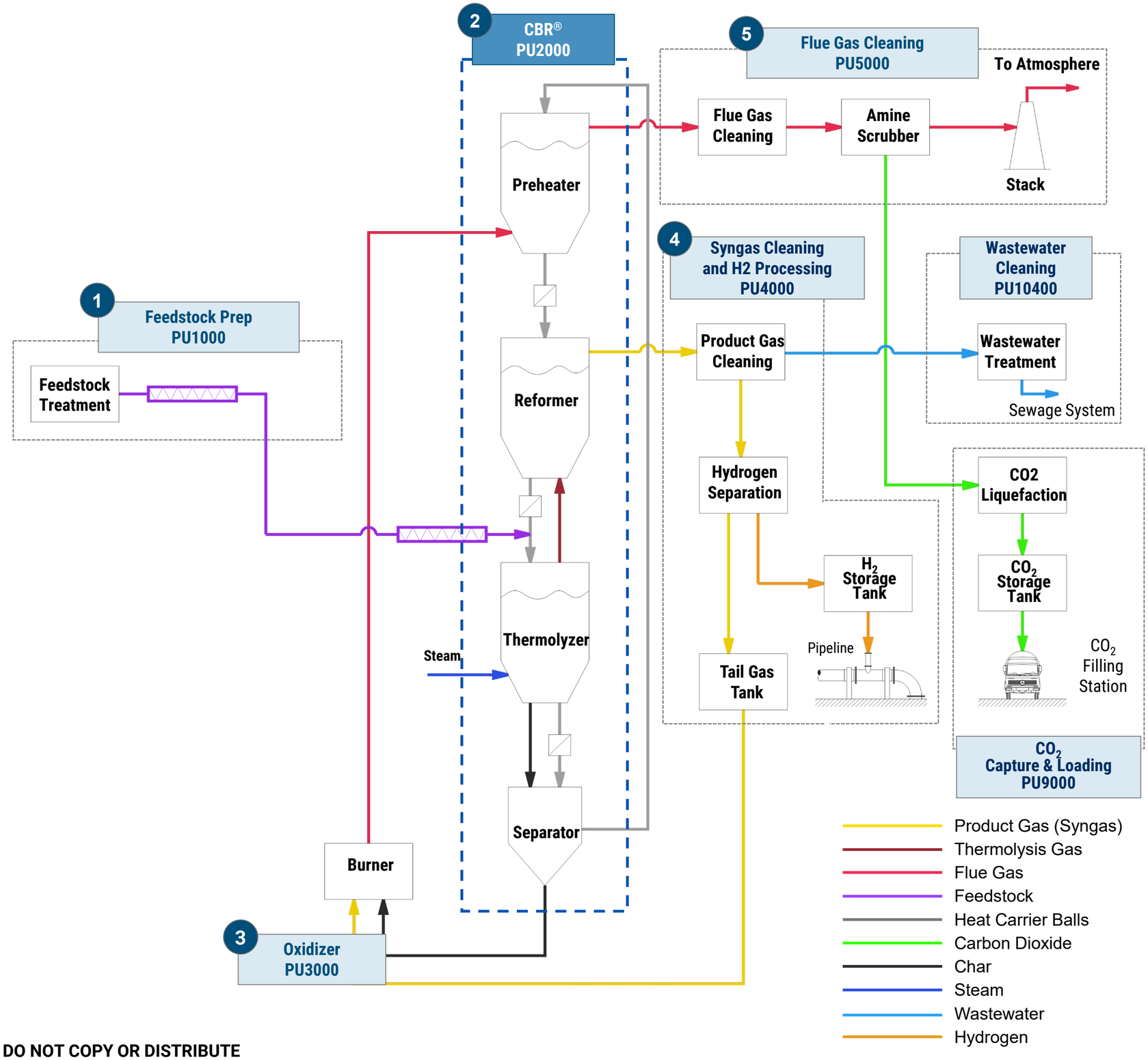
Also many by-products, including biochar, clean water, and heat

Concord Blue's technology has been proven in commercial operating environments, validated through 3rd party technology review by Fichtner and has achieved successful operation in 10 facilities across 4 countries

Major Processing Units

Simplified Block Flow Diagram

CBR® at Lockheed Martin's industrial park in Owego, NY (USA)



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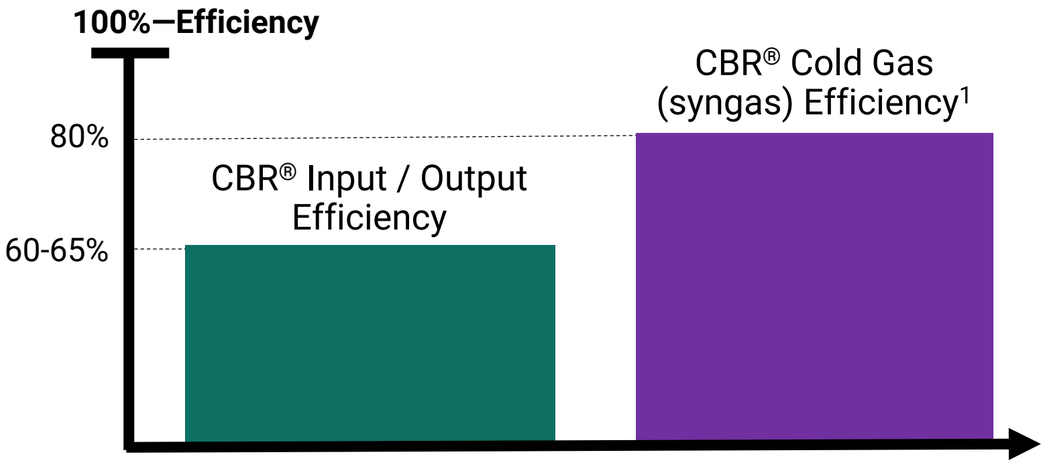
Why Develop Projects Powered by CBR® Technology

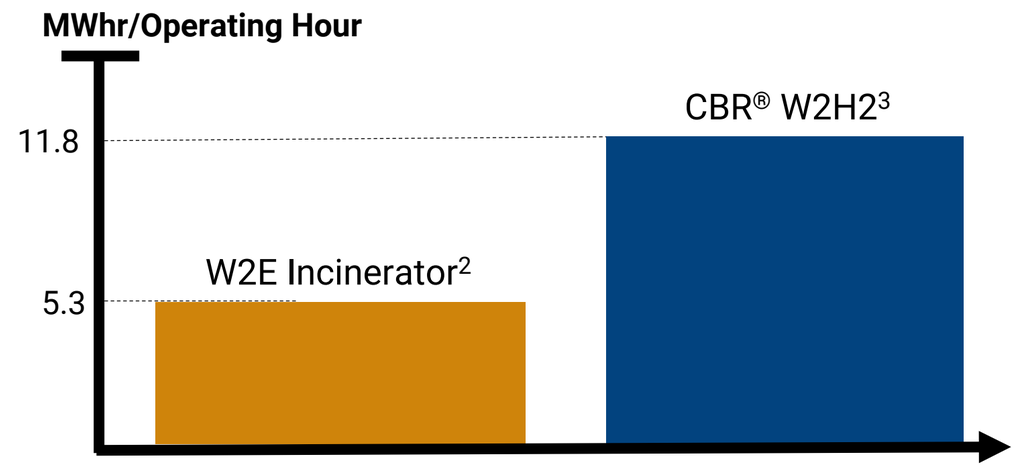
Optimal Solution for Creating Renewable Energy, Eliminating Wastes and Achieving Decarbonization Initiatives

1. Created to Maximize Hydrogen Production



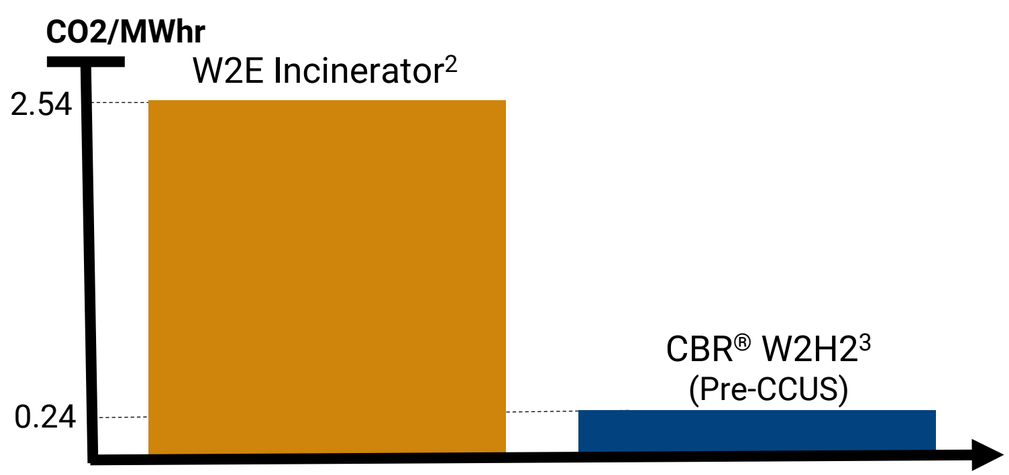
1. Cold gas efficiency is the % of waste input converted into thermolysis gas
2. Input / Output efficiency equals H2 produced in MW divided by MWth of the waste feedstock

2. Produces 2-3 Times > Energy from Waste



1. Results from processing 28,086 tons/yr. of waste feedstock (Herten)
2. Sellable energy of 21.3 MWth feedstock; W2E @25% efficiency source
3. Estimated via 2,624 tons hydrogen/yr., 1 ton of H2 = 33.6MWhr & 7,500 hours/yr.

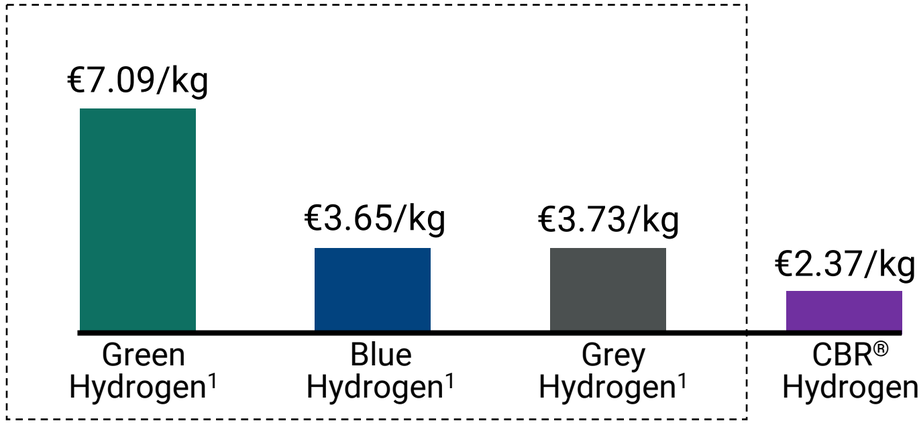
3. Generates < 10% CO2 Emissions / MWhr



1. Results from processing 19,144 tons of plastic wastes
2. W2E CO2 55,518 tons* pa / 21,900 MWhrs = 2.54; 2.9 tons CO2/ton plastics*
3. W2H CO2 18,764 tons pa / 76,675 MWhrs = 0.24; Lower emission achievable via CCUS

*https://www.qmre.ltd/carbon-emissions-and-plastic-waste/

4. Lowest Production Costs for Clean Hydrogen



1. Source: E-Bridge Hydex Index Feb. 2023 average; https://www.e-bridge.com
2. Cost-based price index tracking hydrogen production costs in Germany
3. Green H2 is from electrolyzer; Blue & Grey H2 from steam methane reforming

CBR® Technology Produces Green Hydrogen

CBR® W2H2 technology now certified "Green" by TÜV SÜD November 2021 & Net Negative CO_2 Emissions by RedCert Auditor

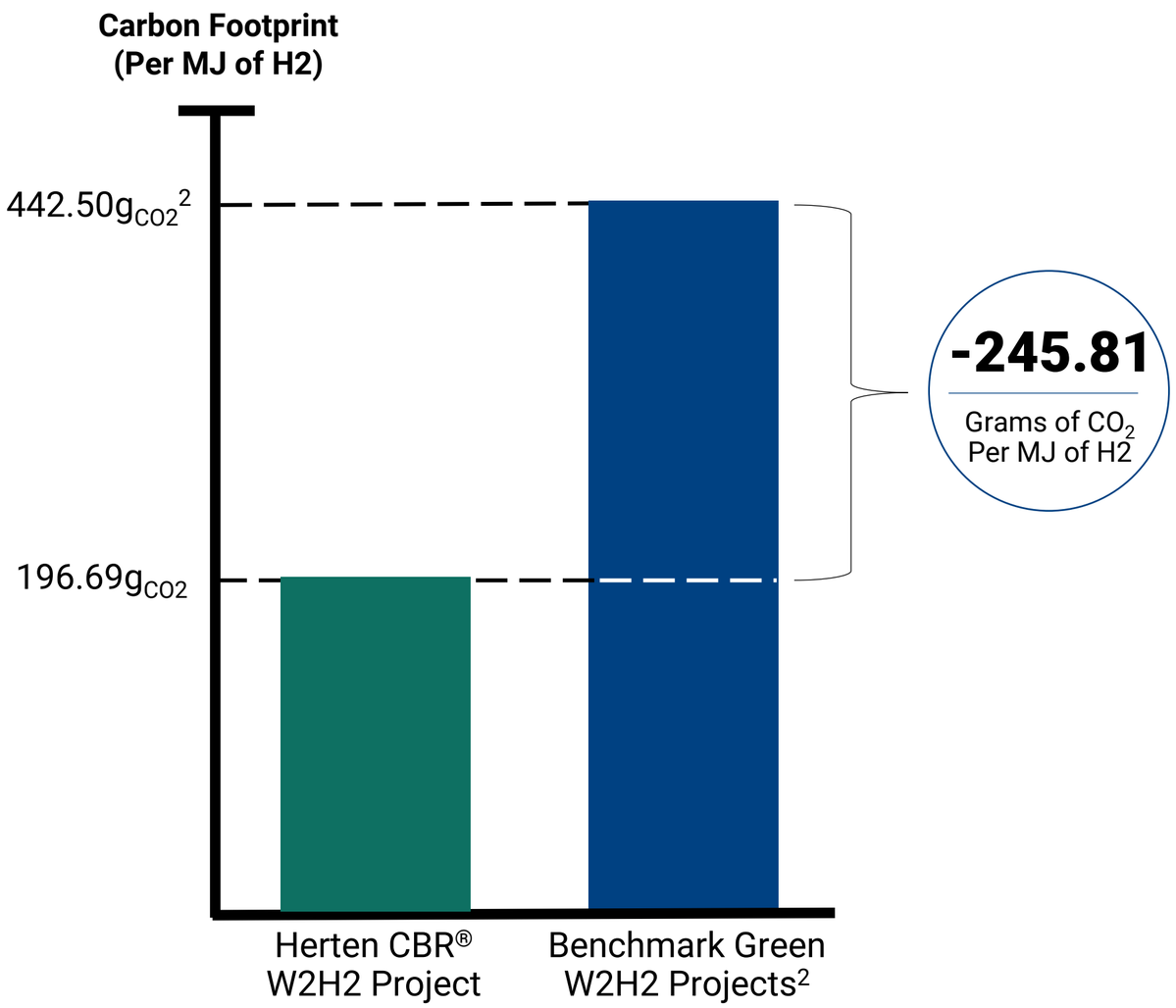
		SMR[1] Natural Gas Fueled GREY HYDROGEN	SMR[1] Natural Gas Fueled BLUE HYDROGEN	Electrolysis High-Cost GREEN HYDROGEN	CBR® Low-Cost GREEN HYDROGEN
01	**Non-Fossil Fuel Derivative** Excludes use of gasoline, natural gas and other fuel sources derived from fossil fuels	✗	✗	✓	✓
02	**Sustainable Fuel Source** Requires renewable sources of energy, which will be replenished through reproduction or other recurring process	✗	✗	✓	✓
03	**Low Carbon Emissions** Significantly lower levels of CO2 emissions per unit of energy than comparable, prevalent technologies	✗	✓	✓	✓
04	**Net Neg. CO_2 W2H2 Technology** CBR® technology certified by RedCert Auditor to produce net negative carbon emissions when compared to SMR[1], incineration & electrolysis	✗	✗	✗	✓

NOTES: 1) SMR = Steam Methane Reforming

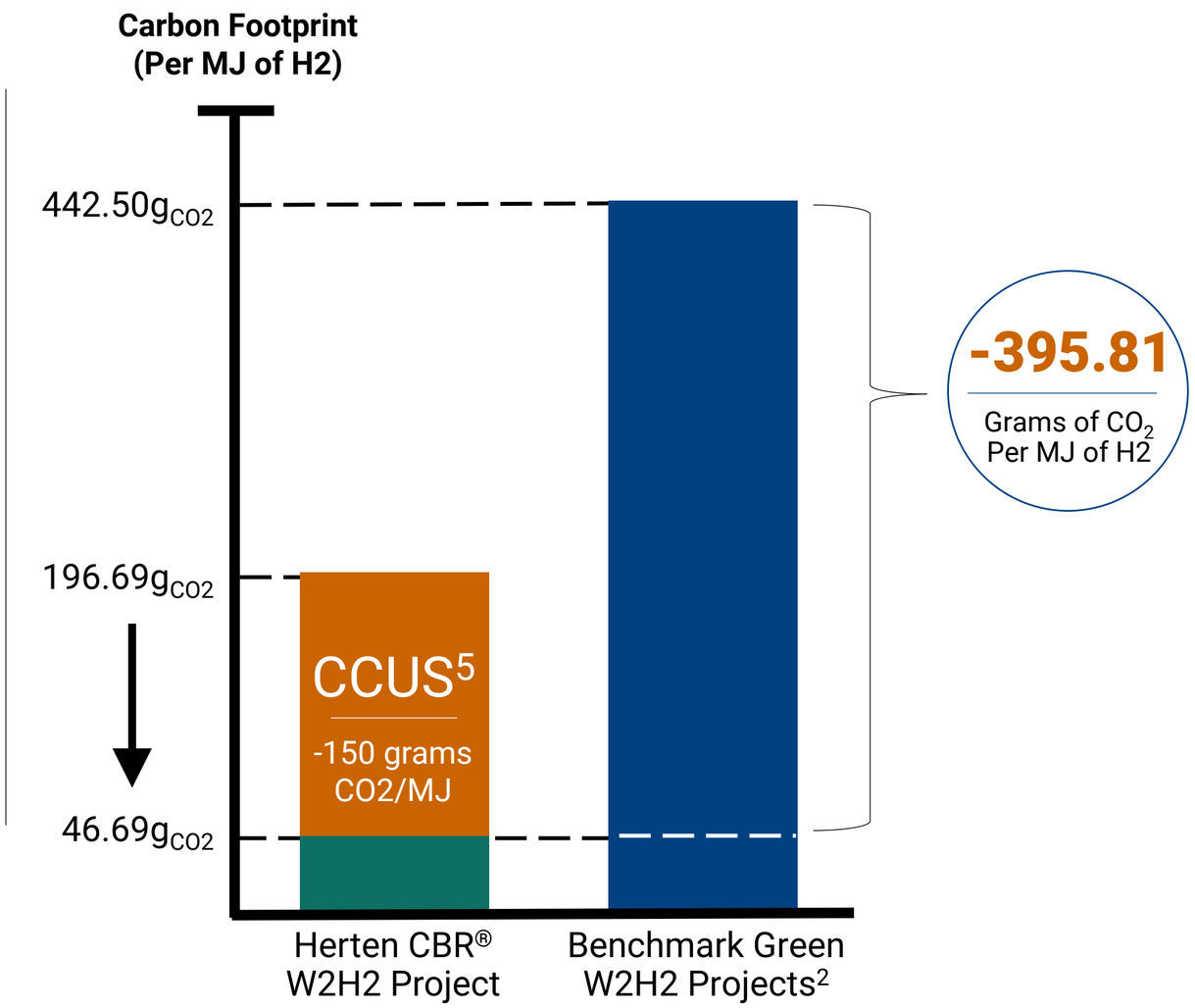
CBR® Technology Certified Net Negative CO_2

Removes 245 to 395 Grams of CO_2 for Every Megajoule (MJ) of Hydrogen Produced

1st **Certified Emission Savings of -245.81 $grams_{CO2}$[1] for Every Megajoule of Hydrogen Produced**



2nd **More Emission Savings will be Captured Integrating Latest CCUS[5] Technologies**



NOTES

1) ELUcert's GHG audit per EU's RED (Renewable Energy Directive) II; Certification subject to verification post-COD; **2)** Benchmark W2H2 technologies selected was incineration and electrolysis; **3)** 442.50$grams_{CO2}$ = 92.92$grams_{CO2/MJ\ FEEDSTOCK}$ / 21% efficiency (Efficiency of incineration (30%) times Electrolysis (70%); **4)** Fluor Corporation estimate; **5)** Carbon Capture Utilization & Storage technologies

Comparison to Other W2H2 Technologies

Six Major Advantages of CBR® Technology

ELECTROLYSIS (E) | INCINERATION + ELECTROLYSIS (IE) | STEAM METHANE REFORMING (SMR) | INCINERATION (I)

Higher Yield

2.81x

CBR®: 0.59 MW_{H2}/MW_{feed} (Meppen)
IE: 21% = I 30% * E 70% efficiency

Lower Opex

67%

CBR® opex = €2.37/H2 kg avg.[1]
Electrolysis opex = €7.09[1]/H2 kg avg.

CO2 Emissions

Certified Net Negative

-245.81 $grams_{CO2}$/MJ H2
CBR® Net Emission Savings[4]

Fossil Fuels

None

CBR®: Zero consumed during operations[5]
SMR: 1 MJ fossil fuels per 0.66 MJ of H2[6]

Less Electricity

⬇88%

CBR®: 6.56 kWhr to produce 1 kg H2[2]
Electrolysis: Minimum 53.3 kWhr for 1 kg H2[3]

Ash & Toxic Pollutants

<1%

CBR®: Minimal ash & pollutants created by reforming
I & IE: 10-20% ash, toxic chemicals & heavy metals[7]

NOTES: 1) CBR® opex €2.37/kg estimated for avg. 3 reformer W2H2 projects, €7.09/kg per Hydex Green Feb. 2023; **2)** Per Herten EMB analysis; **3)** German Ministry of Economic Affairs pg. **3)** BMWi Source; **4)** Herten Project—RedCert Auditor Certified Emission Savings, subject to verification post-COD; **5)** Depending on plant's design natural gas or propane may be used during startups; **6)** SMR 1 MJ of fossil fuel consumed per 0.66 MJ of H2 NREL Life Cycle Assessment Natural Gas Steam Reforming; **7)** Includes dioxins, furans, PFAS, lead, mercury and particulate matter—Why Waste Incineration is Harmful NRDC July 2021 Source

Hydrogen Production: Comparison to Electrolysis

CBR® Eliminates Wastes Producing H2 at Lower Costs

KEY CRITERIA		ELECTROLYSIS PLANT	CBR® W2H2 FACILITY
1	Fuel Source	**ELECTRICITY** Expensive—€91/MWhr Consumes 53.3 kWhr[2] for every 1 kg H2	**WASTE DERIVED FUELS** Cheap / Free Supplier typically pays ➔ revenues
2	Operating Costs	**HIGH** €6-8 per 1 kg of Hydrogen[1]	**LOW** €2-2.50 per 1 kg of Hydrogen
3	Scale	**LARGER / CENTRALIZED** Less flexible, higher upfront costs	**SMALLER / DECENTRALIZED** More flexible, lower upfront costs
4	Transportation Costs	**HIGHER** Larger footprint often means greater distance to customers	**LOWER** Smaller footprint enables less distance to customers
5	CO_2 Footprint	**VARIES** Highly dependent on fuel used to generate electricity	**SMALL** Significantly lower than other waste fueled technologies
6	Efficiency	**EFFICIENT** ~70% reported efficiency	**EFFICIENT** ~60-65% hydrogen yield; ~80% cold-gas (syngas)
7	End Result	**REPURPOSES ELECTRICITY** Consumes more energy in the form of electricity to produce less energy as hydrogen	**SOLVES MAJOR PROBLEMS** Eliminates waste reforming into CO_2 free energy source—hydrogen

NOTES: 1) Source: 2021 EnergieAgentur.NRW H2 2023 market research report; **2)** German Ministry of Economic Affairs pg. 3 Entwicklung des Bruttostromverbrauchs bis 2030 (bmwk.de); **3)** GHG = Greenhouse Gas

Elimination of Wastes: Comparison to Incineration

CBR® Technology is More Efficient, Cleaner & Flexible

KEY CRITERIA	MODERN INCINERATOR	CBR® W2H2 FACILITY
Creates Product Gas	**NO** Creates no core products that can be used outside of steam generated electricity	**YES** Product gas rich in hydrogen demanded in multiple applications—e.g., electricity, jet fuels, cars
Net Electrical Efficiency	**INEFFICIENT** 15-25% average	**EFFICIENT** 35-40% average—limited by turbine efficiency
LOW/HIGH ENERGY WASTE STREAMS **Multiple Feedstocks**	**LIMITED** Difficulty processing high variability feedstocks Higher kcal/kg waste will damage facility	**CAPABLE** Processes wider range of feedstocks including higher caloric value/higher tipping fee waste
Bottom Ash	**HIGH** Generates 15-20% ash—cost to dispose of one metric ton ash is €30 per ton (Germany)	**VERY LOW** Non-combustion process produces close to zero additional ash output; output ash ~/= input ash
Air Pollutants	**SEVERE[1]** Releases toxic pollutants: dioxins, furans, HCBs, PCBs, & emits toxic heavy metal nanoparticles	**MINIMAL** Non-combustion, chemical decomposition process greatly reduces emissions of pollutants
Carbon Footprint	**LARGE** Dirtiest form of energy generation—emits more CO_2 per unit of energy than coal-fired power plants	**SMALL** Greater energy efficiency results in vastly reduced CO_2 emissions per unit of energy produced
Downscaling Upscaling	**IMPOSSIBLE** Inherently inflexible—facility must be built to match fixed capacity to energy production	**CAPABLE** Inherently flexible—robust against fluctuating feedstock, modular design = add/minus towers
Recycling	**LOW** Treats everything as fuel—ignores waste hierarchy	**HIGH** Includes materials recovery facility process (MRF) before thermal treatment to improve performance

NOTES: 1) Why Waste Incineration is Harmful NRDC July 2021 Source

3rd Party Technical Due Diligence

CONCORD BLUE

Independent Technology Reviews

FICHTNER

- Validated CBR® technology works in commercial operating environments achieving constant operations in settings directly relevant for evaluating hydrogen production
- Reviewed and confirmed cost estimates, energy production, operating hour targets of Concord Blue's financial models
- Concluded CBR® technology is not affected by issues, which negatively impacted performance of other gasification technologies including accumulation of tars

LOCKHEED MARTIN

- Evaluated the leading gasification & pyrolysis-based technologies
- Selected CB as "best in class" and Lockheed Martin's exclusive W2E technology
- Reviewed data from 9 CB facilities and third-party reports
- Concluded that CB reforming process is sound, operates as designed, has multiple feedstock capability and ability to scale

MOTT MACDONALD

- Concluded CBR® system has ability to process wide range of feedstocks producing syngas suitable for gas engines to produce electricity
- Determined CBR® technology has low levels of complexity risk and the ability to replicate plant delivery consistently within a continuous process improvement environment
- Confirmed CBE can deliver turnkey W2E solutions in developing markets

AECOM

- Completed 2.5 years working with CBR® technology
- Concluded CBR® is one of the most appropriate conversion technologies to have successfully processed variety of feedstocks
- Confirmed CBR® W2E facility in Pune, India was performing according to design specifications, processing RDF, and generating electricity
- Confirmed CBR® W2E facility in Mumbai, India was operating successfully and processing multiple feedstocks including biomass

"CBR® technology works well with no significant adverse findings."

Conclusion from technical due diligence completed by four separate, world class engineering companies.

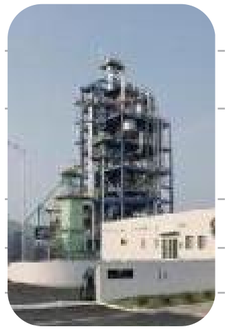
Concord Blue Projects: H2 & Syngas Production

Completed 10 Facilities Across 4 Countries

Concord Blue's scalable modular solution can be as small as 250kW, as large as 400MW

HYDROGEN PRODUCTION

LOCATION	**IZUMO, JAPAN**	**HERTEN II, GERMANY**	**OMUTA, JAPAN**
OPERATED	2005-present	2010-2012	2011-present
SCALE	1 MW_{th} 8.92 kg H2/hour	0.06 MW_{th} 0.60 kg H_2/hour	2.5 MW_{th} 24.6 kg of H_2/hour
FEEDSTOCK	Woodchips	Waste mix / wood chips	Dry Sewage
FLOWRATE	0.6 ton/hour	0.035 ton/hour	0.625 dry ton/hour
	First commercial plant	**Demonstration plant for World Hydrogen Conference 2010**	**The first commercial biomass-to-hydrogen facility in the world**



SYNGAS PRODUCTION

LOCATION	**HERTEN I, GERMANY**	**MAHAD, INDIA**	**HYDERABAD, INDIA**
OPERATED	2002-2005	2011-2016	2022-present
SCALE	1 MW_{th} 340 m^3 syngas/hour	3 MW_{th} 1,200 m^3 syngas/hour	0.4 MW_{th} 600 m^3 syngas/hour
FEEDSTOCK	Various	Toxic waste effluent	Pharmaceutical waste
FLOWRATE	0.35 ton/hour	1 ton/hour	0.15 ton/hour
	First pilot plant	**Fuel used industrially as natural gas replacement**	**Fuel used industrially as natural gas replacement**

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Concord Blue Projects: Electricity Production

Completed 10 Facilities Across 4 Countries

Concord Blue's scalable modular solution can be as small as 250kW, as large as 400MW

ELECTRICITY PRODUCTION

LOCATION	**ANAN, JAPAN**
OPERATED	2006-2009
SCALE	0.15 MW_{th}
	0.038 Mw_e
FEEDSTOCK	Woodchips
FLOWRATE	0.1 ton/hour
	Demonstration plant

LOCATION	**VASAI, INDIA**
OPERATED	2009-present
SCALE	0.18 $MW_{th,}$
	0.063 MW_e
FEEDSTOCK	Various
FLOWRATE	0.065 ton/hour
	4TH Generation Demonstration CBR®

LOCATION	**PUNE, INDIA**
OPERATED	2012-2021 (MRF only)
SCALE	10 MW_{th}
	3 MW_e
FEEDSTOCK	MSW
FLOWRATE	11.1 tons/hour (MRF input)
	Largest operating plant

LOCATION	**OWEGO, USA**
OPERATED	2016-2020
SCALE	750 kW_{th}
	250 kW_e
FEEDSTOCK	Biomass, MSW
FLOWRATE	0.3 ton/hour
	1st Lockheed plant

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Industry Leading Waste to Energy Technology Driving the Hydrogen & Clean Energy Transformation

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