Niagara Region

Administration
Office of the Regional Clerk
1815 Sir Isaac Brock Way, PO Box 1042, Thorold, ON L2V 4T7
Telephone: 905-685-4225 Toll-free: 1-800-263-7215 Fax: 905-687-4977
www.niagararegion.ca

November 19, 2021

CL 21-2021, November 18, 2021
PWC 11-2021, November 9, 2021
PWC-C 31-2021, November 9, 2021

Joanne Hyde, City Clerk
City of Thorold
3540 Schmon Parkway, PO Box 1044
Thorold, ON L2V 4A7

SENT ELECTRONICALLY

Thorold Biomass Pyrolysis Project- Biomass to Renewable Natural Gas and Biocarbon
PWC-C 31-2021

Regional Council, at its meeting held on November 18, 2021, passed the following recommendation of its Public Works Committee:

That the presentation from CHAR Technologies Ltd., respecting Thorold Biomass Pyrolysis Project – Biomass to Renewable Natural Gas and Biocarbon, **BE RECEIVED**;

That Regional Council **SUPPORT IN PRINCIPLE** CHAR Technologies Ltd. proposed Thorold Biomass Pyrolysis Project with no obligation for funding from the Region; and

That a copy of this motion **BE CIRCULATED** to the City of Thorold.

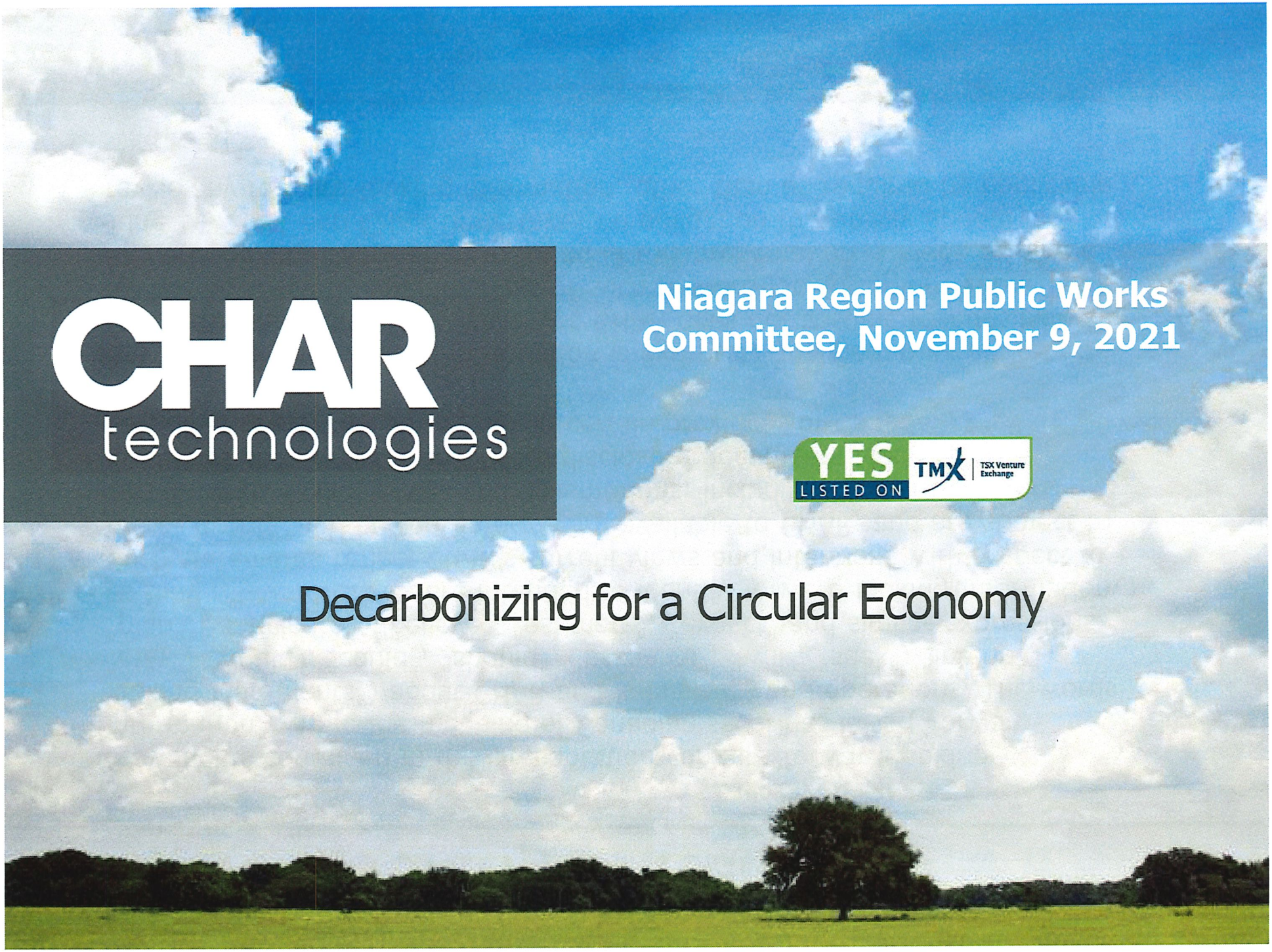
A copy of PWC-C 31-2021 is enclosed for your reference.

Yours truly,

Ann-Marie Norio
Regional Clerk
:cv

CLK-C 2021-170

cc: B. Zvaniga, Interim Commissioner, Public Works
G. Spezza, Director, Economic Development
N. Coffer, Executive Assistant, Commissioner of Public Works
K. Boyko, Administrative Assistant, Economic Development


CHAR
technologies
Niagara Region Public Works
Committee, November 9, 2021
YES
LISTED ON
TMX
TSX Venture
Exchange
Decarbonizing for a Circular Economy

Forward-Looking Statements

Statements contained in this presentation contain "forward-looking information" within the meaning of Canadian securities laws ("forward-looking statements") about CHAR and is business and operations. The words "may", "would", "could", "should", "potential", "will", "seek", "intend", "plan", "anticipate", "believe", "estimate", "expect" and similar expressions as they relate to CHAR, are intended to identify forward-looking information. Such statements reflect CHAR's current views and intentions with respect to future events, and current information available to CHAR, and are subject to certain risks, uncertainties and assumptions, including those risk factors discussed or referred to in CHAR's disclosure documents filed with the securities regulatory authorities in certain provinces of Canada.

Any such forward-looking information is expressly qualified in its entirety by this cautionary statement. Moreover, CHAR does not assume responsibility for the accuracy or completeness of such forward-looking information. The forward-looking information included in this presentation is made as of the June 14, 2021 and CHAR undertakes no obligation to publicly update or revise any forward-looking information, other than as required by applicable law.

CHAR Overview

- Three groups:

ALTECH

  - Environmental Engineering Services & Compliance

CHARTECH SOLUTIONS

  - Advanced Industrial Clean Technologies for:
    - Clean Water
    - Waste Reduction & Renewable Energy

CHAR BIOCARBON

  - Pyrolysis Plant operations, Biocarbon & Pyrolysis Gas Production
  - Pyrolysis Products R&D
  - Biocarbon Market Development & Offtake

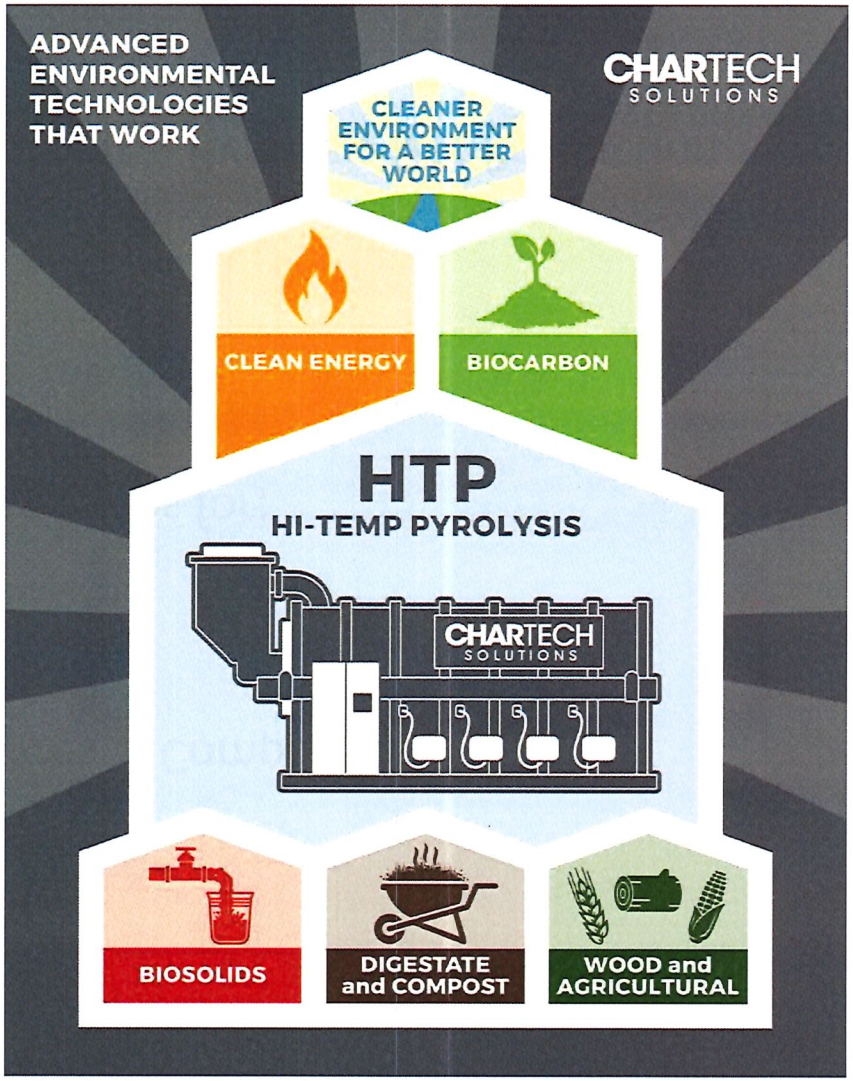
Pyrolysis Future

- ✓ Produce 2nd Generation Renewable Natural Gas (RNG), Green Hydrogen and a GHG neutral biocoal from challenging organic waste streams
- ✓ Complete destruction of PFAS/PFOS ("forever chemicals") in biosolids and eliminating their significant disposal costs

CHAR will capitalize on

>$25 Billion North American Market:

Biosolids Management: $2.7B
Biocoal (Canada): $12B
RNG: $10B



Proprietary Pyrolysis Technology


CHAR HTP facility in London, ON

Zero Oxygen Process – No combustion possible, high temperature conversion

Reduce Mass - Reduces organics waste mass by up to 90%

Self-Sustaining – Gas produced by pyrolysis fuels the system

Value-Added Outputs – Renewable gas and solid biocarbons (biochar, biocoal or activated biocarbon)

PROCESS PATENTS FOR VALUE-ADD PRODUCT OUTPUTS FROM PYROLYSIS ORGANIC WASTE PROCESSING:

SulfaCHAR™ CATALYTIC DESULFURIZATION

CLEANFYRE

CLEANFYRE

March 17th – Milestone 1,000 Tonne Order

CHAR technologies

YES LISTED ON TMX | TSX Venture Exchange

Proprietary Output of Pyrolysis - Biocoal

Fossil coal unloading at ArcelorMittal Dofasco

Potential Biocoal Market	Coal Consumption (Tonne/yr)
Ontario Steel	1,700,000
Canadian Steel (excl. Ont)	2,000,000
Canadian Cement	1,700,000
Canadian Thermal	44,700,000
Canadian Total:	**49,400,000**

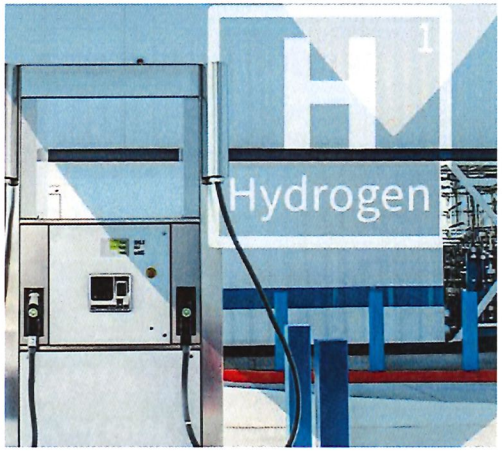
Quick Facts:

- 1 tonne coal = 3 tonnes GHG
- 1 tonne biocoal replaces 1 tonne coal
- 1 tonne biocoal = 0 tonnes GHG
- GHG Pricing = $170/tonne by 2030
- In 2030, 1 tonne of coal will cost an extra $510

CHAR produces a proprietary brand of biocoal called

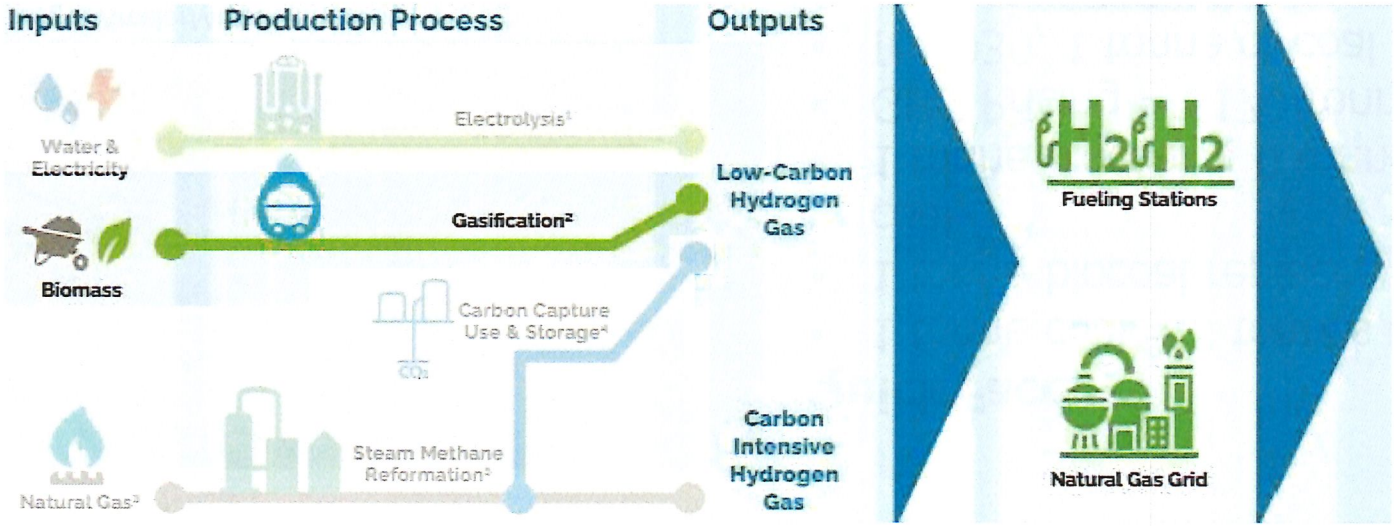
CLEANFYRE

Renewable Green Hydrogen

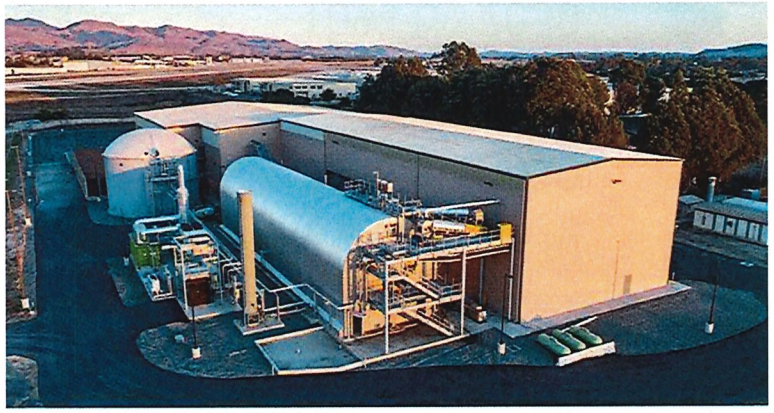


Across North America, CHAR is well positioned for the growing demand for hydrogen energy and is a leader in distributed green hydrogen generated from biomass including anaerobic digestate and biosolids.

CHAR's first facility in California will generate 100 kg/hr of green hydrogen



CHAR / Hitachi Green Hydrogen Project



San Luis Obispo (SLO) anaerobic digestion facility

CHAR and Hitachi Zosen Inova (Hitachi or "HZI") reached an agreement to develop a high temperature pyrolysis (HTP) to green hydrogen system at their existing San Luis Obispo (SLO) anaerobic digestion facility in California.

Under this agreement, CHAR's HTP technology will process 18,000 tonnes per year of solid anaerobic digestate into 1,320 tonnes of green hydrogen per year, and 2,800 tonnes per year of biocarbon.

The Kompogas® plant in San Luis Obispo has lighthouse character for HZI in many respects. When it was commissioned in 2018, it was the first Kompogas® plant in the USA. It is also the first that HZI not only developed and built but also fully owns and operates itself.

This initial system with Hitachi is the second HTP facility for CHAR and is the first HTP facility to be constructed in the United States.

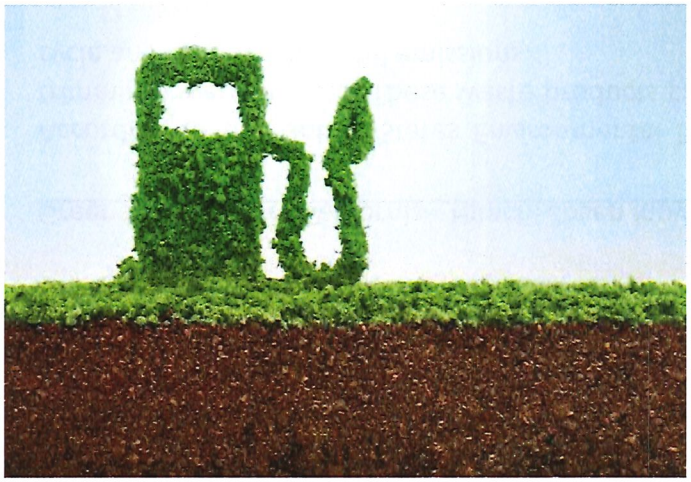
Hitachi Zosen Inova Corporate Announcement

Green Hydrogen for California - Hitachi Zosen Inova AG (hz-inova.com)

According to the United States Environmental Protection Agency (EPA), in 2018 over 98.5 million tonnes of food waste and yard trimmings were created. These waste products can be used in anaerobic facilities to produce green energy, closing the environmental cycle and reducing harmful emissions.

Hitachi Zosen Inova recently completed construction of their 100th anaerobic digestion system

Renewable Natural Gas (RNG)



- Anaerobic digestion (biogas) to RNG is first-generation technology, fed by organic wastes
- Pyrolysis is a second-generation technology, fed by organic wastes, composts and woody biomass
- Recent study shows 82% of RNG in Québec will need to come from Second Generation RNG (Énergir)
- **Anaerobic digestion can't convert woody material into RNG. Pyrolysis is well poised to lead future RNG production**

Jurisdiction	RNG Target	Utility
California	20% by 2030	SoCalGas
Vermont	20% by 2030	Vermont Gas
British Columbia	15% by 2030	FortisBC
Québec	10% by 2030	Énergir

Industry Transition and Opportunity

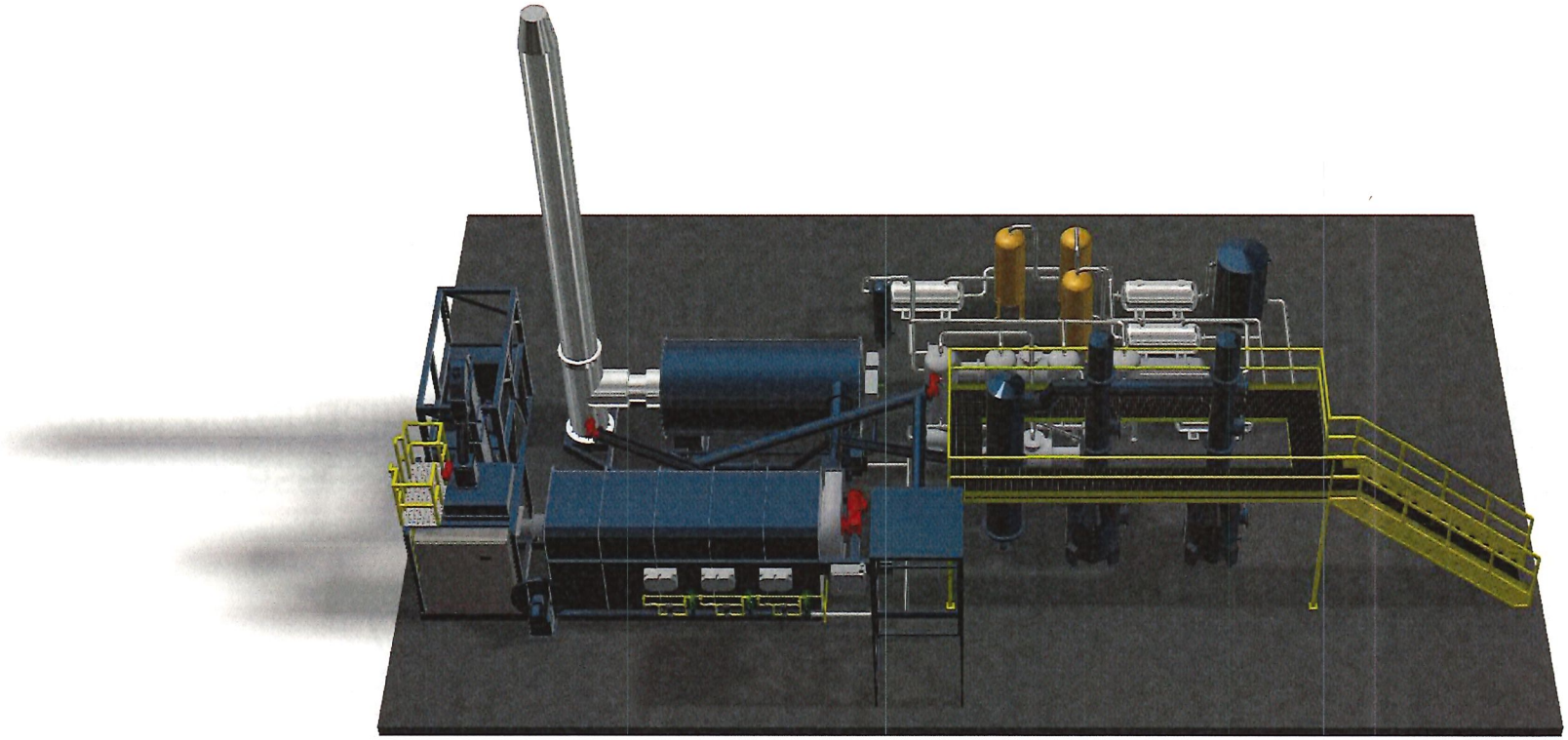
BlackRock is "... removing from our ... active investment portfolios the public securities ... of companies that generate more than 25 per cent of their revenues from thermal coal production."

- Larry Fink, CEO of BlackRock Inc, January 2020

"Studies assessing Canada's feasible RNG supply have estimated that we could potentially produce 90-218 PJ per year. This amount dwarfs the ***6 PJ of RNG that Canada produced in 2019***, but is still well shy of the amounts required to meet ambitious RNG targets being set by companies and governments. For context, [Eight Capital] estimate that FortisBC's 15% RNG blending target ***will require roughly 35-40 PJ of RNG per year***."

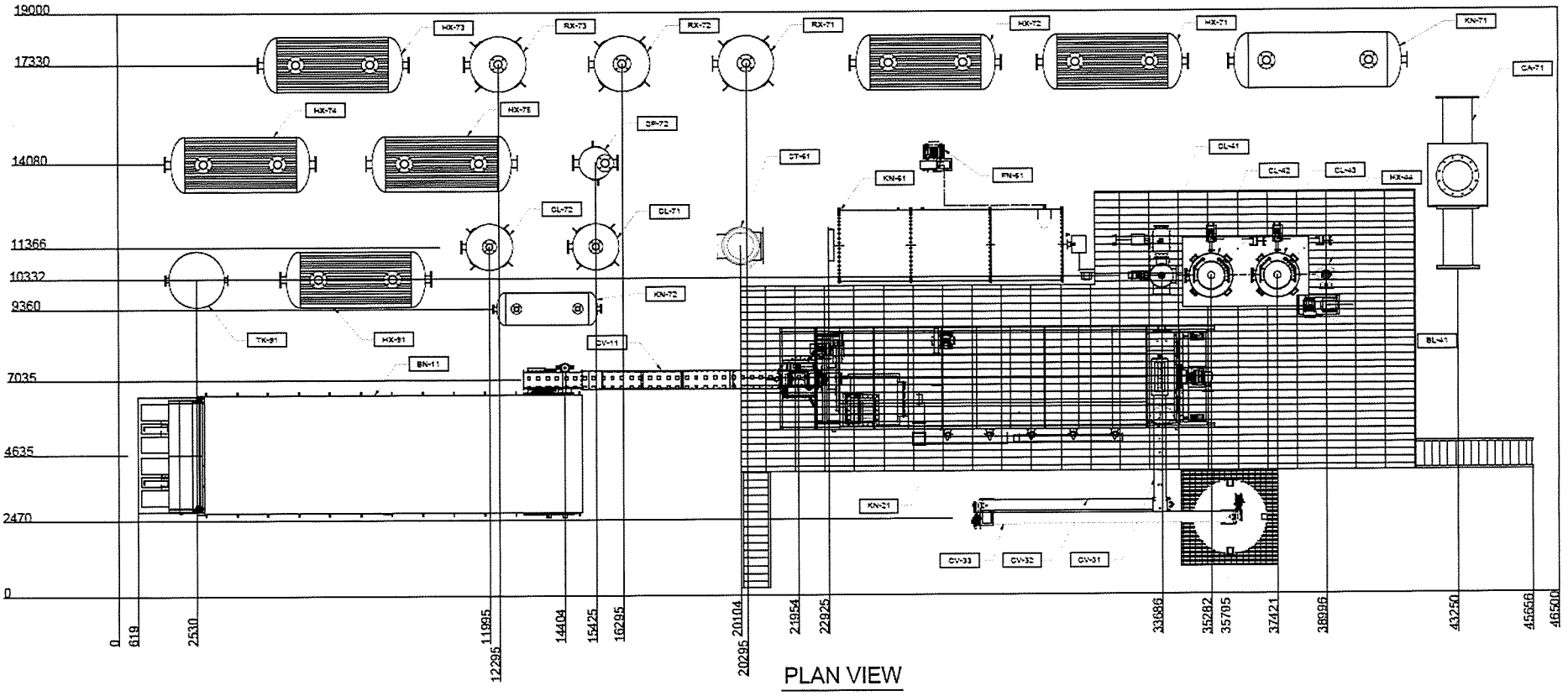
- Sean Keaney, Eight Capital Report on Cleantech, June 2021

Thorold: Phase 1 – 20,000 GJ/yr



- Move existing system to Thorold
- Funding in place (Natural Gas Innovation Fund, Bioindustrial Innovation Canada, CHAR
- Produce RNG and biocoal for steel industry
- Commissioning March 2022

Thorold Phase 2: Single Module



884 m² / 9,500 sqft

Thorold: CleanFyre & RNG

- Produce 500,000 GJ/yr RNG (average gas consumption of 5,500 homes)
  - Potential to grow RNG production hub to service local industrial gas consumers
- Reduces GHGs by over 60,000 tonnes per year (equivalent to removing 13,000 cars from the road each year)
- Processes approx. 76,000 TPY biomass

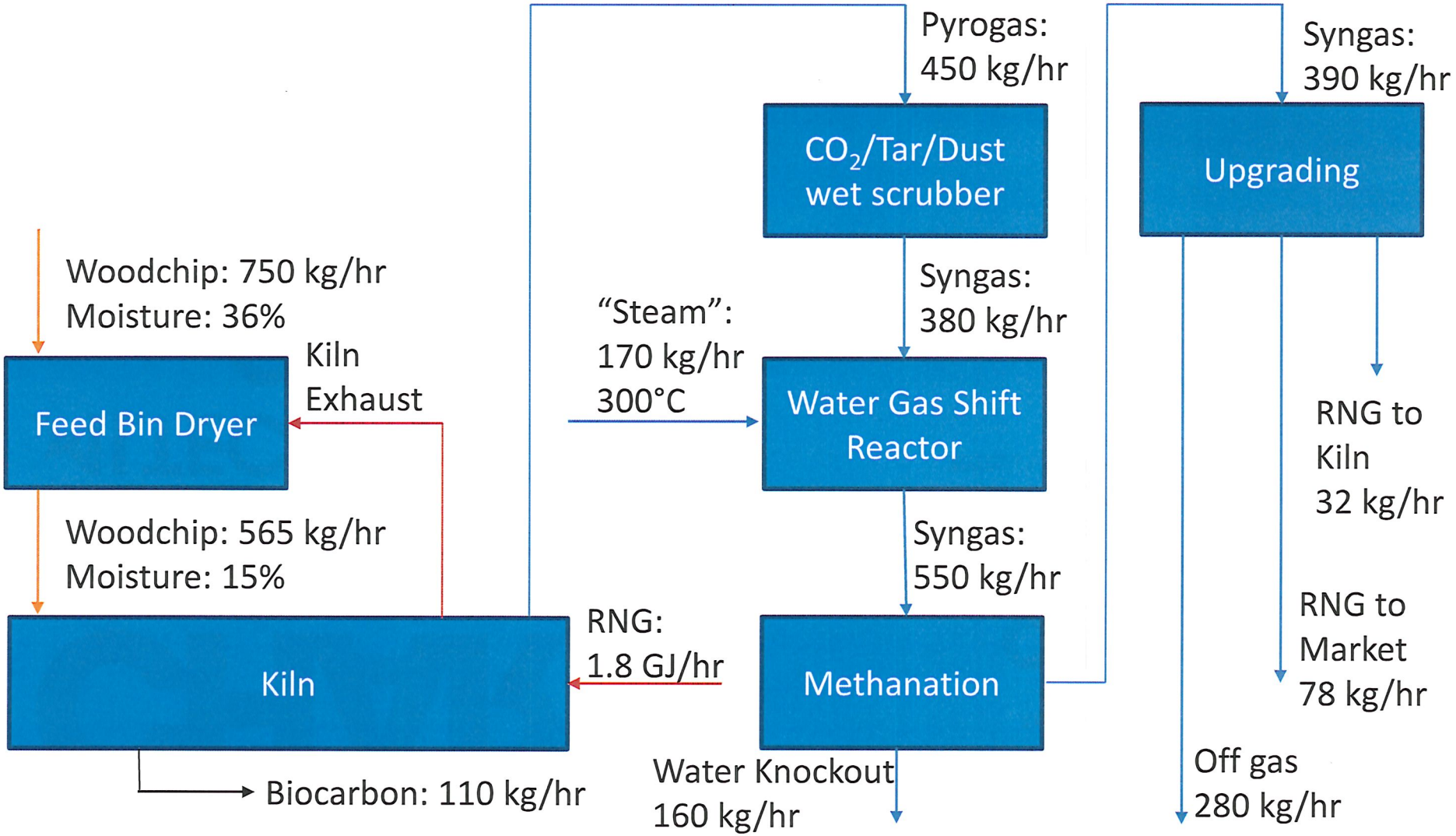
CHAR technologies

ALTECH CHARTECH SOLUTIONS

CHAR BIOCARBON

Andrew White
CEO
CHAR technologies
403 - 789 Don Mills Rd., North York, ON, Canada M3C 1T5
T: 647.968.5347
Andrew.white@CHARtechnologies.com
www.CHARtechnologies.com

S.Ontario Project – Process Flow



S.Ontario Project - Mass Balance

CHAR BIOCARBON

	Input Wood waste	Output 1: RNG	Output 2: Biocarbon
Flow (kg/hr)	750	78 (4.3 GJ/hr)	110

%v/v	Pyrogas	Syngas post Scrub.	Syngas post WGS	Syngas post Meth.	Offgas to Stack	RNG Stream
Flow (kg/hr)	450	380	550	550	280	110
CH_4	-	8%	4%	30%	-	98%
H_2	30%	35%	58%	1%	3%	-
CO	27%	32%	9%	<1%	-	-
CO_2	13%	16%	27%	28%	95%	-
H_2O	15%	2%	2%	40%	2%	-
Other HC	15%	7%	<1%	<1%	-	2%

CHAR technologies

Decarbonizing for a Circular Economy through Advanced Design, Technology and Environmental Services

ABOUT US

CHAR is a cleantech development and services company, specializing in high temperature pyrolysis, converting woody materials and organic waste into renewable gases (renewable natural gas and green hydrogen) and biocarbon (activated charcoal "SulfaCHAR" and solid biofuel "CleanFyre"). Additional services include custom equipment for industrial water treatment, and providing services in environmental compliance, environmental management, site investigation and remediation, engineering and resource efficiency.

CHAR Technologies Ltd is a leading cleantech development and environmental services company listed on the TSXV ('YES.V'). We specialize in delivering innovative service and technology solutions that are environmentally sustainable and cost-effective for our clients.

THOROLD PROJECT

There are two main project partners – Walker Environmental (Walker) and CHAR Technologies Ltc. (CHAR).

CHAR is Walker's technology partner as part of the Walker Environmental & CHAR Technologies - RNG and Biocoal Production via High Temperature Pyrolysis – Project.

CHAR will operate the high temperature pyrolysis (HTP) technology to generate biocoal and synthetic gas (syngas), and leverage their engineering experience to develop upgrading technologies to refine the syngas into renewable natural gas (RNG). Walker will secure the woodwaste feedstock and be responsible to preprocess the incoming material.

The facility, located near the Walker Environmental Waste Disposal and Resource Recovery Campus in Thorold, Ontario, will consist of four major components:

1. Woodwaste preprocessing to grind the wood waste into 3/8-inch (0.95 cm) size wood chips. The preprocessing equipment includes grinders and a hammer mill.
2. Two HTP kiln systems that will heat the wood waste in the absence of oxygen and generate biocoal and syngas.
3. A biocoal collection and bagging system.
4. A syngas to RNG upgrading facility.

The Thorold facility would require between 60k – 75k tonnes per year. The system has been designed to provide end of life use for wood residuals and woodwastes for low grade, low value, and preprocessed wood supply in any number of forms that traditionally end up in landfills.

The facility won't ever be in competition for high value wood products, such as logs or chips, already committed to other sectors. This will be a first of its kind solution towards a fully circular life cycle.

Production estimates are:

- 500k GJ of RNG (gas consumption of 5.5k Ontario home)
- 10k tonnes of CleanFyre™ biocarbon (currently used by steel industry as a drop in substitute for coal)
- 60k tonnes reduction of GHG emissions (equivalent to removing 13k cars)

CREATING RENEWABLE GASES – HOW IT WORKS

High Temperature Pyrolysis Technology

CHAR's proprietary high temperature pyrolysis technology (HTP) is a key growth area for CHAR. HTP heats woody and organic materials to high temperatures in the complete absence of oxygen. Without oxygen, the material does not burn and is instead converted into clean and high value products:

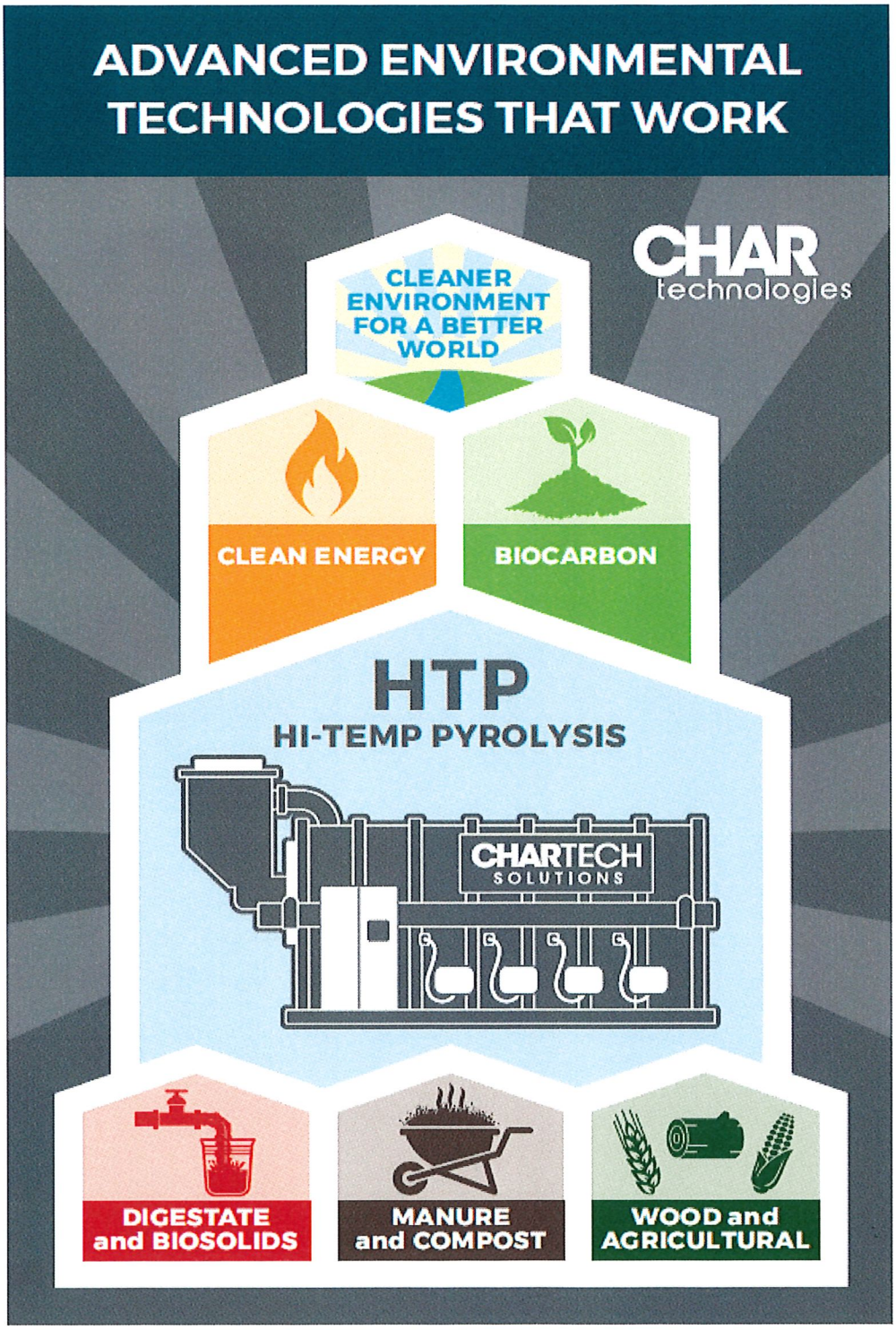
1. **Renewable gases:** The HTP process converts woody-biomass into a hydrogen-rich synthetic gas (syngas). The syngas can be further processed into green hydrogen or renewable natural gas depending on the need of the end user.

2. **Heat:** The HTP process is autothermal – that is, it creates its own energy and does not need external heat sources. A part of this process generates additional heat, which can be captured for various industrial heat load requirements.

3. **Biocarbons:** After the HTP process, the remaining biocarbon can be optimized to be an activated carbon (SulfaCHAR™), a carbon-sequestering soil amendment (biochar) for agricultural use as a fertilizer additive or even a fossil coal replacement (CleanFyre™) for the steel industry. Biochar acts as part of a natural carbon capture and sequestration cycle, fixing carbon from the woody or organic materials into an extremely stable form, locking the carbon into the soils. When used as a drop-in biocoal (CleanFyre™) significant GHG reductions can be achieved with little upfront cost incurred by steel companies.

CHAR technologies

ALTECH CHARTECH SOLUTIONS



789 Don Mills Rd, Suite 403, Toronto, Ontario, M3C 1T5
CHARtechnologies.com – info@CHARtechnologies.com
1-800-323-4937