Innovative Gasification Technology to produce GREEN HYDROGEN from BIOMASS residues

MISSION: HYDROGEN

HYDROGEN
ONLINE
WORKSHOP
March 23 2023

MINNOVA
RENEWABLE ENERGY

www.minnovacorp.ca
info@minnovacorp.ca

We make BIOMASS work

Cautionary Notes

Cautionary Note Regarding Forward-looking Information

This presentation includes market, industry and economic data which was obtained from various publicly available sources and other sources believed by the Company to be true. Although the Company believes it to be reliable, neither the Company nor the Underwriters have independently verified any of the data from third party sources referred to in this presentation or analyzed or verified the underlying reports relied upon or referred to by such sources, or ascertained the underlying economic and other assumptions relied upon by such sources. The Company believes that its market, industry and economic data are accurate and that its estimates and assumptions are reasonable, but there can be no assurance as to the accuracy or completeness thereof. The accuracy and completeness of the market, industry and economic data used throughout this presentation are not guaranteed and the Company and the Underwriters do not make any representation as to the accuracy or completeness of such information.

In this presentation, all amounts are in Canadian dollars, unless otherwise indicated. Unless otherwise indicated or the context otherwise requires, all references in this presentation to "Minnova and Minnova Renewable Energy", the "Company," "we," "our," "ours," "us" or similar terms refer to Minnova and Minnova Renewable Energy Infrastructure Corp., together with its wholly-owned subsidiaries. Any graphs, tables or other information in this presentation demonstrating the historical performance of Minnova and Minnova Renewable Energy or of any other entity contained in this presentation are intended only to illustrate past performance and are not necessarily indicative of future performance of Minnova and Minnova Renewable Energy or such other entities.

An investment in our common shares is subject to a number of risks that should be considered by a prospective purchaser. Prospective purchasers should carefully consider the risk factors described under "Risk Factors" in the prospectus before purchasing common shares.

Forward-Looking Information

This presentation contains "forward-looking information" within the meaning of applicable Canadian securities laws. Forward-looking information may relate to the Company's future business, financial outlook and anticipated events or results and may include information regarding the Company's financial position, business operations, business strategy, growth strategies, acquisitions pipeline, addressable markets, budgets, operations, financial results, taxes, use of proceeds, dividend policy, the reorganization of our corporate structure and our plans and objectives. Particularly, information regarding our expectations of future results, performance, achievements, prospects or opportunities or the markets in which we operate is forward looking information. In some cases forward-looking information can be identified by words or phrases such as "may", "will", "expect", "intend", "plan", "believe", "occur", "predict", or "likely", or the negative of these terms, or other similar expressions, such as "an opportunity exists", "strategy", "pipeline", "outlook", "medium term", "here to stay" or "projection", which are intended to identify forward-looking statements.

Forward-looking information is necessarily based on a number of opinions, estimates and assumptions that the Company considered appropriate and reasonable as of the date such statements are made, and is subject to known and unknown risks, uncertainties, assumptions and other factors that may cause the actual results, level of activity, performance or achievements to be materially different from those expressed or implied by such forward-looking information. These risks and uncertainties include, but are not limited to, those described under "Risk Factors" in the preliminary prospectus. Although the Company has attempted to identify important risk factors that could cause actual results to differ materially from those contained in forward-looking information, there may be other risk factors not currently known to the Company or that the Company currently believes are not material that could also cause actual results or future events to differ materially from those expressed in such forward-looking information. There can be no assurance that such information will prove to be accurate, as actual results and future events could differ materially from those anticipated in such information. Accordingly, prospective investors should not place undue reliance on forward-looking information. The forward-looking information contained in this presentation represents the Company's expectations as of the date of this presentation (or as the date it is otherwise stated to be made) and is subject to change after such date. However, the Company disclaims any intention or obligation or undertaking to update or revise any forward-looking information whether as a result of new information, future events or otherwise, except as required under applicable Canadian securities laws.

All of the forward-looking information contained in this presentation is expressly qualified by the foregoing cautionary statements. Prospective investors should read this entire presentation and, when available, the prospectus of Minnova and Minnova Renewable Energy and consult their own professional advisors to ascertain and assess the income tax, legal, risk factors and other aspects of an investment in our common shares.

Non-IFRS Financial Measures

This presentation makes reference to certain non-IFRS financial measures such as "working capital", "EBITDA", "Adjusted EBITDA" and "operating profit". The Company believes that these measures, together with measures determined in accordance with IFRS, provide investors with an improved ability to evaluate the underlying performance of the Company. Non-IFRS measures do not have any standardized meaning prescribed under IFRS, and therefore they may not be comparable to similar measures employed by other companies. Rather, these measures are provided as additional information to complement those IFRS measures by providing further understanding of the Company's results of operations from management's perspective. Accordingly, these measures should not be considered in isolation or as a substitute for measures of performance prepared in accordance with IFRS. Certain totals, subtotals and percentages may not reconcile due to rounding.

Unless otherwise noted, all dollars in this presentation are in C$ dollars.

MINNOVA
RENEWABLE ENERGY

Scalable Green Hydrogen Production from Biomass

Minnova Renewable Energy invests in new technologies that mitigate climate change by converting waste biomass to energy.

Invest and Develop	 3rd Generation biomass gasification technology can produce a higher hydrogen content syngas Produce carbon neutral pure hydrogen or other valuable biofuels
ESG Focus	 Sustainable Waste to green hydrogen is socially accepted Meets Environmental, Social and Governance (ESG) goals
Bioenergy Opportunity	 Government, industry and society at large are seeking increased sustainable renewable energy supply. Green H_2 and other biofuels from sustainable biomass gasification are an obvious solution

Minnova Renewable Energy

A Bold Vision to be a Leader in Global Energy Transition

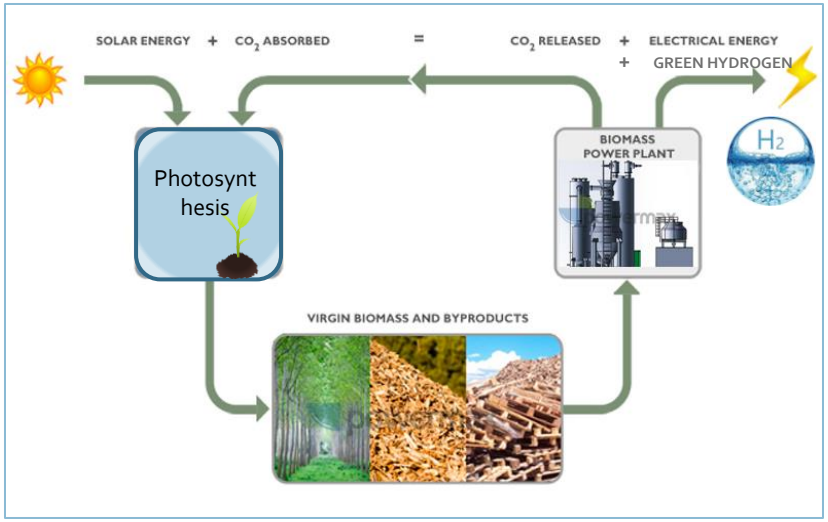
Become a leading global Cleantech company that develops and acquires innovative technologies to create a more a sustainable future:

- Transform biomass to energy
- EFFICIENTLY use WASTE biomass (forest, agricultural and municipal) and MAXIMIZE hydrogen recovery
- Produce GREEN HYDROGEN and a diversity of zero carbon biofuels to accelerate Global Energy Transit to
- Where possible re-use existing and legacy fossil fuel infrastructure (e.g., natural gas pipelines)
- Contribute to reduced fossil fuel use and greenhouse gas emission

Biomass – Living Stored Energy

- Biomass is a natural source of energy from the organic material that makes up plants and organic waste such as: •agricultural crop residues • forestry residues • algae • wood processing residues • sorted municipal solid waste (MSW) • algae • industrial wastes • urban wood waste, and food waste to name a few
- Energy derived from biomass contributes 55% of current renewable energy globally, and over 6% of global energy supply[1]
- 3rd generation MRE technology can replace outdated less efficient biomass gasification technology

Energy contained in biomass is stored solar energy which can be converted into green Hydrogen, clean electrical power or other biofuels for Net Zero CO_2 balance



Notes: 1) IEA (2022), Bioenergy, IEA, Paris https://www.iea.org/reports/bioenergy, License: CC BY 4.0

MINNOVA RENEWABLE ENERGY

Green Hydrogen from Biomass Waste

The World needs more CLEAN ENERGY

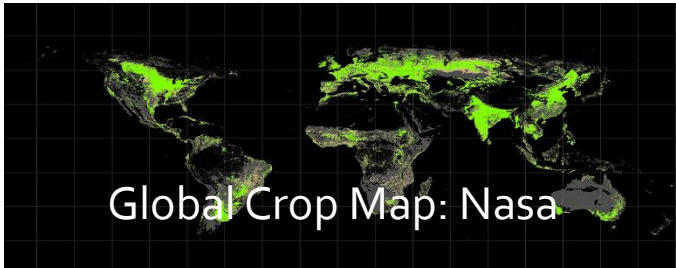
Green hydrogen will be a useful FUTURE FUEL to reduce CO2 emissions

Benefits of **MRE gasification of waste** to produce a clean, high hydrogen content syngas include:

- Sustainable feedstock
- Zero CO2 emissions
- Highly efficient (>50% H2 yield)
- Distributed and scalable
- Simple to operate
- Low maintenance
- Matches NEED with FEEDstock”
- Energy security


Electricity Use: Nasa


Global Forest Map: Nasa


Global Crop Map: Nasa

MINNOVA RENEWABLE ENERGY

Why Hydrogen from Biomass?

- Annual global hydrogen demand estimated at ~100 million tonnes
- Current hydrogen production is GREY hydrogen, produced almost exclusively from fossil fuels, resulting in close to 900 Mt of CO_2 emissions
- Global Energy Transition policies expected to accelerate use of GREEN hydrogen to over 200 million tonnes annually
- MRE's innovative 3rd generation biomass gasification technology focused on:
  - Maximizing yield and recovery of hydrogen in syngas
  - Being low cost
  - Utilizing low value waste biomass
  - Modular scalable design for decentralized and remote applications
  - High reliability compared to intermittent solar/wind electrolytic green hydrogen

MISSION: HYDROGEN

MINNOVA RENEWABLE ENERGY

Biomass Gasification

- Biomass gasification process is extremely complex
- Hydrogen yields and concentration are widely affected by the interaction between:
  - Feedstock characteristics
  - Operating conditions
  - Reactor design
  - Temperature and Pressure
  - Fluidized bed material and size
  - And other factors
- Plants at full scale have been operating in Europe for years (Austria, Germany and Italy) producing syngas from different biomasses primarily as Combined Heat and Power (CHP) applications
- **The MRE design integrates gasification and gas purification to realize tar conversion and gas cleaning in a single reactor to achieve >50% hydrogen in syngas to be followed by multiple options for syngas upgrading (WGS, PSA etc.)**

MISSION: HYDROGEN

Gasification Technology Development

DUMA identified high potential for increasing the efficiency of existing DFB gasifier design

A new innovative design was conceived and developed by DUMA with support from University of L'Aquila (ULA) in Italy

ULA is involved in leading edge research and development of biomass gasification and is considered one of the world's experts on hydrogen production via biomass gasification

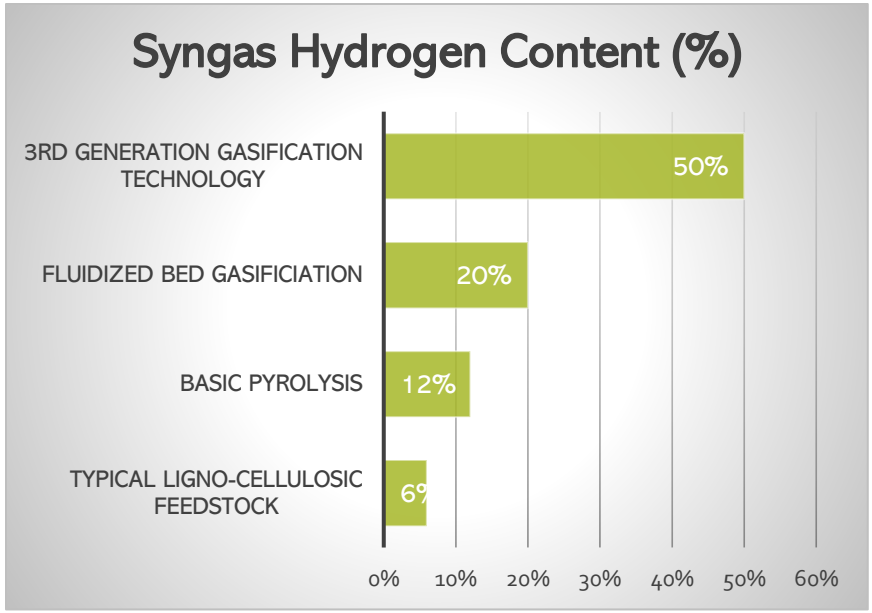
In May 2021, DUMA was awarded an IRAP fund from the Federal Government of Canada through the NRC to develop and test a new DFB gasifier design to produce a hydrogen rich syngas

WIPO process for the patent of the new DFB gasifier configuration in progress

University of L'Aquila laboratory

Innovative New Reactor Design

- 3rd Generation biomass gasification technology is a step change in efficiency
- Innovative design addresses current gasifier limitations and fine-tuned operating parameters.
- Smaller footprint
- High hydrogen content (>50%) syngas can be processed to pure hydrogen and other valuable biofuels or used to produce electrical power
- No external energy requirement post start up

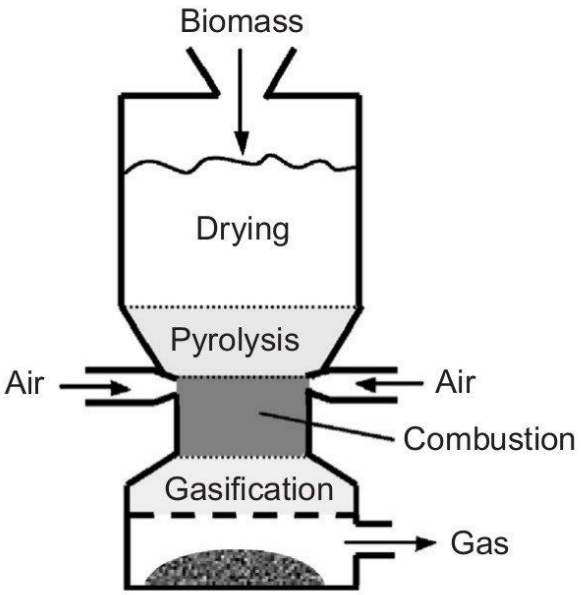


Biomass Gasification Process Description

- Sustainably managed lignocellulosic biomass is used as both the energy source and carbon source for the process. A wide variety of feedstocks are suitable for gasification, in particular to make renewable syngas
- The biomass is shredded and dried in a continuous dryer that uses waste heat from the gasification process
- The dried biomass is sent to a pyrolysis gasifier, where it is transformed into Bio-Syngas and Bio-Char at over 900 degrees Celsius (°C) and in the absence of oxygen.
- Current wood gasification technologies can produce a syngas with hydrogen yields between 8-20% in volume and heating content around 10-11 MJ/kg
- MRE technology has **proven** it is possible to reach >50%$_{vol}$ hydrogen rich syngas, with the heating value above 23 MJ/kg before any upgrading
- Adding a module of Syngas upgrade can increase the H_2 yield up to 70-75%.

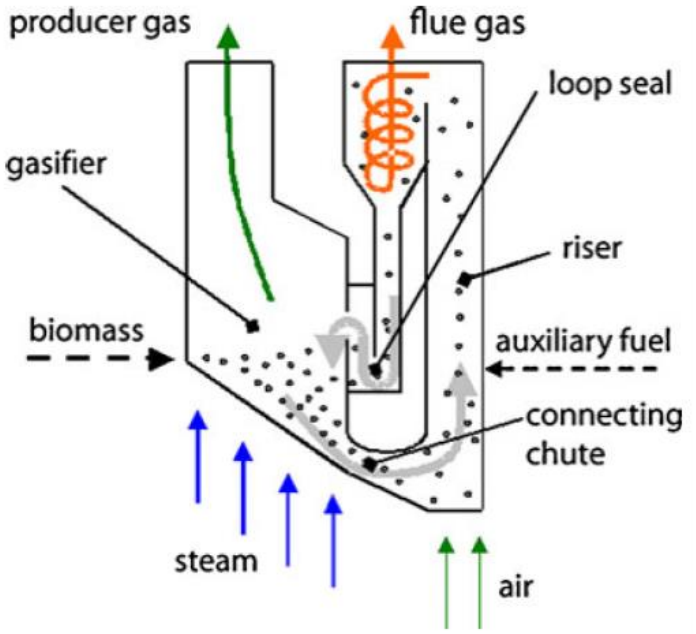
Side by Side Comparison to other Gasifier Designs

DOWNDRAFT GASIFIER



H2 content < 10% vol.

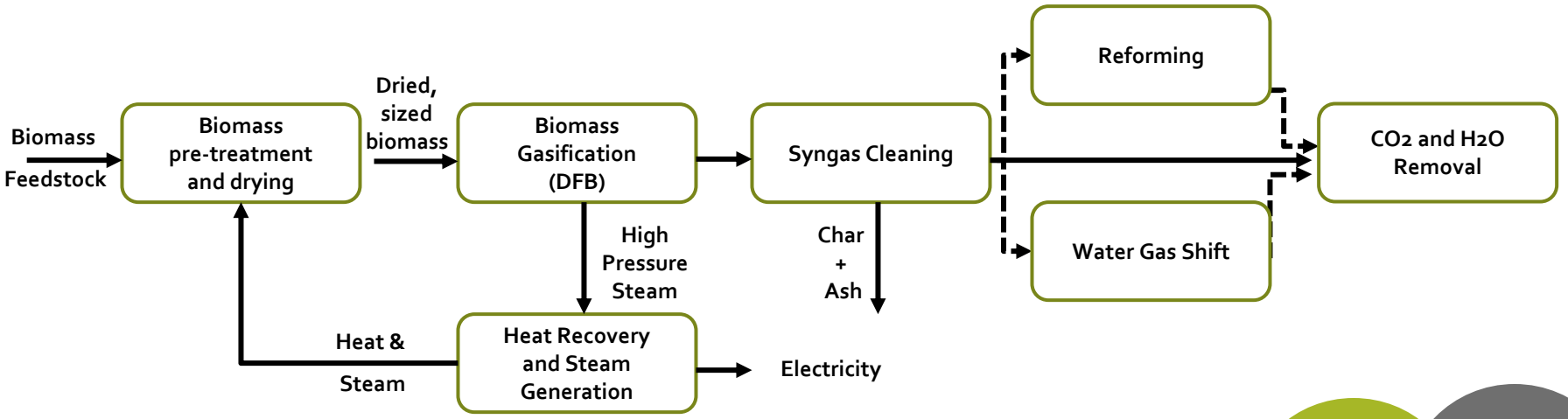
DUAL BED (DFB) GASIFIER

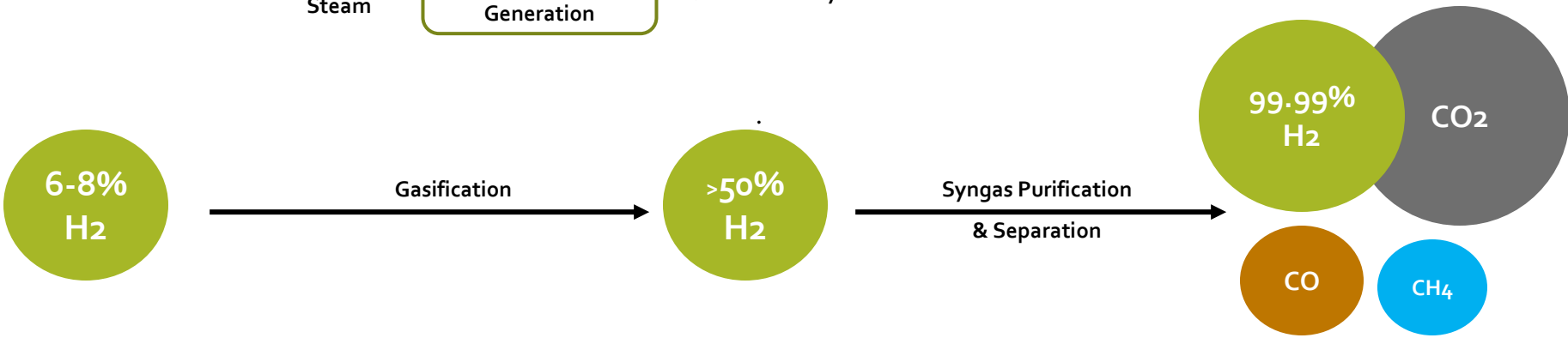


H2 content 50% vol.

MINNOVA
RENEWABLE ENERGY

Process - Schematics





MISSION: HYDROGEN

MINNOVA RENEWABLE ENERGY

Biomass energy Production Options:

Green Hydrogen – Electrical/Thermal Power or Hydrogen + Ammonia

Modular, scalable design

- Basic 10MW$_{th}$ module requires 15,000 to 20,000 tonnes biomass per annum
- ~10,500 Nm3/hr of high-quality syngas to produce
- Pure H_2 output – 1.4 million kgs per annum

or

- 10MW$_{electrical}$ power plus 30MW$_{thermal}$ power
- Minimal environmental impact with small footprint plant

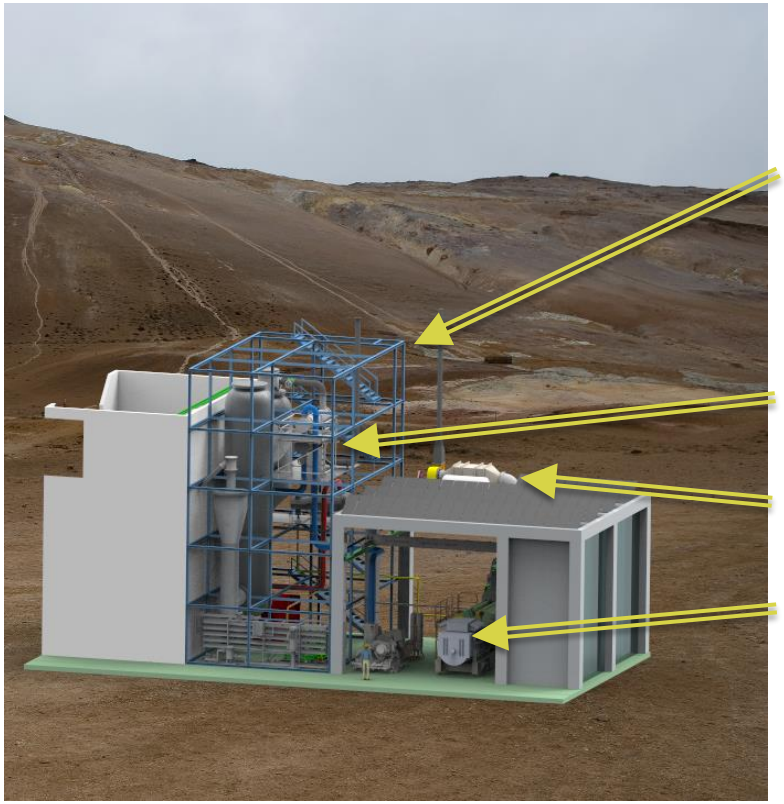
Operational Inputs and Outputs	Feedstock Input 30 MW$_{thermal}$
	3 Modules
Biomass feedstock (tpa)	45 – 60k
Biomass Input (MW$_{thermal}$)	30
Syngas Production (wet, Nm^3/hr)	~10,500
Generator type[1]	Combined Cycle
Bioenergy Output Options	
Electrical Power (MW$_{electrical}$)	~10
Thermal Power (MW$_{thermal}$)	~30
Future Green H2 (kg/yr)[2]	>4 million
Future Green NH3 (kg/yr)[3]	>12 million
Future Green CO2 (kg/yr)[4]	~35 million

Notes: 1) Subject to feasibility study considering thermal loads (heating and cooling) , 2) Fischer-Tropsch reaction of syngas and upgrade to pure H_2 in support of industry and transport sectors , 3) H2 conversion to ammonia NH_3 in support of agriculture sector, 4) suitable for industrial offtake or CCUS

MISSION: HYDROGEN

MINNOVA
RENEWABLE ENERGY

Base 10MW$_{th}$ Module:
2t/h – 2MW Power Plant Layout Shown



150 mTON BIOMASS HOPPER

15 M (50FT) BUILDING HEIGHT

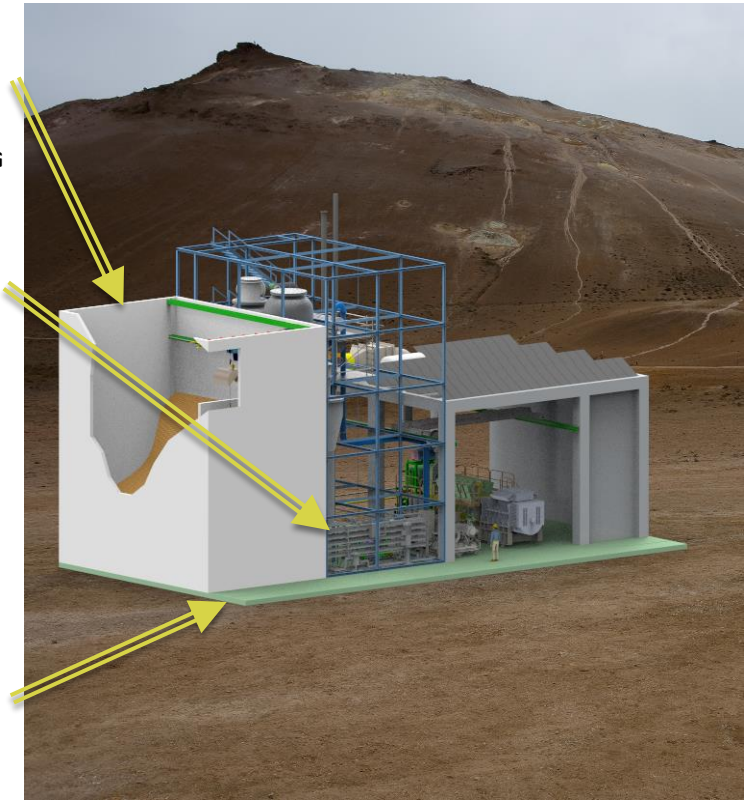
WATER FILTRATION SYSTEM

HEAT EXCHANGERS EASILY SERVICEABLE

SCR UNIT ROOF MOUNTED

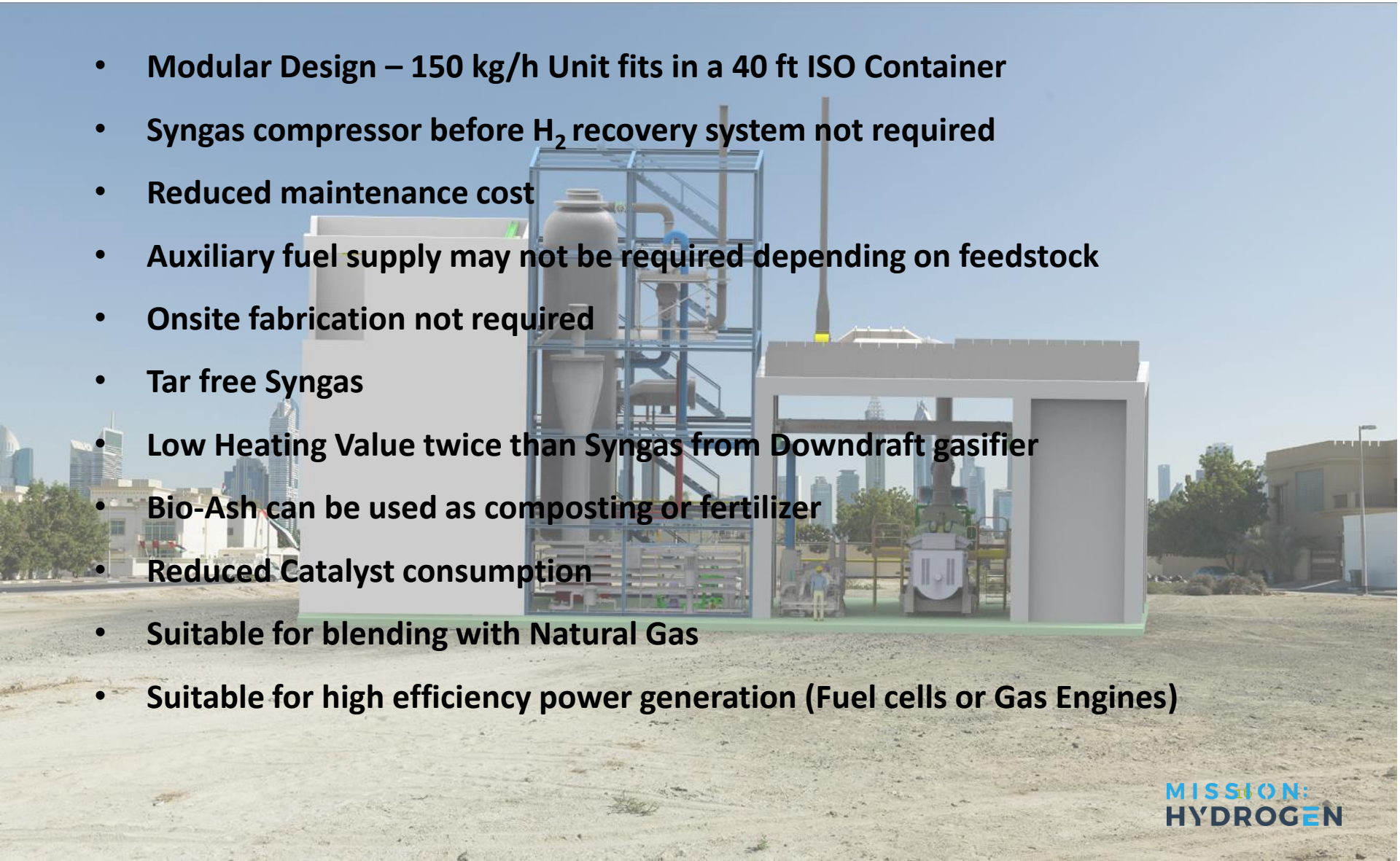
2MWe GAS GENSET

THE WHOLE PLANT FITS INTO AN NBA BASKETBALL FIELD



MISSION: HYDROGEN

MRE 3rd Generation DFB Design Advantages



- Modular Design – 150 kg/h Unit fits in a 40 ft ISO Container
- Syngas compressor before H_2 recovery system not required
- Reduced maintenance cost
- Auxiliary fuel supply may not be required depending on feedstock
- Onsite fabrication not required
- Tar free Syngas
- Low Heating Value twice than Syngas from Downdraft gasifier
- Bio-Ash can be used as composting or fertilizer
- Reduced Catalyst consumption
- Suitable for blending with Natural Gas
- Suitable for high efficiency power generation (Fuel cells or Gas Engines)

MINNOVA RENEWABLE ENERGY

Business Case – Green Hydrogen Production

- Average **H_2** market price: Europe - €10-€13 /kg (C$15-C$19 /kg)
  US (California) - US$15 to US$17 / kg (C$20-C$23 /kg)

- **Base 10MW_{th} Module**
- Yearly **H_2** production: 1,400,000 kg /yr
- Potential revenues (**H_2** @ ~C$18 /kg): **C$25 Million /yr**
- Estimated production cost: C$10 /kg (@350 bar): **C$14 Million /yr**
- Estimated Capex 10MW_{th} module: **C$12-C$14 million**
  (full gasification line + H_2 upgrading and recovery + H_2 compression at 350 bar)
- Plus CO_2 by-product sales

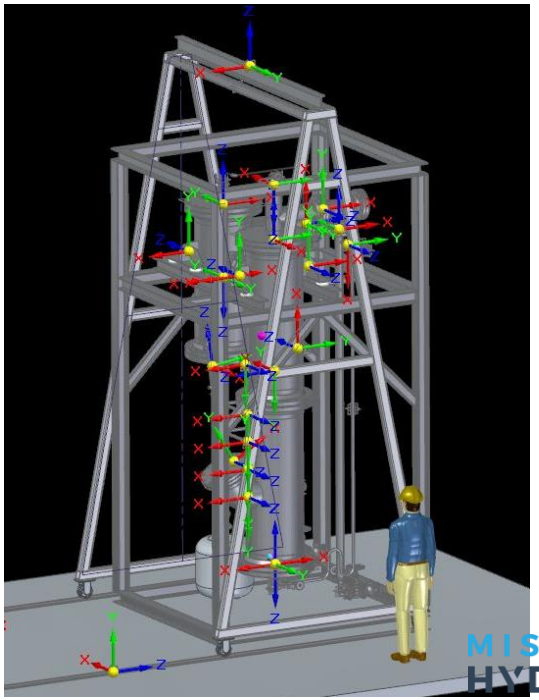
- **Development time: ~18 months**

Notes: 1) Subject to feasibility study 2) configuration above for green H2 production, 3) other configurations include power, green H2 to Ammonia and green H2 to other biofuels. See page 2 Cautionary Notes

MINNOVA RENEWABLE ENERGY

Conclusions and Next Steps

- Gasifying waste biomass addresses priorities such as energy security, climate change, decentralized production and rural economic development
- 3rd Generation gasifier is 60% smaller and 40% cheaper than other gasifiers
- Can use a variety of waste biomass feedstocks
- High hydrogen content syngas (>50% H_2 by vol) with no toxic fly or tars
- Delivering value to all stakeholders
- Site selection and development initiatives are advancing around the world
- Pilot Plant construction is underway in Canada and initial long run rest results target for summer 2023
- Demonstration plant(s) development negotiations underway



MISSION: HYDROGEN

Management Team

Gord Glenn

MRE President and CEO

Education: BScH (Geology)

Queen's University

Experience:

GMP Griffiths McBurney, INMET Mining, TD, Desjardins, MGI Securities, Minnova Corp.

Mario Mantaci

DUMA President and Founder
MRE VP of Engineering

Education: Politecnico di Torino

Experience:

Boeing, Collins Aerospace, Avio Interiors, MCI, SKF

Marco Sonnessa

DUMA VP Operations
MRE VP of Business Development

Education: Università degli Studi di Bergamo, University of Manitoba

Experience:

HyLife, DUMA Engineering Inc., GEO3 Engineering

Minnova Corp.

Minnova Renewable Energy

DUMA Engineering Inc. Experience & Foresight 2018

Mission: Hydrogen

Thank You

MINNOVA RENEWABLE ENERGY

MRE - How to produce Hydrogen from Biomass

Any Questions?

MISSION: HYDROGEN

HYDROGEN ONLINE WORKSHOP

March 23, 2023

www.minnovacorp.ca