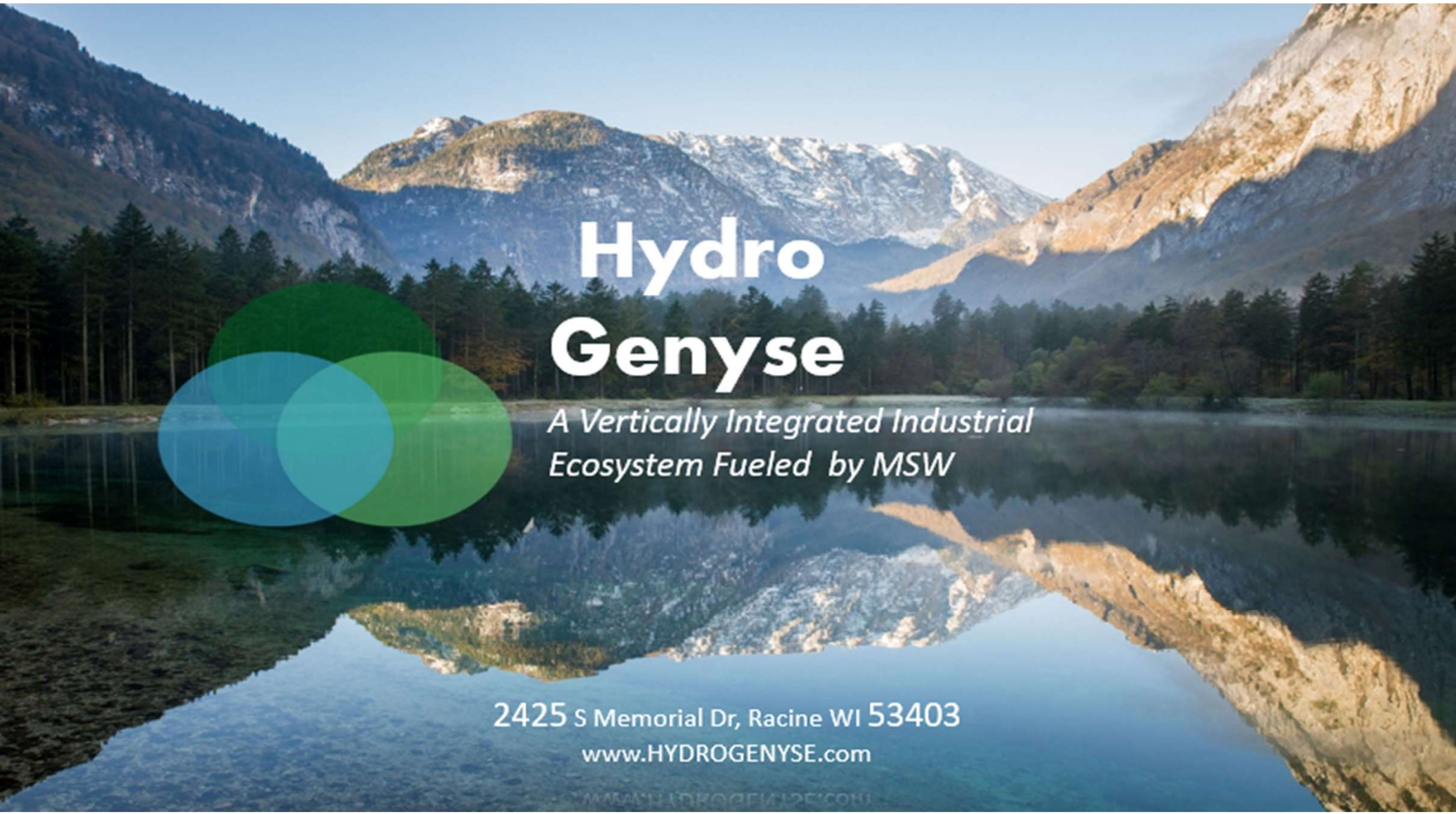

Hydro
Genyse
A Vertically Integrated Industrial
Ecosystem Fueled by MSW
2425 S Memorial Dr, Racine WI 53403
www.HYDROGENYSE.com

About This Project

This project analyzes the economic, social and climate effect of a vertically integrated industrial commercial ecosystem that is connected directly to the output of a high efficiency waste to energy power plant.

10 MW green power generation

10,000 metric tons H2

160,000 metric tons CO2

Data Center waste heat utilization can cut cooling for the data center costs while supplying waste heat to the ecosystem.

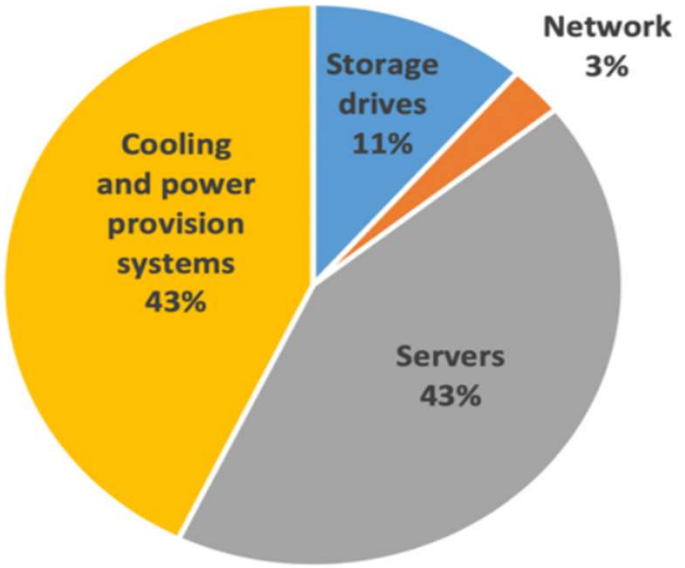
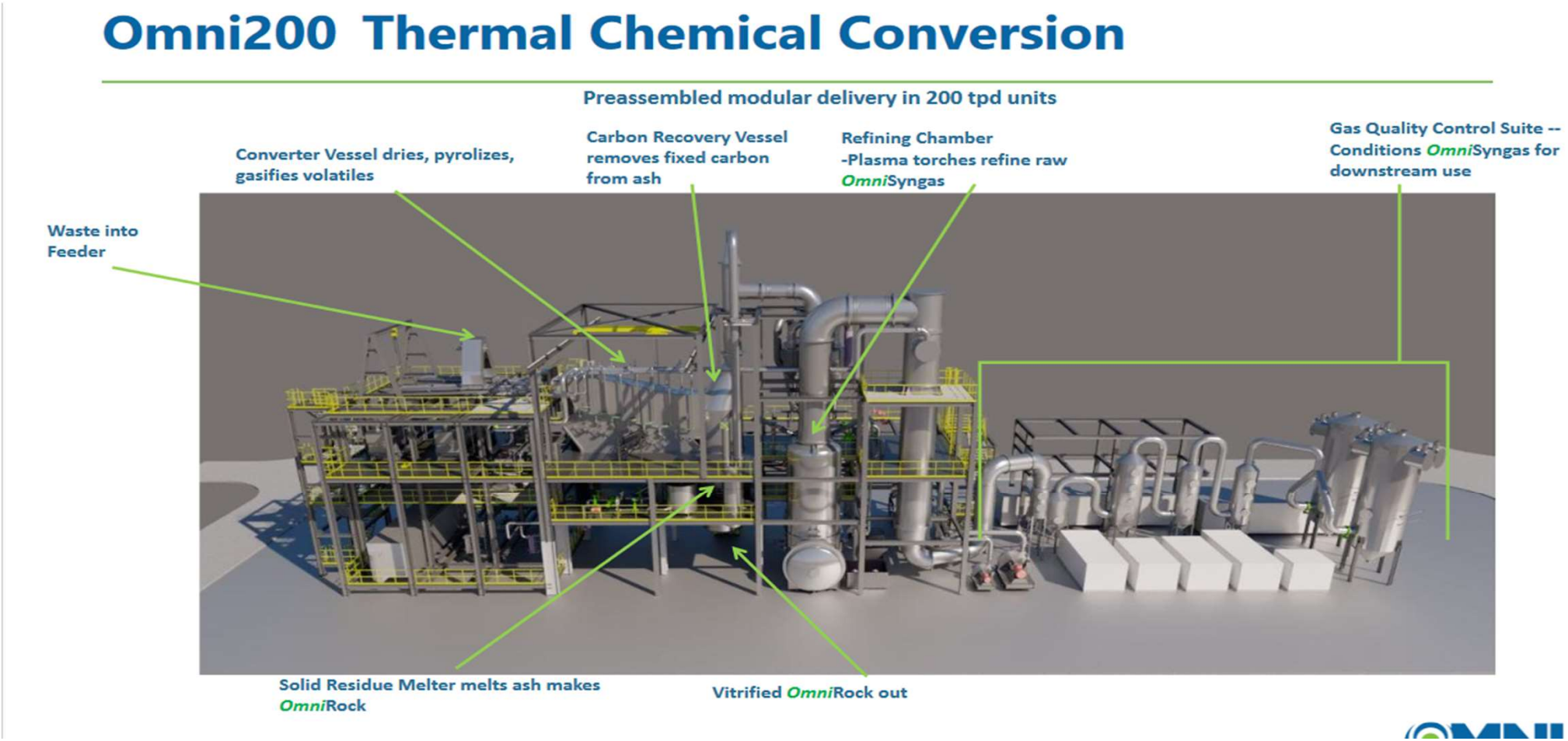


Figure 1. Fraction of U.S. data center electricity use in 2014, by end use. Source: Shehabi 2016.

Gasification of waste will provide sustainable energy, Fuel cell grade H2 and CO2 for refrigeration.



Systems are modular and expandable – this project will use 2 modules

Complete Conversion of Waste to Clean Energy

FEEDSTOCK

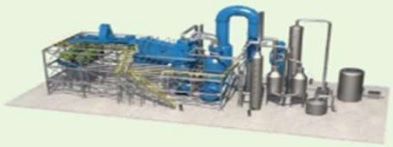
MSW (municipal solid waste)

ICI (institution, commercial, industrial waste)

Waste plastic

Biomass & Agricultural Waste

Omni200
Thermal Chemical Conversion Solution



OmniSyngas

Each unit can process **200 tonnes/day** (1) with **no emissions** or **solid residue**

ANNUAL PRODUCTION
(2)(3)

H_2
– **Low carbon hydrogen**: **5,250 tonnes**

OR

RNG
– **Renewable natural gas: 700,000 MMBtu**

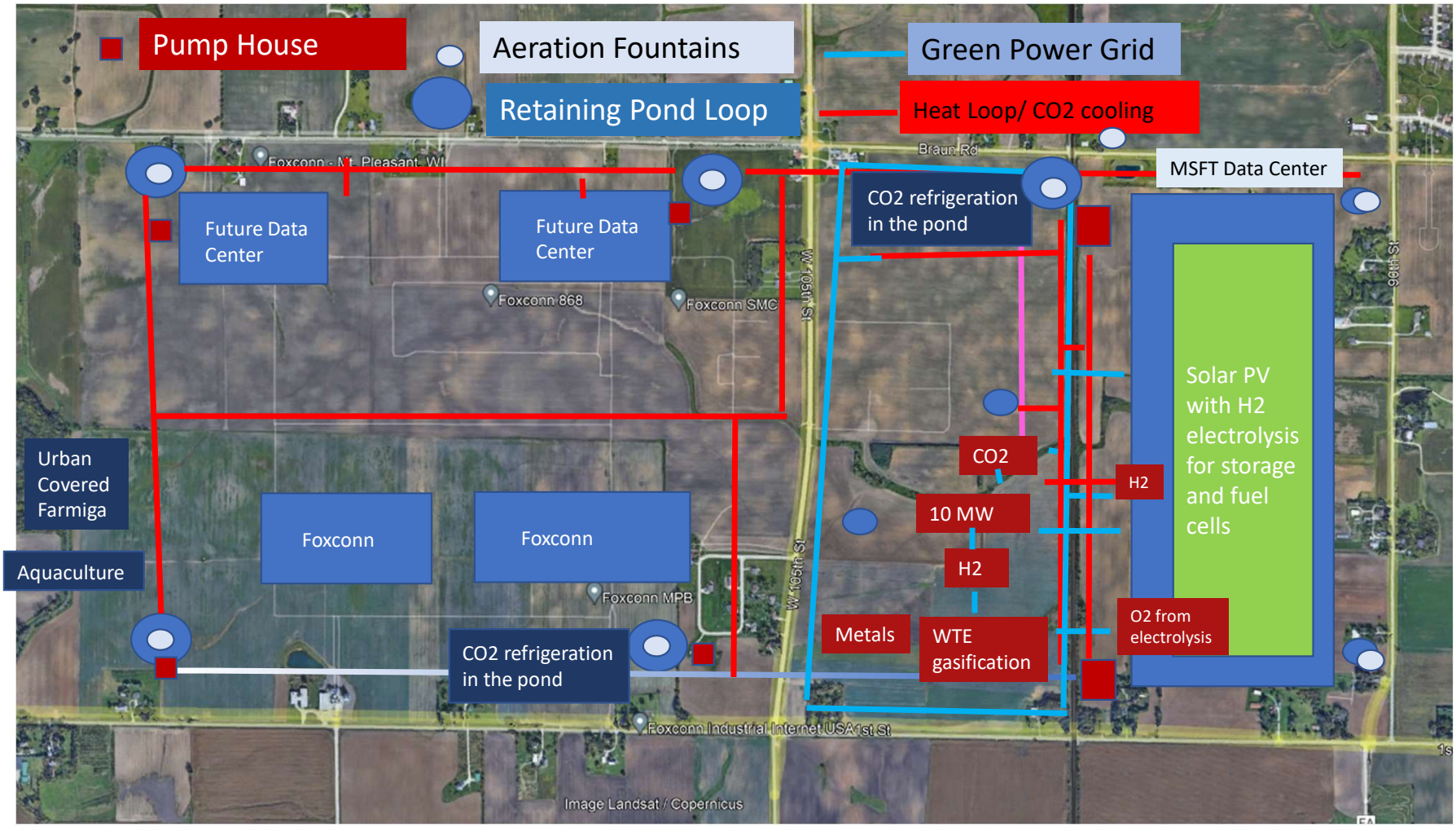
OR

Clean fuels
– **Renewable Diesel: 168,000 Bbls**
– **Methanol: 37,100 tonnes**

Notes: (1) Represents amount of waste received ranging between 70,000 and 100,000 tonnes per year, depending on the moisture content of the waste and drying of waste during preparation phase.

(2) Omni200 produces a synthetic gas tailored to end use.
(3) Figures presented on an annual basis. Illustrative output estimates, subject to feedstock characteristics.

Data Center Waste Heat can be utilized and cooled on site



CO_2 can be de-compressed in the pond under the heat exchangers

160,000 metric tons CO_2- liquified for refrigeration- 900 tons/ hr lowering pond temp

Each standardized ChillEx exchanger rated at 16 tons in the water alone.

Multiple systems would be installed in retaining ponds to match demand

Geothermal Pond Loop Heat Exchanger: An Eco-Friendly Heating And Cooling Solution

By Victor Posted on April 8, 2023

Pond aeration will give natural cooling to the pond

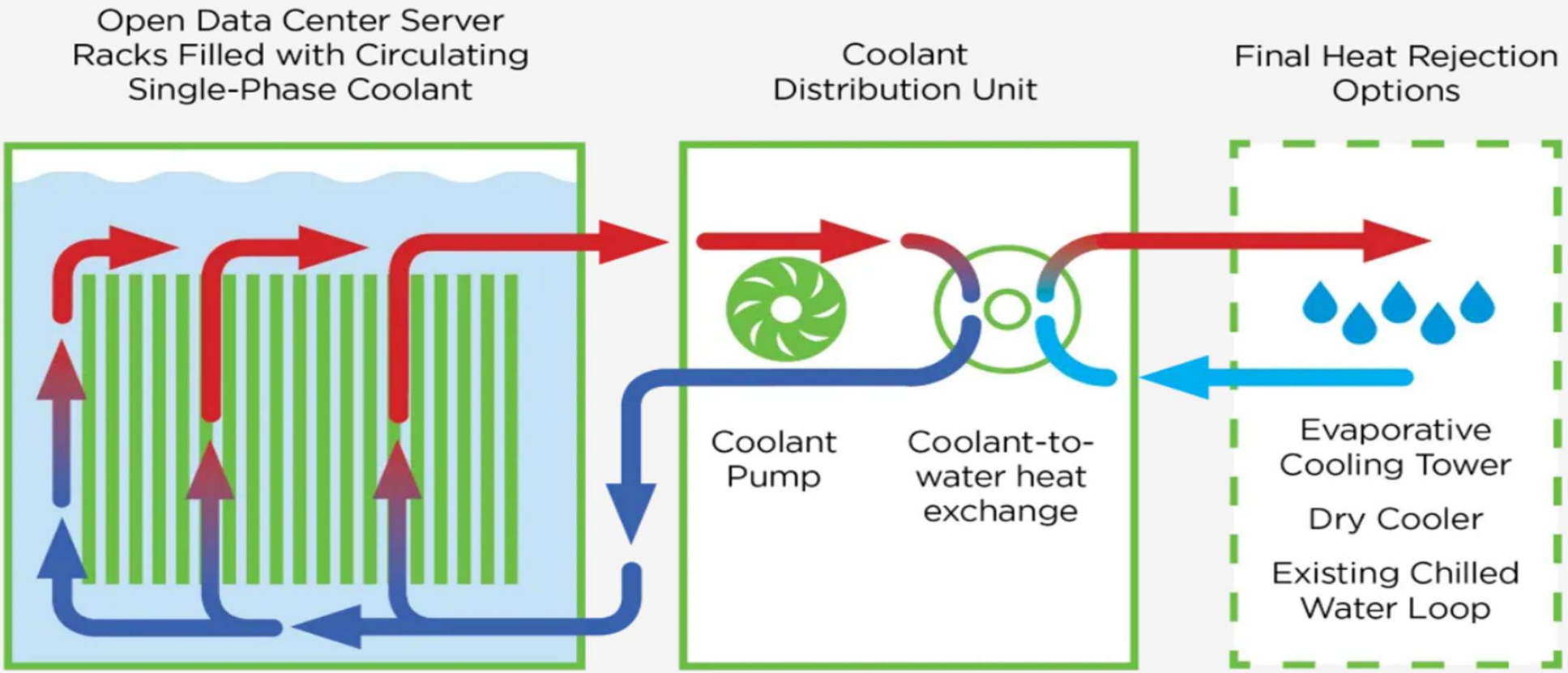
This is **evaporative cooling** with no cost of water- or sewer.

Water flow will **increase efficiency of the exchanger.**

Oxygen aeration will balance the natural lake flora.

This pond will be crystal clear and suitable for recreational activities

The chilled water loop could intercept the evaporative cooler



Heated coolant exits top of rack. Coolant returns to rack from heat exchanger at user-specified temperature.

The green CO_2 can be used to supercharge the exchangers

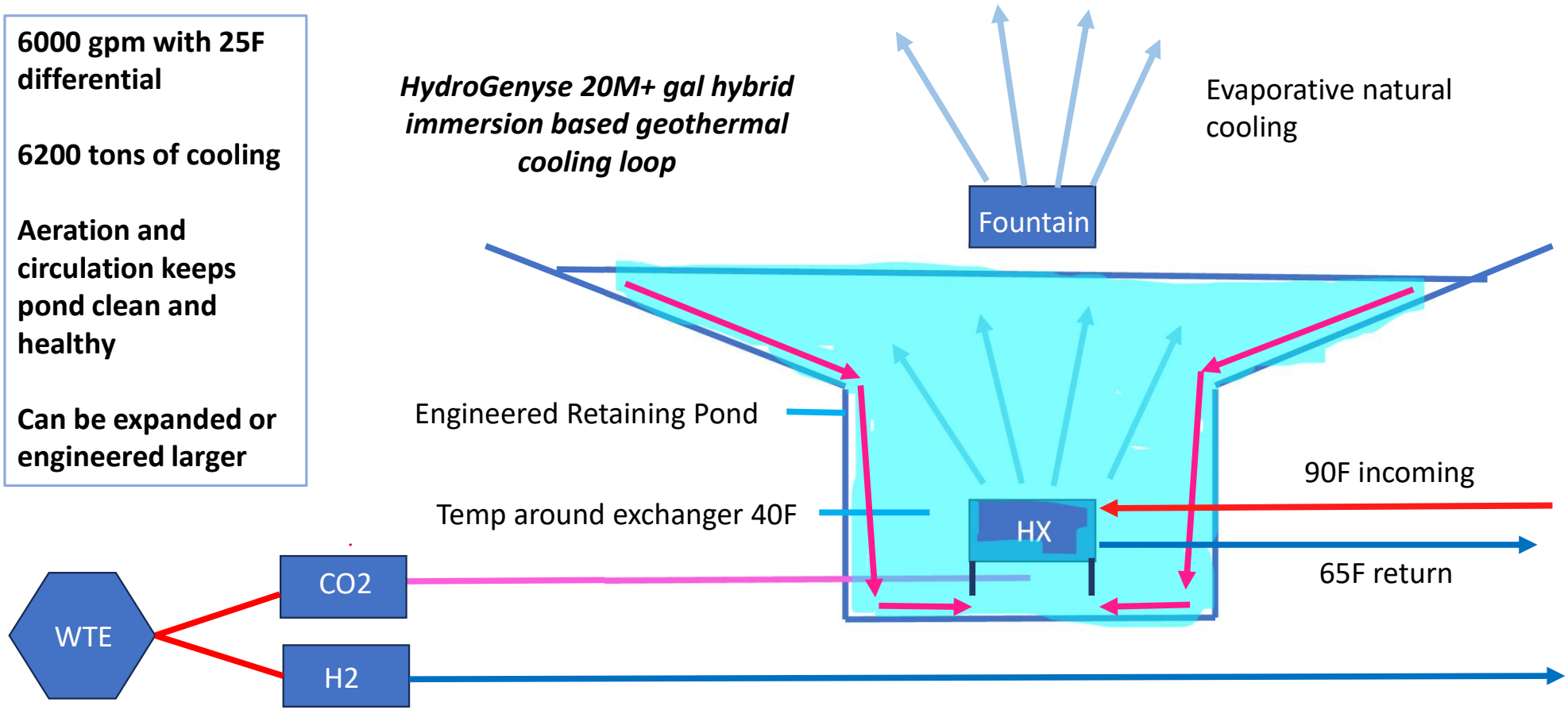
6000 gpm with 25F differential

6200 tons of cooling

Aeration and circulation keeps pond clean and healthy

Can be expanded or engineered larger

HydroGenyse 20M+ gal hybrid immersion based geothermal cooling loop



Plan view of the Foxconn/Microsoft campus showing the stormwater ponds that can be used for cooling the data center

Advantages of Geo-thermal pond supplemental cooling

Simple non mechanical cooling can attach to primary system return and act as a redundant back up

50% federal subsidy – Cuts capitol costs

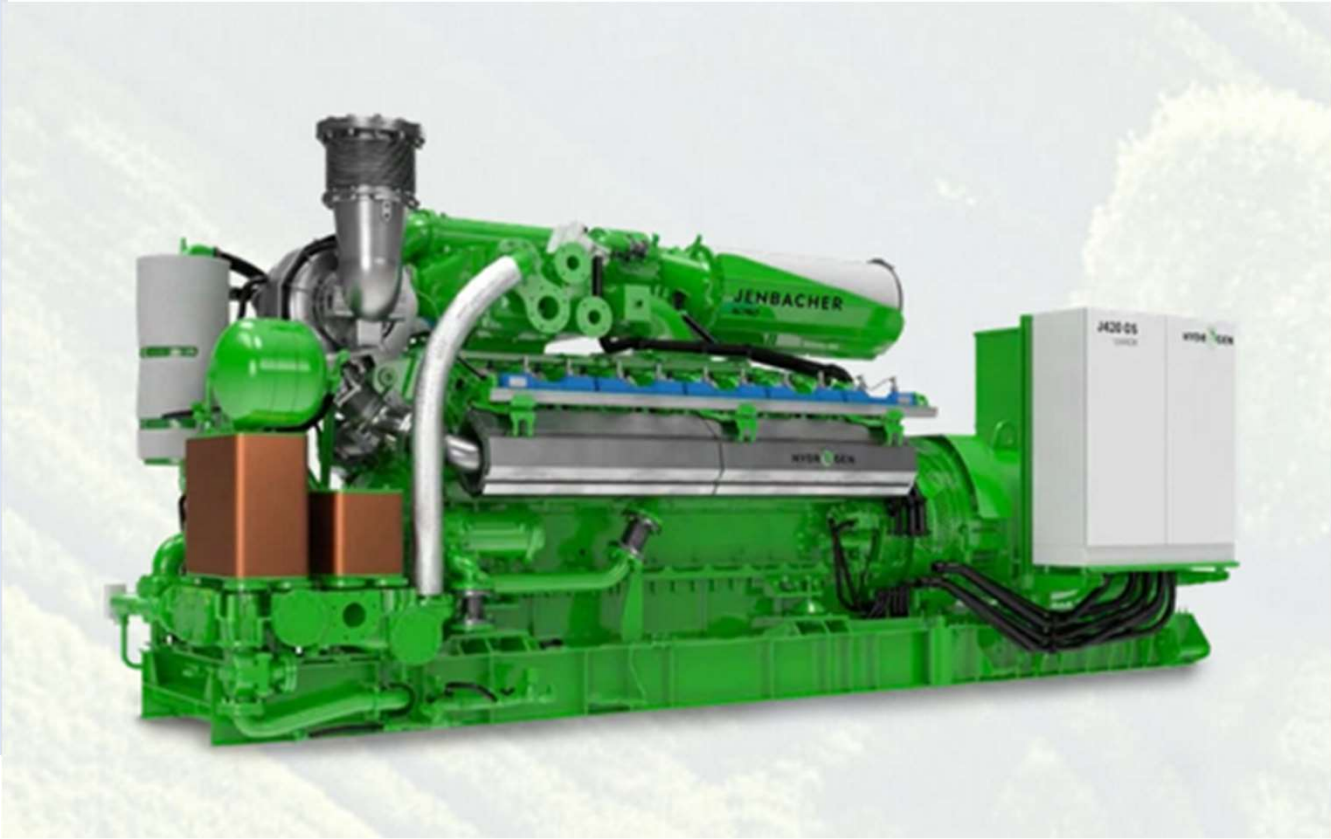
46 M in running Fed subsidy/ guarantees profits

Permanent ongoing revenue and saving

MSW will be converted to 10,000+ metric tons of H2 / year
This will partially be used to run 12- 1.1 MW generators or fuel cells

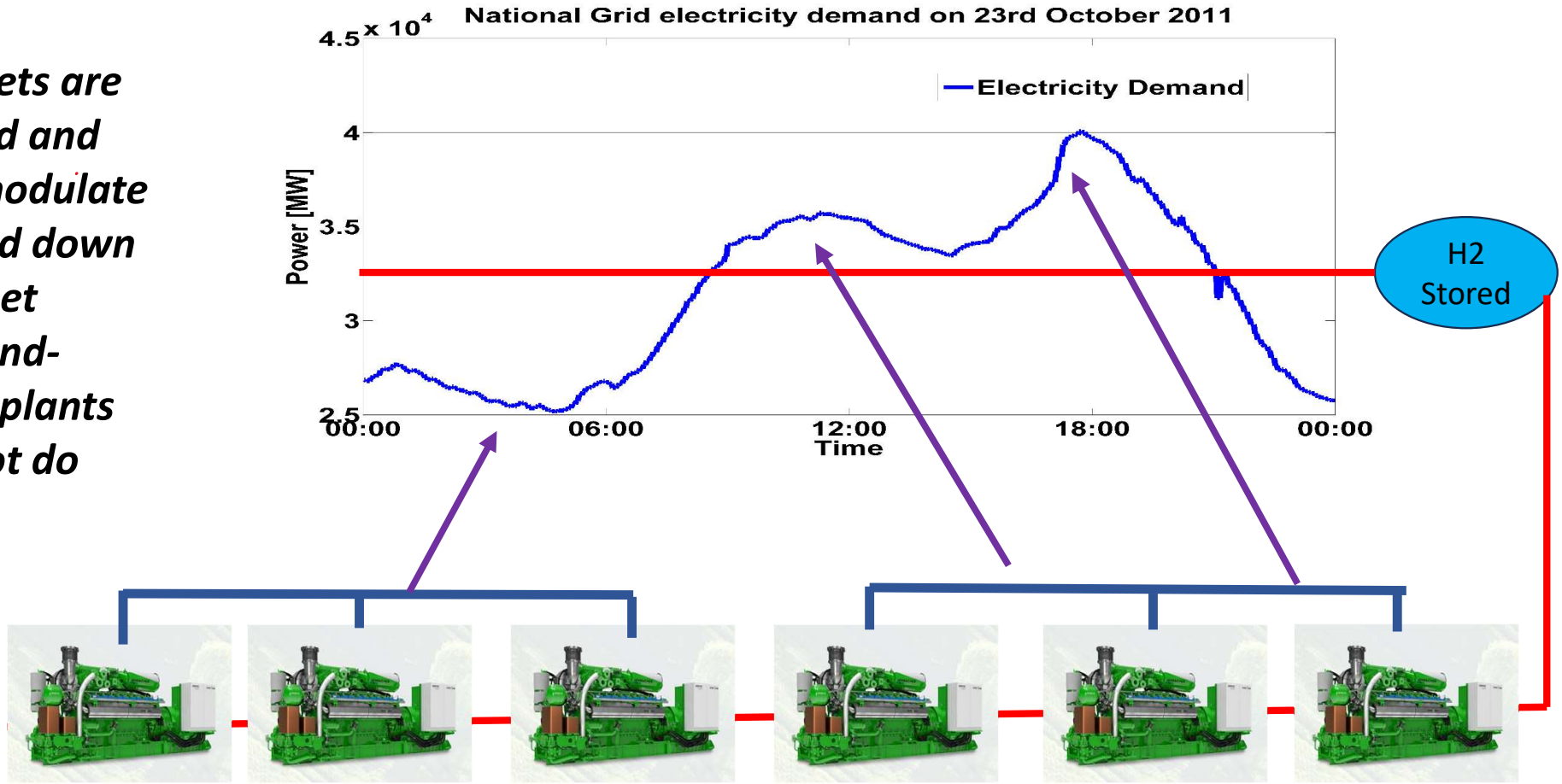
Staged power generators will power the plant and use the H2 for stored energy.
This can be baseload dependable power with stored back-up.

<u>All with no emissions</u>

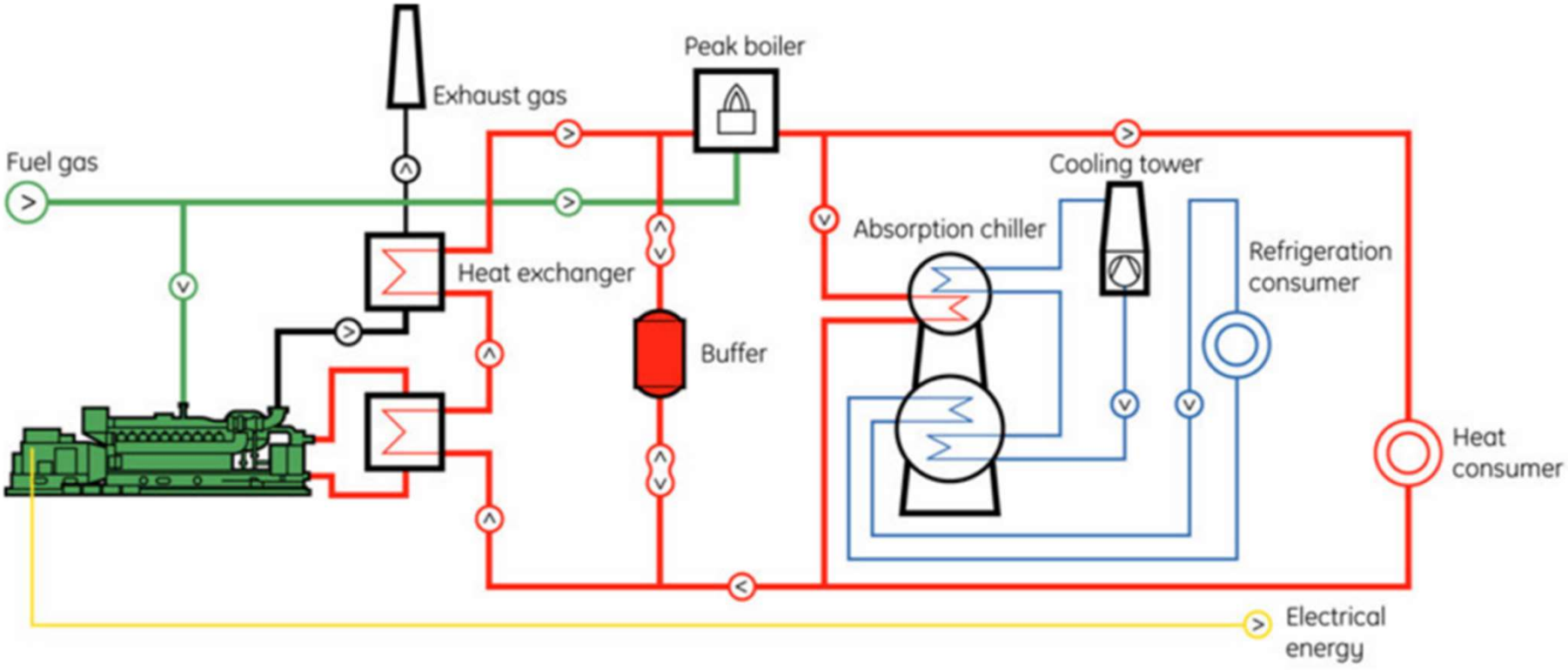


Having H2 as stored energy allows for variable output

Gen sets are staged and can modulate up and down to meet demand- large plants cannot do that



This Generator can provide Combined Cooling Heating and Power CCHP- This will chill the process cooling loop for the WTE site



Rankin Cycle heat recovery will generate power from the waste heat of power generation for use on site.

HEAT TO CLEAN ELECTRICITY

compact – modular – profitable

efficiency PACK
eP 150.200

Plug & Play
Waste heat recovery solution

Any sector, any waste heat
from 80 °C to over 800 °C

Profitable efficiency measure
e.g. for ISO 50001

Green H2 production from MSW is a direct conversion

Manufactured cost of this green H2 is the same as steam re-forming. Not having to super-compress, liquify or transport allows for cost effective use in fuel cells for power.

Green H2 cost	W/O Ecosystem	W / gasification
H2 Cost/ KG	$ 5.00	$ 1.00*

Fuel Cell cost of power: .05 / Kwh

Manufacturing Green H2 PTC = $ 30,000,000/ year

Hydrogen production on site can supply 20 MW of peak demand green power.

With low-cost hydrogen available, power generation and stored energy will be available.

Utilizing the gas on site for fuel cells or generators would generate power at .05/ KWh. This low cost is due to no requirement for high compression or transportation.

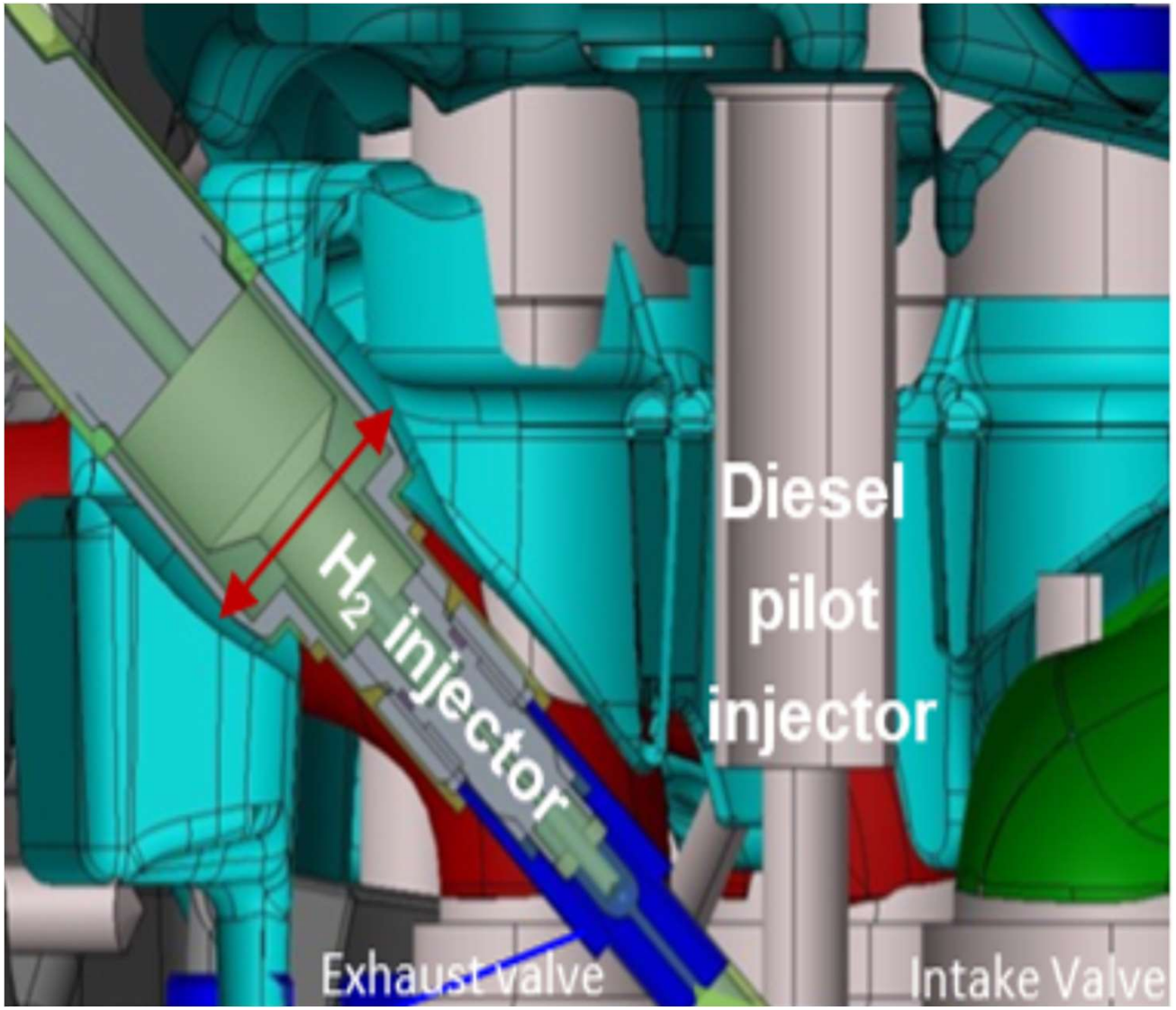
Utilizing during peak power would supplement up to 20 MW and save close to $ 305,000/ month

Diesel truck conversions

- **Uses 90% hydrogen and 10% diesel at a cost of $ 1.00/ relative gal- <u>this will save millions on fuel.</u>**

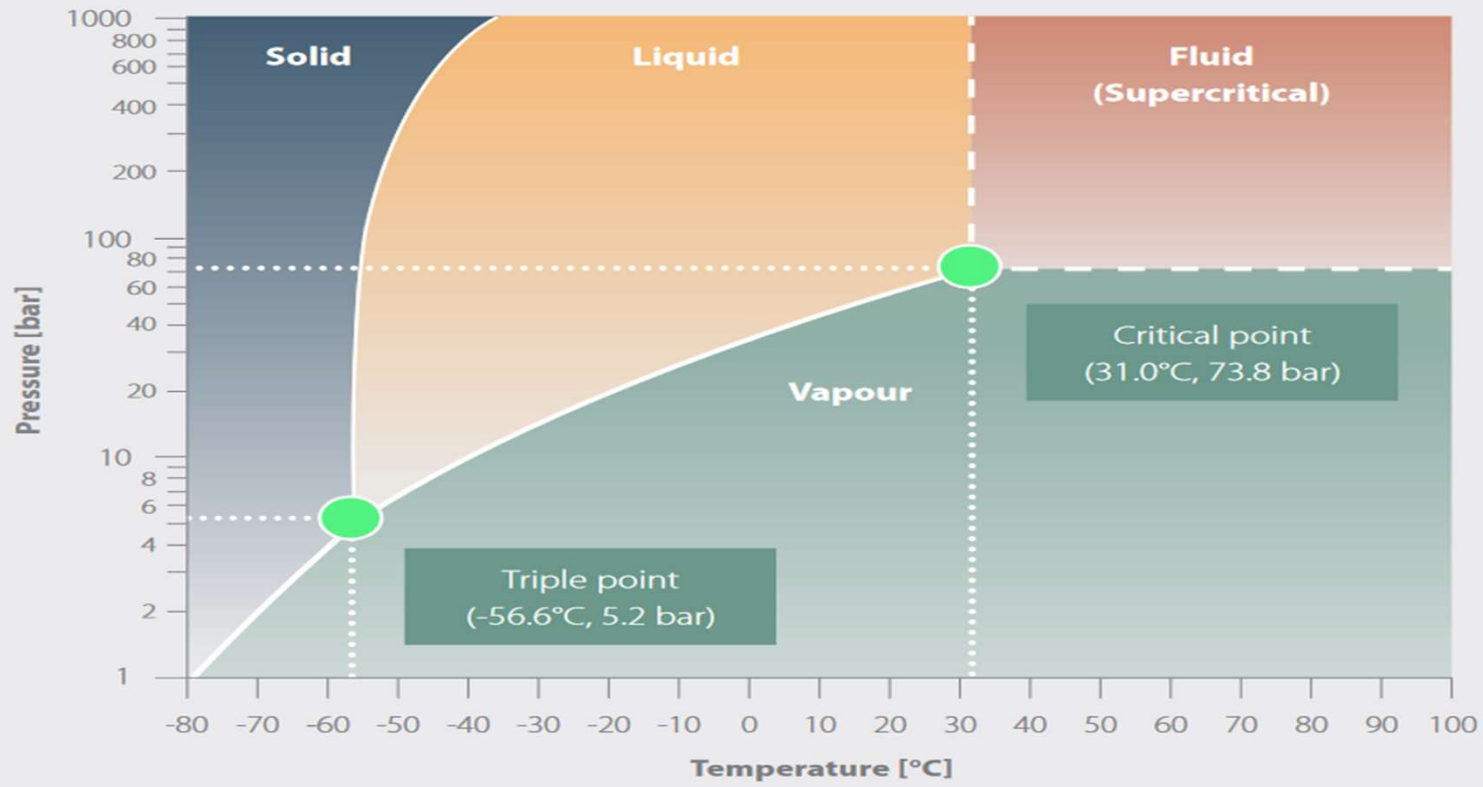
- **Simple conversion that can convert municipal trucks at low cost.**

- **Reduces maintenance and wear on the engines.**



The green CO_2 can be used to cool the loop by simply de-compressing into the retaining ponds under the exchangers

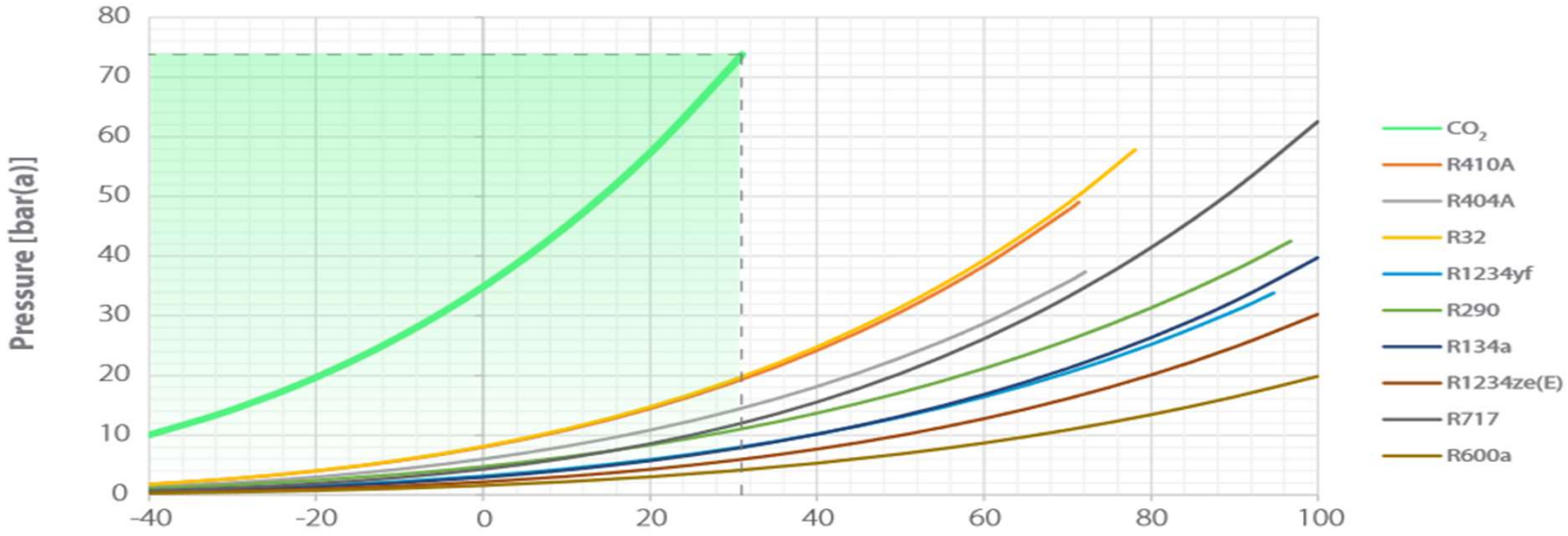
Compressing CO2 only to 75bar and utilizing on site will result in the lowest cost refrigeration possible for the loop

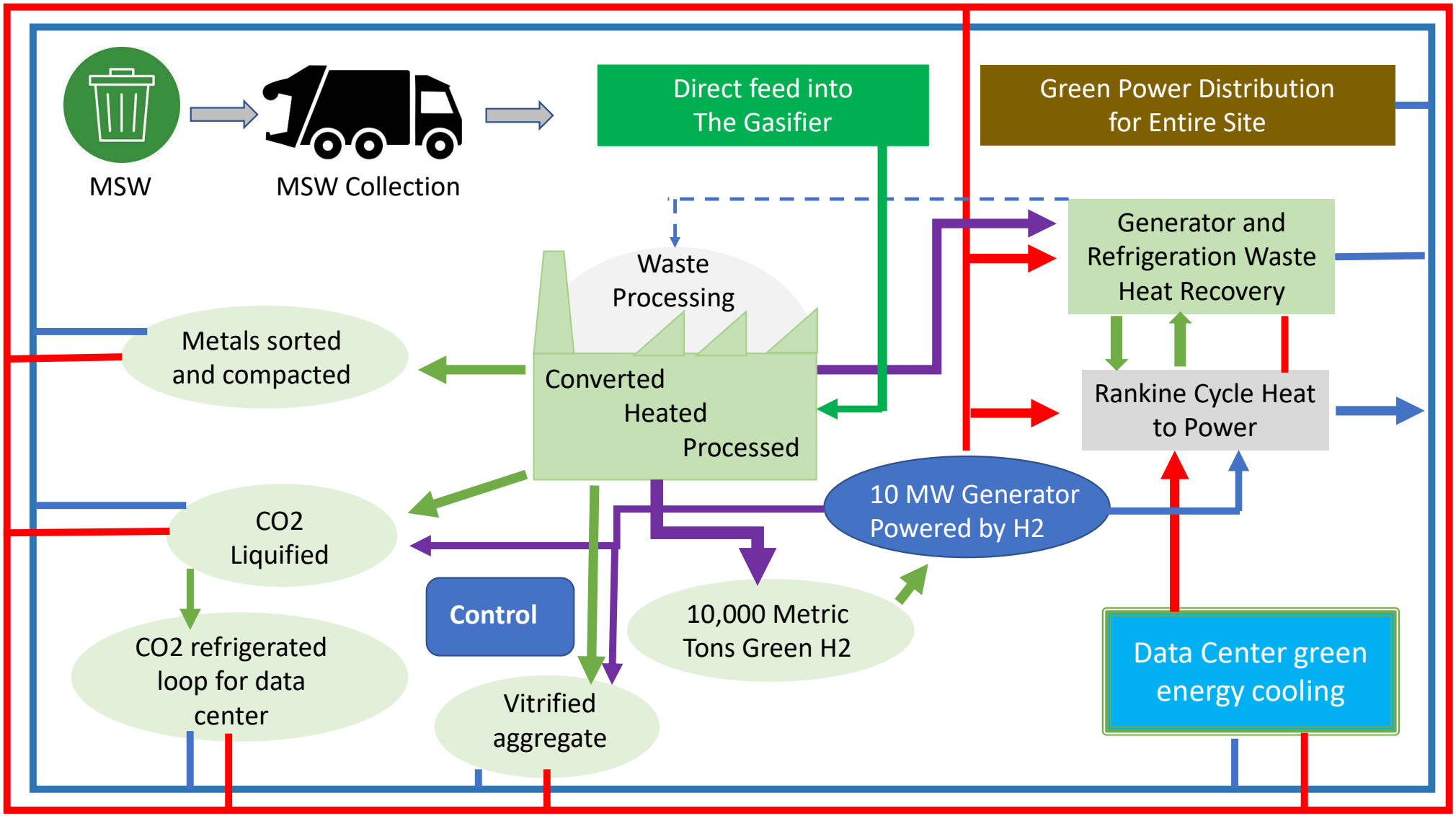


> **Figure 1:** CO_2 phase diagram

A simple de-compression into the retaining pond could cool the pond to just above freezing on the final return to the data center

Figure 3 illustrates the saturation lines of CO_2 and several conventional refrigerants. A clear distinction can be observed: CO_2 operates at significantly higher pressures compared to other refrigerants at identical saturation temperatures. For instance, while the evaporating pressure of all the refrigerants shown at 0°C is less than 10 bar, it reaches 35 bar for CO_2.




MSW
MSW Collection
Direct feed into
The Gasifier
Green Power Distribution
for Entire Site
Waste
Processing
Generator and
Refrigeration Waste
Heat Recovery
Metals sorted
and compacted
Converted
Heated
Processed
Rankine Cycle Heat
to Power
CO2
Liquified
10 MW Generator
Powered by H2
Control
10,000 Metric
Tons Green H2
CO2 refrigerated
loop for data
center
Vitrified
aggregate
Data Center green
energy cooling

The site will attract additional business that can take advantage of the by-products and waste energy

Algae, aquaponics, urban farming, refrigerated warehousing, food processing, ect. will gravitate to the site

Commercial and industrial laundry can utilize the heat and water loop and generate good jobs.

Waste to Energy 400 tons per day CCE Estimated Savings/ revenue

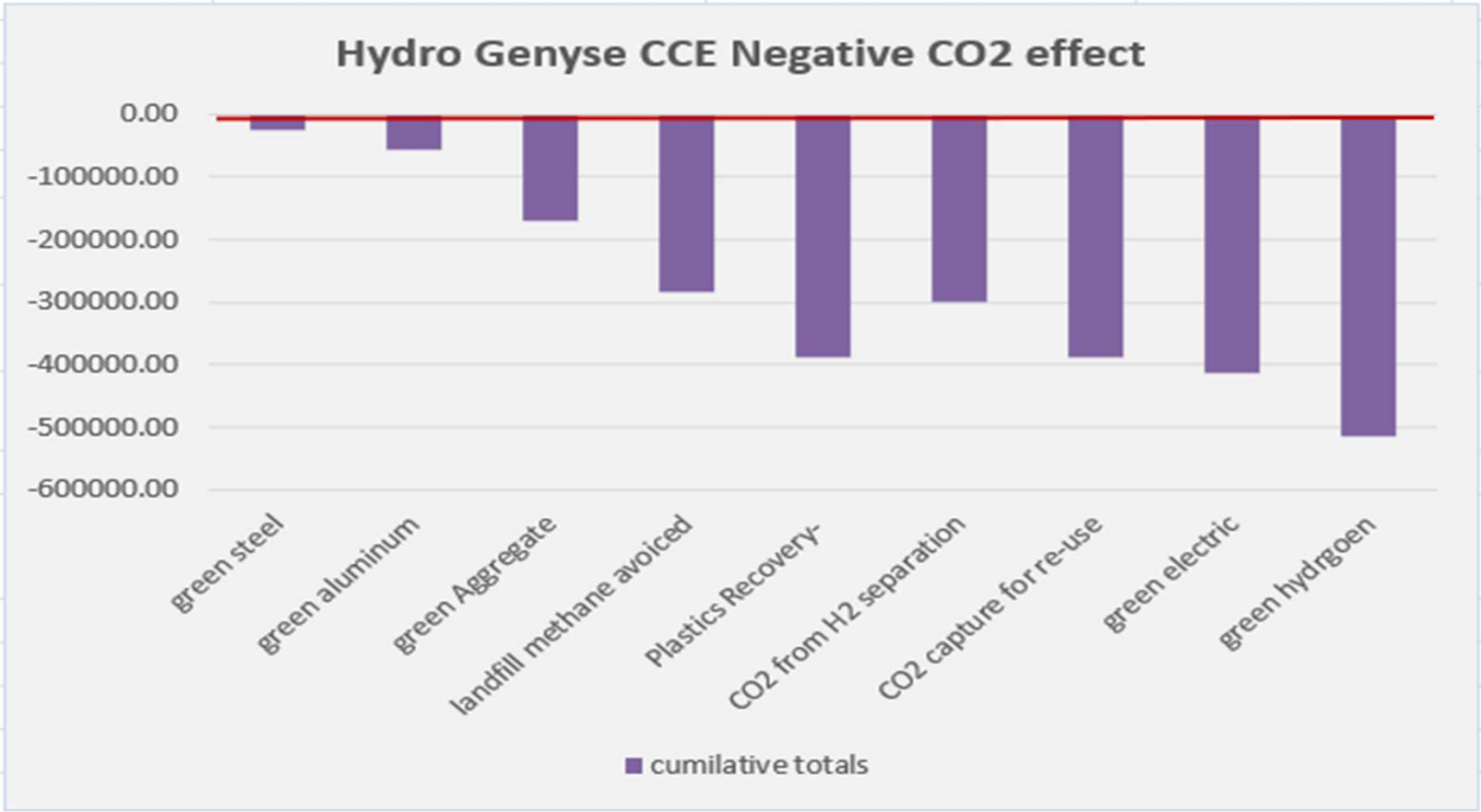
Process	Revenue	
Tipping Fees based on 288,080 tons/ year / $ 75.00	$ 21,681,000.00	
23,418 tons of steel from waste – sorted, shredded and bailed	$ 20,137,312.00	
9510 tons of aluminum - cleaned and bailed	$ 14,266,098.00	
Recycling losses averted for city per sustainability report	$ 6,020,535.27	
Haz Mat Disposal added to tipping fees	$2,091,837.00	Municipal Portion
Pavers from aggregate and crushed glass or blasting sand	$ 12,800,364.00	
Land lease income based on .5/sq/ft/year- private development	$ 630,000.00	
Water/ sewer and storm water saving from capture and reuse	$ 346,275.00	
Hydrogen used on site @ $ 3.50/ Kg with fed subsidy ($ 3.00/ KG)	$ 38,801,961.00	
CO_2 capture Fed grant of $ 60.00/ ton on 160,000 metric tons	$ 10,602.000.00	Private Partner Portion
Fed incentive for generating clean power on site	$ 1,242,150.00	
Sustainable CO_2 sales liquified 180,000 metric tons/ year	$ 53,101,000.00	

Calculated Gross Revenue	$ 210,724,260.00
Calculated IROR 35%	$ 73,753,491.00
Estimated ROI after subsidy	< 3 years
Local Economic Effect x 1.77	$ 372,981,940.00 (Energy Recovery Counsel 2018 report on local economic effect)

NB: Income from additional business is only calculated as rent except for the steel and aggregate

Hydro Genyse CCE system is 2.91 tons negative CO_2 for every ton of MSW diverted from landfills

Tons Per Year



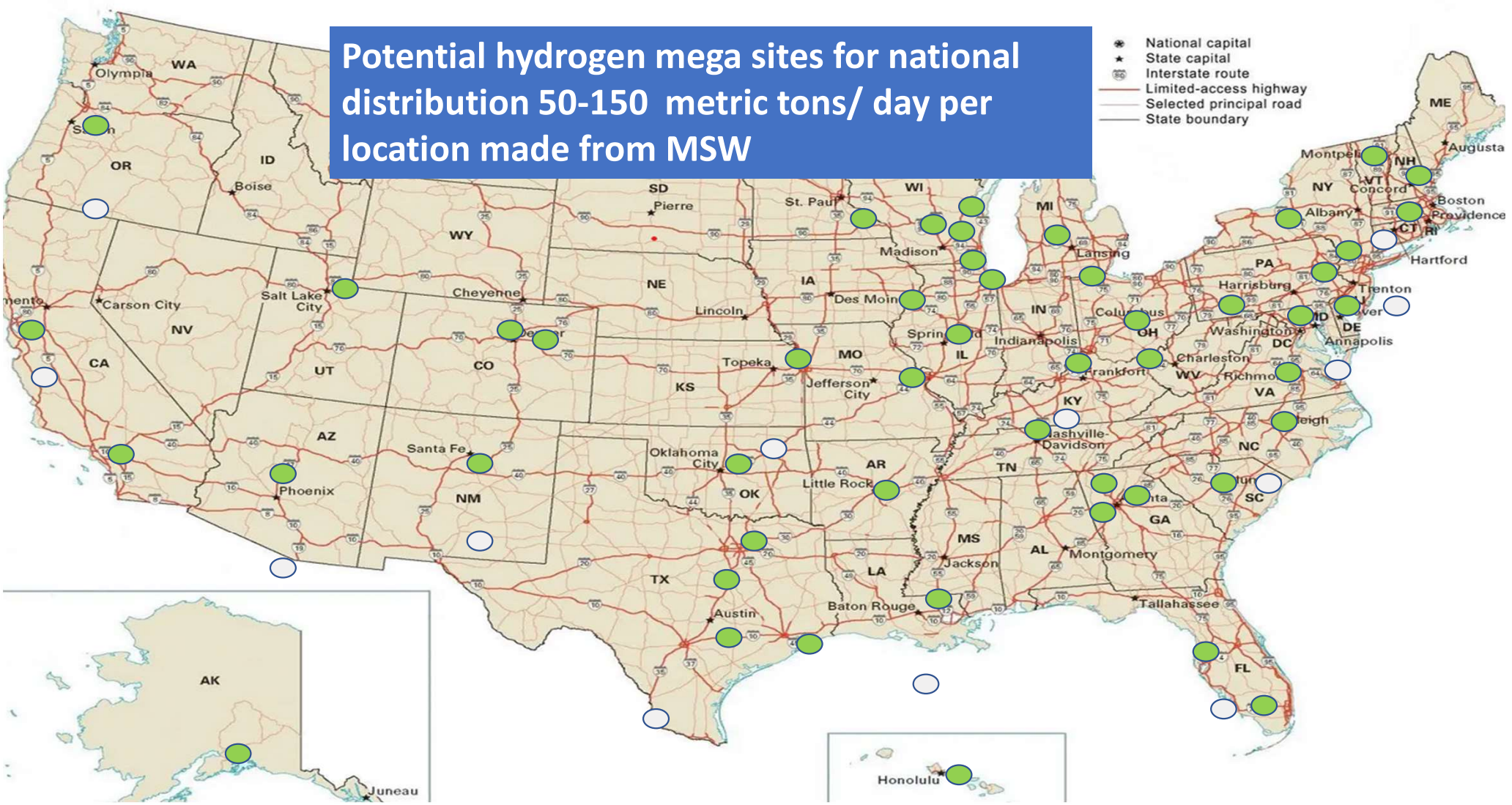
Hydro-Genyse Staff

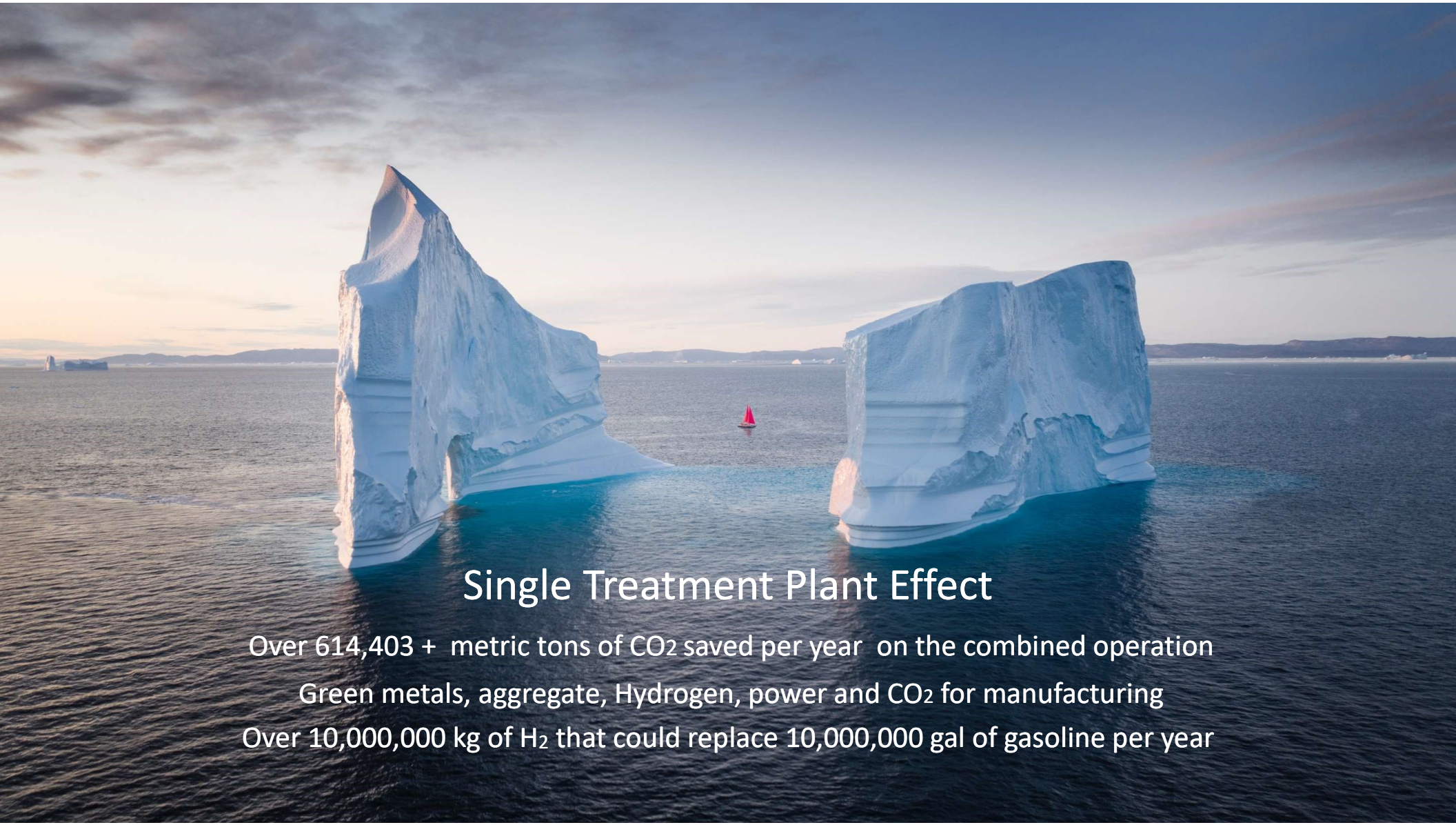
Ralph Bencriscutto, President of Tower Energy International LLC. Founder of Hydro Genyse with over 30 years of experience designing and installing profitable integration of industrial process utilization of waste heat, water and energy. Tower Energy has completed over 3000 grant subsidized projects with paybacks under 2 years.

Dr. Malek Alkasrawi PhD-Chemical Engineering, MS in Biotechnology, BS Food & Dairy Technology. 30 years of experience in applied engineering research. Associate Professor Scientist, U. Wisconsin Stevens Point, Associate Lecturer, Chemistry-U. Wisconsin Parkside and Carthage College.
Languages: Arabic, Swedish, English

Dr. Stephen Lyon PhD-Social Ecology, MS Biology, BS Oceanography, BS Limnology
41 years of experience in the Public, Private and Academic sectors, including the environmental, water, food care, health care and building care industries.
Languages: English, Swedish, Spanish, Russian.

Dr. Peggy James: Business Director: Dr. Peggy James (PhD 1988) Professor of Politics Philosophy and Law, analyzes social/ political challenges for inclusion/cooperation between municipal partners, including community agreements and workforce partnerships.


Potential hydrogen mega sites for national distribution 50-150 metric tons/ day per location made from MSW
National capital
State capital
Interstate route
Limited-access highway
Selected principal road
State boundary
WA
Olympia
OR
ID
Boise
NV
Carson City
Salt Lake City
CA
UT
AZ
Phoenix
CO
Cheyenne
NM
Santa Fe
WY
SD
Pierre
NE
Lincoln
KS
Topeka
Jefferson City
OK
Oklahoma City
TX
Austin
Baton Rouge
LA
Jackson
AR
Little Rock
MO
IA
Des Moin
WI
St. Paul
Madison
IL
Sprin
MI
Lansing
IN
Indianapolis
OH
Columbus
KY
Frankfort
Nashville-Davidson
TN
MS
AL
Montgomery
GA
FL
Tallahassee
SC
NC
Charleston
WV
Richmo
VA
PA
Harrisburg
Washington
DC
MD
DE
Annapolis
Trenton
NY
Albany
Montpel
VT
Concord
NH
ME
Augusta
Boston
Providence
RI
CT
Hartford
AK
Juneau
Honolulu

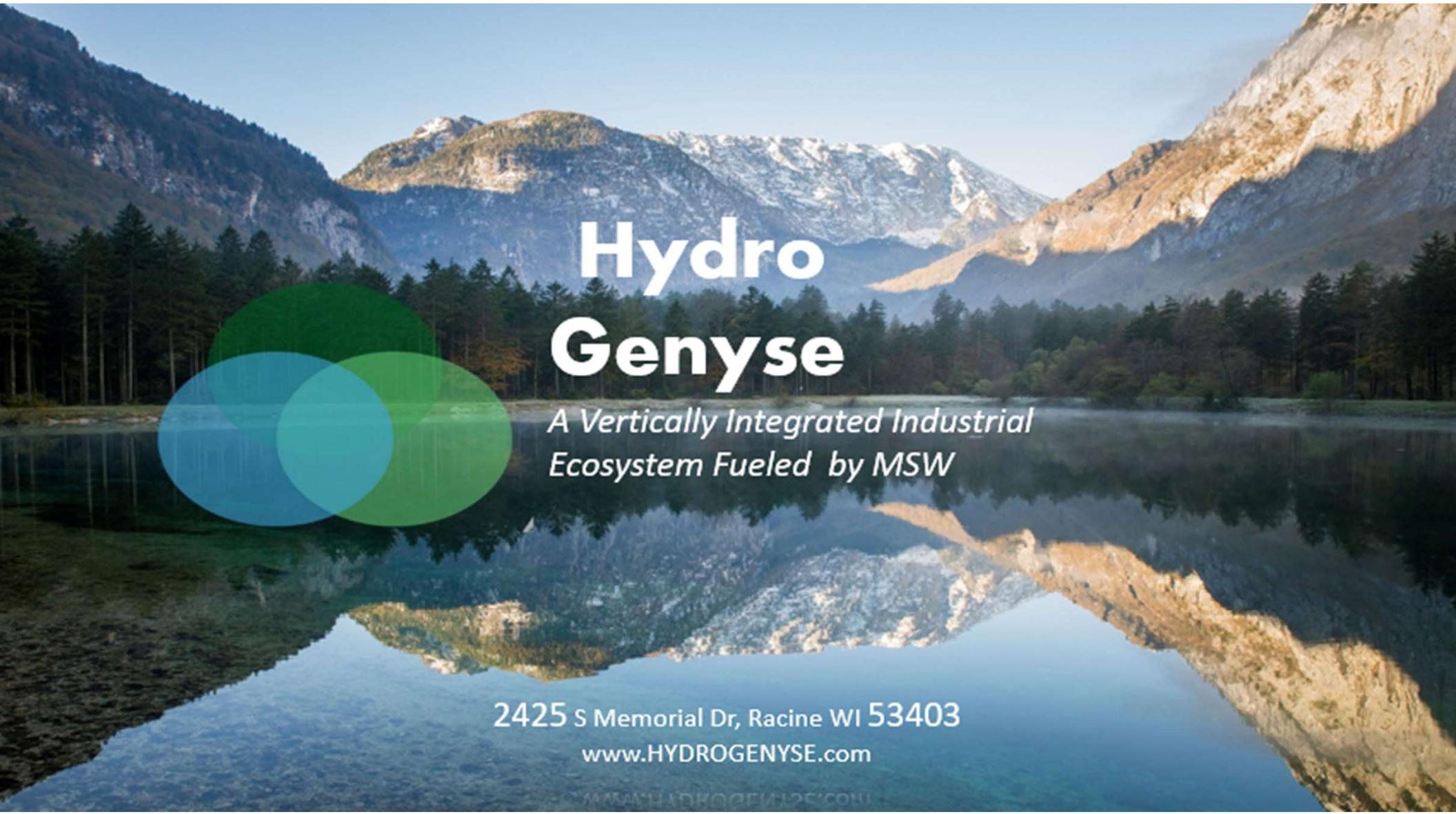


Single Treatment Plant Effect

Over 614,403 + metric tons of CO_2 saved per year on the combined operation

Green metals, aggregate, Hydrogen, power and CO_2 for manufacturing

Over 10,000,000 kg of H_2 that could replace 10,000,000 gal of gasoline per year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