Bio-Hydrogen

Green Fortress Engineering, Inc.

Green Fortress Engineering

Technology & Market

Biomass Feedstock

Crop Waste

Corn stover is the obvious choice.

Miscanthus, switchgrass

Some plastics also okay

Woodchips, Sawdust

Woodworking sawdust

Papermill residues

Utility trimmings

Forest slash

Animal Waste

Cow manure needs dewatering

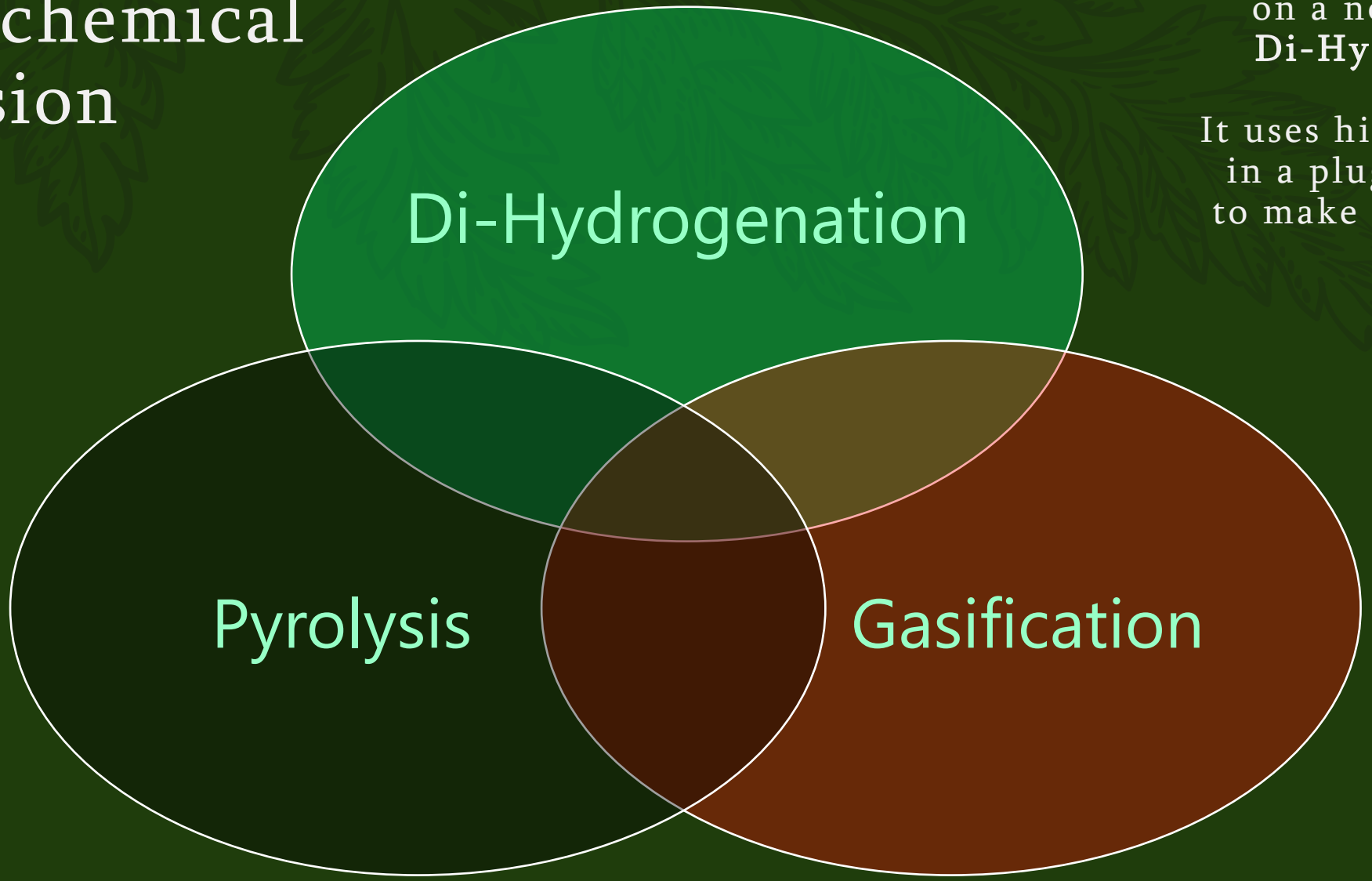
Swine – mix with crop waste

Sewer sludge solids

Thermochemical Conversion

GFE holds 5 patents on a novel method: **Di-Hydrogenation**.

It uses high-temperature in a plug-flow reactor to make tar-free syngas



HFC1000 Bio-Hydrogen System

Basic Concept

- Biomass has C, O, H, H_2O, and ash.
- Crack all organic molecules into gas
- High temperatures **eliminate tar**
- Extract hydrogen from the syngas
- Remaining CO is *self-powering*

- 1032 kg/day 99.5% pure H_2
- Carbon intensity 0.36 w/w
- Energy self-sufficient
- Scalable to 1 MT/day H_2
- Compliant air emissions
- No water discharge
- Simple operation
- Low pressure
- Covered by 5 US patents
- Funding provided by:
  - USDA
  - DOE
  - DoD

Product overview

Unique

NOT a gasifier

NOT pyrolysis

First to market

Single-reactor for farms, factories self-use

Six-reactor HFC1000 for industrial production

Tested

Three pilot-scale systems built

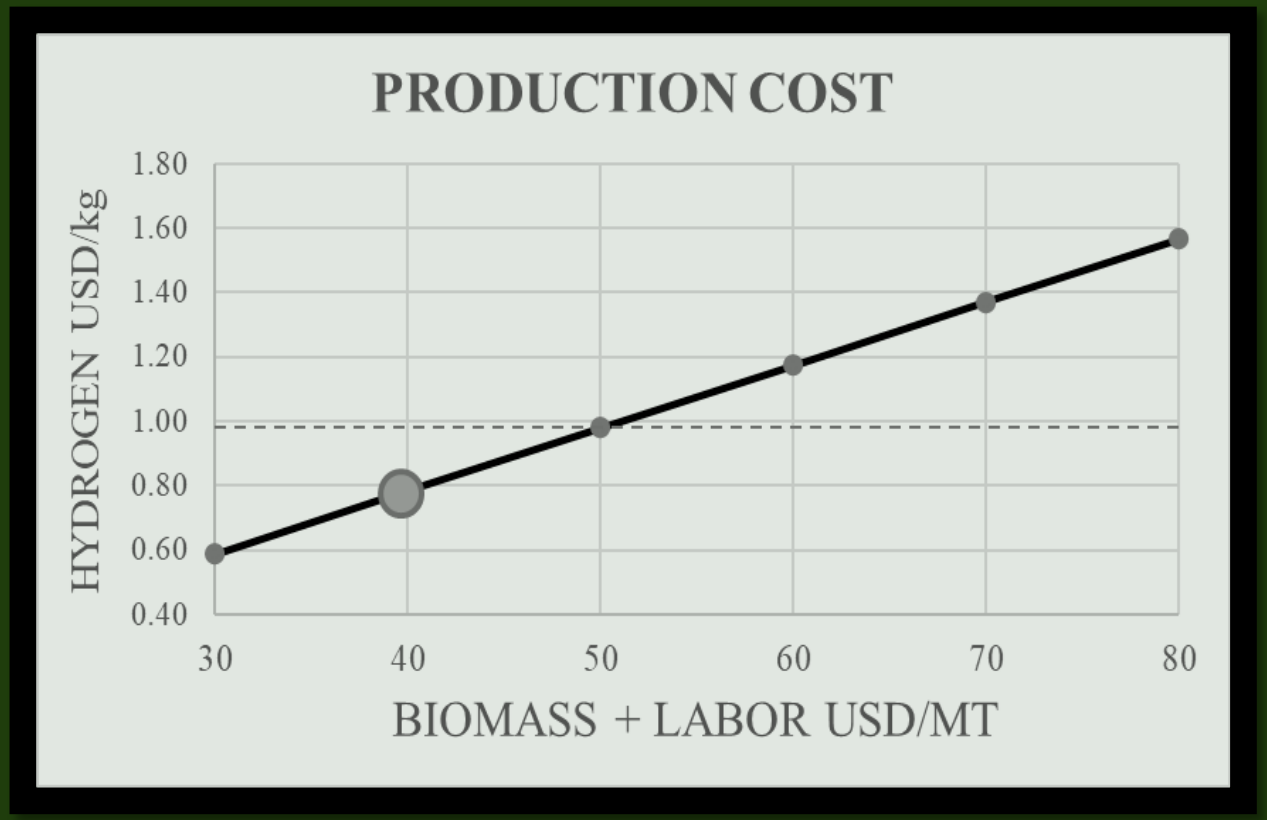
Third-party air emissions stack test done

Versatile

Bio-hydrogen, yes.

Also, electricity, biochar, & heat

“Lowest Possible” Hydrogen Cost



Low-cost Hydrogen

- Sub -$1/kg
  (wholesale is 4.83 $/kg)

Carbon Intensity (CI)

G.R.E.E.T.

DOE standardized tool for IRA compliance
https://greet.anl.gov/

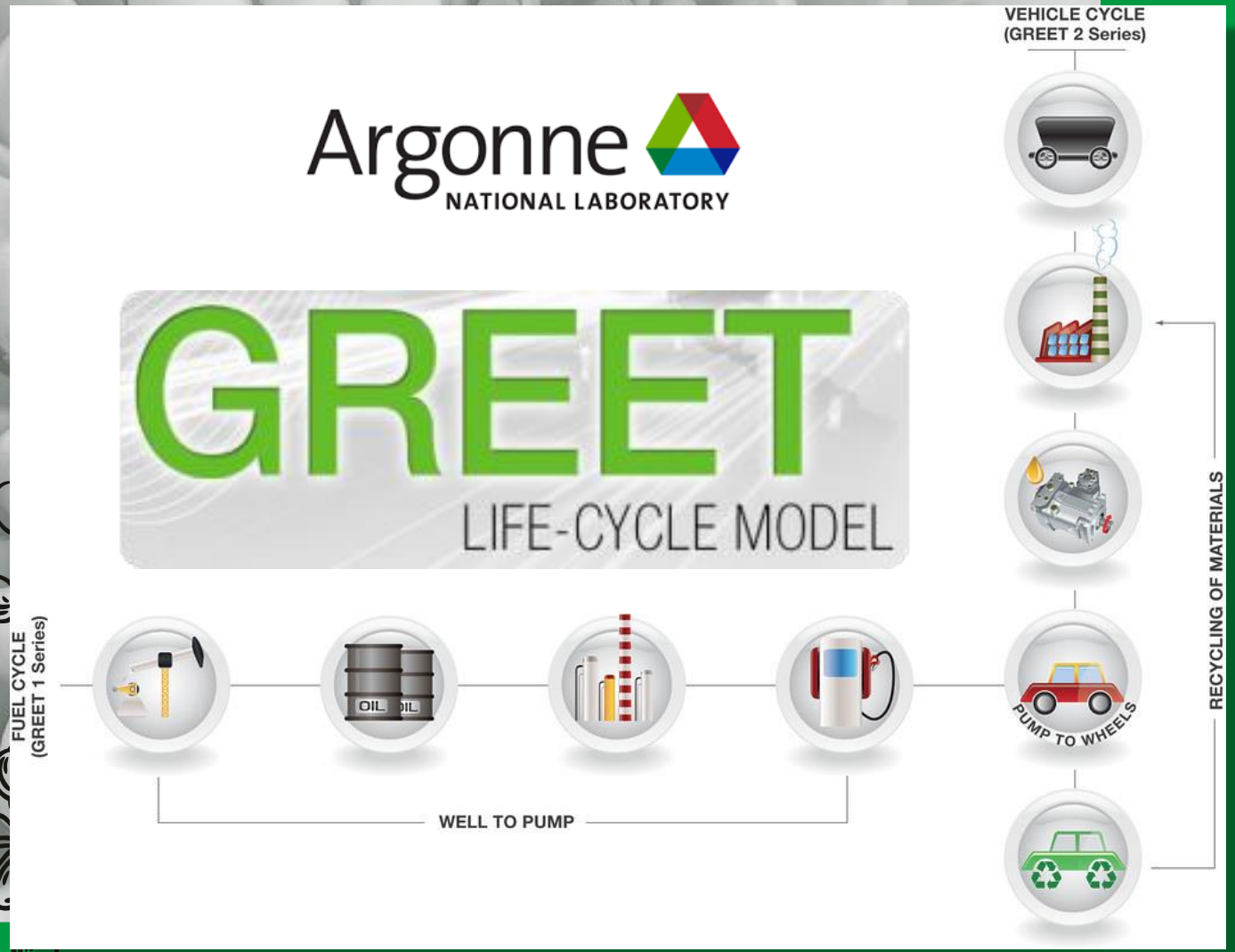
Our bio-hydrogen:

CI = **0.36** kg-CO_2/kg-H_2

Greenest 45V level:

CI ≤ **0.45**

*Qualifies for full **$3/kg** production credit



Customer ROI

HFC1000

$750,000 CAPEX

Use low- or negative-value biomass

Proximity is crucial

Charge tipping fees if possible

Produce

Di-hydrogenate

Self-sustaining process ($1/kg)

Co-locate with offtake facility

Pipe to nearby blend station along natural gas pipeline

Ship by truck using H2US or MH

Sell

Deliver to terminal

Charge sub-wholesale rate ($4.9/kg)

Receive $3/kg production credit

Simple ROI in 3.9 years

How to Build the Company

Beta Test

Emplace pilot system

Work out bugs

Design 6-tube system

Marketing

Early Adopters

HFC1000 to Farms/Factories

Build in-house capacity

Establish mfg. operations

Distribution

Industrial Scale

Clusters of HFC1000

Locate at pipeline terminals

Expand factory

Go Global

Startup & license factories

PCT on trade secrets

Industrial clusters

Developing countries need electricity, biochar, low cost

Market progression

$1 Billion

- On-farm NH_3
- Fuel cell Forklifts
- Fleet FCVs

$8 Billion

- SAF
- Chemical refining
- Metalworks

$15 Billion

- Industrial parks
- Metropolis

Green Fortress Engineering

Company overview

Mission Statement:
Develop and deploy sustainable energy self-sufficiency around the world.

Vision :
Create an ever-expanding portfolio of robust self-sufficiency products and services to enable humans to live sustainably wherever they choose.

Green Fortress Engineering, Inc.

2016

Carmel, Indiana USA

C-corporation, Indiana-based

100% owned by CEO

1-11 employees (varies)

$400,000

Revenues

STTR, National Science Foundation

ERC Prize, Department of Energy

H2 Shot Incubator, DOE

Research contracts, Innovation Core, SEI

12 Patents

US PTO

Biomass conversion (5)

Hydrogen storage (4)

In Situ Resource Utilization (3)

Meet the GFE team

Peter Schubert, Ph.D., P.E.
CEO

Felix Trojer, Ph.D.
Business Development Exec

Randall Gatz, Ph.D.
Business Development Exec

Cyrus Summerlin
Chief Operating Officer

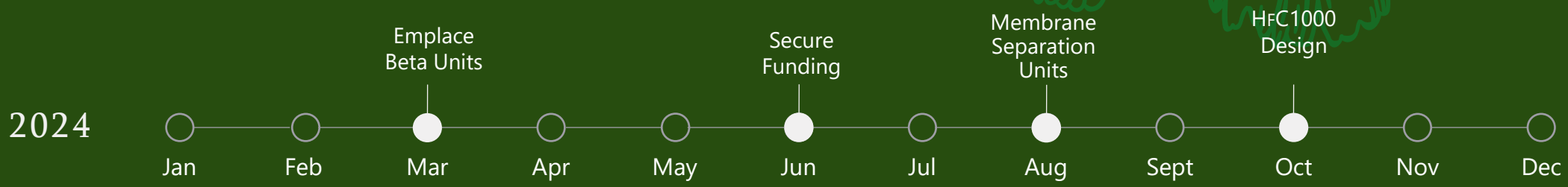
Tom Marchok
VP Sales & Marketing

Megan Headean
Finance

John Christenson
Innovation

Our competition graphic

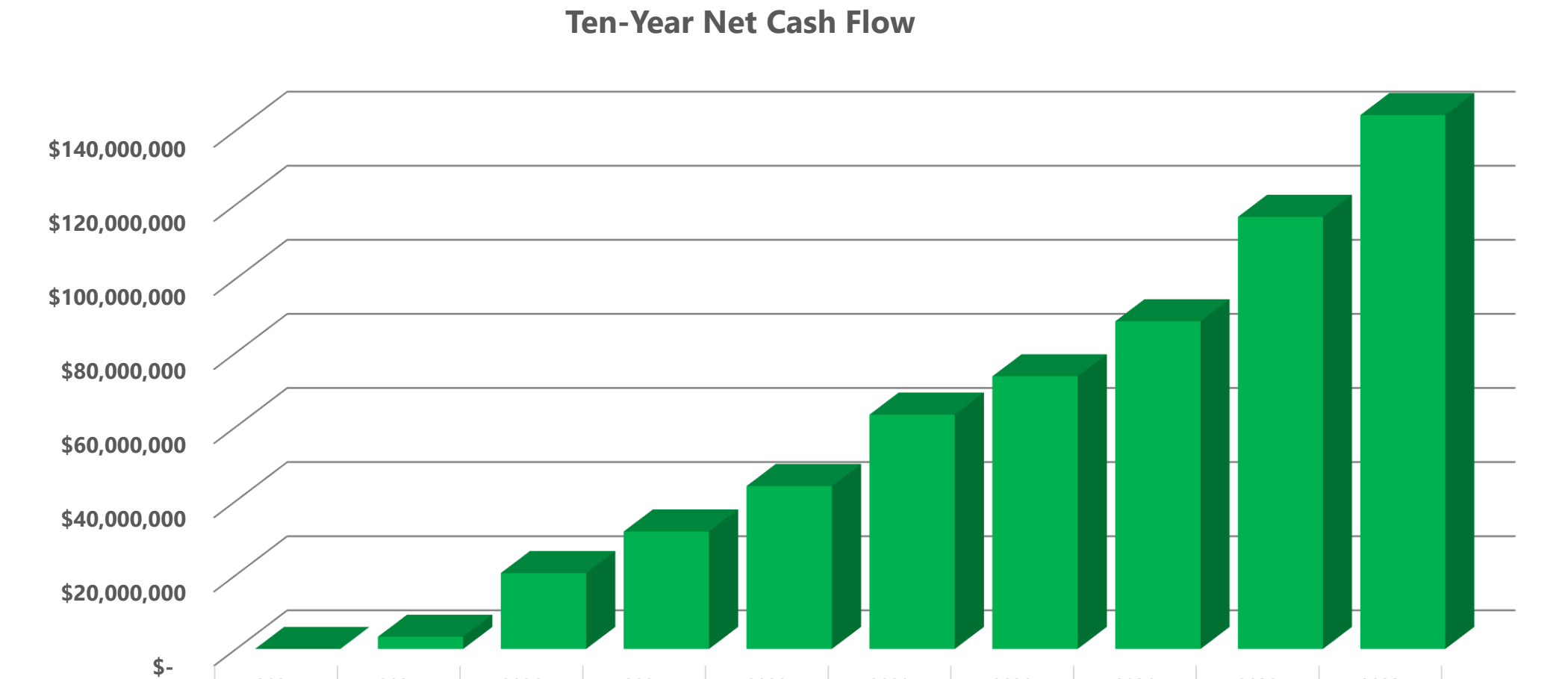
Two-year action plan



Green Fortress Engineering

Financials

Financials – Cash Flow – 10 yr.



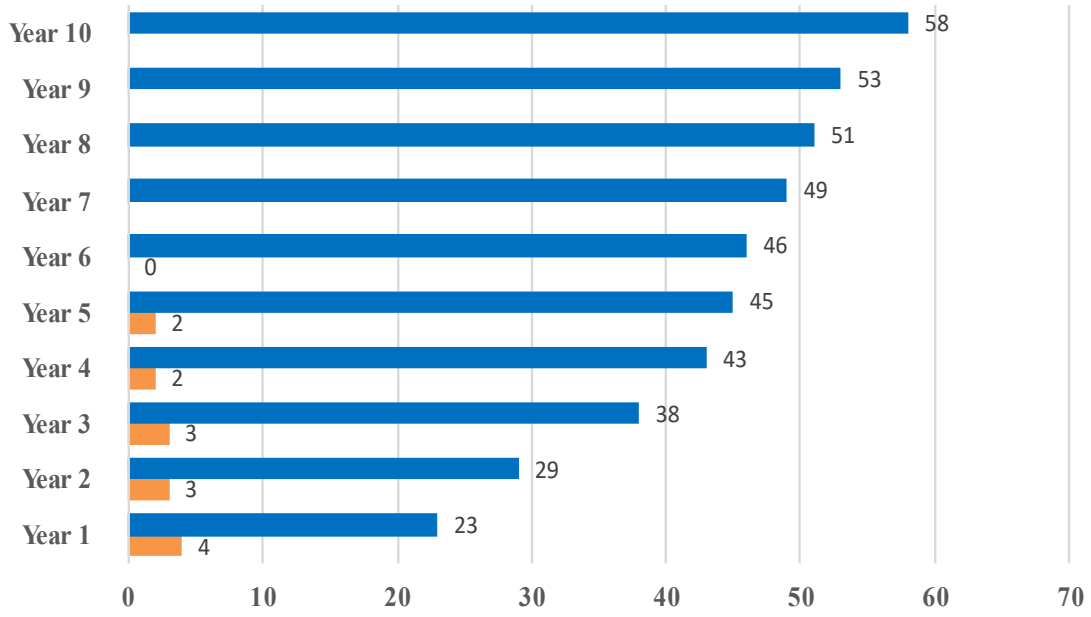
	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Operating Cash Flow	$(1,396,339)	$3,289,273	$20,471,913	$31,690,533	$43,958,967	$63,227,525	$73,564,950	$88,421,250	$116,623,150	$144,097,300

Financials – Balance Sheet

Annual Summary	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Beginning Cash	$ 4,400,000	$ 2,203,661	$ 1,992,934	$ 10,464,847	$ 46,655,381	$ 90,614,348	$ 153,841,873	$ 227,406,823	$ 315,828,073	$ 432,451,223
Revenues	$ 1,500,000	$ 14,250,000	$ 54,000,000	$ 90,000,000	$ 108,000,000	$ 135,000,000	$ 156,000,000	$ 186,000,000	$ 243,000,000	$ 298,500,000
Expenses	$ 2,896,339	$ 10,960,727	$ 33,528,087	$ 53,809,467	$ 64,041,033	$ 71,772,475	$ 82,435,050	$ 97,578,750	$ 126,376,850	$ 154,402,700
Operating Cash Flow	$ (1,396,339)	$ 3,289,273	$ 20,471,913	$ 31,690,533	$ 43,958,967	$ 63,227,525	$ 73,564,950	$ 88,421,250	$ 116,623,150	$ 144,097,300
Investments	$ 4,700,000	$ -								
CAPEX	$ (1,100,000)	$ (3,500,000)								
Ending Cash Bal	$ 2,203,661	$ 1,992,934	$ 10,464,847	$ 46,655,381	$ 90,614,348	$ 153,841,873	$ 227,406,823	$ 315,828,073	$ 432,451,223	$ 576,548,523
Staffing	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Contractors	4	3	3	2	2	0				
FTE	23	29	38	43	45	46	49	51	53	58

Financials – Balance Sheet

Ten-Year Staffing



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FTE	23	29	38	43	45	46	49	51	53	58
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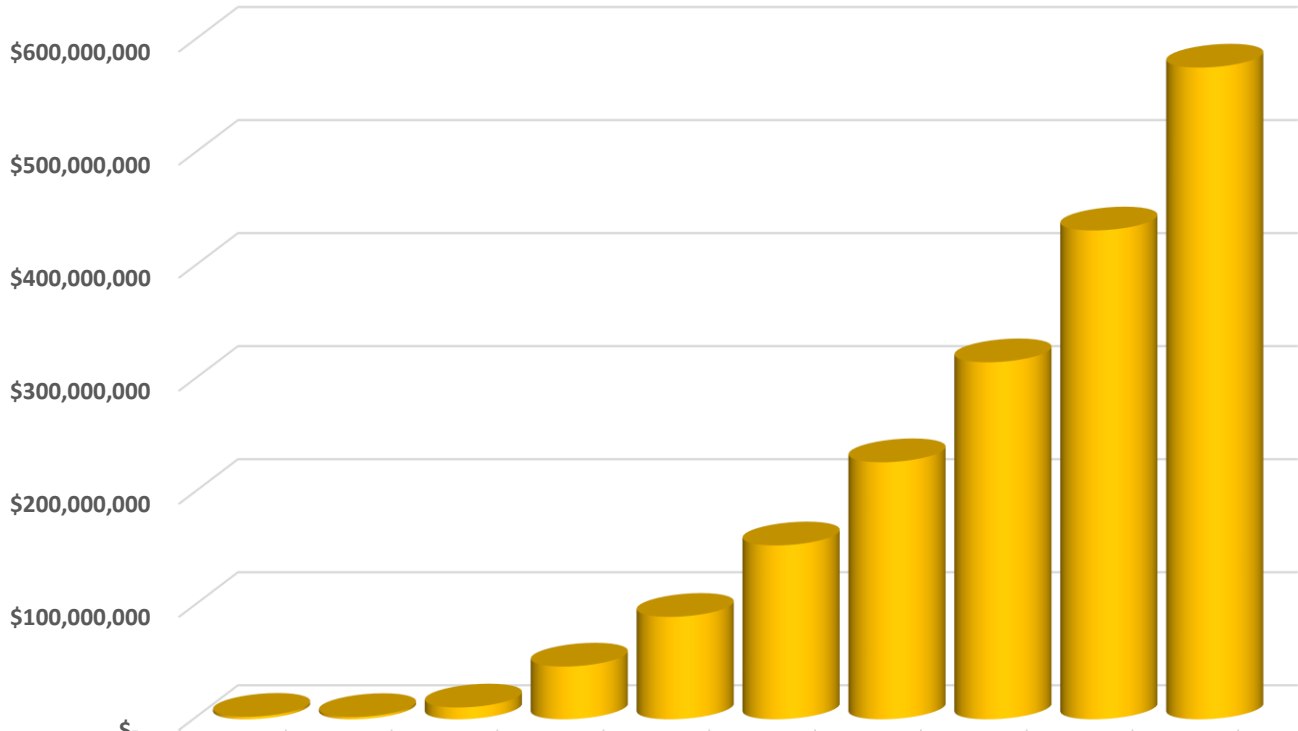
Ten-Year Ending Cash Balance



	1	2	3	4	5	6	7	8	9	10
Ending Cash Bal	$2,203,661	$1,992,934	$10,464,84	$46,655,38	$90,614,34	$153,841,8	$227,406,8	$315,828,0	$432,451,2	$576,548,5

$5,250,000
Biomass Tech Replacement Value

Obtained from grants and invested in patents

$2,130,000
Hydrogen Storage Replacement

Obtained from grants and invested in patents

$50,000
Assets

Equipment purchased and owned

$50,000
Cash

Liquid cash we have on hand

Thank you

Peter Schubert

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