

Investor & Analyst Day

September 13, 2022

Heliogen

Disclaimer

Forward-Looking Statements

This presentation contains certain forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended. Statements that are not historical in nature, including the words “anticipate,” “expect,” “suggests,” “plan,” “believe,” “intend,” “estimates,” “targets,” “projects,” “should,” “could,” “would,” “may,” “will,” “forecast” or the negative version of those words and other similar expressions are intended to identify forward-looking statements. These forward-looking statements include, but are not limited to, statements regarding the Company’s projected financial information and guidance, commercial strategy and progress, market growth, potential additional public-sector funding and reaching key milestones. Forward-looking statements are predictions, projections and other statements about future events that are based on current expectations and assumptions and, as a result, are subject to risks and uncertainties, many of which are beyond our ability to control or predict. Although we believe that the expectations reflected in these forward-looking statements are reasonable as of the date made, such forward- looking statements are not guarantees of future performance. Many factors could cause actual future events to differ materially from the forward-looking statements in this presentation, including but not limited to: (i) our financial and business performance, including risk of uncertainty in our financial projections and business metrics and any underlying assumptions thereunder; (ii) our ability to execute our business model, including market acceptance of our planned products and services and achieving sufficient production volumes at acceptable quality levels and prices; (iii) our ability to access sources of capital to finance operations, growth and future capital requirements; (iv) our ability to maintain and enhance our products and brand, and to attract and retain customers; (v) our ability to scale in a cost effective manner; (vi) changes in applicable laws or regulations; (vii) the ongoing impacts of the COVID-19 pandemic and the potential impacts of Russia’s invasion of Ukraine on our business; (viii) developments and projections relating to our competitors and industry; (ix) our ability to access sources of capital to finance operations, growth and future capital requirements; and (x) our ability to protect our intellectual property. You should carefully consider the foregoing factors and the other risks and uncertainties disclosed in the “Risk Factors” section in Part I, Item 1A in the Company’s Annual Report on Form 10-K/A for the annual period ended December 31, 2021 and other documents filed by the Company from time to time with the Securities and Exchange Commission. These filings identify and address other important risks and uncertainties that could cause actual events and results to differ materially from those contained in the forward-looking statements. Any forward-looking statements speak only as of the date they are made and the Company assumes no obligation and does not intend to update or revise these forward-looking statements, whether as a result of new information, future events, or otherwise.

Today's Agenda

Overview: Heliogen's Vision, Goals and Competitive Advantages
- Bill Gross, Founder & CEO

Facility and Tour Overview
- Andy Lambert, Chief Production & Supply Chain Officer

Facility Tour

Industrial Heat Market Highlights, Path to Attractive Unit Economics
- Christie Obiaya, CFO

Customers & Projects
- Tom Doyle, Chief Commercial Officer

Technology Deep Dive & R&D Highlights
- Paul Gauche, EVP, Engineering and Steve Schell, Chief Scientist

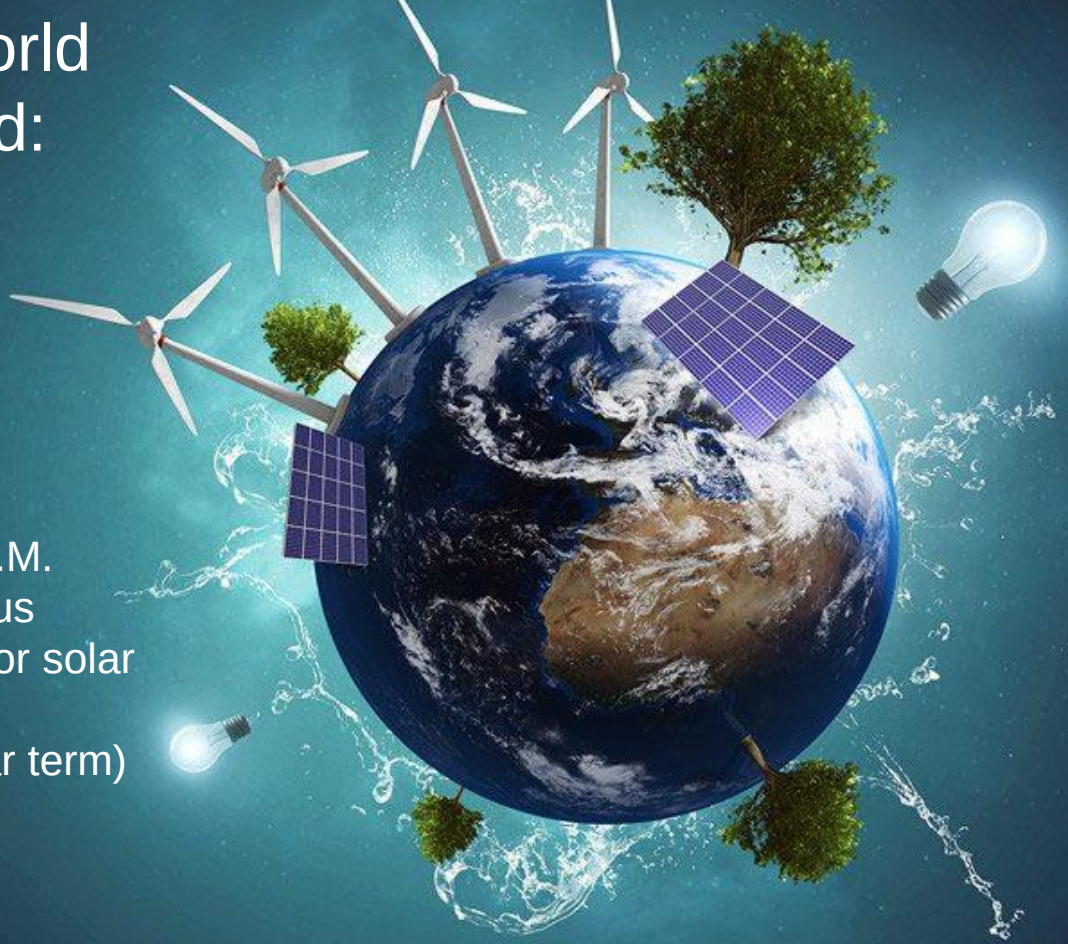
Closing Remarks
- Bill Gross, Founder & CEO

In 6 months, the world completely changed:

* Fossil Fuel prices +++
* Inflation Reduction Act

These two changes:

* Significantly expand our T.A.M.
* Sharpen our geographic focus
* Drive WAY up the demand for solar thermal heat (even more than electricity/hydrogen in the near term)



Five Fundamental Characteristics that Set Heliogen Apart

1. **Durable Competitive Advantages**: Extensive patent portfolio, trade secrets and learnings will enable Heliogen to maintain and defend its competitive advantages
2. **Cutting-edge Software Makes it Work**: Utilizes artificial intelligence, software and cost-effective computation power to simplify and reduce hardware production, installation and maintenance costs, and to generate more energy
3. **Vertical Integration of AI:** Allows utilization of Heliogen's AI across entire value chain to reduce costs
4. **Modularity Enables Scalability and Execution**: Our offerings are modular, making it possible to scale to our customers' behind-the-meter needs while also supporting more efficient execution
5. **The Right Management Team**: Expertise in technology, financial management, EPC, manufacturing and solar design and sales well-suited to Heliogen's needs

Heliogen has the potential to profitably transform the world's energy production and meaningfully address climate change

Heavy Industry Needs to Lower their Energy Cost and Lower their CO_2

- Heavy industry has a high percentage of their costs as energy, so is hit harder by the cost increase and volatility
- Many big-name heavy industry companies have made commitments to lower their CO_2 emissions this decade that are challenging to meet
- We discovered the heavy industry has this problem that is underserved



We believe that Heliogen is the only public solar technology company that has the potential to meaningfully solve the energy problem for industrial customers

Residential/Commercial	Utility	Industrial Decarbonization
sunrun, ENPHASE, TESLA, JinKO Solar, sunnova	NEXTera ENERGY, First Solar, IBERDROLA, shoals, ARRAY TECHNOLOGIES, Canadian Solar	Heliogen







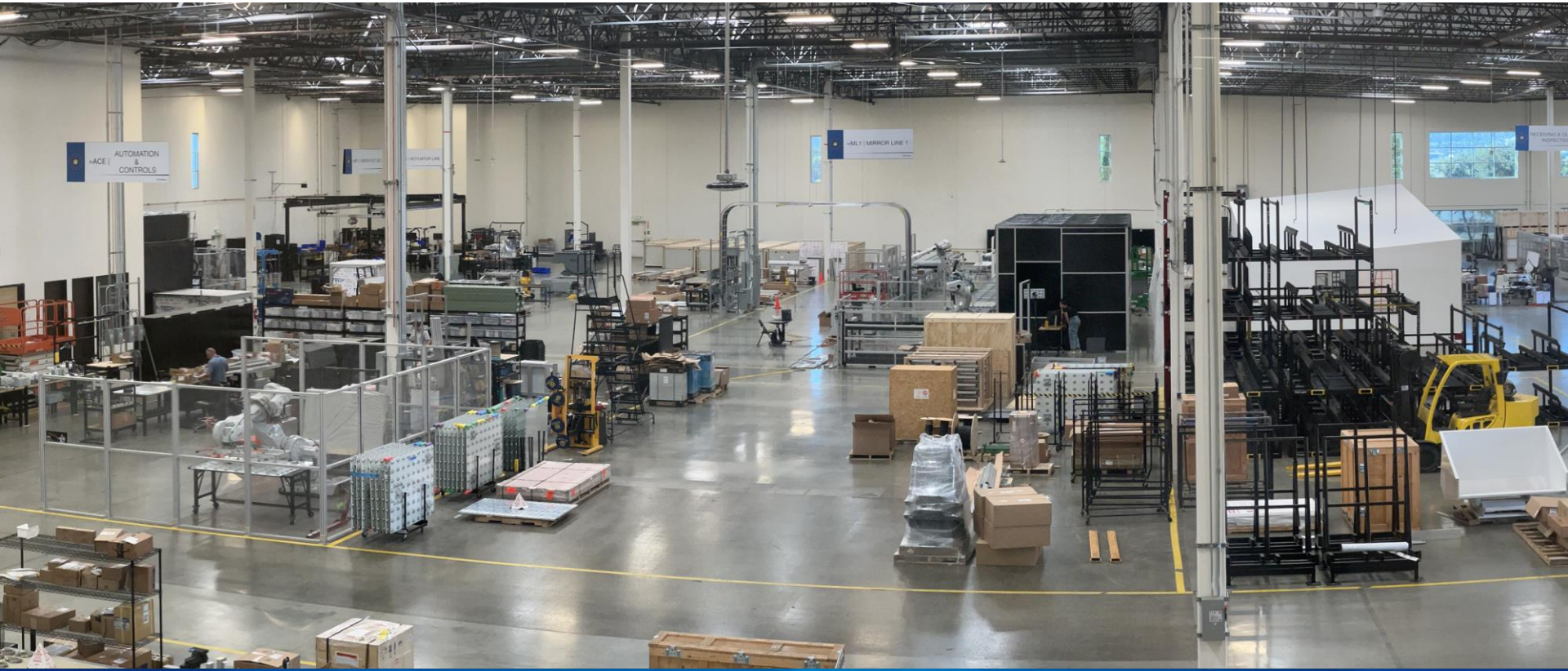
Heliogen's technology will enable avoiding cost of fuel + ZERO emissions(1)



(1) Estimated Scope 1 and 2 emissions
Rendering for illustrative purposes

Our solar concentration system is optimized for automated manufacture

The factory that you will see today automates our miniature heliostats that are possible with our patented control system



Our patented control system is the first ever to dynamically track thousands of mirrors with real-time feedback



The sky is very bright next to the sun, and the intensity decreases further away

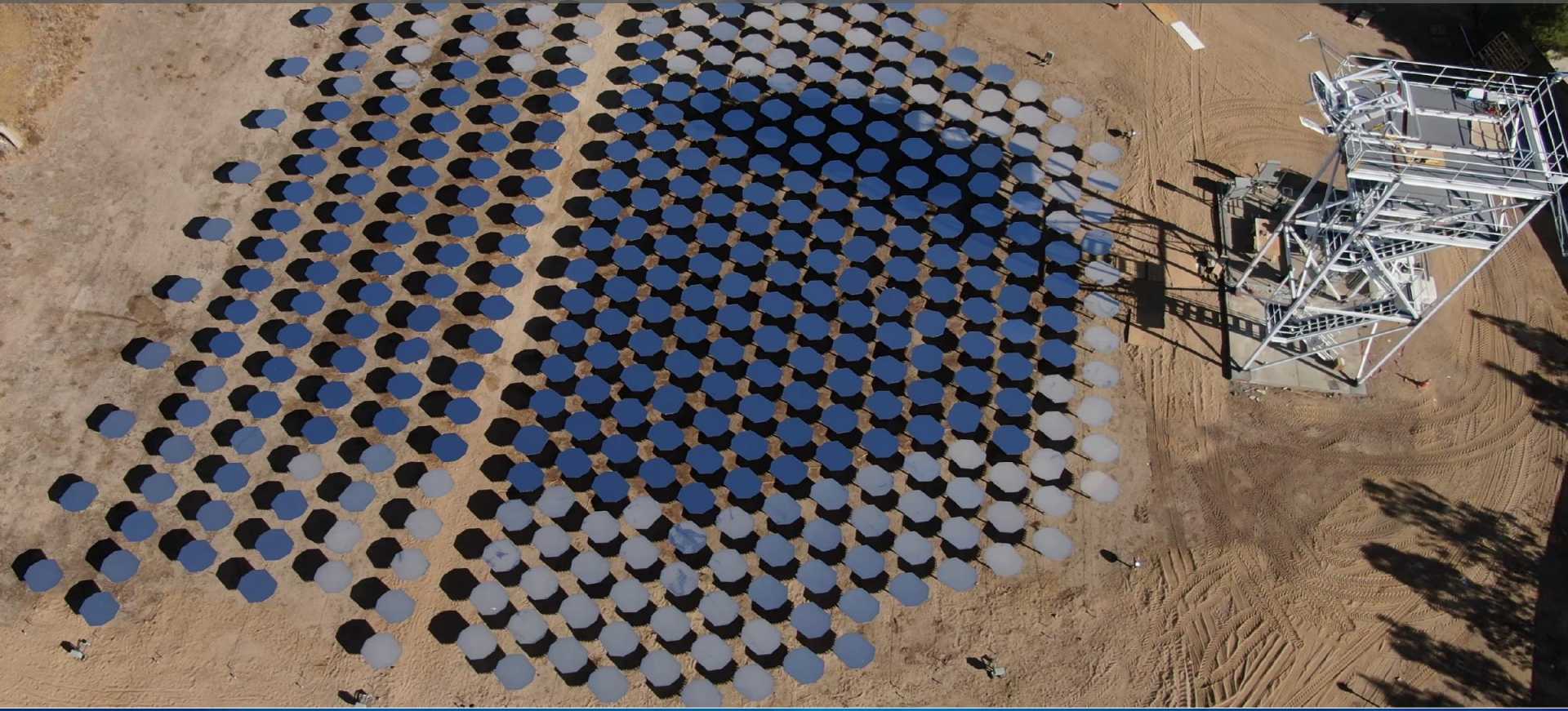
Heliogen's Heliostat Operating System (H.O.S.)

The cameras measure the intensity of sky reflected in each mirror.

Using these four intensity measurements, we calculate the mirror orientation and therefore the direction of the beam, allowing real-time perfect tracking.

H.O.S. is the first commercial closed-loop heliostat field control system.

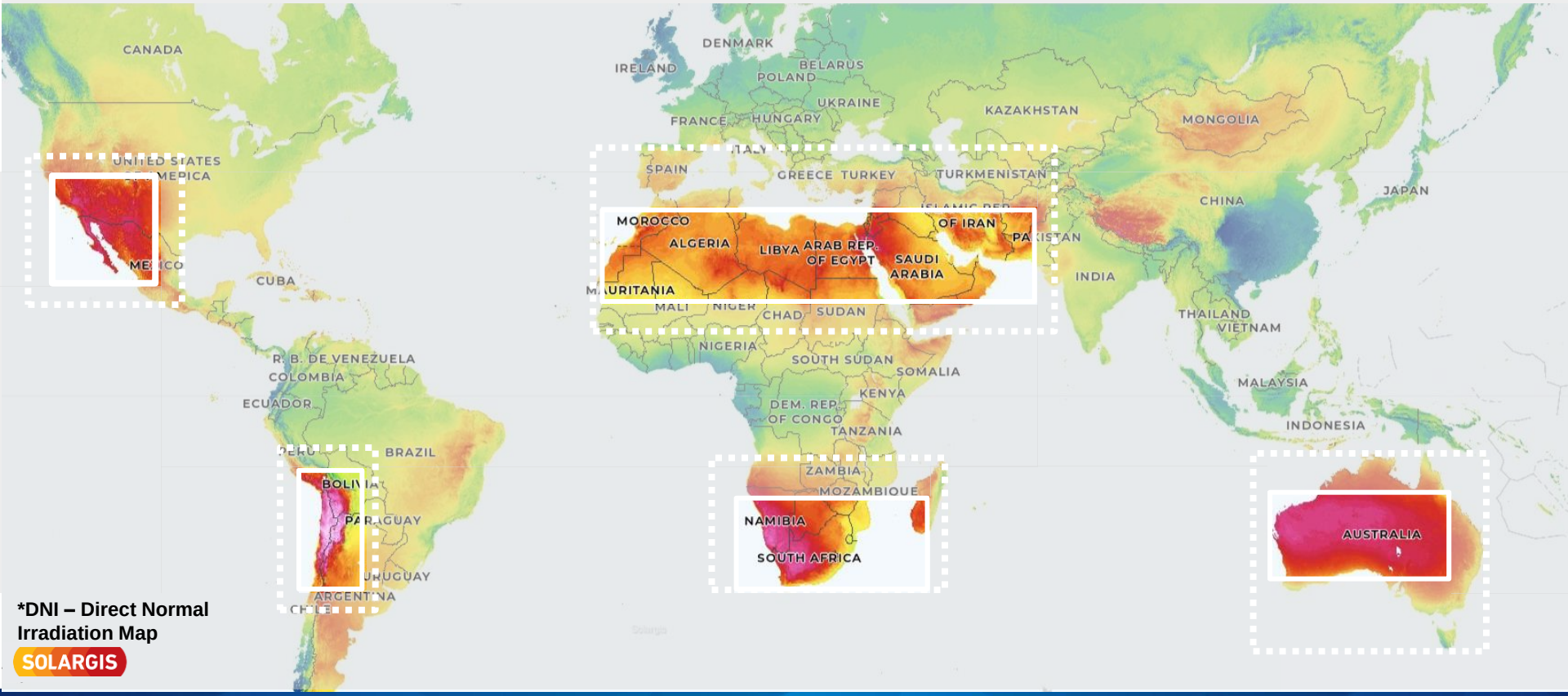
We proved this technology at scale in 2019 at our Lancaster facility



We have now deployed our Generation IV technology, ready for Rio Tinto



Heliogen's bold vision: 1000's of towers in the 5 sunniest areas on earth



*DNI – Direct Normal Irradiation Map

SOLARGIS

Our strategic & commercial relationships demonstrate global demand

ArcelorMittal

- One of the world's leading steel and mining companies
- Largest steel manufacturer in North America, South America and Europe

Won a $39mm award to be applied toward developing, building, and operating supercritical carbon dioxide power integrated with thermal energy storage supplied by heliostat field

Woodside

- Australian oil & gas company with global presence, signed project agreement for commercial-scale deployment of Heliogen's technology and collaboration agreement

RioTinto

- Mining and metals company operating in 35 countries around the world
- One of the largest producers of iron ore, copper, diamonds and gold

Hanwha Power Systems

- Global leader in the development of eco-friendly power generation solutions
- Entered into agreement for production and delivery of sCO_2 power block for Woodside project

Bloomenergy

- Leading provider of electrolyzer uniquely suited to amplify key benefits of Heliogen's technology
- Conducted successful hydrogen production test

Dimensional Energy

- A company working to transform hydrogen, sunlight and air into sustainable liquid fuels
- Letter of intent to produce sustainable aviation fuel with Heliogen

We have a committed, experienced executive team and 200 mission-driven employees to successfully execute against this huge opportunity



Bill Gross
CEO & Founder



Christie Obiaya
Chief Financial Officer



Tom Doyle
Chief Commercial Officer



Steve Schell
Chief Scientist



Paul Gauche
EVP, Engineering



Andy Lambert
Chief Production & Supply Chain Officer



Louis Baltimore
VP, Investor Relations



Fully autonomous installation, cleaning and maintenance will be our differentiation

Designed and built entirely in-house using LIDAR, cameras, GPS and Heliogen's proprietary software





Facility and Tour Overview

Andy Lambert, Chief Production & Supply Chain Officer

Heliogen Team



Andy Lambert

Chief Production & Supply Chain Officer

Previous Experience

25+ years career success leading manufacturing, enabling disruption & innovation

- Led manufacturing for several industry firsts:
  - First premium small car (Mini Cooper)
  - First mass-produced electric car (Mini Cooper Electric)
  - First re-usable rocket (SpaceX)
- Awarded Largest Improvement –by JD Power (Mini)
- Led build reliability to support the first crewed space mission from US soil since 2011

Achievements at Heliogen

- Assembled a world-class team
- Established cost reduction roadmap across a multi-year timeframe
- Stood up full internal capability for product reliability testing and evaluation
- Brought rapid prototyping capability online to support continuous innovation
- Verified complete supply chain, production, test and installation processes, to support time and cost goals for our first customer field
- Automation & autonomy developed entirely in-house

Production & Supply Chain Status

In-house prototyping capability supports rapid innovation

Rapid development of automation & autonomy solutions
Field trials underway with first Customer Autonomous Cleaning Vehicle (expect to be qualified by end of the year)

Virtual creation & programming of robotic solutions
Pilot lines utilized effectively. Now transitioning to main lines (all production processes & equipment expected to be qualified by mid-4Q22)

Rapid product and process iteration to continually improve costs
New product design iterations underway (target to introduce for 2nd customer)

Global manufacturing provides flexibility and reliability

Vertically integrated to leverage internal talent and technologies to ensure adequate supply
Camera modules, heliostat tracked power solutions & components being assembled in-house, in addition to heliostats

Quantified, demonstrated, validated & measured product reliability
Product fully verified. (We will repeat testing with "Production Parts" by end of the year)

Global supply chain optimizes reliability and availability of components

Detailed commodity understanding & forecasting, to support product trades, hedging and competitive sourcing decisions
100% of materials procured for 1st customer. (100% of production ramp parts, expected on site by end of 3Q22)

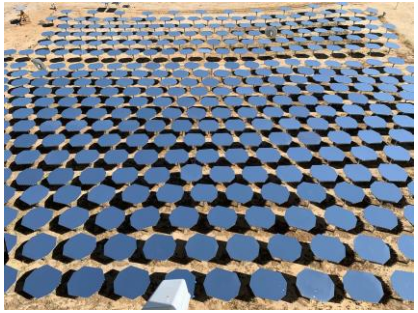
Logistics engineering competence to optimize routes, packaging & 3PL vs in-house trades
Final product packaging optimized, procured & on-site

Paul Parkin – Rapid Prototyping / Field Autonomy & Automation Solutions
Leon Parkhouse & Mick White – Manufacturing Engineering & Production
Brian Julius – Testing & Reliability
Galen Chin – Global Supply Chain

Production & Supply Chain Status: Heliostats

9 months ago







Today







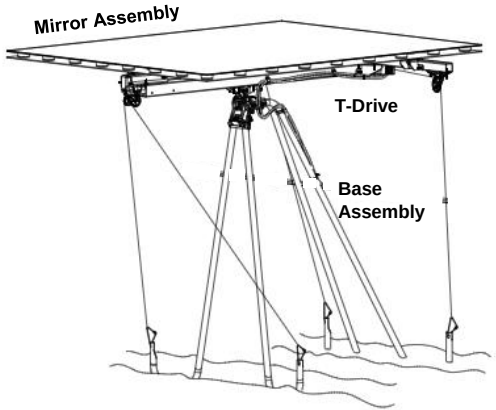
Fourth Generation Heliostat is Production-Ready While Progress Continues on Next Generation

Main Production Lines have entered final completion and qualifying phase

T-Drive & Mirror Assembly lines run incrementally larger batch sizes to validate cycle times & process controls, with quality validation in between each one. Goal to be fully qualified by mid-4Q22

We use finalized production parts for this phase = off tool / off process from each supplier
100 T-Drive part sets & 1000+ mirror assembly sets on-site currently to support this

Previous heliostat generations have focused on performance and reliability while current focus has shifted to cost reduction



Fourth (Current) Generation

Next Generation

Goals: Lower Production & Installation Costs
Improved Manufacturing & Installation

- Exits the factory fully assembled
  - Higher packing density
- Minimal ground preparation in the field
  - Coarse shrub removal only
- Less material overall
- Highly automatable in the factory
- Automated & autonomous installation
- Self-powered
- Meet all requirements for Inflation Reduction Act

Facility Tour Overview: Four Main Areas



Testing & Reliability Lab

For accelerated aging and environmental testing



Supply Chain

Optimization of total landed cost and availability of components



Prototype Shop

Provides rapid development and manufacturing services to engineering and production teams



Manufacturing, Engineering & Production

Enables efficient, rapid deployment of high-volume production

Testing & Reliability

Extensive Testing Validates Heliostat Design and Reliability

Accelerated Aging and Environmental Tests Completed

Temperature and humidity testing includes:

- Humidity and freeze cycling
- Thermal cycling
- Condensation cycling

Full-scale heliostat and mirror temperature and humidity testing

- Heliostats actuated full range of motion throughout test

Wind machine testing

- ‘Operating’ and ‘drive to stow’
- ‘Out of stow’ survival
- ‘At stow’ survival

Blowing sand and dust ingress per MIL-STD 810G

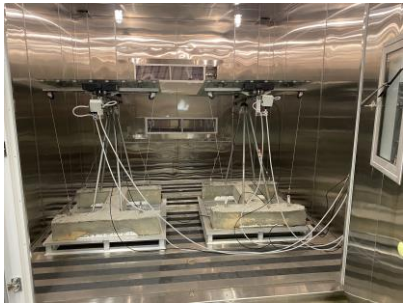




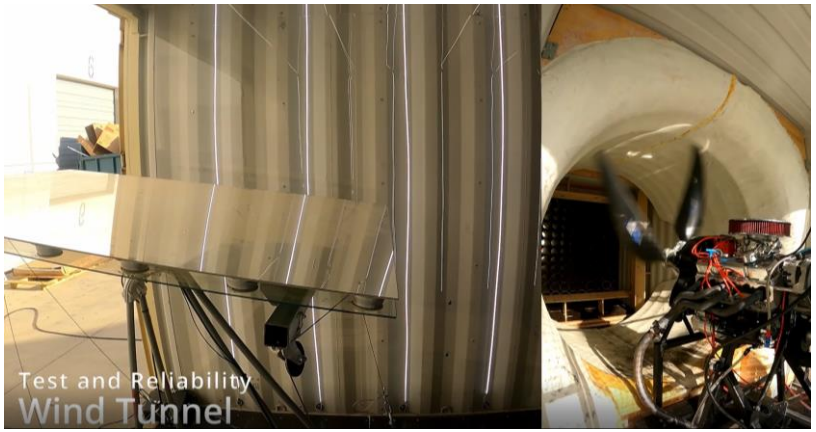




Full Scale Mirror Temp/Humidity



Full-Scale Heliostat Temp/Humidity



Heliogen

Successful Reliability Testing Validates Heliostat Design for Durability

Mechanical testing
- Lap shear/tension: adhesive joint performance
- Wire rope testing: strength, stretch and wear

Mechanical static and dynamic load testing
- Snow loading

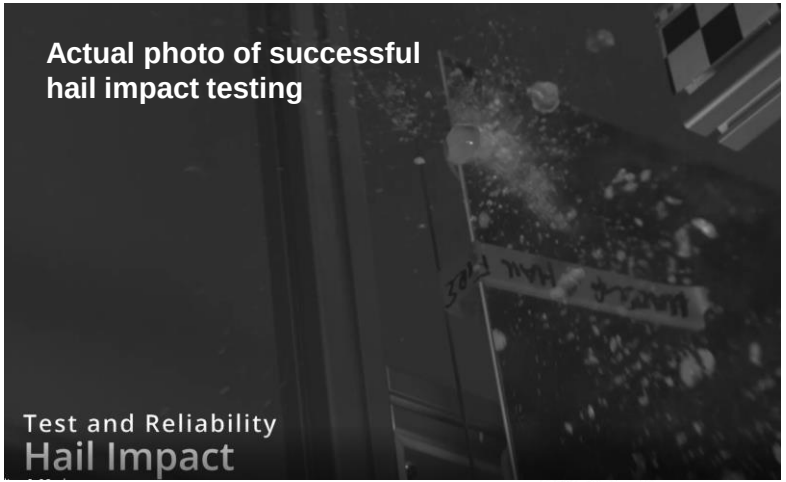
Hail testing
- Large diameter hailstones at terminal velocity

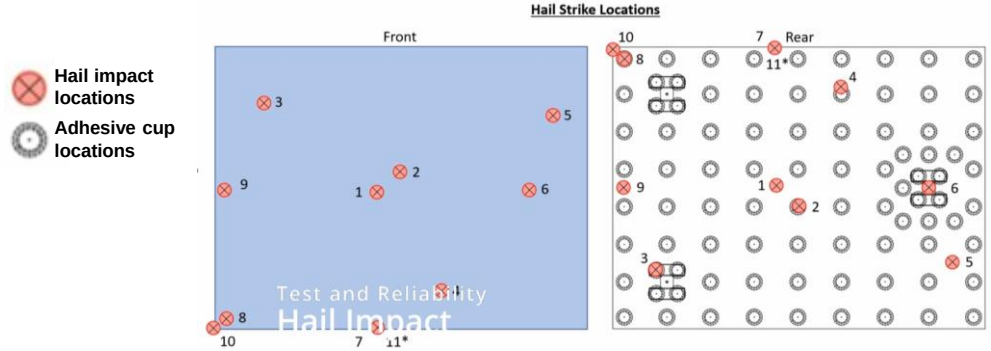
High-intensity UV exposure

Corrosion Testing
- Neutral salt spray
- Copper accelerated salt spray

Inspection
- 20x to 1000x digital microscope imaging
- Sample cross sectioning

SOFAST (Sandia Optical Fringe Analysis Slope Tool)
- Measures slope error and focal length of mirror facets





Process & Lifecycle Validation Conducted at Lancaster

Manufacturing validation: a multi-purpose process
- Reduced risk of production line design through use of pilot line
- Pilot line produces heliostats used for testing at Lancaster

Installation and operation
- Monitor installation process for potential damage/degradation to heliostat performance
- Measure impacts on reflectivity from repeated cleaning

Accelerated operating life wear tests
- Continuous range of motion test for 11,000 cycles = 30 years

Long-term real-time sample aging and wear correlated with atmospheric conditions
- Characterize foundation stability
- Installed dedicated sample exposure rack and weather station to monitor material degradation/wear due to:
  - Water
  - Dust and sand
  - Light exposure: UV, IR, visible light
  - Thermal cycling
  - Corrosion
  - Atmospheric conditions

Quarterly inspection program
- Remove single heliostat from field
- Dismantle and document
- Perform high magnification inspection and cross-sectioning to characterize corrosion and wear



Validating heliostat installation process at Lancaster



Field Operations Testing



Accelerated Operating Life Wear Testing

Supply Chain

Heliogen's World-Class Supply Chain Management

Vision

To be a world-class supply chain, empowering a clean-energy future, by leveraging diverse intelligence and cutting-edge technology to create an unparalleled customer experience.

Mission

We strive to build a foundation of excellence by hiring proven top talent and creating a proactive technology based problem-solving culture. We rapidly adapt to business needs, and relentlessly pursue continuous improvement to increase speed of innovation, revenue capture, and profitability.

Heliogen is well-equipped to navigate the global supply chain and ensure adequate availability

Experience

SPACEX · Honeywell · Ford · ROCKET LAB · BRIDGESTONE · GE · ROMEOPOWER · SIEMENS · Red Bull

Professional Certifications

Lean Six Sigma Black Belt · CPSM Certified Professional in Supply Management · CPIM Certified in Production and Inventory Management · ISO 9001:2015 Internal Auditor

Community & Industry Involvement

ISM Institute for Supply Management · Sustainable Procurement Ambassadors · Dress for Success Worldwide West · boom! The Global Community for Women in Supply Chain

Cutting Edge Technology Investment
Connected Supply Chain



- Infrastructure backbone for our digitally connected and integrated supply chain
- Drives efficient collaboration and creates a data repository to build future supply base optimization models
- 360 degree view of supplier performance and risk
- Integrates current and future planned supply chain technology expansion

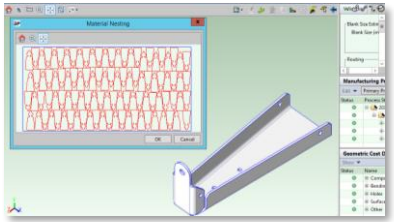
Cutting Edge Technology | Cost, Compliance, and Risk Management

Cost Forecasting & DFM Tools

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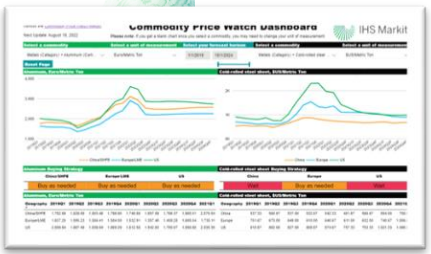


Manufacturing process trades

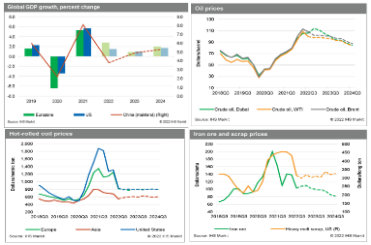


Waste / Cost reduction

IHS Markit



Commodity Price Watch

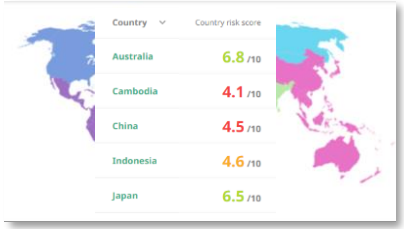


Economic Outlook & Forecasting

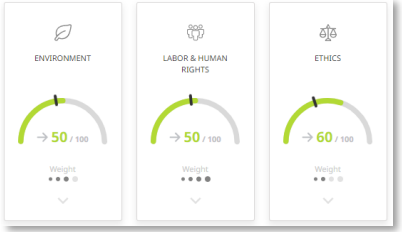
- **Objective cost driver transparency**
- **Fast efficient and scalable across the organization**
- **Data based and empowered supplier selections and negotiations**
- **Design for cost, manufacturability, and sustainability**

Compliance & Risk Management Tools

ecovadis



Global risk profile

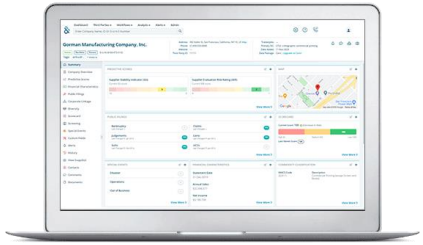


Objective ESG Assessment

dun & bradstreet



Manage 3rd Party Risk



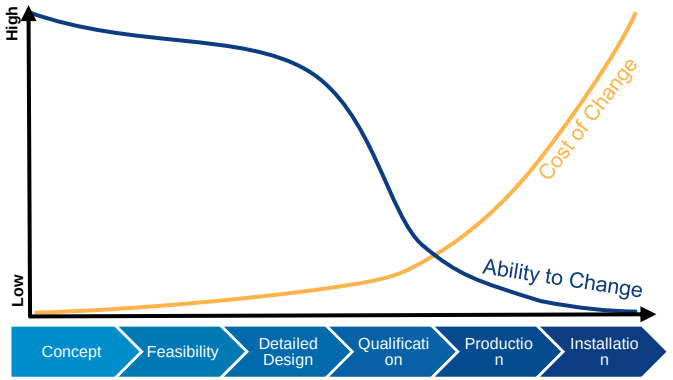
Regulatory Compliance Tracking

- **Objective ESG assessment and risk profiling by Company, Industry, & Country**
- **Paramount for global supply base development**
- **Integrated with our supplier portal and management tools**
- **Critical element of Heliogen's ESG strategy**

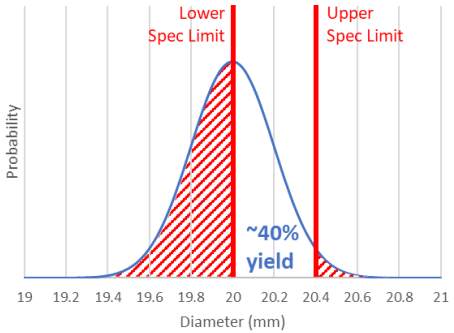
Heliogen

Supply Chain Continuity | High Volume Philosophy for Variation Control

Low Volume Prototype	High Volume Production
Shortest lead-time suppliers used	Most capable suppliers preferred
Cost control via competitive bidding	Should-cost analysis Design for manufacturability YOY cost targets
Manual Inspection / Defect Detection	Process Control / Defect Prevention Inspection Fixtures

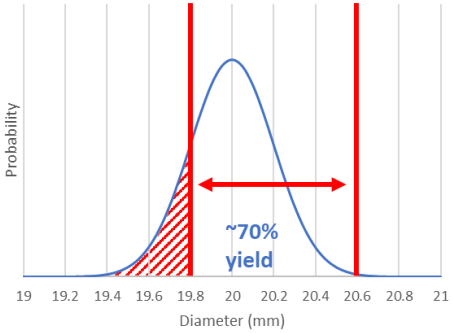


Collaborative Design, Process Control & Variability Reduction



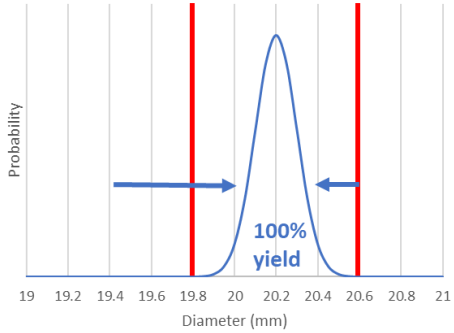
Design Feedback

DFM - DFC



Process Control

PFMEA
Control Plan
Gage R&R
Capability



Heliogen

Heliostat Supply Base | Optimizing Total Landed Cost



50+ trusted global supply partners

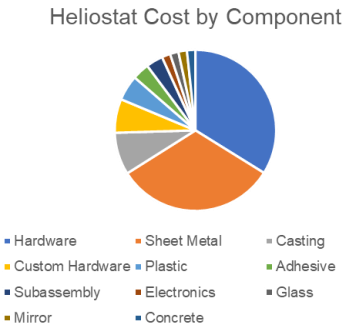
Optimization of total landed cost via strategic selection of product vs country of origin

Creation of Free trade zone to mitigate tariff/duty impact and improve working capital

Optimization drives year-over-year supply cost reductions and closely monitoring raw material deflation

Forecasted heliostat improvements: Generation 5 over Generation 4

- Reduction of unique components > 50%
- Direct material cost reduction > 60%
- No sole sourced / IP controlled components
- Single source component reduction > 80%
- Multi-sourced components > 90%



Prototype Shop

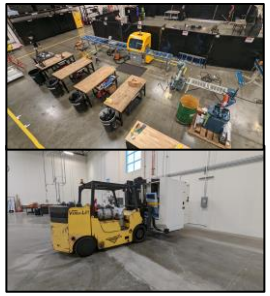
Prototype Shop Enables Rapid Development & Services Manufacturing

Value Proposition: Accelerate development and productionization by skipping outsourcing lead times, undercutting supplier quotes, and rapidly iterating through development cycles which suppliers would not consider undertaking.

Facility

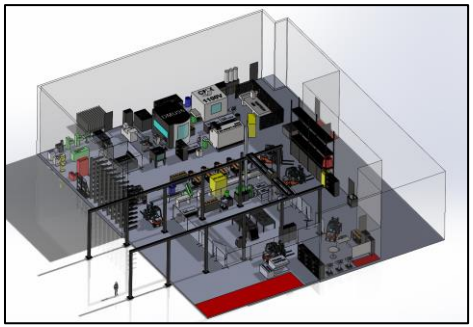
Long Beach
Jan 2022 – Dec 2022





Capabilities Added:
3+2 axis CNC Machining, Manual Lathe, Plasma Cutting, Precision Saw Cutting, Sheet Metal & Tube Bending, Welding to AWS D1.1, D1.2, D14.1, Deburr, 3D Printing, Precision Assembly and Inspection

Long Beach
Jan 2023 – Future



Capabilities to be added:
5-axis CNC Machining, CNC Lathe w/ Live Tooling, Overhead Crane

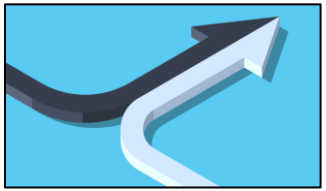
Project Management





Capabilities Added:
Top-level project planning and resource-level planning

225 projects completed YTD
(projected to complete ~300 by year end)

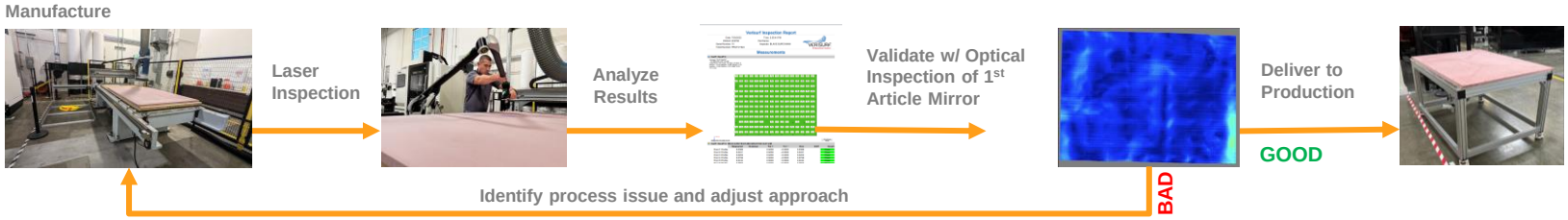


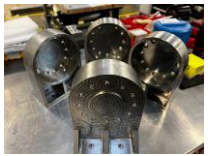
Capabilities to be added:
Multi-site planning
(Long Beach & Lancaster rapid development sites)

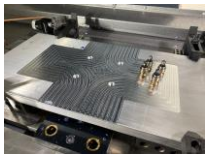
400-500 projects Forecasted Annually

Manufacturing Services | Prototype Shop

Over 50 years of cumulative manufacturing experience, accomplishing the mission, every day





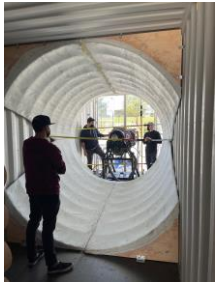












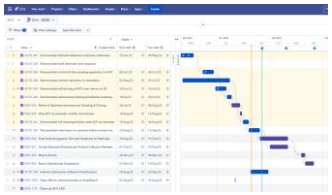
Heliogen

Manufacturing Services Overview

Paul Parkin

1 year design cycle, broken into 2-week sprints

Buy down risk promptly by testing rapidly and representatively

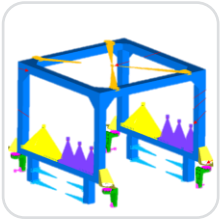


Plan & Execute Work in Jira

Idea



Sprint to proof of concept



Take learning, start detailed design



Get building!



Get testing!

Deploy to customer

Gen 5 Installation Vehicle
Gen 5 Cleaning Vehicle
…

What's next?

Autonomous Cleaning Overview

Paul Parkin

Cleaning Methodology & Modeling

- Built test rig to develop and **understand cleaning methodologies, efficiencies**, and expected reflectivity results
- Implemented code that models the effects of random soiling, field size, cleaning methodology, and cost to **predict cleaning operating** expenditure
- Allows us to **rapidly change parameters** & predict an optimized cost vs. average field reflectivity curve… then go test!
- Next steps will be to **continue developing** the cleaning methods and validate the cost curve against actual data from our first installation




```
Please enter in the following Parameters to Calculate Cleaning Cycle Specifications

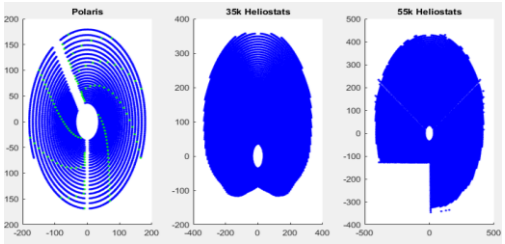
Field Size:
1.  Polaris (7500 heliostats)
2.  35k Heliostats
3.  55k Heliostats
Choose option 1, 2, or 3: 1
Number of days to clean entire field: 5
Clean on Weekend (yes/no)? yes

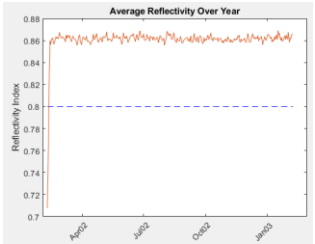
Cleaning Methodologies:
1.  Compressed Air | Air-knife + Air compressor
2.  Eductor | High pressure mist + squeegee
3.  Mist + rotating brush
Choose option 1, 2, or 3: 3

Time durations per working days in cycle:
  Work Day 1:  #HSs: 1431  Duration: 1:43:8  Power(kWh): 4.72  Refills: 1
  Work Day 2:  #HSs: 1517  Duration: 1:47:51  Power(kWh): 4.95  Refills: 1
  Work Day 3:  #HSs: 1549  Duration: 1:51:29  Power(kWh): 5.10  Refills: 1
  Work Day 4:  #HSs: 1791  Duration: 2:3:1  Power(kWh): 5.70  Refills: 1
  Work Day 5:  #HSs: 1212  Duration: 1:44:39  Power(kWh): 4.60  Refills: 1

Would you like to input a start date? (yes/no) yes
What is the starting date? (dd.mm.yyyy) 08.02.2002
Would you like to input a target reflectivity? (yes/no) yes
What is your target reflectivity? (0.0-1.0) .8
Would you like a deep clean hybridized cleaning schedule? (yes/no) no
```







Heliogen

Manufacturing Services Next Steps

Paul Parkin

Generation 5

Asking Key Questions for the Future



Smaller? Lighter? Cheaper?

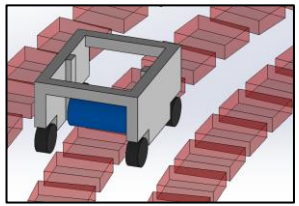


Ground preparation?

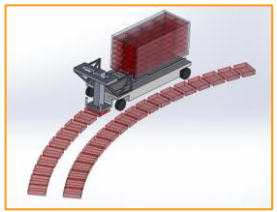


Single pass install? Automation?

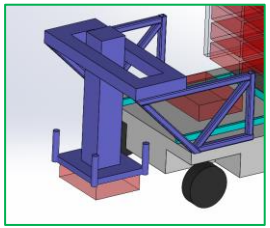
Identifying and generating concepts to eliminate or control the biggest challenges of installation and cleaning



Concept only



Concept only



Concept only

Manufacturing Engineering & Production

Efficient Mass Production Overview

Leon Parkhouse / Mick White

Manufacturing Engineering and Production Operations

Risk Reduction

- Through concurrent engineering, early prototyping, new product introduction process, Design For Manufacture guidance

High Quality

- Through attention to detail, understanding the processes, continuous improvement

Cost Reduction

- Through understanding the cost adders, implementing lean manufacturing, gathering data, seeking out new methods, detailed simulation

Delivery on Schedule

- Through detailed project management, right sized teams, partnerships with Supply Chain, driving for design completeness, understanding the end-to-end product lifecycle

Future Development

- Through staying at the bleeding edge, constant learning, continuous improvement, driving to root cause

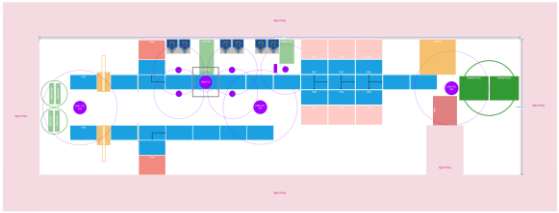
Heliogen is a first-mover in automated, high-volume heliostat manufacturing

Efficient Mass Production Overview

Leon Parkhouse & Mick White

Rapid Deployment of High Volume Production

May 2021*



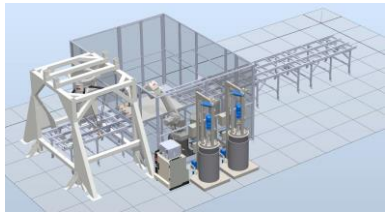
** Facility build-out began*

Initial Concept Designs

- Factory Layout
- Robot Sizing
- Conveyance Technologies
- Material Flow
- Risk Reduction Planning

Pilot Line





Feb 2022

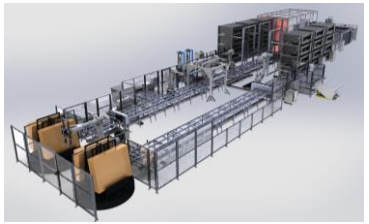


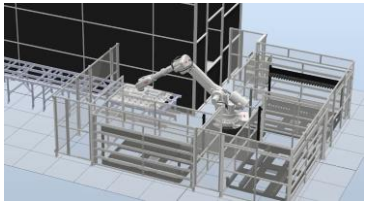
Design

Simulate

Execute

Production Line





Sept 2022



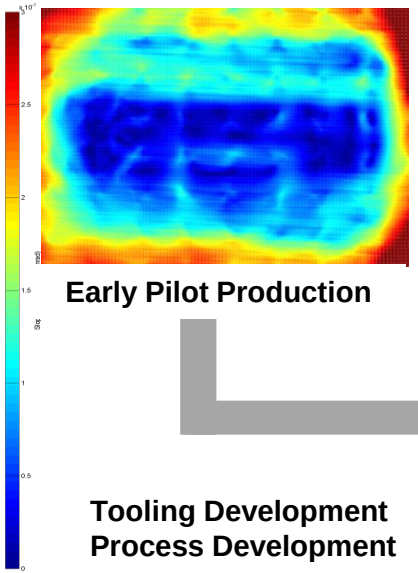
Heliogen is a first-mover in automated, high-volume heliostat manufacturing

Ensuring Optimal Mirror Performance

Leon Parkhouse & Mick White

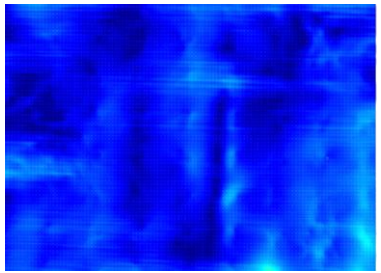
Quality Development Tools

Sandia **O**ptical **F**ringe **A**nalysis **S**lope **T**ool
SOFAST



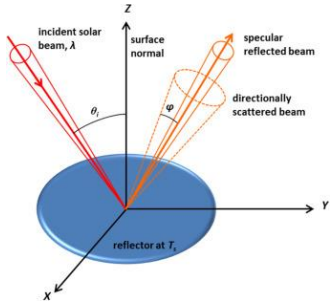
Early Pilot Production

Tooling Development
Process Development



Developed Pilot Process
Pre-Production

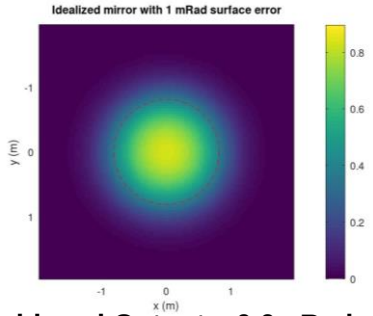
Highly accurate, detailed measurement of the surface quality of a formed mirror.



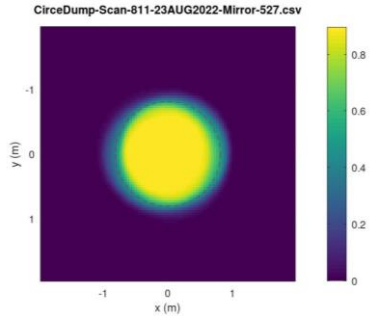
Rapid feedback of mirror quality enables rapid iteration of tooling and process.

Raytracing of Beam

Quality Target < 1.0mRad



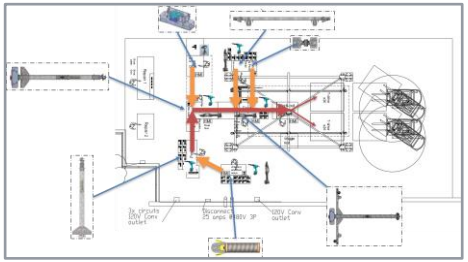
Achieved Output < 0.6mRad

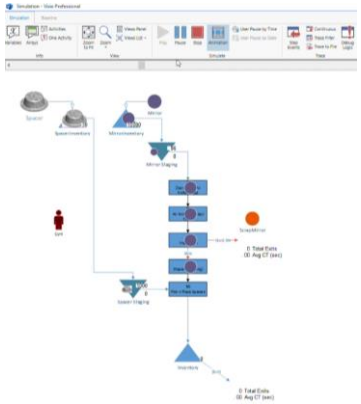


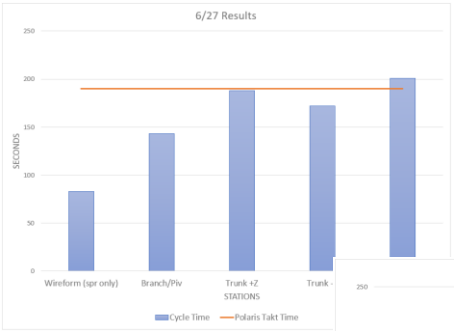
Heliogen

Manufacturing Engineering & Production Overview

Leon Parkhouse & Mick White

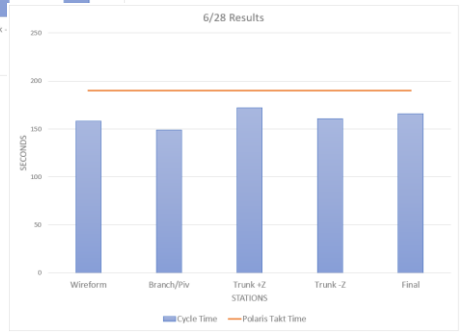






Out of balance line
Over cycle time

Process Development



Design
Flow, layout, tooling

Simulate
Discrete Event Sim Software

Execute
Power Builds - Stress the System

Heliogen

Manufacturing Engineering & Production Overview

Leon Parkhouse & Mick White

Lean approach with regards to workplace efficiency by:

- **Defining value** within our production system through intelligent design & build
- **Identifying and eliminating waste** by Process mapping the Value stream from proof of concept to installation
- **Creating flow** - Using a pull system
- **Build in process quality** and consistently pursue perfection.

The importance of repeatability process qualification, cycle time and labor hour confirmation

Economics:

Industrial Heat Market Highlights, and Path to Attractive Unit Economics

Christie Obiaya, CFO

Heliogen Team



Christie Obiaya

Chief Financial Officer

Previous Experiences

Nearly 20 years of experience spanning energy, finance, and commercial scale-ups

- Led commercial strategy, deal structuring, and contract negotiations for major energy projects
- Experienced in leading strategic investments to accelerate innovation & mitigate risk
- Supported multiple project-financed energy projects over 11 years
- Extensive onsite construction experience
- Served on board of directors of EPC joint stock company in Canada

Heliogen Has Made Significant Progress Since Public Debut

2022

December 31, 2021:
Heliogen becomes publicly traded on NYSE as HLGN

February 8, 2022:
Awarded Exclusive Rights at Brenda Solar Energy Zone

February 22, 2022:
Announced site prep for Long Beach manufacturing facility

March 28, 2022:
Signed contract for commercial-scale demonstration project with Woodside Energy

Woodside Energy

May 3, 2022:
Began testing & implementation of supercritical SCO_2 system with Hanwha Power Systems for Woodside project

Hanwha

August 8, 2022:
Announced partnership with Dimensional Energy for production of sustainable aviation fuel

Dimensional Energy

September 13, 2022:
Holds first Investor & Analyst Day in Long Beach, CA

Key Commercial and Execution Milestones

AREA	MILESTONE	EXPECTED TIMING	STATUS
Commercial	First module contracted	1H 2022	**Complete**
	Second module contracted (third module = stretch target)	2H 2022	----
Execution	First groundbreaking	2H 2022	----
	Assembly line heliostat production	2H 2022	----
	Key supply chain partners announced	2H 2022	Ongoing
	Testing of cleaning functionality for autonomous robots	2H 2022	Ongoing

Industrial Heat Market Highlight

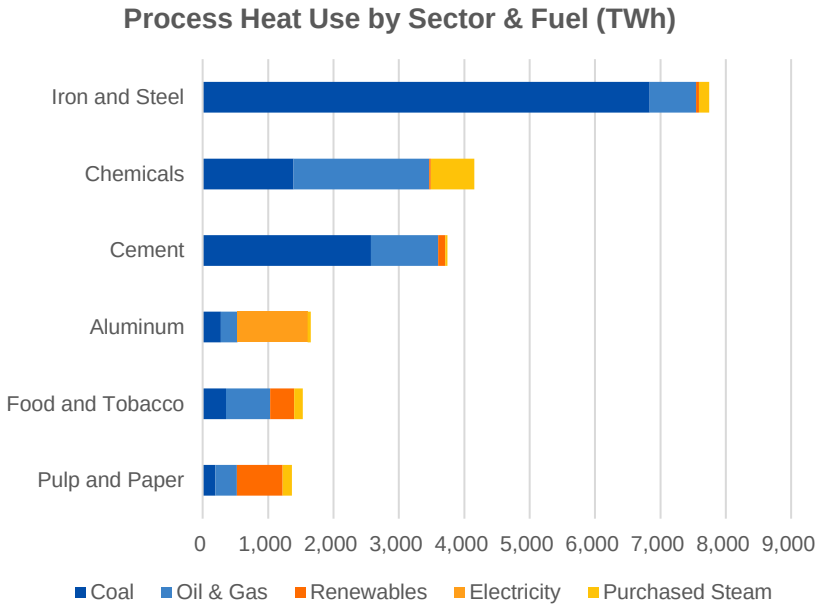
Industrial or process heat refers to thermal energy used in manufacturing processes to induce material transformations and chemical reactions

Six sectors account for the vast majority of process heat requirements

- Iron and steel, cement and chemicals drive most of the demand for process heat
- Aluminum, food and tobacco, and pulp and paper are also major contributors

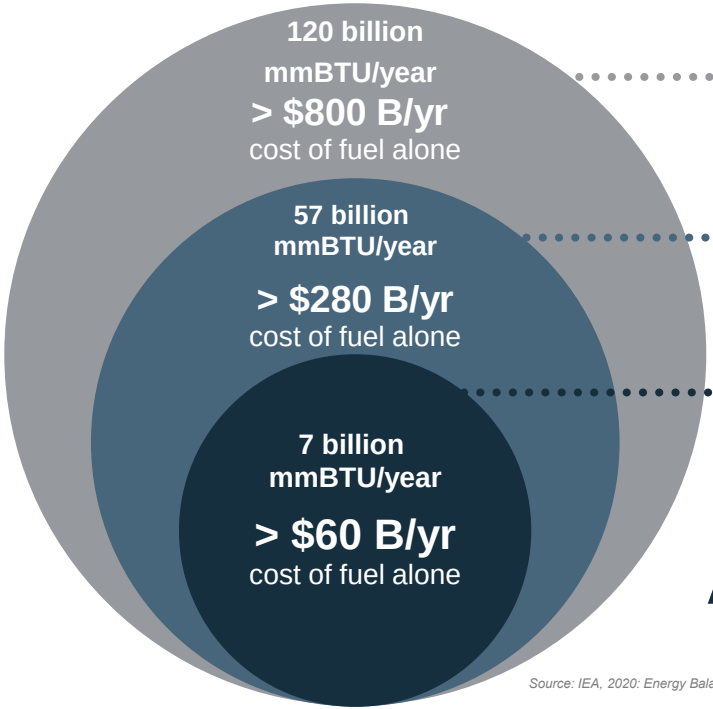
Process heat covers a wide range of temperatures and has minimal renewable energy penetration

- Low = below 150°C
- Medium = 150 to 400°C
- High = above 400°C



Source: Bloomberg NEF, 2019. "Miners Turn to Clean Energy: Costs and Key Strategies"

Industrial Heat Highlight, cont'd



Global industrial energy demand (both heat and power)

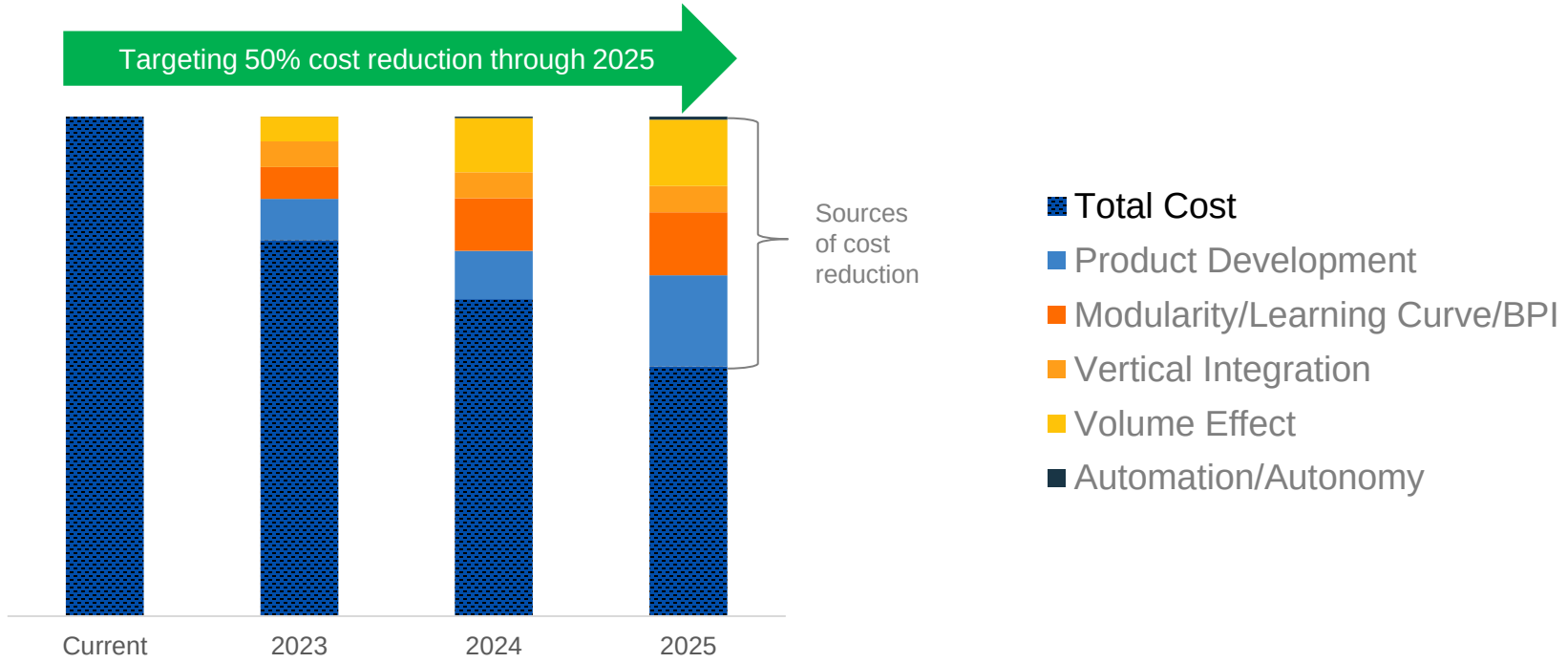
Medium- and High-temp heat only

In Heliogen's near-term strategic countries: U.S., Australia, South Africa, Chile, Mexico

A massive addressable opportunity

Source: IEA, 2020: Energy Balance Data; IEA, 2017. "Renewable Energy for Industry – from green energy to green materials and fuels"

Pathway to Attractive Unit Economics: Steam with Storage



Customers and Projects

Target Customers, Sales Process, Inflation Reduction Act

Tom Doyle, Chief Commercial Officer

Heliogen Team



Tom Doyle

Chief Commercial Officer

Previous Experiences

25 years experience developing utility scale energy projects globally

- Commercial execution of power projects in 10 countries
- Led development for world's largest CSP project - Ivanpah CSP project
- CEO of NRG's Renew. $7.5B of wind and solar capital placed

Leading Global Project Development

- International Sales/Project Development
- Sales
- Project management
- Construction
- Operations and Maintenance

Ideal Customer Profile

Location

- Geographic ‘hot spots’ drive efficiency and economics
- Strong sun, available land, ideally off-grid
- Focus: SW US/Mexico, Australia, South Africa, Chile

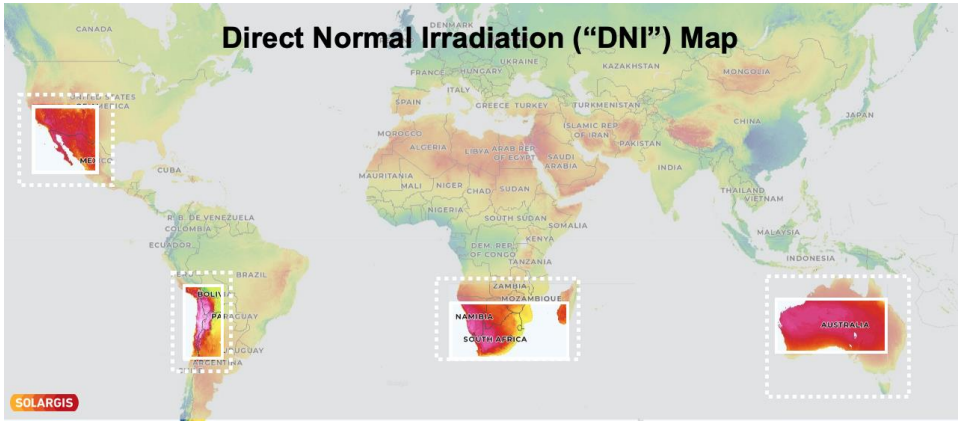
Application

- Thermal applications – steam is ideal
- Industries with high energy needs for process steam

Motivation

- High fossil fuel costs and volatility
- Corporate carbon reduction plans

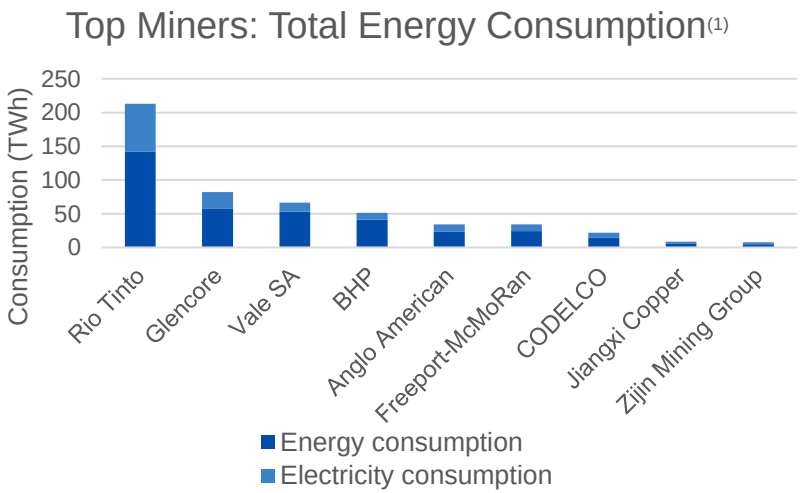
>>> Large Global Mining Sector

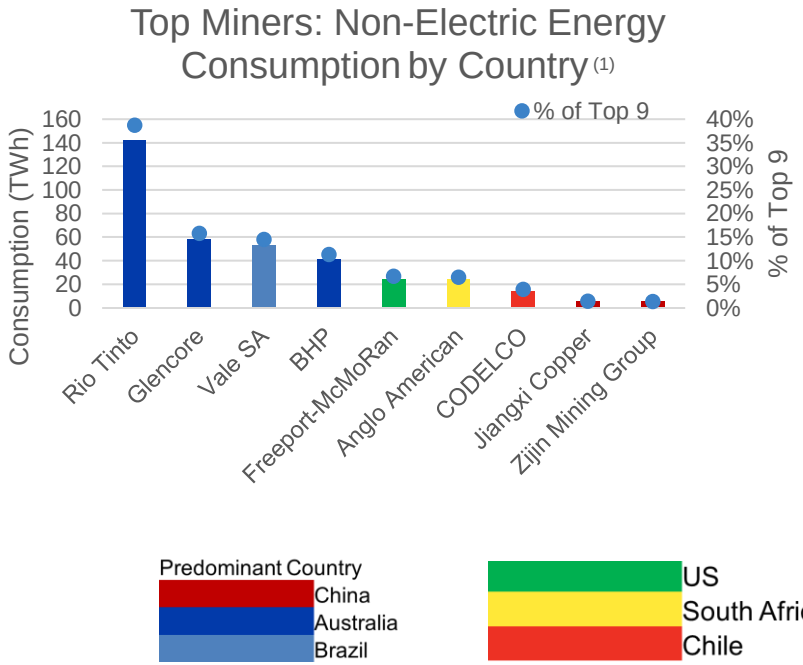






Large Global Miners In Target Areas





(1) *Source: Bloomberg NEF, 2019. "Miners Turn to Clean Energy: Costs and Key Strategies*

Unlocking the power of sunlight for the mining industry

Heliogen was selected by Rio Tinto to explore its proprietary solar thermal technology for a commercial demonstration of solar process steam production.

The project aims to demonstrate that concentrated solar thermal technology can efficiently produce ‘green steam’ and seamlessly integrate into existing mining process operations.

This solar steam allows for boiler turndown, reducing carbon emissions and helping the mining industry achieve sustainability goals.

- Location: Mojave Desert, California
- Peak Thermal Output: 8 MWth
- Steam Generator: Saturated steam produced in Direct Steam Generating Receiver (DSGR)
- Solar Collector: ~7,500 Heliostats (14,400 m2 mirror area)
- Field Control: AI-enabled closed-loop control
- Tower Height: 30 meters

Developing New Customers

Introductions to unfamiliar customers

- Educate customer
- Educate ourselves
- Evaluate requirements

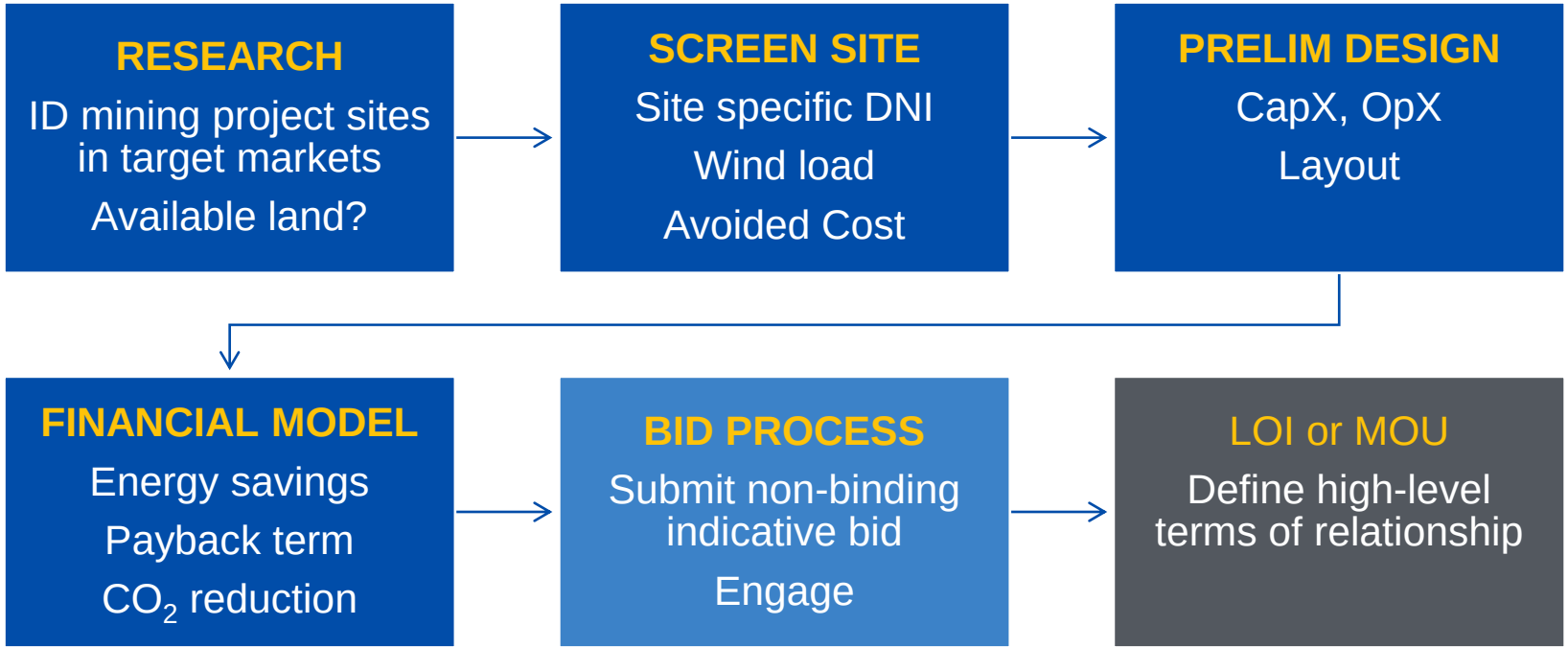
Pilot projects to prove technology

- Single module
- Demonstration tests
- Performance guarantee

Expand project orders

- Multiple modules post pilot
- Engage risk adverse counterparties

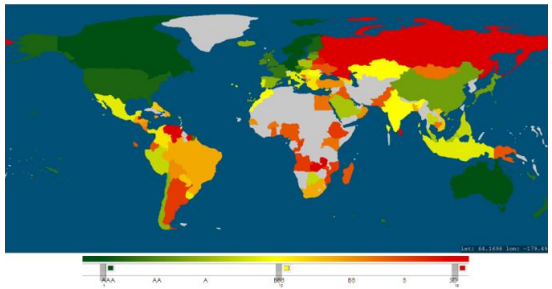
Sales Process Overview



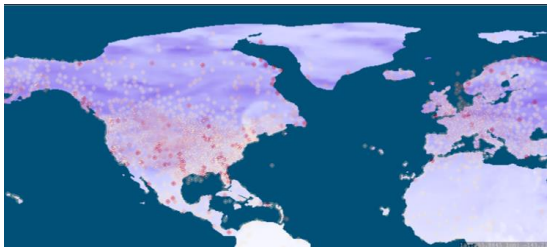
Customer Site Screening App

New screening app evaluates project opportunities by multiple factors

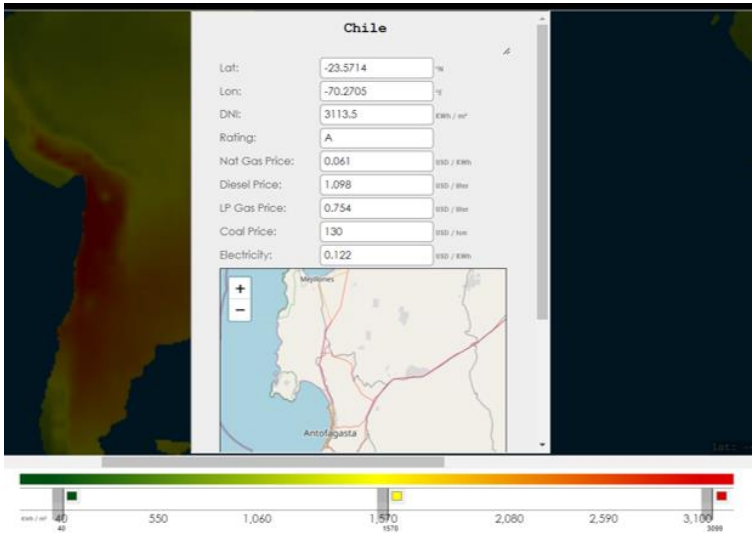
Filter global locations by:
DNI, Wind speeds, Fuel prices
Credit ratings, Competitive landscape



Credit ratings



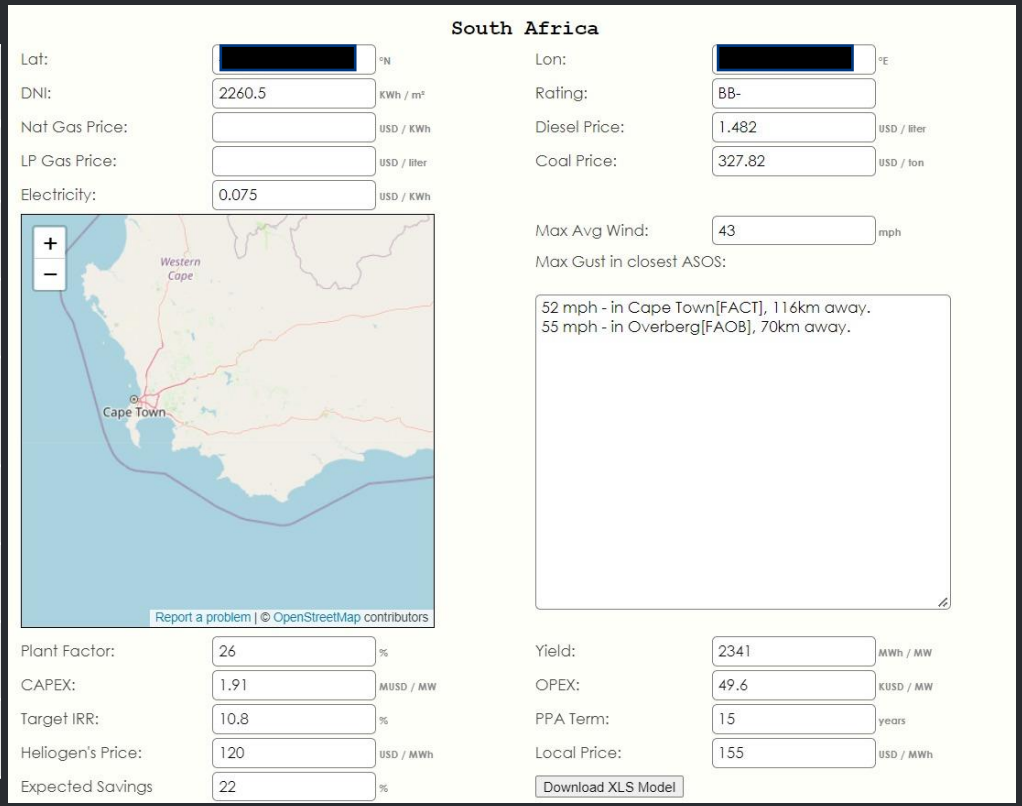
Wind speeds



Calculate and compare the current cost of energy to expected costs → identify savings in CO_2 reduction

South Africa

Cape Town	
PPA Term	15 years
Country Rating	BB-
DNI	2,260 kWh/m2/yr
Local energy price (diesel)[1]	155 USD/MWhth
Heliogen energy price	120 USD/MWhth
Expected savings[2]	22% to 29%
Avoided fuel cost	$143 to $159 USD/MWh
Avoided CO_2 emissions	8,520 tons/yr



1. Most competitive local energy price
2. Range of savings vs. most/least competitive available local energy price
3. Range of avoided fuel costs most/least competitive available local energy price

Heliogen

Develop the first 5MWe commercial scale facility

Heliogen and Woodside are working together designing and deploying a commercial scale, single-module 5-megawatt electric (5 MWe) demonstration facility.

The project will also include the deployment and testing of an innovative approach to converting the thermal energy produced by Heliogen's facility into electrical power, which has the potential to deliver higher efficiencies with a smaller footprint than traditional steam turbines.

The two companies also announced their intent to jointly market Heliogen's technology in Australia.

- Location: Mojave Desert, California
- Peak Electrical Output: 5 MWe module
- Supercritical CO_2 (sCO_2) power block and heat exchanger
- Solar Collector: ~17,000 Heliostats (32,600 m^2 mirror area)
- Field Control: AI-enabled closed-loop control
- Tower Height: 50 meters

Brenda Solar Energy Zone: Attractive Hydrogen Development Opportunity

Heliogen was awarded the right to use 3,300+ acres for green hydrogen production in the Brenda Solar Energy Zone in Arizona along the California border

Site has ample local water supply and proximity to potential offtake partners and key distribution channels

In 2021, Heliogen successfully demonstrated ability to produce low-cost, green hydrogen. Combining Heliogen's technology with Bloom's electrolyzer greatly improves hydrogen production efficiency vs PEM and alkaline electrolyzers



Heliogen

Inflation Reduction Act – A win for all

New incentives catalyze the industrial decarbonization and boost project economics, giving the industry some much-needed certainty

Potential for Solar Energy Facilities (ITC)



10% added to the ITC if a project is in disadvantaged communities

10% added to the ITC if content is domestically sourced

30% base ITC for solar facilities construction if PWAR is met

Additional credit and funding opportunities being explored as further guidelines emerge

On top of the ITC, the bill benefits Heliogen and our partners from multiple angles:

Hydrogen

- Hydrogen PTC at **$3.00 per kg** cost savings

DOE Loan Guarantee Program

- An additional **3.6 billion** for the Title 17 loan program, raising the total funds available to **40 billion**.

Thermal Energy Storage

- The Act extends the ITC to energy storage equipment

Sustainable Aviation Fuel

- SAF gets a boost with a credit of up to $1.75/gallon of SAF

Technology Deep Dive & R&D Highlights

Paul Gauche, EVP Engineering

Steve Schell, Chief Scientist

Heliogen Team



Paul Gauche
EVP of Engineering

SIEMENS intel

Stellenbosch UNIVERSITY IYUNIVESITHI UNIVERSITEIT

Previous Experiences

20+ years of extensive experience managing large, productive engineering organizations

Development of several technology industry firsts:

- Program Manager of 1st sCO_2 loop heated by particles & concentrated sunlight
- Platform Strategy for 1st system-on-chip (SoC)
- Led 1st extreme quadcore gaming CPU
- Achievement award for 1st generation Apple TV chipset

Founded biggest CSP research group in the world and achieved record funding for Sandia CSP program – 5X program growth in 3 years

Current technology development & engineering leadership

Leads development for Heliogen products, subsystems and systems:

- Heliostats
- AI-enabled control systems
- Autonomy
- Thermal systems including thermal energy storage and receiver technologies
- Power generation
- Other high-temperature applications

Heliogen’s Disruptive Technology Strategy

We are a **multi-disciplinary organization,** and **a software-enhanced** hardware company.

Our team brings the best in the **software specialization and AI / autonomy field,** pushing CSP innovation to new boundaries.

That enables **our systems to get smarter over time** and serve higher temperature, previously unserved markets.



Our Team's Technical Depth and Breadth

Systems Engineering	Simulation	Solar Field Systems	Process & Power Systems Examples	R&D Applications
Technology architecture and configuration	Techno-economic tool development	Heliostat field design	Receiver development (air, steam, particles)	Hydrogen & sustainable fuels
Plant engineering	Project siting tools	Heliostat development	Power generation (traditional and sCO_2)	Innovation for heliostats and thermal systems
Financial and techno-economic	Dynamic modeling for HW & controls design	Solar field AI based controls for operating and safety (smart stow)	Thermal transport, P&IDs, control systems, HXs	Calcining and process heat applications
Supply chain expertise	Digital twin development for asset management	Autonomous navigation for solar field services	Thermal energy storage (solid, liquid)	Neural network applications related to machine vision, controls and reduced models

Our multi-disciplinary engineering team includes concentrated solar innovators from eSolar, DLR (German Aerospace Center), Abengoa, GE, Stellenbosch University, sbp sonne, Sandia Labs, and Solaflect Energy, and from other industries, such as SpaceX, JPL, Google, and BMW.

Fusion of Backgrounds is a Gamechanger

Concentrated solar veterans working alongside those from aerospace, automotive, consumer, and other industries

We believe our **Generation 4 heliostats** outperform all heliostats to date, and we are making further improvements on Gen 5 that will **further simplify and automate installation at scale, reducing Heliogen's costs and improving profitability.**

Heliogen's team has the **right experience and background** to achieve lowest cost and best performance for every component of the system

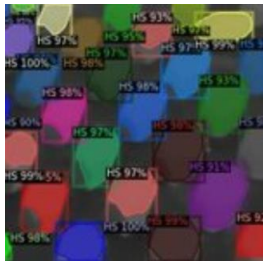


Our software expertise extends to full field autonomy











Control

From SOHOT to plant automation by model-predictive control

Monitoring

Continuous observation and response to changing demand and environment

Maintenance

Predictive maintenance based on models and measurement of wear and soiling

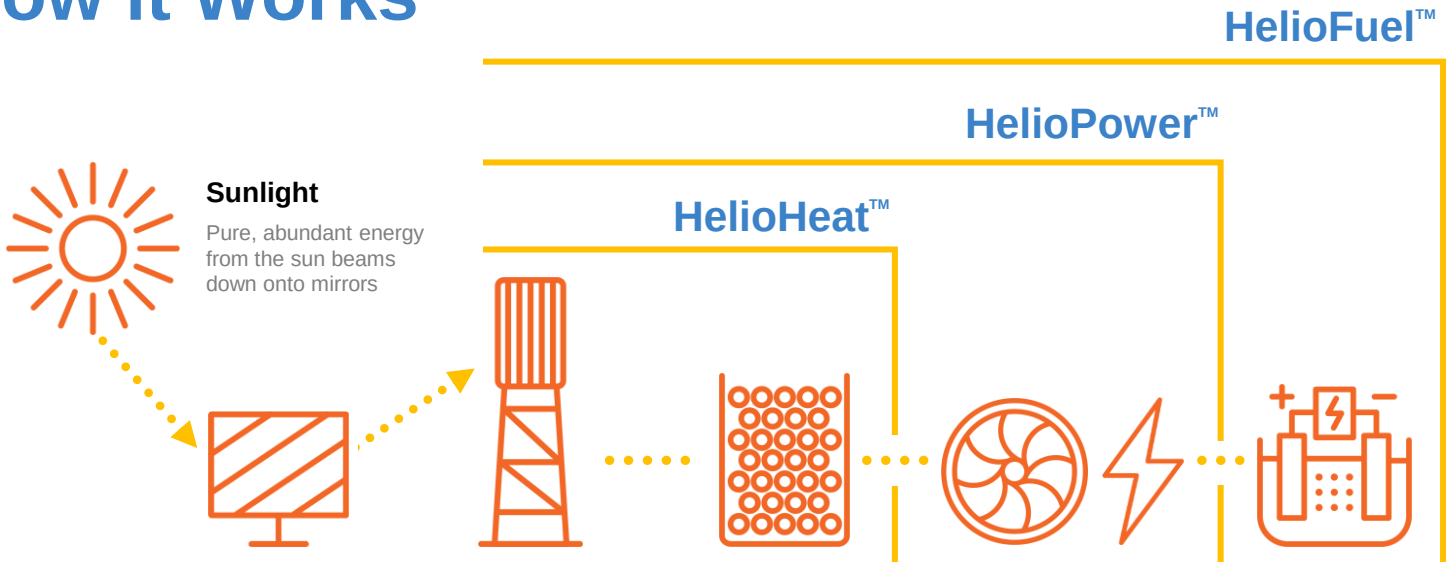
Safety + Security

Sensor networks for full site awareness

Cross-site Datastore

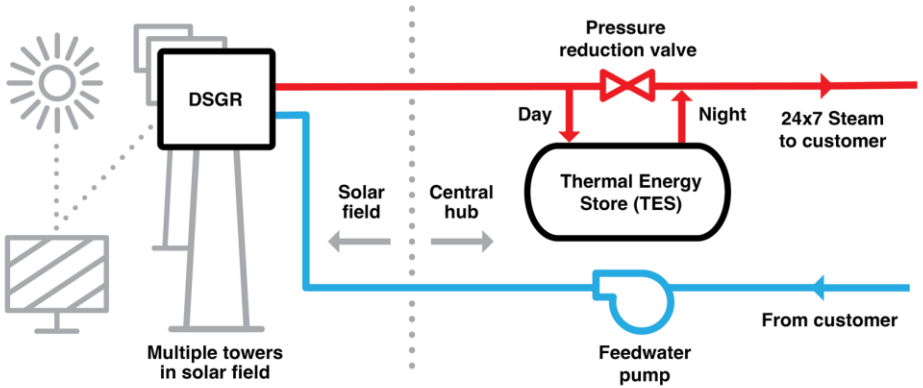
Combining insights from multiple deployed sites to train AI models for rare events

How it Works


HelioFuel™
HelioPower™
HelioHeat™
Sunlight
Pure, abundant energy from the sun beams down onto mirrors
Heliostats
An array of computer-controlled mirrors (heliostats) collects and concentrates sunlight
Receiver Tower
Captured sunlight produces carbon-free thermal energy
Storage
Heat will be accumulated safely in thermal energy storage to be dispatched as needed
Turbine / Generator
Generated heat then drives a supercritical CO_2 power block producing on demand electricity
Electrolyzer
Heat and electricity can drive an electrolyzer to make green hydrogen fuel

Dispatchable Steam

- **Proven commercial technology** for immediate application
- Provides up to **24-hour process steam** at up to 20 bar (300 psia)
- **Direct Steam Generating Receiver (DSGR)** builds on years of successful operation
- Multiple commercially **proven thermal energy storage options** – configured to meet customer needs
- **Active commercial discussions** underway including 3rd party due diligence assessment



Heliogen

Heliogen Team



Steve Schell

Chief Scientist

eSolar AMONIX

NEW MATTER®

Previous Experiences

20 years leading new product development and commercialization

- 1st power tower plant in the US
- World's then-largest CPV plant
- Award-winning 3D printer w/ Wi-Fi & online ecosystem
- Patents in robotics, 3D printing, and solar energy
- 100% CEO rating on Glassdoor

Accomplishments at Heliogen

- Led deployment of Heliogen's technology to Lancaster demonstration site
- Grew company from 12 employees onward
- Led development of 3rd and 4th generation heliostats and control system
- Responsible for connecting technology roadmap to customer needs

Next-Generation Dispatchable Power with Woodside Energy

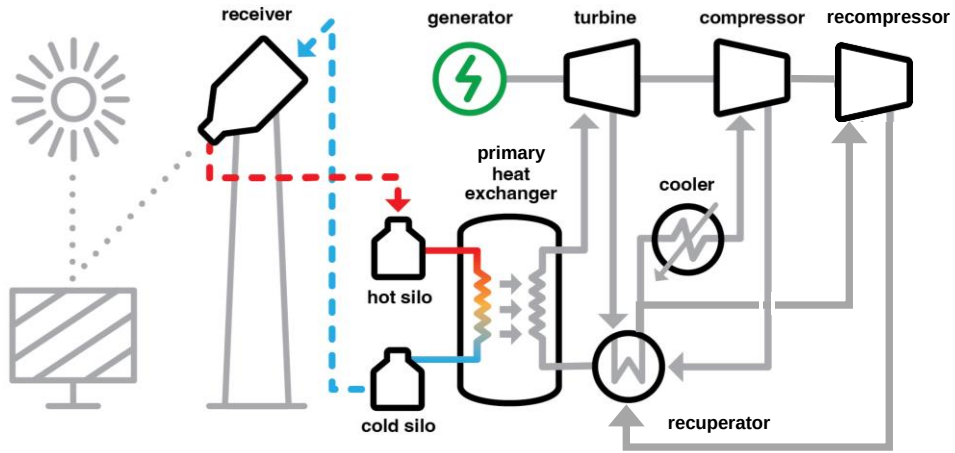
HelioPower™

Low-carbon, dispatchable electricity

- Solid media heated in receiver and for storage
- Coupled with supercritical CO_2 (sCO_2) Brayton cycle to produce power
- Around the clock electricity can be used to drive a high efficiency electrolyzer

Advantages of supercritical CO_2

- Smaller footprint
- Reduced water use
- Lower cost
- High thermal efficiency even at smaller scale



HelioPower Process

(1) BloombergNEF, "Industrial Heat: Deep Decarbonization Opportunities," 2019

Heliogen

Innovations Leading to Competitive Dispatchable Power

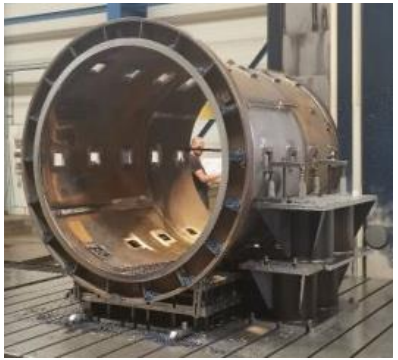
	What we are doing	Why we are doing it
Centrec Particle Receiver	Directly irradiating our particles	Our sunlight is heating particles instead of tubes; no need for costly alloys.
	Rotating our particles in a drum	Control of rotational speed to optimize particle temperature.
Moving Packed Bed Heat Exchanger	Diffusion-bonding our parallel plates	Small channels reduce the size, weight, and cost without sacrificing performance.
	Gravity-driving our particle flow	Fewer moving parts means cheaper construction and reliable operation.
Supercritical CO_2 Power Block	Choosing the right size for deployability	A 5 MW turbine of this cycle can fit in standard globally transportable skids
	Choosing a high efficiency cycle for our size	A 5 MW sCO_2 cycle has comparable efficiency to steam cycles 10x larger.

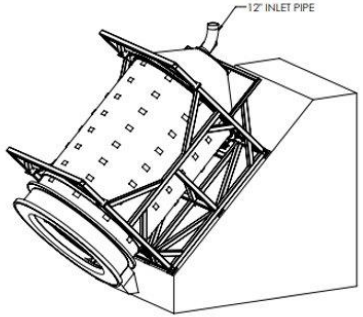
Modular design accelerates cost reduction through learnings, faster fabrication and deployment

Spotlight #1: Centrec Particle Receiver

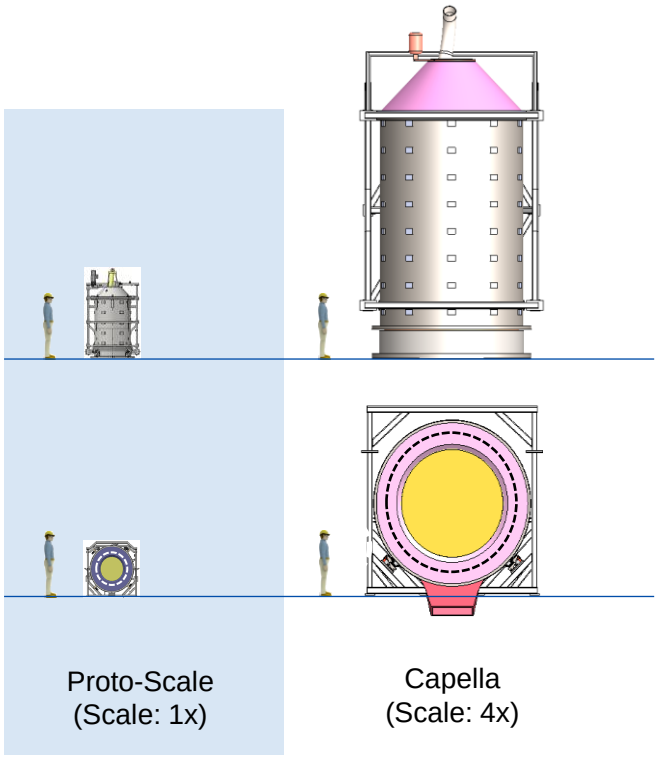
Breakthrough high-temperature particle receiver

1. **Enables direct irradiation** of particles for high temperature and high efficiency
2. Solid particles are **low cost,** thermally & chemically stable
3. Rotating design provides **better control** under varying conditions





ISOMETRIC VIEW
SCALE: 1:50

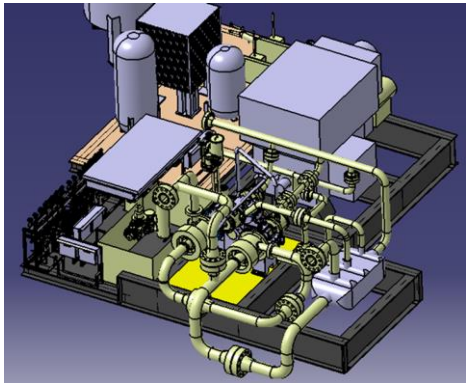


Heliogen

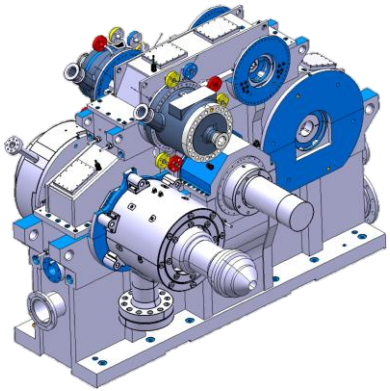
Spotlight #2: Supercritical CO_2 Power Block

Advanced power generation technology

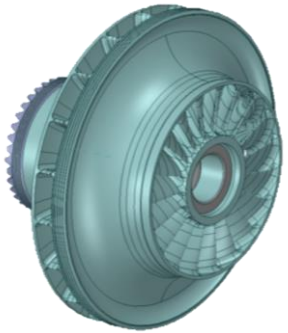
1. **Small size** allows for prefabricated, modular power block
2. sCO_2 provides **high efficiency** at small (5 MW) size
3. Closed system can **operate autonomously** with remote supervision



Modular power block



Integrally geared turbomachinery



Shrouded Radial Turbine

Our R&D opens the door to new opportunities

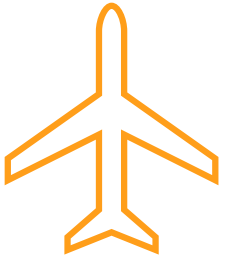
Heliogen's high temperatures enable decarbonization of hard-to-abate applications:



Lithium Extraction
many industrial partners interested



Calcination
for cement and other applications



Sustainable Aviation Fuel
partnership announced with Dimensional Energy

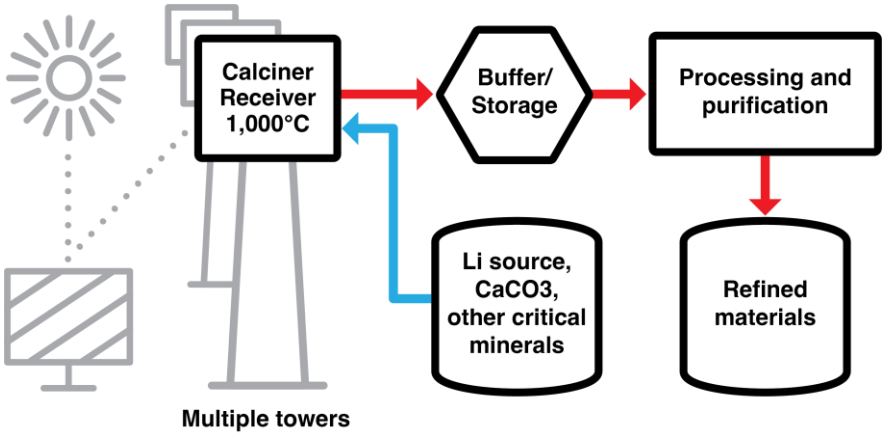
High-Temperature Heat: Another Growth Avenue Beyond Steam

Heliogen is working to develop a high-temperature receiver to heat powdered materials to temperatures beyond 1000°C.

Our high-temperature technology can dramatically reduce carbon emissions from calcining and other high-temperature processes by eliminating or reducing fossil fuels as a heat source.

- **Iron and Steel production:** responsible for 28% of global industrial heat demand(1)
- **Cement production:** responsible for ~13% of global industrial heat demand(1)
- **Lithium and other energy transition minerals:** Heat-intensive process, production growth essential to the energy transition. Many greenfield project opportunities, well-suited for Heliogen's technology
- **Aluminum production, melting applications:** Alumina created from calcination of aluminum hydroxide; melting aluminum for repurposing and recycling

Some reactions can eliminate the need for thermal storage



(1) BloombergNEF, "Industrial Heat: Deep Decarbonization Opportunities," 2019

Dimensional Energy Partnership to Produce Sustainable Aviation Fuel

Heliogen entered into a non-binding letter of intent (LOI) to partner with Dimensional Energy to jointly **produce sustainable aviation fuel (SAF)** at Heliogen's concentrated solar thermal demonstration facility in Lancaster, California.

The project will work to deploy HelioHeat technology to convert sunlight directly into thermal energy in the form of high temperature steam and air, which will be used to produce green hydrogen for Dimensional Energy's Reactor platform

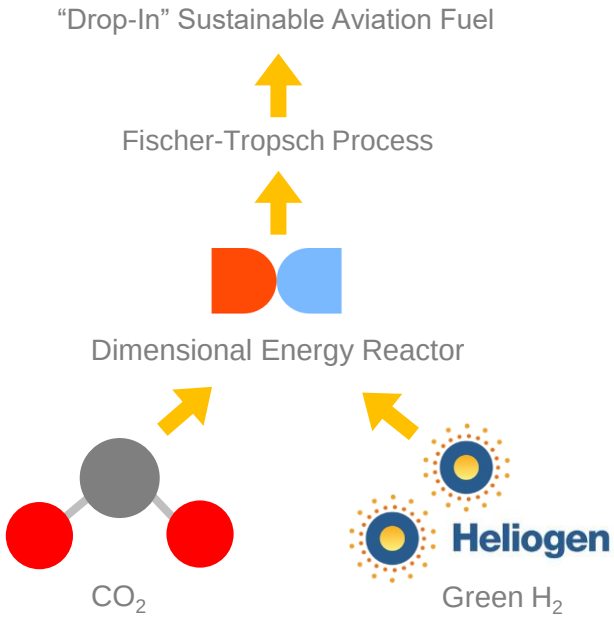
Green hydrogen and CO_2 are the main feedstocks for Dimensional's Energy Reactor platform

Goal is to build a fully **integrated ~1 barrel per day drop-in ready SAF demonstration.**

We expect the demonstration project to be a first step to develop a pipeline for approximately 3 million barrels of fuel over the next ten years.

Heliogen is also providing siting and engineering support to the project.

Simplified Dimensional Reactor Process



We invite you to join us in our mission

- Heliogen is working to be the leading technology provider enabling industrial decarbonization
- There is staggering demand and trillions of dollars of spend this decade
- Heliogen’s technology is superior for meeting this customer demand
- Heliogen’s technology is patented and combines software, hardware, and know-how to realize superior expected margins
- Heliogen’s team is strong, experienced, and capable of seizing this opportunity
- We welcome you to join our belief that industrial decarbonization is a significant and profitable opportunity