



# INNOVATION IN **CLEANROOM SCIENCE**

**How Cobeal Redefined Standards for  
the Cleanroom Industry**

# ABOUT COBEAL

Cobeal specializes in engineering, procurement, construction, installation, and commissioning (EPCIC) for complex environments.

The Cobeal Group is recognized globally for cleanroom expertise and innovation in environmental engineering.





# COMPANY VALUES

A relentless pursuit of engineering excellence and environmental stewardship.

Our collective insights span sectors, ensuring innovative, sustainable, and precise solutions for challenges across industries.

1

## **Precision**

Uncompromising attention to detail ensures performance in every project we undertake.

2

## **Innovation**

Revolutionizing industries with forward-thinking designs and advanced engineering solutions.

3

## **Sustainability**

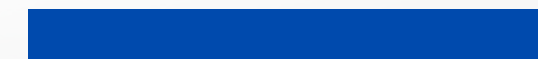
Commitment to creating eco-friendly systems that harmonize with the environment and drive long-term impact.



# COMPANY HISTORY

Founded in 1963 with a mission to advance clean technologies for global challenges.

Over 60 years of redefining standards in cleanroom and environmental engineering.





# OUR COMPANY PERFORMANCE

Revolutionizing contamination control for industries like aerospace, pharmaceuticals, and semiconductors.

Combining cutting-edge engineering with sustainable practices to redefine global IAQ standards.

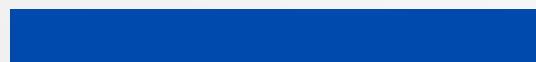
We're not just measuring square feet and hours—we're measuring the impact we create in pushing industries forward.

**299K**  
**FROM**  
**2020-2024**

299k sq. ft. of ultra-clean environments engineered.

**112K**  
**FROM**  
**2020-2024**

112k hours invested in R&D and innovation.





## INDUSTRIES WE **TRANSFORM**

Cobeal's solutions span critical sectors: fusion energy, semiconductors, pharmaceuticals, and aerospace.

**1M**

1M+ sq. ft. of cleanroom projects completed.

**16**

Our expertise is used in 16 Critical Sectors

**92%**

92% industry satisfaction benchmark achieved.



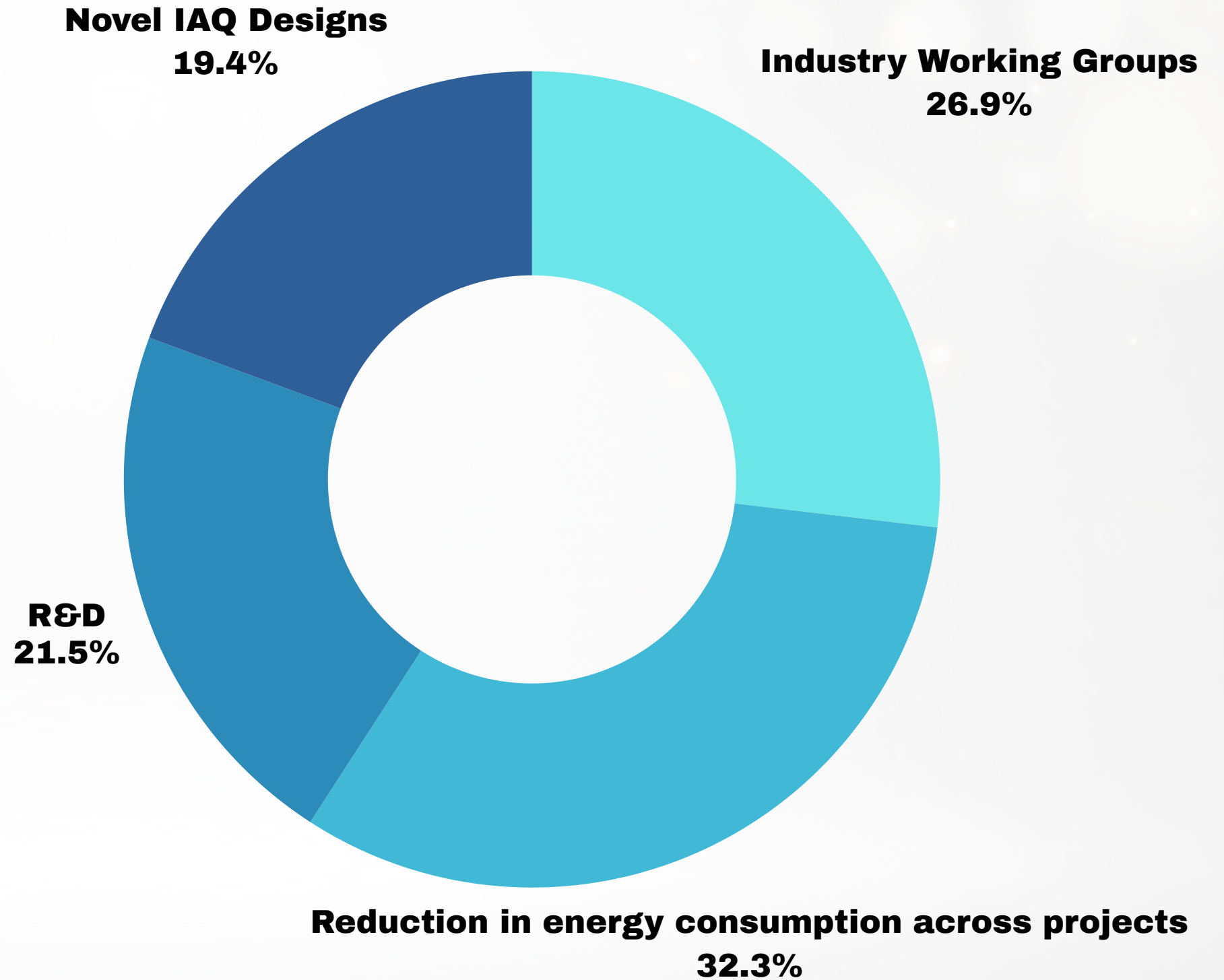
# OUR TEAM'S ACHIEVEMENTS

## Continuous Growth

From 2020-2024, Cobeal engineered ultra-clean environments totalling over 299,000 sq. ft.

## Research & Development Milestones

Our teams invested 112,000+ hours in R&D, enhancing air quality innovations for critical industries.





# WHY WE INNOVATE

To deliver solutions that push the boundaries of science and engineering.

Empowering breakthroughs in industries where precision is critical.

1

## **Challenge Accepted**

Every obstacle is an opportunity to engineer groundbreaking solutions.

2

## **Collaboration at its Core**

Working with global partners to redefine the limits of cleanroom technology.

3

## **Shaping the Future**

Innovations that not only meet today's needs but define tomorrow's possibilities.





**Unmatched Cleanroom Standards:**

Achieved highest cleanroom conditions, eliminating particles larger than 0.1 microns.

**Innovative Contamination Control:**

Introduced latex particle testing for filter validation at submicron precision.

**Advanced Materials Engineering:**

Developed low-outgassing polyurethane adhesives for ultra-clean environments.

1

**Redefining Cleanroom Technology:**  
Electropolished stainless steel vessels set a new benchmark in cleanliness.

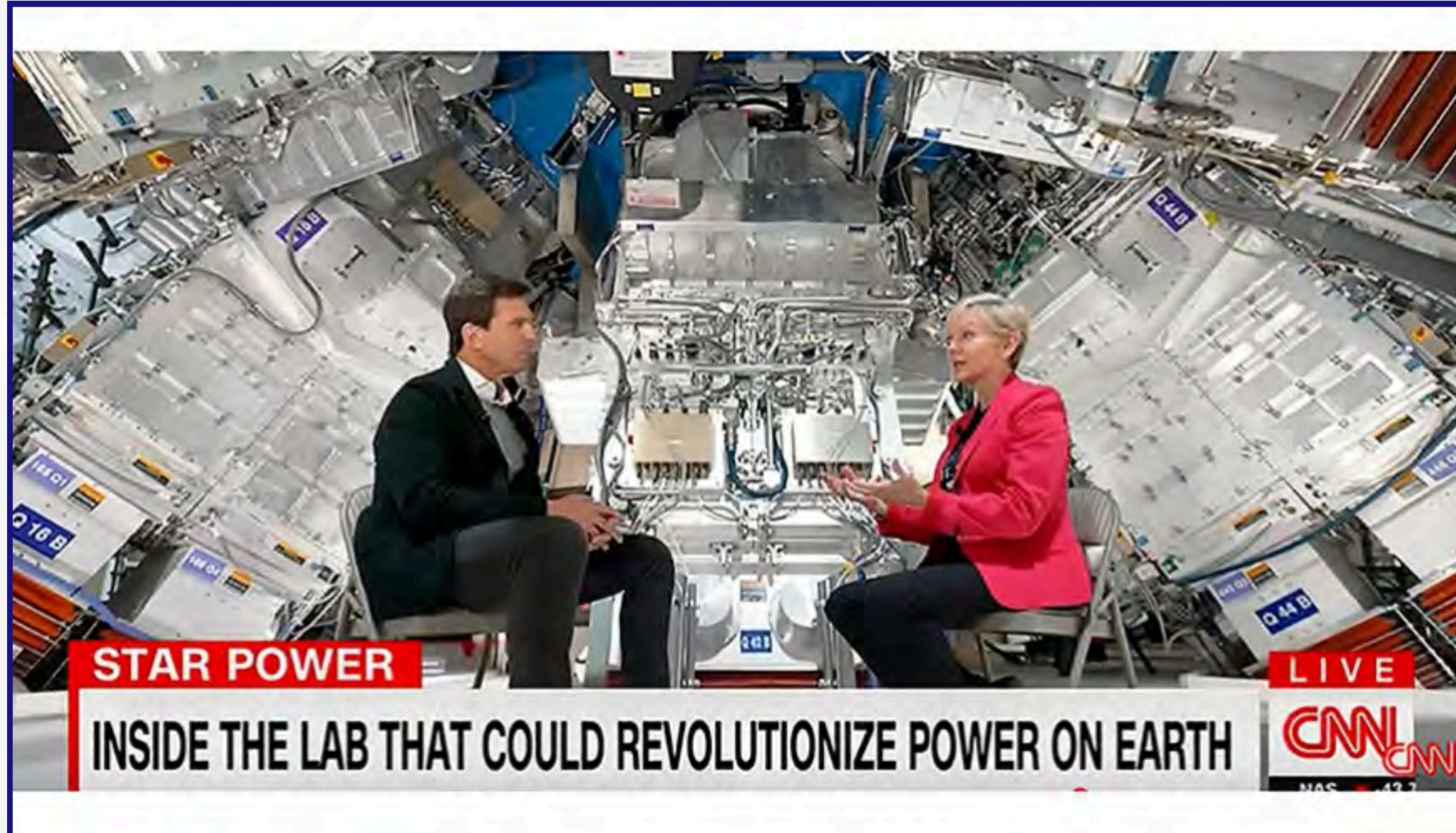
2

**Precision Gas Control:**  
Ensured 99.999999% nitrogen purity for optical performance integrity.

3

**Broad Industry Impact:**  
Innovations now benefit semiconductors, pharmaceuticals, and aerospace sectors.

# EXCELLENCE IN INNOVATION



## CASE STUDY

# LLNL NIF

Achieving the cleanest environment ever created.

Cobeal proudly played a key role in this monumental achievement





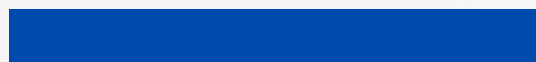
# LAWRENCE LIVERMORE NATIONAL LABORATORY (LLNL) NATIONAL IGNITION FACILITY (NIF)

## **Cobeal's Role in the National Ignition Facility's Groundbreaking Success**

Achieving the cleanest environment ever created, the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory required a Class 1 cleanroom, where even the tiniest particle could disrupt its goal of inertial confinement fusion. This breakthrough could revolutionize clean energy and address critical global challenges.

Cobeal proudly played a key role in this monumental achievement, showcasing our cutting-edge cleanroom technology in the technical report, ["Enemy Particles: Why Lawrence Livermore's National Laboratory/National Ignition Facility is Novel for the IAQ Industry."](#)

NIF's ambitious goal to harness fusion energy demanded extraordinary cleanliness to protect 192 laser beamlines and over 7,000 optical systems from particles as small as 0.1 microns. This challenge pushed the boundaries of traditional contamination control methods.



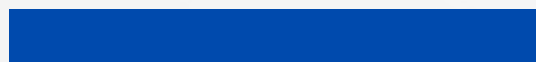


# LAWRENCE LIVERMORE NATIONAL LABORATORY (LLNL) NATIONAL IGNITION FACILITY (NIF)

**At Cobeal, we rose to the occasion with innovative solutions that redefined cleanroom and indoor air quality (IAQ) standards, ensuring the success of this groundbreaking project.**

Our contributions included replacing conventional filter testing with residue-free latex particle systems, electropolishing stainless steel vessels to eliminate microscopic crevices, developing low-outgassing polyurethane adhesives in collaboration with BASF, and designing nitrogen pressure systems with 99.999999% purity. Each solution set new benchmarks in precision and contamination control, enabling NIF's fusion experiments to proceed without disruption.

The impact of this work extends far beyond fusion energy. Cobeal's innovations are already transforming industries that depend on ultra-clean environments, including semiconductors, pharmaceuticals, and aerospace. By raising the standard for contamination control and cleanroom performance, we are proud to help drive progress in technologies that will shape the future of humanity.





# NIF PROJECT HIGHLIGHTS

## **Redefining Ultra-Clean Environments**

Cobeal's journey with the National Ignition Facility (NIF) wasn't just about achieving technical milestones; it was about transforming the way industries approach air quality and precision engineering. From pioneering residue-free latex particle testing to designing vessels with unparalleled cleanliness, we've reimaged what's possible.

**Carry-over-free validation  
with latex microspheres.**

**1**

**Electropolished stainless steel  
vessels for ultimate purity.**

**2**

**Low-outgassing adhesives  
codeveloped with BASF.**

**3**



# A SIGNIFICANT MILESTONE IN CRITICAL ENVIRONMENTAL ENGINEERING

NIF required Class 1 cleanroom conditions —pushing technological boundaries to the limit.

Cobeal designed contamination control solutions that exceeded traditional capabilities.



## **Achieving the Impossible**

To meet NIF's stringent requirements, our team engineered groundbreaking solutions, setting new industry standards for contamination control and cleanroom performance.

## **Collaboration at its Core**

This project exemplified the power of innovation and teamwork. Together, we overcame unprecedented challenges, ensuring the success of one of the most complex scientific endeavors of our time.





# ENGINEERING THE FUTURE

## **Beyond Traditional Solutions**

Pioneering approaches in cleanroom technology to redefine industry benchmarks.

## **Empowering Industries Worldwide**

From semiconductors to pharmaceuticals, our innovations drive advancements where precision is key.

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1

**Revolutionary Cleanroom Standards**  
Developed filtration solutions achieving Class 1 conditions for NIF's critical optical solutions.

2

**Collaboration Drives Progress**  
Partnered with global institutions to integrate cutting-edge IAQ technologies.

3

**Precision Engineering Excellence**  
Addressed unique contamination control challenges with innovative materials and methods.



## MEET OUR **EXPERTS**

The Visionary Leader and the Accomplished Engineer Behind the Breakthrough



### **Sophy M. Laughing, Ph.D., MBA**

A visionary leader in environmental engineering and cleanroom innovations, Dr. Laughing has helped redefine industry standards with her contributions to the NIF project.



### **Bo Erik Gustav Hollsten Ruvalcaba**

An accomplished industrial engineer, chemist, and physicist. Hollsten revolutionized the critical environments industry with his contributions to the NIF project.





# FUTURE INNOVATIONS

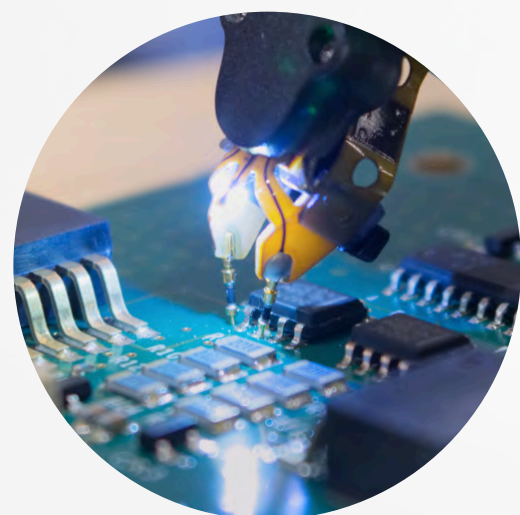
Building on our groundbreaking work with the National Ignition Facility, Cobeal is pioneering solutions that redefine industry standards.



Leveraging NIF insights to drive solutions in pharmaceuticals, semiconductor manufacturing, and aerospace.



Adapting ultra-clean technologies to enhance energy production and storage systems, driving sustainability across industries.



Scaling particle-free environments to broader applications.



Developing advanced air quality solutions tailored for next-generation cleanroom environments and critical healthcare applications.



**THANK YOU**

**VISIT US**



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**[www.cobeal.com](http://www.cobeal.com)**