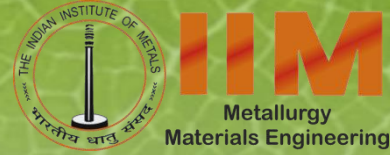


TATA STEEL

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Presents

International Conference on

GREEN & SUSTAINABLE IRON MAKING

January 17 – 18, 2024



HELIOS

Intro to the Helios Cycle: A novel method to reduce iron ore

By

Udi Giladi, Director of Strategic Partnerships



THE HELIOS STORY

Established in 2018, as a space-tech company.

Developing technologies to enable the **separation of oxygen from lunar minerals** in extreme environments, where zero emissions are not an option but a necessity.

Derived from its space technology, Helios developed a novel process to produce iron from iron ore, **using only thermal energy while emitting only oxygen.**

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THE STEEL INDUSTRY'S PROBLEM

- The Steel industry is responsible for 7% of the global CO₂ emission
- Climate regulations force the steel industry to transition to a green solution (and carbon leakage)
- Insufficient clean production alternatives
Green premium
- Declining availability of high-grade ores which is required for current green alternatives



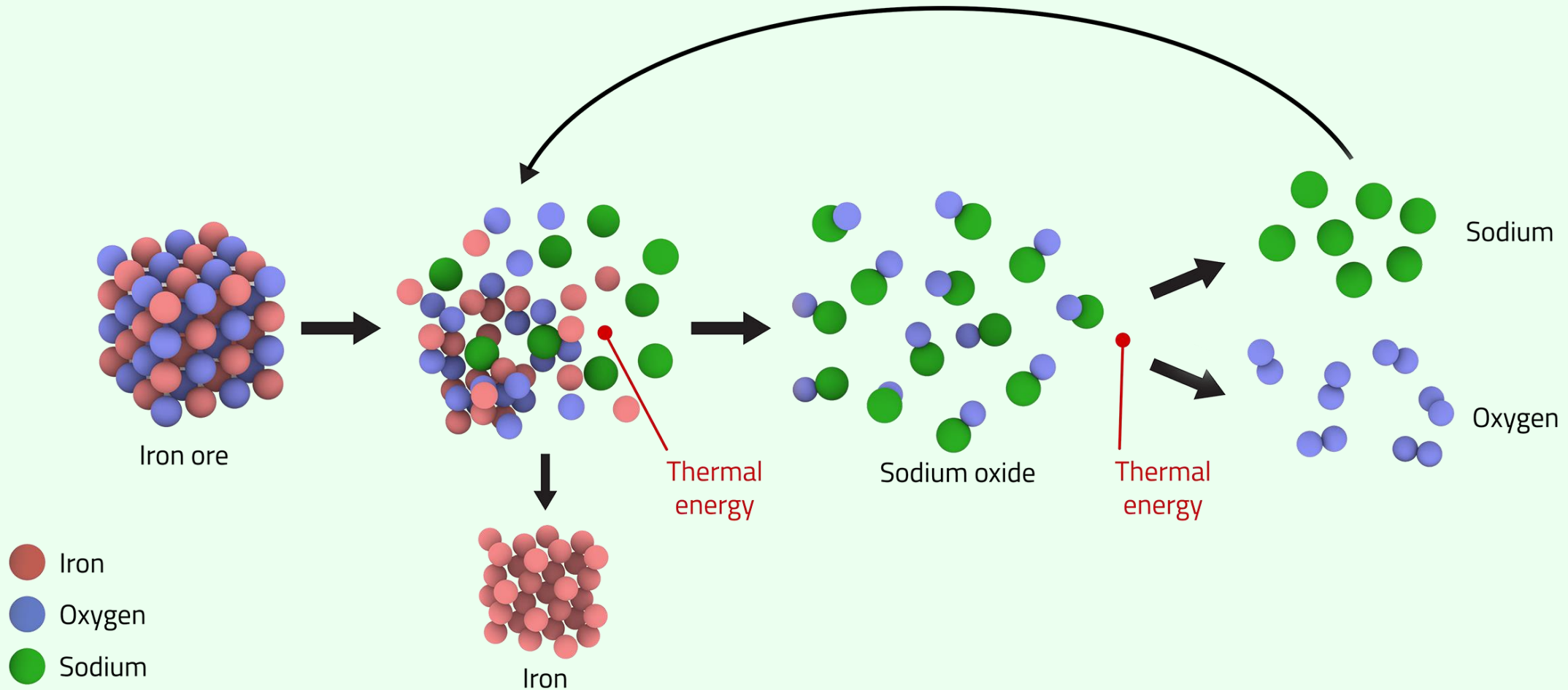
INTRODUCING - THE HELIOS CYCLE

About Helios cycle:

- Using **sodium as a reducing agent**, to replace coal, hydrogen, or electrolysis
- The required input is iron ore and heat, and the output is iron and oxygen
- Helios cycle can **reuse the sodium** (turning OPEX into CAPEX).
- Iron making between 350°C to 750°C



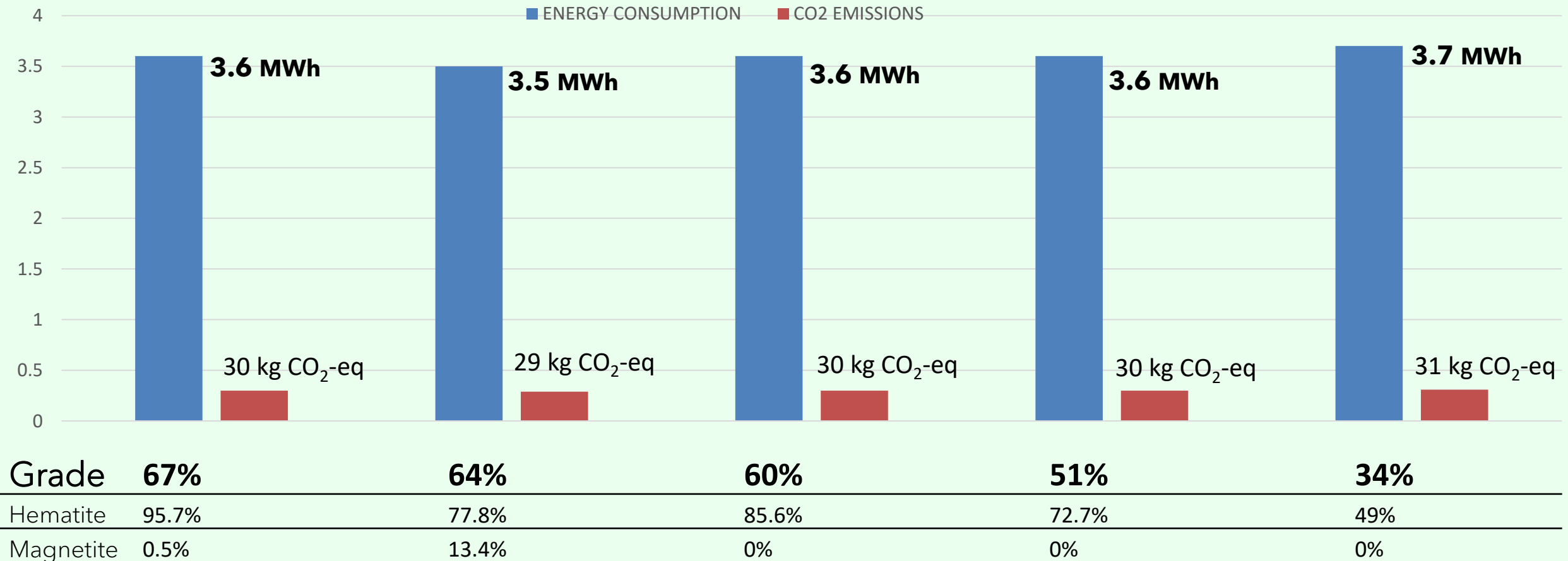
THE HELIOS CYCLE - ZERO CARBON EMISSION



*The required input is iron ore and heat, the output is iron and oxygen.

ENERGY CONSUMPTION AND CO2 EMISSIONS PER TON

* Manufacturing emissions are derived from use of electricity



TECHNOLOGY VALIDATION - TRL5

- Semi-continuous lab scale system with a capacity of 1 kg/hour reduced iron
- Reactor resembles a rotary kiln with several heat zones, auger system, continuous ore and sodium feeder and control system
- Synchronized technology development at all TRL stages for efficient scale-up and de-risking



R&D GOALS FOR - TRL7 PILOT

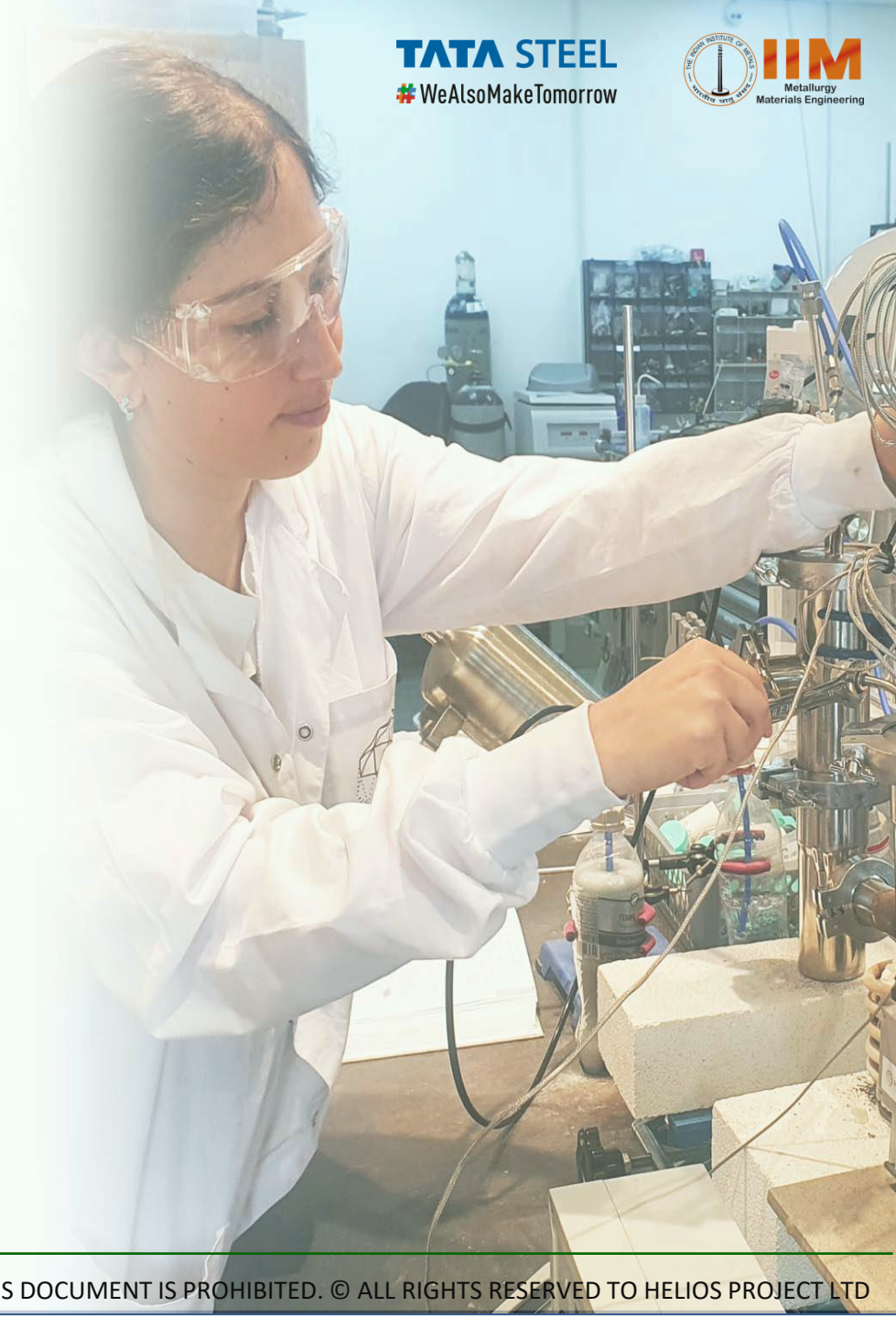
The end goal is to build an iron ore reducing machine:

- Production volume of 1ton/day
- Over 92% metallization
- Below 2% sodium in the slag and below 0.2% sodium in the iron
- Full sodium reclamation



ADVANTAGES CONCLUSIONS

- Zero direct carbon emissions
- 30% less energy and 30% OPEX reduction than traditional production
- No use of coal, hydrogen, or electrolysis in the reduction process
- Compatible with low-grade ores and iron-content minerals
- Geographic flexibility
- *Applicable to additional transition metals (e.g., Copper, Nickel, Chromium, Cobalt, etc.)*

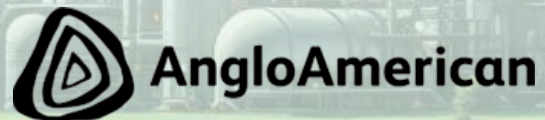


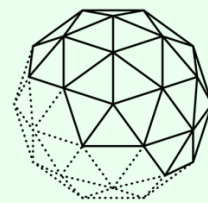
BUSINESS ROADMAP



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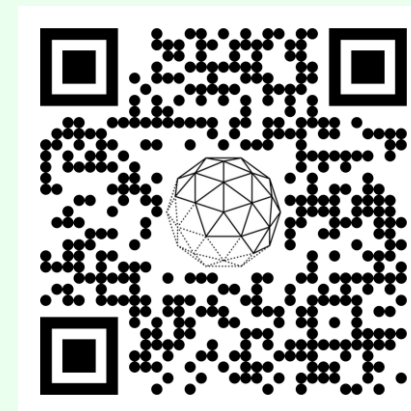
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HELIOS

THANK YOU - STAY UPDATED



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