

Hy³ (Hy-cube) project : Hyundai Steel's carbon neutral strategy

Hyuk Kim, Minju Sun

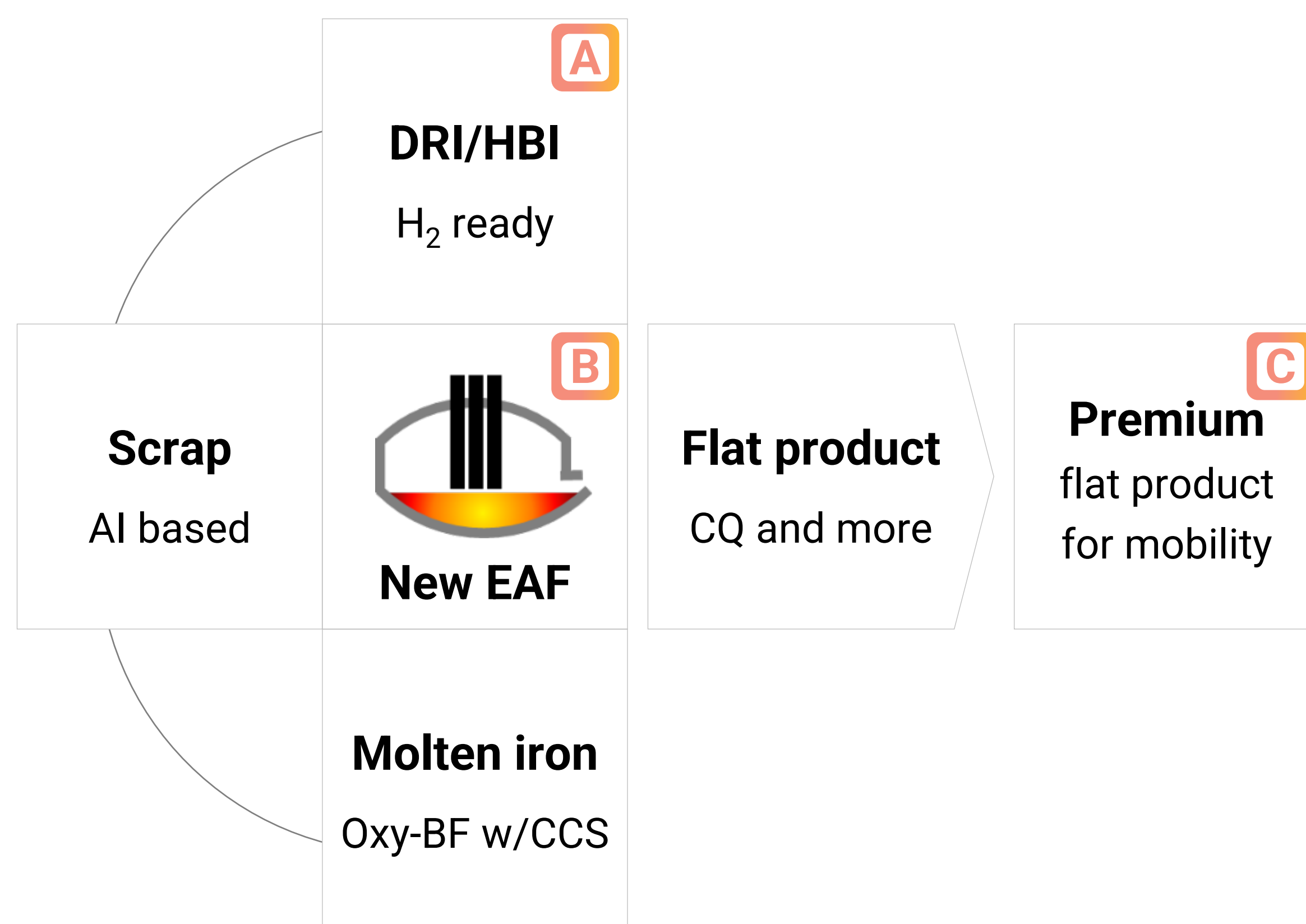
Hydrogen Reduction Research Team, Hyundai Steel, Dangjin-Si, South Korea, 31719

1 INTRODUCTION

Achieving carbon neutrality in the steel industry by 2050 necessitates changes in the blast furnace process, which emits the most CO₂. Global engineering companies (Rassel, 2022; Martinez, 2023) are planning to transition from blast furnace-based steel production to new steel production systems utilizing DRI and smelters. European steel companies (Redenius, 2022; Denecke-Arnold, 2023) focusing on both improving existing equipment and transitioning to DRI-EAF production methods. Steel companies are developing technologies with their strengths to maintain competitiveness. Hyundai Steel aims to secure advanced plate production based on its expertise in EAF technology, planning a phased approach and developing technologies to reduce carbon emissions in line with global trends.

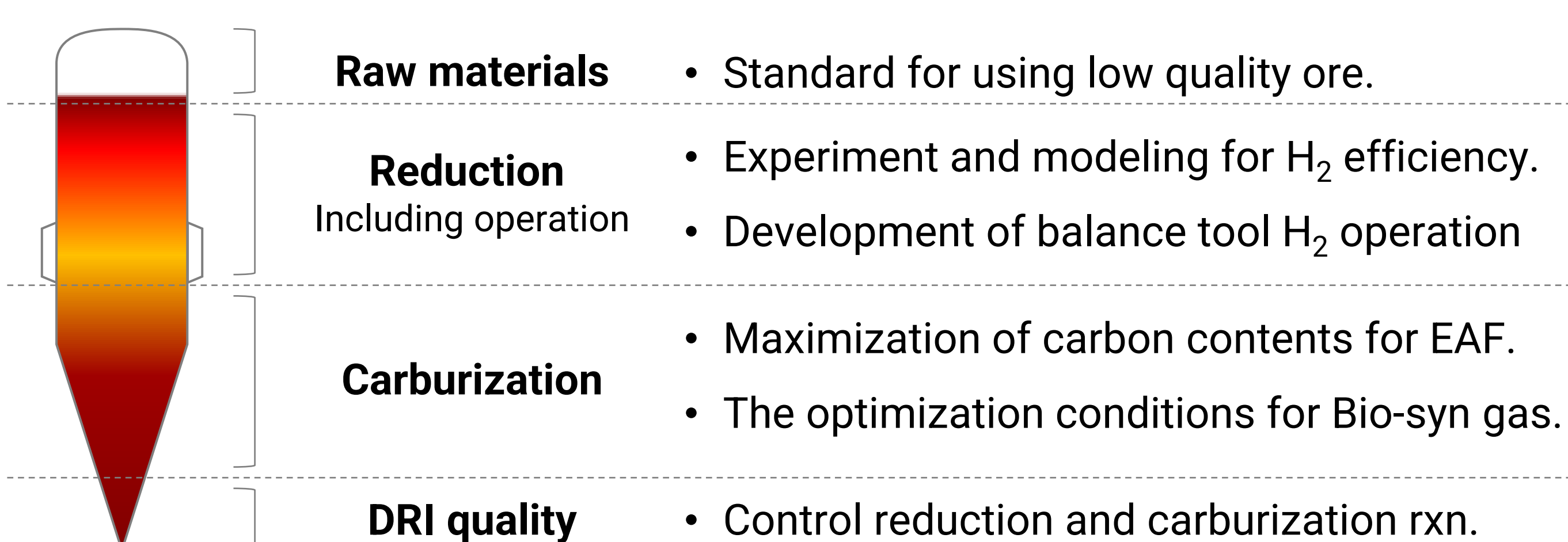
2 Hy-Cube PROJECT

Leveraging Hyundai Steel's rich history in operating electric arc furnaces since 1953, Hyundai Steel has planned the Hy-Cube(Hy³) project, focusing on electric arc furnace-based steel production. The Hy-Cube project represents Hyundai, Hydrogen, and Hybrid processes. The Hy³ process offers flexibility in materials, processes, and products. It incorporates three key technologies: New EAF, hydrogen reduction, and premium product production.



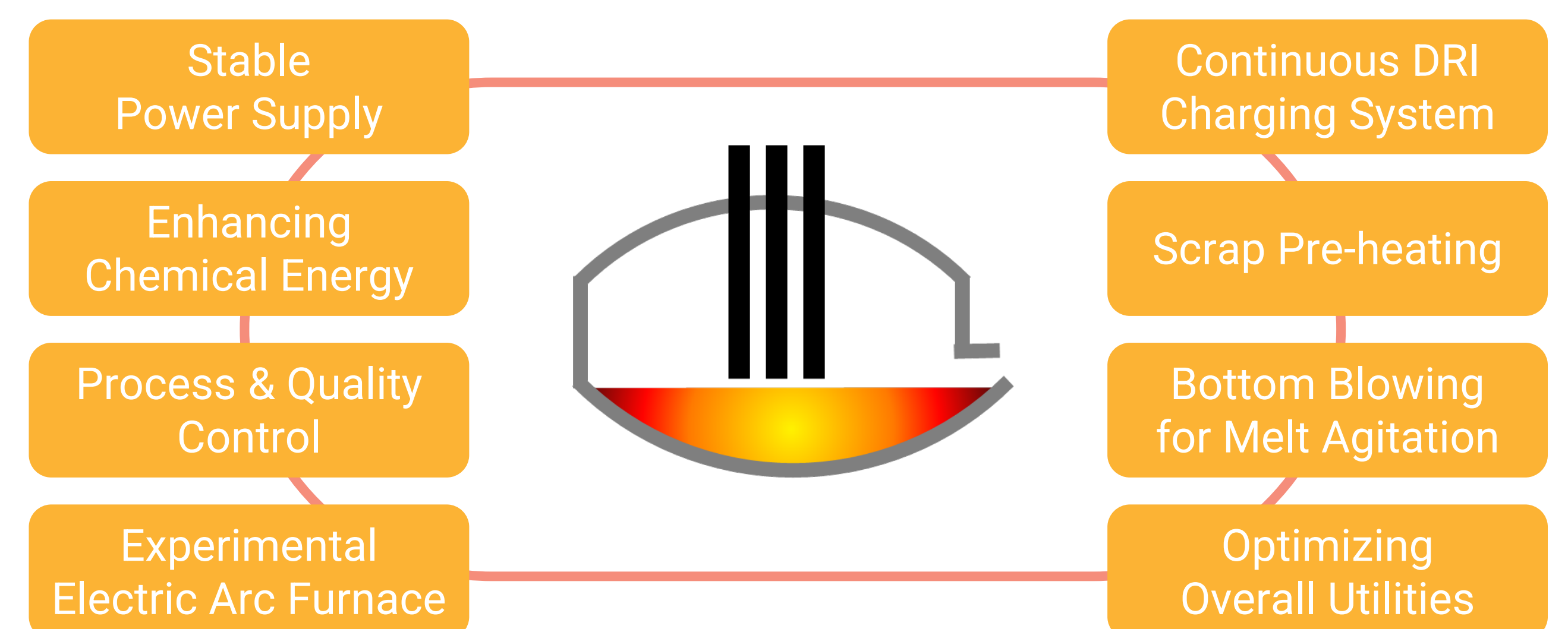
A H₂ REDUCTION TECHNOLOGY

Hyundai Steel is pursuing a fundamental approach to design an optimized process using the developed tool by Sun (2023).



B NEW EAF TECHNOLOGY

Responding to carbon neutrality, the New-EAF process aims to use a significant amount of hydrogen-reduced iron, requiring improvements in the melting characteristics of DRI and enhanced slag separation functions. To this end, eight key technologies have been selected and are under development.



C PROTOTYPE & PRODUCT

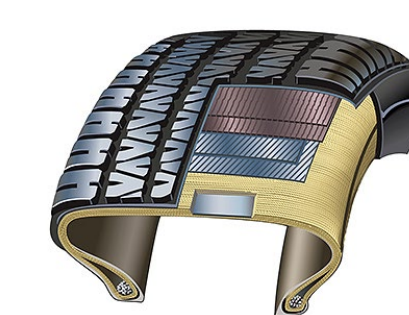
To validate the Hy³ project's concept, Hyundai Steel has conducted tests to produce prototypes. Two notable test cases are the production of low-emission sheet products and tire cords.

Lower Arm



- World first '1 GPa' low-emission sheet & product w/48%CO₂ CFP(1.16) Reduction.

Tire Steel Cord



- High-end wire product /w EAF process.
* Commercialization verification in progress (CFP 33%l)

3 CONCLUSION

In summary, Hyundai Steel's Hy³ project represents a comprehensive approach to achieving carbon-neutral advanced steel products. The strategic shift to electric arc furnace technology symbolizes Hyundai Steel's commitment to environmental sustainability and technological leadership. As Hyundai Steel navigates the complexities of carbon-neutral steel production, the Hy³ project aims to reshape the steel industry landscape and position 'HyECOsteel' as a premier symbol of low-carbon steel production.

REFERENCES

- Denecke-Arnold, H, 2023, Low-CO₂ steel production at thyssenkrupp Steel Europe AG, in *Proceedings 6th ESTAD*.
- Martinez, J, 2023, The ENERGIRON Technology: The Perfect Fit Between Decarbonization and Direct Reduction, in *Proceedings AIST2023*.
- Rassel, G, 2022, Exploring Paul Wurth's latest technological developments: How are we in SMS group building on our metallurgical expertise to advance green iron & steelmaking?, in *Proceedings ICSTI2022*.
- Redenius, A, 2022, SALCOS® – the sustainable way of green steel production, in *Proceedings ICSTI2022*.
- Sun, M, 2023, Estimation of Direct Reduction Process Stability with Hydrogen Increment, in *Proceedings 184th ISIJ Meeting*, p.469 (CAMP-ISIJ).