CHANGE FOR BETTER, GREENER, SMARTER

- Understanding where we are
- Evaluating potential changes to our fundamental process route
- Considering Incremental changes
- Environmental emissions and Waste control.
- Digitalization

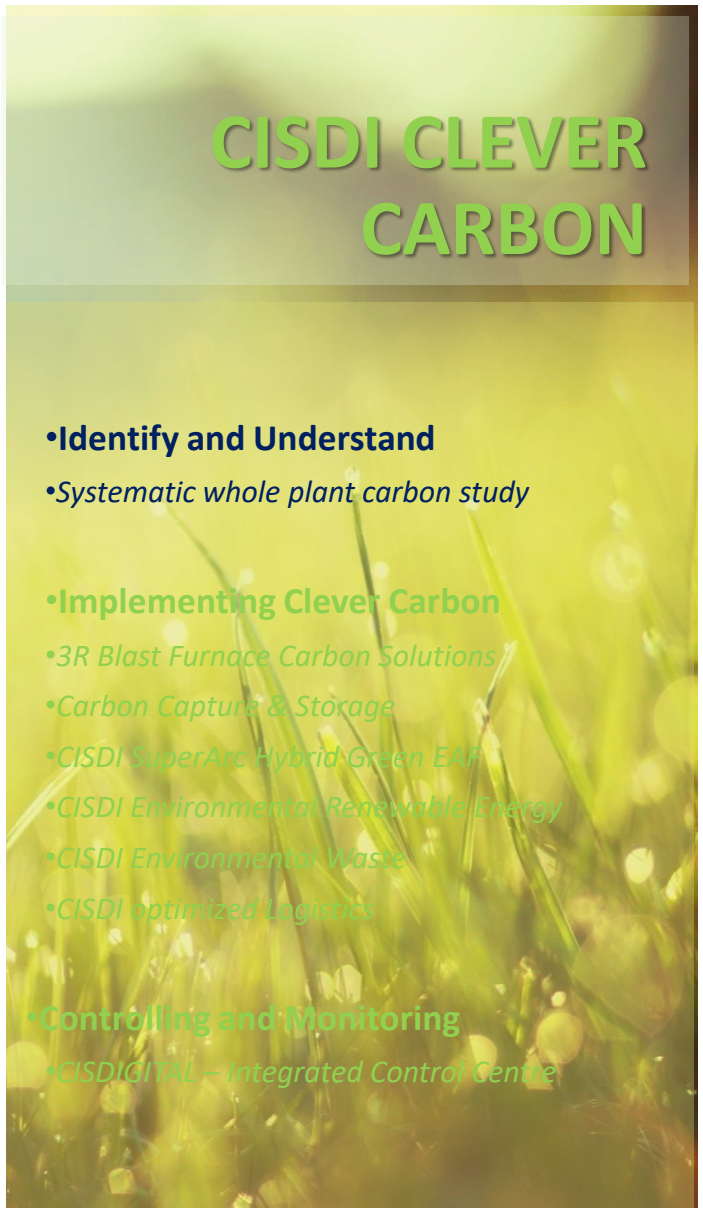
together we can be clever about Carbon ……

Where We Stand

World Steel At Crossroads

Challenges and Opportunities

Identify and Understand . CISDI Whole plant systematic study.



Let's be clever about Carbon…

- Reaching a target of zero Carbon is a huge challenge for the industry.
- Each plant and organization will have its own unique obstacles.
- **How to decide**

Understanding where we are

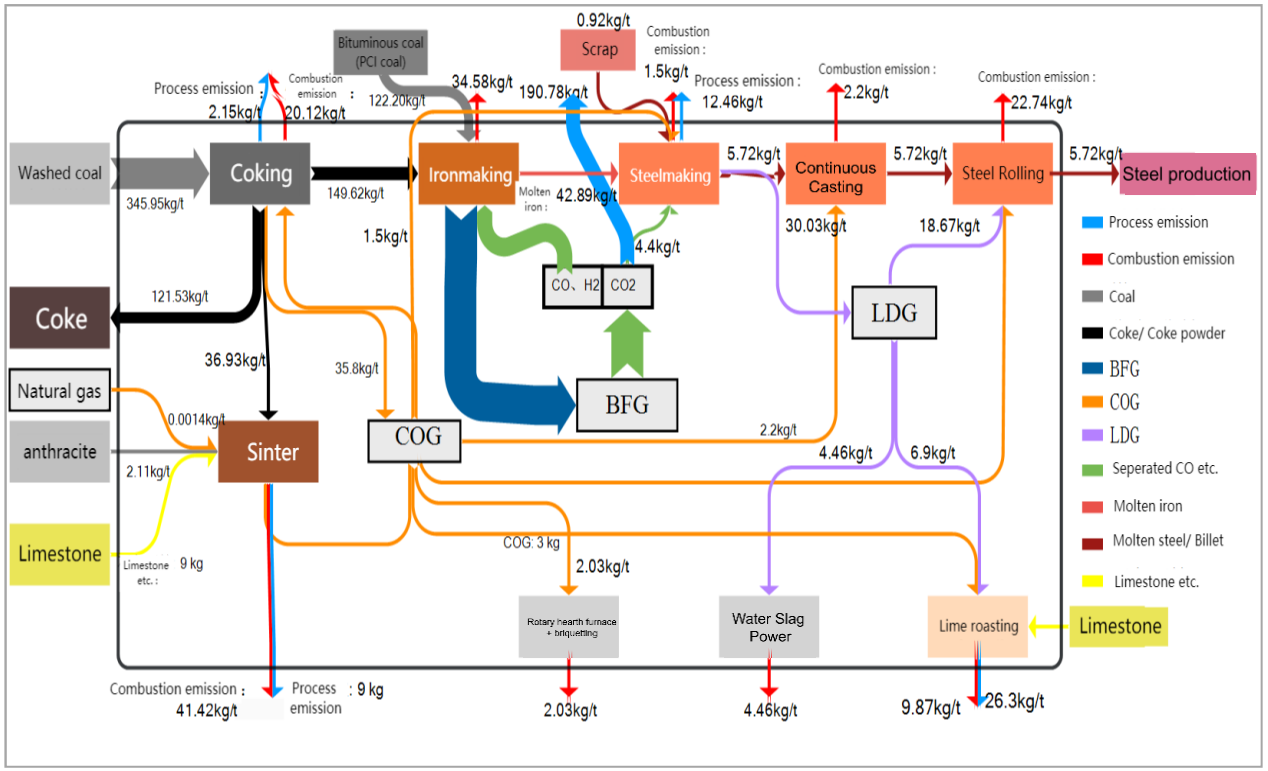
Total Solutions

Systematic Whole Plant Study

- **CISDI has developed a "carbon flow" and "LCA carbon footprint analysis" as the systemic approach to research on green and low-carbon technology path for steel enterprises.**

The role of carbon in steel production	Reduction reaction	Energy supplying reaction

Carbon Flow Method: Based on the material flow and energy flow, study how carbon enters the steel production process, and how to make the carbon **efficiently used and reduced** through **management and control of carbon**



Direct carbon flow diagram of low-carbon process

1 Analyze the use of carbon for reduction

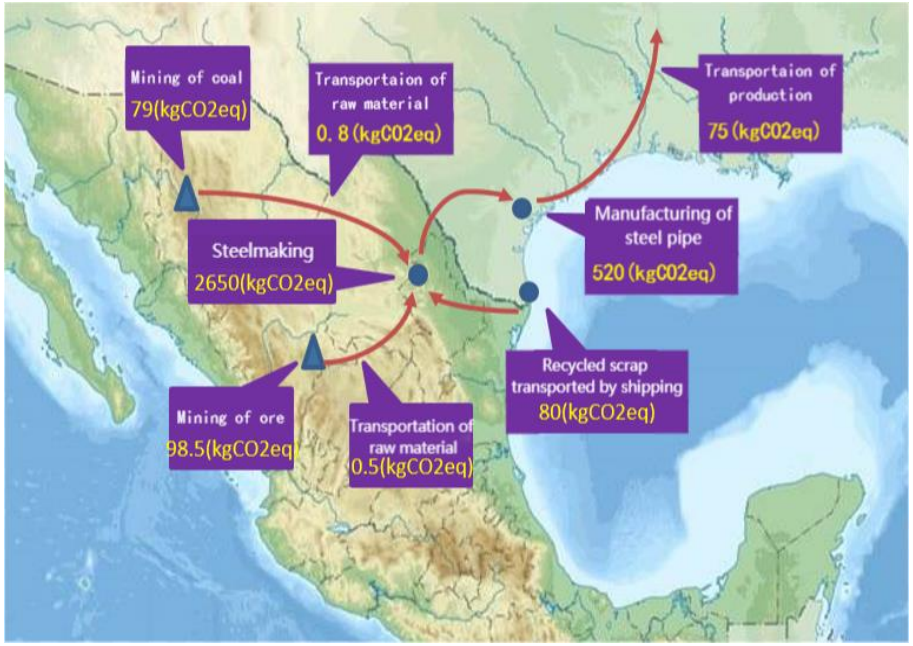
- Hydrogen metallurgical hydrogen reduction is an endothermic reaction, and **the carbon reduction effect of replacing carbon with hydrogen in the existing steel process is limited.**
- The use of hydrogen reduction requires new process technology, but the related new technology is **not yet mature and economical**
- **In the short term it may be necessary to use carbon for reduction, and enrich, recycle and resource the generated CO_2 to reduce carbon**

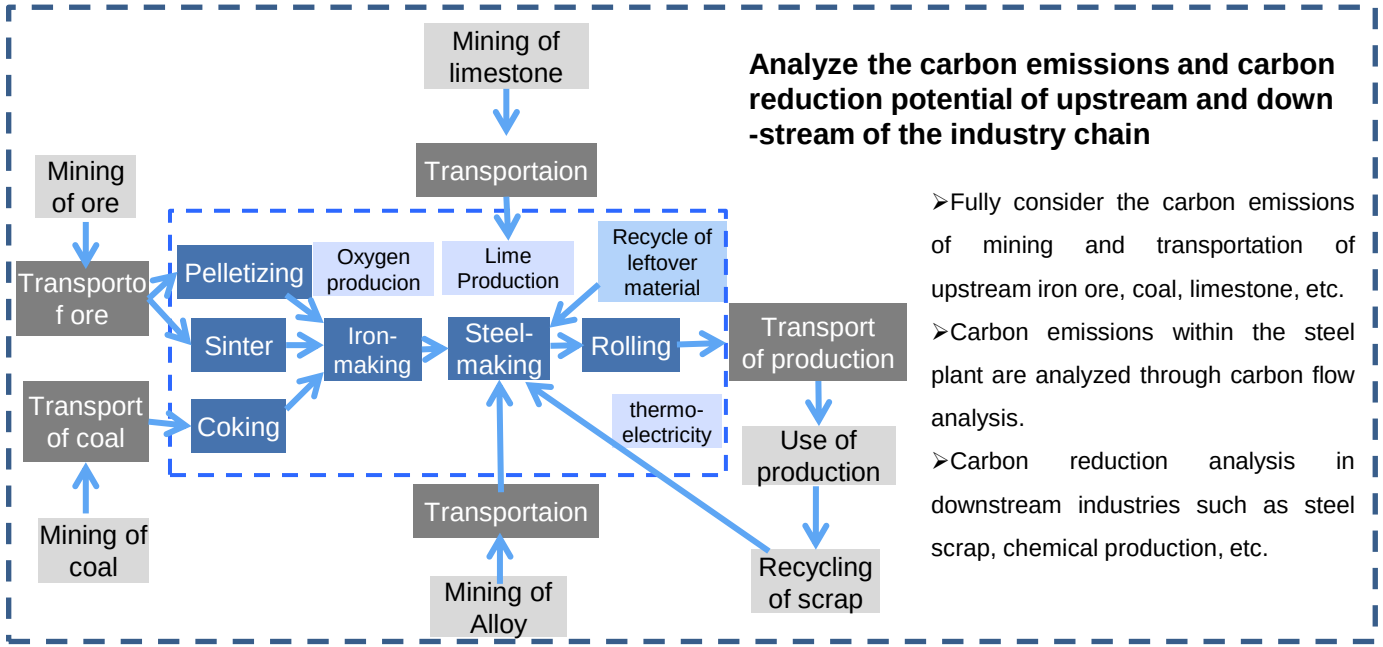
2 Reduce the use of carbon for energy supply

- Minimize the use of carbon for energy supply, such as combustion for power generation; along with the national energy revolution and energy structure adjustment, replace the heat and combustion functions of carbon in the steel process manufacturing, so that the whole steel industry can finally realize the real green and low-carbon

Identify and Understand . CISDI Whole plant systematic study.

Conduct the “cradle-to-gate” life cycle carbon footprint analysis of steel products, analyze the carbon reduction potential of steel production and its upstream and downstream, so as to provide a basis for the construction of carbon reduction measures for the entire industrial chain.





Analyze the carbon emissions and carbon reduction potential of upstream and down -stream of the industry chain

- Fully consider the carbon emissions of mining and transportation of upstream iron ore, coal, limestone, etc.
- Carbon emissions within the steel plant are analyzed through carbon flow analysis.
- Carbon reduction analysis in downstream industries such as steel scrap, chemical production, etc.

PEFCR

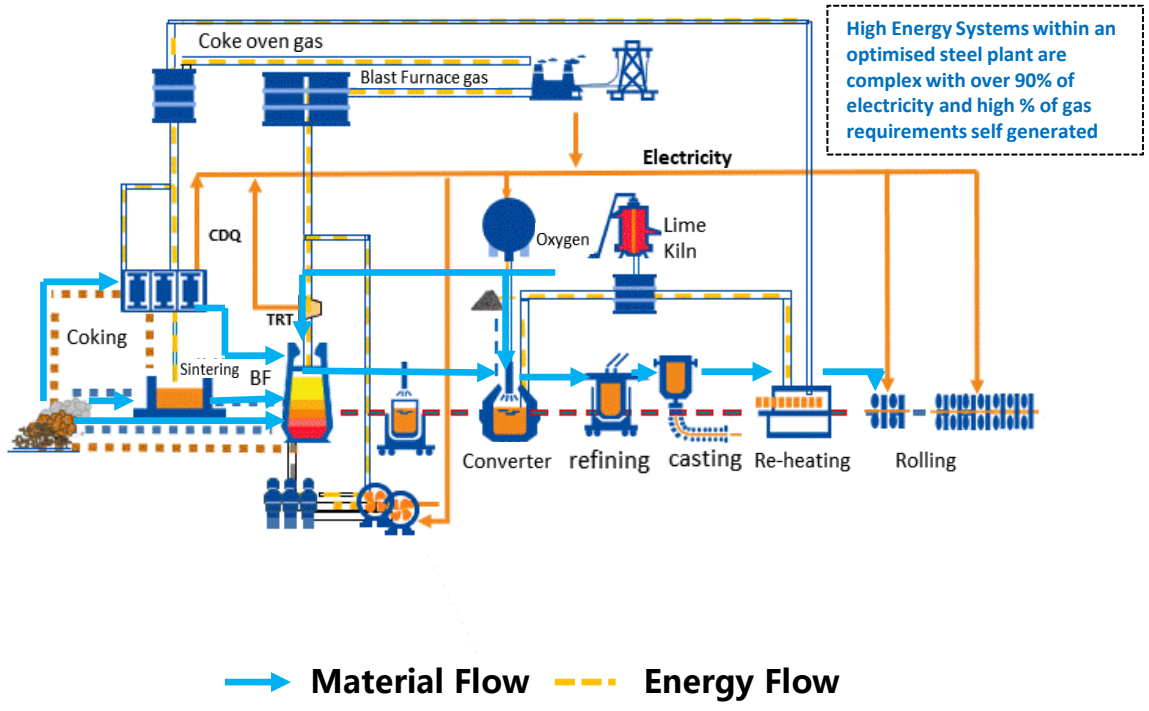
Product Environmental footprint Category rules

Life cycle methodology (World steel)

ISO14067

Steel production, as an interlinked process and is sophisticated and difficult to control. CISDI approaches it with “Five-Flows” method to seek systematic solutions.

Steel production process is sophisticated and difficult to control.

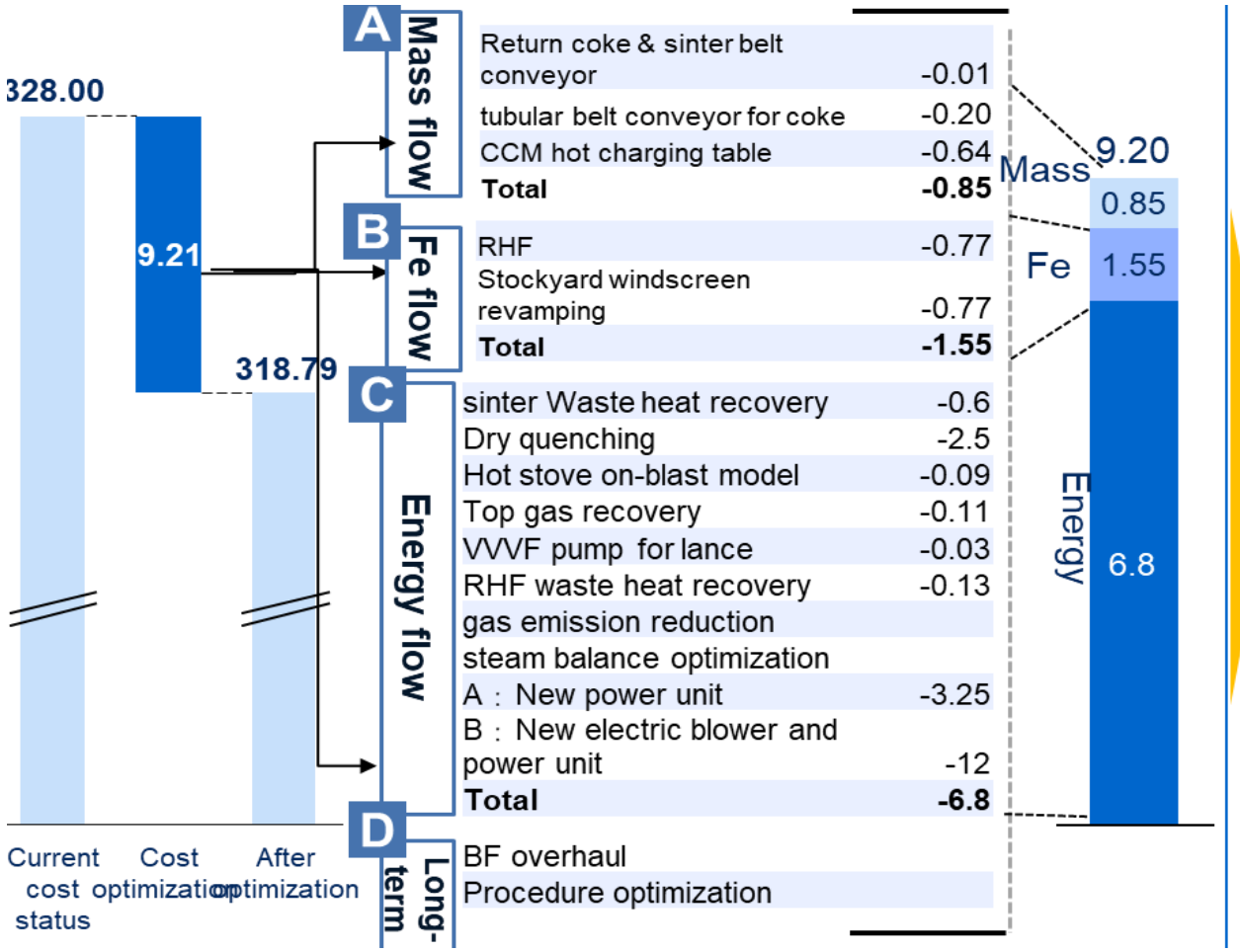


“Five Flows” method

Five Flows	Objects of Research	Targets of Research
Material Flow	Logistics & Fe Element and waste	• Reduce internal and external logistics costs • Improve efficiency of Fe element utilization
Energy Flow	Energy media & C Element	• Optimize efficiency of energy conversion • Reduce energy consumption • Explore pathways to achieve the goals of peak CO_2 emissions and carbon neutrality
Waste	Waste	• Recycle and Reuse is a fundamental part of Co2 reduction
Data & Control Flow	Control	• Build flat system architecture • Reduce numbers of information exchange levels • Increase efficiency of data capitalization
Cost Flow	Money	• Get the economic attributes in the process of flow manufacturing • Improve competitiveness through cost analysis and optimization

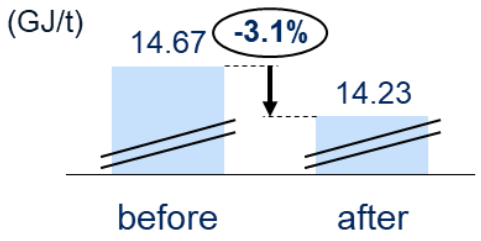
Identify and Understand . Gain an understanding where we are and how to move forward – each plant is different.

Steel production, as an interlinked process and is sophisticated and difficult to control. CISDI approaches it with “Five-Flows” method to seek systematic solutions.

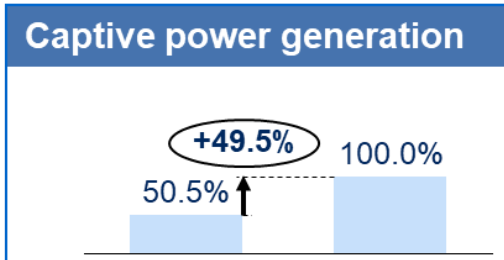


Per-ton steel indicator comparison

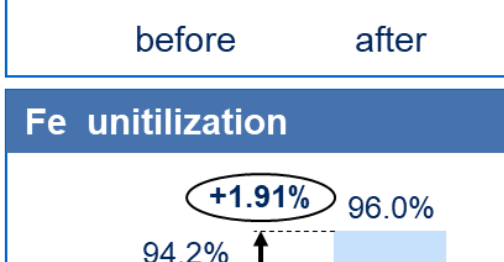
Unit energy consumption



Captive power generation

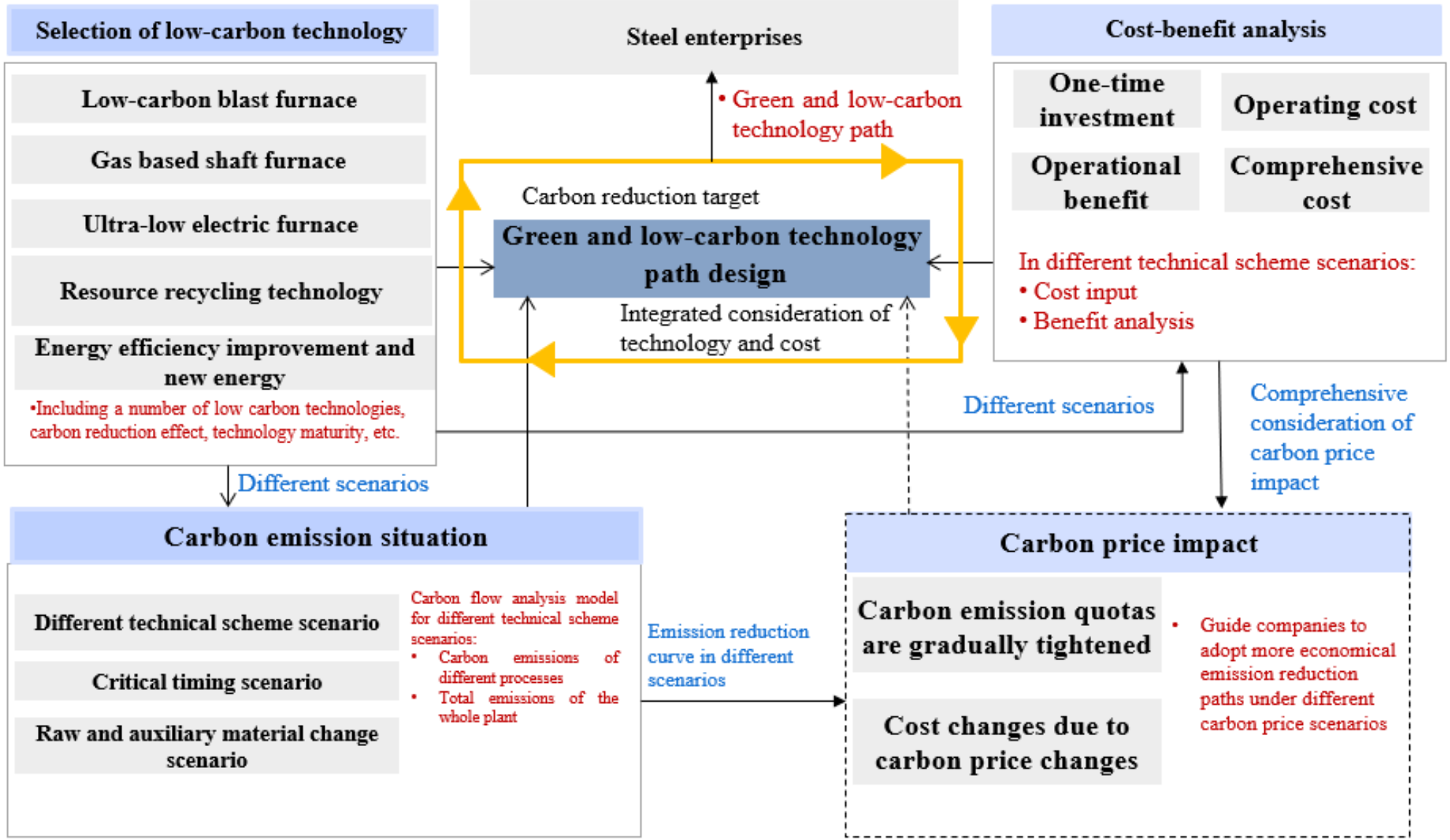


Fe unitilization



Identify and Understand . Gain an understanding where we are and how to move forward – each plant is different.

Adopt systematic analysis methods to conduct multi-dimensional analysis in the aspects of low-carbon technology, carbon emissions, and cost-effectiveness, and combine the impact of carbon price to build a green and low-carbon technology path for steel enterprises that fits the actual situation of enterprises and meets the target requirements.



Clever Carbon Solutions Route 1 – Improve the Blast furnace route – well proven technology efficient but limited carbon reduction

The low carbon technology portfolio has formed three main technology routes, which steel companies can choose and integrate according to their own situation. Technology route Ⅰ is for the traditional blast furnace converter long process lower carbon technology route, the current potential for carbon reduction is about 10-30%. In the long term, the combination of steel and chemical co-production and renewable Energy will also further reduce carbon emissions.

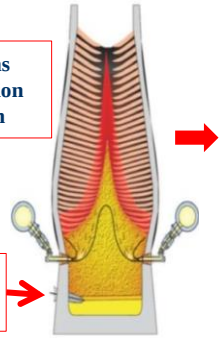
Technical Route Ⅰ: The traditional BF converter long process low-carbon route

New/Renewable energy | Efficiency improvement | Energy storage | Smart energy & environmental protection

Electricity
Ore
Coal
Water
Air

Coking
Sintering
Pelletizing
Lime

Top gas circulation system
Gas heating



Steelmaking
Hot rolling
Continuous casting
Circulation
Cold rolling
Heat treatment & coating
Use
Waste

Food& medical
CO_2 capture
Steel chemical co-production
Urban heating
CO_2 enrichment
Agriculture& industry

Composite furnace materials | Low-carbon 3R - BF | High-scrap-ratio converter | Integrated casting and rolling | Converter blowing CO_2 | Intelligent & green

Induction heating, oxy-fuel recirculation combustion near zero emission systems, oxy-fuel combustion

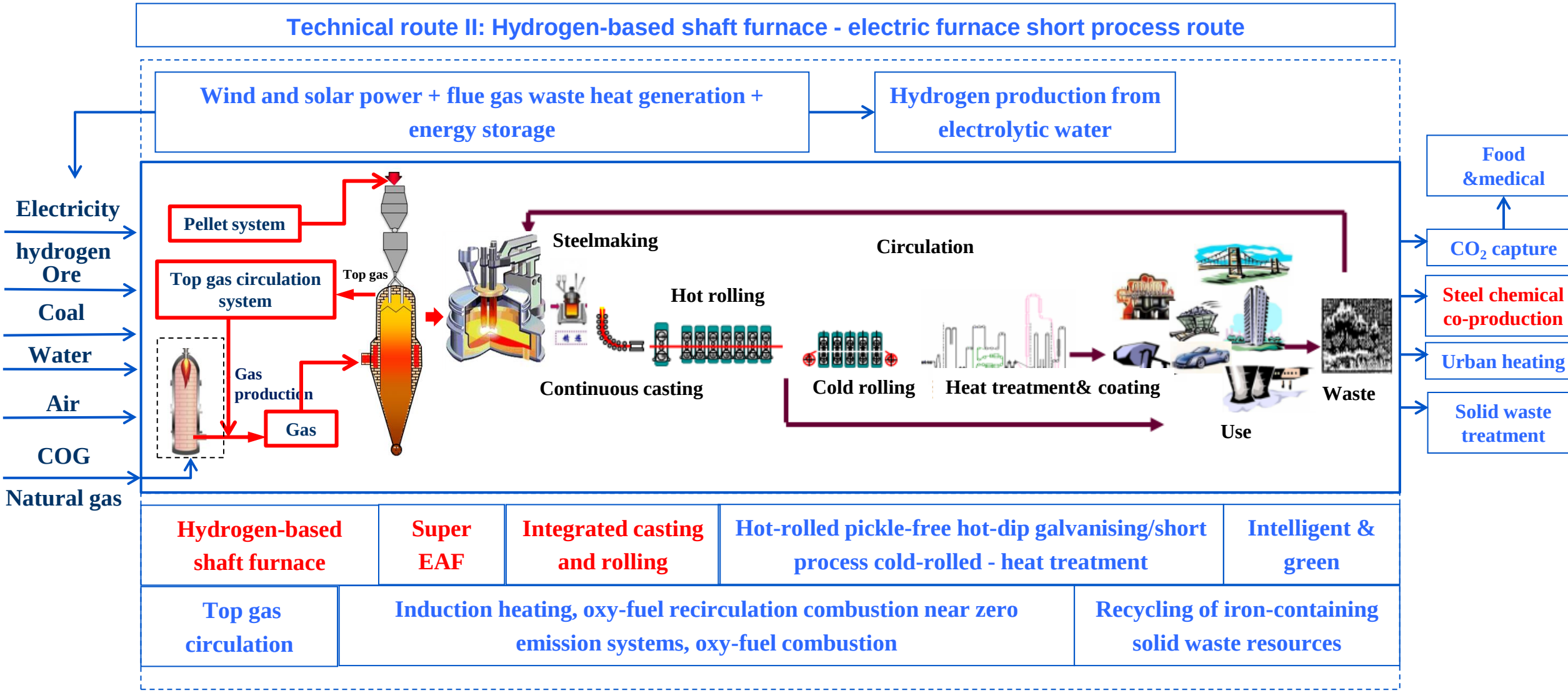
Recycling of iron-containing solid waste resources

Comprehensive utilization of blast furnace slag

Comprehensive utilization of steel slag

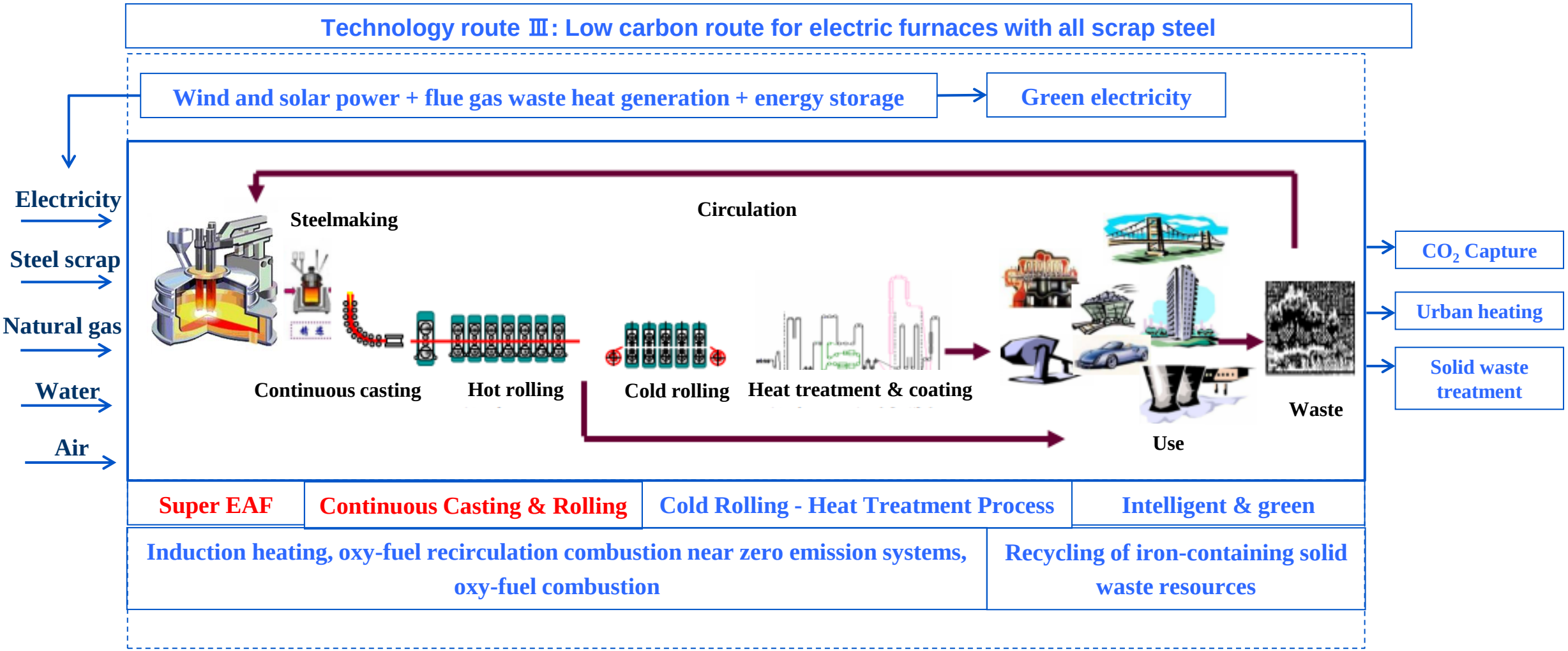
Clever Carbon Solutions Route 2 – DRI / EAF production

Technology Route Ⅱ: Hydrogen-based shaft furnace-electric furnace short process, using natural gas/coke oven gas in the short term, which will increase the carbon reduction potential by more than 40% compared to the traditional long process, and the use of green hydrogen in the long term will further reduce carbon emissions.



Clever Carbon Solutions – Scrap based EAF route

Technology Route Ⅲ: Short process of all-scrap electric furnace, which reduces carbon by 2/3, compared to the traditional long process blast furnace. The use of green electricity in the long term will also further reduce carbon emissions. The key low carbon technologies applied are ultra-low electric arc furnace, continuous casting and rolling, etc.



What CISDI Can Offer: Suggestions on Implementation

All CISDI products can be offered in separate or package forms. A glance of step-by-step example package path to carry out:

Clever Carbon

1
A7:Smart Carbon Roadmap
A1:Optimized Energy

2
A3:Optimized Logistics
A4:Environmental Emissions
A5:Environmental Water
A6:Environmental Waste
C3:Smart Equipment Application

3
A2:Efficient Operations
B1-4: 3R Blast Furnace /AutoARC™ EAF /Rotary Hearth Furnace /Environmental Renewable Energy
C2:Integrated Control Centre
C1:CISDigital Plant

Efficient Operations

1
A1:Optimized Energy
A2:Efficient Operations
A3:Optimized Logistics

2
C3:Smart Equipment Application
C2:Integrated Control Centre
C1:CISDigital Plant

Digital Manufacturing

1
C3:Smart Equipment Application

2
C2:Integrated Control Centre
C1:CISDigital Plant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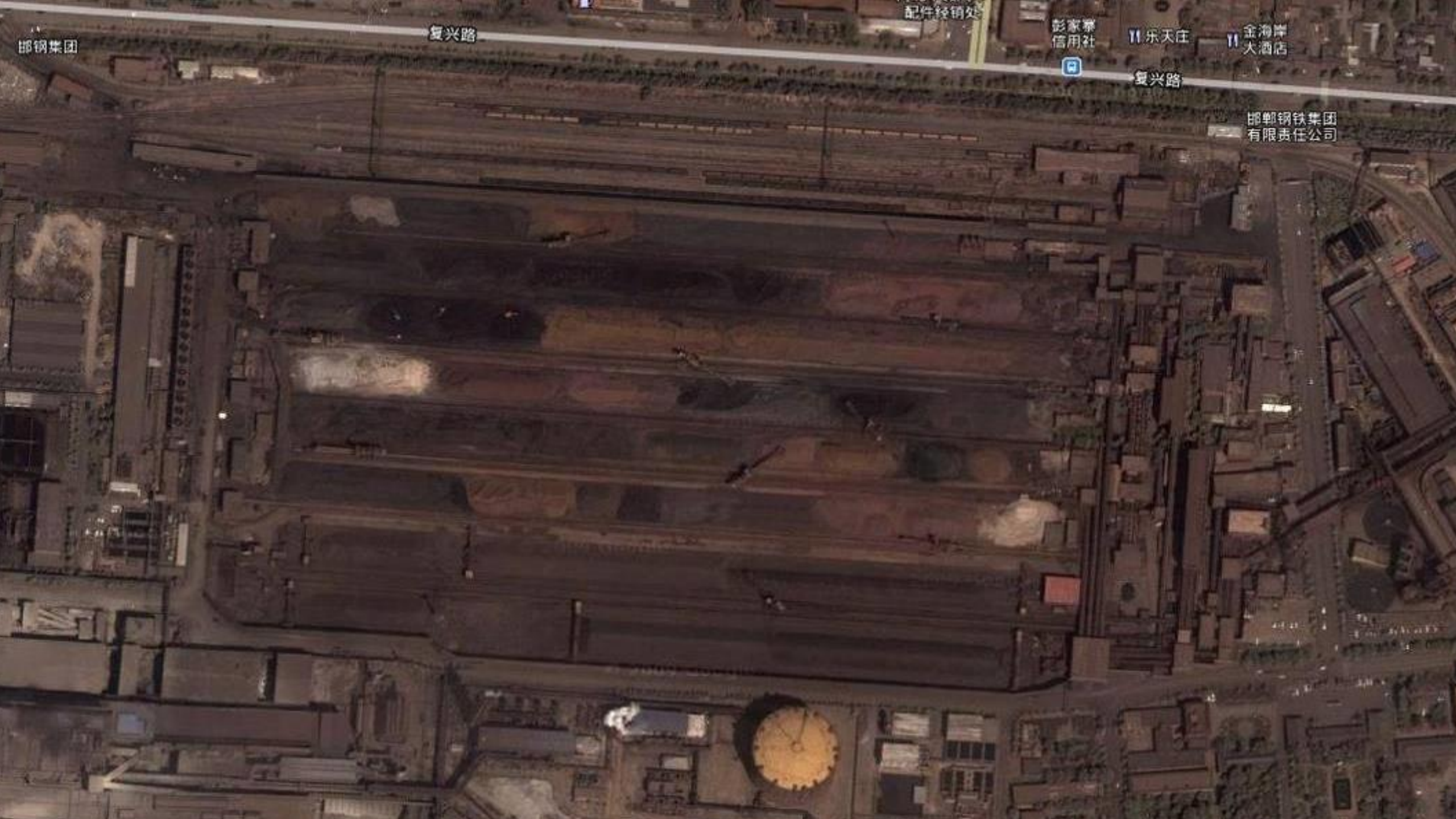
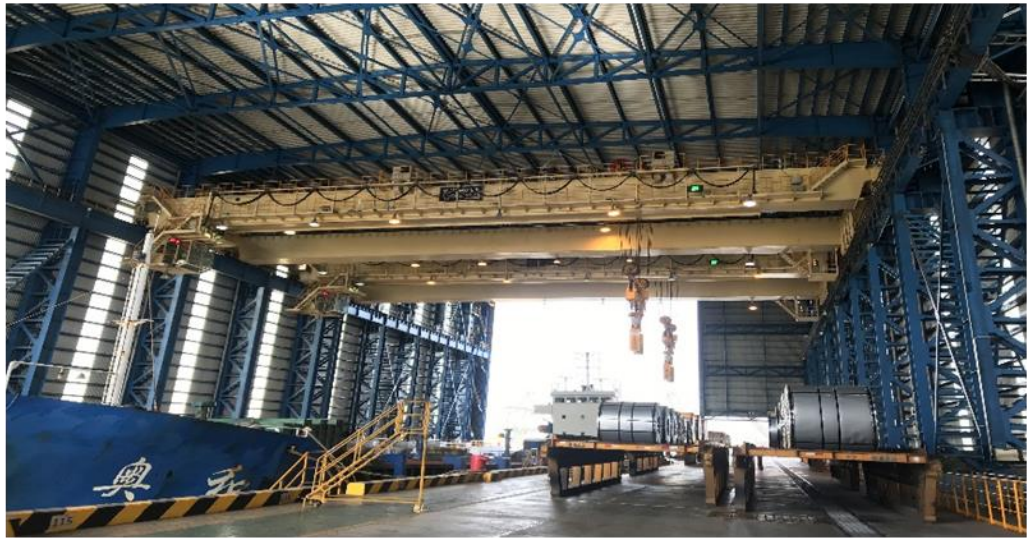

邯钢集团
复兴路
配件经销处
彭家寨
信用社
乐天庄
金海岸
大酒店
复兴路
邯郸钢铁集团
有限责任公司

Case study: Intelligent wharf



Baosteel Zhanjiang had its intelligent wharf operational in September 2019.

It performs intelligent functions against all weathers – driver-less port machinery, machine vision and perception, boathouse's intelligent management and dynamic efficiency analysis.

The intelligent demo wharf has transformed conventional wharf operations to safer, more stable and more efficient, and labour-reduced levels.

Benefit from labour reduction

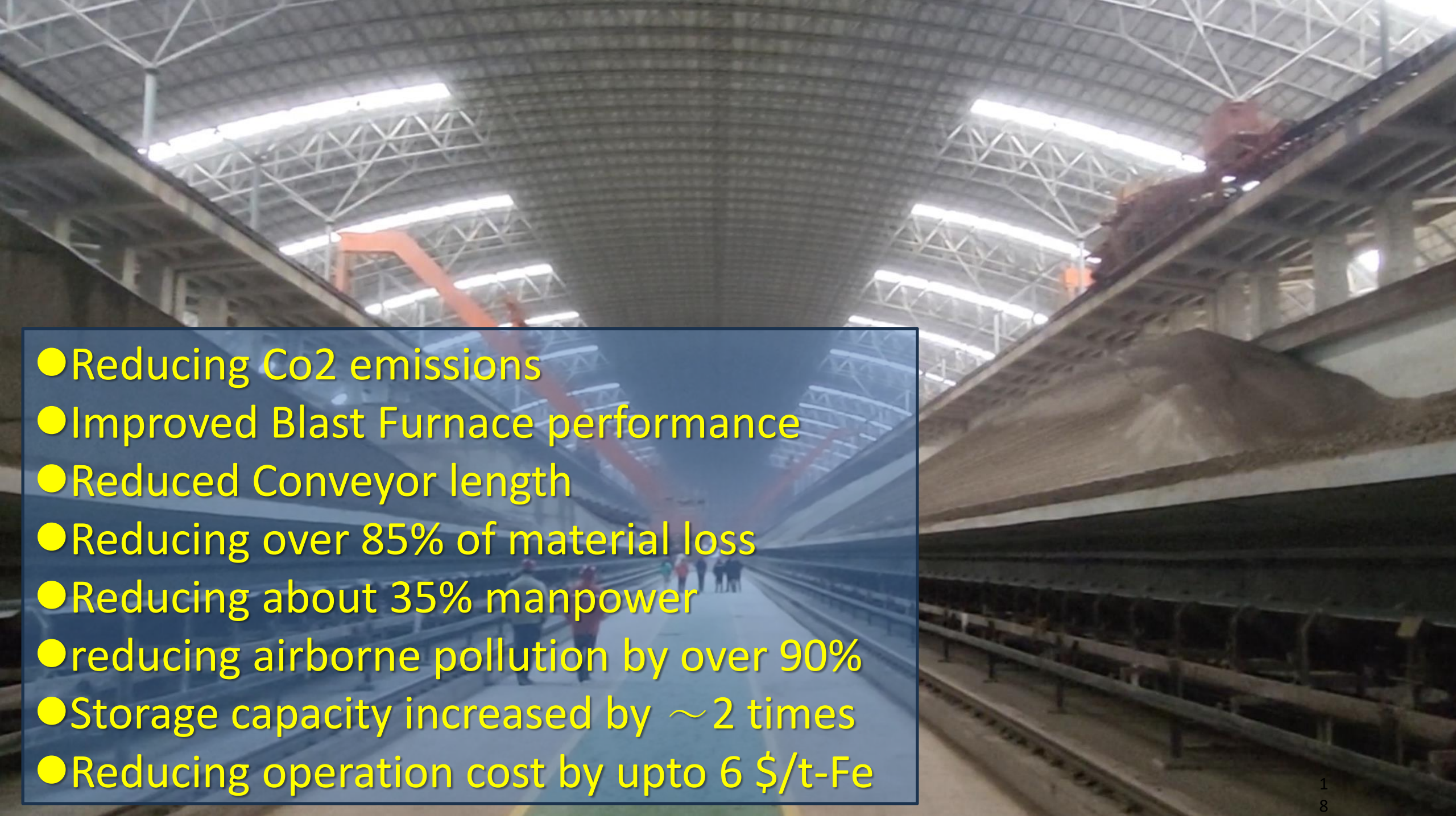
- Over 70% of the workers are not required at the wharf area (28 workers reduced).
- Manmade mistakes and arbitrary orders are eradicated.

Operation efficiency

- Boathouse's operation efficiency has been increased by 10%.
- The lifting well matches the transport, reducing overhead crane's idle time.
- Piling positions are automatically calculated and recommended, resulting in a higher cabin storage efficiency.

Safer conditions for human, machine and materials

- At the wharf has no labour working, creating intrinsic safety onsite.
- There is no manmade material loss or equipment scratch.
- The entire wharf becomes visible, making it 90% safer.



- Reducing Co2 emissions
- Improved Blast Furnace performance
- Reduced Conveyor length
- Reducing over 85% of material loss
- Reducing about 35% manpower
- reducing airborne pollution by over 90%
- Storage capacity increased by ～2 times
- Reducing operation cost by upto 6 $/t-Fe

- **Raw Material management.**
- **Optimizing and controlling the raw material gives a significant improvement in blast furnace efficiency and consequently reduction in Co2 emissions. In our later presentation we will show our latest low carbon BF technology**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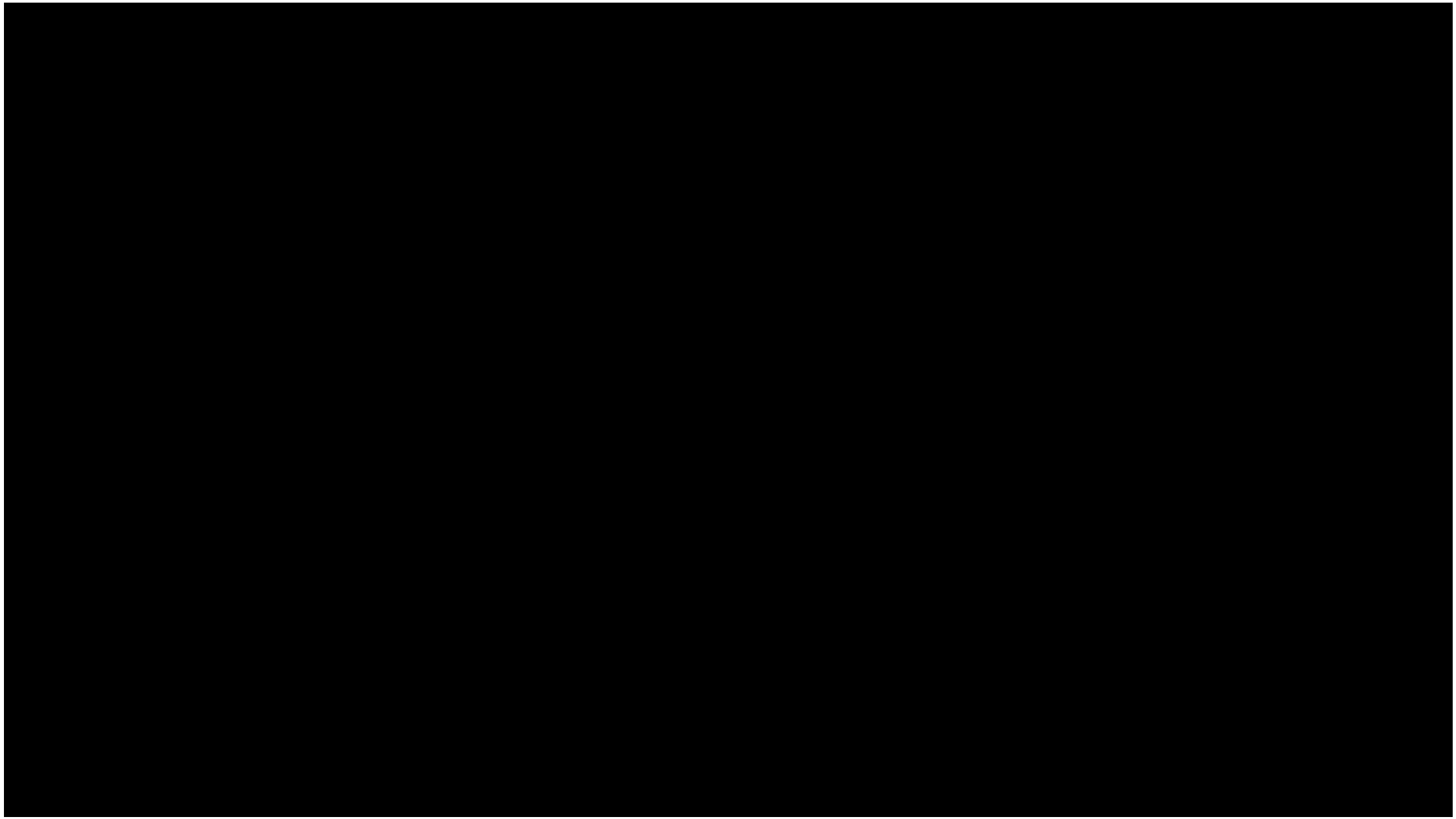
… Revolution of hot metal transport



iSmartOne Case Study - Statistics & Benefit Overview

$4.2~6.7 million

COMPREHENSIVE ECONOMIC BENEFIT

$900,000

ANUAL SAVING OF LABOR COST

70%

STAFF OPTIMIZATION

$3~5 million

ENERGY SAVE

10~20℃ TEMP. DROP DECREASE

4.3 Increase

FROM 3.8 TPC TURNOVER RATE

0.6-1% Co2

Reduction

reduced Energy drop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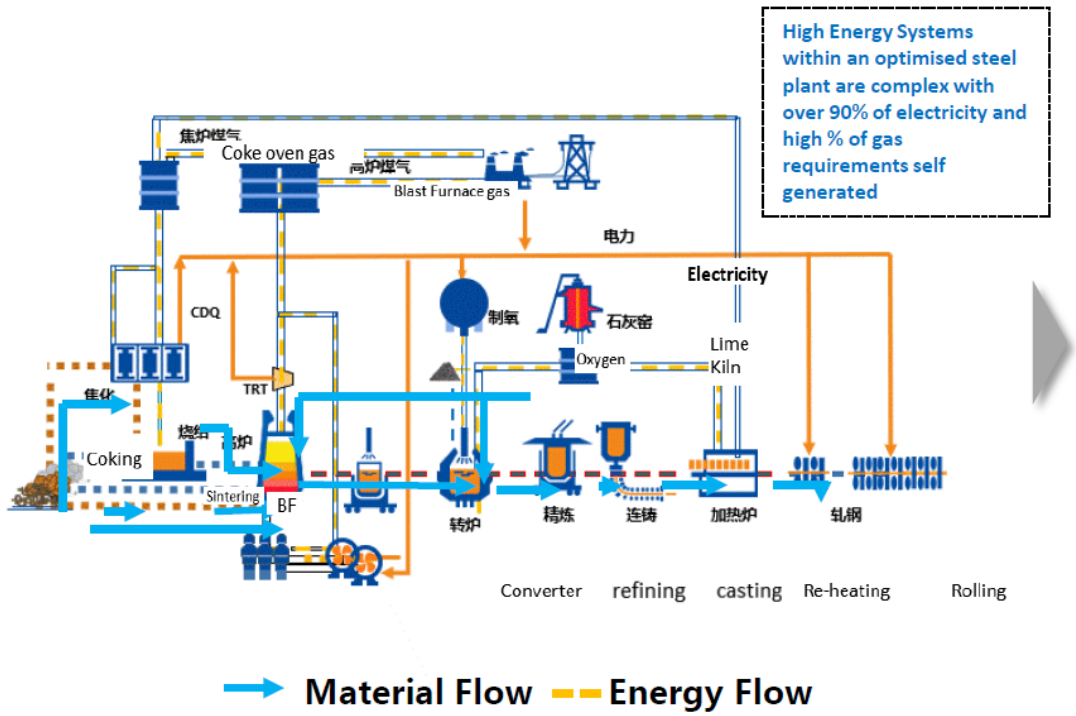
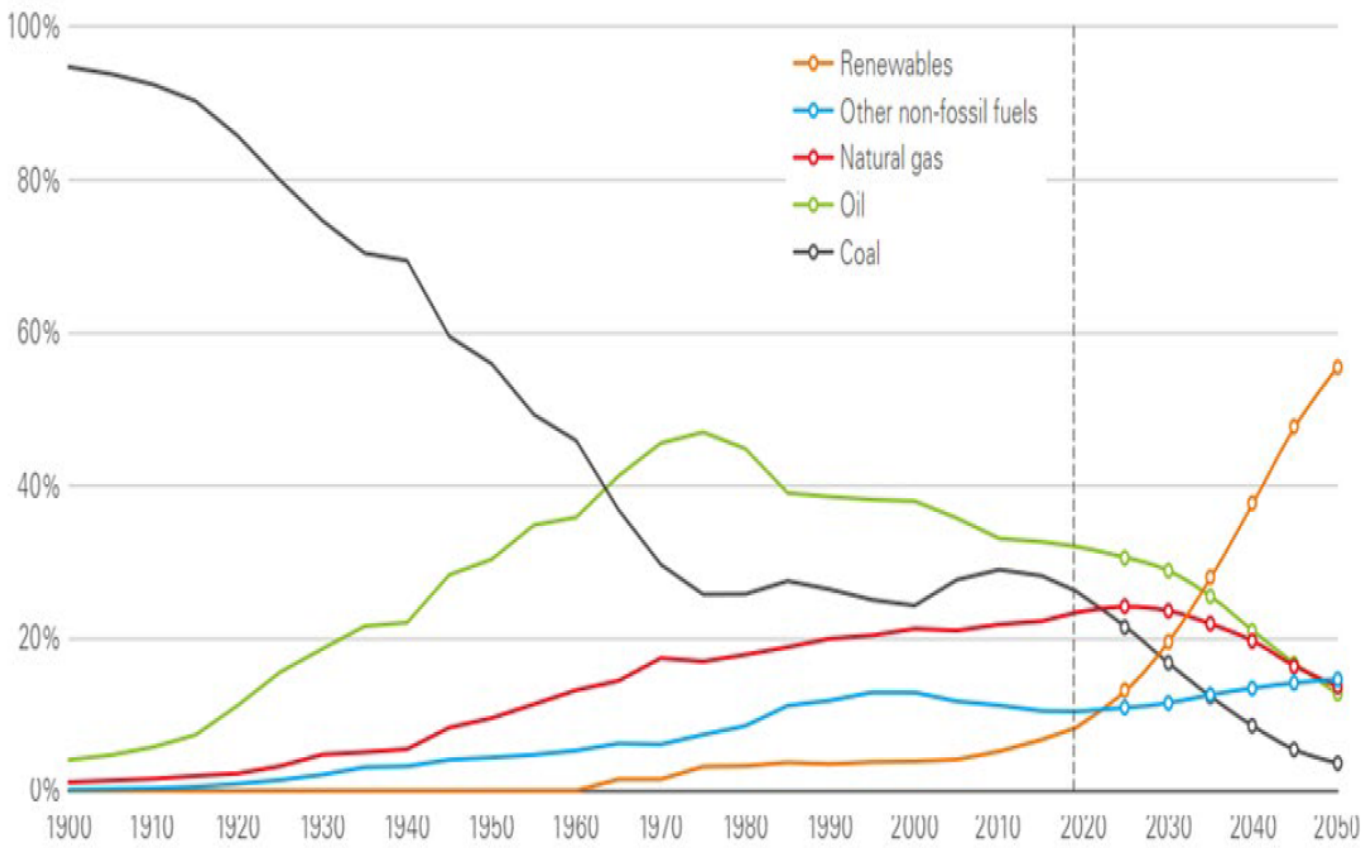
… Availability of renewable Energy

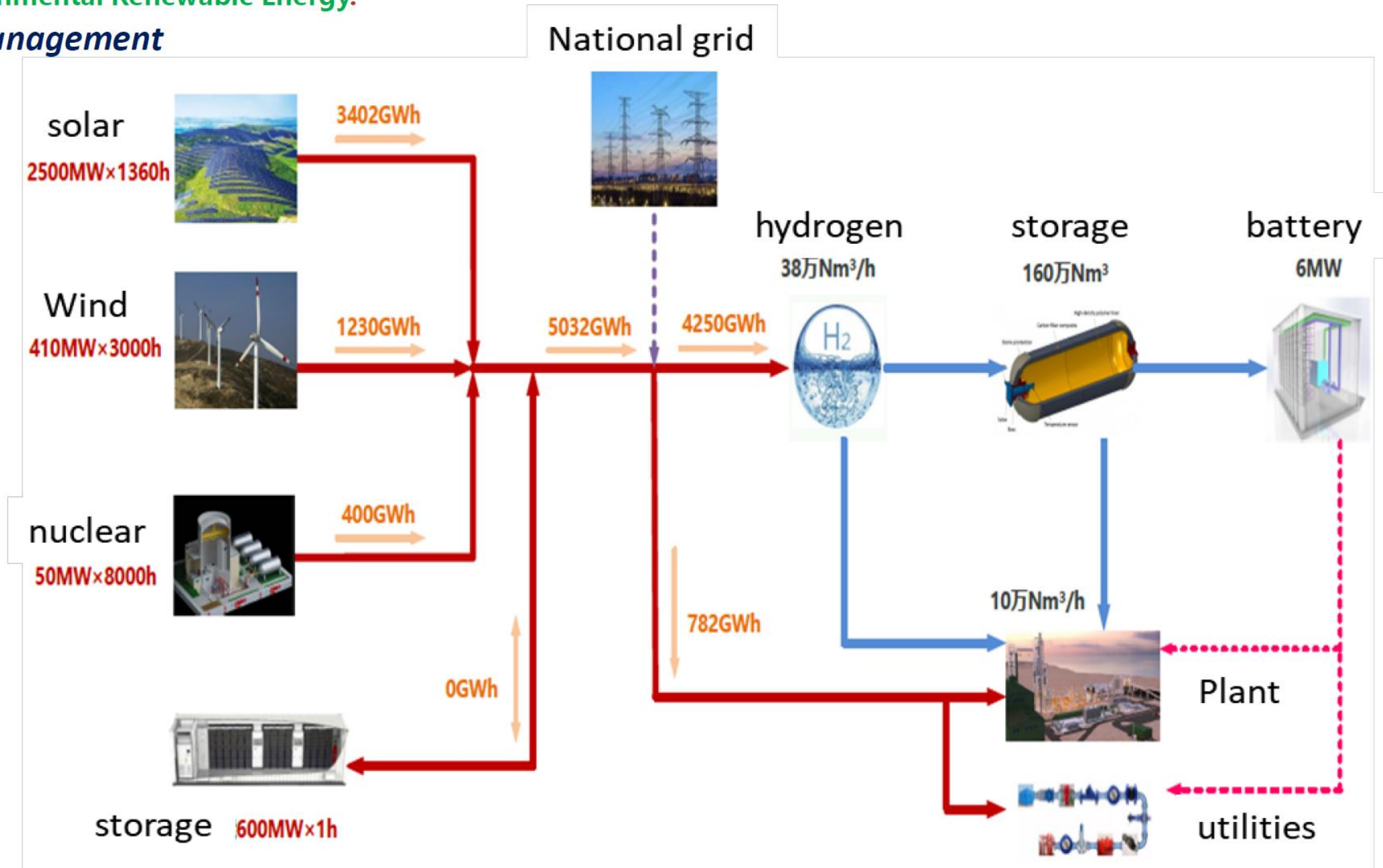
Steel production process is sophisticated and difficult to control.





Shares of Energy Sources in Energy Transition and Their Forecasts*

Energy Management



Let's be clever about Carbon... solar power

We need to consider the external GHG emissions coming from our power requirements. Use of renewable energy and recovered energy is a fundamental part of reaching carbon neutrality.

- 80MW PV power station in Sartu District, Daqing (swampland, -40℃)
- PV Power Station in Guangxi (Mountain area)
- PV Power Base in Weining, Guizhao
- 10MW PV power station in Damxung County, Tibet (4700m above sea level, the highest one in the world)
- 30MW PV power plant in Qamdo, Tibet (4200m above sea level)
- 47MW PV power plant for Zhanjiang Steel (Phase II) (Roof + Ground + Water top, Typhoon of Level 18)
- 100MW PV power plant in Dongying (typhoon of Level 15)

… Availability of renewable Energy

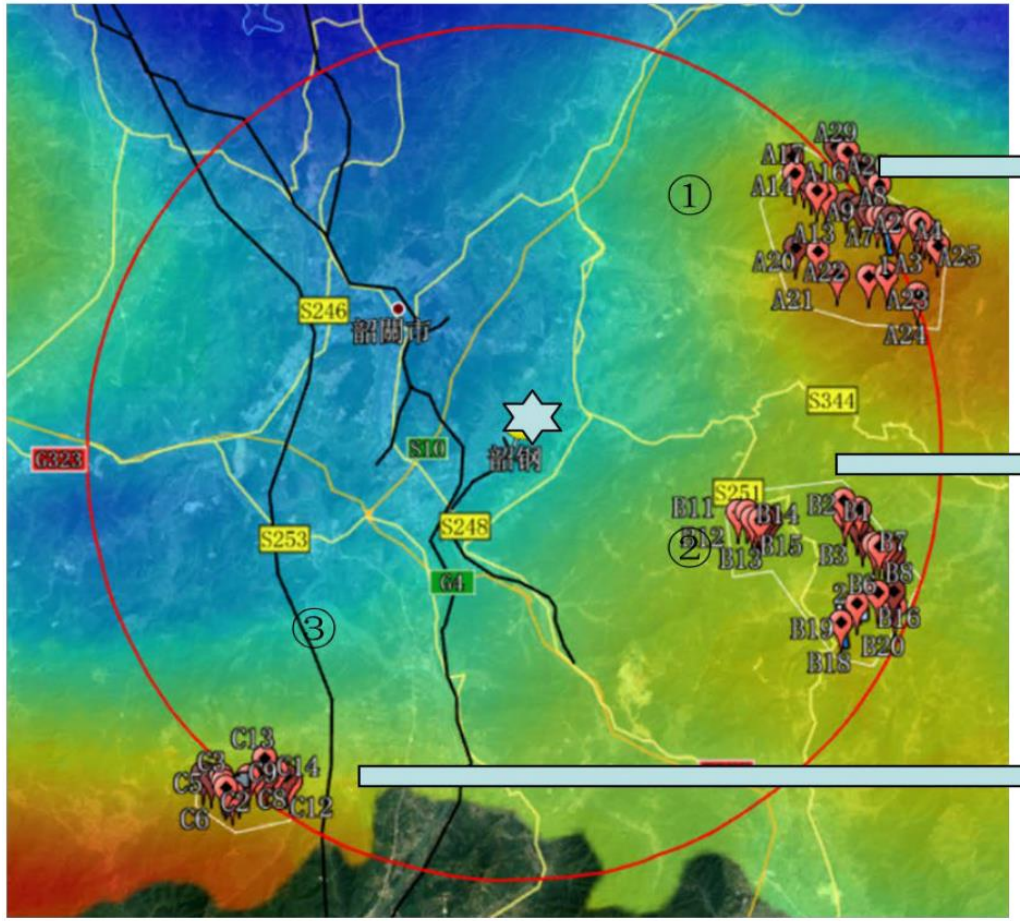
The shed roof of Baosteel raw material yard are equipped with PHOTOVOLTAIC power generation, and the C-type material yard has been connected to the grid for power generation. P1~P3 sheds roof pv has been installed, but has not been put into use. The C1 greenhouse photovoltaic project is the first power generation project, which is incorporated into the 380V power grid, so it is mainly used for the lighting of the material yard. Judging from the consumption amount, there is surplus electricity, so the subsequent projects are incorporated into the 10KV power grid of sintering unit for the use of the whole plant. The installed pv capacity of C1 is 2.4 MW and the annual power generation is ~2 million KWH.

Plant	Closed Aera (m^2)	Power Generation (KWH/a)
Baosteel-C1	44,092	2.0
ISDEMIR	421,500	19.1

... Availability of renewable Energy

Typical case | Shaogang Songshan 211MW wind power

According to the simulation and analysis of wind resource conditions around Shaogang Steel, it is planned to add three regional wind power generation projects, with a total installed capacity of 211MW, a total investment of 1.6 billion, an average annual power generation of 479 million kWh, an average annual carbon emission reduction of 306,000 tons, carbon reduction accounting for 2.07%, a full investment IRR of 12.05%, and a recovery period of 7.07 years 。



Located near the tea garden village of Wanfeng Town, Qujiang District, the height of the 100m wheel hub is ≥ 5.45m/s, the wind power density is ≥ 155W/㎡, and the main wind direction and main wind energy direction are NE and SSW; It is proposed to select 30 machine slots, with a single capacity of 3.2MW, and the planned capacity of wind farms is about 96MW, with an average annual power generation capacity of 227 million kWh。

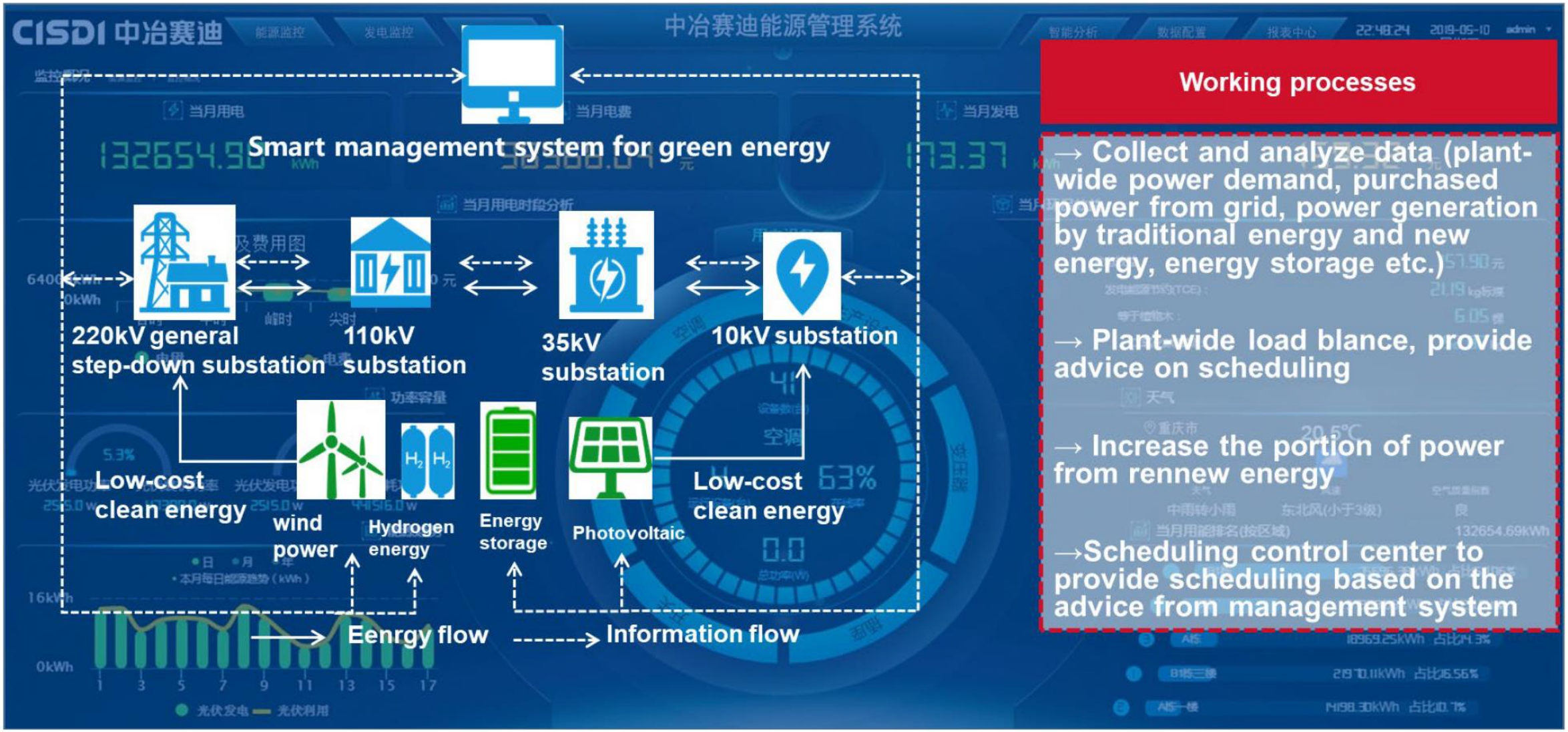
Located in Xiaokeng Town, Qujiang District, He Shuping, Xiaokeng Town/ Wengyuan County, Xinwang Town, Dashuikeng, YaziShan, Youxi Village, 100m wheel height wind speed ≥ 5.15m/s, wind power density ≥ 145W/㎡, the main wind direction and main wind energy direction are NNE, NE, SSW; It is proposed to select 22 machine slots, with a single capacity of 3.2MW, and a planned capacity of about 70MW of wind farms, with an average annual power generation capacity of 145 million kWh。

Located near Renpokeng and Houshan Village, Qujiangzhang Town, the 100m wheel hub has a wind speed of ≥5.5m/s, the wind power density ≥ 170W/㎡, and the main wind direction and main wind energy direction are NNE, N, N, SSW; It is proposed to select 14 machine slots, with a single unit capacity of 3.2MW, and a wind farm planning capacity of about 45MW, with an average annual power generation capacity of 107 million kWh.

CISDI CLEVER CARBON

… Control of renewable Energy

The CISDI Energy Control platform where the key parameters and operation information of all elements in the power grid are collected to optimize the grid performance.

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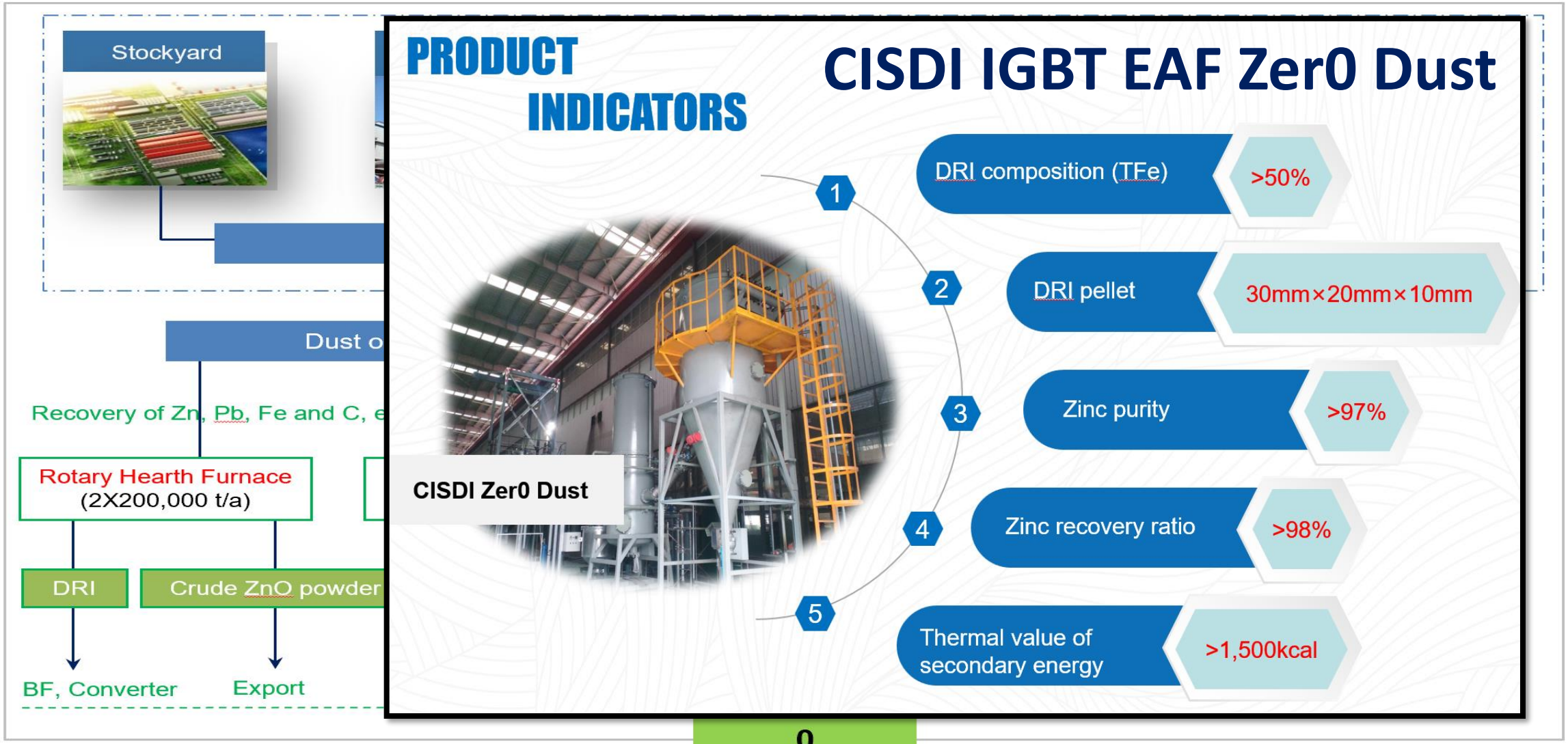
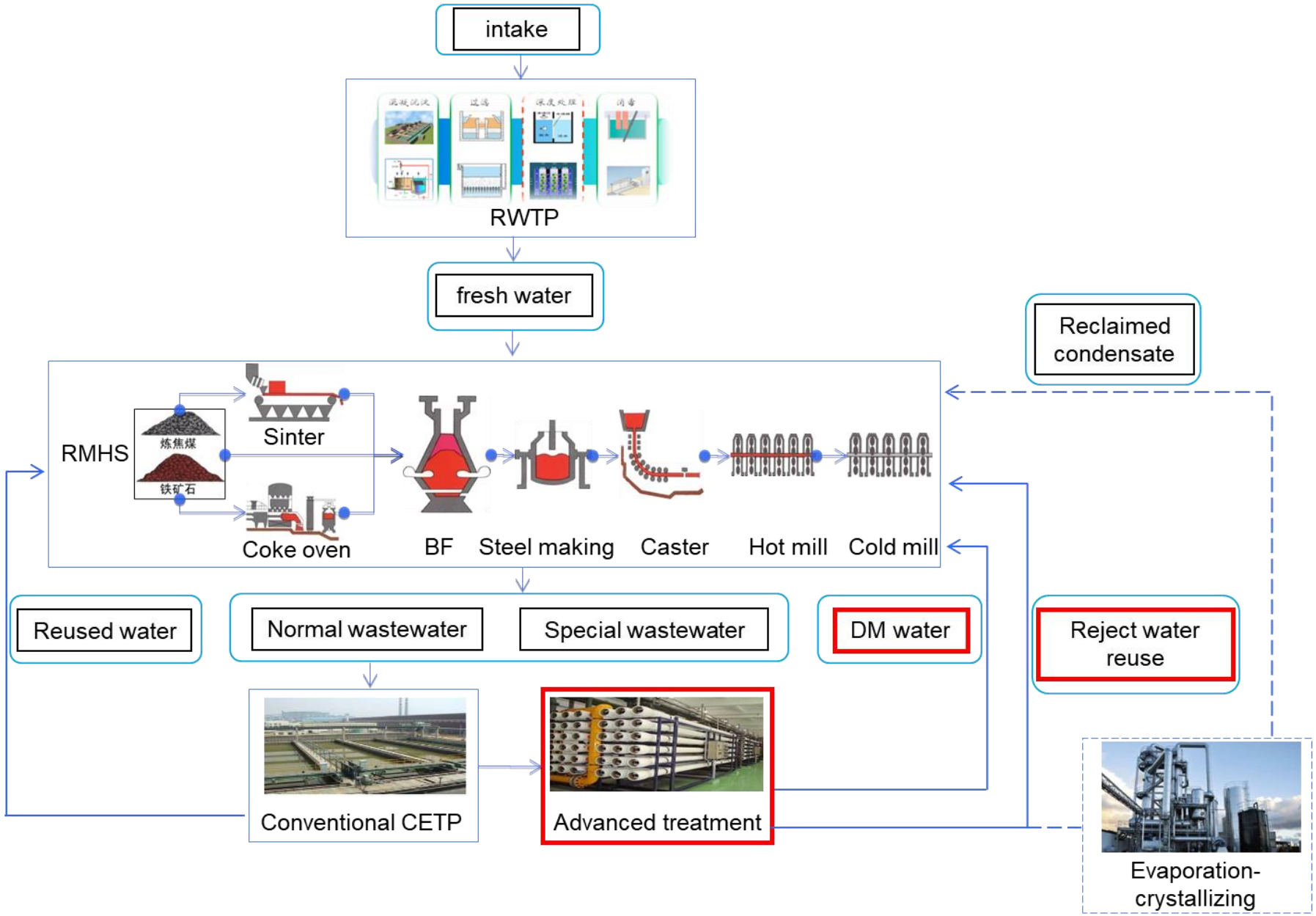
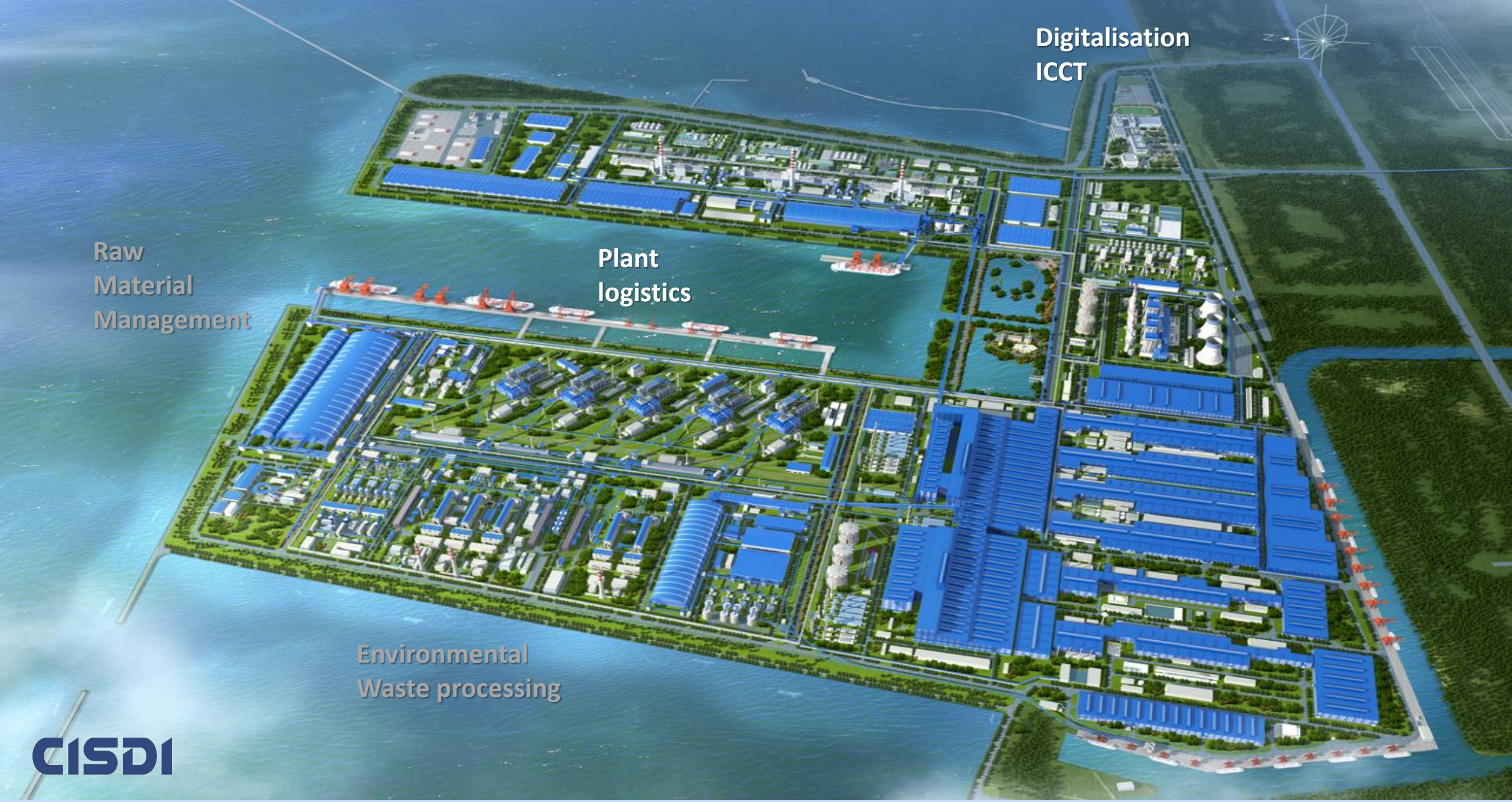

Stockyard
Dust o
Recovery of Zn, Pb, Fe and C, e
Rotary Hearth Furnace
(2X200,000 t/a)
DRI
Crude ZnO powder
BF, Converter
Export
PRODUCT INDICATORS
CISDI IGBT EAF Zer0 Dust
CISDI Zer0 Dust
1
DRI composition (TFe)
>50%
2
DRI pellet
30mm×20mm×10mm
3
Zinc purity
>97%
4
Zinc recovery ratio
>98%
5
Thermal value of secondary energy
>1,500kcal
0
discharge

… recycling waste - Zer0 Liquid

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CISDI CLEVER CARBON – Monitoring and Control

CISDI CLEVER CARBON – Monitoring and Control

- **Wuhan Steel**

- **Panzhihua steel**

- **Rongcheng steel**

- **Nanjing Steel**

- **Yongfeng Steel**

- **Zhongtian steel**

CISDI CLEVER CARBON – Monitoring and Control

Over 2000 modules monitor and control the whole plant optimizing the production efficiency of the plant day by day

In terms of Co2 between 300 – 500 kg/t of Co2 have been seen in the plants

Safety and Humanities

People oriented theory: simple, safe, comfortable and efficient to meet the yearning of iron and steel employees for a better life.

Production Cost and Efficiency

Since 2019, the production index has been significantly optimized compared with that in 2018, and the annual income benefit is expected to reach £22.6 M .

Organization and Management Efficiency

It has completely innovated the organization mode of iron and steel production, changed the current situation of the iron and steel industry, and improved labor production efficiency by nearly 40%.

Production Environment

More than **40** central control rooms

More than **400** employees

Withdraw from major dangerous areas

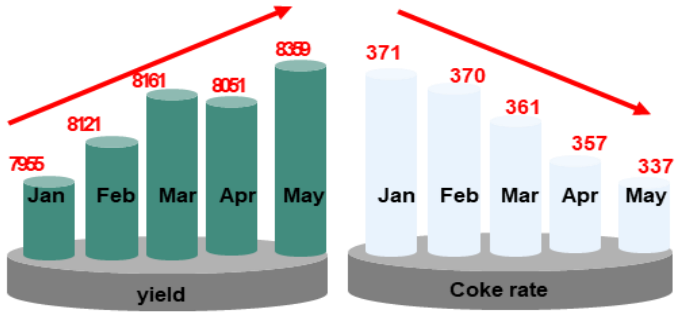
Long distance and large-scale centralized control over 5km

Integrated Management and Control of Iron District

Cost per ton of iron ↓ **£3.06**

Income(2019) **£22.6 million**

100 thousands points big data analysis and diagnosis



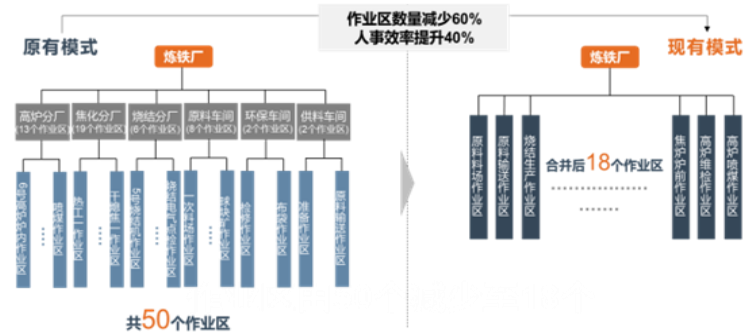
Organizational Change and Synergy

Number of work areas ↓ **60%**

Personnel efficiency ↑ **40%**

Organization: flat and specialization

Borderless collaboration of multi discipline and multi process



CISDI has been always devoted in Low-carbon tech development and created mature and innovative carbon reduction technologies and equipment

together we can be clever about Carbon