



中国节能

CHINA ENERGY CONSERVATION AND
ENVIRONMENTAL PROTECTION GROUP

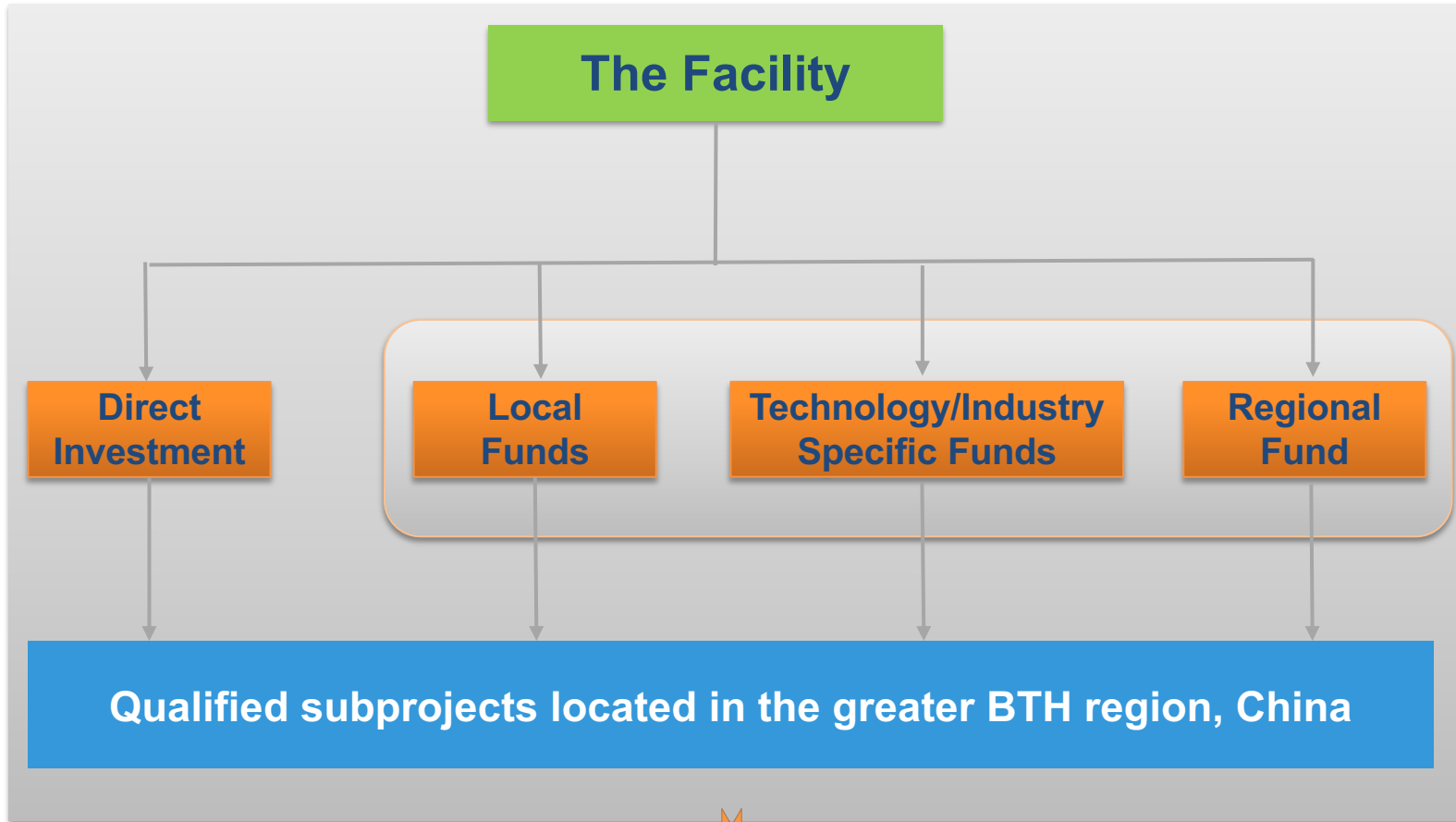
Decarbonization through Fund Investments Adopting High Technologies including CCUS



聚合点滴 创生无限 Going Green, Investing Green

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Fund Overview



provide loan
EUR **428** mn

EA - CECEP
a leading enterprise in clean energy, environmental protection & energy conservation in China

- mobilize investments from local governments, industries and institutional investors

- comply with ADB's SPS & ESMS requirements
- meet fund's investment criteria

Deploy high-level technologies to support air quality improvement & decarbonization



Funds Established

4 funds, total scale CNY **5** billion
innovative use of FIL to establish fund financing mechanism

Subprojects Invested

19 subprojects, CNY **3.6** billion financing from funds
leveraging investments of CNY **26** billion from co-financing



Areas Focused

- residual heat utilization
- integrated waste treatment and utilization
- industrial by-product hydrogen and flue-gas waste heat utilization
- large-scale use of graphene heaters
- treatment of VOCs and fugitive emissions
- new-energy vehicles, PV power generation, green building, etc.

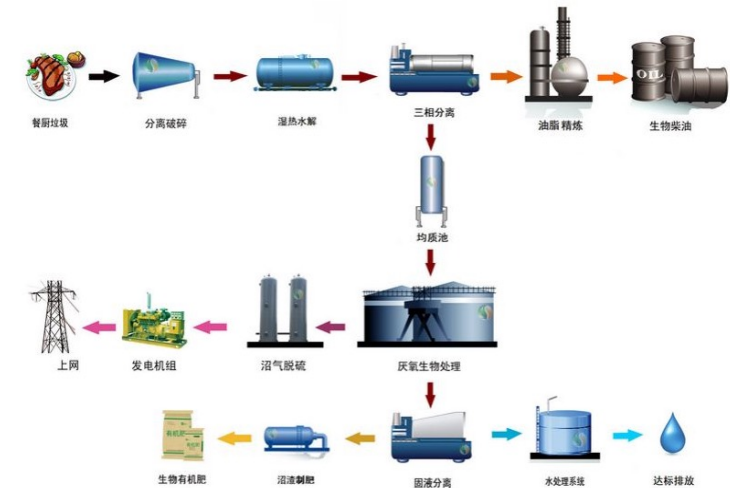


Environmental Benefits

save standard coal **1.04** million tons, provide clean heating **30.02** million square meters, reduce CO₂ **2.1** million tons, SO₂ 18,100 tons, NO_x 6,200 tons and PM 1.2 million tons annually

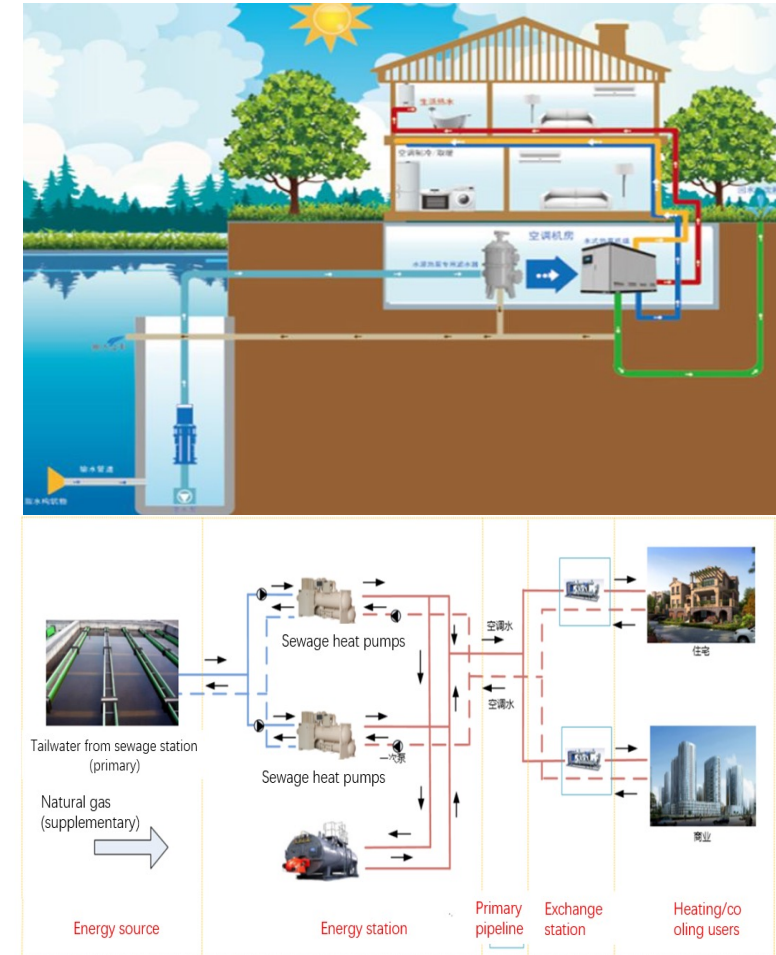
Integrated Waste Treatment & Utilization

Location	Tianjin City, China
Financing from Fund	CNY 290 million
Low Carbon Technology Featured	<ul style="list-style-type: none"> • construction of a waste and furnace slag comprehensive reutilization facility/plant, an organic waste treatment facility/plant and a biogas power plant • collected wastes are converted into biogas and other reusable materials • reduce the pollution and emission as well as promote the circular economy at different levels
Environmental Benefits	annual emissions of CO ₂ , SO ₂ , PM, NO _x and CO were reduced by 16,000 tons, 2.7 tons, 1.5 tons, 67.74 tons and 33.94 tons respectively



Sample Subprojects

Sewage Heat Pump Heating/Cooling	
Location	Shandong Province, China
Financing from Fund	CNY 50 million
Low Carbon Technology Featured	<ul style="list-style-type: none"> thermal energy is recovered from treated sewage for district heating and cooling, by utilizing temperature differences between wastewater and environment providing heating and cooling services for public and residential buildings with a area of 1.8 million square meters
Environmental Benefits	saving 5,586 tons of standard coal per year; 13,927 tons of CO ₂ , 92 tons of SO ₂ , 54 tons of PM and 87 tons of NOx emissions were reduced respectively



Sample Subprojects

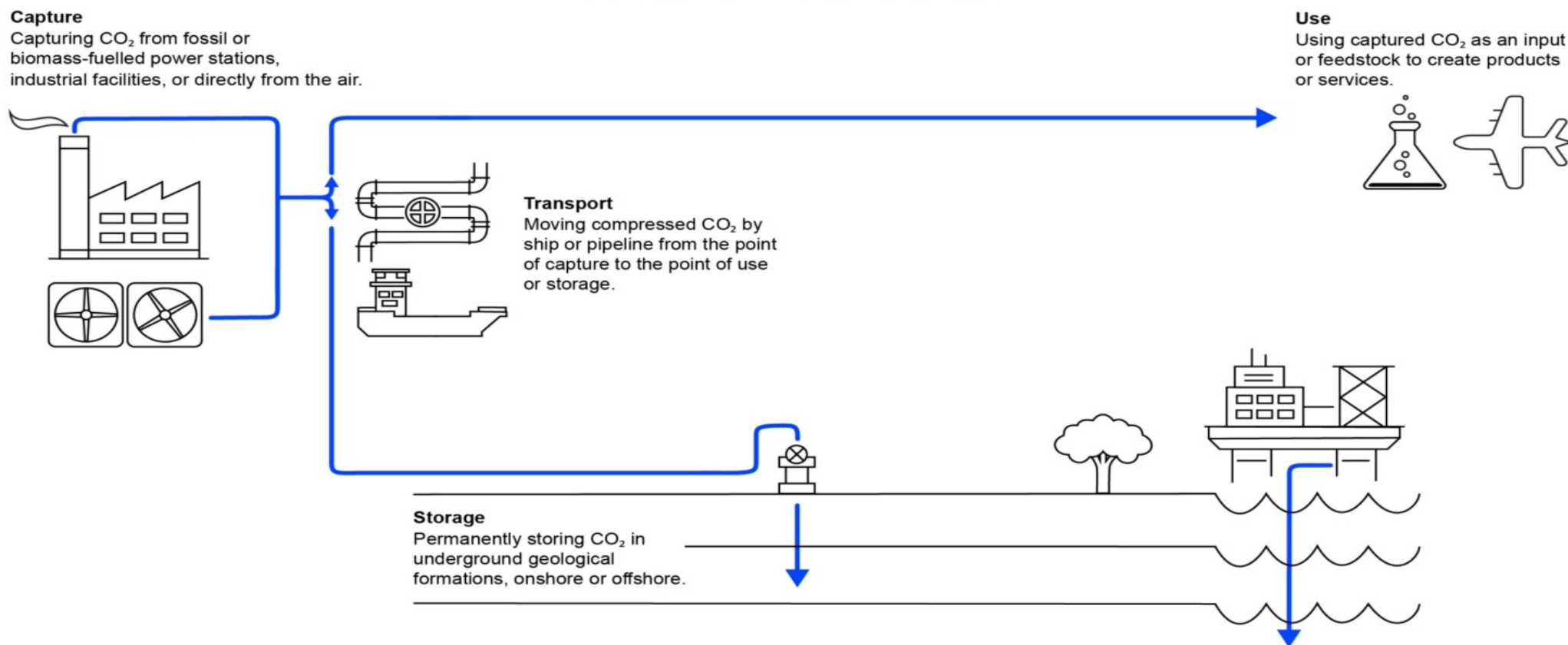
Energy Saving, Emission Reduction and Utilization of Waste Heat and Hydrogen in a Chemical Industry Park

Location	Tianjin City, China
Financing from Fund	CNY 400 million
Low Carbon Technology Featured	<ul style="list-style-type: none">• international leading electrolyzer energy efficiency technology to save energy, and wastewater and gas treatment system to replace the traditional incineration of waste gas and treatment of high concentration wastewater• VOCs are collected from the tail gas and treated within specific tank fields• reutilize waste heat and by-product hydrogen to replace natural gas consumption
Environmental Benefits	saving 224,000 tons of standard coal per year; reduce 24 tons of PM, 214 tons of NOx and 7,008 tons of VOCs emissions respectively



CCUS - a suite of technologies that involves the **capture, transport, use and storage** of **CO₂**

Schematic of the CCUS value chain

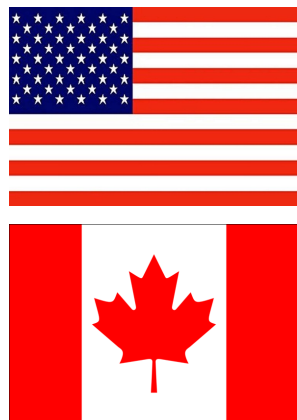




Global

Facilities and Trends

- ◆ 196 projects in the CCS facilities pipeline
- ◆ 244 million capture capacity in development
- ◆ 44% growth in the number of CCS facilities over the past 12 months
- ◆ 34% compound growth rate per annum of the capture capacity since 2017



- US - 34 new projects since 2021
- Canada - 19
- UK - 13
- Norway - 8
- Australia, Netherlands and Iceland - 6 each



CCUS Industry at a Glance

Global

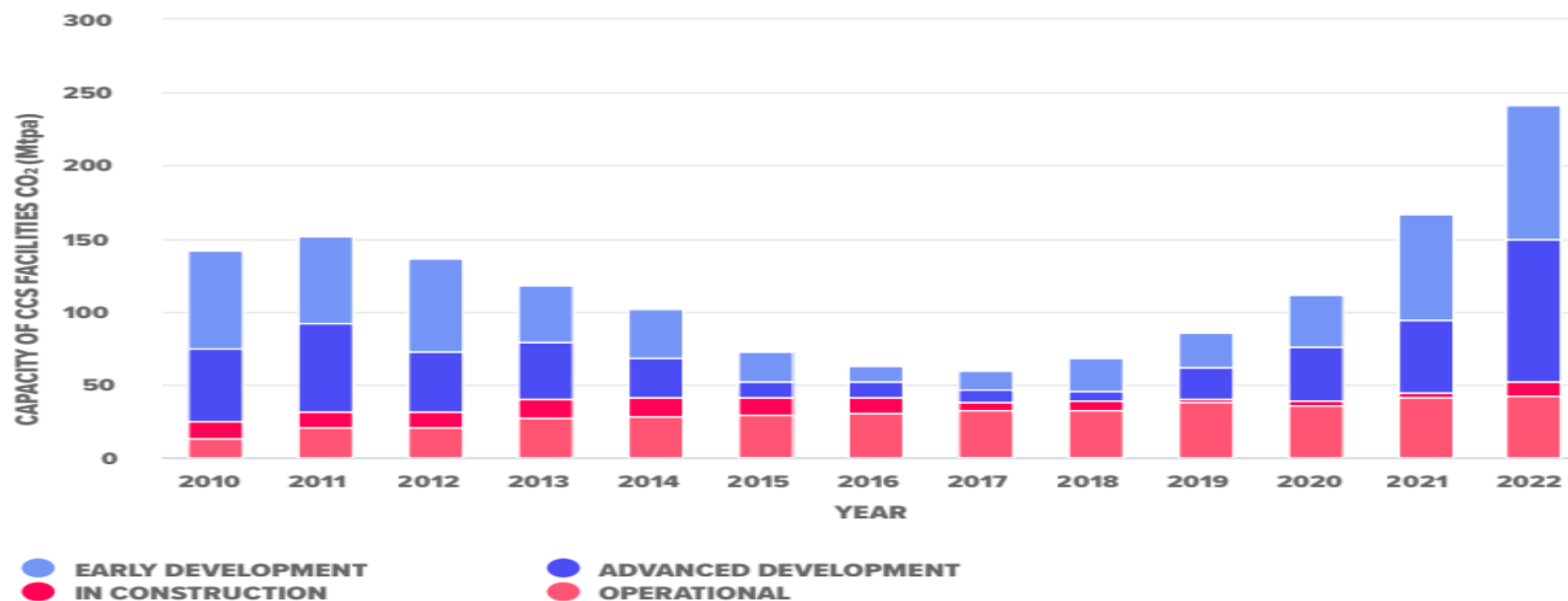


Figure: Pipeline of commercial facilities since 2010 by capture capacity(Mtpa)

	Operational	In construction	Advanced development	Early development	Operation suspended	Total
Number of Facilities	30	11	78	75	2	196
Capture Capacity (Mtpa)	42.5	9.6	97.6	91.8	2.3	244

Table: Commercial CCS facilities by number and total CO₂ capture capacity(mid-September 2022)

CCUS in China-Development

China's CCUS projects started in 2003

- mostly small-scale demonstration projects in petroleum, coal chemical, electric power industry
- Shengli CCUS in 2022 marks China's CCUS entered commercial operation stage

Outstanding New Projects

Facility	Country	Status	Operation Date	Industry	Capture Capacity (Mtpa CO ₂)	Utilization	Significance
SINOPEC QILU-SHENGLI CCUS	China	Operational	Aug 2022	Chemical Production	1	Enhanced Oil Recovery	China's 1st integrated million ton (1 Mtpa) CCUS
CNOOC SOUTH CHINA SEA CCS	China	In Construction	Predicated in 2023	Natural Gas Processing	0.3	Enhanced Oil Recovery	China's 1st CO₂ offshore storage
HUANENG LONGDONG BASE CCS	China	Advanced Development	Predicated in 2023	Power Generation	1.5	Dedicated Geological Storage	Expected to be the world's largest coal power CCUS project

CCUS in China-Policies

In 2020, China announced its **30/60 climate policy** framework

- achieving **carbon peaking by 2030** and **carbon neutrality before 2060**
- 1+N framework lays the groundwork for CCUS policy directions

in 2021, The central bank launched a **carbon emissions reduction facility**

- structural **monetary policy instrument** with low-cost loans to support decarbonization projects including CCUS

China's big climate goals



By 2025
Lower carbon intensity



By 2030
Peak carbon



By 2060
Carbon neutrality

CCUS in China-Demand Potential

CCUS may account for reductions by **2050: 0.6-1.45** billion tons of CO₂ per annum, including **0.05-0.07** billion from **iron and steel** by **2060: 1-1.82** billion tons per annum, of which **0.09-0.11** billion from **iron and steel**

Steel industry is facing rising pressure to reduce carbon footprint, **CCUS will play a critical role** in the transformation of steel industry

Year	2025	2030	2035	2040	2050	2060
Coal	0.06	0.2	0.5-1	2-5	2-5	2-5
Gas	0.01	0.05	0.2-1	0.2-1	0.2-1	0.2-1
Iron & Steel	0.01	0.02-0.05	0.1-0.2	0.2-0.3	0.5-0.7	0.9-1.1
Cement	0.001-0.17	0.1-1.52	0.2-0.8	0.3-1.5	0.8-1.8	1.9-2.1
BECCS	0.005	0.01	0.18	0.8-1	2-5	3-6
DACCS	0	0	0.01	0.15	0.5-1	2-3
Petro-chemical & chemical	0.05	0.5	0.3	0	0	0
Total in China	0.09-0.3	0.2-4.08	1.19-8.5	3.7-13	6-14.5	10-18.2

China CCUS CO₂ emission reduction demand potential by industry from 2025 to 2060 (100million tons per year)

Brief Description

Promote CCUS decarbonization technology in the highly polluted steel industry



demonstration project covering whole CCUS value chain including capture, transportation, storage & utilization

- located in northern China
- built by one of China's major steel manufacturer
- expected to start operation by end 2025
- first phase of the project captures **0.5 million** tons of CO₂ every year



Capture

The CCUS project capture CO₂ from **Maerz Lime Kiln Flue Gas**

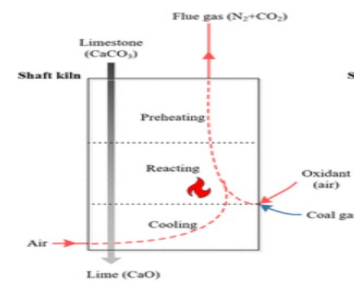
Capture Technology - **Amine-based Chemistry System**

Lime

- an important raw material for producing iron and steel
- obtained by thermal decomposition of limestone into quicklime and carbon dioxide in Maerz Lime Kiln

Two kinds of CO₂ emissions during lime production:

- CO₂ from limestone decomposition
- CO₂ from fuel combustion.



Chemical absorption system

- capture CO₂ in flue gas from Maerz Lime Kiln, capture rate 92%

Alcohol amine

- as a CO₂ absorbent and react with CO₂ in the flue gas to form a weakly bonded compound which is further broken down by heat and produce a concentrated CO₂ stream

The desorbed product(CO₂) is compressed and dried to a supercritical condition and sent to storage, transport and utilize

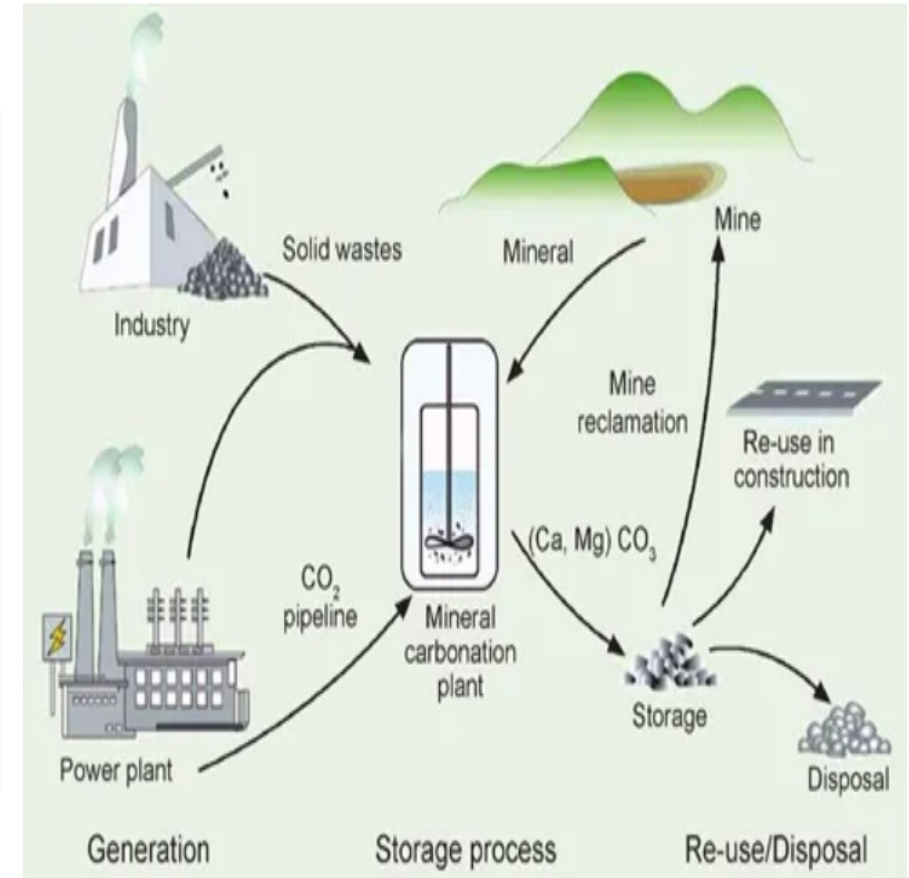


Utilization-CO₂ Mineralization

How to deal with steel slag & CO₂ has been a difficulty for iron and steel makers

CO₂ mineralization(CM) provides a solution and doubles emission reduction benefits

- use CO₂ and steel slag for chemical reactions to **generate new compounds** such as calcium carbonate and magnesium carbonate
- the compounds could be widely used in **plastics, paper, paint, rubber and steel** making process



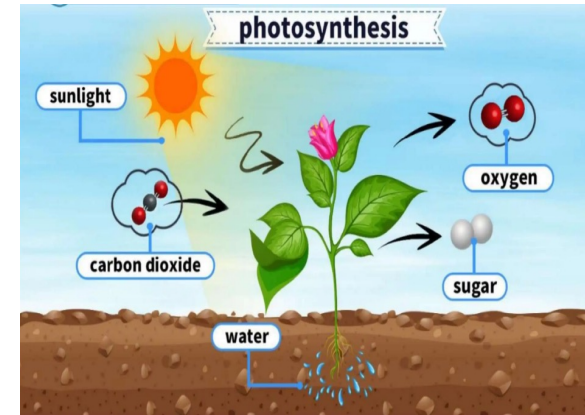
Utilization-CO₂ Fertilization in Agriculture

CO₂ fertilization could enhance photosynthesis, proved highly efficient in greenhouse agriculture

cultivate vegetables out of season, such as the cultivation of grapes and strawberry

When CO₂ concentration increased to 1000-1300 ppm:

- production increase **25-50%** for fruits and vegetables, **60%** for leafy vegetables
- disease incidence rate reduce **40%**, use of pesticides decrease **40-50%**
- organic nutrients increase **15-25%**, improves the quality and taste



CCUS Technologies Adopted

Utilization-CO₂ Fertilization in Agriculture

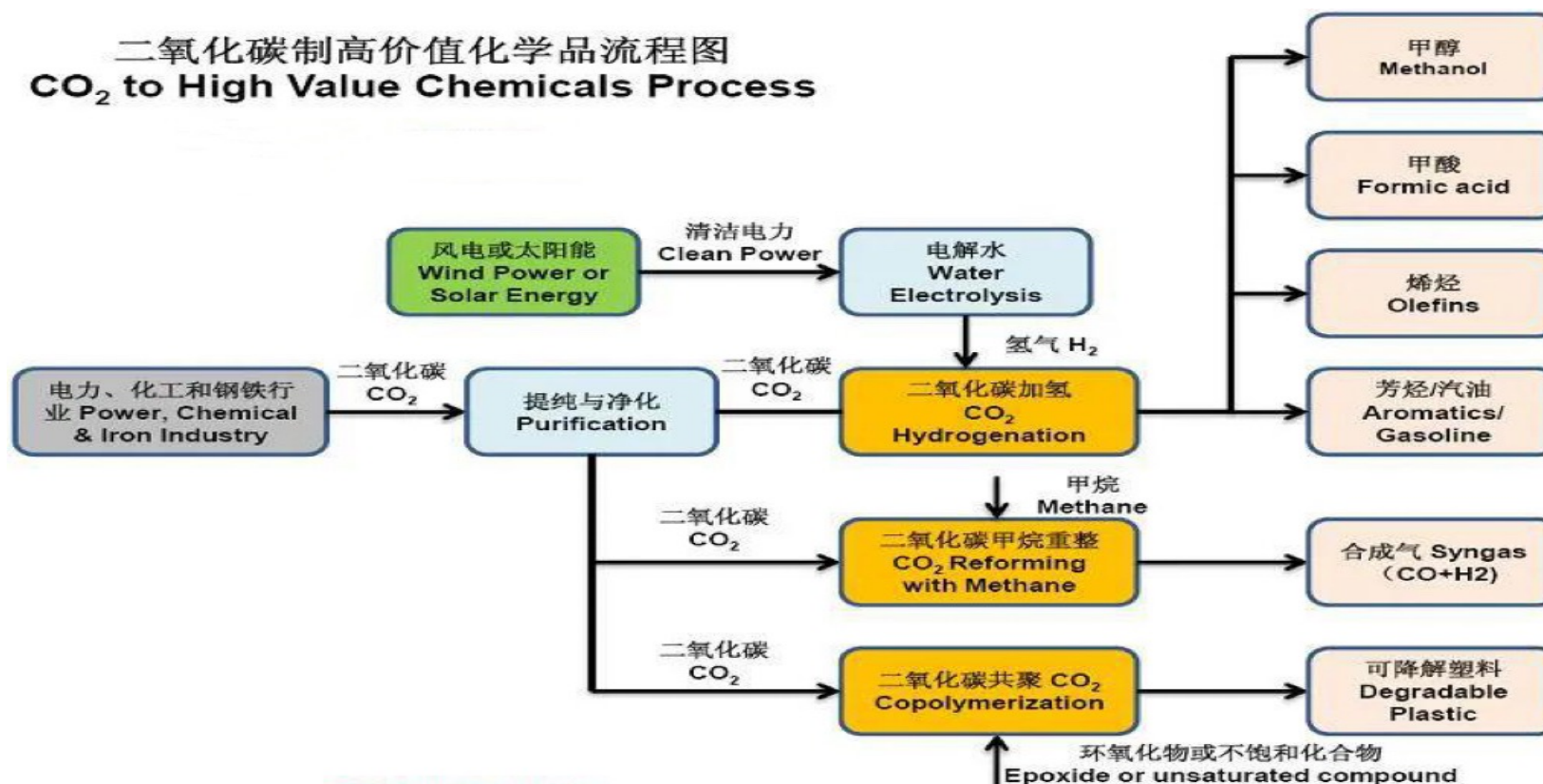
The project is actively cooperating with local agricultural department to develop ecological agriculture bases



Utilization-CO₂ Chemical Utilization

The project is cooperating with universities to develop methods producing chemicals, including use CO₂ to manufacture **methanol, synthesis gas and sodium carbonate.**

二氧化碳制高价值化学品流程图
CO₂ to High Value Chemicals Process



来源：亚化咨询《中国CO₂利用技术与项目年度报告》

Sources: ASIACHEM <China CO₂ Utilization Technology and Project Annual Report>

The project will construct CO₂ capture and liquefaction plants, compression system, pipelines, circulating water station and purchase necessary facilities, etc.

ADB Category

Environmental B, Social C

Status

In Construction

Financing from Fund

CNY 200 million in 2023

Financial Indicators

Total investment cost: CNY 613 million
Operating revenue: CNY 276 million per year
Operating cost: CNY 234 million per year

Financially viable



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