EFC Industry Program Strategy (2020-2022)

This strategy was presented to EF China board in June 2020, and subjects to regular updates.
OUTLINE

01 Background: Challenges and Opportunities in China’s Industry Sector

02 Pathways for Achieving the well-below 2°C Goal

03 EFC’s Vision, Goals, and Initiatives
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   - Cement Sector
   - Petro-Chemicals Sector
   - Non-Ferrous Metals Sector
   - Cross-Cutting Issues
EFC’s Vision: Accelerate the deep decarbonization of China’s industry sector in support of achieving the well-below 2°C goal while tripling China’s total industrial value added by 2050

Conceptual Framework of the Strategy

Structural Transformation ➔ Demand Reduction ➔ EE Improvement ➔ Low-Carbon Energy

Assessment of Challenges and Opportunities ➔ Identification of Key Pathways

Identification of Key Industry Sectors

Iron and Steel
Cement
Petro-Chemicals and Chemicals
Non-Ferrous Metals

Analysis and Assessment: Measures & Tactics
Project Selection Criteria: Emission Reduction & Feasibility

EFC Goals ➔ EFC Initiatives ➔ Key Interventions
Potential Partners

EFC Initiatives

Identification of Key Interventions
Potential Partners
Opportunities in China’s Industry Sector

01 The Industry Sector is a Key Driver for China’s Economic and Social Development

02 China is Moving Fast towards High Quality Development

03 Strategic Emerging Industries are Gearing Up for China's High-Quality Development

04 Green Manufacturing System is One of China's Top Priorities

05 New IT Technologies Will Reinvent the Industry Sector

06 Restructuring of SOEs Promotes Efficiency and Competitiveness

07 China’s Roles in the Global Industry Production and Supply Chains are Irreplaceable in the Coming Decade
Opportunity 1: The Industry Sector is a Key Driver for China’s Economic and Social Development

- Share of GDP: 38%
- Share of Employment: 30%
- Share of Energy Consumption: 63%

Source: China Statistics Yearbook 2019
Opportunity 2: China is Moving Fast towards High Quality Development

- **Decreasing Share of GDP by 2nd Industry**
  - 40% → 21%

- **Increasing High Valued-Added Production**
  - 36% → 58%

Source: China Statistics Yearbook 2019 and ERI Estimations
Opportunity 3: Strategic Emerging Industries are Gearing Up For China’s High-Quality Development

The Value-Added of Strategic Emerging Industries will reach **RMB 43 Trillion** by 2050

China’s on-going efforts:
- 17 Sector Action Plans
- 60 National Projects

Source: China Statistics Yearbook 2019 and ERI Estimations
Opportunity 4: Green Manufacturing System is one of China’s Top Priorities

Less Pollutant Emissions, High Energy Efficiency, High Efficiency of Resources Recycling

<table>
<thead>
<tr>
<th>Green Plants</th>
<th>Green Industry Parks</th>
<th>Green Products</th>
<th>Green Supply Chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1402</td>
<td>119</td>
<td>1097</td>
<td>90</td>
</tr>
</tbody>
</table>

China’s progress up to 2020

Source: Ministry of Industry and Information Technology, 2019

Opportunity 5: New IT Technologies Will Reinvent the Industry Sector

The application of Big Data, AI, 5G, and IIOT will enhance efficiency and reduce costs significantly

<table>
<thead>
<tr>
<th>Company</th>
<th>Production efficiency</th>
<th>Operating cost</th>
<th>Energy efficiency</th>
<th>Defective Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yili Group</td>
<td>+20%</td>
<td>-20%</td>
<td>+10%</td>
<td>-20%</td>
</tr>
<tr>
<td>Changan Auto</td>
<td>N.A</td>
<td>-10%</td>
<td>+5%</td>
<td>-16%</td>
</tr>
<tr>
<td>Sungrow</td>
<td>+383.1%</td>
<td>-30%</td>
<td>N.A</td>
<td>N.A</td>
</tr>
<tr>
<td>Six intelligent steel manufacturing pilot projects of MIIT</td>
<td>+20%</td>
<td>-20%</td>
<td>+10%</td>
<td>-10%</td>
</tr>
</tbody>
</table>
Opportunity 6: Restructuring of SOEs Promotes Efficiency and Competitiveness

41 SOEs were merged into 21 since 2013

- 3-Year Action Plan of SOE Reform is under Development: Goals, Timetable, & Roadmap
- Mixed-Ownership Restructuring (MOR) will refocus government responsibility from the management of people, businesses, and assets to the management of capital.
- Anticipation of more fundamental changes to come, particularly in competitive industries where the government will be more willing to give up control
- SOE reform safeguards the balance and dynamic of the market economy, the efficient allocation of resources, and fair opportunities for private and foreign investors

Source: State-Owned Assets Supervision and Administration Commission (SASAC), 2019
Opportunity 7: China’s Roles in the Global Industrial Production and Supply Chain Are Irreplaceable in the Coming Decade

China’s Industry Value Added Increased ~4.8 Times From 2000 to 2016

- China
- USA
- Japan
- Germany
- Korea
- India
- France

Largest Share of Global Industry Value Added in 2017: 29%

Source: Forward-The Economist, [https://www.qianzhan.com/wenda/detail/181210-d4d2c29d.html](https://www.qianzhan.com/wenda/detail/181210-d4d2c29d.html), and Energy Research Institute, 2020
Challenges in China’s Industry Sector

1. Industrial Energy Efficiency Keeps Improving but Remains Largest Carbon and Air Pollution Emitter
2. Energy-Intensive Products Dominate Energy Consumption of the Industry Sector
3. China is the World’s Largest Manufacturer, but Exports Mainly Low Value-Added Products
4. Gaps are Huge between China and Developed Countries in Resources Recycling
5. Energy and Resource Efficiency Improvement is Not Easy to Integrate into China’s Economic Stimulus
6. Key Industrial Sector-Specific Barriers Exist for Achieving Deep Decarbonization
Challenge 1: Industry Keeps Improving Energy Efficiency
But Remains the Largest Carbon and Air Pollution Emitter


- Coal Power Plants
- Iron and Steel
- Electolytic Aluminium
- Copper
- Cement
- Building Ceramics
- Plate glass
- Oil Refinery
- Ethylene
- Synthetic Ammonia
- Caustic soda
- Soda ash
- Calcium carbide
- Pulp and Paper

Share of Carbon Emission: 70%
Share of Air Pollution Emissions: 65%
Share of Coal Use: 78%
Share of Energy Consumption: 63%
Share of Electricity: 62%

Challenge 2: Energy-Intensive Products Dominate Energy Consumption of the Industry Sector

Challenge 3: China is the World’s Largest Manufacturer, but Export Mainly Low Value-Added Products

![Bar chart showing the share of export products to the total production for various products.](chart)

Source: Research on Industry Sector Transformation and Upgrading and Low-carbon Emission Strategy, Energy Research Institute, NDRC, 2019
Challenge 4: Gaps Are Huge between China and Developed Countries in Resources Recycling

Source: Energy Research Institute, 2020
Challenge 5: Energy and Resource Efficiency Improvement is Not Easy to Integrate into China’s Economic Stimulus

China New Infrastructure Investments: 5G Base Station, Big Data Center, IIOT, AI, Charging Station for New & RE Vehicles, High Speed Train and Urban Transit, UHV Power Transmission

New Infrastructure Investments only share **15-20%** of the Total Investments

Key Focus of the Economic Stimulus:

- Raising the level of ambition and delivering early stimulus impacts, e.g. high energy consumption of 5G and Data Center
- Balancing short-term and long-term perspectives by leveraging energy and resource efficiency improvement
- Choosing the strategic emerging industrial sectors and technology upgrade for investment
- Ensuring stricter enforcement of EE and EP standards in the economic stimulus

China Total Investments in 3-5 Years:

- 50 Trillion RMB in total of 22,000 Projects
- 25 Provinces/Municipalities announced
- The Investments include retrofit of old buildings, infrastructure, upgrade of traditional industry and strategic emerging industry

Challenge 6: Key Industrial Sector-Specific Barriers Exist for Achieving Deep Decarbonization

- Lack of standards and design specifications for high quality steel use
- Early stage of information technology (AI, IIOT, 5G) in the sector
- Insufficient funding support for promotion of low and zero carbon technologies
- No well-established recycling system for Petro-chemical products
- Waste sorting and classification implementation only in some metropolises
- Lack of designed national strategy and action plans for fuel switching and CCS application
- No standards and specifications developed on hydrogen and CCS application
- Lack of national strategy and institutional coordination on alternative fuels
- Insufficient funds and weak implementation of incentive policies
- High cost of CCS application and still in a small scale
- Incomplete regulations, policies and standards of recycling of products
- Lack of enforcement of Extended Producer Responsibility System
- Insufficient funding and incentives to encourage recycling
- Lack of supervision for recycling
2. Pathways for Achieving the 2°C goal

**CHINA:** Based on EFC-supported LTS Project, to achieve the well-below 2°C goal, China’s total CO2 emissions need to be reduced **5.40 Gt CO2e** by 2050 compared to the BAU scenario.

**INDUSTRY:** To achieve the 2°C goal, CO2 emissions from China’s industry sector need to be reduced **75% (2.44 Gt CO2e)** by 2050 compared to the BAU scenario.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Emission Reductions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building sector</td>
<td>11%</td>
</tr>
<tr>
<td>Transportation sector</td>
<td>9%</td>
</tr>
<tr>
<td>Other sectors</td>
<td>35%</td>
</tr>
</tbody>
</table>

Of required emissions reductions must come from the Industry Sector.

Source: EFC-supported LTS project; Research on Industry Sector Transformation and Upgrading and Low-carbon Emission Strategy, Energy Research Institute, NDRC, 2019
Achieving the well-below 2°C Goal: 4 Key Pathways

<table>
<thead>
<tr>
<th>Category</th>
<th>2015 Actual</th>
<th>2050 BAU Scenario</th>
<th>2050 2°C Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2 Emissions (100 MMt)</td>
<td>36.0</td>
<td>32.3</td>
<td>7.9</td>
</tr>
<tr>
<td>Emissions Reduction (%)</td>
<td>-3.1(32.8%)</td>
<td>-2.2 (23.2%)</td>
<td>-7.7 (51.2%)</td>
</tr>
</tbody>
</table>

Source: Research on Industry Sector Transformation and Low-carbon Emission Strategy, Energy Research Institute, NDRC, 2019
Top 4 Sectors: Major Contributors to the well-below 2°C Goal

To achieve the 2°C Goal, 28% of required emissions reductions must come from the Top 4 sectors.

Top 4 sectors account for 38% of China’s total energy consumption in 2018.

Top 4 sectors account for 42% of China’s total CO2 Emission in 2018.

Source: Research on Industry Sector Transformation and Low-carbon Emission Strategy, Energy Research Institute, NDRC, 2019. Note: Direct carbon emission included only from each sector.
<table>
<thead>
<tr>
<th>Structural Transformation</th>
<th>Demand Reduction</th>
<th>EE Improvement</th>
<th>Low-carbon Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron and Steel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Promote strategic emerging industries</td>
<td>- Extend Life of Buildings</td>
<td>- Increase electric furnace and scrap steel use</td>
<td>- Low carbon steel production technologies</td>
</tr>
<tr>
<td>- Upgrade conventional products/high value-added industrial products</td>
<td>- Reduce direct export of steel products</td>
<td>- Implement EE retrofits</td>
<td>- Zero carbon steel production technologies</td>
</tr>
<tr>
<td>- Strengthen service-oriented economy</td>
<td>- Increase the grade of steel strength</td>
<td>- Prioritization of energy management</td>
<td>- CCS/CCUS</td>
</tr>
<tr>
<td>Cement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Extend Life of Buildings</td>
<td>- Extend Life of Buildings and infrastructure</td>
<td>- Apply EE technologies to reduce thermal and electricity intensity</td>
<td>- Increase level of electrification</td>
</tr>
<tr>
<td>- Reduce unnecessary use and demand</td>
<td>- Reduce unnecessary use and demand</td>
<td>- Replace cement clinker with sludge and fly ash</td>
<td>- Promote fuel switching</td>
</tr>
<tr>
<td>- Increase strength grade of cement</td>
<td>- Increase strength grade of cement</td>
<td>- Smart Energy Management</td>
<td>- CCS/CCUS</td>
</tr>
<tr>
<td>Petro-chemicals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Improve recycling, reuse, and comprehensive energy utilization</td>
<td>- Improve recycling, reuse, and comprehensive energy utilization</td>
<td>- Improve EE further for maximizing the potential</td>
<td>- Diversify the source of low-carbon raw materials</td>
</tr>
<tr>
<td>- Export less low value-added products</td>
<td>- Export less low value-added products</td>
<td>- Apply and innovate high-efficient technologies</td>
<td>- Large-scale adoption of “Green Hydrogen”</td>
</tr>
<tr>
<td>- Import more raw materials</td>
<td>- Import more raw materials</td>
<td>- Increase significantly the use renewable energy</td>
<td>- CCS/CCUS</td>
</tr>
<tr>
<td>Non-ferrous metals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Extend infrastructure and consumer product life</td>
<td>- Extend infrastructure and consumer product life</td>
<td>- Strengthen the recycling of non-ferrous metals</td>
<td>- Preplace coal use by clean energy</td>
</tr>
<tr>
<td>- Reduce waste and unreasonable demand</td>
<td>- Reduce waste and unreasonable demand</td>
<td>- Implement advanced EE and low-carbon retrofit technologies</td>
<td>- Increase significantly the use renewable energy</td>
</tr>
<tr>
<td>- Improve material strength level, optimize material structure and usage</td>
<td>- Improve material strength level, optimize material structure and usage</td>
<td>- Strengthen the recycling of non-ferrous metals</td>
<td>- Preplace coal use by clean energy</td>
</tr>
<tr>
<td>Demand Reduction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE Improvement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-carbon Energy</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. EFC Vision, Goals, and Initiatives

**VISION:** Accelerate the deep decarbonization of China’s industry sector in support of achieving the well-below 2°C goal while tripling China’s total industrial value added by 2050

<table>
<thead>
<tr>
<th>2030</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GDP:</strong> 2.5 times of 2015</td>
<td><strong>GDP:</strong> 5 times of 2015</td>
</tr>
<tr>
<td><strong>Total Industrial Value Added:</strong> Doubled from 2015</td>
<td><strong>Total Industrial Value Added:</strong> Tripled from 2015</td>
</tr>
<tr>
<td>Total energy consumption &lt;2.4 Btce</td>
<td>Total energy consumption &lt;1.5 Btce</td>
</tr>
<tr>
<td>Carbon emissions &lt;3.4 GtCO2</td>
<td>Carbon emissions ≤0.8 GtCO2</td>
</tr>
<tr>
<td>Coal consumption &lt;1.4 Btce</td>
<td>Coal consumption &lt;300 Mtce</td>
</tr>
<tr>
<td>Electrification ratio &gt;28%</td>
<td>Electrification Ratio &gt;45%</td>
</tr>
<tr>
<td>Energy consumption per unit of industrial value-added: 55% of 2015 level</td>
<td>Energy consumption per unit of industrial value-added 20% of 2015 level</td>
</tr>
</tbody>
</table>

GOALS

01 **Iron and Steel Sector:** Assist to control and reduce production capacity, promote dematerialization by using high quality steel significantly and steel electrification greatly in China’s iron and steel industry.

02 **Cement Sector:** Promote near net-zero coal use in China’s cement industry by applying alternative fuels, achieve near net-zero carbon emission by deployment of Carbon Capture and Storage (CCS) technology.

03 **Petro-Chemical and Chemical Sector:** Enhance dematerialization and recycling in China’s petro-chemical sector, strengthen innovative production and process, and accelerate use of natural gas, renewable, green hydrogen, and CCUS.

04 **Non-Ferrous Sector:** Establish an integrated circular economy system in China’s non-ferrous sector and maximize the energy productivity and material efficiency.

05 **Cross-cutting Issues:** Support China to develop national/sector strategies and roadmaps, set up ambitious goals and standards, promote energy efficiency significantly, establish near-zero emission industrial parks for achieving deep decarbonization of China’s industry sector.
## Theory of Change

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Initiatives</th>
<th>Sector Outcomes</th>
<th>Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron and Steel</td>
<td>01. High Quality Steel and Dematerialization</td>
<td>- Carbon Reduction: 570MtCO2</td>
<td>- China's industry sector achieves early peaking of carbon emissions</td>
</tr>
<tr>
<td></td>
<td>02. Steel Electrification</td>
<td>- Dematerialization: 130Mt</td>
<td>and contribute to achieving the well-below 2°C goal while tripling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Share of EAF use: 80%</td>
<td>China’s total industrial value added by 2050</td>
</tr>
<tr>
<td>Cement</td>
<td>03. Coal-Free and Fuel Switching</td>
<td>- Crude Steel Production: 380Mt</td>
<td>- China’s Industry Sector achieves co-benefits of both carbon emission</td>
</tr>
<tr>
<td></td>
<td>04. Near Zero-Carbon Emission and CCS</td>
<td>- Scrap Steel Utilization: 70%</td>
<td>reduction and pollution reduction for dramatically improving air</td>
</tr>
<tr>
<td>Petro-chemical</td>
<td>05. Dematerialization and Recycling</td>
<td>- LC technology penetration: 60%</td>
<td>quality</td>
</tr>
<tr>
<td></td>
<td>06. Fuel Switching and CCUS</td>
<td></td>
<td>- China’s industry sector achieves high quality</td>
</tr>
<tr>
<td>Non-ferrous</td>
<td>07. Integrated Circular Economy System</td>
<td></td>
<td>development through deep decarbonization</td>
</tr>
<tr>
<td>Cross-cutting</td>
<td>08. Strategy, Policy, and Standards</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>09. Energy Efficiency Improvement</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10. Near-zero Emission Industrial Parks</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Demand Reduction
- Extend Life of Buildings
- Reduce direct export of steel products
- Increase the grade of strength
- Reduce crude steel by 45 MT\(^1\)[2]
- Reduce crude steel by 50 MT\(^1\)[2]
- Reduce crude steel by 35 MT\(^1\)[2]

- Reduce CO2 by 180 MTE\(^1\)
- Account for 31.6% of the well-below 2\(^\circ\)C goal

### Energy Efficiency Improvement
- Increase electric furnace and scraped steel use
- Recycle scraped steel by 300m tons (70% by rate) and electric furnace reaches 45%
- 100% tech penetration, carbon emissions and energy use beat the current world’s best

- Reduce CO2 by 150 MTE\(^1\)
- Account for 26.3% of the well-below 2\(^\circ\)C goal

### Low-carbon Energy
- Low carbon steel production technologies
- Zero carbon steel production technologies
- CCS/CCUS

- 50% penetration of low carbon production and Hydrogen use by 7.2 MT
- 10% penetration of zero carbon production

- Reduce CO2 by 240 MTE\(^1\)
- Account for 42.1% of the well-below 2\(^\circ\)C goal

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\(^1\)Compared to the BAU; \(^2\) To produce one ton of crude steel: 2.5 tons CO2 emission and 570 kgce energy use.
**Cement**

**Contributions to the well-below 2°C Goal by 2050**

### Demand Reduction
- Extend life of buildings and infrastructure. Reduce unnecessary demand and use

- Reduce Cement by 350 Mt[1]
  - Reduce CO2 by 100 Mte[1]
  - Account for 33% of the well-below 2°C goal

### Energy Efficiency Improvement
- Increase strength grade of cement

- Reduce Cement by 180Mt[1]
  - Reduce CO2 by 50 Mte[1]
  - Account for 17% of the well-below 2°C goal

- Apply EE technologies to reduce thermal and electricity intensity

- Replace cement clinker with acetylene sludge and fly ash

- Decrease thermal intensity and electricity intensity by 10-15%

- 60% Cement Clinker

- Smart Energy Management

- 100% large-scale and smart and digitization

### Low-carbon Energy
- Increase level of electrification

- Promote fuel switching

- CCS/CCUS

- Electrical heating, NG+H2

- Alternative fuel to 70% from current 5%

- 40% penetration of CCS/CCUS

### Contributions to the well-below 2°C Goal by 2050

- Reduce CO2 by 150 Mte[1]
  - Account for 50% of the well-below 2°C goal

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[1] Compared to the BAU
### Petro-Chemical and Chemical

**Contributions to the well-below 2°C Goal by 2050**

### Reduce Demand
- Improve recycling, reuse, and comprehensive energy utilization
  - Produce 4 million tons less of Ethylene[^1]
  - Export less low value-added products
  - Import more raw materials
### Improve Energy Efficiency
- Improve EE further for maximizing the potential
  - Energy consumption of overall refining, Ethylene, Sodium Hydroxide and Sodium Carbonate production decline ~10%
  - Innovative technologies application rate reaches 30%
### Use Low Carbon Energy
- Diversify the source of low-carbon raw materials
  - Energy efficiency of overall refining, Ethylene, Sodium Hydroxide and Sodium Carbonate production decline ~10%
  - Innovative technologies application rate reaches 30%
- Import more raw materials
- Use Low Carbon Energy
  - Diversify the source of low-carbon raw materials
  - Large-scale adoption of “Green Hydrogen”
  - CCS/CCUS
### [^1]Compared to the BAU scenario

- **Reduce CO2 emission by 160 million tons[^1]**
- **Contribute 30.6% to sectorial deep-decarbonization goal**
- **Reduce CO2 emission by 90 million tons[^1]**
- **Contribute 18.5% to sectorial deep-decarbonization goal**
- **Reduce CO2 emission by 260 million tons[^1]**
- **Contribute 50.9% to sectorial deep-decarbonization goal**
CLIMATE
Accelerating the deep decarbonization of China’s industry sector in support of achieving the well-below 2°C goal

GROWTH
Driving China’s long-term economy development and growth quality by tripling China’s total industrial output value

GOVERNANCE
Assisting cross government initiatives: goal setting, planning, finance, environment protection

TRANSITION
Speeding up China’s industry green transition and upgrading through technological innovation, development of emerging industries, transformation of traditional industries, and product quality upgrade

Cross-Cutting Issues

Energy Efficiency

Low carbon Energy

Demand Reduction

Structural Transformation
THANK YOU