Outline

- Introduction to IIP and global industrial energy use trends
- Profile of China’s industrial energy use
- Overview of China’s industrial energy efficiency programs
- Overview of China’s Energy Management Systems program
- IIP’s efforts to support effective implementation of EnMS in China
About the Institute for Industrial Productivity

The Institute for Industrial Productivity provides industry and governments with the best energy efficiency practices to reduce energy costs and prepare for a low carbon future.

- Bridging the gap between government policy and industry implementation.
- Developing original research, analysis and databases.
- Sharing best practices, including policy experience, and providing access to a network of international experts.
IIP’s Best Practice Databases

Industrial Efficiency Technology Database
www.iets.iipnetwork.org

Industrial Efficiency Policy Database
www.iepd.iipnetwork.org

Industrial Efficiency Finance Database
www.iipnetwork.org/databases/finance

Supply Chain Initiatives Database
www.iipnetwork.org/databases/supply-chain
Industry Accounts for 50% of Total Global Energy Use
(Primary Energy Basis*)

* Includes fuel for electricity generation and T&D losses

Source: DOE EIA International Energy Outlook 2013
The U.S., China, and India Represent about 50% of Total Industrial Energy Use

Source: DOE EIA International Energy Outlook 2013
Industry is the Largest Energy Consuming Sector in the U.S., China and India

Primary energy use - 2010

- **U.S.**
  - Industrial: 31.2%
  - Commercial: 27.4%
  - Residential: 6.8%
  - Transportation: 1.5%
  - Total: 97.9 Quads

- **China**
  - Industrial: 75.5%
  - Commercial: 6.8%
  - Residential: 10.5%
  - Transportation: 7.4%
  - Total: 101.2 Quads

- **India**
  - Industrial: 68.5%
  - Commercial: 8.6%
  - Residential: 13.8%
  - Transportation: 9.1%
  - Total: 27.4 Quads

*Source: DOE EIA International Energy Outlook 2013*
Industrial Energy Growth in China: 1980 - 2010

Source: NBS, 1980 – 2011b
China’s Industrial Growth has been Fueled by Exports, Infrastructure and Internal Demand

Source: NBS

Source: NBS, 2011b

Source: IEA, 2012; UNIDO, 2012
China Has Great Disparities in the Level of Development

Gross Domestic Product per Capita by Province, 2010

Source: NBS, 2011
China’s Energy Efficiency Programs

• Comprehensive system of policies and programs based on a mix of government regulation and market-based approaches

• Current aggressive energy efficiency promotion system developed under 11th Five Year Plan (2006 – 2010)
  – Revised Energy Conservation Law - 2007

• Continued under 12 Five Year Plan (2011 – 2015) with focus on capacity building and implementation

• Three Institutional Groups
  – National, provincial and local governments
  – Industrial enterprises
  – Third party service and support organizations
# Key Industrial Energy Efficiency Programs - 1

<table>
<thead>
<tr>
<th>Programs</th>
<th>11th Five Year Plan</th>
<th>12th Five Year Plan</th>
</tr>
</thead>
</table>
| Overall Targets                               | • National – 20% energy/GDP reduction over 2005 by 2010  
  • Provincial – Range from 12-22%            | • National – 16% energy/GDP reduction from 2010 by 2015;  
  17% CO2/GDP reduction  
  • Provincial – Range from 10-18%            |
| 1 - Government-Enterprise Agreement Platform  |                                                                                      |                                                                                      |
| Enterprise Targets and Agreements             | • National – Top 1,000 Program (>108,000 tce/year)  
  • Provincial – additional agreements       | • National – Top 10,000 Program (15,000 enterprises >10,000 tce/year)  
  • Provincial – additional agreements with enterprises >5,000 tce/year |
| Phasing Out Obsolete Capacity                 | Closure program initiated in 2007                                                      | Broader scope and new targets                                                      |
| Enterprise Energy Managers                    | Requirements established                                                               | Large-scale implementation under Top 10,000 and provincial programs               |
| Enterprise Reporting                          | Mandatory for Top 1,000                                                                 | Mandatory for Top 10,000 and provincial                                             |
| Energy Efficiency Assessments for New Fixed Assets | National program launched                                                             | Implementation at nat’l/provincial levels                                          |
| Minimum Energy Consumption Standards          | National unit standards set for production of 27 industrial products                  | New standards under national “100 Standards Program”                              |
### Key Industrial Energy Efficiency Programs - 2

<table>
<thead>
<tr>
<th>Programs</th>
<th>11(^{th}) Five Year Plan</th>
<th>12(^{th}) Five Year Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2 – Enabling and Support Systems</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterprise Energy Audits</td>
<td>Required under Top 1,000 program; Quality varied</td>
<td>Required under Top 10,000 and provincial programs; Efforts to improve 3(^{rd}) party capacity</td>
</tr>
<tr>
<td>Energy Management Systems (EnMS)</td>
<td>Pilot program in Shandong Province; Nation standard 2009</td>
<td>Program to foster implementation for Top 10,000 and provincial; Provincial and local support programs</td>
</tr>
<tr>
<td>Financial Awards for Energy Efficiency Investments</td>
<td>RMB 22.4 billion provided by central government; ESCO investment award program launched</td>
<td>Broader scope and new targets</td>
</tr>
<tr>
<td>Energy Efficiency Rating and Labeling for Manufacturers</td>
<td>Suzhou Energy Efficiency Star</td>
<td>National pilot program</td>
</tr>
<tr>
<td>Other</td>
<td>National guidance on benchmarking; National technology catalogs</td>
<td>Improved benchmarking for key enterprise planning; Improved catalogs</td>
</tr>
</tbody>
</table>
# Key Industrial Energy Efficiency Programs - 3

<table>
<thead>
<tr>
<th>Programs</th>
<th>11th Five Year Plan</th>
<th>12th Five Year Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3 – Market-Based Programs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy Pricing and Tax Policies</td>
<td>Penalty electricity pricing; New taxes tested</td>
<td>Further pricing reforms; review of tax policies</td>
</tr>
<tr>
<td>Expanded Performance Contracting</td>
<td>ESCO industry entered a fast growth stage; Investment reached $4.25 billion in 2010</td>
<td>Continued growth expected; Energy performance contracting becoming mainstream</td>
</tr>
<tr>
<td>Energy Use/Carbon Cap and Trade</td>
<td>Beijing, Tianjin and Shanghai set up exchanges for voluntary carbon trading</td>
<td>Introduction of energy/carbon caps; Launching of pilot trading schemes</td>
</tr>
<tr>
<td>Expanded Commercial Financing</td>
<td>Energy efficiency pilot programs established</td>
<td>Expansion and further development</td>
</tr>
<tr>
<td><strong>4 – Integrated Programs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Carbon Development Zones</td>
<td></td>
<td>Pilot programs in 5 provinces and 8 cities</td>
</tr>
<tr>
<td>Circular Economy/Industrial Remanufacturing</td>
<td></td>
<td>Piloting of provincial by-product synergy program</td>
</tr>
</tbody>
</table>
Results of the 11th Five Year Plan

• 19.1% reduction in energy use per unit GDP – NDRC
  – 82% from industrial sector

• Top 1,000 Enterprises – Goal of 100 Mtce savings (150 realized)
  – Energy savings agreements signed by high-level representatives was effective
  – Heavy investment in new technology and energy savings projects
  – 95% established energy management office
  – Energy audits conducted, but capabilities and quality varied

• Phasing out obsolete capacity – Goal of 91 Mtce savings
  – 19 energy intensive subsectors
    – Cement – 250 Mt
    – Iron making – 100 Mt
    – Steel – 55 Mt
  – Difficult to implement due to loss of tax revenue and jobs at local level
An Example of the Impact of China’s Energy Efficiency Program on Technological Improvement in the Cement Industry
Technology Evolution in China’s Cement Industry

Source: Chinese Cement Association 2013
There is a Wide Range in Energy Performance


- **Minimum Energy Performance Requirements for Existing Plants**
- **World Best Practice**

<table>
<thead>
<tr>
<th>Province</th>
<th>Energy Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beijing</td>
<td>150</td>
</tr>
<tr>
<td>Tianjin</td>
<td>140</td>
</tr>
<tr>
<td>Hebei</td>
<td>130</td>
</tr>
<tr>
<td>Shanxi</td>
<td>120</td>
</tr>
<tr>
<td>Inner Mongolia</td>
<td>160</td>
</tr>
<tr>
<td>Liaoning</td>
<td>140</td>
</tr>
<tr>
<td>Jilin</td>
<td>150</td>
</tr>
<tr>
<td>Heilongjiang</td>
<td>130</td>
</tr>
<tr>
<td>Shanghai</td>
<td>140</td>
</tr>
<tr>
<td>Jiangsu</td>
<td>120</td>
</tr>
<tr>
<td>Zhejiang</td>
<td>110</td>
</tr>
<tr>
<td>Anhui</td>
<td>130</td>
</tr>
<tr>
<td>Fujian</td>
<td>140</td>
</tr>
<tr>
<td>Jiangxi</td>
<td>150</td>
</tr>
<tr>
<td>Shandong</td>
<td>160</td>
</tr>
<tr>
<td>Henan (2006)</td>
<td>170</td>
</tr>
<tr>
<td>Hubei</td>
<td>180</td>
</tr>
<tr>
<td>Hunan</td>
<td>190</td>
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<tr>
<td>Guangdong</td>
<td>200</td>
</tr>
<tr>
<td>Guangxi</td>
<td>210</td>
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<tr>
<td>Hainan</td>
<td>220</td>
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<tr>
<td>Chongqing</td>
<td>230</td>
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<tr>
<td>Sichuan</td>
<td>240</td>
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<tr>
<td>Guizhou</td>
<td>250</td>
</tr>
<tr>
<td>Yunnan</td>
<td>260</td>
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<tr>
<td>Shaanxi</td>
<td>270</td>
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<tr>
<td>Gansu</td>
<td>280</td>
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<tr>
<td>Qinghai</td>
<td>290</td>
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<tr>
<td>Ningxia</td>
<td>300</td>
</tr>
<tr>
<td>Xinjiang</td>
<td>310</td>
</tr>
</tbody>
</table>

Source: China Cement Association, AQSIQ
Waste Heat Recovery was identified as an Efficiency Technology that could be widely applied.
Waste Heat Recovery in Cement
Waste Heat Recovery in China’s Cement Industry

- 2007 – Energy Conservation Law “encourages” rotating kiln technology and waste heat to power
- 2010 – Ministry of Industry and Information Technology requires all new production lines to be equipped with WHR
- 2011 – 12th Five Year Plan (2011 – 2015) sets a target for WHR to be on 65 percent of clinker capacity
- Domestic market nearing saturation.

Waste Heat Recovery in Cement – Market Status

(Chinese Suppliers now dominate market for WHR in Cement)

Waste Heat Recovery in Cement – Number of Units - 2012

- China: 739
- India: 26
- Japan: 24
- Thailand: 12
- Pakistan: 9
- Other Asia: 24
- Mid East: 15
- Europe: 7
- Americas: 5
- Rest of World: 4

Energy Management Systems is an Important Next Step in China’s Efficiency Program

• EnMS piloted in 11th FYP in a small group of enterprises and Shandong Province
  – Shandong interested in EnMS for more effective implementation of efficiency regulations and investments, and to promote continuous improvement

• Shandong issued its own EnMS standard, implementation guidelines and training programs, piloted EnMS in key enterprises, and developed a plan for broader roll out

• Central Government issued a broad national EnMS standard in 2009 – GB/T 23331

• EnMS a key part of Top 10,000 program in 12th FYP
Energy Management Systems Implementation

• 2012
  – GB/T 23331 revised to more closely follow ISO 50001 in 2012

• 2013
  – EnMS Implementation guidance for Iron and Steel
  – EnMS Implementation guidance for Cement
  – EnMS Implementation guidance Plate Glass

• 2014
  – EnMS Implementation guidance for Thermal Power
  – EnMS Implementation guidance for Coke
  – EnMS Implementation guidance Plate Coal Industry
  – M&V guidance on energy performance

• 2015
  – EnMS Implementation guidance for Paper
  – EnMS Implementation guidance for Petrochemicals
Energy Management System Implementation Issues

• Getting management “buy-in”
  – More than a “check off” on a requirements list

• Strengthening support capacity
  – Quality energy audits and assessments
  – Certification organizations
  – Training and education

• Providing implementation support to enterprises
  – Training
  – Tools
  – Guidance
IIP’s China Program

Key Activities:

• Develop best practices, case studies, database and tools in support of EnMS implementation in Top-10,000 Enterprises Program

• Assist provincial/local pilot programs to advance Energy Management Systems in key enterprises

• Develop case studies for energy systems optimization in Iron and Steel and chemicals industries
IIP’s Support of EnMS in China

• Leverage international and domestic best practices
  – Network of international and Chinese experts

• Support of Dezhou pilot program (Shandong Province)
  – Joint workshops on EnMS with Dezhou Conservation Center
  – Conducted Energy Reviews with three of 52 key enterprises
    – Two paper mills and a large international auto parts supplier
    – Chinese experts for technical audit, international experts for EnMS support
  – Providing technical assistance to enterprises during implementation (what next?)

• Developing Energy Review Guidance for Chinese enterprises
IIP’s Support of EnMS in China

• Additional pilot program support in Jiangsu and Sichuan provinces
  – In conjunction with World Bank program

• Promotion of EnMS through supply chain project with CDP (*Action Exchange*)
  – Energy scans to suppliers in Shanghai area
Objectives

- Build capacity at the provincial and city/county level
- Help roll out EnMS programs to other regions
- Provide limited technical support for early adopters
- Develop key tools and guidance documents
- Assist in training third party service providers
- Help establish effective EnMS implementation in China
Thank You!

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