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CHINA’S COAL MARKET: Did peak demand come and go?

EIA Energy Conference: World Coal Markets

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Key implications

• China’s industrial economy is experiencing a “hard landing” as the economic transition accelerates, impacting major industrial fuels, with coal feeling the most pain.

• This long-term restructuring will make the Chinese economy less energy intensive, lowering the overall energy demand trajectory.

• Meanwhile, non-coal fuels and technologies are growing rapidly, supported by environmental and climate policies.

• However, coal remains the cheapest energy source, and the less developed regions in China will continue to rely on coal, effecting a demand migration westward towards inland regions.

• IHS expects coal consumption growth to gradually recover—mainly supported by power generation and coal-chemical use in western provinces—reaching a national peak by the mid-2020s.

• This peak in coal demand is a precursor to a peak in carbon emissions, before 2030.
A “Hard Landing” for China’s industrial economy, and thus industry-dominated energy sectors

Key energy commodities and their driving sectors in China (2013)

<table>
<thead>
<tr>
<th>Key Energy Commodities</th>
<th>Industry-driven energy</th>
<th>Consumer- and service-driven energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Coal</td>
<td>80%</td>
<td>20%</td>
</tr>
<tr>
<td>Diesel</td>
<td>40%</td>
<td>60%</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>80%</td>
<td>20%</td>
</tr>
<tr>
<td>Gasoline</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Jet Fuel</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Demand by Sector</th>
<th>Power generation</th>
<th>Industrial</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mostly heavy-duty transport</td>
<td>Mostly passenger transport</td>
</tr>
<tr>
<td>Power generation</td>
<td>Blue</td>
<td>Red</td>
</tr>
<tr>
<td>Industrial</td>
<td>Red</td>
<td>Blue</td>
</tr>
<tr>
<td>Transport</td>
<td>Gray</td>
<td>Gray</td>
</tr>
<tr>
<td>Residential</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Commercial</td>
<td>Black</td>
<td>Black</td>
</tr>
<tr>
<td>Other</td>
<td>Orange</td>
<td>Orange</td>
</tr>
</tbody>
</table>

Source: IHS, National Bureau of Statistics
Only slight recovery expected ahead for coal
Medium-term outlook for Chinese coal demand

- Demand to “bottom out” by 2018, with a slight recovery by 2020.
- Coal-fired generation will continue to be squeezed by non-fossil generation resources.
- Renewable, nuclear, and gas plant additions will remain robust, and government support will continue to be strong – for both investment and dispatch.
- Wind and solar will account for over 40% of incremental generation; adding in nuclear and hydro, non-fossil generation resources will meet 76% of new power demand in the next five years.

China’s incremental power generation by fuel 2015-20 (IHS Rivalry scenario 2016)

- Demand to “bottom out” by 2018, with a slight recovery by 2020.
- Coal-fired generation will continue to be squeezed by non-fossil generation resources.
- Renewable, nuclear, and gas plant additions will remain robust, and government support will continue to be strong – for both investment and dispatch.
- Wind and solar will account for over 40% of incremental generation; adding in nuclear and hydro, non-fossil generation resources will meet 76% of new power demand in the next five years.
Coal remains the cheapest energy source, and will continue to grow in inland provinces

Estimated levelized cost of electricity

<table>
<thead>
<tr>
<th>Source: IHS Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levelized cost of electricity (2015 RMB / MWh)</td>
</tr>
<tr>
<td><strong>Coal-fired SCPC</strong></td>
</tr>
<tr>
<td>Coastal coal price of RMB 370 per metric ton (coastal)</td>
</tr>
<tr>
<td>Notes:</td>
</tr>
<tr>
<td>1. SCPC = super-critical pulverized coal.</td>
</tr>
<tr>
<td>2. Gas-fired technology refers to combined-cycle gas turbines (CCGT).</td>
</tr>
<tr>
<td>3. Coal prices are converted to 5,500 kcal per metric ton.</td>
</tr>
<tr>
<td>4. Transmission tariffs include line losses.</td>
</tr>
</tbody>
</table>

Note: Excluding carbon compliance costs.

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Coal plant additions slows substantially, with coal’s share in total generation declining to 42% by 2040

China power generation by fuel/technology (IHS Rivalry scenario 2016)

Outlook

<table>
<thead>
<tr>
<th>Year</th>
<th>Power generation (TWh)</th>
<th>Other</th>
<th>Solar</th>
<th>Wind</th>
<th>Gas</th>
<th>Nuclear</th>
<th>Hydro</th>
<th>Coal</th>
</tr>
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<tbody>
<tr>
<td>2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>2005</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>2010</td>
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<td>2015</td>
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<td></td>
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<td>100</td>
</tr>
<tr>
<td>2020</td>
<td></td>
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<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>2025</td>
<td></td>
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<td></td>
<td></td>
<td>100</td>
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<td>2030</td>
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<td>100</td>
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<td>2035</td>
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<td>100</td>
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<tr>
<td>2040</td>
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<td></td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

Source: IHS
The Great Migration of power generation in China
New capacity increasingly sited west and transmitted eastward

Inter-regional power transmission flows

Key Regions in this study
- Electricity flow
- Net export
- Net import
- Generally balanced

Source: IHS
Total coal demand will peak in the mid-2020s
All of the growth will come from western provinces

National coal demand outlook (IHS Rivalry scenario 2016)

Note: SCE = Standard coal equivalent, caloric value at 7,000 kcal/kg
Source: IHS

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“Peak carbon” achieved by 2030, with total emissions growing only by 9% between now and 2028

China’s Energy-related CO₂ emissions (IHS Rivalry scenario 2016)

Emissions Peak: 2028

IHS outlook 2015
Also peak by 2030, but much higher absolutely emissions

Source: IHS
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<tr>
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<th>OUR RESOURCES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 75% of the Global Fortune 500</td>
<td>9,000+ colleagues around the world</td>
</tr>
<tr>
<td>More than 70% of the US Fortune 1000</td>
<td>4,200+ information and industry experts, analysts and economists</td>
</tr>
<tr>
<td>Businesses and Governments in 150+ countries</td>
<td>1,500+ software developers, IT architects and IT analysts</td>
</tr>
<tr>
<td></td>
<td>140+ offices worldwide</td>
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</table>
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