Survey of electricity (and gas) trends and drivers in Asia
10th International Chlor-Alkali & Vinlys Conference 2016, Bangkok, Thailand
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Who we are

Offerings:

- Strategic, commercial, and regulatory support
- Ability to connect the dots between fuel markets and power
- Analysis-based recommendations
- Highly relevant international experience
- Accessible experts focussed on the region

Specialist economic consulting firm to the energy sector based in Asia
Electricity tariffs vary by location by time

2014 industrial prices verse 2015 industrial prices

Source: TLG

Note: Assumed typical industrial customer is connected at tension level greater than 1kV and less than 66kV, consumes 2,187,840kWh per month, with contract demand of 3000kW
The drop in crude oil price was partly driven by the steady increase in US crude production combined with weakening demand growth.

**US crude production**

US crude oil production only drops moderately in 2015, mostly in shale oil basins in Texas. (Texas and North Dakota are the two US states with the largest shale oil productions)

**World oil demand growth**

Oil demand growth reached the highest level within recent three years in the first three quarters of 2015, but weakening in the fourth quarter to 1.1 percent.

Source: US EIA and World Bank

Source: IEA and World Bank
Forward price curves are still converging, but to a lower long-term level – though the range is wide.

<table>
<thead>
<tr>
<th>Year</th>
<th>Dated Brent ($/barrel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>109</td>
</tr>
<tr>
<td>2014</td>
<td>99</td>
</tr>
<tr>
<td>2015</td>
<td>53</td>
</tr>
<tr>
<td>2016</td>
<td>32</td>
</tr>
<tr>
<td>2017</td>
<td>38</td>
</tr>
<tr>
<td>2018</td>
<td>42</td>
</tr>
<tr>
<td>2019</td>
<td>45</td>
</tr>
<tr>
<td>2020</td>
<td>47</td>
</tr>
</tbody>
</table>

Source: ICE
Lower prices are leading to delays in new gas development projects

- 3.6 Mtpa PNG T1
- 3.6 Mtpa PNG T2
- 2.1 Mtpa Indonesia Donggi-Senoro
- 5 Mtpa Australia Gorgon T1
- 5 Mtpa Gorgon T2
- 5 Mtpa Gorgon T3
- 4.25 Mtpa Australia (Curtis) T1
- 4.25 Mtpa Curtis T2
- 7.8 Mtpa Australia Gladstone T1,2
- 4.5 Mtpa Australia APLNG T1
- 9 Mtpa Sabine Pass LNG train 1 and 2 from US
- 9 Mtpa Sabine Pass LNG train 3 and 4

- 2014
- 2015
- 2016
- 2017
- 2018

= coal seam gas projects

Originally planned commission date

Current low LNG prices pushed back new LNG projects
Most tariff reductions linked to fuel markets

Newcastle coal price FOB, USD per metric ton

Brent crude oil price, USD per barrel

China cuts coal-fired power price

BEIJING, Dec. 23 (Xinhua) -- China will cut the price of electricity generated by coal-fired plants and sold to the country's power grid to reduce the burden on enterprises and cut emissions.

Nine Japanese power suppliers to cut January rates on falling oil prices

Nine of nation's 10 major power suppliers will cut their electricity rates for January, reflecting falling prices of crude oil, used as fuel for thermal power generation, according to their billing plans announced Thursday.

Electricity prices to drop 2.33 percent in October

TAIPEI, Taiwan -- Starting in October, utility prices will decrease by an average of 2.33 percent, or NT$2.81 per kilowatt hour (kWh), the Economics Ministry announced on Tuesday.

The adjustment was made to reflect declining global fuel prices, and in order to stabilize domestic price levels and to help lessen citizens' financial burden.

Electricity tariffs will fall in first quarter of 2016: SP Services

The tariff reduction is due to the lower cost of natural gas for electricity generation which fell by 8.9 per cent compared to the last quarter of 2015, the utilities company said.

Source: World Bank
Asian energy cost advantage is now more about residential tariffs than industrial tariffs

### Residential electricity prices (September 2015 Data)

<table>
<thead>
<tr>
<th>Region</th>
<th>US¢/kWh</th>
<th>Average</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASIA</td>
<td>13.1</td>
<td>5.4</td>
<td>6.3</td>
</tr>
<tr>
<td>Europe</td>
<td>24.3</td>
<td>6.3</td>
<td>1.1</td>
</tr>
<tr>
<td>USA</td>
<td>25.6</td>
<td>21.8</td>
<td>2.4</td>
</tr>
<tr>
<td>Oceania</td>
<td>11.5</td>
<td>2.8</td>
<td>4.4</td>
</tr>
</tbody>
</table>

### Industrial electricity prices (September 2015 Data)

<table>
<thead>
<tr>
<th>Region</th>
<th>US¢/kWh</th>
<th>Average</th>
<th>Standard Deviation</th>
</tr>
</thead>
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<tr>
<td>ASIA</td>
<td>11.5</td>
<td>2.8</td>
<td>4.4</td>
</tr>
<tr>
<td>Europe</td>
<td>12.9</td>
<td>4.3</td>
<td>4.3</td>
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<tr>
<td>USA</td>
<td>10.9</td>
<td>4.3</td>
<td>2.1</td>
</tr>
<tr>
<td>Oceania</td>
<td>8.0</td>
<td>2.1</td>
<td></td>
</tr>
</tbody>
</table>

Source: TLG analysis

Note:
- Data compiled for Sep 2015
- Assumed typical industrial customer is connected at tension level greater than 1kV and less than 66kV, consumes 2,187,840kWh per month, with contract demand of 3000kW
- Assumed typical residential customer consumes 400kWh per month.
China
Key factors affecting power cost in China

Upwards factors:
• Emissions control and national ETS
• Renewable share
• Reduction of coal use
• UHV and grid expansion

Downwards factors:
• Fall of fuel prices
• Fall of project cost of wind and solar
• Slowing growth of demand

Opportunities from market reform:
• Direct contracting
• Retail market opening
• Power plant dispatch policies
China’s GDP growth and power demand growth are slowing

China’s GDP and electricity demand growth slowed

- GDP growth dropped from average of 10% over last 15 years or so to below 7%. Growth could continue to drop to 5% even lower.
- Electricity demand growth in 2014 is 3.6% and dropped to 0.5% in 2015.

Reduced on-grid prices for coal plants

- Sluggish economy and electricity demand lead to weak fuel market, falling coal prices
- On-grid prices for coal plants have been reduced a few times.
- Coal-power price linkage mechanism is effective from 1 January 2016

Note: 2015 generation for coal plant is estimated
Environmental problems remain serious and more renewable energy targeted

Curtailment of wind and solar generation from 2013-2015

While the regions in the East, South and Central are perplexed by air quality problems, clean power generation of wind and solar in the west and north is being curtailed. Transmission to link the regions is needed.

Source: NEA publications

Smoggy days of 74 cities in 2013

Days of smog:
- > 100
- 70 ~ 100
- 50 ~ 70
- 30 ~ 50
- 10 ~ 30
- 1 ~ 10
- < 1

National Climate Center
UHV transmission projects have proven expensive and are behind schedule

Regional UHV AC grids are forming in East and North China Grids
Increased capacity to transfer large amount of power regionally
Increased capability to receive large amount of power from outside

Seasonality of hydro leaving the region insufficient supply in dry seasons without thermal generation

Point to point UHV DC can move large amount of power from far west and North to the pollution regions in East, South and Central.
China’s carbon policies have been strengthening, a national carbon market is likely in place by 2017. China pledged to reduce carbon dioxide intensity per GDP by 40%-45% by 2020 and new pledge of 60-65% reduction by 2030 comparing with 2005 level. 

- China is trying a combination of market based approach and administrative control approach to reduce carbon dioxide emissions.
- Seven pilot carbon trading schemes started operation by 2014.
- A national carbon scheme was proposed by 2016 (as of 2016, the planned national ETS for 2017 to start).
- Currently, different carbon markets have different allowance allocation approaches. Some of them allocate initial allowances for free; others impose small fees.

However, these schemes have had only a small impact on costs to date -- more than offset by weakening coal prices.
The planned nationwide carbon market will start in 2017, and even with a carbon market, the carbon prices would be likely low currently running around US$ 4 to 9 per tonne of CO2.
China is reforming its energy and power industry, opportunities exist but…

Network separation and separate transmission and distribution pricing

- Bilateral contracting between end users and generators is becoming possible;
- Changing regulation of transmission pricing already led to lower tariffs in Shenzhen, the pilot reform

Retail market opening

- Competition aimed to improve the efficiency of retailers
- Should increase choices of end-users and potentially lower prices

Reforming generation dispatch

- Increasing competition in the generation sector
- Supply cost reduction overall
Summary

• Dramatically weaker energy cost environment due to fuel market and macro factors

• Some delays to new gas and oil projects seen, some efforts to firm prices, and an upward sloping oil forward curve
  – But forecast is still well below levels projected even a year ago

• Asian electricity prices driven largely by fuel prices, fuel mix, and environmental concern

• Each market affected differently based on its fuel mix, reliance on imported fuels, and supply / demand balance
Thank You

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Fuel prices affect each Asian country differently – reflecting differences in fuel mix and energy policy and regulation.

**China**
Coal generation share was squeezed down by hydro and other renewables. More renewable generation means more levies on end-users to pay renewable generation. On average, tariff increased in 2014 from 2013.

**Japan**
More gas generation to replace expensive oil power generation, reducing overall supply cost, offsetting the replacement cost of cheaper nuclear generation. Tariff on average reduced slightly in 2014 from 2013.

**Australia**
Lower hydro availability was compensated by more gas and renewable generation, which are more expensive. Tariffs increased in 2014 from 2013, even gas price in 2014 was cheaper than in 2013.

**Singapore**
Expensive oil generation was squeezed to 0.9% from 5% by cheaper gas generation. Tariff decreased in 2014 from 2013.
Brent oil price in Asian currencies compared to USD

Brent crude oil price, USD per barrel

Brent crude oil price, CNY per barrel

Brent crude oil price, JPY per barrel

Brent crude oil price, SGD per barrel

Source: World Bank, Oanda

Down 71%
Down 69%
Down 66%
Down 67%