



Logistics of Delivering Supply to Market – Midstream Infrastructure

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Outline and Summary

- Scale of Resources
- Pipelines
- Third Party Access
- Upstream Pricing
- USA and China Shale Gas Comparisons
- Putting the Jigsaw Together



Source Journal of Petroleum Technology

Tantalizing Opportunities for Shale Gas

- The IEA estimated in March that China has 36.1 Tcm of technically recoverable shale gas resources, versus US total recoverable resource of 24.4 Tcm, since reduced by the E.I.A. to 15.3 Tcm.
- The Ministry of Land and Resources plans for 6.5 bcma of shale gas to be produced by 2015 and 60 bcma by 2020, which is ambitious.
- First awards were four blocks awarded to Sinopec and Henan Provincial Coal Seam Gas Development and Utilization Company in June 2011, with the latter seeking to farm out some acreage.
- Second bidding round allowed minority stakes in JVs to foreign companies.
 - The legal classification of shale gas as a separate “mineral resource” in late 2011 means that the current regulations that give CNPC and SINOPEC exclusive rights for exploration of onshore oil and gas resources probably do not apply to shale gas.



Source: EIA

Map of Main Trunk Pipelines

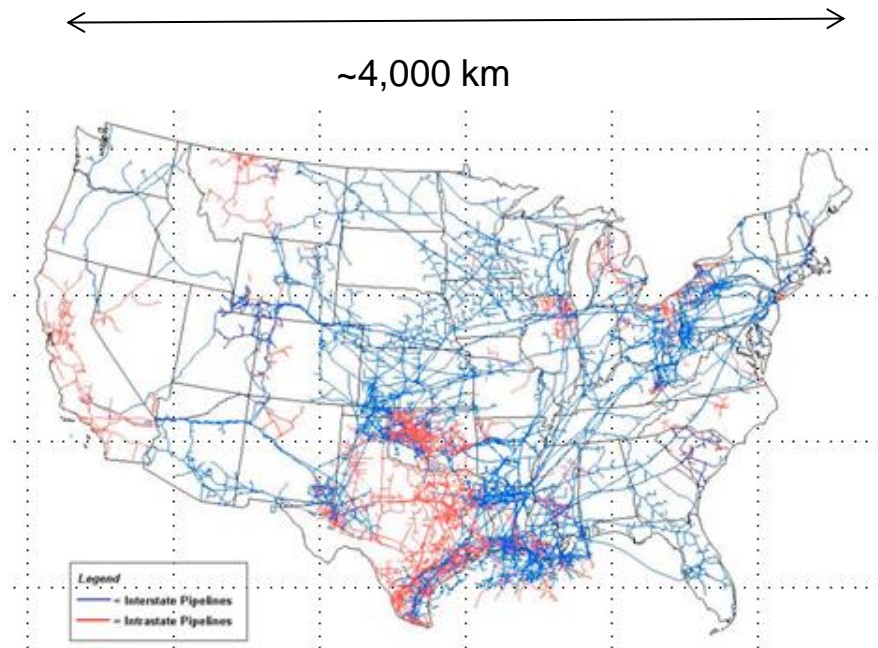
- China's gas pipeline network will have to expand to reach into unconventional gas production areas in order to avoid becoming a bottleneck as output increases. As major gas pipelines are currently run by national oil companies, mainly Petrochina making access more available to other producers will be key.



Source: EIA

US Gas Transmission compared to China

US gas pipeline infrastructure
Inter-state pipeline length – 360,000 km



Source: EIA

China gas infrastructure, 2012
45,000 km



Source: PetroChina, news reports and TLG analysis

US gas pipeline infrastructure is much more extensive

Infrastructure Liberalised Markets vs China

- Open access under FERC and State rules and laws for inter and intra state pipelines.
- Open access under EU rules, but some legal challenges remain and fines have been imposed on those deemed to have colluded to restrict access.
- Negotiated third party access is more about negotiation than access.
- The experience of Europe, USA and other nations is that negotiations tend to be long and drawn out.
- Negotiated access introduced in Peninsular Malaysia – wait to see how this works out



Third Party Access – Slow Train Coming

- Third party access also comes with a whole package of other rules.
 - Gas network code would need worked out
 - Breaking up of incumbents that dominate the market
 - Gas quality needs to be standardized
 - Penalties for delivering off specification gas
 - Capacity booking
 - Postage stamp or more likely distance related tariff
 - Entry and exit pricing
 - Dispute resolution process
 - Gas balancing

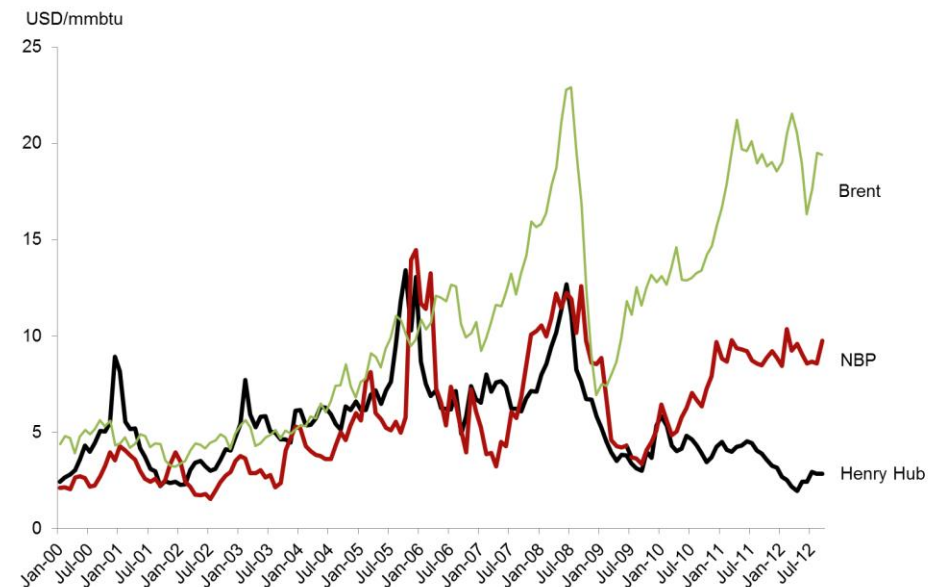


Source: Petrochina

Move to Market Prices?

- According to the 12th Five-Year Plan, the pricing regime for shale gas will be market-based, an important signal that the government is willing to allow higher end-user prices (relative to current controlled prices for natural gas) to encourage development
- But what is a 'market price'?
 - Determined by an LNG hub (Shanghai?) with adjustment for transmission similar to US Henry Hub method.
 - Or price determined by alternative fuels, such as oil indexation in Europe or fuel oil times a discount as in Southeast Asia.
 - Market pricing experience in Guangdong and Guangxi might provide pointers (60% fuel oil and 40% LPG times 0.9, to encourage use of piped gas).
 - Bi-lateral negotiation instead of regulated price.

Wide Spread in Market Prices for Traded Oil and Gas



Source: Nymex, UK DECC, IPE

Upstream Gas Pricing Liberalising in China? – Who Captures the Rent?

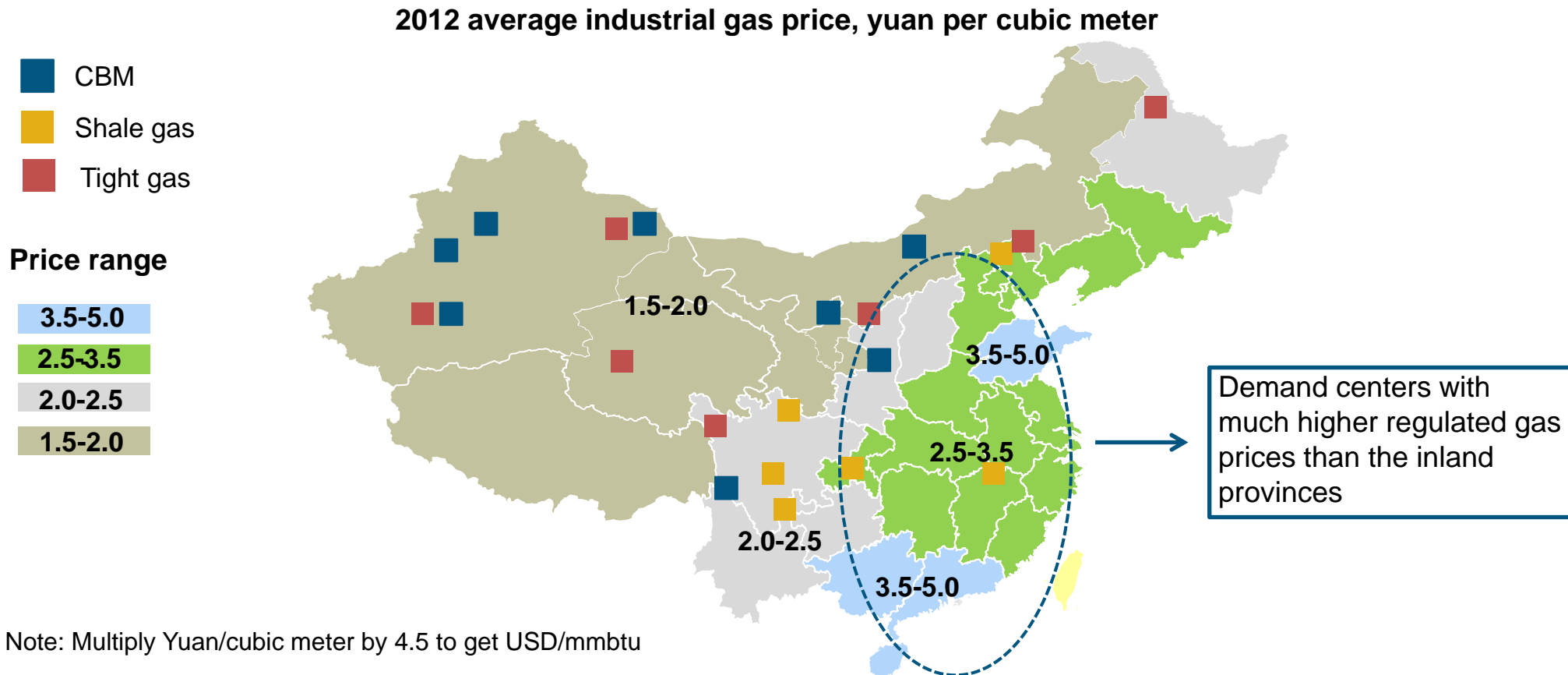


- This will tend to **disincentive** foreign players in upstream sector



- This will tend **incentive** foreign players in upstream sector

Gas Prices Higher Nearer the Coast



The unconventional gas reserve basins are located in the inland provinces that have low gas tariffs and limited consumption growth, so getting the unconventional gas production to the coastal areas in the cheapest way will be critical to make its economics viable

Land Rights - US compared to China

USA

- About 273,000 km² in the USA is classified as leased shale acreage.
- In most cases the owner of the land also owns the rights to the minerals beneath that land.
- This allowed unfettered development of shale gas.
- Some 6,000 (six thousand) large and small E&P companies are involved in shale gas exploration and production.
- Arguably resulted in inefficient build out of infrastructure.

China

- Mineral rights granted by Ministry of Land and Resources. A more orderly approach might be the better solution in terms of capital spent.
- Second bidding round offered 20 areas/blocks. Ministry of Land and Resources said it received 83 qualifying bids for shale gas blocks during its second auction that ended today.
- The winning bids will be announced after their exploration plans, capital budgets, and support measures are evaluated. The licenses offered in the auction consist of 20,002 km² in area and cover eight provincial regions
- Chongqing municipality, and the provinces of Guizhou, Hubei, Hunan, Jiangxi, Zhejiang, Anhui, and Henan.

Local Content and Incentives - USA and China

USA

- For example we understand that one major is keen to bring in exactly the same equipment that it has used in the US.
- "We've taken to China what we've learned in shale fracing in the United States," said the major's CEO in recent comments. "The geology's pretty similar. We can use the same skills and equipment."

China

- Local content restrictions and limits on use of foreign experts have arguably slowed down the development of CBM in Indonesia.
- Might the same problems face shale gas in China? Perhaps not.
- Indeed equipment used upstream in CBM and shale gas exploration and production is expected to get import tax credits or other incentives.

Geology – Still Early Days

USA

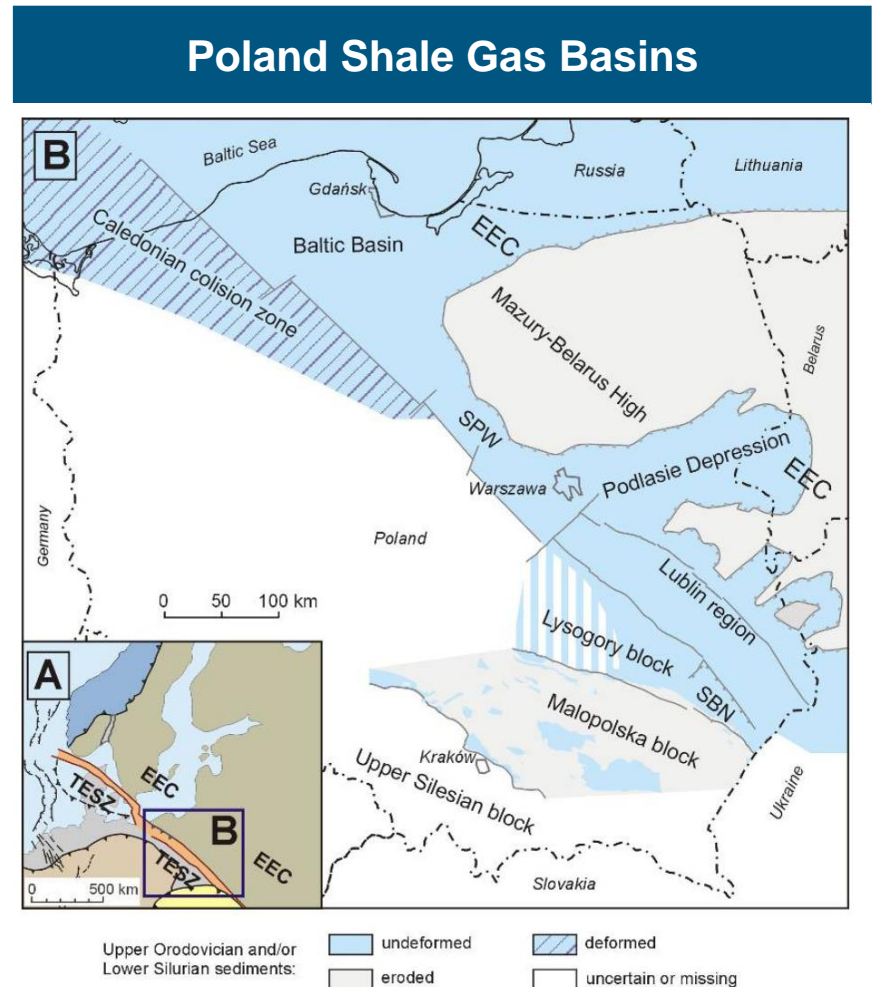
- Shale gas wells drilled in 2010 numbered close to 3,500 and 20,000 in the last ten years.
- This level of activity dramatically lifts the level of knowledge of petroleum geology.
- Most shale gas in the US comes from Barnett (TX) Haynesville (TX, LA), Fayetteville (AR) and Marcellus (WV, PA).

China

- There have been 20 shale gas wells drilled in China to date according to latest IEA data.
- The Sichuan a known province of both, conventional and unconventional natural gas, located in the South China.
 - Black shales are ubiquitous in the Paleozoic marine formations and Mesozoic transitional and lacustrine formations.
- It has been recognized as one of the most promising shale gas provinces in China.
 - Success will depend in part on fraccability of the Lower Silurian Longmaxi black shale and Lower Cambrian Qiongzusi black shale in the Sichuan Basin and Upper Yangtze Platform, South China.

Let's Not Get Too Excited Just Yet – Poland a Cautionary Tale

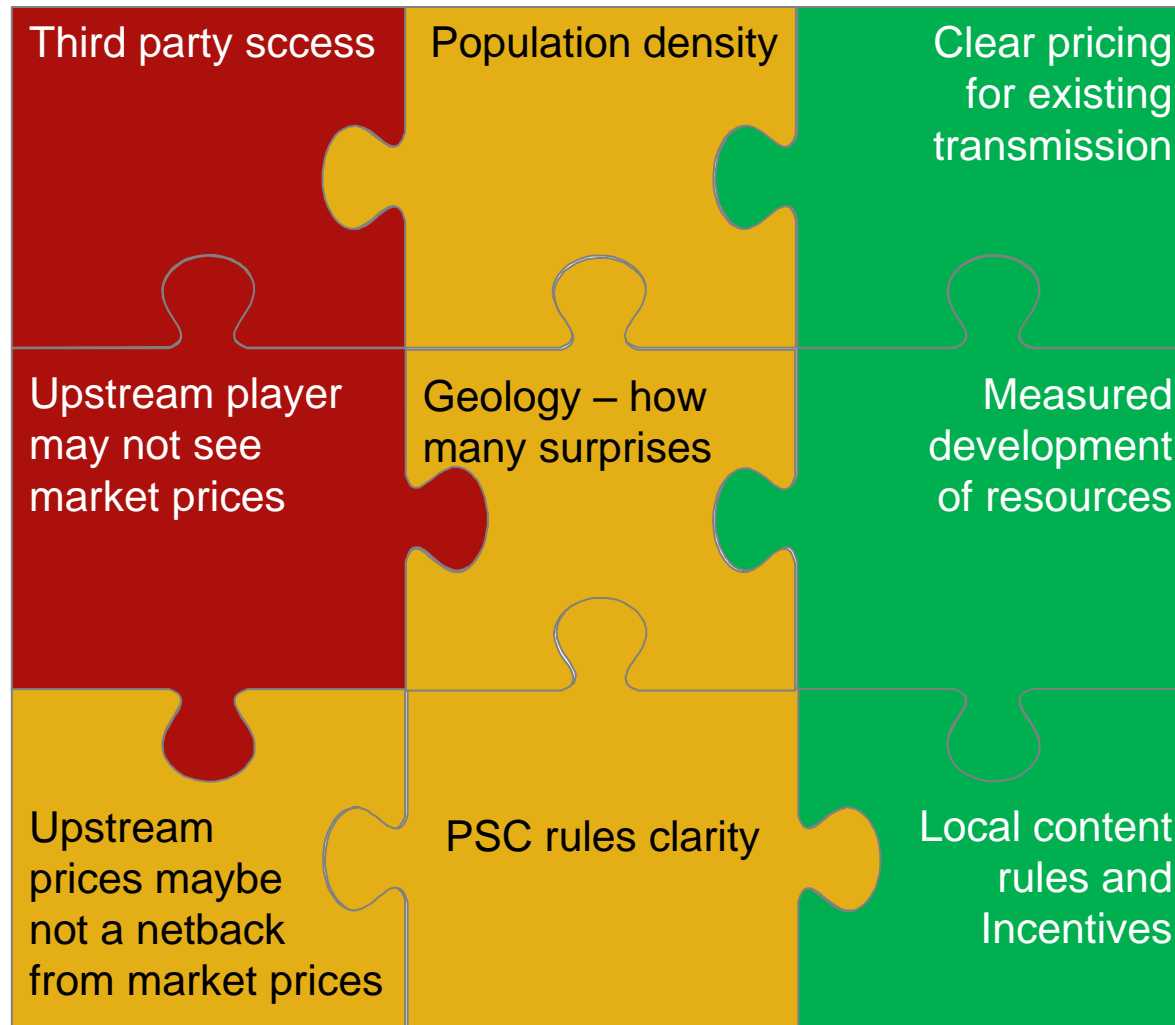
- Energy companies and the government were enticed by an estimate last year from the US Energy Information Administration, which said Poland might hold **5.3 Tcm of shale gas** – the largest reserves in Europe.
- However, a newer estimate by Poland's government geological institute cut about 90 per cent off that, suggesting reserves of 346-768bn cubic metres although later revising that number to **1.93 Tcm**.
- After several poor results from some exploration wells, ExxonMobil exited from two shale gas areas in Poland but still holds onto four others.
- Regulations and fiscal terms for exploration and production of shale gas are being finalised, led by the Ministry of the Environment.
- Clarity in the former and generosity in the latter are expected.



Other USA to China Comparisons

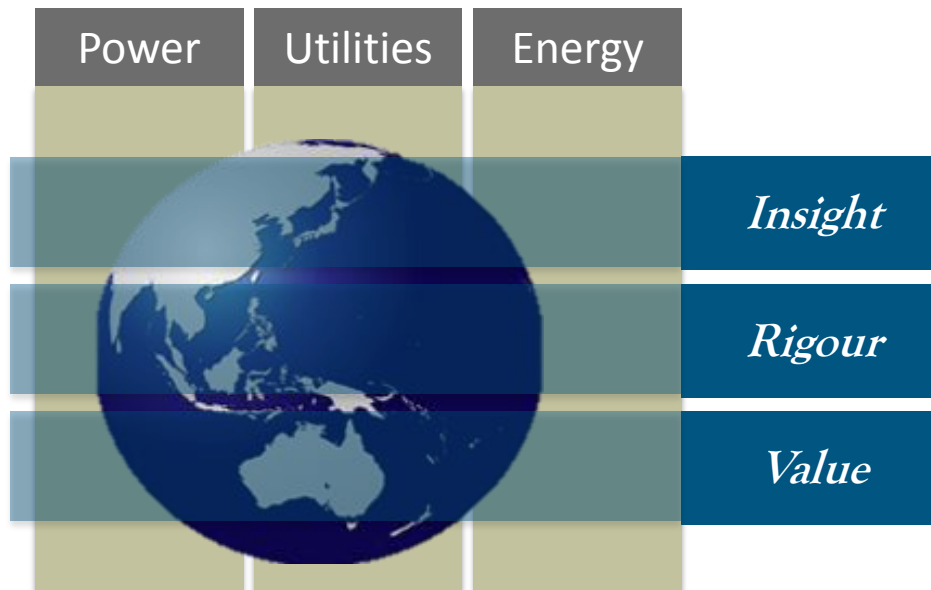
	USA	China
Population Density	<ul style="list-style-type: none">• Not such an issue in most States• But New York State has a ban in place on high volume fracking but not on conventional drilling	<ul style="list-style-type: none">• Could definitely turn out to be an issue.• Some farmers already complaining from conventional gas plays.
New LNG Contracts	<ul style="list-style-type: none">• There is now so much gas it is now aiming at the export market via LNG.• FERC approval is slow in coming for LNG exports terminals to non free trade area countries.	<ul style="list-style-type: none">• In the past three years, China has not signed much new long term LNG contracts, possibly due to the high LNG price and has focused on the domestic shale gas plays and overseas equity investment of unconventional gas and oil assets.
Regulations and Appeals	<ul style="list-style-type: none">• Still evolving with some conflict between State and Federal levels and different agencies.• But business proceeds all the same	<ul style="list-style-type: none">• Early days for shale gas PSCs.• Regulation processes yet to be fully worked out.

Putting the Jigsaw Together - Slower Paced Development of Shale gas in China as compared with USA





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