

China's gas demand in low carbon transition: implications for the international natural gas markets

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1. Background

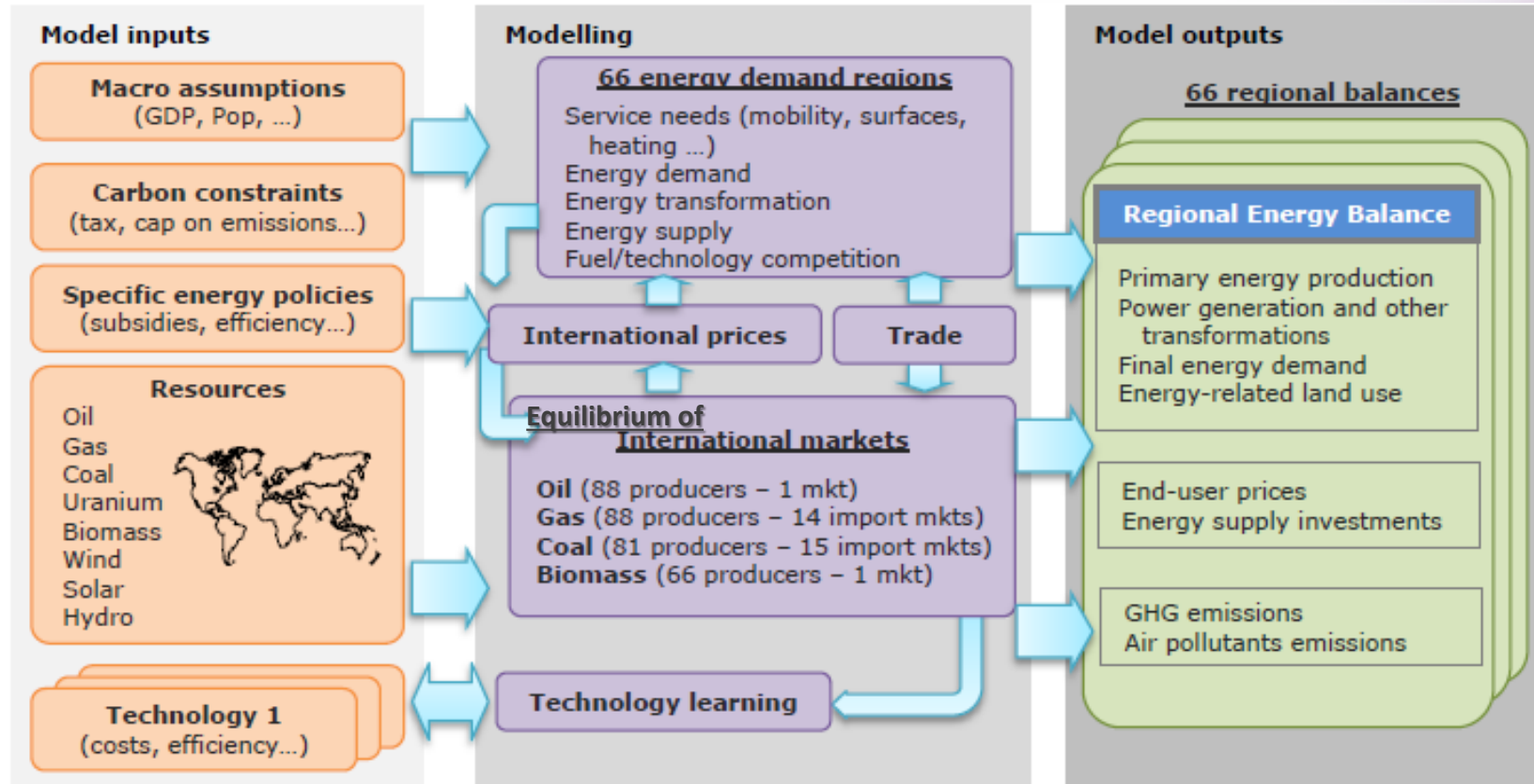
- The huge economic rise and high-carbon fossil energy consumption has transformed China in the world's largest CO₂ emitters and with big problems of air quality.
- So the clean development of energy has become people's urgent demand introducing environmental legislation on air quality.
- However China is going away from a reliance on export driven heavy industrial sectors towards domestic consumption, it's economic expansion is expected to continue which will boost furthermore the demand for energy.
- China is facing many energy challenges :
 - Reinforce the country's security of supply through further development of the national supply portfolio and diversification of the imports
 - Win the battle for “blue skies” through the achievement of the Nationally Determined Contributions (NDC).
 - Being cleaner than oil and coal and relatively flexible, natural gas is considered as an option to switch from dirty coal, reduce the carbon intensity of the energy system and improve air quality.



1. Background

- To be a key option for cleaner energy mix, gas needs :
 - to have more affordable prices than other substitutable sources and
 - it's value must be recognized by electricity market designs that remunerate its flexibility.
- The China's government wants to ensure a strong push on gas market through :
 - Strengthening the gas production, speeding up LNG import, pipeline transportation and gas storage capacity.
 - Increasing the scale of clean coal utilization (such as underground coal gasification),
 - Promoting the development of natural gas hydrates.
- In this framework we wanted to analyze :
 - if natural gas is the crucial option for clean transition
 - the implications of China's gas demand for the international natural gas markets

2. Methodology : POLES model



2. Methodology : Scenarios

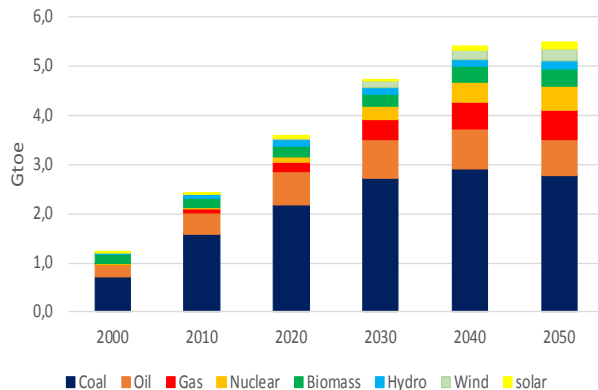
- **BI** - Baseline scenario is a business as usual situation and is used as a counterfactual case for comparisons with other scenarios
- **2Ds** - corresponds to a 2° type of scenarios. In this scenario most of the Nationally Determined Contributions (NDC) are taken into account.
- **2Ds gas+** scenario makes the assumption of a strong government push for a cleaner energy mix where natural gas will be used in a more optimistic way than in the 2Ds.

3. Current and future challenges of China's gas market

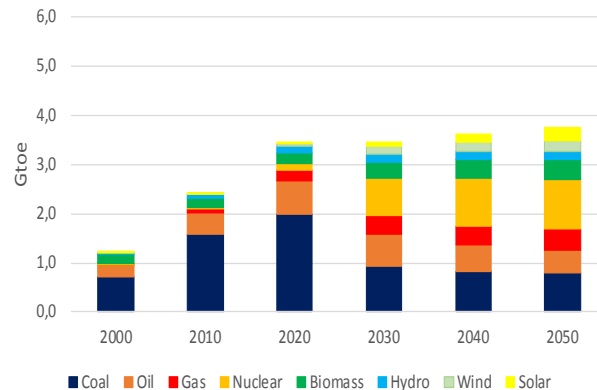
3.1 China's primary energy demand by scenario

- China's economic expansion is expected to continue which will boost furthermore the demand for energy: from around 3 Gtoe currently to 5,5 or 3,8 Gtoe by 2050 in the BI and 2D scenarios.
- In the BI coal remains the major energy source while the 2Ds and 2Ds gas+ change the coal-dominated mix with nuclear, renewables and natural gas as winner.
- Natural gas accounts for only around 7% of China's primary energy mix today, but demand is estimated to expand to 13% to 18% of the primary demand according the scenarios by 2050 .

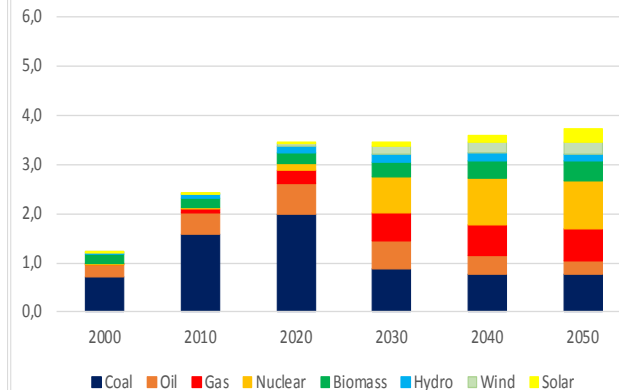
China's primary consumption BI



China's primary consumption 2D



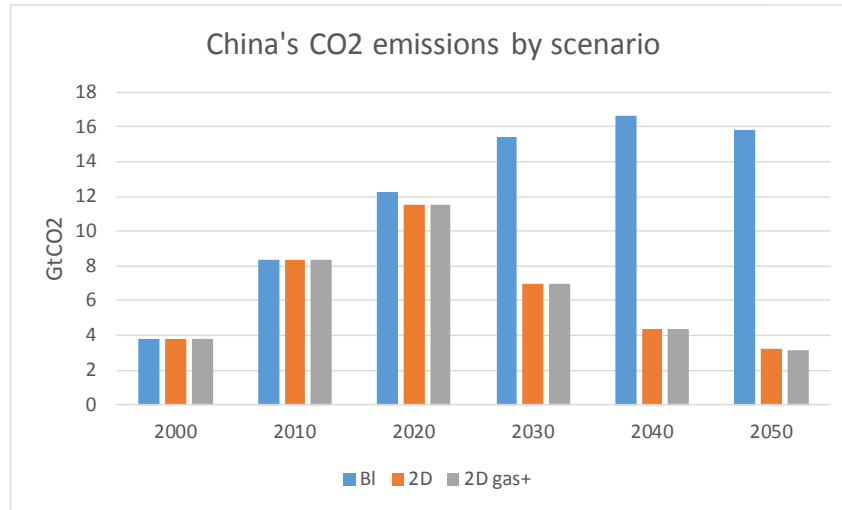
China's primary energy consumption 2D gas+





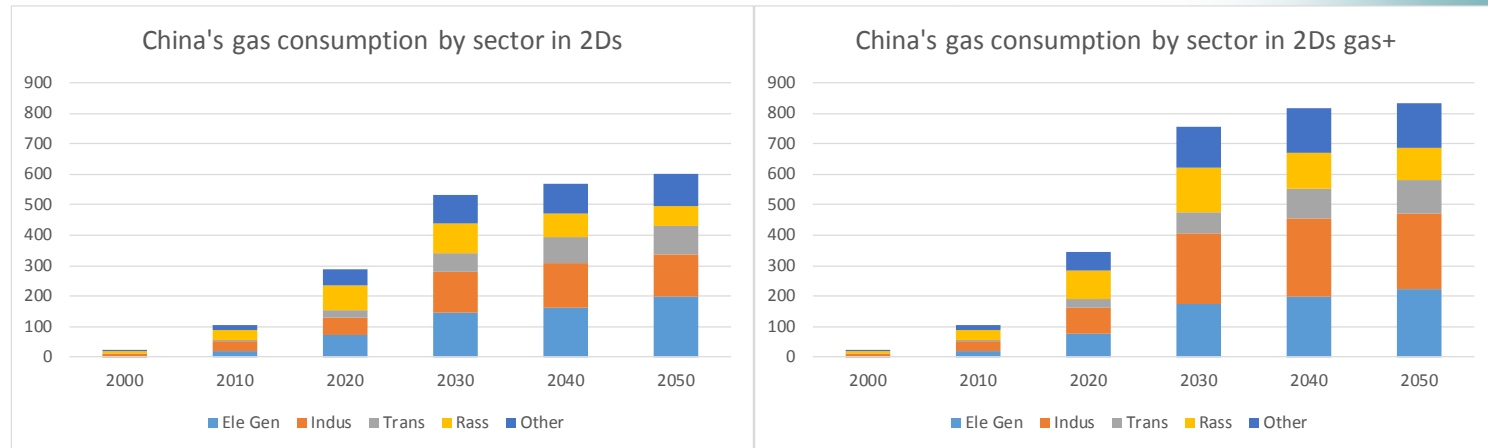
China's CO2 emissions by scenario

- The use of the natural gas (but also of other options like renewables and nuclear) can achieve rapid environmental benefits when it replaces coal or oil, as demonstrated for instance in the following graph.



China's gas consumption by sector

- Because of a lot of uncertainties, China's gas demand varies significantly from one model/scenario to another. Our 3 scenarios run with the POLES model cover the considerable range of this variability.
- Over the short term (2020), natural gas demand is expected to grow moderately in both scenarios.
- In longer term it is expected that China may more than double its gas demand.
- Growth is particularly strong in the industry followed by the electricity generation, while gas consumption in the buildings sector grows more modestly due to important expansion's needs of the distribution network.
- Gas is expected to increase also in the road passenger and freight sectors.





3.2 China's gas production

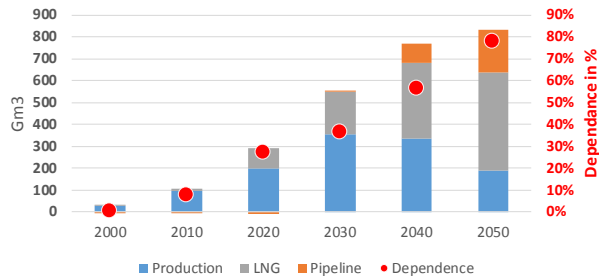
Prospective estimations of the China's gas production face many uncertainties :

1. Uncertainties about the size of the resources either conventional or shale and tight gas resources.
2. International and domestic pricing:
 - The current context is characterized by low price competitiveness of natural gas for end users.
 - Lower gas prices can help growth in gas penetration and stimulate the substitution of more polluting fuels such as coal and oil.
 - Higher domestic gas prices that covers LNG import prices may conversely impact the demand.
 - Making unconventional gas competitive needs even higher prices.
3. Currently conventional gas production accounts for over 70% of the country's gas output, but it is expected to change. The 13th Five-Year Plan targets 120 bcm conventional gas production by 2020 taking into account the remaining resources. In longer term, our projections indicate a slight decline in 2050.
4. The prospects for overall gas production in China depend heavily on the prospects for shale. IEA estimates 90 bcm shale gas production between 2017 and 2040. Gunningham (2013) underline that Chinese shale gas exploitation will continue to grow but not at a speed comparable to that achieved in the US.
5. Coal gasification projects are studied as security of supply and regional development options. However the success of shale gas may impact coal gasification projects, and vice versa.

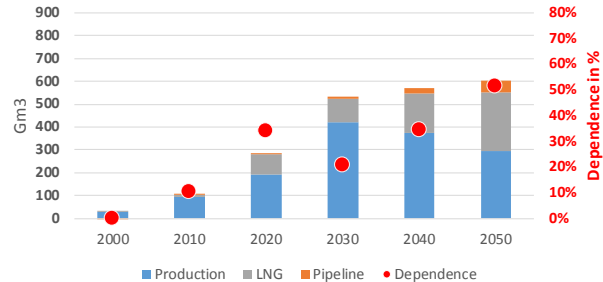
China's natural gas production, imports and dependency

- China's energy demand is growing faster than national supply. To supplement the future gap LNG and pipeline imports should be tripled.
- The dependence on foreign natural gas increases quickly to more than 40% after 2040 in 2Ds and after 2020 in 2Ds gas +.
- The high proportion of import dependence will increase the risk of natural gas supply security requiring more gas storage and distribution infrastructures.

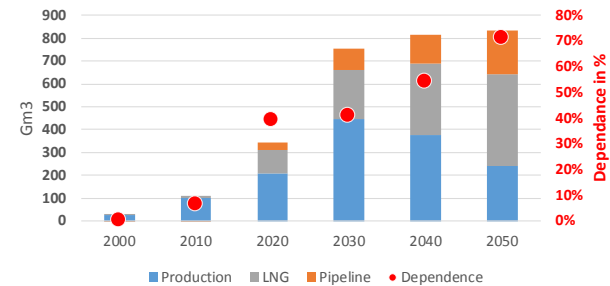
China's consumption, production, pipeline & LNG imports and dependency (BI)



China's consumption, production, pipeline & LNG imports and dependency (2D)



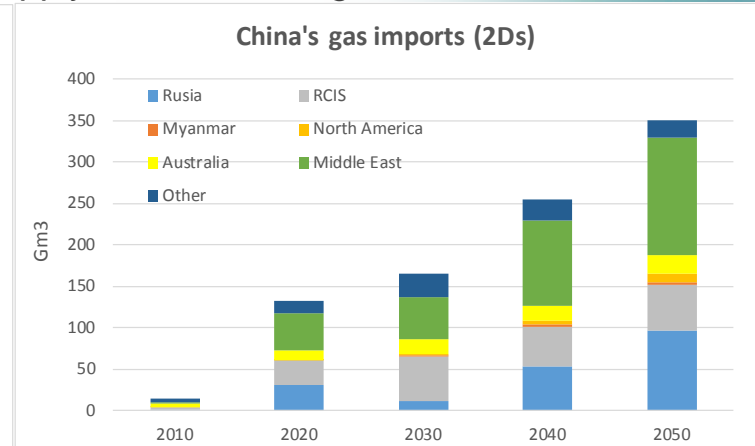
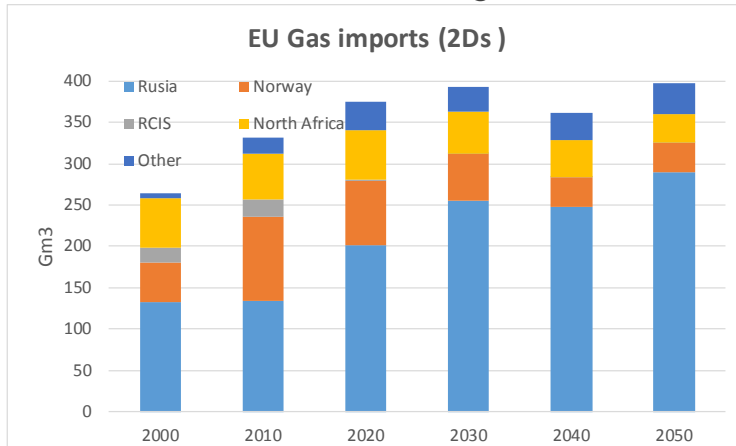
China's consumption, production, pipeline & LNG imports and dependency (2D gas+)



Source: Poles-GAEL

3.3 Gas imports in China and EU

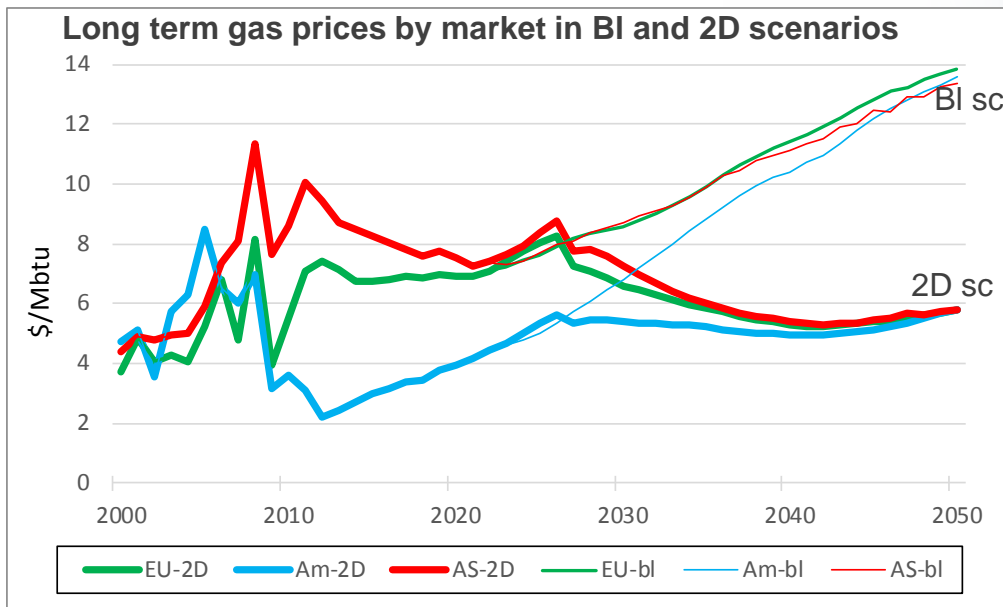
- The outlook for gas demand in China is one of the most important questions facing the global gas market, as it will have significant consequences for gas producers and consumers across the world (Miyamoto & Ishiguro, 2018).
- China's net imports approach those of the European Union by 2050. International LNG market are very interested on the future course of China's growth in imports. The failure of Turkmenistan to meet the expected level of supply during winter 2017/2018 (Henderson, 2018) may impact the increase of gas imports via pipeline from Russia.
- Despite lower demand, declines in indigenous production mean that the EU's import dependence rises to 76% by 2050. Russia remains the largest source of supply with the among the least-cost.





4. The implications of China's gas demand for the international natural gas markets

- However that natural gas supply (shale gas in North America and conv. gas in the Middle East, Central Asia and deep sea) is expected to be abundant in a long run gas prices are not expected to decrease.
- The natural gas trading is shifting to the Asia-Pacific region because gas production growth is much lower than consumption growth in this region. A US and a Russian arbitrage between Europe and Asia/China can be profiled. A LNG scarcity would mean that EU will have to offer a price close to the Asian price to get gas.
- Rising share of LNG use narrows the gap in natural gas prices in key markets: European and Asian gas prices converge after 2020 in both scenarios. American prices follows more slowly decreasing more than two times in the 2D sc than in BL at the end of the period.



5. Conclusions

- The China's gas market prospects remain subject to many uncertainties about the level and the speed of the gas penetration, domestic production and the role of the shale gas, as well as the effectiveness of national policies to promote a greater gas use and a high level of security, availability of the interconnection infrastructures and storages capacities.
- China is aware of the need to high rises of the gas imports, so its strategic goal is to diversify alternative sources of imports with questions like: LNG versus gas pipeline? What role for the Iranian gas?
- The implementation of measures to meet the climate change mitigation targets under the Paris Agreement (2Ds) affect demand for natural gas. In the 2Ds renewables and nuclear are more competitive in substituting coal and oil than natural gas. Furthermore the implications of shale gas as 'game changer' are not clear for the climate change: So the natural gas does not seem to be the fuel savior to cleaner transition in China in the long term.
- The competition for the Russian gas between China and EU depend not only on economics and commercial considerations but also by geopolitics and political motivation of the concerned governments.

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