

# Natural gas involvement in China's energy transition

Silvana Mima, Catherine Locatelli (GAEL, University Grenoble-Alpes)  
Olga Garanina (Graduate School of Management, St Petersburg University)

16 IAEE European Conference  
Ljubljana, 26 August 2019

# Natural gas involvement in China's energy transition

## 1. Background

## 2. Methodology and scenarios

## 3. Results

- Natural gas demand in China by scenario
- Natural gas supply in China
- Gas imports

## 4. May China's demand have a substantial impact on global natural gas trade dynamics?

## 5. Conclusions

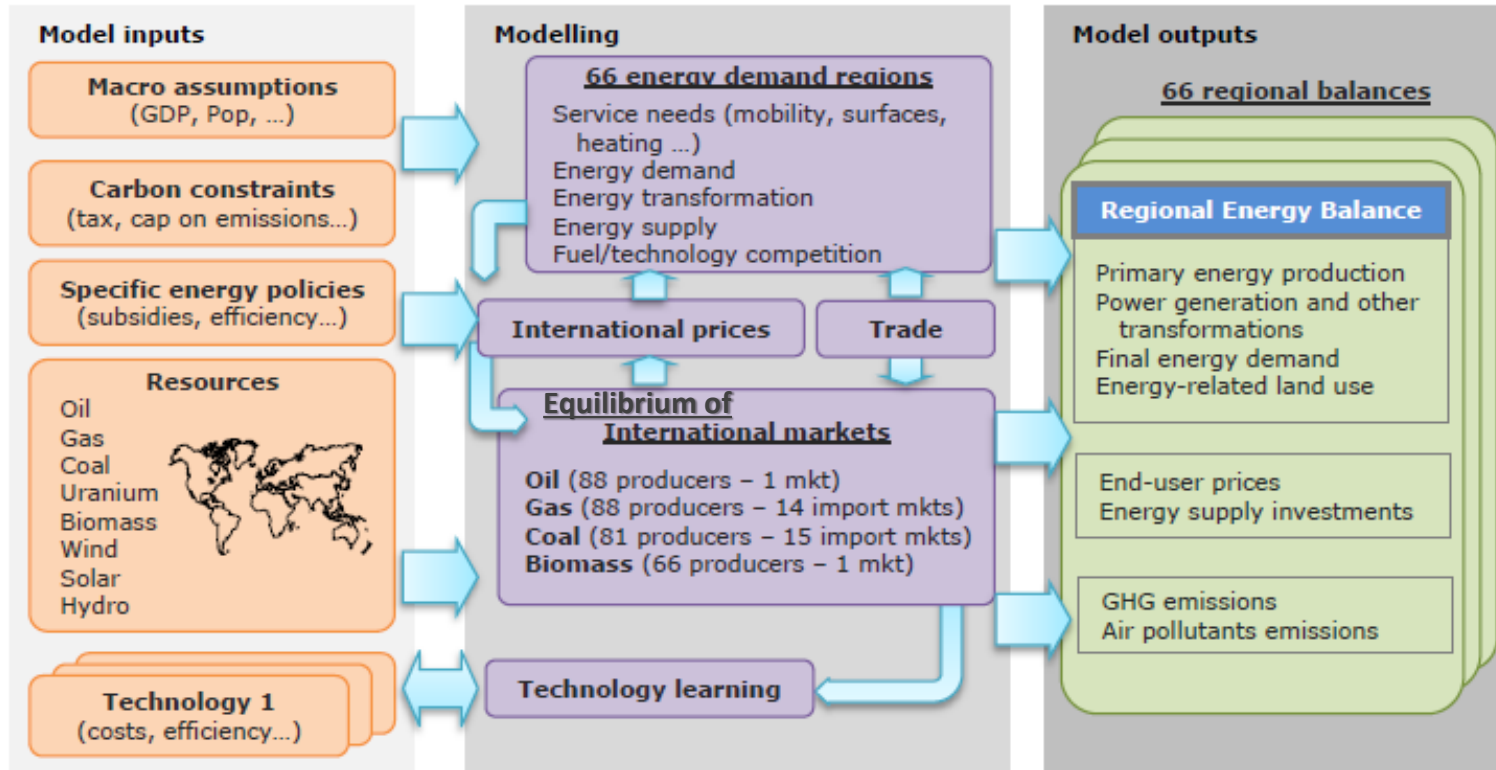
# 1. Background

- The huge economic rise and high-carbon fossil energy consumption transformed China into the world's largest CO<sub>2</sub> emitter with big problems of air quality.
- So the clean development of energy became people's urgent demand pushing for environmental legislation.
- However China is going away from 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 energy challenges :
  - To reinforce the country's security of supply through further development of the national supply portfolio and diversification of imports
  - To 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 away from dirty coal, reduce the carbon intensity of the energy system and improve the air quality.

# 1. Background

- To be a key option for cleaner energy mix, gas needs :
  - to have more affordable prices than other substitutable energy sources and
  - it's value must be recognized by electricity market design that remunerate its flexibility
- China's government intends to ensure a strong push on gas market through :
  - strengthening up domestic gas production, speeding up the LNG import, increasing pipeline transportation and 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 different China's demand gas levels on global gas import-export relationships

## 2. Methodology : POLES model



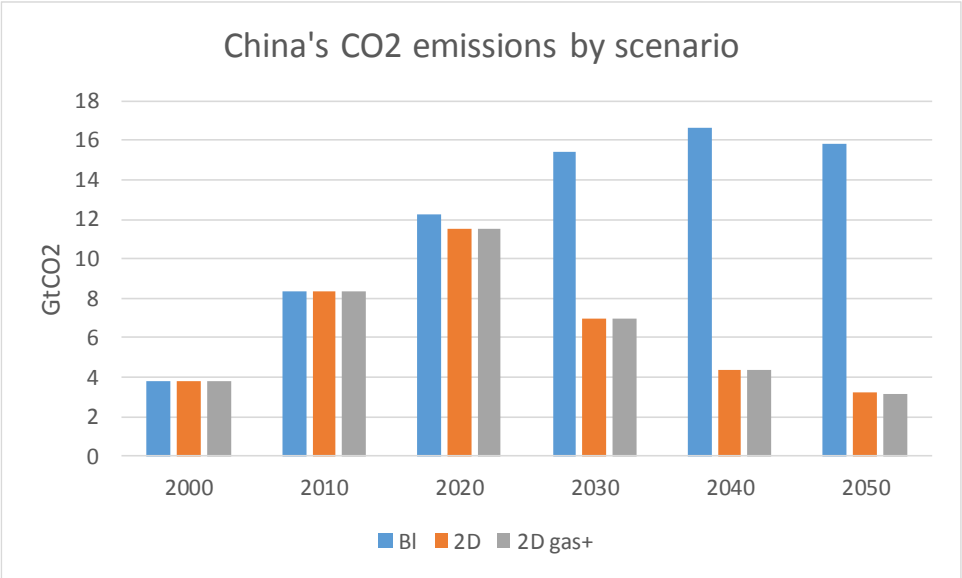
The model permits to capture the complex interactions of multiple aspects and generate quantitative projections on likely evolution of energy systems and global market developments

## 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 governmental push for a cleaner energy mix where natural gas will be used in a more optimistic way than in the 2Ds

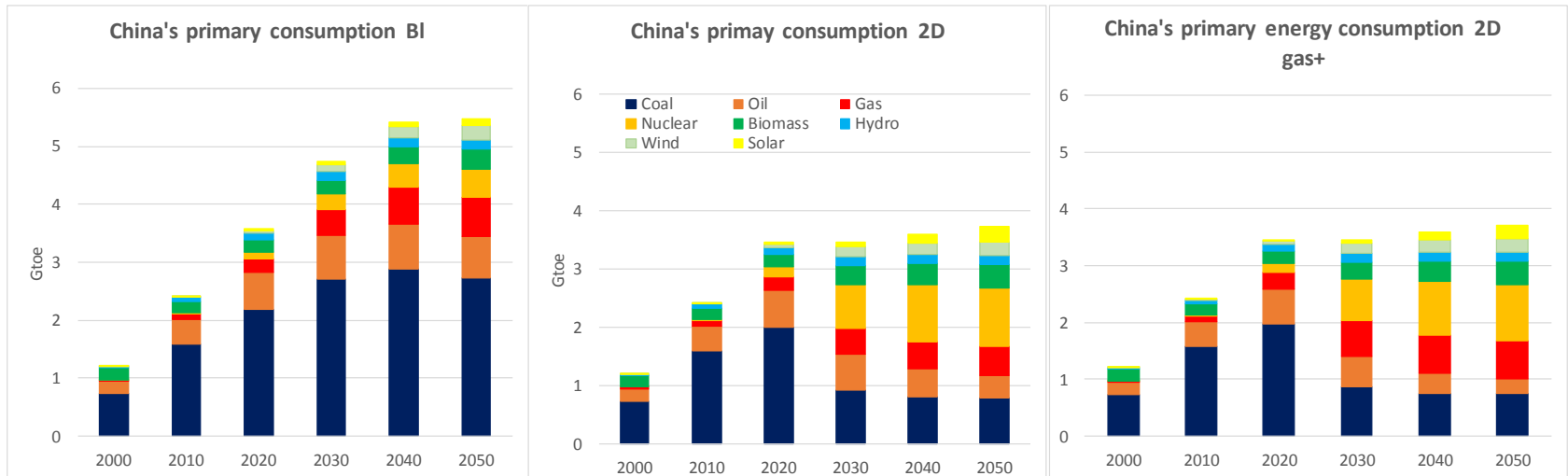
### 3.1. China's CO2 emissions by scenario

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.



## 3.2. China's primary energy demand by scenario

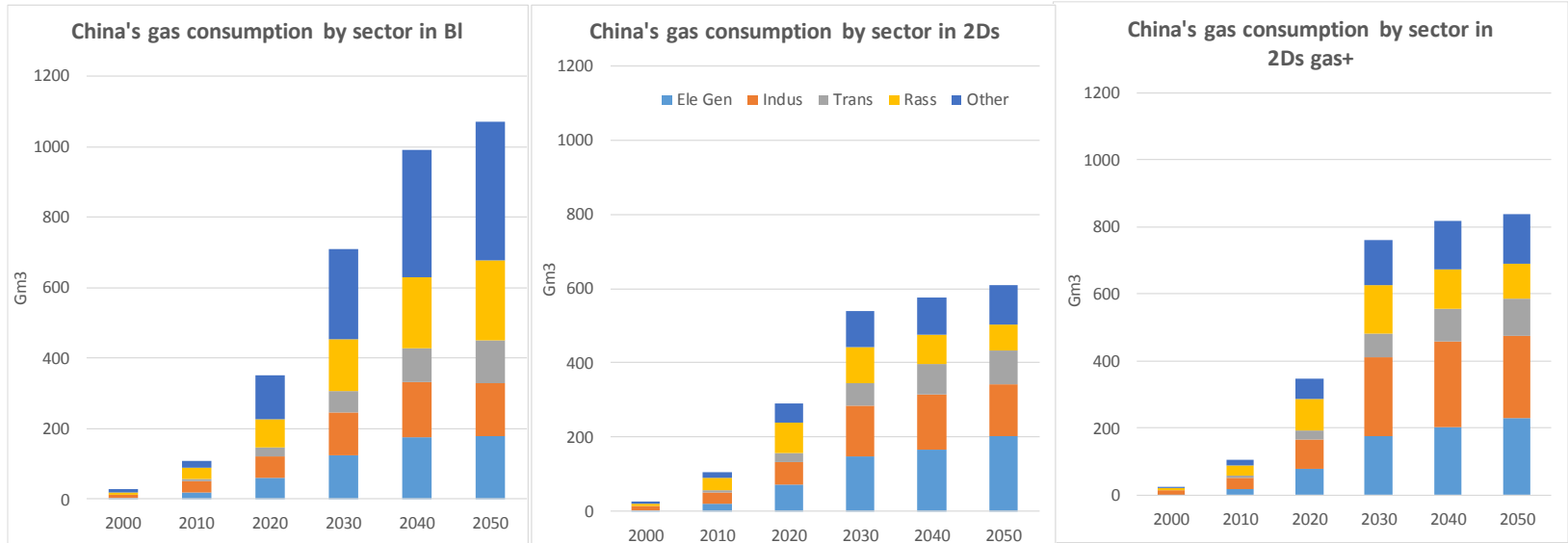
- China's economic expansion is expected to continue which will boost furthermore the demand for energy: from around 3 Gtoe currently to 5,5 or 3,7 Gtoe by 2050 in the BI and 2D scenarios.
- In the BI coal remains the major energy source while in the 2Ds and 2Ds gas+ nuclear, renewables and natural gas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





### 3.3. 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 in the three scenarios. In longer term it is expected that China may more than double its gas demand.
- However we observe limitations to natural gas demand growth in power generation which testifies to the impacts of competition with nuclear and renewables. The major demand drivers remain to be the industry demand, as well as governmental regulations affecting the use of gas in transport and residential sector.



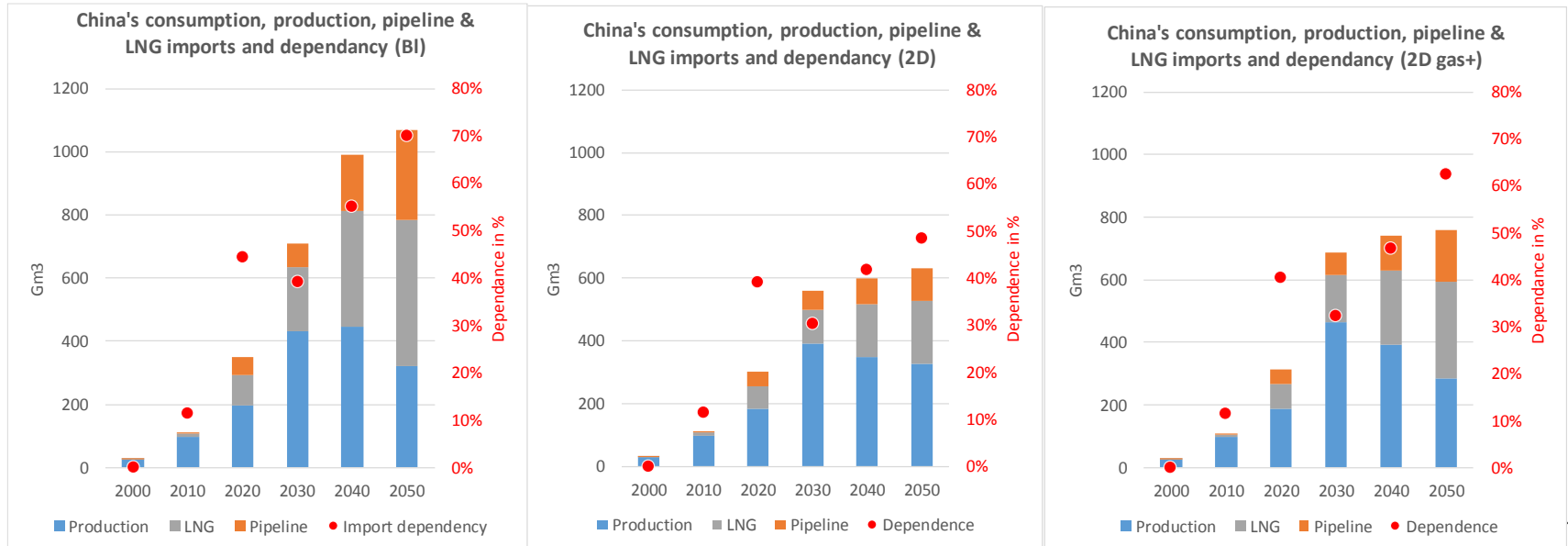
## 3.4. China's gas production

Prospective estimations of 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 the gas penetration and stimulate the substitution of more polluting fuels such as coal and oil.
  - Higher domestic gas prices that cover 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. In perspective by 2040, about half of production could be provided by shale gas (EIA 2017).
4. The prospects for overall gas production in China depend heavily on the prospects for shale. Gunningham (2013) underlines that Chinese shale gas exploitation will continue to grow but not at a speed comparable to that achieved in the US. Currently China is lagging in terms of domestic unconventional gas targets.
5. Our projections indicate that domestic gas output will peak around 2030 at the level between around 350 bcm in the BI and 430 bcm in 2D gas + scenario.
6. 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.

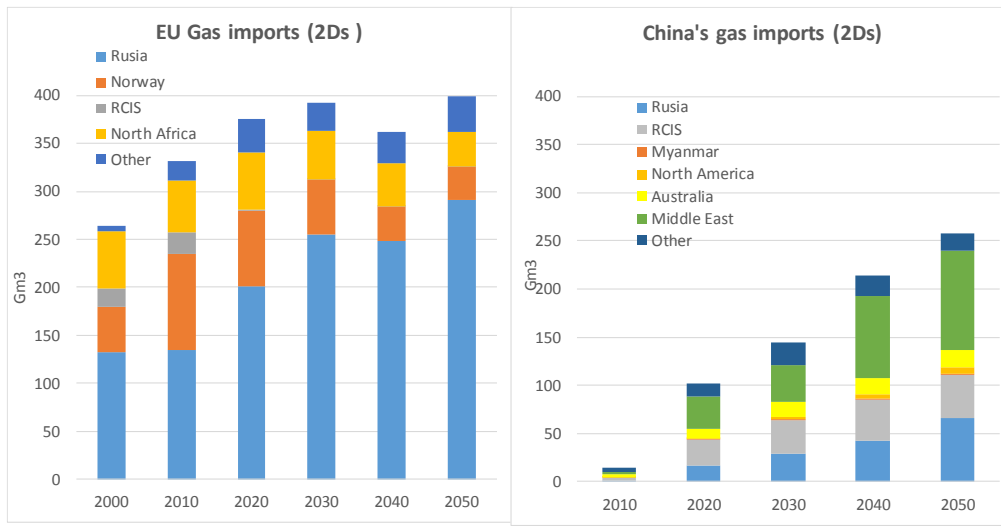
### 3.5. China's natural gas production, imports and dependency

- China's energy demand is growing faster than national supply. To supplement the future gap, LNG and pipeline imports should be drastically increased.
- Dependence on foreign gas supplies increases quickly overpassing 50% in BI and 2Dgas+ scenarios.
- High import dependence will increase the risk of natural gas supply security requiring more gas storage and distribution infrastructures.



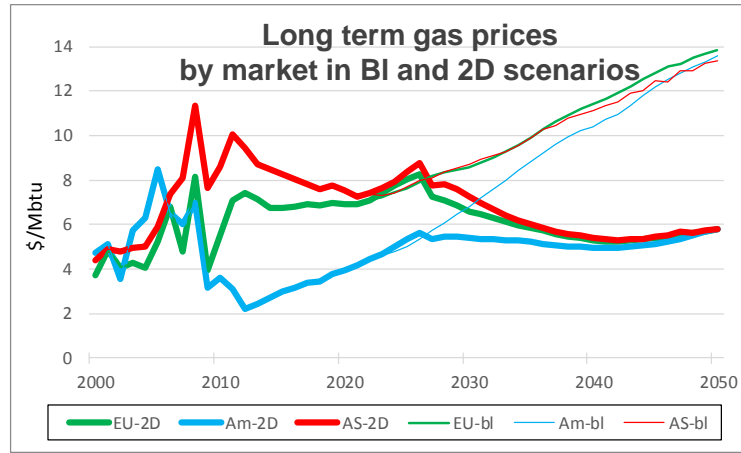
## 4. May China's demand have a substantial implication on global natural gas trade dynamics?

- The outlook for gas demand in China is one of the most important questions facing the global gas market (Miyamoto & Ishiguro, 2018).
- China's net imports approach those of the European Union by 2050. Therefore, arbitrage between Europe and Asia/China can be profited on behalf of the major producers (i.e. Russia, US).
- Russian gas projects are cost-competitive for the Chinese market, making Russia a major source of incremental supplies (Henderson 2018).
- International LNG market players are very interested in the future course of China's imports. Rising imports of US LNG face political constraints in context of the US-China trade war.



## 4. May China's demand have a substantial impact on global natural gas trade dynamics?

- However that global natural gas supply is expected to be abundant, in a long run gas prices are not expected to decrease.
- Prices are more than twice lower in the 2D scenario than in BL at the end of the period.
- Rising share of LNG narrows the gap in natural gas prices in key markets: European and Asian gas prices converge after 2020 in both scenarios. LNG scarcity would mean that EU will have to offer a price close to the Asian price to get the gas.
- The prices in 2D+ scenario follow closely the trends of 2D scenario which means that incremental gas demand from China is absorbed by the international market and is not sufficient to push the prices upwards.



BI sc

2D sc

## 5. Conclusions

- China's gas demand can vary significantly depending on the pathway of decarbonization, renewable or nuclear deployment, energy efficiency improvement, and climate legislation.
- So 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 shale gas, as well as the effectiveness of national policies to promote a greater gas use and a high level of security, availability of transportation infrastructures and storage capacities.
- China is aware of the need to increase the gas imports, so its strategic goal is to diversify alternative sources of supply taking into account geopolitical issues.
- The implementation of measures to meet the climate change mitigation targets under the Paris Agreement and more (2Ds) affects the demand for natural gas. But in this case 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 run.