



Renewables Curtailment in China – is there light at the end of the tunnel?

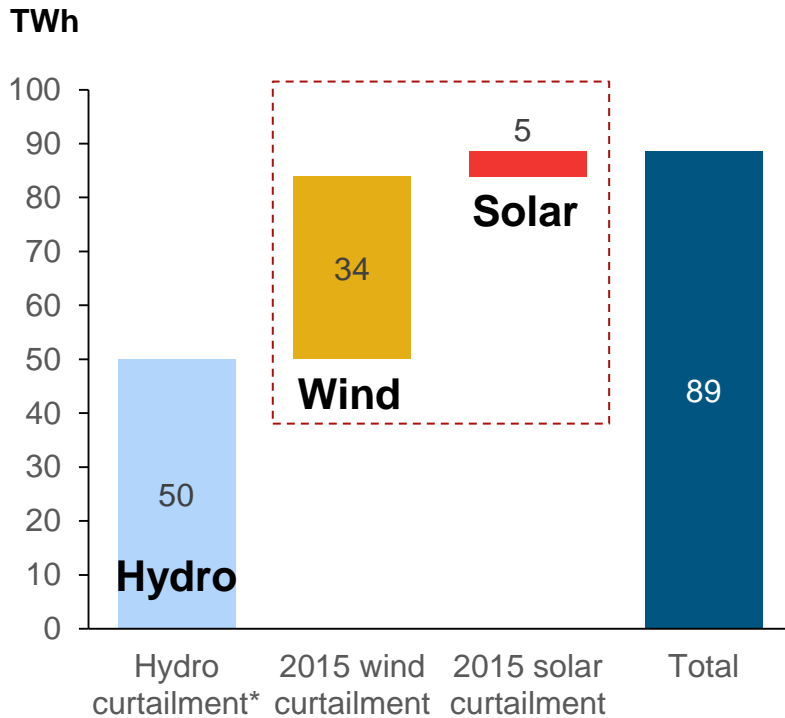
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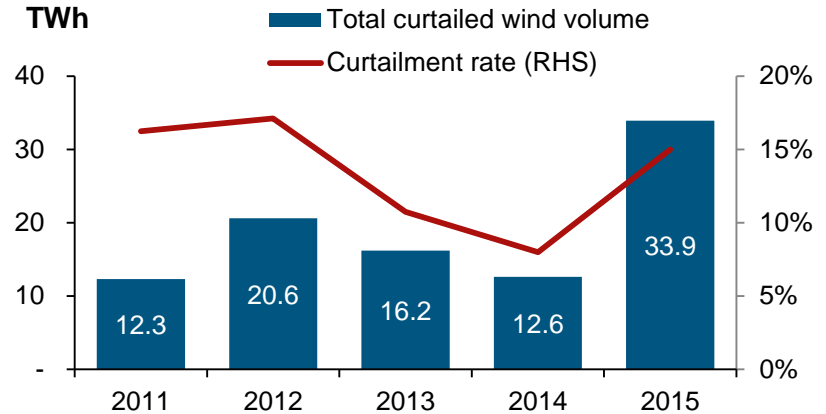
Renewable curtailment in China – All ready to generate but no place to go

RE curtailment in China

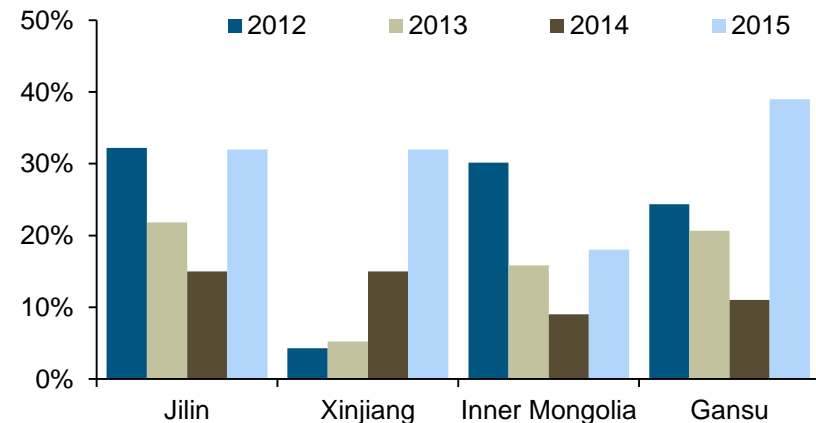


Total curtailment amount in 2015 is equivalent to **2x Singapore's power consumption**

Wind curtailment details

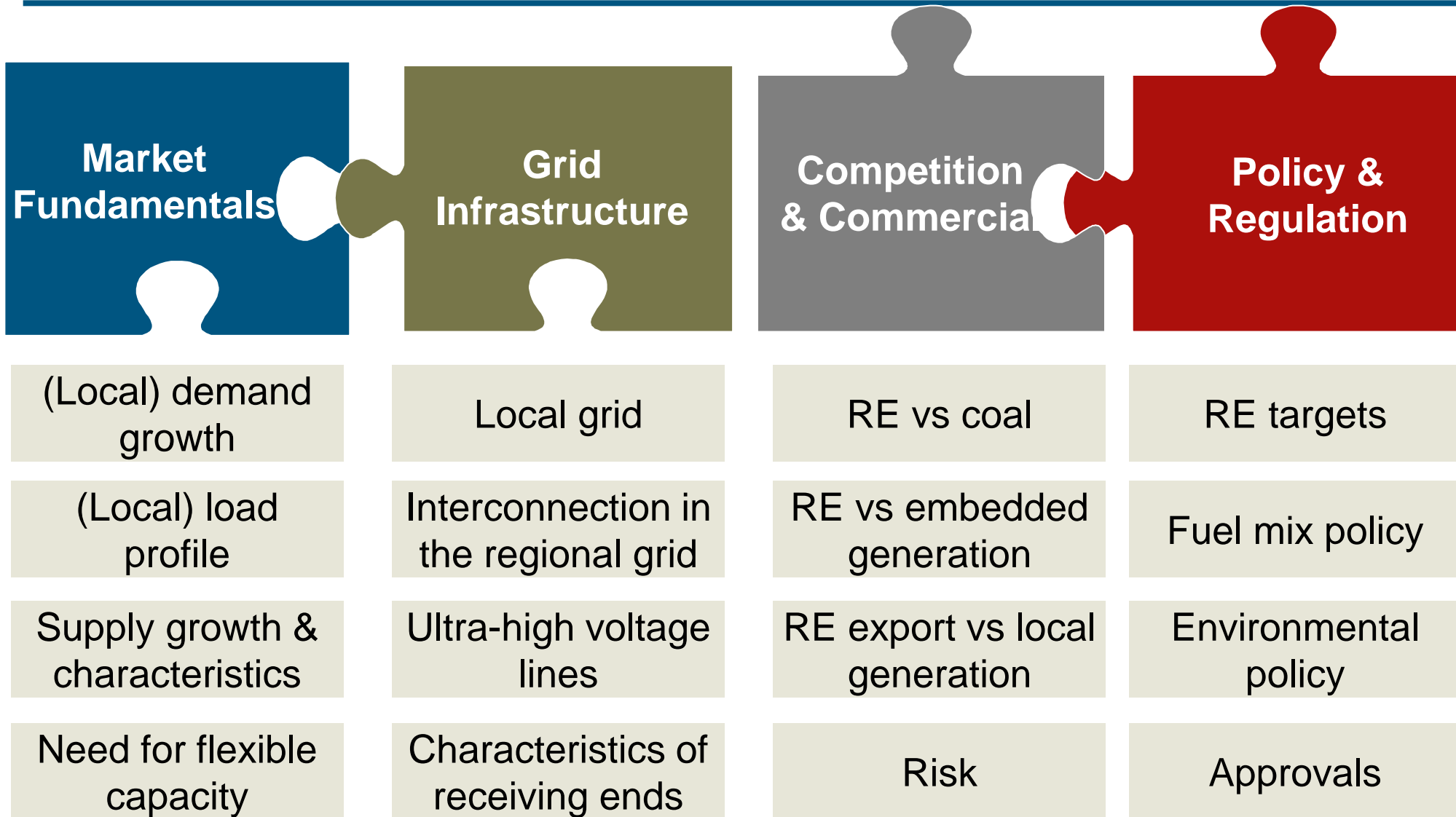


Wind Curtailment rate in selected provinces



Will it get better???

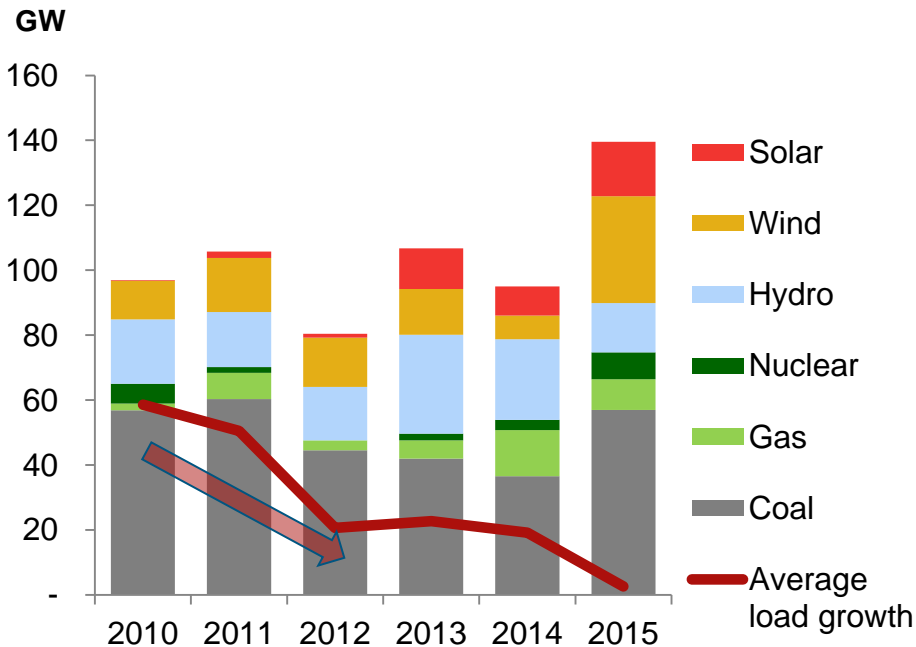
We use four “lenses” to analyze how curtailment will evolve in the future



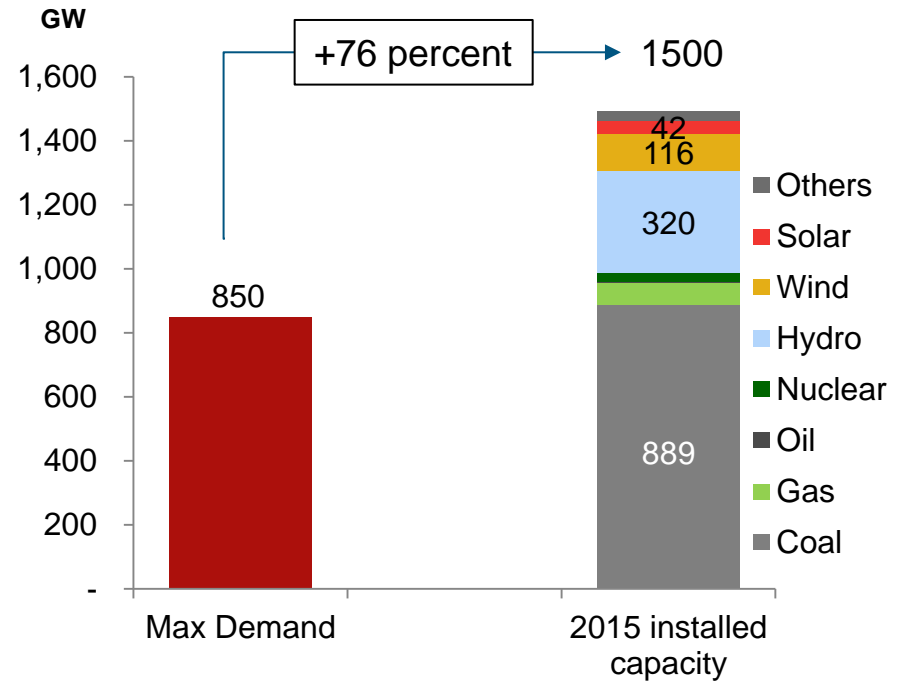
It will be a daunting task for China to resolve the power over-capacity issue

Incremental annual power supply & demand

No supply response to slow-down in demand growth so far...



Reserve margin is at historically high level

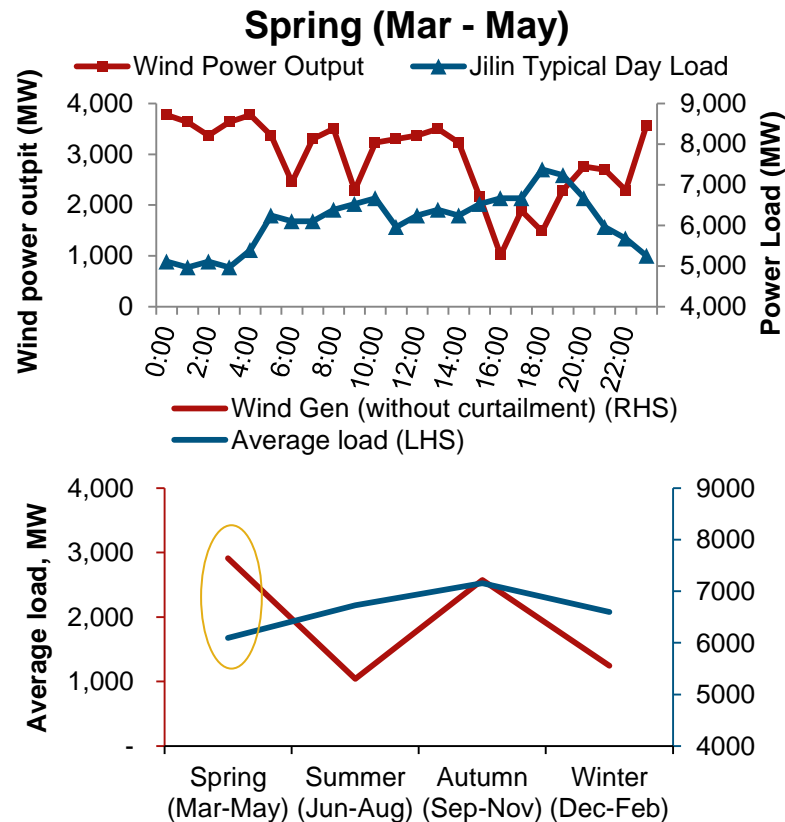


Annual average incremental surplus capacity is about 90 GW in 2012-2015, close to the total installed capacity in UK

Retirement and rationalization of new capacity build is needed to resolve over-capacity – a new realm faced by China

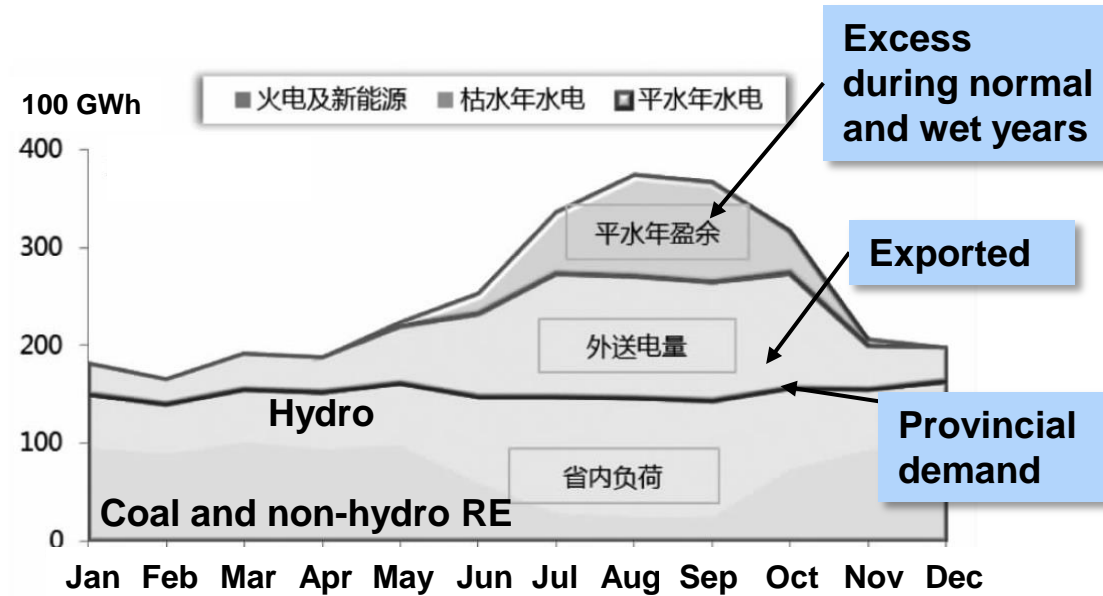
Mismatch of supply and demand timing is a key challenge for RE generation, leading to curtailment

Jilin wind case study



Strong wind speed is at the wrong time of the day and the year

Yunnan case study



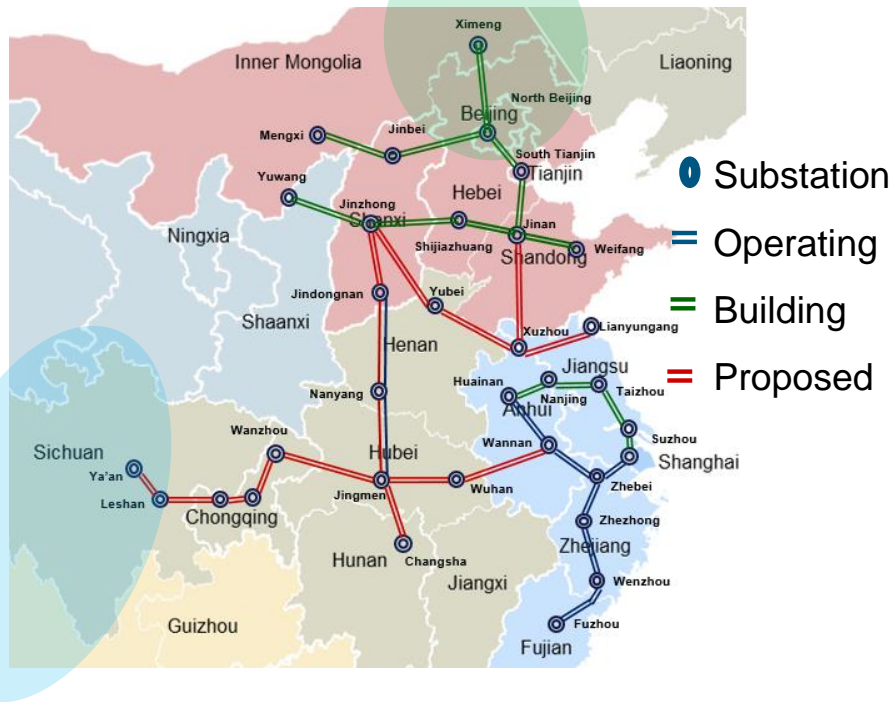
Source: The Causes and Spatial and Temporal Distribution of Seasonal Hydro—electricity in Yunnan Province. Gao et al. (EHV Power Transmission Company, China Southern Power Grid and Yunnan Electric Power Design Institute) Yunnan Electric Power Vol 42 No. 5. Oct 2014.

Seasonality of hydro-generation poses challenges for power balancing and export arrangement

UHV DC and AC lines expansions will enable power exports from the curtailed regions, but they are also driving new generation capacity additions

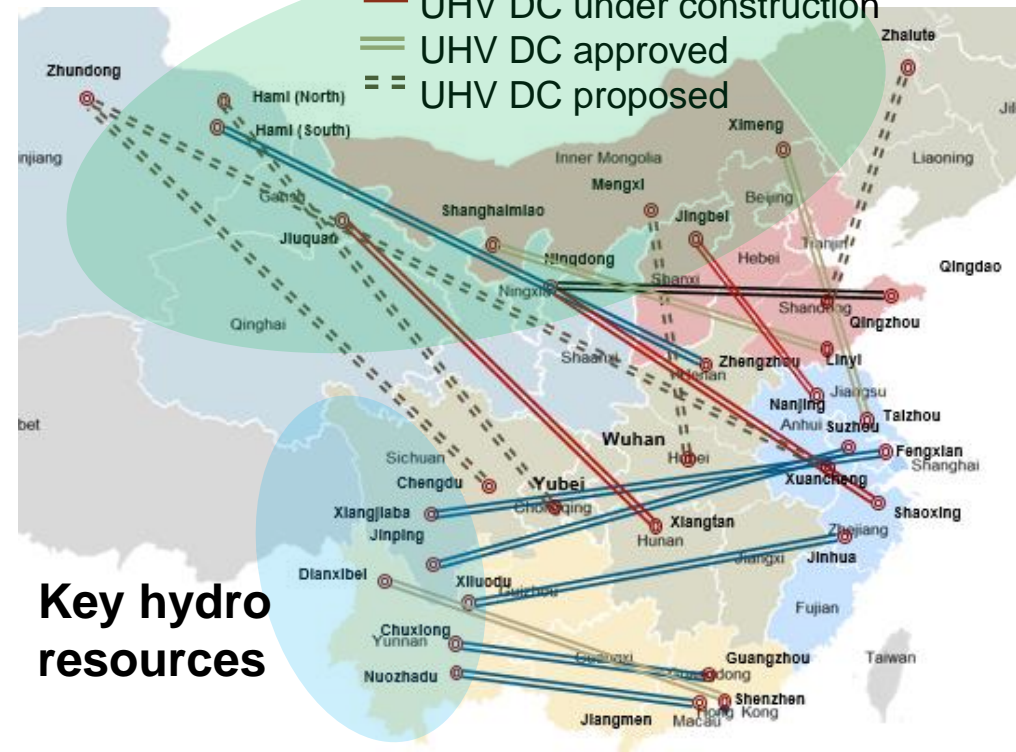
UHV AC lines

Large new coal plants + solar/wind



UHV DC lines

- ⊙ DC Terminal
- ≡ ±660kV EHV DC in Operation
- UHV DC in Operation
- UHV DC under construction
- UHV DC approved
- ≡≡ UHV DC proposed



Key hydro resources

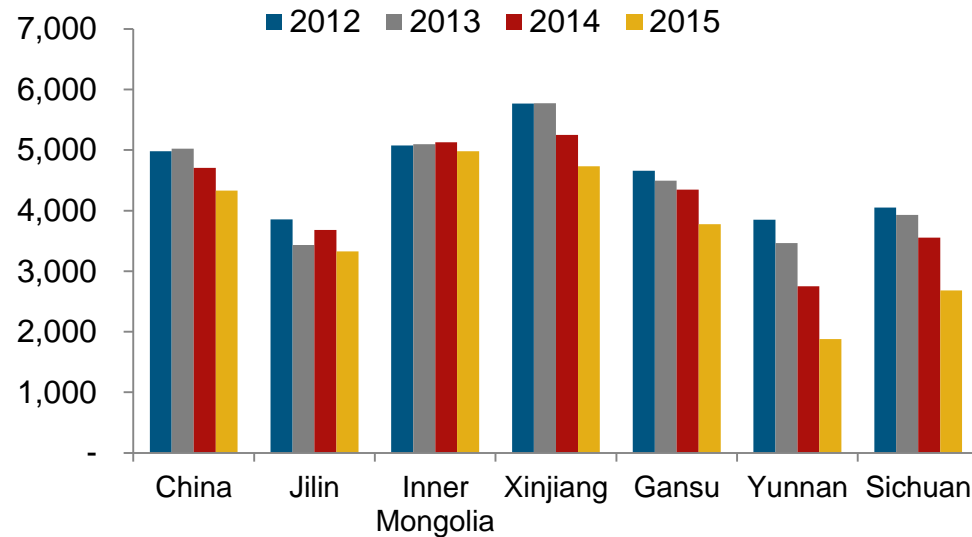
The power re-balancing across provinces/regions in China due to the commissioning of these UHV lines is a key factor to watch

More RE generation will have to squeeze out something else in an over-capacity and low demand growth market

Renewables vs Coal

Annual average generation hours of thermal capacity in China

Utilization hours



How low can coal-fired power generation go?

Import vs Local generation

Coal + Solar/wind or Large hydro in resource rich regions



More exports to Load centres (coastal cities in South and East China) via the UHV lines?

Local governments do not want more imports to squeeze out more local generation as demand growth slows

Reform and policy changes are under-way, and progress could be slow

Sector-wise reform and policy changes

- **Reform of transmission and distribution sector:** uncertain impact on RE dispatch
- **Direct negotiation between generators and large end-users:** likely negative for RE
- **Continuing on-grid tariff reform:** uncertain impact on RE dispatch

Proposed policies to mitigate curtailment

- **Slow-down approval or halt new solar and wind projects in highly curtailed regions:** POSITIVE
- **Better planning and coordination of real-time dispatch:** POSITIVE
- **Increasing flexibility of the system:** POSITIVE
- **Various RE Targets*:** UNCERTAIN
- **Wind/solar for heating:** UNCERTAIN

* Note: Several Non-hydro RE targets have been discussed in China:

- Consumption-side: 5-13 percent each province (nation-wide average at 9 percent) in 2020. Non-hydro RE generation needs to almost double from current level.
- Generation-side: 15 percent non-hydro RE obligation on coal power

RE curtailment – probably will get worse before getting better

- **Slow demand growth**
- **Supply** – Still no visibility on slow-down in new addition
- No easy way to resolve the RE supply and demand mismatch

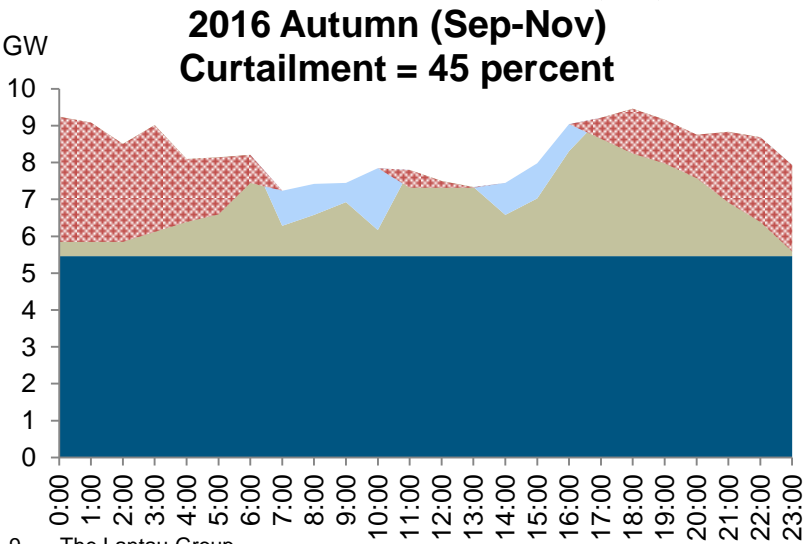
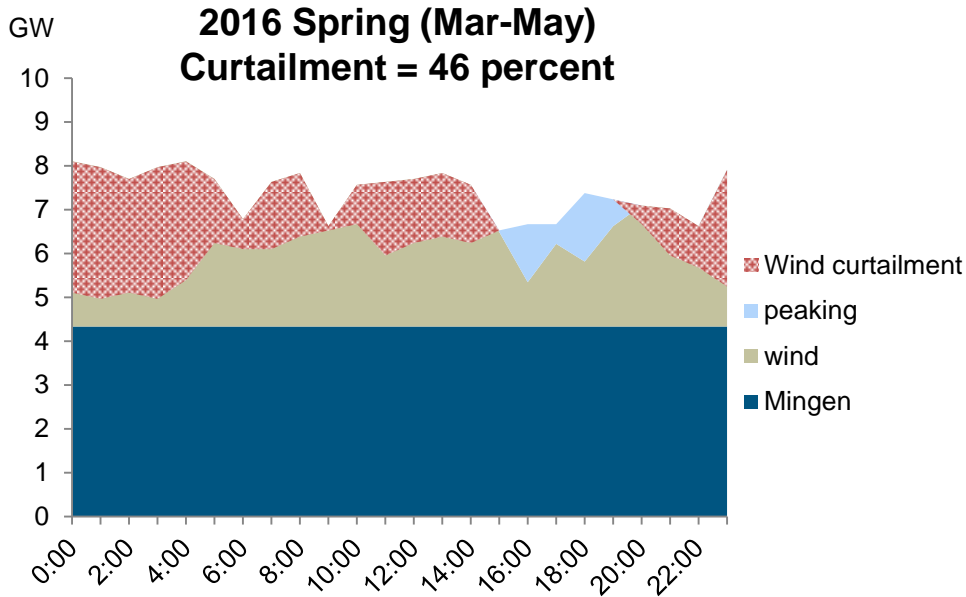
- More enhancement of local and regional grids
- More UHV DC and AC lines are built and approved
- *BUT Who will take the power?*

- Coal utilization hours will likely continue be squeezed; but will there be early retirements?
- Tension between imports and local generation will increase

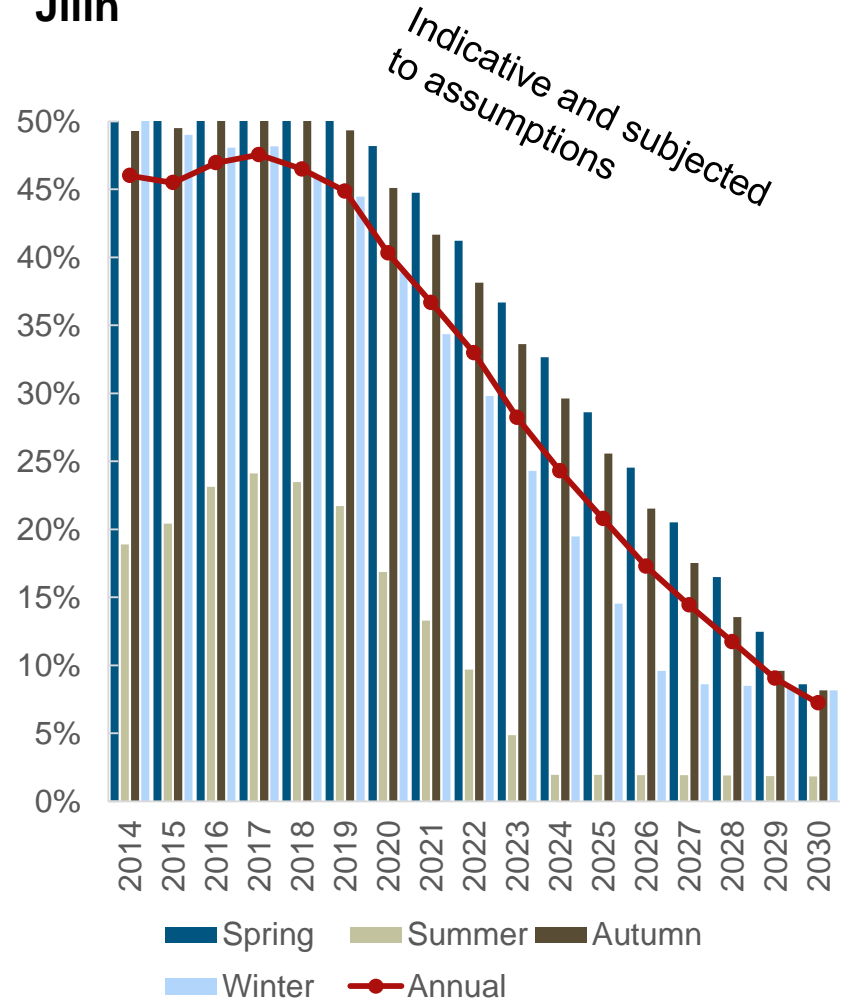
- Push on direct purchase will probably favor non-RE projects
- Policy initiatives such as proactively slow-down/halt new build will be most positive to reduce curtailment if implemented

Each provinces face different trends

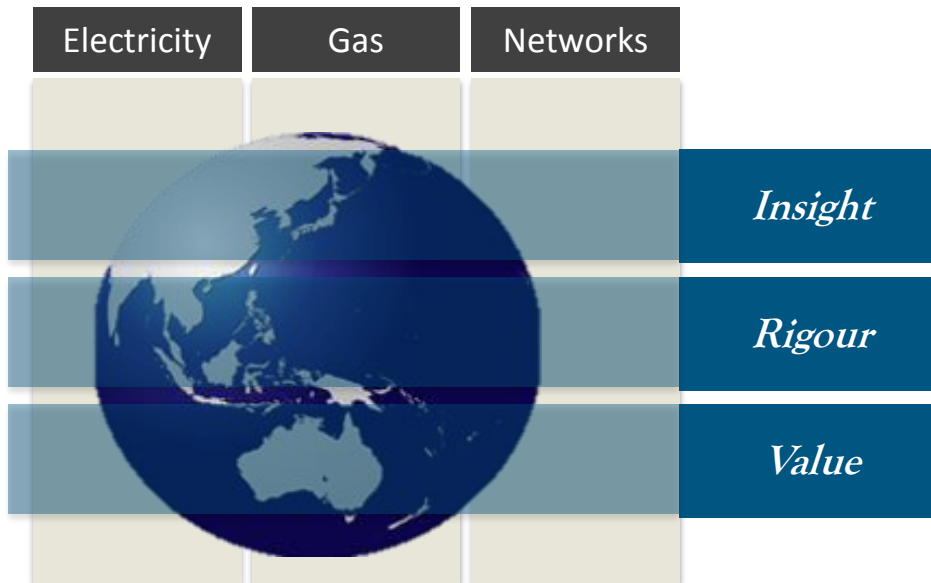
Quantitative wind curtailment forecast from TLG's model (for illustration)



Case study: Wind curtailment forecast in Jilin



Thank you



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