The electricity sector is being challenged by a complex mix of innovation, market-dynamics, and legacy regulatory and policy factors.

Creating Risk and Opportunity…

Energizing the Future

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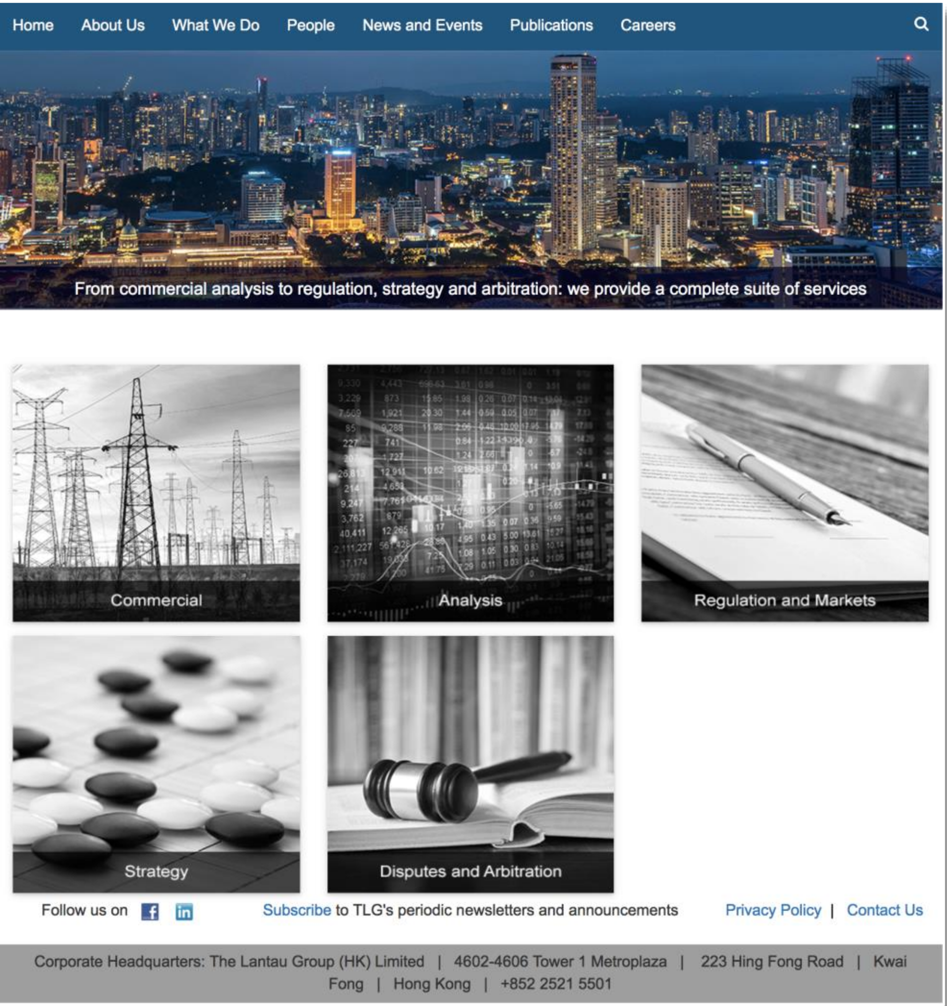
About The Lantau Group



Staff ★

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Languages:

Arabic*
Cantonese
Mandarin
English
Bahasa Indonesia
Bahasa Malaysia
Bengali
French
German
Hindi
Japanese
Korean
Swedish
Tagalog*
Thai*
Vietnamese*

*External Advisors

Shaping the future of energy

Unrivalled experience across the power and gas value chain (examples)

Vietnam
- Gas and LNG demand supply
- Analysis of coal versus gas competition
- Gas master plan assistance (NOC)
- LNG infrastructure

Malaysia
- Single Buyer market design
- Post PPA expiry valuation / PPA disputes
- Incentive-based regulation (IBR)
- Cost of service / Tariff Design
- Load forecasting enhancement

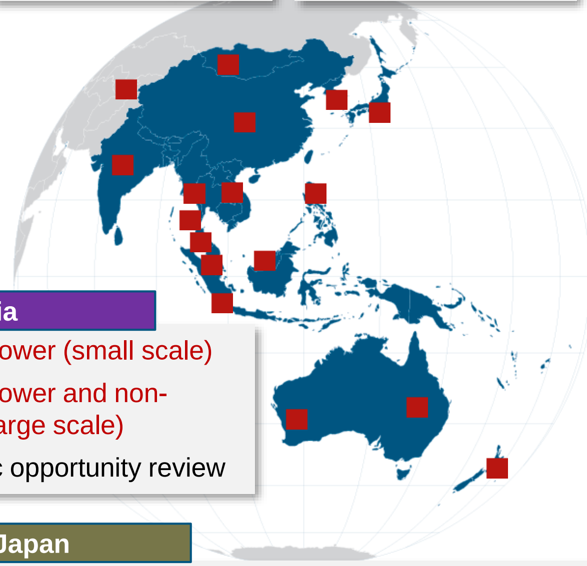
Singapore
- Market design / Structure/ regulation
- Market Power / Vesting Contracts
- Fuel Mix
- Tariff benchmarking
- Market price projections
- Gas network cost recovery

Philippines
- IPPA Design/Execution
- Ancillary services opportunities and regulation
- LNG entry strategy and economics
- Natural Gas Masterplan
- Distribution cooperatives support
- Most of the major renewable, gas, coal, geothermal, and hydro project market transactions

India
- Wholesale market modelling for IPP developer
- Fuel switching study
- End user pricing / invoice tracking

Mongolia
- Fuel switching study

Uzbekistan
- CNG Vehicle Market



Indonesia
- Gas to power (small scale)
- Gas to power and non-power (large scale)
- Strategic opportunity review

Japan
- Solar Entry Strategy
- End user pricing of gas and electricity

New Zealand
- Transmission cost recovery and evaluation
- Market design and regulation
- Hydro development cost-benefit analysis
- Gas market development

China
- Curtailment study in Gansu, Jilin and West Inner Mongolia
- Transmission system review
- Multiple studies on small-hydro power opportunities
- Coal-fired power generation and carbon policy in Zhejiang
- Coal-fired power investment opportunity in Chongqing
- Assessment of gas-fired CHP opportunities in Guangdong
- Strategic assessment of opportunities in Guangxi Province

Korea
- Korean “CBP” market review (KEPCO)
- Korean Nuclear Sector Review (KEEI)
- Vesting Contract Design (KEPCO)
- Gas and coal IPP opportunities

Australia
- Capacity market design
- Contract dispute
- Market design and policy
- Energy Market Review
- Demand response economics
- Renewable energy opportunities and regulation/policy
- Market analysis / modelling
- Market design and regulation
- Network regulation and cost recovery
- Gas market development

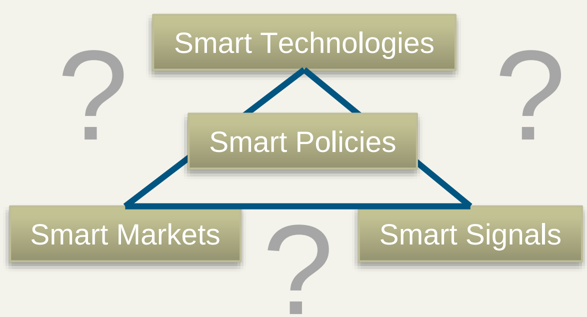
How we see it – Three (inter-related) Megatrends

Shifting fuel and generation mix

- Strong focus globally on renewable energy, and improvement in price/performance points
- 2ºC goal is estimated to require:
  - Full decarbonisation of the power sector by 2050. If this is met by the renewables, annual growth rates in the range 25% - 30% are needed.
  - Half of the light-duty vehicles need to be electric by 2050
- 1.5ºC goal is estimated to require:
  - All vehicles must be electric by 2050
  - No more combustion engine vehicles sold post-2035.
  - Further gains in the buildings sector.

Changing the way we price energy usage

- Pricing influences incentives and behaviours, which can in turn shift costs from one group to another
- Speed of change in technology and adoption rates outpaces adaptability of regulation and policies
- How to signal and support the right overall mix of resource capabilities and responses?
- Smart usage requires smart meters and smart pricing, but few customers have these



Aligning incentives on both sides of the meter

- Increasingly the world of the ”grid” and the world “behind the meter” are becoming disconnected, with implications for cost and equity (who pays)
- Deployment of distributed energy sources proceeds in an ad hoc, opportunistic, and often imbalanced and cost-shifting way given rigidity in current tariff structures
- Energy storage becomes more valuable as various constraints and distortions increase due to less integration between economics of energy, environment, and security of supply objectives
- New challenges for grid operators to manage system security (keep the lights on)

What is driving these megatrends?

More Stakeholders

- Renewable energy developers
- Demand response providers
- New business models
- Tech

More Technologies

- Smaller scale technologies
- More differentiating factors (capacity, energy, security, sustainability)
- Rapidly falling costs and improving performance

More Policies

- Renewable energy policies
- Environmental standards
- Energy poverty protections
- Corporate sustainability trends

More "Choices"

- Massive increase in "state awareness" and controllability
- Options for "behind the meter" generation or cogeneration
  - Rooftop solar systems and energy storage
- Pricing options
- Ability to use competition to get lower prices from exposed suppliers

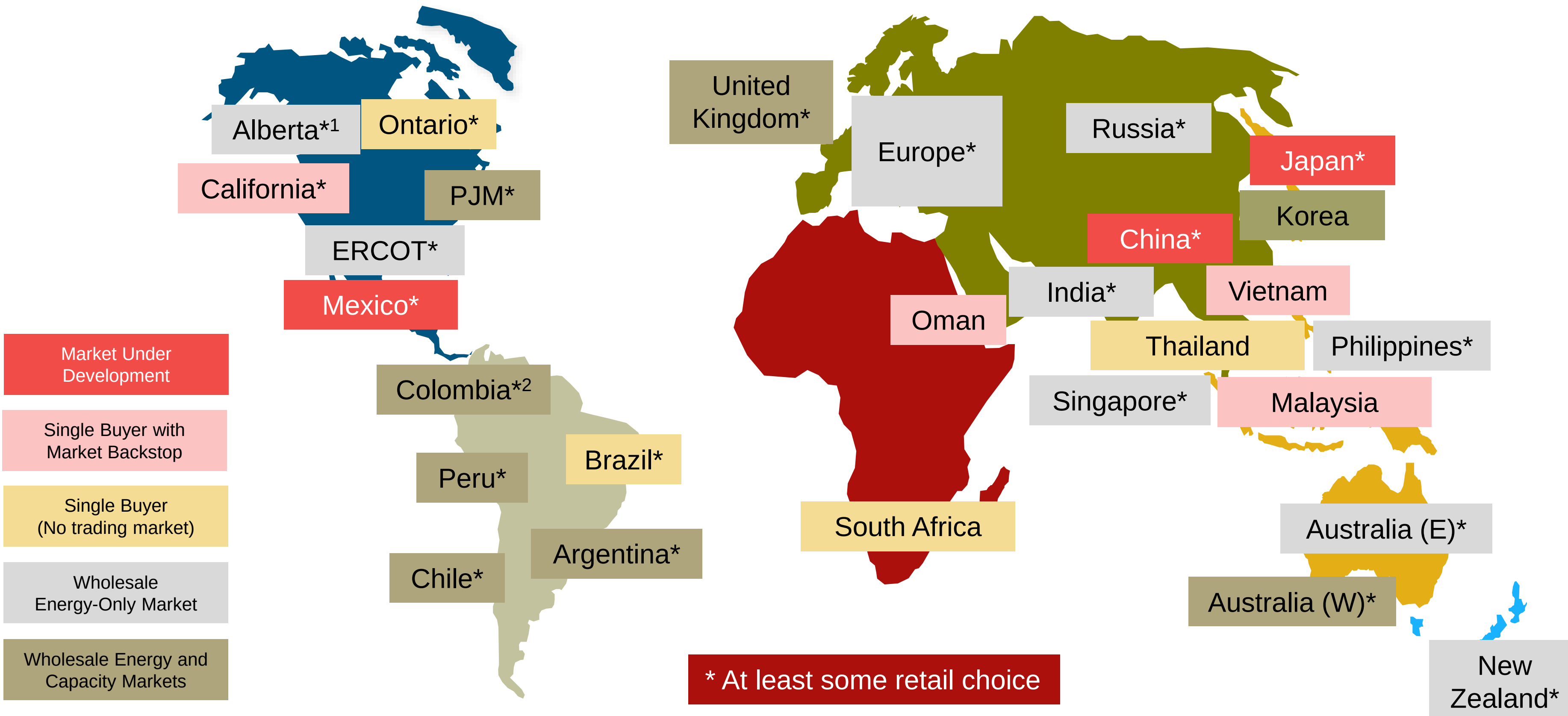
Ability to avoid costs (shift them to others)

- Use distributed energy resources (DERs) to avoid paying for their share of the grid
- Cherry picking of profitable customers, creating stranded costs
- Exploiting imperfect regulatory or market mechanisms, stranding or shifting costs

Choices have consequences

Few are satisfied – everyone has been introducing changes….

All major economies are dealing with more and more energy stakeholders



But the solutions are not simple, and many choices can increase cost or risk

1 In November 2016 Alberta approved AESO's recommendation to develop a capacity market
2 Colombia has a Reliability Charge scheme that replaced the capacity market in 2006

Energy system security is increasingly "in the news"
…..On 28 September 2016, South Australia went black

Source: ABC News: Dean Faulkner

850,000 customers lost electricity supply, affecting households, businesses, transport and community services, and major industries.

40 percent of load was restored within 4 hours and was not until nearly 8 hours later was power restored for 80 to 90 percent of customers. It took another two weeks to restore powers to all customers as fallen transmission lines were bypassed.

Tornadoes tripped transmission lines

- High speed tornadoes damaged three transmission lines and caused them to trip
- The increasing number of faults in the transmission network triggered protection features of wind farms

Wind farm gen.reduction triggered

- Sustained generation reduction of 456 MW from 9 wind farms;
- Imported power surged in response to reduction in wind output

Victoria-SA Interconnector tripped

- Flow on the Victoria-SA In Heywood Interconnector activated a protection scheme that tripped it offline
- SA system becomes separated from the NEM.

Blackout in SA

- The loss of flow from interconnector and automatic load shedding were unable to respond and frequency level in SA grid dropped and collapsed completely.

Emerging concern that the loss of system "inertia" as renewables displace traditional generation was a contributing factor

…. And Taiwan went black in August 2017, triggered by a gas supply mishap at a time of low reserve margin largely due to policy uncertainty

15 August 2017

4:50 pm: Gas supply interrupted at Tatan power station, 6 units totaling 4,000 MW went offline

4:50 – 9:40 pm: Blackout affected 7 million users in 17 counties

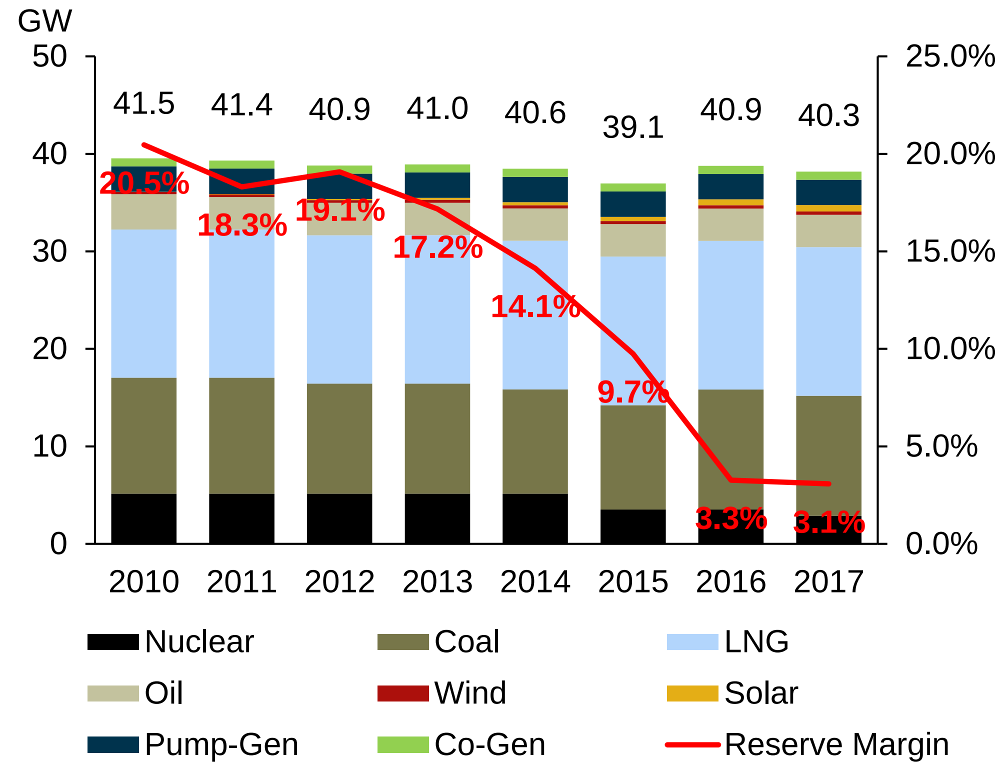
Economic Affairs Minister Lee Chih-kung resigned

9:40pm: Power restored and power rationing lifted

16 August 2017

President Tsai publicly apologized for the power outage and on Facebook reiterated her policy on "Nuclear Free Home" by 2025.

Taiwan Power Supply and Est. Reserve Margin 2010-2017



Source: Taipower

- Power supply has been alarmingly tight in Taiwan since 2015, particularly so given the early retirement of nuclear units ahead of licenses expiry
- Air-conditioning is shut for two hours a day in certain public service offices for over a week in July 2017 after typhoon toppled a pylon in Eastern Taiwan

Megatrend 1

Shifting the fuel and generation mix

- Strong focus globally on renewable energy, and improvement in price/performance points
- 2ºC goal is estimated to require:
  - Full decarbonisation of the power sector by 2050. If this is met by the renewables, annual growth rates in the range 25% - 30% are needed.
  - Half of the light-duty vehicles need to be electric by 2050
- 1.5ºC goal is estimated to require:
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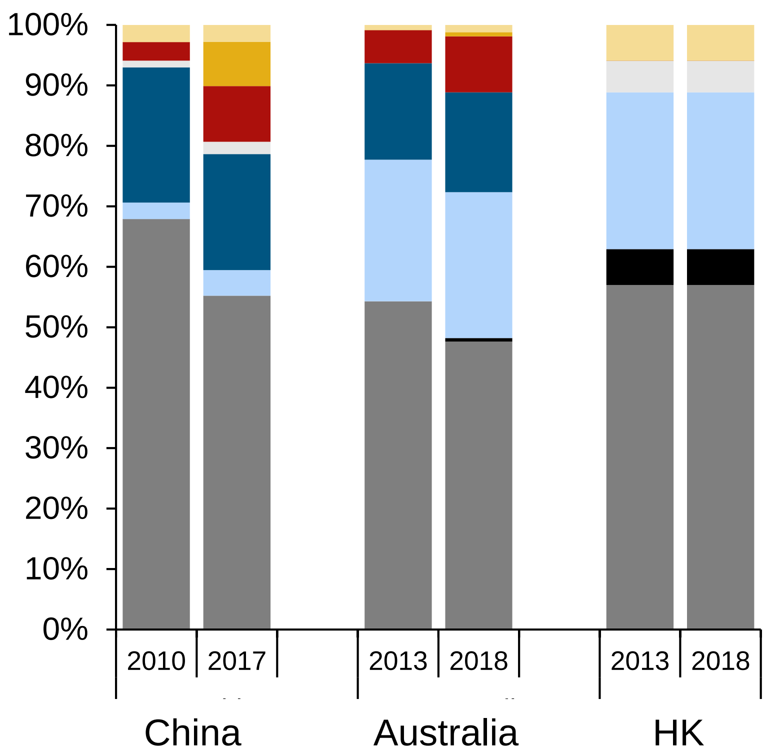
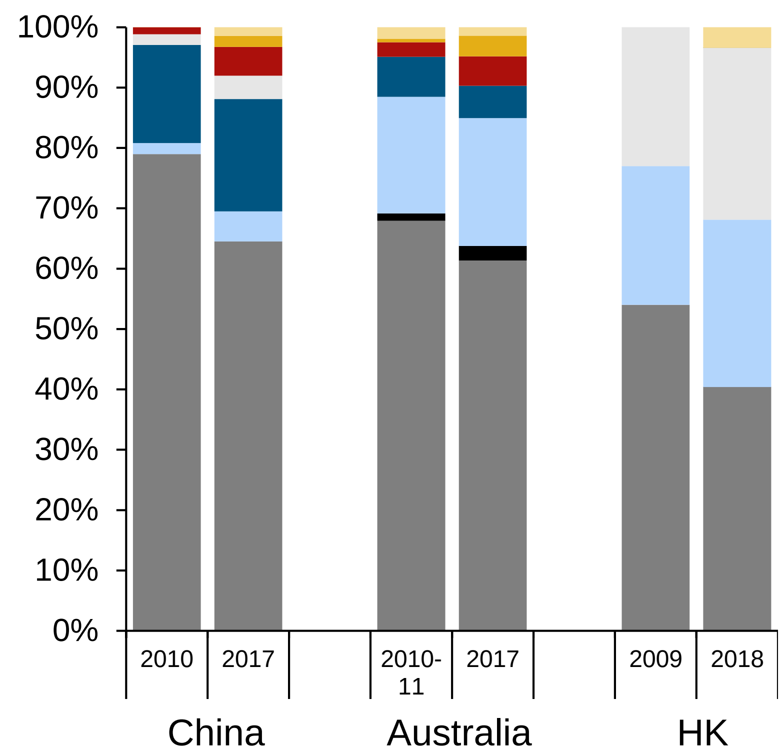
Regionally….coal down, renewables up

Capacity Fuel Mix (what exists)

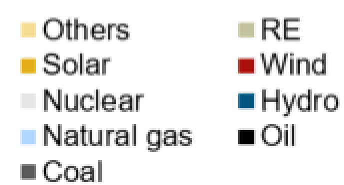


Generation Fuel Mix (what matters)



Notes:
"RE" only includes solar and wind and is only a category for HK
Capacity:
- Australia: the 2018 capacity was updated on March 16, 2018; biomass is included in Others
- HK: Hydro is included in "Others" since the hydro generation data is part of "Others"

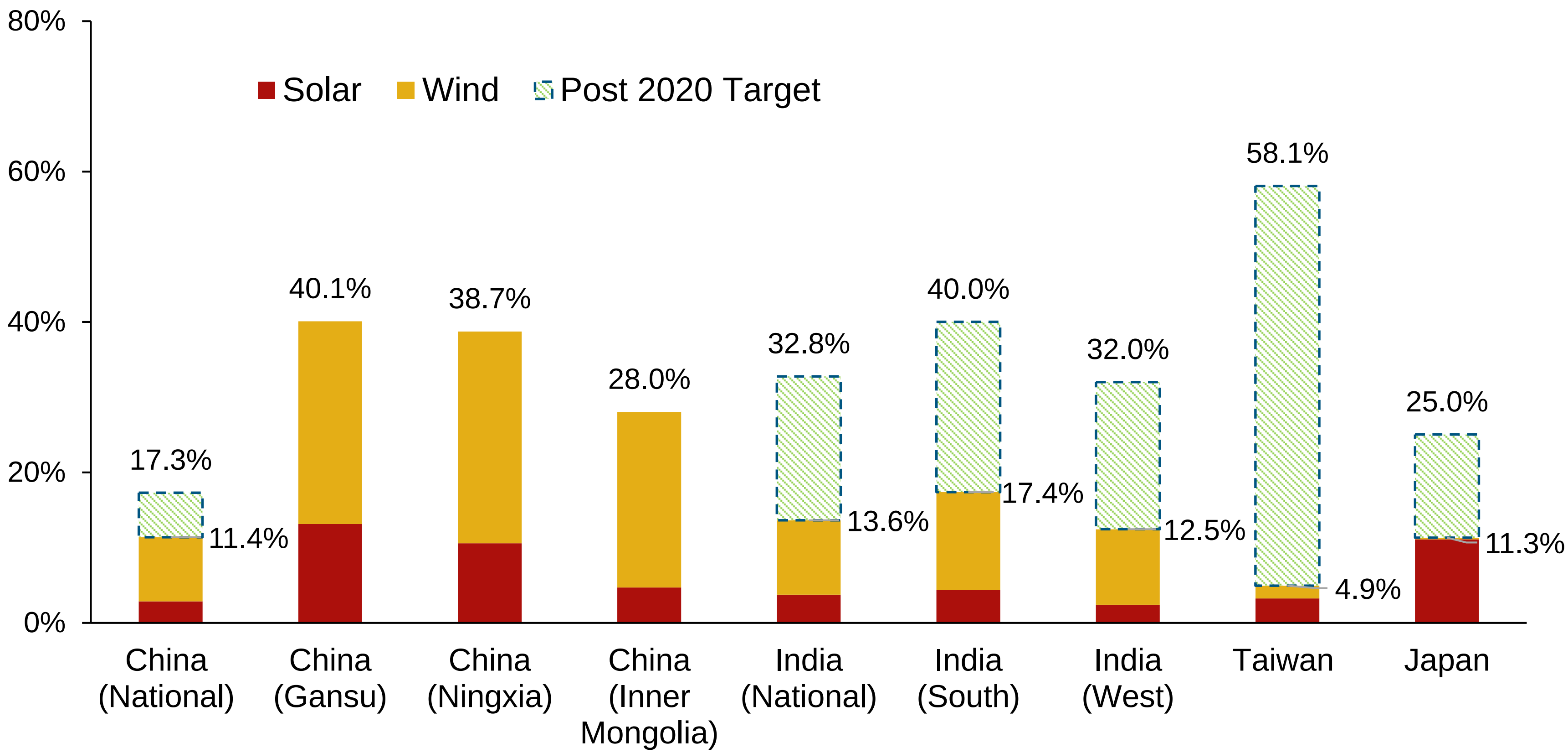
Generation:
- Australia: Biomass and geothermal are included in Others
- HK: 2018 generation fuel mix is based on CLP's reported generation and an assumption of 4 GWh RE generation



Source: CLP, HKEC, AEMO, Department of the Environment and Energy, NEA, China Electric Council; TLG analysis

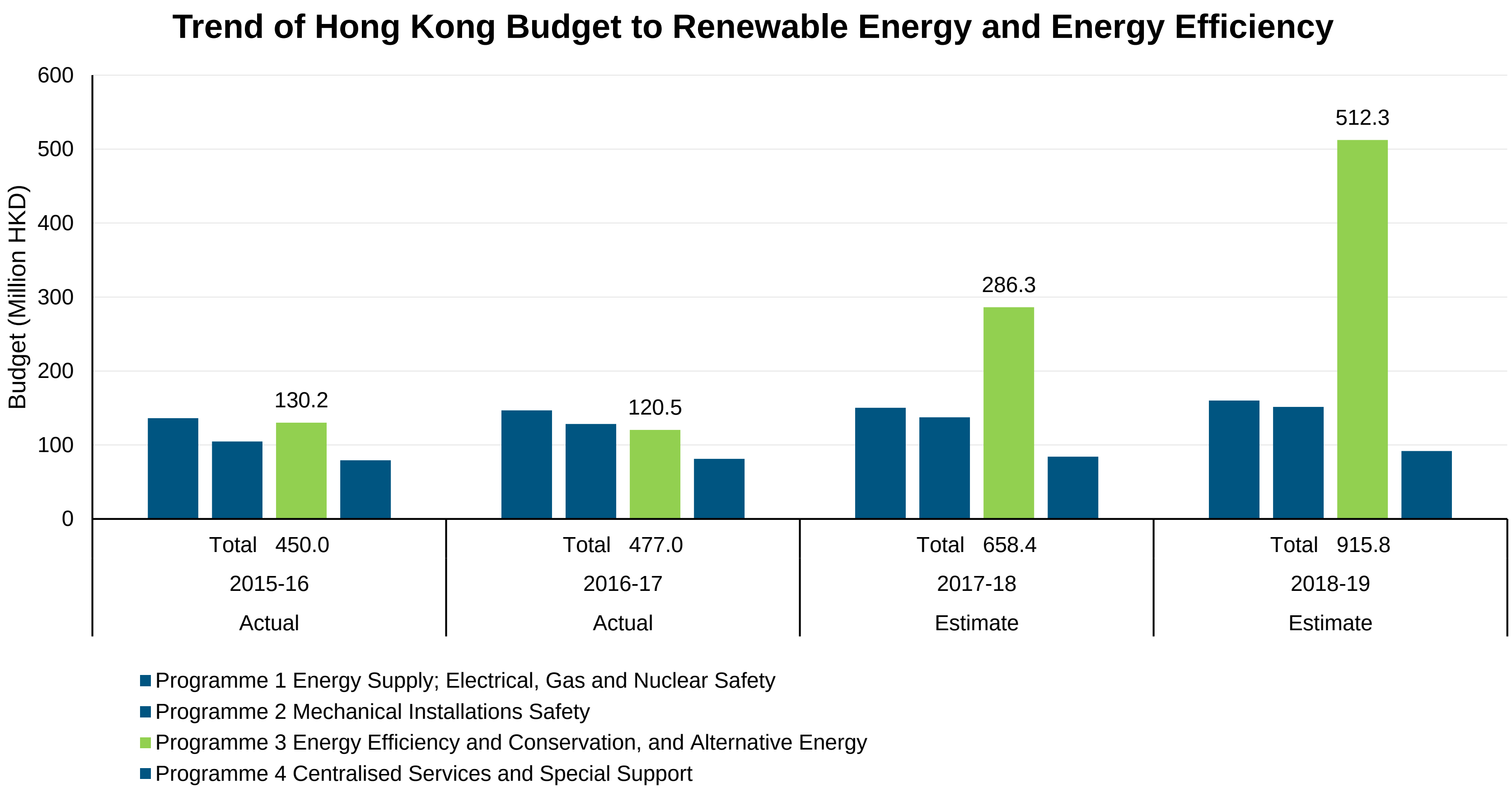
Throughout Asia plans are in place to greatly increase renewable energy

Share of Intermittent Renewable Energy (Wind And Solar) in Capacity Mix



Source: TLG Research

Hong Kong's green budget is rising

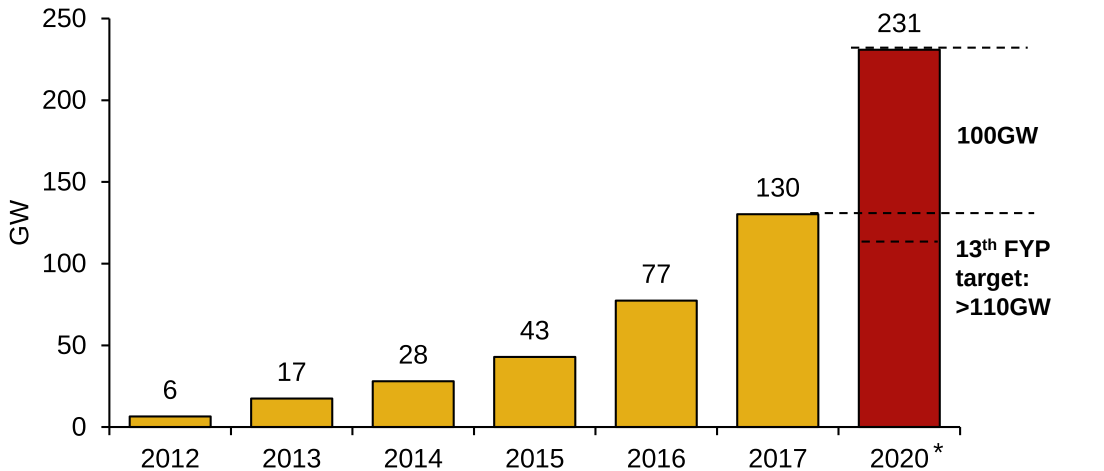


Hong Kong government boosted EE and RE spending by 80% in 2018

Note: The budget is for the Electrical and Mechanical Services Department
Source: Hong Kong 2018-19 Budget; 2017-18 Budget

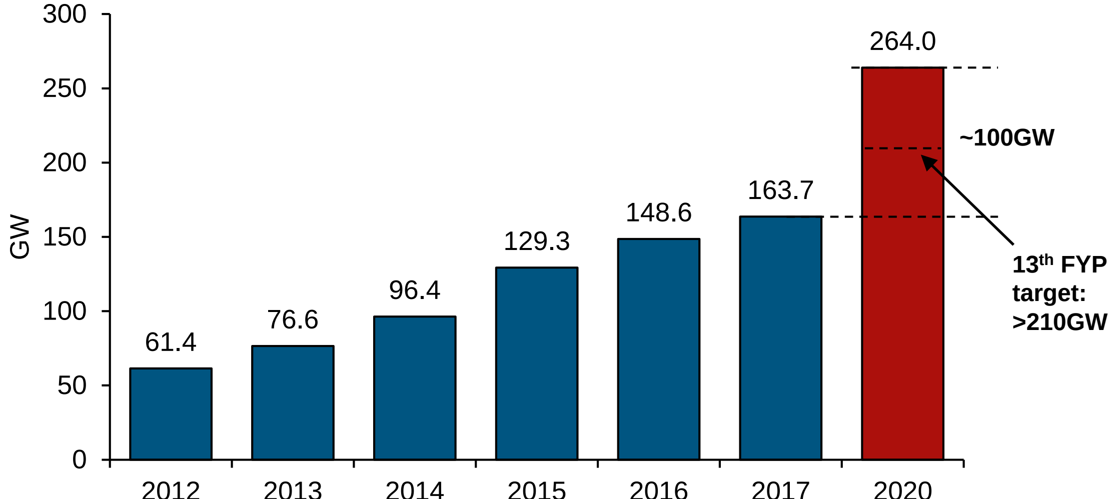
But the story so far has been about China as the global solar and wind giant (294 GW in 2017)

Solar installed capacity



- Solar grew 53 GW in 2017.
- 13th FYP target exceeded.

Wind installed capacity



- Wind grew 15GW in 2017 (>67GW in 3 years).
- Long track record of steady growth: >15GW every year since 2009.

Note: 2020 target for wind and solar is estimated according to wind and solar development quota (2017-2020) announced by NEA in July 2017.

Source: NEA

Solar and Wind capacity additions in 2017

New solar power capacity			
		World	**93.8 GW** (+21.2)
1		China	**53.1 GW** (+18.5)
2 (▲)		India	**9.6 GW** (+5.4)
3 (▼)		USA	**8.2 GW** (-3.1)
4 (▲)		Japan	**7.0 GW** (-1.3)
5 (▲)		Turkey	**2.6 GW** (+2.0)
6 (▼)		Germany	**1.7 GW** (+0.8)
7 (▲)		Australia	**1.2 GW** (+0.4)
8 (▲)		Korea	**1.1 GW** (+0.2)
9 (▲)		Brazil	**1.0 GW** (+0.9)
10 (▼)		UK	**0.9 GW** (-1.5)

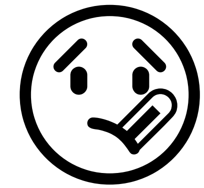
New wind power capacity			
		World	**46.7 GW** (-3.7)
1		China	**15.1 GW** (-2.3)
2 (▲)		Germany	**6.3 GW** (+1.3)
3 (▼)		USA	**6.3 GW** (-2.5)
4 (▲)		UK	**4.3 GW** (+2.4)
5 (▼)		India	**4.2 GW** (+0.6)
6 (▲)		Brazil	**2.2 GW** (-0.3)
7		France	**1.6 GW** (+0.4)
8		Turkey	**0.8 GW** (-0.5)
9 (▲)		South Africa	**0.6 GW** (+0.2)
10 (▲)		Belgium	**0.5 GW** (+0.3)

- 93.8 GW solar power added
  - Most Ever
  - 25 % more than 2016
  - China accounted for more than half of all new capacity and almost all of the growth
- 46.7 GW of wind power added
  - A bit less than in 2016
- China
  - 56% of new solar in 2017
  - 32% of new wind in 20176
  - 93% of total new solar and wind compared to 2016 relative to entire rest of the world

Solar soared, wind flat

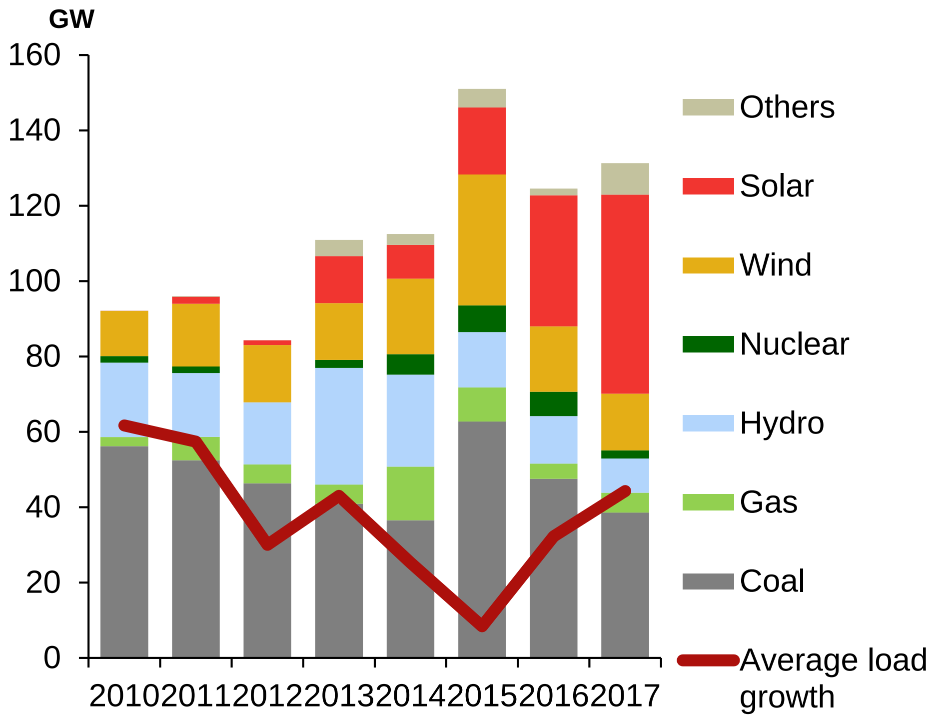
Note: Numbers in parentheses in the tables indicate the increase or decrease in annual capacity additions between 2016 and 2017.
Source: IRENA

China just keeps on building more and more and more

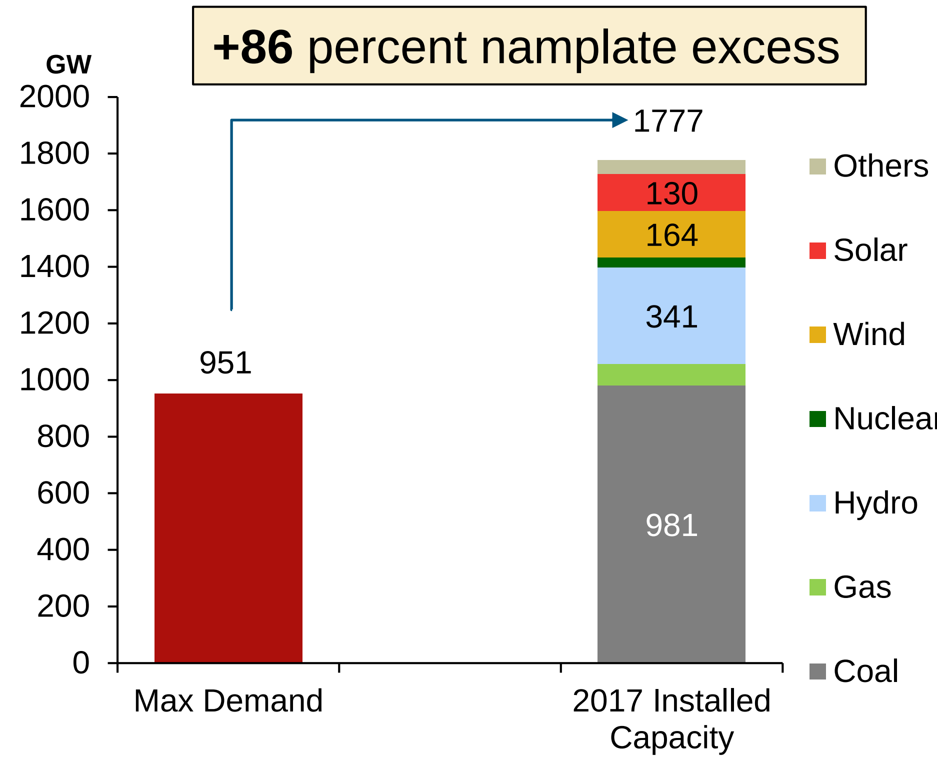


Incremental annual power supply & demand

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



Reserve margin is at historically high level



Annual average incremental surplus capacity was about 119GW in 2012-2017, more than the installed capacity of the UK

Over-supplied situation is particularly serious in the resource - rich regions in the inland provinces.

Source: CEC; TLG research and analysis

Note: Average load and peak load are estimated based on historical electricity consumption.

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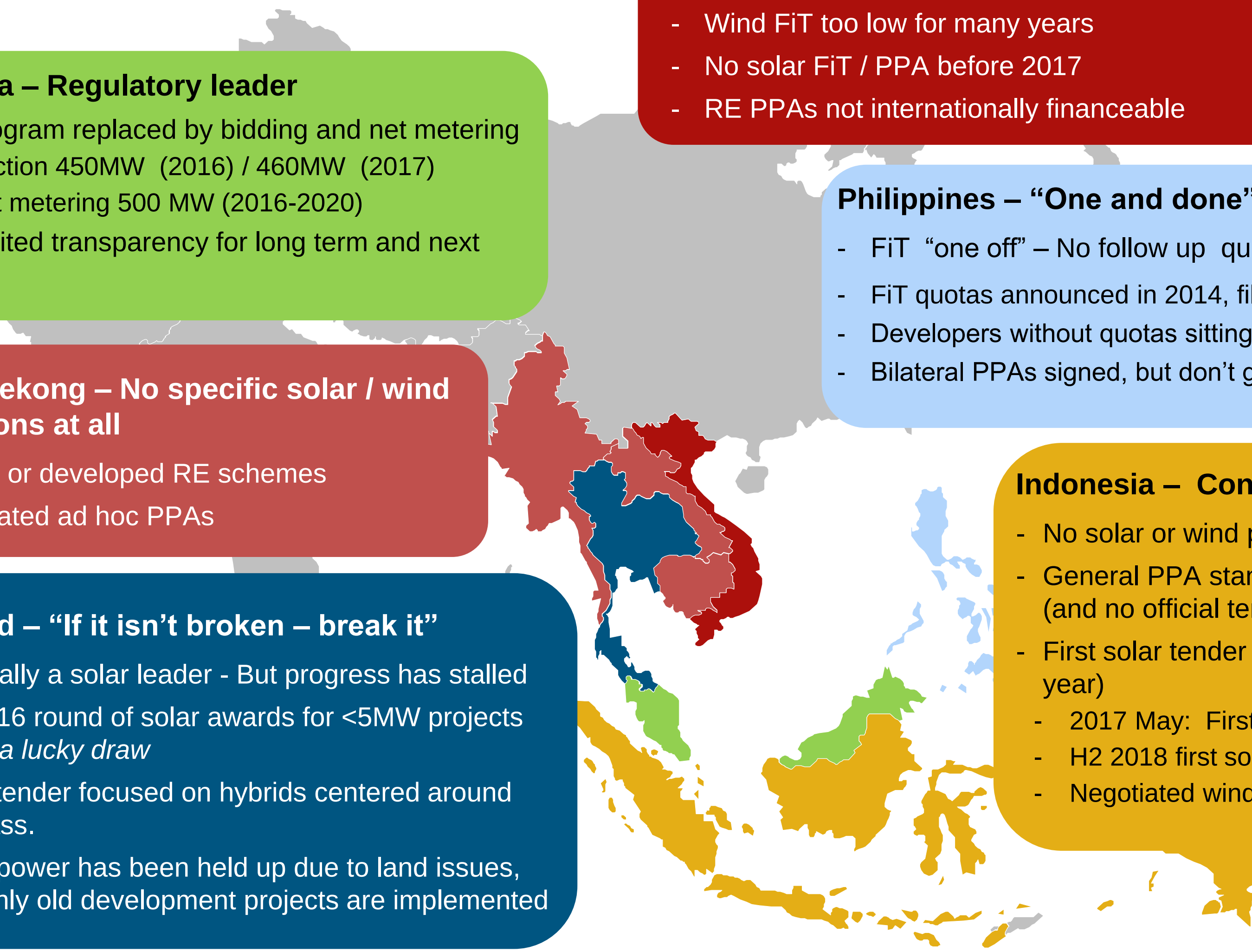
Meanwhile in Southeast Asia…much less activity



Malaysia – Regulatory leader

- FiT program replaced by bidding and net metering
  - Auction 450MW (2016) / 460MW (2017)
  - Net metering 500 MW (2016-2020)
- But limited transparency for long term and next steps

Minor Mekong – No specific solar / wind regulations at all

- No FiT or developed RE schemes
- Negotiated ad hoc PPAs

Thailand – "If it isn't broken – break it"

- Originally a solar leader - But progress has stalled
- 2015-16 round of solar awards for <5MW projects *using a lucky draw*
- 2017 tender focused on hybrids centered around biomass.
- Wind power has been held up due to land issues, and only old development projects are implemented

Vietnam – Regulations slow in coming and flawed

- Wind FiT too low for many years
- No solar FiT / PPA before 2017
- RE PPAs not internationally financeable

Philippines – "One and done"

- FiT "one off" – No follow up quotas
- FiT quotas announced in 2014, filled up in 2015
- Developers without quotas sitting on 'stranded" development projects
- Bilateral PPAs signed, but don't get ERC approvals

Indonesia – Constant regulatory changes

- No solar or wind projects in operation
- General PPA standards were revised 3-4 times in 2017 (and no official template PPA for solar and wind)
- First solar tender announced is still pending (after one year)
  - 2017 May: First tender announced – but still pending
  - H2 2018 first solar PPA signed
  - Negotiated wind PPAs used as template for solar

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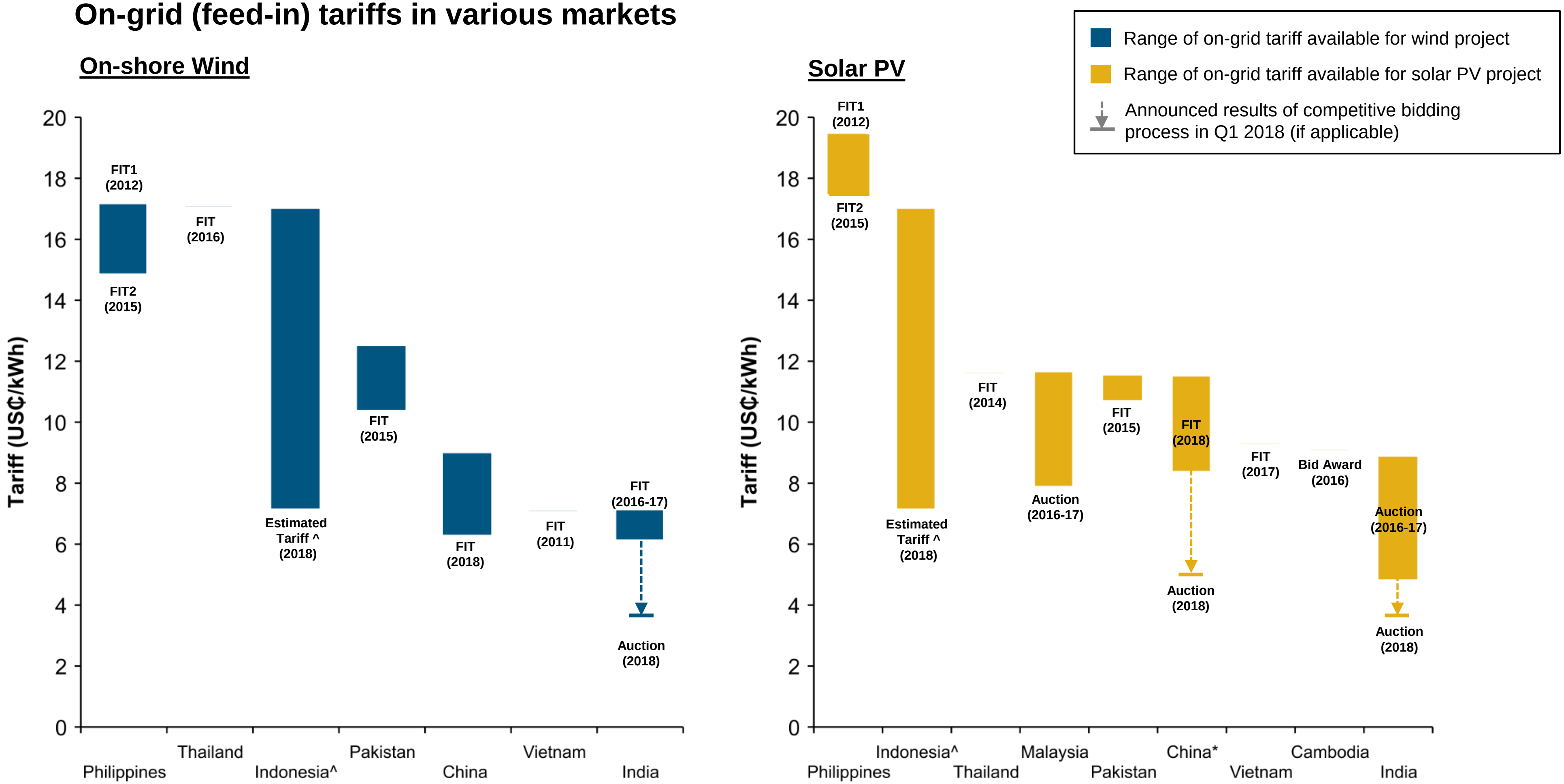
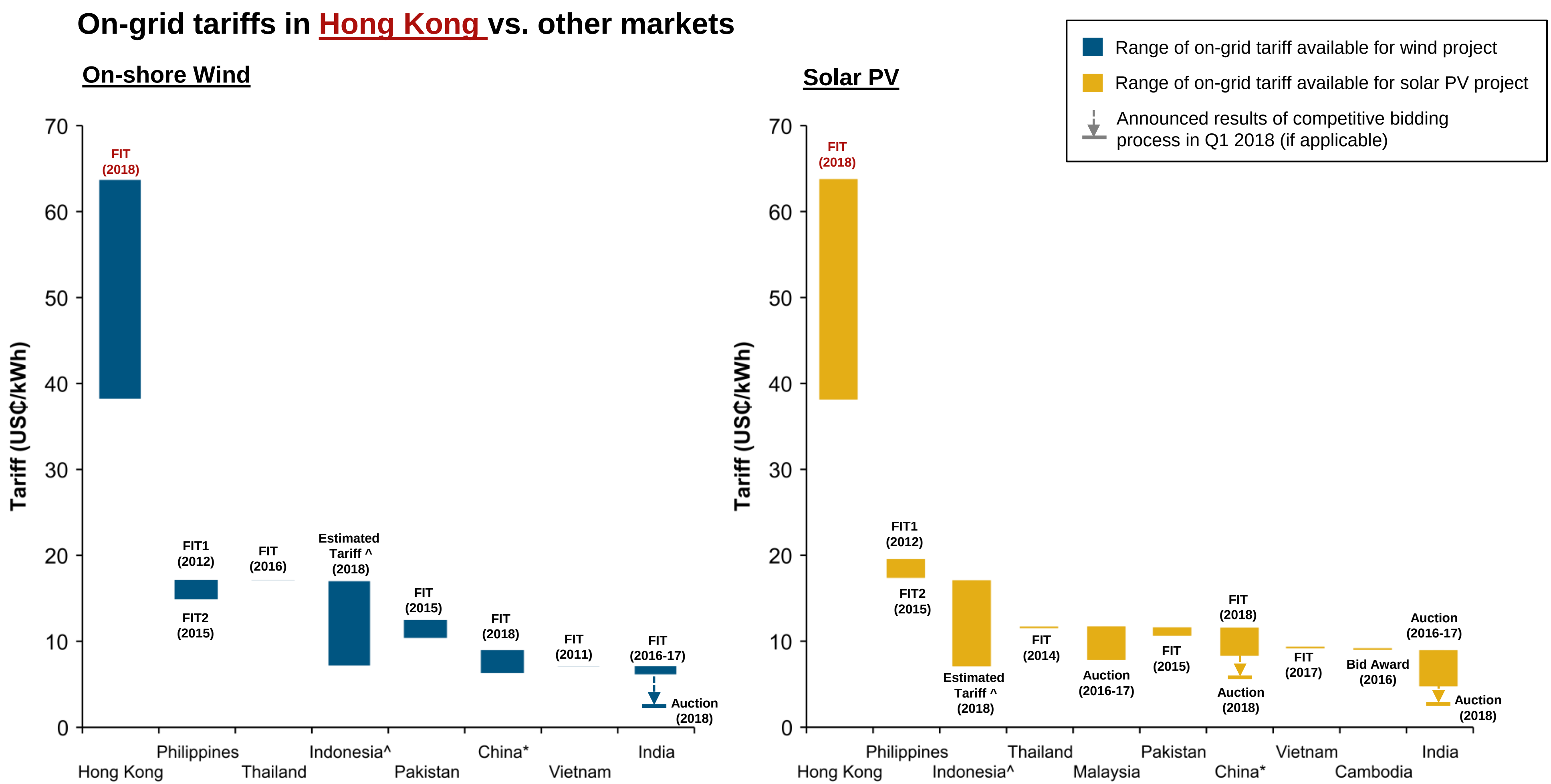
Feed in tariffs have commonly been used to attract RE investment

On-grid (feed-in) tariffs in various markets



Note: ^**Indonesia –** Ranging 7.17 - 17 US₵/kWh depending on the region if regional BPP>national BPP; B2B negotiation if regional BPP<=national BPP; ***China –** The auction results only include 9 Front Runner solar projects announced in Q1 2018;
Source: CERC, PLN, Global Climate Scope, SEDA, IRENA, ST; news announcements; TLG Analysis;

Hong Kong's new Feed in Tariff for Comparison…. (WOW)



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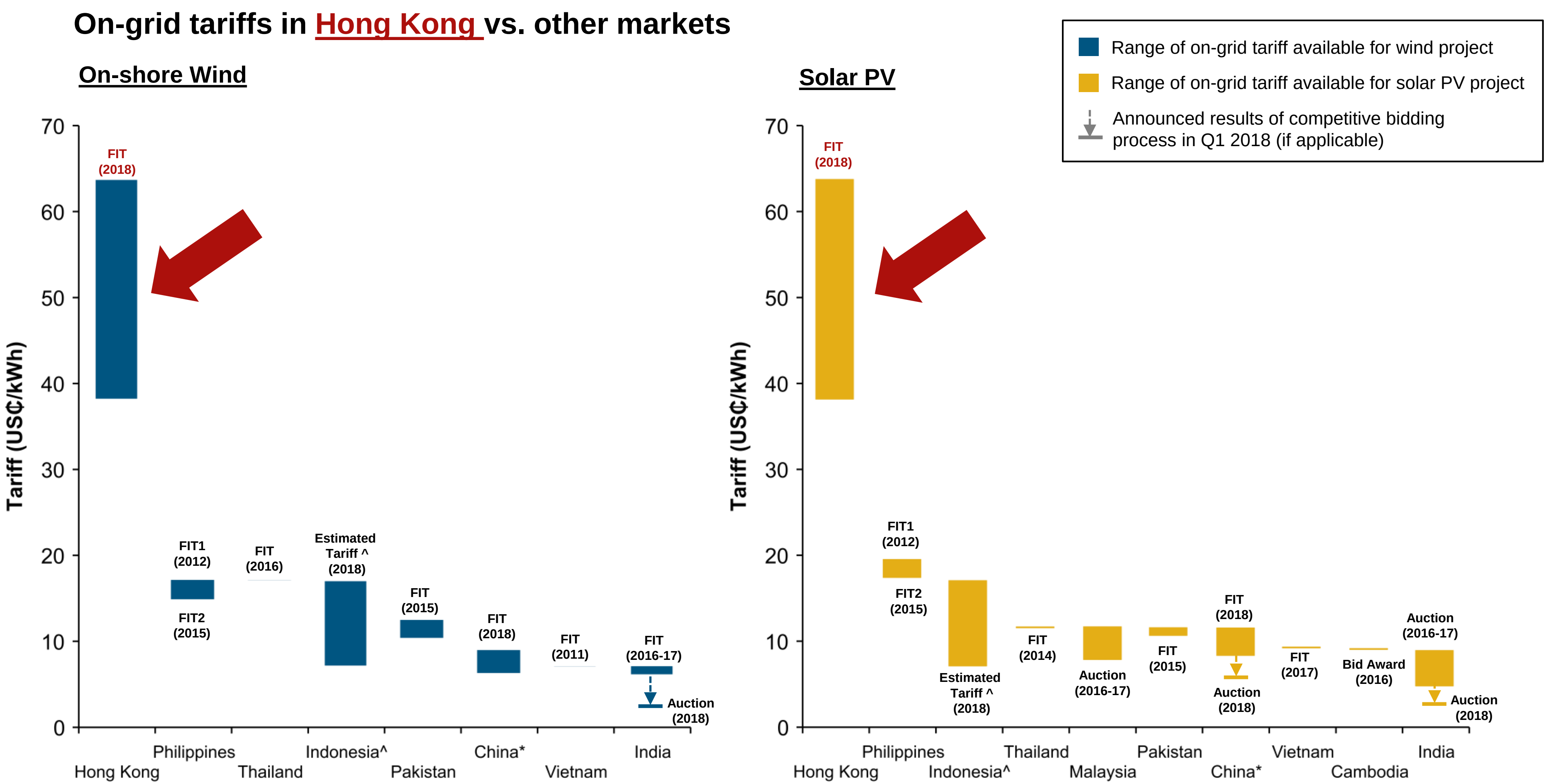
Just in case you missed it….



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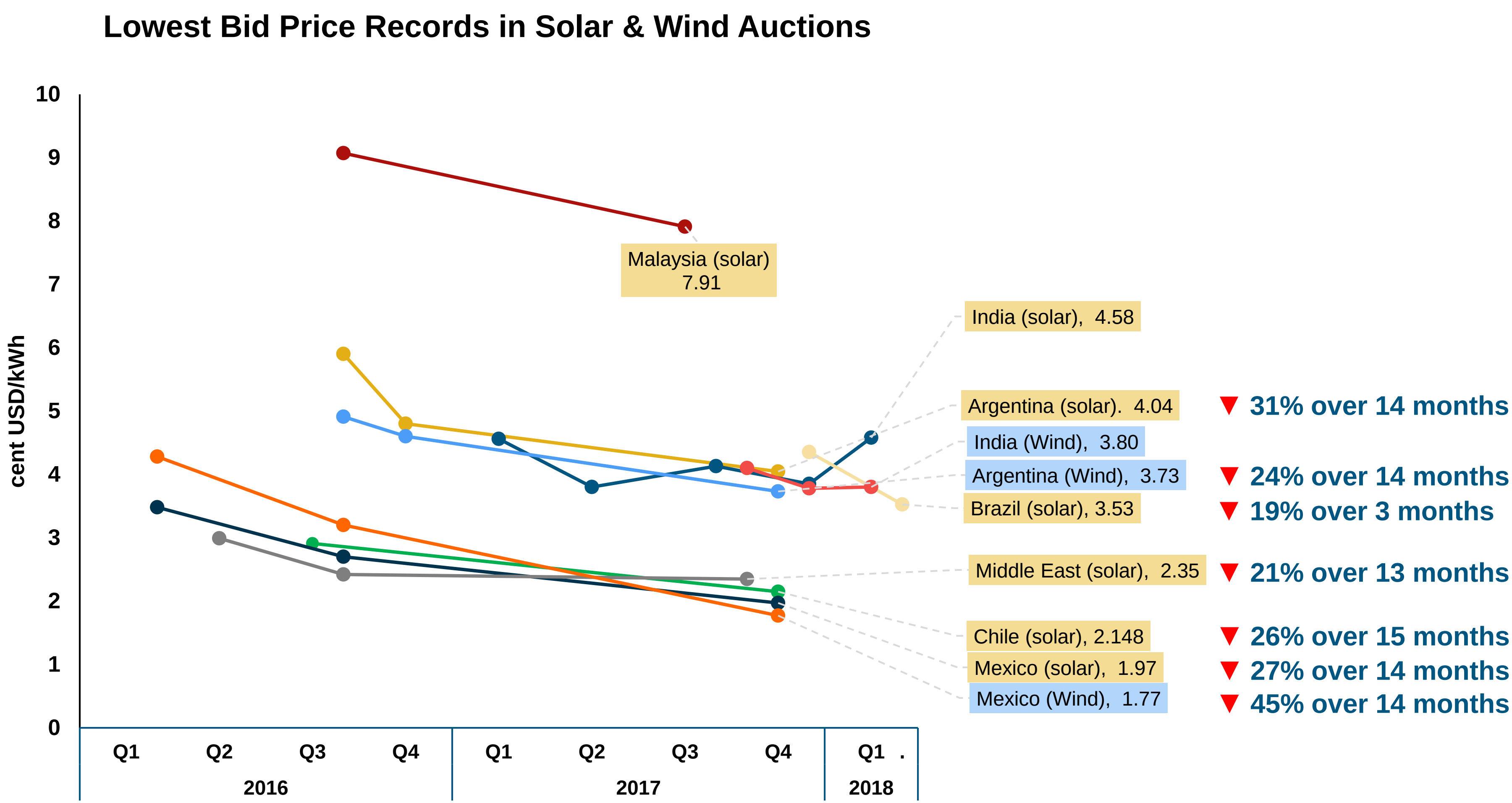
More recently, feed-in-tariffs have given way to auctions, leading to high profile price delinces (and much greater information dissemination)



Source: Various press releases and reports

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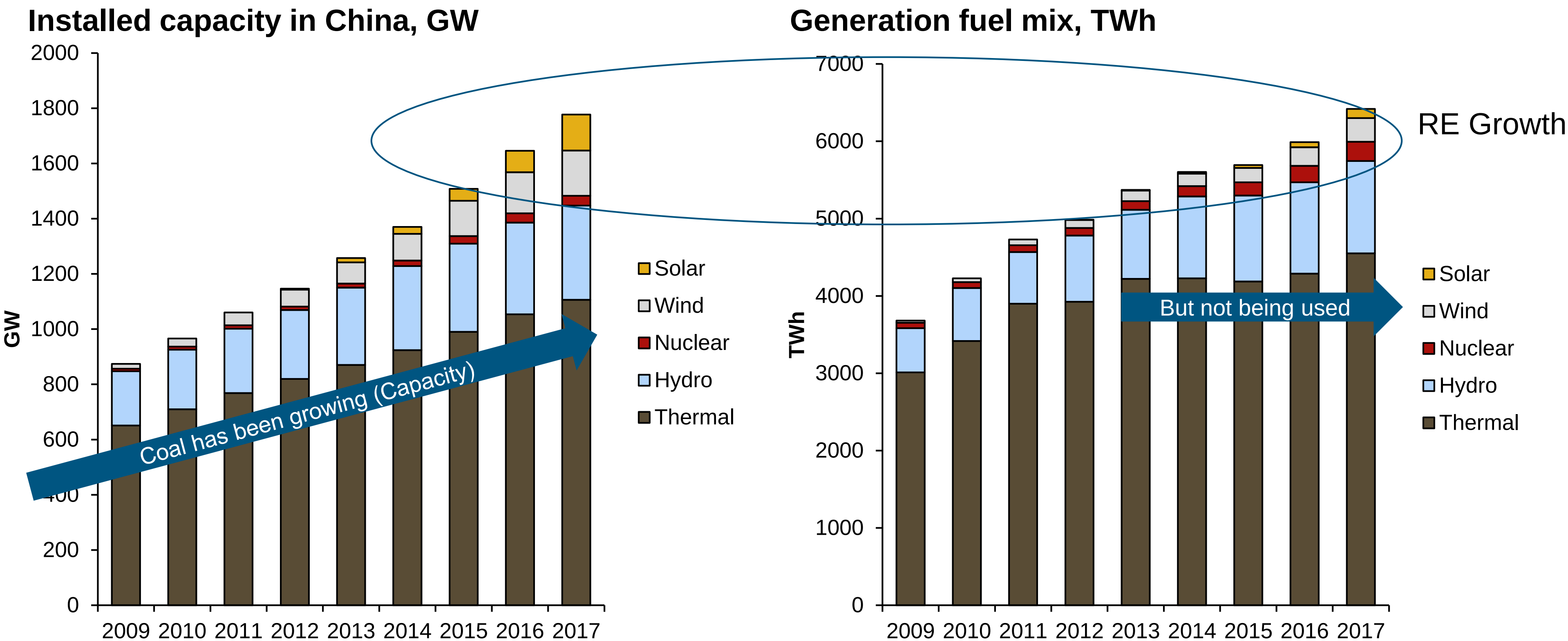
China's power system is a good example of a costly integration challenge.



Source: China Electricity Year Books National Bureau of Statistics of China (NBS), TLG Research and analysis

- Wind and solar generation capacity has been increasing fast, reaching 164 GW and 130 GW respectively by the end of 2017.
- Other sources of generation also expanded rapidly
  - Net capacity addition of coal was 38.5GW in 2017, which slows down slightly from 2016.
  - China is also adding new hydro, nuclear and gas-fired power plants, though demand growth has slowed materially.

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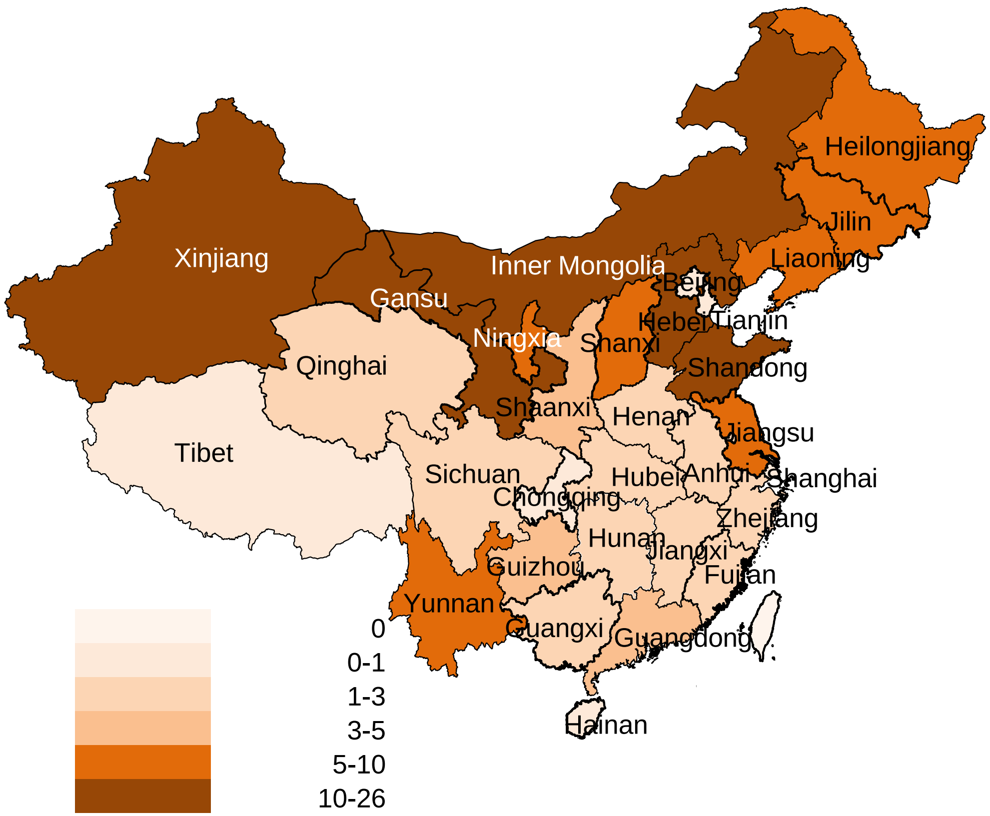
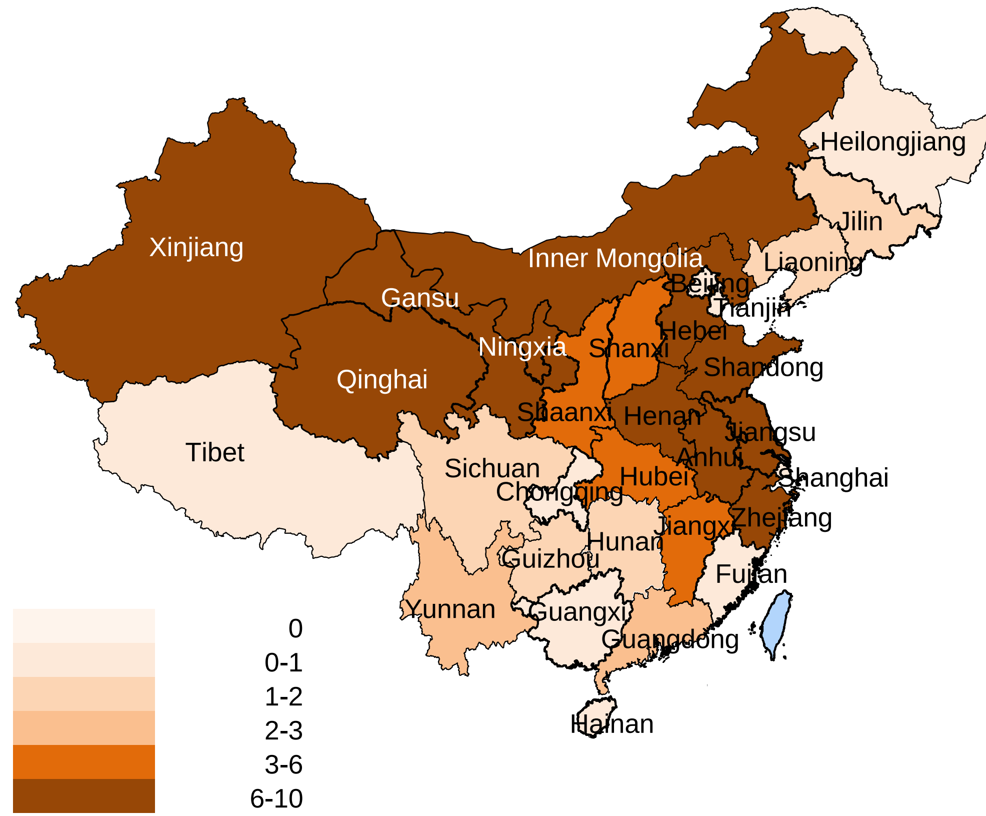
China's wind and solar capacity is mostly found in Northwest, North and Northeast regions (areas that now have high curtailment rates)

Wind capacity in 2017, GW



Total wind capacity in 2010: 30 GW
2015: 128 GW
2016: 149 GW
2017: 164 GW

Solar capacity in Q3 2017, GW



Total solar capacity in 2010: Negligible
2015: 43 GW
2016: 77 GW
2017: 130 GW

Source: NEA

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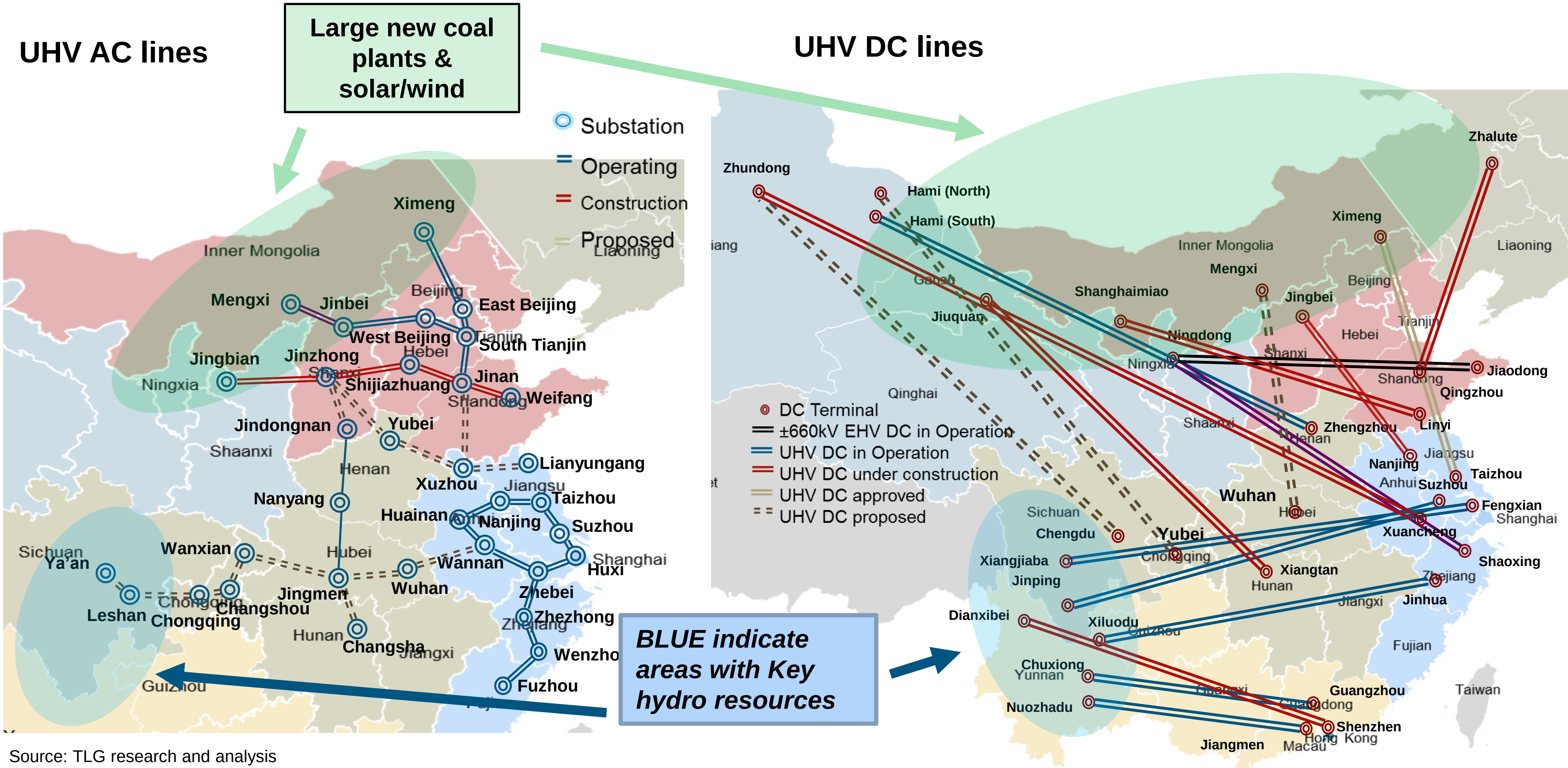
Historically China has proposed mega transmission projects to reduce curtailment, improve eastern air quality and access far-away resources



Source: TLG research and analysis

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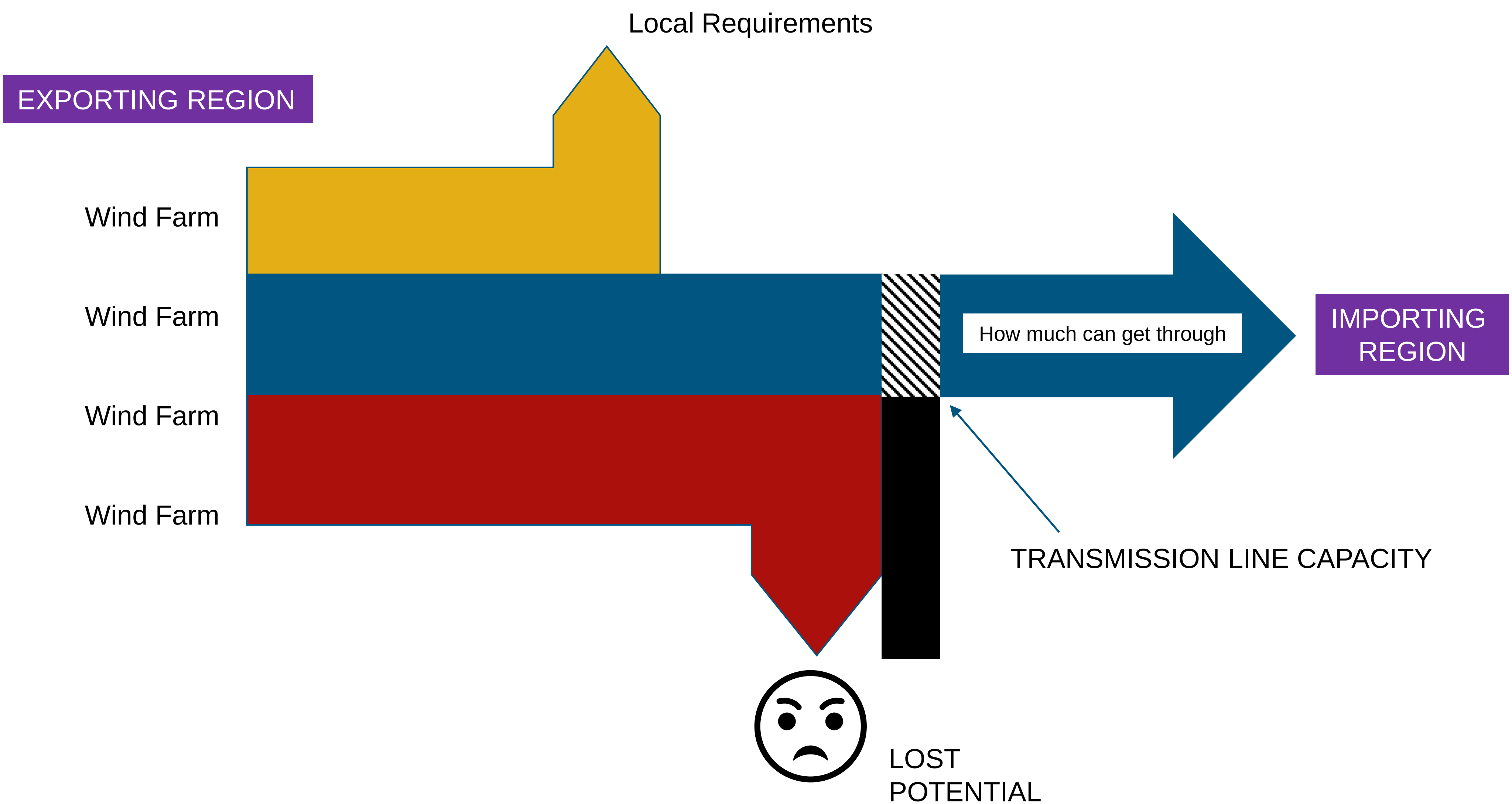
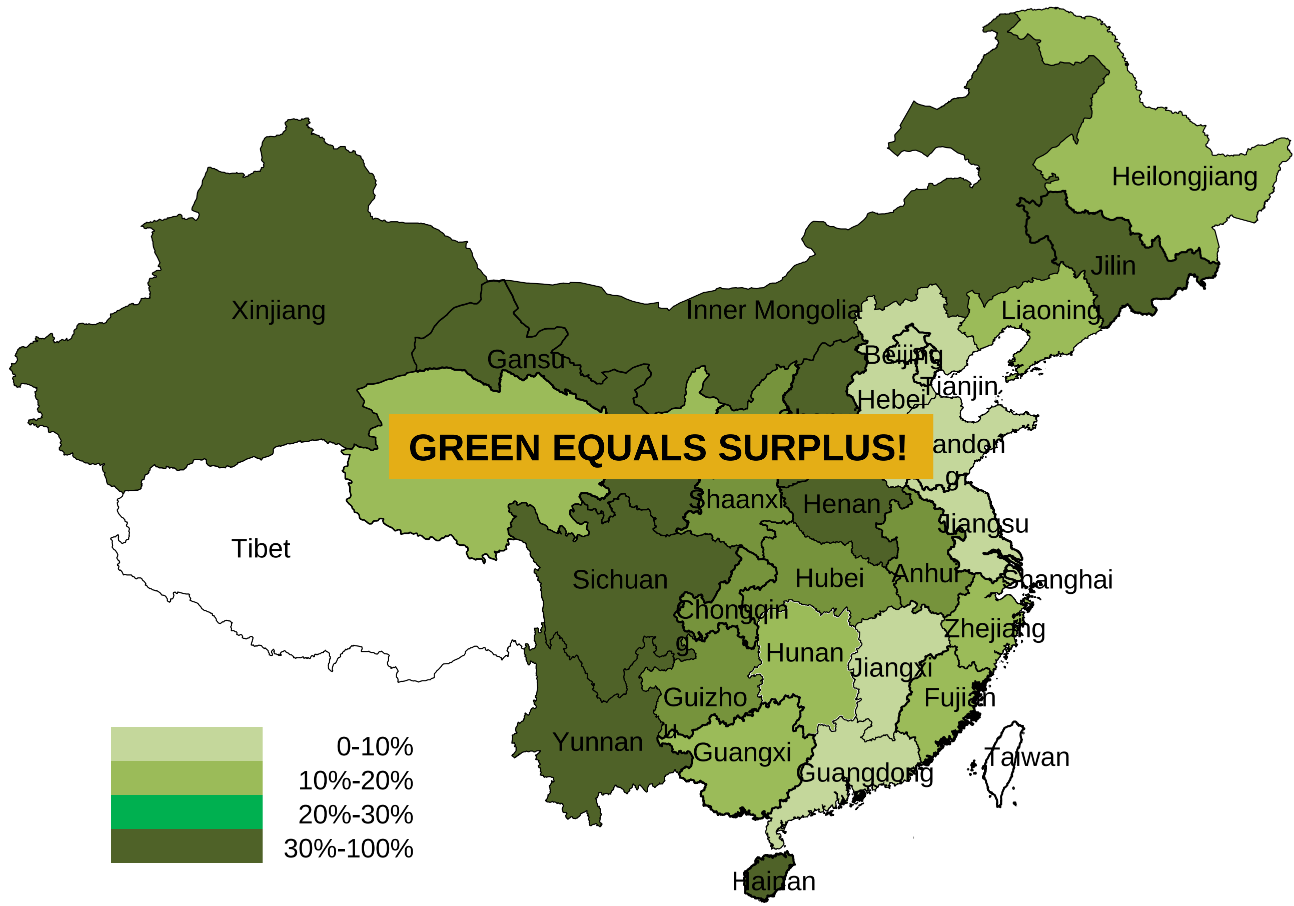
What is curtailment?



But few provinces can justify expanding their uptake of power imports, slowing development considerably

- Even in the 13th FYP Electric Power Development Plan there is no clear plan for UHV development. The source locations of surplus power are clear, but the destinations are not. The Pearl River Delta, Yangtze River Delta and Shandong were the main receiving regions in previous rounds of UHV projects. These markets are now saturated.
- Other possible destinations could include the central provinces such as Jiangxi, Hunan, Hubei and Henan given their demand growth, lack of energy resources, and environmental capacities.
- The most optimistic scenarios would require China to further limit new capacity additions and speed up the retirement of older thermal generating capacity, neither of which is certain.

Provincial supply adequacy in 2015



Source: National Energy Administration (NEA), China Energy Yearbook and TLG research from news reports (Tibet's data are not available)

Note: The import and export of a province are based on their historical levels and existing inter-province
The provincial supply surplus is defined as:
Surplus rate= (Theoretical local generation-Local demand + Import - Export)/(Local demand)

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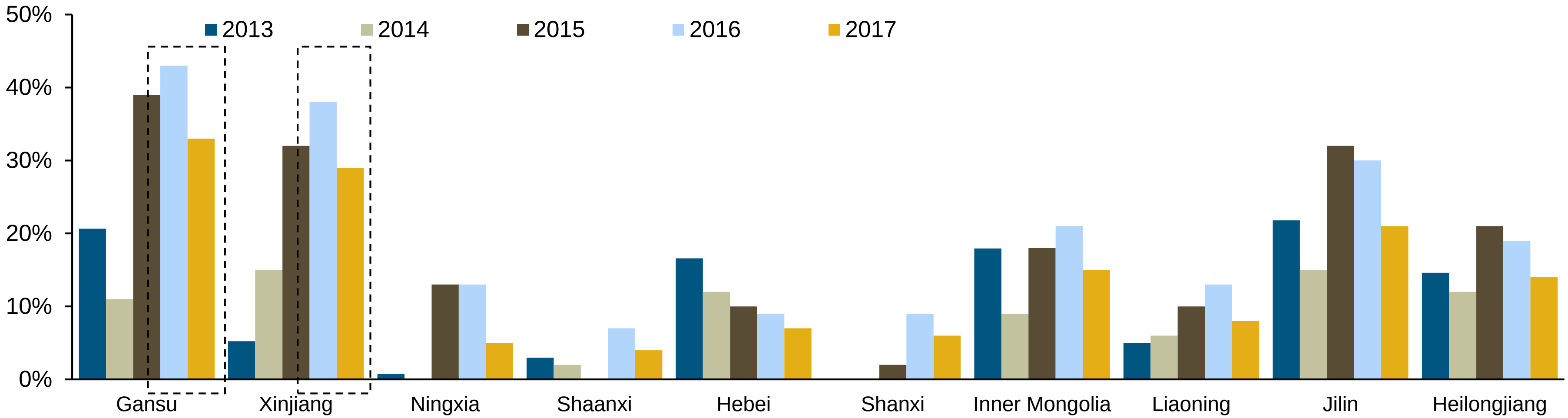
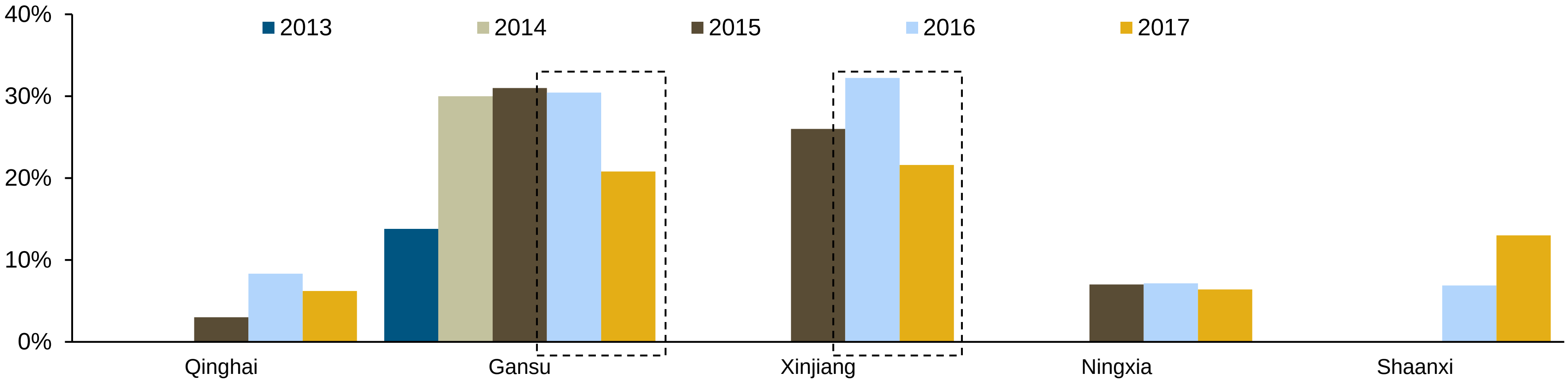
Curtailment rates have improved somewhat, although they are still high, especially in Northwest region

Wind curtailment rates in 10 provinces



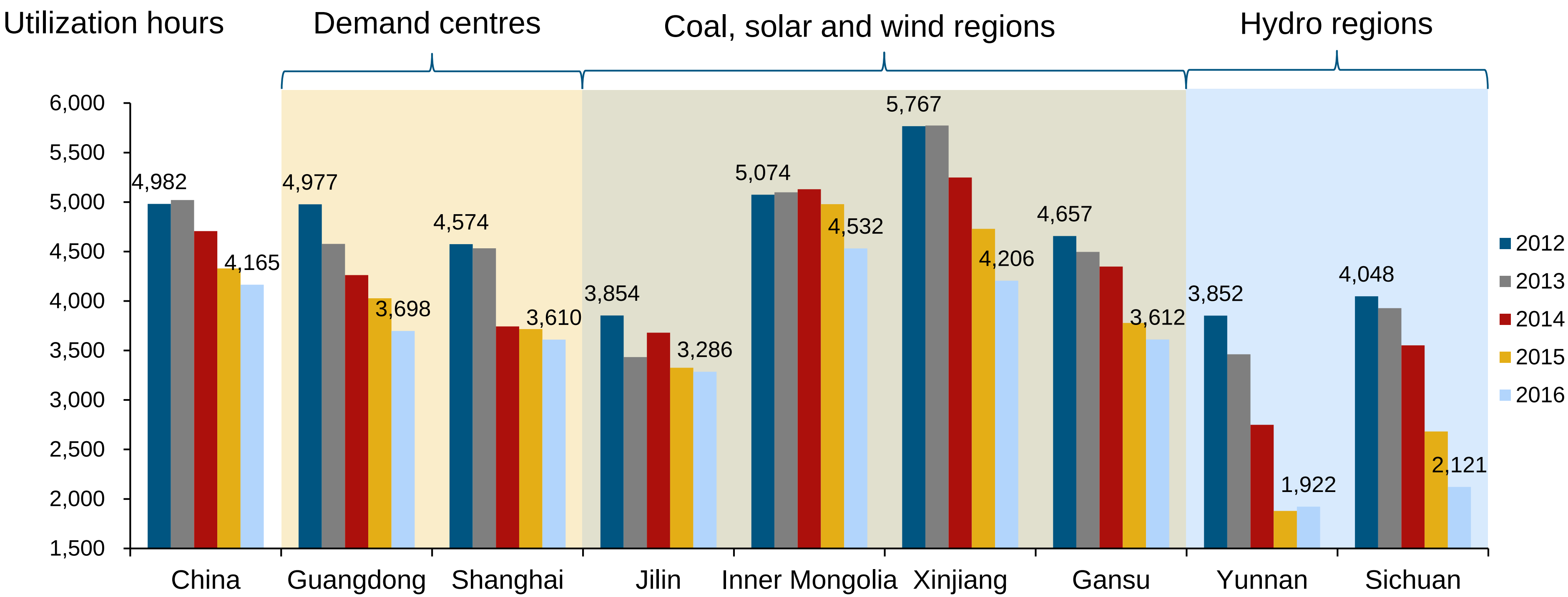
Solar curtailment rates in 5 key provinces



Source: NEA, Northwest China Energy Regulatory Bureau and TLG research from news reports.

Coal-fired generators in China run less than 50 percent in most provinces particularly so in renewable rich provinces – making them desperate for opportunity

Annual Average Generation Hours of Thermal Capacity in China

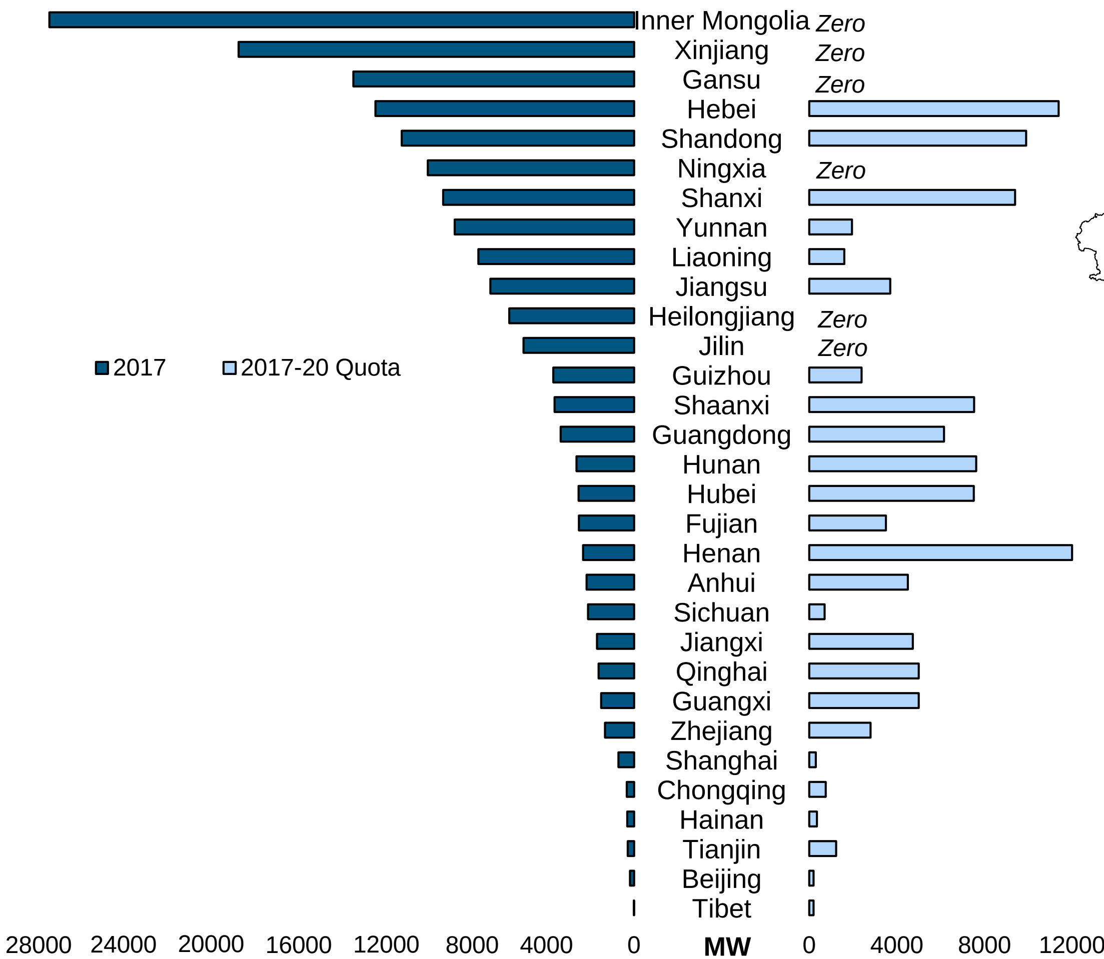


This presented opportunity for large end-users to negotiate low prices with underutilized coal-fired power plants

 Source: CEC; TLG research and analysis

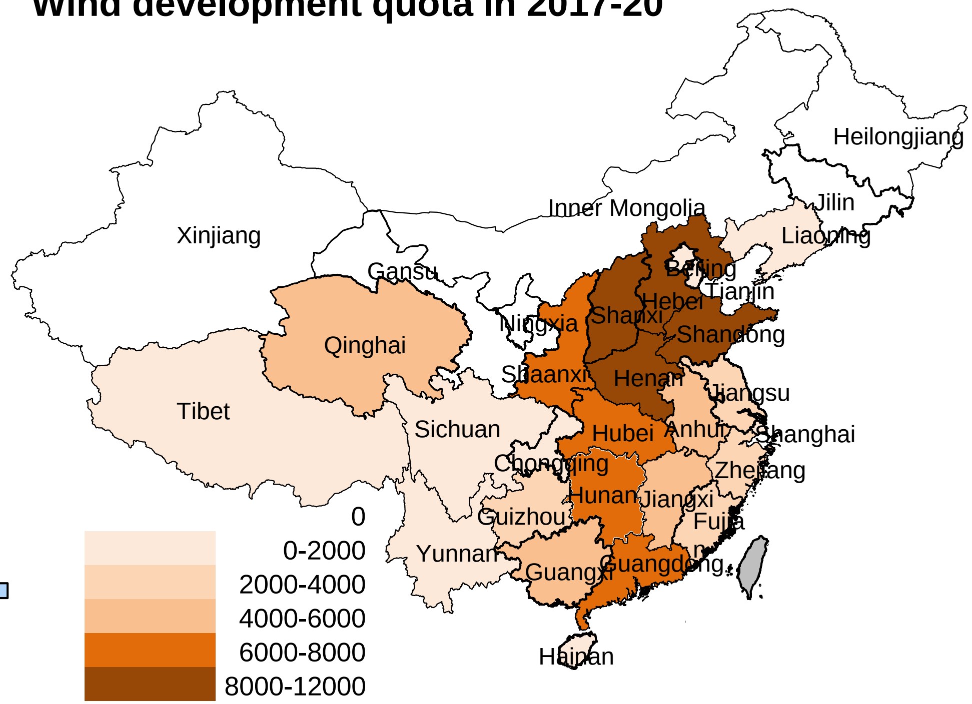
Central government is shifting wind development focus to provinces with lower curtailment rates

2017 existing capacity vs. 2017-20 new capacity quota



Source: NEA

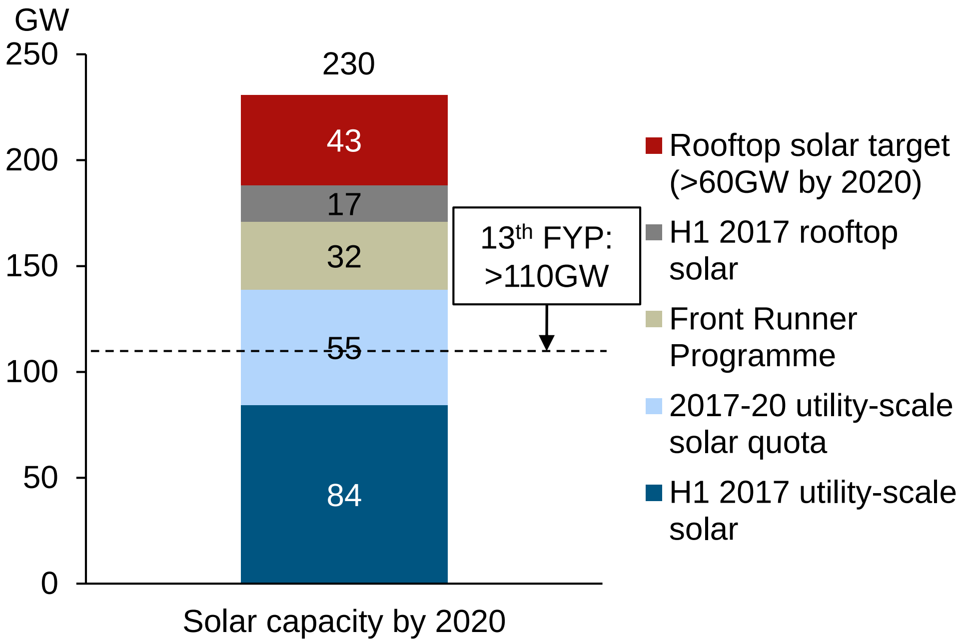
Wind development quota in 2017-20



- Inner Mongolia, Xinjiang, Gansu, Heilongjiang and Jilin are **not allowed to build new wind** capacity before curtailment problem is mitigated.
- Provinces in North China (Hebei, Henan, Shanxi and Shandong) are allocated the highest development quota in the next four years.
- Wind development quota is 110GW in 2017-20

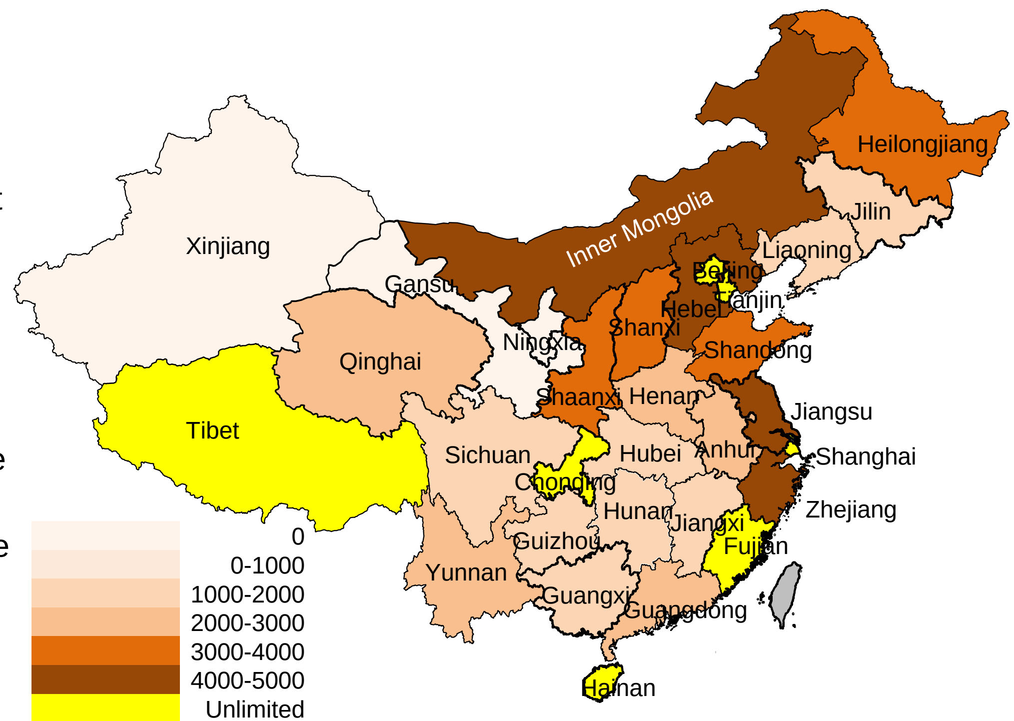
Central government is shifting solar development focus to provinces with lower curtailment rates, rather than reduce 2020 targets

Estimated solar capacity by 2020 under new development plan



Source: NEA, TLG analysis

Utility-scale solar development quota in 2017-20



Note: *Quotas do not include Front Runner Programme, rooftop solar project and village-level poverty alleviation project.*

In July 2017, NEA published provincial development quota and target during 2017-20 for wind and utility-scale solar. NEA assigns provincial development quota with 87 GW for utility-scale solar and 110GW for wind by 2020, which does not include provinces are not suitable to build more renewable capacity due to curtailment issues.

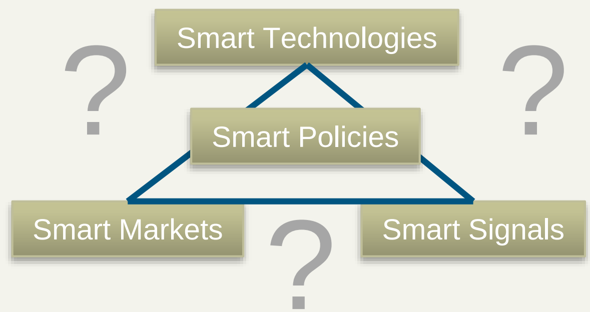
Megatrend 1

- RE is becoming commercially viable in more and more countries and under a wide range of circumstances
- Huge pressure to integrate renewable energy especially as cost falls
- Policy drivers remain the biggest factor
- Getting the integration right with the rest of the system, however, is not that easy
- Increasingly we are seeing RE investors beginning to face “merchant” risk exposure
  - Asset stranding due to curtailment
  - Incomplete contracting arrangements
  - Competitive tendering processes with price outcomes that must then be delivered….
- Players with a strong “funnel”, robust access to capital, and a proven delivery track record have attracted significant value

Megatrend 2

Changing the way we price energy usage

- Pricing influences incentives and behaviours, which can in turn shift costs from one group to another
- Speed of change in technology and adoption rates outpaces adaptability of regulation and policies
- How to signal and support the right overall mix of resource capabilities and responses?
- Smart usage requires smart meters and smart pricing, but few customers have these



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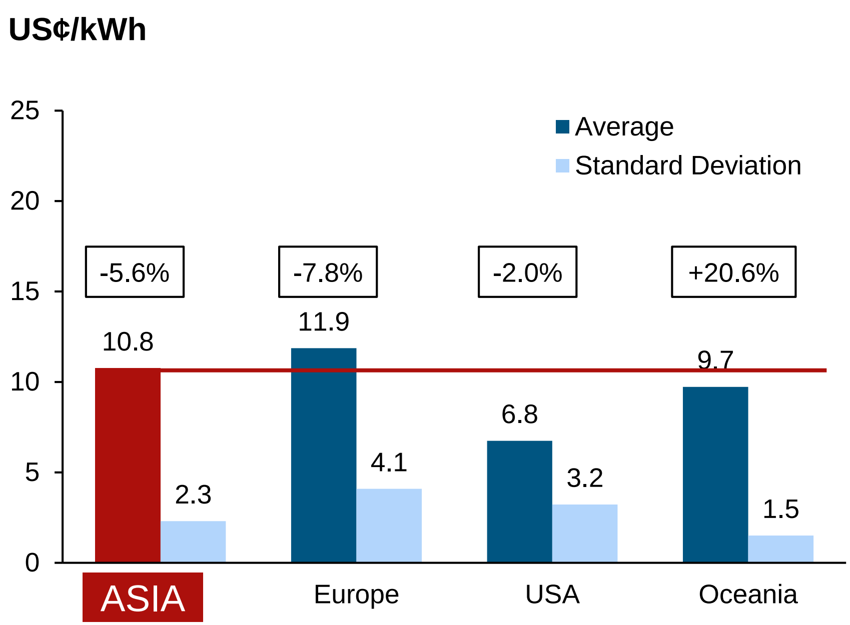
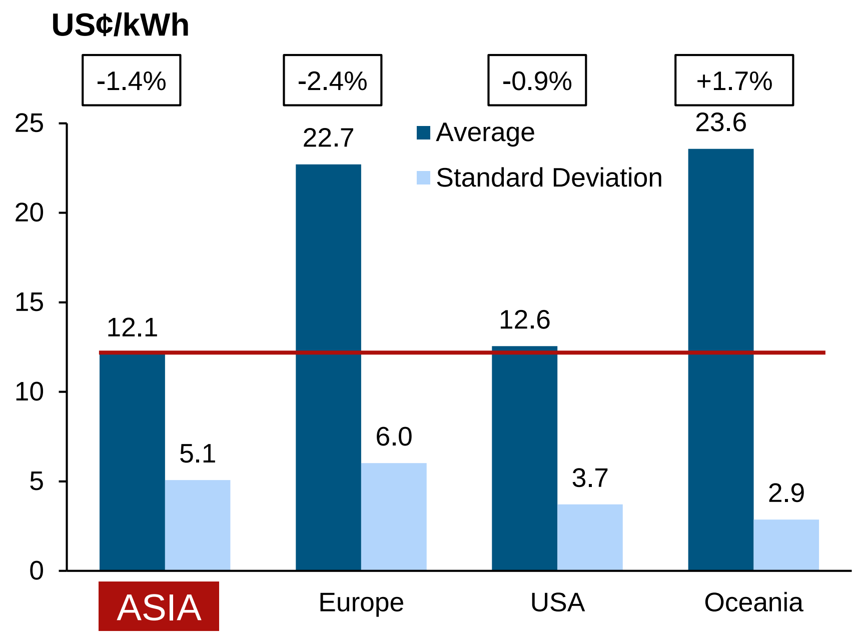
Large customer tariffs in Asia are, on average at the top end, globally, creating stronger pressure for energy management and cost avoidance

Industrial electricity prices have risen



Residential electricity prices are *kept low*

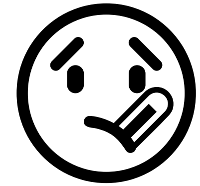


Source: TLG Research, Eurostat, EIA

Note:

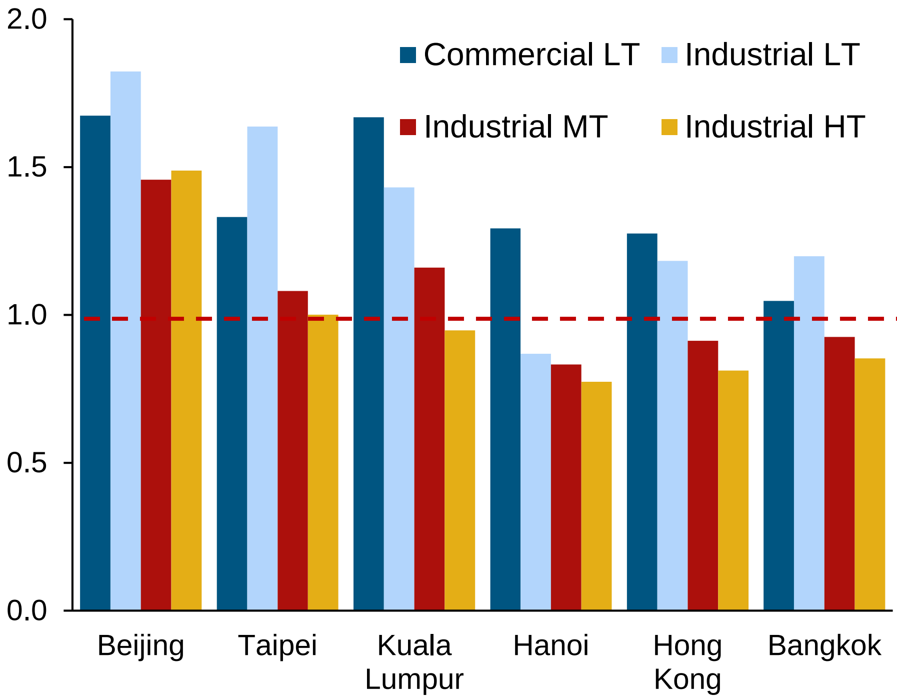
- Data compiled for 2016
- Europe represents European Union (28), residential consumption ranges between 2,500~5,000kWh per annum, industrial consumption ranges between 20,000~70,000MWh per annum
- USA represents 50 states, residential and industrial usage corresponds to utility reported segment revenue.
- In Asia, price calculated based on typical residential consumption of 3,336kWh per annum.
- In Oceania, price calculated based on typical residential consumption of 4,800kWh per annum.
- Typical industrial customer is connected at tension level greater than 1kV and less than 66kV, consumes 2,176MWh per annum, with contract demand of 3000kW

Cross subsidies are generally significant across most Asian countries



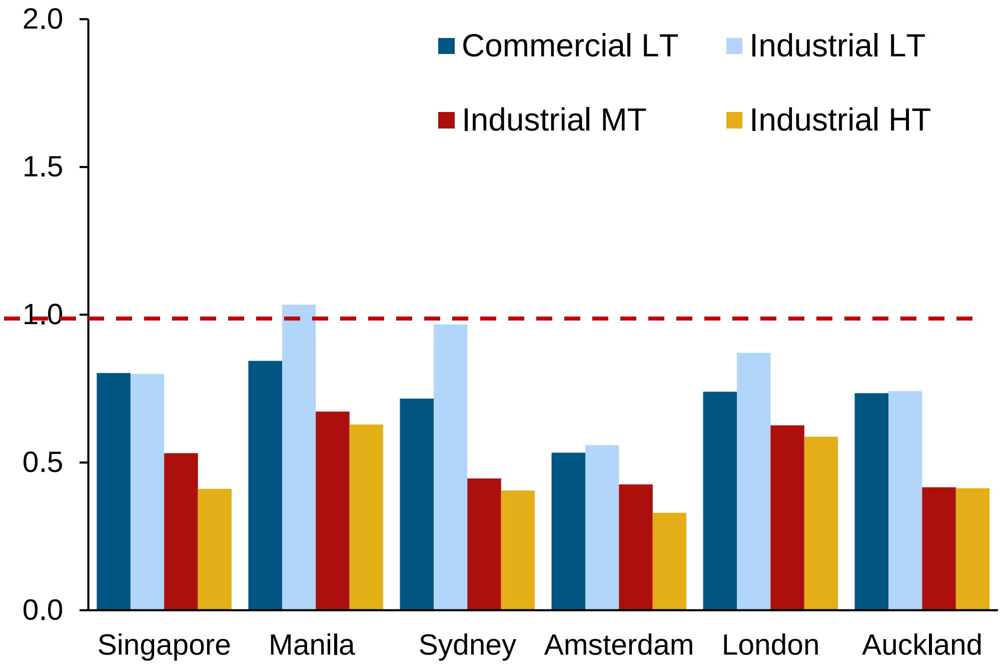
Large Customer Tariffs compared to Residential Customer Tariffs

C&I Customers Pay More (per kwh)



Source: TLG

C&I Customers Pay Less (per kwh)



Relatively Robust Cost-Based Regulatory Regimes

Keeping residential customers tariffs low, means C&I customers have to cover cost increases….

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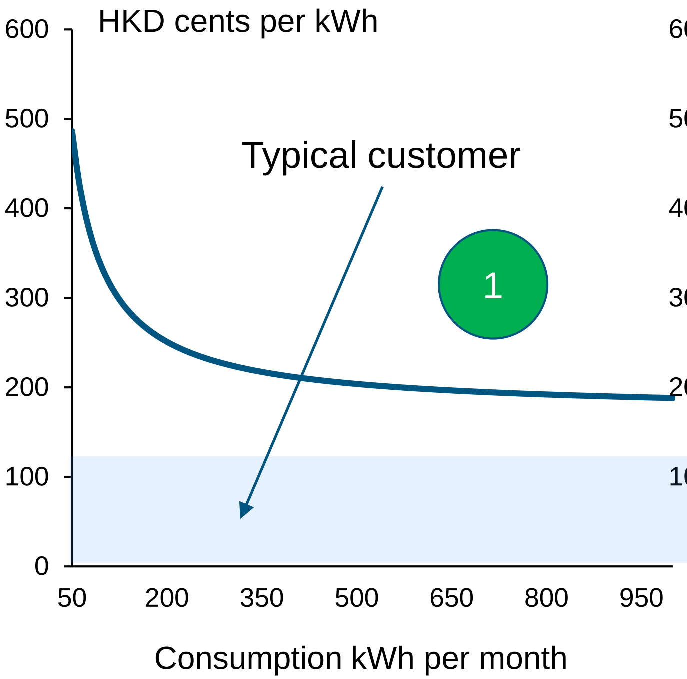
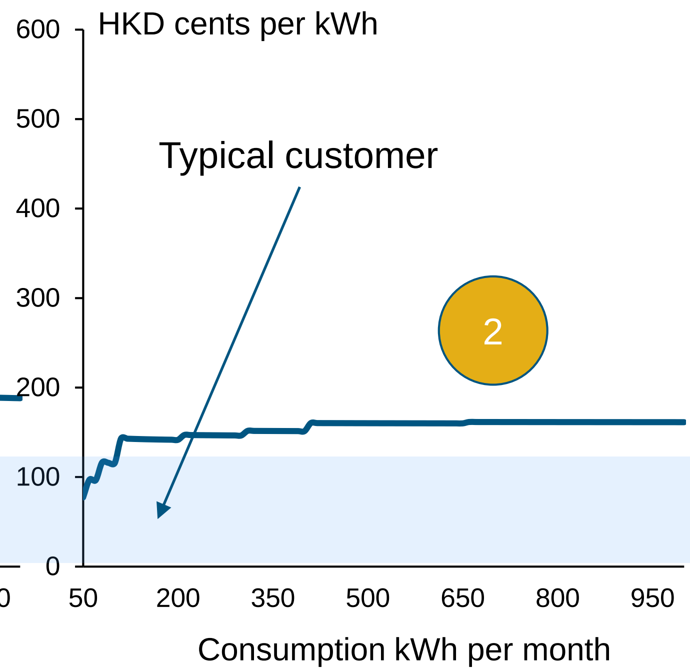
Residential Tariff Structure Comparison

Sydney



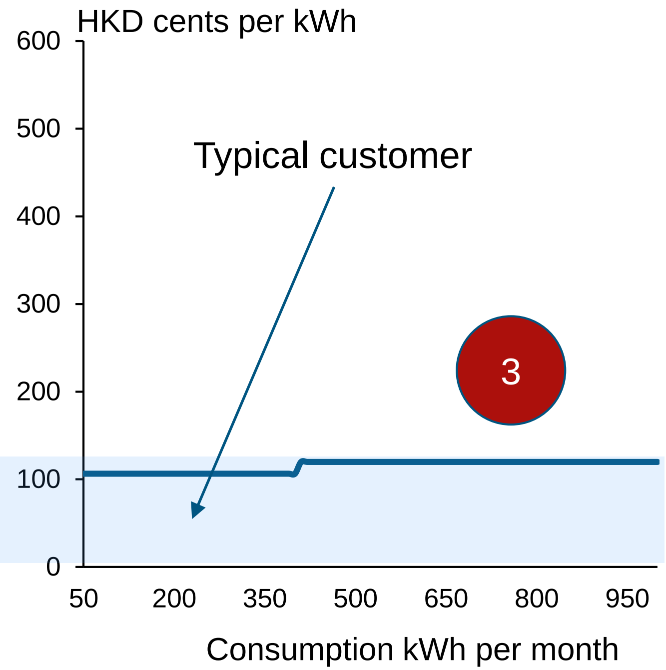
Massive BTM Market Activity

Manila



Emerging Interest for larger customers

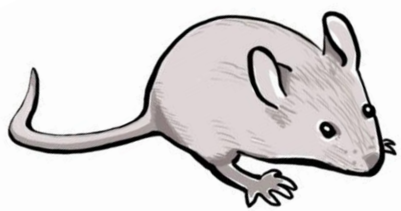
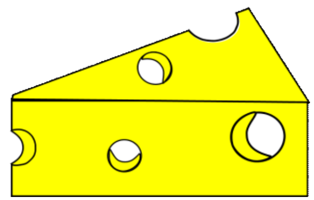
Hong Kong



Not well placed

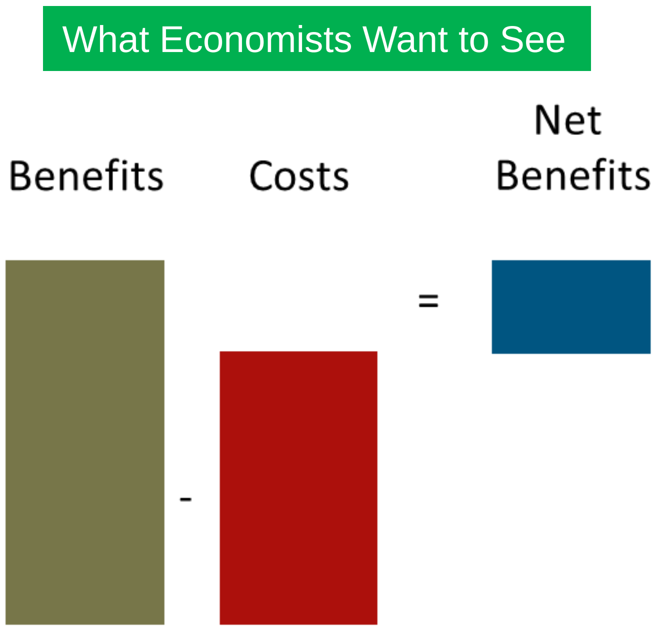
Who is going to be most active “behind the meter?”

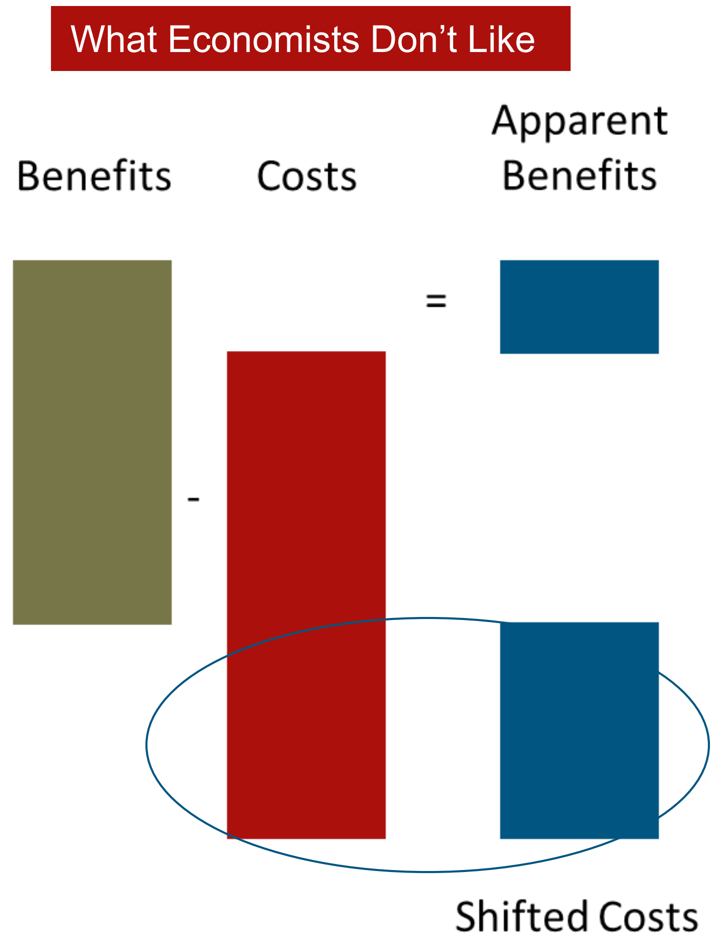
When tariffs are high enough, customers start pursuing “bypass” options….

		Disrupted!	Implication
		Bill	CHANGE TARIFF DESIGN ↓ INCREASING ENERGY POVERTY ↓ **EVEN MORE PRESSING NEED TO RETHINK LOW INCOME SUPPORT**
Solar Rooftop Customer	Hidden Avoided Cost Subsidy (Volumetric Tariff)	Other Customers	

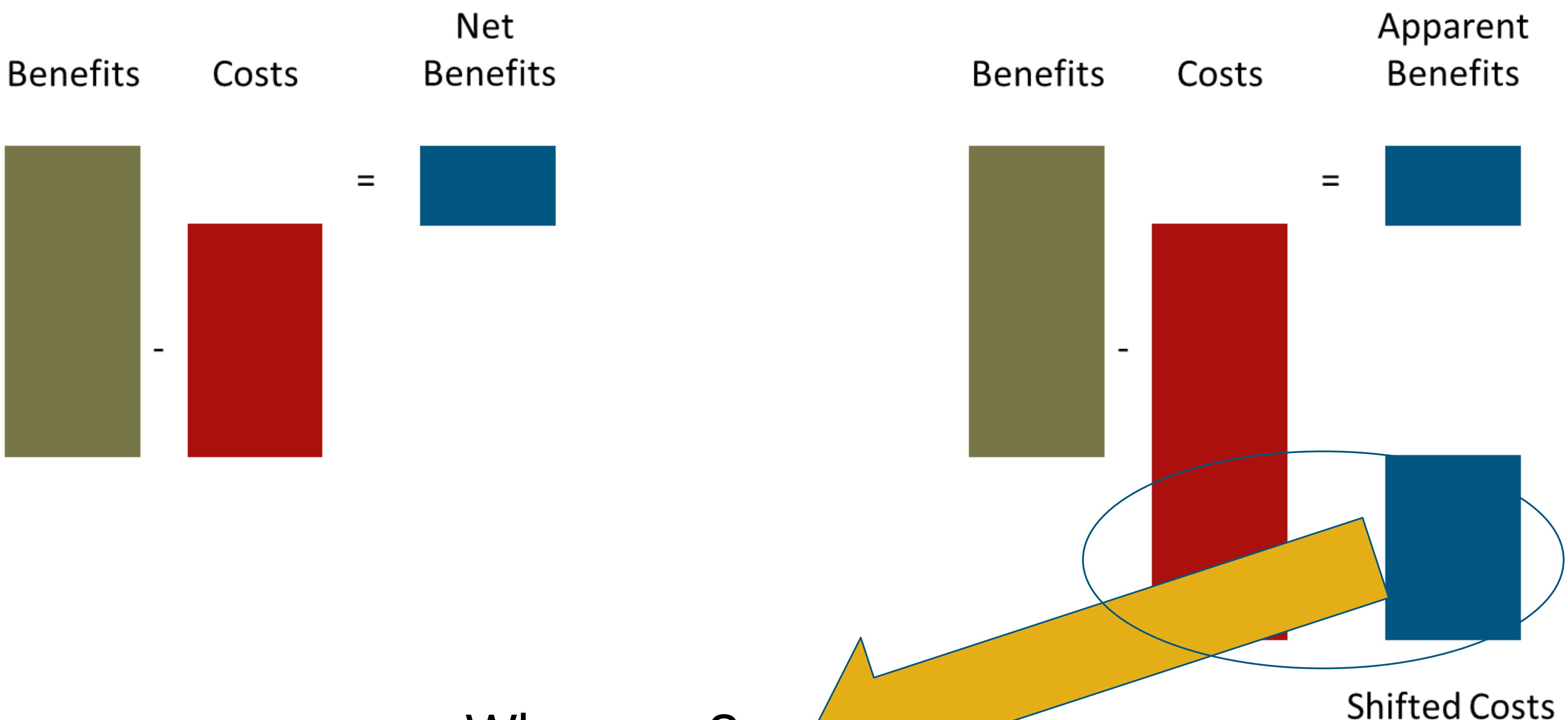
A customer with a higher tariff will have a stronger incentive to “save money”

Too often, customer bypass options shift costs to other customers….





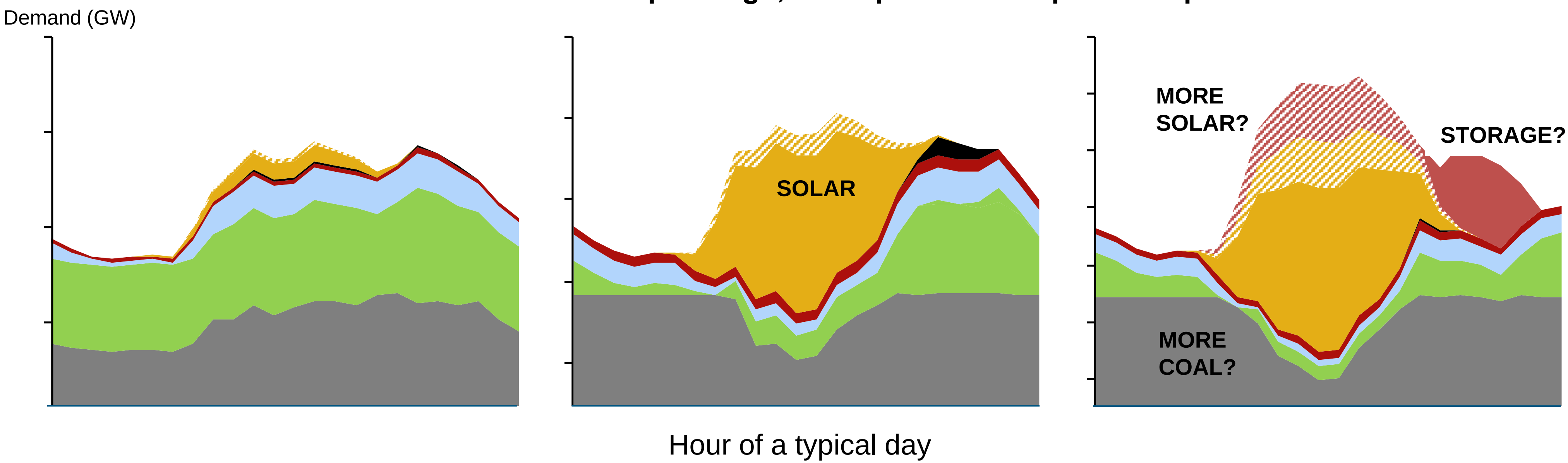
Is this what you want?



Who pays?
(and why should they?)

But the future is coming…..and it is different….

Once solar becomes cheap enough, it's impact can be quick and profound



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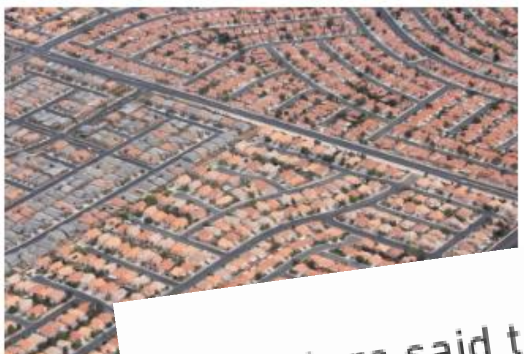
Behind the meter solar can reduce utility revenue to pay for the grid….

Does Nevada's Controversial Net Metering Decision Set a Precedent for the Nation?



What Nevada's decision could mean for other states

by Julia Pyper
February 04, 2016

Regulators said the order was designed to make solar customers pay their fair share for use of NV Energy's grid. Solar companies warned that the changes make rooftop solar economics unworkable.

What is fair? What is efficient? So many stakeholders, so much debate.

Source: https://www.greentechmedia.com/articles/read/nevada-net-metering-decision

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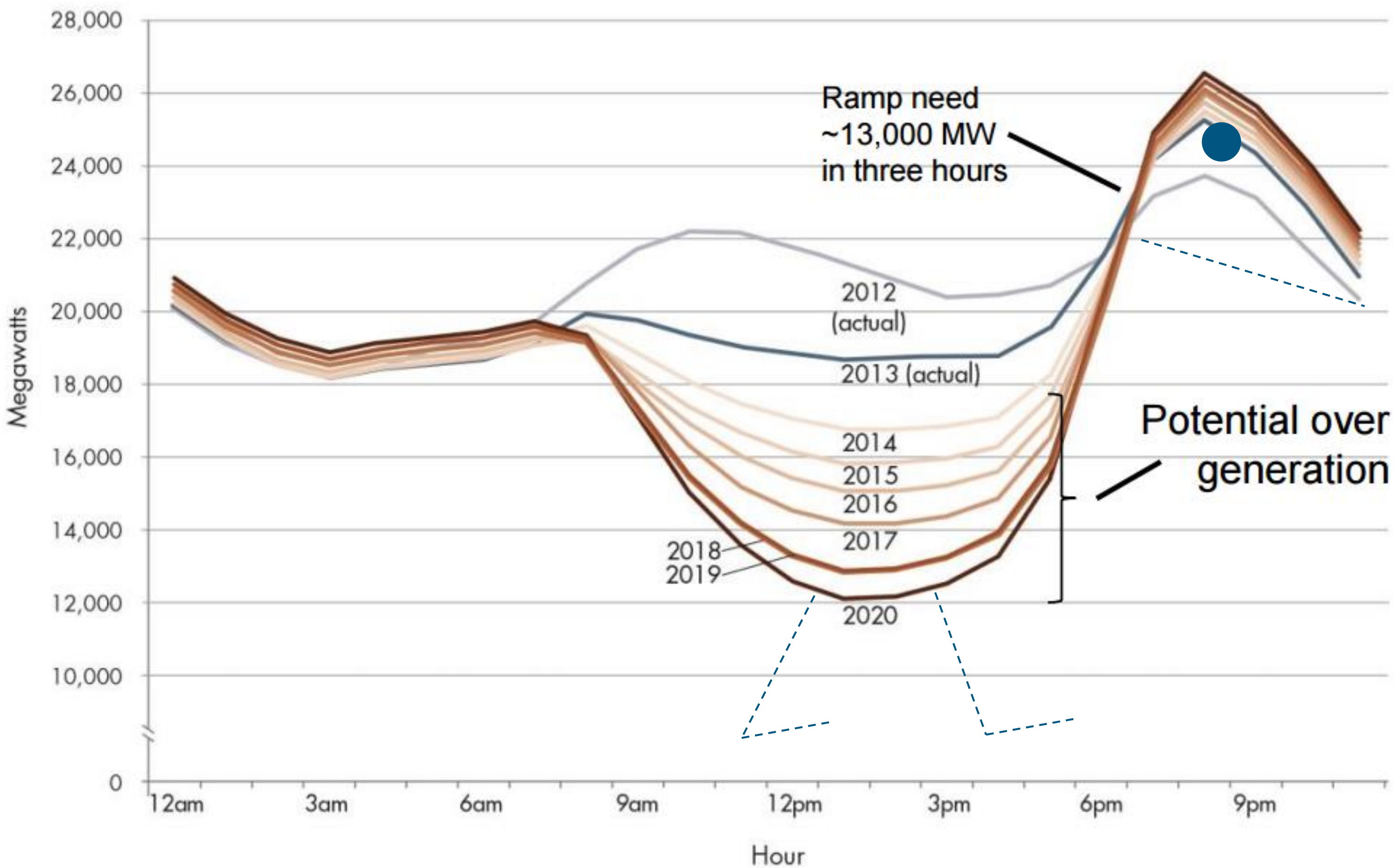
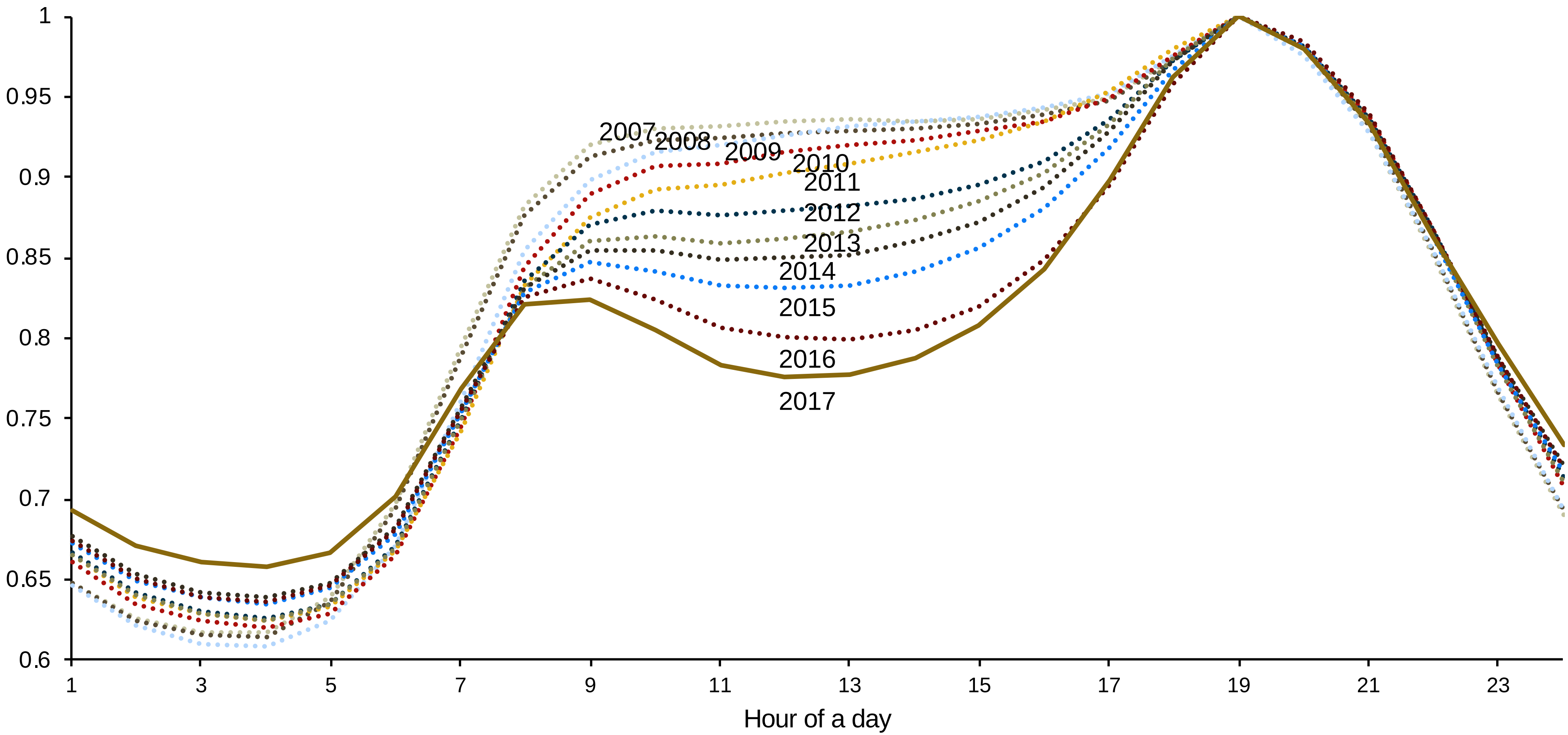
Meeting the daily (diurnal) generation cycle is becoming technically more challenging (possible, but not without planning) --- California's "Duck" Curve

California's "Duck Curve": Impact of Solar Output on Net Generation Requirement



Source: California Independent System Operator
(with "duck" features added by TLG)

The emerging Western Australia “Duck” Curve — energy markets are being pushed out-of-balance by renewable energy policies



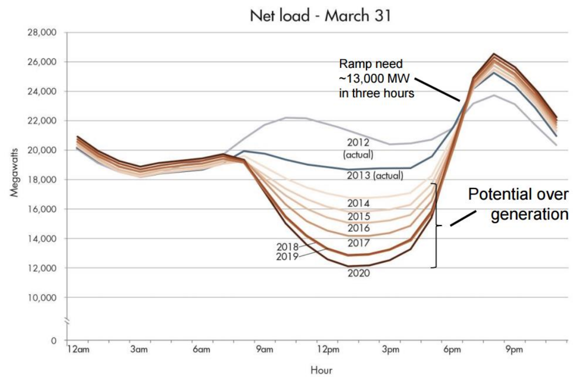
Based on 11 years of sent out generation data from AEMO on half-hourly generation in Western Australia.

 Source: AEMO, TLG analysis

If the duck curve creates a big enough problem, someone will sell you a solution…..

Battery storage

+



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Excess renewable energy creates a market for energy storage solutions

Dig a deep enough hole, and you need to buy a ladder!

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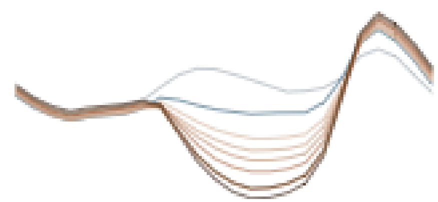
California ISO

A shift to storage led by the need for “ancillary services” and fast response….

- “To reliably operate in these conditions, the ISO requires flexible resources defined by their operating capabilities.
- These characteristics include the ability to perform the following functions:
  - sustain upward or downward ramp;
  - respond for a defined period of time;
  - change ramp directions quickly;
  - store energy or modify use;
  - react quickly and meet expected operating levels;
  - start with short notice from a zero or low-electricity operating level; • start and stop multiple times per day; and
  - accurately forecast operating capability”



California’s big battery experiment: a turning point for energy storage?

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Megatrend 3

Aligning incentives on both sides of the meter

- Increasingly the world of the ”grid” and the world “behind the meter” are becoming disconnected, with implications for cost and equity (who pays)
- Deployment of distributed energy sources proceeds in an ad hoc, opportunistic, and often imbalanced and cost-shifting way given rigidity in current tariff structures
- Energy storage becomes more valuable as various constraints and distortions increase due to less integration between economics of energy, environment, and security of supply objectives
- New challenges for grid operators to manage system security (keep the lights on)

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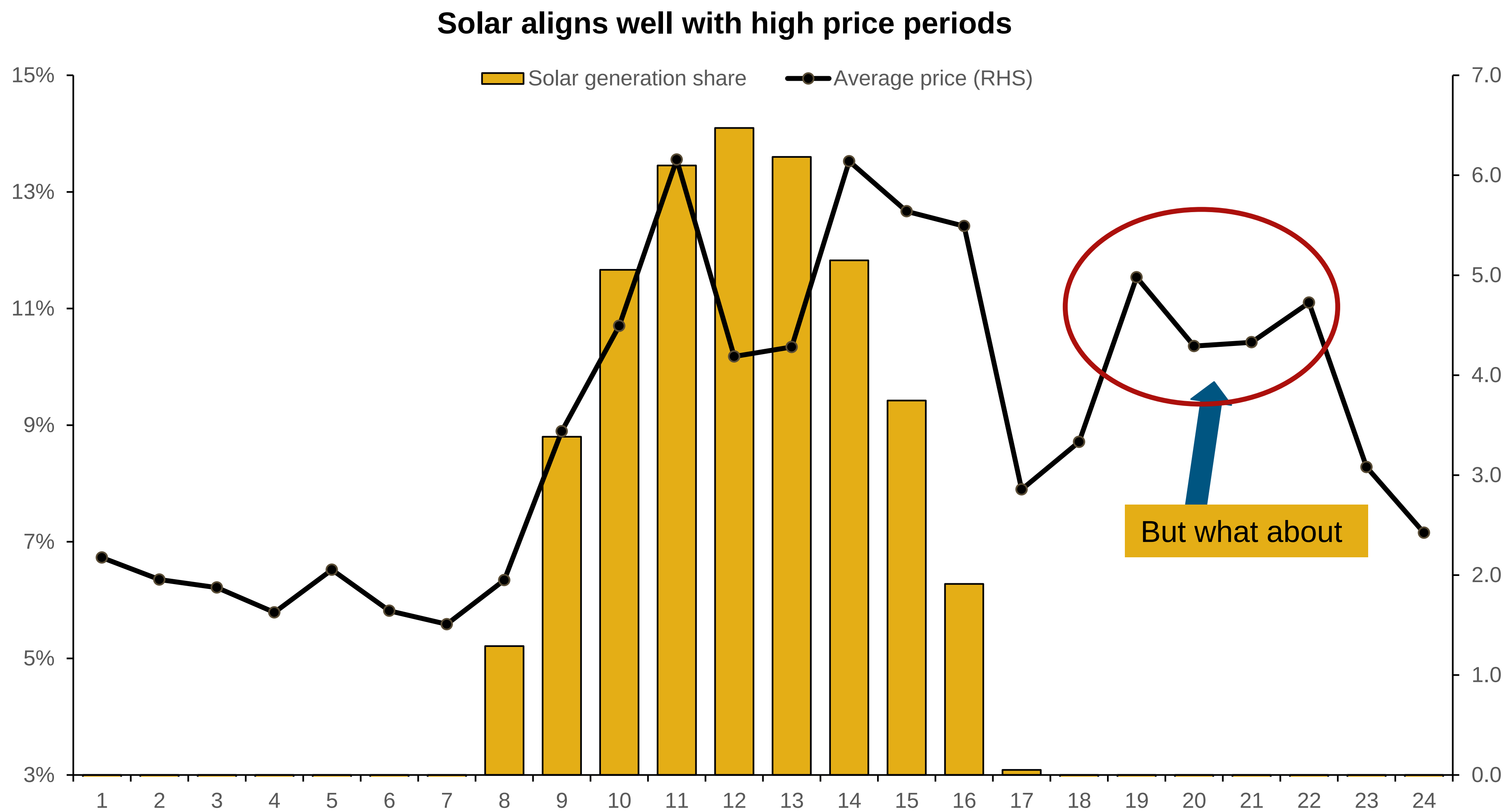
Solar makes sense for the daytime peak, but many countries have a high evening peak…too…meaning very little cost savings to the network businesses



Note: based on 2016 average hourly load and prices in Luzon
Source: WESM and TLG analysis

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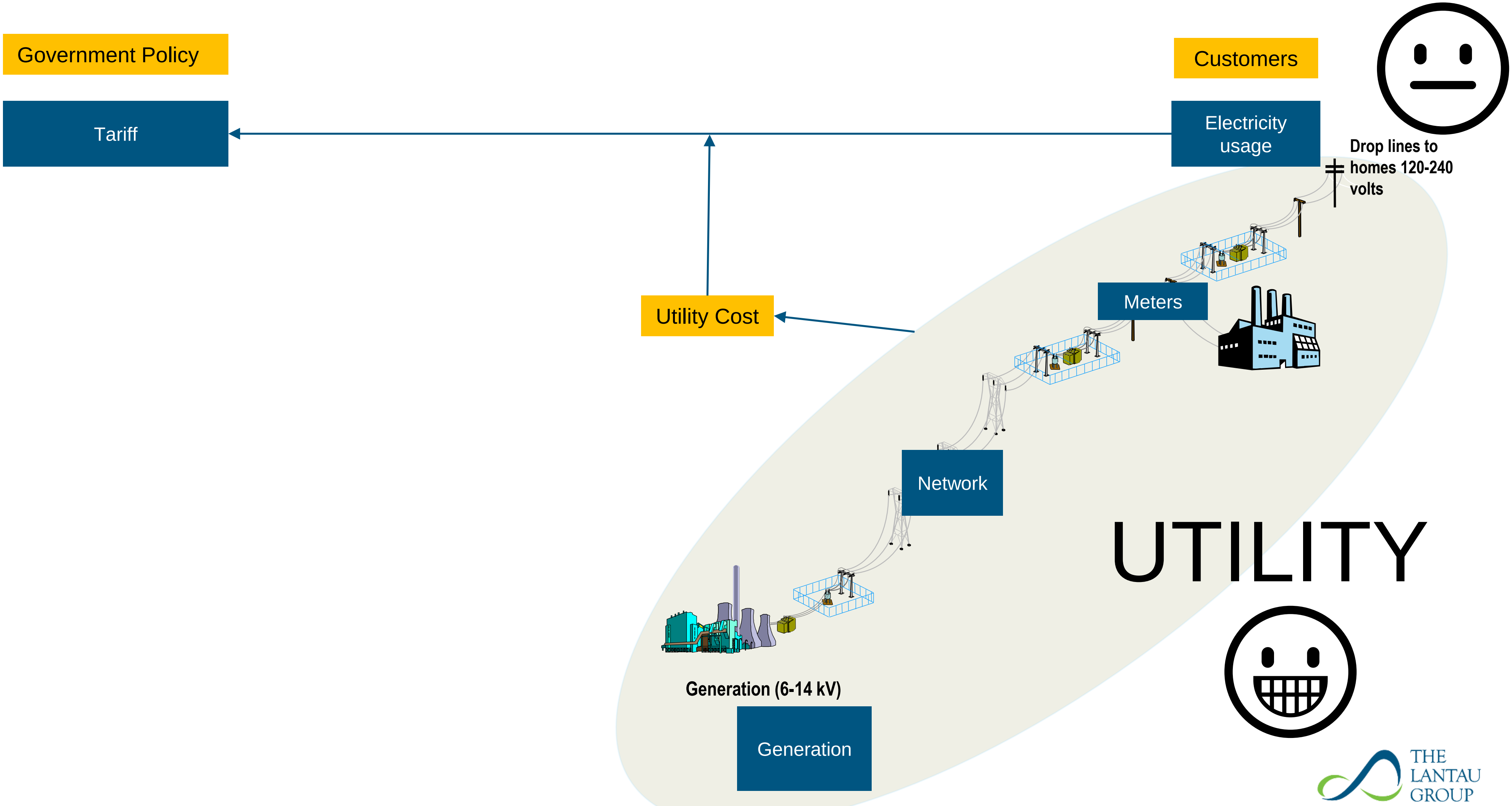
Once upon a time, a utility's (and customer's) life was simple



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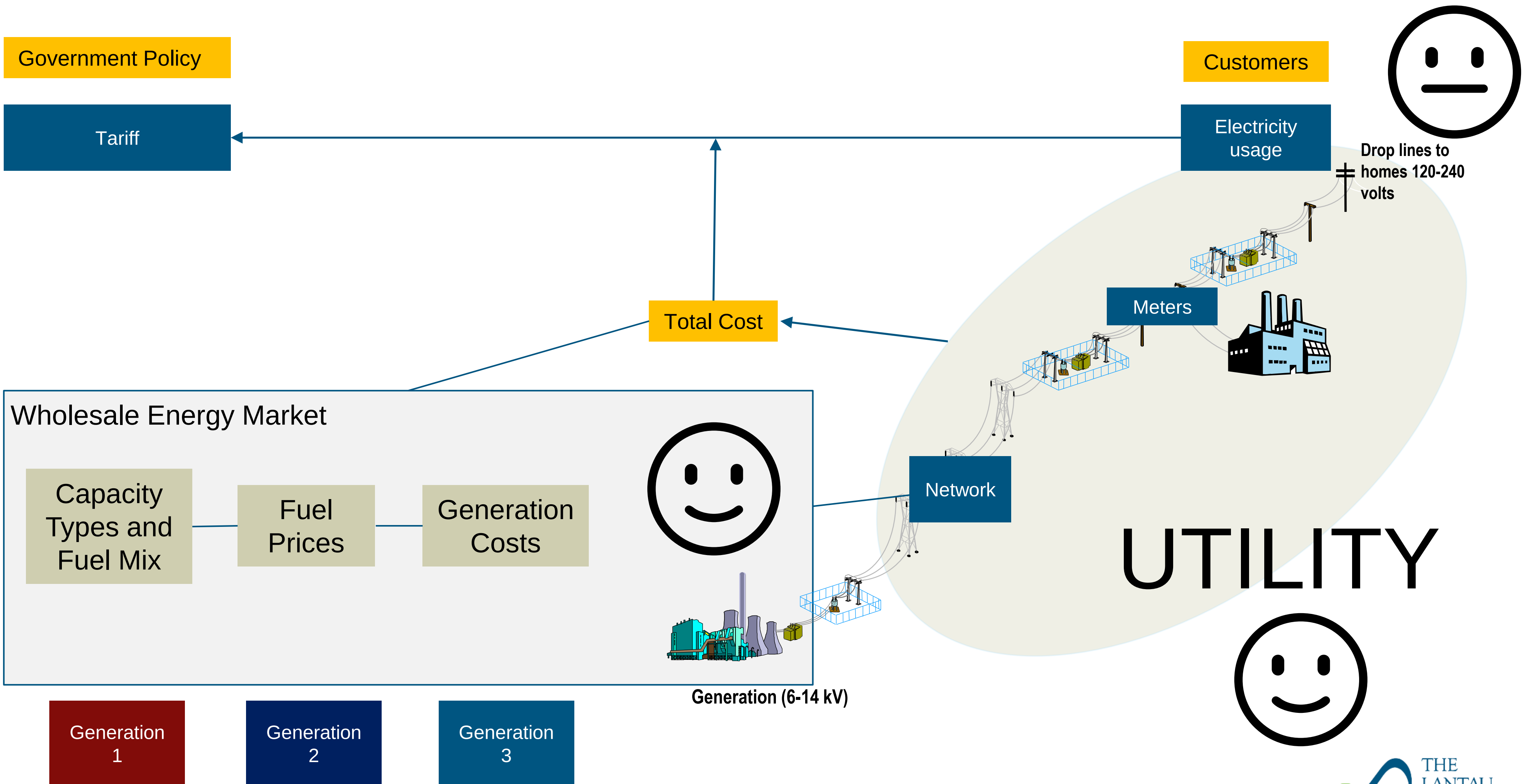
Many countries introduced “IPPs” and/or “Electricity Wholesale Markets”



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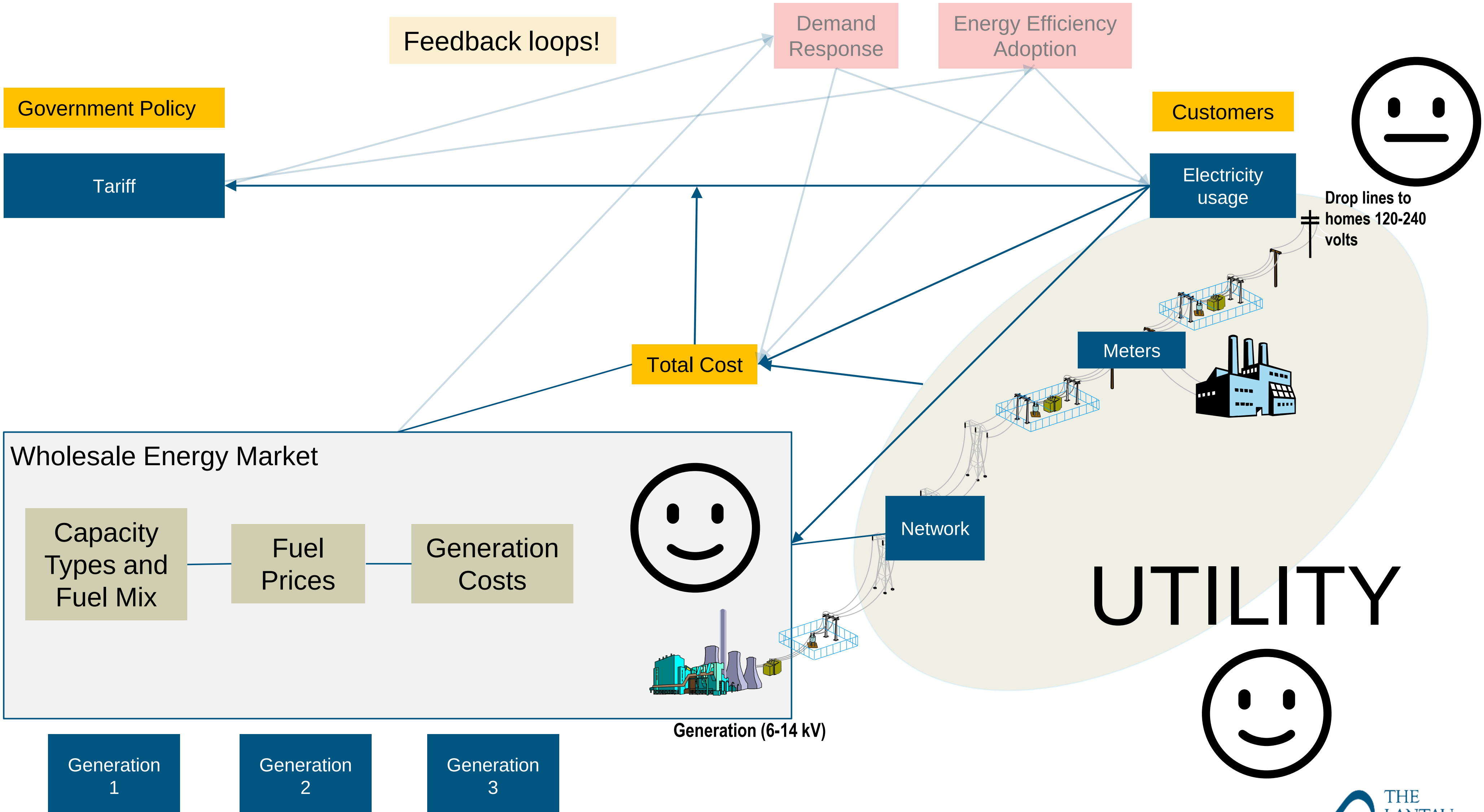
Demand response and energy efficiency were amongst the first "complications", but were relatively modest in their initial impact in most markets….



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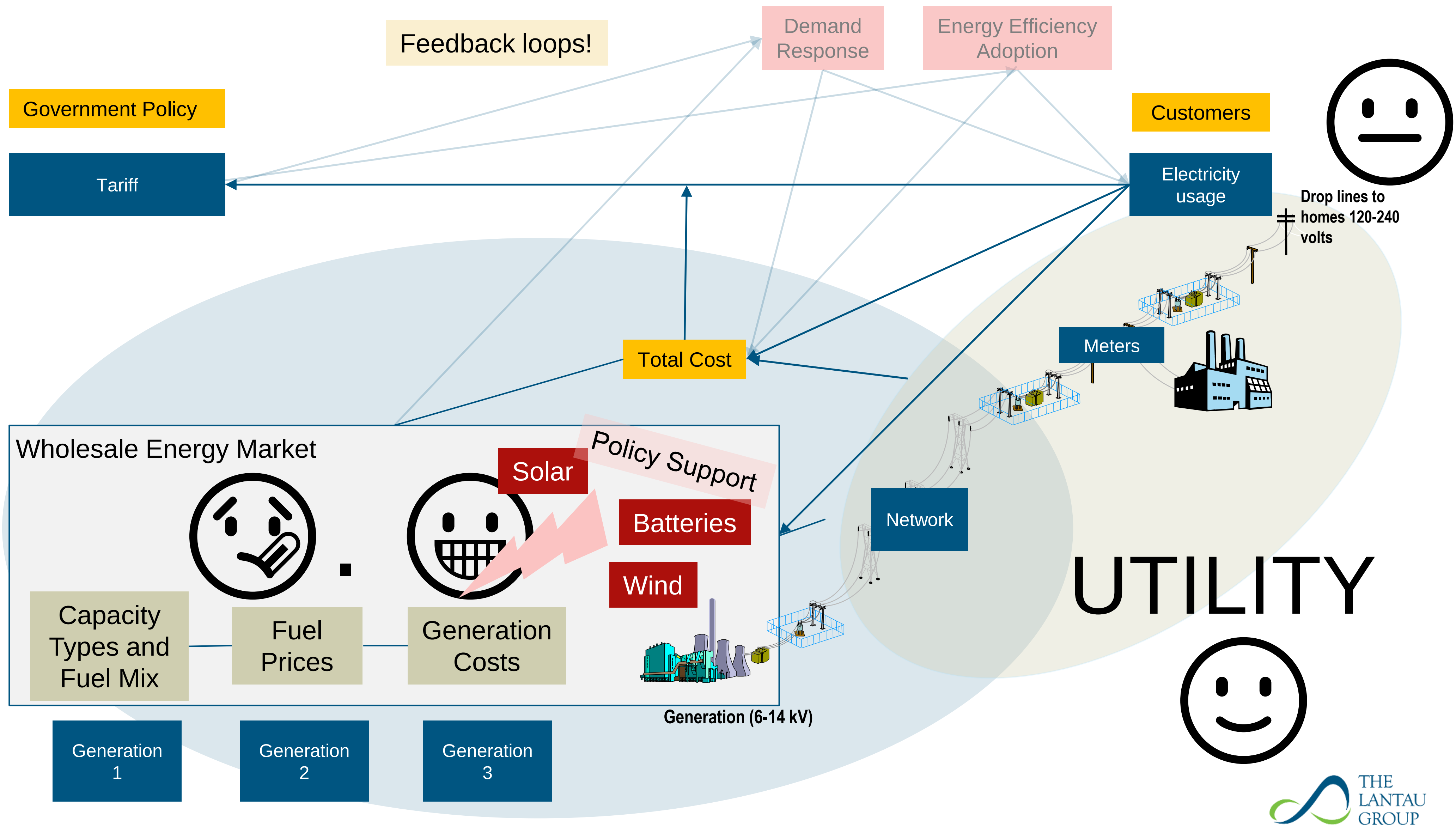
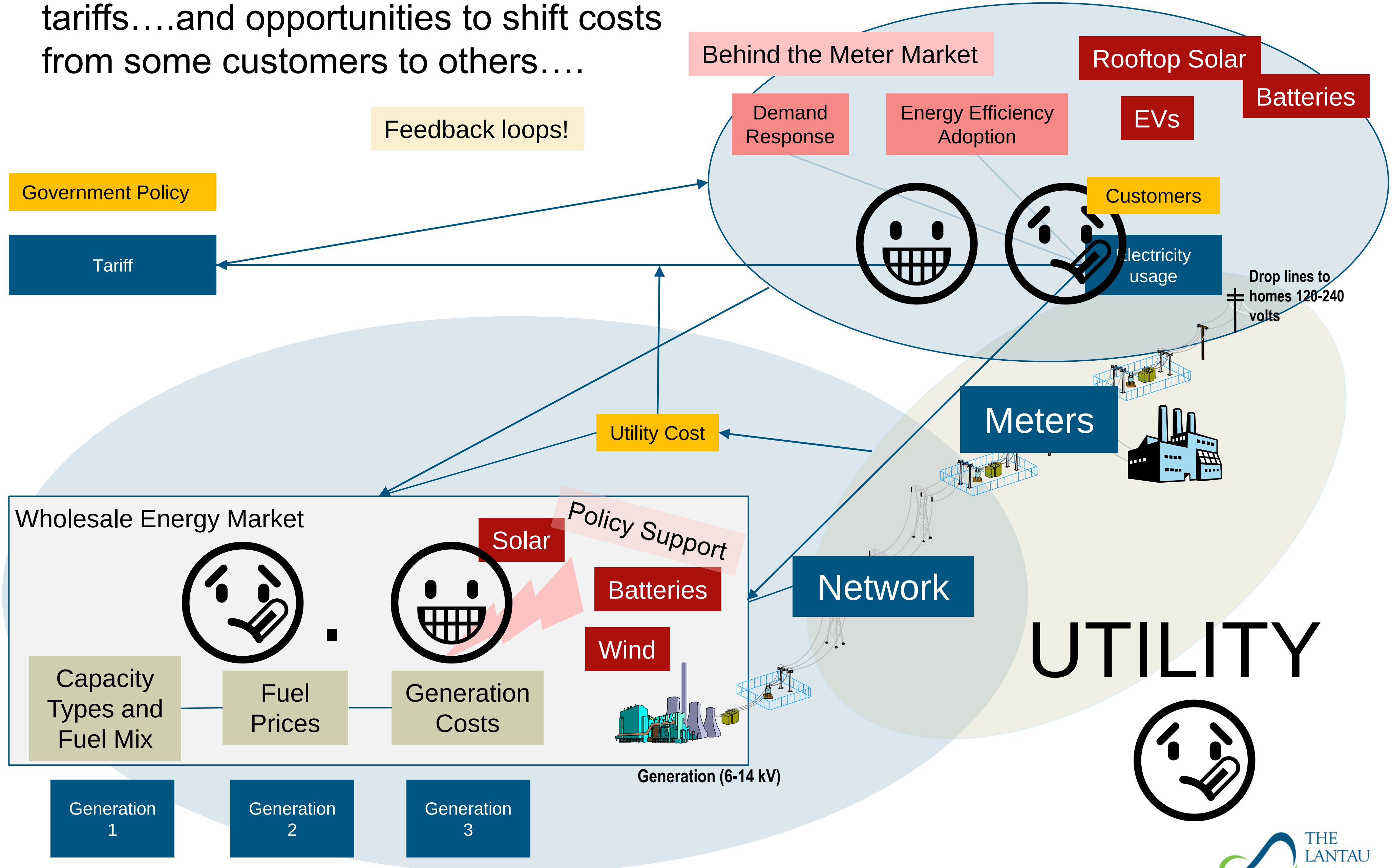
Policy support for grid-connected renewable energy (feed-in-tariffs and other mechanisms) pushed many wholesale energy markets out-of-balance



The “behind the meter” market is taking off in many countries, driven by rising tariffs….and opportunities to shift costs from some customers to others….



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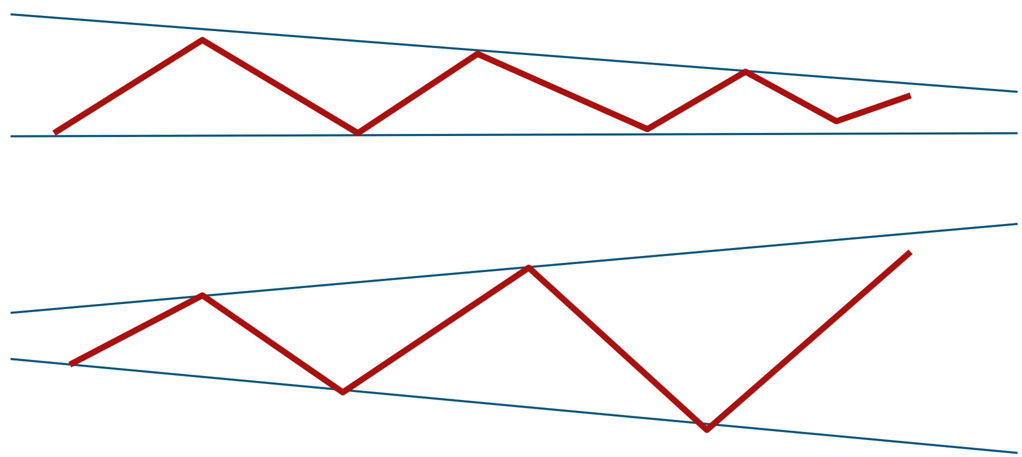
The Revenge of the Economists

- The introduction of new technology (or the maintenance of existing technology) into the electricity sector is likely to be problematic if:
  - It is adopted (or not adopted) due to a pricing anomaly (i.e., a distorted or incomplete, or missing price signal)
  - Its adoption (or non-adoption) creates or worsens a pricing anomaly
  - Its inappropriate presence (or absence) reduces reliability or security of the system
  - It results in a material shift of costs to other stakeholders
- Usually there is some triggering of additional forces, which can either be:

– Self regulating

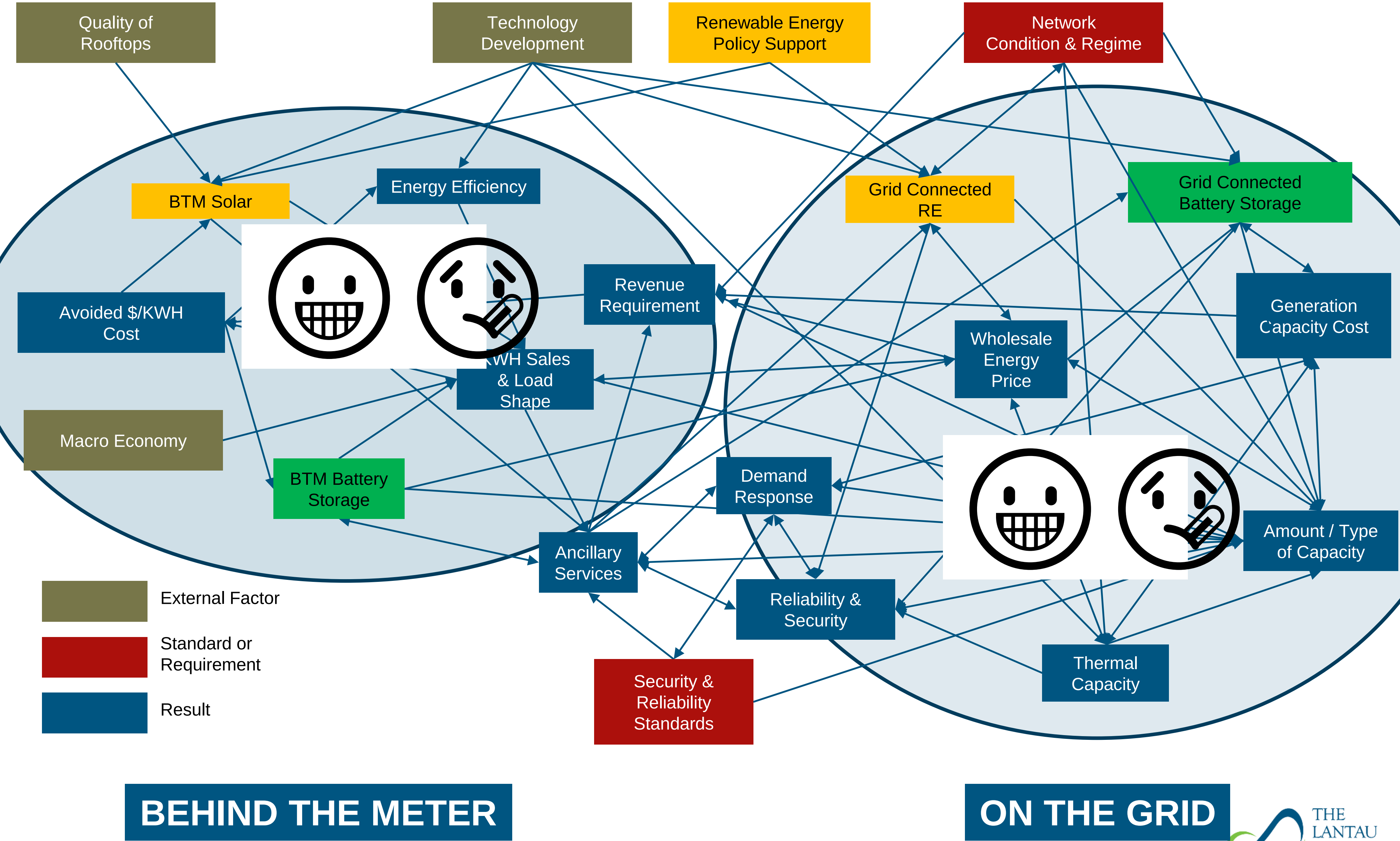


Benign

– Auto-catalysing

Disruptive

The truth is even more complicated…..almost everything affects everything else in the energy supply chain, with many winners and losers….



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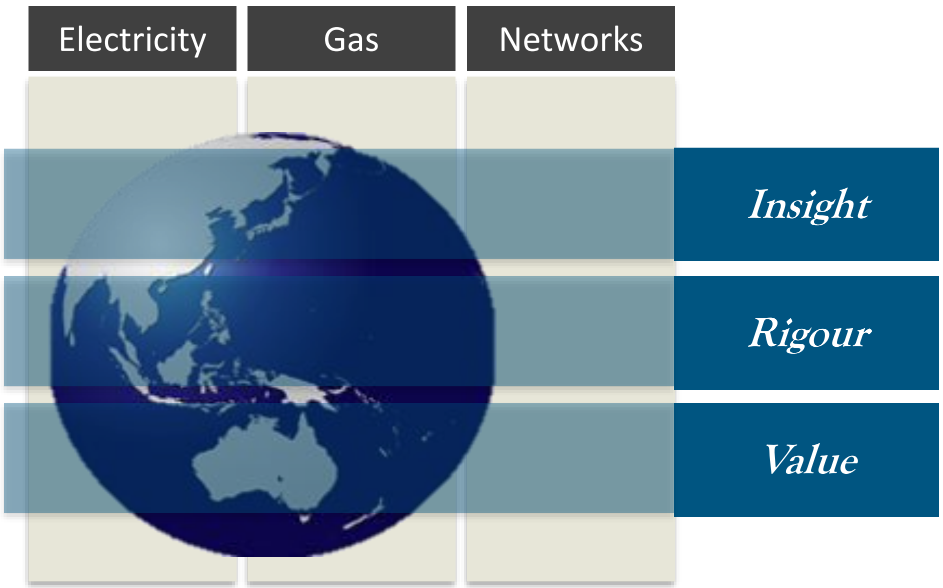
Everything is a bit messed up, but there’s no going backwards

Issues

- The energy market and the environmental and technology agenda have long been out of sync
  - Higher financial risk to shareholders
  - Greater risk of blackouts
- Few fully understand these trends and their implications
  - Too many conflicting messages from competing stakeholders
  - Tariffs are too political and do not respond to changing conditions or risks
  - Policies may be developed without a realistic view as to what they will cost or what impact they will have
- Various reforms and policy shifts are removing or altering subsidies and cross-subsidies
- Supply and demand are often materially out of balance in major Asian countries like China

It's going to take some work to make our energy systems secure, adequate, sustainable, and equitable

Thank you



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