



How Sustainable are the Renewables in the Philippines Power System?

Sarah Fairhurst

About The Lantau Group

Consultants to the Energy Sector

Competition, Markets, Regulation, Policy

Decisions Support Analysis

Disputes

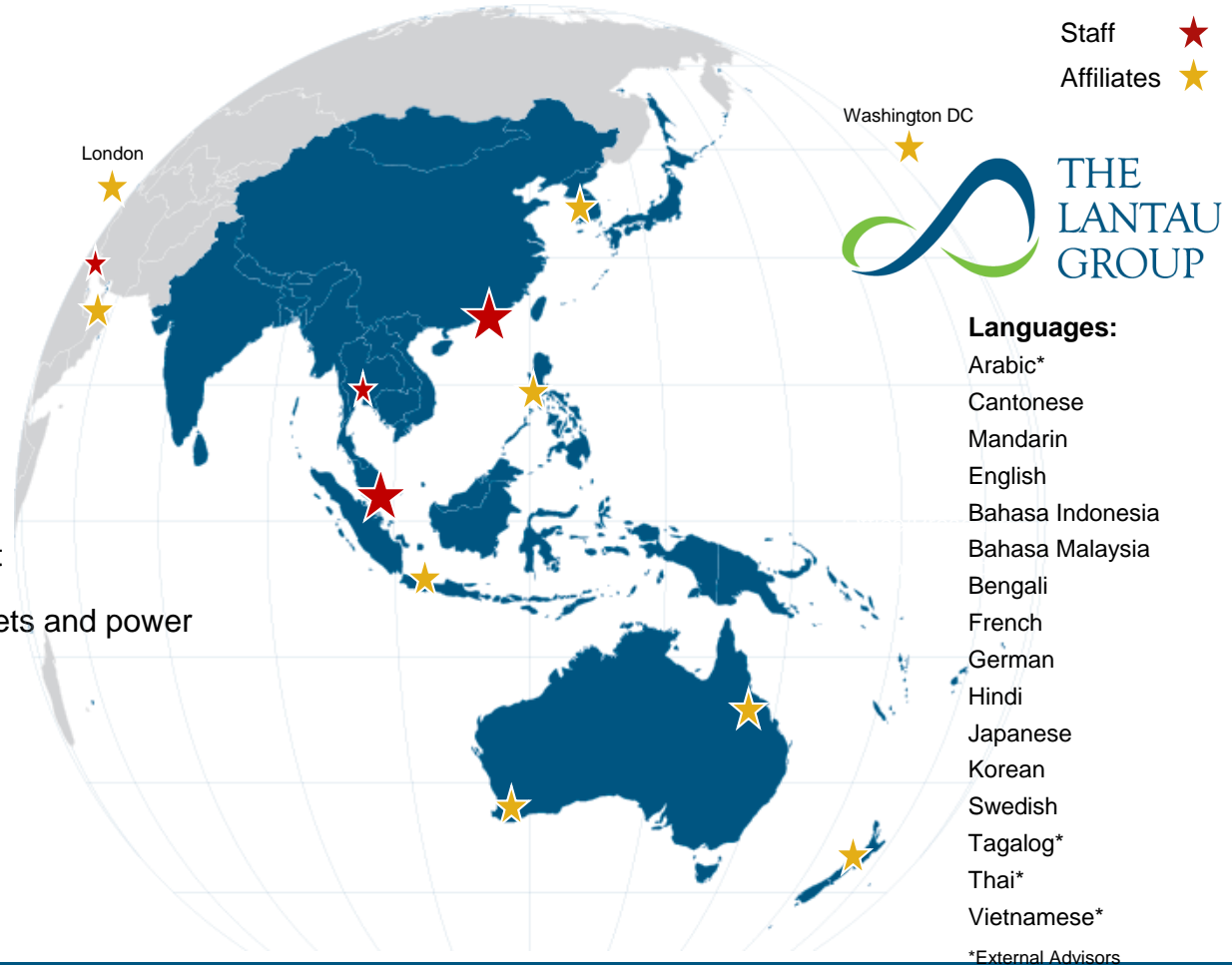
Market Analysis

Asset Valuation

Strategy and Advanced Analytics

Offerings:

- Strategic, commercial, and regulatory support
- Ability to connect the dots between fuel markets and power
- Analysis-based recommendations
- Highly relevant international experience
- Accessible experts focussed on the region
- Pricing, trends, drivers, risks



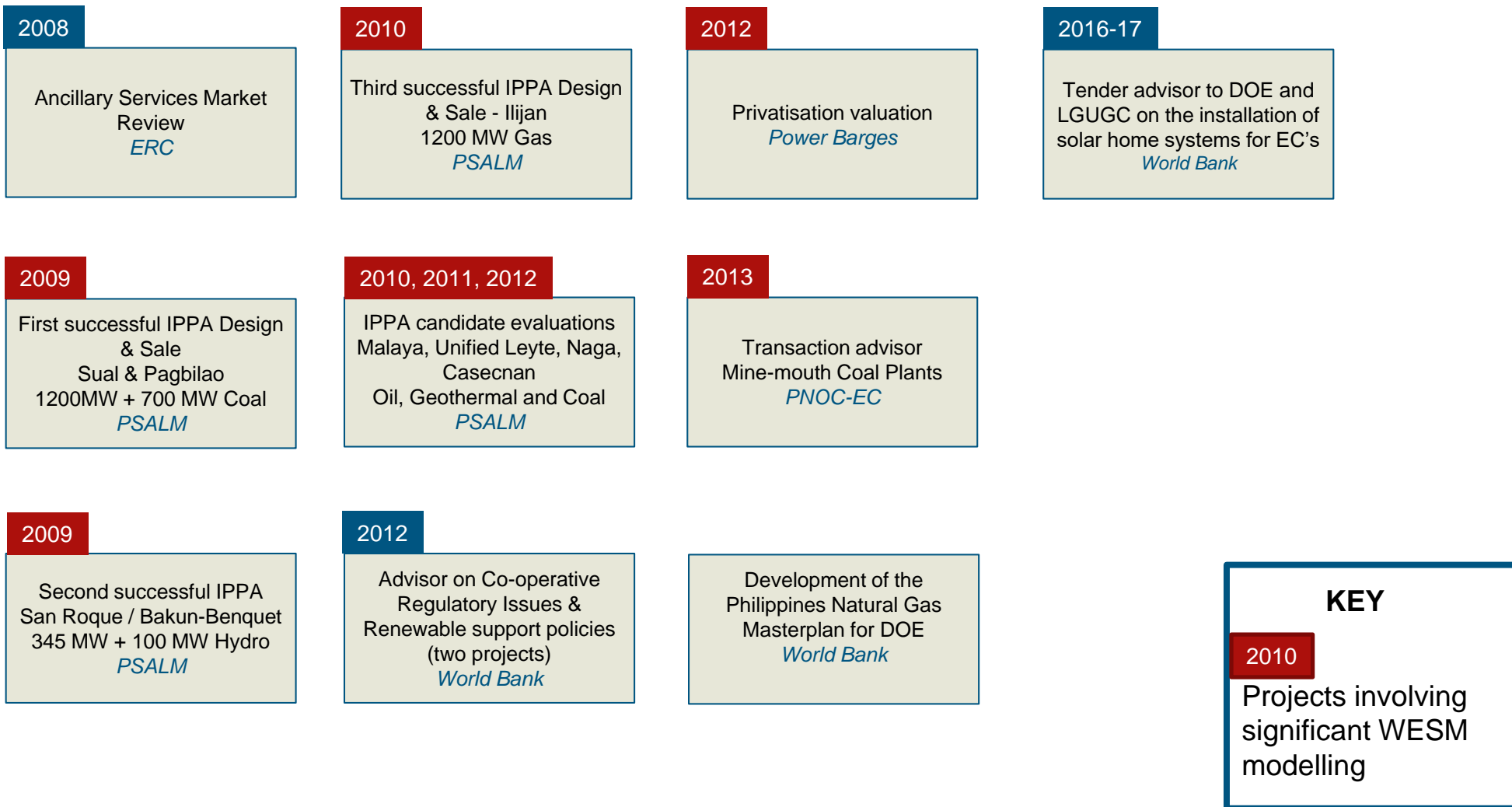
We work with clients who are shaping the future of energy

Our work in the Philippines covers the full range of commercial and regulatory challenges

Issues with New Build	Maximising value of assets	Economic Regulation
<ul style="list-style-type: none">• Difficulties obtaining financing for new greenfield coal plants and assessment of off-taker credit risk• Positioning of LNG-fired generation• Incentives for Renewable Energy projects such as the Feed-in Tariff• Delays on approving contracts and frequent refusals to allow costs to pass through create very high levels of uncertainty for new build – causing failure of bidding processes and financing problems for some players• Uncertainties over future load growth and off-taker demand	<ul style="list-style-type: none">• Impact on market participants' contracting behaviours• New opportunities and market entrants with whom to contract for the supply of power• Potential for increased credit risks• Regulatory reaction to increased threat of vertical integration• Building detailed models of plant and market operation (for example a detailed model of a hydro station for understanding Ancillary Services revenues) to assist clients make good investment and operational decisions	<ul style="list-style-type: none">• Advising ERC on Ancillary Services market design• Efficient incentives in the design of the Ancillary Services market• Minimising regulatory risk for commercial structures• Support for clients making submissions to the ERC• Analysis of ERC decisions and interpreting impacts on client risk

We help our clients make better decisions about value

We have worked with many parts of the Philippine “Energy Family”



As well as numerous projects for private sector participants

2014 Advisor on coal fired asset sale <i>Confidential Client</i>	2016 Advisor on Philippine market opportunities <i>Diamond Generating Asia</i>	2016 Advisor to IFC on sale of stake in Masinloc <i>IFC</i>	2016 Gas opportunities in the power and non-power sector <i>Confidential Client</i>	2016-17 Pumped Storage project scoping study <i>Confidential Client</i>
2014--2015 Advisor three wind power projects seeking to obtain the wind FIT <i>Confidential Clients</i>	2016 Advisor on sale of stake in GN Power <i>Sithe/Blackstone</i>	2016 Advisor to client looking to build a CCGT in Visayas <i>Confidential</i>	2016 Advice on the implications of the Competitive Selection Policy <i>Confidential Client</i>	2017 Evaluation of a distribution utility <i>Middle East Investment Sovereign Investment Fund</i>
2015-2016 Advisor on seven solar projects seeking to understand the FIT and sales to the WESM <i>Confidential Clients</i>	2016 Battery energy storage economics in the WESM <i>Confidential Client</i>	2016 Detailed WESM Review for a Japanese Financial Institution <i>Confidential Client</i>	2016-17 Tender advisor to DOE and LGUGC on the installation of solar home systems for EC's <i>World Bank</i>	2017 Future Fuel Mix Options <i>Japan Bank for International Cooperation</i>
2016 Market entry strategy for utility seeking to enter roof-top solar market <i>Confidential</i>	2016 WESM opportunities and strategy workshop <i>Confidential Client</i>	2016 Market price forecast update and WESM seminar <i>WESM Genco</i>	2016-2017 Advisor to local group looking to build small scale projects across Luzon and Visayas <i>Confidential</i>	2016-2017 Market Entry study for equipment manufacturer into Philippines <i>Confidential</i>

Discussion topics

- How the market is supposed to work
- Growth of renewables and impact on new investment
- Impact on the system
- Key issues

The EPIRA and reforms intended to create a competitive market and promote a sustainable electricity supply industry....

- The designs included:
 - A spot market designed around the “energy only” market design where plants are run in order of cheapest first, most expensive last
 - Retail Competition and Open Access (“RCOA”) which allows customers to choose who to buy their power from
 - Independent regulation
 - Privatisation of the government monopoly assets and contracts

There have been many issues since the reforms, such as:

- Regulatory framework based on old precedents - not taking into account the new market
- Long life of decisions made prior to the reforms (PPA's etc) which have meant that new efficiencies not passed through to customers
- Fuel price fluctuations – which can dwarf efficiency improvements in terms of price impacts
- New build decisions made based on dubious foundations (such as related company transactions, not taking into account the total system costs etc).

...

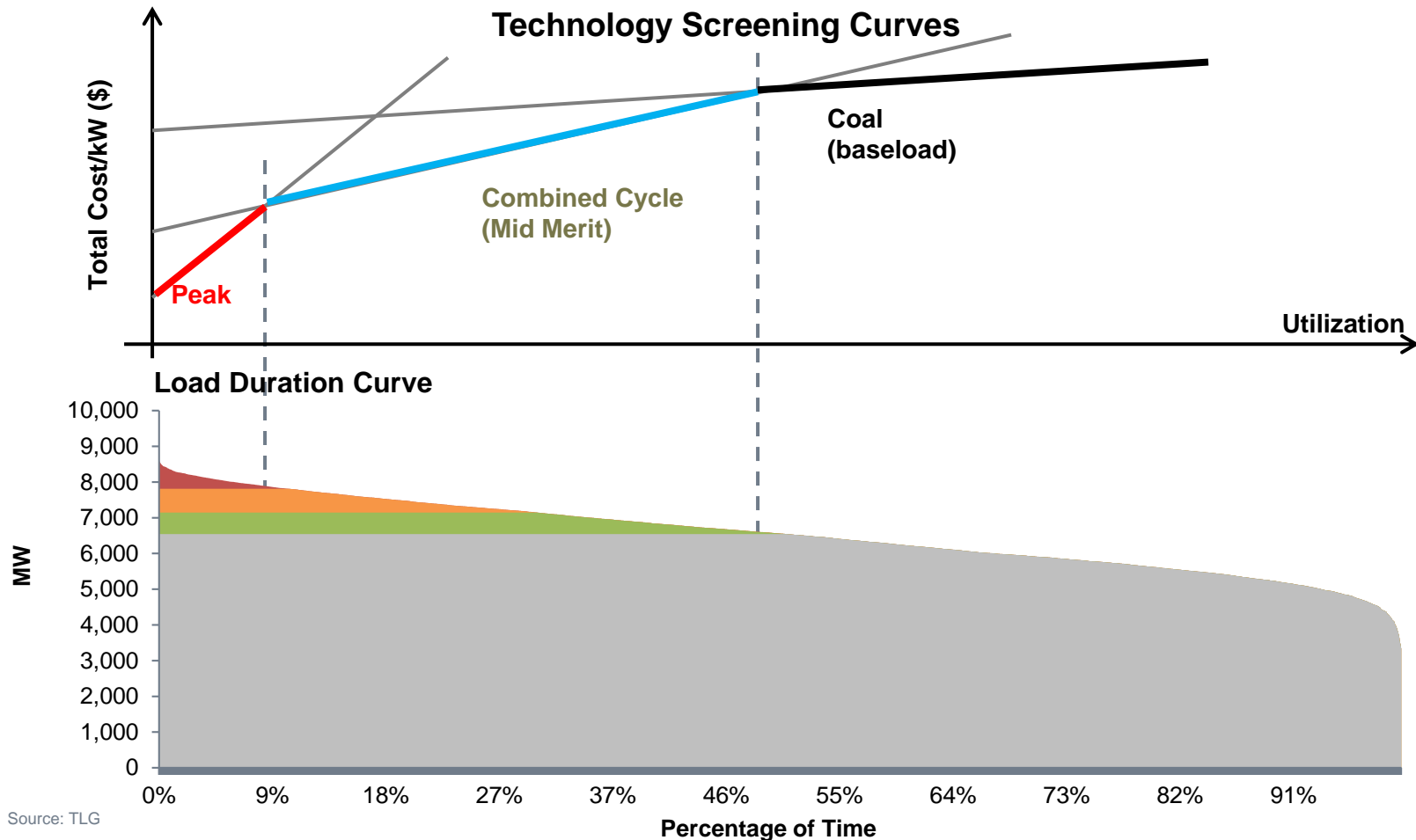
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- All of which are technically outside the scope of today's discussion – which is just about the impact of renewables on the market – but which all impact on how we find solutions.

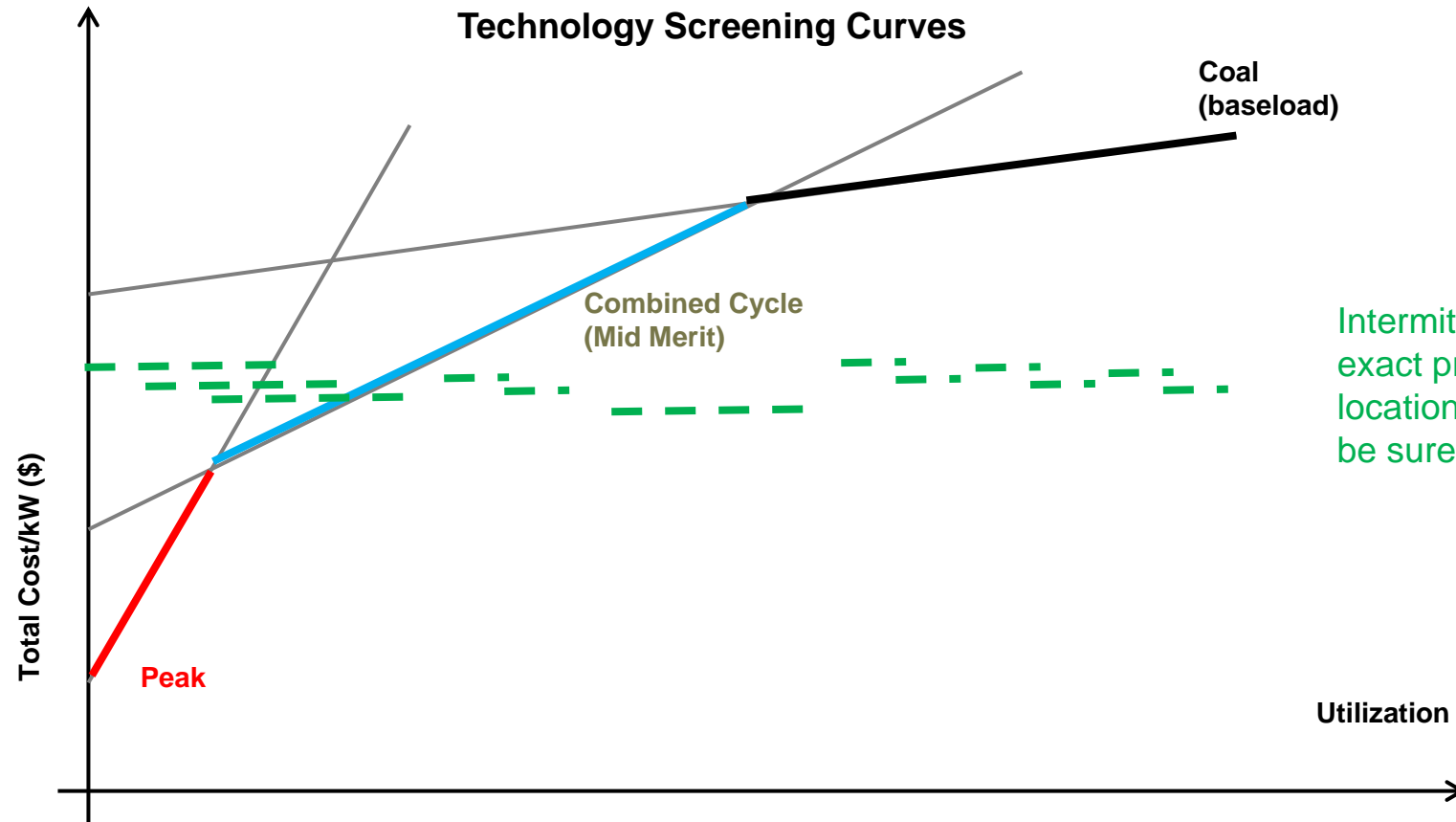
So let's take a more detailed look at the market

Traditionally, an “energy only” spot market works because different types of plant have different mixes of fixed and variable cost



This is the ideal – and the Philippines never met the ideal because gas was run baseload rather than mid-merit as economics would suggest

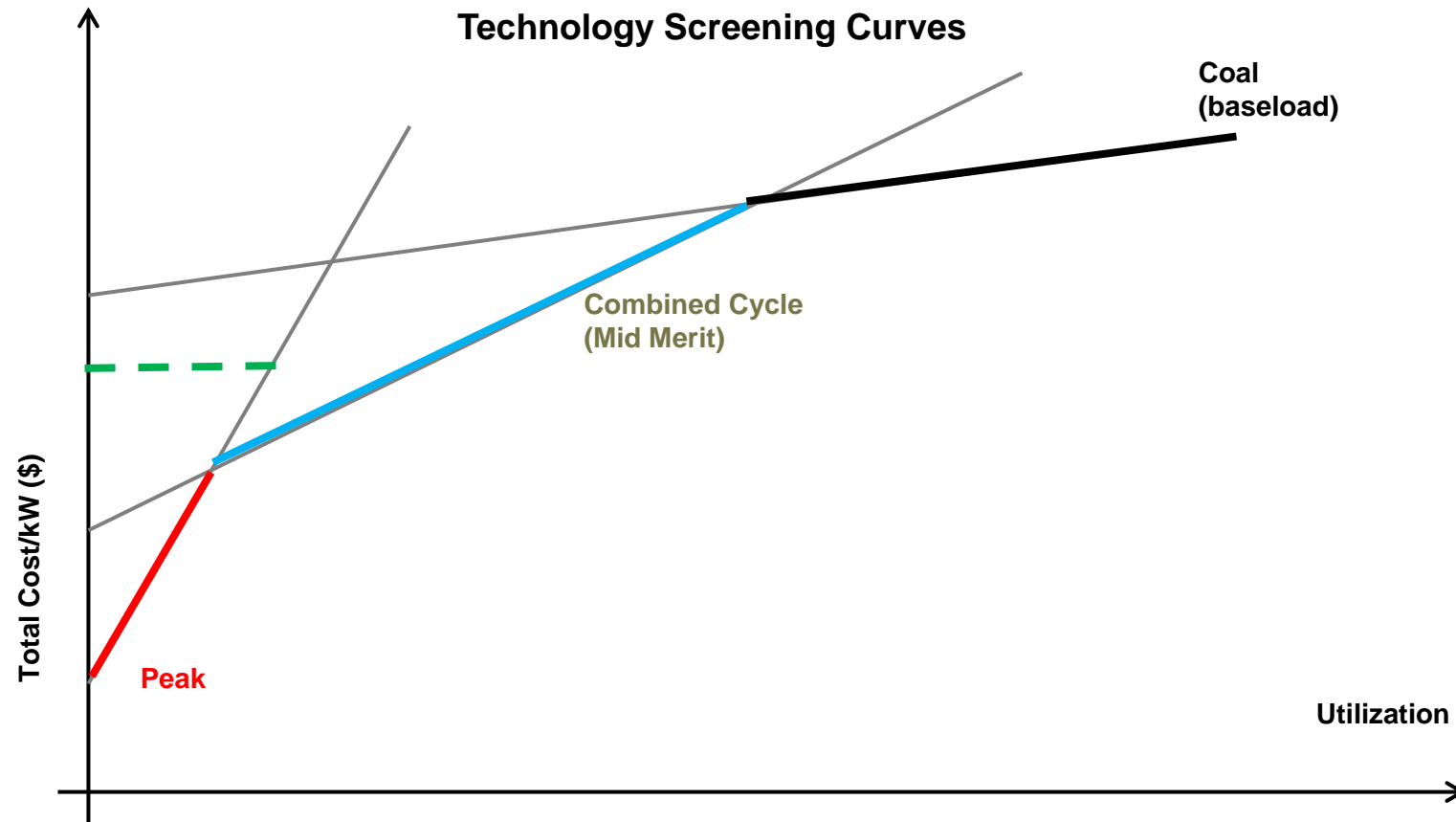
But solar and wind (and run-of-river hydro) do not fit this story either



Intermittent renewables – exact price depends on location and you can never be sure when they will run

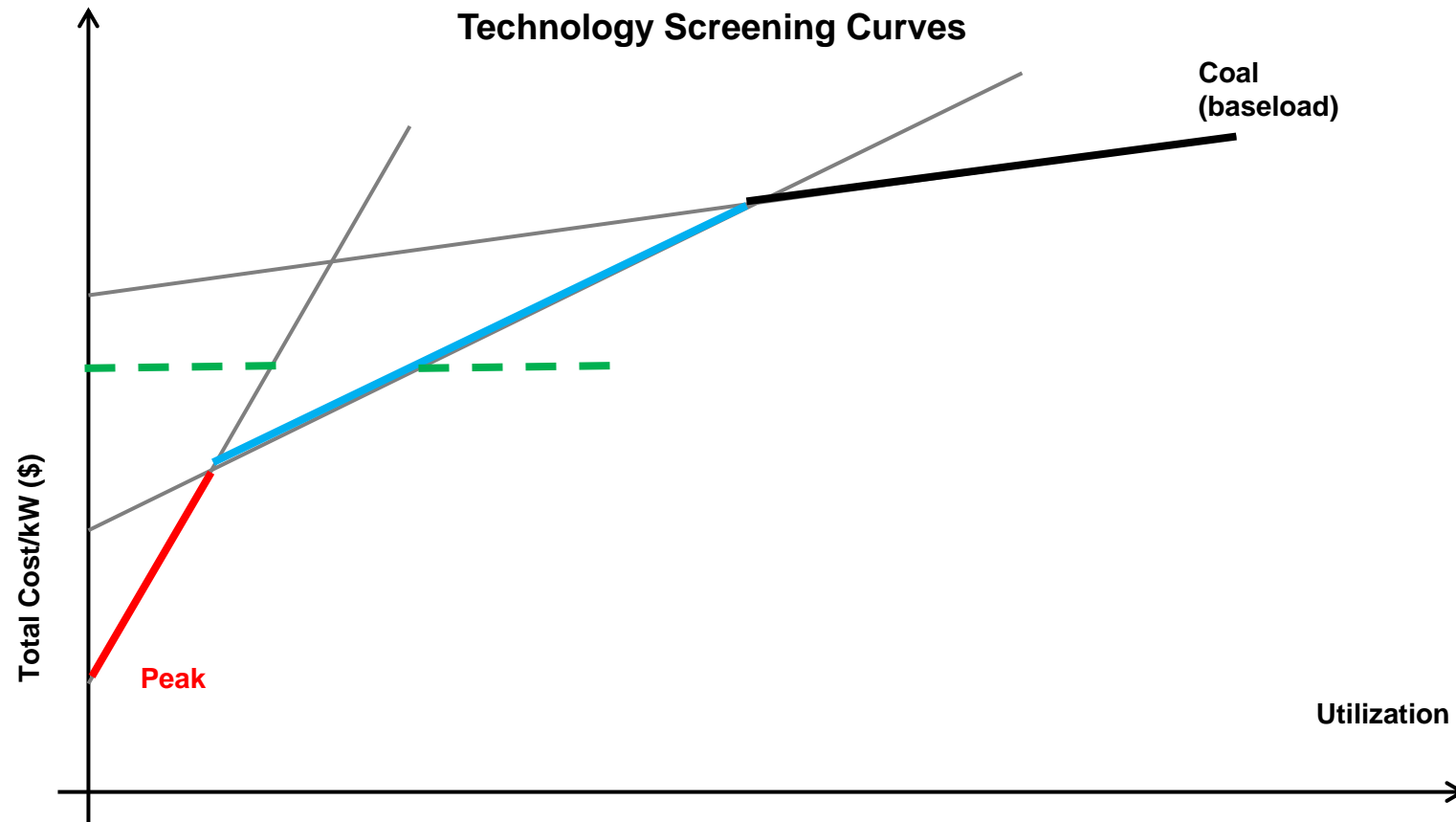
Most renewables are all fixed cost – the “fixed vs variable” trade-offs no longer hold, and the fact that intermittent renewables are not dispatchable makes the problem worse

Solar in Luzon has reasonably good alignment with the peak....



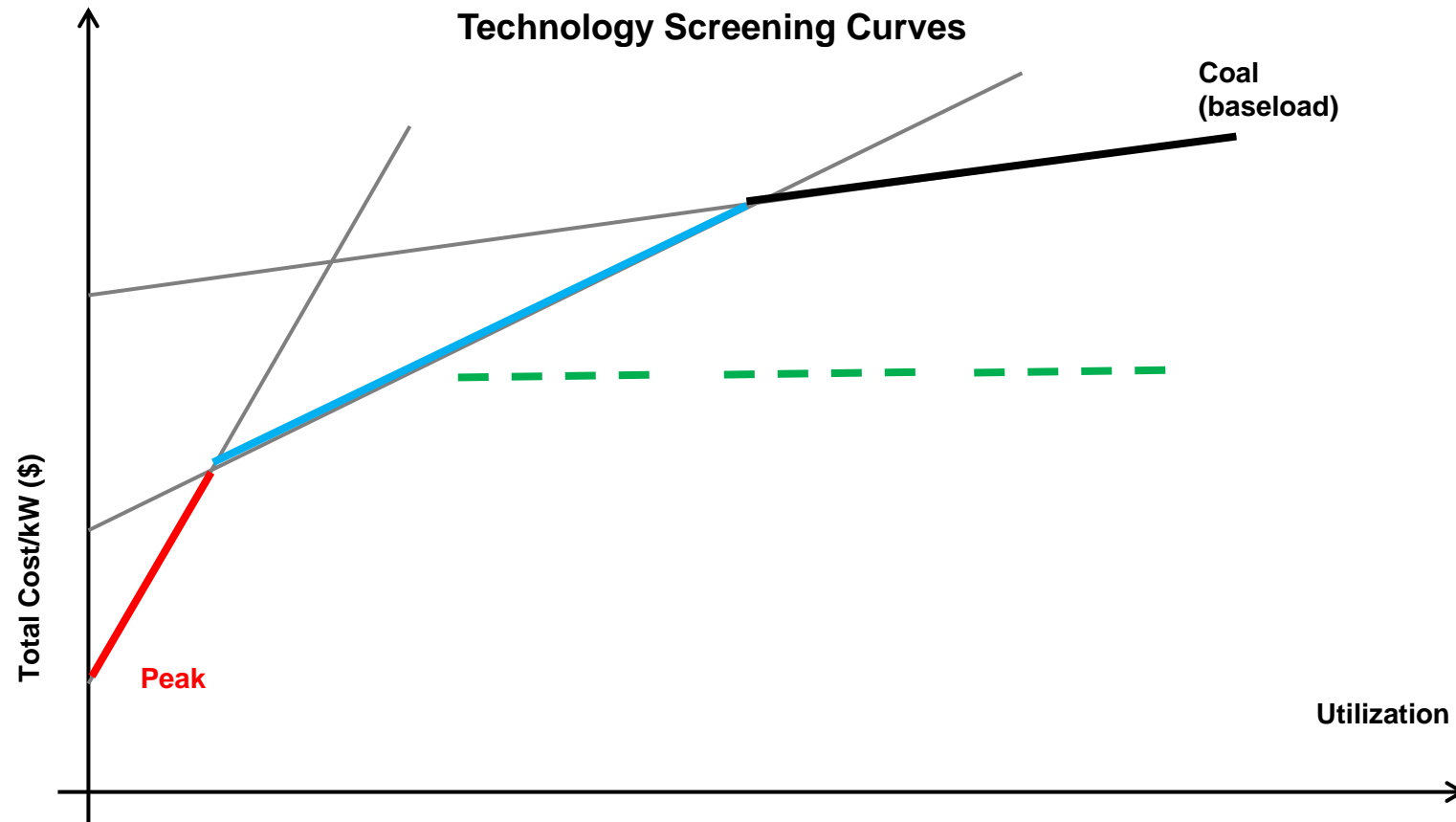
...as long as a cloud does not come past

But solar in Visayas not so much...



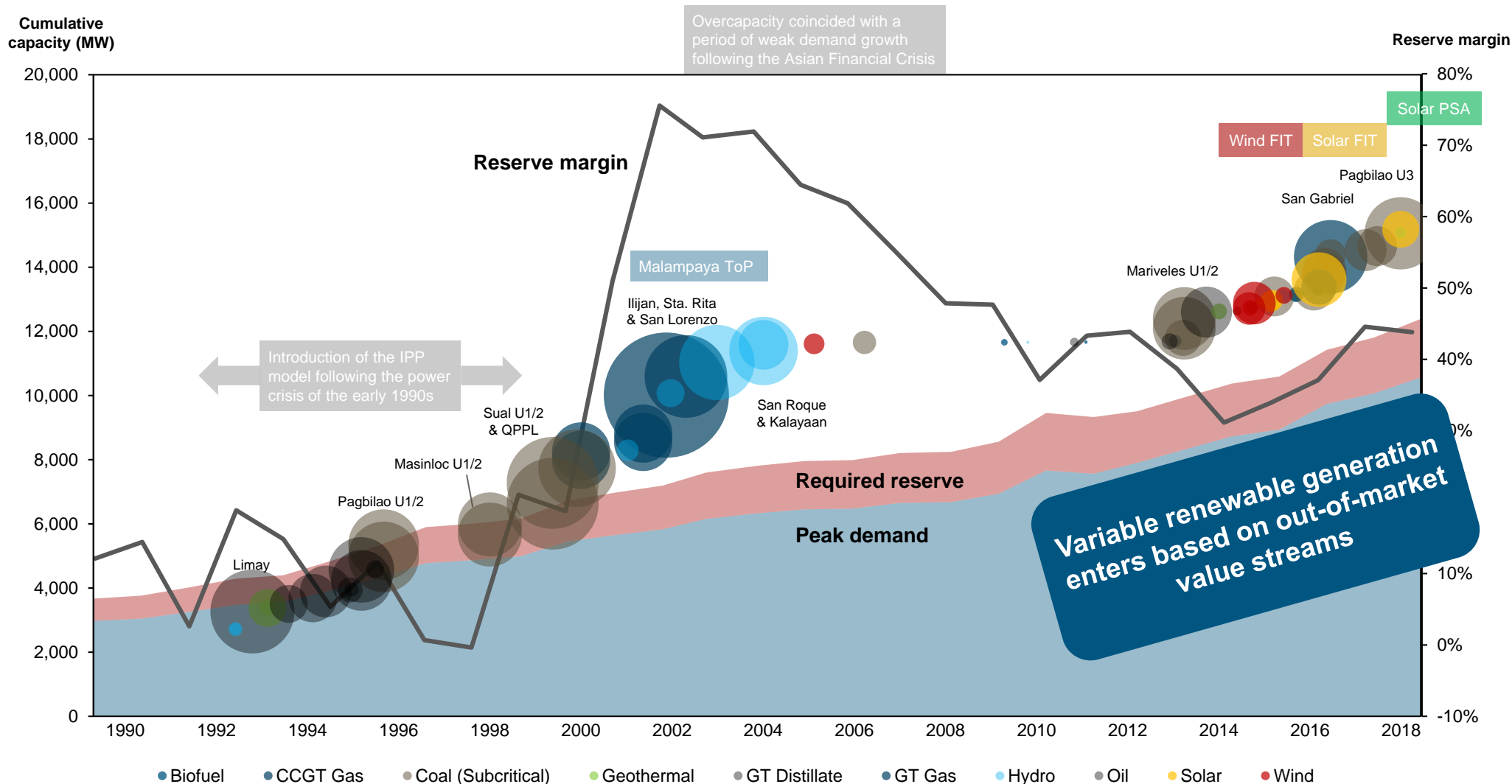
... because Visayas has a more pronounced evening peak

And wind is much less correlated with the peak...



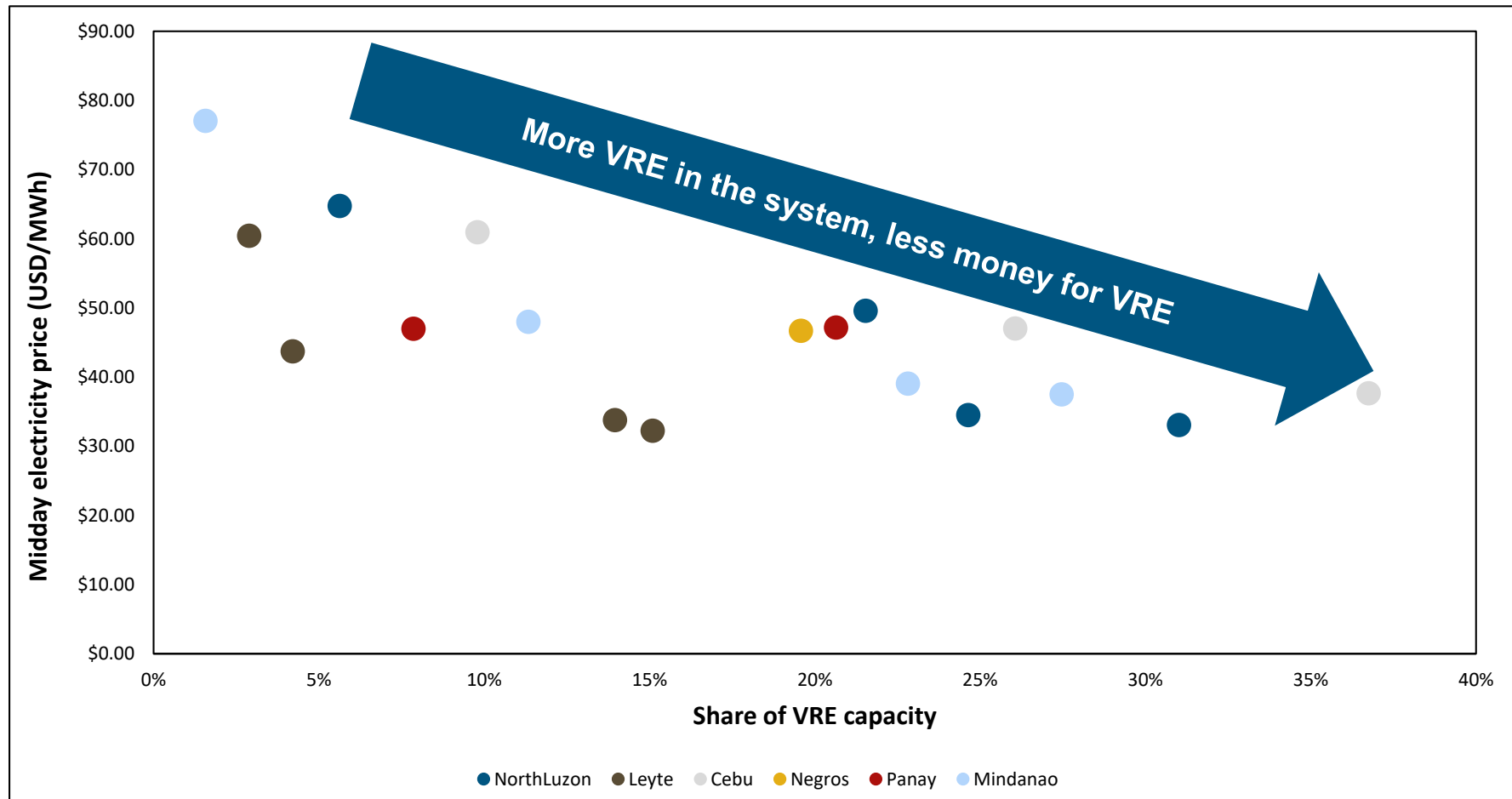
...tends to blow more in winter (lower demand) and when hydro is more available

Until now, this has not affected renewables as most addition of wind and solar capacity was driven by the out-of-market payments



Note: Bubble equates to one genset and size of bubble corresponds to its size (MW dependable)
Source: TLG analysis

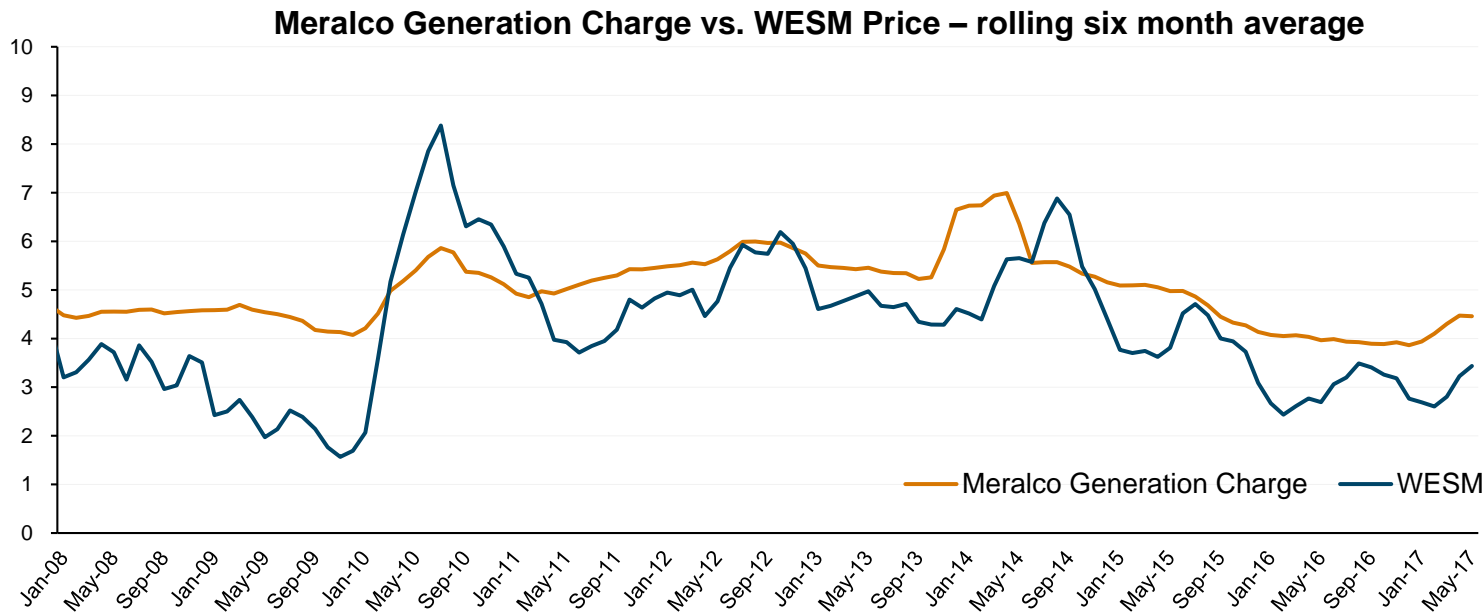
But it has impacted the market – and will impact future investments in renewables



The impact has been to push down WESM prices, while half the solar and all the wind does not see the impact of this because of the FIT – but the other half of solar, and new projects, do

And just as an aside, consumers are not necessarily benefitting

- Only about 10% of the WESM costs is passed through to consumers, most of the generation charge is made up of legacy contracts
- Plus they have to pay the FIT_ALL charge!

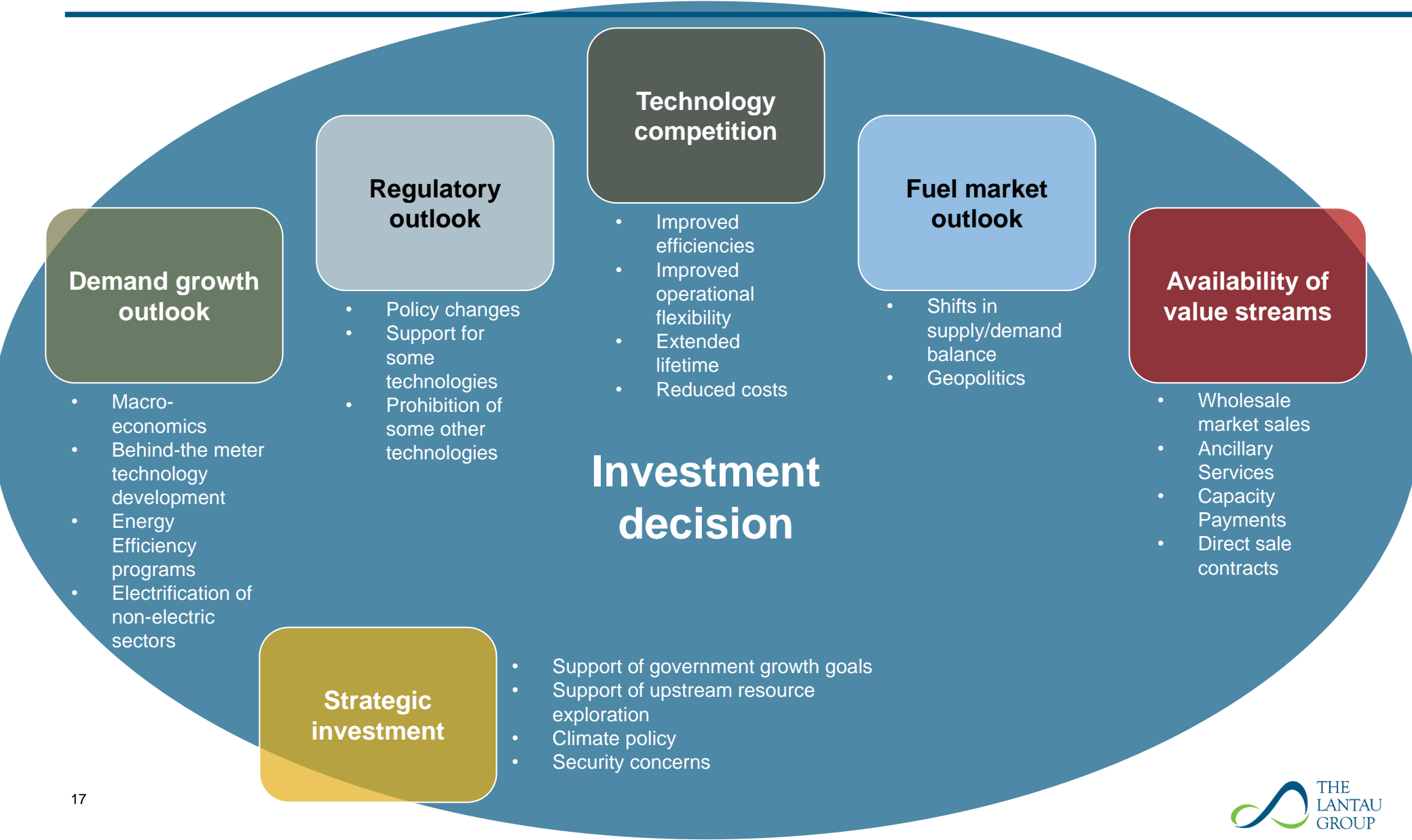


WESM prices have averaged ~ 15% lower since the beginning of the market, mainly due to fuel price changes

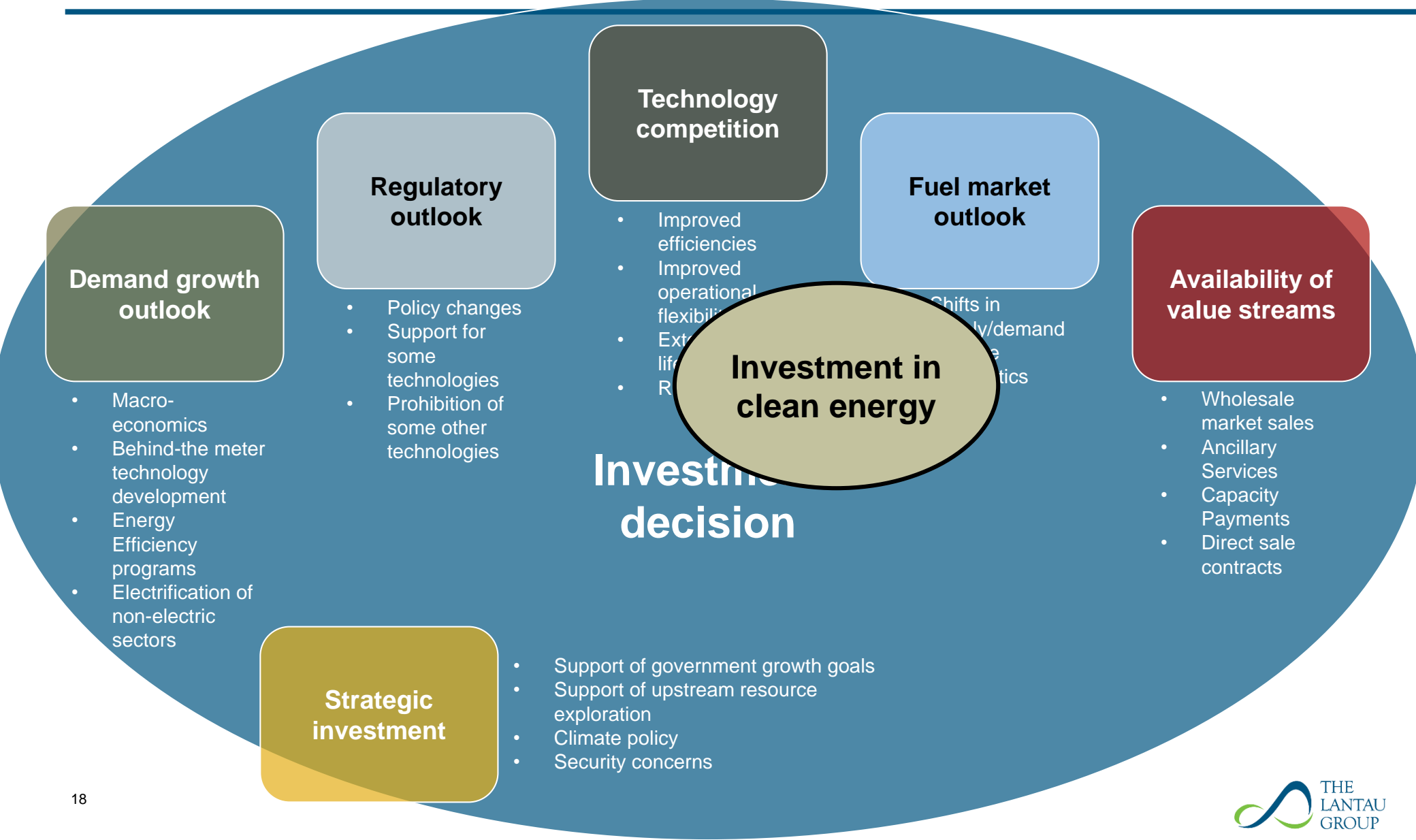
The renewable energy law changed the way investment decisions were made

**Investment
decision**

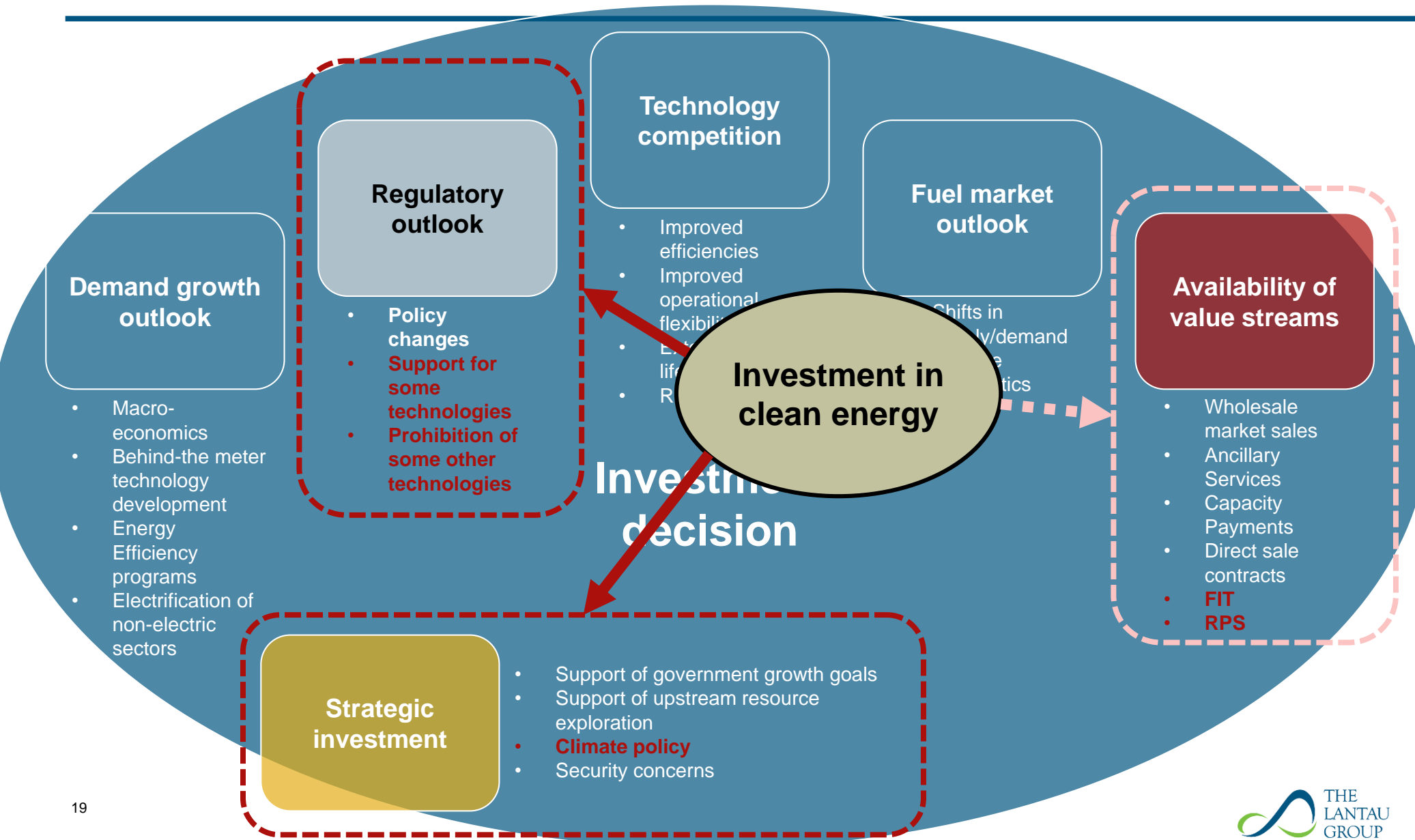
Traditionally, there were many factors that need to be considered










But when it comes to the clean energy investment...



... availability of special revenue streams reduces the importance of some factors and focuses on others



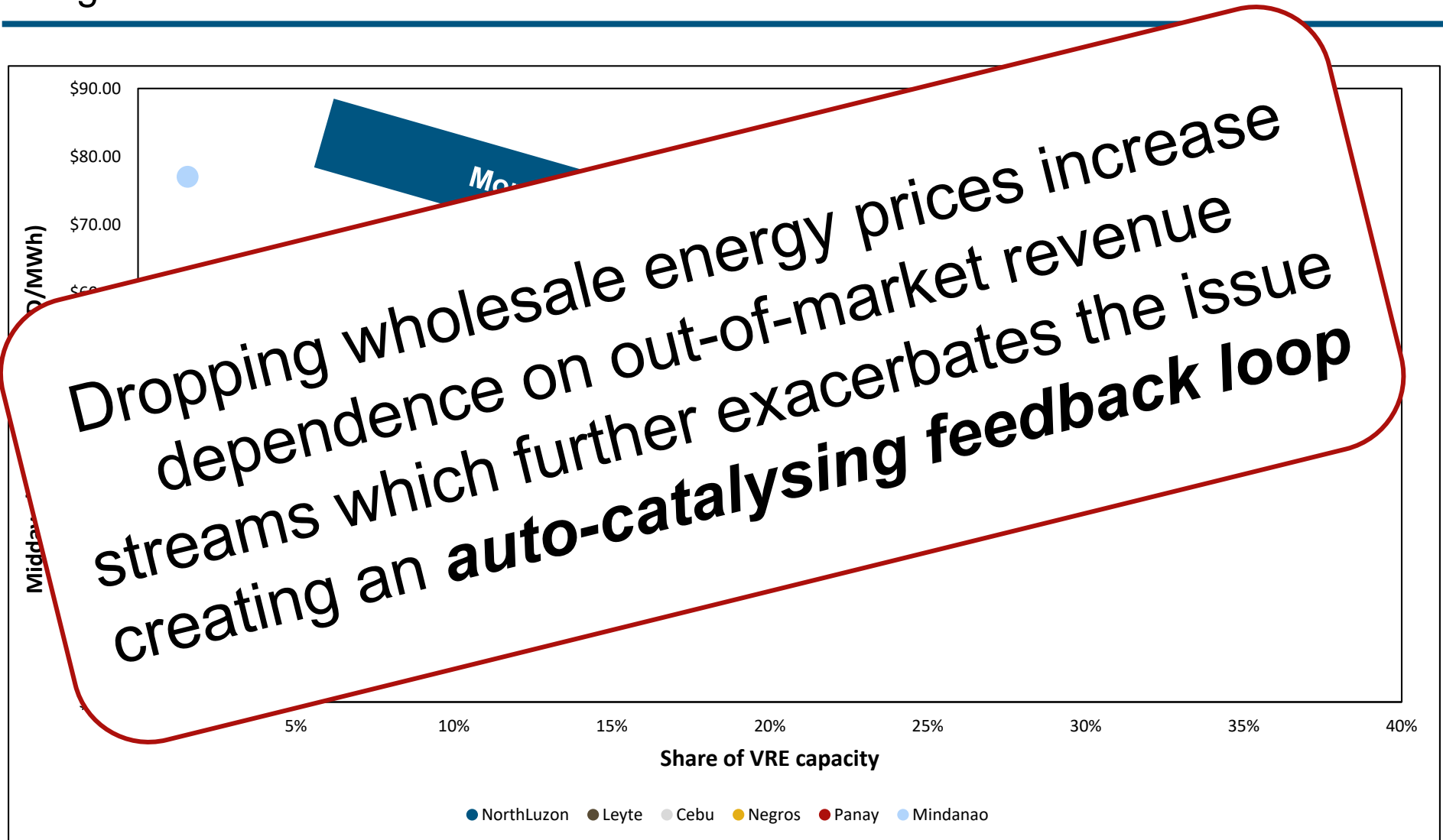
After expiry of FiT programs securing out-of-market PSA with the offtakers is crucial for clean energy projects to get off the ground

Original Suppliers		Powersource First Bulacan Solar Inc. (PFBS)		Pilipinas Newton Energy	Island Wind Energy Corp.
Result of Negotiations	50 MW 5.39 PhP/kWh	50 MW 5.39 PhP/kWh	75 MW – 85 MW 3.50 PhP/kWh	50 MW 2.9887 PhP/kWh	150 MW 3.5 PhP/kWh
Counterparty (off-taker)	 MERALCO	 MERALCO	 MERALCO	 MERALCO	 MERALCO
Qualified Price Challenges	None	Soleq Solar Co. 4.69 PhP/kWh	Solar Philippines 2.9999 PhP/kWh	TBD	TBD
Option to Match	N/A	Matched by PFBS	Not Matched	TBD	TBD
Current Status of CSP	PSA signed Regulatory Approval Pending ERC Case No. 2017-014-RC Price: 5.39 PhP / kWh* Term: 20 Years	PSA signed Regulatory Approval Pending ERC Case No. 2017-012-RC Price: 4.69 PhP / kWh* Term: 20 Years	PSA signed Regulatory Approval Pending ERC Case No. 2017-094-RC Price: 2.9999 PhP/kWh Term: 20 Years	PSA TBC Undergoing price challenge Yet to be submitted to ERC Price: 2.9887 (TBD) Term: TBA	PSA TBC Undergoing price challenge Yet to be submitted to ERC Price: 3.5 (TBD) Term: TBA

Solar PV Projects

Wind Project

Unfortunately, increasing penetration of clean energy dampens the prices for the generators



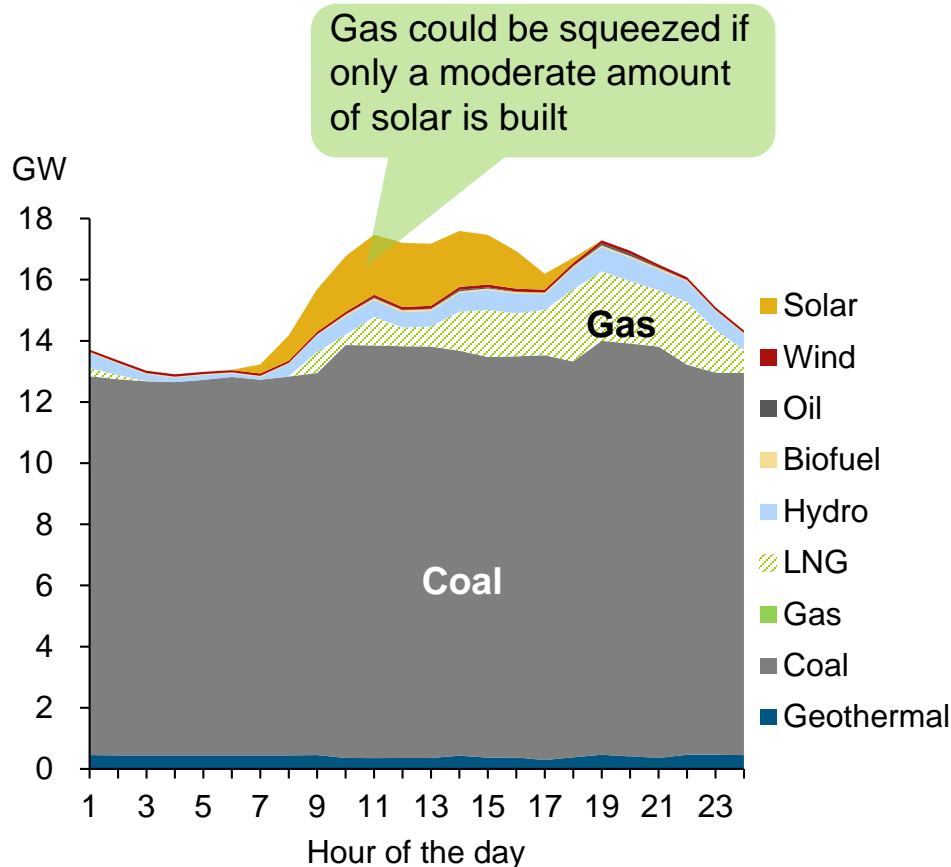
And it's also a problem for other kinds of investment – like the gas or battery options needed to keep the grid stable

- Adding intermittent generation to the grid means that flexible generation is needed to provide electricity at times when the renewable plant is not available
- The WESM is the market where this plant is dispatch for intervals greater than an hour; the ancillary services “market” is where sub-hour dispatch takes place
- There are two ways to incentivise this plant:
 - High WESM prices during periods of time when plant are needed
 - Higher Ancillary service prices to encourage more plant to be flexible and provide ancillary services
- Both are lacking:
 - WESM prices depressed (on average) by renewable entry
 - WESM price caps prevent individual hours being high enough to incentivise entry
 - Ancillary services market not started – ancillary services currently contracted by NGCP

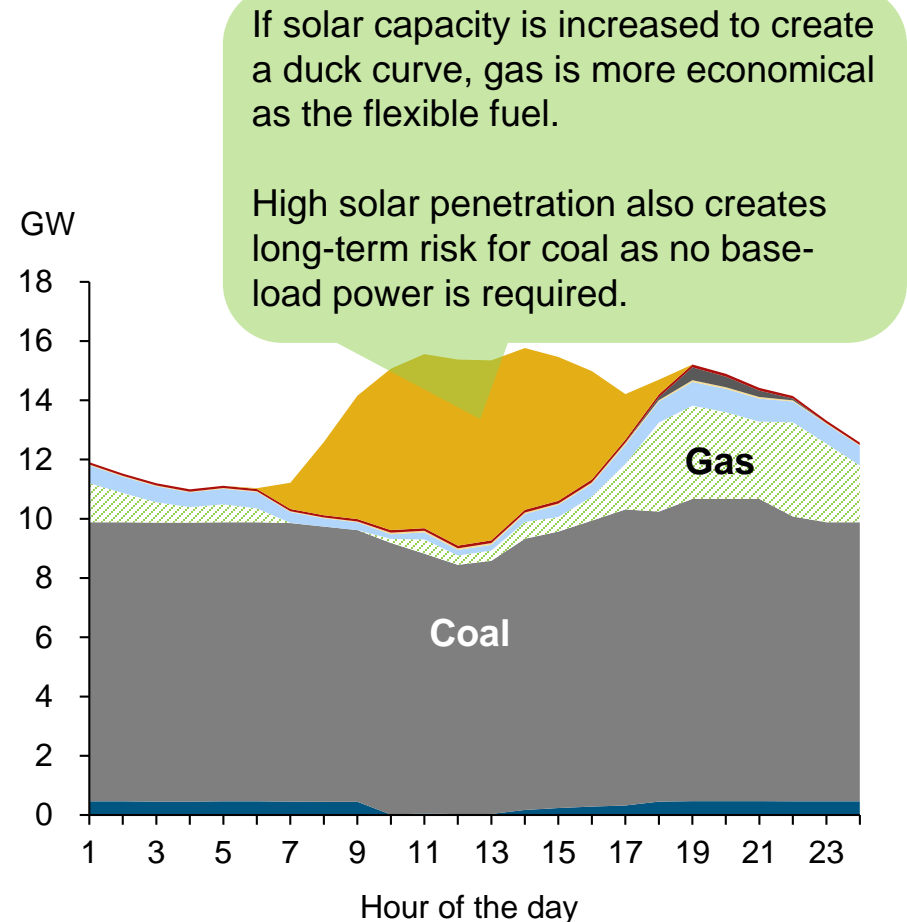
What will provide the flexibility if the WESM prices are so depressed that gas or batteries cannot enter?

Example: Gas can be compatible with solar, especially under the possible scenario that solar expansion is aggressive in the very long term

Reference Case in Luzon (2040)



Aggressive Solar Entry Case in Luzon (2040)

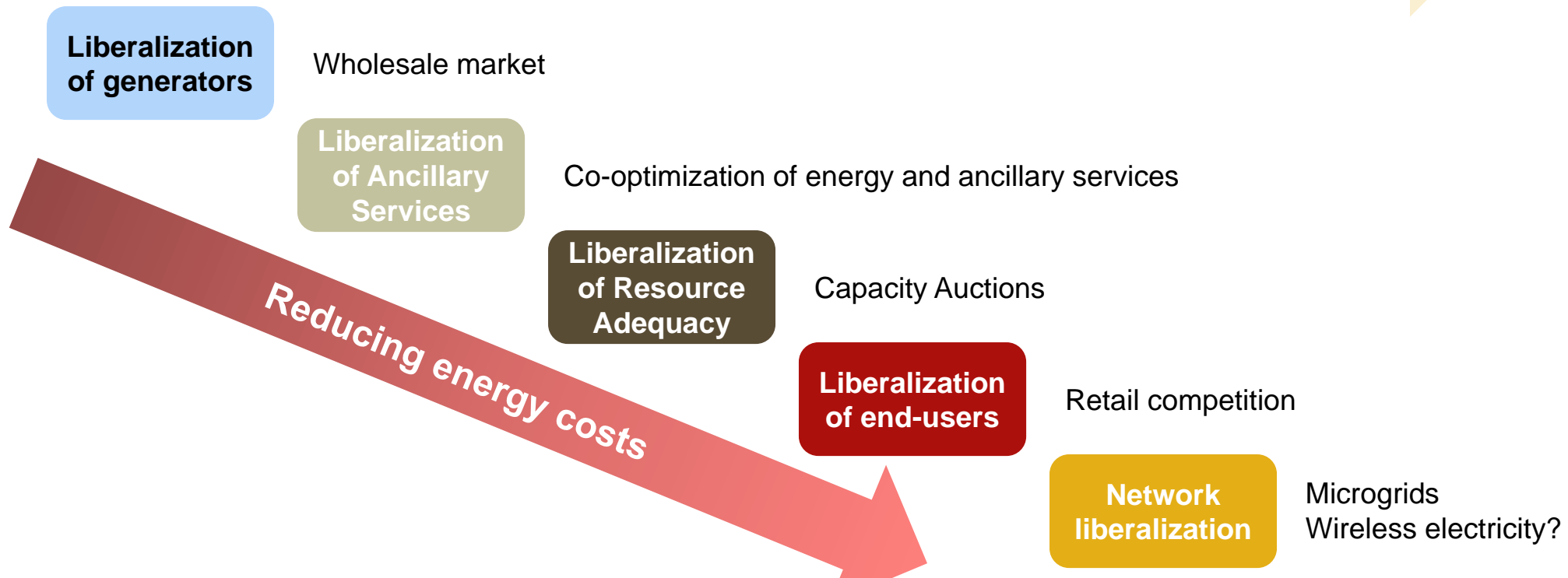


There is no going backwards
(but which way is forward?)



We deregulated the markets in hope of lowered costs and more efficient investment

Market liberalization thrust



Liberalized (deregulated) markets promise competition, efficient investment signals and ultimately lowered costs, but they are blind to externalities and in need of submarkets

But markets are blind to externalities and ended up being subject to out-of-market interventions

Market liberalization thrust

Liberalization

- **Fuel mix policies**
- **Feed-in tariffs**
- **Capacity payments**
- **Renewable energy targets**
- **Premature asset retirement**
- **Special arrangements for some assets to enter the market (national interest based)**

Liberalized (deregulated) markets promise competition, efficient investment signals and ultimately lowered costs, but they are blind to externalities and in need of submarkets

Robust design, incorporation of externalities and assurance of certainty is possible and needed to monetize on the promise of market deregulation

Market liberalization thrust

Liberalization

Earning revenue out-of-market distorts the deregulation efforts and leads to long term inefficiencies and reversal to the regulated market.

- sets to enter the market (national interest based)
- rents

Liberalized (deregulated) markets promise competition, efficient investment signals and ultimately lowered costs, but they are blind to externalities and in need of submarkets

These value stream do not need to come from out-of-the-market – there are sufficient market mechanisms but they need to be allowed to work

VALUE STREAM	ELIGIBILITY	VALUE
Energy sales	Every generator producing energy when there is demand for it	Market or cost based
Ancillary services	Generators having specific technical capabilities, e.g. ramp-rate or ability to sustain firm output for specified period of time	Market or cost based
Special payments	Externality payments, e.g. capacity payment, green energy payment	Market or cost based
Direct Sale Agreements	Power Purchase Agreements, Power Supply Agreements, etc	Market or cost based

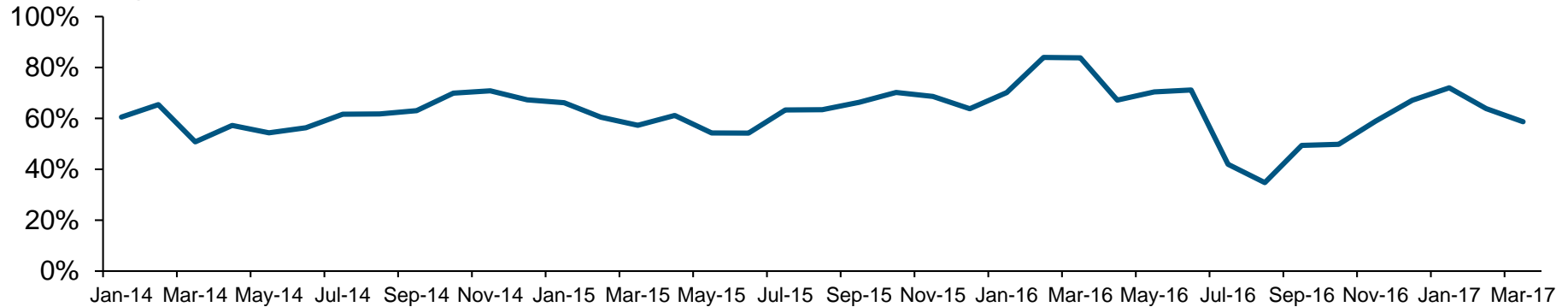
These value stream do not need to come from out-of-the-market – there are sufficient market mechanisms but they need to be allowed to work

VALUE STREAM	ELIGIBILITY	VALUE
E	Energy market needs to be allowed to work – without excessively low caps as currently seen	
A	Ancillary services market needs to be formally started, with greater focus on how to define the level of AS needed with increased penetration of intermittency or time	
S	Special payments need to work with the market mechanisms not against them – RPS is better than FIT in this regard	
D A	Ongoing education needed so the DU's and retailers understand the implications of renewables and the need to procure a balanced mix of plant	

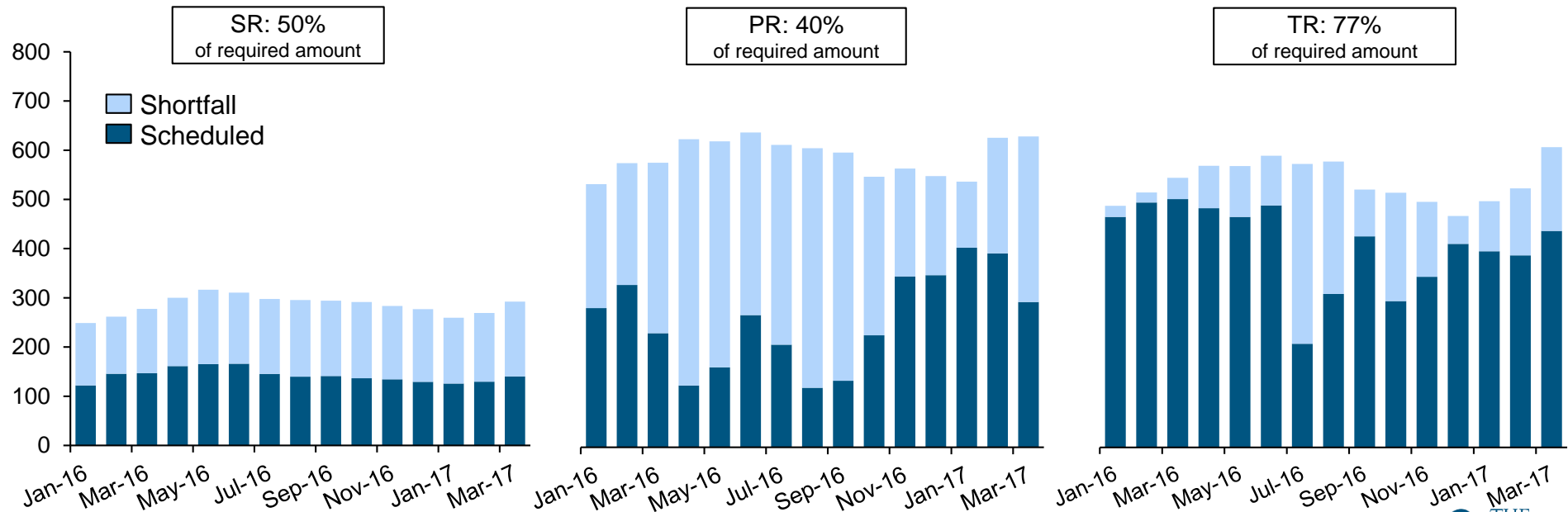
Let's take a look at the Ancillary Services issues, for example

NGCP requirements for AS reserves are not being met at present, and whilst data is not published for Visayas, the situation is arguably more acute

Percentage of AS scheduled vs. required amounts of AS (2014 - Q1 2017)

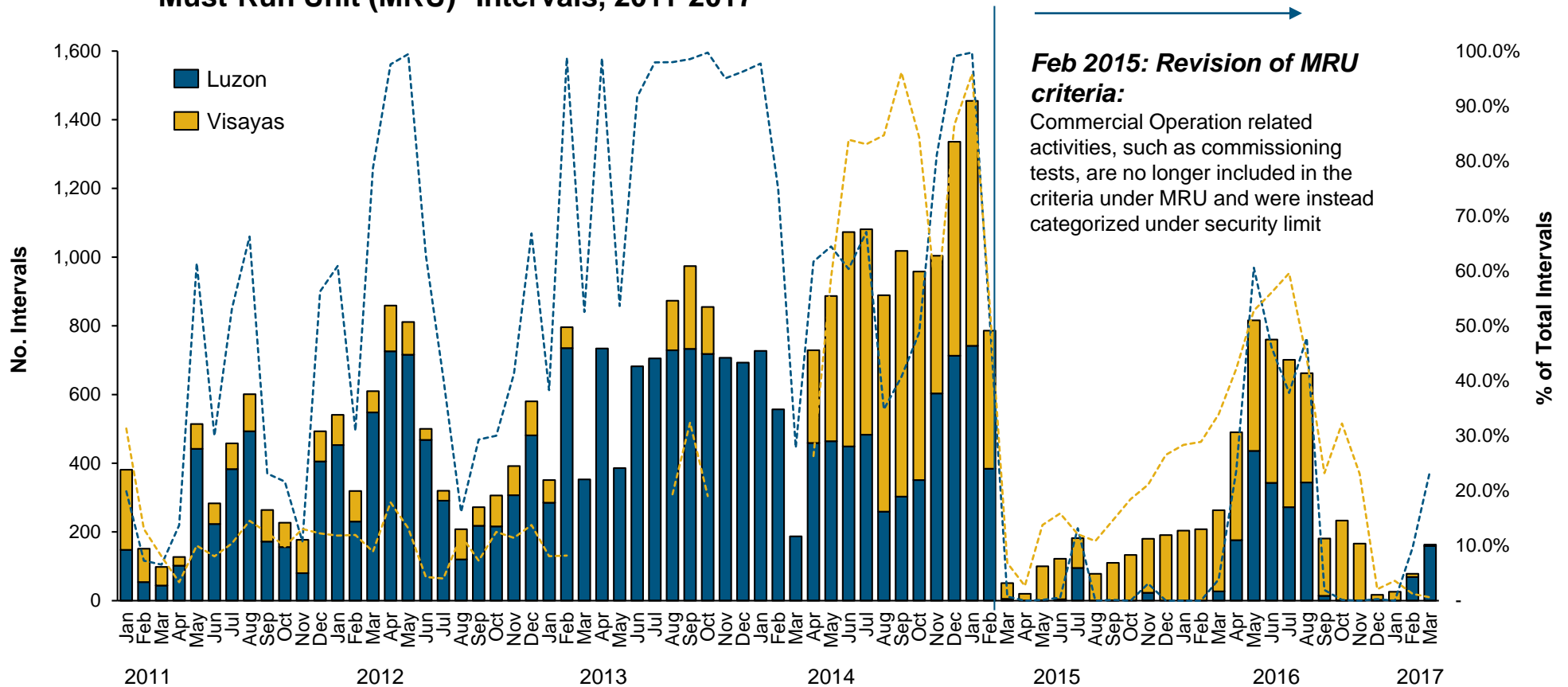


Scheduled and required AS in Luzon (2016 – Q1 2017)



Must Run Units are used as a last resort by NGCP to maintain system security, again signalling a lack of available AS (and an inefficient market)

Must-Run Unit (MRU)* Intervals, 2011-2017

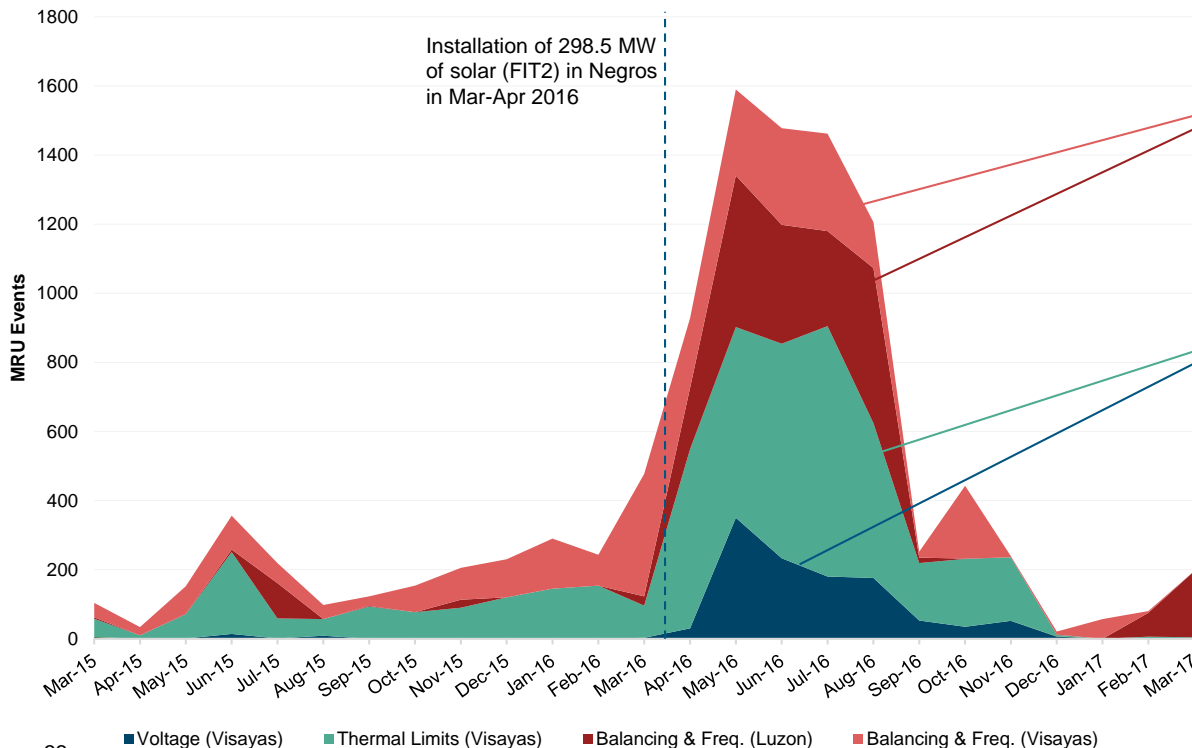


Note: *Must-Run Units (MRUs) are generating units required by the System Operator to be on-line on a particular trading interval to help cover system security requirements, regulatory and commercial operational requirements, and support the system during local emergencies and calamities. Data is only available for Luzon and Visayas. MRUs are settled in the WESM, and the compensation of MRUs is based on a generation price index (GPI) which is computed for each trading interval of the billing month (i.e., there are 24 GPI for each billing month).
Source: PEMC (Monthly Summary Report)

MRU events occur relatively more frequently in Visayas, due to a less robust transmission grid and from having to manage the effect of intermittent solar

- Since the recategorisation of MRUs in February 2015, Visayas has accounted for an increased number of MRU events, again signalling that insufficient ancillary service reserves are available.
- MRU events typically occur when all available AS is exhausted, with units compensated based on a Generation Price Index that is a function of the prior month's WESM prices. This therefore signals an inefficient market and will likely provide impetus for NGCP to contract more ASPAs.

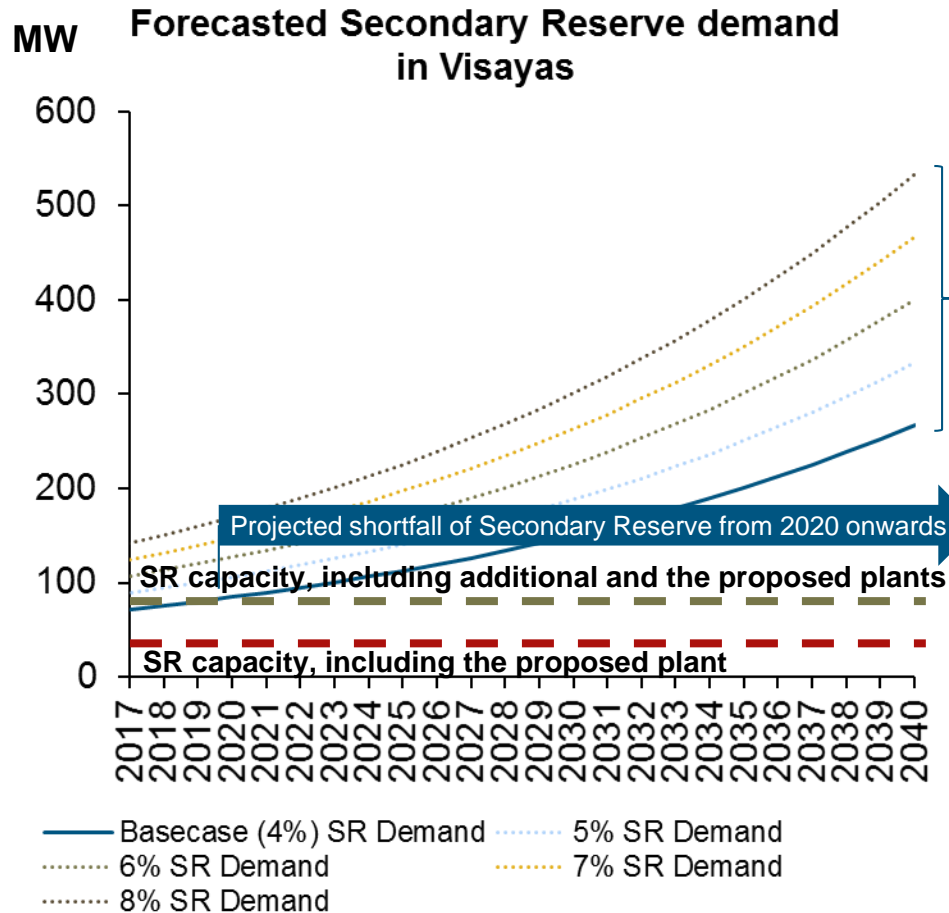
Must-Run Unit Events by Category (Luzon and Visayas)



Since the introduction of large amounts of intermittent solar under the FIT2, there has been a significant uptick in MRU units running for real-time power balancing and frequency control, highlighting insufficient secondary reserves

Visayas is a far less robust grid, evidenced by MRU events to maintain system voltage and ensure the transmission system is operating within its thermal limits, that almost exclusively occur in Visayas. This may also signal the need for NGCP to procure Reactive Power AS within the region.

Our modelling suggests this will get worse, with a looming shortfall of Secondary Reserve capacity in Visayas linked to the installation of renewables

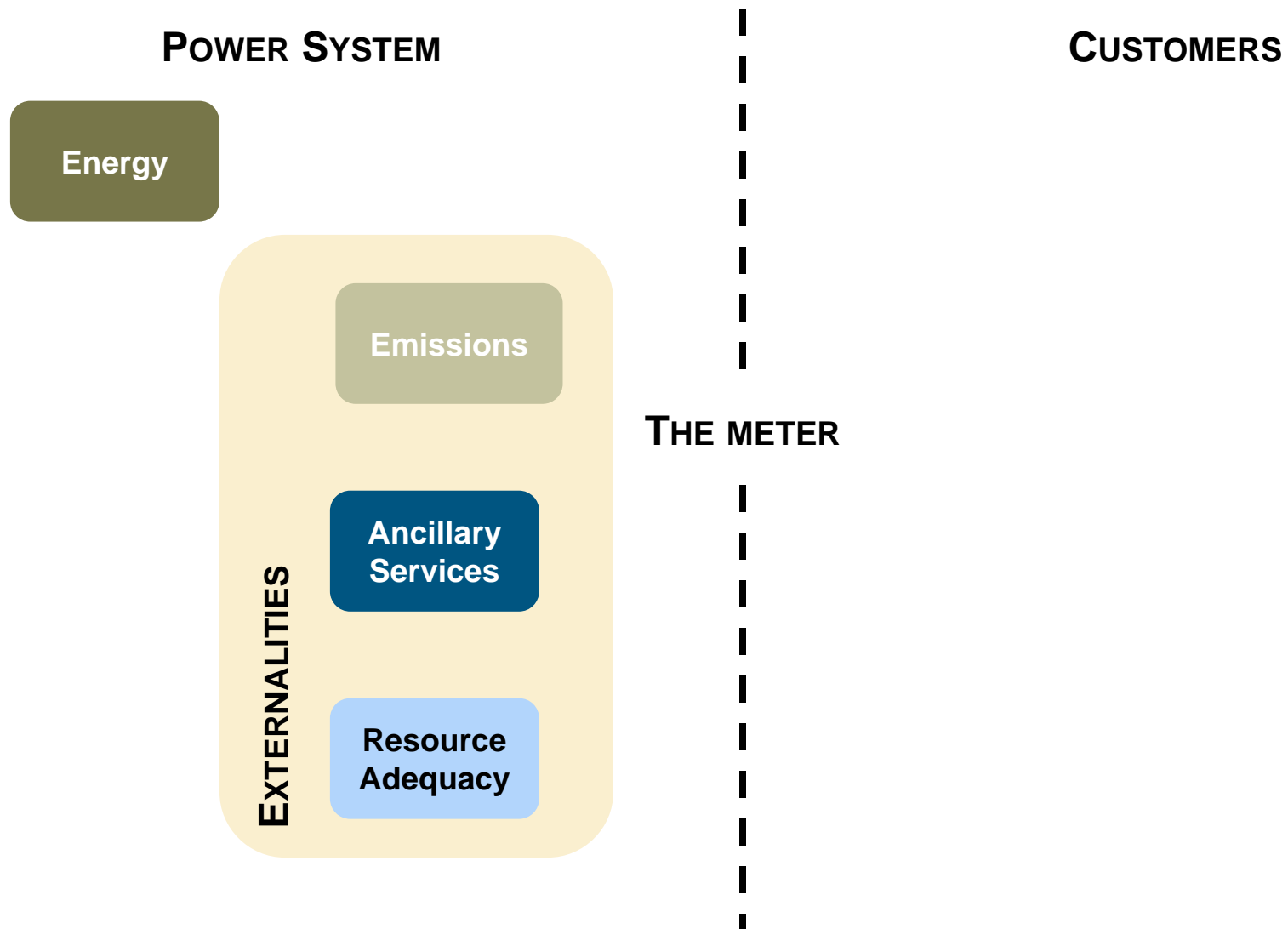


- The Ancillary Services Procurement Plan has a requirement of 4% of demand for the Secondary Reserve
- However this does not account for intermittency and we believe the methodology needs to change to incorporate this
- Demand for secondary reserves is larger than for primary reserves - indicating that variable generation sources and demand volatility are likely to put increasing strain on the grid, and drive requirements for SR higher

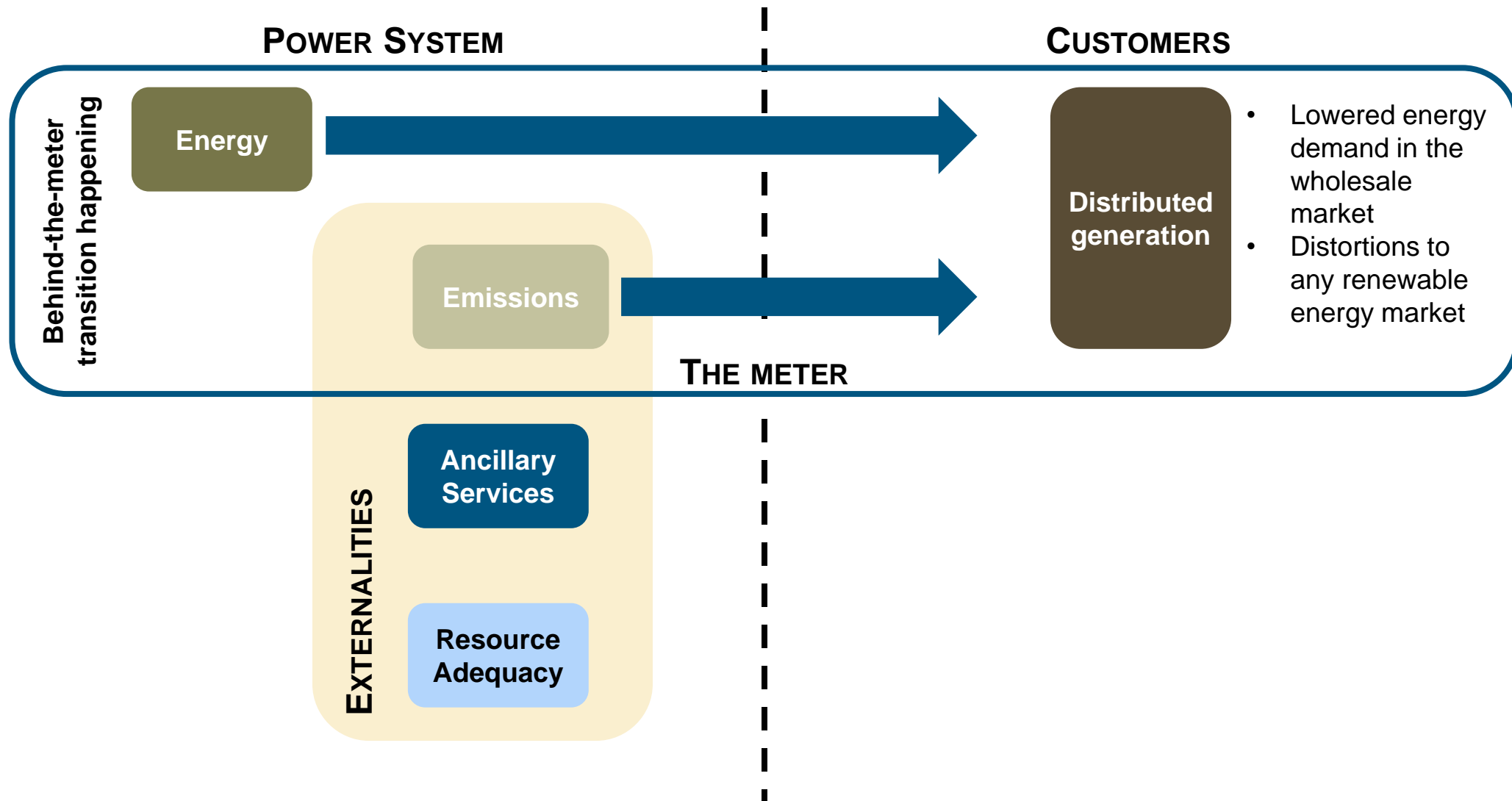
What about the roof-top solar?

Impact of the behind-the-meter developments

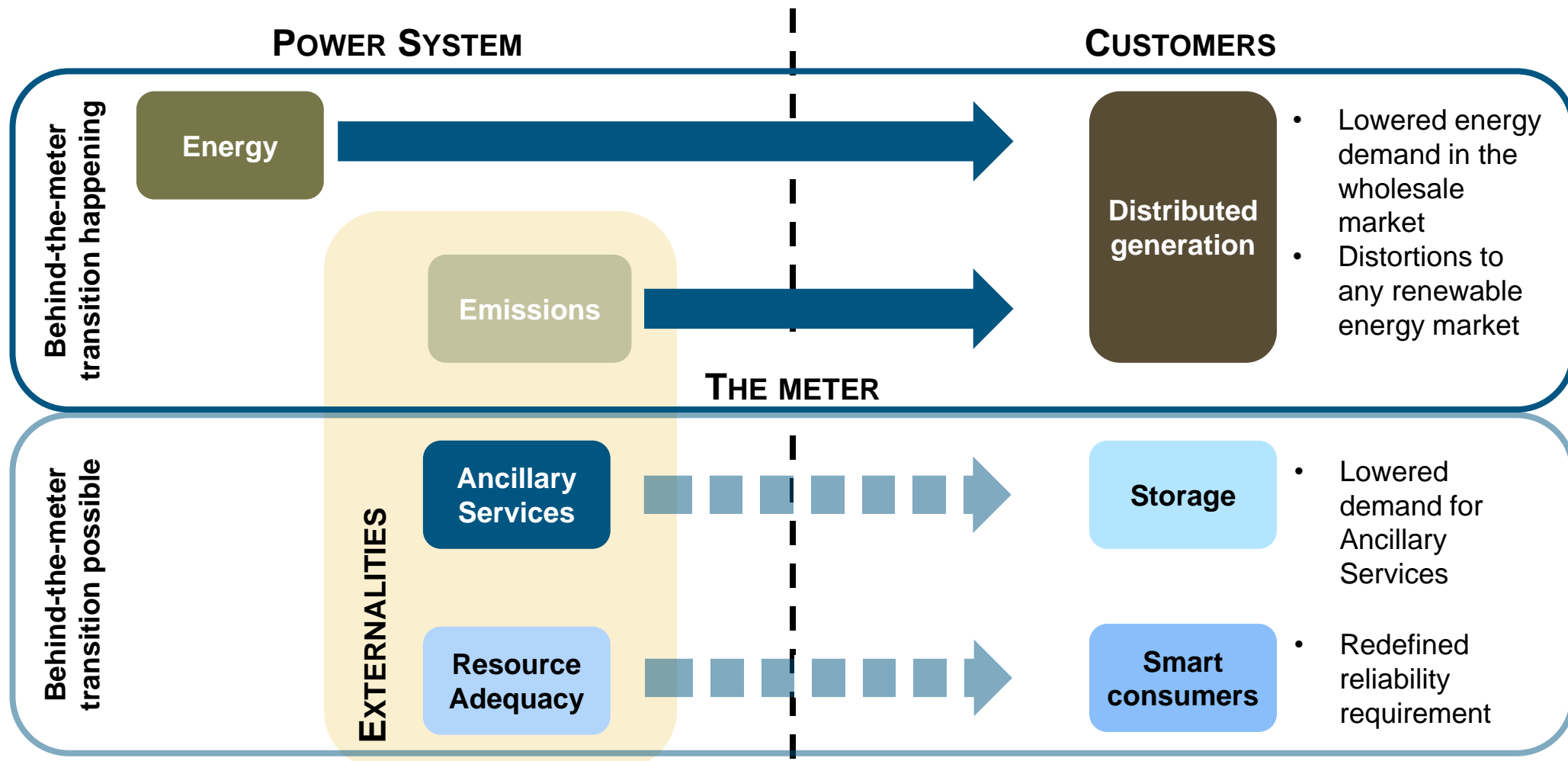
Roof-top solar is called “behind-the-meter”



Rooftop solar dampens the demand for energy at times when clean energy generators produce the most - exacerbating the impact on WESM prices



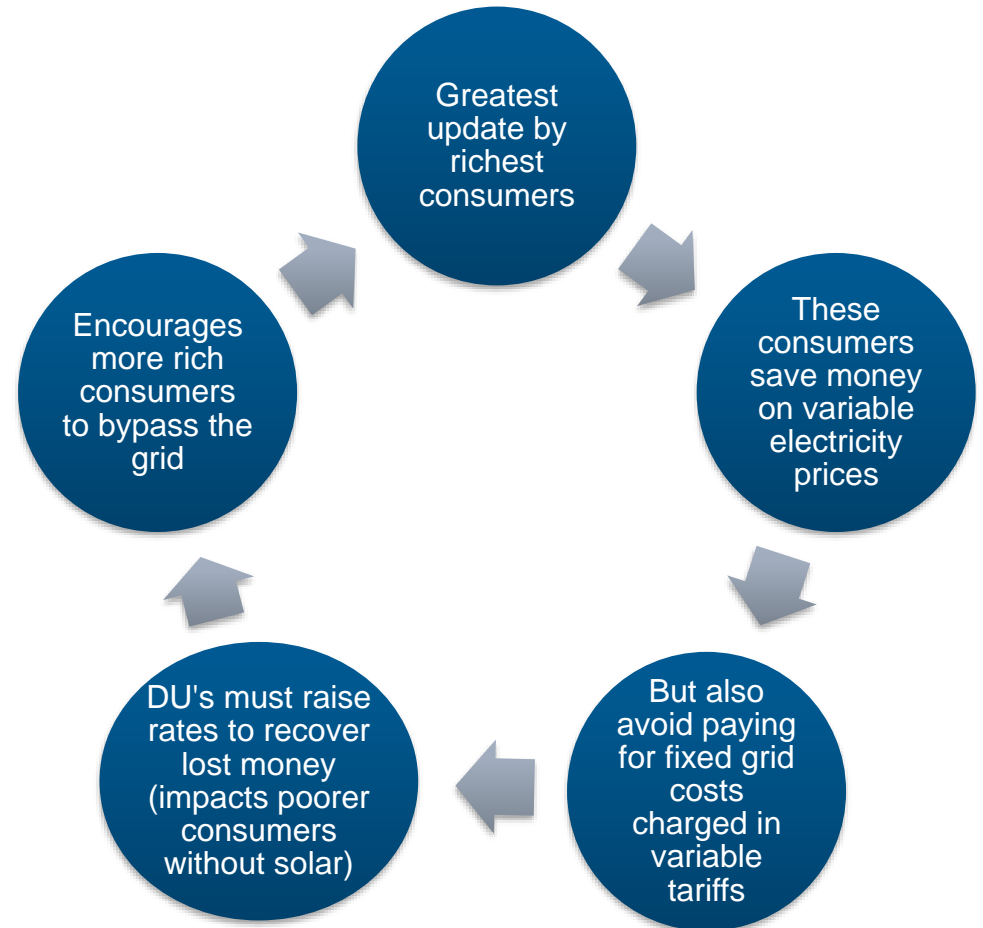
Entry of smart devices and storage can cause more problems, or be part of the solution



“Smart consumers” may undermine the market, or be part of the solution to supplying flexibility

Tariff structures are also part of the solution (although Philippines is not the worse offender here!)

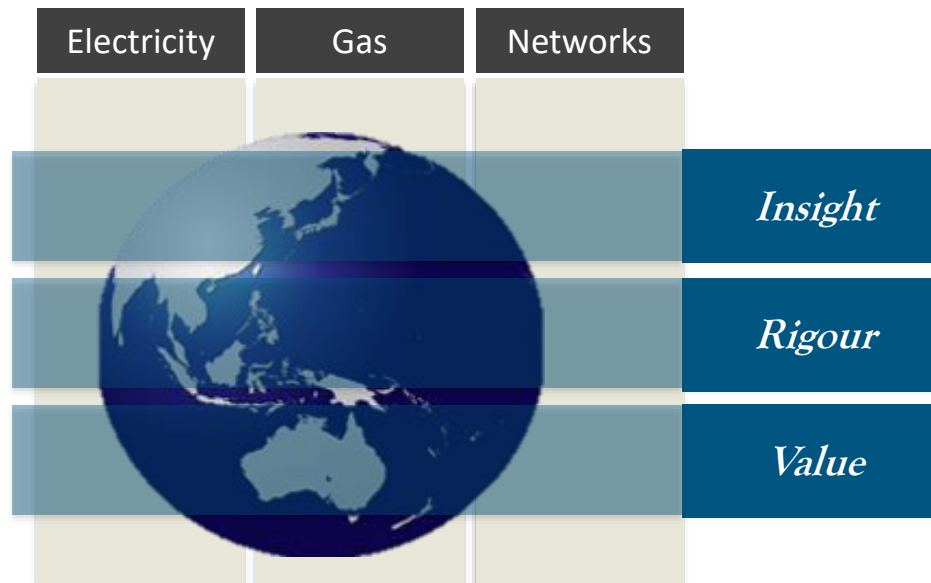
- Rooftop solar is actually more expensive than utility scale solar
- So for maximum climate impact, it's better to focus on utility scale solar (even if the public doesn't like it)
- Rooftop solar can also have social impacts – uptake is greatest by richer consumers who can afford to buy the units
- The exception is anywhere without a current grid – where rooftop solar (and batteries) have a useful role in electrification



In summary

- Renewables **can** be the cheapest option to meet electricity demand growth
- But if they are encouraged by non-market mechanisms, they depress the market and make it harder to bring more plant (**of any kind**) in
- But they have to be matched with **flexible plant** to allow the intermittency to be absorbed
- Market mechanisms needed include:
 - Remove barriers to renewables without giving them “out of the money” incentives that undermine the market
 - Removal of artificially low WESM price cap to encourage gas or storage
 - Remove regulatory barriers to installation of battery storage
 - Allow ancillary services market to start (and function properly)
 - Improve analysis of quantity of ancillary services to procure

Contact Us



Contact

Sarah Fairhurst - Partner
sfairhurst@lantaugroup.com

By phone

+852 2521 5501 (office)

By mail

4602-4606 Tower 1, Metroplaza
223 Hing Fong Road,
Kwai Fong, Hong Kong

Online

www.lantaugroup.com