Sustainable Power Market Products: RE and Conventional

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Introduction to The Lantau Group (TLG)

The Lantau Group is an Asia Pacific strategy and economic consultancy focusing on energy and sustainability.
Asia Pacific electricity and gas/LNG
Decades of experience in commercial and regulatory matters

Energy Sector Areas of Focus

Strategy
Disputes and Arbitration
Analysis
Commercial
Regulation and Markets

Markets & Transactions
Industry Insights
Impact
Economic Regulation
Client Service

We focus on what can be measured and substantiated.
We provide objective, independent, well-grounded advice for decision-makers facing high stakes choices.

We focus on what matters to energy stakeholders facing changes in markets, technologies, regulations, and policies.
This is what we do.

We advise on key projects throughout the Asia Pacific region and the rest of the world.
We influence the evolution of the energy sector through our work and expertise.

We apply economics and analysis to address challenges facing regulators, commercial stakeholders, and policy makers.

Our senior team members are actively involved in the execution of mandates and assignments.
We own our company, so when we say we are dedicated to our clients we mean it.

Economic, commercial, and strategy advisory for energy sector stakeholders throughout the region
Working with the region’s leaders on energy matters (sample)

C&I End Users • Development Agencies • Financial Institutions • Government Ministries • Independent Power Producers • Leading Utilities • Market and System Operators • Oil & Gas Companies • Regulatory Agencies
We draw from a diverse range of experience and expertise

**Singapore**
- Market design and regulatory support
- Demand forecasting
- Commercial transactions
- Tariff benchmarking
- Corporate PPA support
- LNG and gas strategy
- Disputes / expert witness
- Capacity market

**Mainland China**
- Curtailment study in Gansu, Jilin and West Inner Mongolia
- Multiple studies on small-hydro power investment opportunity
- 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 multiple provinces
- Green procurement options / end user market support

**Korea**
- Renewable energy study for solar and wind
- Due diligence on CCGT and renewable power plants
- Capacity/ancillary market design and evaluation
- SMP/REC modelling and implications to IPP business
- Gas and coal IPP opportunities
- LNG/Coal competitive procurement

**Taiwan**
- Offshore wind
- Transaction support
- Corporate energy pricing
- Market development

**Philippines**
- Market design and development
- Due diligence support
- Business strategy
- Natural Gas Masterplan and LNG entry strategy
- Distribution sector structure and regulation
- Power price forecasting

**Indonesia**
- Gas to power (small and large scale)
- Evaluation of market entry opportunities
- Market development

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

**New Zealand**
- Market development / regulation / pricing
- Retail sector development
- Gas pipeline access policy
- Market trading and market making
- Disputes / expert witness

**Malaysia**
- MESI 2.0 reforms
- PPA (Green and Other)
- Electricity/gas markets
- Tariff benchmarking
- Third party access
- Demand forecasting
- Commercial transactions
- Disputes / expert witness

**Australia**
- Capacity market design
- Contract disputes / expert witness
- Market design and policy / reviews
- Corporate green procurement
- Demand response
- Market modelling / transaction support
- Market design and regulation
- Network regulation and cost recovery
- Storage

**Thailand**
- Demand response pricing
- Grid solar evaluation
- Gas to power economics
- Market development
- Renewable energy
Such a simple world no longer exists. The introduction of demand response was an initial complication, as that established a stronger linkage between demand and capacity and between demand and prices. But system complexity increased dramatically mainly because of the emergence of renewable energy and battery storage technologies on both sides of the meter. The result is a much more complex set of interactions.
Current and Emerging (Complex) Energy World

Behind The Meter
- Quantity / Quality of rooftops for Solar
- BTM Solar
- Energy Efficiency
- Tariff Level and Structure
- Macro-economy
- BTM Battery Storage

Technology Development

Policy Support

On the Grid
- Network Condition & Regime
- Available RE sites
- Grid Connected RE
- Wholesale Energy Price
- Reserve Capacity Price
- Grid Connected Battery Storage
- Reserve Capacity
- Demand Response
- Ancillary Services
- Market rules and standards
- Grid Reliability & Security
- Thermal Capacity

Mostly External Factors
Mostly Endogenous Factors
Changes initially driven by subsidies, and more recently due to technological advancement and declining costs (and increasing savings for customers)

Source: Energy Policy WA – Distributed Energy Resources Roadmap
The Economics (and to some extent, environmental considerations) has been driving up the PV uptake in Australia

...such that, in Western Australia, rooftop PV can be considered the largest single generator with approximately 1.59 GW of grid-connected installed capacity [as at Mar 2021], almost as much as the combined coal-fired capacity in the SWIS (1.65 GW).

...and forecast to keep increasing to become the largest grid-connected installed capacity.
On per capita basis, Australia leads the world in Solar power, primarily driven by rooftop solar
Increased rooftop solar gives rise to the “duck curve”

The ‘duck curve’ with reference to WA’s residential customers’ average demand on any given day.

Operational vs underlying demand 12-13 October 2019

Source: Western Power

Source: Energy Policy WA – Distributed Energy Resources Roadmap
...And the duck is getting ‘fatter’ causing inefficiencies and system security risk

Grid Demand Minimum Day on the SWiS with Increasing Solar Penetration

Shape of the Load Curve on the Minimum Demand Day

Source: AEMO
Source: Energy Policy WA – Distributed Energy Resources Roadmap
Impacting system stability

14 March 2021

- System Load including Rooftop PV
- System Load

Avg ramp rate 1.2 MW/min
Avg ramp rate 4 MW/min

1,074 MW
2,509 MW
Similar problems exist in other Australian States with high rooftop penetration.

The shape of demand in South Australia has changed profoundly over the last decade.

Source: Endgame Economics

System Security at risk
Solar panels switched off by energy authorities to stabilise South Australian electricity grid

By Daniel Keane, Nick Hearsm and Sara Tomevska
Posted Wed 17 Mar 2021 at 2:34pm, updated Wed 17 Mar 2021 at 4:00pm

Energy authorities in South Australia have used their new power to remotely switch off thousands of household solar panels for the first time, making the intervention when electricity demand plunged over the weekend.

Last year, transmission authorities were given permission to deliberately "trip" existing rooftop solar panels in rare circumstances to prevent sudden dips in demand leading to widespread blackouts.

The Australian Energy Market Operator (AEMO) recommended the measure as a means of mitigating the threat to grid security posed by the rapid growth of rooftop solar, which has led to days of very low demand.

Low demand poses a major problem for operating the grid securely, particularly when South Australia’s ability to export electricity to the eastern states is hampered.

AEMO said such a dip occurred on Sunday, with South Australia experiencing "near-record minimum demand levels for electricity from the grid" during a planned outage of circuits feeding the Heywood Interconnector which links the state’s grid with Victoria.

That planned outage meant a tighter-than-normal system running in a state that relies on large-scale wind and solar generation.

Key points:

- SA’s spot demand for electricity recently dipped to "near-record minimum levels"
- AEMO was forced to intervene, instructing ElectraNet to stabilise the grid
- That resulted in about 12,000 solar generation units being remotely switched off

Rush to renewables
...and Impacting Pricing

Balancing Prices are becoming increasingly negative, with a greater spread of pricing outcomes.

For the first time since the WEM commenced in 2006, the Balancing Price cleared at the Minimum STEM Price of -$1,000/MWh during three Trading Intervals over 12-13 October 2019.
Enter Batteries… the saviour (or is it?)

Year on year growth in behind the meter PV and battery storage, 2012 to (April) 2021

Proportion of installed battery storage, by system size, 2008 to (April) 2021
Typical Economics of RE Supply Options

- **Roof Top Solar**
  - No Wheeling and Transmission Charges and losses.

- **Group Captive**
  - No CSS and AS applied.

- **Third Party PPA**
  - Reducing costs from competitive supply

- **Green Trading**
  - Market based (marginal cost) of supply

- **Commercial Tariff**
  - Physical supply cost PLUS purchase of REC

- **Industrial Tariff**

Illustrative only

INR Rs/kWh
Key take away

• BTM becomes an attractive option as tariff increase, solar and battery costs decline and technological innovations are made.

• At some point, India too will begin to face some of the system security and pricing and economic inefficiency problems that Australia is experiencing.

• Dealing with this will require a combination on technical solutions (e.g. inverter controls), tariff structure issues, and market design issues.

• Ancillary Services, ‘Ancillary’ no more. Need for enhanced ESSENTIAL system service (ESS)

• Power Exchange will deliver financial hedging instruments that will become more and more critical for the market with increasing price volatility. Eg:
  • ESS hedge products
  • weather insurance and weather caps
  • secondary settlement residue auctions
  • wind and solar firming products
  • load following hedges
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Electricity | Gas | Networks

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Hong Kong | Singapore | Seoul | Perth | Bangkok | Shanghai
ADDITIONAL SLIDES
Growing number of dwellings have rooftop solar installed

It's not just the number of Rooftop Solar, but its size is also increasing.