

ONE-PAGE ELECTRICITY MARKET DESIGN SUMMARY

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Entities responsible for electricity market functions

Where the jurisdiction procures capacity separately from energy:

1. Capacity is procured through an auction.
2. The price is set by a central authority rather than an open market mechanism.
3. Retailers/large consumers are obliged to hold contracts or capacity certificates.
4. Retailers/consumers can engage directly with producers to meet capacity obligations.

Risk management mechanisms:

1. Standardised contract forms for bilateral contracting
2. Exchange traded futures
3. Financial transmission rights, settlement residue auctions and the like

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Centrally managed, financially &/or physically firm spot energy markets.

Non-energy services. Also known as as System Support Services or Essential System Services

Retail market characteristics:

1. Whether the market allows at some or all consumers a choice of electricity retailer.
2. Minimum demand required to qualify as a contestable customer.
3. Whether the market allows consumers/retailers a choice of meter equipment and/or data provider.
4. Approach to reconciling meter data and allocating unmetered consumption.

Scheduling and dispatch characteristics:

1. Gross pool: participants offer all generation capability, all generation quantities determined in central dispatch. Net pool: participants nominate self-scheduled quantities, deviation quantities determined in central dispatch.
2. Time granularity for which dispatched quantities are calculated
3. Extent to which facility commitment is managed by the participant vs instructed by the market operator
4. Extent to which market scheduling algorithms account for network and security constraints
5. How the market algorithms treat network losses
6. Dispatch compliance requirements on intermittent generation
7. Extent to which battery storage devices can provide market services

Governance		ELECTRICITY MARKET SUMMARY - NEW ZEALAND																					
Policy	Ministry of Business, Innovation & Employment	Dispatch																					
Regulation	Electricity Authority (market), Commerce Commission (monopolies)	Settlement	Final prices	1	1																		
Market design lead	Electricity Authority	Trading interval	30 mins	2	2																		
Rule making	Electricity Authority	Energy price floor	\$0/MWh	3	3																		
Scheduling & dispatch	Transpower	Energy price ceiling	\$20,000/MWh	3	3																		
Power system operation	Transpower	Reserve price floor	\$0/MWh	3	3																		
Market operation	NZ X (NZX, ASX, EFX)	Reserve price ceiling	None	3	3																		
Metering	Vector, AMS, IntelHub, SmartCo, + 9 other metering equipment providers	Scarcity pricing	Intervention pricing	4	4																		
Network planning	Transpower	Ancillary services	<table border="1"> <thead> <tr> <th>Service</th> <th>Procurement</th> <th>Cost recovered from</th> </tr> </thead> <tbody> <tr> <td>Contingency Reserve</td> <td>Instantaneous Reserve 6s & 60s; co-optimised with energy; Over frequency reserve: contracted</td> <td>IR: generators >60MW pro-rated to injection, HVDC owner OFR: Tx owner</td> </tr> <tr> <td>Regulation</td> <td>Single service: contracted then cleared ahead of energy</td> <td>Loads pro-rated to offtake</td> </tr> <tr> <td>Inertia</td> <td>N/A</td> <td>N/A</td> </tr> <tr> <td>Black start</td> <td>Contracted, availability fee + event fee</td> <td>Grid owner</td> </tr> <tr> <td>Network support</td> <td>Voltage Support considered, but none currently contracted</td> <td>Affected distributors in relevant zone per peak kVar</td> </tr> </tbody> </table>			Service	Procurement	Cost recovered from	Contingency Reserve	Instantaneous Reserve 6s & 60s; co-optimised with energy; Over frequency reserve: contracted	IR: generators >60MW pro-rated to injection, HVDC owner OFR: Tx owner	Regulation	Single service: contracted then cleared ahead of energy	Loads pro-rated to offtake	Inertia	N/A	N/A	Black start	Contracted, availability fee + event fee	Grid owner	Network support	Voltage Support considered, but none currently contracted	Affected distributors in relevant zone per peak kVar
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DX owner	Vector PowerCo, Chon, Wellington Electricity, +25 other regional distributors	Spot	<table border="1"> <thead> <tr> <th>Spot</th> <th>Real-time</th> </tr> </thead> <tbody> <tr> <td>Day-ahead</td> <td>✓</td> </tr> <tr> <td>Intra-day</td> <td>✓</td> </tr> <tr> <td>Real-time</td> <td>✓</td> </tr> </tbody> </table>			Spot	Real-time	Day-ahead	✓	Intra-day	✓	Real-time	✓										
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Settlement approach:

1. Ex-ante: prices firm at time of dispatch. Ex-post: prices determined after dispatch
2. Time granularity of settlement.
3. Whether market prices are explicitly adjusted during times of scarcity.
4. Whether market prices can be adjusted where the system operator or regulator has overridden market outcomes.
5. Locational granularity of prices.
6. Extent to which prices include the effects of network congestion.

Version number and release date

Physically connected neighbouring jurisdictions



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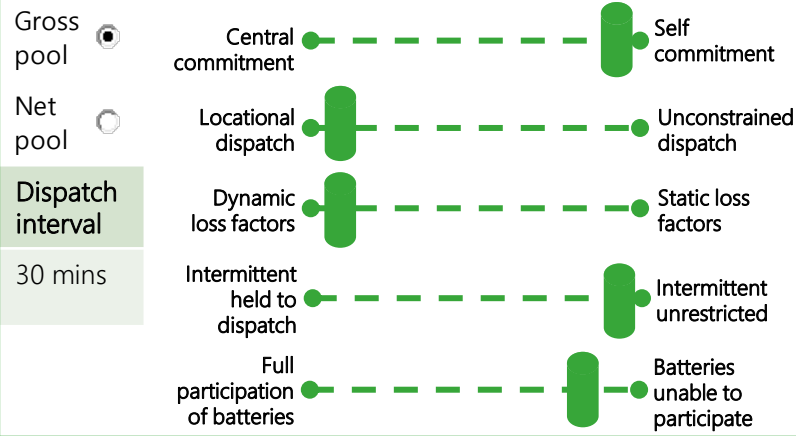
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ELECTRICITY MARKET SUMMARY – SINGAPORE

Governance

Policy	Energy Market Authority (EMA)
Regulation	EMA
Market design lead	EMA
Rule making	EMA , on recommendation from Rule Change Panel
Scheduling & dispatch	Energy Market Company (EMC)
Power system operation	EMA as Power System Operator (PSO)
Market operation	EMC
Metering	SP Services Ltd
Network planning	SP PowerGrid Limited , EMA
TX owner	SP PowerGrid Limited
DX owner	SP PowerGrid Limited

Dispatch



Settlement

Final prices	Ex-ante
Trading interval	30 mins
Energy price floor	-4,500 SGD
Energy price ceiling	4,500 SGD
Reserve price floor	0 SGD
Reserve price ceiling	Varies by product
Scarcity pricing	✗
Intervention pricing	✗

Inter-connects



Ancillary services

Service	Procurement	Cost recovered from
Contingency Reserve	Primary and Contingency Reserve co-optimized with energy	Generators >= 10MW
Regulation	Regulation co-optimized with energy	Loads, Generators < 10MW
Inertia	No separate service	-
Black start	Supplied under contracts – must run for as long as nearest generator starts	Recovered from load via monthly energy uplift charge
Network support	Required under Transmission Code, or directly contracted by TX operator	-

Capacity	Contracts		Spot	Contracts	
Auction	✗	OTC	✓		
Administered price	✗	ETFs	✓		
Retailer obligations	✗	Locational hedges	✗		
Bilateral agreements	✗	Day-ahead	✗		
		Intra-day	✗		
		Real-time	✓		

Retail	Retail competition	✓	Threshold	None	Metering competition	✗	Reconciliation approach	Settlement by difference
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