

What went wrong with Australia's National Electricity Market?

The Missing Money & Missing Policy

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Overview of Australia's National Electricity Market

- Mandatory energy-only gross pool, no formal day ahead or capacity market
- Very high VoLL (currently \$14,500)
- Covers Eastern Seaboard (Queensland, New South Wales, Victoria, South Australia, Tasmania, Aust. Capital Territory)
- 46,000 MW of generation plant, 196 TWh Load
 - Coal 80% and falling, Gas 10%, Renewables 10% and rising
 - Customers 8.8 million households (~28% load)

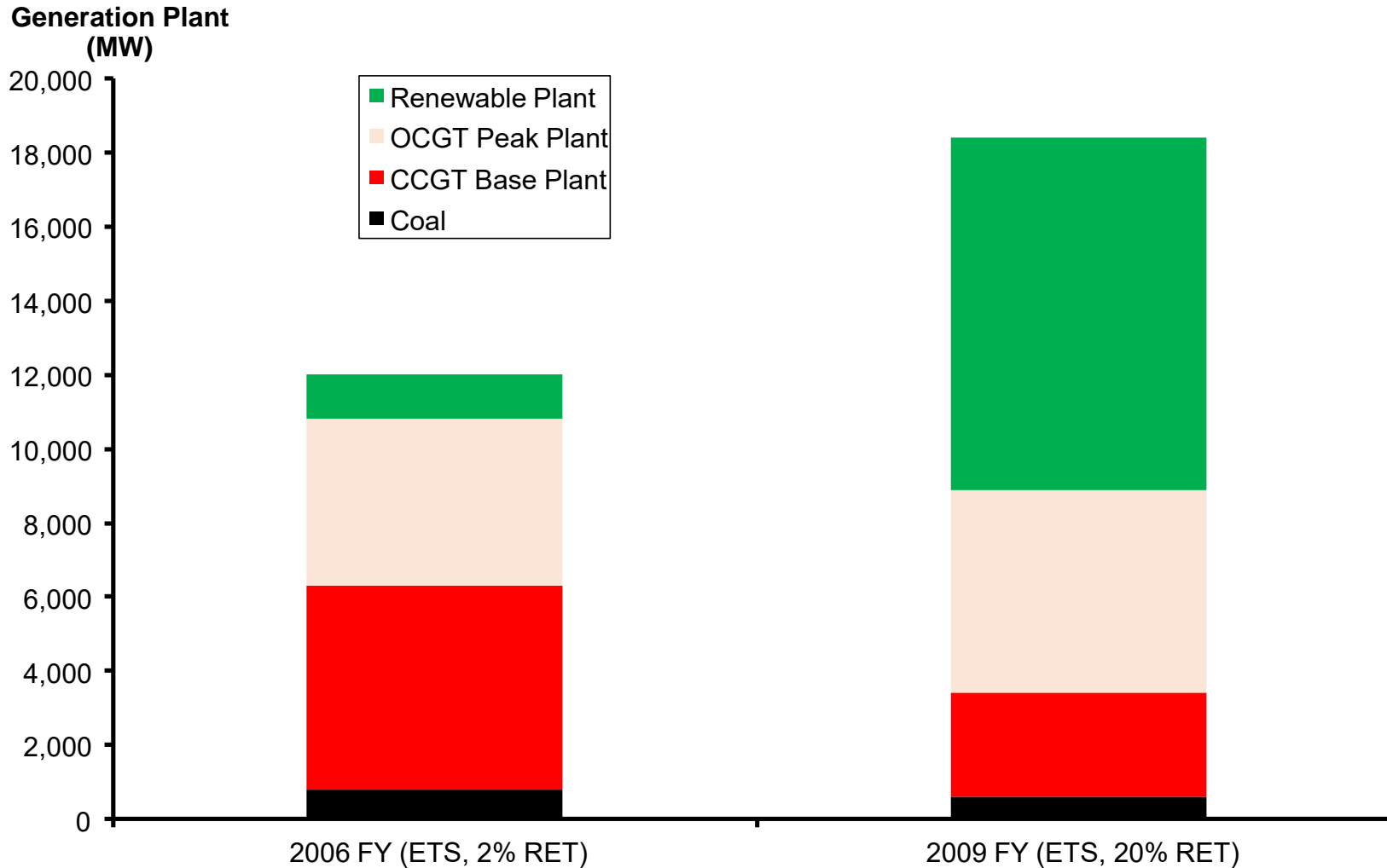
The NEM in 2016-2018

- After two decades of consistent economic & technical performance, NEM wholesale market prices doubled, and the SA grid collapsed (Sept 2016)
 - Nov 2016 Hazelwood Power Station closure announced (5 months notice)
- The NEM's wholesale market has been the centrepiece of Australia's energy market reform, a world-class market and market design
- For policymakers, an energy market crisis was unfolding. Context is important:
 - From 2007-2014 residential retail-level tariffs doubled (networks & envir. policy)
 - Just as network charges & environmental costs stabilised, wholesale prices surged
 - Change in political strategy at Commonwealth level
- To understand what happened in the NEM, we need to trace through a decade of policy decisions vis-à-vis impact on investment

Policy backdrop: climate change policy discontinuity

- Australia's Renewable Energy Target
 - World's first RPS, originated in 1997, legislated in 2000.
 - Formally reviewed on 6 separate occasions
 - Fundamentally changed 3 times (20%, Large/Small, 33TWh)
- Emissions Trading in Australia
 - Policy can be traced at least as far back as 1997
 - 7 formal policy development cycles / attempts (1997-2001, 2005-2006, 2008-2010, 2011-2014, 2016, 2017, 2018).
 - 1 false start (2011-2014).
- Five State-based schemes (a tech set-aside scheme, baseline & credit ETS, 3 separate energy efficiency schemes and 4 Premium FiT schemes for rooftop solar PV)

Policy-induced plant: 2% to 20%



The Sequence:

1. Policy induced plant

Into an oversupplied market...

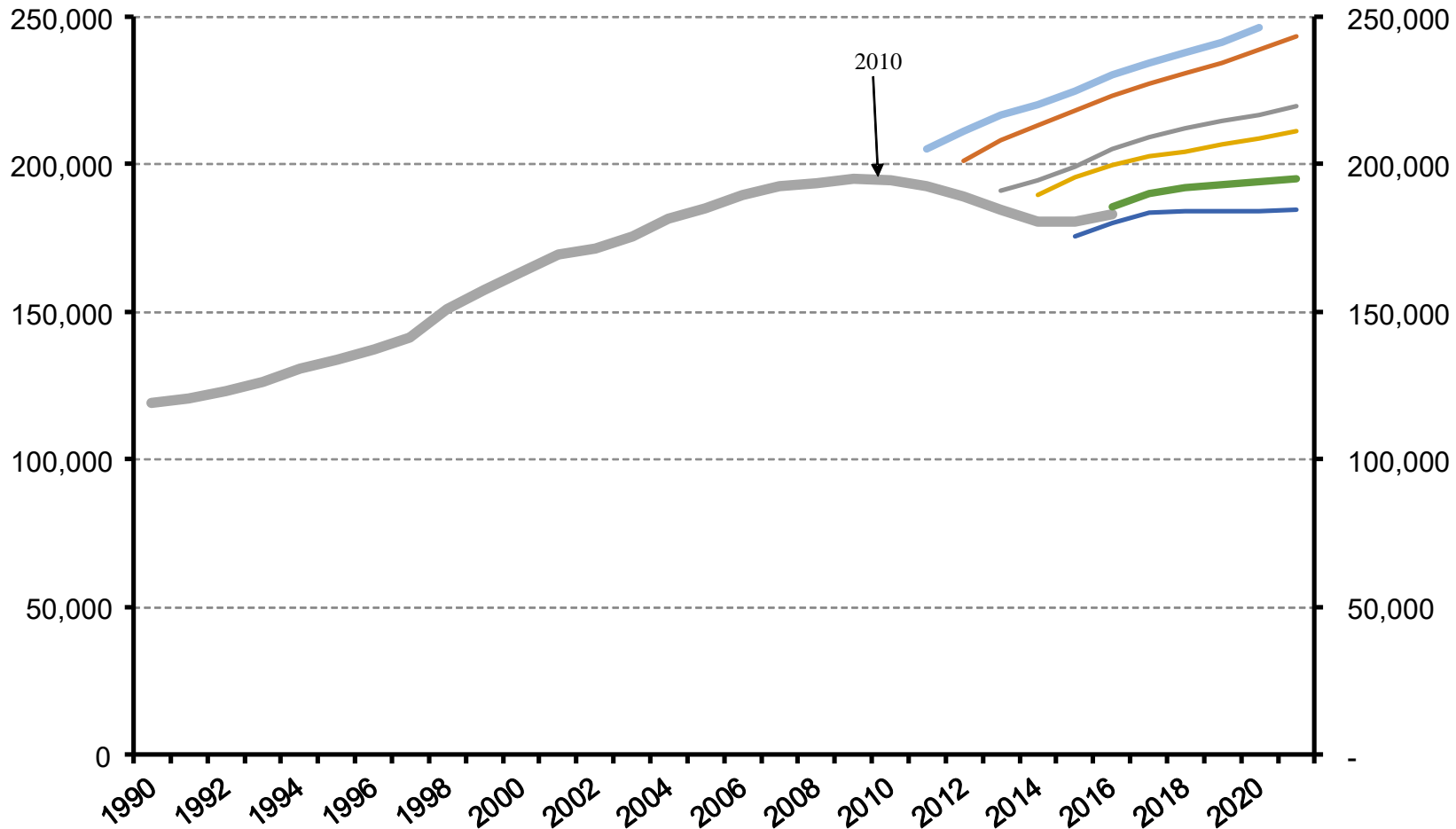
The Sequence:

1. Policy induced plant
2. Into an oversupplied market

Operating Duty	Optimal	Actual	Imbalance	Weighting
(Peak load: 35,700 MW)	(MW)	(MW)	(MW)	
Base load plant	25,000	29,000	4,000	Overweight
Intermediate	3,600	6,000	2,400	Overweight
Peak load plant	10,700	10,200	-500	Underweight
Renewables	985	2,200	1,215	Overweight
Aggregate Supply	40,285	47,400	7,115	Oversupplied
Capital stock	\$45,909.70	\$55,248.80	\$9,339.10	Overcapitalised
Source: Simshauser (2010)				

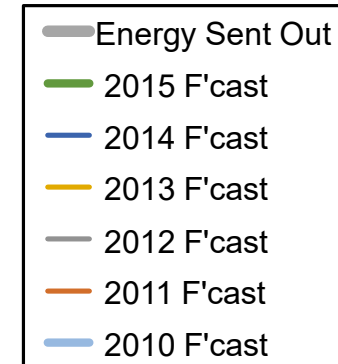
With contracting final demand...

Energy Sent Out
(GWh pa)

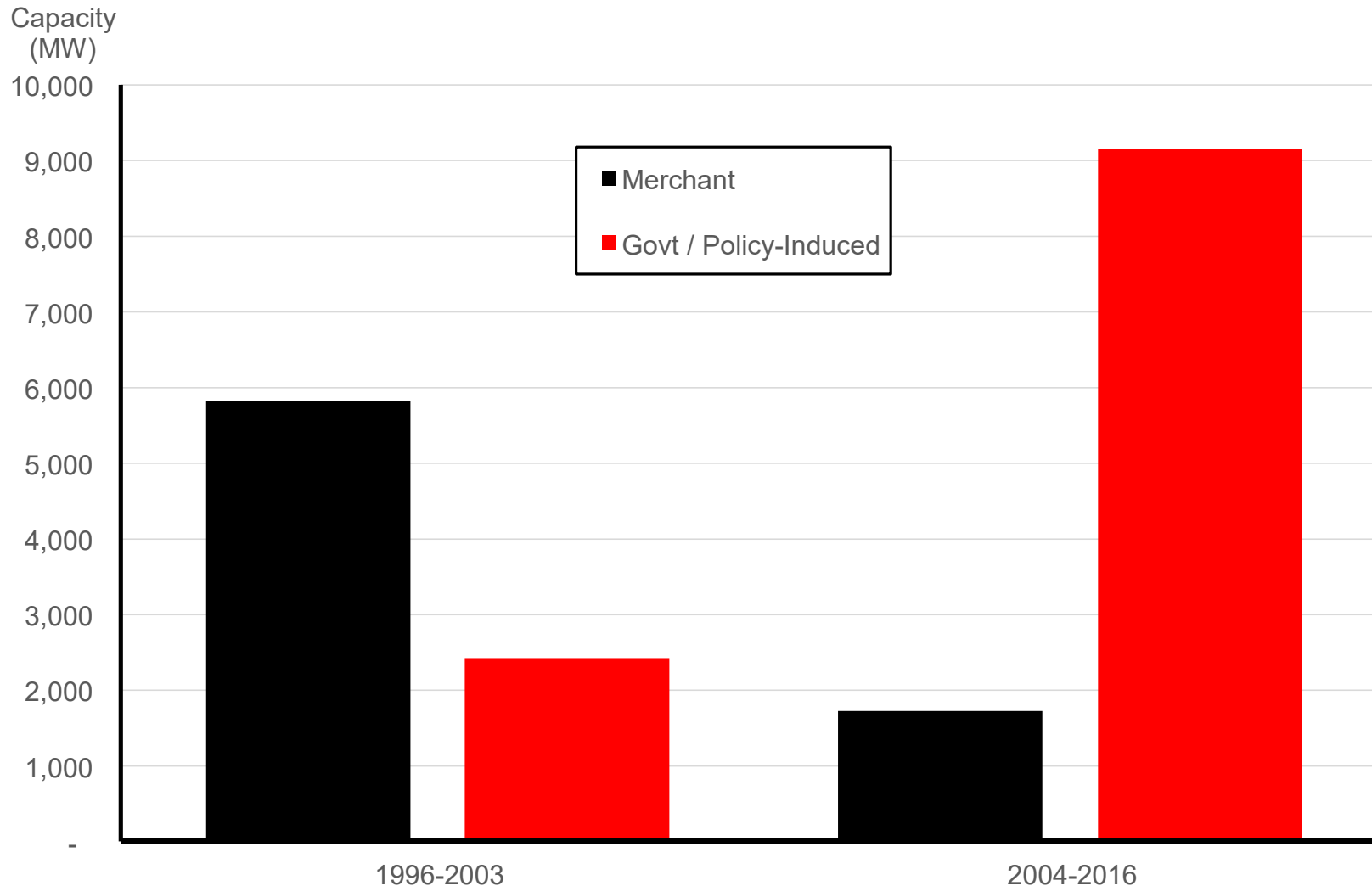


The Sequence:

1. Policy induced plant
2. Into an oversupplied market
3. With contracting final demand



Investments moved from market signals to policy signals



The Sequence:

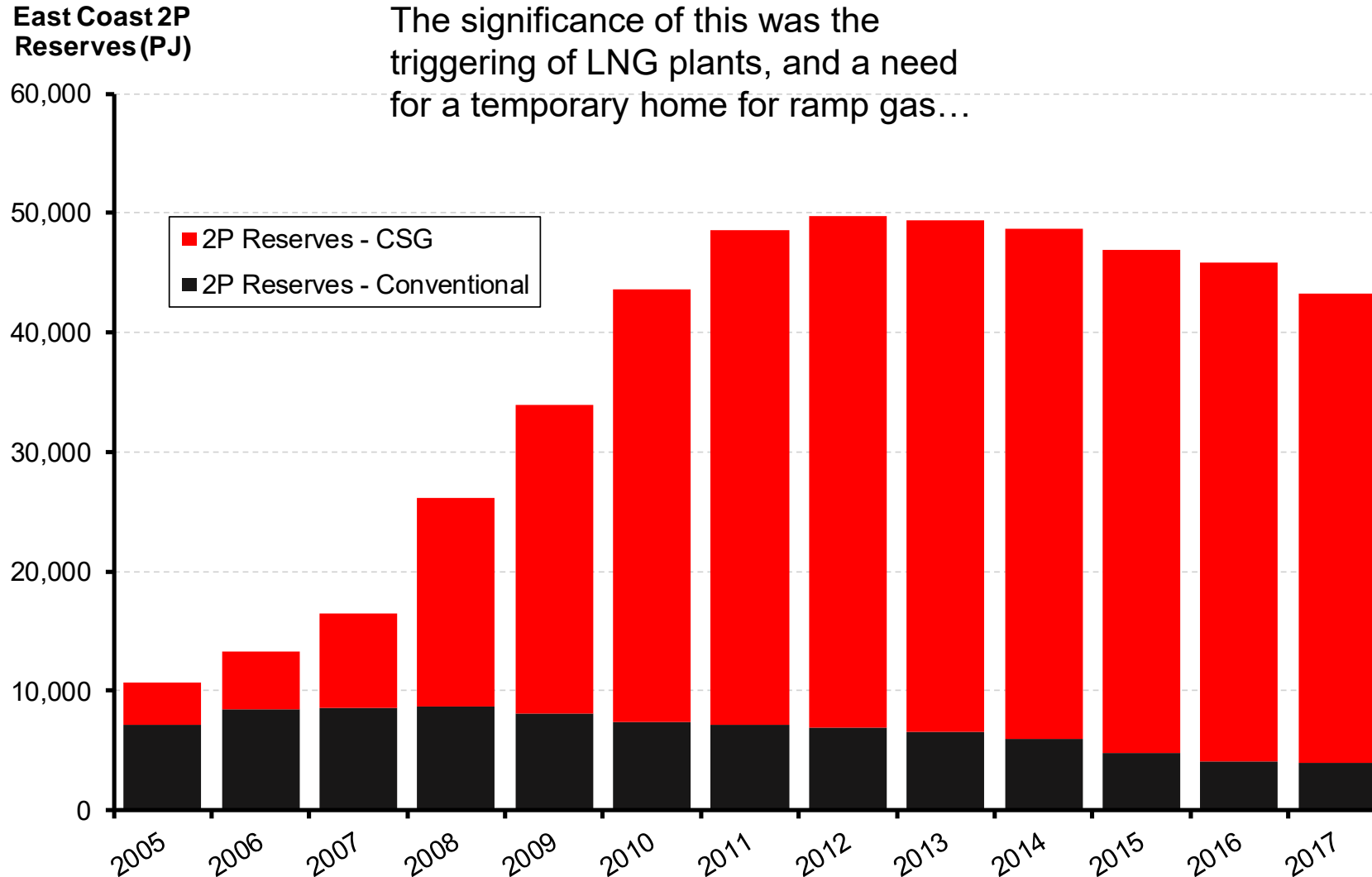
1. Policy induced plant
2. Into an oversupplied market
3. With contracting final demand
4. Investment responding to policy

Adding to the pressure: 2P Coal Seam Gas Reserves

The Sequence:

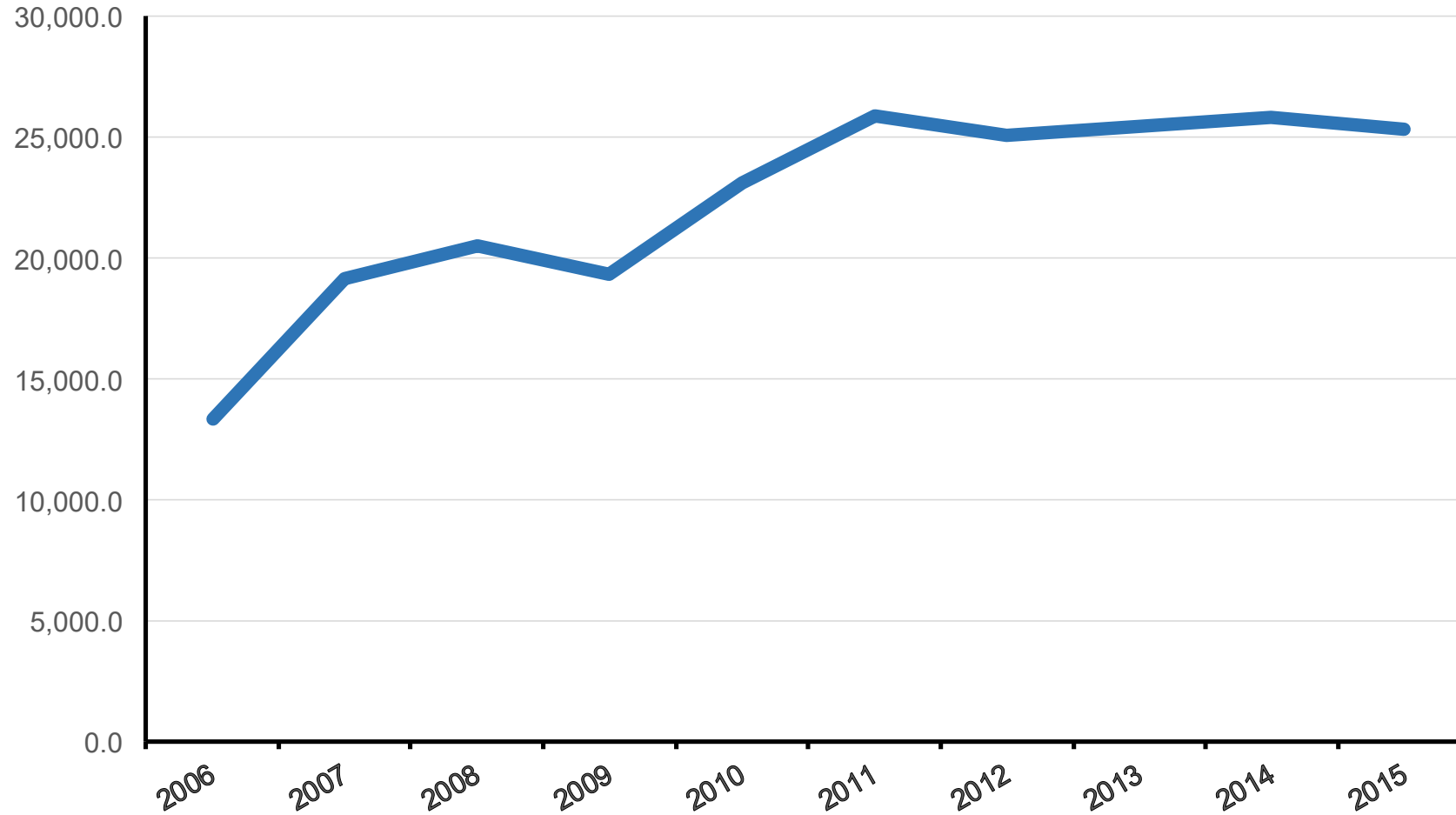
1. Policy induced plant
2. Into an oversupplied market
3. With contracting final demand
4. Investment responding to policy
5. Large gas discoveries

The significance of this was the triggering of LNG plants, and a need for a temporary home for ramp gas...



Gas-fired generation increased, adding more supply

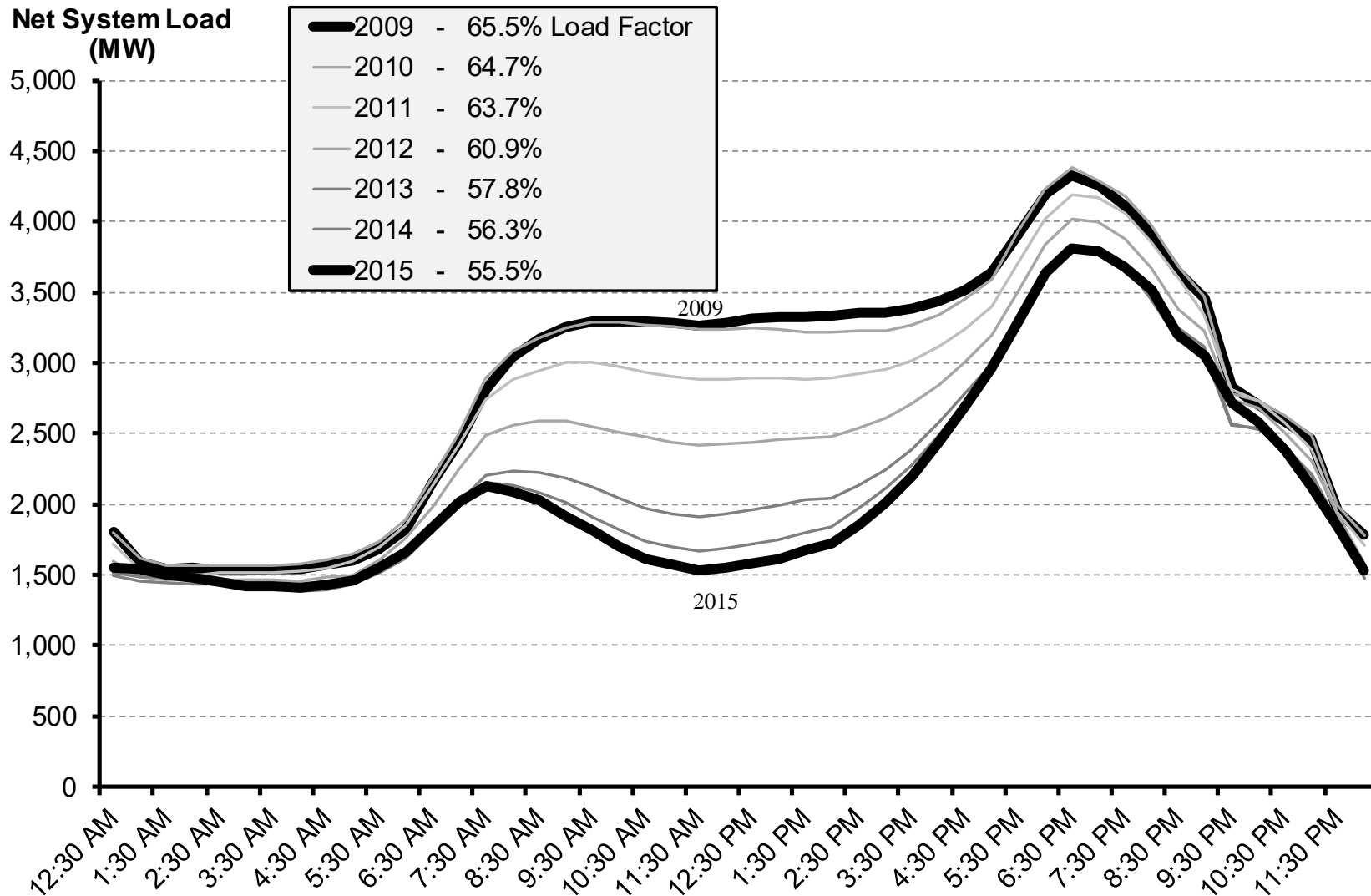
Gas-fired generation
(GWh pa)



The Sequence:

1. Policy induced plant
2. Into an oversupplied market
3. With contracting final demand
4. Investment responding to policy
5. Large gas discoveries
6. Gas needing a temporary home

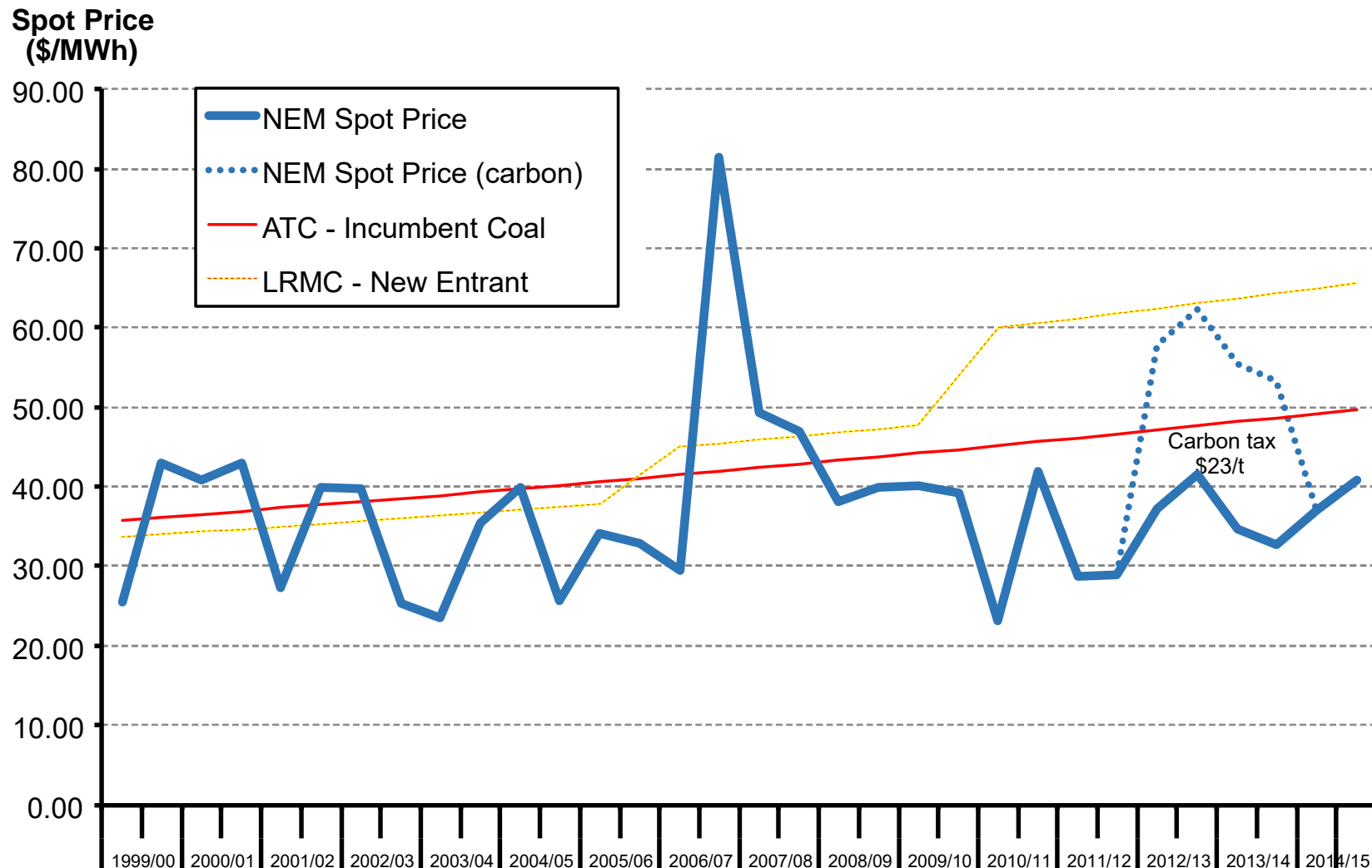
Solar PV hollowing out daytime load, FiT recovery adding to price



The Sequence:

1. Policy induced plant
2. Into an oversupplied market
3. With contracting final demand
4. Investment responding to policy
5. With large gas discoveries
6. Gas needing a temporary home
7. With a Solar PV boom

Wholesale prices fell well below ATC...



The Sequence:

1. Policy induced plant
2. Into an oversupplied market
3. With contracting final demand
4. Investment responding to policy
5. With large gas discoveries
6. Gas needing a temporary home
7. With a Solar PV boom
8. Elongated price collapse

The missing money: mounting losses for thermal plant

Year	ATC (\$/MWh)	NEM Price (\$/MWh)	Shortfall (\$/MWh)	Generation (GWh)	Missing Money (\$ Billions)
2009	43.30	39.11	-4.19	197,380.7	-0.730
2010	44.23	39.46	-4.76	192,848.5	-0.812
2011	45.18	31.96	-13.22	187,438.1	-2.190
2012	46.15	28.83	-17.32	184,892.2	-2.829
2013	47.14	39.61	-7.53	173,965.5	-1.158
2014	48.16	33.78	-14.37	168,160.4	-2.135
2015	49.19	39.60	-9.59	173,369.7	-1.469
Total	46.09	36.06	-10.03		-11.322

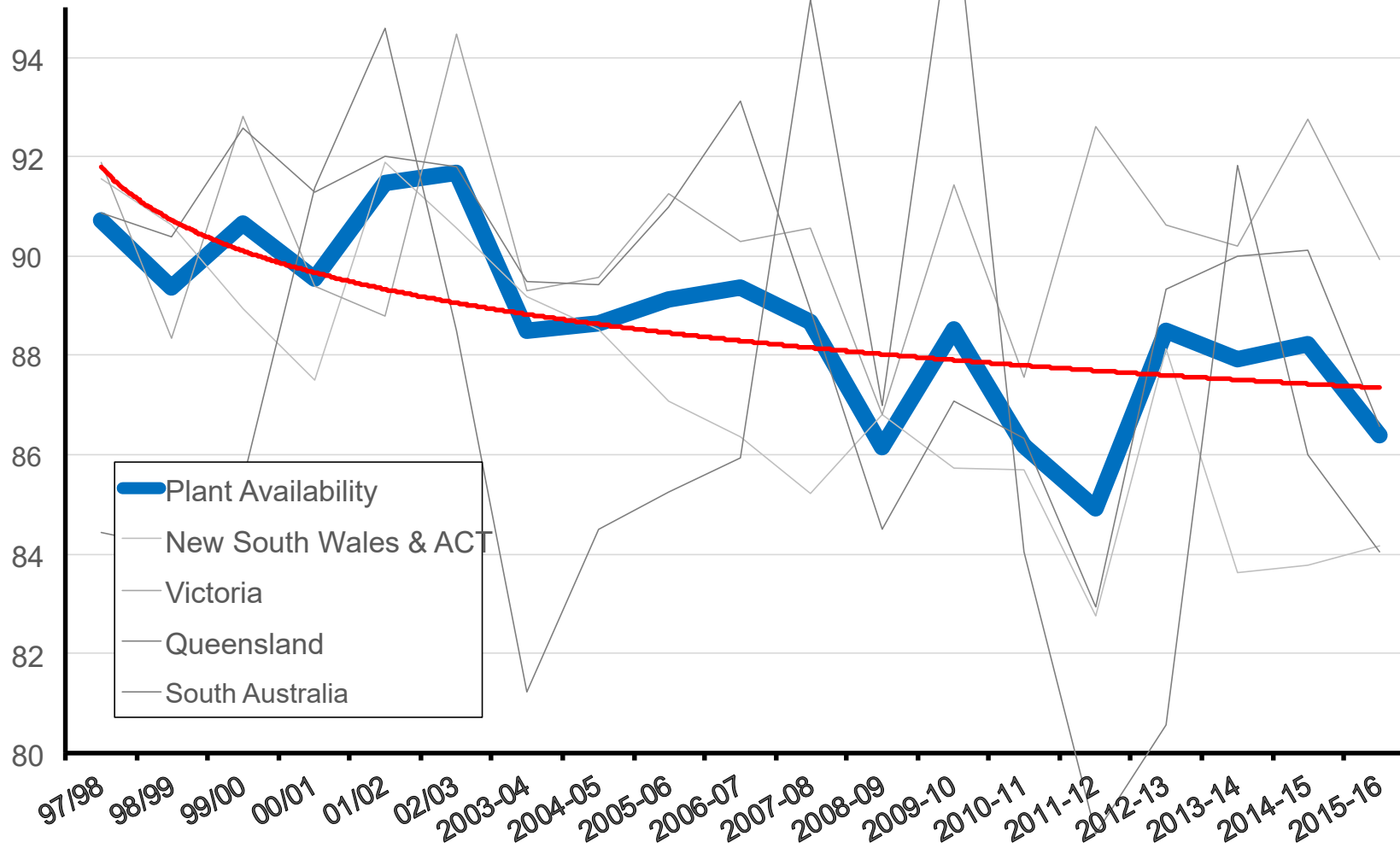
The Sequence:

1. Policy induced plant
2. Into an oversupplied market
3. With contracting final demand
4. Investment responding to policy
5. With large gas discoveries
6. Gas needing a temporary home
7. With a Solar PV boom
8. Elongated price collapse
9. Missing money compounds

Reverse Gear

Strained P&L: pensioner plant & reduced health care spending

Power Station Fleet
Availability (%)



Sequence (reverse gear)

1. Missing money compounds
2. Maintenance cutbacks

Exit: average warning period: 5.2 months

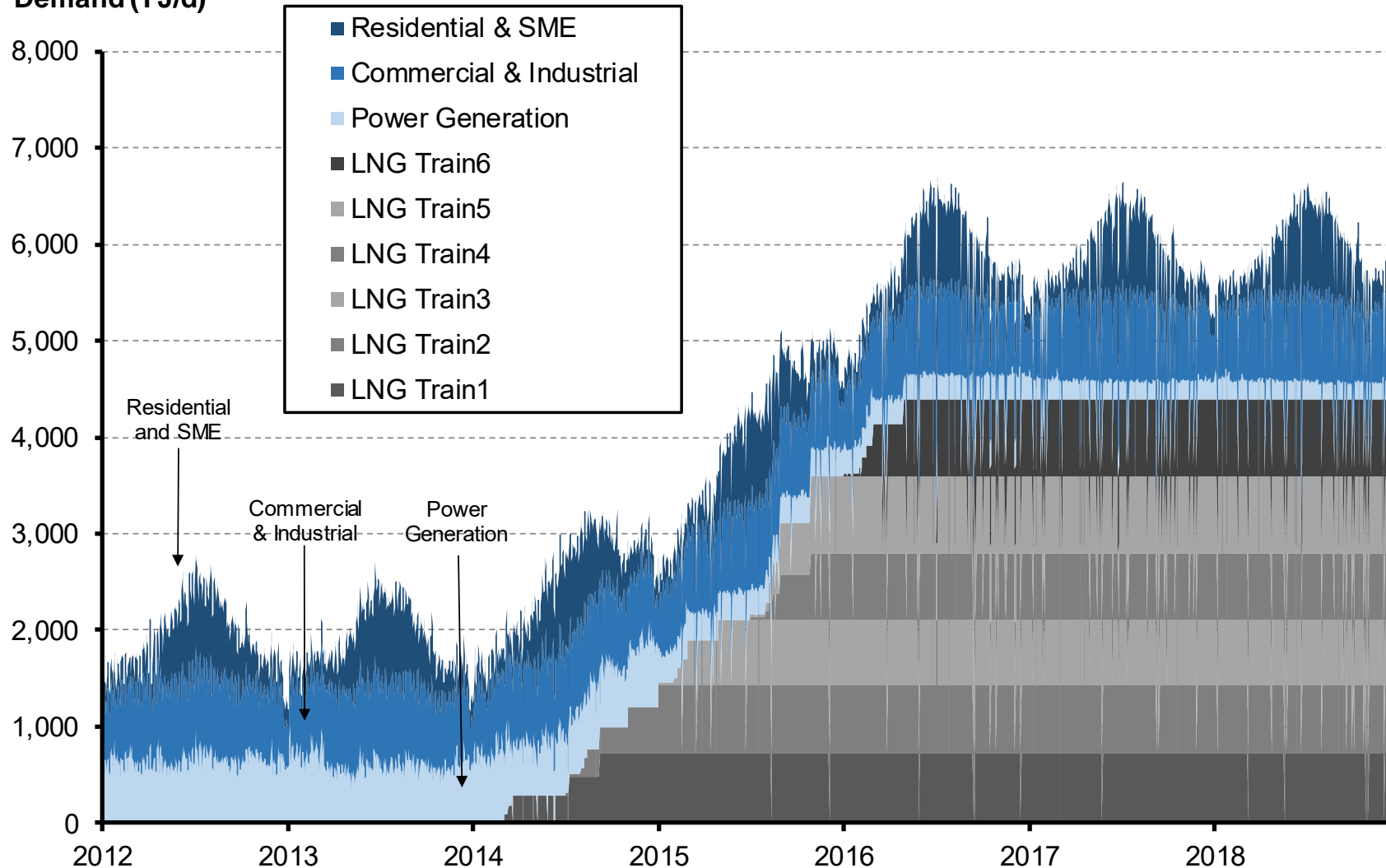
Coal Plant	Capacity (MW)	NEM Region	Exit (Year)	Enter (Year)	Age at Exit (Years)	Warning (Months)	Notice Date	Closure Date
Swanbank B	500	Qld	2012	1972	40	23.6	26-Mar-10	27-Mar-12
Playford*#	240	SA	2012	1960	52	6.9	7-Oct-15	8-May-16
Collinsville	180	Qld	2013	1972	41	5.9	1-Jun-12	1-Dec-12
Munmorah~	600	NSW	2013	1969	44	0.0	3-Jul-12	3-Jul-12
Morwell	195	Vic	2014	1958	56	1.0	29-Jul-14	30-Aug-14
Wallerawang~	1000	NSW	2014	1978	36	0.0	1-Nov-14	1-Nov-14
Redbank	151	NSW	2015	2001	14	0.0	31-Oct-14	31-Oct-14
Anglesea	150	Vic	2016	1969	47	3.6	12-May-15	31-Aug-15
Northern#	540	SA	2016	1985	31	6.9	7-Oct-15	8-May-16
Hazelwood	1600	Vic	2017	1967	50	4.8	3-Nov-16	1-Apr-17
Total / Average	5156			1972	42.5	5.2		
* Mothballed in 2012								
# Original notice 11 June 2015 w ith planned closure date of March 2018								
~ Mothballed, Notice w as therefore immediate								

Sequence (reverse gear)

1. Missing money compounds
2. Maintenance cutbacks
3. Sudden coincident coal plant exits

Final gas demand triples

Aggregate Gas Demand (TJ/d)

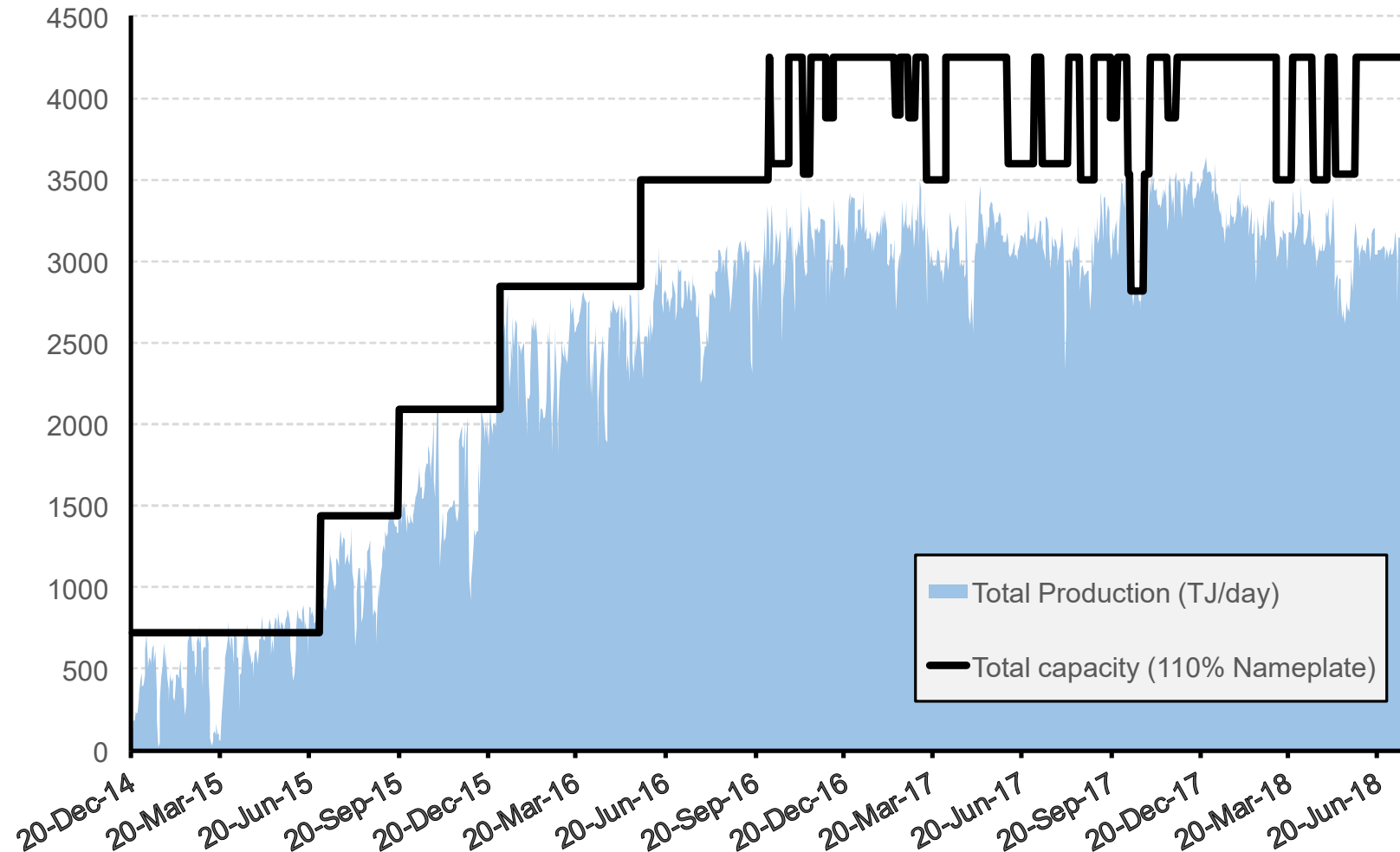


Sequence (reverse gear)

1. Missing money compounds
2. Maintenance cutbacks
3. Sudden coincident coal plant exits
4. Just as LNG exports commence

LNG fleet was overbuilt: short gas

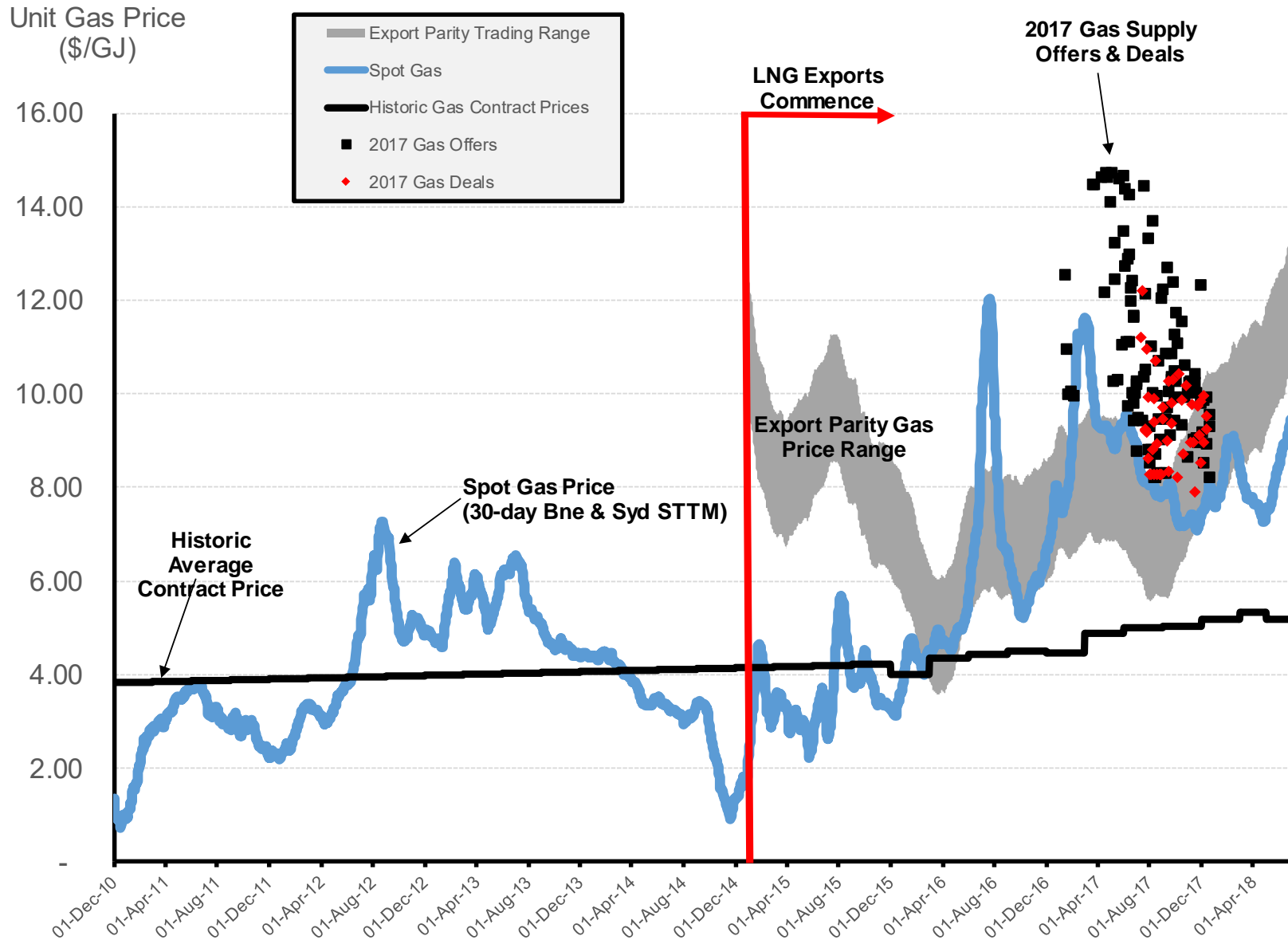
LNG Production
(TJ/day)



Sequence (reverse gear)

1. Missing money compounds
2. Maintenance cutbacks
3. Sudden coincident coal plant exits
4. Just as LNG exports commence
5. Creating gas shortages

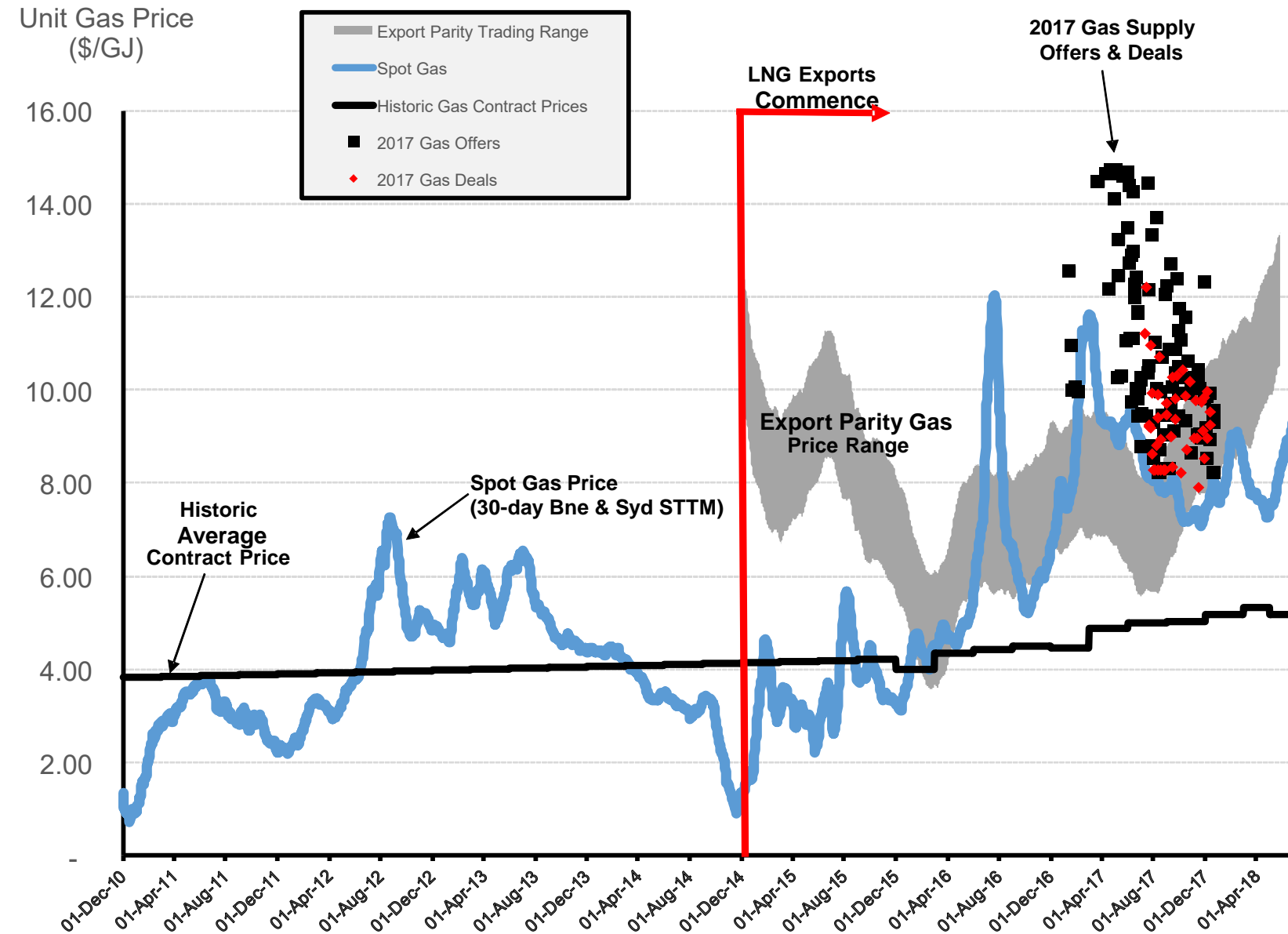
Gas prices increased sharply



Sequence (reverse gear)

1. Missing money compounds
2. Maintenance cutbacks
3. Sudden coincident coal plant exits
4. Just as LNG exports commence
5. Creating gas shortages
6. Causing a gas price shock

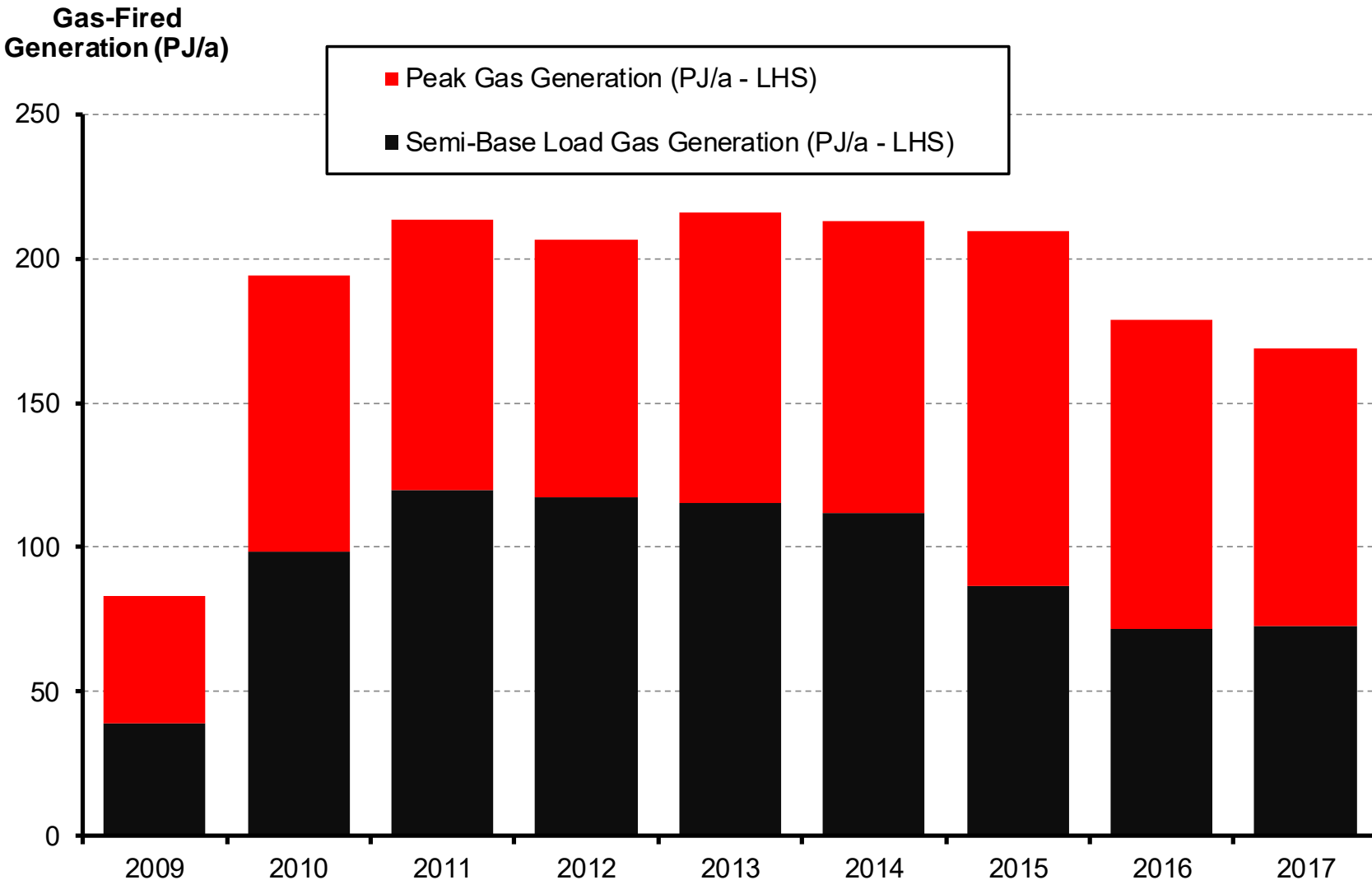
In slow motion...



Sequence (reverse gear)

1. Missing money compounds
2. Maintenance cutbacks
3. Sudden coincident coal plant exits
4. Just as LNG exports commence
5. Creating gas shortages
6. Causing a gas price shock

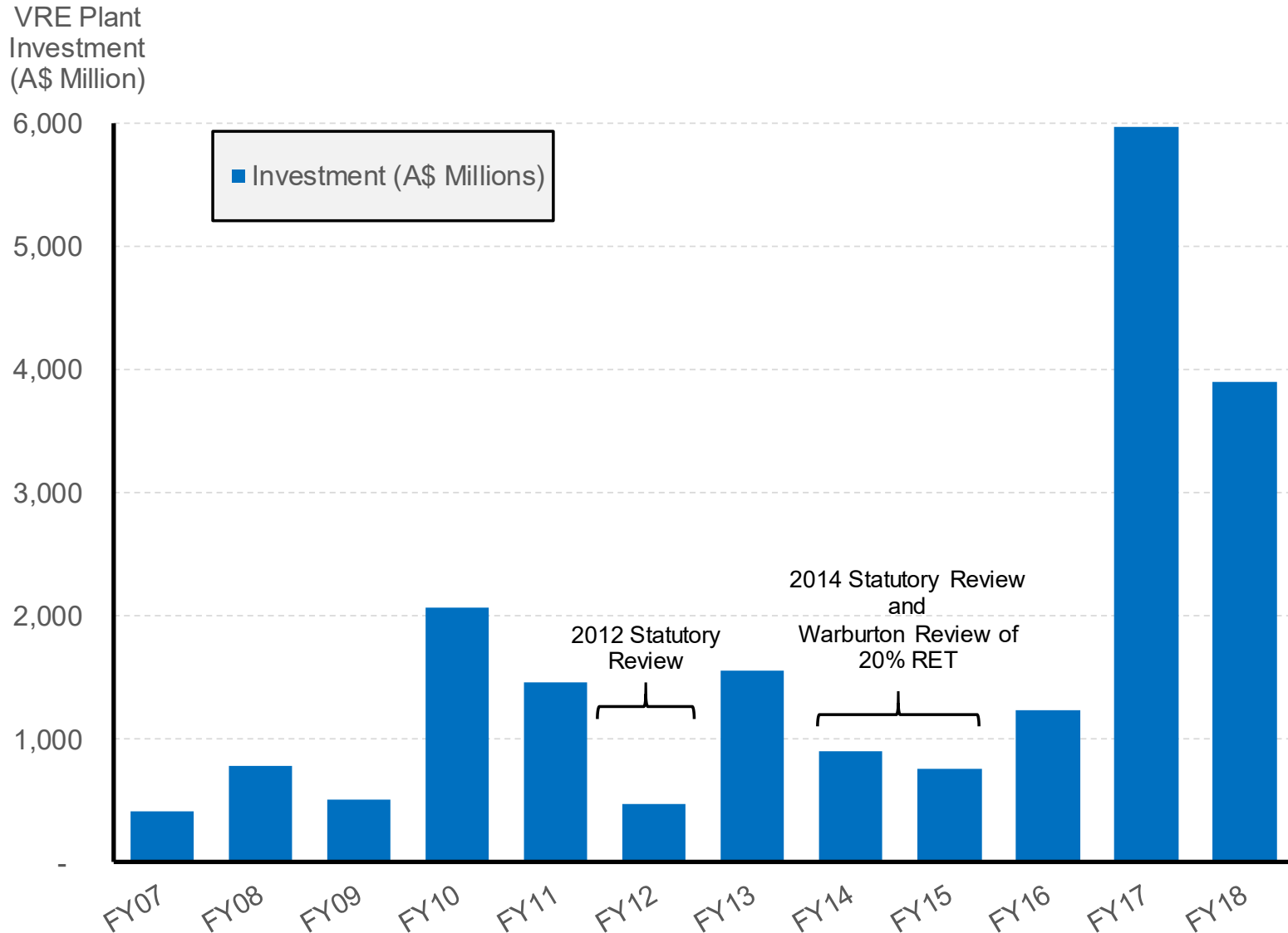
Contraction in gas generation



Sequence (reverse gear)

1. Missing money compounds
2. Maintenance cutbacks
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4. Just as LNG exports commence
5. Creating gas shortages
6. Causing a gas price shock
7. Gas generators reduce output (had pre-sold fuel at #1)

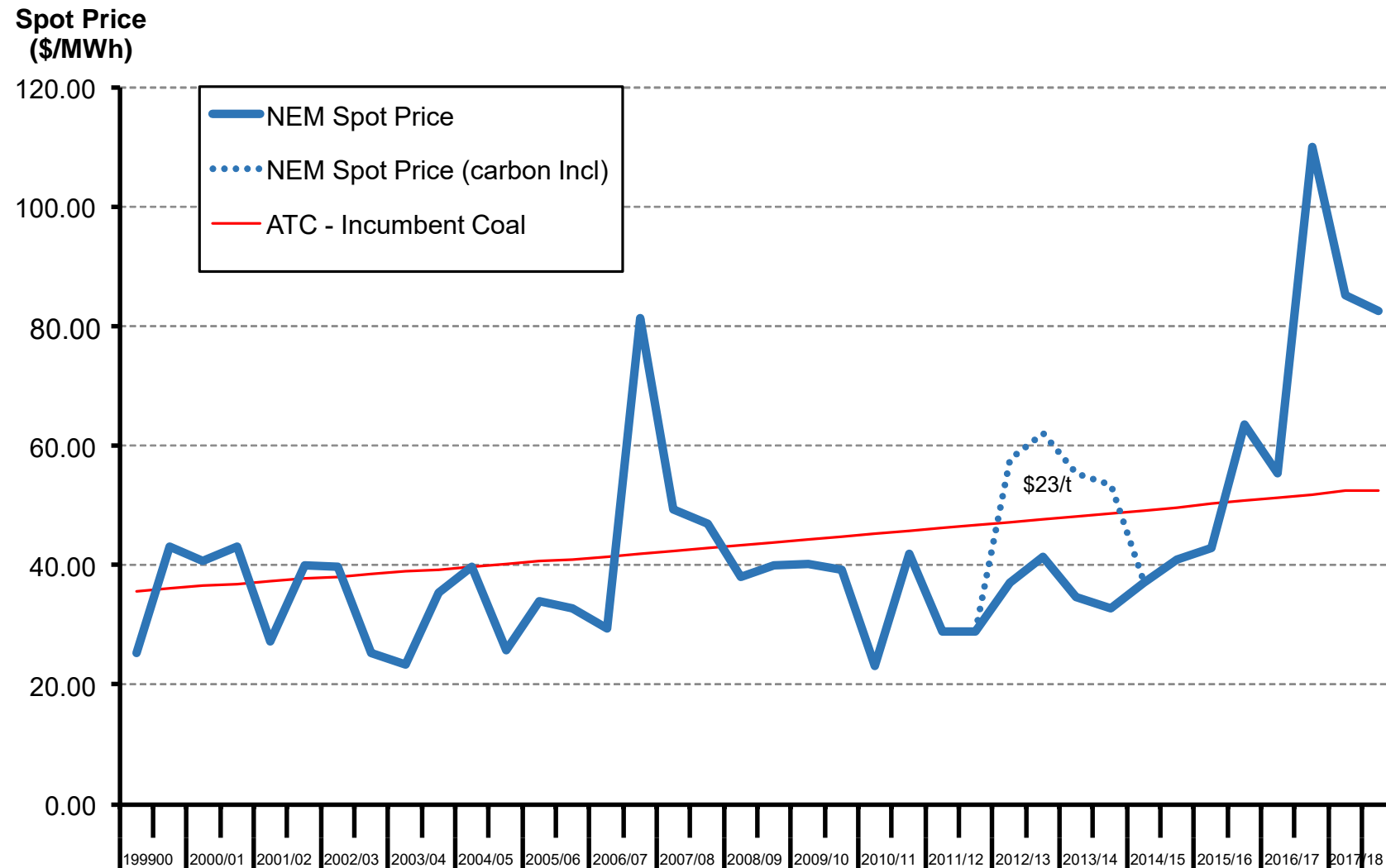
Renewable entry lags (policy uncertainty)



Sequence (reverse gear)

1. Missing money compounds
2. Maintenance cutbacks
3. Sudden coincident coal plant exits
4. Just as LNG exports commence
5. Creating gas shortages
6. Causing a gas price shock
7. Gas generators reduce output (had pre-sold fuel at #1)
8. Policy uncertainty (at #1) delayed RE entry

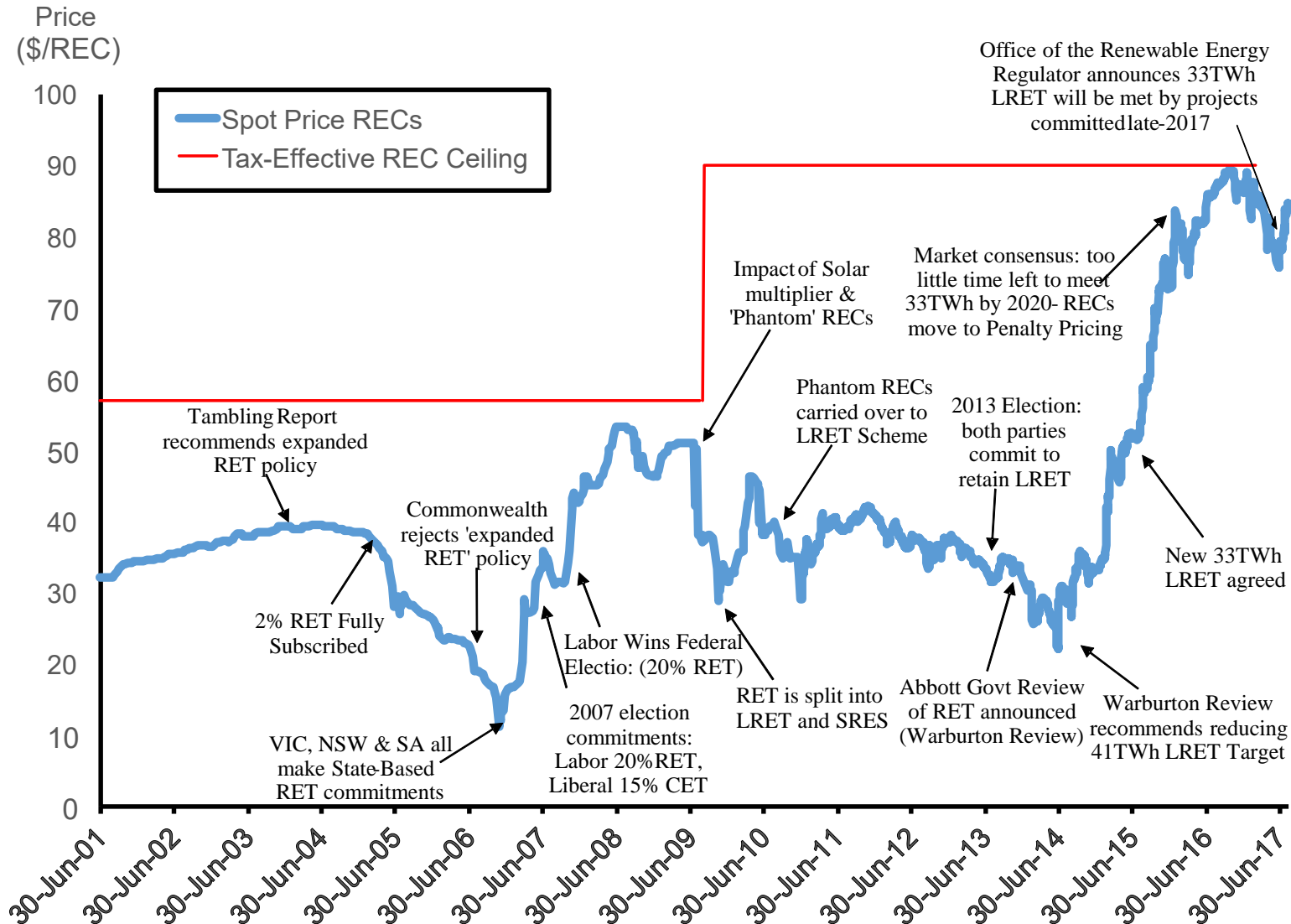
Coal exit + gas contraction + RE entry lags = high spot prices



Sequence (reverse gear)

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2. Maintenance cutbacks
3. Sudden coincident coal plant exits
4. Just as LNG exports commence
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6. Causing a gas price shock
7. Gas generators reduce output (had pre-sold fuel at #1)
8. Policy uncertainty (at #1) delayed RE entry
9. Coal exit, gas shortages & RE entry lags cause spot prices to surge

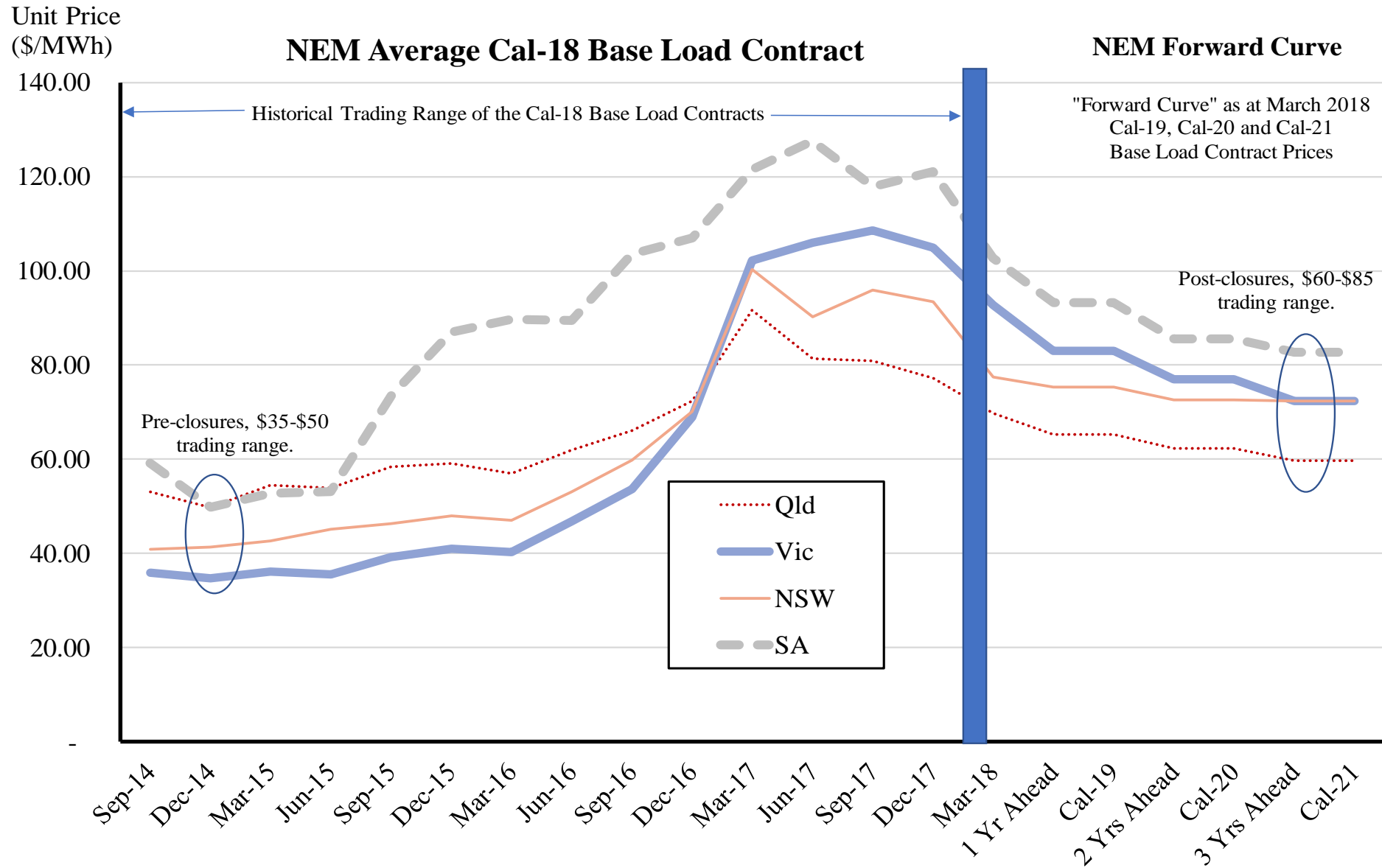
With coincident LGC prices rise (so much for equilibrium theory)



Sequence (reverse gear)

1. Missing money compounds
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6. Causing a gas price shock
7. Gas generators reduce output (had pre-sold fuel at #1)
8. Policy uncertainty (at #1) delayed RE entry
9. Exit, gas shortages and RE entry lags cause spot prices to surge
10. RE entry lags causes coincident RE Certificate price surge

Supply responded and so prices will fall...



Conclusion

- The NEM's wholesale market was the centrepiece of the energy industry reforms of the 1990s.
- Has delivered consistent economic and technical performance for two decades
- Problems that emerged:
 - Disconnect between energy policy and climate change policy
 - Excess (i.e. uncoordinated) coal plant exit with little warning
 - Excess LNG plant entry
 - VRE entry lags (i.e. policy reviews)

Conclusion

- How could this have been averted *with the benefit of hindsight*?
 1. Transparency around plant exit, and a policy mechanism to manage the pace of specific plant closures if market failure is predictable (vis-à-vis entry lags)
 2. Closer link between energy policy and climate change policy
 3. Link LNG capacity approvals to export 2P reserves
 4. Substantial revision of regulation, 6 second, 60 second and 5 minute FCAS volumes (increase & localise vs minimise and global)

Simshauser, P. 2018, “Missing money, missing policy and resource adequacy in Australia’s National Electricity Market”, EPRG Working Paper 1821, University of Cambridge.

Available at <https://www.eprg.group.cam.ac.uk/>