

# What can we learn from the crises in the Australian and Texan Energy Markets?

CEPA London

22 September 2023



# Overview

- The Australian NEM and Texas ERCOT are two of the most important “energy-only” wholesale electricity markets in the world.
- During a period in 2021-2022 both markets experienced unprecedented crises.
- Is there a fundamental problem with the energy-only market design?
- What were the drivers and causes of these crises in each case?
- What are the lessons for energy-only wholesale electricity markets in the future?



# Texan and Australian Electricity Markets

## Texas: ERCOT

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- Energy-only wholesale spot market with Locational Marginal Pricing (about 4000 pricing nodes)
  - Five-minute dispatch interval. Major reform in 2010 introduced LMP and 5 min dispatch (down from 15 min).
  - Price Cap USD 9000 (approx. 14000 AUD) at the time, lowered to USD 5000 in December 2021.
  - Limited interconnection with the rest of the US.
  - Competitive retail sector.
  - Peak demand: 70 GW (February 2021, subsequently exceeded in August 2023)
  - Fuel Mix: Gas 46%, Wind 23%, Coal 18%, Nuclear 11%, Solar 2%
  - Texas population: 30 million

## Australia: NEM (National Electricity Market)

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- Energy-only wholesale spot market with regional pricing (five pricing regions).
  - Five minute dispatch interval (30 minute averaging dropped in 2021).
  - Price Cap around 15,000 AUD
  - No interconnection with West Australia or Northern Territory power systems, but moderate interconnection between pricing regions.
  - Competitive retail sector.
  - Peak demand: 35.6 GW (January 2023)
  - Fuel Mix: Coal 56%, Gas 9%, Wind 13%, Hydro 11%, Solar 10%, Biomass 1%
  - Population covered by the NEM: 22.7 million

# Why study the Texas and Australian crises?

- Around the world, wholesale electricity markets are facing substantial pressure, due to decarbonisation, increasing penetration of renewable generation, electrification of heating and cooking, electric vehicles, smart devices, and so on. There is increasing nervousness about energy-only market designs.
  - In both markets there have been calls to abandon the energy-only market design.
- Is there something fundamentally wrong with energy-only market model? Is there a need to re-think our market design?

WINTER STORM 2021

## “It looked like the end of the world”: Listen to the stories of Texans who lived through 2021’s historic winter storm

One year later, dozens of Texans from around the state shared their unforgettable stories.

BY JACOB OHARA, ASHLEY MIZNAZI AND TODD WISEMAN FEB. 17, 2022 5 A



WINTER STORM 2021

## ERCOT can’t be sued over power grid failures during 2021 winter storm, Texas Supreme Court rules

The all-Republican court narrowly found that the nonprofit corporation operating the state’s electrical grid qualifies for sovereign immunity, which protects government entities from lawsuits.

BY EMILY FOXHALL JUNE 23, 2023 3 PM CENTRAL

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GENERATION & STORAGE, POLICY & REGULATION, RETAIL, TRANSMISSION & DISTRIBUTION — 10 MINS READ

## Timeline to the perfect storm - what caused the 2022 energy crisis?

Australia’s worst energy crisis this century rapidly unfolded. This timeline explores the sequence of local and international events that led to the crisis, to help you get a better understanding of the key events that led to the crisis, to help you get a better understanding of why.

AUG 25 2022

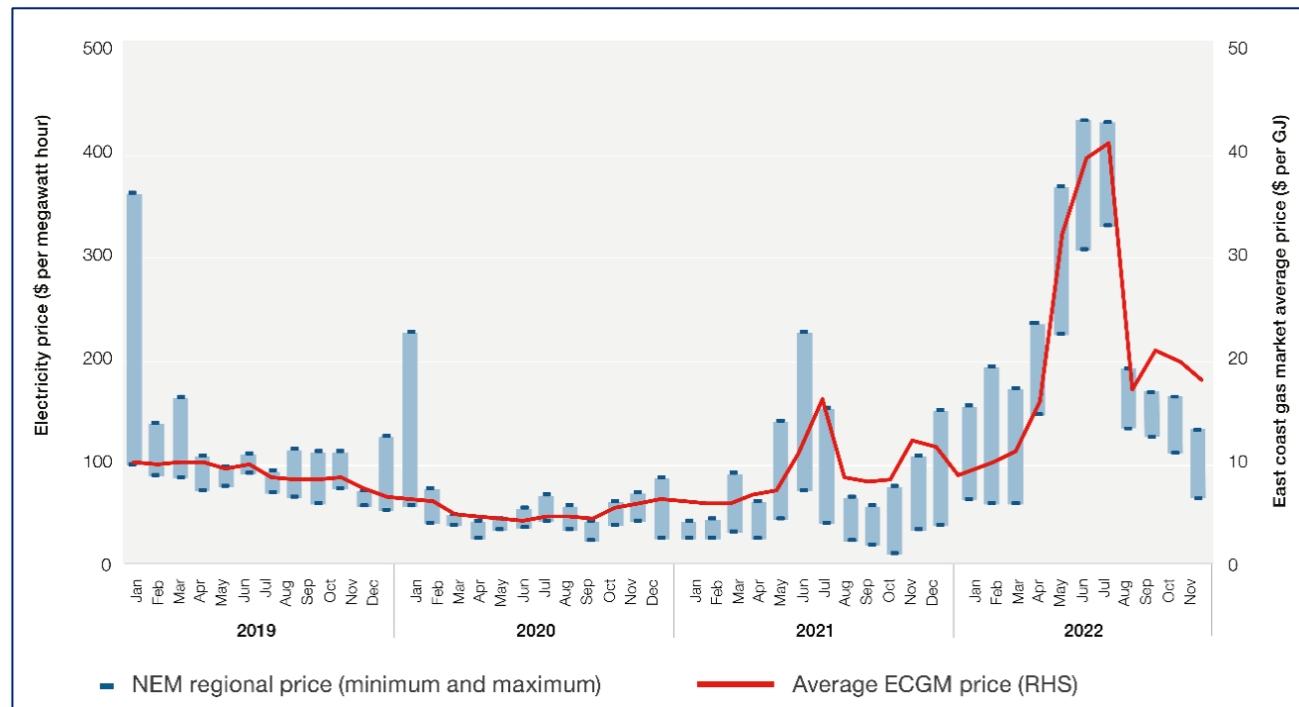
## AEMO Market Suspension Report: Anatomy of a Crisis

On 18 August the Australian Energy Market Operator (AEMO) published its much anticipated statutory **report** on the National Electricity Market (NEM) events in the fortnight between 10 and 24 June 2022. While the terms “crisis” and “unprecedented” are over-used in industry commentary, the scale of the events portrayed by the report most definitely justify them.

The seeds of the crisis were sown with international events months earlier, at the end of the pandemic and the start of the Ukraine war, spiralling into a perfect storm of bad luck by June.

# The crisis in Australia in June 2022

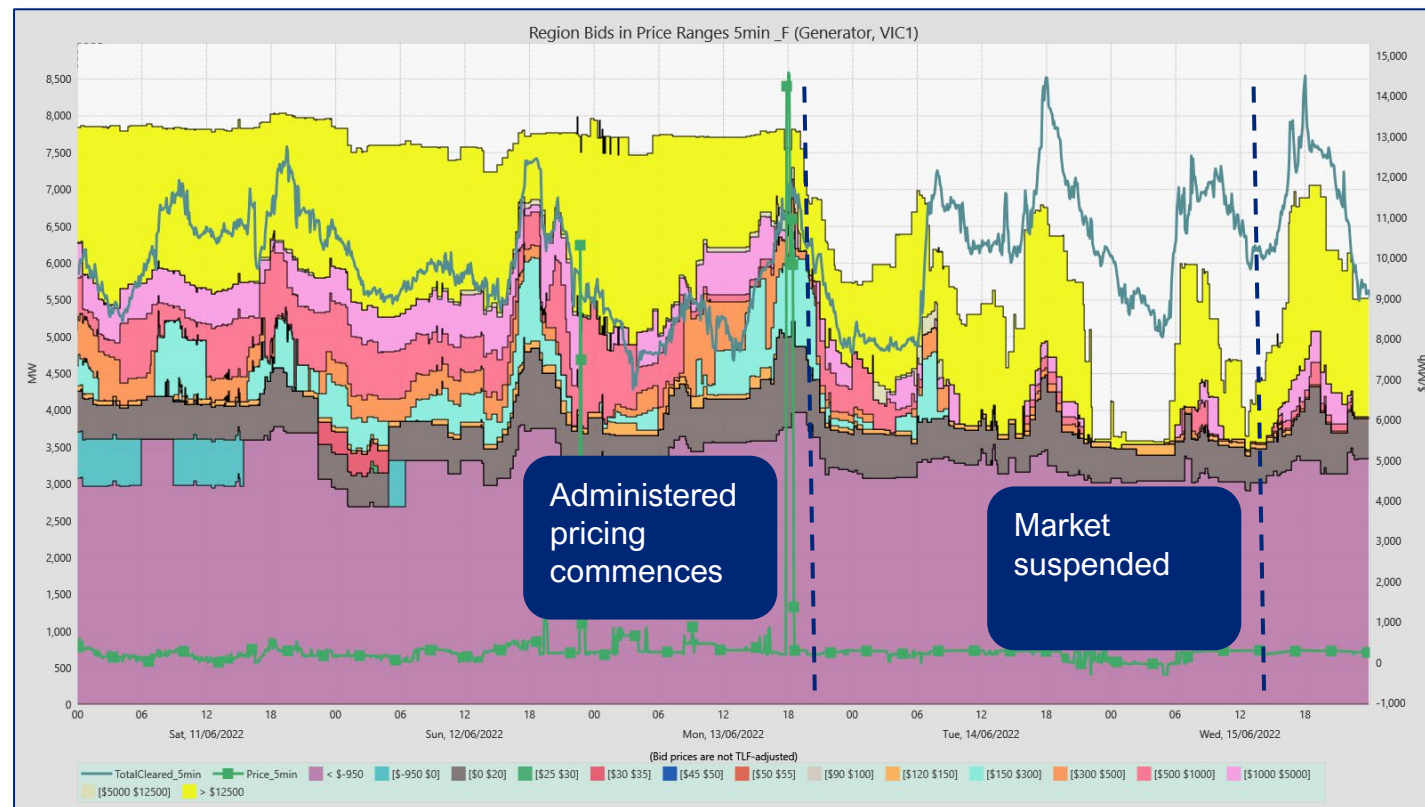
- The Australian NEM is dominated by coal, but gas is the marginal generator; the wholesale gas price has a big impact on the wholesale electricity price.
- Australia is one of the world's largest exporters of LNG, so the domestic gas price is tied to the world LNG price.
- After many years of moderate prices, following the war in Ukraine the world gas price increased rapidly.
- This coincided, in early June, with a cold snap and the outage of some large generating units.
- On 13<sup>th</sup> June 2022, a price cap on a 7-day moving average price known as the Cumulative Price Threshold was triggered.



When this price cap is triggered, the market enters a period of Administered Pricing, when the price cap is set at the Administered Price Cap (APC) which is \$300/MWh.

# The crisis in Australia in June 2022

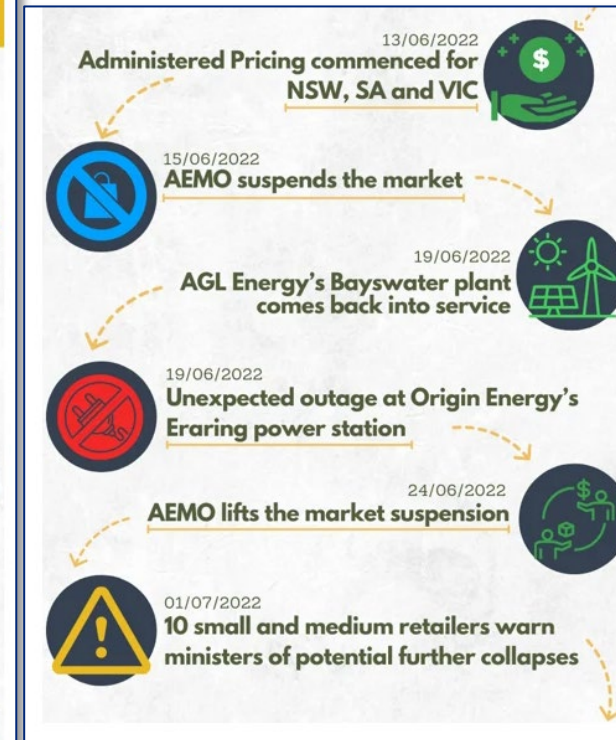
- This cap (\$300/MWh) was below the cost of production for much gas plant (given the high prices for gas).
- There is a mechanism for generators to receive compensation for producing during an Administered Pricing period but this mechanism was untested.
- There is some suggestion that generators preferred to declare themselves unavailable and to be “directed on” by the market operator, which is subject to an established compensation mechanism.
- Whatever the reason, once the APC was triggered many generators started withdrawing capacity from the market.



The graph shows the total availability (in different price bands) in one region of the NEM (Victoria). As can be seen, within a few hours of the price cap being triggered nearly half of the available generation had been withdrawn in this region.

# The crisis in Australia in June 2022

- In addition, when the price is capped for long periods storage facilities do not have an incentive to use their resources efficiently – that is when the supply-demand balance is tightest.
- Within a relatively short time AEMO decided to suspend the wholesale market.
- During the period of market suspension AEMO was able to use its power of direction to ensure that sufficient generation was available to meet demand.
  - There was no involuntary load shedding during the crisis.
- After seven days, normal market operation was restored.
- The period of high wholesale prices did bring about the collapse of a few smaller retailers.



# Fallout from the Australian crisis

- The crisis had no immediate impact on electricity consumers, but there is a sense that this was primarily due to luck and that we “dodged a bullet”.
- The Cumulative Price Threshold was subsequently raised from \$300/MWh to \$600/MWh.
- Episodes like this tend to undermine confidence in, and support for, the wholesale electricity market.
- In Australia there have been calls to renationalise the electricity market, as well as on-going work to introduce a “capacity market”.



**The national electricity market is a failed 1990s experiment. It's time the grid returned to public hands**

Published: June 22, 2022 5:55am AEST

Dean Lewins/AAP

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A crisis, as the saying has it, combines danger and opportunity. The dangers of the current electricity crisis are obvious. The opportunity it presents is to end to the failed experiment of the national electricity market.

Having suspended the market last week, the Australian Energy Market Operator



674 JOURNAL OF MODERN POWER SYSTEMS AND CLEAN ENERGY, VOL. 11, NO. 2, March 2023

**Suspension of Australian National Electricity Market in 2022 Necessitates Mechanism Evolution Ensuring Power Supply Security**

Zhenfei Tan, Hua Geng, Xiaoyuan Xu, Sijie Chen, and Zheng Yan

*Abstract*—The National Electricity Market (NEM) in Australia was suspended during June 15-23, 2022, with a primary attribution to the lack of available generation capacity. This inci-

and analyze its causes and effects. Three factors, namely the incompatibility between the market and the administration, inadequate energy supply due to fuel shortage, and lack of the incoming supply selection, and ward se-



**Capacity Investment Scheme to power Australian energy market transformation**

8 December 2022

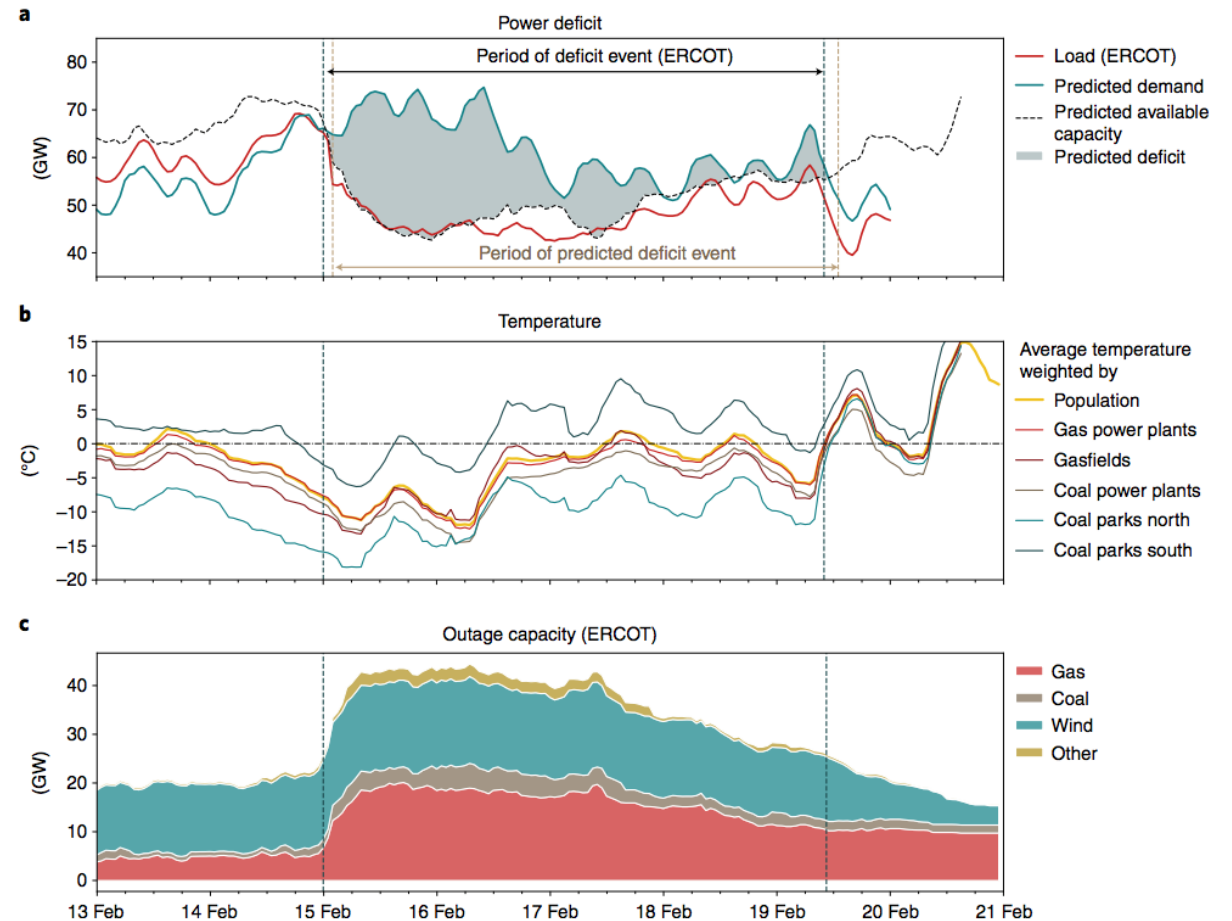
The Albanese Government today received endorsement from State and Territory Energy Ministers to establish a Capacity Investment Scheme (CIS).

The Capacity Investment Scheme will provide the national framework needed to drive new renewable dispatchable capacity and ensure reliability in Australia's rapidly changing energy market over the next decade and beyond.



# The crisis in Texas in February 2021

- In February 2021 Texas was hit with an intense winter storm.
  - The temperature at Dallas/Fort Worth airport reached -19 Celsius, the lowest temperature in north Texas in 72 years.
  - Demand for electricity hit a new record high of 69.6 GW on February 14.
- At the same time, due to the extreme cold, a large amount of generation went off-line.
  - At the peak 51 GW of generation capacity was off-line, with about half of that due to “weather-related factors” and a quarter due to “fuel limitation” issues, related to outages on the natural gas pipeline network.
- This resulted in a period of 77 consecutive hours of involuntary load shedding.



# The crisis in Texas in February 2021

- Many customers experienced prolonged periods without power at a time when temperatures were at record low levels.
  - This caused widespread hardship. The crisis has been implicated in hundreds of deaths.
- The economic harm from the event was substantial. We can do very rough back-of-the-envelope calculations (assuming VoLL of about USD 25,000/MWh) and we find an economic harm in the region of \$20 billion.

“The excess costs incurred as a result of the storm on the power grid alone would have funded a fleet of brand-new natural gas-fired generators sufficient to meet the entire peak demand of the ERCOT system by itself. That’s right—ERCOT could have achieved well over a 100 percent reserve margin for the same cost that this storm imposed on its system.”

June 11, 2021 ARTICLES

## Power Failure by Design: The Texas Energy Market

Winter Storm Uri exposed what had remained relatively obscure until a black swan event arrived on the scene: fundamental structural flaws in the Texas electric market.

By T. Lynn Allen

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# The crisis in Texas in February 2021

- Several retailers were forced into bankruptcy.
- The market price cap was subsequently lowered from \$9000/MWh to \$5000/MWh.
- Wholesale-pass-through retail contracts were subsequently banned.

OPINION

## Don't kill the variable rate electricity plan. It can help keep the grid reliable.

Retail electric providers must add a price cap to protect customers from extreme wholesale prices.

By Michael Lee  
1:30 AM on Mar 3, 2021 CST

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*This op-ed is part of a series published by The Dallas Morning News Opinion section to explore ideas and policies for strengthening electric reliability. Find the full series here: [Keeping the Lights On](#).*

Consumers should never be subject to astronomical energy bills.

COMMUNITY  
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MONEYWATCH >

## Texas electricity company Griddy declares bankruptcy as winter storm fallout continues

**MONEY WATCH** BY KRISTOPHER J. BROOKS  
MARCH 15, 2021 / 5:27 PM / MONEYWATCH

[f](#) [t](#) [m](#)

WINTER STORM 2021

## Texas puts final estimate of winter storm death toll at 246

Officials added 36 to the estimate of lives lost in the disaster, which knocked out power in much of the state. Some experts place the toll even higher.

BY PATRICK SVITEK JAN. 2, 2022 UPDATED: JAN. 3, 2022 [SHARE](#) [REPUBLIC](#)



Companies Energy Extreme weather [Print article](#)

## Texas power co-op files for bankruptcy as storm fallout mounts

Justin Jacobs and Gregory Meyer

Updated Mar 2, 2021 - 4:14pm, first published at 4:11pm

Washington/New York | Texas's largest co-operative power generator filed for bankruptcy protection on Monday as the financial fallout from a winter storm that plunged millions into darkness and sent wholesale electricity prices soaring.

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TEXAS LEGISLATURE 2021

## Sweeping legislation to overhaul state's electricity market in response to winter storm heads to Texas House after Senate's unanimous approval

Senate Bill 3 would require all power generators, transmission lines, natural gas facilities and pipelines to make upgrades for extreme weather. Its prospects are uncertain in the House, which is scheduled to take up a series of related, standalone bills on Tuesday.

BY SHAWN MULCAHY AND ERIN DOUGLAS MARCH 29, 2021 UPDATED: 7 PM CENTRAL [SHARE](#) [REPUBLIC](#)

# What was the root cause?

- The proximate cause of the crisis was the extreme cold. But power systems in the northern US routinely experience similar winter storms without outages.
- Other power systems invest in hardening or resilience against extreme cold, known as “winterization”, but those investments did not occur in Texas.
- In Texas similar events occur approximately one in ten years – this was not entirely unforeseeable.
- In our paper we propose that the failure to invest in winterization was a rational response given the price cap.
  - There is not enough rent available in extreme events to justify protective investment.

WINTER STORM 2021

## “Power companies get exactly what they want”: How Texas repeatedly failed to protect its power grid against extreme weather

Texas regulators and lawmakers knew about the grid’s vulnerabilities for years, but time and again they furthered the interests of large electricity providers.

BY J  
FEB. 2

### Texas power crisis revealed flaw in market’s design ↗

By [James Dean](#)

February 8, 2022

Blog » February 25, 2021

### Winter weather in Texas and the importance of infrastructure resilience investment

Texas is reeling from the impacts of a sustained, record-breaking cold weather event for the second time in about a decade. It’s the latest example of the impacts of climate change striking here and now. And with that, comes the need to develop resilience measures to lessen impacts from future events that could be even more severe.

In recent years, we’ve seen increased frequency and intensity of potentially climate-related events like polar vortex storms in Texas, wildfires in California, hurricanes on the Atlantic and Gulf coasts, and heat waves and droughts in the Southwest. In addition to addressing the causes of these events (mitigating carbon emissions), it is necessary to prevent and prepare for the future impact of these events (adaptation and resilience).

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# Comparison of the two crises

- In summary, we suggest that both crises are, at root, driven by the effect of price caps...

	Australian NEM	Texas ERCOT
Role of price caps...	Large drop in the price cap at a time of very high input fuel prices induced the withdrawal of large volumes of generation capacity.	Exceptional winter storm increased demand to record levels and reduced availability, increasing the spot price to the price cap and forcing large volumes of involuntary load shedding.
Elimination of price caps would...	Elimination of the CPT and the APC would have allowed the market to clear, eliminating the need for the suspension...	Elimination or a significant increase in the wholesale price cap would have allowed electricity and gas producers to recover the cost of winterization investments during winter storm events without load shedding.

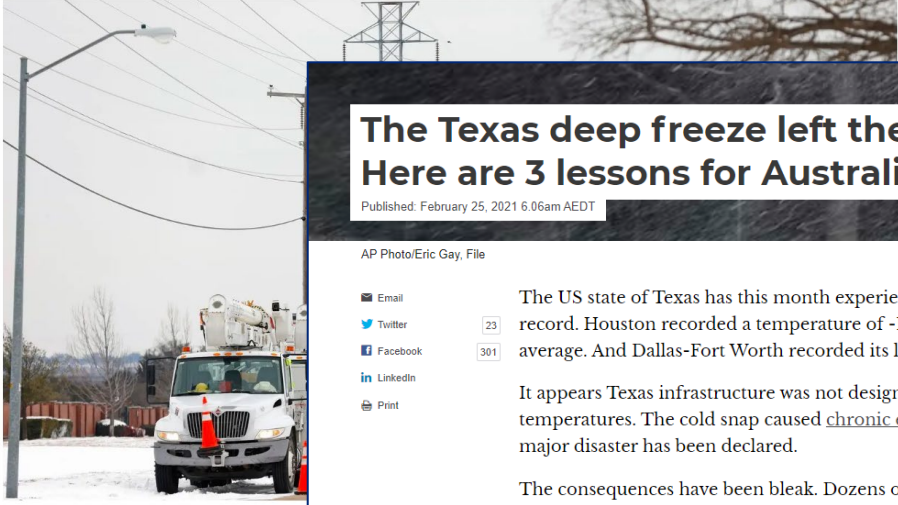
# What are the lessons?

- What lessons can we learn from these events?
  - Crises seem to be an opportunity for stakeholders to advance their agenda (e.g., more gas, less renewables, etc.).
- Price caps are a threat to wholesale electricity markets. They should be reconsidered. There seems to be several myths:
  - Price caps do not affect average wholesale prices; Price caps are not required to mitigate market power; With smart meters and demand response price caps are likely not needed at all.
- Supply-chain linkages across electricity and gas need to be examined – and possibly subject to regulatory scrutiny...
- More effort should be put into ensuring that demand is responsive to wholesale prices.
- More sophisticated retail contracts would insulate customers from spot prices while ensuring they have an incentive to respond.

US POLITICS

## What can Australia learn from the energy crisis in Texas?

24 February 2021



### The Texas deep freeze left the state in crisis. Here are 3 lessons for Australia

Published: February 25, 2021 6:06am AEDT

AP Photo/Eric Gay, File

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The US state of Texas has this month experienced some of its coldest weather on record. Houston recorded a temperature of -10.6°C, which is around 20°C below average. And Dallas-Fort Worth recorded its lowest-ever temperature of -18.9°C.

It appears Texas infrastructure was not designed to deal with such extreme low temperatures. The cold snap caused [chronic electricity and water shortages](#), and a major disaster has been declared.

The consequences have been bleak. Dozens of people [have died](#) and others, especially the vulnerable, have been [left shivering](#) in their homes.

Australia does not generally experience such cold winter temperatures. Yet our electricity systems are also vulnerable to climate change, extreme weather and power outages. So, there are valuable lessons to be learned from the Texan disaster.

— Opinion

## Four lessons from an energy crisis we could have avoided

Without a stable energy system that includes gas, the mandate for a green transition could be lost.

Robert Wheals

# Conclusion

- Texas and Australia are two of the leading examples of energy-only wholesale markets in the world. These crises have undermined confidence in the effectiveness of energy-only markets and are worth examining more closely.
- These two crises were different in their immediate causes and their effects on consumers.
- Texas crisis was driven by a winter storm which forced much generation offline, tightening the supply-demand balance.
- The Australian crisis was driven by a run-up in input fuel costs which triggered a cap on cumulative prices.
- Both crises can be viewed as an example of the failure of price caps.
  - In the case of Australia, the triggering of a low price cap put at risk the ability of generators to earn a normal return, causing them to withdraw capacity from the market.
  - In the case of Texas, the price cap reduced the return from investments in protecting the power system from extreme cold events, so those investments were not made. When an extreme cold event occurred much generation was forced offline.
- Rather than implementing capacity markets, in my view it is preferable to reinforce the market fundamentals – allow prices to rise to clear the market and ensure that wholesale demand is price-responsive.

## Further Reading:

- Biggar, D. R. and M. R. Hesamzadeh, 2023, “Crises in Texas and Australia: Are there lessons for the design of energy-only markets?”, currently “revise and resubmit” with *Energy Policy*



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## Crises in Texas and Australia: Are there lessons for the design of energy-only markets?

Darryl Biggar and Mohammad Hesamzadeh

Revised, July 2023

### Abstract

The Australian National Electricity Market (NEM) and the Texas wholesale electricity market (ERCOT) are two of the most prominent examples of energy-only wholesale electricity markets in the world. In early 2021 and mid 2022 these markets suffered from unprecedented crises, prompting some commentators to question the energy-only market design. Both markets are now considering implementing a form of capacity mechanism. Are these crises evidence of a fundamental flaw in the energy-only market design, or something else? We argue that, although the crises were very different in form, the root cause of both can be traced to the operation of price caps in the wholesale market. **We show that setting a price cap too low reduces incentives for investment in hardening generation against extreme weather events.** Rather than further lowering the price caps – as was done in Texas – we propose a range of reforms to strengthen and enhance the confidence in the wholesale market.

### 1 Introduction

The Australian National Electricity Market (NEM) and the Electricity Reliability Council of Texas (ERCOT) are two of the most well-known energy-only **wholesale electricity** markets in the world.<sup>1</sup> These markets are broadly similar in both annual generation and peak demand. Both have a deregulated retail sector, with retailers competing to supply end-customers.

In early 2021 and mid 2022 the Australian and Texas markets suffered unprecedented crises. The fallout from these episodes is continuing. In Texas the

<sup>1</sup>The other energy-only **electricity** markets are the New Zealand Electricity Market (NZEM), the Singapore Wholesale Electricity Market (SWEM), and the Alberta Electric System Operator (AESO) in Canada.

