Electrification of Industrial Heat: An Emerging Gap in Electricity and Gas Planning

Aratherm Input to the Australian Energy Market Commission Integrated System Plan (ISP) Review

Aratherm Services Pty Ltd

ACN 678 820 909

Public submission

aratherm

Version Control

Document approval		Date
Authors		
Review		
Approval	Mark Pickering	2 Sep 2026

Version	Changes	Date

Related Documents	Date

Acknowledgements

Acknowledgement of Country

In the spirit of reconciliation Aratherm acknowledges the Traditional Custodians of Country throughout Australia and their connections to land, sea and community. We pay our respects to Elders past and present and extend that respect to all Aboriginal and Torres Strait Islander peoples today.

Acknowledgement of Support

Aratherm acknowledges the financial support of the ACT Energy Innovation Fund to enable the preparation of this report.

Disclaimer

Contents

1 Introduction 1

2 Industrial Heat Electrification is Potentially NEM-Scale 1

3 Electrified Industrial Heat is not Conventional Load 2

4 Commercial and Industrial Rooftop Solar Reinforces the Opportunity 2

5 The Planning Interaction Occurs Primarily Within Distribution Networks 3

6 The Opportunity is Network Utilisation, not Simply Electrification 4

7 Implications for the ISP Straw Persons 4

7.1 SP1 and SP2 4

7.2 SP3 4

7.3 SP4 5

7.4 SP5 5

8 Recommendations 5

1 Introduction

The Australian Energy Market Commission (AEMC) is reviewing the rules for the Integrated System Plan (ISP) framework. AEMC published a Discussion Paper on 23 July 2026 describing five Straw Persons (SPs) and calling for submissions.

Aratherm Services is a project developer focussed on the electrification of industrial heat, particularly hybrid gas-electric technologies such as electric thermal energy storage systems, also known as heat batteries.

Australia's industrial heat market is almost the same size as the National Electricity Market.

The most comprehensive assessment of Australian industrial process heat, prepared by ITP Thermal for CSIRO, estimates approximately 674 PJ/year of useful industrial heat demand, equivalent to approximately **187 TWh/year of end-use heat energy**.[1] Gas accounts for about 53% of the input energy, coal for 21% and other hydrocarbons for 8%. Just **3% is electrified**.

By comparison, the **National Electricity Market** currently supplies around **200 TWh/year of electricity**. Industrial heat therefore represents one of Australia's largest remaining energy sectors yet to be incorporated into electricity system planning.

The ISP review has appropriately focused on transmission, consumer energy resources, demand-side participation and the interaction between electricity and gas systems. However, it has placed little attention on one of the largest prospective sources of future flexible demand: electrified industrial heat. Aratherm's submission therefore considers a single question:

How should the ISP plan for a future in which a substantial proportion of Australia's industrial heat demand becomes flexible electricity demand?

2 Industrial Heat Electrification is Potentially NEM-Scale

Industrial heat electrification is often discussed as a niche decarbonisation issue. It is much more than this.

If one-third of existing industrial heat demand were electrified by 2050, the resulting electricity supply requirement could be of the order of **60-70 TWh/year**. If two-thirds were electrified, the resulting requirement could be in the region of **120-140 TWh/year**, depending on technology mix and conversion efficiency assumptions. For context, 70 TWh represents approximately one-third of current NEM electricity consumption. 140 TWh approaches two-thirds of current NEM consumption. These volumes are comparable to other major structural changes already considered in ISP modelling.

[1] Available at https://itpthermal.com/wp-content/uploads/2025/04/itpproccess-heat-report_final08042025.pdf

The planning question is therefore not whether industrial heat electrification matters. The question is whether current planning frameworks represent it correctly?

3 Electrified Industrial Heat is not Conventional Load

Current electricity planning largely conceptualises **flexibility** as the movement of electricity consumption across time. This is appropriate for many forms of demand response such as electric vehicle charging, grid-connected battery energy storage systems and consumer energy resources.

Industrial thermal storage introduces an additional dimension. A hybrid gas-electric thermal storage system dispatched on a price-sensitive basis can:

- **avoid consumption during peak periods** by limiting consumption to low-price periods and storing the energy as heat;
- **absorb excess renewable generation** and thereby reduce curtailment;
- shift electricity consumption **between hours in the day** by utilizing relatively cheap materials to store heat for many hours;
- shift electricity consumption **between seasons** by flexing the gas-electricity mix over the year depending on electricity spot prices relative to gas prices; and
- critically, shift energy supply **between the electricity and gas systems**.

Conventional demand flexibility adjusts the time of day when electricity is consumed. Hybrid thermal storage allows industrial heat to adjust whether it is supplied from the electricity or the gas system. This distinction matters.

Underlying industrial heat demand remains firm.

The energy source becomes flexible.

Existing demand-side frameworks largely recognise temporal flexibility. They do not recognise this form of cross-sector flexibility.

4 Commercial and Industrial Rooftop Solar Reinforces the Opportunity

Recent Commonwealth policy support for commercial and industrial rooftop solar highlights another emerging interaction.

Industry commentators have suggested that commercial, industrial and agricultural rooftops may support more than 80 GW of solar PV capacity – capable of producing 100 to 140 TWh per year.[2] While deployment outcomes remain uncertain it is clear that future distributed generation could be substantial.

[2] https://theenergy.co/articles/bowen-shares-rooftop-solar-spoils-with-industry

There is a neat symmetry with industrial heat electrification plausibly accounting for 70-140 TWh/year of flexible electricity demand by 2050.

These developments should not be considered independently. Commercial rooftop solar is frequently discussed as a source of additional supply. Industrial heat electrification is frequently discussed as a source of additional demand.

The possibility that flexible industrial thermal loads could absorb large volumes of distribution-connected renewable generation has received little attention in ISP discussions.

This is particularly relevant because current policy support strongly incentivises rooftop PV deployment without providing corresponding support for behind-the-meter storage solutions. Flexible thermal loads may therefore become an important mechanism for converting distributed solar generation into productive industrial energy use.

5 The Planning Interaction Occurs Primarily Within Distribution Networks

Much of the debate surrounding the ISP has focused on transmission infrastructure.

Future industrial heat electrification is likely to occur predominantly within distribution networks. Consequently, the relationship between annual energy consumption, peak demand, distribution utilisation and transmission augmentation becomes an empirical question that should be tested rather than assumed.

Many electrified heat projects are likely to:

- connect directly to distribution networks;
- incorporate thermal storage;
- utilise flexible connection arrangements; and
- operate behind the meter with embedded PV or locate nearby commercial and industrial rooftop solar from a network perspective.

As a result, annual energy consumption and network capacity requirements will increasingly disconnect. A facility may consume substantial quantities of electricity over a year while contributing relatively little or nothing to system peaks.

This creates an important planning challenge.

The ISP may forecast electricity consumption correctly, while simultaneously overstating the generation, storage, transmission and network infrastructure required to support that consumption.

The key planning challenge is that industrial heat electrification will likely occur at the same time as rapid growth in distribution-connected renewable generation. Government support for commercial and industrial rooftop solar, combined with growing interest in flexible industrial electrification, creates the possibility of a large new energy ecosystem emerging largely within DNSP networks. The ISP presently has limited visibility of how these developments interact. The risk is not that electrification is ignored. The risk is that electrification is included as demand growth while the flexibility that accompanies it is excluded from the analysis.

6 The Opportunity is Network Utilisation, not Simply Electrification

The electricity sector increasingly faces periods characterised by abundant energy but constrained capacity.

The challenge is often not whether sufficient renewable energy exists over the course of a year. The challenge is when and where that energy becomes available.

Industrial thermal storage provides a mechanism for converting surplus renewable generation into useful industrial heat, whilst displacing carbon emissions and extending the life of existing gas resources. It can increase utilisation of existing generation and network infrastructure, reduce curtailment and improve the economics of renewable energy investments. This possibility has been identified repeatedly in industrial heat studies and industry analysis, but remains largely absent from ISP planning frameworks.

The relevant planning question is therefore not simply:

How much additional electricity demand will industrial electrification create?

It is:

How much additional renewable generation, network utilisation and system flexibility can industrial electrification unlock?

7 Implications for the ISP Straw Persons

7.1 SP1 and SP2

SP1 and SP2 largely retain the existing planning framework.

These approaches risk continuing to treat industrial electrification as an exogenous demand forecast rather than a flexible system resource.

Aratherm considers that neither option adequately addresses the planning challenge identified in this submission.

7.2 SP3

SP3 represents a significant improvement.

The broader treatment of demand-side resources and distribution-level considerations provides a foundation for recognising flexible industrial thermal demand.

However, SP3 should explicitly recognise industrial thermal flexibility as a distinct resource class rather than subsuming it within broader categories of demand-side participation or consumer energy resources.

7.3 SP4

SP4 potentially extends actionability beyond transmission.

Aratherm does not consider expansion of actionability to be necessary to address the planning issue identified in this submission.

The immediate challenge is improved modelling and system representation rather than additional investment mandates.

7.4 SP5

SP5 is the only Straw Person that directly engages with the issue raised in our submission.

The Grattan Institute correctly observed that electricity and gas planning continue to operate under largely separate frameworks, despite increasing interaction between the two systems. The same applies to industrial heat.

Future electricity-gas interactions will occur not only through gas-fired power generation but also through industrial facilities capable of switching heat production between electricity and gas.

Existing ISP gas analysis focuses primarily on gas-fired generation. Industrial heat represents a second and potentially much larger source of future electricity-gas interaction. Unlike gas-fired generators, industrial heat consumers already possess gas delivery infrastructure, combustion equipment and thermal demand. As a result, hybrid industrial heat systems may provide a lower-cost source of flexibility than building new gas-fired generation solely to support periods of electricity scarcity.

Aratherm therefore supports further investigation of the integrated planning concepts contemplated by SP5. The key benefit is not gas infrastructure planning itself. The key benefit is the ability to model cross-sector flexibility and determine how industrial heat can contribute to least-cost energy system development.

8 Recommendations

The Commission should ensure that the ISP framework:

1. **Develops integrated electricity, gas and industrial heat modelling under SP5**, explicitly considering the ability of hybrid industrial heat systems to switch between energy sources.
2. **Tests industrial heat electrification scenarios by 2050**, distinguishing firm load from flexible thermal load and assessing the resulting implications for peak demand, renewable utilisation and infrastructure requirements.

3. **Examines industrial flexibility at the distribution level**, including its interaction with distribution-connected renewable generation, network utilisation and future DSOO development.

In Aratherm's view, the principal ISP planning gap is not transmission planning, actionability or governance. It is the absence of a framework capable of representing how large-scale industrial electrification may simultaneously increase electricity demand, reduce gas demand, improve renewable utilisation and increase network utilisation. Addressing these gaps will become increasingly important as Australia's industrial heat sector electrifies over coming decades.

Ends.

Aratherm Services PTY LTD

5 Darambal Street, Aranda ACT 2614

aratherm.com