Heavy Industry Low-carbon Transition CRC
Lot Fourteen, Frome Road
ADELAIDE SA 5000
Email: admin@hiltcrc.com.au
Web: www.hiltcrc.com.au

3/9/2026

Via online submission

Submission to the Australian Energy Market Commission Review of the Integrated System Plan Framework – Discussion Paper (EPR0092)

The Heavy Industry Low-carbon Transition Cooperative Research Centre (HILT CRC) welcomes the opportunity to provide feedback on the Australian Energy Market Commission's (AEMC) Review of the Integrated System Plan (ISP) Framework.

HILT CRC supports the ISP remaining the primary strategic planning mechanism for Australia's future electricity system. However, the ISP framework should evolve in a staged and practical way to better account for the scale, location and characteristics of energy demand associated with heavy industry decarbonisation, and the increasing interdependencies between electricity, natural gas, hydrogen and storage infrastructure.

Industrial decarbonisation is changing the energy-system planning challenge

Heavy industry decarbonisation has the potential to create substantial new electricity demand, alongside hydrogen demand, storage requirements and associated network investment. Importantly, this demand is unlikely to emerge as gradual, linear load growth. Major industrial loads can instead arise as **large, discrete and geographically concentrated increases in demand at scales of hundreds of MW to GW, linked to individual capital investment decisions, infrastructure upgrades and industrial transition pathways**.

This has important implications for energy-system planning. In major industrial regions—including Gladstone, the Hunter Valley, Port Kembla, the Upper Spencer Gulf and Bell Bay—multiple industrial decarbonisation projects may proceed within similar investment timelines, notwithstanding the bespoke nature of the sector. The resulting energy requirements could materially affect transmission investment, gas infrastructure, emerging hydrogen networks, storage requirements and system flexibility.

These issues were highlighted in HILT CRC's submission to AEMO's Draft 2026 ISP and are being examined further through HILT CRC's broader industrial decarbonisation research program. In particular, Research Project 3.007, Unlocking investment in new energy infrastructure for net zero industrial hubs, is examining the energy-system implications and infrastructure requirements associated with decarbonising hard-to-abate sectors including alumina, steel, cement and lime. This research reinforces the importance of representing industrial demand at sufficient geographic and temporal resolution, rather than relying on aggregate load assumptions alone. It is also important to note that AEMO is a HILT CRC partner and a partner in Project 3.007, and we value our collaborative relationship in sharing insights that can inform the evolution of the ISP.

The ISP framework should progressively strengthen its treatment of industrial decarbonisation

HILT CRC recommends that the ISP remain the core national electricity-system planning mechanism, while progressively strengthening its treatment of heavy industry and its interaction with other energy infrastructure.

In particular, the future ISP framework should:

- **better represent large, location-specific industrial loads** and the investment pathways through which they may emerge;
- **improve transparency around industrial demand assumptions**, particularly for major industrial regions and hubs;
- **better incorporate industrial flexibility and demand response**, including the potential contribution of flexible industrial loads to system optimisation;
- **progressively improve co-optimisation across electricity, gas, hydrogen and storage infrastructure** since interactions between these systems are expected to materially affect least-cost planning outcomes; and
- **strengthen mechanisms for identifying and facilitating strategic infrastructure** where timely investment is important to enabling industrial decarbonisation.

These changes need not require the ISP to immediately become a fully integrated whole-of-energy-system planning framework. HILT CRC supports a **progressive approach**, beginning with targeted analysis of major industrial regions and transition pathways where electrification, fuel switching, hydrogen readiness, infrastructure coordination and potential asset-stranding risks are most material. HILT CRC's RP3.007 is demonstrating how these capabilities could be developed to better inform infrastructure planning and investment.

Strawperson 5 warrants deeper investigation

While Strawpersons 3 and 4 are important to the broader evolution of energy-system planning, their emphasis on greater integration of distribution planning is less directly relevant to HILT CRC's focus on heavy industrial decarbonisation.

HILT CRC considers that the potential scale of electricity and gaseous infrastructure required for heavy industry decarbonisation warrants deeper investigation of Strawperson 5 (SP5). In particular, SP5 provides an opportunity to consider how integrated electricity and gas planning could better prepare for options such as industrial fuel switching, hydrogen development, CO_2 pipelines that could be needed for carbon capture, utilisation and storage (CCUS), infrastructure interdependencies and potential asset-stranding risks, without unnecessarily expanding the ISP framework where such integration would not materially improve planning outcomes.

In applying SP5, hydrogen should be recognised for its potential role in producing high-value products, long-duration storage, system flexibility and industrial decarbonisation, while being assessed transparently against alternatives such as batteries, CCUS, demand response, thermal storage and other firming options to ensure least-cost whole-system outcomes. Furthermore, these options are not necessarily mutually exclusive. For example, hydrogen is prospective in some of the CO_2 regeneration options within the CCU framework, which HILT is presently evaluating within the industrial context.

AEMO has acknowledged limitations in the representation of industrial energy demand in the 2026 ISP process and has indicated that it will continue to improve and consult on these assumptions, including through development of the 2027 Inputs, Assumptions and Scenarios Report. HILT CRC welcomes this

direction and looks forward to contributing further evidence. As RP3.007 progresses towards completion in September 2027, HILT CRC expects to be increasingly well placed to inform both improvements to industrial demand modelling and consideration of how a more integrated planning framework could be implemented in practice.

The objective should be an ISP framework that remains focused and practical, while ensuring that major industrial decarbonisation opportunities—and the infrastructure required to enable them—are visible early enough to inform least-cost, timely and coordinated energy-system investment.

We recognise that the SP5 model is ambitious and requires legislative and rule changes. If this is deemed too large an undertaking by the AEMC then insights from Project 3.007 should still be incorporated as much as is practicable, regardless of which ISP model emerges from this review.

Question 1 – The ongoing role of the ISP

HILT CRC strongly supports the continued role of the ISP as Australia's primary strategic energy infrastructure planning mechanism. The ISP delivers substantial value by identifying least-cost development pathways, coordinating investment in transmission, generation and firming, providing investment signals to market participants, and supporting reliability and security outcomes during coal retirement phases.

An additional benefit that is not fully explored in the Discussion Paper is the ISP's potential to support industrial decarbonisation and the development of emerging industrial energy hubs. Heavy industry dominates total energy consumption in several regional nodes across the NEM, and sectors such as alumina/aluminium, iron/steel, cement, lime and chemicals are expected to undergo substantial transformation over coming decades. This transition will involve large-scale electrification, hydrogen production and use, thermal storage, carbon management infrastructure, and close coordination with electricity grid expansion.

The ISP provides a unique opportunity to coordinate these developments with transmission, generation and storage investment. However, current ISP scenarios do not adequately represent the scale, timing and geographic concentration of future industrial loads. HILT CRC recommends that future ISP processes explicitly recognise industrial decarbonisation as a core planning objective and incorporate dedicated industrial load scenarios within the planning framework. Industrial facilities operate on multi-decade capital replacement cycles, often 30 to 50 years, with narrow investment decision windows. If actionable transmission capacity and firming resources are not committed well in advance of these retrofit windows, facilities may need to extend the operating life of existing fossil-fuel infrastructure.

Question 2 – Key Changes in the Environment in Which the ISP Operates

HILT CRC agrees that increasing penetration of distributed energy resources (DER) and consumer energy resources (CER) is changing the nature of system planning. However, alongside DER and CER growth, another significant structural change facing the energy system is the electrification of heavy industry. Industrial electrification will represent a significant growth in centralised demand, particularly at the high-voltage transmission level. These large, concentrated loads differ fundamentally from residential and commercial demand patterns, so must also be considered. Furthermore, they are likely to be introduced as increments of hundreds or Fthousands of MWs linked to major capital investment decisions, rather than as

incremental growth trends. Hence they will require coordinated planning across transmission, firming, hydrogen, gas and industrial storage infrastructure. HILT CRC's RP3.007 is undertaking scenario analysis of plausible transition pathways for key industries in the network that identify representative increments that can be expected particularly for the iron/steel and alumina sectors.

For example, alumina production may begin by partially electrifying calcination, steam generation or heat recovery processes through electric calciners, electric boilers and mechanical vapour recompression (MVR) to recover waste heat. This staged approach can reduce disruption to plant operations, limit upfront capital investment, and allow some use of existing assets before full electrification is pursued. Similarly, large-scale electrolysers, hydrogen-based direct reduced iron facilities and supporting storage systems may be introduced progressively to support the near-continuous operation of heavy industry, with some pathways moving first through natural-gas-based DRI before transitioning to hydrogen.

National and jurisdictional energy planning are complementary when they provide coordinated investment signals and support infrastructure development. However, coordination challenges emerge where transmission, hydrogen, gas and industrial infrastructure are planned independently. Future ISP assessments should therefore explicitly consider industrial electrification that may need to occur within relatively short timeframes, hydrogen production and transport infrastructure, industrial flexibility resources, integrated energy systems, and regional industrial development strategies. These elements will be critical to ensuring the ISP remains resilient under a range of future energy system pathways.

Question 3 – The choice of future comes down to the plan and actionability

HILT CRC agrees that both the plan and the actionability mechanism are critical to the future role of the ISP. The ISP currently provides valuable information for regulated network businesses, but it provides less direct guidance for unregulated investors such as industrial project developers, hydrogen infrastructure providers, industrial energy users and storage developers. These stakeholders increasingly rely on ISP outputs when making investment decisions.

Current ISP modelling largely represents industrial demand through aggregated assumptions rather than detailed process-based modelling. Consequently, industrial stakeholders have limited visibility of how their future energy requirements are represented within the Optimal Development Path (ODP).

HILT CRC recommends publishing industrial hub demand assumptions, improving visibility of industrial flexibility assumptions, strengthening the representation of hydrogen and industrial storage infrastructure, and expanding stakeholder engagement with industrial energy users. Collaboration with relevant HILT CRC research activities, including RP3.007 on energy infrastructure for net-zero industrial hubs, would help ensure that future ISP modelling reflects practical industrial transition pathways and infrastructure investment needs. These improvements would enhance the value of the ISP for a broader set of market participants.

Question 4 – Strawpeople are used to illustrate possible futures

HILT CRC supports Strawperson 5 (SP5) as the preferred future direction because it provides the strongest basis for recognising the increasing interdependence between electricity, hydrogen, natural gas, CO_2, storage and industrial energy infrastructure. This integrated approach is particularly important for heavy

industry, where decarbonisation pathways are unlikely to be delivered through electricity planning alone. Future industrial hubs may require coordinated development of large-scale renewable electricity, firming capacity, hydrogen production and storage, thermal storage, CCUS, transport infrastructure, and transitional natural gas or hydrogen-ready assets. Treating these systems separately risks underestimating the scale, timing and location of infrastructure required to support hard-to-abate sectors such as alumina, iron/steel, cement, lime and chemicals.

Hydrogen should be considered within this broader planning framework where it can provide whole-system value, including as long-duration storage, a source of system flexibility, or an energy carrier for industrial processes that are technically or economically difficult to electrify directly. However, SP5 should not assume that hydrogen will always be the preferred flexibility or storage solution. Its role should be tested transparently against alternative technologies, including batteries, demand response, thermal storage, other firming options and CCUS – all of which are continuing to evolve – and against changing technology cost assumptions. The latest CSIRO GenCost findings indicate that battery technologies continue to reduce in cost, while the future cost trajectory for green hydrogen and electrolysers remains more uncertain. In addition, other hydrogen production technologies are also under development, spanning new types of steam-methane reforming to methane pyrolysis and photo-catalysis. A staged implementation of SP5 should therefore begin with major industrial regions where electricity, gas, hydrogen and storage infrastructure materially interact, supported by transparent regional industrial demand assumptions, dedicated hydrogen and industrial storage scenarios, improved modelling of industrial flexibility, and closer engagement with industrial energy users, infrastructure providers and project developers.

Question 5 – Framework for choosing the future purpose of the ISP

HILT CRC broadly agrees with the Commission's proposed assessment framework for considering the future purpose of the ISP, particularly the focus on whether each option improves the usefulness of the plan, strengthens actionability, and maintains a manageable level of complexity. Applying this framework, HILT CRC considers that Strawperson 5 (SP5) provides the most appropriate long-term direction for the ISP because it better reflects the increasingly integrated nature of Australia's energy transition. SP5 would allow the ISP to consider electricity, gas, hydrogen, storage and industrial energy infrastructure in a more coordinated way where these systems materially interact, rather than treating them as separate planning questions. This is particularly important for heavy industry, where decarbonisation pathways may require large-scale renewable electricity, hydrogen production and storage, thermal energy storage, firming capacity, transitional gas use and new network infrastructure to be developed within aligned investment windows.

HILT CRC recognises that SP5 would introduce additional modelling, governance and implementation complexity. However, these risks can be managed through a staged and targeted approach. HILT recommends consideration of the use of scenarios that consider plausible industrial decarbonisation pathways to evaluate prospective needs for electrical grids. In the near term, the ISP framework could prioritise major industrial hubs and regions where electricity, hydrogen, gas and storage infrastructure are most likely to interact and where infrastructure decisions could materially affect least-cost outcomes. This would allow AEMO and market bodies to develop modelling capability, data transparency and stakeholder engagement processes progressively. In applying SP5, the framework should also test hydrogen assumptions carefully against alternative flexibility and storage options, including batteries, demand response, thermal energy storage and other firming technologies.

Question 6 – We will consider potential benefits of extending the ISP to gas

HILT CRC supports consideration of extending the ISP framework to include gas infrastructure planning. Heavy industry decarbonisation pathways often involve integrated combinations of natural gas, hydrogen, CCUS and electrification. These pathways are highly interconnected and cannot be assessed effectively through electricity-only modelling. While the 2026 ISP considers natural gas primarily as an electricity firming mechanism and backup fuel, natural gas also has a broader role in some heavy industry decarbonisation pathways. In particular, it may act as a transitional fuel, or as a primary energy source when integrated with CCS, in pathways proposed for sectors such as iron and steel. For this reason, gas infrastructure planning should be considered alongside electricity, where important gases include hydrogen and CO_2 for carbon management infrastructure.

Extending the ISP to gas could improve infrastructure coordination, strengthen assessment of fuel-switching pathways, reduce the risk of stranded assets, support more efficient planning of hydrogen-ready infrastructure, and better integrate industrial decarbonisation pathways. The main risks are increased modelling complexity, additional governance requirements and regulatory coordination challenges.

Nevertheless, HILT CRC considers that the benefits outweigh the risks where gas infrastructure materially interacts with electricity, hydrogen and industrial decarbonisation pathways. HILT CRC therefore supports the progressive development of integrated electricity and gas planning capability, beginning with targeted analysis of major industrial regions and transition pathways where fuel switching, hydrogen readiness and potential asset stranding risks are most significant.

Question 7 – Evidence of material issues with the planning framework and potential solutions

HILT CRC considers that current modelling limitations reduce the credibility and usefulness of the ODP for industrial decarbonisation planning. Current approaches often aggregate industrial demand, simplify industrial energy requirements, do not fully represent industrial flexibility, and inadequately capture interactions between electricity and gas systems including natural gas, hydrogen and CO_2. In particular, assumptions about hydrogen as a flexible load should be tested more rigorously.

More comprehensive modelling could materially improve planning outcomes by forecasting future industrial loads more accurately, identifying transmission requirements earlier, recognising the value and limits of industrial flexibility, and supporting coordinated development of hydrogen infrastructure. HILT CRC recommends that future ISP guidelines require testing of at least one dedicated heavy industrial load scenario and include more explicit representation of industrial energy systems, including process heat, hydrogen production and storage, industrial demand response, and thermal storage.

Question 8 – Evidence of material issues with the delivery framework and potential solutions

Careful planning and coordination are needed to ensure timely infrastructure delivery, owing to the co-dependence on energy demand of industrial users' need for certainty and the need for grid development. Both types of investment operate within narrow approval processes before final investment decisions can be made. HILT CRC's ISP submission highlighted the importance of projects serving major industrial regions, including Gladstone, the Hunter and Bell Bay.

Where transmission infrastructure is delayed, industrial proponents may defer decarbonisation investments, extend the operation of existing fossil-fuel assets, or develop standalone energy solutions that do not optimise overall system outcomes. HILT CRC recommends that the delivery framework provide clearer links between ISP-identified infrastructure needs and actionable delivery pathways for major industrial regions, including stronger coordination between transmission planning, industrial project timelines, renewable energy zones, hydrogen infrastructure and state-based development processes.

Question 9 – Evidence of material issues with the governance arrangements and potential solutions

Transparency and stakeholder engagement are critical to maintaining confidence in the ISP framework. HILT CRC supports continued improvements in data transparency, stakeholder engagement, accessibility of modelling assumptions and governance arrangements. Industrial stakeholders have consistently emphasised the need for access to more granular regional demand and flexibility assumptions.

Current high-level representations do not adequately reflect the realities of industrial decarbonisation pathways and can limit stakeholder confidence in modelling outcomes. HILT CRC recommends greater publication of regional industrial assumptions, dedicated engagement pathways for industrial stakeholders, inclusion of industrial representation within ISP governance processes, and more flexible mechanisms for updating assumptions between ISP cycles.

Question 10 – Other issues for the review

HILT CRC encourages the Commission to consider several additional issues during the next phase of the review. These include the integration of industrial process heat within planning frameworks, representation of industrial thermal storage, valuation of industrial flexibility services, hydrogen network planning, coordination between transmission and industrial infrastructure development, and consideration of supply chain and port infrastructure constraints affecting industrial hubs.

Addressing these issues would strengthen the ISP's ability to support Australia's industrial decarbonisation objectives and ensure the framework remains fit for purpose in a rapidly evolving energy system.

HILT CRC thanks the AEMC for the opportunity to comment on the discussion paper.

If the AEMC would like to discuss any elements further, I can be contacted via ceo@hiltcrc.com.au.

Kind regards,

Jenny Selway
Chief Executive Officer
HILT CRC