# How to control costs in Australia's transmission build out



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## The industry now needs to make these lessons transferable by moving knowledge between projects to foster a consistent, shared approach to cost control that can bend the cost curve at pace.

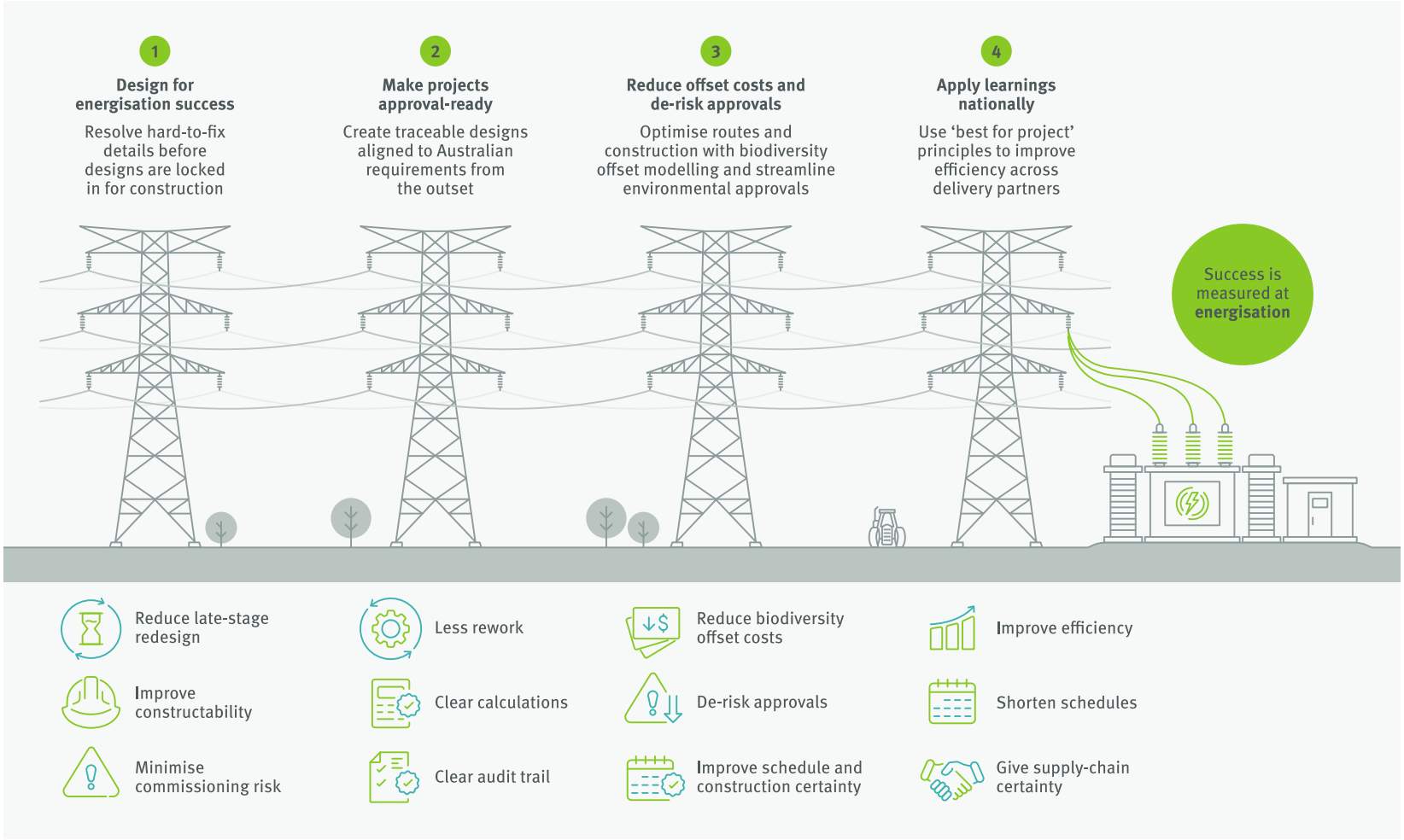
Major energy transmission projects are showing some of the same early cost warning signs seen during Australia's transport megaproject boom. This time, there is still an opportunity to intervene.

As renewable generation connections accelerate, rising capital costs and tighter investor scrutiny mean delivery confidence now hinges on whether constructability, schedule certainty, social licence and cost forecasts stand up to scrutiny. Delays, rework and fragmented delivery no longer stay contained at the project-level but compound across portfolios, pushing out timelines and increasing whole-of-system costs.

Experience across transmission, generation, storage and grid integration — benchmarked against global best practice — points to a consistent lesson: effective cost control starts early and continues throughout delivery.



# Four proven ways to improve cost control in Australia's transmission build out



## 2. Success is measured at energisation, so ‘hard-to-fix’ details need to be resolved early

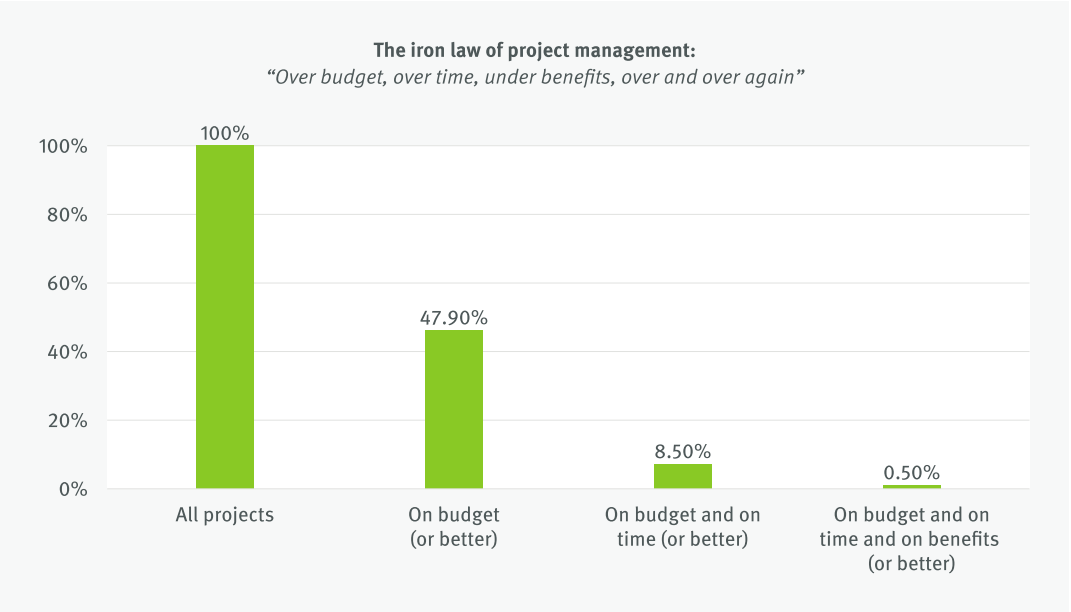
The biggest cost and schedule outcomes are determined at the outset. Rushing front-end decisions to meet design milestones creates risk of delays and cost escalations once projects move into construction and commissioning.

Global research into major infrastructure delivery by Flyvbjerg and Gardner (2023) argues for a ‘plan slow and act fast’ approach.

This means investing time upfront to resolve details that will reduce construction time as well as rework and commissioning risk.

Once procurement starts and costly on-site teams mobilise, this front-end decision-making helps deliver efficiently, to budget and to schedule. Practical approaches project teams can build into early design for constructability and operability, and lower total cost, include:

- **Early alignment of designers and construction teams to reduce on-site labour**
  Constraints must be identified and designed-in early, including access, equipment requirements and site logistics. For example, crane selection can dictate track gradients, tower locations and route alignment. If resolved later, these constraints can force late route redesigns and longer access tracks, increasing on-site hours and cost just as delivery is mobilising.




*Flyvbjerg B., Gardner D. (2023). How Big Things Get Done. Penguin Random House.*

- **Standardised over bespoke designs for construction efficiency and workforce flexibility**
  Reducing bespoke asset designs (such as substations, tower and line infrastructure) creates repeatable ‘assembly line’ construction efficiencies that improve productivity. This also improves the predictability of forecasting on-site labour time and cost, opens access to a wider resource pool from adjacent markets, and allows crews to carry efficiencies from one site to the next.

- **Long-distance logistics-ready design to reduce remote on-site work**
  Australia’s distances and climate variability need logistics-driven design: fewer heavy lifts, weather-resilient construction sequences and modularisation to reduce remote workforce requirements.

- **Design for operability and cutovers to minimise outages and whole-of-program costs**
  As the NEM becomes more interconnected, cutovers are no longer confined to a single operator’s network. Optimising staging, temporary earthing, commissioning and cutover planning avoids extended energisation windows, rework and elevated outage risk. Simpler staging and shorter outage windows reduce whole-of-program cost and reliability risk.



***EnergyConnect:*** *One of Australia’s largest energy transmission projects and first 500 kV transmission line built in over 30 years.*

Case study

## Design flexibility improves constructability and cost efficiency for first Australian Renewable Energy Zone

For the development of Australia's first Renewable Energy Zone with new market participants, it required early design priorities to be right, given the influence on later delivery phases. As a set of design standards hadn't yet been established, initial design work progressed in parallel with procurement, approvals and investor decision gates.

Conservative technical assumptions were adopted to provide certainty and satisfy assurance expectations, but did not always reflect eventual construction methods, access constraints or grid connection staging. As delivery teams mobilised and local conditions became better understood, elements of the design were reassessed and optimised to improve constructability and cost efficiency, highlighting the value in preserving optionality right through delivery.



## 2. Make designs and projects approval-ready and traceable for Australian conditions from the outset

In Australia, design approval gates, approvals pathways, workforce capacity and climate resilience regularly become key drivers of schedule and cost. With approvals, landholder engagement and design often progressing in parallel, teams also need to design for Australian regulatory and design gate expectations, so decisions are approval-ready and traceable from the outset. This reduces churn and avoids 'stop-start' delivery – it also protects investor confidence.

- **Approval-ready design packs with full traceability to reduce rework cycles**
  Align route and staging to the Environmental Protection and Biodiversity (EPBC) Act triggers, biodiversity offsets, cultural heritage constraints and state approval requirements (often alongside federal approvals), recognising rules and requirements can shift over long project timeframes. Talking to regulators from the start helps teams anticipate changes and reduce the risk of needing to resubmit Environmental Impact Statements which can trigger additional rounds of public consultation. In parallel, technical approval gates (including Independent Verification) can become a schedule driver when designs are not supported by the level of detail, justification and traceable calculations expected in the Australian market, leading to iterative review cycles. 'Approval-ready design packs', with clear traceability from impact assessment to mitigation commitments, reduce iterative submissions and the resulting project delays.

- **Workforce and training pipelines to address construction and electrical constraints**
  The transmission pinch point goes beyond civil resources and also encompasses specialist construction crews needed before stringing and commissioning can begin. It also includes specialist skills in high-voltage electrical capability such as line workers and stringing crews, commissioning technicians and HV testing resources that can energise safely and reliably. Planning regional skills pipelines with TAFEs and Original Equipment Manufacturers can help build that capacity early, while training yards and simulators can accelerate competence and safe productivity. The payoff is highly practical with fewer commissioning bottlenecks and less rework at the back end. It also results in a more predictable delivery.

- **Bushfire, heat and flood risk addressed early to reduce re-design and whole-of-life costs**
  Bushfire risk is now a leading community and approvals concern, and network operators are increasingly expecting it to be addressed at the design stage, not after route selection. Factoring bushfire exposure, extreme heat and flood risk into asset siting, easements and construction methodology early can reduce redesign and strengthen social licence. It also contributes to lower whole-of-life costs through fewer outages, less damage exposure and reduced insurance pressure.



***HumeLink East:*** *Expansion of existing Bannaby 500 kV substation and design and construction of a new 500 kV double circuit transmission line.*

Case study

## Avoid re-work with approval-ready and traceable designs from the outset

On one major transmission program, initial civil foundation designs prepared by an external design partner were progressed to meet approval milestones but did not include the level of traceable engineering and documented justification expected by the Independent Certifier and assurance reviewers. Where that evidence trail is incomplete, teams can lean toward conservative assumptions to satisfy project requirements.

In this case, the design proceeded with the adoption of a conservative ‘oversizing’ approach to steel and concrete to reduce uncertainty. However, once construction teams priced the additional materials and installation effort, the cost impact was untenable, resulting in a series of rework cycles. The takeaway is to embed assurance-ready evidence early, so designs can be both approved and optimised without losing flexibility.





## 3. Optimise to avoid unnecessary biodiversity offset costs and environmental approval delays

Biodiversity offsets can materially shape route selection, CapEx, and investor confidence and approval timelines. Teams can avoid redesign, reduce contestability and improve certainty for investors, regulators and communities when offset implications are understood early.

Treating offsets as a strategic design input, with visibility of ground and land values and escalation factors (labour, commodities and land), supports approvals and investment decisions. Analytics and geospatial modelling can significantly reduce offset requirements while at the same time streamlining approvals and reducing project risk.

- **Holistic costing across route options and metrics for design and cost certainty**
  Treat offsets not just as a compliance cost but as macro-benefit levers: faster approvals, improved community acceptance, reduced legal risk and reputational upside. Using digital multi-criteria analysis to compare route and design options across CapEx/OpEx, schedule, biodiversity offsets, cultural heritage, carbon footprint and social license metrics helps optimise design and cost certainty.

- **Set the offset strategy early to manage price escalation and scarcity risk**
  Offset markets can tighten quickly which is why securing pathways, such as like-for-like biodiversity credits or restoration programs, limits price escalation and scarcity risk. Where possible, bundling offsets across a portfolio can lower unit costs and reduce administrative burden.

- **Design for offset minimisation through micro-routing and low-impact construction**
  Reduce triggers while also simplifying mitigation and streamlining approvals by micro-routing around high-value habitats, choosing construction windows that limit impact and using low-impact access methods (such as matting systems).

Case study

## Biodiversity offsets must be treated as a strategic design parameter, not an afterthought

On large, linear transmission infrastructure projects, the approvals and biodiversity offsets cost task is complex given it spans multiple bioregions and has a high degree of landscape variability. At the feasibility stage, forecast costs for biodiversity offsets may be up to hundreds of millions of dollars, having a material impact on CapEx as part of investment approvals.

With the right geospatial analytical tools and digital reporting, the process can be automated to simultaneously assess multiple criteria analysis in order to compare routing and design alternatives that include aspects such as constructability, social impacts and operational requirements – alongside the cost of biodiversity offsets.

Recent modelling shows that a change to alignment may materially reduce offset cost requirements while maintaining the ability to deliver a project efficiently. These analytics can also provide robust avoidance and mitigation scenarios to quantify potential impacts and adjust design and model different options such as long-term maintenance strategies to give more optionality to downstream operators. For example, reducing the initial biodiversity offset cost by devising a vegetation trimming and maintenance program during tower construction and asset operation instead of full vegetation clearing.



## 4. ‘Best for project’ principles and national learnings improve delivery efficiency, shorten schedules and give supply-chain certainty

Transmission delivery is as much a commercial and behavioural challenge as it is a technical one. Incentives that are aligned around shared outcomes encourage teams to surface issues sooner as well as solve problems faster and protect schedule certainty. That makes it more likely cost forecasts will hold and lessons learned can be transferred from one project to the next. A national approach is one way to make collaboration real through transparency and incentives that reward collaboration, reduce duplication, manage sequencing impacts and sustain industry capability:

- **Share project learnings nationally to reduce duplication**
  Create mechanisms to share constructability lessons, environmental avoidance and mitigation approaches, and design evidence that improves delivery certainty and reduces duplication across portfolios. Specification harmonisation also lowers re-engineering overheads, reduces testing and acceptance friction and strengthens supplier competition. Converging around nationally consistent templates for typical substation bays, line structures, relay settings families, cyber standards, and FAT/SAT protocols improves quality and predictability.
- **Standardise and reuse tower testing outcomes to shorten schedules and lower risk**
  Testing often sits on the critical path because facilities must be booked ahead of time and results are project specific. Sharing outcomes nationally and developing an ‘envelope’ of proven tower designs that can be reused across multiple projects would reduce retesting, support modularisation, shorten schedules and lower risk – especially where Australian precedents are limited.
- **System level sequencing and pipeline certainty to retain capability and supply chain**
  AEMO’s Integrated System Plan (ISP) sets out the generation, storage and network investments needed to reach net zero by 2050. With the ISP updated every two years, the question is whether planning is keeping pace with the transition, or whether modelling and prioritisation could be streamlined to refresh sequencing more often. Knock-on effects ripple through portfolios when initial stages are delayed leading to disrupted supply chains and leaving crews without steady work. A clearer, committed pipeline helps retain capability in Australia by keeping teams employed from project to project. Coordinating bulk procurement signals for transformers, reactors, and HV gear can also stabilise OEM pipelines and shorten lead times.
- **Coordinated, state-level oversight to improve efficiency, manage cumulative impacts and support joined-up delivery**
  A single coordinating body can plan and connect multiple transmission and generation and storage projects in a more efficient, cost-effective and reliable network, aligning corridors, land access, environmental approvals and engagement, while taking a holistic view of cumulative impacts and benefits. This coordinated approach supports more effective consultation and better-targeted regional benefits, while supporting timely delivery and minimising disruptions, such as road upgrades and access for oversized vehicles.



Case study

## Avoiding duplication through coordinated packaging

On a large transmission program delivered across a long corridor, the work was packaged geographically to suit delivery and market capacity. A practical learning was that geographic splits can create duplicated effort and diluted buying power, particularly when separate packages approach the same OEMs for equipment, negotiate in parallel or apply different technical preferences.

On programs of this scale, shared ‘best for project’ principles, including community outcomes and whole-of-system cost, and earlier state-level system planning can reduce fragmentation while anticipating cumulative impacts and aligning roads infrastructure needs.
In renewable energy zones, while contracts still drive delivery accountability, coordinated land-use planning and community consultation can further support a joined-up approach.



## What does this mean for cost control on major energy transmission projects?

Australia's energy transition is one of the most significant challenges of our time. To meet this challenge we see optimism as a strategic choice. It's a belief that progress is possible, even in the face of adversity and change.

One of the most important things Australia can do in the face of rising costs in transmission projects is to make sure that lessons across design, construction, environmental mitigation and commerciality are shared more freely between projects.

Applying these lessons between projects and partners will help the industry bend the cost curve at pace, reduce whole-of-system cost pressures and deliver the infrastructure Australia needs for the energy transition.





## About the author

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Industry Director, Transmission & Distribution

Renene is an energy industry leader and technical expert bringing to life some of the largest and ‘first’ energy infrastructure projects in Australia.

With key roles on major transmission infrastructure, such as EnergyConnect, HumeLink and Renewable Energy Zones connecting large scale generation and storage, she helps clients deliver critical projects to strengthen Australia’s energy network and accelerate the energy transition.

She is passionate about using innovations and fostering collaboration locally and globally to deliver megaprojects at the pace and scale that’s needed.

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