From Ground Up:
Stabilisation's Impact on the Renewable Energy Transition

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Designing for Reuse and Resilience

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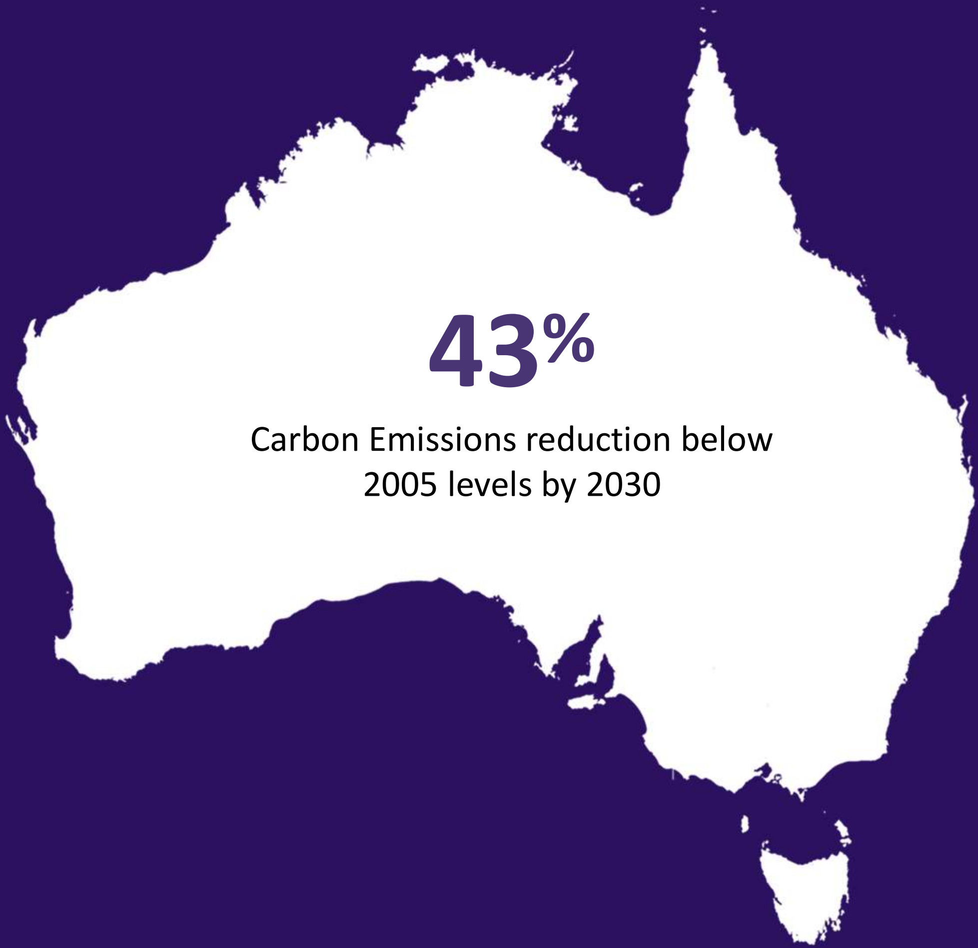

Australia has committed to achieving net zero emissions by **2050**

Meeting this target entails the retirement of aging fossil fuel generators and their replacement with decentralised renewable energy infrastructure, such as solar and wind farms, supported by battery energy storage systems and other long-duration storage solutions, such as pumped hydro.

Introduction to icubed

Lincoln Gap Windfarm, 2018

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Renewables Capability

icubed consulting have played a significant role in the Australian wind and solar industry for over **20 years**.

Since beginning as wind turbine foundation designers, our services now extend to providing specialised and expert advice, from conception to completion, on utility-scale wind and solar projects.

Our work encompasses planning, approvals management, civil and structural design for complete internal and external civil balance of plant (BOP) documentation, as well as onsite engineering and project management construction support.

We have delivered 7GW through 2000 tower bases of detailed design works and over 10GW in additional preliminary design works.

i3 Renewable Insights

01 We have been designing wind farms and other renewable energy projects for 20 years in ANZ

02 We have modelled nearly 4,000 turbines footing at various stages of project design life and 5,000km of access tracks

03 In 2020, icubed carried out the detailed design of 70% of the commissioned wind farms in Australia

Wind farms generate electricity using wind turbines that convert kinetic energy from the wind into electrical energy.

Siting for wind turbines is crucial for optimising their efficiency in generating energy. Ideal sites are typically at higher elevations where wind speeds are generally stronger and more consistent.

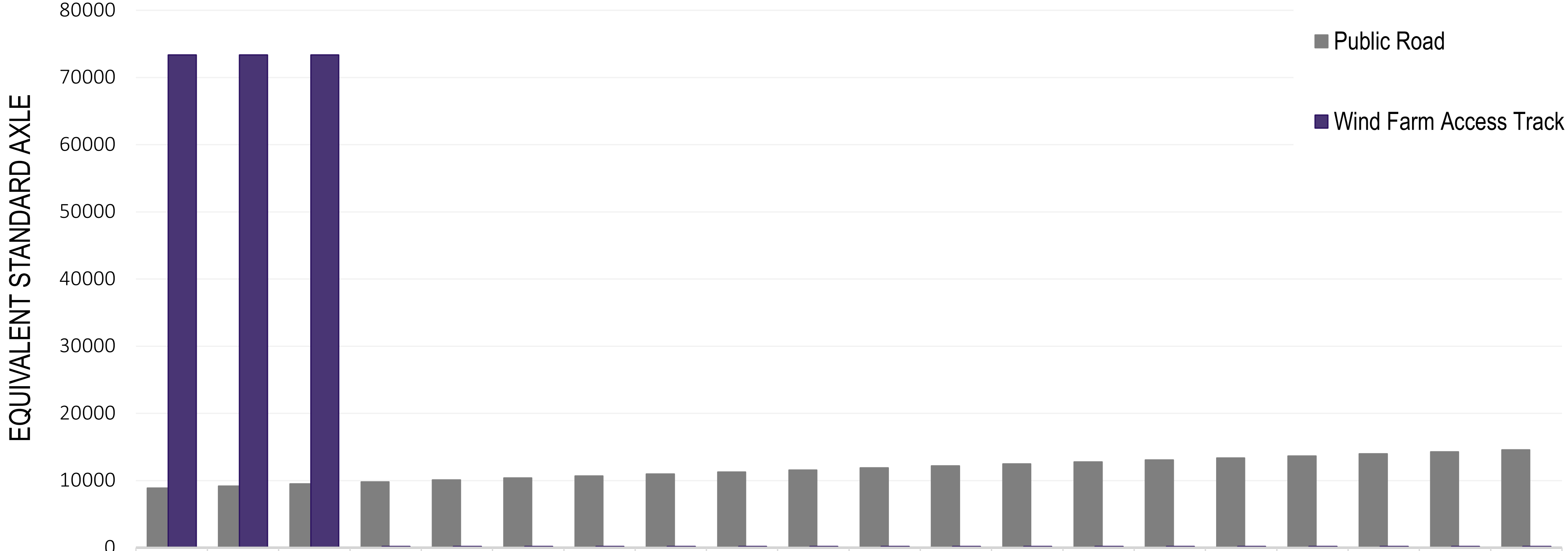
Elevated locations capitalise on the natural increase in wind speed with altitude, owing to reduced surface friction. Moreover, these sites often have fewer obstructions that can disrupt wind flow, such as trees.

While our case studies focus on wind farms, we note that stabilisation has been utilised in Substations and Battery Energy Storage System (BESS) benches and Solar Farms.

Source, Stringfellows, Turitea Wind Farm, 2020

Lower Order Road vs Wind Farm Access Track

Equivalent Standard Axle Generation



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Public Road	8898	9197	9495	9793	10091	10390	10688	10986	11285	11583	11881	12179	12478	12776	13074	13372	13671	13969	14267	14566
Wind Farm Access Track	73342	73342	73342	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205

DESIGN LIFE (YEARS)

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Over-Sized Over-Mass Vehicles

Crawler Crane

Source - icubed, Taralga Wind Farm, 2014

Transformer Delivery Vehicle

Source - Zenviron, Rye Park Wind Farm, 2022

Case Study 1

Berrybank Wind Farm Stage 2

Source: GPG Naturgy Group, 2024

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Site Geology






Source: icubed, Berrybank Wind Farm, 2021

The initial pavement solution proposed was a typical unbound pavement that would have variable thickness based on the subgrade strength encountered across the site.

PAVEMENT THICKNESS ASSESSMENT – Tracks and Hardstands		
Cu (kPa)	Pavement Thickness Required (mm) (Considering Imported Crushed Rock and Stabilised Subgrade)	
	Access Tracks	WTG Hardstands - Load 250kPa
<60	Consult Geotechnical Engineer for Advice	Consult Geotechnical Engineer for Advice
60	500	Consult Geotechnical Engineer for Advice
80	300	600
100	200*	300
120	200*	200*
120 - 200	200*	200*

To achieve suitable subgrade strengths, the adopted pavement solution utilised a lime-stabilised subgrade, with typically 3% lime. As a result, the access tracks were overlayed with a consistent 200mm of pavement material.

Lime Stabilisation Application

Lime Application – Spreading over access track

Source - icubed, 2020

Lime Application - Mixing

Source - icubed, 2022

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45,000m³

Reducing the final imported pavement material by an estimated half

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2,360

Truck and Dog round trips eliminated

1.8E04

ESA loads from the local public roads

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WTG Foundation Treatment

Source: Agnew Mine Wind Farm, 2021

Case Study 2

Lal Lal Wind Farm

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Ground Improvement for WTG’s

Source: icubed, Footing Excavation Lal Lal Wind Farm, 2019

Source: icubed, Footing Excavation Lal Lal Wind Farm, 2019

Source: icubed WTG, 2021

Source: icubed, Blinding Concrete Pour, Lal Lal Wind Farm, 2019

Source: icubed, Concrete Pour, Lal Lal Wind Farm, 2019

Source: icubed, Partially Backfilled Footing, Kennedy Energy Park, 2018

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Excavation Problems

Over blasted &
Over excavated rock

Excavation inundated
with water

Source: icubed, Lal Lal Wind Farm, 2019

CTB Backfill

Cement-treated base (CTB) material provides an effective compromise between conventional pavement material and blinding concrete for backfilling applications.

It effectively addresses compaction and saturation challenges by harnessing the strength-enhancing properties of cement.

This solution not only mitigates construction complexities but also minimises resource scarcity concerns, as CTB generally requires less cement than blinding concrete and pavement materials respond well to CTB.

Stabilisation Future Opportunities

Source, Stringfellows, Turitea Wind Farm, 2020

Potential for Stabilisation in Steep Access Track Grades

Source: icubed, Lincolns Gap Wind Farm, 2021

One of the most promising applications for stabilisation on wind farm sites lies in addressing steep to very steep access track grades. The decision to apply treatments such as unsealed pavements with sealing or binding to enhance traction for OSOM vehicles and ensure site user safety varies from project to project. Generally, treatment is recommended for pavements with longitudinal slopes ranging from 12% to 18%.

Challenges and Maintenance

Pavement Rutting On a Gentle Graded Access Track

Source - icubed, Turitea Wind Farm, 2022

CTB Treated Access Track – Grades >15%

Source - icubed, Turitea Wind Farm, 2022

Remote Sites & Long Haulage

Source, Stringfellows, Turitea Wind Farm, 2020

Stabilisation techniques have proven pivotal in optimising project outcomes across diverse terrains, enhancing subgrade materials performance and reducing reliance on imported pavement materials

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Looking ahead, these growing challenges presents the stabilisation industry with a unique opportunity to innovate, market solutions, and deploy treatments that can withstand the heavy loadings of construction phase, while remaining resilient against environmental factors and maintaining the stabilised properties through subsequent maintenance activities.

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