Why the way you maintain assets no longer matches the risk you're carrying

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Date

The system changed faster than the asset

Climate change is altering operating conditions

- More extreme heat, flood, fire and weather variability
- Historical operating assumptions becoming less reliable

The response to climate change is reshaping infrastructure

- Renewable generation changing power system behaviour
- Worldwide electrification increasing demand for electricity
- Desalination increasing dependence on energy-intensive water supply
- Data centres increasing demand for power, water and communications

Infrastructure is becoming more interconnected

- Greater dependence between power, water, communications and transport
- Small disruptions increasingly capable of creating wider impacts

Asset roles are changing faster than asset replacement

- Assets designed for one operating context now support another
- Maintenance strategies often still reflect historical assumptions

The plant was never meant to run like this

Asset duty is changing faster than asset replacement

- Baseload generation becomes cycling generation
- Backup infrastructure becomes primary infrastructure
- Legacy networks support new demand patterns

Economic margins are tightening

- Revenue and utilisation becoming less predictable
- Major renewals often deferred
- Maintenance budgets remain constrained

Performance expectations continue to rise

- Higher reliability expectations
- Less tolerance for outages
- Greater dependence on infrastructure services

The challenge

- Deliver more service from ageing assets
- Maintain reliability with less margin for error
- Make better maintenance decisions with finite resources

Different industries, same constraints

The constraints are remarkably similar

- More defects and risks than available funding
- Ageing assets remain in service longer
- Reliability expectations continue to increase

New infrastructure brings new failure modes

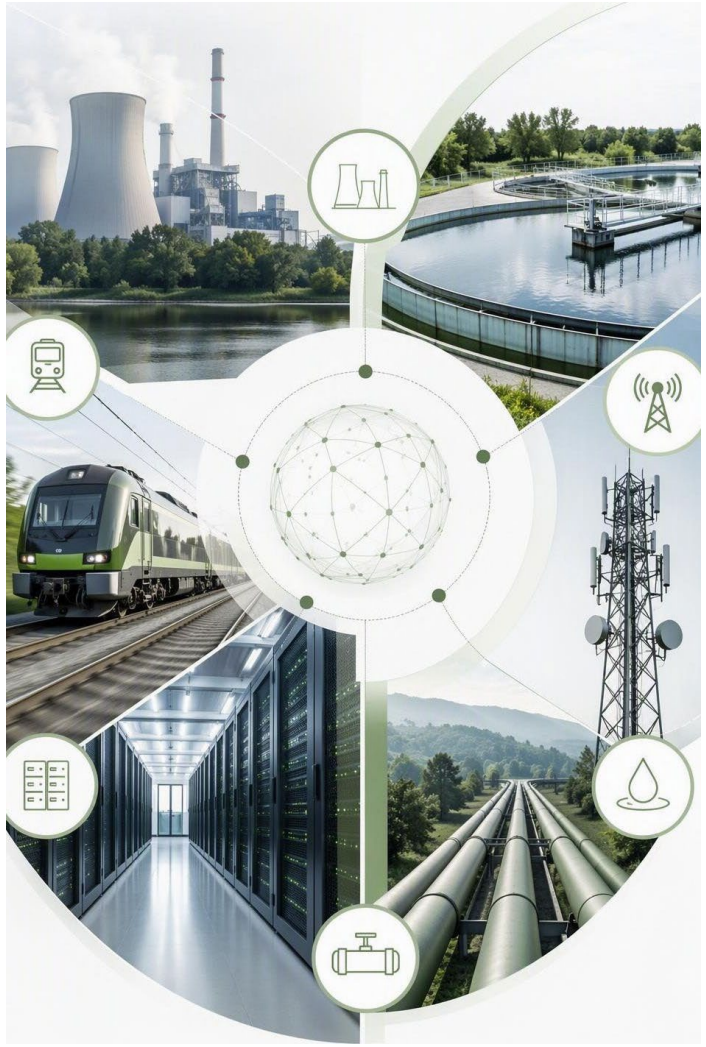
- New technology is not always more robust
- Supply chains, software and thinner designs introduce new risks

Many critical assets cannot be easily accessed

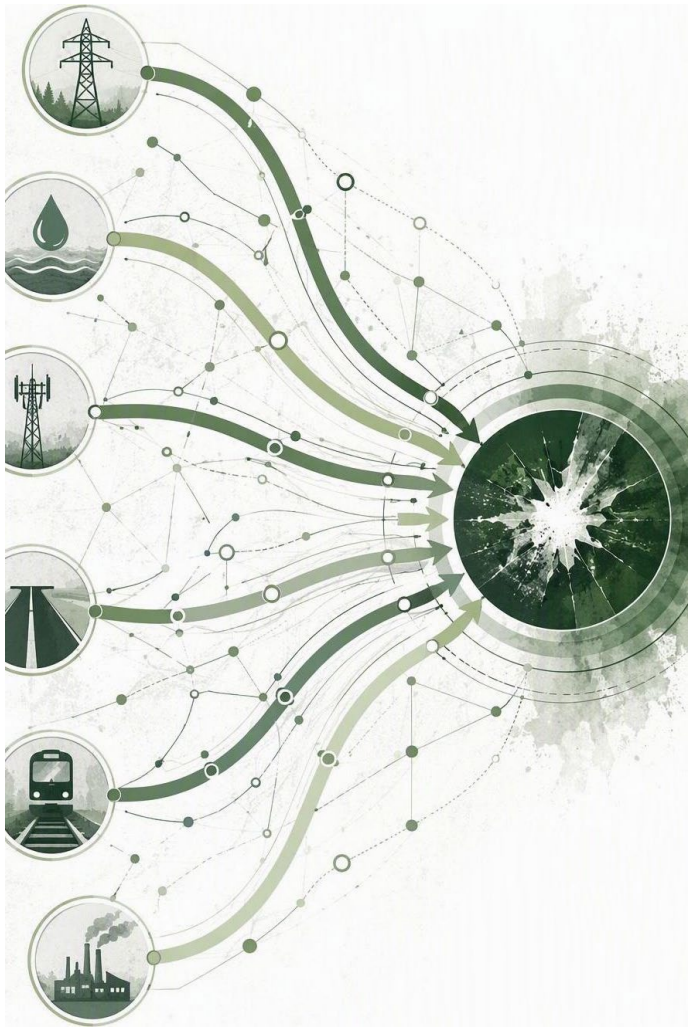
- Buried pipelines
- Linking transformers
- Subsea communications cables
- Remote and hazardous infrastructure

The real challenge

- Decide where the next maintenance dollar has the greatest effect
- Accept that not everything can be maintained or replaced



The system is changing faster than the organisation



Most failures no longer occur in isolation

- Power, water, communications and transport increasingly depend on each other
- Disruptions often propagate across multiple systems

Traditional ownership boundaries remain

- Assets managed separately, generally between different organisations
- Budgets allocated separately
- Risks assessed separately

The biggest vulnerabilities are often invisible

- Shared dependencies
- Common mode failures
- Temporary loss of redundancy
- Critical interfaces between systems

Resilience depends on understanding the whole system

- Not just the assets we directly own
- But the assets our assets depend on

Risk matrices have a blind spot

Risk matrices work well for routine problems

- Individual failures
- Known failure modes
- Stable operating assumptions

The blind spot

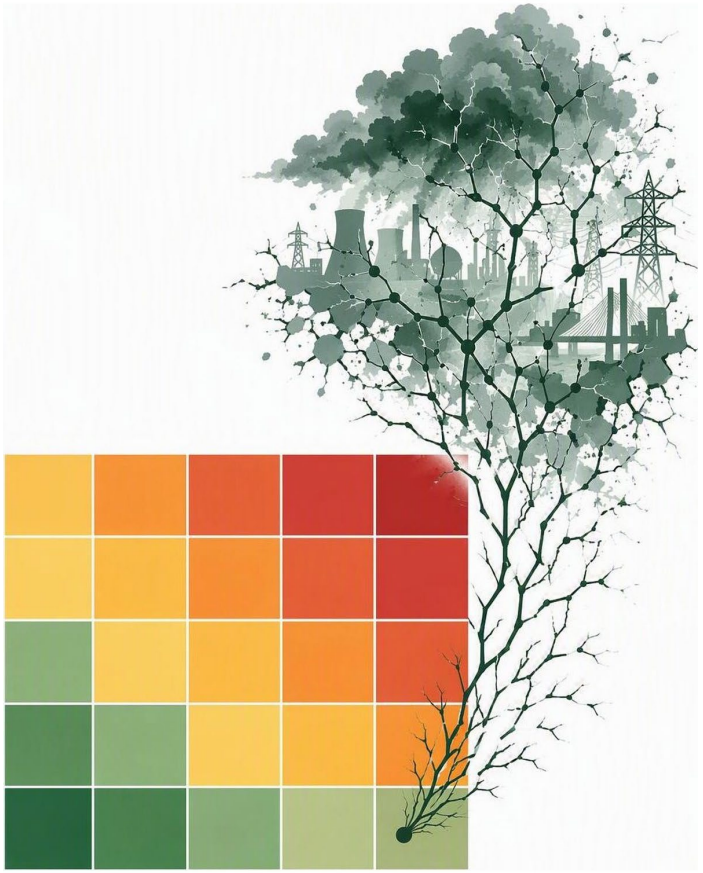
- Very low probability events score lower than they deserve
- Consequences may exceed the organisation's ability to recover

Climate stress changes the equation

- Historical likelihood assumptions become less reliable
- Previously theoretical scenarios become credible

The real challenge

- An organisation can survive thousands of routine failures
- It only gets one organisational wipeout event



Separate the critical from the clutter

Not everything deserves asset status

- Record only assets that materially influence safety, service, resilience or cost
- A 50 mm valve you can buy at Bunnings should never make it onto the asset register!

Static criticality is an essential first step

- Identifies the assets that genuinely matter
- Aligns maintenance, operations and investment decisions

Make criticality understandable

- Express consequences in business terms ($ risk)
- Use simple rules to place assets into 5 buckets
- Consistency beats precision
- No analysis paralysis

The payoff

- Focus scarce maintenance effort where it matters most
- Stop spending resilience dollars on clutter

Dynamic criticality: what is critical now?

Asset importance is not fixed

- Criticality changes as operating conditions change
- The most important asset this week may not be the most important asset next week

Context matters

- Condition
- Redundancy
- Weather
- Demand
- System configuration

Use the information you already have

- Asset register, Static criticality, Condition data, Operational status

The outcome

- Focus effort on assets currently protecting resilience
- Make better maintenance decisions with the same budget

When medium-critical assets become critical

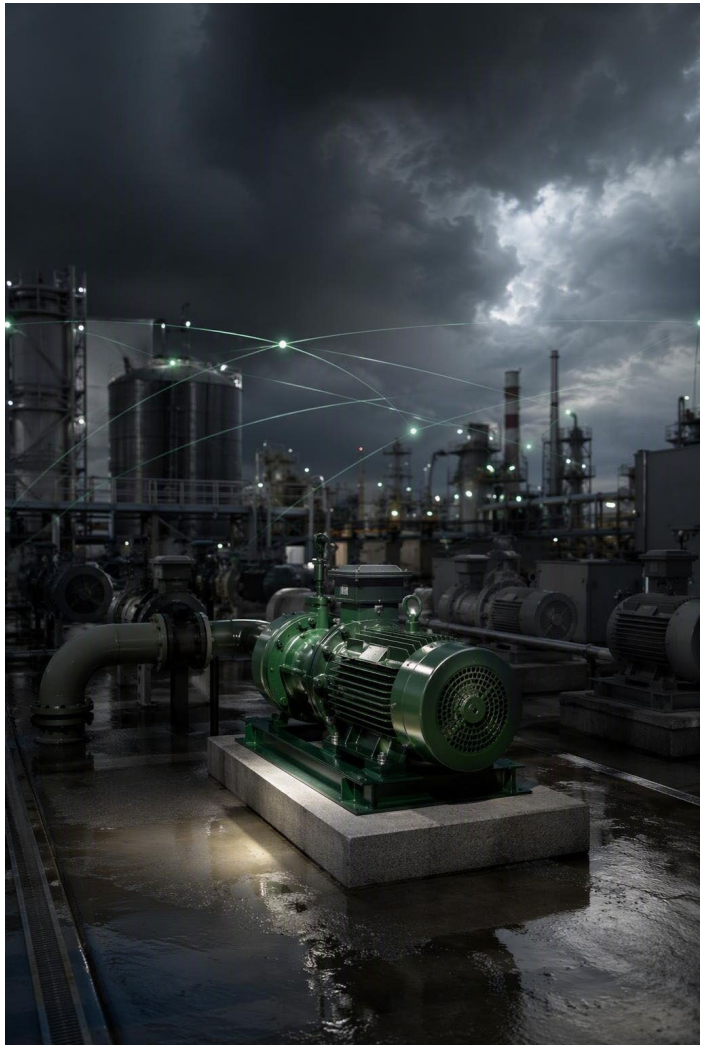
Criticality can change overnight

Loss of redundancy
- Standby equipment becomes operationally critical
- Remaining assets inherit the full system risk

Changing operating conditions
- Extreme weather
- High demand periods
- Emergency response situations

System reconfiguration
- Maintenance outages
- Temporary bypass arrangements
- Supply chain or access constraints

The implication
- Yesterday's medium-critical asset can become today's most important asset



Hidden assumptions create hidden vulnerabilities

Redundancy can duplicate vulnerability

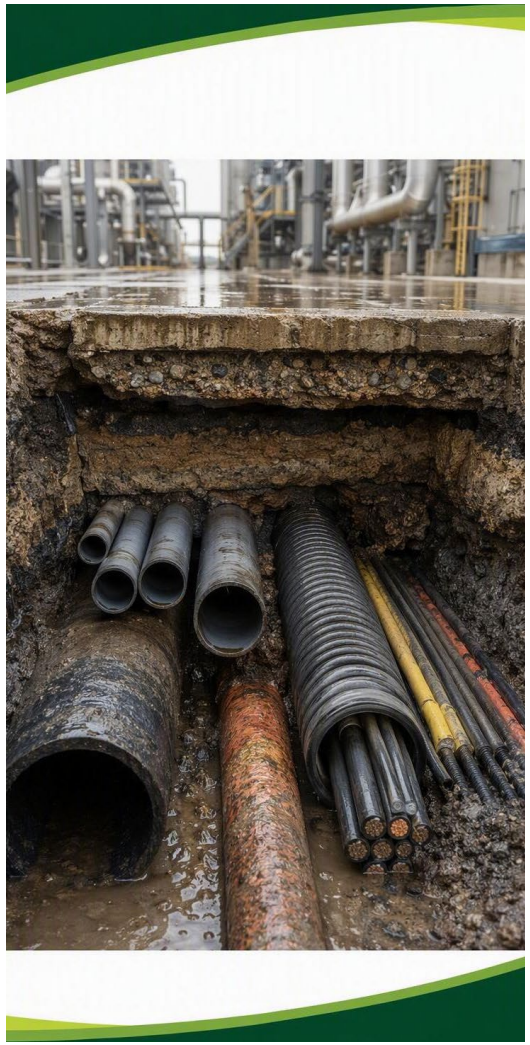
- Backups may sit in the same hazard zone
- Separate systems may rely on the same power, fuel, access or controls
- Recovery plans may assume roads, suppliers or communications still work

Assumptions stay hidden while they hold

- Power is available
- Communications work
- Fuel can be delivered
- Backup systems are ready when needed

The real test

- Redundancy only works if it survives the same event
- Resilience depends on whether the assumptions still hold under stress



Recognising Emerging Vulnerabilities

Monitor the conditions that move risk

- Asset condition changes
- Redundancy changes
- Demand, weather or operating configuration changes

Look beyond your organisation

- Shared infrastructure dependencies
- Supply chain and spares constraints
- Third-party service providers
- Power, water, access and communications interdependencies

Respond before resilience is exposed

- Recognise when consequence has changed
- Prioritise maintenance where resilience is weakening

Spend maintenance dollars where they matter most

Not all risk reduction costs the same

- Small interventions can remove major exposure
- Expensive projects do not always deliver the greatest resilience benefit
- Timing matters as much as condition

Prioritise interventions, not just assets

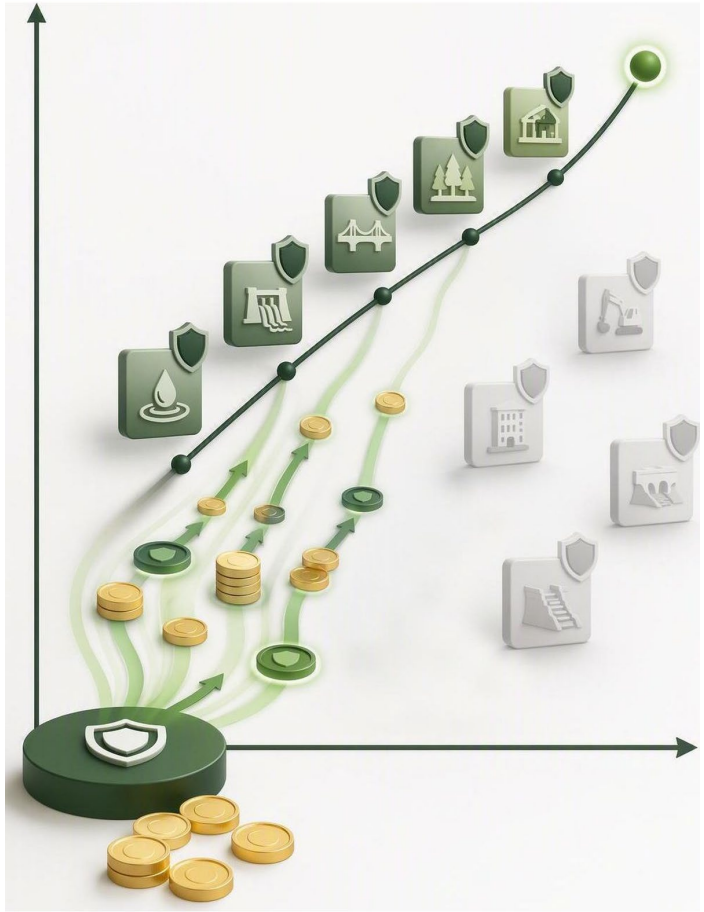
- Maintenance, Inspection, Defect repair
- Critical spares
- Redundancy improvements

Follow consequence, not habit

- Redirect effort when criticality changes
- Focus on assets currently protecting resilience
- Reassess as operating conditions change

The objective

- Maximise risk reduction for the available budget
- Prevent manageable failures becoming major events



Not all assets need the same level of condition monitoring

Get the fundamentals right first

- Asset hierarchy and asset alignment
- Critical assets identified and understood
- Basic maintenance routines consistently executed

Match monitoring to consequence

- Low consequence assets → basic inspections
- Medium consequence assets → targeted condition monitoring
- High consequence assets → advanced monitoring and analytics

Use technology where it adds value

- Online monitoring
- Thermal imaging
- Vibration analysis
- Acoustic monitoring
- Remote condition assessment

The payoff

- Better visibility of emerging risk
- Condition effort aligned with consequence

Intervene before resilience is exposed

Not every defect needs immediate action

- Condition alone should not drive intervention
- Consequence and operating context matter

Consider the whole operating picture

- Current criticality
- Available redundancy
- Condition trend
- Remaining life
- Opportunity for repair

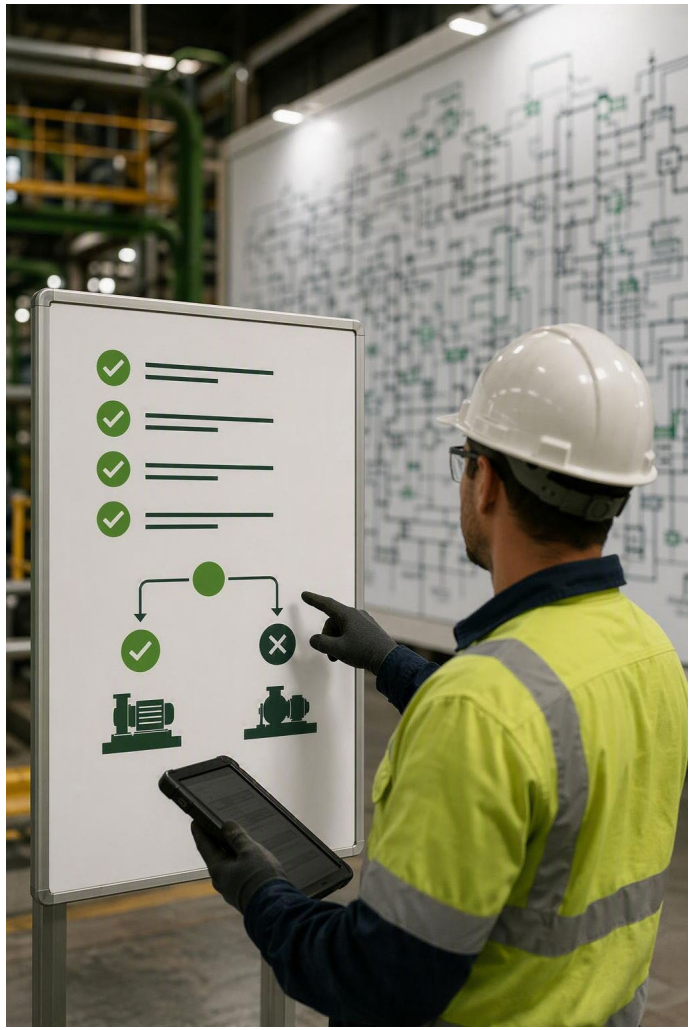
Choose the right response

- Monitor/ Nurse
- Repair/ Replace
- Defer

The objective

- Act before resilience is compromised
- Maximise risk reduction per maintenance dollar

Simple rules beat perfect models



Most decisions are not complicated

- Focus on the assets that matter
- Monitor the conditions that move risk
- Escalate when predefined triggers occur

Avoid false precision

- Five consequence buckets are enough
- Consistency beats precision
- A good model implemented beats a perfect model on the shelf

Rules scale

- Apply across thousands of assets
- Consistent decisions across the organisation
- Rapid implementation and maintenance

The payoff

- Better decisions without more complexity
- Faster adoption and greater organisational trust

What changes on Monday morning?

Separate the critical from the clutter

- Clean up the asset register
- Focus on assets that materially affect business outcomes
- Stop spending resilience effort on noise

Test the assumptions

- Where has redundancy been lost?
- What dependencies have appeared?
- What changes under extreme weather, demand or outage conditions?

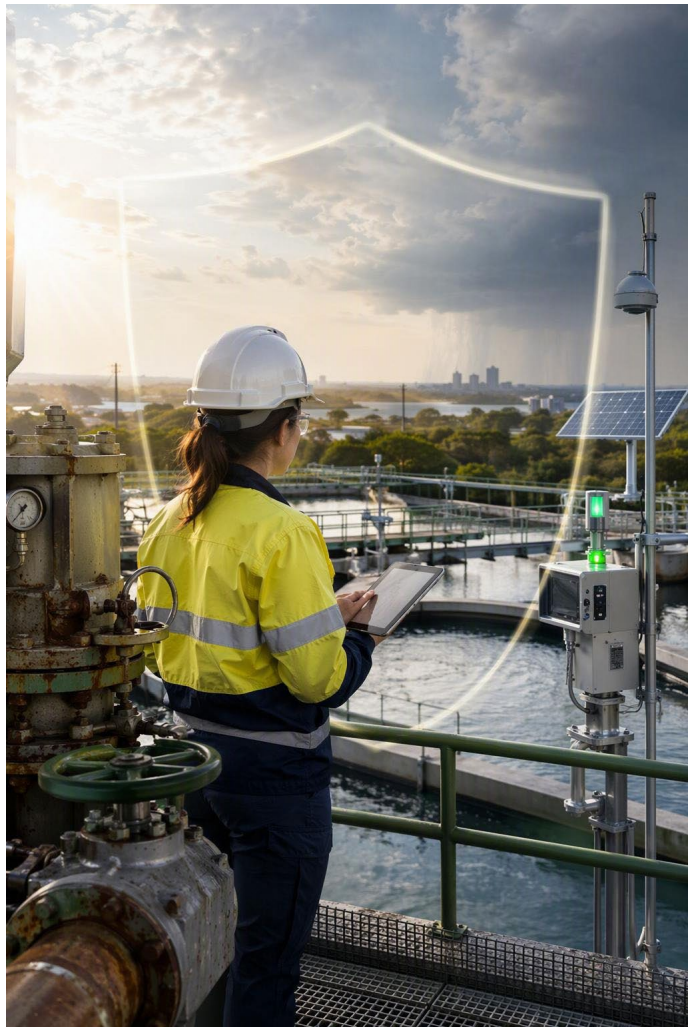
Follow risk as it moves

- Monitor condition, redundancy and operating context
- Re-prioritise when consequence changes
- Direct effort toward assets currently protecting resilience

Invest in maintenance capability

- Better visibility
- Better decisions
- Better resilience

Resilience is a maintenance decision



The world is changing faster than many assets

- Climate, demand and system dependencies continue to evolve

Some assets must be managed for generations

- Many critical assets will remain in service for decades
- Others may never be economically replaced during our careers

New assets bring opportunity – and new risks

- New infrastructure will continue to be added
- New technology can introduce new failure modes, supply chains and dependencies
- Newer does not automatically mean more resilient

Maintenance bridges the gap

- Dynamic criticality identifies what matters now
- Maintenance priorities move as risk moves
- Resilience is protected before failure occurs

The outcome

- Existing and new infrastructure work together to support a changing world
- Better resilience without waiting for the next capital project

What this looks like in practice

Better decisions before bigger investments

- Improving resilience using the assets already in service
- Identifying vulnerabilities before failure occurs
- Reducing exposure while larger capital programs catch up

Focus on consequence, not just condition

- Understand where failure would hurt most
- Test assumptions and hidden dependencies
- Recognise when asset importance changes

Maintenance as a resilience capability

- Maintenance, monitoring, renewals and redundancy working together
- Priorities changing as risk changes
- Resources directed to assets currently protecting resilience

Remember this

- The asset may not have changed
- The consequence often has
- Maintenance priorities should move as risk moves
- Resilience is built one maintenance decision at a time

Thank you

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