Where are the Real Benefits of a “Digital Twin”

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THE EVOLVING NEEDS FOR CONTROL

Renewable Integration

Renewable Integration changes the response behaviors needed to be addressed by Control systems

- Two-way power flows
- Renewables are intermittent
- Much larger set of independently operating systems
- Unexpected feedback loops
- “Smart” optimization (“Tail wagging the dog”)

We have a reducing time-frame to address issues.

WHAT IS A DIGITAL TWIN?

More than just a smarter version of Analytics

Why is a digital Twin different ?

- A speedometer is a useful analytic device to monitor speed
- Allows a driver to control a car

- A self-driving car requires an internal model of all the aspects of the car's motion
- AND the ability to understand the current location of the car
- AND the intent of what the driver wants the car to do.

The "car" digital twin has a feedback loop

WHAT IS A DIGITAL TWIN?

Electrical Grid Digital Twin

"A comprehensive, real-time virtual representation of the physical electrical infrastructure of the as-operated state that combines multiple data sources, advanced modelling, and simulation capabilities to mirror the actual behaviour and performance of the grid"

- **SCADA** - digital twins add predictive capabilities, comprehensive modelling, and advanced analytics.
- **GIS** - digital twins add real-time operational data and dynamic behaviour modelling.
- **Traditional planning** - digital twins incorporate live data and can model real-time scenarios.

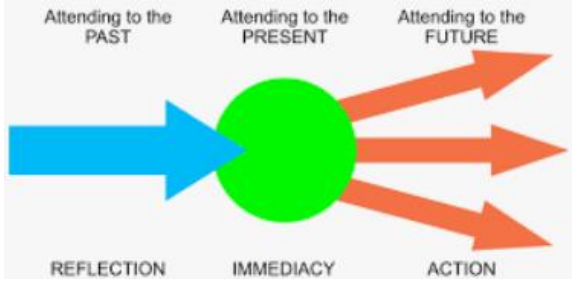
THE IMPORTANCE OF DATA

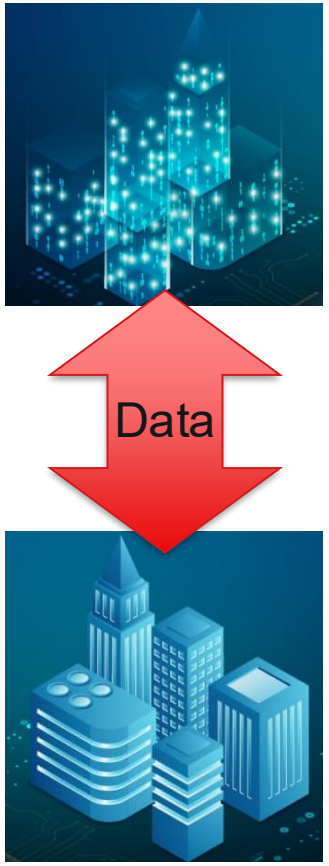
High Quality Measured Data is Key

Digital Twins and Conventional Analytics Differ in Approach

	Process	Data	Model	Intelligence
Conventional Analytics	World	Any		Human
Digital Twin	World	Realtime	Virtual	Automated

Key to this is the data (real-time, the “right” data) and a quality model





VALUE STREAMS FROM A DIGITAL TWIN

The breadth of Choice

Digital Twins are applicable across the enterprise

- Predictive Maintenance and Asset Management
- Grid Optimization and Load
- Outage Management and Response
- Integration of Renewable Energy
- Capital Investment Planning Utilities
- Regulatory Compliance and Reporting

Models can be joined together

- Common Data Set
- Common Data Timeline

DIGITAL TWINS & ARTIFICIAL INTELLIGENCE

Both aim to provide decision making support

“A computational system that is designed to perform tasks that typically require human Intelligence”

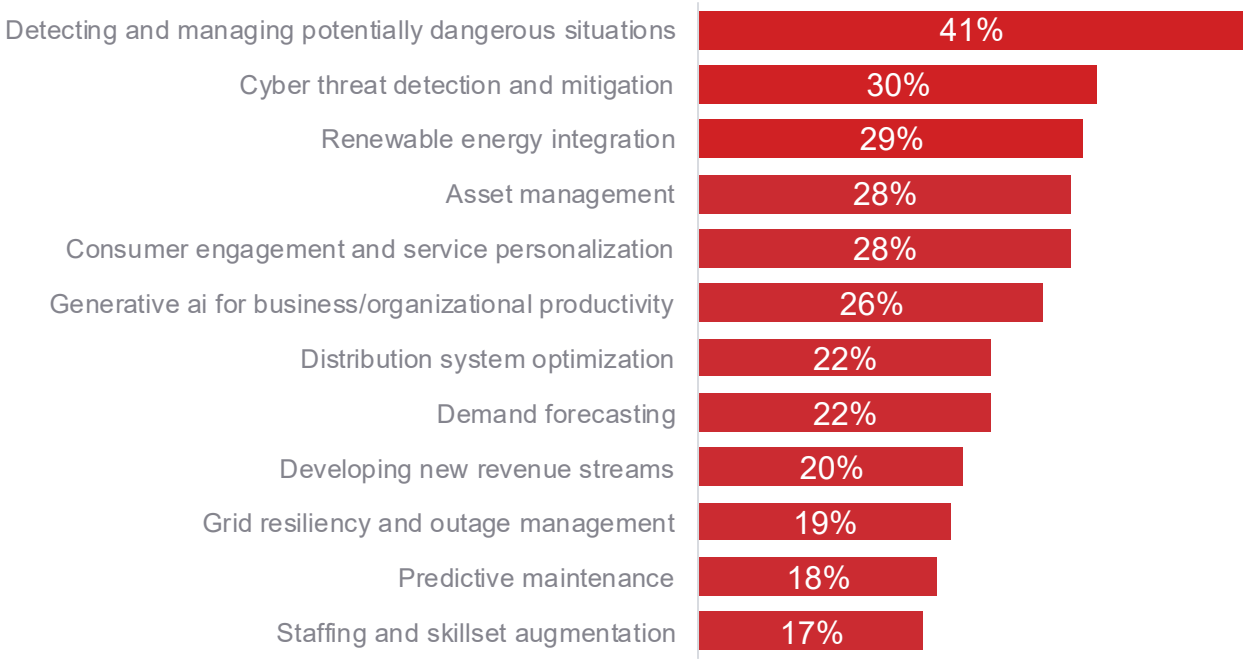
- A Digital Twin requires an algorithm to mirror the real-world activity it is replicating
- Artificial Intelligence can implement that algorithm
- Not all Artificial Intelligence Processes are Digital Twins

Both Require significant high-quality data

- For AI training
- As input to the model

WHERE CAN AI HAVE THE GREATEST BENEFIT

Itron 2024 Resourcefulness Report Highlights AI Benefit Areas



RENEWABLE INTEGRATION

Digital Twins in Practice

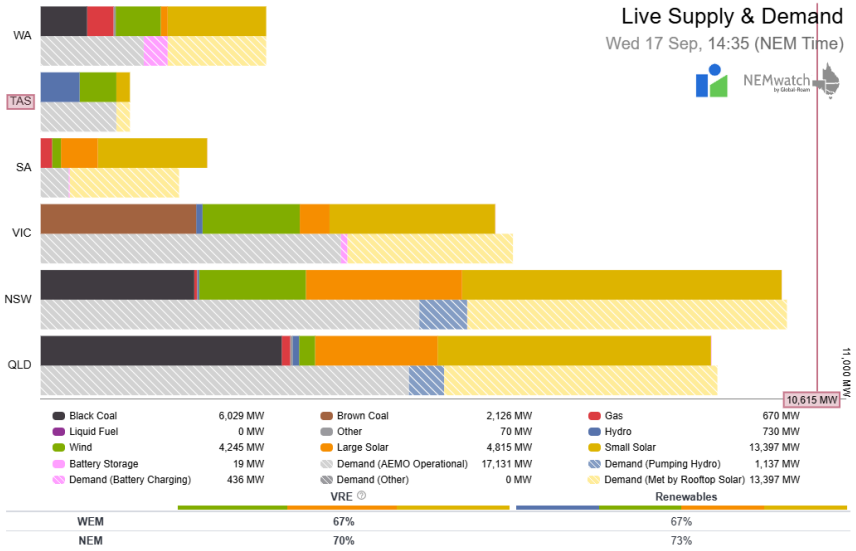
Solar PV Integration

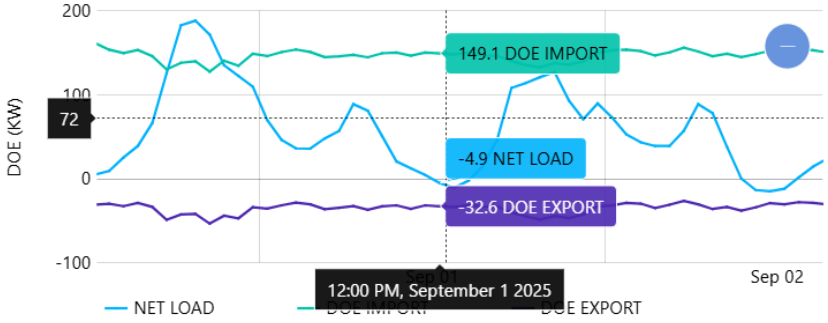
» Maximise the amount of Safe Solar on the network

» Maintain Grid Resilience

From Analytics to Digital Twin

1. Understanding Capacity Constraints
2. Controlling to limit overloading in Network Bottlenecks
3. Understand the impact of Outages / Planned Maintenance
4. Solar Compliance & Verification





PREDICTIVE MAINTENANCE

Digital Twins in Practice

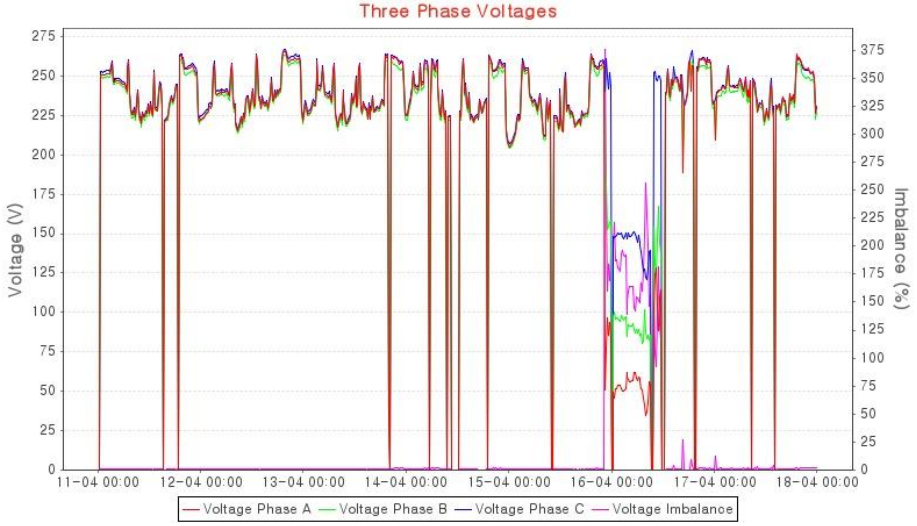
Transformer Overload Detection

» Mitigate Outages to Consumers

» Savings from the avoidance of additional costs of Catastrophic Failure

From Analytics to Digital Twin

1. Monitoring when Overloads Occur
2. Understanding the Impact of Overloads on Transformer Lifespan
3. Identifying Patterns of behaviour that can result in Failure



OUTAGE MANAGEMENT

Digital Twins in Practice

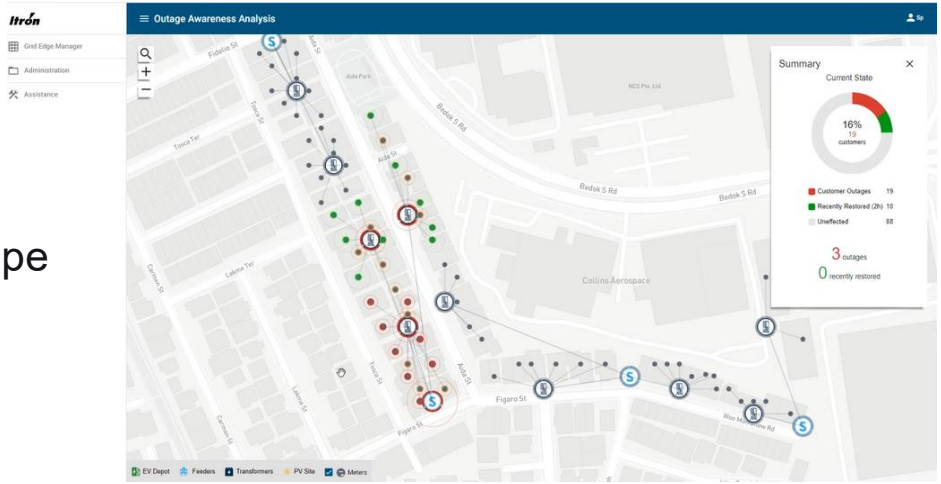
Outage Management

» Minimise Outage Time (SAIDI)

» Ensure Renewable availability

From Analytics to Digital Twin

1. Identifying Outage Extent
2. Predictive Root cause Analysis
3. Predicting & Verifying True Outage Scope
4. Simulate fault propagation in real-time
5. Optimizeing restoration sequencing

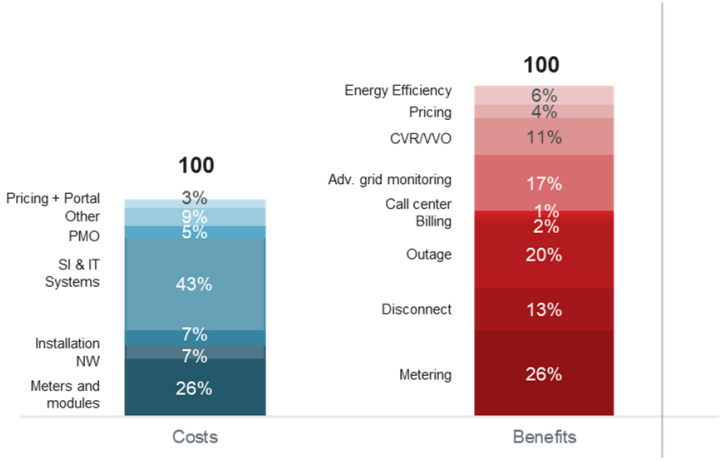


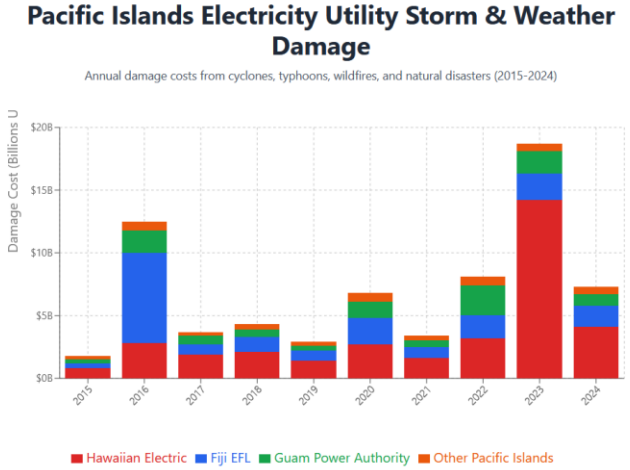
WHERE TO START

What benefits a Pacific Island Nation the Most?

- New way of working is all about shifting from reactive to predictive
- Current Issues ➔ Target for Analytics

- Xcel Energy
  - Identify overloaded transformers proactively.
  - Reduce blackouts through predictive monitoring.
  - Monitor voltage irregularities
  - Save significant dollars compared to the cost of rolling trucks to manage incidents.

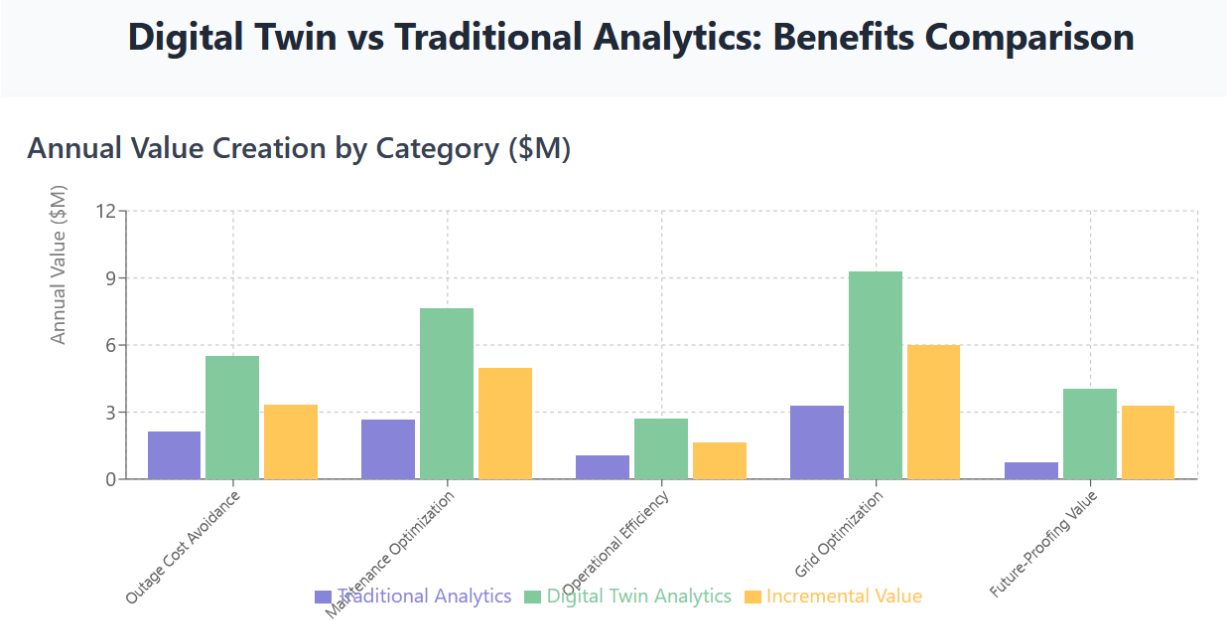




IS IT WORTH IT ?

The Perceived Value of Advancing to Simulations

- Greater Upfront Cost in Implementing the Twin Model
- Higher Complexity means greater potential risk for project failure
- Greater return on Investment (break-even around 35%)
- Relatively short ROI timeframe



CONCLUSION

The Real Benefit of Digital Twins

- The Digital Twin allows you to move from a **reactionary** view of the World to a **proactive** one
- Enables you to mitigate and control critical events before they happen
- The value is in the operational and human costs saved through avoiding issues

- High Quality Data forms the key
  - A common data repository used by all analytic models
  - Near real-time data gathering
  - Derived data from one Simulation can be used in others

THANK YOU