



Creating and Automating a Digital 3D Virtual World for Smarter Utilities & Improved Customer Outcomes

GEOSMART ASIA 2018 & LOCATE 18

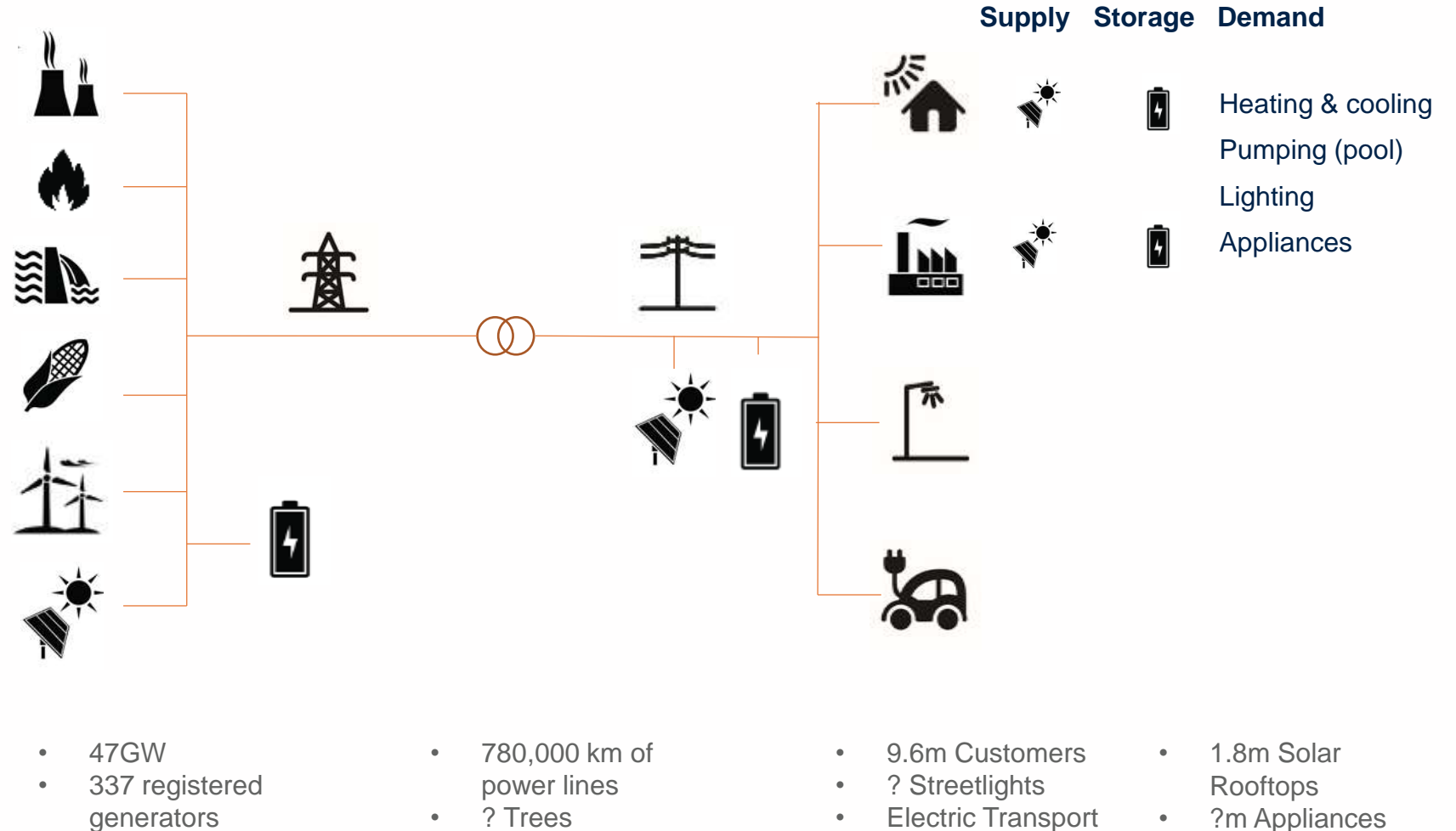
10 APRIL 2018

SPEAKER: IAN MCLEOD - ENZEN AUSTRALIA PTY LTD

Utilities Becoming Customer Centric



What **Knowledge** Do We Need & **Why?**



Spatially Connected

enzen

The National Electricity Market stretches from Cooktown in the tropical north to Tasmania in the south and across to South Australia



Connected, But, Capital & Resources Are Not Efficiently Deployed

- Energy Networks Australia's "Electricity Networks Transformation Roadmap" is a good example of why greater intelligence on "where" is needed
- More intelligence on the network is needed to enable the Distribution System Operator role

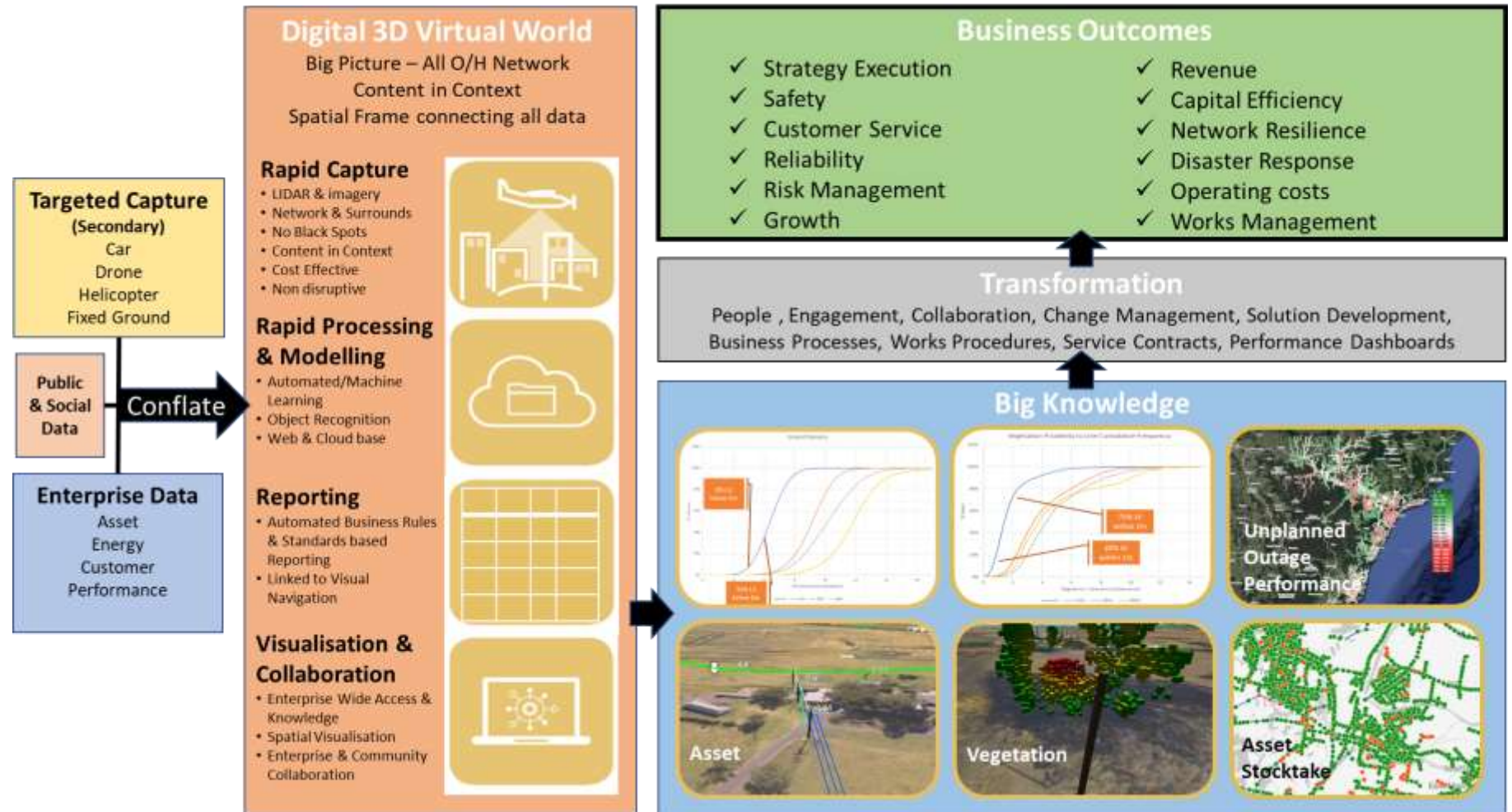


	FOUNDATION						IMPLEMENTATION					
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2027+
CUSTOMER ORIENTED ELECTRICITY	Improve trust with customers through better engagement, customised services and reform of customer protection frameworks.						Networks provide a service platform that is responsive to the changing needs of diverse customers and which provides open information stimulating new market innovation.					
POWER SYSTEM SECURITY	Improve new frameworks and services for achieving system security with diverse generation and energy technologies and retain focus on physical and cyber security.						Enhanced system operations at all voltage levels, as transmission networks offer additional services and distribution networks provide visibility of resources and other services.					
CARBON ABATEMENT	Secure a stable carbon policy including a trading scheme for generator emissions, enabled by agile network connection and integration of large and small technologies.						Review scope for consensus on more efficient carbon pricing, refocus technology specific schemes and increase the Australian international emissions reduction target (2027) ¹ .					
INCENTIVES & NETWORK REGULATION	Incentivise efficiency and innovation through: implementing fair and efficient demand based network tariffs; enabling standalone systems and micro-grids, and; modernising regulation and competition frameworks.						Transform efficiency of energy delivery with orchestration of distributed energy resources as networks pay for support in the 'right place at right time' including use of stand alone systems and customer focussed regulation.					
INTELLIGENT NETWORKS & MARKETS	Develop essential information tools for a cost effective integrated grid, including: open standards, extended monitoring, advanced planning and feeder hosting analysis, and the mapping and locational valuation of distributed energy resources.						Establish active distribution system operations and markets for technical stability and optimising investment by procuring distributed energy resource based grid support. Evaluate cost benefit analysis of procuring these services through a digital market platform.					

Transforming Big Knowledge to Business Performance

Attributes

- Fast Capture
- Fast Processing
- Full Network
- Spatial Data Frame
- Data Conflation
- 3D Visualisation
- Process Automation
- Machine Learning
- Scalable
- Web base collaboration
- Advanced Analytics
- Business Transformation

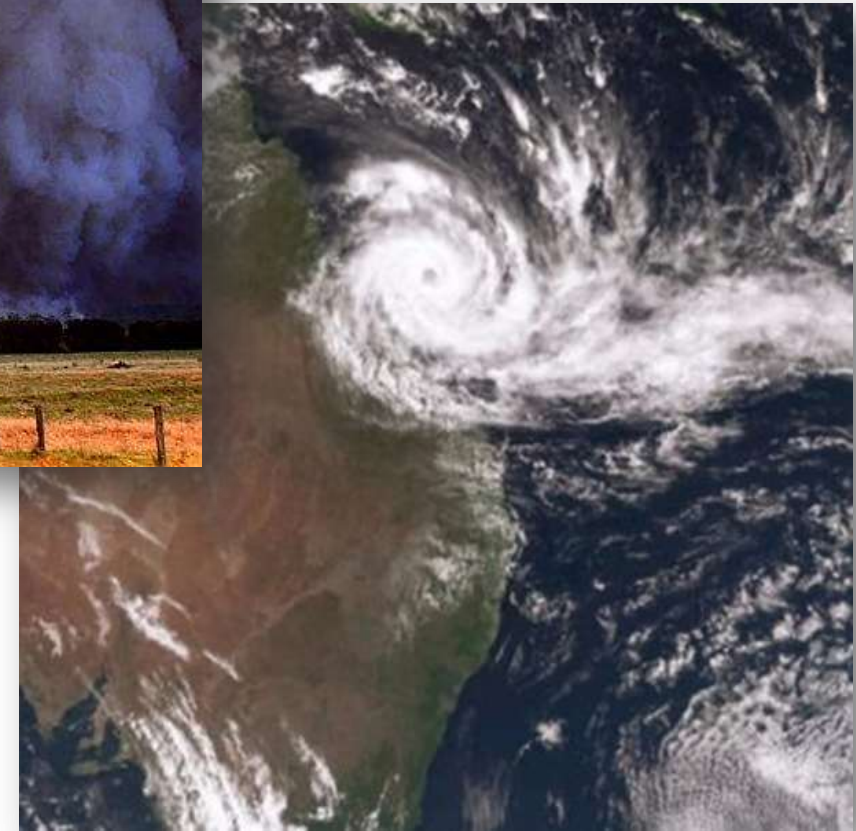


Disasters: The Moments that Define Us

Dunalley,
Tasmania



Yasi, Queensland



Black
Saturday,
Victoria

Physical Vulnerabilities: Consequence

2017 US Hurricanes – Up to \$400B Cost



Hurricane Maria

Disaster

Hurricane Maria is regarded as the worst natural disaster on record in Dominica and is potentially the costliest Caribbean hurricane on record as a result of causing catastrophic damage and a major humanitarian crisis in Puerto Rico. [Wikipedia](#)

Highest wind speed: 280 km/h

Date: 16 September 2017 – 3 October 2017

Direct fatalities: 66

Category: Category 5 Hurricane (SSHWS)

Lowest pressure: 906 mbar (hPa); 26.81 inHg

Affected areas: [Puerto Rico](#), [Dominican Republic](#), [France](#), [MORE](#)

Total fatalities: 97 direct, 32 indirect (as of November 13), 583 reported (unofficial)



Hurricane Irma

Catastrophe

Hurricane Irma was an extremely powerful and catastrophic Cape Verde-type hurricane, the strongest observed in the Atlantic since Wilma in 2005 in terms of maximum sustained winds. [Wikipedia](#)

Total fatalities: 134

Highest wind speed: 295 km/h

Date: 30 August 2017 – 16 September 2017

Total fatalities: 134 total (as of October 10)

Affected areas: [Florida](#), [Cuba](#), [Puerto Rico](#), [Bahamas](#), [MORE](#)

Category: Category 5 Hurricane (SSHWS), Category 4 Hurricane (SSHWS), Category 1 Hurricane (SSHWS)



Hurricane Harvey

2017 tropical cyclone

Hurricane Harvey was the costliest tropical cyclone on record, inflicting nearly \$200 billion in damage, primarily from widespread flooding in the Houston metropolitan area, breaking the previous record set by Hurricane Katrina. [Wikipedia](#)

Total fatalities: 77

Dates: 17 Aug. 2017 – 3 Sep. 2017

Date: 17 August 2017 – 3 September 2017

Fatalities: 82

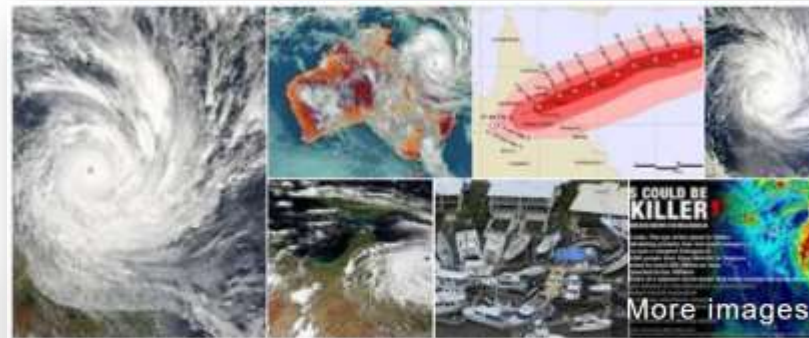
Category: Category 3 Hurricane (SSHWS), Tropical Depression (NHC/CPHC)

Affected areas: [Texas](#), [Louisiana](#), [Belize](#), [Nicaragua](#), [Honduras](#), [MORE](#)

Did you know: Harvey is the costliest Atlantic hurricane (\$198.6 billion in damage). [wikipedia.org](#)

Physical Vulnerabilities: Consequence Australia

- Ash Wednesday Fatalities – 75
- Black Saturday Fatalities – 173



Cyclone Yasi

2011 tropical cyclone

Severe Tropical Cyclone Yasi was a very powerful and destructive tropical cyclone that made landfall in northern Queensland, Australia on 3 February 2011, causing major damage to affected areas. [Wikipedia](#)

Total fatalities: 1

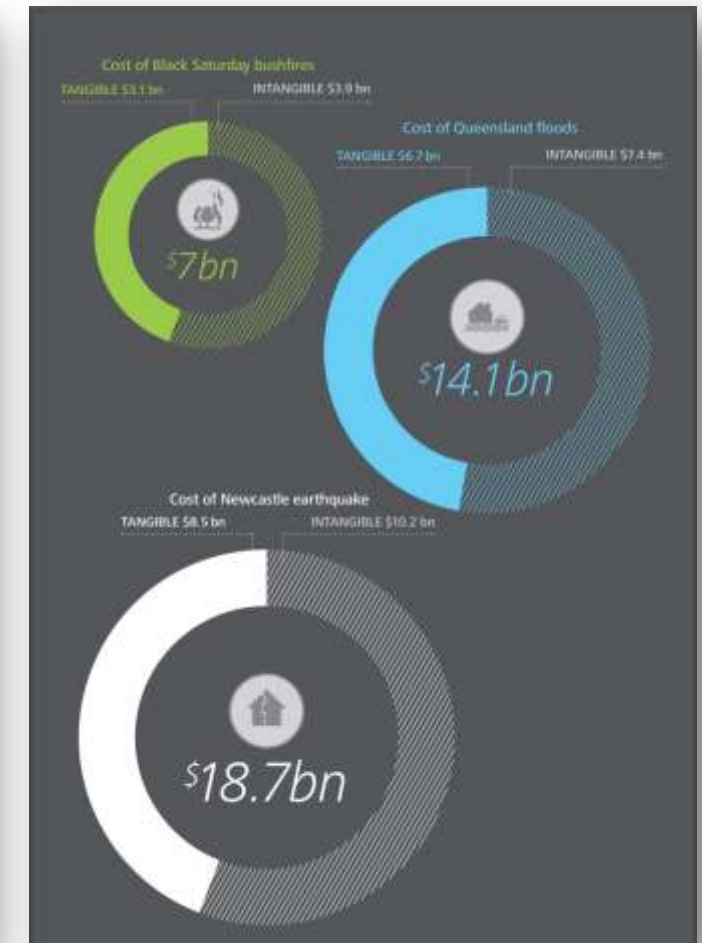
Date: 26 January 2011 – 6 February 2011

Damage: \$3.6 billion (2011 USD)

Highest gust: Gusts: 285 km/h (180 mph)

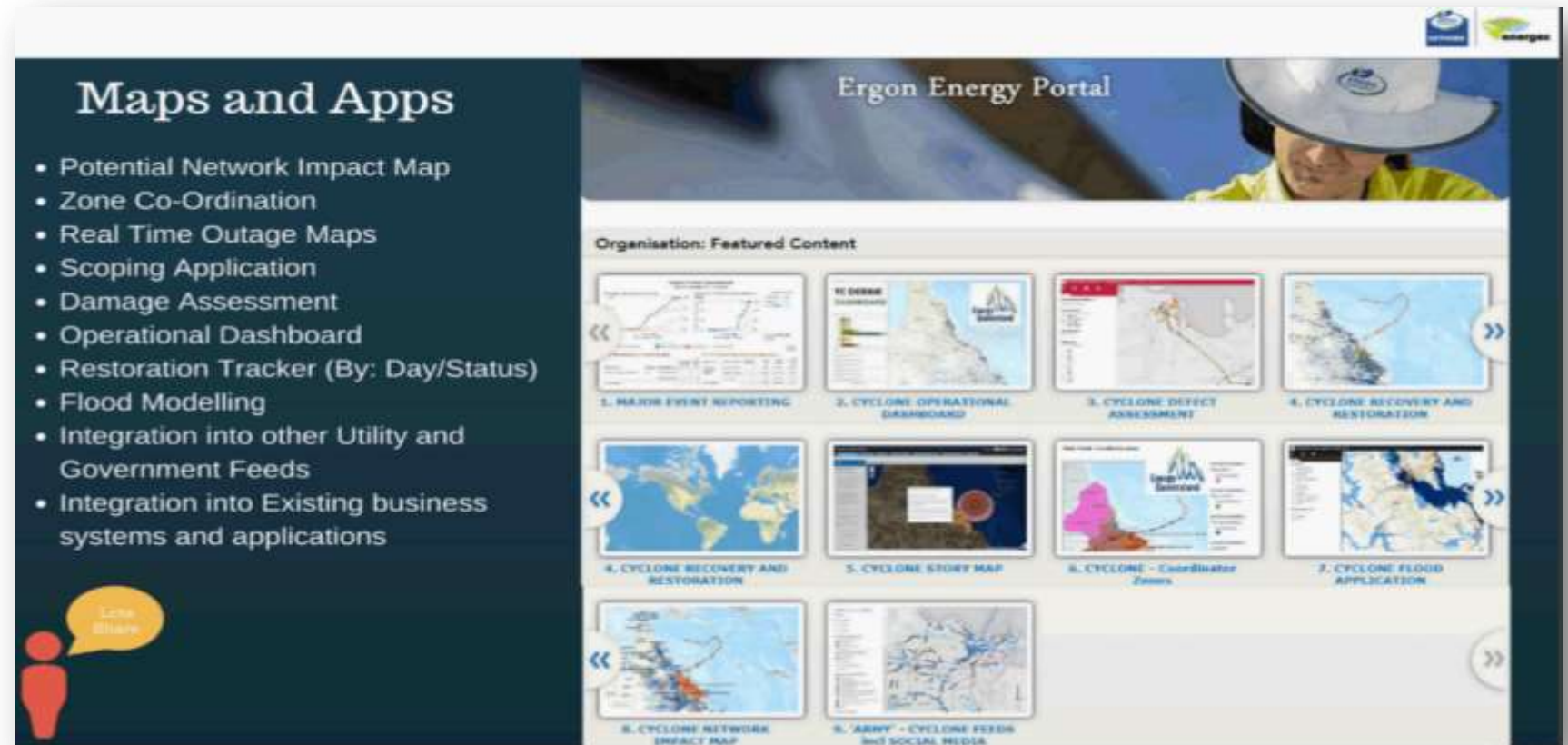
Affected areas: Queensland, Papua New Guinea, Vanuatu, Solomon Islands, New South Wales, Northern Territory

Category: Category 4 Hurricane (SSHWS), Category 5 Severe Tropical Cyclone (BOM)



Improving Grid Resilience & Response: Technology & Data Conflation

Data conflation, visualisation and analytics improves resilience planning and disaster response



The screenshot displays the 'Ergon Energy Portal' interface. On the left, a dark blue sidebar titled 'Maps and Apps' lists various tools: Potential Network Impact Map, Zone Co-Ordination, Real Time Outage Maps, Scoping Application, Damage Assessment, Operational Dashboard, Restoration Tracker (By: Day/Status), Flood Modelling, Integration into other Utility and Government Feeds, and Integration into Existing business systems and applications. Below this list is a red person icon with a yellow speech bubble saying 'Like Share'. The main content area, titled 'Organisation: Featured Content', shows a grid of eight map and app thumbnails, each with a number and title: 1. MAJOR EVENT REPORTING, 2. CYCLONE OPERATIONAL DASHBOARD, 3. CYCLONE DEFECT ASSESSMENT, 4. CYCLONE RECOVERY AND RESTORATION, 5. CYCLONE STORY MAP, 6. CYCLONE - Coordinator Zones, 7. CYCLONE FLOOD APPLICATION, 8. CYCLONE NETWORK IMPACT MAP, and 9. 'ARMY' - CYCLONE FEEDS AND SOCIAL MEDIA. The thumbnails show various maps of Australia and Queensland, some with overlays indicating cyclone paths or affected areas.

Improving Grid Resilience: Modelling & Technology

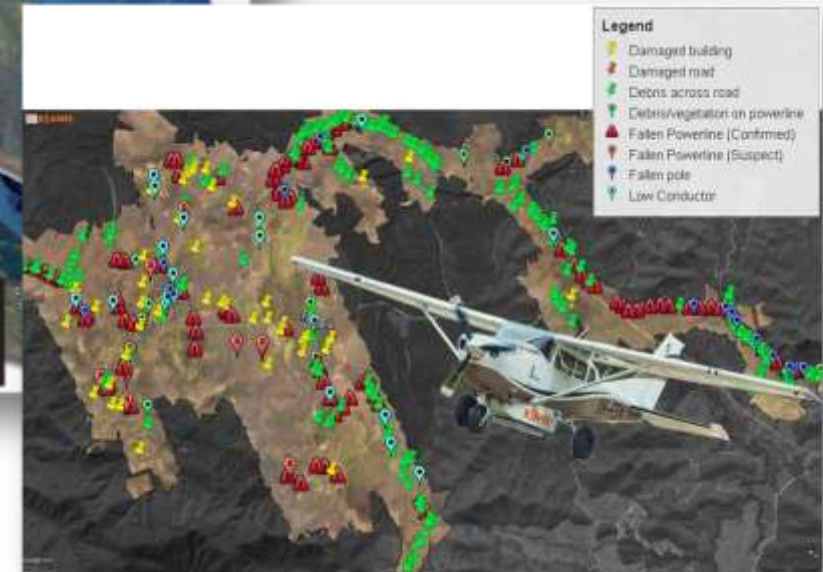
- Adaptation through understanding risk (modelling) & executing good design
- Scenario analysis
- Identify changes for asset renewal
- Reduce disaster impact
- Smart, Embedded & Micro Grids – Intelligent switches
- Distributed Energy Resources – Solar, diesel



Improving Response: Spatial

Visualisation & analytics

- A digital response replaces labour intensive high risk ground based defect identification
- Rapid aerial damage capture & processing (24 hours)
- Automated spatial digital intelligence
- Enables rapid response, logistics and restoration planning



Improving Response: Resource Planning & Field Force Automation

- Visualisation to improve deployment of field crews to priority areas
- Field Force Automation to improve work allocation and closure, workforce productivity and data management Improved

Note: Field crews replacing low voltage poles and wires to loads that no longer exist

60,000 response personnel deployed to Irma – were that many needed?

Often *the same problem is re-instated* – non fire resilient wood poles



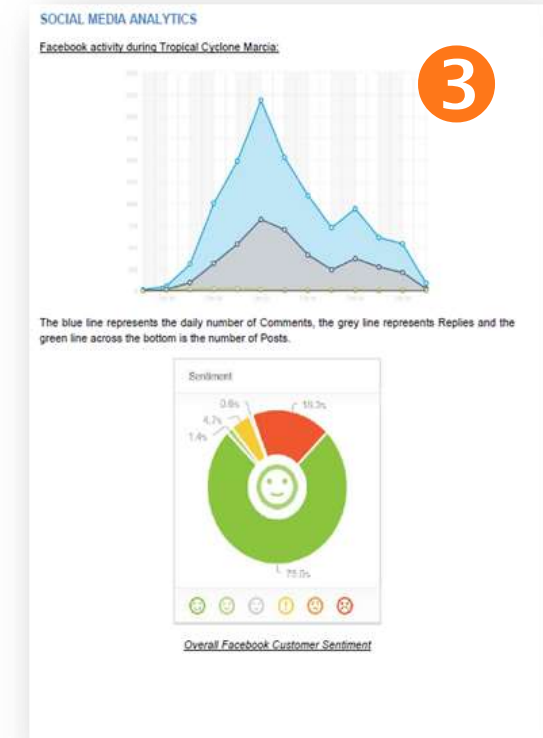
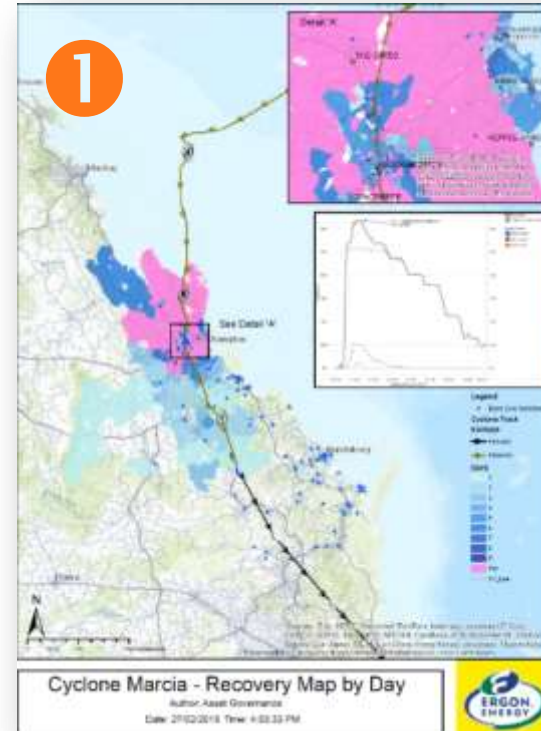
Improving Response: Communication & Social Media

Cyclone Marcia (Central Queensland):

1. Target restoration dates for areas published on the web site
2. Website hits peaked when plans were published
3. Social media monitored to improve response. Social media sentiment favourable and overall response results in improved brand and reputation

Observation

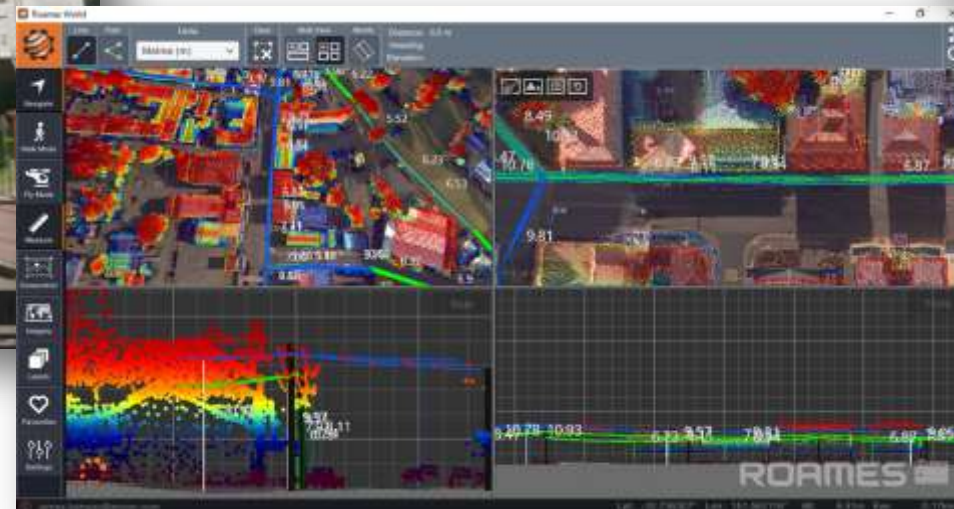
Customers further north who had experienced a number of cyclones helped set reasonable expectations for customers in Central Queensland hit by Marcia. The last Cyclone to hit the area was in 1976



Asset Analytics: Safety 1.5M High Voltage Clearance from Building

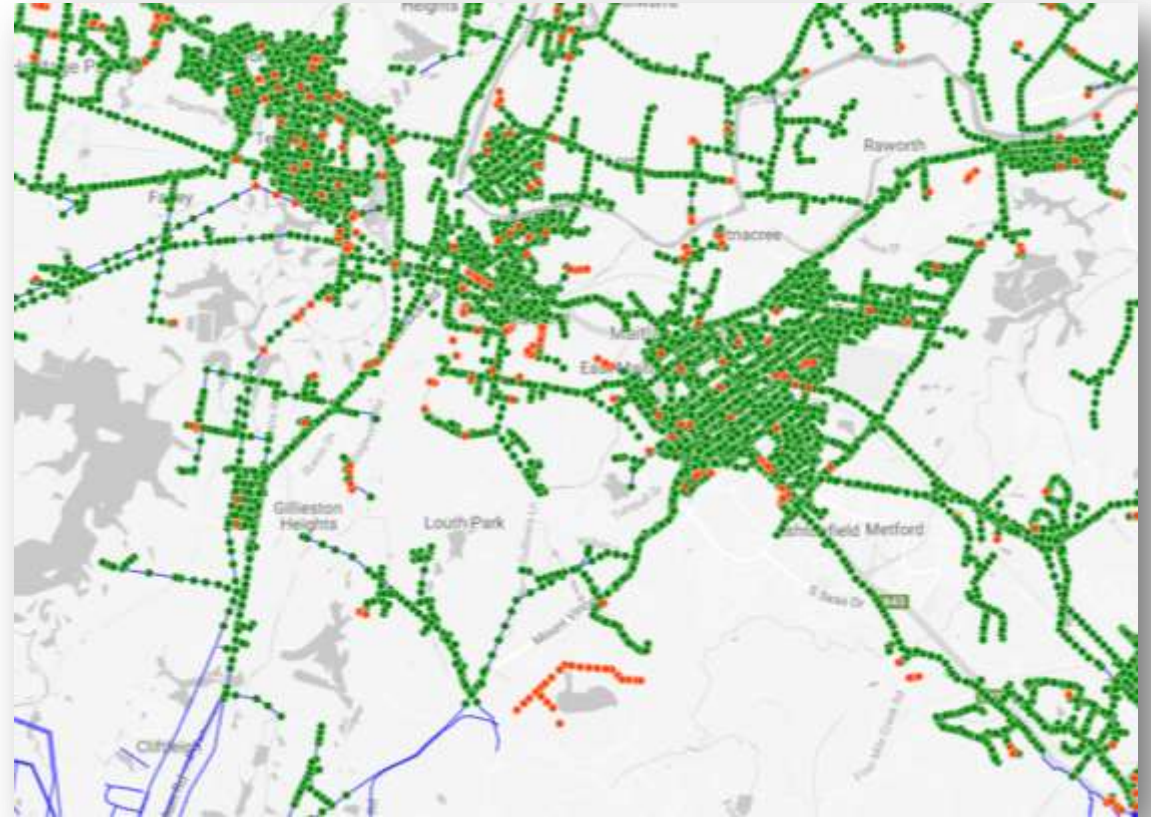


22KV live 1M off ground

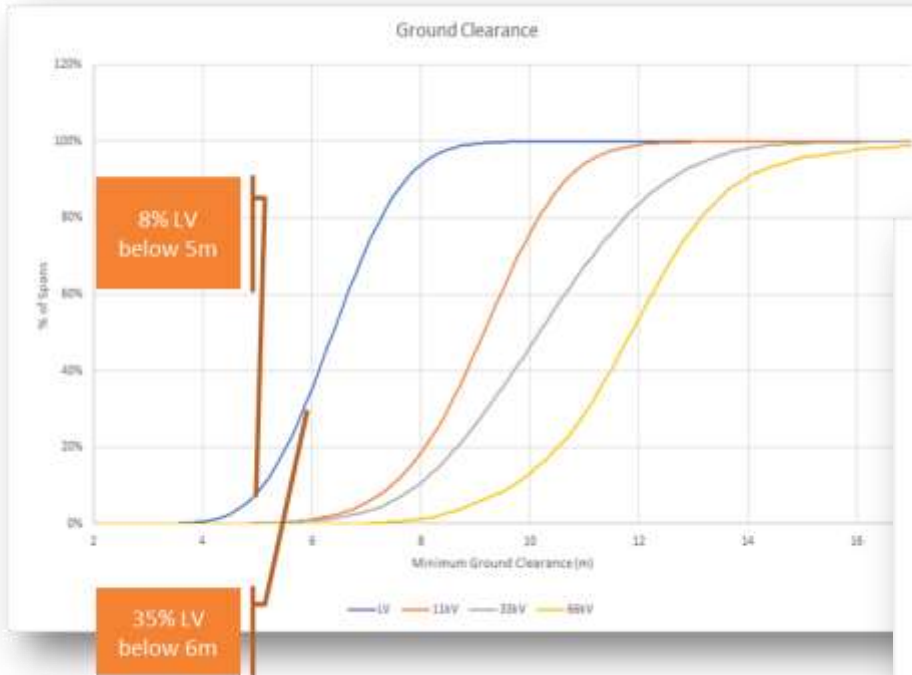


Asset Analytics: Asset Stocktake

- In Australia Benchmarking is being used by the regulator as a key input in determining performance & revenue
- It is therefore critical to have an accurate stocktake of assets
- The red dots indicate poles that were not in the utilities asset records (some may be private poles).

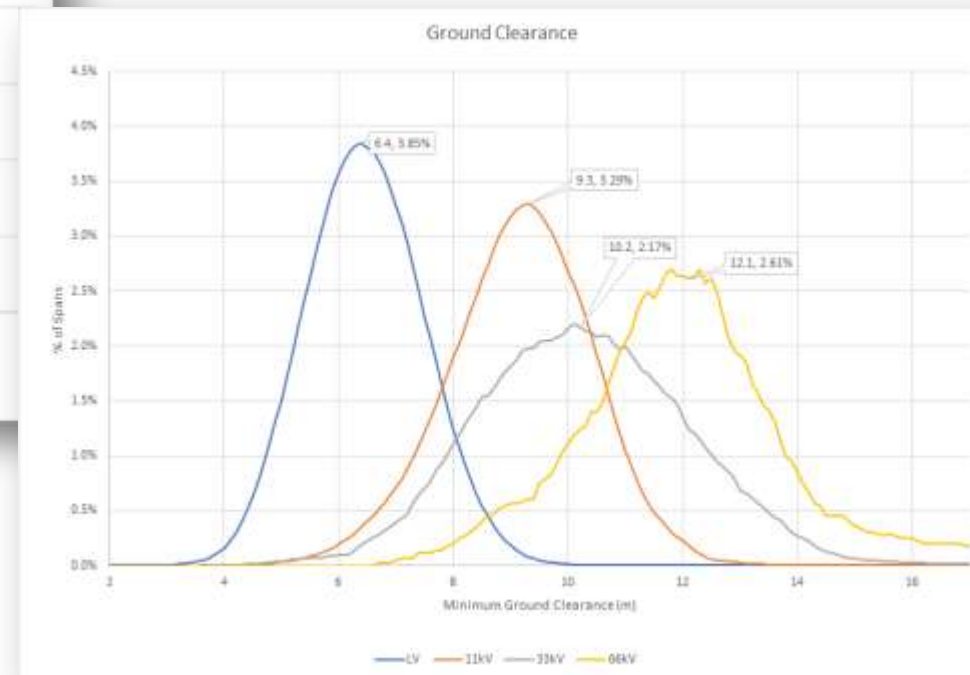


Asset Analytics: Conductor Clearance Curves – The Bell & S

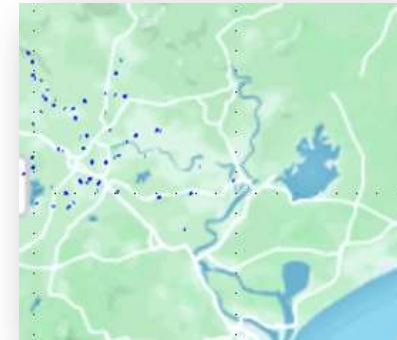
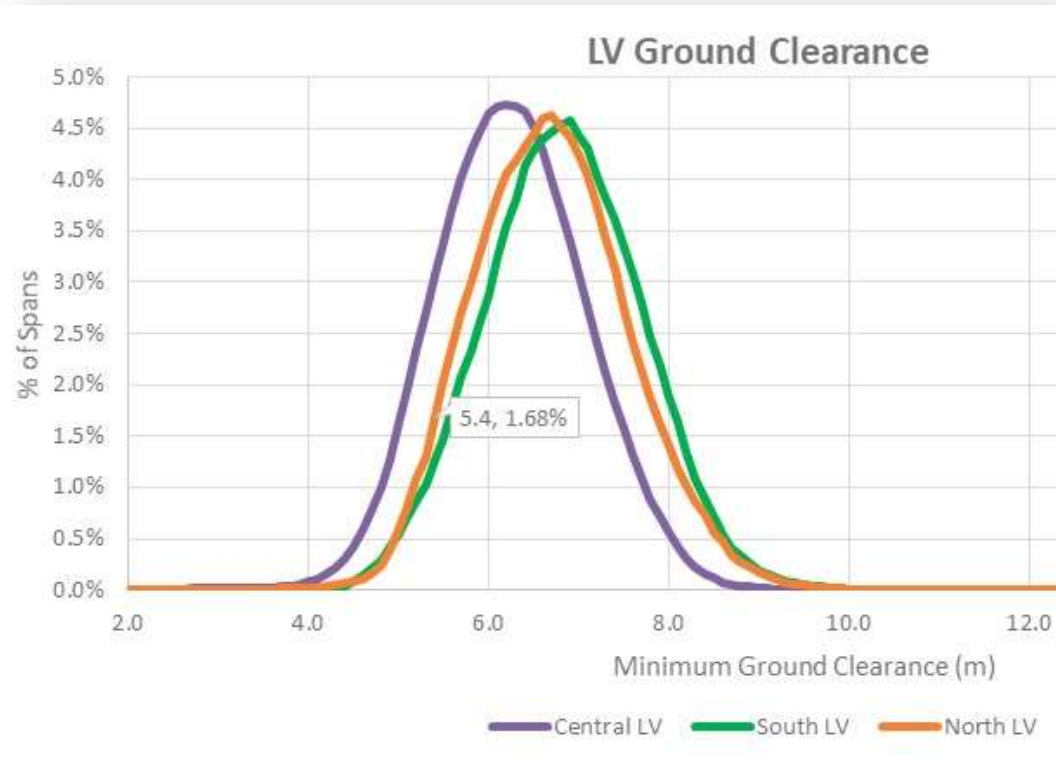


Key Attribute

Every wire is measured at 100mm intervals along the line.



Asset Analytics: Conductor Clearance – Data Slicing for Targeted Risk & Strategy



Blue Dots = Low Clearance

Rural

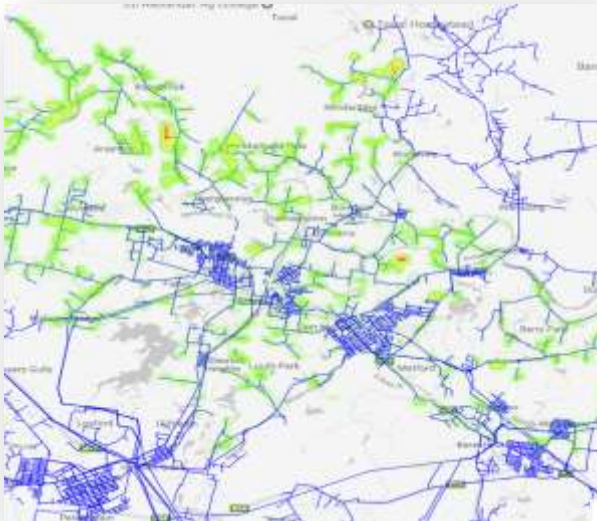
- Agriculture risk
- Land use overlays
 - Irrigation
 - spraying



Urban

- Building risk
- Rubbish removal

Asset Analytics: Pole Location



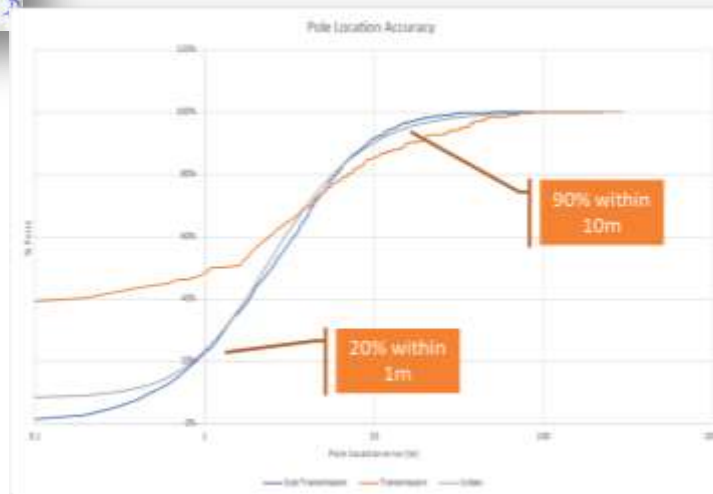
What utilities say:

Locations of poles are accurate

What is usually the truth:

They're not

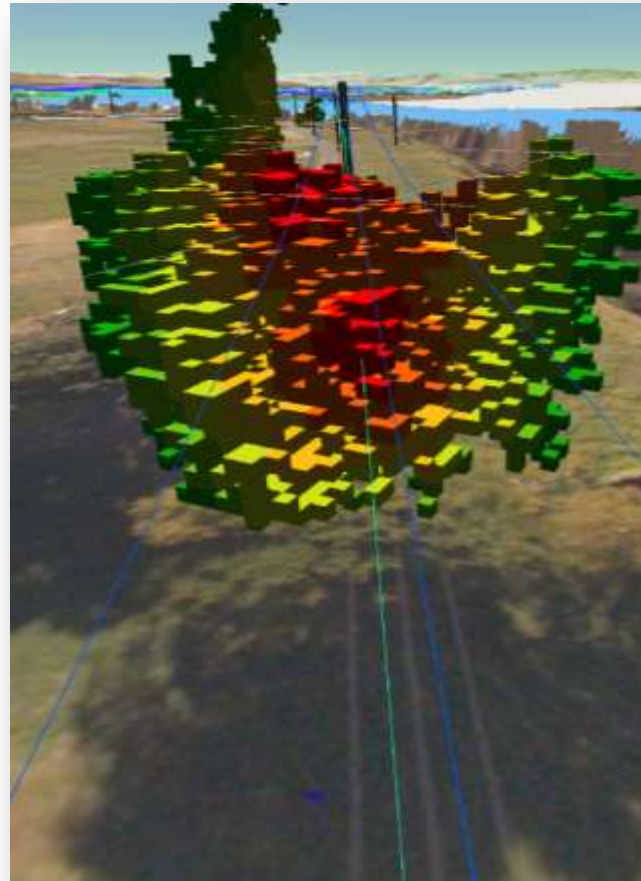
This heat map depicts the locations of the poles with potentially inaccurate locations



Errors in location can impact:

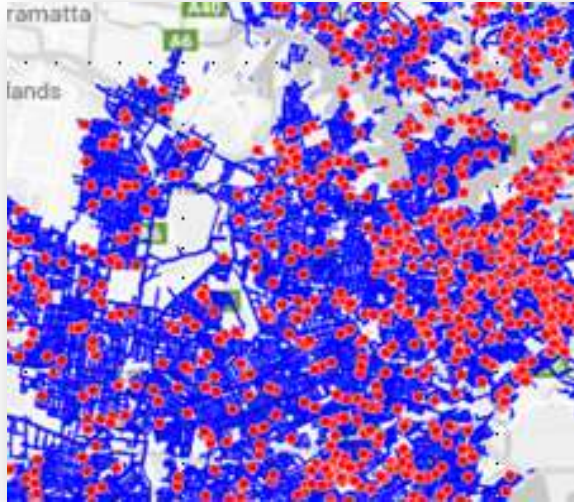
- property access information
- Assessment of physical loading of a pole (automated or manual)
- Risks related to pole loadings
- Conductor ground clearances from increased DER

Vegetation Analytics: Vegetation Encroachment



Vegetation Analytics: Bow Wave Peak

Urban



Customer Complaints

Rural

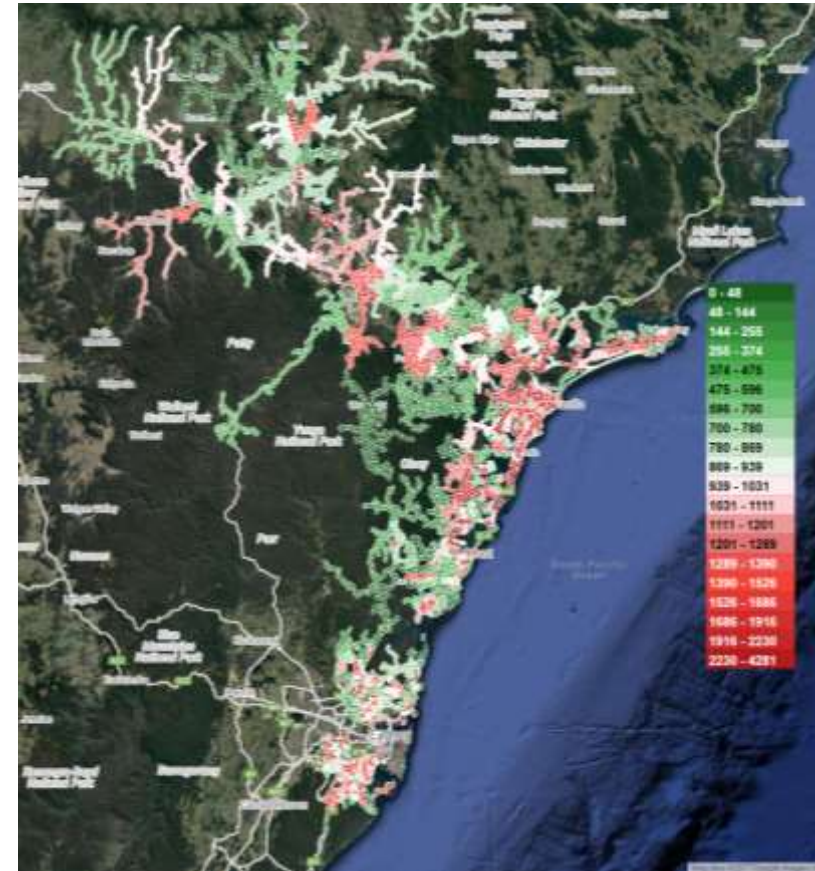


Vegetation Clearance

Location	A1	A2	A3	A4	C1	C2	C3	C4	C5	C6	C7	OH	TOTAL
Region 1	20	88	181	40	705	1134	1491	2105	1616	1232	866	4	9843
Region 2	0	27	210	33	1234	938	626	620	407	181	74	0	4647
Region 3	10	87	599	144	5653	4688	2169	1372	398	135	37	0	16592
Region 4	12	124	396	63	1951	1430	650	455	207	87	20	5	5975

Reliability Incentive – Performance & Risk Analytics

- Revenue and service opportunity
- Data conflation
 - Customers
 - Vegetation
 - Asset condition
 - Performance history
- Risk rank entire network



Economic Analytics: Ensuring Best Low Cost Solution

- Work is often done in silos
- By conflating and making visible vegetation, asset attribute, asset condition, clearances, risk, augmentation, customer extension and other data, the best financial and risk decision can be made



