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Reliability analysis and strategy for an electricity distributor

Our client is an electricity distribution network manager, grappling with producing a coordinated reliability strategy and improvement program that would yield optimal outcomes under a new regulatory regime. The regulatory changes introduced significant penalties and incentives around reliability performance, and our client needed to develop its understanding of current and baseline future performance against the regime to guide its investment decisions.

Network reliability is inherently probabilistic. This fact can make it challenging to assess the impact of improvement initiatives on business performance, as it can be difficult to separate the impact of the initiative from other factors. However, having a robust framework to measure reliability benefits is crucial for good investment decision-making, for post-project validation and learning, and to support the regulatory funding case.

Our client had a set of reliability improvement projects at various stages of development and implementation, but had opportunities to improve the rigour with which the reliability benefits of each project were determined, and hence how the projects should be prioritised.

Marchment Hill Consulting (MHC) was engaged to strengthen the business' over-arching reliability strategy – incorporating commentary around optimal performance targets – and develop a model capable of explaining historical performance and modelling future performance under an assumed suite of conditions, such as weather and asset failures. This modelling needed to provide both the future baseline, and be able to model the change in performance expected from each of the business' existing improvement projects.

Ultimately, the strategy and model would help the business prioritise its investment decisions, and provide guidance on how to respond to the Regulator on a variety of reliability questions.

MHC initially worked with the client and its key reliability personnel to develop an understanding of its business-specific drivers of reliability performance. This comprised of workshops where the generic drivers of overall reliability performance (Figure 1) were broken up at a more granular level, to qualitatively understand how each are influenced by factors such as geographic location, customer density, network topology, design standards, and time. This qualitative assessment was then supplemented with a detailed quantitative analysis.

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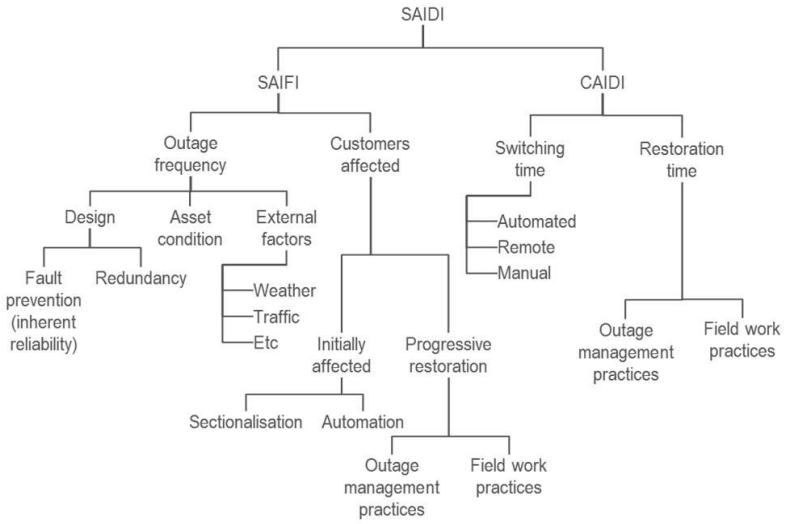

Figure 1: Illustrative break-down of the drivers of overall reliability performance (SAIDI)

Subsequently, MHC conducted detailed statistical analysis on the client's historical data to understand the strength of the observed relationships between each contributing factor and overall performance. These relationships were then input into a spreadsheet-based model, and used to replicate historical performance. Once the modelling results reached an acceptable margin of error compared to historical performance, the model was used to predict a baseline of future performance (Figure 2). By changing various parameters and assumptions in the model, it was also possible to model the reliability impact of various existing improvement projects – and understand the level of investment needed to achieve a given change in performance.

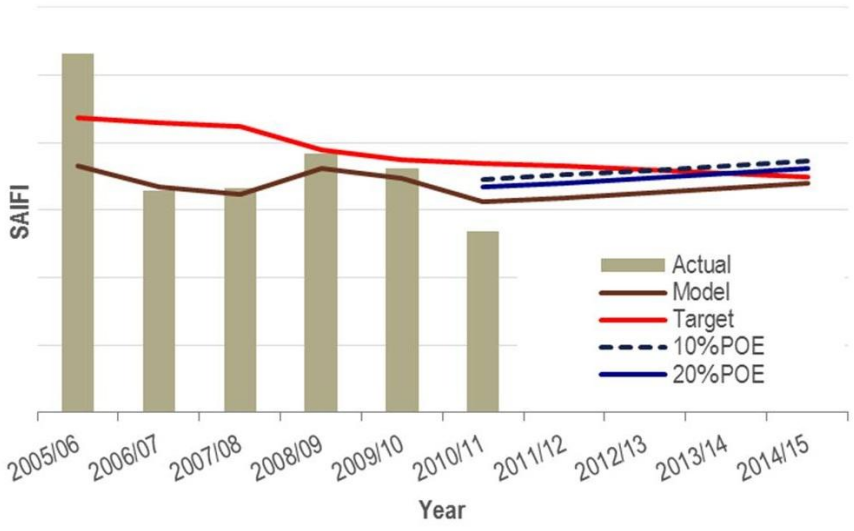

Figure 2: Comparison of actual SAIDI performance against both modelled and target performance, including 10 per cent and 20 per cent probability of exceedance for future years

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In parallel with the modelling aspect of the project, MHC also undertook analysis of the current set of regulatory performance targets, and made commentary on both the appropriateness of the framework and methodology, and on the actual targets set for the business.

Both sets of analysis were then incorporated into a single Reliability Strategy document for the business – which outlined its historical performance, highlighted the gap between targeted and baseline-predicted performance, and presented a clear program for closing this gap.

Our client gained a co-ordinated, holistic strategy for improving its reliability performance, and addressing its various regulatory requirements. Our analysis enabled our client to revise and refocus its reliability improvement plan to achieve maximum overall reliability improvement by targeting network regions and asset classes contributing the most customer minutes off supply on a probabilistic basis. The client also gained a clear understanding of their historical and baseline future reliability performance and its key explanatory drivers – as well as a clear sizing and prioritisation of its existing portfolio of reliability improvement projects. Additionally, our analysis of regulator-stipulated network reliability thresholds identified a number of issues with the calculation methodology applied by the Regulator which may assist our client in future regulatory determinations.

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Marchment Hill Consulting has offices in three locations which serve Australia and New Zealand, Asia and the Middle East.

Melbourne
Level 4
530 Lonsdale Street
Melbourne VIC 3000
Ph: 03 9602 5604
Fax: 03 9642 5626

Brisbane
Level 5
199 George Street
Brisbane QLD 4000
Ph: 07 3012 7242

Perth
Unit 14
123a Colin Street
Perth WA 6005
Ph: 08 9322 5422

marchmenthill.com