Climate Change Adaptation
Good Practice - Case Study

Fortescue Metals Group Extreme Weather Events Risk Assessment Project

About Adaptation Good Practice

Adapting to climate change is a relatively new concept to many. It is important to learn from practitioners who are undertaking adaptation activities that are beginning to have tangible outcomes. Documenting examples of good practice and identifying the criteria that makes them work, enables those interested in adaptation to learn about how to take action.

There are expectations that Adaptation Good Practice (AGP) includes a definite start and finish to a project. However climate change practitioners' experiences show that adaptation projects are often steps in longer learning journeys. There are no golden rules on how to adapt and often practitioners across Australia are inventing the wheel that drives future AGP. This case study of an Extreme Weather Events Risk Assessment Project undertaken by Fortescue Metals Group (Fortescue), at its operations located in the Pilbara region in Western Australia, is part of a series of 16 case studies that recognise exemplars for AGP in Australia. Through the development of these stories of successful adaptation it was refreshing to see an emergence of similar experiences and challenges regardless of the project or location. A synthesis of these stories can be seen in the Synthesis Report 'Climate Change Adaptation Good Practice: Key lessons from practitioners experiences', which will help practitioners to understand that they are not alone in their challenges and to see some of the clear lessons learned about what drives good practice in adaptation.

Following the Snapshot there is a more in depth narrative of the experiences, learnings and network links to stimulate further engagements and knowledge sharing among the growing community of adaptation practitioners.

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The views expressed herein are not necessarily the views of the Commonwealth of Australia, and the Commonwealth does not accept responsibility for any information or advice contained herein.

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References: **1.** Fortescue Metals Group (FMG) 2013b, *Company Overview*, Fortescue Metals Group Ltd, Available online from: http://www.fmgl.com.au/ [accessed 25 March 2013]. **2.** BOM/CSIRO 2007, *Climate Change in Australia Technical Report*. Commonwealth Scientific and Industrial Research Organisation (CSIRO). Canberra. **3.** Fortescue Metals Group (FMG) 2013a, *Operations Map*, Fortescue Metals Group Ltd, Available online from: http://www.fmgl.com.au/ [accessed 26 March 2013]. **4.** Fortescue Metals Group (FMG) 2013c, *Image and Media Gallery*, Fortescue Metals Group Ltd, Available online from: http://www.fmgl.com.au/ [accessed 28 March 2013]. **5.** WorleyParsons, 2011, *Extreme Weather Events Project Report*, Report prepared for Fortescue Metals Group, WorleyParsons Services Pty Ltd, Perth, Australia (Unpublished). **6.** Loechel, B., 2012, *Mining adaptation case study report: Learning from the Fortescue Metals Group (FMG) Extreme Weather Events Risk Assessment project*, CSIRO EP 126964. **7.** Department for Communities and Local Government (England) 2009, *Planning Policy Statement 25: Development and Flood Risk Practice Guide*, Department for Communities and Local Government, Bressenden Place, London. **8.** Department of Planning 2012, *Draft State Planning Policy 2.6 State Coastal Planning Policy*, Prepared under Part Three of the *Planning and Development Act* 2005 by the Western Australian Planning Commission, Department of Planning, Perth.

Case study snapshot

Fortescue Metals Group Extreme Weather Events Risk Assessment Project

Fortescue Metals Group (Fortescue) is an iron ore producer that operates solely in the Pilbara region of Western Australia. The company was established in 2003 and delivered its first ore shipment in 2008[1]. Since this time, the company has experienced rapid growth. The Cloudbreak mine ore processing and transport infrastructure were constructed between 2006 - 2008. More recently, a second mine was established at Christmas Creek to comprise the Chichester Hub[1].

Fortescue has a long-standing expansion target of 155 million tonnes per annum, to be reached by 2014. To achieve this target, an expansion program involves increasing existing mining operations, and construction of new mines and supporting facilities. Ore processing facilities and other supporting infrastructure (including roads, rail and port facilities, work camps and containment dams) are elements of the expansion plan. A new risk management framework was applied to identify and assess the impacts of extreme weather events and longer term climate change risks[2] on the expansion plans.

This project was focused on understanding the risks to infrastructure investments, during production expansion planning. It addressed all climate-exposed components of the company's operations, including its staff, infrastructure and operational procedures.

The project journey

Consultants sometimes get the opportunity to re-engage with clients after a project has been completed. This can be a frustrating experience when a project showed promise for making a difference by effectively adapting to climate change, only to find that subsequent action had been limited.

Encouragingly, this was not the case with the Fortescue operations located in the Pilbara region in Western Australia (see figure 1)[3]. Integration of key climate change risks into the company's corporate-wide risk management system was achieved despite a very high staff turnover immediately after completion of the project, followed by the sudden and sharp reduction in the iron ore price in late 2011.

→ Lesson learnt:

This points to the importance of ensuring that climate change risks, once initially assessed, are integrated into core corporate systems, rather than being viewed as the domain of environment or sustainability teams.

The key role of individual project 'champions' within an organisation are brought out with the Fortescue good practice case study.

→ Lesson learnt:

Quite simply, without a handful of individuals taking a strategic leadership view, this project would not have been started or completed.

Finally, company representatives were forthright in their views that any future climate change risk assessments should be undertaken on the basis of rigorous science – presented in a manner relevant to real-life decision-making contexts in the mining industry.

© Source: FMG[3]

Figure 1: Fortescue operations located in the Pilbara region, Western Australia

In 2011, the project was conducted with the need to ensure design paramenters were robust despite a changing climate.

Lesson learnt:

This suggests a critical ongoing role both for climate change science and also for 'knowledge brokers' able to interact with both scientists and decision-makers.

Critical success factors are identified in the case study. These include:

- Alignment to an identified business need; integration with existing operational frameworks (the company's established risk management framework)
- Strong internal leadership
- A pragmatic and action orientated approach to risk assessment.

Drivers for adaptation action

Over many years, Fortescue has undertaken significant and associated infrastructure expansion. In 2011, the project was conducted with the need to ensure design paramenters were robust despite a changing climate.

Impact and risk addressed

Low, medium and high climate change projections for the 2030 planning horizon were developed using the most recent published and emerging non-published information available for the following five key climate variables:

- Sea level
- Cyclone intensity and frequency
- Storm surge
- Rainfall intensity frequency and duration
- Temperature.

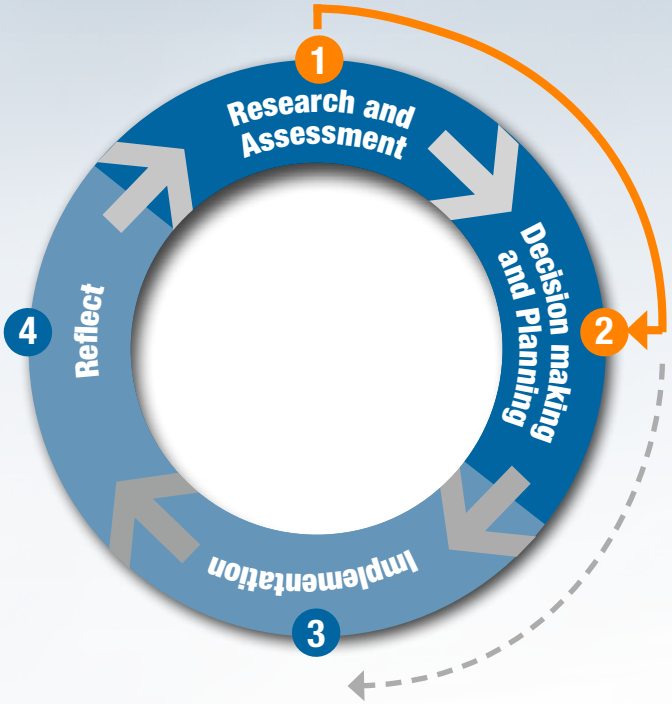


Figure 2: Fortescue Extreme Weather Events Risk Assessment Project Adaptation Good Practice phase

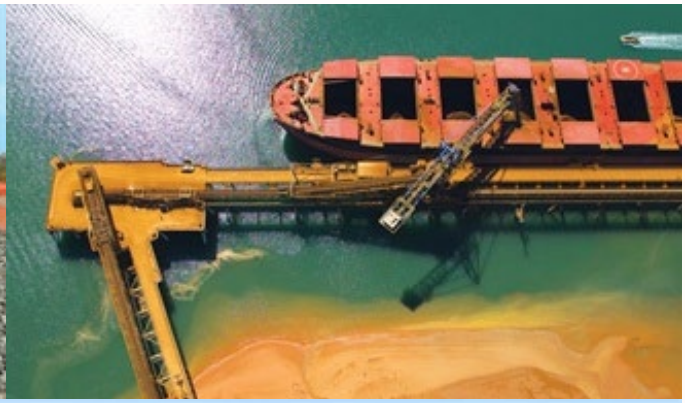
Outcomes achieved

- Scenarios of key climate parameters at a regional scale
- Critical climate change risks integrated into the company's corporate risk register.
- Update of the company's Standard Engineering Specification for Drainage and Flood Protection to ensure that potential climate changes are factored into design considerations for new infrastructure.

Adaptation action

This project provides an example of climate change risk assessment in the resources sector and offers a systematic, collaborative and transparent approach to climate risk assessment for other sectors.

The project



Source: FMG[4]

Fortescue operations located in the Pilbara region, Western Australia

Driven by an effort to understand risks to infrastructure investments during production expansion planning Fortescue reviewed the company's exposure to existing and planned Fortescue projects, operations and infrastructure (together with their associated engineering methodologies) to extreme weather events to 2030. The result was a recommended action plan to address any deficiencies. By aligning to an identified business need, integrating with existing operational frameworks including Fortescue's established risk management, strong and pragmatic internal leadership delivered an action oriented approach to risk assessment. The highest level risks were incorporated into Fortescue's risk database to ensure risk and their adaptative actions have corporate owners within the database. This project has learnings for other mining companies and other sectors.

As part of its ambitious expansion process in the Pilbara, Fortescue's new risk management framework was applied to identify and assess climate change risks to the expansion plans. During the assessment, decision makers involved in the assessment recognised that they did not have a strong appreciation of the levels of climate change risk faced.

As an outcome, for both good risk management practice and to ensure due diligence, the decision was made that a specific climate change and extreme weather assessment should be undertaken. The project was undertaken in 2011; with the primary aim of ensuring that investments made during expansion would accommodate projected changes in climate over the lifetime of the infrastructure. In addition, the risks posed by projected changes in climate to existing infrastructure were considered to explore opportunities to enhance its

the most recent published and emerging non-published information available for the following five key climate variables:

- Sea level
- Cyclone intensity and frequency
- Storm surge
- Rainfall intensity frequency and duration
- Temperature.

The climate scenarios included a mix of quantitative scenarios and qualitative

'best estimates' based on the best available information at the time, while taking at all times an upper limit of the scenario of projected changes to ensure a prudent risk management approach[5].

Response strategy

A recommended action plan to address identified risks to existing and planned Fortescue projects, operations and infrastructure and any opportunities for improvement in risk management practices, including engineering methodologies, to cater for projected changes in climate to 2030.

Implementation phases

The project was implemented through five phases:

1. *Review of Current Design Criteria Thresholds*. A review of all available Fortescue Basis of Design (BOD) information including the Basis of Design Criteria (BoDC) covering current engineering design standards applied to Fortescue infrastructure was undertaken. This led to identification of areas of exposure in existing and proposed developments, particularly identifying the exposure of core infrastructure to extreme weather events.
2. *Extreme Weather Event Scenarios to 2030*. In addition to the low, medium and high climate change projections for the five key climate variables, outlined above, projected changes in solar radiation, wind speed, evaporation and relative humidity were examined.
3. *Facilitated Risk Identification Workshops* were held to consider risks to rail and port related infrastructure and mine and human services infrastructure. The Workshops and Development of Action Tables (Phase 4) were undertaken simultaneously applying a spreadsheet-based tool developed by Adaptive Futures called a ClimateAdaptor™[5]. Fortescue's Group Manager Risk was engaged in the project and shared the company's draft corporate risk strategy and associated templates to construct the spreadsheet tool.
4. *Development of Action Tables*, including prioritised risks, risk-mitigation measures and an implementation priority rating were developed during the Facilitated Risk Identification Workshops (Phase 3).
5. *Project Report and Presentation*. At completion of the project a final report summarising the key adaptive actions derived through the assessment was produced capturing the outcomes and a presentation was delivered to Fortescue stakeholders, including representatives from the Executive level.

Key challenges in implementing the project included (modified from Loechel 2012):

- Gaining broad, senior level support across relevant functional areas within the company was initially a challenge because the environment and sustainability team initially led the project. However, once climate change risk was identified as a corporate risk by senior management, support across relevant functional areas was ensured and provided key impetus for the project.
- Translating often diffuse and high level climate change data (e.g. temperature, rainfall, sea level) into meaningful and useable forms for use in the company standard risk assessment process was a challenge given that data were not readily available for the Pilbara region and required consultation with climate science experts to generate information for use in the assessment.
- Field visitation was not a component of the assessment. With mining operations based in the Pilbara and office based activities delivered from Perth, where the workshop was held, engagement of Pilbara-based company stakeholders was done through videoconferencing facilities.

Some concerns were raised regarding the timing of the assessment, given that some elements of the expansion had commenced prior to the assessment[6]. However, Fortescue clearly recognised that the infrastructure constructed prior to the assessment was done so in accordance with Australian standards. Fortescue also recognised that in a changing climate there may be scope for moving "beyond best practice" to consider potential climate changes during the lifetime of assets, and in doing so, provide additional resilience to infrastructure already constructed. This could be achieved through a planned schedule of maintenance and upgrading components of assets identified as particularly vulnerable.

Outcomes achieved

The outputs of the assessment indicated that the BoDC did not require radical change given existing factors of safety and the relatively short

infrastructure design lifetimes. However, recommendations for revision to the BoDC criteria to reflect assessment outcomes were made with a focus on the *Standard Engineering Specification for Drainage and Flood Protection*. Fortescue adopts a risk-based, informed approach to engineering design that uses variable design standards depending on the type of asset under design, its planned lifetime and the consequence of failure.

As a result of the assessment, the *Standard Engineering Specification for Drainage and Flood Protection* was updated to ensure that potential climate changes are factored into design considerations. The Standard directs staff to consider a 'check storm' that has an Annual Recurrence Interval (ARI) greater than what has been designed for, i.e. if a 1:50 year storm was adopted as the design event; then a lower frequency (higher impact) event is examined. This process allows the sensitivity of the design to climate change to be considered

Fortescue recognises that access to State level guidelines on incorporating climate change projections into engineering design could enhance the process adopted. For example, in the United Kingdom the English Planning Policy Statement (25) for flood risk provide recommendations on how to incorporate climate change projections within flood risk design[7]. Such information relevant to Western Australia would be helpful.

Fortescue's corporate risk management software is a repository for all corporate level risks. The highest-level risks identified in the project were incorporated into Fortescue's risk database to ensure

© Source: FMG[3]

Fortescue operations located in the Pilbara region, Western Australia

a focus on addressing these risks via implementation of the identified actions. Each risk and their mitigation (adaptive) actions have 'owners' within the corporate risk management database, which allows for continual updating of adaptive actions through periods of corporate change.

Emerging outcomes

This project provides an example of climate change risk assessment in the resources sector and offers a systematic, collaborative and transparent approach to climate risk assessment for other sectors.

Critical success factors

AGP analysis of the project

Success of this approach has been driven by strong leadership, connectivity with corporate risk process and excellent connectivity between all stakeholders.

This project is strong in:

- **Leadership**
- **Engagement**
- **Connectivity**

Leadership

At the outset of the project, internal meetings were held to establish and frame the issue of climate change across the organisation. Participants from the environment and sustainability team, risk management group and engineering services acted as champions within Fortescue and the various project implementation teams attended the meetings. This provided an opportunity to discuss/clarify climate risks and the approach that would be adopted through the risk assessment. Technical 'pre-screening' workshops were held to ensure focus on priority risks and from this point onwards, Fortescue staff demonstrated high-level buy in.

The staff that jointly led the project became critical 'project champions' both promoting engagement across the company and at senior management levels.

The final presentation of the project outcomes and key findings was delivered to senior company representatives which demonstrated Fortescue's commitment to, and interest in, the project.

This study was seen as raising the upper limits of standards and specifications, rather than addressing new challenges.

Leadership lesson learnt:

Project champions can promote engagement across companies and departments including senior management.

Engagement

Having the correct balance of Fortescue representatives across environmental sustainability, risk, engineering and business/infrastructure development contributed and the right mix of expertise and experienced consultants (i.e. engineering knowledge specific to Fortescue operations and climate change adaptation knowledge)[6] also contributed to project success. WorleyParsons staff engaged in the project had a long-standing relationship with Fortescue and therefore the experience in the operational and structural elements required to aid risk assessment. For example, experience in working with the BOD documentation was a considerable benefit to the project, particularly for the initial risk screening exercise.

This study was seen as raising the upper limits of standards and specifications, rather than addressing new challenges. During project implementation, severe flooding occurred in Queensland resulting in impacts to mining areas in this region which further increased awareness of the potential impacts that extreme weather events could have on Fortescue operations.

Stakeholders regarded the project as producing something meaningful and user-friendly and raised company awareness of the scale of climate change risk facing their operations, as detailed discussion of climate science and a structured analysis process to determine risk levels had not previously been adopted.

The project was considered valuable as it informed the discussions that were underway across the organisation and provided the evidence base needed to inform decision-making. In addition, the outputs indicated that the severity of the risk (to the 2030 timeframe) was not severe and indicated the actions that could be taken both immediately and as ongoing management approach, to manage the risks. This, as an outcome, provided reassurance to the management team.

Engagement lesson learnt:

Creaing the right balance of representatives, the right mix of expertise and experienced consultants contributes to project success.

Connectivity

The project was integrated with the corporate risk process, ensuring alignment between risk templates and evaluation criteria. Thresholds for risk were established (i.e. the numbers of

The project provided a forum to discuss an issue that was relevant to representatives from a range of operational areas, including environment, risk, infrastructure, and corporate management.

days of production lost), which ensured the risk narrative was clearly understood and comparable across other corporate risks.

At the time of the project, Fortescue were in a major expansion phase and as such were focused on ensuring quick decision-making processes using the best available information. This climate of decision-making was advantageous. Stakeholders were aware of the direct relationship between the decisions they were making and the outputs of the assessment, as it related to meeting the long-term business objectives. In addition, there was also recognition that mining infrastructure requires high maintenance over relatively short asset lifetimes. As such, opportunities to consider climate change during planned maintenance are available, and this was recognised. The output was a two-pronged approach to adaptation, with changes to the *Standard Engineering Specification for Drainage and Flood Protection*, and recommendations to monitor and evaluate existing infrastructure with a climate lens.

The project provided a forum to discuss an issue that was relevant to representatives from a range of operational areas, including environment, risk, infrastructure, and corporate management. In addition, it provided an opportunity for Fortescue to revisit business operations and risks from a different perspective, i.e. to obtain greater insight into operational risks and the opportunity to reduce specifications and costs in areas where risks may have been overestimated, providing a guide for future corporate expenditure in terms of value for dollar spent on risk mitigation[6].

→ Connectivity lesson learnt:

A climate of decision-making is advantageous because Stakeholders can see the direct relationship between their decisions and project outputs.

Sustainability

At the time of the study, and indeed now, the only mandatory requirement for inclusion of climate change into infrastructure construction in Western Australia is to consider sea level rise figures according to the State Coastal Planning Policy[8] for the construction of marine-based infrastructure. There are currently no construction standards required at State level to incorporate climate change into other infrastructure types. As such, it is at the discretion of companies to decide if they factor-in climate change considerations into their risk management practices.

In addition, the changes implemented to date, in combination with the realisation that projected climate impacts to infrastructure can be managed through ongoing maintenance programs and upgrades to the BoDC, has reduced the urgency for adaptive action. This is largely because the identified risks have been reduced to more acceptable levels through the actions implemented. Fortescue representatives recognise that the approach that was adopted to complete the Extreme Events Risk Assessment has provided 'peace-of-mind' that the issue of climate change risk to key infrastructure has been addressed in a substantive and systematic way.

Fortescue would consider reviewing its climate change risks at regular intervals in the future. However, this would require significant improvement in climate change projections for the Pilbara to justify such a review.

→ Sustainability lesson learnt:

Ongoing maintenance and upgrades can reduce the urgency for adaptive action.

Cost

While a cost-benefit analysis was not undertaken as a component of the project; when climate risks are mainstreamed within the corporate risk register, cost-benefits may be considered as part of the risk review process.

The cost of undertaking the project was justified on the basis of ensuring due diligence requirements and that the company is empowered to ensure that its resources are rationally allocated.

Conclusion

© Source: FMG[3]

Fortescue operations located in the Pilbara region, Western Australia

The mining industry plays a critical role in the Australian economy and is potentially at risk from the projected impacts of climate change through the climate-exposure of its infrastructure and operations. The project initiated by Fortescue provides one of the few examples of climate change risk assessment in the resources sector. As such, it provides learning for other sectors and demonstrates the benefits of a systematic, collaborative and transparent approach to climate risk assessment. In this case, the benefits extended beyond the identified adaptive actions (i.e. changes to the *Standard Engineering Specification for Drainage and Flood Protection*) to raised awareness of climate risks.

One of the key benefits may be in the recognition that climate risks to the infrastructure elements of resource operations can be addressed through ongoing incorporation of climate science into BoDC as well as ongoing maintenance programs. Despite these benefits, sustained investments in adaptation planning may be difficult when businesses undergo significant operational change without the focus on corporate-level risk management systems used by Fortescue. In order to support future climate change risk assessments the company would benefit from the receipt of ongoing (and appropriately tailored) climate change impact information and methodological guidance to assist in maintaining the impetus and sustainability for adaptation investments in the longer-term as the scientific evidence for climate change builds and as new risk assessment and adaptation planning methodologies become available.

Gaps and future challenges

A key information gap was the availability of reliable, authoritative and specific climate change data for the Pilbara region of Western Australia. The lack of detailed climate projections specific to the study site resulted in a reduced sense of certainty in the projected future forecasts which was addressed through a collaborative, consensus building approach.

Links to more information and projects

For information on the operations of Fortescue, see www.fmgl.com.au

For more information on managing risks associated with the effects of climate change on the mining industry see two recent NCCARF reports:

Sharma, V, van de Graaff, S, Loechel, B, and Franks, DM, 2013 *Extractive resource development in a changing climate: learning the lessons from extreme weather events in Queensland, Australia*, National Climate Change Adaptation Research Facility, Gold Coast, pp.110.

Mason, L, Giurco, D. 2013 *Climate change adaptation for Australian minerals industry professionals,* National Climate Change Adaptation Research Facility, Gold Coast, pp. 60.

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