**Myanmar Energy Risk – Technical Workshop, Centre for Disaster Reduction, London, 17th April 2019**

**Workshop Summary**

***Background***

The workshop was organized by the Crisis and Disaster Risk Finance team to take advantage of colleagues from the Energy and Extractives Practice being in London, and the potential for the London Hub [1] to convene an expert group from academia, research and the specialty insurance market at Lloyd's, to discuss in an informal context, the energy infrastructure challenges, including DRF, for the electricity sector in Myanmar, specifically in respect to the ongoing US$400 Mn National Electrification Project and aims to expand the electricity service nationally, through both on- and off-grid approaches, while also increasing resilience against natural hazards.

Based on the workshop findings, the potential of financial instruments, including risk transfer, to protect the energy systems in Myanmar from natural hazards will be further explored.

Hosted in the London Centre for Disaster Protection, the workshop had the combined objectives of:

- to jointly explore potential of risk assessment methods and data sources which can be applied to resilience and recovery approaches for energy infrastructure in Myanmar to natural disasters and shocks;
- to identify priority risk assessment needs, and approaches for resilience of Myanmar energy infrastructure, including the role of DRF.

**Objectives of the Workshop:**

- exploring the data, analytics and financial instruments that can be applied to manage shock risk and increase resilience of energy infrastructure in Myanmar;
- sharing approaches and ideas on the above between external experts from the private sector, including catastrophe modelling, insurance sector, research, and the World Bank;

[1] The Disaster Protection Program is a program of the World Bank Group Finance, Competitiveness, and Innovation Global Practice, financed by the UK Department for International Development, and implemented by the Crisis and Disaster Risk Finance team (CDRF) to advance Disaster Risk Finance and Insurance (DRFI) work in developing countries. At the heart of the Program is the establishment of a new World Bank DRFI Hub (the Hub) in London. The Program and its Hub will rely on the experience and expertise of DRFIP to build the capacity of governments, provide neutral advice based on strong analytical evidence, ensure finance is linked into national plans and systems, and invest in research, innovation and learning.

The objective of the Disaster Protection Program is to improve the financial resilience of low- and middle-income countries against disaster risks through sovereign disaster risk finance and insurance solutions, and to protect the lives and livelihoods of poor and vulnerable people, while helping countries recover faster in the aftermath of a disaster. The Program will focus on strengthening pre-disaster planning, catalyzing innovative finance for resilience and using disaster risk finance and insurance tools to provide more cost-effective, rapid and reliable finance in emergencies.

- considering end-to-end infrastructure lifecycle and characteristic risk considerations, as well as energy infrastructure as a network, and as a component of a systemic infrastructure network, with particular risk considerations;
- considering current and future energy mix (including renewables and off-grid) implications from a risk perspective.

**Key questions explored at the workshop:**

- how to support the Government in prioritizing resources to increased resilience in a Low-Income Country such as Myanmar;
- how to engage Government agencies in understanding scale and implications of energy infrastructure risk and value of resilience investment, including visualization approaches;
- can key vulnerabilities be identified along the energy supply chain, in respect to multiple hazards.

**Key Outcomes and opportunities for collaboration:**

- Priority actions are to gain a better understanding of the risk faced by energy infrastructure in Myanmar and to help clients gain a deeper understanding of disaster risk and potential financial solutions for risk management.
- **Risk assessment and mapping:** As a first step the team will create initial risk mapping with existing for increased risk understanding and communication with clients. The team will also explore a contract with Oxford University for mapping energy infrastructure in the country. Next steps:
    - *Energy team to share any existing data on asset location*
    - *CDRF Team to prepare initial hazard and exposure mapping with existing data*
    - *CDRF Team to prepare draft TOR for Oxford University*
- **End-to-end risk understanding:** As a second step the team will engage a risk engineering expert to serve as an advisor (STCs) to the Energy team on key resilience considerations for the whole lifecycle of energy investment projects in Myanmar, including power generation and transmission/distribution. *Next steps:*
    - *CDRF Team to prepare a draft TOR, building on market good practice for risk engineering assessments.*
    - *Energy team and CDRF team to look for candidates with a priority for candidates based in the region, who can join a mission to Myanmar as soon as possible to carry out a full 'risk audit'*

- These two steps will feed into a short and medium term workplan to increase risk understanding and identify intervention to strengthen risk financing and preparedness for faster response.
- A power and transmission grid data collection exercise will be piloted, potentially employing local ground truthing data, to assess the applicability to Government risk assessment and decision making. In addition, a solar panel identification pilot will be considered for trialing using satellite data and classification algorithms.

- Working examples of the use of geospatial data and visualization tools to integrate hazard, energy grid and asset exposures to assist in risk prioritization and scenario building, particularly re-using analytics and modelling outputs from other applications, will be developed for use in client presentations of capabilities and potential uses for decision making.

***Workshop Participants***

External participants included academic and research experts in the fields of satellite based and geospatial data, catastrophe modelling, and infrastructure network analytics.

In addition, Lloyd's of London and the Lloyd's Market Association assisted in the identification of expert insurance market practitioners across the whole energy infrastructure sector, including power generation (conventional and renewable), transmission and distribution, and delivery.

| Name | Affiliation | Key focus areas |
|---|---|---|
| Dr Goran Trendafiloski | AON Impact Forecasting | Catastrophe modeling of energy infrastructure, exposure data requirements and approaches to non-physical damage potential (business interruption) |
| Gemma Ball and Christophe Christiaen | UK Space Catapult | Sources and extraction methods for data on hazard, exposure and risk/resilience attributes related to power generation, transmission and delivery systems |
| Dr Conrad Zorn | Environmental Change Institute, University of Oxford | Network risk analysis to energy infrastructure systems, identification of system-critical assets, systemic power risk visualization (Myanmar example) |
| Kevin Seakins, Steve Cross | Axis London | Construction and ramp up phase risks including cargo transportation to site, conventional power generation underwriting, T&D, risk engineering approaches and key market trends and risk appetites, restoration cost overheads versus initial construction costs |
| Robert Bates | GCube Underwriting | Renewable Energy (Photo Voltaic, battery, onshore wind) risk, claims management and underwriting approaches |

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| Captain Adrian McCourt | Munich Re | Marine and offshore energy risk, including offshore wind generation, risk engineering approaches, certification and market trends |
| Steven Thomson | Royal Institute of Chartered Surveyors | Construction valuation approaches, risk engineering, certification and competency assessment approaches |
| Sunil Khosla | Energy and Extractives Practice, World Bank | |
| Huong Mai Ngyuen | Energy and Extractives Practice, World Bank | |
| Benedikt Signer | Crisis and Disaster Risk Financing, World Bank | |
| Cathy Ansell | Crisis and Disaster Risk Financing, World Bank | |
| Evie Calcutt | Crisis and Disaster Risk Financing, World Bank | |
| Tatiana Skalon | Crisis and Disaster Risk Financing, World Bank | |
| Matt Foote | Crisis and Disaster Risk Financing, World Bank | |

The workshop highlighted both potential data sources, including satellite-based transmission and distribution mapping, systemic risk assessment and key underwriting decision considerations, current and future market appetite for infrastructure risk, and discussed potential future resilience protection mechanisms which could provide sovereign asset owners and Finance ministries with options for encouraging greater resilience of critical assets.

The following key points and insights arising from the discussion were noted:

- Data representing energy infrastructure assets is a critical requirement for improved strategic asset management but is not always easily available, especially in respect to the risk-specific attributes necessary to enable effective risk assessment. The spatial accuracy of asset positioning is critical for some hazards (e.g. flood, landslide), but less so for others (e.g. earthquake), but attribute accuracy enabling representation of specific functional and construction characteristics are materially important for all assets. Costs for data capture can be very high, but there are approaches that use existing data and algorithms which can potentially provide fit-for-purpose data at lower expense. Methods such as the automated extraction of power lines and pylons using visible waveband and radar satellite and UAV / drone-based platforms, can be employed to capture data in cost effective ways, particularly if local ground-truthing and augmentation is also possible to calibrate and validate data. Additionally, options to identify off-grid solar panel installations via semi-automated techniques are possible. Open and freely accessible data sources can help begin the process, potentially augmented by other sources.

- Where there are significant data gaps, inferential approaches can be used as a first-pass approach – for example the use of proxy datasets from remote sensing (including night-light) and demographics to infer likely low voltage power line network patterns from high voltage nodes, as already applied to http://blogs.worldbank.org/opendata/node/2196 using the GRIDFINDER open source application.
- The energy specialty market is poorly performing at present, mainly due to reducing premium rates (resulting from the general market capital overcapacity), increased and large claims, reduced real terms retention levels, and expanding coverage. Premium rates are expected to start increasing to respond to this. However, the market could be interested in diversified energy risks in emerging markets, including LICs and MICs including Myanmar, especially if power assets are designed with resilience. Better risk data would support better rates, capacity and terms for any transactions.
- Consideration should also be made of the long-term financial security of insurers in respect to energy risk transfer, as well as potential for insurers to pull out of the class.
- Insurance cover is available for all stages of the infrastructure lifecycle, and it usually falls to either an intermediary, or third-party consultant, to arrange the required cover for each aspect of lifecycle risk.
- Costs of re-instatement of energy asset function (e.g. due to failure of critical components, or catastrophic impacts from natural hazards) can be significantly larger than original construction costs. An example is in the cabling required to connect power generation units to transmission and distribution nodes, particularly offshore-onshore marine cabling, which is often produced as a bespoke component and cost for replacement of damaged cable can be much larger than original installation. Costs can fluctuate significantly over time, with changes in currency rates and material costs.
- This can be partly mitigated by ex-ante risk mitigation approaches, including redundancy options for critical components (e.g. backup power sources) or stocking of spares. However, this may not be possible for all components (e.g. bespoke cabling cannot be cost-effectively duplicated) and stocking all spares can add significant and uneconomic costs to the operational lifetimes of projects. Long term maintenance contracts with the equipment suppliers can be cost effective, but there is a potential for the amount of liability cover available from a supplier or constructor in event of failure and subsequent damage or downtime to be limited or otherwise capped. This returns the risk to the asset owner unless there is another form of insurance available.
- Professional risk engineers are a key but under-used source of expertise to assess, certify and recommend resilience improvements to critical assets. Expert opinion from risk engineering teams remains a key resource in the evidence-based approach to risk pricing and underwriting of complex commercial / infrastructure assets.
- Insurance markets have driven energy sector risk management best practice development across a range of construction and operational areas as prerequisites before cover is provided, making insurability dependent on asset owners applying the required methods of risk management or construction.