risk analysis, management and related services for hydro projects
We advise a broad range of clients on risk management and mitigation issues on a day to day basis. Our advice ranges from conceptual and implementation issues for new and existing hydropower assets to hydro-mechanical equipment for flood protection with the UK’s Environment Agency.

This document introduces stakeholders, especially financial stakeholders, to some of the topics related to risk and the various service areas where KGAL can offer professional advice.

What is Risk and Risk Management?

As defined in ISO 31000, risk is the effect of uncertainty on objectives; risk management is the identification, assessment and prioritization of risks followed by the coordinated and economical application of resources to minimise, monitor and control the probability and / or impact of unfortunate events (negative events), or to maximise the realisation of opportunities (positive events).

The first step in the risk management process is to acknowledge the reality of risk. Denial is a common tactic that substitutes deliberate ignorance for thoughtful planning.

Charles Tremper

In addition to identifying and eliminating (or mitigating as far as possible) the primary risks of personal injury, project failures and legal liabilities, professional risk management has many facets and can benefit organisations or projects in several ways:

- Adds value to the organisation / project.
- Integral to organisational or project processes.
- Informs and improves planning and decision making.
- Systematically addresses uncertainty.
- Protects company image and reputation.
- Specific to the organisation and / or project.
- Makes issues transparent and maximises the identification of risks.
- Iterative and responds to changing situations as they develop.
- Used effectively contributes to continuous improvement and development goals.

What makes hydro different?

There are a wide range of risk types; generally, at the highest level, they can be categorised into four main types, all of which could be driven by either internal or external factors:

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There are, however, a particular set of issues that make hydropower different from conventional power and some other types of infrastructure project which are of particular interest to financial stakeholders:

- The balance between the higher cost of generation over a typical fiscal agreement period - compared to the much lower overall cost of generation that the project might achieve over the asset’s life - will influence those fiscal arrangements to a disproportionate degree.
- The nature of projects which have to rely on increasing levels of survey data as the project development unfolds leave them with a higher level of risk related to their investment, for example, the civil engineering design will develop as a more detailed understanding of the exact geology becomes apparent.
- Elements such as hydrological risk which can also be impacted by climate change give rise to unique risks (e.g. flooding during construction, seasonal and annual variations in flow or head), each of which needs to be managed at each stage.

The environmental and social impacts of hydropower projects, particularly impounded projects, has been synonymous with hydro development for a number of years. This has reduced new project development since the ‘90s until relatively recently during which period the multi-lateral funding agencies avoided such projects.

Currently, the funding agencies are taking a more balanced view to supporting hydropower and the multi-functional dam projects they often help to support, promoting local benefits and helping in the fight to de-carbonise economies.

Studies have identified that risk related costs can account for 50% of hydro project spending. According to the Hydro Finance Handbook, ‘It [hydro] is capital intensive and highly site specific to the extent that no two projects are alike. It is often impossible to predict the amount of engineering needed – and therefore the final costs – until construction is well advanced. It is inherently more risky, in terms of cost overruns and delays, than a thermal power station.’

Good risk management fosters vigilance in times of calm and instils discipline in times of crisis.

Dr Michael Ong
There is another factor which is almost unique to hydropower projects. Whilst hydro-electricity has the potential to transform economies, many of the larger schemes being proposed sit in seismically active areas. In some instances the seismic activity itself can be induced by the new weight of water created by the HPP’s reservoir.

How KGAL can contribute

KGAL has a deep understanding of hydropower projects: from inception to commissioning and operational phases. Collectively, KGAL staff have over 200 years of experience in managing and engineering hydropower projects and their development.

Knowing our risks provides opportunities to manage and improve our chances of success.

Roger VanScoy

We apply this knowledge and experience within the formal structure of an appropriate risk based approach to help ensure:

- Stakeholders are aware of risk items.
- Risk owners are advised of actions they should consider.
- There are fewer surprises for all parties.
- Setting and managing of risk budgets with confidence.
Storr Lochs HPP, Isle of Skye, Scotland

KGAL provided a full risk analysis and assessment service for the overall project implementation for the entire site refurbishment and hydro plant replacement. Key concerns related to access due to the remoteness of the site and the frequently harsh weather conditions.

The breadth and depth of KGAL’s experience make us the consultant of choice as hydropower related investors’ and lenders’ technical advisors. No matter what development model or contracting strategies are being applied we are constantly cognisant of stakeholders’ interests. We are equally at home with traditional public lead development - through to PPP initiatives - working with multilateral development agencies to investment banks.

We provide training to management and delivery teams to help them focus on the important issues and develop and manage their identification, understanding and management of risks. This helps them to minimise the potential impacts and maximise the potential benefits of risks. This is achieved through the application of structured risk management methodologies - including risk management plans, risk registers, risk analysis and risk reports.

We can also facilitate risk workshops: a key service that brings together stakeholders and helps to identify the maximum number of risks. We are then able to offer guidance and support in terms of the various forms of risk response / treatment. This might be through direct advice, intervention, or through the facilitation of access to a wide range of industry contacts who have specific knowledge in areas ranging from financing to insurance.

With our commercially-focused specialists, all of whom are able to articulate technical issues to financial stakeholders, we are able to provide technical due diligence services to the parties involved in investment decisions; we can identify and calculate risk and can verify the physical characteristics of an asset: its current status and / or condition, its development potential and the likely future costs to develop and / or maintain its ongoing usefulness.
The chance of success is increased by being risk aware, rather than risk averse.

We can help organisations and teams become more knowledgeable and proactive in their approach to risk. An informed decision-maker is more likely to take the best decisions. And informed, knowledgeable stakeholders are most likely to raise issues that may impact on projects.

Areas of expertise encompass the whole risk management cycle from contextualisation, risk identification, analysis, evaluation to treatment / response.

Each of these areas is important and cannot stand alone in any systematic process to tackle risk. However, for the purposes of example, we highlight some of the risk response strategies below:

- **Avoid**: eliminate the threat or the cause of the risk (perhaps by extending the schedule, reducing the scope or removing or replacing parties or activities from the project).
- **Transfer**: shift or transfer the impact of a threat. This attempts to give another party the responsibility of the risk. In practice risks are not avoided by allocating them to contractors, since they will only add such costs and uncertainties into their bid prices. Other measures such as insurances also fall into this category.
- **Mitigate**: reduce the probability of the occurrence or impact of a risk; at a basic level through staff training, or through measures to avoid environmental impacts.
- **Accept**: acknowledge the risk (as in the case of storm weather for example). Have essential contingency plans in place but take no further action until the risk occurs. This can be passive where the risk is documented only, or active where those contingency plans are adopted.

Similarly, several strategies can be used to address a positive risk or opportunity:

- **Exploit**: where the business ensures the opportunity is realised and happens.
- **Enhance**: this to increase the probability and / or positive impacts of an opportunity.
- **Share**: forms alliances or partnerships so that all parties gain from the opportunity.
- **Accept**: accepting the opportunity when it occurs but not actively pursuing it.
KGAL has experience in defining strategies and actions to deal with all hydropower project risks.

**Risk related costs can account for 50% of a hydro project spending.**

*Perception and Management of Risk  
Hydro 2014 Conference session paper,  
Lake Como, Italy.*

**Types of risk**
- Geological
- Hydrological: too little or too much (in construction and operation) and seasonal / annual variation
- Weather
- Environmental
- Social (e.g. civil protest)
- Political
- Reputational
- Economical and financial situation risk
- Regulatory / legal
- Communication
- Interface
- Inflation: future cost variation
- Market fluctuations
- Contract system
- Design
- Supply: availability of material and / or resources
- Labour: shortages / stoppages
- Engineering: under-estimated or unanticipated challenges
- Contractor: failure to perform
- Construction risk
- Quality
- Testing and commissioning

**Changes in project scope during implementation can have a significant impact on the project cost and schedules.** Such changes can arise, for example, from the inability of design-stage investigation to eliminate risks from unknown geological conditions for construction of underground works, particularly for many hydropower projects.

*World Bank 1996*