Development & Export Strategy for a Remote Gas Field

Strategies	Decisions	
	Pipeline Capacity	Include Market 2?
Mkt 1 - 10 BCM	BCM 10	Yes
Mkt 1 - 20 BCM	BCM 20	No
Mkt 1 and 2 - 10 BCM	BCM 30	
Mkt 1 and 2 - 20 BCM		
Mkt 1 and 2 - 30 BCM		

Figure 1. Strategy Node Data

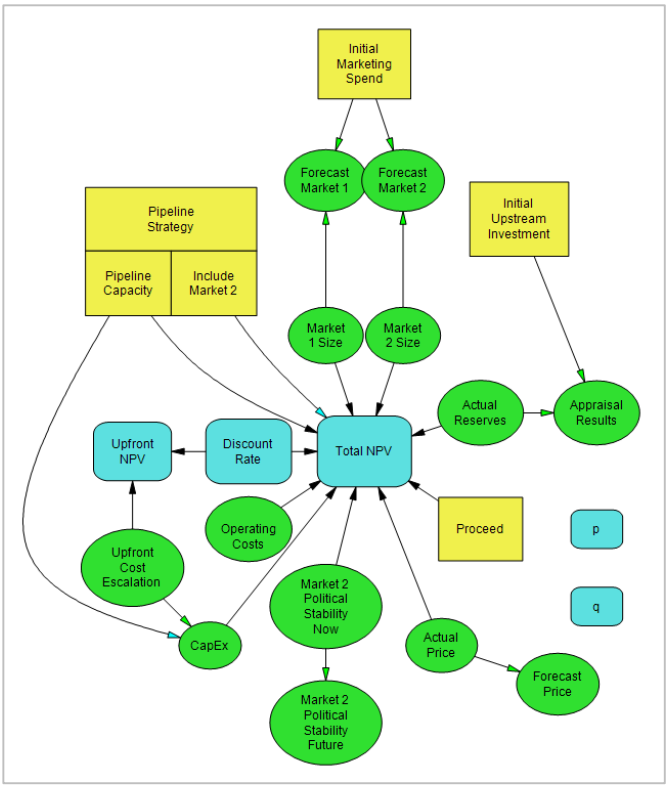

Figure 2. DPL™ Influence Diagram

The Situation

GasCo owns development rights to a large natural gas field in a developing country. The cost of developing the field and extracting the gas was expected to be low. However, as the gas was located in a remote, landlocked area, monetising the gas would require investment in a major pipeline.

Two nearby countries, both with rapidly growing economies, had the potential to serve as markets for the gas. The first, which we'll call Market 1, was the smaller of the two, and concerns were raised that it might not have sufficient demand. The other country, Market 2, was larger, but its political situation was uncertain. Regional experts believed there was a significant chance that Market 2's government would arbitrarily curtail imports, or even seize GasCo's in-country assets.

The population centres of both markets were near each other, so a pipeline could be built to serve both for slightly more than the cost of a pipeline to only one of them. In addition to the uncertain political situation in Market 2, and the rate of growth in the two markets, GasCo faced several other uncertainties. The size of reserves in the field, the world market price for gas and both capital and operating expenditures were all uncertain.

Initially GasCo needed to decide how much to invest in marketing to secure base load demand in both markets, and how much to invest upstream to reduce the uncertainty in reserves. Subsequently, GasCo needed to decide whether to proceed with the venture at all, and if so, whether to build the pipeline to Market 2 and how much pipeline capacity to build.

The Influence Diagram is shown in **Figure 2** above. The green-tipped arrows indicate probabilistic conditional relationships between nodes. In less technical terms, these relationships tell us about the "learning" in the model. For example, Market 2 Political Stability Now gives us some information about Market 2 Political Stability Future.

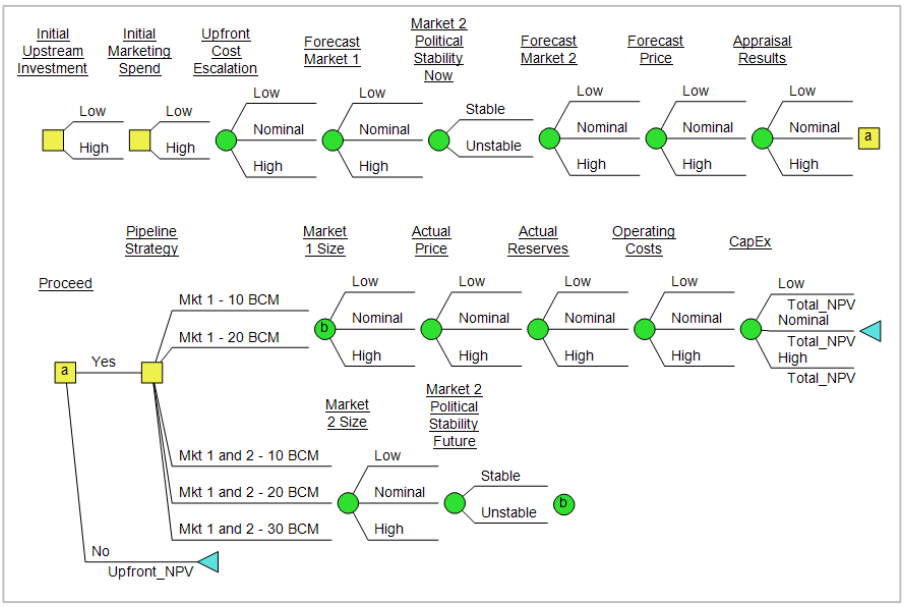

Figure 3. DPL™ Decision Tree

The Influence Diagram uses a simple Strategy table (**Figure 1**, above) to enumerate the reasonable combinations of pipeline capacity and market inclusion. The Decision Tree, shown in **Figure 3** below, has about 9.5 million distinct paths.

DPL Case Study

The Results

A key question for senior management was how often it would be uneconomic to actually build the pipeline (the Proceed decision). While contractually, GasCo could walk away any time, doing so after actively marketing to large customers would be embarrassing, making GasCo less credible in its other ventures in the region.

The Policy Summary™ (**Figure 3**) shows the probability that each decision alternative is taken plus the policy dependent probabilities of the uncertainties. Figure 3 shows us that based on expected NPV, a "No go" decision occurs about one third of the time.

A more tactical issue was that of pipeline sizing. As with most capital investments, there are significant economies of scale, but there is no point in building capacity that will never be used. Because of the remote location of the field, the team believed there was little chance of selling pipeline capacity to other producers. The Policy Summary shows that if both markets are to be served, either 20 or 30 BCM could be optimal, depending on the outcome of the intervening uncertainties. For the upfront decisions on marketing spend and upstream investment, a high level of expenditure is optimal in both cases to reduce the uncertainty around potential future demand and actual reserves.

DPL's Policy Tree™ (**Figure 4**) indicates in which scenarios each downstream decision alternative is optimal. A small subset of the Policy Tree highlighting the Proceed decision is shown in **Figure 5** at the right. Management uses this tool to understand which set of outcomes results in a proceed vs. not proceed decision. The Policy Tree™ indicates that in this set of scenarios, when Appraisal Results and Forecast Price are low, the optimal decision is to not proceed. However, when Forecast Price is nominal and Appraisal Results are either Nominal or High, the optimal alternative is to proceed.

A DPL Risk Profile for the project is shown in **Figure 6** below. The analysis indicated that the project had an expected net present value of about $135 million. The Risk Profile below also shows how the option not to proceed after the initial investment has value. The ability of management to abandon the project after having learned about near term uncertainties is worth approximately 15% of the expected value of the project. It also substantially mitigates risk -- the probability of losing more than $50 million decreases from 35% to 10%. However, that option value is only applicable if management is willing to walk away.

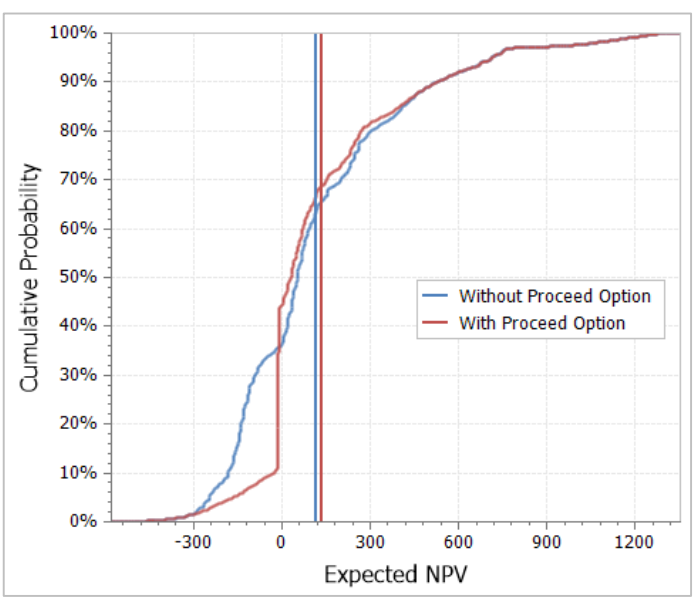

Figure 6. Risk Profiles with and without Optionality

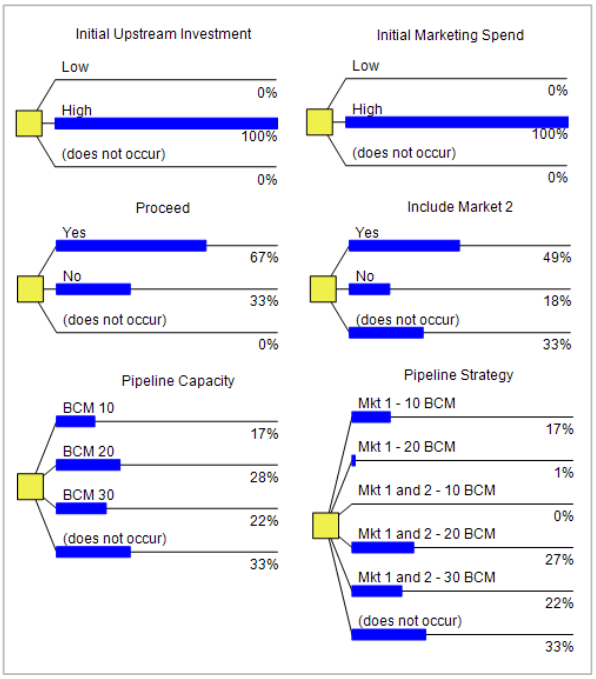

Figure 4. Policy Summary™ showing Optimal Exercise of Decisions

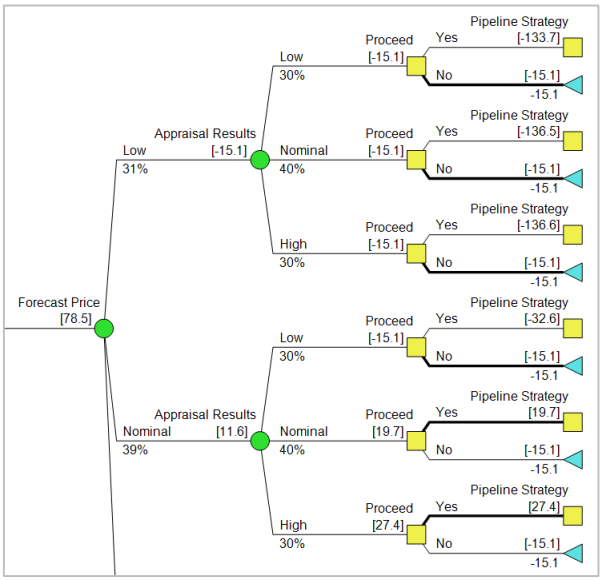

Figure 5. Policy Tree™ showing Proceed Decision in certain scenarios

The Decision

GasCo decided to proceed with the venture and fund the initial upstream and marketing activities. Because the analysis showed that the optimal pipeline capacity was dependent on the outcome of several uncertainties, GasCo was willing to spend more on engineering studies to preserve flexibility. The high probability of not proceeding in the future was more difficult to accept. To attempt to mitigate the potential loss of face, GasCo resolved to explore opportunities for marketing partnerships that would give it a marketing presence in Market 1 even if the pipeline was not built.