Synergies
ECONOMIC CONSULTING

Contact: Sam Lovick
T +61 437 581 009
E s.lovick@synergies.com.au

Real options and water investment

Since 2004, Synergies Economic Consulting has provided quality advice and delivered innovative, client-focussed solutions to the private and public sector throughout Australia. Synergies has built its reputation for timely and high quality professional advice through the expertise, skills and flexibility of a dedicated and experienced team.

What sets us apart from our competitors is the ongoing hands-on involvement of our senior professionals in all our projects. We take great pride in the quality of our work, our people, the way we work together and our ability to deliver practical solutions using sophisticated commercial and economic techniques.

We are known for our thorough approach, innovative thinking and clear communication. This has been reflected in the diverse range of specialised economic and financial modelling projects we have undertaken, including for mining, water and telecommunications clients. An example of such a project is summarised below.

The model

Australia is the driest inhabited continent on the globe. Not only are we dry, but rainfall is sporadic, ranging from severe drought to severe floods. In light of this, how and when should we invest in new water storage facilities? What economic intuition can we gather, for example, from the Melbourne desalination plant arriving just before the wettest winter on record?

Envisage the investment decision as water storage levels decline and demand grows. How should that decision be framed? The simplest rule is to add capacity when storage levels fall below some threshold level (often preceded by gradually increasing water restrictions). But suppose one year after the investment commences, a wet year refills the water storages? The new investment might not then be needed for a several more years, but we are committed.

All prospective investment projects have associated with them 'real options' to delay. The value of the real option depends upon the type of information that may arise during a delay in deciding whether to commit. If the new information informs the investor that it is no longer sensible to make the investment (eg. because rainfall has refilled existing water storages), then the real option to delay is valuable. That value is lost as soon as the investment is made.

In the case of water investments, we typically know the probability that it will rain next year, and we also know the costs of interim short-term measures (more stringent rationing, greater use of treated recycled water etc.) that may allow us to defer the major investment for a year without running out of water. If it then rains, we can further defer the costly new investment. If it does not, then we have to go ahead at the end of the one year delay. Real option analysis formalises this assessment: if the real option value from delay is greater than the cost of the interim measures, then the socially efficient decision is to delay (even if, *ex post*, it is apparent that no further delay is possible). The interim measures can be thought of as the costs of buying an option to delay.

Synergies constructed a model to evaluate the real option to delay a major water storage investment, developing a model constructed using:

- a realistic characterisation of bulk water supplies in Central Queensland;
- water inflow volatility derived from historical data on inflows into the major water storage facilities;
- candidate projects including:
  - additional rationing measures; and
  - diversion from existing other sources using different capacity (30GL and 60GL) pipelines with different costs; and
- backward induction to determine real option values and the preferred investment option.

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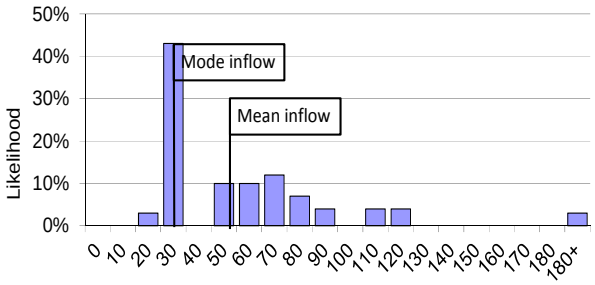
Practical commercial and economic advice to shape your decisions

Some typical results



Historic inflow patterns (GL/annum)

	Year 1	Year 2	Year 3	Net present cost ($m)
'Conventional' NPV analysis	Build 30GL pipeline	→	→	$354
'Real option' approach that takes account of new inflow information	Do nothing	→ *Re-assess* 60GL (19%) 30GL (25%) Do nothing (56%)	→ *Re-assess* 60GL (24%) 30GL (25%) Do nothing (51%)	$288

Real option value of delay
$354m-$288m = $66m

Some of our other modelling

- Modelling the commercial value of additional under-sea trans-Pacific telecommunications cable capacity having regard to the expected level of growth in demand for broadband transmission, technological change, the likely behaviour of existing trans-Pacific carriers, and the impact of new capacity on prices.
- Using real options modelling approaches to determine the value of increased flexibility in the supply chain of a major mining operation, and hence the value of securing additional supply chain capacity.
- Using Monte Carlo modelling to assess how the risk of viral contamination of blood products is affected by blood donation regulations, the characteristics of tests for viral contamination, and testing and manufacturing processes.
- Pricing models for transport supply chains used to determine appropriate end-user tariffs.
- Modelling the optimal mix of contract and self-provision of overburden removal in an open-cut mine in the face of uncertainty over market prices, the extent of the overburden, and plant and equipment failure rates, when there are indivisibilities such as minimum contract duration and equipment purchases.
- Input-Output modelling to assess the economic contribution of a major pharmaceutical and R&D company to the Australian economy.
- A combination of game-theoretic and Monte Carlo simulation modelling to forecast the likely pattern of vaccine prices in the face of significant future demand and supply uncertainty.
- Empirical models of the causes and consequences of industrial accidents, including modelling the impact on the rate of accidents of improved workplace health and safety legislation.

Our people

Sam Lovick, a Principal at Synergies, has developed a large number of practical models in his 25 years of international economic consulting, using a broad spectrum of modelling techniques. His modelling encompasses: electricity markets; real options modelling of water investment, pharmaceutical R&D, supply chain infrastructure; the cost of capital for new investments at airports; game-theoretic models of vaccine markets, pharmaceuticals and broadband transmission; and simulation models of a variety of commercial activities ranging from blood collection to mine overburden removal.

Ross Muir is a Director at Synergies with over seventeen years' experience in the water sector including tariff setting and pricing, water trading and the development of water infrastructure. He has also led the development and negotiation of water supply contracts with the irrigation, mining, power generation and local government sectors. He has a unique knowledge and understanding of the full spectrum of regulatory, commercial and resource management aspects of the water industry, particularly as they relate to water users and service providers.

Sam Lovick
+61 437 581 009
s.lovick@synergies.com.au

Ross Muir
+61 7 3227 9500
r.muir@synergies.com.au