A comparison of approaches for incorporating adaptability into long term capacity expansion planning using water system simulation.

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In recent years robust optimisation has been applied to the problem of long term capacity expansion planning in water systems under uncertainty. The application of these decision making under uncertainty (DMU) approaches initially sought to find stationary portfolios at fixed points in the future, but have progressed to solve for a sequence of optimal (but non-adaptive) planning decisions over a finite planning period. More advanced techniques have utilised tree based frameworks to develop adaptive strategies dependent on future scenarios (e.g. real options analysis). These methods can be described as time-based decision models.

Alternative approaches, such as Dynamic Adaptive Policy Pathways (DAPP), utilise signposts and triggers to incorporate adaptivity in to long term planning strategies. In these cases robust optimisation can be utilised to find efficient values for trigger thresholds and associated interventions. More advanced formulations can optimise for multiple signposts and/or interventions.

In this work we compare the application of these different approaches to long term capacity expansion planning using a synthetic case study. The case study includes multiple objectives and interventions, but remains parsimonious to allow study of the different DMU formulations. We first use the traditional approach of a non-adaptive time based model as a baseline. We then compare time-based decision tree approaches and several configurations using different triggers. Finally we comment on the implementation issues and scalability of the different approaches to larger problems.