WATER INDUSTRY INSIGHTS

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NATURAL RESOURCES

Frontier Leakage Optimisation (FLO)

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MAKING COMPLEX EASY

NATURAL RESOURCES

FRONTIER LEAKAGE OPTIMISATION

A collaboration between Chris Rees and Reagan Hawkins of Dŵr Cymru Welsh Water, and Mike Butler and Georgina Cope of RPS.

The concept

Frontier Leakage Optimisation (FLO) is a tool for examining leakage maintenance and reduction options to achieve frontier targets at least cost, accounting for innovation and efficiency. Without best practice for new leak detection and repair technologies and practices being established, FLO has set a new, innovative standard for investment targeting.

FLO was developed to overcome the limitations of previous Sustainable Economic Level of Leakage (SELL) assessments used in Water Resource Management Plans (WRMP). Previously economic leakage targets were set based on historic cost~leakage relationships which acted as a barrier to innovation.

Regulatory pressures were also introduced as part of PR19 consultation and subsequent AMP7 determinations, when Ofwat challenged companies to achieve at least a 15% reduction in leakage or upper quartile performance, to be delivered economically.

This drove Dŵr Cymru Welsh Water (DCWW) to develop its strategy and approach to leakage reduction to ensure regulatory compliance, and to preserve DCWW's frontier position of their industry as it drives towards a more ambitious leakage performance commitment for its customers.

The methods developed for SELL over the last decade provided important information, however, this needed to be applied in a different way. Instead of using these tools to set the target, they could be adapted and used to meet strategic frontier targets as efficiently as possible.

DCWW engaged RPS with the objective of integrating their existing supply/demand policy options with more innovative and intensive leakage reduction policies which were likely to be technically necessary to achieve ambitious leakage reductions in AMP7.

A pragmatic solution

FLO was developed by RPS as part of a collaborative project with 6 Water Companies. DCWW were the first to develop a full company-specific model for the purpose of PR19 business planning.

The DCWW Water Demand Strategy Team, led by Chris Rees and Reagan Hawkins, worked collaboratively with their Operations teams and the Water Analytics team of RPS led by Mike Butler and Georgina Cope to review and define their leakage options, data availability, field trial information, and assumptions required to build the FLO model.

The FLO model was built around new leakage intervention options that were being trialled by DCWW ahead of AMP7, for which the overall effectiveness and relationships to other activities had not been assessed.

To develop these policies, the RPS model based on the 'life of a leak' was initially applied to break leakage into four parts - Prevent, Predict, Detect, Repair - this allowed the review of each activity that goes into addressing leakage.

New data played a key part in the improvement of these areas, and to ensure it was being used appropriately with actionable insight the consultation involved leakage managers and operatives on the ground. Data gaps were also identified, allowing for further improvements in future.

A key aspect was to develop the understanding of the interactions between competing options and their relative impacts on supply, demand, leakage, network dynamics, customers, and budgets.

Beyond best practice

Innovative leakage policy options were assessed to understand their viability, and to optimise the targeting and investment requirements over the course of AMP7. New policies and cost~leakage relationships were developed for Enhanced Active Leakage Control (ALC), Permanent Acoustic Logging, 'Lift and Shift' Acoustic Logging, SMART Metering, Customer Supply Pipe Policy, Trunk Mains Repairs and Trunk Mains Renewal policies, in addition to traditional ALC, Pressure Management and Asset Renewal.

Our challenge was to integrate new options into an economic model alongside historic options and existing best-practice relationships. No best practice exists for the development of these new policies, so the project team were breaking new ground.

Additionally, the inter-relationships between options have never been defined and the ability to find a least cost combination of options depended on this. For example, the savings associated with active leakage control will vary following the implementation of SMART metering. DCWW are industry leaders in this space, which avoids overstating the benefits of multiple investments.

With the additional data, options and relationship insight, it was found that previous optimiser software used for SELL was insufficient. The number of new policies were too great and the complexity of relationships too vast for the model to solve. A new optimiser was identified and applied based on the latest iteration of Evolver in consultation with Palisade – an innovative software tool for the optimisation of Excel spreadsheets.

Evolver combines a genetic algorithm (GA), OptQuest, and linear programming technology to quickly solve problems that can be modelled in Excel.

Absolute benefit

DCWW have determined the impact of new and innovative leakage reduction policies and technologies on individual water resource zones (WRZs), including where and when these are more efficient than traditional practices in delivering their frontier target.

FLO considered the viability of investments linked to geography and network constraints. The application of the latest Evolver optimiser ensured the best overall 'global' solution was delivered.

The least cost mix of options were resolved concurrently across each WRZ to achieve the company target. This wholistic optimisation resulted in an efficiency saving of 3% which equates to a £2m saving over 5 years for DCWW. Further significant savings were associated with the development and inclusion of new technologies and policy options.

Modelling the inter-relationships between options ensured the benefits were not overstated, and that the savings from investment were achievable where multiple activities are combined within a single location. The cost savings determined included social, environmental, and carbon benefits in addition to direct savings to DCWW and their customers. Outputs included 'what-if' scenarios to show the cost risk to delivering the frontier target associated with variations to investment profiles, efficiency assumptions and seasonal weather events.

RPS and DCWW are industry-leading with a fully integrated frontier leakage model and delivery plan in place ahead of AMP7. It is now easy to solve to company targets across any number of sub-areas inclusive of emerging technologies and practices, with faster improved accuracy, and the ability to update as required.