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Analytics to manage sludge production

The asset base, internal structures and geographies that exist within water companies can make understanding the overall impact of a single decision challenging. When multiple options are being evaluated in a dynamic operational environment, such as sludge treatment, the complexity of the trade-offs can become overwhelming and lead to silo thinking and suboptimal decision-making.

In 2013, Yorkshire Water (YW) began to re-think the way it optimises its sludge treatment and recycling processes. Rather than simply optimise each individual process unit, YW began to consider the unit cost of sludge production across the whole of the value chain. The objective was to understand the lowest cost option for operating assets in a dynamic environment. This shift in thinking towards sludge production planning has enabled the organisation to consider the full impact of individual or combined decisions on both sludge operational performance and its costs.

Once the dependencies between decisions and cost were better understood, the YW team looked to understand real-time capacity, headroom, bottlenecks and the marginal cost of sludge treatment. This type of information, considered with up-to-date information each week, has supported improved decision-making around prioritisation of maintenance activity on sludge assets.

The recent Ofwat Water 2020 consultation, and proposed introduction of a market for sludge

Thermal hydrolysis plant construction at Yorkshire Water's Esholt WwTW serving the City of Bradford

Esholt WwTW'S thermal hydrolysis plant

within the water industry in England and Wales, has highlighted to Yorkshire Water the importance of having a clear view of its unit costs. Additionally, the introduction of a separate price control creates a catalyst to drive increasingly targeted efficiencies for sludge processing.

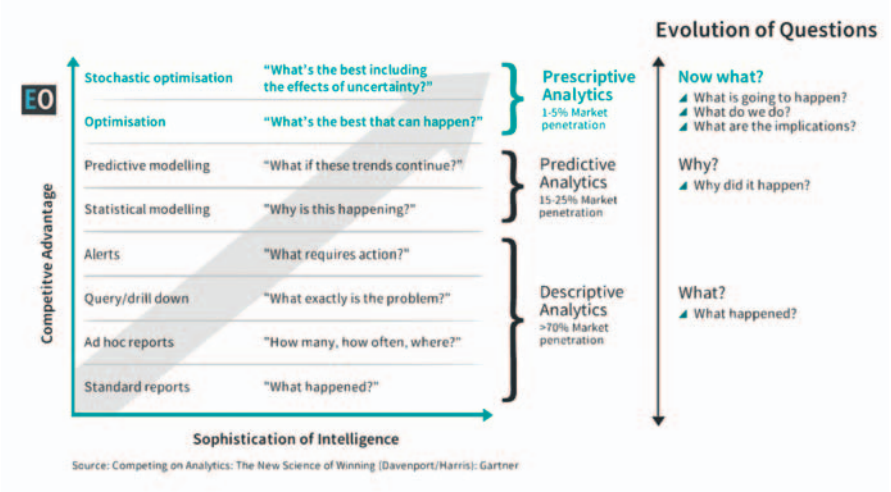
Data-driven decisions

YW's approach to business analytics has matured across recent Asset Management Plan (AMP) periods. Historically, descriptive analytics including scorecards and performance reporting drove business improvement. Throughout AMP5, diagnostic analytics were also used with regular root-cause analyses being carried out to understand why events had occurred. While valuable, this type of data analytics is not able to deliver forecasts or provide plans to optimise future activity. In a dynamic operational environment, such as sludge treatment, scorecards and root-cause analysis couldn't help YW make the leap from silo thinking to end-to-end optimisation.

Creating a production-planning approach to sludge required both a technological and cultural change to occur. This entails going beyond the conventional business scorecards of a few metrics reported in arrears weekly, monthly or quarterly. Production planning provides a wider ranging dashboard of measures that are recorded and monitored in as near real time as possible.

YW, in partnership with Business Modelling Associates (BMA), embedded a decision-support tool, the SludgeOps DST. Underpinned by leading-edge analytics, SludgeOps DST provides a data-driven view of sludge processes. The analytics hierarchy, shown in figure 1, highlights the progression that YW made from

EVOLUTION OF QUESTIONS



Source: Competing on Analytics: The New Science of Winning (Davenport/Harris): Gartner

The gas bag at Esholt WwTW

using historic data to make decisions, to using technology to prescribe the optimal future actions, minimising cost and increasing efficiency.

Culturally, YW refocused its activities to bring people together in performance hubs around the outputs of the SludgeOps DST. These daily and weekly hubs review the previous week's performance against the plan, look for opportunities to improve and continually refine the plan for the forthcoming weeks.

The benefits of this approach

Each of the teams that are involved throughout the sludge process now have clearer targets and performance expectations. These targets are based on the outputs of the SludgeOps DST and show both the process and financial impact of achieving performance. The weekly hubs and use of SludgeOps have increased both the speed of response to operational challenges and identification of opportunities to improve performance.

In each weekly hub, the team use the SludgeOps DST for:

- Maintenance prioritisation
- Outage planning (planned & reactive)
- Sludge movement optimisation to treatment facilities
- Resource and vehicle availability planning
- Energy-generation planning
- Compliance, decision making and prioritisation

Sludge throughput, as well as energy generation through the sludge asset base have increased. This overall performance improvement is attributed to the aggregate impact of regular improvement across all parts of the sludge process. SludgeOps has been instrumental in highlighting the connectivity throughout sludge treatment and recycling, helping to avoid silo thinking.

Culturally, the team report that sludge is now a calmer world with SludgeOps being used to run scenarios to support business continuity planning and capital investment. Decisions are now data driven and objective, and the tool has provided the team with choices about how to achieve the best outcome for the sludge process.

What next?

SludgeOps DST is based on operational costs. However, the team are starting to use it in light of the recent Ofwat markets consultation to get a clearer view of their unit rate for treatment. The scenario capability of the tool has enabled the team to look at a range of potential options and assess the impact on the business. In response to this consultation, SludgeOps may also be expanded to include return liquors.

Operationally, the team are beginning to look across a longer time horizon and will be carrying out monthly reviews to analyse where there are differences between planned and actual performance.

Longer-term plans include using the modelling technology to predict the reactive failure of assets and creating a probabilistic view of the failure rates of kit in an operational environment.

The sludge production-planning approach at YW is continually evolving, with ongoing enhancements to both the SludgeOps and the weekly hub meetings. The approach has delivered success through increased sludge throughput and energy generation. The two key factors in delivering these successes were the use of analytics in decision-making and managing sludge as a single process. While the prospect of a separate price control for sludge may appear challenging, YW is in a strong position to understand its unit costs and drive further efficiencies throughout the process.

Yorkshire Water worked with Business Modelling Associates, using their SludgeOps Decision Support Tool, part of their Sludge Optimisation Suite.

Developing a market for sludge - the challenge

A sludge market has the potential to provide opportunities to optimise the way sludge is managed, resulting in lower costs for customers and a more efficient use of resources.

Understanding the scale of the opportunity is critical for companies interested in being part of this future sludge market. Existing data and processes hold the key to understanding the opportunity; the challenge is making an optimal decision using all of this information.

Sludge Optimisation Suite

Business Modelling Associates (BMA) combines its leading-edge decision support tool, Enterprise Optimizer®, with water industry experience to provide companies with a comprehensive understanding of their options. BMA's approach helps companies reduce silos of sludge management, providing a unit cost of your sludge process from start to finish, at company, process and site level.

Capable of handling large volumes of data, the Sludge Optimisation Suite optimises across a range of timescales from a weekly sludge production plan, to a strategic view of sludge strategy and regulatory change. Able to handle OPEX, CAPEX and TOTEX, the Suite provides an end-to-end view of sludge processes and financials in one place. Using advanced analytics, it cuts through complexity providing teams with clear actions to deliver outperformance.

Experience

BMA UK has built out decision support tools for a number of leading companies. The Sludge Optimisation Suite is used by Yorkshire Water to support optimised decision making in dynamic operational environments; South West Water are utilising the Suite to model the TOTEX impact of regulatory change over the next 25 years.

BMA is a consulting and solutions development firm specialising in analytics solutions. Solutions are tailor-made to help clients systemically and holistically model their end-to-end operations, analyse what-if scenarios and explore how potential changes affect service, costs, investor returns, sustainability and risk.

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A breakthrough approach for end-to-end sludge management

A separate price control for sludge will require Water & Sewerage companies to have a clear understanding of their sludge operations including the unit cost to treat. Existing data and processes hold the key to understanding the opportunity, the challenge is how to best use all of this information to make the optimal decision.

sludge optimisation SUITE

Business Modelling Associates (BMA) combines its leading-edge Sludge Optimisation Suite with extensive water industry experience to provide companies with a comprehensive understanding of all available options. BMA helps companies truly understand their end-to-end cost and process data in a single view. Using advanced analytics, the solution cuts through complexity highlighting opportunities for efficiency improvement and providing teams with clear actions to deliver outperformance.

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