SMART DEMAND MANAGEMENT AT PIONEER VALLEY WATER

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ABSTRACT

Faced with end-of-life control systems and the challenge of overseeing a complex water ordering process with a small team, Pioneer Valley Water embarked on a journey of renewal and innovation.

A key component of this was the upgrade of decades-old, obsolete control and communications technology to new, open solutions. PV Water made the decision to completely rethink its demand-management workflow to empower its customers to manage their water orders and allocations and to for it to directly drive water delivery through the control system.

INTRODUCTION

Pioneer Valley Water Co-Operative (PV Water) is a not for profit irrigation water distribution operator in the Mackay Region. The scheme comprises large river raw water pump stations, storage and pump stations for a gravity feed system, pipelines and open channels to service almost 400 customers with 47 gigalitres of allocations. Using a control system that had exceeded its usable life, was expensive to maintain and was hindering PV Water's objectives to provide resilient water supply and an intuitive and customer-centric demand management system.

In early 2020, facing the obsolescence of their control system and the expense and inflexibility of another licenced radio frequency, PV Water went to the market for an open solution. Previously locked into a proprietary solution with a Victorian vendor with no local support presence – a scenario that often resulted in extended downtime – PVWater went to a number of local engineering firms with an RFP

PV Water sought an open solution that did not lock them into a single vendor as well as building efficiencies in customer water ordering and demand management business processes.

THE CHALLENGE OF WATER DELIVERY

The Pioneer River is the circulatory system of nearly 2,000 square kilometres of highly fertile agricultural land and the primary source of drinking water for over 100,000 residents in the Local Government Area of Mackay, in North Queensland.

Although known for its vast fields of sugar cane, the Pioneer Valley also supports livestock and horticulture, as well as sugar processing and other industries that depend on a reliable supply of water. The actual delivery of much of this water, requires the management of a number of reticulation systems, pumps, channels, valves and sensors.

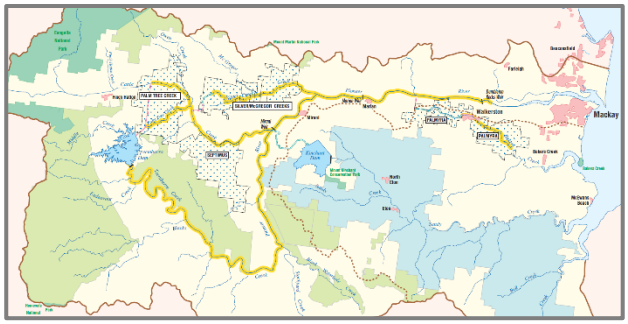

Figure 1: Pioneer Valley Water Service Area (Excludes Eton Irrigation Scheme in blue)

When these components fail, or when they are no longer able to be adequately supported, even by their original suppliers, these important businesses are placed at risk. Additionally, when every customer water order requires manual intervention from PV Water's limited number of staff, including all hours of the night, it makes for poor outcomes for customers and an unsustainable work environment for staff.

The equipment in question was an 18-year-old control system based on proprietary communication standards. As expected of equipment of this age, failures were frequent, and with limited support provided from the original vendor, PV Water's only response was to scrounge parts from other water schemes or buy them second-hand on eBay.

Presiding over and directing this outmoded technology was an equally obsolete and user-unfriendly software solution, provided by the same vendor as the hardware. Customers would become so frustrated attempting to place or change complex water orders that they would give up and phone PV Water's staff directly. At the same time, they were unable to easily track how their own orders and actual consumption were comparing against their water entitlements.

The impact of COVID lockdowns in Victoria during the first few months of 2020 was the final nail in the coffin of this outdated system when the already limited support from PV Water's existing vendor reduced to unsustainable levels.

But changing such important technology is not as simple as replacing a few pieces of hardware. An irrigation water authority doesn't just control water flows, but interfaces directly with customers in order to manage their legal obligations around water allocations, as well as network configuration, water ordering and meter reading.

It was clear to PV Water therefore that an incremental change would not be enough, but that a significant advancement in the entirety of their water demand management and delivery system would be required.

A SIMPLE GUIDE TO DEMAND MANAGEMENT

An understanding of the fundamentals of water delivery can be very helpful to finding the best solution to PV Water's problem.

The majority of water releases managed by PV Water are in direct response to customers requiring water at some point across its large distribution network. The rest of those releases, in partnership with Sunwater, may relate to environmental flows or flushing of channels. Still, it is primarily the customer that drives demand which in turn drives water delivery.

Water delivery is not instant however. Though some of PV Water's clients connect to pressurised networks, most receive water through riparian or controlled water releases that can take hours, even days to arrive at their destination. Adding to this, the time required for the system or staff to receive orders and configure the equipment required to provision and execute that release only prolong the process.

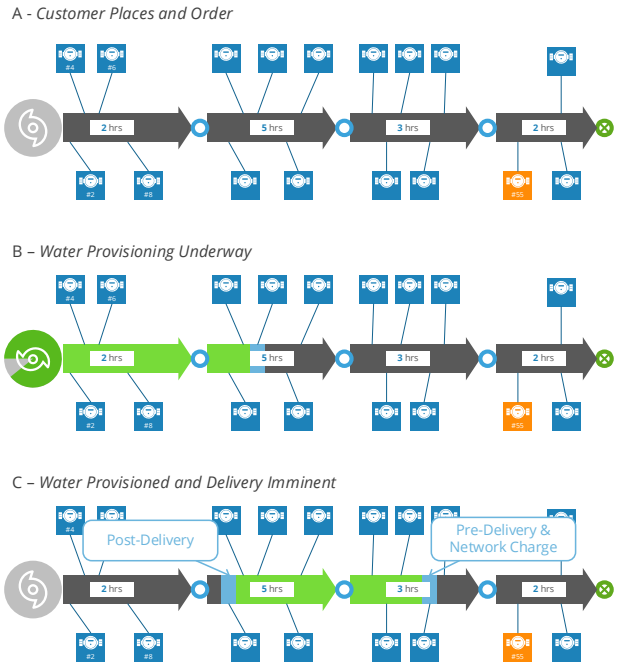

Figure 2: Example of a simple water network

The examples in Figure 2 illustrate a very simple network, where a customer (identified as the orange water meter) requests delivery of water. As shown, that order will take 12 hours to arrive at the customer's water meter once the pump starts to supply the water (provisioning). As a result, the timing of the release itself from the pump will have occurred some time prior and needed to include many complex factors such as the capacity of the network, the pump limitations and if there are other orders already on the network.

A lot can happen in 12 hours, including the weather. As shown in the further examples of Figure 3, the water ordering and delivery solution needs to be able to respond to the changes made by the customer. In this example, the customer requests a stop to provisioning which the system responds to immediately. These scenarios happen more frequently than one may expect, particularly during seasons where irrigation demand is higher and where customers proactively plan their water orders a long time in advance.

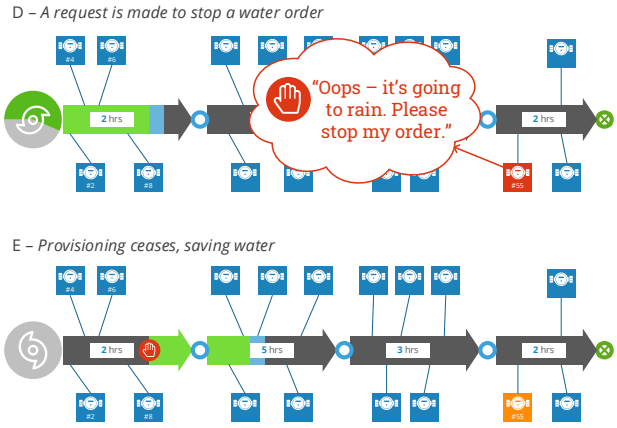

Figure 3 - Stopping a Water Order

With this context in mind, and with the lofty goals of improving system reliability, total cost of ownership and customer service, PV Water engaged two key local partners to revolutionise its demand management business processes.

CONTROL SYSTEMS UPGRADE

Logicamms Mackay led the management, design and implementation activities for the control system upgrade. Rather than relying on proprietary systems for control and communication, the new solution was built around open and interoperable technologies from Schneider Electric (SE) and Cybertek.

Switching from licensed radio to a combination of cellular and license-free solutions allowed PV Water to cancel a lease on an expensive radio tower relay and to remove their own personal responsibility for the entirety of the control systems communication environment. Migrating from proprietary control systems to the SE platform also removed all dependency and risk from being locked into a single

service provider, as this equipment can be serviced by any number of local vendors.

Seizing the opportunity whilst these systems were being upgraded, PV Water also upgraded some of the motor protection relays and pump protection relays at some sites. The opportunity was taken to reprogram the motor start sequencing, improving pump efficiency and taking advantage of the use of the variable frequency drives.

Over the course of 6 months of design, implementation and commissioning, the new solution was well complete before the 30 June 2021 deadline, ready for the influx of water orders that begin as the dry season sets in and demand increases.

DEMAND MANAGEMENT & CUSTOMER PORTAL

To achieve its requirements, PV Water partnered with local software developer, Tyeware to create a brand-new solution. Having developed the internationally recognised MiWater and myH2O systems for Mackay Regional Council, Tyeware was uniquely positioned to provide a fresh and innovative response to PV Water's needs.

The end result was the development of the Telemex Smart Irrigation solution, a secure, cloud-based solution that empowers water customers to directly control and visualise their water orders and PV Water to oversee and provision those orders within the complex business rules of the water network. A philosophy of "minimal human intervention" was adopted, such that the network's business rules are built into the system and therefore customer orders can automatically drive water delivery control systems.

No longer did PV Water's customers have to suffer through the complex menu structure of an outdated integrated voice response (IVR) system to place and manage water orders. Instead, those orders and outstanding allocation balances could be easily visualised within their own customer portal, as shown in the screen shot in Figure 4.

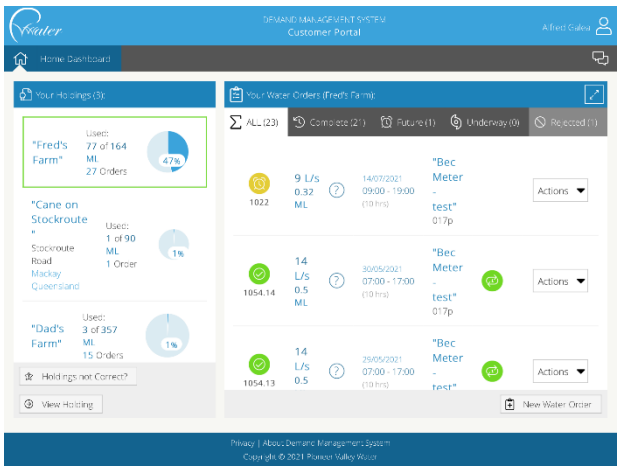

Figure 4: Example Telemex Smart Irrigation Customer Portal

Not only did the system need to manage water ordering, but also the design and configuration of the network and the day-to-day operations of PV Water in lodging water titles, ownership transfers, allocations and meter reading. This removed PV Water's dependency on a Microsoft Access database and enabled better tracking of historical transactions from meter changes to title transfers.

In development of this new solution, Tyeware sought feedback across the water industry, from utilities in a similar position to PV Water, but also from customers directly in order to design a solution that wasn't limited to PV Water's needs, but the needs of the sector as a whole. Often forgotten in these discussions, customers in particular played an important part of that process, with the opportunity identified that the right solution could also deliver measurable improvements to farming operations.

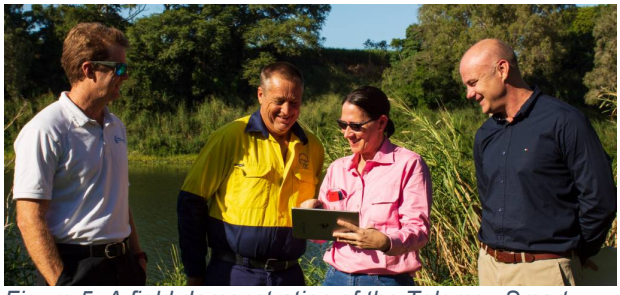
Figure 5: A field demonstration of the Telemex Smart Irrigation solution with Lee Taylor (Logicamms), Richard Faulkner (PV Water), Julie Ferlazzo (Samari Farms) and Steven Tye (Tyeware)

After successful customer testing in May, the Telemex solution went live on 1 July 2021. This allowed for the decommissioning of the older Rubicon DMS and IVR systems and their associated hardware. Instead, the Telemex platform required no hardware or installation as it is provided under a cloud Software as a Service (SaaS) solution.

The response time of the system, from order to the commencement of provisioning, is now as low as 5 minutes, allowing customers to make more informed

water order decisions closer to when water is required rather than place them blindly for some future date and time.

ENVIRONMENTAL AND ENERGY SAVINGS

Although the main goal of PV Water's project was to successfully transition away from its outdated system, the goal of improving water efficiency in order to achieve positive energy conservation and environmental outcomes was also a factor.

There is a direct correlation between efficient water delivery and energy savings since most water supplied by PV Water requires energy to pressurise the network, or to pump water between rivers, storages and channels. As a result, any means by which wastage of water orders can be reduced will provide a benefit both for energy bills as well as the environment.

Using the previous example from Figure 3, between the Telemex DMS system and the new control system, customers are able to more easily cancel water orders that won't be required or at least stop them part-way if their needs change in order to minimise provisioned water that may otherwise go unused and flow out to the ocean.

FURTHER IMPROVEMENTS

Pioneer Valley Water's objectives to improve customer service and operational efficiency are planned to continue over the next twelve months. A new customer mobile application for Telemex Smart Irrigation will be released, placing the power of water ordering directly in the hands of farmers and other customers as well as providing automatic notifications on the status of their orders.

Figure 6: The Telemex SI customer mobile app will be released in Q3, 2021.

Further extending the system's functionality before the end of 2021 will be the inclusion of support for smart water meters (or AMRs). This builds upon Tyeware's unrivalled expertise in this area by bringing live and near-live water consumption data into the hands of customers and operators. This initiative is hoped to be piloted first with PV Water before extending to other Australian water utilities.

The benefits of smart metering should be well known across the water industry, but some very unique opportunities exist within the irrigation space. One example is where the solution is able to detect and alert customers when their water consumption is less than what was ordered, which may indicate a faulty or under-provisioned pump. A pump failure may be predicted, or the customer simply alerted to the fact that the rate at which they are actually irrigating is less than what they expect, leading to sub-optimal crop outcomes.

The same technology also offers opportunities to improve the algorithms and tolerances around actual water provisioning and to improve the hydrological model of the water network to fine tune the delay times between releases and delivery.

FINAL OBSERVATIONS

Pioneer Valley Water's project was not just the successful delivery of a solution, but a clear example of how partnerships between not-for-profits, business and customers can create high-quality and original solutions. PV Water is more than happy to allow other water utilities to benefit from its experiences and, having succeeded in this project, Logicamms is well placed to provide similar services to other utilities.

The Telemex Smart Irrigation platform is now also commercially available across Australia to assist utilities to provide greater oversight of the demand management process and to empower customers to take control of their water allocations.

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