

# Operations Optimisation at Wellington Water

## Innovation that lead to World-Wide Change

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ready for the resource revolution



# The Wellington Water Energy Optimisation Project

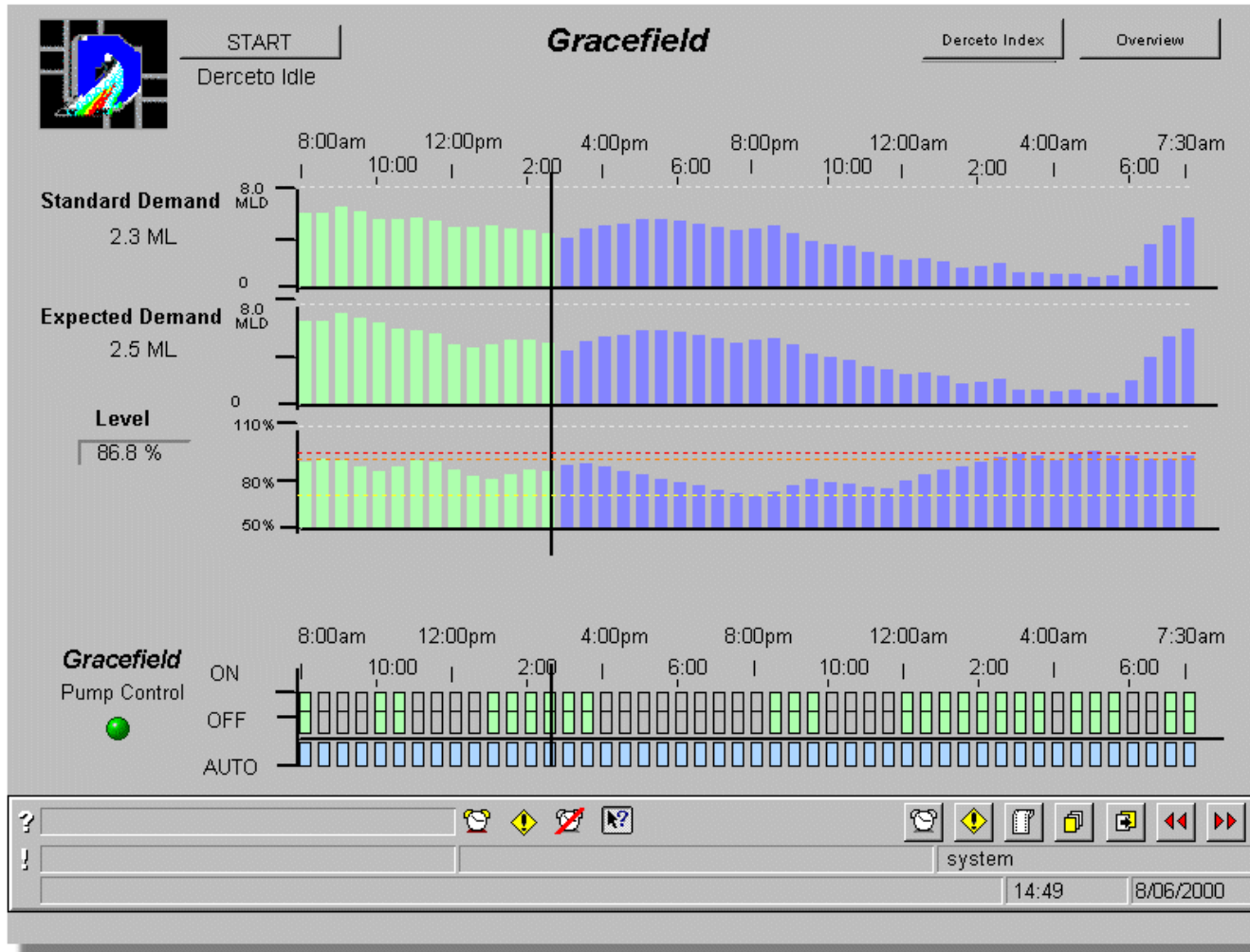
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1. Introduction
2. Why is energy the target
3. Growth in the years subsequent to Wellington
4. Application Overview
5. Summary

# Wellington Water – Energy Management RFP

- **In 1999 Wellington Water (Greater Wellington Regional Council at the time) went to market for a “Systems Control Project” primarily to minimise OPEX mainly energy cost**
- **Main project driver was Murray Kennedy, General Manager**
- **An International bid project in Tenderers Gazette, with two international bidders plus Beca**
- **Beca awarded based on previous successful project for New Plymouth water distribution network control**
- **This was the genesis for Beca to create a commercial software tool, ‘Derceto’ which went on to become Derceto Aquadapt, and now called Suez Aquadvanced Energy after Suez bought Derceto in 2015**

# Derceto 3.0 delivered in June 2000



# First project and Subsequent additions

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**Initially controlled from Wainuiomata to the City, 3 treatment plants plus 12 reservoirs and 10 pumping stations.**

**In 2006 extended to all Greater Wellington Water treatment works and reservoirs including Te Marua network**

**Now controls 4 WTPs, 17 pump stations, 57 tanks, 41 fully controllable FCVs**

**Upgraded to Aquadvanced Energy (HTML5 based) in 2016**

# Wellington Water Limited, New Zealand

- Primary driver was operational control of a large number of valves, tanks and WTPs
- 210 MLD from two well fields plus two surface water plants
- Real-time spot energy pricing

“The SUEZ Aquadvanced system has never been turned off and has operated faultlessly for ten years – delivering annual energy cost savings of more than 10 percent, and a project payback inside three years.”

Murray Kennedy, General Manager  
Greater Wellington Water.



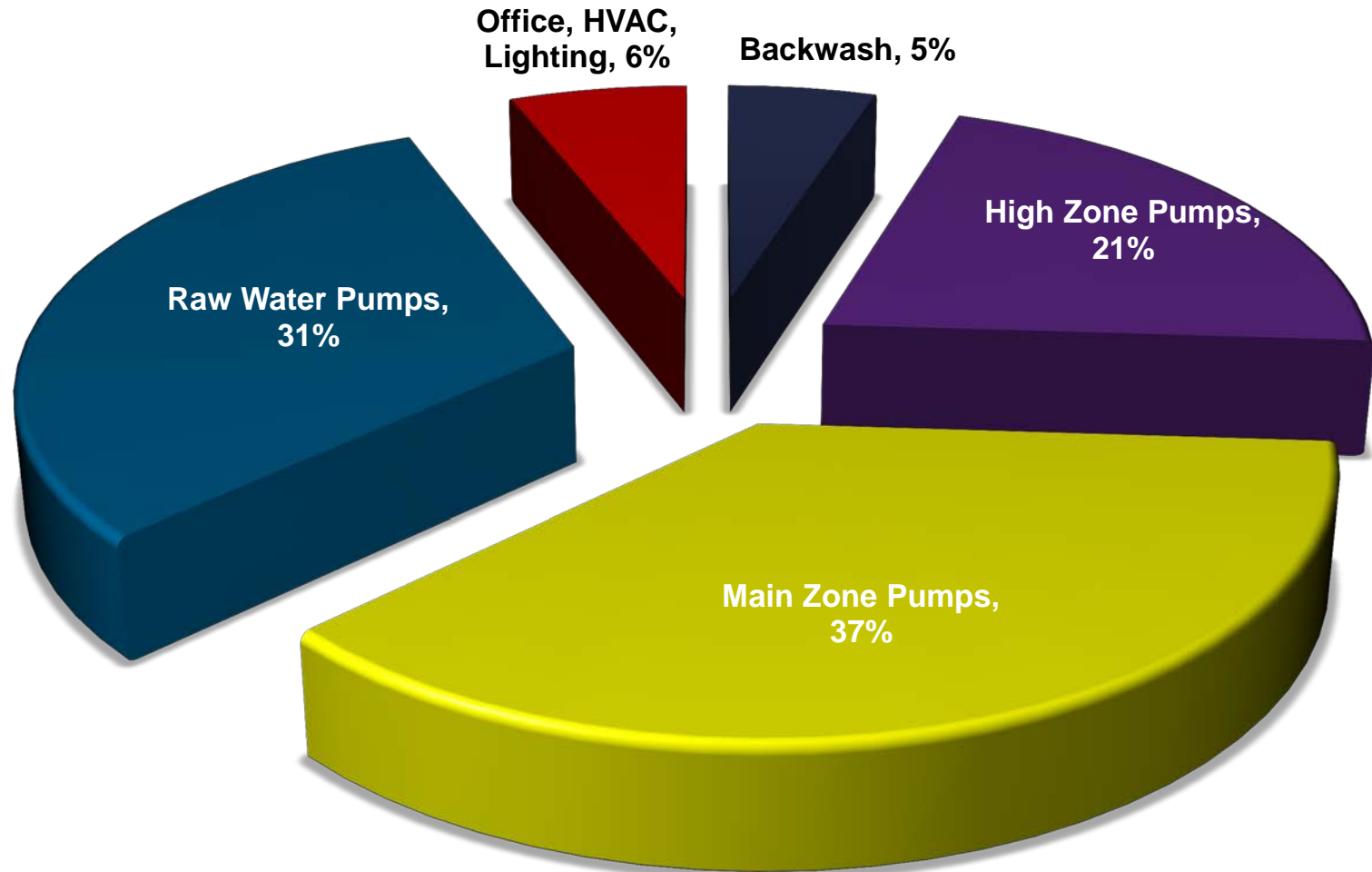
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# Energy is typically the second highest OPEX behind labour

Energy used by pumps is the dominant cost in a drinking water system





# Techniques to optimise the distribution network

## System Efficiency

Interaction of the assets across the network, hydraulic behaviour

### Pump Station Efficiency

Pump combination based on flowrates

### Pump efficiency

Using the pump as close to its BEP as possible

## Energy Source Management

Combine self-production

### Load Shifting

Making use of the energy when this is cheaper.

## Demand Charge Management

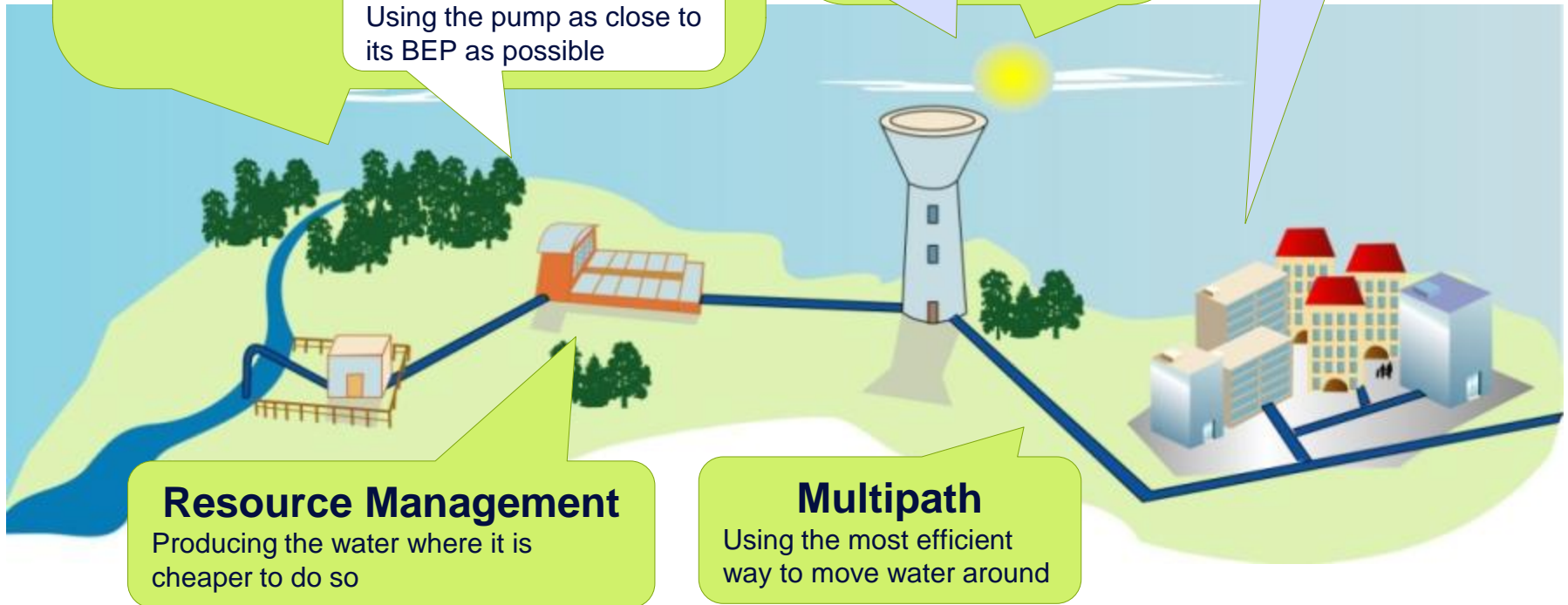
Tariff peaks avoidance (TRIADS,...)

## Resource Management

Producing the water where it is cheaper to do so

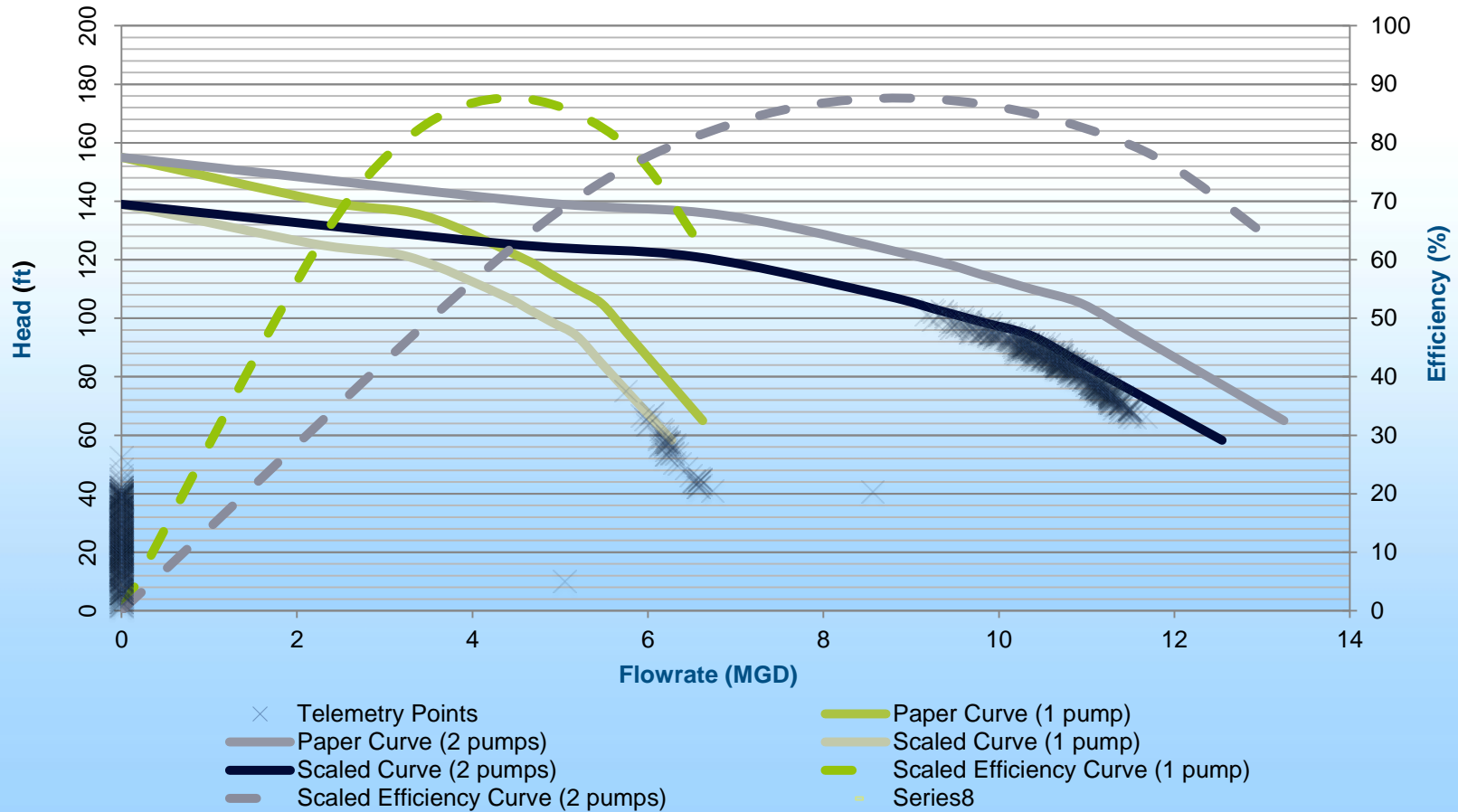
## Multipath

Using the most efficient way to move water around



# Choosing the best pump combinations

## Combining Pumps



## Misleading information

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**1 pump: 25.2MLD @ 15.2m, efficiency ~60%**

**2 pumps: 41.6MLD @ 27.5m, efficiency ~85%**

**So what would you use?**

- 1 pump used 59kWh/ML
- 2 pumps used 88kWh/ML,

**50% more energy used by 2 pumps!**

# Automated Operations Benefits

**Lower energy costs:** using the energy when it is cheaper to do so or by making use of self-production capacity when it is worth it. Aquadvanced can handle any kind of tariff and reacts to any change in real-time.

SAVINGS

Up to 20% \$/ML

**Lower energy consumption:** using less energy as a result of a more efficient system operation. These are savings that are achievable even when an energy tariff is flat and this can represent 50% of the usual savings that can be generated. Our customers have been able to obtain a consistent 6 to 8% efficiency savings this way.

SAVINGS

6 to 8% kWh/ML

**Lower production costs:** when multiple production sources are available, Aquadvanced will operate those that represent lower running costs. This may depend on the chemical costs, energy costs or external constraints as well as abstraction license limitations.

SAVINGS

Up to 5% \$/ML

RESILIENCE

**GHG reduction:** producing less water and using less energy will directly lead to a 6 to 10% reduction of emissions.

ENVIRONM.

6 to 8% CO2/ML

Average cost savings 12% to 15% overall

# Automated Operations Benefits

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**Event Management/Dynamic adaptation:** as a result of the holistic view and the profound understanding of the system behaviour Aquadvanced will react to any event to minimise the impact on the supply service. Should a burst occur, Aquadvanced will reconfigure the system to keep the service up through alternative distribution paths.

RESILIENCE

**Water quality management:** Aquadvanced will reduce the water aging in the system, handle source blending and source smoothing to keep the quality parameters within the desired limits.

RESILIENCE

**Leakage reduction:** operating the system within the right pressure to guarantee the supply service quality will lead to a harmonisation of the pressure throughout the network and, therefore, reduce the volume of non-revenue water. Improvements of up to 10% have been reported.

RESILIENCE

SAVINGS

**Operational Consistency:** overcome the inconsistent adoption of standard operating procedures by individual operators.

RESILIENCE

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# AQUADVANCED™ Energy in operation

Implemented worldwide for water utilities supplying more than 15 million end customers



# AQUADVANCED™ Energy in operation

Major growth in European market





# Northumbrian Water Group

- 3 Regions - Northumbria, Essex and Suffolk
- 57 Water Treatment Works
- 338 Service Reservoirs, £20M annual energy bill

“ I think the energy cost savings from Aquadvanced tend to be highlighted because cost savings are a way of convincing the finance guys. But the benefits go way beyond energy cost savings.”

Mick Baker, Network Control Manager,  
Northumbrian Water PLC.



# Northumbrian Water Group

- Targeting energy cost savings as well as operational efficiencies and water quality improvements
- Driven primarily by the need to control, manage and predict energy costs
- Used to negotiate more favorable three-year energy supply contracts

“ We certainly found no other product that would do what Aquadvanced can do. Some vendors said they could develop a solution, but we saw SUEZ’s Aquadvanced as a proven and working solution, already doing what we want to do at other water utilities in North America, New Zealand and Australia.”

Northumbrian Water Network Manager Dennis Dellow.



# WaterOne, USA

- 85 pumps, 18 tanks, 11 valves 2 treatment plants
- 556 MLD peak day, 246 MLD average
- US\$5.5M annual energy costs



“You can’t argue with the bottom line. SUEZ’s Aquadvanced is saving WaterOne more than a million dollars a year. That’s around 20 percent of our total annual energy bill.”

Chuck Weber, Superintendent of Operations  
WaterOne, Kansas.

# ConSORCI D'Aigues de Tarragona, **Spain**

- Complex control of more than 60 valves and tanks

## CASE STUDY

CONSORCI D'AIGÜES DE TARRAGONA

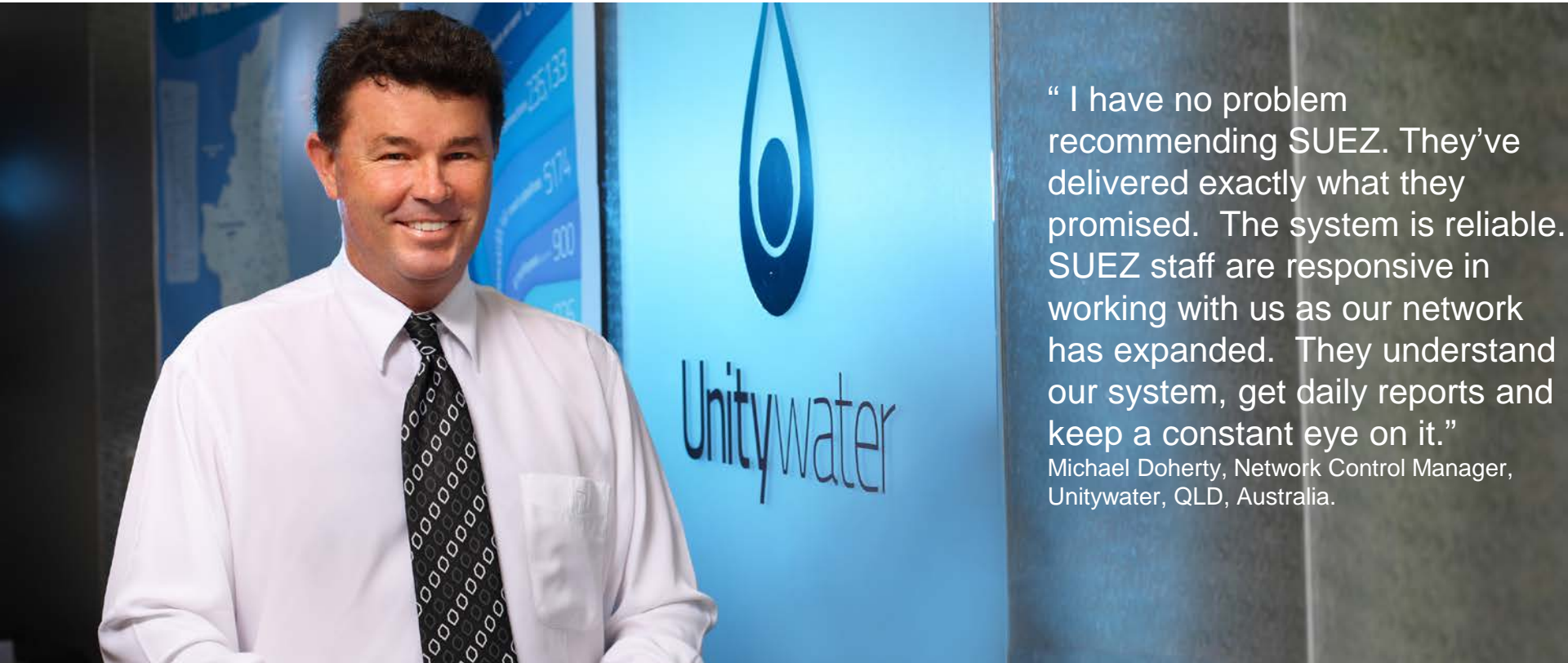
**“Really, Aquadvanced is delivering on its promise. I am an automation engineer and I was really surprised and impressed that they could make it work so well. It had to work... and it does. It really works.”**

Andreu Fargas-Marquès,  
CAT's maintenance chief and energy manager.



# Unitywater, Queensland Australia

- Main driver was operations optimisation, balancing flows into inlet valve controlled storage tanks to improve tank turn-over, safe storage levels and pressure management
- Smoothing out-flows from treatment plants was a primary goal
- Energy costs were already low and automation for consistent operation was important



“ I have no problem recommending SUEZ. They’ve delivered exactly what they promised. The system is reliable. SUEZ staff are responsive in working with us as our network has expanded. They understand our system, get daily reports and keep a constant eye on it.”

Michael Doherty, Network Control Manager,  
Unitywater, QLD, Australia.



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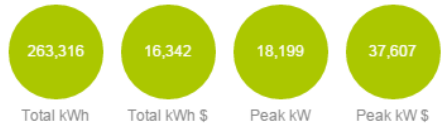
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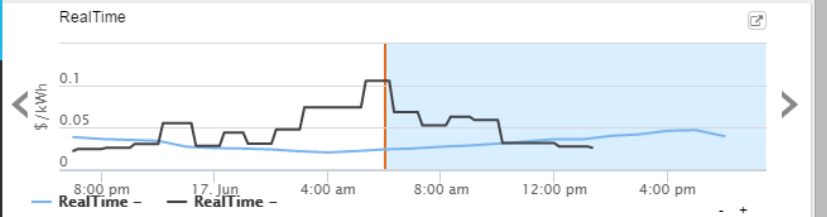
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Energy use summary

Today Electric

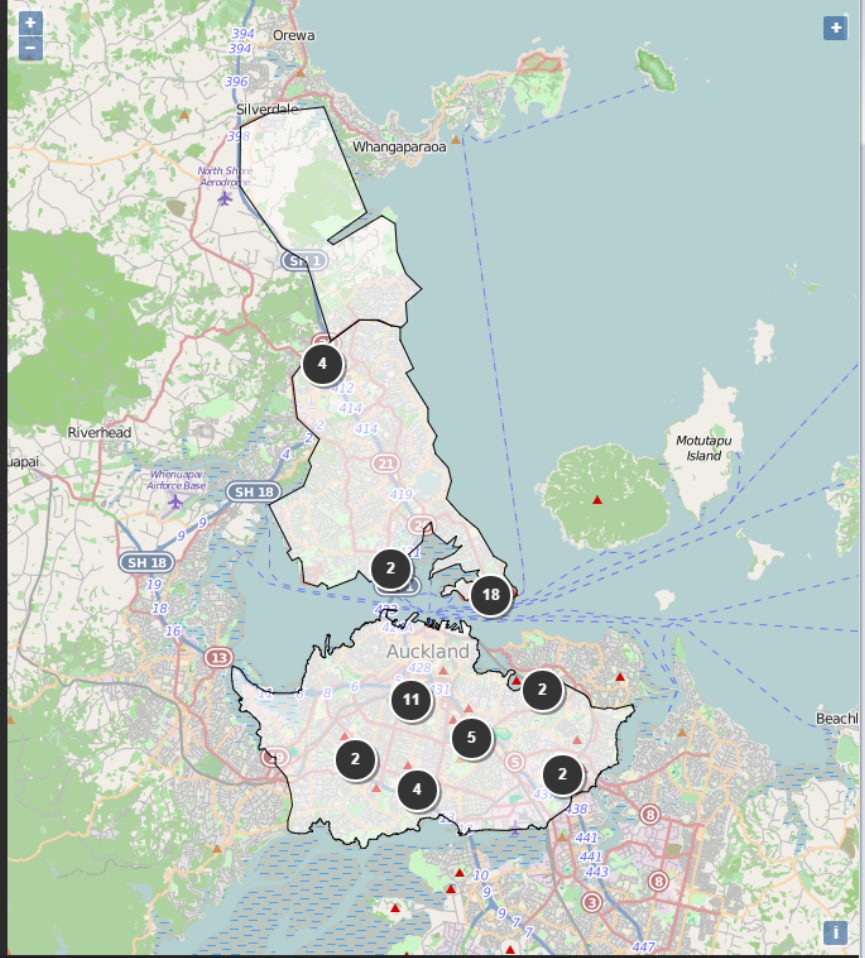


Energy tariff details



Scheduled energy use

Station	Tariffs	Total	Peak	8:00 AM	8:30 AM	9:00 AM	9:30 AM	10:00 AM	10:30 AM	11:00 AM
DevonportHL	TeslaTOULarge	5324	230	83	85	85	86	87		
DevonportRW	TeslaTOULarge	6531	244	240	238	244	241	141		
EdenHL	RealTime, Triad Demand	19853	520	177	177	368	368	368		
EpsomHL	RealTime, Triad Demand	12635	463	438	435	428	425	185		
Hillsborough	TeslaTOUSmall	1220	82	0	0	0	0	0		
<b>Total</b>		<b>92035</b>	<b>3727</b>	<b>2470</b>	<b>2465</b>	<b>2054</b>	<b>2048</b>	<b>1353</b>	<b>1357</b>	<b>1160</b>





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<https://aqdenergy-itg.ondeosystems.com/#/home/panel/Aquadapt/view/dbc7c159-6214-92be-18bd-77d881843167>

**AQUADVANCED ENERGY** TESTENG

Navigation: Civilisation > South > Southern Pumping Plants > Eden HLPS

Demands: Eden HLPS (PMPS)

**Newmarket**

Yesterday: 39.76 ML  
 Today: 43.48 ML

Reservoirs: Eden HLPS (PMPS)

Target volume: 43 ML  
 Max volume: 47.73 ML  
 Min volume: 29.55 ML

Flows: Eden HLPS (PMPS)

Map: Auckland area with various districts labeled (Westhaven, Auckland Central, Grafton, etc.).

06/17/2015 6:30 AM

<https://aqdenergy-itg.on> | 
 <https://aqdenergy-itg.ondesystems.com/#/home/panel/Aquadapt/view/3bddfcbc-8774-7196-faad-bf63b940310b>

**AQUADVANCED ENERGY** | GUEST | Refresh: Wednesday, June 17, 2015 5:50 AM

**Navigation:** Civilisation > South > Southern Treatment > Cornwall WTP

**Target volume 29 ML**  
**Max volume 31 ML**  
**Min volume 10 ML**

**Flows: Cornwall WTP (WTPS)**  
 CornwallRaw\_VSDs | CornwallRW

**Max flow 77 MLD**  
**Min flow 20 MLD**  
**Max st. Up 11 MLD/15h**  
**Max st. Dn 0 MLD/15h**

**Logical schedule** | Individual schedule

TeslaTOULarge  
 CO\_RW\_P1  
 Cornwall  
 Cornwall\_Step Point  
 CO\_RW\_P2  
 CornwallRaw\_VSDs  
 CornwallRW

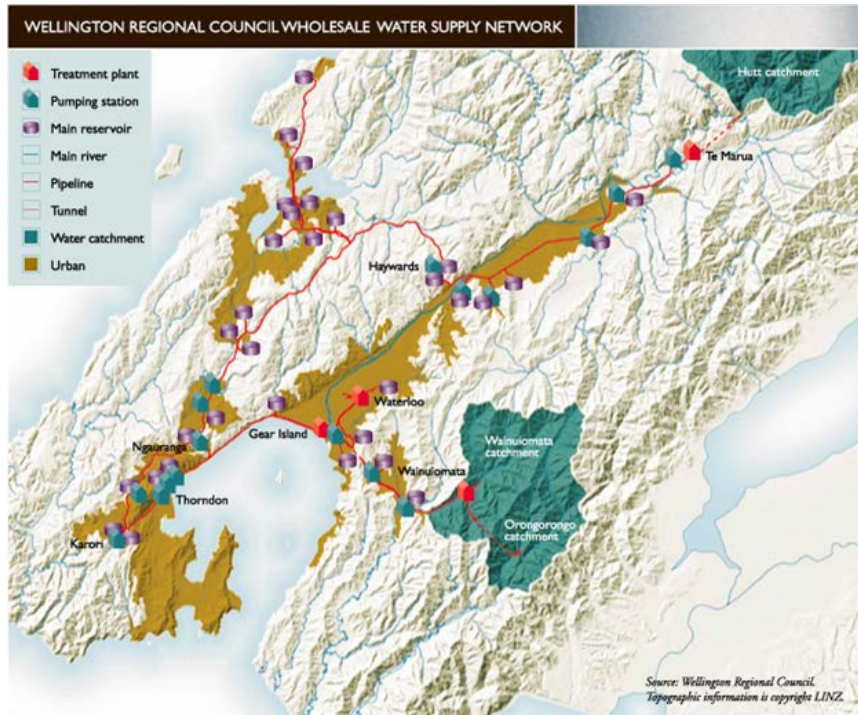
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# Wellington Water led the way



- **Still the only commercial fully automated optimiser in the world**
- **Savings achieved have been consistent world-wide, showing that operations are similar**
- **New challenges arise e.g.**
  - Real-time pricing,
  - pressure systems with no storage,
  - Demand Response programs
- **Wellington Water have been at the forefront of most of these initiatives**

# Thank You

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