emech™ control

Value from New Technology Achieving Tighter Temperature Control

Nigel Bartlett
Emech Control Ltd

Improving Winery Performance

emech control

"Improving valve performance is one of the most critical steps manufacturers can take to become more profitable.

Reducing process variability lies at the heart of maximising profitability.

By maintaining process variables as near as possible to the set point, improved valve performance allows manufacturers to run their plants closer to constraints, thereby increasing production and reducing waste".

Automation Research Council Report 2001

ARC Advisory Group

VISION. EXPERIENCE. ANSWERS.

WEA NZ CONFERENCE 2008

MARLBOROUGH • SEPTEMBER 18-19

Water

The Worlds Most Valuable Resource !

McKinsey&Company

The world's resources are increasingly constrained.
Water shortages will be the key constraint to growth in many countries.
Innovation in technology, regulation, and the use of resources will be central to creating a world that can both drive robust economic growth and sustain environmental demands.

– Mc Kinsey and Co. 10 Trends to Watch #7

The McKinsey Quarterly

WEA NZ CONFERENCE 2008
MARLBOROUGH • SEPTEMBER 18-19

Improving Winery Performance

emech control

Sustainability

Triple Bottom Line Accounting

- Is it real or just another fad
- Is it really…….. People, Planet and Profit
- Alternatively is it ……..People, Planet verses Profit

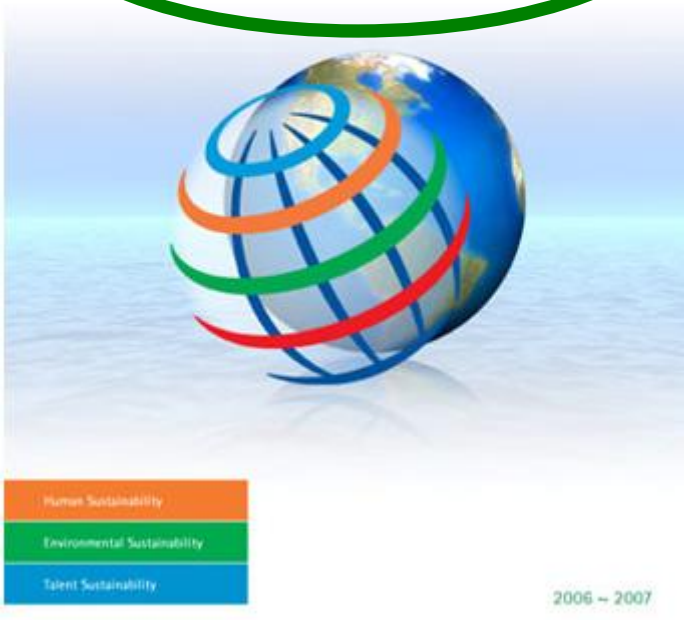
WEA NZ CONFERENCE 2008

MARLBOROUGH • SEPTEMBER 18-19

Improving
Winery Performance

emech™
control

Performance with Purpose
PepsiCo Corporate Sustainability Report



PepsiCo Corporate Sustainability Report

NEW ZEALAND SUSTAINABLE WINEGROWING

TIMESONLINE

CLOSE WINDOW

PRINT THIS PAGE

From The Times

October 8, 2007

Watchdog sees red and tells companies to come clean when they try to go green

Elizabeth Judge

A crackdown on fake and exaggerated "green" claims has been launched by Britain's advertising watchdog after a flurry of complaints about unsubstantiated environmental boasts by some of the world's best-known companies.

After upholding complaints about companies including Toyota, Volkswagen and Scottish & Southern Energy, the Advertising Standards Authority (ASA) has told businesses that they must not misrepresent or overstate their claims to being eco-friendly.

In the rush to win over environmentally conscious customers, it says, companies are too easily associating their products with "buzz" phrases such as "carbon offsetting" and "carbon neutral" without providing evidence to back up their claims.

The watchdog is reminding companies that any such claims must be supported by proof. Companies should also not present claims as being universally accepted if the science is, as yet, inconclusive, it says.

In addition, it is telling businesses to avoid sweeping statements about being "environmentally friendly" if there is no way that they can prove it.

As eco-friendliness becomes universally accepted as worthy cause, companies are jostling to prove their green credentials and tap into the lucrative market for associated products.

A recent report from the Soil Association found that last year organic food and drink sales in the UK approached the £2 billion mark for the first time.

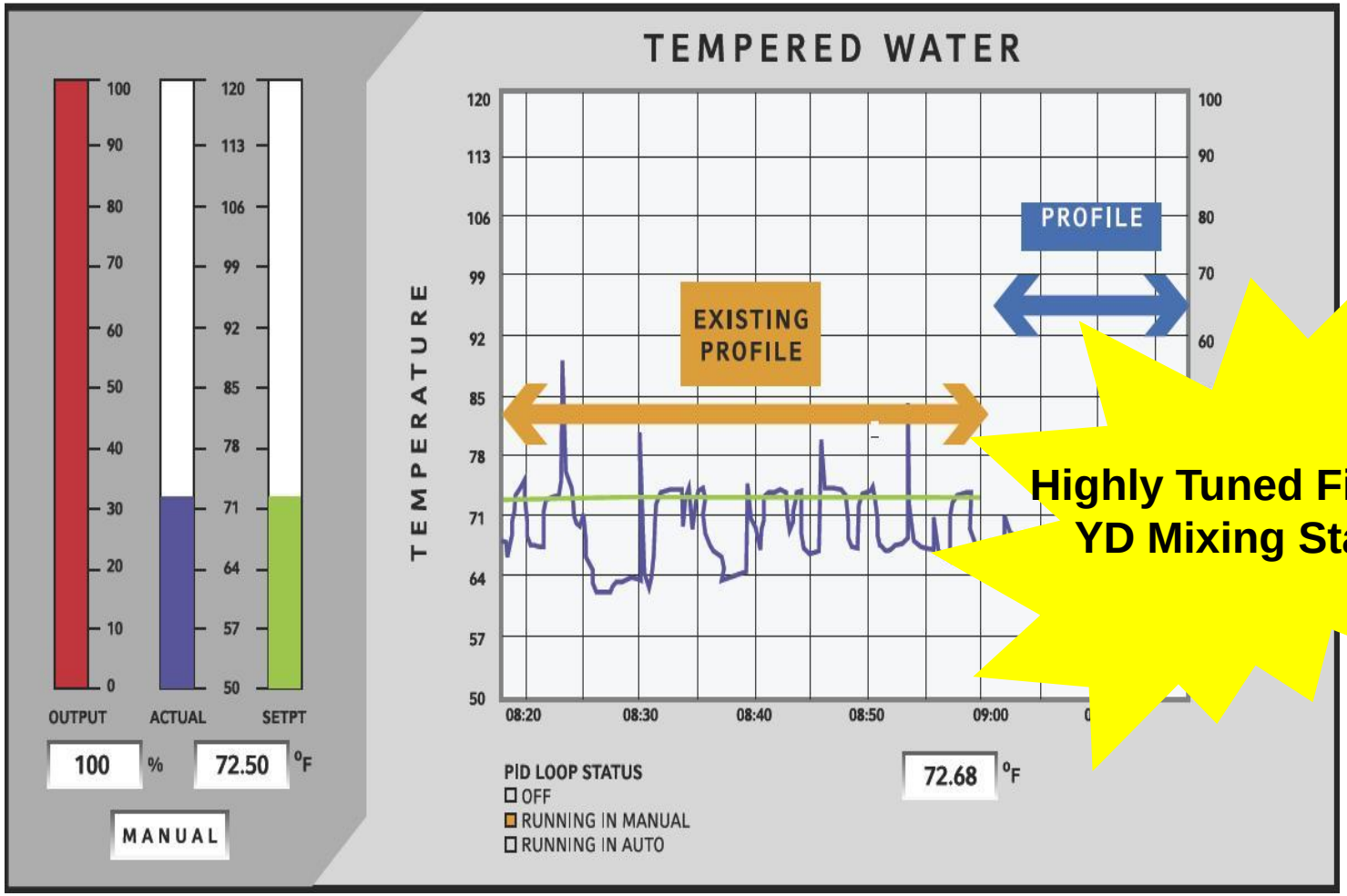
Retail sales of organic products were worth an estimated £1.9 million, up 22 per cent on the previous year. Britain's organic market is now the third-largest in Europe, after Germany and Italy.

WEA NZ CONFERENCE 2008
MARLBOROUGH • SEPTEMBER 18-19

Improving Winery Performance

As Good As It Gets?

emech control™



Highly Tuned Fisher ™ YD Mixing Station

WEA NZ CONFERENCE 2008
MARLBOROUGH • SEPTEMBER 18-19

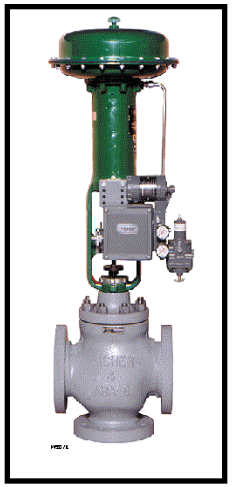
Improving Winery Performance

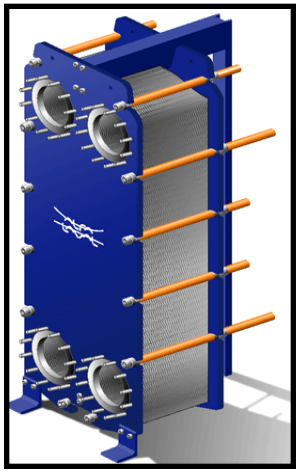
emech control

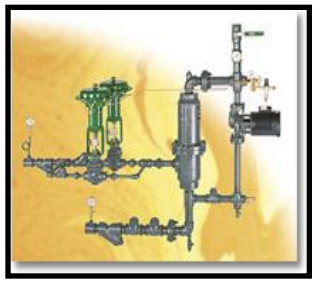
Traditional Mixing Systems

Traditionally comprise 4 elements

1. Heating / Mixing Element
2. The Sensing Element
3. The Controlling Element
4. The Motive Element







WEA NZ CONFERENCE 2008

MARLBOROUGH • SEPTEMBER 18-19

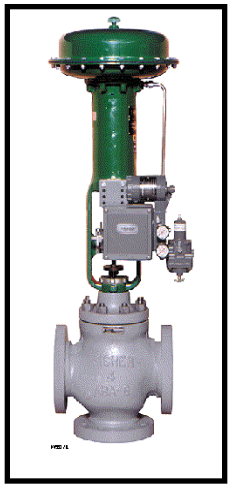
Improving Winery Performance

The 30 Year Legacy

emech™ control

Little has changed in the process of blending tempered water, with a latent acceptance of 30 year old valve design, pneumatically actuated, and externally controlled using independent monitoring and control logic.

Incremental improvements in components have delivered little significant change in process performance.



"If it isn't broken, then why fix it".

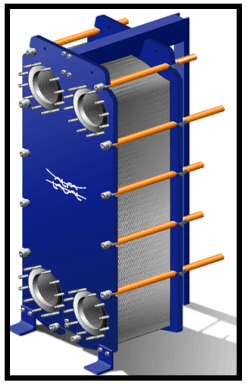
The Heating / Mixing Element

The method of energy transfer to either heat up, or cool down a liquid medium can be achieved in a number of forms.

Depending on the stage in the process, the change in temperature to be achieved and the end use of the heated media different forms of heat transfer are used.

Direct mixing valves are common to blend hot and cold water.

Plate heat exchangers are common if the heating medium is steam, or regenerative heating is employed.



These typically rely on nearly laminar flow conditions to achieve adequate mixing and reduce maintenance intervention.

The result of this is a requirement to provide adequate distance of typically 8 ~ 15 pipe diameters for the mixing to be complete before the sensing element can be introduced.

The Sensing Element

The sensing element used to detect change in temperature traditionally employed in the beverage industry is referred to as a Resistance Temperature Detector or RTD.

High quality RTD's demonstrate good linear response to changes in temperature and are marketed as providing a wide range of temperature accuracy from below freezing to more than 850 Deg° C. (1,562 Deg ° F).

The limiting factor of Resistance Temperature Detectors is their speed of response. A temperature shift of 100 Deg° C (212 Deg ° F). can take as long as 30 seconds to register across a high performance probe.

The mechanical action that occurs across the resistance element due to temperature expansion and contraction can cause the temperature response to drift, requiring RTD sensing elements to be calibrated to maintain a high degree of accuracy.

Improving Winery Performance
WEA NZ CONFERENCE 2008
MARLBOROUGH • SEPTEMBER 18-19

The Controlling Element

The process control element is typically referred as the actuator and or controller and is used to change the position or flow across the mixing element.

Traditionally these have been pneumatically controlled linear or rotary positioners.

These are very reliant on the quality of the energizing or motive element and are susceptible to leakage, wear and stiction. This results in a high degree of maintenance intervention.

Recent advances in the use of add on switching and monitoring have provided a degree of visibility of the controlling action, however the fundamental design constraints of pneumatic actuators and positioners limit the potential for advanced and accurate control.

WEA NZ CONFERENCE 2008
MARLBOROUGH • SEPTEMBER 18-19

Improving Winery Performance

emech control™

The Motive Element

Most mixing valves, and the control valves used in heat exchangers are reliant on pneumatic positioning to achieve a degree of control.

The cost to supply consistent high quality air is intensive both in terms of labor for monitoring and maintenance and energy to not just drive compressors, but the driers and compensators that are required in the instrument air circuits that wineries and other industrial plants use.

The alternative has been electro mechanical motion using gear driven electric motors which traditionally has been slow and also energy intensive.

Improvement and or Innovation

The focus on process improvement in the area of tempered water mixing has been around speed of monitoring and additional field equipment to monitor what is happening in the process.

Little has been done to review the basic elements of this process and learn from other industries what can be applied to and fundamentally improve blending to provide tangible and tacit value to organizations.

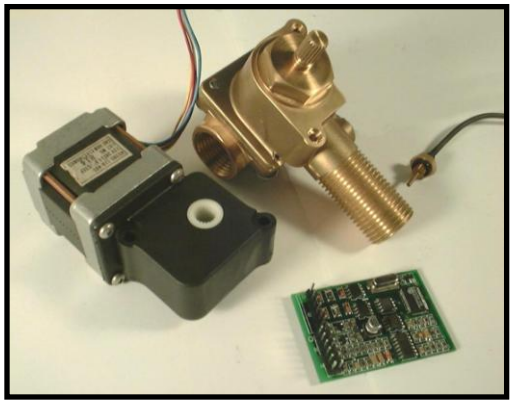
Improving Winery Performance

Invention By Chance

emech control™

Invention by chance based on a premise to prevent scalding of people in domestic showers has lead to the design of a number of new technologies that combined have radically improved the level of performance that can be achieved.

Collectively these combined technologies have delivered significant value to a number of industries including the beverage sector.



Peter Jeromson Brad Houghton

WEA NZ CONFERENCE 2008

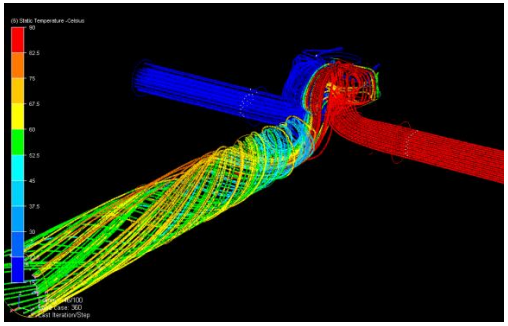
MARLBOROUGH • SEPTEMBER 18-19

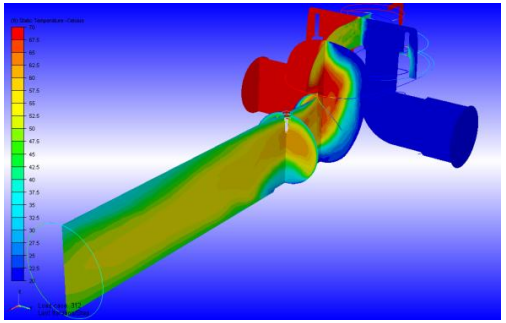
Heating / Mixing Element ~ Shear Action Swirl Mixing Valves

The ability to complete the mixing at the outlet point of the mixing valve reduces the time and volume lag that exists in traditional systems. This is particularly relevant in real life situations where flows and pressures are not always constant, despite the best of design considerations.

The segment design of new shear action valves provide a highly improved broad span linear control response when used either as mixing valves or as control valves in comparison to plunger valves or rotary action control valves.

This results in a faster and more accurate response to variation in process condition



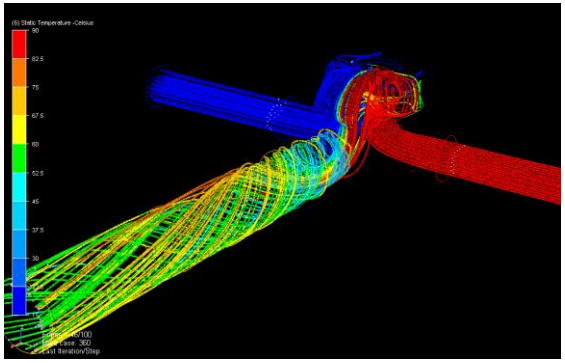


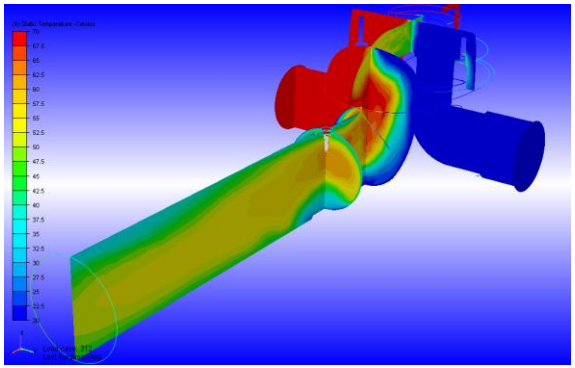
WEA NZ CONFERENCE 2008
MARLBOROUGH • SEPTEMBER 18-19

Improving Winery Performance

emech control™

Heating / Mixing Element ~ Shear Action Swirl Mixing Valves





WEA NZ CONFERENCE 2008

MARLBOROUGH • SEPTEMBER 18-19

Improving Winery Performance

emech control™

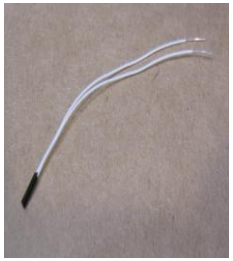
The Sensing Element

Speed and accuracy are vital to achieving accurate process control.

The latest Negative Coefficient Temperature (NTC) probes deliver both, at the expense of having to select the correct operating range.

Appropriately selected NTC probes deliver a higher degree of accuracy and speed of response that are thermally stable and are not subject to the work hardening effect that “typical” metallic RTD probes suffer.

A temperature span and shift of 100 Deg° C (212 Deg ° F) for a NTC probe is typically accurately measured less than 800 milliseconds, and the advancement in signal processing means that high order logarithmic equations can be used to exceed the level of accuracy and consistency that beverage processes require .



WEA NZ CONFERENCE 2008
MARLBOROUGH • SEPTEMBER 18-19

Improving Winery Performance

emech control

The Controlling Element

Precision stepping motors in conjunction with planetary gearboxes now used as part of a self controlling actuator provide speed, resolution and consistency not seen previously in valve actuation.

Self controlling actuators are now available that can produce 0.03 degree step resolution and operate under full duty cycle conditions providing speed and accuracy that delivers consistent high value performance inside critical processes.

The integration of controller boards means that these actuators can think for themselves when operating in closed loop temperature control mode, and allow facilities to generate a distributed intelligence network that can communicate with site management systems, reducing the need for large heavily customized PLC networks.

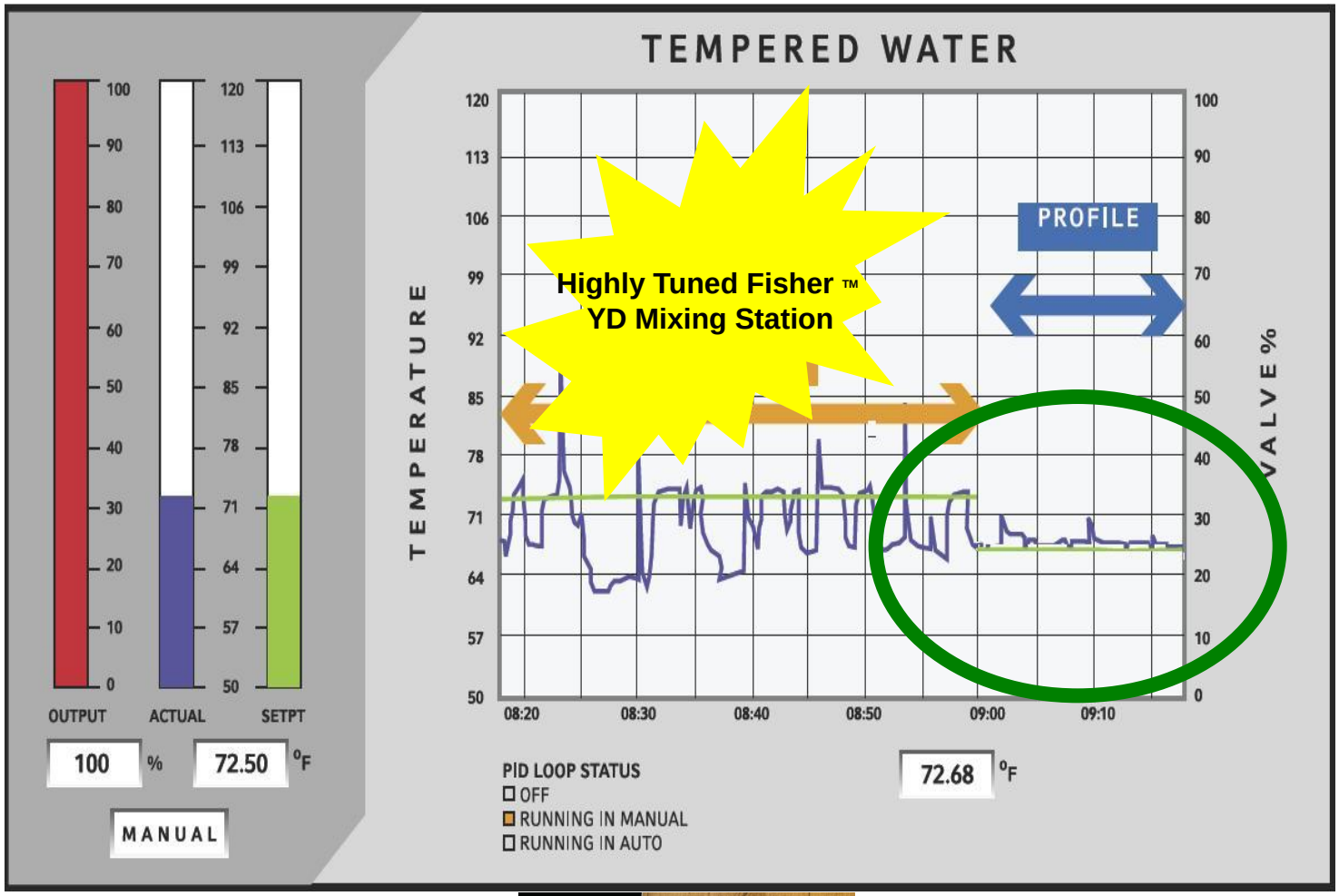
WEA NZ CONFERENCE 2008

MARLBOROUGH • SEPTEMBER 18-19

Improving Winery Performance

Automated Shear Action Swirl Mixing Valve

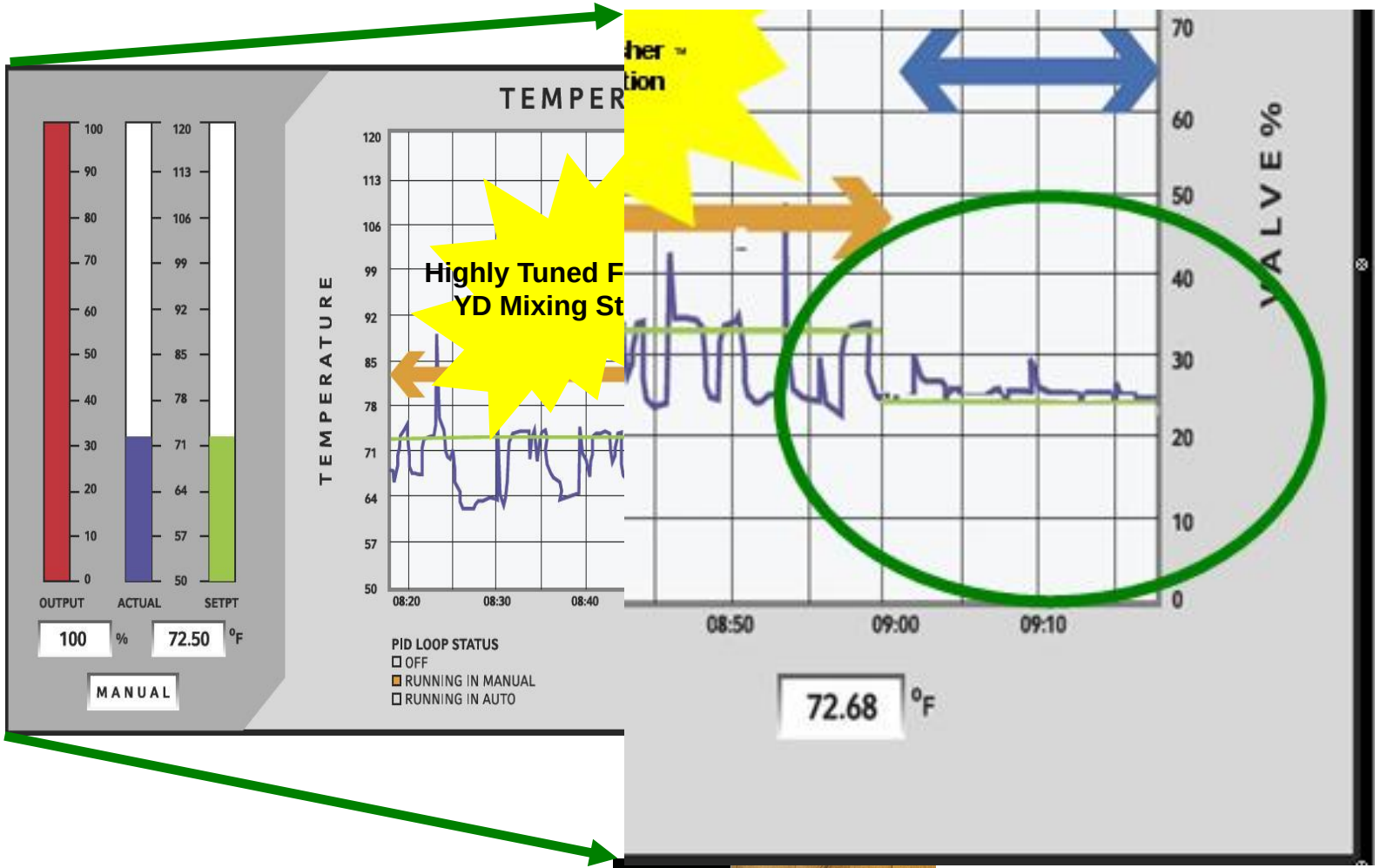
emech control™



Improving Winery Performance

Automated Shear Action Swirl Mixing Valve

emech control™



Determining the Value

The value in deploying this new technology appears across different aspects of a business and process.

The value can be both tangible and tacit, and be observed in measurable yield improvements, as a consistent process delivers a consistent high quality product.

This can be measured quantitatively depending on the individual process and the value calculated in a monetary form.

It can be observed in a maintenance budget, as the technologies have been seen to require less maintenance intervention in the form of spare parts, and maintainer activity. Often the area of maintainer activity is more of a tacit benefit in the form of reduced headaches and tweaking, rather than a pure cost driven activity.

$ € £ ¥

¥ £ € $

Determining the Value

Given the current focus on global warming, and energy conservation it is easy to quantify the energy savings available by implementing new technology that will reduce process variance, particularly relating to heating water.

If temperature monitoring via chart recording, or SCADA recording is used, the energy available to be saved can be seen as the area under the temperature trace line that is above the actual temperature required.

For large flow rate processes, even a small reduction in process variance produces significant energy savings.

Improving Winery Performance

emech control™

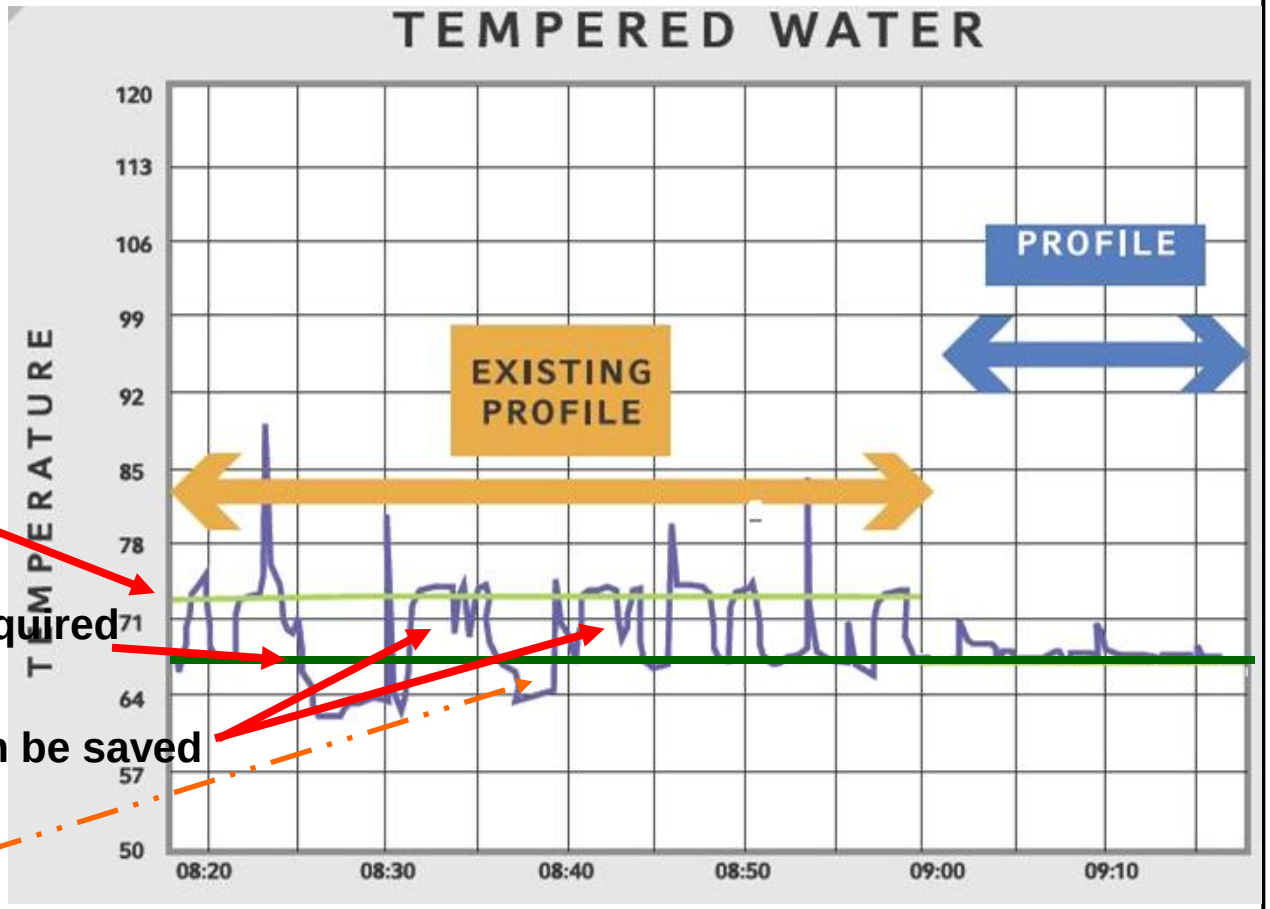
Determining the Value

Traditional Set point

Actual Process Temp Required

Available Energy that can be saved

Quality issues ?



Calculating the Value

- **Energy Savings Calculation**

The modified engineering equation used to calculate the specific heat in a process can be used to approximate the available energy that can be saved. Understanding the cost to produce the energy can further produce a dollar value that can be used to calculate return on investment.

$$Q = \rho (M * C * \Delta T)$$

Where M is the mass flow rate, C is the specific heat, ΔT is the reduction in temperature set point to meet the process requirements and ρ is an approximating factor. The approximating factor is a percentage of the available energy that can be saved, i.e. a proportional estimate of the area below the trace line that is above the revised temperature set point.

Calculating the Value

Assuming a 50% approximating factor, a 500 litres per minute flow rate, and reducing the temperature set point by 5 degrees the hourly energy saving by achieving more accurate control is

$$Q = 0.5\ (30000 * 4.186 * 5) = 313{,}950\ \text{KJ/hr}$$

Given the current cost of natural gas in the NZ is currently NZ$0.10 dollars per MJ, this becomes a **$31.30** per hour saving at one station alone.

Annualised over an intensive 6 week vintage this $ 22,320

Computer models now exist to help evaluating the monetary savings using this approximated formula

Acknowledgements

Emech Control Technology which is the basis of this presentation has been developed across multiple industries in New Zealand and internationally including the Beverage and Wine industry.

Work to validate the material presented has been conducted in conjunction with Pernod Ricard, DB Breweries, Lion Breweries in New Zealand, and also with international companies such as Browns Brothers Winery in Australia and Anheuser Busch in the United States of America.

Emech Control Limited wish to thank those companies for their support in validating actual improvement within their processes, and helping grow an innovative New Zealand enterprise.

Pernod Ricard New Zealand

LION BREWERIES

dbreweries

BROWN BROTHERS MILAWA AUSTRALIA

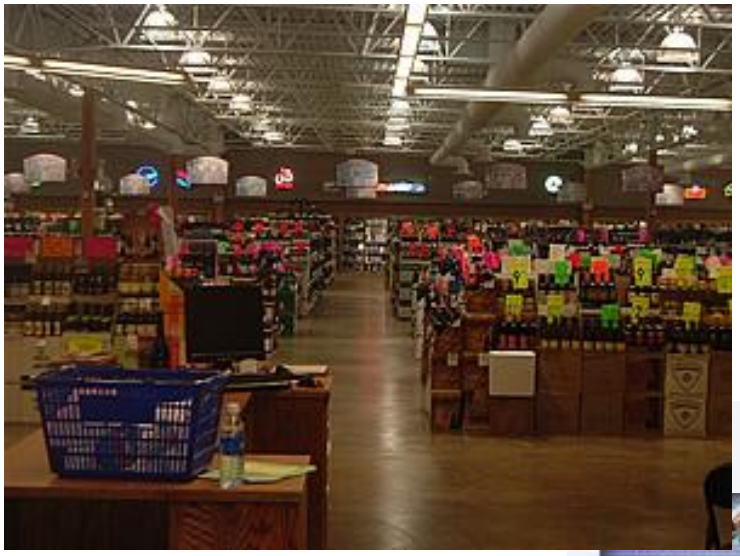
Anheuser-Busch

WEA NZ CONFERENCE 2008

MARLBOROUGH • SEPTEMBER 18-19

Improving Winery Performance

emech control



Questions

Emech Proudly Supporting NZ Wine in the USA, through DaveCo, the worlds largest wine store

WEA NZ CONFERENCE 2008
MARLBOROUGH • SEPTEMBER 18-19