Sustainable laboratory

How to conserve natural resources and save money

suez

a strong demand for improved sustainability

Sustainability continues to be a hot topic, with socially responsible businesses looking ever more closely at their operations to find new ways of minimising environmental impacts. This white paper shows how water and energy can be saved – and their costs reduced – by applying some existing technology to modify water purification systems.

Why be sustainable?

From many conversations with laboratory managers, it is clear to SUEZ that there is a strong demand for improved sustainability. Having devoted much thought and effort to reducing electricity and gas consumption, in line with society and industry as a whole, labs see examination of their water usage as the next step.

There are several drivers for this. Many organisations simply feel that conserving natural resources is the right thing to do and, like SUEZ, make it a fundamental part of their ethos. For any business that understands corporate social responsibility, looking after the planet is an imperative – and being seen to care brings a public relations bonus.

On an international level, most countries agree that climate change needs to be tackled and have signed up to the Kyoto Protocol. The resulting political pressure is encouraging fuel consumption and carbon footprint reduction in every sector. The NHS, to give just one example, reduced its carbon footprint by 11% between 2007 and 2015.

A commitment to conserve other resources, like water, is part of the same mindset. Scotch whisky distillers, for instance, reduced their water consumption by 14% between 2009 and 2014 and continue to set ambitious targets. Having more than halved its water consumption over 25 years, the University of Cambridge is targeting a further 20% reduction by 2020 against a 2005 baseline.

As this white paper will demonstrate, there are also strong economic drivers for using resources wisely. In addition to cost savings related directly to lowering consumption, there are grant, loan and support schemes specifically designed to benefit those who choose eco-friendly equipment.

Laboratories can be big water consumers, tending to use much more per square metre than typical commercial buildings. At some US universities they account for up to 50% of the total campus water consumption. Cooling towers are particularly thirsty but many other lab processes require a substantial water supply.

how to save water in your laboratory

Water purification equipment takes a small but significant share and should be seriously considered on the basis that every drop counts.

Saving water

When confronted with water recovery rate figures for water purification systems based on reverse osmosis (RO), lab staff are often surprised to see how wasteful they can be. In some cases recovery is as low as 10%.

In other words, for every 100 litres of input water, only 10 litres of purified water may be produced, leaving 90 litres to flow down the drain.

Increasing recovery rate to around 50% can be straightforward using existing technology. SUEZ achieves this in the ECO versions of its water purification units by re-engineering the drain flow hydraulics and using state-of-the art high recovery membrane technology. ECO conversion kits are available and can be fitted by a SUEZ engineer as part of a service visit*.

A normal membrane is unsuitable for a high recovery system. To obtain the necessary robustness and performance, SUEZ has worked with a partner to utilise a new ECO membrane.

*compatible only with Select L3G laboratory water equipment

Table 1 compares the drain flow, water usage and water cost between normal and ECO versions of four models in the SUEZ Select range of purification systems. Depending on model, the annual saving ranges from £1,440 to £1,860.

These results are based on typical water costs. It could be argued that some customers' tariffs are a little lower or higher, but the figures give a useful indication of the scale of saving per purification unit.

Table 1: Comparison of water consumption and costs between ECO (high recovery) and standard (normal recovery) purification systems

Select model	Product output (l/hr) [1]	Drain flow (l/hr)		Approx. water usage per year (m3) [2]		Total annual water cost [3]		Potential annual saving [4]
		Standard version	ECO version	Standard version	ECO version	Standard version	ECO version	ECO version
40	3.6	66	c.4	840	96	£2,100	£240	£1,860
80	7.2	66	c.8	876	180	£2,190	£450	£1,740
160	14.4	66	c.15	960	360	£2,400	£900	£1,500

[1] Based on 60 psi, 10°C
[2] Based on 10 hrs/day, 240 days/year usage
[3] Based on typical water charges of £1.50/m3 for mains water and £1.00/m3 for waste water
[4] It should be noted that the high recovery RO system described cannot be used if input water has very high levels of hardness

how to save electricity in your laboratory

Saving electricity

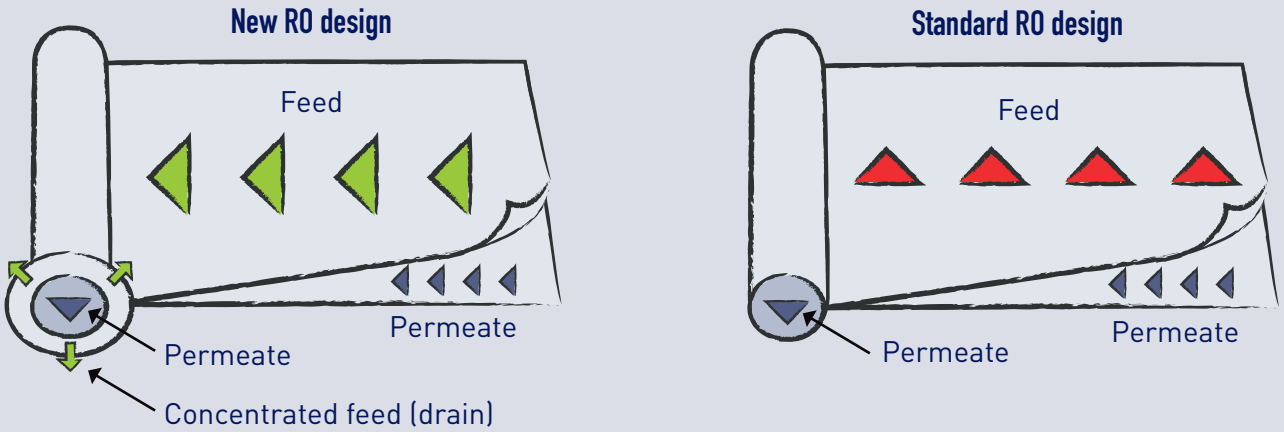
If purified water is not being dispensed for a period of several hours or more, it makes sense to put the unit on standby and save both electricity and water. It should not be entirely idle in this 'sleep' mode, as some circulation is needed to discourage microbiological activity. In SUEZ machines the sleep cycle involves a 10-minute flushing programme every 2 hours. At its simplest, a standby switch is a manual feature which is operated – provided someone remembers – at the end of the working day and especially before weekend closedowns. SUEZ has now introduced an intelligent standby option, which is available on selected models. Intelligent standby automatically imposes the sleep cycle at any time that a set period has elapsed without water being dispensed.

This may seem like an obvious feature for all manufacturers to provide, but it is not as easy as it sounds. It requires someone to write the necessary programme and to recode whenever changes in software become necessary. This is a costly service to buy in, so only manufacturers like SUEZ with in-house code-writing specialists and a commitment to keeping machine software up to date will consider it.

New ECO membrane encapsulated Green RO element

The key features of an encapsulated RO element are a permeate tube, feed and permeate spacers, and a membrane (see below). The rectangular TLC (thin layer composite) membrane is rolled together with the spacers onto the tube, like a wound-up scroll. Input water, under pressure, enters the scrolled membrane from one end. Some passes through it into the permeate spacer and exits through the permeate tube. The rest exits as a drain flow from the other end of the scroll.

In the standard arrangement, feedwater flow is perpendicular to the rectangle's width. In these newer designs, it flows along the full length of the rectangle. This maintains an ideal flow rate across the membrane, creating the necessary turbulence to help prevent clogging, but with a reduced volumetric flow rate in the drain stream.



potential savings calculations

Table 2 compares typical electricity costs between continuous and intelligent standby operation of its Select purification units. Again there will be some variation in the tariffs charged by different providers, but the projected annual saving of £107 on each machine gives some idea of its scale.

Calculate your potential savings

Table 3 summarises the combined saving on water and electricity made possible by ECO versions of four Select models with intelligent standby. Based on typical tariffs, it ranges from £1,547 to £1,967. For an organisation running multiple water purification units, those savings will multiply.

To find out how much you could save, based on your own site-specific figures, you'll need the following information:

- Your kWh tariff
- Your pence per m^3 water tariff for both water supplied and waste water charges
- Your unit's operating hours per day
- Your purified water usage per day

Table 2: Comparison of energy consumption and costs between purification units using continuous and intelligent standby modes

Select model	Operating mode	Max power draw (kW)	Typical annual consumption (kWh)	Average energy tariff (pence/ kWh) [3]	Total annual cost [4]	Potential annual saving
40, 80 and 160	Continuous	0.1	876 [1]	20	£175	-
40, 80 and 160	Intelligent standby	0.1	341 [2]	20	£68	£107

[1] Based on 24-hr operation, 365 days/year
[2] Based on typical 8 hrs/day continuous use followed by 10 min recirculation cycle every 2 hrs for remainder of day, 365 days/year
[3] Based on typical kWh daytime electricity tariff (this may vary between providers)
[4] Excludes any daily standing charges (these will vary between providers)

Table 3: Summary of potential savings through use of ECO versions with intelligent standby

Select model	Annual energy cost		Annual water cost		Total cost		Potential annual saving
	Standard version	ECO version + intelligent standby	Standard version	ECO version + intelligent standby	Standard version	ECO version + intelligent standby	ECO version + intelligent standby
40	£175	£68	£2,100	£240	£2,275	£308	£1,967
80	£175	£68	£2,190	£450	£2,365	£518	£1,847
160	£175	£68	£2,400	£900	£2,575	£968	£1,607

Based on the same assumptions as tables 1 & 2

meet your sustainability goals

Start saving now

SUEZ will soon be introducing the option of WiFi capability to its water purification systems. This opens up the possibility of monitoring the activity and consumption of individual units, and reacting rapidly to maximise their performance and economy.

Something laboratories can do immediately is arrange for SUEZ to carry out a water purification audit.

It will reveal the true financial and environmental cost of their equipment, as well as identifying large and small changes which will quickly pay for themselves if implemented.

The technology is available now and SUEZ is keen to use it in meeting its sustainability goals and those of its customers.

contact

Water Purification Systems Ltd

Email: mail.waterpurificationsystems.uk@suez.com

Web: www.suezwatertechnologies.com

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