

School of Science and Technology water use and efficiency study

Laboratories frequently use a lot of electricity. A lot of time, effort and expenditure has been spent on reducing energy consumption in the labs at NTU with a significant reduction in power consumption and carbon footprint.

University laboratories can also get through a lot water – it's used as a coolant, in the production of purified water and for cleaning equipment and glassware.



In January 2018, an interdisciplinary team of technicians led by Darren Hodgkinson from the School of Science and Technology was set up to investigate and understand water consumption within our laboratories. They paid particular attention to the Rosalind Franklin Building (RFB) Superlab, which is a large lab with a wide range of equipment and water uses.

The RFB uses approximately seven million litres of water per year (the equivalent of 42,000 baths or 329,000 toilet flushes) at a cost of £22,000. Clearly, finding ways to reduce this water usage would make a significant environmental and economic impact.

What we found

- Most large labs have moved away from water stills to produce purified water, and are investing in reverse osmosis machines. A traditional water still was found to waste approximately 470 litres of tap water in producing 25 litres of distilled water, with an energy consumption of 3kWh. It would take 7.5 hours to produce 25 litres of water. While reverse osmosis machines are relatively expensive, they use only 300W and only waste as much water as they produce; purified water is then available on demand.
- Traditional autoclaves (steam under pressure sterilising machines) use the majority of the water to produce the vacuum and to cool the waste water. A cycle can use more than 8000 litres of water. Cooling technologies on our autoclaves reduce this substantially.
- Chemistry equipment often uses running water to lower temperatures in processes. For example, a rotary evaporator will use 2.5 litres per minute. A standard reflux condenser will also use this quantity of water. Significant investment has therefore saved millions of litres of water. Projected return on investment time for the purchase of a new piece of cooling equipment is 1 year 7 months.
- Standard hand wash basins use approximately 10 litres of water per minute. Superlab taps have a flow rate of 9.2 litres per minute, but a 'magic' eye restricts flow when hands are placed in front of the sensor. Other alterations to conventional taps for handwashing were also investigated – taps with aerators on the nozzle should always be fitted, and the use of other specialist nozzles have the ability to reduce water from the tap even further.



A reverse osmosis machine purchased for a chemistry lab with the help of a grant from the NTU Sustainable Development team

Conclusion

There are clear benefits to reducing water consumption in our labs. Careful use of water is obviously important, but it is the investment in efficient specialised technology that leads to the greatest reductions in water consumption.

The School of Science and Technology has well equipped labs that make efficient use of water – but even in established labs, there are new water saving opportunities to be identified. It's vital that water saving continues to be part of the design criteria and budgets of new facilities.