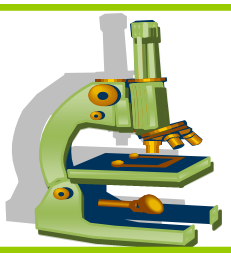


Resource Efficient Design

New buildings or refurbishments provide a perfect opportunity to implement strategies that can reduce the environmental footprint of the lab. Good laboratory design can have a significant impact on resource use over the life of a laboratory.

Laboratory spaces are highly specialised and do not use resources in the same way as office and teaching spaces. Requirements such as the high demand on the air conditioning system due to the operation of fume cupboards, high plug loads to run the equipment (that is energy used by equipment plugged into the wall) and large water use provide challenges for designers.

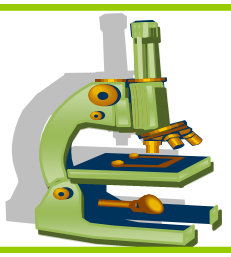
Interaction between designers, engineers, architects and the final lab users at the earliest stages of a design project is essential to ensure the most efficient design.

Below are some tips to be considered during the design stage of laboratories in order to optimise energy and water efficiency. The US EPA Labs for the 21st Century Program have compiled a design guide for laboratories with a particular focus on energy efficiency. This guide is available at: www.labs21century.gov.

PACE Savings from the start

During the early stages of design of the new Pharmacy Australia Centre of Excellence building at Woolloongabba, lab users were able to interact with architects and engineers to implement many energy and water saving strategies. These include:

- Total building management system so that room temperature and humidity can be controlled down to individual days and specific times.
- Motion sensor lights installed so that lights automatically turn off if there has been no movement for 20 minutes. This is most effective for after-hours work in research labs.
- 600,000L of rainwater tanks were installed to capture water from the roof which is used for toilet flushing and garden watering.
- Chilled recirculating water is available in fume cupboards which reduces once pass water options.
- Sensor opening doors to reduce air conditioning leakage.
- Building emergency electricity generator provides electricity to only red coloured General Power Outlets (GPOs) to allow easy identification of all GPOs that will have emergency power supplied if main power fails (e.g. for essential equipment such as refrigerators/freezers and servers to prevent loss of experiments during a power outage).
- Cleaners only use green GPOs to prevent electrical circuit failure if they use high energy load cleaning machinery.



Planning stage

Some steps taken during the initial planning stage can significantly improve the environmental footprint of the final design. Consider aspects such as:

- Whole of life cycle costs as often a small saving during construction can lead to significant additional costs during the operational phase.
- Isolation of office and support spaces from lab spaces as they have significantly different requirements.

Building wide energy and water monitoring and control systems during installation can assist long-term resource management of the building.

Air conditioning

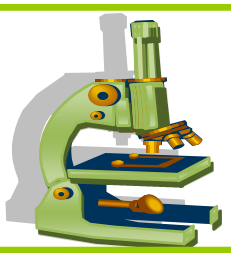
Air conditioning plays a major part in energy use within a laboratory. Fume cupboards suck large amounts of air out of the ducts every day which needs to be replaced with conditioned fresh air. Therefore it is essential that designers of laboratories ensure the air conditioning system is suitable for the additional load of the fume cupboards and is as efficient as possible. Some ideas to improve energy (and water) efficiency of air conditioning include:

Well planned air conditioning units can significantly reduce energy use.

- Zonal planning of the laboratory space so that areas that have similar ventilation requirements are zoned together.[1]
- Select variable air volume fume cupboards to significantly reduce energy loads when operated correctly (i.e. keeping the sash lowered when possible).
- Install controls to shut down one or more cooling towers if demand lowers.
- Insulation in walls and ceilings to reduce air conditioning requirements.
- Keep in mind that not all pieces of equipment or fume cupboards will be operating at capacity 100% of the time. For large buildings it is unlikely that a 100% load will ever be achieved.[2] Air conditioning systems should be sized with that in mind.
- Select efficient air conditioning systems which have a high co-efficiency of performance, that is, high heating/cooling output per energy consumed.

[1] US EPA, Labs for the 21st Century, Laboratories for the 21st Century: An Introduction to Low-Energy Design, August 2008, http://www.labs21century.gov/pdf/lowenergy_508.pdf

[2] US EPA, Labs for the 21st Century, Laboratories for the 21st Century: An Introduction to Low-Energy Design, August 2008, http://www.labs21century.gov/pdf/lowenergy_508.pdf p7



Lighting

Lighting can have a significant impact on energy use. Some ideas to allow efficient operation of lights include:

- Natural light utilisation, for example large windows and skylights. The downside is they must be cleaned and can create glare and reflection. The additional heat load from sunlight must be considered for air conditioned areas. Proper design and installation of skylights can minimise these downsides.
- Individually controlled task level lighting directs light to where it is needed rather than lighting large areas.
- Photoelectric sensors measure natural light and adjust lights accordingly, including security lights.
- Occupancy and movement sensors automatically turn off lighting in inactive areas such as freezers and storage rooms.
- Light switch segregation to allow lights in areas not in use to be switched off.
- Using fluorescent light fittings with high frequency eco-controllers or LED light fittings to increases efficiency and reduce energy use.
- Auto or step dimmers can reduce total energy demand by up to 20-30 per cent.
- Walls and ceilings painted in light colours reduce light requirements.

Light switch segregation allows individual banks of lights to be switched off.

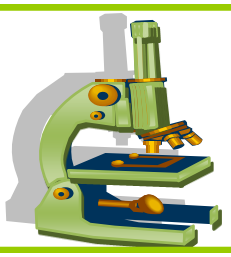
Fume cupboards

Fume cupboards are large energy users within labs. Some considerations when selecting fume cupboards include:

- Use of variable air volume fume cupboards which can significantly reduce energy loads when operated correctly compared with constant volume fume cupboards.
- Installing fume cupboards that can be moved if future lab requirements change can improve flexibility over the life of the lab.
- Installing individual lights for the fume cupboards which can be switched off independently when not in use.

Equipment

Whilst equipment selection can often be left to researchers once the building is constructed, often there are pieces of equipment selected before operation. Plug in loads, that is the energy used by equipment plugged into the wall, can have a significant impact on overall energy costs. Interaction between designers, engineers and the final lab users is essential



when selecting equipment. Oversized equipment can significantly increase water and energy use for the life of the lab.

Considerations during design include:

- Sizing equipment such as air conditioners or chillers with incremental modes to use as the load changes.
- Purchase of a highly efficient motor, correctly sized for the task can significantly reduce energy use over it operational lifetime. Electric motors can use 4-10 times its purchase price in electricity annually.[3]
- Correctly sizing pumps and fans to suit operational needs. Oversized pumps and fans waste energy.
- Selecting only recirculating (closed-loop) vacuum pumps or waterless vacuum pumps to reduce once-pass water use.
- Establishing communal equipment to allow smaller local equipment and perhaps larger communal equipment for the occasional larger load.

Waste collection spaces

Often during the design of new buildings sufficient space for the collect waste is overlooked. There is generally allocated areas for general or co-mingled waste but allocation of spaces for the collection of infrequent items such as cardboard, wooden pallets and polystyrene is neglected. The consideration of the need for this space allocation should be included in the initial design.

Waste collection spaces need to be considered in the initial design.

For further information contact:
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[3] Australian Department of Environment, Water, Heritage and the Arts, 2003, Motor Solutions Online – Selecting the Best Motor and Equipment, www.environment.gov.au/settlements/energyefficiency/motors/reference/r2.html