

Fact Sheet

Energy Efficient Stage Lighting

This Fact Sheet is an introductory resource developed to outline the basics of energy efficient stage lighting. The objective of fact sheet is to support steps by technical professionals to integrate energy efficiency into our theatres and onto our stages.

Greener Live Performances
through energy efficiency



Stage lighting

Stage lighting is often seen as the visible front end of energy use within theatre and the performing arts. Though industry studies in the UK have determined that on average only 9% of a theatre's total energy use is attributed to stage lighting.

As small as this may seem, a theatre can experience an electrical demand spike of approximately 240 kW/hour or 92% above baseline during a performance.

This is a significant increase during a short amount of time, typically 90 -150 minutes. Therefore it is important that efficiency aspects are integrated into stage lighting, where possible.

Efficient design

Lighting Designers are charged with the sole responsibility of ensuring the stage is lit in such a way to complement the artistic vision of the Director.

The Lighting Designer has a number of constraints within which he/she needs to work. They include:

- Creative integrity;
- Lighting stock; and
- Budget.

First and foremost, creative integrity of the piece is vital, followed closely by what lighting stock is available and the overall cost to set the rig.

Before the design has commenced, the production team meets to discuss project objectives, proposed creative outcomes and budget. This is the ideal time for Lighting Designers to engage with others, collaborating on possible efficiency inclusions for the project.

Initial production meetings provide an opportunity for Lighting Designers to outline proposed efficiency actions, which may include:

- Setting an overall power limit on the rig;
- Equipping the rig with the least amount of light sources as possible; and
- Designing a mixed rig of both old and new lighting technologies.

As the production process moves forward, conversations with theatre venue staff will help to identify:

- Equipment available;
- Luminaire maintenance program; and
- Opportunity to measure show power consumption.

Working with what you've got...

Lighting inventory

Lighting Designers can feel limited by available equipment supply, particularly if the latest technology is not to hand. But, rather than feel constrained, this is an opportunity for designers to creatively challenge themselves.

A typical lighting inventory can include:

- Profiles ranging from 650W to 1000W;
- Fresnels ranging from 650W to 2000W;
- Par Cans from 60W;
- Wash ranging from 150W to 500W;
- Moving lights ranging from 575W to 2500W; and
- Dimmer racks ranging from 2.4kW to 5kW.

A venue of approximately 400 seats may have around 240 lamps in stock and a heavily laden rig may contain as many as 100+ lights. It becomes easy to see how such large electricity demand peaks are achieved.



*Image: Heavily laden lighting rig
Credit: 02ma*

Setting an objective of reducing the overall rig lighting consumption capacity by 10% can achieve significant energy reductions.

New technologies

LED theatre lighting is growing in popularity in the Australian theatre scene primarily due to:

- New generation stock being more aligned with lighting designer's needs; and
- Cost of equipment moving towards market expectations and venue budgets.

LED lights are now producing equivalent light output and colour rendition of conventional tungsten halogen lighting fixtures, with much lower power consumption. The dynamic colour mixing capabilities of LED lights means lighting designers and venue technicians no longer need to incorporate gels into rig requirements, saving labour time, materials costs and disposal fees.

The generated light beam from LED produces:

- No reduction in light from ultraviolet or uncomfortable infrared wavelengths;
- Homogenous light output with no coloured shadows;
- Flicker-free light output;
- Calibrated colour temperatures selected via remote control; and
- Consistent image quality.

Substituting, or at least mixing, old generation stage lighting with new generation stock, allows the Lighting Designer to create a product that balances creative intent with energy efficient outcomes.

Case Study:

Interview with David Walters, Lighting Designer for *Water Wars*, La Boite Theatre 2011

Much about modern theatrical lighting systems are wasteful in terms of energy use. A normal filament bulb is little more than an electrical heater with light as a by-product. About 4% of the electrical energy used is emitted as light. The bulky size and weight of standard lighting fixtures is largely due to designs trying to dissipate heat.

When we colour lights, energy waste reaches new heights. To achieve

a saturated blue, as much as 98% of the light is wasted in heat, thus a large theatre set-up might use up to 40,000W of energy. In addition air-conditioning operates at peak load to manage high internal temperatures.

LED light sources are more efficient with up to 10% of electricity energy converted into light. They also produce very little heat, are less bulky and last up to 100 times longer. They

are especially effective in producing coloured light, with 100% of the light used allowing for brighter colour washes with radically less power usage.

Maximum power use for lighting during *Water Wars* was 7 amps – at curtain call.

Courtesy:
Umber Productions.