



Proving the capability of the Panasonic RZ670

Executive summary

Task

Evaluate the performance of Panasonic's laser projector, the RZ670 (rating 6,500lm), against a range of the best selling lamp-lit projectors in three key verticals:



Museums &
Galleries



Higher Education
Organisations



Rental &
Staging

The following pages are an extract from the RZ670 laser projection whitepaper, focusing on the results for the Museums & Galleries industry. The evaluation was conducted across a lifetime of 20,000 hours and against two performance measures:

[Financial](#) – Lifetime Cost of Ownership

[Environment](#) – Lifetime Carbon Emission

Technical summary

The latest generation of laser-light projectors delivers much enhanced brightness, making laser projection a reality for the largest halls in Museums & Galleries.

ROI team has already demonstrated the operational superiority of laser technology in various aspects including:

- Superior cumulated light output
- Maintenance free lifetime of 20,000 hours or more
- Power consumption adjustment
- Instant on/off capability
- Installation versatility
- Reduced environmental impact

In addition to these attributes the Panasonic RZ670 incorporates:

Flexible operational mode

Operator can now select to maintain brightness at a desired level

Superb colour and brightness

Across the colour spectrum, not just for white projection

Automated Geometric Alignment function

Saving the technician time at location (optional upgrade ET-CUK10)

Computer driven colour/brightness adjustment function

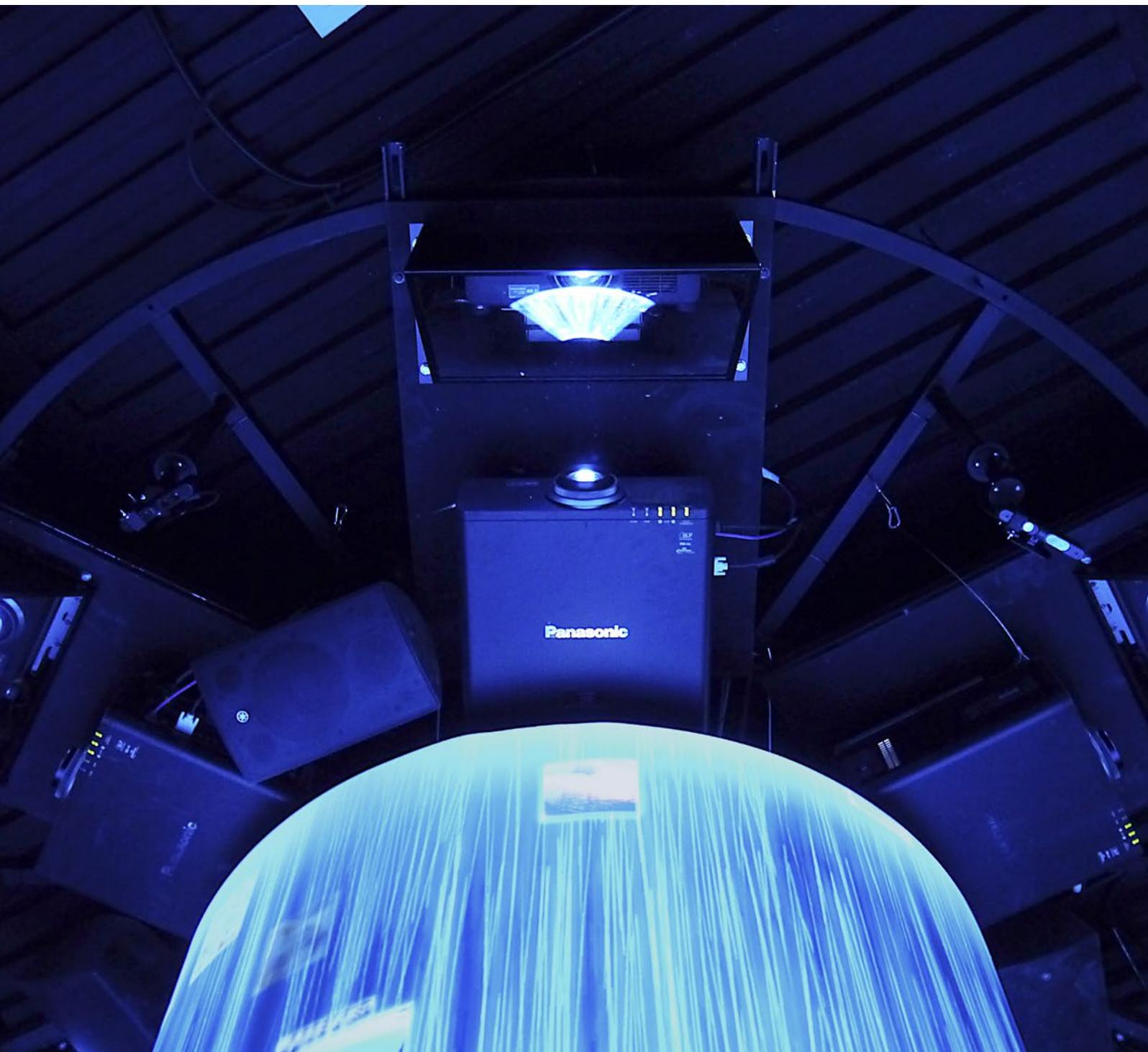
Again saving technician time at location (optional upgrade ET-CUK10)



Commercial analysis

ROI team's evaluation has highlighted important operational and commercial gains for the museums and galleries under analysis by adopting laser projection systems:

- Minimise disruption or closure of galleries to allow for maintenance
- Reduce environmental damage
- Safer and more comfortable room conditions for visitors



Lifetime performance evaluation

Museums & Galleries

Lifetime Cost of Ownership

Taking into account all costs associated with the purchase and effective operation of a projector for this sector we find a clear advantage for the Panasonic RZ670 compared with a range of lamp-lit projectors:

- Panasonic RZ670: €13,551
- Conventional projectors: €15,259

Although the initial purchase price may be higher, lifetime freedom from maintenance and lamp changes gives the Panasonic RZ670 a Lifetime Cost of Ownership **11% lower** than a range of conventional projectors of equivalent brightness.

Lifetime Carbon Emissions

In terms of carbon emissions the lifetime comparison between the two projector types shows:

- Panasonic RZ670: 4.76 tonnes
- Conventional projectors: 6.40 tonnes

Across its lifetime the Panasonic RZ670 produces only **74% of the carbon emissions** of a conventional projector of equivalent brightness.



1. Brighter, faster visual communication

Laser projection steps up to a new level



In our whitepaper 'Clear Advantage for Lamp Free Projectors', released at ISE 2013, we evaluated the benefits and prospects for an interim generation of projectors, represented by the Panasonic PT-RZ370. This hybrid combines the best available attributes of both lamp-lit and laser technology, to provide a laser-lit projector with an extended maintenance-free life of 20,000 hours.

Brightness capability is a convincing 3,500lm, making this the first laser-lit projector with sufficient brightness to operate in public access environments such as museums and galleries.

Since that study Panasonic has taken laser technology to a new level, introducing the RZ670 family in 2014. This projector series boasts all of the attributes and features seen in the PT-RZ family, but with initial brightness of 6,500lm laser technology, is now suitable for professional use in all but the largest arenas and for the whole range of indoor halls.

This progress into larger spaces benefits museums and galleries, where projectors are sometimes used in combination to convey key background information to support exhibitions, and more and more to recreate an 'experience' of an era or location to bring alive an exhibition. Projectors in this setting need sophisticated features to enable them to be used in combination to create a concerted effect.

Here the gain in brightness enables projectors to be used in entrance halls and main galleries and in near daylight conditions to enrich the visitors' experience.

I. TECHNICAL ANALYSIS

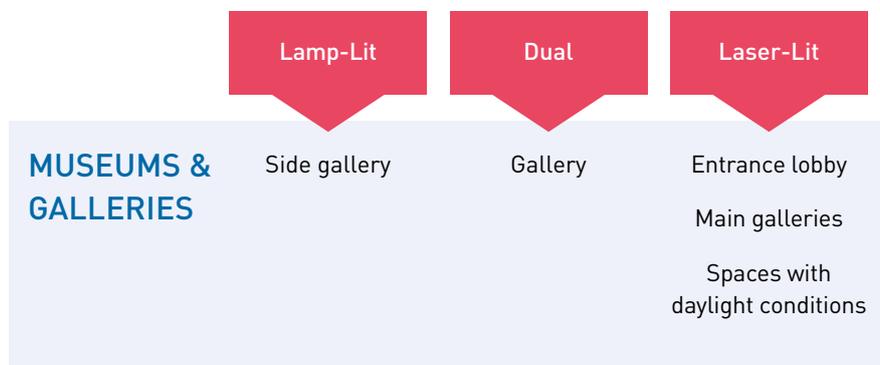
2. Advance of laser-lit technology

Laser-lit technology has already proved its superiority to lamp-lit in many ways. Now it is suitable for professional use in bigger and bigger spaces.

Technical analysis

Laser technology, in the form of the Panasonic RZ670, has clear advantages for museums and galleries, which will be detailed in following sections.

Suggested usage of laser projection vs lamp-lit projectors



Advantages of laser as a light source

The use of the projector as a tool for public-facing visual communication and teaching has been restricted by performance limitations of the conventional lamp-lit projector including:

Lamp life

A projector requiring a lamp is subject to the decay curve associated with the conventional bulb. Manufacturers recommend that a bulb is no longer functional and must be replaced when brightness falls to 50% of initial output meaning that, according to their recommendations, the bulb must be renewed at some point between 1,500 and 6,000 hours depending on the model.

In a higher education setting a projector might be in use 60 hours per week for 45 weeks a year, it can be seen that the university must budget for a lamp-change at least yearly – or face deterioration and possible failure of essential teaching equipment. It is also relevant to consider that, as the Panasonic RZ670 has a life of 20,000 hours, this estate manager may need to budget for 10 or more lamp changes to keep their lamp-lit projector operational for the same period. Depending on the usage, similar calculation can be made for museums and galleries.

Warm-up/cool-down time

Conventional lamps need to be operated within a very specific temperature range to avoid damage to the lamp. For this reason a conventional projector needs a warm-up time of up to two minutes before it can achieve operational brightness; it's also essential that it must remain connected to the power supply during cool-down time to ensure its fans continue to cool the bulb.

Not surprisingly these requirements make the conventional projector cumbersome in the context of a fast-moving teaching session. The tutor must either keep the projector switched

on throughout his lecture, and accept an uncomfortably hot and possibly darkened room – or accept a pause of two minutes before he can respond to a student's question. Either way he must switch off the projector five minutes before the end of the lecture to ensure it can be fully cooled before he vacates the lecture room for the next class.

A laser projector on the other hand operates at a much lower temperature and provides instant-on/off and power-saving shutter technology.

Power consumption adjustment

Conventional projector lamps run at 100% of their power requirement, producing 100% of their brightness capability, regardless of the brightness of the image they are projecting. For darker contents the additional light projected to the screen is either absorbed within an optical engine, or reflected away from the light path. Both systems produce additional heat which is dissipated from the projector.

Laser diodes on the other hand are dimmable light sources for a superior contrast ratio. They use 100% power only when full brightness is called for – i.e. a 100% white picture. To project a typical mixed output of darker pictures a laser light source will automatically reduce its power consumption – and heat output.

It can rapidly be seen that the laser projector represents a major advance in operational efficiency and flexibility.

Laser light source

- Light source life span will last more than 20,000 hours
- 20,000 hours maintenance free lifetime
- Dust-resistant optical parts do not require filters
- Operates at much lower temperature, requiring less energy
- Instant-on/off technology reducing power consumption and making projector instantly usable
- More eco-friendly
- Adjusts power consumption according to room lighting and brightness of the image

Lamp as light source

- Bulbs no longer functional after brightness falls to 50%
- Lamp-life range: 1,500 to 6,000 hours
- Needs up to 13 lamp changes during 20,000 hrs lifespan
- Need to change or clean filter to keep optical parts free of dust
- Needs up to 20 costly maintenance visits during 20,000 hrs lifespan
- Warm-up time up to two minutes
- Cool-down time five minutes or more
- Remains connected to power supply during cool-down time, increasing power consumption
- Bulb contains mercury and other toxic materials
- Runs at 100% power requirement at all times, causing additional heat output



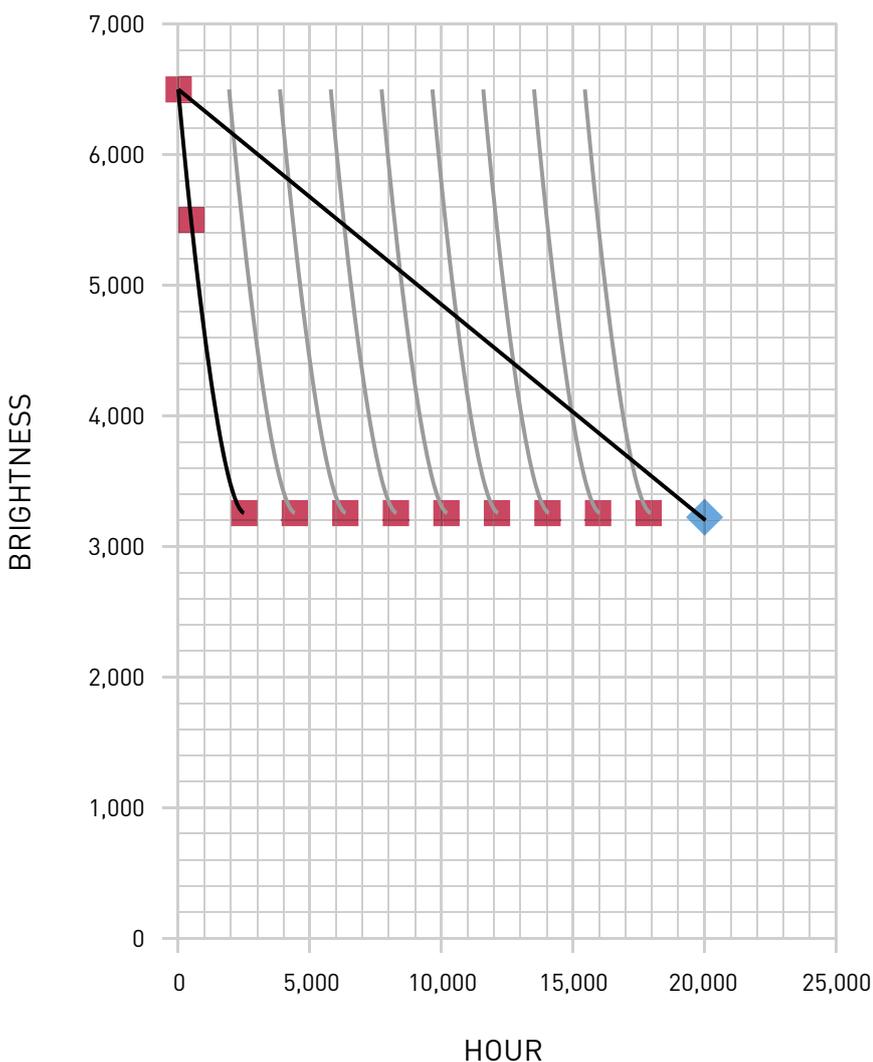
3. Brightness decay and its impact on bulb life

All types of light source (car headlights, household bulbs, etc.) exhibit brightness decay and a limited lifetime. They are consumable items.

Conventional projector lamps show a Regressive Decay. This means that a lot of initial brightness is lost in the early hours of operation. The decay curve then flattens out before finally reaching 50% of initial brightness, at which point the bulb is no longer functional and must be changed. This means that a conventional projector bulb will spend as much as half of its life operating at close to half of its full capacity.

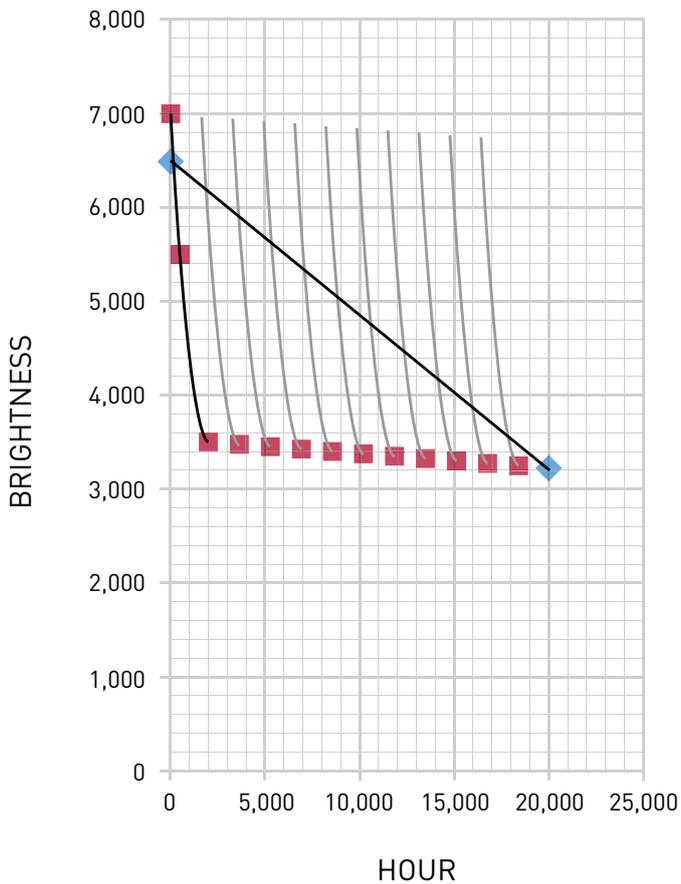
A laser light source on the other hand, displays a **Linear Decay** – so the projector loses operational brightness much more slowly and in a steady decline. This means that soon after starting its lifetime a laser projector will be providing more brightness than its equivalent conventional lamp-lit projector.

The latest Panasonic models incorporate a **Brightness Priority Setting** which enables near to full (above 80%) brightness to be maintained – albeit at the cost of shortening the operational lifetime of the projector. Panasonic are currently working to make this setting, currently available only as a factory setting, available to professional end-users.



The graph opposite shows the brightness output of two projectors, both with an initial rating of 6,500lm: one a conventional lamp-lit projector, the other a laser projector. It can be seen that the brightness of the lamp-lit model rapidly falls below the Solid Shine model. Even after an expensive bulb change, the conventional model matches the performance of the Solid Shine model only for a short time.

◆ Series 1 = Panasonic RZ670
■ LAMP = Lamp Projector



Where we compare the performance of a conventional projector rated at 7,000lm against that of a Solid Shine model rated at 6,500lm it can be seen that, because of the **Regressive Decay** pattern of the lamp-lit projector, after only a short period of use, the Solid Shine model is operating at a superior level of brightness. In the attached graphic, the brightness of the lamp-lit 7,000lm projector falls below that of the 6,500lm Panasonic RZ670 model after just 159 hours of use.

- ◆ Series 1 = Panasonic RZ670
- LAMP = Lamp Projector

4. Cumulated light output

The best known and most widely accepted method to measure projector brightness is the ANSI Lumen specification devised by the American National Standards Institute (IT7.227-1998) which considers not only brightness, but also the uniformity of brightness as projected on a screen.

However brightness ratings following the ANSI model or any other specification are time-specific measurements which cannot track differences in brightness decay. Historically, this limitation has been acceptable because all projectors used similar technology and so followed a similar **Regressive Decay** path.

However, as observed above, the development of the laser projector now introduces alternative technology and the entirely different **Linear Decay** path. This means that a laser projector delivers a higher level of brightness or a greater proportion of its operational life.

To make a meaningful comparison between projectors using such different light sources, we need to evaluate brightness output over the lifetime of the projector. The cumulated light output can be expressed by the equation:

$$\text{BRIGHTNESS (ANSI LM)} \\ \times \text{HOURS OF OPERATION} = \\ \text{CUMULATIVE LIGHT OUTPUT}$$

The **Panasonic RZ670** with initial brightness of 6,500lm ANSI **produces 12% more brightness** than a conventional projector of the same initial brightness that may require four or more lamp changes within its 20,000 hours operating lifetime.

When benchmarked against a conventional projector with ANSI rating of 7,000lm, the **Panasonic RZ670** (brightness rating of 6,500lm) **still produces 10% more brightness across the same period.**

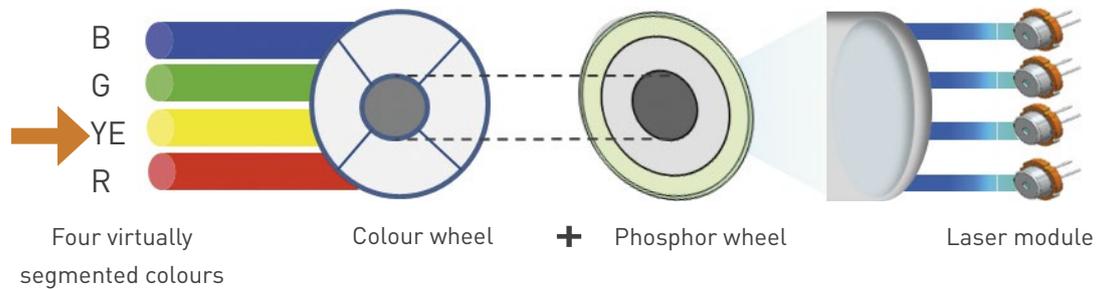
A projector is chosen for a specific application (such as lecture hall, museum gallery, or theatre auditorium) according to lighting conditions, and the brightness required to run the material. Requirements may include comfortable and stress free attention to teacher presentations in daylight conditions, or maybe crisp and clear reproduction of content in a museum or performance context.

The Panasonic RZ670 projector **with an initial brightness of 6,500lm** ANSI produces more brightness over the same period than a conventional projector measured initially at 7,000lm. Therefore both are suitable for the same applications and can be considered equivalent models.

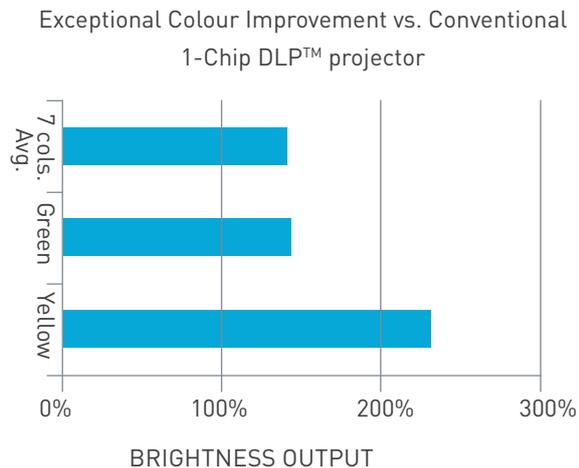
5. Brighter and clearer colour reproduction

The Panasonic RZ670 surprises with a rating of ANSI 6,500lm providing outstanding brightness of natural pure white at a duv value of just 0.006 – just ¼ the duv value of lamp-lit competitors.

Supplementing this white brightness the Quartet Colour Harmoniser (Colour Wheel plus Phosphor Wheel) ensures exceptional clarity right through the BGYR spectrum. Uniquely the Panasonic RZ670 uses a four colour wheel, with white created by combination of the four colours.



Not only does this make the colour more balanced it also contributes to a higher perceived brightness as the brightness output per colour channel is significantly increased. Another reason why the Panasonic RZ670 can perform well against projectors of a higher brightness category.



II. COMMERCIAL ANALYSIS

Technical analysis of the capability and performance of the Panasonic RZ670, set out previously, is derived from sector analysis and in particular work and analysis by Panasonic engineers working in laboratory conditions.

To evaluate the performance of the Panasonic RZ670 in the commercial arena ROI team gathered data for the performance of the Panasonic RZ670 against a range of lamp-lit projectors most purchased for each of three key sectors:

[Museums & Galleries](#)
[Higher Education](#)
[Rental & Staging](#)

Data and understanding derives from various methods:

- 1 Questionnaire-based survey of sector professionals across 10 European territories targeting:
 - Resellers and dealers exposed to the museums, galleries and higher education sectors
- 2 Depth interviews with the above groups
- 3 Performance and cost data was derived from manufacturers' product specification sheets
- 4 Futuresource (www.futuresource.com) provided data concerning sales volumes and actual selling prices for projectors in the relevant sectors

We now examine performance and contribution of the RZ670 to the Museum sector.

6. Breakthroughs for Museums & Galleries

In the Museums & Galleries sector projectors are used more and more widely to enhance the visitor experience, creating a facsimile of the landscape or historic environment against which exhibits are set. In some galleries the entire presentation is created by projectors with very few actual exhibits.

There is now an appetite to use projectors in large and well lit galleries as well as darker side rooms, and the new generation of laser-lit projectors rises to this challenge, with the Panasonic RZ670 achieving an ANSI rating of 6,500lm, sufficient for large galleries and near-daylight conditions.

Advantage of laser projectors in museums and galleries

Key factors for use of projectors in a museum environment include:

Minimal maintenance

Many museums now open seven days per week and stretch opening hours into the evening; so opportunities for maintenance access are rare. The RZ670, offering maintenance free life of 20,000 hours (equating to 6.6 years at typical usage levels in this sector) offers a big advantage.

Projector location

The minimal requirement for maintenance access enables the Panasonic RZ670 to be installed safely and out of sight, with significant gains for space and visitor safety. Panasonic laser-lit projectors are also posture agnostic – so can be installed into small existing spaces where necessary.

Reducing distraction from noise and heat emissions

Emissions from laser projectors are less than half that of lamp-lit competitors. In terms of noise emission the Panasonic RZ670 operates at between 35db to a maximum of 45db, largely because of a different cooling design; whilst operating temperature is a maximum of 45°C. Both of these factors are significant in maintaining a safe environment for preserving exhibits, and ensuring a comfortable and tranquil experience for visitors.

Reducing environmental damage

Museums & Galleries, especially those in public ownership, have a tradition of taking leadership in environmental responsibility. Unfortunately traditional lamp-lit technology has implied environmental hazard. Vans driving up and down the country to make scheduled and unscheduled maintenance trips plus the need to dispose of as many as 10 bulbs incorporating harmful metals and gases during the lifetime of a projector are all unavoidable factors of the historic technology. On the other hand a laser-lit model, like the RZ670, brings environmental impact to a minimum. The projector is designed to be maintenance free for 20,000 hours use with its original laser light source.

7. Conclusions

Sector professionals such as resellers/dealers and experienced end-users welcome the user-friendly qualities of Panasonic's lamp-free projectors:

- 20,000 hours maintenance-free lifetime
- Always ready for use, never in the repair workshop
- Instant ON/OFF capability
- Reduced environmental impact
- Heat sink means cooler and quieter running
- Flexible projection position

ROI team's evaluation over the second half of 2014 finds clear advantages for the Panasonic RZ670 against the projectors most purchased by the Museums & Galleries sectors:

- Brighter better projection: Cumulated Light Output **22% greater**
- Environmental stewardship: Carbon emission **reduced by 26%**
- Lifetime Cost of Ownership: More than **11% lower**

Lifetime power consumption

If we assume the effective operating lifetime of a modern projector to be 20,000 hours, then the lifetime power consumption is:

- Panasonic RZ670 9,621kW
- Conventional projectors 12,135kW

By this measure the Panasonic RZ670 uses only 79% of the power consumed by a conventional projector of equivalent brightness, whilst producing 26% greater Cumulated Light Output across its lifetime.

Lifetime cost of ownership

Taking into account all costs associated with the purchase and effective operation of a projector we see again a clear advantage for the Panasonic RZ670 compared with a range of most-purchased lamp-lit projectors:

- Panasonic RZ670 €13,551
- Conventional projectors €15,259

Although the initial purchase price may be higher, lifetime freedom from maintenance and lamp changes gives the Panasonic RZ670 a Lifetime Cost of Ownership 11% lower than a range of conventional projectors of equivalent brightness.

Lifetime carbon emissions

The lifetime comparison between the two projector types shows:

- Panasonic RZ670 2.18 tonnes
- Conventional projectors 3.78 tonnes

Across its lifetime the Panasonic RZ670 produces only 74% of the carbon emissions of a lamp-lit projector of equivalent brightness.

8. Evaluation of lifetime cost of ownership and environmental impact

Approach to the project

ROI Team's brief:

Benchmark the performance/ consumption of the Panasonic RZ670 series of projectors against a range of historic lamp-lit projectors against the following fields:

- Lifetime Cost of Ownership
 - Financial Cost
- Lifetime Carbon Consumption
 - Environmental Impact

Market sectors

- Museums and public access galleries
- Higher Education organisations: Universities, colleges, training schools etc.
- Rental & Staging: performance and live events

Models for comparison: Solid Shine model: Panasonic RZ670 – 6,500lm ANSI versus a range of models identified by resellers and dealers across Europe as projectors in class 6,000 to 7,000lm most purchased by the above three verticals.

Projector lifetime

Assumed to be 20,000 hours (equivalent to advertised maintenance-free lifetime of the Panasonic RZ670).

Usage pattern

Museums & Galleries:
58 hours/week x 52 weeks =
3,016 hours per year

Sources of performance metrics

- Resellers/dealers independent of Panasonic, and actively selling into the Higher Education and/or Museums & Galleries sectors. ROI team survey made initial contact with 90 from 7 different territories. Information received from these sources was averaged.
- Manufacturers' published product data sheets.
- Aggregated Cost Calculator built for this project by Project Subject Expert, Dr. Joyce Tsoi with assistance from Ruby Sehmbi of ROI team.

Research Approach Work undertaken by project team from ROI team, London, UK (www.roiteam.co.uk), Project Director, Andrew McCall, with expert input from Subject Expert Dr. Joyce Tsoi.

Research approach and method adopted was scrutinised and endorsed in 2012 by UL (www.ul.com).

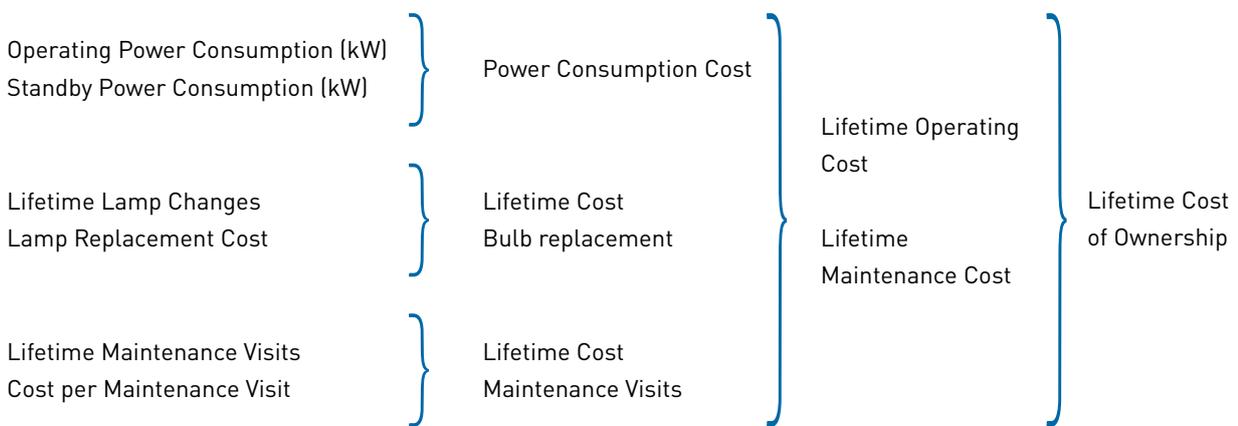


9. Appendices

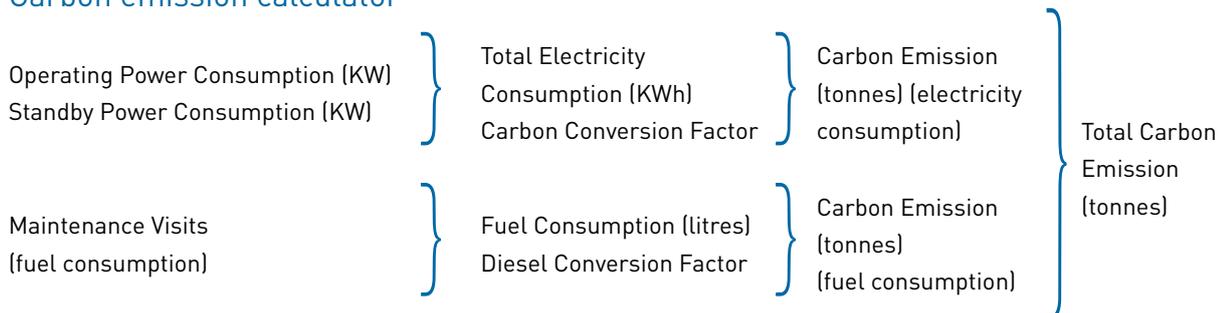
Anatomy of calculators

Sector: Museums – lifetime cost of ownership calculator

Actual Purchase Price



Carbon emission calculator



Profile of ROI team

ROI team is a research consultancy that works to understand clients objectives, strategies, and challenges, devising and managing programmes of research to provide the hard evidence to enable well informed strategies and commercial decisions.

Clients include retailers such as Harrods, Flying Brands, and Best Direct; owners of retail property like Capital & Regional plc, Cadogan Estates, and Orion Land; the NHS and Department of Health and various regional health boards; and media companies such as Thomson Reuters, community TV operator The Life Channel, and publisher JLD Media.

Directors of ROI team have also led projects to benchmark performance of key products for leading companies such as 3M, JCDecaux, and Media Zest plc as well as Panasonic PSCEU.

In 2013 ROI team, in conjunction with counting company PFM Intelligence, launched the UK Markets Index, the first performance index for the UK retail markets sector. ROI team is currently developing its second index, the Retailers' Revival Index for launch in 2015.

ROI team is wholly owned by its founding directors and does not have any financial arrangements or obligations within its fields of operation. Our aim is to provide sound information, impartially interpreted, to provide a basis for informed business decisions.

ROI team (www.roiteam.co.uk) was founded in 2006 by Jo Johnson and Andrew McCall, who continues as Managing Director of the firm.

Dr. Joyce Tsoi is the Subject Expert for this project. Joyce has over 10 years of international experience in leading and managing sustainability projects in more than 15 countries, exploring strategic and pragmatic lines of progress in the areas of supply chain sustainability on behalf of leading international companies and governments. Her work has ranged from analysis of product and organizational life cycle, energy and climate change, sustainable water management, to reporting on sustainability and communication issues. Throughout her career, Joyce has conducted extensive research on Corporate Social Responsibility and sustainable supply chain management topics, and is a contributor to *Journal of Business Ethics*; *Journal of Cleaner Production*; and contributed a chapter to the book *Corporate Social Responsibility*.



Andrew McCall



Dr. Joyce Tsoi



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