



Reducing Operating Costs and Energy Consumption in Digital Cinema

Andrew Robinson & Richard Mitchell - Harkness Screens

Harkness Screens – Over 80 Years Experience

- Founded in 1929
- World leader in cinema with screens in more cinemas worldwide than any other manufacturer
- From single-screen independent theatres to large multiplexes to large format immersive theatre experiences or live events
- Production facilities in America, France, China and UK
- Indian production in late 2012/early 2013
- Unrivalled experience and knowledge



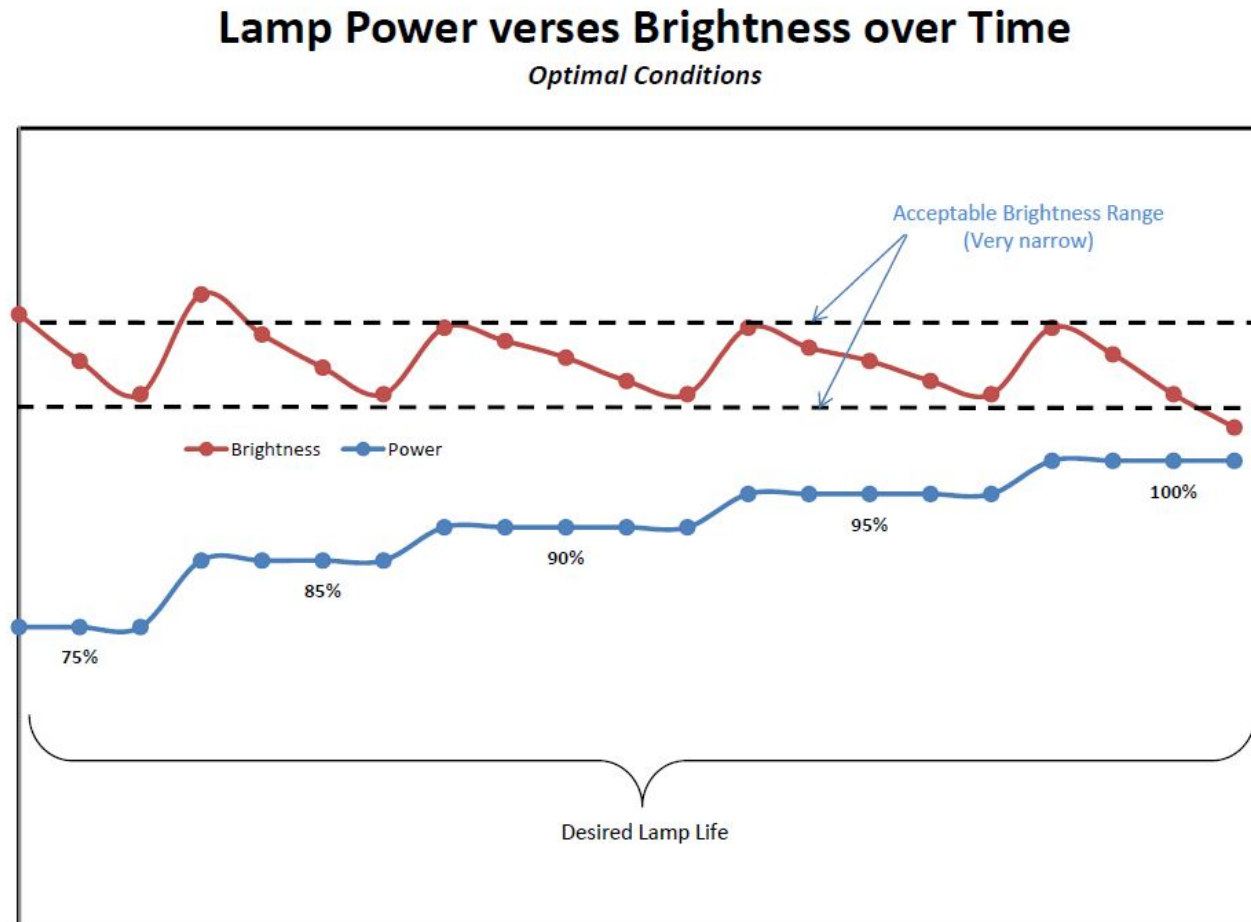
Operating costs in Digital cinema

- Experience shows that DCI projector operating costs are much higher than 35mm film projection
- Digital lamps are more expensive and have shorter lives than 35mm film lamps
- Power consumption will be more if higher kw lamps have to be used
- Cooling costs can be more than film projectors
- Overall operating costs can be more than double film projector operating costs
- Digital 3D compounds the problem as 3D systems are inefficient and need powerful lamps

Operating cost savings

- Operating costs of digital projection are significantly more than film projection - lamps cost more, have shorter lives and consume more power
- By using high gain screens correct brightness levels can be achieved with smaller lamps
- Smaller lamps last longer, cost less and use less power, so this can reduce total operating costs of the theatre
- It may be possible to use a smaller projector saving even more cost
- Smaller projectors and lamps can reduce booth HVAC costs

Lamp use optimization



Lamp operating cost examples

- Typical benefits from running with a smaller lamp:

Christie Solaria projectors							
lamp kw	warranty life hours	lamp cost \$	annual lamp cost \$	annual power cost \$	total annual cost \$		lamp down savings \$
6	500	1650	13728	3744	17472		na
4.5	1000	1350	5616	2496	8112		9360
3	1500	1275	3536	1872	5408		2704
2	2400	975	1690	1248	2938		2470
1.4	3000	825	1144	874	2018		920

A Practical Example

- Christie Series 2 Projector
- 14m screen
- 14fL required brightness for 2D presentation

Screen Gain	1.8	1.4	1
Projector Maker	Christie	Christie	Christie
Projector	CP2220	CP2220	CP2230
Lamp	CDXL-30	CDXL-30	CDXL-45
Lamp power (kW)	3	3	4.5
Brightness	14 FL	14 FL	14 FL
Warranty Lamp life Hours	1500	1500	1000
Lamp purchase cost \$	900	900	1350
Total Lamp Cost	2496	2496	5616
Operating costs per Year \$	1872	1872	2808
TOTAL COST	5268	5268	9774

How quickly does the screen yield a return?

- Taking the previous example, a saving of \$4,506 could be achieved from replacing a 1.0 matt white screen with a 1.8 gain white screen.
- Cost of 1.8 gain screen c. \$6,000 (inc shipping and install)
- Screen paid for in 16 month
- If a smaller projector is used then the return could be immediate

How might this benefit your cinema?

- Taking the previous screen example
 - Net saving of \$4,506 per annum
- Cinema complex with 10 screens

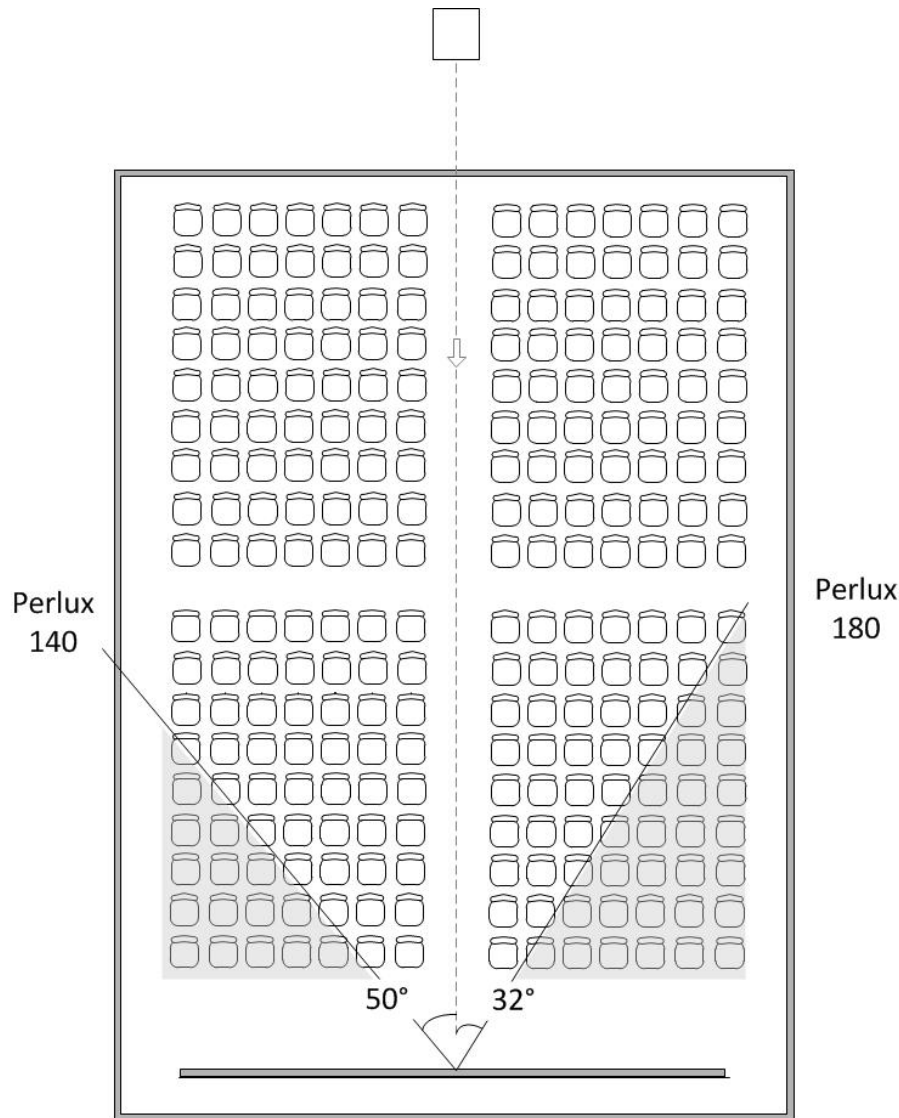
	Year 1	Year 2	Year 3	Year 5
Accumulated Savings	+\$1494	-\$3012	-\$7518	-\$16530

- Over 5 years, \$16,530 per screen or across a 10 screen multiplex, \$165,300
- Imagine the cost saving for a cinema chain with 30 – 50 sites and 400 screens
 - Saving could yield as much as \$6.5m over five years

Disadvantage of using high gain screens

- The peak brightness is on axis and the light distribution is reduced at the sides of the theatre
- The light distribution over the screen varies – a tendency to ‘hot spot’
- Fortunately the light distribution from a digital projector is more even than a film projector – so gain screens are less inclined to hot spot with digital
- Good theatre design can minimise the disadvantages

Designing to use gain screens – theatre shape



- In this typical theatre almost all seats have better than half-gain level even with 1.8 gain screens.

Considerations for using high gain screens

- Theatres with a square auditorium – short throw, short focal length are less suitable for high gain screens
- Screen shape – a curved screen is recommended over 1.4 gain
- Screen rake – check the spectral path is to the centre of the seating area and tilt the screen (forward or backward) as necessary
- Choose the highest screen gain level that works with geometry of theatre
- In retro-fit may have more limitations than in new construction

Considerations for using high gain screens

- For 3D applications choose screen to suit technology – normally has to be high gain
- Use silver screen (gain 2.4) with polarised light; high gain white (2.2 or 1.8) with other 3D systems
- For 2D, where possible use the highest gain to optimise lamp choice and achieve the correct brightness level (use smallest lamp possible)
- Use smallest projector possible with 2D only auditoriums

Best practice to control costs and ensure brightness levels

- Measure brightness of screen regularly
- Use screen of optimum gain
- Size lamp correctly – consider screen gain and lamp together
- Set new lamp to run at 75-80% of maximum power
- Adjust power setting as lamp degrades to maintain brightness
- Replace lamp at end of useful life

What to do next?

- Carry out regular maintenance checks
 - Harkness Screens can advise on this
- Visit our website www.harkness-screens.com
- Visit us at ShowEast or CineAsia
- Call or email your Harkness Screens representative:-

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Digital Screen Selector

- Free to use on the Harkness web site to consider screen options with 2D and 3D projection



HARKNESS SCREENS

Digital Screen Selector

The Digital Screen Selector is intended as an aid to theatre operators seeking to optimise their investment in digital cinema. It can help to:

- Reduce operating costs for 2D
- Optimise light levels for both 2D and 3D

Additional savings may be achieved if the screen is considered prior to converting an auditorium to digital, as it can enable the purchase of a smaller projector.

The Selector is meant to be objective, but necessarily makes certain assumptions which are noted. It is a guide to screen and projector selection, but it is not a substitute for consultation with projector makers, lamp manufacturers, and 3D technology providers.

For more information on the Selector, or to discuss your screen requirements further, please contact Harkness Screens.

Please input your exhibition needs here

Step 1

Please choose your application:

2D

Step 2

Please input image width:

10

☐ Feet ☒ Metres

Step 3

Please select your Projector Manufacturer:

Barco: Series 2 :: 2K-4K upgradeable

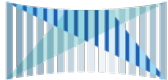
Step 4

Please choose desired screen brightness:

14

☒ Foot Lamberts ☐ Candela

Input Auditorium Number: (optional) [Show Results](#)



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2D Notes:

- Default Centre screen brightness 14 FL
- Peak lumens of projectors per manufacturers' specifications
- Light loss of 25% from peak lumens due to lamp life, port glass and other factors
- Screen assumed to be constant height Scope 2.39 : 1 aspect ratio: resulting light loss of 21%
- All zoom lenses equally efficient
- Total light loss 40%
- Selector also valid for 'constant width' screens: light losses are less but screen is larger.

Digital Screen Checker



Questions and Answers

- Type your question into the chat box

Thank you!
www.harkness-screens.com