



T8 HIBAYS

REPLACING SPUN ALUMINUM DOMES AND 400W METAL HALIDES AT THE SAN DIEGO ICE ARENA



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T8 Hibays improve lighting quality and save energy at the San Diego Ice Arena

Background

The San Diego Ice Arena (SDIA), one of San Diego's premiere indoor recreational ice rinks, is used year round for figure skating, ice hockey, and other winter sports. In addition to the ice rink, the facility is home to a full service pro shop, game room, snack bar and multipurpose exercise rooms.

Faced with escalating power costs, the ice arena owners have been searching for ways to reduce electrical usage and demand, and at the same time increase the quality and reliability of equipment.



One area of concern was the ice rink lighting (shown above). The 400 Watt Metal Halides (with spun aluminum domes) illuminating the ice rink were identified as energy inefficient by an audit provided by the San Diego Regional Energy Office. A Lighting consultant suggested installing new T8 hibay fixtures in a one-for-one retrofit to improve lighting quality, reliability and to reduce electrical power consumption.

Hibay Comparison

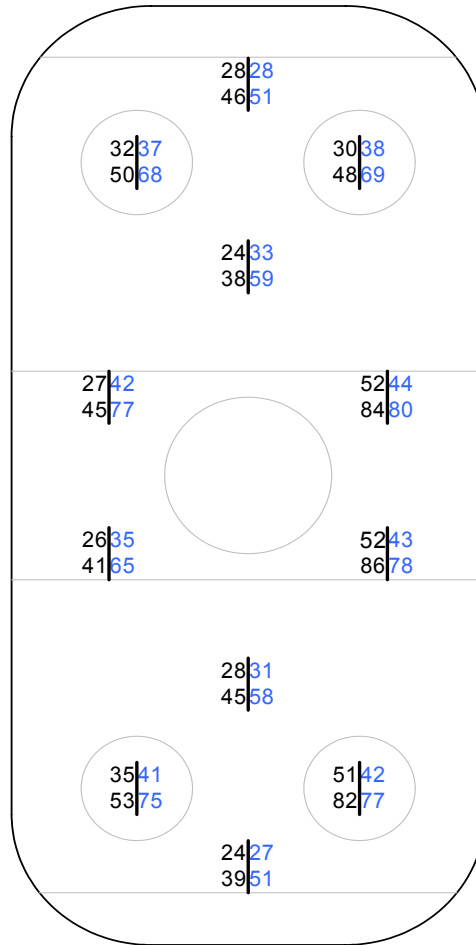


The pre-existing combination of 400 Watt Metal Halide lamps and magnetic ballasts consumed 416 Watts/fixture based on power readings¹ taken just before the retrofit. The Philips MH400/U lamps are rated for 36,000 initial lumens (24,000 mean lumens), 65 CRI, 4000 K and 20,000

hours. The new T8 hibay fixtures, using six Ushio F32T8/850 lamps (3050 lumens) and two GE-332-Max-H/Ultra ballasts (1.15 ballast factor), consume 221 Watts/fixture. These fixtures provide 21,045 initial lumens, at 86 CRI and 5000 K. The lamps last 30,000 hours at 12 hour starts.

¹Power readings are Power Factor (PF) corrected.

Actual illumination readings taken before and after the retrofit indicate an overall increase in both photopic and scotopic lumen levels². Photopic lumens showed an average increase of 3 foot-candles (fc). Scotopic lumens showed a dramatic increase of 12 fc at the ice surface, a 21% over previous levels. Lumen maintenance, a measure of light output over the life of the lamp, will improve significantly with the new T8 Hibays. As Metal Halides near the end of their rated life span, light output can decrease by as much as 55%. Compare that to an 8% decrease in light output by a T8 lamp. The lumen depreciation of Metal Halides results in an uneven distribution of light on the ice surface when a new lamp is installed next to an old lamp. The 8% lumen depreciation of a T8 will still provide an even light distribution.



| Lumen Levels | | | |
|-----------------|-----------|-----------|-----------|
| Metal Halide | | T8 Hibays | |
| Photopic | Scotopic | Photopic | Scotopic |
| 32 | 50 | 37 | 68 |
| 28 | 46 | 28 | 51 |
| 30 | 48 | 38 | 69 |
| 24 | 38 | 33 | 59 |
| 27 | 45 | 42 | 77 |
| 52 | 84 | 44 | 80 |
| 26 | 41 | 35 | 65 |
| 52 | 86 | 43 | 78 |
| 28 | 45 | 41 | 75 |
| 35 | 53 | 31 | 58 |
| 51 | 82 | 42 | 77 |
| 24 | 39 | 27 | 51 |
| 34 (avg) | 55 | 37 | 67 |

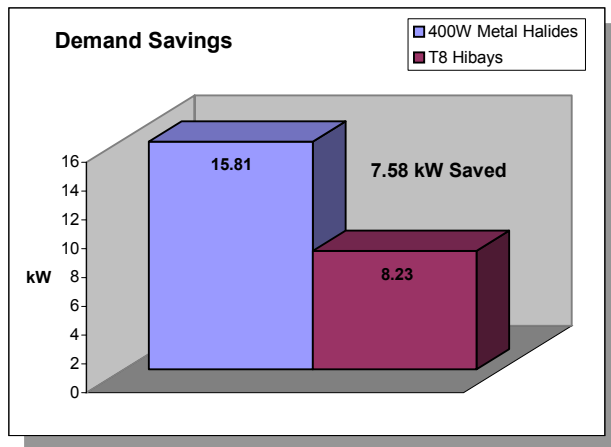


| How can fluorescents with half the initial lumens replace HID lamps? | | | | | | | | | | | | |
|---|-------------------------------|------|----------------------------|-----------------------------|-----------------|----------------------|---------------------------|--------------|------------------------------------|-----------|---|--|
| Lamp/Ballast/Fixture type | Initial catalogue lamp lumens | BF | Actual initial lamp lumens | EOL lamp lumens maintenance | EOL lamp lumens | Luminaire efficiency | EOL lamp luminaire lumens | System watts | EOL lamp luminaire lumens per watt | S/P ratio | EOL lamp luminaire task modified lumens | EOL lamp luminaire task modified lumens per watt |
| spum aluminum reflector with 400W 4000K 65-CRI standard MH and magnetic ballasts | 36,000 | 1.00 | 36,000 | 45% | 16,200 | 75% | 12,150 | 416 | 29 | 1.60 | 17,530 | 42 |
| white reflector with six 32W 5000K 86-CRI lamps and two 1.15 BF electronic ballasts | 18,300 | 1.15 | 21,045 | 92% | 19,361 | 90% | 17,425 | 221 | 79 | 1.83 | 27,918 | 126 |

² Light levels are traditionally measured photopically, or the ability of your eye's cones to see in daylight, in lumens. A second way to measure light, scotopically, or the ability of your eye's rods to see in dim light, is an effective way to account for the light quality of the lamp. The resulting scotopic/photopic (S/P) ratio gives the most accurate value of the lamp's brightness and quality. This ratio is not currently used in IESNA (Illuminating Engineering Society of North America) standards; however, studies over the last fifteen years have concluded that lighting with a high S/P ratio results in better visual acuity².

Savings Analysis

The 400 Watt Metal Halide (MH) and magnetic ballasts consumed 416 Watts/fixture according to power readings taken just before the retrofit. The new T8 high bay fixtures, using six Ushio F32-T8/850 lamps and two GE-332-Max-H/Ultra ballasts, consumed 221 Watts/fixture, a savings of 195 Watts/fixture or 7.41 kW for the facility. Using \$0.0824/kWh for the usage charge and \$15/kW for demand, the SDIA stands to benefit from \$5,861/yr in energy savings.



Energy savings summary

| No. of Fixtures | Hours of Operation (hrs/yr) | Current Demand (kW) | Current Energy Usage (kWh/yr) | Proposed Demand (kW) | Proposed Energy Usage (kWh/yr) | Demand Savings (kW) | Energy Savings (kWh/yr) | Total Energy Cost Savings (\$/yr) |
|-----------------|--------------------------------|------------------------|----------------------------------|-------------------------|-----------------------------------|------------------------|----------------------------|--------------------------------------|
| 38 | 7,200 | 15.81 | 113,832 | 8.23 | 59,256 | 7.58 | 54,576 | 5,861 |

Conclusions

Implementation Costs

| | |
|-------------------------------|-------------------|
| Fixtures and installation | \$10,260 |
| High abuse wire guards | \$1,330 |
| Lift rental and lamp disposal | \$517 |
| Rebates | <u>-\$4,598</u> |
| Total Installed Cost | \$7,509 |
| Energy savings | \$5,861/yr |
| Maintenance savings | \$339/yr |
| Total annual savings | \$6,200/yr |
| Simple Payback | 1.2 yr |

The goals of the project have been met. T8 Hibays last longer, produce a better quality of light, and consume half the energy over the previous Metal Halides. Factoring in maintenance savings from purchasing cheaper lamps less often, the SDIA will recoup their initial investment of \$7,509 in less than 15 months.

"I've noticed we only use two banks of lights now, that seems to be bright enough for our coaches pretty good all round." Mark Linssen, SDIA Special Projects Coordinator