HYBRID LIGHTING

9/21/00

Fade in:

Graphic 1:

Hybrid Lighting:
Illuminating the Power of Sunlight

Fade in:

1. Night **city-scape**, *time lapse*:

A prominent multi-story building, dotted with lighted windows. The surrounding streets are painted by streaming automobile headlights. The impression-- beauty and modern, rapid activity.

NARRATOR:

Electric lighting is everywhere.
It's easier than ever to "burn the midnight oil."

2. Match-dissolve to same (or similar) **building**, *time lapse*, day.

Even more activity-- bustling automobiles and pedestrians. If visible, activity inside the windows.

NARRATOR:

Yet the peak demand for electric lighting is during the day—from nine to five—when *natural light* is most available.

3. **People working** in various settings--offices, shops, factories.

NARRATOR:

That's because in today's society most of our work is indoors.

Graphic 2:

Over existing scene-- Light bulb-shaped matte with the title:

20%

NARRATOR:

Most people are unaware that lighting accounts for about 20 percent of total U.S. electricity consumption.

4. Array of **electric meters** on the side of a building.

Graphic 3:

Super-- Light bulb-shaped matte with the title:

40%

NARRATOR:

And in commercial buildings during peak periods, it's almost double that value.

5. Electric meters, cont'd., *slow motion*; *crash zoom* to **a single meter**--full frame.

NARRATOR:

This translates to tens of billions of dollars a year in the United States alone..

6. Building interiors with **windows, skylights**.

NARRATOR:

To curb our demand for electric lighting, one response is the use of natural lighting-or "daylighting."

Daylighting is a passive use of solar energy, which might be quite efficient. . . .

7. Interior, **room**. Over-illumination or variability created by the use of window(s) or skylight(s) is evident.

But there are some drawbacks.

Graphic 4:

Super the following floating titles:

Glare
Variability
Heat gain
Architectural inflexibility

8. **Louvers** or **blinds**.

NARRATOR:

In attempts to overcome these drawbacks, daylighting schemes often incorporate overhangs, window tinting and shading systems. But in the process, almost all of the direct sunlight is wasted.

What if, instead, sunlight could be captured and dispensed exactly where, when, and how it's needed?

9. **Light guide** held by Mike Cates *glows* at the proximal end.

10. Interview, **Mike Cates**, ETD (or other).

Mike Cates, Live:
(in his own words)

Flexible light guides like this can transport large amounts of light over long distances without losing quality. . . .

Glowing end of light guide.

Mike Cates, Cont'd., O.S.:

So, sunlight from a small roof-mounted collector can be transmitted inside a building and branched into different rooms.

Mike Cates, Cont'd., Live.:

We can now do this in a way that maximizes the use of sunlight while virtually eliminating the glare, variability and heat gain commonly associated with traditional daylighting strategies.

11. **Scientists, technicians** working with light guide materials, other components.

NARRATOR:

The Oak Ridge National Laboratory is leading a coordinated effort.

An effort to develop a practical, yet remarkable new approach to lighting. . . .

One that promises to unlock the door to a major advance in both energy conservation and lighting quality.
It's called *Hybrid Lighting*.

Animation 1:

Collector on the roof tracks the sun.

NARRATOR:

Hybrid lighting is a combination of direct sunlight and electric light, working together in the same lighting system.

Animation 2:

Collector. Arrows indicating sunlight strike the primary parabolic mirror and reflect inward to the smaller convex secondary mirror. As they strike the secondary element, they reflect back to the optical fiber bundle situated in the center of the primary mirror.

NARRATOR:

In a hybrid lighting system for a commercial building, collectors on the roof will concentrate sunlight.

Zoom/dissolve to:

Animation 3:

Close up, **secondary optical element**. Arrows indicating concentrated sunlight continue to strike the surface and reflect off. The outer surface of this element fades to transparent, revealing a photovoltaic cell and red arrows that indicate the selective penetration of the infrared portion of the incoming beams.

NARRATOR, Cont'd.:

At the collector, the visible and infrared portions of sunlight are separated to be used for different purposes. The infrared energy is converted to electricity using solar cells, while the visible light is reflected to a bundle of fiber optic light guides which transmit cool, bright light to the rooms below.

Animation 4:

Collector on roof, with cutaway view of room below. Depiction of light branching down to four fixtures in the ceiling. As the light reaches the fixtures, the room becomes illuminated.

Dissolve to:

Animation 5:

Hybrid light fixture, seen from below ceiling. The plastic cover fades away to reveal that the outer tubes are glowing. Gradually, the tubes dim as the inner sunlight diffuser brightens.

NARRATOR:

In the fixtures, the natural and artificial light will work together to provide consistent lighting.

At midday—during peak demand periods when electricity costs the most—sunlight will provide most, if not all of the illumination.

With the center diffuser completely bright, the process begins to reverse, with the tubes brightening and the diffuser dimming.

When direct sunlight is not available—during cloudy periods and at night—the electric lights will take over.

Inexpensive sensors and ballasts in the unit will continually adjust the level of electric light to compensate for variability in sunlight. . . .

Dissolve to:

Animation 6 (existing):

Animated multi-story building. Outer surface of the building fades away, revealing the interior. A network of light guides, represented by lines of light, appears, extending to each area of the buildings various floors. The sunlight increases again, causing the lines to glow brightly.

NARRATOR, Cont'd:

The occupants will be largely or totally unaware of the process. . . .

But the result will be a cleaner, cooler, more efficient, and more maintenance-free lighting system.

One that provides the advantages of natural light without the earlier disadvantages, maximizes the value of the entire solar spectrum, and provides other benefits that could actually dwarf that of energy conservation.

12. **Classroom of children** *[preferably with a lot of sunlight entering the room]*.

13. **Document** representing research findings on the effects of electric light and sunlight on student performance. A one-line statistic is highlighted and/or rises to prominence above the rest of the page.

NARRATOR, Cont'd.:

Recent studies have shown that the performance of workers and students increases significantly when natural light is used to illuminate offices and classrooms.

14A. ??**DOE Independent Evaluator** working in his office or talking to a colleague??

NARRATOR:

Recently, the U.S. Department of Energy commissioned an independent evaluation of hybrid lighting technology.

14B. Live Interview, **independent DOE evaluator**:

DOE Evaluator:

I'll have to admit that when we first looked at this, I was a little skeptical, I thought "Okay, another solar technology."
But now, viewing sunlight from this new perspective, we're convinced it may be possible to double the efficiency and affordability of solar energy in commercial buildings.

14. **Hybrid Lighting Partnership Logo**? Or, **montage of names** of partners:

SAIC	**University of Nevada, Reno**
TVA	**Ohio University** (?)
3M	**University of Arizona**
Honeywell	**Oak Ridge National Laboratory** (last)

NARRATOR:

Several companies, universities and national laboratories have entered into a partnership led by Oak Ridge National Laboratory.

The goal of the Hybrid Lighting Partnership is to bring together expertise and strengths in various areas—optics, solar collection systems, electric lighting systems, and control systems, as part of the Zero Energy Buildings Program at the U.S. Department of Energy.

Animation 7 (existing):

Street light, with person sitting at adjacent bench. Zoom to light source chamber. Reveal components inside--source, lens, light guide.

NARRATOR:

But buildings aren't the only potential venue for this technology.

Remote light sources for street lamps may soon make the job of changing bulbs much easier.

Animation 9:

Interior, **passageway of a ship**. Overhead on the sides, we see light pipes with glowing areas at intervals. "Camera" moves forward to focus on illuminator above hatch.

NARRATOR:

Many naval surface ships and submarines may soon be equipped with remote lighting systems using fiber optics.

This will decrease stowage requirements, enable weight reductions of about 15 tons per ship, and reduce lighting maintenance by a factor of ten, saving the Navy millions of dollars annually.

Animation 8:

Representation of CO_2 **algae filter** for power plants.

NARRATOR:

Researchers are investigating the use of this technology at *power plants* to simultaneously generate additional electricity *and* remove unwanted carbon dioxide from plant emissions using sophisticated bio-reactors. These bio-reactors will

function by use of the visible portion of sunlight. [*Alternate read:* These bio-reactors will function by direct use of the visible portion of sunlight.]

16. Live action. **Laboratory work** with optics, light guides, etc.

NARRATOR:

A coordinated R&D program will lead to further advances in areas like optics and thin film filters, maximizing the true *value* of solar energy, and enabling us to better harness the abundant renewable energy of the sun.

17. **City-scape,** the sun is prominent. Creative/abstract shot(s).

NARRATOR:

While we have spent millions to bring down the cost of individual uses of solar energy. . .

Something new and more cost-effective is coming over the horizon.

18. Live Interview, **TVA representative**:

TVA Representative:
(In his own words)

"When you consider that such a large portion of the electricity consumed in buildings is from lights, it may make more sense to use the visible portion of sunlight directly for lighting rather than inefficiently converting it into electricity using solar cells—only to reconvert a large portion back into light using electric lamps."

19. Live Interview, **DOE Evaluator**:

DOE Evaluator:
(In his own words)

When one considers the full-spectrum or hybrid solar component of this technology, it provides an opportunity to potentially achieve simple paybacks in the sunbelt of under 3 years. *[or a stronger point]*

20. Live/O.S. Interview, **Mike Cates**:

Mike Cates:

The U.S. is at the forefront of this cutting-edge technology but other countries are already beginning to develop natural lighting systems.

If the United States is going to continue to lead in developing this new generation of lighting, *now is the time for a coordinated effort on a national level.*

21. Stock footage: **Oil Tanker**; **Oil Refinery** or Petroleum-burning **Power Plant**; **smoke or steam** coming from smoke stacks. Then **montage**: scenes of hybrid lighting technology and artist's concepts of components.

NARRATOR:

Less dependence on foreign oil,
cleaner air,
lower demand during peak periods,
better lighting in the workplace and in the classroom. . .

Montage continues—people working. Children. Person looking at smoky mountain sunset. American flag.

There are *many* good reasons to develop hybrid lighting.

It's a team effort toward a new opportunity;
one that's good for business,
*good for the environment,
good for citizens of all ages,
good for *America*.

* we may cut out this line for redundancy and to improve the flow.

Graphic 6:

Partial reprise of Hybrid lighting logo: Dissolve from American flag or image of light bulb to **earth view**. Earth spins. Credit(s)/Information in dark portion of screen, includes the following:

www.ornl.gov/hybridlighting

End.