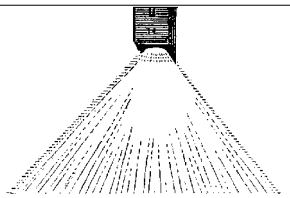


LIGHTING BASICS

How to pick the right lamps, fixtures, and lighting strategies for each room in the house.

Use track lighting sparingly, and make sure it relates to the space—such as here where the track outlines a heavy exposed beam. Don't locate a track in the middle of a flat ceiling.

For millenia, useful artificial lighting could be produced only by an open flame fed by oil, wax or—toward the end of the 19th century—piped gas. The electric-power revolution changed this picture utterly.

While an electric light cannot duplicate the special qualities of sunlight, it is hard to imagine a world without it. Electric lighting is everywhere: in our vehicles, our streets, our buildings, our movie projectors and TV picture tubes, our signs.

It has extended a typical day well into the evening, and allowed us to travel indefinitely without having to stop for the night. Electric lighting sets the rhythm of our busy lives and determines the usefulness of our interior spaces.

Despite its ubiquity, designers, owners, and builders have great difficulty realizing the extraordinary possibilities of electric lighting. In this article, two experienced architects present some ideas for taking full advantage of this wonderful and essential design element.

Our strategy in this article is to keep the choices simple, although we will begin with a brief sketch of the technical aspects of artificial lighting.

The first step is to break the problem down into manageable bites. There are four main elements to consider:

- The source of light (lamp type)
- The fixture that houses the lamp
- The lighting effect desired
- The type and location of switching

Lamp Types

There are basically two types of electric lamps: incandescent and gaseous discharge. The latter falls into two categories, low-intensity discharge fluorescent and high-intensity discharge (mercury-vapor, high- and low-pressure sodium-vapor, and metal-halide).

Incandescent Lamps. Incandescent lamp filaments don't exactly "burn," as we say, but the lamp gives off a light we are all comfortable with because it resembles the light from burning wood, burning oil or gas, and of course, the hot flame of the sun.

Scientifically, the spectrum of incandescent light is a continuous curve (a spectrum is the graph of light intensity plotted against wavelength). Each type of incandescent light presents the eye with only one color—for example, white from the sun overhead, blue from a hot gas flame, or yellowish from an incandescent light bulb. There is no substitute for the warm glow of incandescent light, and so the authors are big fans of incandescent lamps in homes. For practical purposes, the choice is between normal pear-shaped, spherical, or reflective lamps that screw into ordinary 110-volt light sockets and low-voltage, high-intensity lamps.

The chief advantage of low-voltage, high-intensity lighting is that it is easy to aim precisely—to display a painting, for example. Other advantages of low-voltage lighting are:

- Over their life, they are more efficient than ordinary incandescent lights because they do not gradually blacken as do standard lamps.
- Because the lights and the fixtures they inhabit are small, they can fit anywhere—under and in cabinets, in coves, or left exposed like Christmas-tree bulbs.
- They give off a more intense, sun-like light (technically, they have a higher "color temperature").
- They can be switched easily using cheap, quiet, low-voltage relays. You can, for example, turn on every light in the house from a switch by your bed, or have a computer program operate your lights. Relay switches for line-voltage lights are noisy and very expensive.

To balance the picture, low-voltage lights have some disadvantages as well:

- They are available in low wattage only.
- Currently available low-voltage fixtures are not very durable.
- Some low-voltage fixtures have the transformer built-in, making them bulky.
- They require special dimmers.

Ordinary incandescent lights come in a bewildering variety of lamp types, each with its own letter followed by a number. The number attached to a lamp is the number of 1/8-inches it is in diameter. For example, a G-40 bulb is spherical (G stands for "globe") and 40/8 or 5 inches in diameter. In general, G and R lamps (R stands for reflector flood or spot) cost about $5 each, compared to the $1 cost of an ordinary A-type pear-shaped lamp, while the PAR (parabolic) headlight-type lamps used in outdoor security lights cost about $10 each.

Avoid the "T" series of incandescent lamps, which are long tubes that look a bit like fluorescents; they are an old and inefficient design with very short lives, and jiggly filaments.

Fluorescent Lamps. Gas-discharge lamps are generally awful-looking but very efficient.

Fluorescent lamps work by generating an extremely high-voltage. high-frequency arc inside a tube filled with selected gases and coated with various compounds. When the arc forms, the various materials in the tube fluoresce, each producing a sharp spike of light at a particular color. These colored spikes are added to a background continuous spectrum, such as a weak, bluish incandescent light.

The original fluorescent tubes, like mercury-vapor lamps, had only a few colored spikes, and picked out particular colors in the objects they illuminated. People looked like corpses, and an apparently green garment under fluorescent light might end up orange

by
Jeremiah Eck
and
Gordon Tully
with
Jeffrey Berg

in daylight.

Contemporary fluorescent lamps have so many chemicals in them, fluorescing at different colors, that the overall effect approximates a continuous spectrum. The mixture can be tuned to cast a slightly colored light, as in pinkish "deluxe warm white" or bluish "cool white" tubes, to produce a deliberate color effect.

Besides the traditional long 10/8-inch diameter F-10 tubes and circular or U-shaped tubes, you can today buy

The only place to use hanging fixtures is over a table or in a high space such as a stair hall where the ceiling needs to be visually lowered.

fluorescent lamps which resemble slightly oversized pear-shaped incandescents, and so will fit into the same kind of fixture as incandescent lamps.

To produce the discharge needed to get the chemicals fluorescing in the lamp, you need a gizmo called a ballast. Ballasts hum, and when they get old, buzz annoyingly at voice frequencies. It is a good idea to order special electronic ballasts when you use fluorescents in a home, but even they hum a bit and can be disturbing.

We recommend that you never use fluorescent lighting except in kitchens or bathrooms, unless the ballasts are installed in a remote space. This unfortunately requires that the wiring from ballast to fixture run in metal conduit, since they carry high voltages; but it eliminates the noise problem. (For more on fluorescents, see "Brilliant Solutions," in this issue.)

Lighting Effects

Before electricity, the only artificial lighting source was an open flame, which had to stay clear of the ceiling or wall to keep the flames from burning the building down. Concealed light sources were unusual.

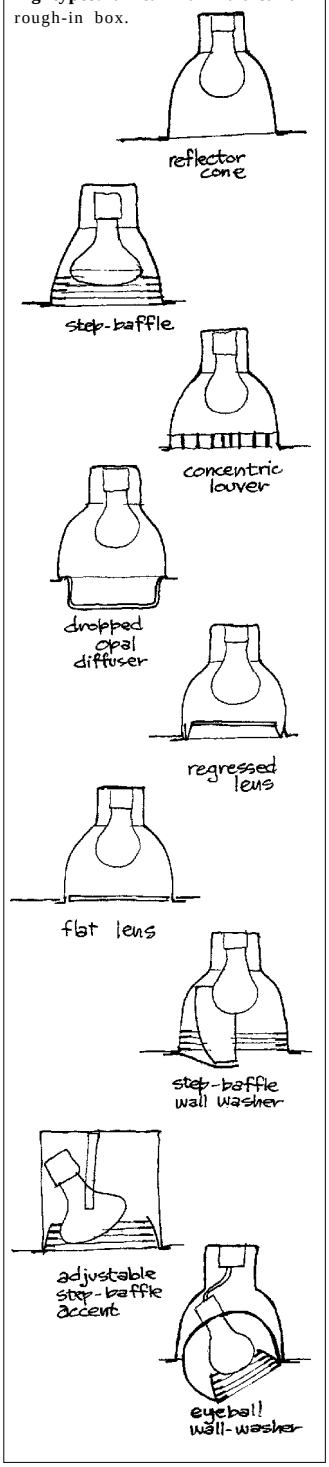
Today, it is very easy to conceal the source of light, and so we have a basic choice when designing lighting: do we show the fixture and make it a decorative element, or do we conceal it and pay attention only to the light it emits?

Decorative Fixtures. A good design practice is to select a few crucial places in a house for special decorative lights. These lights can set the mood of a house: a contemporary Italian-designed wall fixture can set a modern mood, while an imitation Early American candle-holding wall sconce can make a house seem traditional.

Typical places where a decorative focus is appropriate are:

- Over a dining room table, where a highly ornate fixture is often appropriate, even in a contemporary house.

Figure 1. Recessed down lighting types: all can fit in the same rough-in box.



- Alongside a buffet in a dining room, adding decoration to the room.
- At the entrance, where the choice of a fixture can have as much impact as the choice of a door.
- Along hallways, where the added interest of decorative fixtures can enliven an otherwise bare space.
- At either side of a fireplace, of a style that reflects the character of the house. These light fixtures can help counteract the traditional character of the fireplace, if the house is not traditional in style.

When you arrive home after a hard day, or are visiting someone else's house, the hall is the first space you see. It is pleasant to be greeted by a handsome and exciting wall fixture, which along with pictures and perhaps a couple of small pieces of furniture are the only features of interest in a hall. In a living room or working place, however, the fixtures should stay in the background. You are not trying to be alert in a living room, and you are concentrating on something else in a working space.

In a dining room, where you sit up and notice things such as the meal, the place settings, or the flowers, decorative fixtures add to the overall show.

Hanging Fixtures. There are only a few places where a hanging fixture works. Because it visually reduces the height of a room, a chandelier works well over a table where you sit. It will help the ceiling to come down and meet you, so to speak. Also, you can't bang your head on the fixture if it is over a table.

The other place to use a chandelier is in a high space, typically a stair hall, where the ceiling needs to be visually lowered, and where it will still be high enough to clear heads.

Outside at the Entry. As you approach a house, it is good to have a decorative fixture alongside the door, of a style that is in character with the house. Don't put this fixture at eye level; it looks and feels better lined up with the top of the door. The latch side of the door is usually the best place to mount it. Avoid the false monumental look of symmetrical double doors with a symmetrical pair of lights besides them.

If the porch is roofed, it is a good idea to add a downlight recessed into the porch ceiling. The downlight by itself might be overly dramatic, but coupled with the wall sconce, it adds a useful general glow.

Recessed Downlighting. Decorative fixtures that call attention to themselves are appropriate in only a few situations. Most built-in fixtures for general lighting, utility lighting, and task lighting should be concealed. The most useful and common concealed light is the recessed ceiling fixture.

Because any number of fixtures can fit into the same recessed rough-in box (see Figure 1), it is possible to fine-tune exactly what kind of light to use after the walls are up. The choices are extremely varied. There can be a lens on the fixture, either set in, flush, or dropped. A lensless fixture can have a reflector of various materials, or a black ribbed baffle which makes the source almost invisible (but is very inefficient). The fixture can be designed to shine to the side, or even cast a calculated rectangle on the wall (but low-voltage fixtures are much better for lighting paintings).

Each of these fixtures gives a unique and particular kind of light. If a flush or dropped lens is used, the fixture is more noticeable and casts a wider and less dramatic light than fixtures in which the light is baffled and directed down in a well-defined cone. In between are recessed bulbs with shiny reflectors, which still cast a conical, theatrical light, but which spread it much wider and produce less contrast.

Wall-washers of various kinds are extremely useful, not only to light walls and pictures on the walls, but to keep the light from shining straight down. For example, in a corridor it can be unpleasant (especially if the ceiling is low) to walk alternately in and out of the beams of a row of downlights. By using wall-washers, the light goes to the side instead of onto people's heads.

Recessed fixtures are useful to light points of passage and transition, as over doors into rooms. They are also helpful in providing general room lighting in kitchens and baths, where decorative exposed lights seem inappropriate, and where utility surface-mounted lights (such as those you might use in a closet) seem dowdy. Recessed downlights give these rooms class and sparkle for little cost. They even make messy areas look better.

Concealed Lighting. There are many occasions when you need a general glow from a linear source, and that is when cove lighting or concealed cabinet lighting is appropriate. The classic living-room cove light was used by Frank Lloyd Wright and is still a wonderful way to light a room.

Cove lighting gives a very specific architectural effect, namely visually lifting the ceiling off the walls. It helps if the cove is made artificially low, perhaps 7 feet from the floor, with the ceiling at 8 1/2 feet. The light then magnifies the small difference and gives the effect of a grand ceiling in a small space.

Be careful, however, to do engineering calculations for the cantilevered cove (see Figure 2). If it can't hold the weight of an inebriated man chinning himself at a party, forget it.

As mentioned above, you can use fluorescents in a cove providing you move the ballasts downstairs, an added expense. Do not put fluorescent ballasts in the living or dining spaces! Ballast hum is tolerable in an office, but not in quiet spaces at home.

Another option is a socket strip with incandescent bulbs, or even better, a chain of low-voltage bulbs.

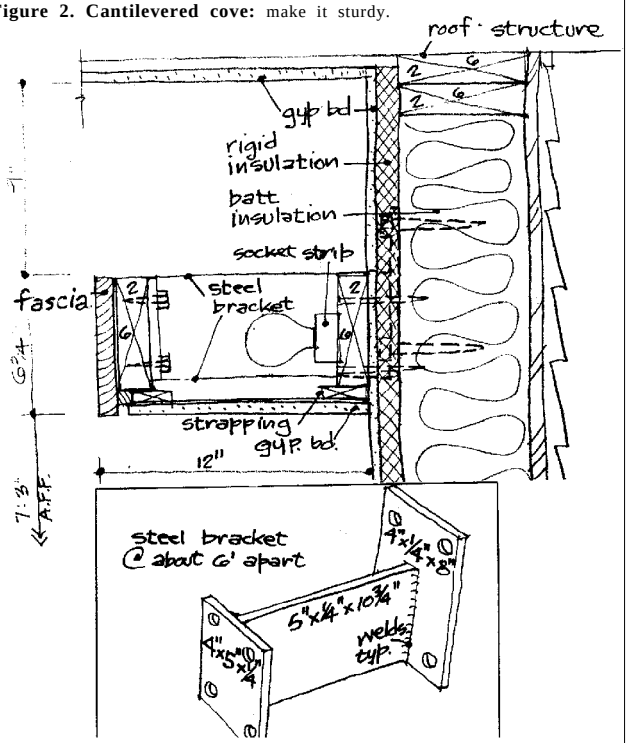
Low-voltage is now the best choice for lit display cabinets and (as noted below) under-cabinet kitchen lights.

Track Lighting. Track lighting is difficult. It always seems to be a simple solution, but it seldom solves anything. Track lighting was developed for galleries and other places where the type of light and the exact location had to vary frequently.

It is rare for a homeowner to move track-light fixtures once they are installed. The only flexibility gained is putting off the decision of where to locate the fixtures until after the walls are complete. While this is an advantage, it is paid for dearly by visually cluttering up the ceiling. If your house style features exposed steel joist and ducts, track-lighting is an obvious choice. Otherwise, use it cautiously.

If you must use track-lighting, relate it to the space. For example, recess the track at the ridge of a high space (see Figure 3). Another use is where a ceiling suddenly rises up. Here, track-lights can be very useful if concealed behind a fascia and aimed up into the high space. Put the track on or next to a beam.

Figure 2. Cantilevered cove: make it sturdy.



Don't put the track out in the middle of a flat ceiling!

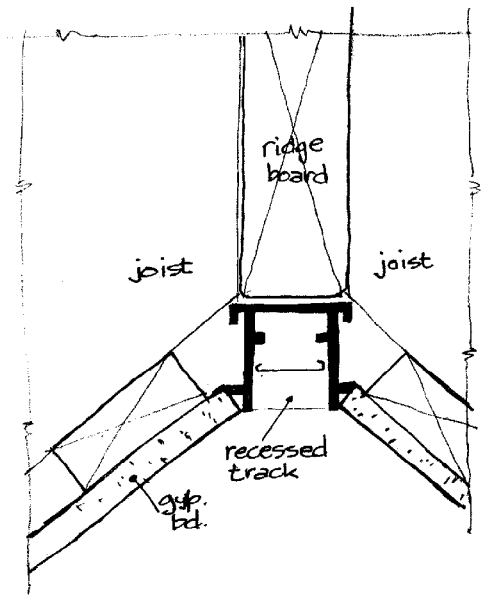
Track-lighting fixtures are similar to recessed fixtures, only exposed, and are therefore useful where a recessed fixture is desirable but can't be used. An example is in a cathedral ceiling, where recessed lights interrupt the insulation and create potential condensation problems. In these cases, consider a mono-point fixture, which is really a track just long enough for one fixture. They at least avoid the clutter of the track.

Exterior Lighting. Security lighting can wreck the appearance of a house and shine in peoples' eyes unless you take great care in locating it. A good place for lights is of course at house corners, where they can shine in various directions. Avoid placing the lights where they can be seen from the inside. Shine the lights on important objects to extend the inside space of the house outward during the evening.

Up-lighting of trees can be effective with special weatherproof fixtures, but the effect is very theatrical and should be used with care. Mounting floodlights on the trees themselves is an excellent way to keep the ugly fixtures off the house and to send the light downward and out of peoples' eyes. If you plan to keep these lights on a great deal, consult a tree expert to choose a lamp that attracts the least bugs and does the least damage to the trees.

If the house has a wide overhang, downlight floods (not spots) can be mounted in the soffit to produce useful yard lighting and nice scalloped shadows on the building.

Figure 3. Recessed lighting track at ridge: make track lighting relate to space.



Never use hanging fixtures in a bathroom. They are illegal there, and look awkward as well in such a small room. One solution is recessed downlights set into a dropped ceiling over the vanity.

Bathrooms. Never use hanging fixtures in a bathroom. They are illegal there, and they look awkward as well in such a small room. The basic light in a bathroom is the one over or next to the mirror. One nice solution is to encase a fluorescent (with electronic ballast to cut noise) inside a wooden fascia that matches the vanity. Rest a plastic sheet or grille on a lip at the bottom of the fixture so you can't see up into the light.

Another nice solution is one or two recessed downlights set into a dropped ceiling over the vanity and mirror. Finally, you can fall back on the exposed multi-bulb fixtures that mount on either side of the mirror, as in a theater dressing room. These come in endless sizes and finishes, are all pretty ugly, but are occasionally indispensable.

In addition to the mirror light, mount a recessed light (or a wall sconce if the bath has a cathedral ceiling under the roof) to provide general light in the room. A special waterproof light in the shower is common. Be sure there is enough light at the water closet and bathtub to read by.

In the bathroom, it is important to tie together the many disparate elements in the design: medicine cabinet, vanity, tilework, lights, mirror. Just placing them at random on the wall creates chaos. The fixture can be an important linking element in the overall scheme.

Kitchens. There should be a general set of downlights in the kitchen, perhaps only one in a small kitchen. The key lights are those over the work area. An ideal arrangement is to avoid any overhead cabinets, and set downlights to shine on the work surfaces. Provide a full-height cabinet or two to make up for the missing overhead shelving.

Overhead cabinets, however, are installed in most kitchens, raising the difficult problem of lighting under the cabinets. Undercounter fluorescents are notoriously noisy and unreliable. And, if they are not baffled on the front, they shine in your eyes if you sit in the kitchen. Low-voltage lights are an obvious solution here. Another solution is to set an ordinary downlight up into the overhead cabinet; some cabinet space is lost, but the heat can help keep crackers fresh.

Closets. Door-operated switches, either the traditional mechanical switch or the newer magnetic ones, are a nice feature for closets with swinging doors, provided they are kept closed most of the time. A simpler solution is a standard compact fluorescent closet light operated by a pull-chain, or better yet, by a switch outside or just inside the door. Work out switch locations carefully ahead of time. The use of incandescents in closets is severely restricted by code, and some inspectors don't allow it at all.

Mounting Heights. Try to avoid putting wall fixtures at eye level. Instead, line them up with the door head. Stairs pose special problems, because your eye level moves as you rise or descend a stair. Wall lights at the landing can be set above head level, but you always need to choose the fixture carefully if you can see down into it from the landing above. Many fixtures look awful from the top. Looking up at a fixture can also be unpleasant, but this seldom happens except as you climb a stair.

Accessibility. Fixtures should always be easy to re-lamp. Fixtures out over high spaces are a classic problem. Be sure there is a place to set a ladder from which you can safely reach and replace the bulb.

Lamp Size. One piece of advice is to use low-wattage pear-shaped A-lamps in recessed downlights. Many people love the brilliant, clean look of high-wattage lights, but you really don't need that much light. Overlighting raises energy costs and produces a harsh glare, overwhelming subtle colors and washing out nice woodwork. One of the authors has recently re-lamped the fixtures in his own house with 25- to 60-watt lamps. For reading and other tasks, use table or floor lamps located close to the work.

Lower-wattage lamps also soften the edges of shadows. The scalloping that occurs when a recessed downlight shines on a wall can be very nice if the contrast is not too severe. If you use pear-shaped A-lamps instead of reflectors, the scallops will also be softer.

Switching and Dimmers.

Dimming the lights in the major living spaces is always a good idea. So is 3-way switching, which allows you to "chain" yourself through a house without backtracking to turn off the last light. If you have to dim a 3-way or 4-way circuit, you can add a special dimmer at each end.

We never put fixed lighting in bedrooms, relying instead on switched receptacles. (The code requires a switched light in every room, except bedrooms where a switched receptacle is acceptable.) One strategy is to switch half of one receptacle; another is to switch one half of each receptacle in the room. A really neat ides is to provide a 3-way circuit to a receptacle at each side of the bed, with the second switch right by the bed, so you don't have to get out of bed to turn off the room light.

When there are several switches in one area, it is visually good to gang them together, and Jeremiah likes to do that. Gordon, on the other hand, deliberately separates switches for functional clarity, at the expense of clutter. Jeremiah tries to line switches up over receptacles, again to neaten things up.

As for switch types, almost any choice is good. Rocker and push-button line-voltage switches are nice, but more expensive than the traditional silent toggle switch.

Neither of us has direct experience with a complete low-voltage lighting system, largely because of the high extra cost. As the systems become more common, they will be more widely used. The big switching advantage is that lights anywhere in the house can be controlled from anywhere else.

The possibilities are obviously endless, including overall control from the master bedroom for security. The down-side is added complexity, for which there seems to be no obvious cure. Do we really need to memorize yet another set of codes to operate our home-control system?

Recessed downlights provide ideal lighting in a kitchen with no wall cabinets over counters. With standard wall cabinets, some form of under-counter lighting is needed.

The Final Word

Keep the lighting system simple. Don't try to do too many things. Use decorative lights sparingly. Don't overlight. Don't overcomplicate the switching. If in doubt, leave it out, or put in a recessed fixture. Avoid track lighting and fluorescents in the living and sleeping spaces.

Light fixtures themselves, and the light they cast, have a powerful visual impact on a home, and a lot of thought is required to use them well. Don't accept the ordinary approach; your extra care will be well rewarded.

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Brilliant Solutions:

A Look at Energy-Efficient Lighting

To evaluate the energy efficiency of a home lighting system, you have to look at its competition. The standard that all residential users will compare the new lighting with is your basic Edison light bulb. Aside from the energy factor, it's a real tough product to compete with. It's been around a long time, is inexpensive, fits in practically any fixture, is 100-percent dimmable, and is available in many light (lumens) outputs. On top of that, it gives off a pleasing light.

The familiar Edison light bulb, however, really doesn't do its job very well. Most of the electricity that goes into it—about 90 percent—is lost in heat. And its net light output drops even further when you put it into most light fixtures. When you get right down to it, it's actually a space heater that gives off light as a byproduct.

Utility bill savings for the individual homeowner will not be a major incentive to invest in energy-efficient lighting products. In a conventional house, lighting only consumes about 3 percent of the total electric bill. So, if you replace your incandescents with the new products and save 50 percent of your bill, you're really talking about saving 1-1/2 percent of your electric bill—not a whole lot. Even so, in new home construction, it's almost always justified, because the marginal cost of upgrading from the typical so-so product to a high-efficiency one will be rapidly paid back in energy savings. It's less clear in retrofits, where you may be able to justify the replacement of bulbs, but not of the more costly fixtures.

For Starters

For builders interested in energy-efficient residential lighting, it's important to remember that there are lamps (bulbs), *and* fixtures (lighting jargon: luminaires). You want to be careful that both the lamps and fixtures you specify are energy-efficient. The most energy-efficient lighting system will combine lamps and light fixtures that produce the highest quality of usable light with the least power consumption.

With the lamp, you are mainly concerned with efficacy: power (watts) in for light (lumens) out. The greater the lumens-per-watt ratio, the more efficient the lamp. Bear in mind, however, that such efficacy measurements tell you nothing about the most important factor: the quality of light. Lamps and light fixtures that provide high visual acuity, high-contrast, low-glare, and good color rendition can dramatically reduce the quantity of light needed to effectively illuminate the space. That's because the human eye can use the higher quality light more efficiently.

With the fixture, you are concerned with how much usable light gets out of the thing...its "coefficient of utilization." Shop for fixtures that project light out to where you want it.

With the fixture, you are concerned with how much usable light gets out of the thing, its so-called "coefficient of utilization." Whatever the type of fixture—tracklight, recessed can, or wall sconce—you need to shop for fixtures that are engineered to efficiently project light out to where you want it. A highly reflective interior finish, for example, can increase the fixture's coefficient of utilization. The popular recessed cans with the dull black reflectors, however, would be very inefficient.

What's Out There

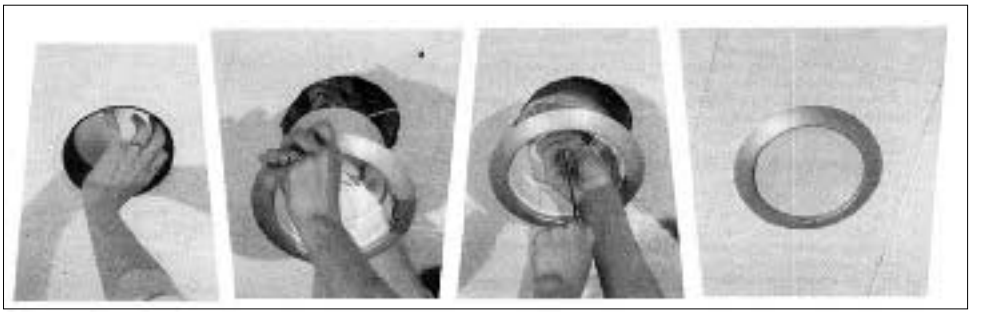
A whole new generation of energy-efficient fixtures has just come out. These are designed to work with the two most energy-efficient light sources suitable for home use: compact fluorescent lamps, and tungsten-halogen incandescent lamps. Most of these fixtures are intended for new construction or replacement of existing fixtures. There are, however, several retrofit products designed to fit into or over existing fixtures.

Compact fluorescent lamps, which are essentially miniaturized versions of full-sized fluorescent tubes, consist of two or four parallel tubes with a pin-based mount. The 5-to 13-watt models range in length from 4 to 7-1/2 inches respectively, and will fit into many existing residential fixtures by using an adaptor base: these screw-in ballast bases regulate the current (voltage) going into the lamps. (All fluorescents require a ballast.) Some compact fluorescents, available in 15-to 18-watt-models, combine tube and ballast in a single package and screw in to the existing fixture. Both varieties are approximately four times more efficient than standard incandescent light. Compact fluorescent lamps and fixtures cost more, but they are much longer-lived and less expensive to operate. Depending on their usage, they will pay for themselves fairly quickly (the greater the usage, the faster the payback).

Compact fluorescents, like other modern fluorescent bulbs, have resolved the major complaints homeowners had about the older fluorescents. They don't flicker, hum, or give an odd-bluish hue to everything they shine upon.

On the down side, compact fluorescents are bulkier and heavier than standard incandescents, which makes them impractical for some uses. There are other limitations as well. At present, most of the compact fluorescents flicker for 1/2 to 2 seconds when turned on, or take from 15 seconds to 2 minutes to come to full brightness. In situations where you need full brightness right away—say a bathroom or stairwell—a compact fluorescent would not work well. And in situations where you want a range of brightness, your options are limited since only one compact fluorescent lamp assembly is dimmable. (Silver Star, by American Energy Controls, Elk River, Minn.)

Another poor application, although not generally an issue in home interiors, is in low-temperature environments. The compact fluorescents have a hard time turning on at lower temperatures—although this



The patented "zip cord" feature that comes with the X-18 light (Scientific NRG Incorporated, 1500 E. 79th St., Suite 117, Minneapolis, MN) makes installation into an existing recessed can a snap: 1) The incandescent lamp, trim ring and collar is removed; 2) the X-18 screw base with zip cord is inserted into the can socket; 3) the X-18 is "zipped" in place flush with ceding; 4) two PL tubes (5 or 7-watts) are inserted, lens is snapped on, and the light is ready.

varies with the type. A PL-5 or -7 will turn on when temperatures are as low as 0°F, but a PL-9 or -13 will have trouble if the temperature goes below 20°F.

Finally, compact fluorescents are not likely to be cost-effective where they are rarely used.

On the other hand, there are some excellent applications. A really slick product is the X-18 recessed-can retrofit fixture (Scientific NRG, Minneapolis, Minn). I've installed this product in many kitchens, where people commonly use 75-to 100-watt floodlights in recessed cans. The 18-watt fixture fits right inside the existing can. A built-in zip cord conveniently pulls the fixture into place. It's a neat retrofit, and it delivers the same amount of light as a 75 to 100-watt flood will, but uses about 75 percent less power.

Halogen lighting is basically a more efficient form of incandescent lighting. Because it runs at a higher temperature, it can produce a crisper light. It's less efficient than the compact fluorescents but about 20 percent more efficient than regular incandescents. Track-lighting and recessed-can fixtures are the main applications for halogens. They are available in a variety of flood and spotlight models that deliver a very controlled light beam—a plus over compact fluorescents since the light from the relatively large compact fluorescent lamps can't be focused nearly as precisely. There's a lot of call in housing for accent lighting where you want a small light source that can really punch the light out. Halogens fit that bill. Many decorator fixtures are available that operate with compact halogen floodlamps. (Halogens come in a range of sizes; the compact halogens are about the size of a ping-pong ball).

Halogens are normally set up to work on low voltage and incorporate a transformer to knock the current down to 12 volts. These low-voltage halogens require special fixtures. Some halogens, however, screw in to a standard Edison base.

I recently used this type in a room in my house. The room has a cathedral ceiling, with a recessed can fixture. I replaced a 100-watt incandescent floodlight with a 55-watt halogen. Quantitatively, it delivers more light; qualitatively, it is much more appealing. Its brighter "white light" really brings out the true colors of my wooden dining room table 15 feet below. Because it operates off line voltage I could simply screw it in to the existing fixture. Had I used a low-voltage unit, it would have required a costly fixture replacement. The beauty of this particular product (Sylvania Designer 16PAR Capsylite) is that it is the first compact line-voltage halogen. All the other compact halogens require a tranformer.

Final Considerations

To make the most of an energy-efficient lighting system, you need to keep the following in mind:

• Be careful about mixing and matching lamp types in the same room. Lamps can be ordered having various color temperatures—ranging from "cool white" to "warm white"—and various color rendering indexes (showing how accurately the light renders the colors of the objects it shines upon). Cool white light will not mix well with warm-white. It will lessen the quality of both, and often will make the homeowner feel that something is "off." Specify light sources that complement rather than fight each other.

There's a tendency to overkill lighting in general. But you can greatly reduce lighting levels, and still be effective, by carefully designing and specifying energy-efficient lighting that delivers the highest quality light for the least energy consumption.

The Ultima system (VL Service Lighting, Bank St., Hightstown, NJ 08520) uses a combination (and removable) ballast that operates replaceable PL-7, PL-9 lamps.

• Do make use of natural daylight. I think it's downright criminal in a new home to have to turn on lights during the day in anything but a north closet. With the new insulated high-tech windows there's really no excuse not to get natural light anywhere you want it in the house.

• If you are designing an energy-efficient house, don't assume that the energy-efficient lights will give off the heat that their predecessors gave off. In the early days of superinsulation (five years ago), builders relied on lights and inefficient appliances to heat the home. This won't work with the new lights (nor with the new energy-saving appliances). Also, remember that your cooling load may be reduced. Where you might have specified a half-dozen 100-watt floods in the kitchen, now you can often do the same job with 13 to 20 watts. There will be a lot less heat beating down on the heads of those in the kitchen.

Optimize, Don't Minimize

Most builders are accustomed to going with run-of-the-mill cheap lighting packages. But you can now custom order virtually any type of light fixture, whether you are specifying atmospheric or accent lighting.

To upgrade to energy-efficient lighting, it takes some extra planning, and a marketing approach that sells energy-efficiency. For one thing, it's important not to sacrifice the client's quality of life in the name of energy-efficiency. There's no point in installing energy-efficient lighting if it's ugly or inconvenient. People aren't going to use it. The bottom line is that when someone walks into a house you've built, you want the lighting to make them feel good, show off their home, and be easy on their eyes. There's a tendency to overkill in lighting in general. But you *can* greatly reduce lighting levels, and still be effective, by carefully designing and specifying energy-efficient lighting that delivers the highest quality light for the least energy consumption. ■

—NEB