

CHAPTER 9

Looking to the Future

What does the future hold for European green design? I think it's obvious that low-energy designs will dominate the future but also that BREEAM and LEED rating systems, or their variants, will spread, forcing European architects and engineers to open up their thinking to the broader concerns of sustainable design, including land use, water recycling, renewable energy, sustainable materials, and indoor environmental quality.

Here's a look ahead at a few trends that are likely to be more prominent in the future. The key to a low-energy outcome is to set stretch goals for the entire society, as we saw in Chapter 7 with the Swedish examples. Swiss researchers have done that with their goal of a 2,000-watt society. Building design and construction, along with existing building renovations, will be increasingly dependent on and driven by the availability of good software to guide results in the right direction, as we show with the Environmentally Viable Architecture (EVA) tool and Calcon's Energy Performance, Indoor Environmental Quality Refurbishment (EPIQR) software. Building designers will become increasingly interested in and guided by post-occupancy evaluations and more interested in the "soft landing" approach to finishing projects and improving the first year of occupancy. The implementation of the European Energy Performance of Buildings Directive (EPBD) will radically change building design and renovations because the penalty for not achieving high-performance results will be that the building's value will be degraded in the marketplace.

Zero-net-carbon buildings will replace zero-net-energy buildings as the goal for sustainable design as people become increasingly concerned about the life-cycle impact and embodied energy of buildings. Product manufacturers are likely to pick up on the Dutch approach to "slim and smart buildings" as they look for ways to integrate new building systems into the construction process, to save time and money in implementing sustainable buildings. Finally, we are already beginning to see the export of European design techniques and sustainable planning practices to Russia, the United Arab Emirates, and China. It won't be long before the same approaches start winning more design competitions in the United States and Canada.

THE 2,000-WATT SOCIETY

Most of the current North American green building rating systems such as LEED and Energy Star look at the percentage of improvement in energy systems, compared with today's existing

codes. But the carbon challenge of this generation is to reduce energy use by absolute numbers, to much lower levels than today. Even stretch goals such as those found in the Architecture 2030 Challenge¹ are presented in terms of a 90 percent reduction by 2030 from today's high levels of energy use.

In 1998, the Swiss Federal Institute of Technology presented an alternative approach, not just for buildings but for an entire society.² The 2,000-watt society challenges the developed world to cut energy use to 2,000 watts (or 17,520 kilowatt-hours per year) by the year 2050, the current world average. This is a real stretch. Western Europe currently uses about 6,000 watts per capita, and the United States uses about 10,000 to 12,000 watts. This goal implies cutting U.S. energy use by 80 to 83 percent and Western Europe's by 67 percent. Table 9.1 shows what the average Swiss person uses today.³

The implications for buildings are clear. Only dramatic cuts in building energy consumption such as those found in the PassivHaus standard and the Architecture 2030 year 2025 goals will be sufficient. Cutting energy use by this much also involves radically reducing the energy use of the existing building stock, changing patterns of urban settlement toward much higher density, aiming at 100-mile-per-gallon autos powered by renewable sources, and so on. Of course achieving this average would mean that Chinese energy use would also have to fall by one third, whereas that of Bangladesh could climb 300 percent (Figure 9.1).

There's one other kicker to this concept. Within 50 to 100 years, 1,500 of the 2,000 watts would have to come from carbon-free sources such as solar, wind, biomass, hydro, and even nuclear, so that the net carbon drain would be only 500 watts, about 4,000 kilowatt-hours per person per year. Multiply that number by 7 billion people, and you still have a lot of carbon emissions, about 28 trillion pounds, or 14 billion tons.⁴ (Carbon dioxide emissions in 2004 were about 30 billion tons.)⁵

TABLE 9.1 ENERGY USE PER CAPITA, SWITZERLAND, 2007.

CATEGORY	ENERGY USE PER CAPITA (W)
Living and office (heat and hot water)	1,500
Food and consumer items, including transport	1,100
Electricity	600
Auto	500
Air travel ^a	250
Public transportation	150
Public infrastructure	900
Country total	5,000

^aOne round trip between Zürich and Shanghai would be equivalent to 800 watts, so the 250-watt allowance covers only a few, much shorter air trips.

Source: Elizabeth Kolbert, "The Island in the Wind," *The New Yorker*, July 7, 2008, www.newyorker.com/reporting/2008/07/07/080707fa_fact_kolbert?currentPage=all, accessed August 7, 2008.

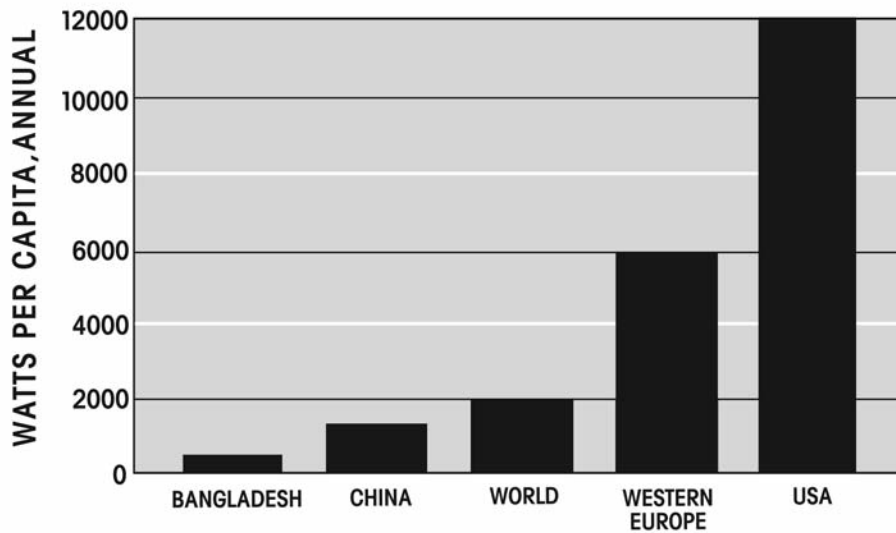


FIGURE 9.1 Average energy use in selected countries according to the Swiss research institute ETH, which is credited with pioneering the concept of a 2,000-watt society that reduces human impact to sustainable levels without giving up the amenities of modern life.

You can see the challenge to U.S. architects, engineers, and building owners and developers: Stop thinking that a 15 to 20 percent improvement over current codes is sufficient and begin designing zero-net-energy buildings with enough on-site and off-site renewables produced or purchased to offset the energy use in the building (Table 9.2). For a 100,000–square-foot building using 15 kilowatt-hours per square foot per year, that would mean buying or producing 1.5 million kilowatt-hours per year. With a \$0.02 cost premium per kilowatt-hour, that’s only \$0.30 per square foot per year. With average urban rents at \$30 per square foot per year, that’s only a 1 percent premium. Why is that so hard to swallow? Even assuming that a project spent \$3 per square foot extra to reduce energy use dramatically (i.e., about 2 percent on \$150 per square foot

TABLE 9.2 THE COST OF A 100,000–SQUARE-FOOT ZERO-NET-ENERGY BUILDING.

Building net energy use after conservation measures	15 kWh/sq. ft./year	1,500,000 kWh/year
Additional cost to achieve this goal based on a \$150/sq. ft. cost	\$3/sq. ft. (2%)	\$300,000
Annual additional cost of energy investments at 10% annual capital recovery	\$0.30/sq. ft.	\$30,000
Annual cost of purchased renewable energy at \$0.02/kWh	\$0.30/sq. ft.	\$30,000
Average urban rent	\$30/sq. ft.	\$3,000,000
Percentage rent increase to cover zero net energy	2% (\$0.60/\$30)	—

construction cost) that would amortize at an additional \$0.30 per square foot, the cost would only double to about 2 percent of rent (Table 9.2).

So why can't we accept the Swiss challenge and live on 2,000 watts per day? This was the average energy use in Switzerland, a very cold country by the way, in 1950. As a child in 1950, I knew no one who thought that we were suffering a great hardship, at least in energy terms. Since 1950, U.S. energy use per capita has grown 50 percent.⁶ If we're a 12,000-watt society today, what would be the harm in going back to an 8,000-watt society (the 1950 level), especially when we know we could do it without giving up much because our buildings, cars, factories, and homes are much more energy efficient today?

Here's the saving grace: About two thirds of primary fossil fuel energy used today is just wasted, lost as heat in our engines, motors, power plants, and so on, primarily because energy has been so cheap that there hasn't been much incentive to save energy and make our physical plants more efficient.⁷ So, if we can double the efficiency of primary energy conversion, we'll get down to 6,000 watts in the United States rather quickly. Then the remaining two-thirds drop to 2,000 watts can be made much less painfully.

Back to the Swiss 2,000-watt society: The metro area of Basel began a pilot project in 2001 to develop and commercialize some of the technologies involved. The city of Zurich joined the project in 2005. Recall that the 2009 Swiss Minergie standard is only 38 kilowatt-hours per square meter (about 3.5 kilowatt-hours per square foot, or about 6,000 kilowatt-hours annually for a 1,700-square-foot home or apartment, less than 1,000 watts) at the present time, and you'll see that the Swiss are well on their way toward 2,000 watts.⁸

TACKLING THE PROBLEM OF EXISTING BUILDINGS

Although it is technically not a green building issue, the problem of upgrading the energy efficiency and indoor air quality of existing buildings is critical to reaching the 2,000-watt society goal (or even remotely approaching that level of building energy use). My friend Christian Wetzel in Munich is a former researcher at the Fraunhofer Institute for Building Physics, Germany's leading energy research lab (comparable to the U.S. national laboratories such as Lawrence Berkeley National Lab) and now runs a small software company called Calcon.⁹ His software tool is called Energy Performance, Indoor Environmental Quality Refurbishment, or EPIQR, after the Greek philosopher Epicurus (from whom we derive the word *epicurean*).

The goal of EPIQR is to evaluate a building as user-friendly, as holistically and independently as possible, with a maximum effort of a few hours to determine the most cost-effective (energy) retrofits. Imagine taking only a handful of easily gotten measurements of an existing building (preferably a group of buildings) and coming up with an estimate of energy demand within 10 percent, then generating a series of energy upgrades that yield whatever return on investment the building owner specifies. Wetzel and his colleagues have done this for more than 1.5 million flats and, including the commercial areas, altogether more than 100 million square meters (more than 1 billion square feet) gross area in just 5 years.

And it's all based on Fraunhofer's exhaustive research (along with other European energy researchers) into the key variables determining building energy use, which are easily observable, such as the roof condition, window type and condition, number of stories, number of apartments and

stairwells, and age of a building. Wetzel has licensed this information database and created the software to make it into a practical analytical and investment tool. By reducing the front-end cost of energy audits, the EPIQR tool allows building owners to quickly and painlessly specify a series of economically beneficial retrofits to reduce energy consumption. The software evaluates the degradation state, estimates refurbishment and retrofit costs, and then generates actions and budgets over a 1-year, 5-year, and 10-year horizon. It also analyzes heating energy demand according to the European Union EPBD, allowing an Energieausweis (Energy Certificate) to be issued for the building.

LIFE-CYCLE DESIGN TOOLS

Everyone is looking for the ultimate tool that will assess how well a home, building, or urban development will affect the environment on a life-cycle basis. One Englishman, David Kirkland, has come up with a piece of software called EVA Tool that promises to do just that (Figure 9.2).¹⁰ Kirkland says, “When just 1 percent of a project’s up-front costs are spent, up to 70 percent of its life-cycle costs may already be committed. If you integrate green design directly into the processes and even the software that people use to design buildings, then thousands of designers will automatically do it right.”

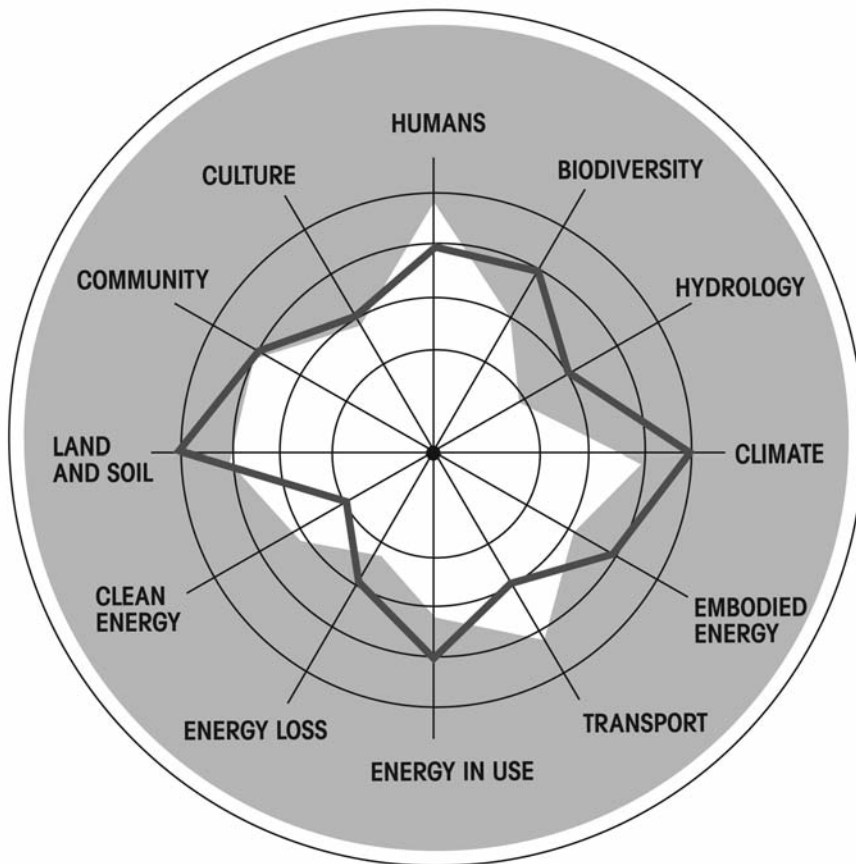


FIGURE 9.2 David Kirkland’s EVA Tool’s graphic interface allows teams to monitor a project’s progress across 12 environmental impacts associated with the built environment.
(© Enviarch, Ltd. www.evatool.com, www.evacology.org)

Kirkland describes the purpose of EVA Tool in the following way:

One of the core things that we're concerned about is the current design paradigm for buildings. What we're finding on a lot of these projects is, although their design performance metrics are pretty good, the actual operations—the real-world operation once they've been running for a few years—fall short. Our feeling is that you can't separate sustainable design aspects from the core design process. Therefore, we've designed a tool that helps the designer to make the right decisions at the right time, without making life a burden with long checklists and those sorts of things.

The EVA Tool graphic itself summarizes twelve impacts that are within the control of the project's architect and design team. Kirkland says,

For each of those impacts, before you start your project, you must set yourself a benchmark of what your design goals are, and that's what the bold line is. That is something you establish beforehand. One of the key aspects of EVA Tool is that we're trying to move away from generic benchmarking. We're finding that to make a building really work performance-wise, it boils down to very particular, local issues for that particular building. So, we push for setting a unique benchmark for each project, given the project parameters, which means it's much more finely tuned. The white space represents the self-scoring and self-measuring of how you're doing so far in terms of the goals that you set yourself.

Kirkland says that the lessons learned and recorded on each project provide a template of knowledge for the next one and provide a dynamic and ever-evolving “knowledge ecology” within an architectural practice. Armed with the right knowledge and process, design teams should do a much better job of developing the best green buildings.

SOFT LANDINGS FOR GREEN BUILDINGS

Bill Bordass works at the Usable Buildings Trust (UBT), a nonprofit based in the United Kingdom that promotes better buildings through improved understanding of how they actually work.¹¹ He and his colleagues have concluded that post-occupancy evaluation (POE) must become a routine activity for design and building teams.

In collaboration with the Building Services Research and Information Association,¹² UBT has converted a brilliant idea known as “soft landings” into a formal process that everyone can use. Soft Landings was initiated by architect Mark Way. He researched and tested it with the support of the Estates (Facilities) Department at Cambridge University and a team of designers and constructors with input from UBT. Soft Landings is designed to run alongside any procurement process, enhancing three critical stages: briefing and programming; before and after handover, known as the “finish” stage; and into the first 3 years of use.

Soft Landings includes the following key elements:

- A means of engaging the design and construction team beyond handover to help guide a new or refurbished building through the first crucial months of building operation and beyond. This helps to reduce the tensions and frustrations that can occur when people move into a new building.

- An opportunity for the design and building team to examine the operation of the building and its control systems and to undertake debugging and fine-tuning. This allows clients and users to get more out of their buildings and designers to improve their specifications for future work.
- Associated independent post-occupancy surveys to help inform the team, the building users, and the client about functionality, usability, manageability, energy efficiency, environmental performance, and occupant satisfaction.
- A way of managing client expectations and design intent by routine performance benchmarking throughout the design and construction process and into monitored performance use. The energy benchmarking provides additional technical and operation detail to augment the requirements of the energy certification, which is now mandatory in Europe.
- Aftercare is included as an additional paid service from the design and building team. It allows the designers to help the occupiers get the best out of their building and, if necessary, tackle the problems that can occur with complex systems. (Bordass believes that the present warranty arrangements often only treat symptoms.)
- Clients can respond to the basic framework by setting specific roles, responsibilities, and sign-off duties.

If one understands the difficulty of moving to truly sustainable buildings over the long run, then one will see the brilliance in the Soft Landings approach. It makes into a formal and accepted process the handover, troubleshooting, and fine-tuning activities that go with any complex modern building. POE and feedback also become routine activities that will benefit the industry, its clients, and the planet.

EPCs AND DEC'S

The most exciting thing I found in Europe was the EPBD (introduced in Chapter 3) and the associated Energy Performance Certificates (EPCs) and Display Energy Certificates (DECs) for existing buildings, based on annual kilograms of carbon dioxide emissions, considering primary energy sources. Figure 9.3 shows what the full EPC looks like, rating buildings on a seven-letter

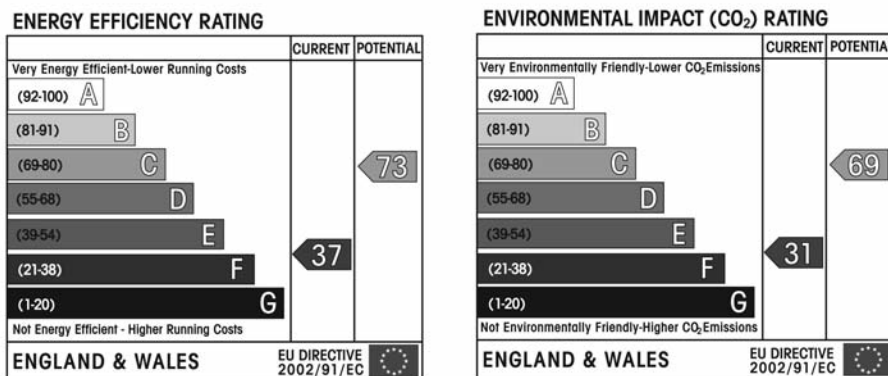


FIGURE 9.3 The energy performance chart shows relative energy use and carbon emissions from designs and gives an easily remembered grade and suggestions for improvement.

scale, from A to G, with A being a zero net energy use per unit area, and showing the carbon production equivalents. Most office buildings would rate between a D and an E on this scale.

The EPC certificates contain information about the building type, the asset rating, reference values and benchmarks, and a series of recommendations for investments to reduce energy use that have less than a 3-year payback (“no or low cost”), less than a 7-year payback (“medium cost”), and greater than 7 years (“strategic investments”).¹³ The asset rating is defined by using about 200 data inputs and then calculating energy use and determining a numerical ranking with the following formula:

$$\text{Asset rating} = \text{Building emissions rating (kg CO}_2\text{/sqm)}/\text{National building rating (kg CO}_2\text{/sqm)}.$$

So if a building generates less CO₂ from its energy use than the national average for its type by 30 percent, for example, then its EPC score would be 70, giving it a respectable “C” energy performance asset rating. The certificate and rating are good for 10 years.

The DEC’s asset rating is determined in a similar fashion, except that actual energy use data are used. The purpose is to determine actual energy use and to see whether the building is being operated as efficiently as it could be.

$$\text{Asset rating} = \frac{\text{Annual building emissions rating (kg CO}_2\text{/sqm)}}{\text{Typical building rating (kg CO}_2\text{/sqm)}}.$$

In the case of the DECs, the certificate is valid for only 1 year, the recommendations for 7 years. Every prospective renter or lessee must be given a copy of the certificate, and a poster with the certificate must be displayed publicly. The display must include ratings from a prior 3-year period, so that building occupants can see whether improvements have been made.

The British government expected that about 1.5 million commercial buildings could be affected by EPCs and DECs and that more than 200,000 certificates would be issued in 2008 alone.¹⁴

What I really like about this approach is that it substitutes information for regulation. All that’s required is to rate the building’s energy use against an objective scale and to tie energy use to carbon emissions. We do that in the United States already with the Energy Star program, but it’s only a relative ranking (the top 25 percent) as opposed to an absolute scale. If we want to get serious about reducing energy use in buildings and inducing energy-saving remodels, refurbishments, and renovations, we have to start broadcasting energy use per unit area.

ZERO-CARBON HOMES AND BUILDINGS

To get to a zero-carbon home or zero-carbon building, first let’s consider what a zero-net-energy use home might be. Once you start to look at it more closely, you find a series of ever more stringent definitions.

1. A sort-of zero-net home might just buy carbon offsets sufficient to provide for its total energy use, using the better economics of off-site renewables. A variant of this approach is to have specific renewable sources, such as a nearby wind turbine installation or solar photovoltaic (PV) farm tied directly to a specific development.

2. A zero-net-electricity home might consist of a grid-tied solar PV system that on an annual basis generates as much electrical energy as it consumes. (This assumes an efficient building envelope and efficient appliances, but total use still might amount to 50 kilowatt-hours per square meter per year, or about 10,000 kilowatt-hours per year for a 2,200-square-foot home.)
3. An all-renewable home might have solar PVs plus a small biomass boiler fed with purchased wood pellets and generating all the heating, hot water, and electrical power for the home.
4. An all-grid zero-net-energy home might buy renewable energy from the grid and indirectly power everything with solar, wind, biomass, and other renewables.
5. A zero-net-energy development might be in local balance with renewables, similar to Beaufort Court, or a British eco-town with 20 percent on-site renewables, the rest from a district energy plant or local combined heat and power (CHP) system running on biomass. This can be called on-site carbon neutral.
6. What about source energy, or all the wasted energy needed to get electricity from the initial fossil fuel to your home? If that were also considered (in Germany it's called "primary energy"), then you might need to generate four times your electrical use on site to produce the energy needed to run the home.
7. A true net-zero home might be totally disconnected from the grid and use its own harvested biomass to run a boiler. (There are thousands of such homes in the backwoods of the United States and Canada already.) This is called site autonomy.
8. But what about the gray energy, the embodied energy of all the building materials, transportation system, and so on? The Europeans are quite serious about measuring this also, and it appears to be about 20 percent of the total direct primary energy use of society. If you count that in the equation, you have to generate even more renewable power.
9. Finally, what about transportation energy use? One recent U.S. study put the energy use of the average 12-mile, one-way American commute at 130 percent to 237 percent of the energy use in a typical office building.¹⁵ So it's clear that the location of a home and distance to work, along with options for getting to work, are also vital components of the low-carbon lifestyle equation.

Other sources of greenhouse gas emissions must be counted, such as refrigerant leaks from air-conditioning systems, methane emissions from waste treatment plants and herd animals, and other chemicals that have significant global warming potential. Yes, bovine flatulence is a problem at the global scale. Buildings are only part of the solution.

Obviously, if you care about the problem of global warming and CO₂ production, you know that nature doesn't care for any of these accounting niceties. She cares only whether CO₂ concentrations in the atmosphere are increasing. That's where we have our work cut out for us.

In the United Kingdom, the Beddington Zero Energy Development (BedZED) was an early attempt to find out how to create a zero-net-energy development. BedZED is located in Wallington, Surrey, and represents an eighty-two-unit, multifamily residential mixed-use development with about 27,000 square feet of commercial space. Built on a brownfield site and completed in 2002, BedZED had a goal of no net carbon dioxide generation from energy production.

After 1 year of monitoring, the development had reduced energy use for space heating by 73 percent and for hot water by 44 percent, along with a 25 percent reduction in electricity use, compared with average new homes built in the United Kingdom in 2000.¹⁶

The chief advocate for this approach is architect Bill Dunster, who continues to evolve his thinking about what to do to get British lifestyles back down to a “one planet” level. Figure 9.4 shows the estimated energy use of a well-designed BedZED town, contrasted with the British average, showing 70 percent lower carbon emissions, from an average of 12 tons per capita to about 3.5 tons. The authors of this most recent study state, “The only way of living in a low-carbon future is to reduce our current demand by 80 percent and then micro-generate the remaining 20 percent with building-integrated renewable technologies.”¹⁷

The aim of the entire U.K. program is to show people how “Code 6” (zero-net-carbon) homes can be built. Figures 9.5 and 9.6 show production housing that represents Code 6 homes. In Figure 9.5 we see a building called “The Lighthouse” at Kingspan, located at the Innovation Park of the Building Research Establishment (BRE) in Watford, just outside London. According to the BRE, the timber-clad Kingspan Lighthouse has an elegant barnlike design derived from a 40° roof pitch that accommodates a PV array. The Kingspan Lighthouse has achieved Level 6 of the Code for Sustainable Homes. This means it is a zero-net-carbon home. It has a zero-carbon energy supply for space and water heating and all electrical power demand for the home, including electrical cooking and appliances.¹⁸

This superinsulated, airtight building fabric was designed to provide generous daylight levels and includes effective solar control. Integrated building services are based around a platform of renewable and sustainable technologies. These include water efficiency techniques, such as low-volume sanitary ware and appliances and wide-ranging renewable energy technologies.

The Code 6 home was built by Barratt, the United Kingdom’s largest homebuilder, and

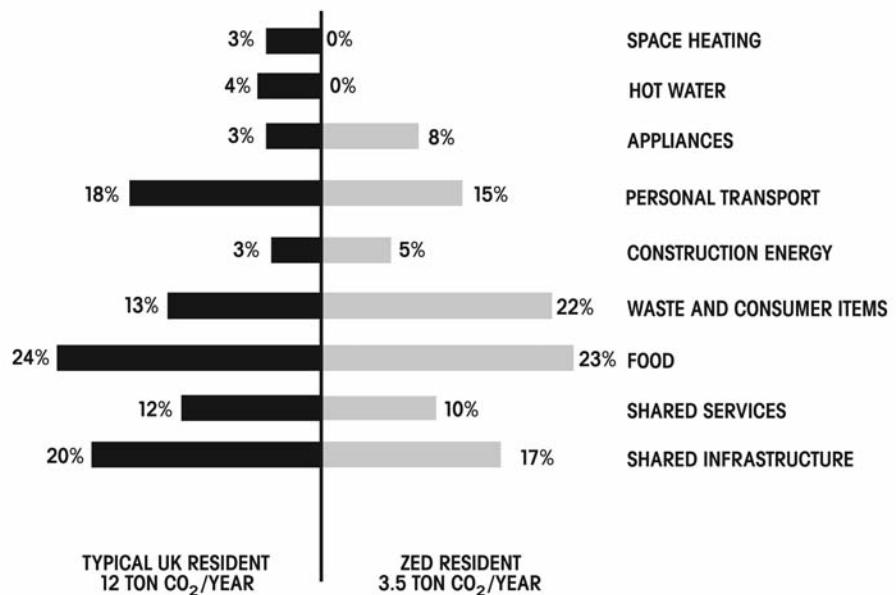


FIGURE 9.4 Bill Dunster Architects continues to push the envelope on zero-energy development; this chart compares the estimated energy use of a well-designed BedZED town with the British average, broken down by major life activities.



FIGURE 9.5 With a strong commitment to zero-carbon housing, the United Kingdom is pioneering stylish sustainable buildings such as this home, designed by Sheppard Robson.
(Sheppard Robson)

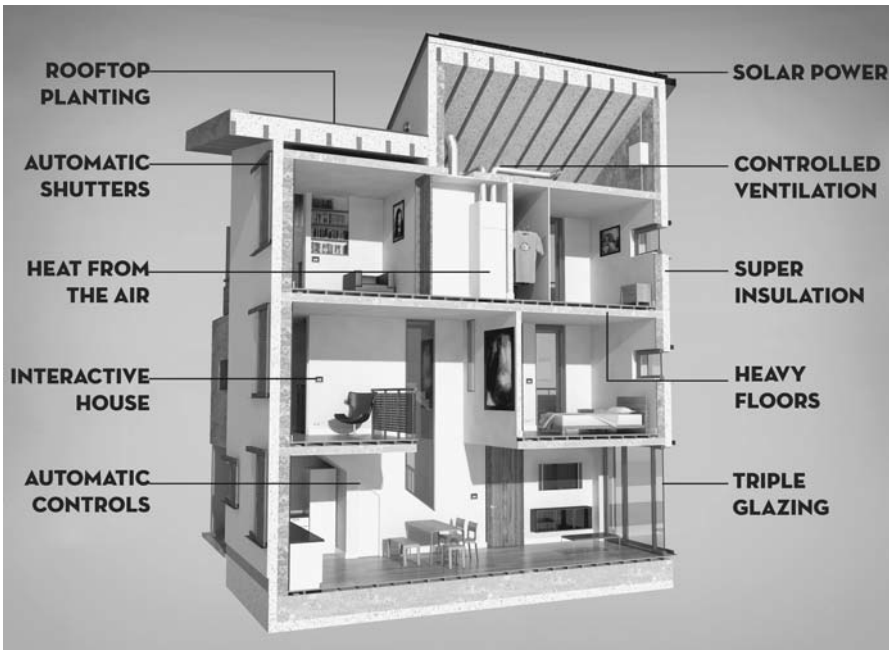


FIGURE 9.6 The Barratt Green House includes well-insulated walls and windows, along with efficient heat recovery ventilation.
(Barratt Developments)

Figure 9.6 shows the sustainable features incorporated into the design of the Barratt Green House. A big difference between the Lighthouse and the Barratt Green House is the heating solution. The Lighthouse has a wood pellet-fired biomass boiler, but Barratt shied away from this. Andrew Sutton, project architect, said, “We don’t believe biomass is a mass market solution. It’s unrealistic to expect householders to run wood pellet boilers, and there are issues of supply, which might work on a district scale but not for individual homes.”¹⁹

Instead, the team took a development-wide approach by assuming the Barratt Green House would be part of a bigger development and supplied by a district heating system. The home’s heating needs are supplied by an air source heat pump located on the outside of the home; the hot water pipes run into the house, just like those from a district heating scheme. The power for the heat pump comes from PV panels located remotely. A second array of PV panels is mounted on the roof of the home to power appliances within.

The home uses six sustainable strategies that will be familiar to anyone who followed the PassivHaus story in Chapter 1:

- Mechanical ventilation with heat recovery
- Triple glazing to keep heat in during the winter
- Exposed concrete floors to increase thermal mass for summer cooling
- Super insulation, with 7 inches of insulation over 8 inches of aircrete planks
- External shutters to block solar gain
- Thermal storage for water and space heating, supplied by an external air source heat pump.²⁰

A recent U.K. government report put the current extra cost of a Code 6 home between £19,000 (\$38,000) and £47,000 (\$94,000) per unit. The report commented that the lower costs would come from developments “where there is potential to use site-wide carbon-saving technologies (e.g., CHP systems),” typically sites with high numbers of housing units and greater densities.²¹ The report concluded that “the costs of achieving the specific energy standards required at Code level 6 are typically higher than those associated with achieving zero carbon status” because of the “cost associated with the additional thermal efficiency measures and the impact of the reduced heat demand on the carbon savings from CHP systems.” The bottom line is that the cost of trying to meet zero-net-energy standards with just on-site systems is unacceptably high. The report expected that by 2016, these costs would be reduced by 16 to 25 percent as builders acquired more experience with new systems.

SMART, SLIM BUILDINGS

Professor Jos Lichtenberg at Holland’s Technische Universiteit Eindhoven has proposed a system he calls Slimbouwen, or smart buildings, as the way to bring sustainable design into the affordable realm by using standardized or industrially manufactured components.²² Lichtenberg’s idea is that Slimbouwen is based on a skeleton structure and the separation of services (such as heating, ventilation, air conditioning, and plumbing) from the building structure. A crucial development for this approach is a floor system that enables the installers to mount their prepared and prefabricated

services practically as a whole. He believes that our current system of building has reached the end of its useful product life cycle.

In his view, one of the main ideas is to rearrange the building process from a parallel process into a serial process consisting of only a few main steps. He says, “The traditional building process, and especially the finishing process, can be characterized as a complicated process in which the participants carry out activities with a high rate of interdependency to other participants. The result is a lot of overlap, inefficiency, failure costs, complex coordination, lack of mutual respect, etc. Participants have to return on site several times since the proceeding is dependent of other participants. In fact this process is a kind of parallel process. By contrast, a sequential process containing only a few major sub-activities can only be obtained by a separation of services from the rest of the process.”

I find this idea intriguing and a useful antidote to all the wonderful but highly customized architecture featured in this book because a basic tenet of good sustainable design is to “build it in, don’t bolt it on,” meaning that building systems should be completely integrated with the building. This is supported by the idea of getting rid of most finishes and most services, integrating them with the building structure, or making sure they can come in via a factory-built system. I also think that design process has to be attacked to secure better results, a topic I explored at length in a recent book.²³

EUROPEAN GREEN DESIGN GOES EAST

In this book, we’ve been looking mainly at opportunities for European green design to go west, to North America. But it’s also going east (to Eastern Europe, Russia, the Arabian Peninsula, and China). I met in April 2008 with Guy Battle, head of the Battle McCarthy firm at his office in London.²⁴ Battle has been at green design for at least 15 years. Designed in cooperation with U.K.-based international architects RMJM, the Okhta Tower in St. Petersburg, Russia is one of their largest projects to be based on sustainable design principles. The seventy-nine-story Okhta Tower (Figure 9.7), the new headquarters for Russian energy giant Gazprom, would be the tallest building in Europe when completed, about one third taller than the Commerzbank in Frankfurt.

RMJM won the competition to design this building in late 2006, amid a lot of controversy over the size of the tower. RMJM claims the tower will be the world’s most sustainable building, consuming half the energy of an ordinary skyscraper, thanks to a “fur coat” of two double-glazed layers around the outside, with atrium spaces in between.²⁵

The 396-meter (1,307-foot), \$2.4-billion structure will have to battle winter temperatures of -30°C (-22°F), but in summer the outside air will only be about 25°C (77°F). To accomplish a low-energy design, the building will be encased in two giant glass-and-steel, sensor-lined envelopes, with plants and shrubs filling the buffer zones between them.²⁶ The plants are expected to provide natural thermal insulation in winter and a source of fresh air in summer to keep offices cool. Heavily sensed, the building will decide how to regulate its own climate, keeping offices at 21°C (70°F) in winter, with the buffer zone at 10°C (50°F) even when it’s -30°C outside.

With the double-skin building, energy use is reduced about 65 percent, according to engineer Guy Battle. The building also has rainwater recovery systems and building-integrated PVs.

FIGURE 9.7 Slated to be Europe's tallest building, RMJM's Okhta Tower in St. Petersburg, Russia deals with a very cold climate in imaginative ways.
(RMJM)



Battle calls his approach “decarbon-8” and has created a service mark called “Planet Positive” for his firm’s approach to design.

The pentagram design of the tower maximizes access to daylight and allows spectacular views for the internal offices without heat loss through exposed surfaces.

In the earlier stages of the design process, results showed that 1,200 different-sized glass panels were needed, meaning a greater construction cost and a heavy environmental burden. After much analysis, RMJM found a more environmentally friendly solution by creating seven standard panels, allowing repetition and a much smaller environmental impact.

The design allows a generous number of social spaces and green breakout zones spread out along the floors. These enable office workers to access leisure areas without wasting valuable time and energy commuting to ground level.

Construction begins in 2008, with completion expected in 2012. Tony Kettle, RMJM’s group design director, said of this project,

Most buildings take a limited approach to sustainability, picking a handful of issues to concentrate on which are often considered at the latter stages of the design or building process. With the Okhta Tower, we thought about sustainability issues right from the start and as such it has been totally integrated into the design, frame and structure. The Okhta Tower is a complex, innovative building but we feel we have got the design right—integrating social, economic and environmental aspects in harmony.²⁷

We began this exploration of European green building trends by noting some of the reasons why Europeans might be greener than we are, including culture, politics, economics, and climate. We then took a long look at the PassivHaus movement, the EPBD, and other trends that are driving European green building forward. Looking to the future, I think we will see the PassivHaus movement push into all the countries of northern and Western Europe within 5 years because it makes so much sense, both economically and environmentally. As the EPBD enters its second decade with real teeth, I think there will be a strong improvement in energy performance in new buildings and a growing importance of retrofitting or refurbishing older buildings to meet green building standards such as BREEAM, the French Haute Qualité Environnementale, and the German Gütesiegel. The likelihood that European green building improvements, designs, and installations will outpace those in the United States is still quite strong, and I think 5 years from now we will still have a lot to learn about green building and green development from our friendly colleagues and competitors across the pond.

