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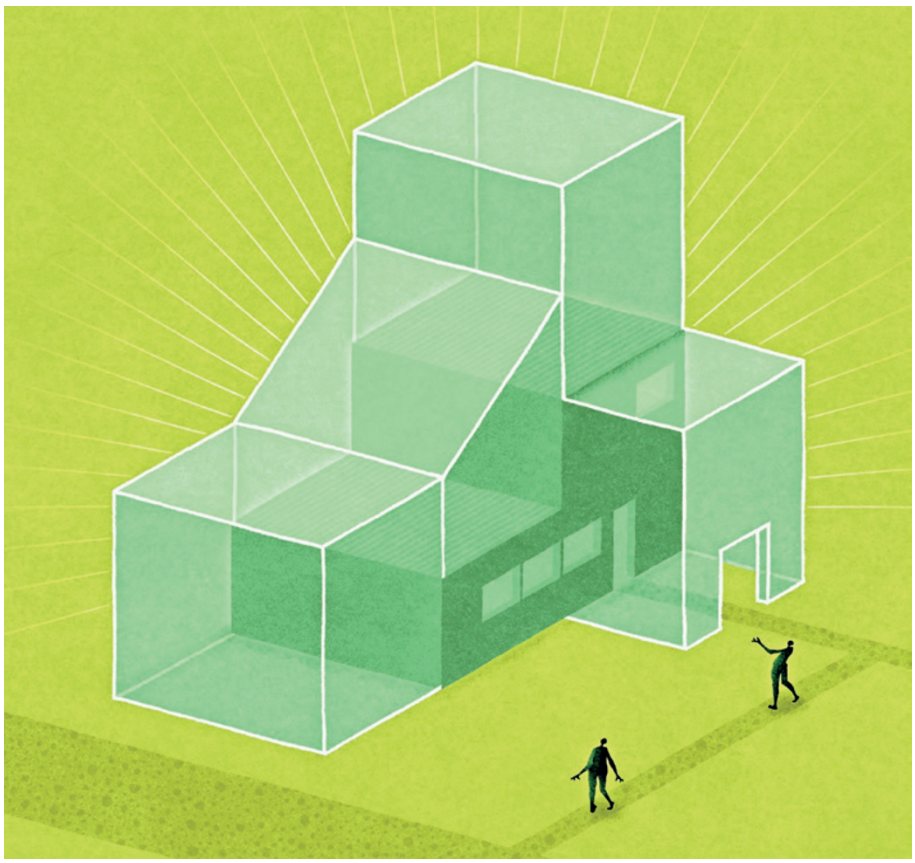

ENVIRONMENTAL TECHNOLOGY

Green light

The scientific design of low-energy sustainable buildings is moving into the mainstream.

BY BRYN NELSON

Before her 'aha' career moment, Yetunde Abdul studied cancer in labs in Berlin and in Ravenna, Italy. But ambivalent about a future stuck at the bench, she found a new direction while doing a master's degree in environmental technology at Imperial College in London.

There she created a set of criteria and a scoring index to assess the sustainability of buildings in urban areas, and learned of a UK-based international environmental rating system for buildings. The scheme, which certifies buildings that meet standards for environmentally friendly design, construction and operation, immediately piqued her interest.

Today, Abdul is involved in the economic and humanitarian aspects of 'green' building, and has never thought longingly of the lab. "As a career option, it's looking a lot better than it did when I started out," she says of the booming green-building field, in which she works as a principal consultant and project manager at the rating system's parent organization, the Building Research Establishment in Watford, UK. "It's a lot more buoyant."

Green construction, also called green or sustainable building, aims to reduce a structure's overall environmental impact by applying principles that govern features such as its location, size, design, construction, maintenance and energy needs. Those working in the field could, for example, be involved in assessing the sustainability of building materials, designing windows that maximize daylight or evaluating energy-use patterns or understanding how occupants might interact with redesigned homes, offices and schools. Green building also incorporates life-cycle analysis, which evaluates a building component's lifetime environmental impact on the basis of its manufacture, transport, installation and disposal or reuse.

In the United States and the European Union (EU), buildings account for 40% of all energy use, a level that has made them increasingly attractive targets for energy and emission-reduction goals and certification schemes that reward more-efficient structures. That heightened focus, in turn, has given young researchers ample new opportunities to land positions in non-profit organizations and industry aimed at greening new and existing buildings around the world. Graduate students and postdoctoral fellows are making the transition from disciplines as varied as biochemistry, toxicology, geography, physics and environmental engineering.

Although architectural training is not strictly required for most positions, a familiarity with sustainability and building science often is. More universities are offering courses in building science or building physics — areas that take a research-oriented and hands-on approach to the physical attributes of buildings. Portland State University in Oregon, for example, offers both undergraduate and graduate degrees in mechanical engineering or architecture with an emphasis on building science. Students who complete the programme have been very successful at finding jobs in the industry, says David Sailor, director of the university's Green Building Research Laboratory.

Volunteering with green-building-related non-profit organizations can also help early-career scientists to make connections and break into the field. But most experts in green building agree that internships and fellowships are often the most direct path to a position.

INTERNATIONAL OPPORTUNITIES

Job prospects vary by country, but most forecasts suggest strong growth internationally throughout the green-building sector. Business-management consultants Navigant Consulting in Chicago, Illinois, recently predicted that ▶

the European market for energy-efficient buildings, including products and services, would grow from €41.4 billion (US$47 billion) in 2014 to €80.8 billion in 2023. The US market has likewise seen a rapid growth in the adoption of green buildings that is widely expected to continue. China, with around 2 billion square metres of new construction every year, is the world's largest commercial building market and an increasingly attractive target for research programmes in green building. In 2009, the United States and China established the Clean Energy Research Center, and one aim of the centre's Building Energy Efficiency Consortium is to speed the research and development of energy-saving technologies by testing them in demonstration buildings throughout China.

In academia, US funding for green-building research has increased in recent years, with the money spread among multiple agencies such as the Department of Energy, the National Science Foundation and the Environmental Protection Agency.

In the EU, the €80-billion Horizon 2020 programme for research and innovation (covering the years 2014–20) includes green-building-related research in its Climate Action, Environment, Resource Efficiency and Raw Materials challenge and other programmes. Researchers say that this funding commitment has boosted the prospects for academics throughout the EU. "If you look at the research opportunities in the green-building field, job opportunities are good in all EU countries," says Michael Krause, group manager for building technologies at the Fraunhofer Institute for Building Physics in Kassel, Germany.

"Green buildings are good business."

Krause, who studied physics before moving from basic research in renewable energy to applied work on energy efficiency within the building sector, joined his institute colleagues in planning the energy-efficiency scheme for Munich's NuOffice I, one of the most lauded green buildings in the world. At the time of its 2013 certification, the office tower earned the highest score ever awarded for a building of its type by the Leadership in Energy and Environmental Design rating system for green buildings, which is recognized in more than 140 nations. It sports a rooftop solar array to produce much of its own energy, automated window shades to prevent overheating and a groundwater cooling system in lieu of an energy-hogging air conditioner. As part of the project, the Fraunhofer team calculated how to increase the building's efficiency through features such as a thick layer of insulation and triple-paned windows.

Energy-efficiency consulting is another growing employment opportunity for researchers. Last May, Sailor got a call from SBW Consulting in Bellevue, Washington, which helps home and business owners to measure energy and water efficiency and was looking to recruit people. He recommended Santiago Rodriguez, his lab manager and a specialist in development and maintenance of building instrumentation. Rodriguez, who had initially been drawn to the mathematics of thermal dynamics and fluid mechanics, had used his sensor-programming savvy to land a position in Sailor's lab. Among other projects there, he developed and deployed sensors to evaluate how a green roof atop a retail store interacted with the building's envelope — the physical barriers between its interior and exterior — and with its heating, ventilation and air-conditioning system.

After completing his master's degree in mechanical engineering, Rodriguez joined SBW in July 2014 as an energy-efficiency engineer. He now installs and maintains sophisticated sensors that help clients to reduce and track energy consumption. "I like evaluating energy models that other people have developed and building my own energy models," he says. "And the technical aspects of instrumentation I find fascinating."

But green building is not limited to technology and engineering. Abdul, the former cancer researcher, recently helped to create a tool that aids charities such as the International Federation of Red Cross and Red Crescent Societies to assess the sustainability of their reconstruction projects after natural disasters. As part of an education effort for professionals and volunteers in the humanitarian field, she went to the Philippines to teach volunteers and professionals to use the tool in reconstruction programmes in an area devastated by Typhoon Haiyan. Course participants said that the tool would help them to make more-informed decisions.

INDIRECT PATHS

Lindsay Baker, vice-president of business development at start-up company Building Robotics, based in Oakland, California, focuses on how people interact with the environment within green buildings. While majoring in environmental studies, she completed three internships that introduced her to the green-building field, and after completing her undergraduate degree, she helped to develop the LEED (Leadership in Energy and Environmental Design) rating system at the non-profit US Green Building Council in Washington DC.

Now a doctoral student in the building-science programme at the University of California, Berkeley, she is helping the company to promote a proprietary software system that plugs into a building's digital heating and cooling system and lets occupants act as sensors to fine-tune the indoor environment. Baker expects the start-up, which employs a dozen people, to add staff by the end of 2015.

Chris Pyke, vice-president of research at the US Green Building Council, says that the council finds some of its top job candidates through internships. The best ones, he says, are flexible, analytical, curious and able to multitask.

PORTLAND STATE UNIV.

David Sailor checks a weather station in a green-roof study on the Portland State University campus.

Pyke, who is also the chief operating officer for the Global Real Estate Sustainability Benchmark, which helps potential investors to compare the green attributes of global real-estate portfolios, originally honed his analytical expertise on a study of the effects of urbanization on a tropical forest. Although his past research might seem a world apart from his current role, he says that they use similar tools. "Whether you're looking at a bioclimatic analysis of a community of trees in the forest or a community of real-estate funds, mathematically they're not that different," he says.

His move into green building, with intervening stints at non-profit organizations, the US Environmental Protection Agency and a private consulting firm, has allowed him to direct his skills towards helping people make smarter decisions about the urban environment.

Ellen Quinn followed a similarly indirect route into the sector from mining geology. Now vice-president of environment, health and safety at UTC Building & Industrial Systems, part of United Technologies Corporation in Hartford, Connecticut, she focuses on proactive solutions to reducing the company's environmental footprint. Quinn monitors metrics that tally the energy, water, waste and efficiency of the company's factories and research and development centres. Every year, she says, her team sets environmental improvement targets for each building and develops a customized plan to track its progress. "Green buildings are good business," she says.

Increasingly, they also lead to a broad range of employment opportunities, says Jelena Srebric, a green-building expert and mechanical engineer at the University of Maryland in College Park. "You can come from an unprecedented number of fields in science, engineering or technology and make a contribution." ■

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