

Preface

On December 3, 2015, global representatives of the building construction industry convened the first ever “Buildings Action Day” as part of the Conference of the Parties United Nations Climate Change Conference, or “COP21.” This meeting was an open acknowledgement of the key role that buildings play both in the mounting impacts of climate change, but more important, in developing real strategies to stall, halt, and even reverse global warming. There were 70 signatories to a joint statement produced during the meeting, which included the creation of the Global Alliance for Buildings and Construction. One of the key conclusions was to invite all stakeholders along the “value chain” of construction to commit to solid actions within their spheres, be they governmental, institutional, commercial, academic or residential sectors. One of these “greater actions” is a call by the Alliance to “work together to develop comprehensive action plans across the entire buildings value chain, including focus on workforce development, skills and training, support for technology transfer, and capacity building.”¹

We believe this book is a beginning resource that will provide students with a vital tool with which to engage in this particular action plan. It will also assist in understanding the interlocking layers of sustainable building design. In design and construction, layering technologies onto a building only gets us part of the way towards high performance buildings that have low environmental impact and that provide healthy spaces for occupants. The practice of integrated building design enables us to

reach further. For that, designers, builders, managers, and users need to be well versed in sustainable building issues and technologies in order to assimilate them into standard practice. The information in this book provides ways to begin doing so.

Four main topic areas transect the contents of this book: (1) the historic arc of environmentalism, green buildings ratings, certifications and policy, (2) indoor chemical pollutants and occupant health and comfort, (3) resource conservation and materials efficiency, and (4) building energy use and technologies for low-energy building design. This edition has two new chapters on energy modeling and metering and net-zero energy buildings, as well as a new chapter on climate change, health and building resilience and an expanded chapter on industrial chemistry of building materials. Because of the nature of the subject matter demands it, we treat these topics so that they are interspersed through the book.

This book is written by practitioners. It is the result of research done for real projects, with experience gained in the field. Rather than providing descriptions on a few selected strategies, we bring you essentials on what matters most in the hierarchy of sustainable design. For that which we can cover as introductory material, we suggest resources and exercises for additional study. As you read and study, you will conclude that among the numerous environmental issues that sustainable design responds to, climate change impacts are among the most prominent. Impacts are being felt that make the need for solutions urgent and a certain degree of activism is required in order to change the course. Paul Hawken postulates that we can and should harnesses this action to find

¹United Nations Environment Programme, Buildings Day at COP21, Take Action, <http://web.unep.org/climatechange/buildingsday/take-action>.

"impactful, substantive solutions" to climate change and create what is known as drawdown. Drawdown, as described by Hawken, is "the point at which greenhouse gases in the atmosphere begin to decline on a year-to-year basis."² The technical, social and ecological solutions that Hawken and his organization have brainstormed embrace issues such as land management, agriculture, reforestation, but many have direct relationships with building design and urban planning. As of press time, these newer cutting-edge solutions to integrated design tracks are also being discussed by colleagues Janine Benyus of Biomimicry 3.8, sustainable design leaders at Google, healthcare expert Gail Vittori and sustainable structural design engineer, Frances Yang of Arup. A great deal of overlap lies in their focus on "low-carbon construction." We are called on to:

- a. Reduce the embodied energy of building materials, create materials whose characteristics warrant a low-carbon product designation.
- b. Shift the design and construction of buildings into part of a circular economy, "made to be made again."³ Specify materials with local, minimal processing and which can be easily recycled, deconstructed and reused.
- c. Use optimized structural design and look for materials and building components that perform more than

one function, e.g., integrate light and thermal management into trusses. Employ materials efficiency: use less.⁴

Finally, this book is about science. For green buildings, science includes natural science, building science, material science, climate science, social science, and health science. The understanding of thermal comfort and its relationship with mechanical cooling systems can be engineering heavy. Understanding industrial chemicals and their impacts to human health is a complex field of study unto itself. Our goal is to make the science accessible and easy assimilated so that it can in turn be presented to an integrated design team. The issues and approaches presented in this book will evolve, as any science does; so will technologies and the policy landscape. However, some things simply make sense. The basics of sustainability will remain intact: turn equipment off when you don't use it; don't waste resources, and; never assume, ask.

Through the chapters of this book, with the variety of issues, technologies and design solutions we discuss, we hope can convey these basics so that they become a default part of your approach to design, construction and operation.

We invite you to use this book as a guide as you begin your journey of sustainable buildings.

²Project Drawdown, www.drawdown.org.

³Ellen McArthur Foundation, www.ellenmacarthurfoundation.org.

⁴Frances Yang, Presentation "Embodied Carbon: Material Optimization by Design," Session: "Reducing Embodied Carbon in Buildings and Materials," BuildWell 2016 Conference, February 12, 2016, San Francisco.