Green Construction

An introduction to a changing industry

Alison Dykstra

See http://www.KirshnerBooks.com

Also by the Author

Construction Project Management: A Complete Introduction
LEED Certification: An Introduction to Certifying a Green Building

Library of Congress Control Number: 2015960690

Printed in the United States of America 10 9 8 7 6 5 4 3 2 1

ISBN: 978-0-9827034-2-7

Cover design and cover photograph by Andrea Young Arts, Berkeley CA
Interior design by Lauren Woodrow Design, Chicago IL

Kirshner Publishing Company
Production Offices:
PO Box 14132
Santa Rosa, CA 95404
Editorial Offices:
San Francisco, CA
www.kirshnerbooks.com
www.kirshnerpublishing.com

Appendix B

Our Power: Where Does It Come from and How Is It Used?

How we get our power

Fossil fuels (oil, natural gas, and coal) plus a relatively small amount from nuclear and renewable energy sources currently provide the power our buildings require, primarily for heating, cooling, and lighting.[1] Despite recent improvements in building and equipment efficiencies, overall power consumption in the building sector is growing. This is due to several factors, including the fact that an increase in the population requires more buildings to accommodate its needs. The size of our structures is also growing; houses, for example, have doubled in size since 1950.[2] Buildings are also filled with an increasing number of gadgets that get plugged in, such as computers and other electronics, refrigerators, microwaves, air conditioners, and even toothbrushes.

It's not an exaggeration to say that "cheap energy" keeps us afloat economically. But our addiction to relatively inexpensive power costs a lot: Americans pay over $1 *trillion* every year just on the direct *consumption* of energy.[3] And this doesn't take into account the multiple other costs associated with the use of fossil fuels. (As noted in Chapter 10, energy and power are not the same. The terms, however, are often used interchangeably and I will do so in this appendix.)

Low-cost power available at the flip of a switch, endless quantities of cheap consumer goods, limitless fresh water inside every home—the goodies we've come to rely on and expect—and the society they help define is a relatively new phenomenon. Our ancestors, and today almost half the world's population, derived their power primarily from wood, sun, water, animal waste, and human toil. Fossil fuel changed everything and is now continuously mined, refined, and delivered by the world's biggest corporations to every corner of the globe. This offers some of us astounding options regarding how and where we spend our time, where we live, what we do.

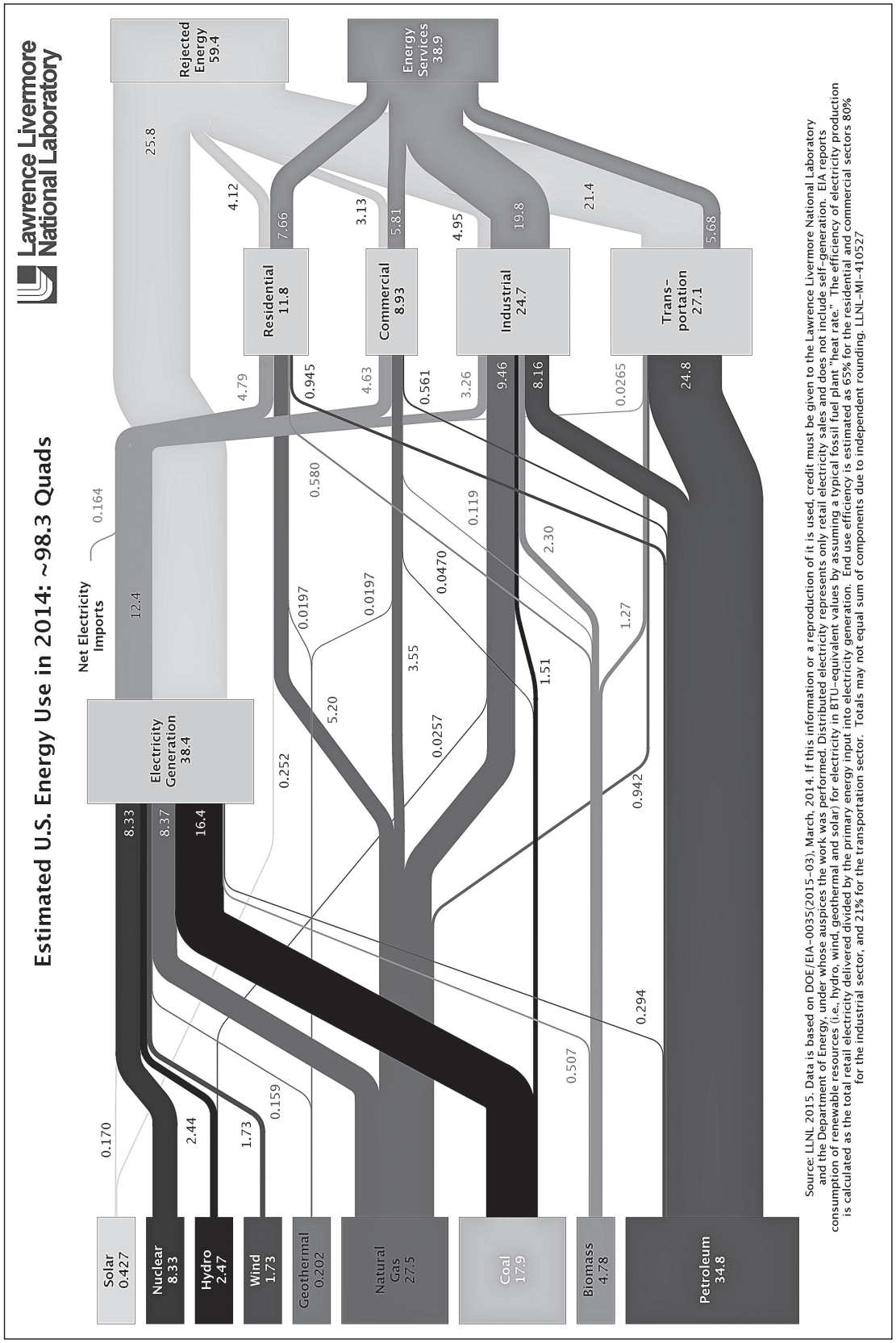
Energy flow charts

Where does all this power come from? The Lawrence Livermore National Laboratory at the University of California is a national research center that, among other things, works on issues around the production, development and deployment of energy resources and technologies. Every year, it publishes an energy flow chart that shows the sources of energy production, how the energy is used, and how much of it is wasted. At right is the 2014 Chart. (To see the chart in full color, go to *https://flowcharts.llnl.gov*)

As noted in the title of the chart, in 2014, total energy use in the United States was 98.3 Quads. (1 Quad equals a quadrillion BTUs and is equivalent to about 172 million barrels of oil.[4]) Along the left vertical axis of the chart are energy sources and the amount of energy each contributes to the total, starting with solar, at .427 Quads. Petroleum is the last entry on the list, and at 34.8 Quads, provides almost 35% of our energy.

The flow chart identifies other interesting data, including:

- Almost 40% of the energy we use is in the form of electricity. Electricity is a secondary form of energy, which means it is generated by conversion of primary sources of energy such as coal, natural gas, and wind. The flow chart shows the relatively modest contribution of renewable energy sources toward the generation of electric power.
- The chart details how many Quads are used in each of the residential, commercial, industrial, and transportation sectors. The commercial



Lawrence Livermore National Laboratory/U.S. Department of Energy

sector consumes the least energy (8.93 Quads), and the transportation sector the most (27.1 Quads).

- The 98.3 Quads of energy used in 2014 includes both energy consumed and energy wasted (called rejected energy). On the upper right side of the chart, the reader can see that waste equals 59.4 Quads, or almost 40% of the total energy used in the United States. Electricity is the biggest culprit and almost 70% of the electricity that is converted from other forms of energy is lost as waste, due primarily to inefficiencies in production and distribution systems. According to the Environmental Protection Agency, fossil-fuel-based electric power plants in the United States are only about 33% efficient, and "two-thirds of the energy in the fuel is lost—vented as heat."[5]

A great idea—body heat as an energy source

As we go about our lives—sitting, walking, exercising, sleeping—each of us gives off energy in the form of heat. One may ask, "Why waste it?" In Paris, architects designed a system that captures the heat generated by subway commuters and uses it to radiantly heat 17 nearby apartments. A similar project in Stockholm's Central Rail Station harnesses the heat from 250,000 daily commuters. The station's ventilation system captures the body heat, which it uses to heat water in underground tanks. From there, the hot water is pumped to the heating pipes of a nearby office building, saving it 25% on its annual energy costs.[6]