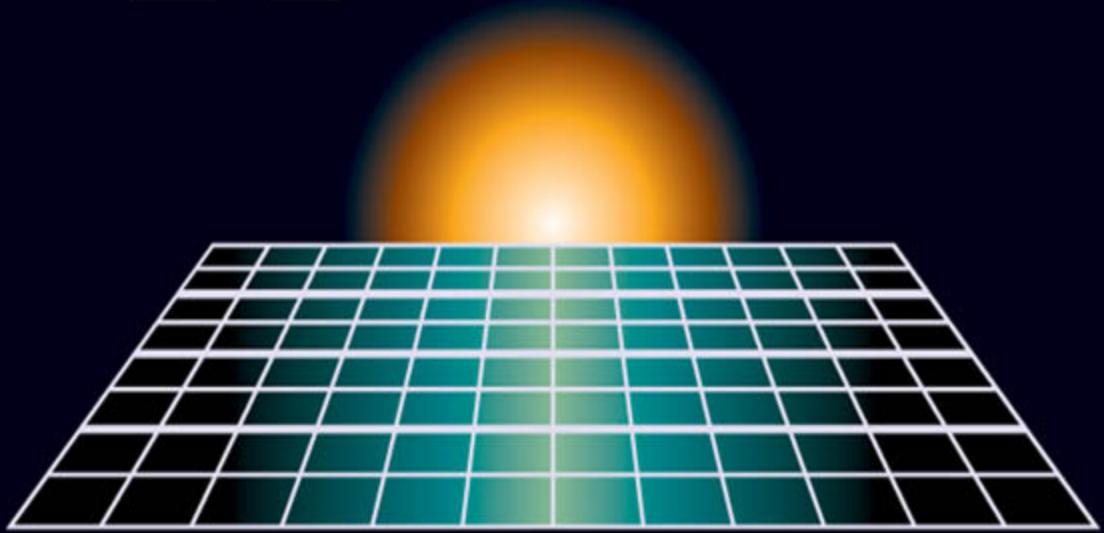


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# SOLAR ENERGY PROJECTS FOR THE EVIL GENIUS 50 BUILD-IT-YOURSELF PROJECTS



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GAVIN D. J. HARPER

FOREWORD BY WILLIE NELSON



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# Solar Energy Projects for the Evil Genius



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To the late Mr. P. Kaufman  
who never failed to make science exciting

## About the Author



Gavin Harper is a sustainable technology advocate and popular author of how-to books. His other publications include *50 Awesome Auto Projects for the Evil Genius*, *Model*

*Rocket Projects for the Evil Genius*, and *Build Your Own Car PC*, all for McGraw-Hill ... and if you enjoyed the chapter on fuel cells, his forthcoming book *Fuel Cell Projects for the Evil Genius* will hit the shelves later this year. Gavin has had work published in the journal *Science* and

has written for a number of magazines and online weblogs. His family continue to be bemused by his various creations, gadgets, and items of junk, which are steadily accumulating. He holds a BSc. (Hons) Technology with the Open University, and has completed an MSc. Architecture: Advanced Environmental & Energy Studies with UeL/CAT. He is currently studying towards a BEng. (Hons) Engineering with the Open University, and filling in spare time with some postgraduate study at the Centre for Renewable Energy Systems Technology at Loughborough University. He is rarely bored. Gavin lives in Essex, United Kingdom.



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# Foreword

Gavin Harper's book *Solar Energy Projects for the Evil Genius* is a "must read" for every sentient human on this planet with a conscience, a belief in the bottom line, or a simple belief in the future of humanity.

At a time when such a book should be offered as suggested reading for the 19-year-old Gavin Harper, he's bucking the trend by actually being the author. Okay, so he's written a book on solar energy you say, big deal you say. You would be wrong. Not only is this Gavin's fourth book, it is nothing short of pure genius.

To be able to write about solar energy is one thing. But to possess the ability to put the knowledge of

solar energy into layman's terms, while including examples of do-it-yourself projects which make the practical applications obvious, gives this boy genius the "street cred" (industry savvy) he so very much deserves.

This is a "how-to" book, which debunks the myth that "these things are decades away," and, without exception, should be in every classroom under the same sun.

So crack this book, turn on your solar light, and sit back for a ride into our "present"... as in "gift" from God.

**Willie Nelson**

# Acknowledgments

There are always a lot of thank-yous to be said with any book, and this one is no exception. There are a lot of people that I would like to thank immensely for material, inspiration, ideas, and help—all of which have fed in to make this book what it is.

First of all, a tremendous thank-you to the staff and students of the MSc. Architecture: Advanced Environmental & Energy Studies course at the Centre for Alternative Technology, U.K. I never cease to be amazed by the enthusiasm, passion, and excitement members of the course exude.

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Also a big thank-you to Ben Robinson and the guys at Dulas Ltd. for their help in procuring images, and for setting a great example by showing how companies can be sustainable and ethical.

I'd also like to thank Hubert Stierhof for sharing his ideas about solar Stirling engines, and Jamil Shariff for his advice on Stirling engines and for continuing to be inspirational.

Thanks also to Tim Godwin and Oliver Sylvester-Bradley at SolarCentury, and to Andrew Harris at Schuco for sharing with me some of their solar installations.

An immense thank-you to Dave and Cheryl Hrynkiw and Rebecca Bouwseman at Solarbotics for sharing their insight on little solar-powered critters, and for providing the coupon in the back of the book so that you can enjoy some of their merchandise for a little less.

A massive thank-you to Kay Larson, Quinn Larson, Matt Flood, and Jason Burch at Fuelcellstore.com for helping me find my way with fuel cells, and for being inspirational and letting me experiment with their equipment. It would also be wrong not to mention H<sub>2</sub> the cat, who was terrific company throughout the process of learning about fuel cells.

Also, many thanks to Annie Nelson, and Bob and Kelly King of Pacific Biodiesel for providing me with some amazing opportunities to learn about biodiesel.

Thanks to Michael Welch at *Home Power* magazine, and also to Jaroslav Vanek, Mark “Moth” Green, and Steven Vanek, the designers of the fantastic solar ice-maker featured in Chapter 5. Their solar-powered ice-maker has already proven its immense worth in the developing world ... and if you guys at home start building them at home and switching off your air-con and freezers, they stand to be a big hit in the developed world as well.

A big thank-you to my grandfather, who has seen the mess upstairs and manages to tolerate it, to my grandmother who hears about the mess upstairs and does not realize its magnitude, and to Ella who does a good job of keeping the mess within sensible limits—and knows when to keep quiet about it. Thanks are also long overdue to my dad, who is always immensely helpful in providing practical advice when it comes to how to build things, and to my mum who manages to keep life going when I have got my head in a laptop.

A huge thank-you to Judy Bass, my fantastic editor in New York who has been great throughout the trials and tribulations of bringing this book to print, and to the tremendous Andy Baxter (and the rest of his team at Keyword) who has managed to stay cool as a cucumber and provide constant reassurance throughout the editing process.

# Chapter 1

## Why Solar?

### Our energy

In everyday life, we consume a tremendous amount of energy. Our lives are styled around consumption—consumption of natural resources and consumption of energy.

Figure 1-1 dramatically illustrates where all of this energy goes.

These figures are for a U.K. lifestyle, but we can take this as being representative for people who live in the “developed world.”

The bulk of our energy consumption goes on space heating—58%—this is something that can easily be provided for with passive solar design.

Next is water heating, which requires 24% of the energy which we use—again, we will see in this book how we can easily heat water with solar energy.

So already we have seen that we can meet 82% of our energy needs with solar technologies!

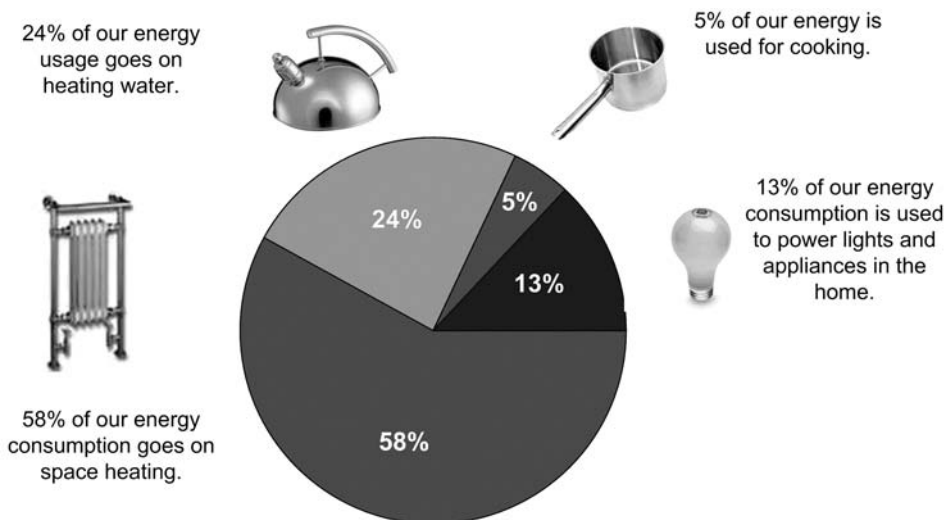
The next 13% of our energy is used to provide electrical power for our lights and home. In Chapter 10 on solar photovoltaics, we will see how we can produce clean electricity from solar energy with no carbon emissions.

The remaining 5% is all used for cooking—again we will see in this book how easy it is to cook with the power of the sun!

So we have seen that all of our energy needs *can* be met with solar technologies.

### Why solar?

The short answer to this question, albeit not the most compelling is “Why not solar?”



Above is how UK household energy consumption can be split up into different uses.

Figure 1-1 Domestic energy use. Information extracted from DTI publication “Energy Consumption in the United Kingdom.” You can download this information from [www.dti.gov.uk](http://www.dti.gov.uk).