Preface

Modern society needs reliable electricity at an affordable cost.

I am in my sixties now and I have enjoyed reliable electricity for most of my life. Sure, there was the occasional brown-out or black-out, particularly in my youth. They were kind of fun. We could light candles or sit by the light of the open fire when the power went off. They were no fun for commerce and industry that had to close their doors. No fun for their workers who could not work and were sent home.

If you live in a western city today, you hardly ever see an interruption to your power supply. I would like to see it stay that way.

As a child, I never wondered where the power came from that worked the lights, the refrigerator, and the radio. When you flicked the switch it was just always there.

I am sure there are many people today who still do not know where their electricity comes from. They have not needed to know. It is just there!

Well, I hate to worry you, but that may be about to change.

All my life, nearly all my electricity has come from burning coal. That would be true for many of us all over the world. It is the cheapest source of electricity. Problem is, burning this coal produces air pollution and greenhouse gases (GHG) like carbon dioxide which is causing changes to the climate. Stop burning this coal and you stop producing the carbon dioxide but the lights go out unless you make the electricity some other way.

How easy is it to change the way we make electricity? Will we still have power to our homes and workplaces whenever we want it? Will we still be able to afford to pay the electricity bill? Well maybe, but maybe not—depending on how we finish up making the electricity. These are the questions we will explore in this book.

Low-carbon and affordable electricity are going to be key planks of any politician's agenda over the next few years. Renewable energy sources are widely seen as a key part of replacing dirty coal. We already have a pledge from the US President for 10% of their electricity to come from renewable sources by 2012, and

25% by 2025. The European Union (EU) has a target of 20% by 2020 as do China and my home country, Australia.

Decarbonizing electricity is going to happen, eventually, but which solutions make sense today and which do not?

One of the most significant barriers to replacing coal with most renewable energy sources is that renewable energy is relatively dilute and variable in supply. It took immense pressure over millions of years to create those energy-rich fossil fuels like coal from plant matter. Extracting the equivalent energy from "new" energy sources is proving to be difficult and expensive.

Renewable energy is becoming a bit like a religion with its own high priests who usually head up renewable energy companies or conservation organizations. Renewable energy is seen by some as *the* solution to replacing dirty coal and delivering low-carbon electricity. The savior from the ravages of climate change. Along with religion often comes zealotry claims supported by misinformation.

Many still see the problem as more political than technical. "We just need to fix government policy decisions", they say, blaming the coal, oil, and nuclear power lobby groups while ignoring the significant limitations of current generation renewable energy solutions. Not the least of which is cost.

Both sides of the debate (traditional sources vs. renewables) are at fault—each by over-stating their own case. The aim of this book is to inject some realism into the debate about making our electricity low-carbon while keeping the lights on and the electricity bills manageable.

Looking to a future where computers and other electric appliances dominate nearly every aspect of economic life, electricity is likely to be even more essential. Even with transport, where oil has enjoyed a near monopoly for over a century, electricity is making tentative inroads with electric cars and improved batteries. The future is electric.

We cannot indefinitely keep using up the Earth's stored energy resources like coal and oil faster than the Earth can replace them. Eventually they will run out and there will be no more concentrated stored energy left. Sustainable energy is a must. The real question is: how quickly can we transition from the stored energy sources of coal, oil, and gas to truly sustainable energy resources? And what resources are sustainable anyway?

Fission is the richest source of energy readily available on the Earth today. Natural radioactive decay takes place deep in the earth producing hot aquifers that we use to produce electricity and heat buildings in some places. But this natural radioactive decay only supplies a small fraction of the energy we need.

For over 50 years, man-made fission energy has made a significant contribution to meeting our electricity needs. It has turned out to be the safest and cleanest way to produce vast quantities of cheap electricity. Much safer than coal, gas, oil, or renewable hydro and even safer than many of the other renewable sources. Much cleaner than coal, gas, and oil, producing no carbon dioxide in operation. Fission can also be made to be sustainable, unlike fossil fuel stored energy sources. So why do we not just use more man-made fission energy? Unfortunately, there are influential lobby groups who do not see it this way.

Let us come clean right up front. Fission energy is just another name for nuclear energy. So why rename it? For many, nuclear power has bad vibes. Some will go to any lengths to stop its use. Nuclear power reminds them of nuclear bombs and nuclear wars. Nuclear bombs mean millions of innocent people dying from radiation sickness. Some think that because nuclear energy involves radiation so nuclear energy must be dangerous too. This is not so. The time has come to decouple this (often unconscious) association; hence the name change. Call it marketing spin if you like.

Man-made fission energy is the best option to address climate change. Not only is it the best option—it is the *only* option if we are to avoid expensive changes that disrupt our electricity supply. Fission is clean, green, and affordable.

All bold statements you might think, so they need to be defended. For those that doubt this can all be true, it is fine to be sceptical. Why not check these statements again after you have finished reading this book? If I have done my job properly, you should be nodding your head next time around.

I have titled this book *The Power Makers' Challenge* so I had better tell you who the Power Makers are. These are the people we trust to build, run, and control our electricity system and ensure the electricity gets safely and reliably to our homes and workplaces—the generator operators, the system operators and the network operators. For many years in most countries the Power Makers all worked for governments. Now many work for private businesses but the governments maintain a regulatory role—as they should; electricity is an essential service that we mess with at our peril.

The challenge facing our Power Makers is reliable, clean electricity. With over 65% of our electricity currently coming from fossil fuels (coal, gas, and oil) that produce 44% of the world's greenhouse gas emissions, this is no small challenge.

The Power Makers have no choice but to either clean up the fossil fuel power plants or replace them. As we will see in the book, they will probably do a bit of both. Neither is straightforward. Both are likely to be more expensive. And some of the replacement solutions are much better than others.

The Power Makers face this challenge at a time of ever increasing demand for electricity. The continuously rising world population; the moves by third and second world countries to become first world countries; the unsustainable reliance on oil for transport all guarantee a greater need for electricity everywhere for the foreseeable future.

This means alternative fuels need to reliably replace the fossil fuels and be sufficiently scalable to meet this future demand.

As we work through this challenge, we will see that many of the popular alternatives proposed are either not up to the task or will be so expensive when deployed on the scale needed that they will prove to be unattractive replacements. Hopefully, we can dismiss some of the popular myths about alternative energy sources for generating electricity as well as some of the popular myths about fission energy.

I have structured the book into five parts:

Part I Explains what electricity is and how we make it.

Part II Looks at the pluses and minuses of renewable energy technologies.

Part III Does the same for clean coal technologies.

Part IV Covers fission energy, how it works and answers the tricky questions.

Part V Looks at the likely future of electricity production.

There are a number of technical appendices and literature references for further reading for those who want a more in-depth understanding of the technologies. It is not necessary to read these to understand the book but they provide some useful reference material for those that have an interest. They might also answer many of those nagging questions you may have about the material.

Martin Nicholson