

Energy Policy by the Numbers
by Russ Mitchell

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A Cambridge scientist says it will take better arithmetic and less passion to replace fossil fuels by 2050.

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There is more than enough analysis and positing these days about energy costs and policies, the impact of global warming, cap and trade, sustainability, alternative sources, and the like. But most of this posturing, says Cambridge physicist David MacKay, is merely “hot air.”

Fed up with the cacophony, MacKay assembled a rational, non-political, “pro-arithmetic” analysis of what can be done to wean energy users (businesses and individuals) away from fossil fuels by the year 2050 — an ambitious goal he strongly believes is technically feasible. The book, *Sustainable Energy — Without the Hot Air* (UIT Cambridge, 2009), is available in bound form or as a free PDF download and is endorsed by such disparate players as Royal Dutch Shell and Friends of Earth. It is rapidly becoming essential reading for anyone serious about crafting reasonable energy policies.

MacKay’s idea is simple: To realistically examine energy policy alternatives, passion and hyperbole must be eliminated. Instead, only the numbers need add up for rational trade-offs between different forms of energy and conservation to be made. For example, if every inch of the United Kingdom were covered with wind farms, fossil fuel consumption would fall radically, he writes. But that’s not possible. How about 10 percent of the country, adding up to an area the size of Wales? That’s

aggressive, McKay says, but doable. The problem is, such a project would contribute only about 16 percent of daily average energy use across the U.K.; in other words, a long way from solving the problem.

In similar fashion, MacKay explores the limits of each form of alternative energy — how many rooftops could be covered with solar panels and what could they produce; how many wells could be dug to draw out geothermal energy and how much energy they could generate. Then he stacks the answers up in a bar chart placed alongside another bar chart that shows energy consumption at current levels. The conclusion: Plenty of sustainable energy is available to replace fossil fuels without a major change in lifestyles. Recently, MacKay spoke to *strategy+business* about his novel ideas and the political, economic, and social will it would take to implement them.

S+B: What do you mean by hot air?

MacKay: Hot air is the twaddle that many companies, campaigners, politicians, and journalists emit when they are discussing how to solve our energy problems. Insignificant gestures are dressed up as “green initiatives,” as if they’re going to make a big difference. The latest example of that was in a recent newspaper article about a supermarket in England that is installing speed

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bumps to convert the motion from customers' cars into energy; that's supposed to power all of the checkout tills in the store. I did a calculation of how much energy you could plausibly get from an arriving car and it amounts to 1/4,000 of the energy used during the car's trip to and from the supermarket, assuming it's three miles [4.8 kilometers] to the supermarket and three miles back. This is just a tiny, tiny amount.

S+B: But doesn't every little bit help?

MacKay: Not really. Say you're trying to raise money for a hurricane victim and a million people each give one dollar. You would end up with \$1 million for the one victim — so yes, in that case, all these little contributions add up to a lot. Not so with energy. The difference is that we all use energy; if everyone does a little and saves 1/4,000 of his or her energy use by driving to a green supermarket, it adds up to 1/4,000 across the board. You can multiply it up and make it sound big by saying 300 million people are doing it, but still all we've saved is 1/4,000 of the energy consumption.

What the climate scientists are advocating, and what we should do to ensure the security of the global energy supply, is creating new forms of energy that replace not 1/4,000 of the total, but more like 10 percent or 50 percent or 100 percent. Those are numbers worth talking about. Everyone doing a little isn't going to help. We need to make big changes.

S+B: But these green marketing initiatives work in attracting customers, right?

MacKay: They work because people don't use numbers to examine what is being proposed. My mission is to help people be more numerate, so that when, say, a new

wind farm is announced, people understand how much land needs to be used and how much energy it adds up to. I really want us to end up with a plan that adds up. It is a good idea to get off fossil fuels. And if we can become more numerate, then maybe we can have more constructive conversations, instead of all these emotional arguments that we have at the moment, with the anti-wind people against the pro-wind people, the anti-nuclear people against the pro-nuclear people.

S+B: What should business leaders do to better facilitate this discussion?

MacKay: The ones who are participating in the "green-washing" and emitting the hot air, it would be nice if they stopped doing that. We need to engage the public in constructive consensus building. At the moment all the conversations are polarized and mistrustful. What I advocate is that each country produce a road map, based on the consensus of, say, a group of 60 business leaders, engineers, and political leaders, for what actually adds up, what actually can be accomplished, respecting the laws of physics, the laws of economics, and the financial and political reality.

Targets for cutting greenhouse gases by 17 percent by 2020 [the Obama plan] or 100 percent by 2050 are too vague. We need to visualize in more detail the scale that is required to meet these challenges. If the goal of these road maps is to emit zero carbon by 2050, how do we get there? It is technically possible by then to stop using fossil fuels. Among the technologies that could make the biggest contributions, the most significant are energy-saving technologies, wind power, solar power, so-called clean coal (as yet an unproven technology, by the way), and nuclear power. The scale of building

required is far bigger than most people realize. For the U.S., to get half of today's total energy consumption from wind, solar, and nuclear, we need wind farms with an area equal to the size of California, solar panels covering an area greater than all existing buildings, and a fivefold increase in nuclear power. Once people understand the scale of the energy challenge they'll realize they can't say no to anything; indeed, they have to say yes to pretty much every form of alternative energy.

We've got 40 years left; we have time to create a world free of fossil fuels by 2050 if we start now. There's time to build lots of green stuff, such as nuclear power stations and electric cars, and to insulate a lot of buildings — all in a way that adds up to real reductions in fossil fuel use.

S+B: How much hot air is coming from the Obama administration and the new Secretary of Energy, Steven Chu?

MacKay: I think Steve Chu is wonderful, but I'm a bit distressed by how he is being forced to tread softly. It sounds like the Obama administration is being very cautious, by pushing very modest reductions in greenhouse gases. Maybe Obama's right. Maybe being tentative is the only way for the administration to achieve its ultimate goal of greenhouse gas reduction, given its slender majority.

S+B: Is taking the emotion and political or activist posturing out of the equation realistic?

MacKay: The first few times that I gave talks about energy, I encountered very emotional reactions. I'd say something like, "We've got to commute shorter distances, people have to live closer to where they work," and people would respond, "How dare you suggest that I should live somewhere else."

So I changed my attitude to "Look, you figure it out." That became the title of my book for awhile, *You Figure It Out*. Now I say, here are the numbers. If you reduce speed limits, then you would save this much energy; here's a map showing that if you covered this much land with wind farms, this is how much energy you get; here's another map with lots of nuclear power stations on it, this is how many you'd need to get free of fossil fuels — you'd need a 10-fold increase over today's number of nuclear power stations; and if you don't like that, here's the exchange rate, 2,000 wind turbines for one nuclear power station. Take your pick — do what you want to do — as long as it adds up.

I'm trying to be the numbers guy. I'm not telling

people what to do. I'm not recommending anything; I just offer you the facts. I'm not pro or anti any particular form of energy. I'm pro-arithmetic. I'm hoping that once people actually see the numbers, what we need to do will become self-evident. +

Resources

David J.C. MacKay, *Sustainable Energy — Without the Hot Air* (UIT Cambridge, 2009): An examination of the fiction and truth about a carbon-free future. www.withouthotair.com/

Business Roundtable Web site: A site for corporate leaders on energy policy. www.businessroundtable.org/initiatives/growth

International Energy Agency Web site: An essential source for global energy statistics. www.iea.org/Textbase/stats/index.asp

Sustainable Energy — Without the Hot Air Web site: David J.C. MacKay's sustainable energy blog. <http://withouthotair.blogspot.com/>

Sustainable Energy — Without the Hot Air Wiki: An open-source wiki based on the book. www.inference.phy.cam.ac.uk/wiki/sustainable/en/index.php/Main_Page

U.S. Department of Energy Web site: Official data about energy use, trends, breakthroughs, and concerns. www.energy.gov/

WattzOn Web site: Among other things, a tool to quantify, track, compare, and understand your energy consumption. www.wattzon.com/

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