

# Energy in a Changing Climate

## Is Renewable Energy looking like a new religion?

Firstly, what does renewable energy (RE) actually mean? [Wikipedia](#) says renewable energy refers to the provision of energy via renewable resources which are naturally replenished as fast as being used. RE resources include sunlight, wind, biomass, rain, tides, waves and geothermal heat.

In "[The myth of renewable energy](#)" (Dawn Stover, published in the Bulletin of the Atomic Scientists), Stover believes that "renewable energy" is a meaningless term with no established standards.

RE certainly needs to deliver energy that we can readily use - more than just the RE resources (sunlight, wind, etc.). These RE resources have to be converted into usable energy. We need wind turbines, solar panels, farming equipment and generators for biomass, and water catchment and generators for hydro sources. Alas wind turbines and solar panels do not grow on trees.

Renewable energy converters require the use of steel, copper, concrete and rare earth elements plus all the land on which to build these converters. Wind farms and large scale solar plants require transmission lines to connect to the electricity grid. The materials used to make the energy converters and transmission lines are not naturally replenished so Stover is probably correct when she says "renewable energy" is a meaningless term. But let's stick with the term for now because it is in the common vernacular.

But is RE looking like a new religion?

It certainly seems to have its Gurus. In the USA there is Amory Lovins - Chairman/Chief Scientist of the Rocky Mountain Institute USA and Bill McKibben – Founder of [350.org](#). In Australia we have Professor Mark Diesendorf from the University of NSW. All seem convinced that 100% RE is the ultimate target for the future to replace all fossil fuel energy sources.

RE even has its own institutions, creeds and denominations, in the guise of Greenpeace, The Sierra Club, the Rocky Mountain Institute and 350.org, among many others. RE bibles have even been published such as Greenpeace's [Energy \[R\]evolution](#). Alas the sermons often contain a good dose of greenwashing.

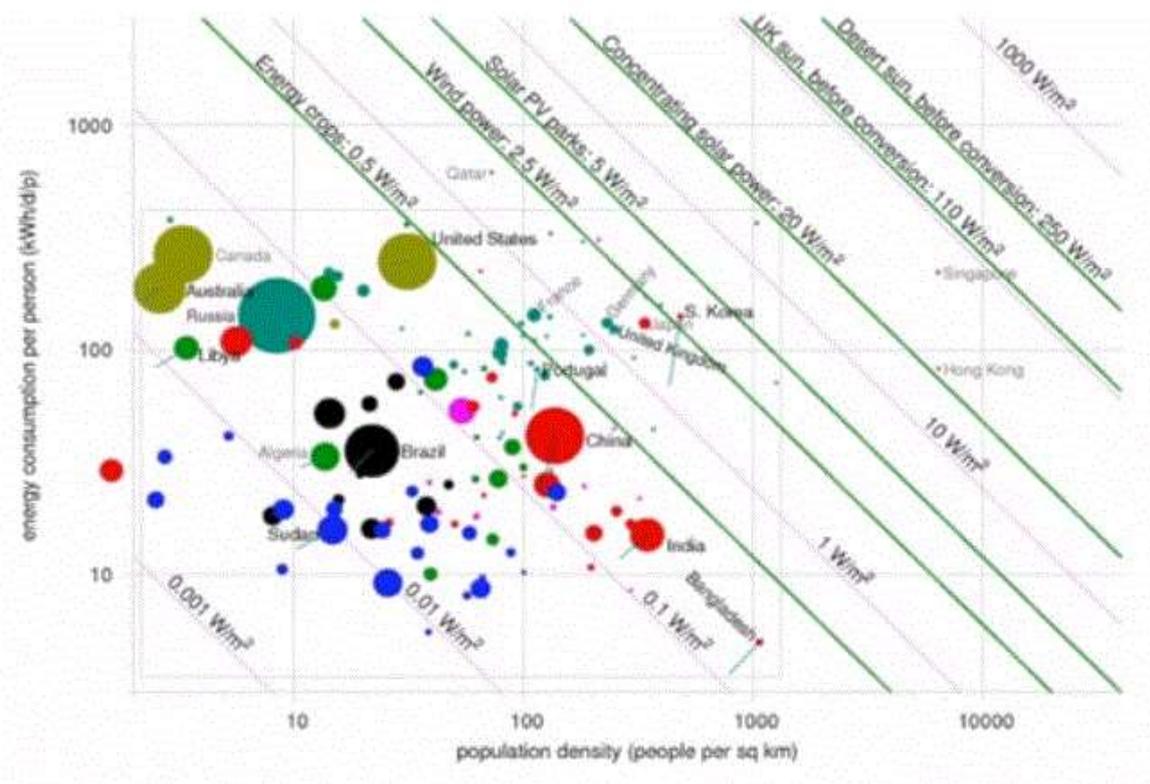
But the RE religion also has its critics. David MacKay FRS is the Regius Professor of Engineering at the University of Cambridge. MacKay has written a book titled "[Sustainable Energy - without the hot air](#)" - available for free at MacKay's website. More recently, Mackay presented a TEDx talk titled "[How the Laws of Physics Constrain Our Sustainable Energy Options](#)".

In this TEDx talk, MacKay looks at the land use for RE resources. He calculated the power density in watts per sq. metre for wind, solar, water and plants/biomass (see Figure 1). All RE resources are diffuse.

Wind	2.5 W/m <sup>2</sup>
Plants	0.5 W/m <sup>2</sup>
Solar PV panels	5–20 W/m <sup>2</sup>
Tidal pools	3 W/m <sup>2</sup>
Tidal stream	8 W/m <sup>2</sup>
Rain-water (highlands)	0.24 W/m <sup>2</sup>
Concentrating solar power (desert)	15–20 W/m <sup>2</sup>

**Figure 1 - Power density for various RE resources. Source MacKay TEDx talk 03-2012.**

He then compares these power densities to the energy consumption per person and population density for countries around the world (see Figure 2). MacKay tells us that to use RE sources alone, you would need to consider the land use as “country” sized or at least a good part of the country. For example, to power the UK with RE alone would require about 25% of the total land area for the UK.



**Figure 2 – Energy consumption and population density. Source MacKay TEDx talk 03-2012.**

In comparison, MacKay estimates that the alternative low emission energy source, nuclear power, has a power density of about 1,000 W/m<sup>2</sup>. But within the RE religion, nuclear power is treated like Mephistopheles: demonised at every turn, despite it being one of the [cleanest and safest sources](#) of energy. Why do the 100% RE advocates demonise nuclear power when it has a land use 1/500<sup>th</sup> of the most efficient RE source?

[Gaia](#) has given us many energy sources, but the most land efficient sources are uranium and thorium because of their very high energy density – why are we not using them more often? Perhaps the renewable energy story was too good to be carefully fact-checked.

Don't get me wrong. I'm not against renewable energy. I'm just concerned that RE devotees, who genuinely believe that we can supply all our energy needs from RE sources alone, recognise this excellent work from MacKay suggests that using RE sources alone will not be the case for most countries. The laws of physics are against it.

Written by Martin Nicholson and first published in Brave New Climate 14 April 2015