

Review of *Burn Out*, by Dieter Helm

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ENERGY

Mapping the energy revolution

Michael Grubb is impressed by the breadth more than the depth of Dieter Helm's radical study on the lingering death of oil.

Dieter Helm, an outspoken and influential energy commentator, is back on form – maybe for both good and bad. In *Burn Out* he presents a thesis and analysis which should certainly grab attention, send forecasters scurrying back to their models, and have established energy industries quaking in their corporate asset evaluations. It may also both please and infuriate environmental communities, and probably do the same for some schools of geopolitical thought. It is, in short, a big picture provocation more than a scholarly tome, but one which should rightly stimulate more far-reaching debate about what on earth is going on in the energy sector and what it may imply.

The essential thesis is not new, but is shaped in a new way and explores much further the implications.¹ Dieter's core argument is that three "predictable surprises" will revolutionise the energy world of the 21st Century. These are the end of the commodity supercycle with the collapse of oil (in particular) prices; the tightening pressures to decarbonise in the face of overwhelming scientific evidence on climate change (and its accumulating impacts); and the revolutionary scale and pace of technological change. Whilst *Nature* readers might be most interested in the resource, technology and CO₂ dimensions of this, Dieter's big contribution lies not just in the integration of these three mega forces, but his exploration of the geopolitical and corporate implications.

The commodity boom has bust not only because of the predictable impact of prices on demand and the inevitable slowdown in the Chinese economy, but most of all because of the shale revolution, in which the last couple of years has seen shale gas and oil costs – like offshore oil in the 1980s – falling much further than most thought possible. Combined with other technical advances, in principle, the world thus has access to far more oil, more cheaply, than seemed conceivable a decade ago: "*It is no longer plausible to assume that the stock of future oil reserves is known, that it is limited to the conventional wells, and that there is a limit of around 100-110 mbd production that cannot be exceeded ...*".

The text alternates between poking fun at the 'peak oil brigade' and quoting the long history of erroneous official forecasts. Conventional wisdom is slowly adjusting to the oil price fall, but against the backdrop assumption that we are in for another long commodity cycle in which present under-investment will end with escalating prices. Dieter's far more radical conclusion is that "*Re-normalised, prices may fall over the medium to longer term*". This follows from combining shale developments with the wider framework: "*The odds are against any more super-cycles This time it may really be different. Or rather the cycle may be swamped by other factors outside the oil market's*

¹ Other books with a similar underlying thesis: On electrification, **Walt Patterson (2015)**, *Electricity Vs Fire: The Fight For Our Future*; On solar, **Chris Goodall (2016)**: *The Switch: How solar, storage and new tech means cheap power for all*.

control – carbon policies and technology. (p.36).” The IEA’s World Energy Outlook 2016 sees oil prices rising back to US\$78–145 per barrel by 2040.² Helm posits just \$40–60 per barrel, long-term.

So the energy problem is not peak-oil, but peak carbon, the next “predictable surprise”. Helm starts by zeroing in on the gulf between climate goals and industry expectations. There is plenty in the climate chapter to irritate many sides of the debate but one cannot dispute Dieter’s independence of mind: “For the Europeans, warming by up to 2°C will probably do little harm to the main economies.... After that, all bets are off.” The problem is that along with a plausible overall thesis – the inevitability that scientific realities will slowly tighten the policy screws and the fossil fuel industries are fooling themselves on this - he cannot resist poking fun, ignoring inconsistencies, and sometimes rewriting history.

While Helm emphatically supports carbon pricing — charging for CO2 emissions — he gives a ritual bashing to the 1997 Kyoto Protocol, which was designed to set a cap and price on CO2 across the industrialised world. Lacking emission caps for China, Helm calls it “worse than useless”, after the US (under President George W. Bush) pulled out of a protocol that his own predecessor (Bill Clinton) had largely designed. Yet elsewhere he acknowledges it was intended as a first step, but neglects to note that all the countries which stayed with it fulfilled their commitments and most correspondingly cut emissions.³ Indeed In the introduction (p.5) he acknowledges that climate policy has already had a big impact on the coal industry and power generation. The Paris Agreement Helm deems “good politics, bad economics” – good politics because it reached a global deal engaging all, bad economics apparently (this remains unclear) because it failed to deliver binding national emission caps, instruments and prices.

Technology — the third ‘surprise’ — takes pride of place in *Burn Out*, partly perhaps because it relieves the ambiguity arising from Dieter’s disdain for past policy. Helm sees energy innovations, from next-generation renewables to robotics as “unstoppable”.⁴ As an economist, he professes to be technology-neutral; in practice, his vision is electrification of almost everything, as it lies at the heart of digitisation, smart controls, batteries and by extension transport. Dieter has grown far more sceptical about both nuclear and carbon capture, and argues: “The future of electricity is probably solar, but not as we know it.” But however compelling, his thinking here contains some problematic simplifications.

The first two stem from ignoring seasonal realities particularly in temperate regions. Solar intensity in a UK winter, for instance, is only a tenth of that in summer, yet electricity demand is at least 20% higher. Worse, winter energy demand for heating – mostly gas — is four times that of electricity demand. Electrifying heat would require digging up the entire electricity network, and vast amounts of new generating capacity to cover a fraction of the year. It is fantasy to imagine that batteries could bridge this. Energy storage from summer to winter would need at least 100 times the capacity of a diurnal one, but would get paid for this only through seasonal not daily discharge. Thus the economics of seasonal storage look several hundred times worse than daily storage.

² (<http://www.iea.org/newsroom/news/2016/november/world-energy-outlook-2016.html>)

³ Shishlov, I., Morel, R., & Bellassen, V. 2016. Compliance of the Parties to the Kyoto Protocol in the first commitment period. *Climate Policy* Vol.6:6 doi:10.1080/14693062.2016.1164658. See also extended Editorial, Grubb (2016), ‘Full legal compliance with the Kyoto Protocol’s first commitment period – some lessons’, *Climate Policy* <http://www.tandfonline.com/doi/full/10.1080/14693062.2016.1194005>

⁴ A similar view to that advanced by Nick Stern (2015) *Why are we waiting?* : for *Nature* review see <http://www.nature.com/nature/journal/v520/n7549/full/520614a.html>).

Wind, by contrast, offers a good match to seasonal demand, and complementarity to solar, and is amongst the cheapest renewable resources. Unfortunately Dieter simply reiterates his semi-populist stance that “*Wind has little to contribute at scale,*” with scant evidence: globally, wind energy capacity has reached almost 500GW (around eight times total UK generating capacity) with hardly a dent in the global resource. Dieter’s dislike of wind is evident, but remains unexplained by anything in this book, and it is a real pity because acknowledging wind’s potential and in particular complementarity to solar would make his overall thesis far more scientifically credible.

Helm has chosen not to include detailed references and endnotes, declaring that he wants readers “to think longer-term and generally”. Yet in some areas, the simplifications matter. Most fundamentally for a book stressing technofixes, it omits the complexity of innovation and dissemination processes. It fails to mention the depth of government involvement in almost all emergent industries,⁵ and the vast literature on the ‘technology valley of death’ by which the billions of pounds of past energy R&D investments have often failed to deliver commercial industries at scale.⁶ That literature (and industries) often emphasise the centrality of learning-by-doing and scale economies that arise from deployment, rather than R&D per se.

The IEA hugely underestimated the recent growth and cost reductions – yet in fact it correctly estimated the *relationship* between them: what the IEA underestimated was the impact of European, US and Chinese renewable energy policies in vastly scaling up the solar industry. For shale Dieter notes (p.31) “*massive learning-by-doing*” effects yet he seems to decry the same principle having been applied to renewables. Moreover, in placing his big emphasis on new breakthrough solar technologies rather than deployment the book overlooks the other interdependence: companies will chase new technologies when the market is large (which it now is), not when it is small (which it was). More R&D would be welcome but if Helm is right about the solar breakthroughs to come, cutting back on deployment would hinder, not help, the industries (and demand-led funding) that could deliver them to market.

The list of potential gripes with *Burn Out* is a long one, and along with such analytical issues can extend to politicisation of some of the text. Apparently the Europeans (and especially Germans) are always wrong. Europe’s ETS system to put a cap and price on CO₂ is castigated for its low prices, but not as much as German-led support for renewables. It still seems odd that Dieter turns his rhetorical fire on the EU, which at least has both a carbon price and policies to build low-carbon industries, rather than regions which have neither. As US emissions have also declined with shale gas displacing coal, “*it is the Europeans that now look foolish*” – though US emissions remain 2.5 times EU levels per capita, and twice as high on a consumption basis (ie including imports).⁷ Having lambasted the German *Energiewende*, his conclusion seems to be that a similar electricity-and-renewables strategy needs pursuing across Europe and globally – albeit with more R&D and a slower pace to allow more time for newly developed renewables, storage and systems technologies into the market.

Personally I enjoyed the rest of the book much more. Part 2 offers a broad sweep across the geopolitical consequences, with chapters on the US, Middle East, Russia, China and Europe, each of which starts with a sketch of how energy has been interwoven with their history. Specialists in individual regions might find issues to dispute in detail and many could be irritated at some of Dieter’s caricatures. China is the main villain, both for its CO₂ and for pushing dangerously into the

⁵ M. Mazzucato (2014), *The Entrepreneurial State: debunking public vs private sector myths*

⁶ M.Grubb, J.C.Hourcade and K.Neuhoff (2014), *Planetary Economics: Energy climate change and the Three Domains of Sustainable Development*, Routledge.

⁷ Recent ‘carbon footprints’ & decoupling eg: <https://www.ineteconomics.org/perspectives/blog/carbon-decoupling>

South China Seas, and will face a bumpy transition as the new technology wave confers no natural manufacturing advantage. The Europeans are dupes for having pushed hardest on building up low carbon industries and their inadequate (surely, better than absent) carbon pricing. Still, they will on the whole benefit, but not as much as the 'lucky' US which the transition also frees from the noose of Middle East oil. The Russians are – well, Russians; Putin rode the commodity cycle and may now increasingly struggle, whilst their (perfectly rational) attempts to gas diversify export routes are viewed with immense suspicion (even though gas is central to Dieter's medium-term view). Notwithstanding simplifications, most substantively troubling is Dieter's compelling argument about the Middle East – dire enough, but with the *strategic* collapse in the value of oil that Dieter foresees, things can only get worse as desperate regimes are no longer able to buy off domestic discontent.

This grand tour of geopolitical consequences – mostly enjoyable and compelling in much of its logic – is followed in the final Part 3 by a similar *Tour d'Horizon* of implications for companies and market structures. Dieter's discussion of 'stranded assets' has much to inform both industry ("*the reserve-to-reduction ratio is going to be redundant as a measure of value ...*") and others, since for investors "*the long run does not matter much*" – and provocatively, "the only plausible disinvestors are ultimately political leaders like Putin, King Salman of Saudi Arabia and Xi Jinping". More likely, he implies, oil will be squeezed by collapse in demand driven by more attractive transport systems. The endgame for the fossil fuel industries he envisions as "slow death", whilst electricity markets – covered in the concluding chapter - undergo revolutionary changes in structure to accommodate growing dominance by sources (like renewables) that cost almost nothing to run.

Whilst some of the views are necessary to his argument (particularly in the section on the geopolitics), many are not at all and will simply irritate the more analytic reader with a more nuanced view of the complexities of history and international politics. But the analytical flaws geopolitical simplifications do not change the big picture. The book is important not only because of the way it welds its core thesis, but because it does then move on to explore the implications, for both countries and companies.

The combined shocks since 2008 – culminating (for the present) with the political earthquakes of 2016 – have had many of us scurrying back to our history books to try and read the runes. The result in this book is a vastly richer and sweeping narrative, which folds history into a radical view of how the three 'predictable surprises' may transform the future. One can disagree with the detail – even important details – and yet agree with the thesis. Ultimately the good in this book outweighs the bad. The energy world has entered a revolution, with implications that will reverberate across the wide span of economic and geopolitical development of the 21st Century – and this book is one of the first to offer a big picture view of why, and how.