Wind turbines near Palm Springs, California.

ENERGY

Scanning the energy horizon

Michael Grubb finds more breadth than depth in Dieter Helm's study on oil's demise.

With *Burn Out*, Dieter Helm — one of the most outspoken and influential commentators on energy — is back, with a big, broad view on the energy revolution. He pokes fun at the “peak oilers”, who believe that shrinking fossil-fuel resources will force the transition to renewables. The alternative thesis he offers should send forecasters scurrying back to their models, and set established energy industries quaking in their corporate asset evaluations.

Helm's core argument is that three “predictable surprises” will revolutionize twenty-first-century energy. The commodity boom, or supercycle, of the past 15 years has bust, and will not return. The pressure to decarbonize will increase in the face of overwhelming evidence of climate change. And technological innovation will flourish, with solar-based electricity dominating energy supply. The book's great contribution is to integrate these three megafactors, and explore

their geopolitical and industrial implications.

First, Helm kicks against conventional wisdom on the supercycle, radically concluding that “renormalized” oil prices could continue to fall. Shale-gas extraction technologies, in particular, have advanced so far and fast that they open up a new global resource, yet demand may shrink. The International Energy Agency's *World Energy Outlook 2016* sees oil prices rising back to US\$78–145 per barrel by 2040. Helm posits a mere \$40–60 per barrel, long-term.

Thus, the energy problem is not peak oil but peak carbon, the next “predictable surprise”. Here, Helm zeroes in on the gulf between climate goals and industry expectations. He notes that climate science and the

Burn Out: The Endgame for Fossil Fuels

DIETER HELM
Yale University Press:
2017.

impacts of climate change will slowly tighten the policy screws. (And one can hardly dispute his independence of mind when he argues that in Europe, “warming by up to 2°C will probably do little harm to the main economies... After that, all bets are off.”)

His argument on climate policy contains some irritating inconsistencies. He says industry is still not facing up to the realities of carbon control, yet he is scathing about past climate policies. Then, elsewhere in the book, he acknowledges that the same policies have had a major impact on the coal industry and on power generation.

He emphatically supports charging for carbon dioxide emissions but gives a ritual bashing to the 1997 Kyoto Protocol, designed to set a cap and price on CO₂ across the industrialized world. He neglects to note that all the countries that stayed in the agreement after the United States and Canada withdrew complied with their commitments, most achieving significant emissions reductions. The 2015 Paris climate agreement Helm deems “good politics” — because it reached ▶

➔ **NATURE.COM**
For more on science
in culture see:
[nature.com/
booksandarts](http://nature.com/booksandarts)

► a global deal — but “bad economics”, presumably because it lacks binding national emissions caps, instruments and prices.

Technology, the third surprise, takes pride of place in *Burn Out*. Helm sees energy innovations, from next-generation renewables to robotics, as “unstoppable” (see also M. Grubb *Nature* **520**, 614–615; 2015). As an economist, he professes to be technology-neutral. In practice, his vision is the electrification of almost everything. Over time, Helm has grown more sceptical about nuclear power and carbon capture, arguing: “The future of electricity is probably solar, but not as we know it.”

Again, the sheer breadth of the analysis is more impressive than the depth. He ignores seasonal realities, particularly in temperate regions. Solar intensity in a UK winter, for instance, is one-tenth of that in summer, yet electricity demand is 20% higher. Worse, winter energy demand for domestic heating — powered mostly by gas — is four times domestic electricity demand. Electrifying heat would require digging up the entire electricity network, and vast amounts of new generating capacity would be needed to cover a fraction of the year. Moreover, battery storage from summer to winter is rendered infeasible by the need to store at least 100 times as much energy as in a daily cycle, and yet sell most of it only annually.

Wind, by contrast, offers a good match to seasonal demand. Globally, wind-energy capacity has reached almost 500 gigawatts — half the electricity-generating capacity of the entire European Union — with hardly a dent in the global resource. Acknowledging

wind’s potential and complementarity to solar power would make Helm’s overall thesis much more scientifically credible. Unaccountably, he simply reiterates his longstanding scepticism, asserting that wind “has little to contribute at scale”.

Helm eschews 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 the innovation and dissemination processes. It skims over the depth of government involvement in almost all emergent industries. And it ignores the vast literature on the ‘technology valley of death’ — in which billions in energy research and development investment have often failed to deliver commercial industries at scale. Today’s dramatically reduced costs of solar and wind of course benefited from research, but can be traced more directly to deployment policies in Europe, the United States and China that built demand and scale. Helm also overlooks other interdependences: companies will chase new technologies much harder when the market is large, as it is now.

To Helm, Europe is always wrong. In his view, the EU’s Emissions Trading System to put a cap and price on CO₂ is a failure, along with its renewable-energy policies. (Yet surely, having both some carbon price and policies to build low-carbon industries is better than having neither?) He avers that the decline in US emissions over the past decade, as shale gas has displaced coal, makes Europe “look foolish” — even though US emissions per capita remain 2.5 times those in the EU.

He lambasts Germany’s energy-transition plan, which focuses on efficiency and renewables, yet his overall thesis implies that a similar strategy — already much cheaper thanks to the advances made — is going global.

More interesting is the book’s sweeping discussion of the geopolitical consequences of energy transition. Chapters on the United States, Middle East, Russia, China and Europe each outline how energy has been interwoven with their history. Helm caricatures China as the villain, partly because of its emissions, but does acknowledge its burgeoning efforts to tackle these. He sees a difficult economic transition there, because new manufacturing

“The energy world is in revolution mode, with impacts that will reverberate throughout the century.”

technology confers no natural comparative advantage.

Helm notes that Russia may struggle after hugely benefiting from a decade of high oil and gas prices. Despite arguing that natural gas has a central

role in the transition, he is suspicious of the country’s intention to diversify gas export routes by building more pipelines. Most alarming is Helm’s perspective on the Middle East. With the oil-price collapse, he foresees the current turmoil in the region worsening, as desperate regimes are no longer able to buy off domestic discontent.

In a similar *tour d’horizon*, he surveys implications for companies and market structures. He notes that the ratio of oil reserves in the ground relative to annual production, long used by investors as a measure of asset value, is going to be redundant. Provocatively, he sees political leaders such as Russian President Vladimir Putin and King Salman of Saudi Arabia as the only supply-side players who might plausibly disinvest from fossil fuels. Finally, he looks at how electricity markets are likely to restructure to accommodate the growing dominance of renewables and other low-carbon sources, which could become so cheap that their use will hardly be constrained. In this, he sees “slow death” for the fossil-fuel industries.

The combined economic and political shocks since 2008 have had many of us squinting at the past to read the runes. The energy world is in revolution mode, with impacts that will reverberate through the century. *Burn Out* is one of the first to offer a big picture view of why, and how. ■

Michael Grubb is professor of international energy and climate-change policy at the Institute for Sustainable Resources of University College London, and chair of the UK Panel of Technical Experts on Electricity Market Reform.
e-mail: m.grubb@ucl.ac.uk

Gas pipelines in Russia, where the economy has benefited from high fossil-fuel prices.

ALEXANDER ZEMLIANCHENKO JR./BLOOMBERG VIA GETTY