Why high-technology must be sustained
By Patrick Beautement

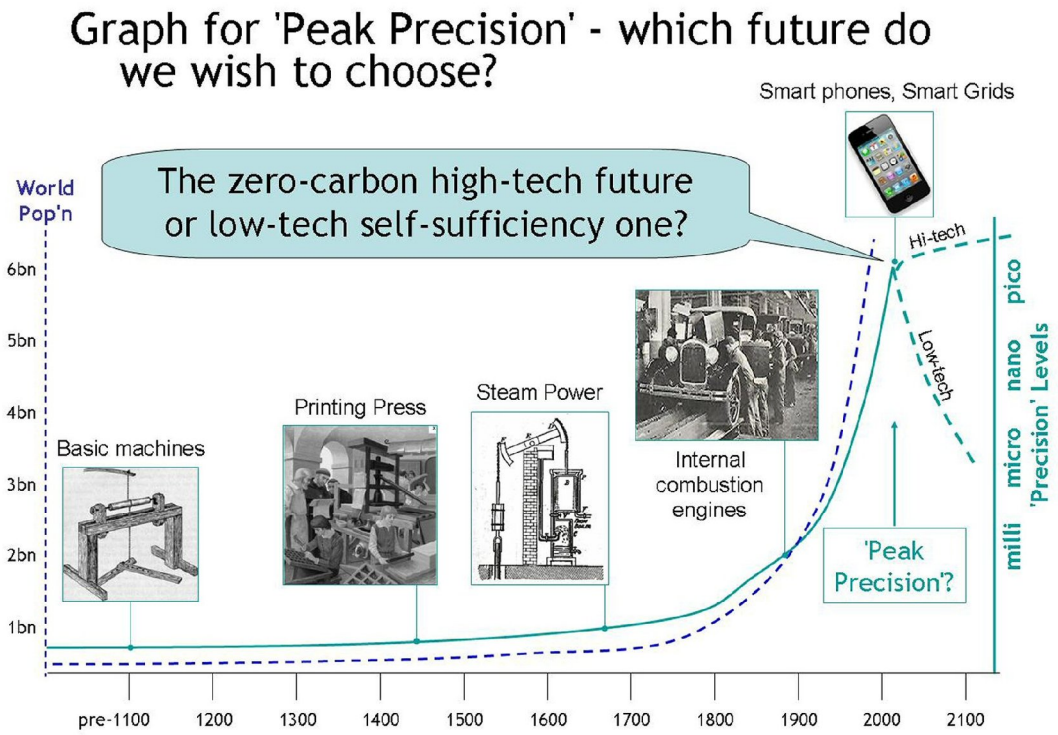

Figure 1: The 'Peak Precision' graph – which future to take?

Wind and solar power and heating, hydro-electricity, 'intelligent' energy-saving buildings, 'smart' power grids and meters and other ZCB3 solutions clearly require high-technology. Using them enables a zero-carbon future that is not only feasible but that the majority of people would also accept. The more 'traditional' route to low carbon would in fact be to renounce technology (except the handmade variety) and go straight for self-sufficiency. The question is: have we made the dependency of 'zero carbon' on 'high technology' clear enough, in scientific and technological terms, to convince high-technology doubters? Talking about 'green skills' is necessary, but not sufficient. We must examine the possible 'unintended consequences' that might come from an ill-informed shift to inappropriate alternative technology.

If we don't do this we may lose the ability to make finely engineered devices, and find ourselves forced to take the low-technology self-sufficiency route away from ZCB3. The reason we should avoid this is simple: high-tech can't be handmade, but it is necessary for our low-carbon future. So what have been the technology trends? Over time humanity has moved from manual to computer-controlled manufacturing machines that require software, clean rooms, chemicals, material fabrication, and many other industrial processes that sound like part of an eco-person's nightmare.

Looking at figure 1 you can see a link between our development and our ability to produce standardised and precisely interchangeable objects. When everything had to be handmade, when even every individual nut, bolt and screw was unique, production took time. When something broke, you could not reach into a box for a replacement, you had to make another to match the broken part. Then innovation moved on, and we were able to harness machines to expand our capacity and influence – for good or for ill.

The Enlightenment brought more growth in science and technology, and incentives to invent ever more intricate devices. Along with this came population growth. The connection between increases in precision engineering and expanding populations is complex, but together they have led us to today's climate change challenges. The only way to achieve the ZCB3 vision and overcome these challenges it to sustain Peak Precision.

Step one to sustain Peak Precision is to appreciate which aspects of the zero-carbon formula rely on high-technology solutions so that they can be sustained or

Patrick Beautement, Research Director
The *abaci* Partnership LLP, Registered UK Business: OC316272, VAT No: 946 1122 39

provisioned accordingly. An analysis of ZCB 2030 reveals its reliance on high technology, including to:

- Research, develop, process and fabricate new materials;
- Mitigate finite and limited resource availability (such as minimising waste by smart recycling);
- Actively balance variable supply and demand (from national to domestic levels);
- Actively balance transmission and storage opportunities/losses;
- Provide, maintain and adapt flexible, 'intelligent' smart grids able to communicate with smart metering that control resource-aware smart devices;
- Research and develop new generation transmission and storage technologies;
- Improve the efficiency of heating and insulating technology;
- Design new structures and materials for dwellings and workplaces;
- Maintain efficient functioning of low-carbon technologies, infrastructures and devices;
- Make modular, interchangeable, flexible and resilient hybrid devices;
- Electrify transport and enable efficient biofuel delivery;
- Inform agricultural practice, and research and develop new foods; and
- Research and develop alternative ways of sequestering carbon.

Step two is to articulate the challenges and opportunities, and to find ways to deal with them. For instance, one significant challenge is that there will be a capability deficit (see figure 1) if we delay the development of the 'green skills' zero carbon Britain needs. New technologies and more efficient design are also essential to decarbonisation (a potential challenge), but most of ZCB's technical solutions exist today and are tried and tested (an opportunity). These technologies must also work together in complementary combinations – a challenge and an opportunity.

Meeting these challenges and taking advantage of these opportunities will necessitate a series of changes to the way we work and think. The transformation to zero carbon requires permissive legislative, commercial and intellectual property frameworks, and joined up policymaking that maximises the benefits of ZCB technology. At the same time, we must work at 'economies of scale' that minimise energy and resource use.

This requires a commitment to, and education in, attention to detail so we can manufacture, maintain and use smart devices and systems that work effectively and efficiently for many years. Standards and assessment criteria will not just be formulated in monetary terms, so how low-carbon 'value' is declared and 'measured' must be robust and defendable. We must have and sustain high-performance design and manufacturing capabilities, down to nanometre precision levels.

In the same way that you can't make iPhones and Facebook work with the technology used to make steam engines, you also can't make smart grids and smart devices with the same mindset we used to manufacture consumer products. We need a supportive social environment where selfish motivations and lax behaviours do not undermine the energy efficiency gains obtained by engineering, manufacture and production. We must recognise that investing in the transformation of research, education, training and green skill development for low-carbon technologies is the same as investing in a viable future. A key part of this transition will be 'learning by doing' – and recognising that this can be a Good Thing.

Step three is to understand that we might unwittingly lose these precision-engineering capabilities unless we take purposeful action. Precision is almost invisible, and it's not 'cool'. Precision engineering is also not directly on anybody's 'bottom line' – if 'the market' doesn't want it then it will let precision go. Nonetheless, we need sustain precision to achieve a high-quality, zero-carbon future. ***ZCB3 must indicate clearly that we need to consider how to make that that happen if the value of high-technology is not to be lost***.

About the author:

Patrick Beautement is the Research Director of The *abaci* Partnership LLP which is currently supporting the Africa Climate Change Resilience Alliance. Originally trained as a geologist, Patrick has changed 'career' about 14 times, and is endlessly fascinated by the 'complexities' of the World. He likes challenging 'received wisdom' and then discussing how to make possible futures a practical reality.