

## EVOLVING MARKETS



Malcolm Brinded CBE,  
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# Energy is improving life for billions

**Continuing the 'Energy in Conversation' series of discussions, *Petroleum Review* Editor Kim Jackson speaks with Malcolm Brinded CBE FREng, President of the Energy Institute, Trustee of the Shell Foundation and former Executive Director of Royal Dutch Shell.**

*Malcolm, your global career has spanned over 40 years, bringing a wealth of experience and insights. Between your start as a young engineer and today, what are some of your biggest take-aways about the energy industry?*

I find it simply astonishing that in my lifetime, global average life expectancy has increased by 50% – an increase of **24 years** from 48 to 72. In China, it's up from 41 to 76. And in Africa, from just 36 to over 60.

It is of course down to advances in nutrition and medicine. But, enabling all of these is a sustained increase in global GDP per head – up by 75% in real terms purchasing power parity since 1990.

Driving all that has been a huge increase in access to energy, where the world is using 55% more than in 1990. Meeting that huge increase in energy needs has been an immense triumph of our industry – and underpinning that, the astonishing progress in energy technology.

*On that last point, we know the energy sector must continue to evolve to meet the challenges of rising energy demand. Can you provide some examples of the exciting developments since 2000?*

In East Africa over the last decade, a quiet revolution has been taking place, with the installation of solar home systems designed for people living off-grid and on say \$4–30/d. These systems typically have an 8 W solar panel, four LED bulbs, a control unit with a lithium battery, a phone charging port, a radio and an LED torch. Many are made by MKOPA Solar, one of the innovative enterprises supported by the Shell Foundation. Customers buy a solar home system on credit and make daily payments through a mobile money platform called MPESA to keep the lights on. After a year they own the whole system outright.

By embedding mobile technology into a solar product, MKOPA pioneered the 'pay-as-you-go' solar movement which is transforming rural Africa – the system costs less per day for the user to buy than they previously paid for kerosene for one smoky lamp.

Solar home systems are one revolution. But for the energy revolution of our lifetime, US shale could also be seen as the current winner.

In just 10 years, US shale gas output increased by a factor of 13, and now produces the energy

equivalent of over 8mn b/d of oil. US shale oil has added another 5mn b/d, mostly in the last six years. Together, this is a massive energy windfall for the US and for the world.

Furthermore, by displacing coal in the US – and in Asia via LNG exports – this shale gas supply looks more likely to ease, rather than increase, climate stresses.

*With these developments and many more as a backdrop, how have you seen the global energy mix transforming?*

Surprisingly, the overall primary energy mix in percentage terms has changed little from when I started work, with over 80% of it still coming from fossil fuels.

The big shift is that the world uses an incredible **two and a half times** as much energy now. It is also encouraging to see the rapid growth now coming in renewable power. However, the impact so far on the overall energy mix has been minor. Indeed, shale oil and gas just from the US is today supplying 30% more energy than all the global wind and solar combined.

We've seen some remarkable and rapid advances – but we are on the brink of an era of yet greater

opportunity and more rapid change, which offers huge scope for more energy research and innovation.

*As you have said, we are on the brink of even greater opportunities – what do you see as the biggest opportunities for energy in the next 50 years?*

Let me highlight one opportunity, and I'll draw on Hans Rosling's brilliant book *Factfulness*<sup>1</sup>. He doesn't talk about the developed and the developing world, but shows the world as broadly split between four income levels.

There are about 800mn people living at Level 4, on over \$32/d per person – mostly in the OECD. And sadly, another 800mn live at Level 1, in desperate poverty on less than \$2/d, mostly in Africa and South Asia.

The UK mostly sits at Level 4 – and so, unsurprisingly, UK energy research is also mainly focused on this income level. But Level 4 is **not** where the real issues of energy supply or climate change will be played out in the next 50 years. Indeed, energy demand from people today in Level 4 will very likely fall.

But whether we can meet 2°C, or even 1.5°C, will be determined by Levels 2 and 3 – where nearly **6bn** people live today, all of whom very understandably aspire to move up one or two levels.

*There are really two issues here – to raise living standards of billions of people, and to do so in a way that doesn't harm the environment. If we look at those people living at Level 1 and 2, who have the acutest needs, how can we meet these dual challenges?*

In Rosling's analysis, 4.5bn people today live on less than \$8/d – that's about the cost of two coffees!

Let's consider **their** two toughest energy and climate challenges. Firstly, access to affordable, clean energy, as 1bn people still live without electricity today and 3bn still do all their cooking on open fires. Secondly, sustainable urban transportation, as the global urban population has more than quadrupled in the last 50 years and is set to add another **2.5bn** by 2050, nearly all in the developing world.

Those 3bn people whose cooking is done on open fires, mostly inside their homes, are exposed to choking smoke – which kills over 4mn people a year.

I've been impressed by tech entrepreneurs Envirofit who research clean, low cost wood and charcoal cookstoves, and then take them to market at scale, with 1.6mn sold so far.

These cookstoves reduce dangerous emissions by up to 80%, cut CO<sub>2</sub> significantly, and save costs and time buying or gathering the wood and charcoal, time which can be spent working to improve education or livelihoods.

Envirofit's latest product targets the hundreds of millions in Africa and India moving up from Level 2, so above \$8/d, helping them climb the energy aspiration ladder, coupling a modern LPG stove with a mobile-money-based pay-as-you-go payment system which only opens the gas valve when in credit.

It's another simple example of combining new technology and innovative business models to meet people's energy needs.

*Are there any technologies with the potential for benefitting the community on a larger scale?*

Successful communities need reliable power at much greater scale to run businesses, water treatment plants, clinics and schools. That is where mini-grids come in if the main grid is still missing or simply very unreliable.

One such company is Husk Power. They design, install and operate small-scale 25 kW power plants that use solar energy and agricultural waste gasification for power in rural India and East Africa. By using solar power in the day, and biomass gasification for power at night, Husk is providing electricity 24/7 at a cost 30% less than small-scale diesel. Clever innovation and simple technology are key to their solution.

Even when villages are on the grid, it often cannot meet peak power demand. In India, 50% of states have over 20% peak energy deficit, leading to power outages of over 10 hours a day in many places.

This greatly disrupts refrigeration effectiveness – and adds huge wastage in the food supply chain due to rotting food.

Incold design, make and sell affordable thermal energy batteries for the cold food chain, both on and off-grid. They are now growing fast in India, especially in the small dairy business, since milk is a \$100bn/y business there that suffers greatly from unreliable refrigeration.

*You mentioned urban transport – what do you see as credible ways forward in this area?*

Every year there are more and bigger cities around the world, with over 40 megacities predicted by 2030, and Lagos set to pass 80mn people by 2070.

Travel in these cities is a nightmare for the urban poor – who



spend disproportionate time and money getting to and from work and essential services, and face chronic air pollution, in cities from Delhi to Cairo to Rio. The health, social and economic costs are huge. We need innovative technology and businesses to address this misery, such as better urban planning, leveraging advanced people movement modelling; big-data enabled traffic signals and traffic management; hybrid and electric minibuses and BRT systems; more CNG taxis, and hydrogen and LNG-powered buses.

UK researchers, entrepreneurs and impact investors are well-placed to address this chronic problem.

*Finally, are you optimistic about what innovative technology and businesses together can achieve?*

Yes, given the right enabling policies and financial support. Rosling uses UN central GDP growth forecasts to highlight the huge benefit of sustained economic growth, lifting 1.4bn out of Levels 1 and 2 by 2040 and – with population growth – meaning 3.1bn **more** people will be living pretty decently in Levels 3 and 4.

I hope we can do even better – given more backing of early stage technology and entrepreneurs. Such an outcome would be simply terrific! ●

1. *Factfulness*, Hans Rosling, with Ola Rosling and Anna Rosling Ronnlund, Sceptre/Hodder & Stoughton, 2018.

In our March 2019 issue, Malcolm will discuss UK energy research priorities given the challenges outlined above.

Urban transport is a chronic problem, with huge health, social and economic costs – it is an issue that UK researchers, entrepreneurs and impact investors are well-placed to address  
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