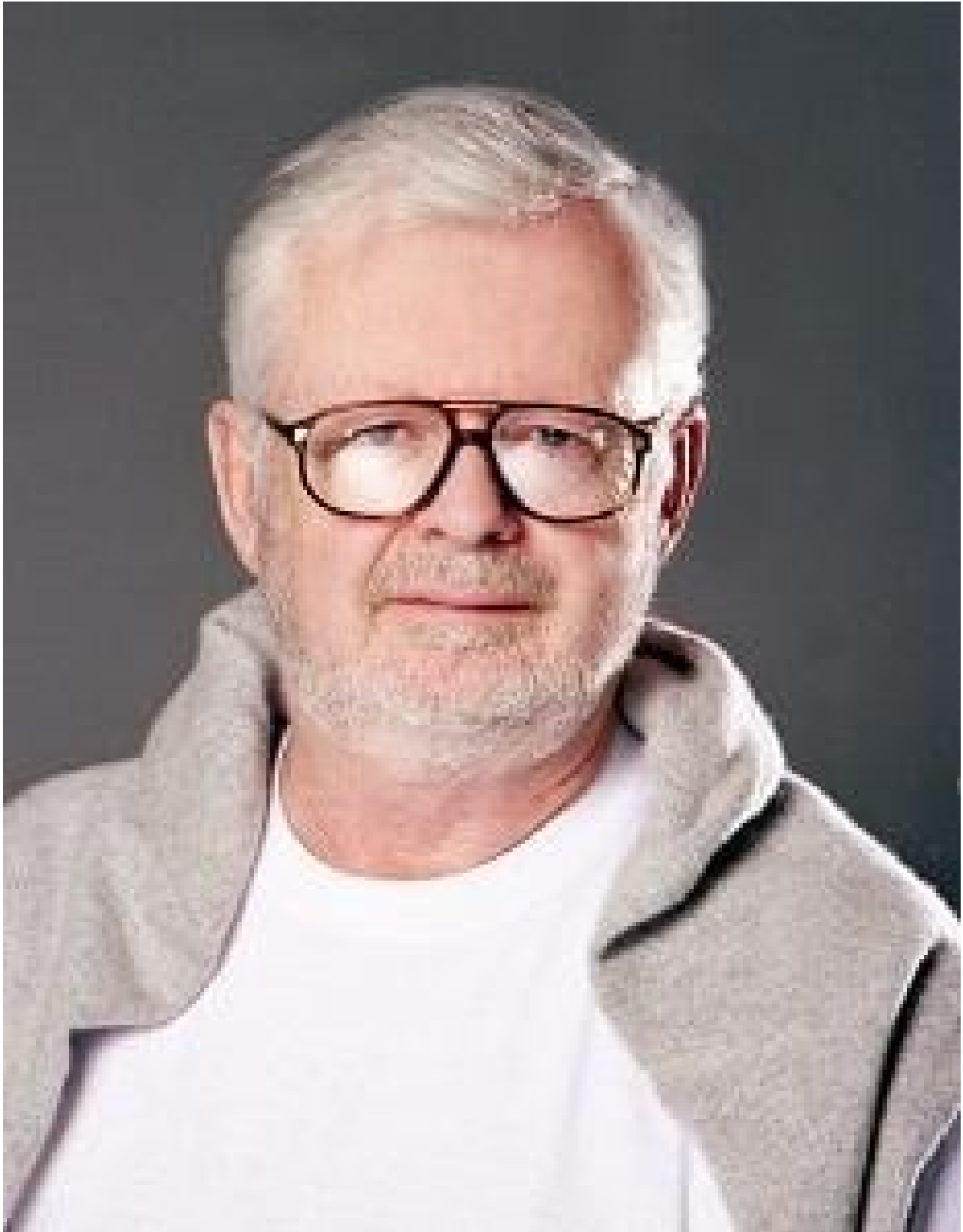

Powering the economic growth engine



It has been a key driving force, powering economies since the Industrial Revolution, yet it continues to take a backseat to other heavily-touted engines of growth, most recently consumer spending.

In a new book, INSEAD's [Robert U. Ayre](#)



s, Emeritus Professor of Economics and Political Science and Technology Management, and Senior Research Fellow Benjamin Warr say that economists are missing out on a major growth driver for the economy – and that is energy as converted to “useful work”.

The book veers away from the mainstream economics model developed in 1956 by American economist Robert Solow. Whereas earlier economists had believed that the engines of growth were predominantly an increasing labour supply together with savings and investments, the belief now is that growth is driven by technological progress, expressed as “human capital”, not to mention consumption. Ayres and Warr agree with the conventional view, insofar as increasing demand brings about economies of scale, experience, as well as R&D that cuts costs, which in turn means lower prices, and then leads to increased demand again. They disagree about the role of energy and useful work.



The Economic Growth Engine

How Energy and Work
Drive Material Prosperity

Richard H. Ayres
and
Benjamin Wiser

Ayres explains: “According to the standard theory, energy is an intermediate good that can be ‘produced’ by some combination of capital investment and labour (plus technology). This means that economic growth is essentially independent of energy use, which suggests – in turn – that growth can continue indefinitely at historical rates. And when people talk about recovery, implicitly that's what they're saying – that right now the world economy has a hiccup or is perhaps suffering from a case of the swine flu, and that we can expect to get back sooner or later to a trajectory of growth that's based on the last 100 years.”

“But if we're right – and I think there's much more than a small chance that we are – you can't make that assumption. It's a very dangerous assumption and it's leading to potentially very risky advice to political leaders. For example, we're immediately faced with a possible inconsistency between the idea of taxing energy use, or putting a cap on carbon emissions – either of which will raise the price – while, at the same time, hoping that growth will not be affected.”

“So we've got to be very smart in the coming years and decades to avoid that kind of contradiction. We've got to find ways of increasing the efficiency with which we produce useful work, useful materials, products, services and so on, without necessarily increasing the costs. In fact, on the contrary, we have to look for ways of producing more of that useful work and doing it with fewer resource inputs – in other words, cheaper.”

Yet, changing mindsets is going to be tough, says Warr. “The standard approach is so widely accepted all over – maybe not even widely accepted but so widely assumed. It's built into all of the major global forecasting models or financial models – the companies' future cashflow models.”



And this is the issue that their research and book try to address. Culled from empirical findings dating back to 1900, Ayres and Warr developed a database on energy-use efficiency, different from the standard textbook database of energy consumption and costs. For example, this new approach looks at how a motorist is less concerned about the petrol price at the pump than he is about getting more mileage from the cost of a tankful. In other words, the cost of energy service – they call it useful work – is taken into account.

"Oil is used for driving, for heating, for industrial processes. And we've gone back in time and estimated the efficiency of each of these different technologies, based on engineering data, since the beginning of the twentieth century. Putting all that together we can make a pretty reliable estimate of the efficiency with which energy has been used in the entire economy – from source to end use."

"So from this very robust starting point of detailed empirical data, thermodynamics principles which allow us to quantify improvements on the basis of fundamental thermodynamic principles, we're able to accurately reproduce the historical rates of growth for several countries for which we were able to find the necessary data. Now that's a good starting point to be able to look towards the future," says Warr.

Another good starting point, he adds, would be to acknowledge that energy and GDP are in fact linked. "What we show is that if you constrain the amount of energy input into an economy without improving the efficiency for which the energy is used, you're constraining the amount of useful work you're delivering to people. And this will have very negative effects on growth. Growth can slow down, stop, (or even) decline."

"What we also show is the route out of this trap. With the same amount of 'raw' energy input, if you improve the efficiency with which it's used, you generate more useful work delivered to the point of use in the economy. This is the role of technology. So you generate more energy services per unit of energy input for the same price. And that's a reliable source of growth."

Act now, not later

To take this a step further, Ayres says energy inefficiency may even have been partly to blame for the current financial crisis. "You could argue that

the high price of energy last summer may have been the trigger, or at least one of the triggers that set off the real estate crash. Why? Because by increasing the living costs of a lot of people, who were already in trouble paying for adjustable rate mortgages, the price of real estate began to peak or go down. And that's what set off the whole financial problem, starting with the mortgage-based securities that have now become 'toxic' ... So it's extremely important to make the processes of converting energy into useful work (as well as useful products and services) much more efficient. And to make it happen much sooner than might happen if we just let the markets take care of it ... The investment in those alternatives need to be accelerated."

We simply cannot wait for a crisis to hit and then start thinking about energy, Warr says. "Phenomena such as the credit crisis, oil price hikes, pressure due to the growing population are going to (mean increased) demand for energy, for water; and if you think about water, it all has to be pumped and purified. In places like the United Arab Emirates, a very large fraction of energy use is required for water purification. Agriculture is entirely dependent on energy inputs, industrialised agriculture, for fertilisers, tractors and all the rest."

"So this dependence on energy will keep on revealing itself in event after event after event. And every time one of these events happens, then people scratch their heads and ask 'but why did our current way of thinking fail to provide us any warning of this event?' It's a good question."

'The Economic Growth Engine: How Energy and Work Drive Material Prosperity' by Robert U. Ayres and Benjamin Warr is published by Edward Elgar Publishing.

INSEAD will host the **22nd Alumni Sustainability Executive Roundtable on Energy**: 'Smart and sustainable Super-grids' on 16 and 17 November 2009.

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