

The Future of Energy

A fundamental change is coming sooner than you might think

SINCE the industrial revolution 200 years ago, mankind has depended on fossil fuel. The notion that this might change is hard to contemplate. Cars and generators may move up the efficiency scale but it is hard to imagine replacing oil dependant engines. While stories of alternative energies have been doing the rounds for quite some time, not much action has been seen with respect to implementation of commercially viable projects.

Such a failure of imagination is seen in the efforts towards handling issues arising out of climatic change. The green message of using less energy is simply not sustainable by improvement in the efficiencies of the oil guzzlers due to the rapid economic growth seen in emerging markets like China, India, Brazil, Russia, South Africa etc. One can't wish potent economies to slow down. Therefore any efficiency build up will be nullified by the pace of this growth.

Therefore the need of the hour is disruptive and not marginal change which can only be brought about by thinking beyond fossil fuel.

In this context the collective imaginations of a group of physicists, biologists and engineers are in the midst of giving shape to an alternative world. And even as you read this article, plans for the end of the fossil-fuel economy are now being laid and they do not involve much self-punishment. Instead of bullying and scaring people, the prophets of energy

technology are attempting to seduce them. They promise a world where, at one level, things will have changed beyond recognition, but at another will have stayed comfortably the same, and may even have gotten better.

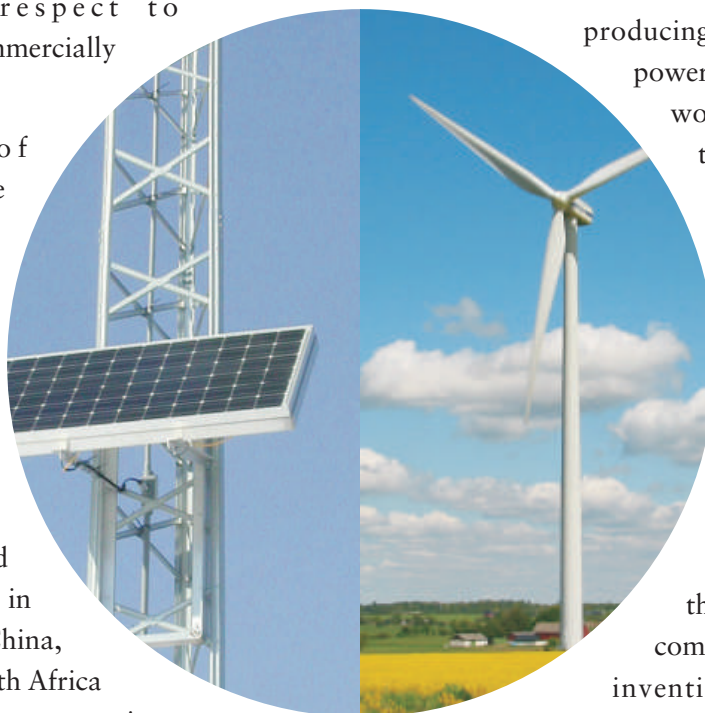
This time it's serious

As of now, alternative energy sounds like a less effective way of meeting our needs. Windmills and solar cells hardly seem like ways of producing enough electricity to power a busy, self-interested world, as furnaces and steam-turbines now do. Battery-powered cars, meanwhile, are more like concepts than a practical and commercial solution. But the proponents of these new alternative sources of energy are serious. The reason for this optimism is based on their objective of making a commercial success of their inventions besides providing environment benefits as a by-product.

And for the alternatives to do that, they need to be both as cheap as (and cheaper than) and as easy to use as (or easier than) the gas guzzlers.

On the back of accelerated price inflation seen in oil in the recent weeks, alternatives beating the fossils on price suddenly look less of a problem. The biofuels or batteries that will power cars in the future should beat petrol at today's inflated prices.

However just like the prices have spiralled all the way in no time there is always a possibility of it slipping in the same way in the foreseeable future. However, even the commercial prices of alternatives will dip on the



back of technology improvement and scale of production. Somehow the time seems ripe now to present the alternatives like bio-fuels and solar energy on the commercial platform and bite the bullet.

Electrical energy, meanwhile, will remain cheaper than petrol energy in almost any foreseeable future, and tomorrow's electric cars will be as easy to fill with electricity from a socket as today's are with petrol from a pump.

Unlike cars powered by hydrogen fuel cells, like the Civic Hybrid launched by Honda this month, battery cars do not need new infrastructure to deliver their energy. Simply tweaking the existing infrastructure will provide the appropriate stage for making electrical cars commercially viable. What is important, however, is which alternate source of energy will the power plants use? They too, are more and more likely to be alternative.

The price is right

Wind power is taking on natural gas, which has risen in price along with oil. Wind is closing in on the price of coal, as well. Solar energy is a few years behind, but the most modern systems already promise wind-like prices. Indeed, both industries are so successful that manufacturers cannot keep up, and supply bottlenecks are forcing prices higher than they otherwise would be. It would help if coal—the cheapest fuel for making electricity were taxed to pay for the climate-changing effects of the carbon dioxide produced when it burns, but even without such a tax, some ambitious entrepreneurs are already talking of alternatives that are cheaper than coal.

Therefore, the recent oil price spike and environmental issues form perhaps the best launching pad ever for alternate energy to take off commercially.

However this needs to be viewed in the context of the previous oil shock of early 1970s when oil prices increased four-fold. Alternatives were discussed then too with as much fervor as they are being discussed

now. Then, too, a spike in the price of oil coincided with a fear that natural limits to supply were close. The newspapers were full of articles on solar power, fusion and converting the economy to run on fuel cells and hydrogen.

The shock then was induced due to political manipulation and not due to geological shortage. Even now the geological shortage perhaps is not the biggest hurdle for we know that fossils still lie unexplored in various parts of the world.

But that does not matter, for there are two differences between then and now which makes one believe that the alternate energy solutions will fructify this time over.

The first is that this price rise is driven by demand. More energy is needed all round. Emerging economies such as China, India, Brazil, Russia, South Africa, etc. together have the potency to drive world economical growth in the long term. That gives alternatives a real opening to scale up operations and make energy easily available and commercially viable.

The second is that 35 years of improvements have made wind, solar power and high-tech batteries more attractive.

A bigger boom

As these alternatives start to roll out in earnest, their rise, optimists hope, will become relentless. Economies of scale will develop and armies of engineers will tweak them to make them better and cheaper still. Some, indeed, think alternative energy will be the basis of a boom bigger than information technology.



Alternatives are also the only solution to cleaning the environment.

Certain initiatives will go a long way in hastening the process of transformation into a new world of alternate energy. These being:

1. Encouraging alternatives by taxing carbon

2. Removing subsidies that favour fossil fuels.

Competition will do the rest to make alternate energy commercially friendly and viable.

Thus, alternative sources of energy are the future and a bright new hope for both the world and the planet.

Box 1

The Next Boom

The next technology boom may well be based on alternative energy. But which sort to back?

All of us love a booming market, and most booms have happened on the back of technological change. The world's venture capitalists, having profited from the computing boom of the 1980s, the internet boom of the 1990s and the biotech and nanotech boomlets of the early 2000s, are now looking around for the next one. They think they have found it: **Energy**.

Many past booms have been energy-fed: coal-fired steam power, oil-fired internal-combustion engines, the rise of electricity, even the mass tourism of the jet era. But the past few decades have been quiet on that front. Coal had been cheap. Natural gas had been cheap. The 1970s aside, oil had been cheap. The one real novelty, nuclear power, never really took off. The pressure to innovate, thus, has been minimal.

But in the space of a couple of years, all that has changed. Oil is no longer cheap; indeed, it has never been more expensive. Moreover, there is growing concern that the supply of oil may soon peak as consumption continues to grow, known supplies run out and new reserves become harder to find.

The idea of an environment-friendly, alternative way of growing what you put in the tank of your

car no longer looks unrealistic. Nor does the idea of discarding the fuel tank and plugging your car into an electric socket instead.

The Present Situation



Though the recent 'oil shock' has indeed caused havoc for economies worldwide, it would be wrong to call it a 'shock' because oil

tremors have been persisting but ignored for a long time. Perhaps this time the intensity has been too strong.

On a long-term basis, irrespective of any number of global meets or political pressures, there can be only two solutions to this crisis (1) Reduction in demand for oil by curtailing consumption; and (2) Using alternative fuel. The current situation clearly calls for an action plan globally which could achieve both objectives.

Solution (1): Reduction in demand for oil on a sustainable basis by curtailing consumption.

One way the problem could solve on its own would be if the end price of petroleum products were cost based, with no subsidies at all. High prices would automatically curb consumption and

Box 1 (Contd.)



make alternate energy commercially viable. However, since we cannot ignore the political compulsions in virtually every country which lead to subsidies being provided by governments, various other suggestions are being made to achieve the desired result.

Subsidies could be treated in the following ways:

- (i) Restriction of the subsidy to only that section of population whose income is below a certain threshold level; and
- (ii) Even for those, the quantity being restricted according to average need.

Interestingly in India, we have achieved both of the above for food articles under an administered price scheme by issuing ration cards to select categories with clear restriction on quantities. What could be done is to just extend the same to oil. With advanced technologies available today, this can now be easily controlled remotely by way of smart cards, which can be loaded periodically with determined quantity to persons falling under select categories. So, every time they fill petrol from a gas station at subsidised rate, the smart card would have to be swiped and relevant quantity deducted from the balance. This would be on the same lines as a prepaid card for telecom or a debit card in banking, for which technology is already proven. Any of the IT majors would be delighted to provide end to end secure solution worldwide on these lines and create e-ration cards. The governance would thus be significantly easier than in case of paper ration cards. Such cards can easily be issued to all vehicle owners of any category covered under subsidy. This holds true all over the world.

The quantities in each category can be determined based on data available giving normal or average consumption under each category, on the same basis by which quantities of food items for a family are determined.

As per the official data available, there were over 13 million cars and other four wheelers in India in 2007. If each vehicle consumes an average of even 80 litres per month (based on 1,000 km per month as an average and an average consumption of 1 litre for 12 km) it would amount to approximately 12,500 million litres on which subsidy goes off. Assuming a subsidy of average Rs 20 per litre, the subsidy saved would be of the order of 25,000 crore from this alone. Considering the fact that subsidy on cars may be small as compared to some others, e.g., LPG subsidy on supplies to non-ration card homes and savings from passenger transport segment (air, rail & road), the total savings on account of the above could be substantial. These would bring noticeable reduction to the current subsidy of over Rs 200,000 crore.

Needless to say, this may need to be implemented in phases. However, more importantly, this would be a strong signal to oil producing nations that, unless they decide to maintain a discipline with respect to oil prices, major consuming countries would be taking some bold measures to curb consumption.

If economies like India and China take a lead in this, many others would quickly emulate them and soon this would be the norm since all economies, particularly the developing ones are being crushed under the weight of oil subsidy.

These steps would curtail demand for oil, whereby oil prices would come within reasonable range and go out of control of speculators.

More importantly, with oil being largely sold at market price, alternative sources of energy would

Box 1 (Contd.)

start becoming commercially viable. This is in any case needed in the long term so that dependence on just one major source of energy, particularly for transport, is reduced.

The implementation may require some initial investment by government but considering that this would be practically a permanent arrangement and that it would result in instant savings on subsidy for government, it would be worthwhile to make this investment.

Solution (2): Using alternative fuel.



In theory, there is a long queue of coal-fired power stations waiting to be built in America. But few have been completed in the past 15 years

and many in that queue have been put on hold or withdrawn, for two reasons. First, Americans have become intolerant of large, polluting industrial plants on their doorsteps. Second, American power companies are fearful that they will soon have to pay for one particular pollutant, carbon dioxide, as is starting to happen in other parts of the rich world. Having invested heavily in gas-fired stations, only to find themselves locked into an increasingly expensive fuel, they do not want to make another mistake.

That has opened up a capacity gap and an opportunity for wind and sunlight. The future price of these resources-zero-is known. That certainty has economic value, even if the capital cost of wind and solar power stations is higher than that of coal-fired ones at the moment.

Global warming may not be uppermost in people's minds during an economic downturn. High fuel prices may fall as new sources of supply are exploited to fill rising demand from Asia.

Consistency of supply may improve if hostile governments are replaced by friendly ones and sources become more diversified.

But in the long run, global warming, dependence on a single kind of energy source and the availability of the same not being diversified across the globe are genuine impediments for the global community. Hence long terms solutions will have to be sought.

The Opportunity



The market for energy is huge. At present, the world's population consumes about 15 terawatts of power. (A terawatt is 1,000 gigawatts, and

a gigawatt is the capacity of a large coal-fired power station.) That translates into a business worth \$6 trillion a year, about a tenth of the world's economic output. And by 2050, power consumption is likely to rise to 30 terawatts.

Therefore, any transition from an economy based on fossil fuels to one based on renewable, alternative, green energy could be slow but the attractive size of the energy business coupled with the opportunity that has been provided by oil price inflation will trigger the alternate energy movement at a pace faster than one can imagine.

While great strides are being made in wind power, the day is not far for plug-in cars to make their appearance and which could be fuelled with electricity at price equivalent to as low as Rs. 10 a litre of petrol. That would certainly shake up the oil, car manufacturing and electricity industries all in one go.

The Interest Generated

The possibility of this happening has brought

Box 1 (Contd.)



many industry leaders out of their homes. Larry Page and Sergey Brin, the founders of Google, have started an outfit called Google.org

that is searching for a way to make renewable energy truly cheaper than coal (or RE<C, as they describe it to their fellow geeks). Sir Richard Branson, too, is getting in on the act with his Virgin Green Fund.

This renewed interest in energy is bringing forth a raft of ideas - some bright, some not so, that is indeed reminiscent of the dotcom boom. As happened in that boom, most of these ideas will come to naught. But there could just be a Google or a Sun among them.

More traditional companies are also taking an interest. General Electric (GE), a large American engineering firm, already has a thriving wind-turbine business and is gearing up its solar-energy business.

Meanwhile, BP and Shell, two of the world's biggest oil companies, are sponsoring academic researchers with bright ideas, as is DuPont, one of the biggest chemical companies. Moreover what is worth noting is that boardroom discussions around renewable and eco-friendly energy are no longer seen as just a way of keeping environmentalists off companies' backs. The search has truly begun in all sincerity.

Another boost that alternate energy development can get is through earnest deployment of tax on carbon - as is starting to happen in Europe. If that occurred, wind-based electricity would start

assuming commercial viability sooner than later. Otherwise special treatment for alternatives is yet another option to breathe life into alternatives.

Developing Nations Too Are Joining In



Developing countries are also taking more of an interest in renewable energy sources. It is true that China is building coal-fired power

stations at a blazing rate. But it also has a large wind-generation capacity, which is expected to grow by two-thirds this year, and is the world's second-largest manufacturer of solar panels, not to mention having the largest number of solar-heated rooftop hot-water systems in its buildings.

Brazil, meanwhile, has the world's second-largest (just behind America) and most economically honest biofuel industry, which already provides 40% of the fuel consumed by its cars and should soon supply 15% of its electricity, too (through the burning of sugarcane waste).

South Africa is leading the effort to develop a new class of safe and simple nuclear reactors not renewable energy in the strict sense, but carbon-free and thus increasingly welcome.

These countries, and others like them are prepared to look beyond fossil fuels. They will get their energy where they can. So if renewables and other alternatives can compete on cost, the poor and the rich world alike will adopt them with alacrity.

This will augur well for a healthier and more economical planet for us to live in.