

Balancing the power options

While it is important to make the best of potential of green energy sources, it is equally necessary to recognise their limitations and open one's mind to alternatives

5 ANANTHANARAYANAN

Should the nuclear sector have a greater role in India's energy plan? The question is one that is controversial in many circles. R B Grover, Emeritus professor, Homi Bhabha National Institute and member, Atomic Energy Commission, while speaking before the Indo French Technical Association, at Mumbai, outlined the many issues that arise before the energy planner, to help see the nuclear option in context. The context was the proposed nuclear project at Jaitapur, on the Maharashtra coast, said to be, at 9,900 MW, the largest in the world.

Grover commenced his presentation with a description of how energy has shaped the growth of civilisation. While there were great developments in science and the arts over the centuries, it was only in the 18th century that mankind was empowered with plentiful energy. Till then, water, wind and coal had been used, and industry had grown, but coal, the great driver, could not be mined in quantity. This was because mines rapidly got flooded and limitations of technology in pumping out the water limited the depth to which the mine could go. In England and Europe, where industry started expanding, recourse was taken to burning wood, with limited benefit and at the cost of forests.

In 1698, Grover said, the steam driven, mine dewatering pump was developed, and this brought about a revolution in the output of coal. The vast supply of coal that steam made available, in turn, supported steam power, to drive machinery, manufacturing, spinning and smelting, the steam locomotive, and the steamship, which could sail, at will, the world over.

However, the early steam engines were notoriously inefficient, at just one per cent, growing to three per cent, at the start. And when engines got more efficient, the scales grew high, leaving us with the crisis of global warming that the countries of the world face today.

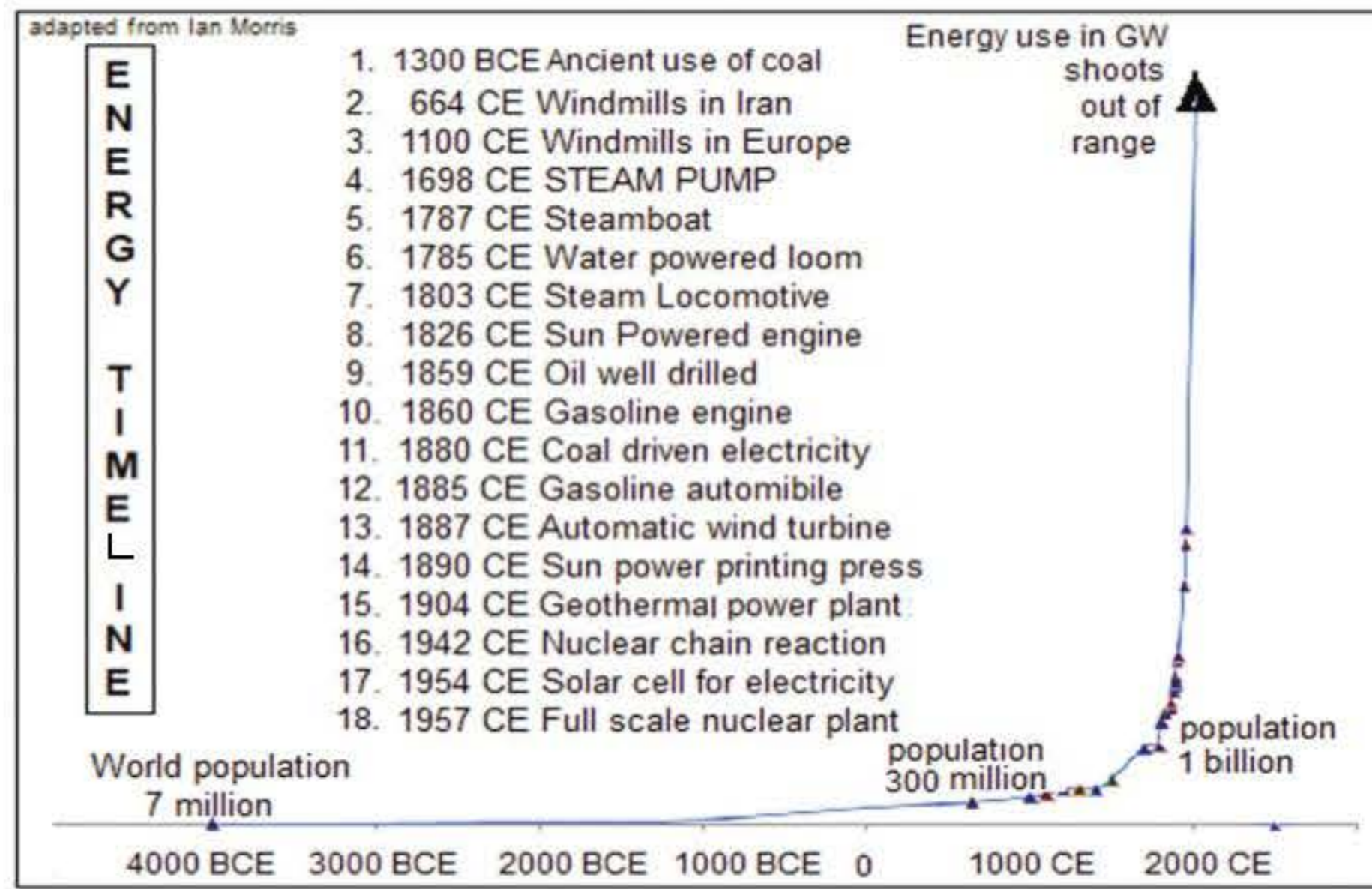
In the rising prosperity of earlier times, too, there was the increase in the number of horse drawn carriages in cities, and the streets, Grover said, were covered with horse dung. So severe had the problem become, that it was said that many large cities would soon disappear! And then, the freely available coal was now used for domestic heating and the cities were enveloped in a pall of soot. The Lon-

don smog is legendary - one could not see one's own hand if one stretched one's arm, it was said. And the animal waste and soot in the air brought infection and respiratory disease. The entry of the IC engine, the automobile and electricity companies put an end to all these troubles, but they brought with them the dependence of the world on huge energy, and the present global challenge to keep up the supply without further damage to the environment.

Coming to India's own needs of energy, Grover noted that during the last decade, electricity generation has grown by nearly six per cent every year. The problems of distribution, however, have not made it possible to provide assured service and there is increasing reliance on private generation.

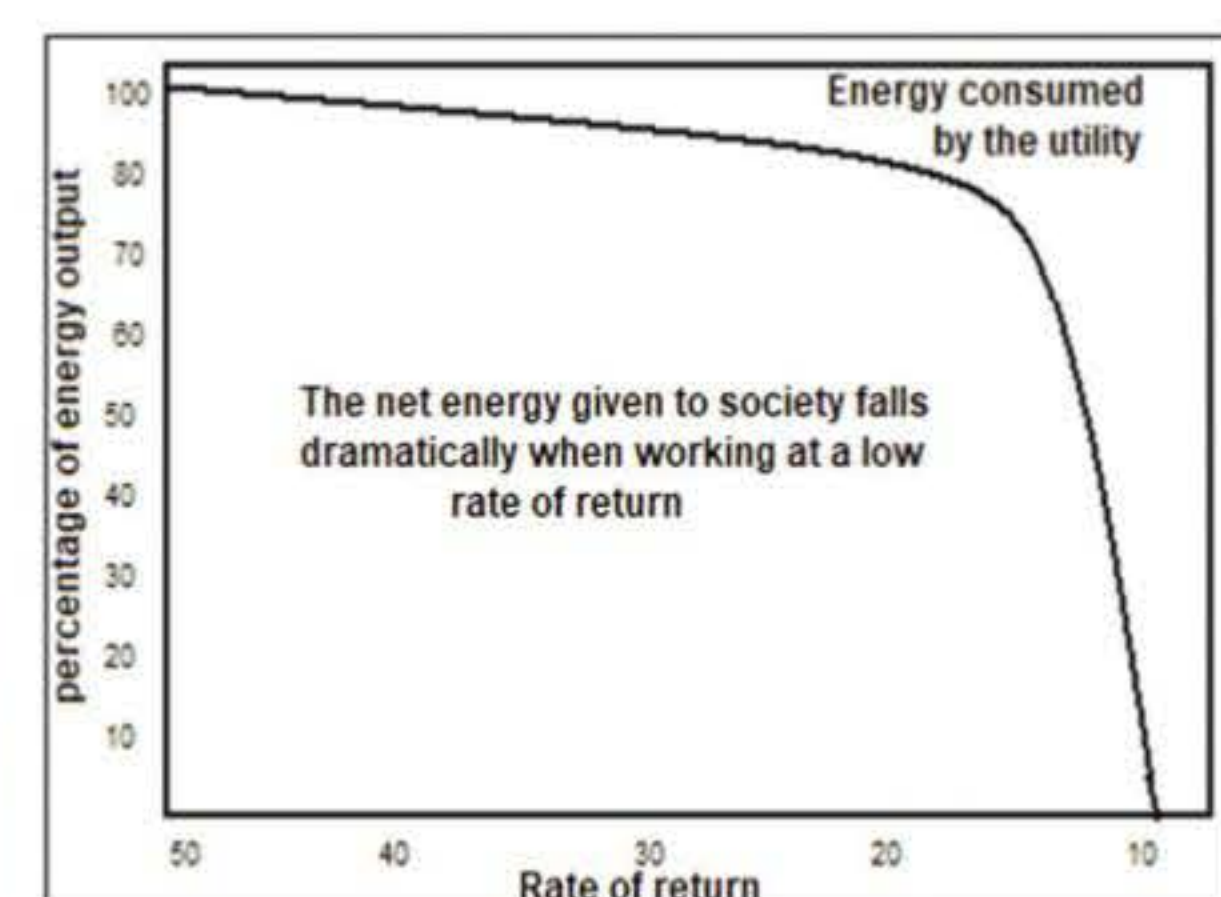
An estimate of how much power India needs could be arrived at from statistical bases, but it may be more instructive to consider how much power we need to provide Indians with a reasonable level of well-being. There exists a correlation with development indicators of a country, the dimensions of health, education and GDP, and the power consumed per capita. Countries that score high on development are found to consume more than 10,000 units of power, per capita. India produced 1,500 billion units of electricity during the 2017-18. For a population of 135 crore, this works out to 1,100 units per capita. According to the International Energy Agency, the world average per capita electricity consumption in 2015 was 3,052 units and in India's comparable neighbours, the figures are: Malaysia - 4656 and Thailand - 2621. Grover hence considered 5,000 units, per capita, to be a reasonable target for India to place before herself. Taking it that the population would plateau at 1.6 billion and the transmission losses of electricity are contained at seven per cent, this implies production of 8.600 billion units, Grover said.

Globally, the share of coal and oil in power production is 81.4 per cent, of nuclear, it is 4.9 per cent, of hydro, it is 2.5 per cent, of biofuels and waste, it is 9.7 per cent and of wind, solar and others, it is just 1.5 per cent. India's own hydro production in 2017-18 was 122 billion units and the potential from wind and solar is 1,840 billion units. All renewable sources, hence cannot meet even a fourth of what we need. While we recognise, with the world, the need to cut down our



reliance on coal, Grover said changing the mix and reducing the role of large investments made so far would need careful study.

In respect of the emphasis being laid on increasing production from wind and solar, Grover drew attention to two indices of a utility that need to be measured -- the net energy gain, or energy return rate, and the system cost. As it takes investment of energy for utilities to be set up, it is important to measure the ratio of the energy output by the utility to the energy used in setting it up. Grover referred to a study in 2006 by the Princeton University, which found that this ratio, the Energy Returned on Investment, was high in the case of coal (38 per cent), nuclear



(62 per cent), large hydro (57 per cent) and wind (39 per cent) but low in the case of solar PV (six per cent).

In addition to the cost of the investment and operation of a utility, the system cost is what the distribution network and other utilities have to bear because of features of the first utility. In the case of wind and solar, the output is intermittent, or only when the wind blows or only when it is sunny. The distribution mechanism, the grid, hence needs to make provision to keep up the supply when these sources are not available. In the case of wind and solar, States provide various subsidies, as these sources are "green". In many cases, at the times when the

wind or solar plants are peaking, thermal plants in the grid are turned down. This amounts to further subsidy, this time at the cost of the thermal units.

While there are limited places where hydro plants are possible, there is a limit to the number of wind farms that can be installed in a region before efficiency falls. Solar farms too, would consume land resources. While it is important to make the best of the potential of these sources of power, it is important to recognise their limitations and open one's mind to alternatives.

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PLUS POINTS

Potent technique



A genetic technology that could be used to eradicate disease-carrying insects has been successfully used in mammals for the first time. Scientists think so-called "gene drives" could one day be used to spread harmful DNA that can wipe out pests or invasive alien species.

The United Nations (UN) recently considered a total ban on the technique after many expressed concerns about unintended and uncontrollable knock-on effects.

So the controversial practice is currently confined to the laboratory, but publishing their findings in the journal Nature, a team of scientists from California have successfully used it to change the colour of white mice to grey.

Led by Professor Kimberly Cooper, the team used Crispr gene editing to add a segment of DNA known as "CopyCat" into a gene controlling fur colour.

This gene drive tilted the scales in favour of the desired gene, meaning when the new mice are born they were more likely to have darker fur. After two years, around 70 per cent of mice being born had genes for the greyer complexion compared to around half of those in a normal population.

The technique only worked in female mice during the production of eggs and had no effect on the sperm of males. Excitement about gene drives in the scientific community has largely focused on their potential to tackle deadly diseases like malaria and dengue fever by wiping out biting insects.

This technique has already proven effective in laboratories, where malaria-carrying mosquitoes have been prevented from laying eggs. The scientists behind the new study hoped to lay the groundwork for the creation of mice that could be used in medical research for complicated genetic diseases. However, some have proposed similar gene drives could be used to control pests, such as rat infestations.

The technique might be more effective than alternative methods such as dangerous pesticides. The work was welcomed by other scientists as a crucial step that confirms gene drives as an effective technique for use in mammals, but they warned that a lot more work needed to be done.

While the proposed moratorium by the UN failed to gain support from biotechnology-friendly countries, concerns about mutations and wider environmental impacts still abound. With the technology still at a fledgling stage, the scientists concluded that both fears and wider speculation about its applications are likely premature.

The Independent

Effects of haze



While there are studies on the impact of haze on human well-being, its effect on other species and ecosystems is rarely explored.

A study led by associate professor Antonia Monteiro from the Department of Biological Sciences at the National University of Singapore's Faculty of Science has revealed that toxic chemicals in haze can affect the survival and development of butterflies.

Insects are very sensitive to changes in air quality because air reaches their inner cells directly through valve-like openings known as spiracles on the sides of their bodies. The diffusion of gases then takes place close to each cell via very fine tracheal tubes that transport the air from the spiracles to the inside of the body. In humans, the air first diffuses into the blood system in the lungs before reaching cells.

The researchers discovered that when the caterpillars of the squinting bush brown butterfly (*Bicyclus anynana*) were exposed to artificially generated smoke from burning incense coils, a large proportion did not survive to adulthood. Those that did survive took longer to reach adulthood, and were smaller. A smaller size usually leads to lower egg production.

These findings provide insight into the adverse effects of haze smoke on insects, said NUS. As butterflies are easy to identify and monitor, they could be used as bio indicators of the health of an ecosystem for better haze management, the researchers believe.

The Straits Times/ann

Giving shape to ideas

In urban rooms people can engage with physical space to understand the past, present, and future of a city

TIM DIXON
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Despite the strong utopian traditions of urban planning, there has often been a reluctance to think beyond the short term. Long-term planning is complex; electoral cycles are short and it's easier to focus on the everyday challenges than those of the far-off future. For this reason, urban planners have often

struggled to describe how a city might develop over the next 30 or 40 years.

Recent research has shown that it's essential to take a long-term, participatory approach to urban planning, to manage continuous socio-economic and environmental change. This means bringing together local government, universities, businesses and people living in cities.

Newcastle, Milton Keynes and Reading are examples of this in action

in the UK, as shown by the government's recent Future of Cities Foresight Project, which used a range of tools and techniques (including workshops with local people) to imagine different possible futures for the cities.

But there also needs to be a physical space where everyone can reflect on how a city has evolved, understand what sort of a place it is now and debate how it should develop in the future. That's where "urban rooms"

come in - they're an important building block in making a city vision "real" for the people who live there.

An urban room can act as an exhibition hall, a community centre and a learning space, while giving people opportunities to help redesign and reimagine their city's future. Urban rooms are already commonplace in countries such as China and Singapore, in the form of urban planning museums, city galleries or exhibition centres. These are all places where the public can directly engage with a physical space dedicated to understanding the past, present and future of the city.

Many of these spaces not only incorporate very large physical models, but also have space dedicated to understanding the urban planning

and future paths of these cities. Models are a useful tool to help people visualise key public spaces, and the impact that new design proposals will have on the cityscape.

Only relatively recently have urban rooms started to garner interest in the UK. For example, research has shown how urban rooms can positively shape strategic urban development and regeneration projects, by increasing civic engagement and public participation in forging a vision for the city.

A network of urban rooms has now sprung up across the UK facilitated by the Place Alliance with Sheffield University, which brings together places as diverse as Newcastle, London, Hereford, Bristol and Weymouth. Each urban room creates a physical space where people can go to understand, debate and get involved in the past, present and future of the place where they live, work and play.

In Reading, we have linked the development of the urban room with the Reading 2050 vision, which brings together the university with local business, local government and local people.

The vision imagines how Reading could become a low carbon city with a smart and sustainable future.

The urban room being developed at the University of Reading houses a much smaller model of the local area than some of the above examples, but through digital and physical media (virtual reality models, interactive exhibits and exhibition spaces) it will offer similar opportunities for the public to form a deeper understanding of proposed new developments.

Urban rooms are just one way of giving communities the confidence to actively participate in helping shape places, often in relation to the small scale changes of good open space and housing provision and air quality improvement that are so important in people's lives. In this way, universities have a crucial role to play in creating stronger engagement with local people, and helping them to understand and influence the long term future of their city.

The Conversation / the Independent

