In this issue

Solar Energy

Collectors and converters

Energy, in the form of light from the sun, comes to us at a rate of more than 1000 Watts per square metre. Solar panels can help transform only a part of this energy to electricity. To improve solar energy harvesting, the intensity of light falling on solar panels can be increased using lens and mirror arrangements. But this calls for even more space for solar energy farms – a difficult proposition, especially in densely populated areas. So how can we improve the efficiency and effectiveness of solar energy harvesting?

Researchers from VIT Vellore suggest two other simple methods in this issue. The first is to use plastic doped with fluorescent material to collect light. If the plastic material is rightly chosen, the light can be guided by total internal reflection towards the edges of the solar cells. These doped plastic materials can cover the walls and roofs of buildings. The colour of such materials depends on the plastic and the dopant. So you can choose the material for aesthetic appeal. Moreover, by using a laser diode, the fluorescent emission can be stimulated and made coherent, increasing the intensity. To make the system self-sufficient, a part of the power output can be used to run the laser diodes.

The other strategy is to use antennae designed to capture infrared and visible light radiations. These nano-sized antennae generate small amounts of alternating current. The current needs to be converted to DC for storage in batteries. A large number of these nano-antennae can be connected together to produce adequate power to run electrical devices. If the nano-antennae are designed to capture infrared radiations, they can generate electricity even at night from the long-wave radiations from the earth. Moreover, the theoretical efficiency of energy conversion by the nano-antennae is nearly 100%, compared to a maximum of 30% in existing solar panels.

Energise your day by turning to the General Article on solar energy collectors and converters on **page 1652** in this issue.

2D Nanomaterials

Though the existence of graphene has long been acknowledged, it was the accidental discovery, in 2004, of a method to separate single graphene sheets from a stack of graphene that led to a flurry of scientific activities and a full appreciation of its properties. The simple method of using scotch tape to separate single sheets of graphene deserved a Nobel Prize. And the incredible properties of a single layer of interconnected carbon atoms, and the promise of its varied applications, led to the search for similar two-dimensional nanomaterials.

Now, Inderdeep Singh Bhatia and Deep Kamal Kaur Randhawa from the Guru Nanak Dev University, provide us an update on a wide variety of 2D materials, their properties and potential applications. They also spell out the challenges that need addressing to develop technologies based on 2D materials. Read the Review Article on **page 1656** in this issue to understand today's science behind tomorrow's technology.

Air Quality Warning

From monitoring to modelling

There are nearly 11 million vehicles in less than 1500 square kilometres of Delhi. A thermal power plant in the middle of the city and one at the border, besides many incinerators and diesel generator sets add to pollution. But it is not merely these local emissions that make Delhi's air unhealthy. Meteorological phenomena that bring smoke and dust from elsewhere add to the burden.

Air-quality monitoring can help provide data on air-quality and pollution in real time. But what we need is an air-quality warning system. The Ministry of Earth Sciences initiated the development of a warning system a few years ago and now it is going through testing and refining.

In a Research Article on **page 1816** in this issue, you will read about the trials and tribulations of modelling for forecasting Delhi's air quality as well as the agonies and ecstasies of testing it in the last two years.

Sustainability of Oceans

Servicing humans

India has more than 7500 kilometres of coastline battered by waves and eroded by currents. Occasional tsunamis and frequent cyclones make the coast vulnerable. How can we ensure protection from such hazards to the hundreds of millions living in coastal towns and cities?

About four million fisher folk depend on the sea for their survival. How can science help ensure sustainable livelihoods for them? How can we leverage on our scientific understanding to provide sustainable potable water from the abundant sea water? How can we harvest the energy of the waves and currents of the sea to reduce our dependence on fossil fuel? How can we develop our port and shipping infrastructure for tourism and fishery while ensuring conservation of the ecosystem?

How can we identify precious mineral ores and extract them from the deep? How can we explore the oceans for new antibiotics and bioactive compounds? And what mysteries are lurking in the deeper oceans where no human has ever been?

The Special Section starting from **page 1679** in this issue examines the sustainability of oceans as a resource for the service of humans.

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