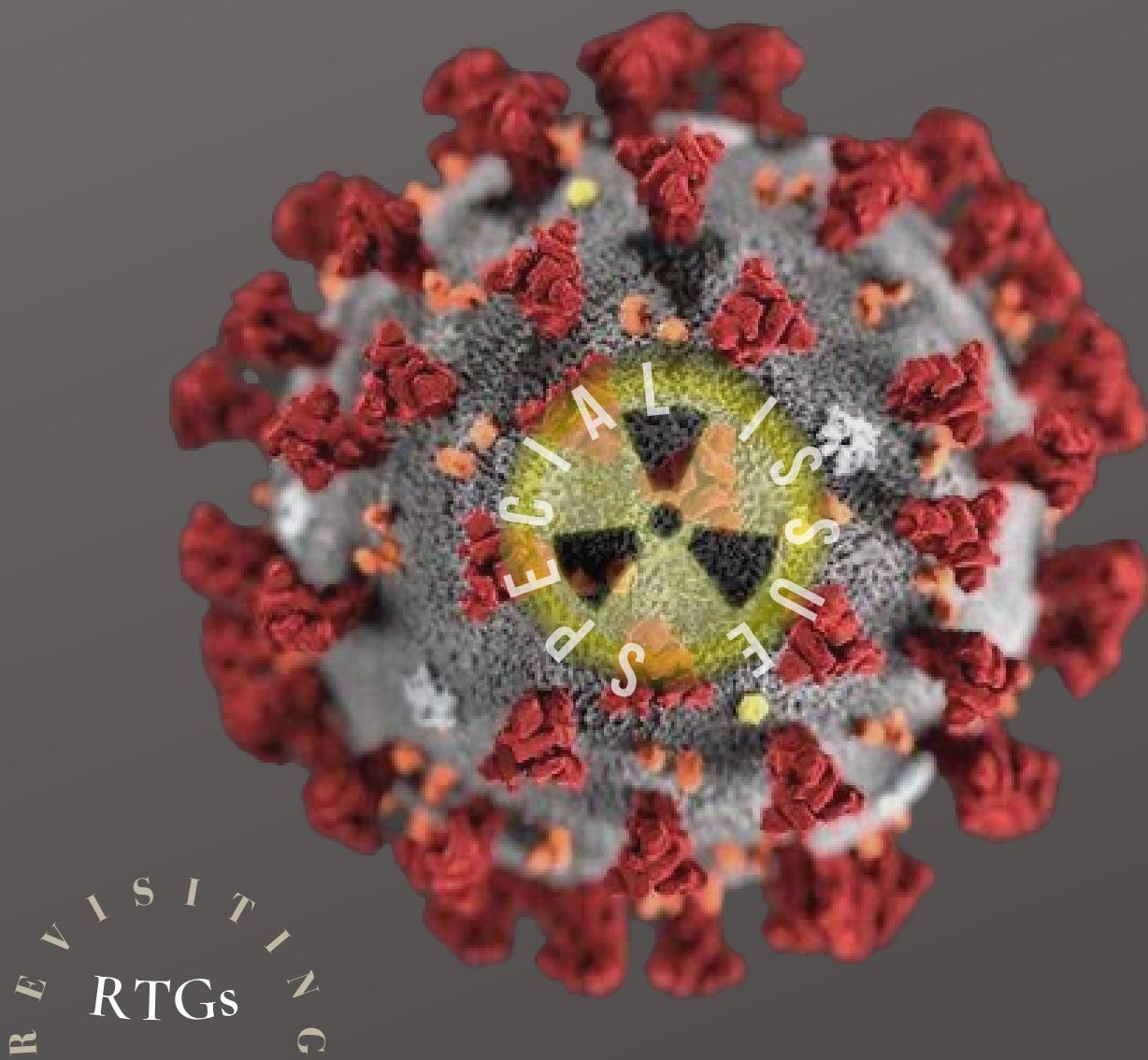


NUCLEAR ENERGY

THE BETTER ENERGY

February 2021 | Issue 5



NUCLEAR TECHNOLOGY
COMBATING COVID-19

Letter From The Founder



The world started the year 2021 on a hopeful note. With the announcement of a COVID-19 vaccine, everyone was eagerly looking forward to start a life they could call 'normal' again. What the word 'normal' would entail, however, still remains debatable.

At nUeBe, we try to look past the gloom and uncertainty of the pandemic and do what we can to bring to our loyal readers the best of what nuclear technology has to offer. With everything that is currently happening all around us, nothing seemed more reasonable than talking about how current advances in nuclear technology can help us fight COVID-19.

It is high time we realize that the applications of nuclear technology goes beyond just electricity production. There is so much more we can do by relying on this clean source of energy and that is exactly what this issue is all about (keeping the pandemic in mind, of course!).

I want to especially thank my content writers, Nilormi Das and Vaishnvi Tiwari, for doing all the research and making this magazine possible.

That's me signing off and hoping that you will all find something in here that's informative, surprising and enjoyable all at the same time.

Happy Reading!

Nirupama Sensharma
(Founder)

COVID-19 AND SUSTAINABLE ENERGY

Author: Nirupama Sensharma

The world as we knew it has changed. Covid-19 has forced our society to transition into a new way of life. This new normal is often described as a way of life adhering to stricter health guidelines, social distancing and embracing sustainability whenever and wherever possible.

With Covid-19 lock-downs forcing people to stay at home, factories to shut down and many businesses to halt, the electricity market faced a major calamity. Suddenly countries were seeing a considerable drop in their energy demands raising unprecedented challenges to the successful operation of their electric grids. The International Energy Agency (IEA) projected a 5% reduction in global electricity usage for the year 2020.

Under these extraordinary circumstances, the fossil fuel industry suffered a severe setback. Price-setting mechanisms on electricity markets and high operational costs led to the decline of fossil-fuel generated electricity. It was at this time that the world got a glimpse of what the *future energy mix* might look like. Since many countries are obligated by climate laws to dispatch renewable electricity ahead of other generators, sustainable and low-carbon energy sources started dominating the energy market.

Talking about sustainability and not mentioning nuclear energy would be like talking about Covid-19 and not mentioning masks or sanitizers! However it is important to remember that while the world can achieve its normalcy post proper vaccination, there is no going back as far as climate change is concerned. With time, it will only get worse and its effects more

prominent. It is therefore imperative to open our minds to sustainable and low-carbon energy technology vis-à-vis nuclear energy.

Nuclear energy, more than any other form of energy, has proven to be dependable and adaptable. In June 2020, the International Atomic Energy Agency (IAEA) reported that they have adjusted their ways of working to ensure minimal disruptions during the Covid-19 pandemic (<https://www.iaea.org/newscenter/news/new-iaea-reports-on-response-to-the-covid-19-pandemic>). This helped in avoiding the unnecessary shut down of nuclear power plants and ensured their safe and smooth operations.

The Sustainability Times published an article on August 25, 2020 in which they said,

“During the height of the global lockdown, nuclear power’s competitiveness and resilience led to an increase in its market share, rising by 9% in South Korea and being instrumental in nearly eliminating coal from Britain’s energy mix for two months”

The observed decline in fossil fuel electricity generation during the pandemic was successfully responded to by the generators and system operators. However, as we further the energy transition from fossil fuels to nuclear and other renewables, steps need to be taken to secure grid stability and maintain power quality. In the current energy mix, fossil fuels generation is largely relied upon to maintain balance of the grid and electricity system. As more and more renewables replace fossil fuels, it may lead to increased instability and power blackouts. Nuclear power plants and related technologies are therefore needed to fill this role and lower the possibility of sudden disruptions in a projected completely decarbonized society.

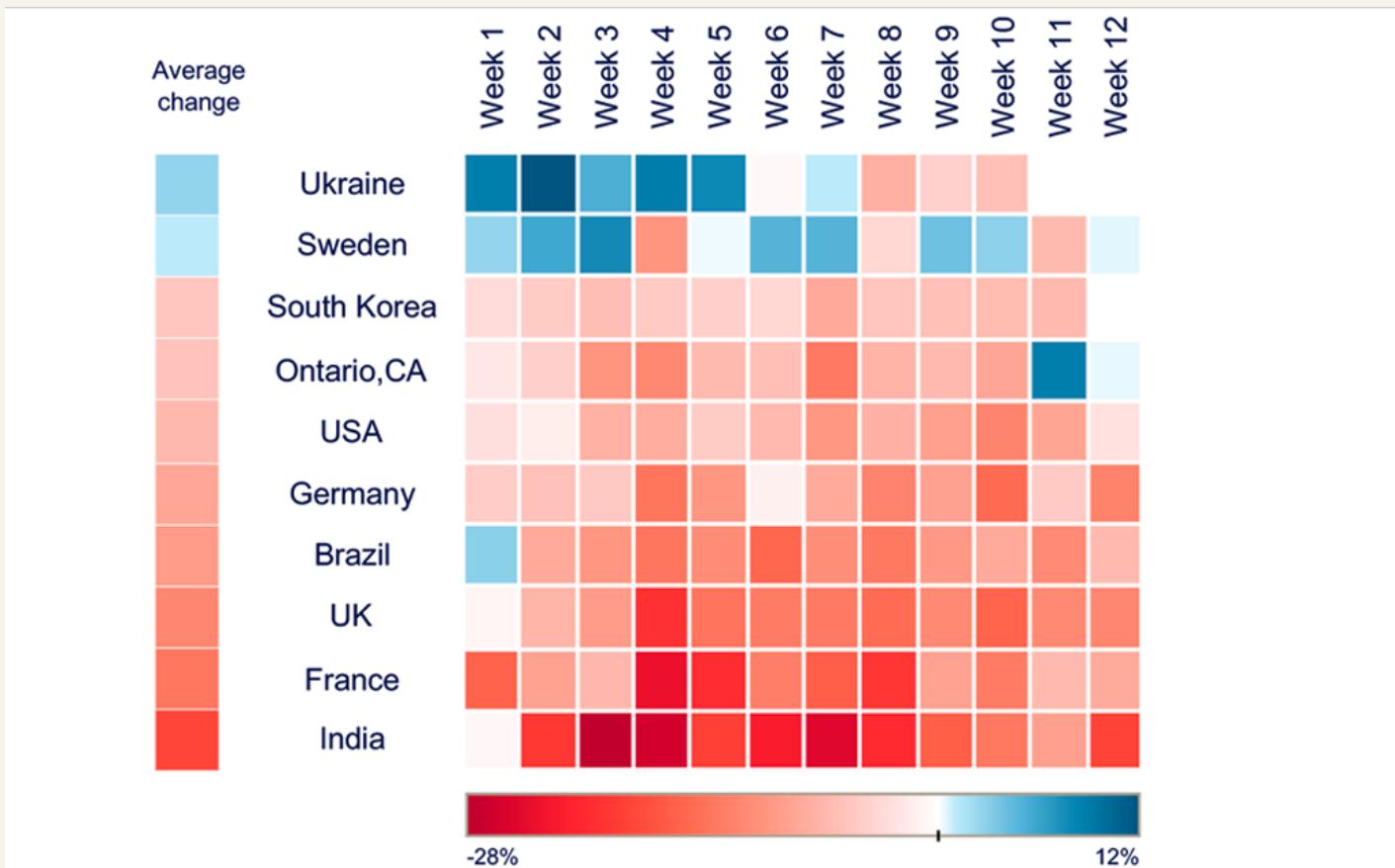


Image from iaea.org. Shown is the weekly change in 2020 electricity demand relative to 2019 in selected jurisdictions (March 15–June 6).

The IAEA Department of Nuclear Energy has rightfully said,

“The performance of nuclear power during the crisis provides a timely reminder of its ongoing contribution and future potential in creating a more sustainable, reliable, low carbon energy system.”

After being in a locked-down state for over a year, our society has been forced to revisit and discuss our priorities to make responsible decisions for ourselves and our next generations to come. Nuclear energy is and shall always be a part of this discussion.

NUCLEAR TECHNOLOGY – STANDING TALL AGAINST COVID-19

Author: Vaishnvi Towari

The 21st century has faced many global disasters. From earthquakes, floods, heat waves to all the other natural disasters, the world has battled many grave situations that have cost millions of lives. Before the world could settle on the fact that global warming is the *crisis of the hour*, 2020 saw the rise of a new global catastrophe - the Coronavirus pandemic, famously known as "COVID-19".

First identified in December 2019 in Wuhan, China, COVID-19 was declared a pandemic by the World Health Organization in March 2020. The world came to a standstill as the people were confined to their homes whilst the frontline medical workers slaved round the clock to save the lives of infected patients. As we enter the year 2021, more than 110 million people have contracted the virus, with over 2 million lives lost. What's more, is that the situation is far from being cured!

Even in these trying times, the benefits of nuclear technology continue to amaze human-kind. Nuclear Energy is credited for its essential role in fighting against climate change. But it is much more than just electricity! Nuclear technology has numerous benefits, ranging from applications to the industry, food and agriculture, space explorations, medicine and mining. Furthermore, this technology has also been crucial to our fight against COVID-19.



Image from brucepower.com. BrucePower located in Ontario, provides medical isotopes for equipment sterilization and to assist in fighting diseases.

Sterilization of medical equipment: Gamma radiation from isotopic sources and high energy electrons from accelerators have the potential to kill disease-causing germs and neutralize other harmful organisms. Radiation is a safe and cost-effective method for sterilizing single-use medical devices such as syringes and surgical gloves, bandages, and other equipment routinely used during medical procedures. One of the key advantages of using radiation is its ability to sterilize already-packaged products. Cobalt-60, an isotope that emits gamma rays, is indispensable to the medical community for its utility in cancer treatments and sterilization of medical devices. Artificially "harvested" from nuclear reactor facilities, the Cobalt-60 sterilization technique is faster (within a day) than other conventional methods, which can take up to two weeks. This time-efficiency is of the essence for situations like this pandemic, where clean and safe medical supplies are urgently needed.

Mapping the COVID-19 protein: Understanding the structure of the Coronavirus is necessary to facilitate anti-viral drug development. Nuclear imaging techniques such as *Positron Emission Tomography* (PET) and *Single-Photon Emission Computed Tomography* (SPECT) are based on the use of gamma-emitting radioisotopes to obtain structural information on the covid-19 virus. This allows for obtaining functional imaging of various activities that occur on the cellular or molecular level, which can be useful

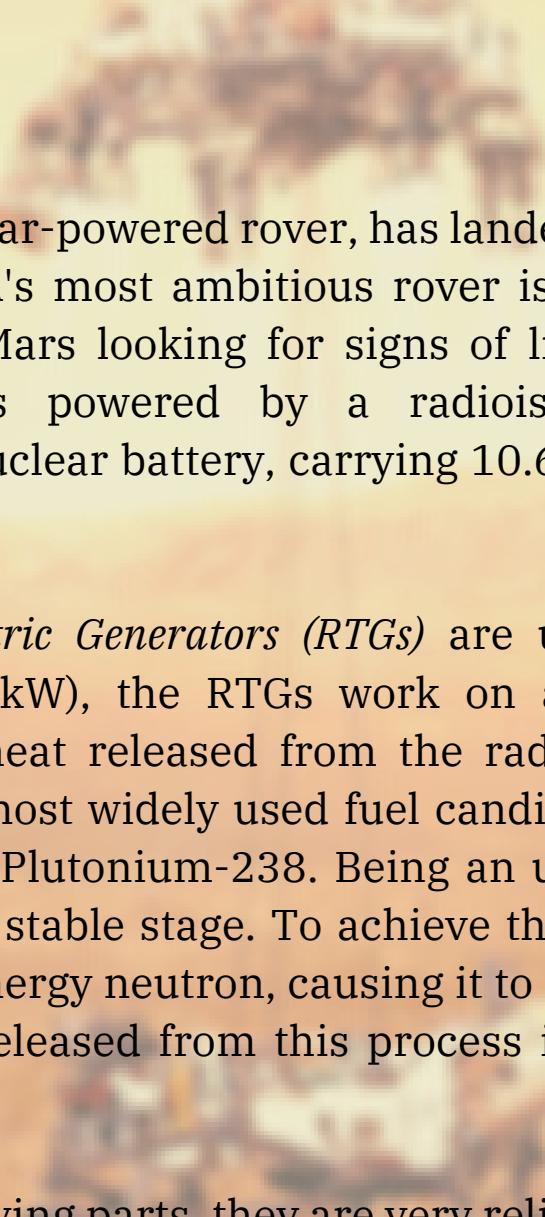
in terms of studying the effectiveness of the interaction of the drug with the virus. Furthermore, the ongoing efforts at the ANSTO research center in Australia, to use its synchrotron (a cyclic particle accelerator) to determine the structure of the proteins on the COVID-19 virus are vital to combat the problem.

Radiation therapy- a possible treatment: With an increasing number of hospitalizations every day, health care workers have been trying to discover alternate treatments that can lead to faster recovery of patients. One such story is of a team of researchers at the Winship Cancer Institute at Emory University, Atlanta, who conducted a study on the use of low-dose radiation therapy to recover oxygen-dependent patients exhibiting COVID-19-related pneumonia. Their preliminary study shows hope for the therapeutic efficacy and safety of low-dose radiation therapy in the context of recovering vulnerable patients. There is a need to conduct more extensive studies before jumping to conclusions, but the preliminary effort does seem promising.

The world today is at crossroads. Fighting the pandemic has become the number one priority, so no stone must be left unturned. There is an immediate need for collaboration and innovation, not just in medicine but also in other industries. In these circumstances, the resilience displayed by the nuclear industry and its commitment to exploring new ways to help find solutions to combat COVID-19 is commendable and praiseworthy.

The author (Vaishnvi Tiwari) acknowledges inputs from various articles published by world-nuclear.org, The Sustainability Times, powermag.com, issues.org, The International Atomic Energy Agency (IAEA), brucepower.com, mdpi.com and ascopost.com.

THE RED PLANET SHALL NO LONGER REMAIN A MYSTERY!



Perseverance, the nuclear-powered rover, has landed!

As we write this, NASA's most ambitious rover is voyaging around the rocky, red surface of Mars looking for signs of life. This life-changing scientific discovery is powered by a radioisotope thermoelectric generator, which is a nuclear battery, carrying 10.6 pounds of plutonium fuel.

Radioisotope Thermoelectric Generators (RTGs) are used for small power requirements (up to 5kW), the RTGs work on a simple principle of converting the decay heat released from the radioactive isotopes into electrical energy. The most widely used fuel candidate for these RTGs is the radioactive isotope Plutonium-238. Being an unstable atom, Pu-238 loses energy to reach a stable stage. To achieve this, the Pu-238 atom is bombarded by a high energy neutron, causing it to split and release alpha particles. The energy released from this process is then converted into electricity.

Since RTGs have no moving parts, they are very reliable and continue for as long as the radioisotope source produces a useful level of energy. RTGs have been used to power various space exploration missions such as Pioneer-10, Pioneer-11, Voyager-1, Voyager-2, Galileo, Cassini, and the Mars Science Laboratory.

Cover image from NASA. An illustration of NASA's Perseverance rover landing safely on Mars.

COMING UP NEXT ...

INDIAN CONTRIBUTION TO ITER

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Article by *Pranjal Singh*

**DIAMONDS AND NUCLEAR TECHNOLOGY
- IS IT LOVE?**

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Guest Article by *Aditya Chincholkar*

AN INCREDIBLE THORIUM REPOSITORY

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Article by our member *Nilormi Das*

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