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## Science & Technology

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### Nations Building Nuclear Power Plants at Near Record Pace

As of May 2021, 19 nations have 52 new nuclear plants under construction, the largest builders being China (14), India (6), South Korea (4), Russia (3), United Arab Emirates (3), and Turkey (3). These six countries account for 33 nuclear plants under construction, or 63% of the total.

All 52 plants, once built, will add approximately 383 TWh of annual electricity generation, compared to the 2,553 TWh of electricity that the world's 441 existing nuclear power plants generated in 2020—an expansion of 15%.

But behind these developments are two processes with respect to durable survival.

The Western nations, intent on turning themselves into post-industrial husks, are turning their back on their own future durable survival. Of the 19 countries that have nuclear plants under construction, only three are in Europe and North America: One is in the United States, where Georgia Power is building the Plant Vogtle power station with two 1,115 MW Westinghouse AP1000 reactors in Waynesboro, Georgia. But these two units are part of a process that started in 2009 when they were first approved. The second western nation is the UK, where France's EDF is building the Hinkley Point C power station, with two 1,600 MWe European Pressurized Reactors, in Somerset. Neither the U.S. nor the UK is planning any more nuclear power plants. The third nation is

France, which is constantly updating its fleet of 56 plants.

Otherwise in Europe, Slovakia and Belarus have one nuclear plant each under construction; Poland is talking about several. And that's all.

It is where the principle of durable survival and development of one's people is most active, that nuclear power is being built. China, in addition to the 14 nuclear power plants under construction, is planning to build thorium reactors. An [article](#) in the Sept. 9 issue of *Nature*, "China Prepares to Test Thorium-Fuelled Nuclear Reactor," reports that China is scheduled to run tests this month in its experimental molten salt thorium reactor, whose construction was to have been finished in August in the city of Wuwei. Thorium is more plentiful than uranium, and China hopes to solve several problems to build, by 2030, a 373 MW commercial reactor capable of powering hundreds of thousands of homes and businesses.

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### Mars Rocks Reveal Once Watery Home for Possible Ancient Microbial Life

On Sept. 10, NASA [announced](#) exciting results from examinations of rock samples obtained by its *Perseverance* rover on Mars. Project scientist Ken Farley of Caltech said, "It looks like our first rocks reveal a potentially habitable sustained environment. It's a big deal that the water was there a long time." If groundwater was present for long stretches, it could have been "welcoming to microscopic life in the past,"

according to the announcement.

*Perseverance* has taken two samples from a rock NASA has nicknamed "Rochette," which "appears to be volcanic in origin." The samples "could end up on Earth as soon as the early 2030s, as NASA is working on an ambitious sample-return mission. A closer study under lab conditions on our planet could give scientists tons of information about the crater's history."

"The salt minerals in these first two rock cores may also have trapped tiny bubbles of ancient Martian water," NASA said. "If present, they could serve as microscopic time capsules, offering clues about the ancient climate and habitability of Mars."

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### France Celebrates 40th Birthday of High-Speed Intercity TGV

In celebration of the 40th birthday of France's *Train à Grande Vitesse* (TGV), the intercity electric high-speed rail service, French President Emmanuel Macron and SNCF President Jean-Pierre Farandou were on hand Sept. 17 at the Gare de Lyon in Paris to unveil the "TGV of the future." SNCF is France's national railway company. Only the highly aerodynamic shell of the nose was on display; everything else, including the interior, is still confidential.

Standing before a full-scale model of the new TGV M (the M is for modern and modular), Macron hailed the TGV as a prime example of "French genius" and promised to unlock €6.5 billion to further develop the TGV network, in-

cluding new lines serving cities such as Nice and Toulouse. At present, of France's 30,000 km of track, only 2,800 are rated for high-speed.

The streamlined version of the bullet train, set to be on tracks in 2024, promises to carry more passengers—up to 740 passengers from 600—while using 20% less electricity. Like the present service, it will operate at up to 320 km/h (200 mph).

The TGV M trains will be modular, enabling many aspects of their configuration to be changed easily, and maintenance costs will be 30% less than current models.

It is expected that by the end of this year, 3 billion travellers will have been carried by the TGV since 1981.

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## Parasitic Bacteria Point Way to a Cure for Plant Disease

Bacteria-borne diseases cause some of the most serious crop losses worldwide. “A newly discovered manipulation mechanism used by parasitic bacteria to slow down plant aging may offer new ways to protect disease-threatened food crops,” reports a Sept. 17 [press release](#) from the John Innes Centre, a UK-based “independent, international, center of excellence in plant science, genetics, and microbiology.”

“Research from the Hogenhout group at the Centre and collaborators, [published](#) in [the journal] *Cell*, has identified a manipulation molecule produced by Phytoplasma bacteria to hijack plant development. When inside a plant, this protein causes key growth regulators to be broken down, triggering abnormal growth.

“Phytoplasma bacteria belong to a group of microbes that are notorious for their ability to reprogram the development of their host plants. This group of bacteria are often responsible for the ‘witches’ brooms’ seen in trees, where an excessive number of

branches grow close together.

“These bushy outgrowths are the result of the plant being stuck in a vegetative ‘zombie’ state, unable to reproduce and therefore [it] progress[es] to a ‘forever young’ status.

“Phytoplasma bacteria can also cause devastating crop disease, such as Aster Yellows, which causes significant yield losses in both grain and leaf crops like lettuce, carrots, and cereals.

“Professor Saskia Hogenhout, corresponding author of the study, said: ‘Phytoplasmas are a spectacular example of how the reach of genes can extend beyond the organisms to impact surrounding environments.

“ ‘Our findings cast new light on a molecular mechanism behind this extended phenotype in a way that could help solve a major problem for food production. We highlight a promising strategy for engineering plants to achieve a level of durable resistance of crops to phytoplasmas’.”

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## Pfizer Announces Its COVID-19 Vaccine for 5-11 Year-Olds Is a Success

Pfizer and BioNTech [announced](#) Sept. 20 that the Phase 2/3 study of their COVID-19 vaccine for 5-11 year-olds, using a 2-dose regime, has shown it to be “safe, well tolerated, and [providing] robust neutralizing antibody responses.”

Pfizer will now expedite the filing of their application to the FDA for an Emergency Use Authorization. The vaccine is the same mRNA vaccine formulation for adults, but in a dosage appropriate for children—not only because of children’s smaller size, but also because their growing bodies have a different dynamic and different immune response than adults. Pfizer said that the dosage level is approximately one-third that of their current vaccine. The trial involved about 2,000 children.

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## Chinese Scientists Search for Helium-3 in Moon Samples

Scientists in China have begun studying lunar rocks collected by the Chang’e 5 mission, including their potential as a source of helium-3 for use in nuclear fusion reactors, media reports say. The Chang’e 5 mission delivered 1.73 kg of lunar material to Earth in December 2020. A first batch of 31 samples, totaling 17.4764 grams, including fine grains, basalt fragments, and glasses, were distributed to 13 Chinese institutions in July following a first round of applications, Space.com reported.

The Beijing Research Institute of Uranium Geology is studying a 50 milligram sample of lunar rocks to look for the presence of the helium-3 isotope. Helium-3 has been promoted as a potential fuel for future nuclear fusion power plants. While extremely rare on Earth, helium-3 is thought to be more abundant on the Moon, deposited on the lunar surface by the solar wind. The scientists aim to determine the concentration of helium-3 in the lunar soil and how to extract it and transfer it to Earth.

Meanwhile, Chinese scientists are working on generating electricity from fusion power using helium-3 as the fuel. But why all the effort?

The fuels currently being considered by most scientists for fusion power are the hydrogen isotopes, deuterium and tritium, which are abundant on Earth. Although helium-3 has a higher temperature requirement than the hydrogen isotopes to reach fusion ignition, once achieved, the even greater energy released can be contained within the plasma, permitting direct conversion to electricity without requiring a steam cycle—a revolutionary advance over all previous sources of fuel, whether fossil or nuclear, for producing power. And, since the reactions are completely controllable by magnetic fields, helium-3 fueled fusion could be used to propel rockets in space.