



News & Views

U.S. scientists announce breakthrough in fusion energy that powers the sun and stars

Energy Secretary Jennifer Granholm announced a “major scientific breakthrough” on 13th Dec 2022 in the decades-long quest to harness fusion, the energy that powers the sun and stars.

Researchers at the Lawrence Livermore National Laboratory in California for the first time produced more energy in a fusion reaction than was used to ignite it, something called net energy gain, the Energy Department said.

The achievement will pave the way for advancements in national defense and the future of clean power, officials said.

Granholm was appearing alongside Livermore researchers at a news conference in Washington.

“This is a landmark achievement for the researchers and staff at the National Ignition Facility who have dedicated their careers to seeing fusion ignition become a reality, and this milestone will undoubtedly spark even more discovery,” Granholm said in a statement.

Proponents of fusion hope that it could one day produce nearly limitless, carbon-free energy, displacing fossil fuels and other traditional energy sources. Producing energy that powers homes and businesses from fusion is still decades away. But researchers said it was a significant step nonetheless.

“It’s almost like it’s a starting gun going off,” said Professor Dennis Whyte, director of the Plasma Science and Fusion Center at the Massachusetts Institute of Technology and a leader in fusion research. “We should be pushing towards making fusion energy systems available to tackle climate change and energy security.”

Net energy gain has been an elusive goal because fusion happens at such high temperatures and pressures that it is incredibly difficult to control.

Fusion works by pressing hydrogen atoms into each other with such force that they combine into helium, releasing enormous amounts of energy and heat. Unlike other nuclear reactions, it doesn’t create radioactive waste.

Billions of dollars and decades of work have gone into fusion research that has produced exhilarating results - for fractions of a second. Previously, researchers at the National Ignition Facility, the division of Lawrence Livermore where the success took place, used 192 lasers and temperatures multiple times hotter than the center of the sun to create an extremely brief fusion reaction.

The lasers focus an enormous amount of heat on a small metal can. The result is a superheated plasma environment where fusion may occur.

Riccardo Betti, a professor at the University of Rochester and expert in laser fusion, said an announcement that net energy had been gained in a fusion reaction would be significant. But he said there's a long road ahead before the result generates sustainable electricity.

He likened the breakthrough to when humans first learned that refining oil into gasoline and igniting it could produce an explosion.

"You still don't have the engine and you still don't have the tires," Betti said. "You can't say that you have a car."

The net energy gain achievement applied to the fusion reaction itself, not the total amount of power it took to operate the lasers and run the project. For fusion to be viable, it will need to produce significantly more power and for longer.

It is incredibly difficult to control the physics of stars. Whyte said it has been challenging to reach this point because the fuel has to be hotter than the center of the sun. The fuel does not want to stay hot -- it wants to leak out and get cold. Containing it is an incredible challenge, he said.

Net energy gain isn't a huge surprise from the California lab because of progress it had already made, according to Jeremy Chittenden, a professor at Imperial College in London specializing in plasma physics.

"That doesn't take away from the fact that this is a significant milestone," he said.

It takes enormous resources and effort to advance fusion research. One approach turns hydrogen into plasma, an electrically charged gas, which is then controlled by humongous magnets. This method is being explored in France in a collaboration among 35 countries called the International Thermonuclear Experimental Reactor as well as by researchers at the Massachusetts Institute of Technology and a private company.

Last year the teams working on those projects in two continents announced significant advancements in the vital magnets needed for their work.

Source: The Hindu, 14.12.2022

University of Birmingham, hyperTunnel collaborate to change the way tunnels are built

hyperTunnel, a British technology company innovating underground construction, and the University of Birmingham have signed a Memorandum of Understanding (MoU) to work together to progress completely new methods of underground construction, enlargement, monitoring and repair.

New automated construction methods being developed by hyper Tunnel are designed to benefit the construction sector and society as a whole by reducing carbon footprint and building tunnels faster and at a lower cost vs. conventional methods.

At the heart of the concept is the use of robots to 3D-print the shell of the underground structure, according to a digital twin. Using this method, the construction material is deployed directly into the ground.

Initially focusing on autonomous tunneling technologies, imaging and digital simulations, the partnership between the two organizations is likely to include activities such as collaborative research, technology projects, joint publications, secondments, internships and education programs. Key to the MoU is the University of Birmingham's National Buried Infrastructure Facility (NBIF), which is part of the UK Collaboratorium for Research on Infrastructure and Cities (UKCRIC). UKCRIC is designed to stimulate research activities in the fields of infrastructure and cities through close collaboration between academia, industry and government. NBIF is currently leading research into areas such as soil/structure interaction, digital twinning, tunneling and quantum-technology sensing.

hyperTunnel and the University of Birmingham will also engage in joint activities at the University's new campus in Dubai, which includes the development of a multi-million pound Tunnelling Centre of Excellence.

"We're really looking forward to diving into this collaboration," said Nicole Metje, Professor of Infrastructure Monitoring at the University. "Joining forces with pioneering British organizations like hyperTunnel to expand our research and amplify our impact and theirs is exactly what we're about. This partnership is a significant milestone for NBIF."

"The University of Birmingham is one of the top 100 academic institutions in the world and NBIF is a world-class facility," said hyperTunnel co-founder Jeremy Hammond. "Both our organizations are deeply involved in radically innovating underground infrastructure and use of underground space. It's really exciting to think about what we can achieve by combining our expertise like this."

Source: Online Tunnel Business Magazine, 19.12.2022

Sela tunnel project in Arunachal Pradesh, India

The Sela tunnel project in China-bordering Arunachal Pradesh, one of the key elements of India's big infrastructure push in forward areas, has been hit by delay and is now expected to be completed only by April 2023.

The earlier deadline for the completion of the ₹700-crore project was June 2022, which was later revised to November, said one of the officials cited above. The reasons for the delay vary – from a prolonged winter slowing down construction activity earlier this year to technical aspects such as delay in concrete setting inside the tunnel now, HT has learnt.

"There's been some delay in the concreting part as we are not getting the right setting cycles inside the tunnel. In other areas, concrete setting happens in 24 hours but here it is taking up to four days before the shutters can be moved. This is because of the peculiarity of the area, terrain, cold and the humidity profile," said a second official.

The Sela tunnel, announced by the government in 2018, will be the longest twin-lane tunnel above 13,000 feet in the world, and will cut down travel time to Tawang by at least one hour as well as provide all-weather connectivity. Prime Minister Narendra Modi laid the foundation of the project in 2019. It is being executed by the Border Roads Organisation (BRO).

BRO doesn't want to push the finishing work as construction quality is the foremost priority, the officials said.

The project consists of Tunnel 1, which is 980 metres long, and Tunnel 2, a 1,555-metre twin tube tunnel. The tunnels are coming up through two ridges west of Sela. It also includes the construction

of two roads, measuring 7 km and 1.3 km. Tunnel 2 has one bi-lane tube for traffic and one escape tube for emergencies. Only tunnels longer than 1,500 metres need to have an escape passage alongside.

More than 50 engineers and 500 workers are directly involved in the construction of the Sela tunnel, using latest Austrian tunneling techniques, which involve observing and studying the rock, and designing tunnel support according to rock behaviour.

Source: Extract from news item, Hindustan Times, 1.12.22

Tunnel boring machine-TBM Shakti (S-1309A) starts working for the construction of Rishikesh - Karnaprayag rail line project in Uttarakhand, India

Larsen & Toubro (L&T) this week began assembling parts of tunnel boring machine TBM Shakti (S-1309A) for the 125 km Rishikesh-Karnaprayag railway line project's Package 4.

This new railway line by Rail Vikas Nigam Ltd (RVNL) will link both towns in Uttarakhand through 12 stations. L&T was awarded a Rs. 3337.60 crore contract for Package 4 in January 2021 to build the section from chainage 47.360 to 63.118km.

Package 4 includes 14.577-km up-line and 13.123-km down-line tunnels, out of which 10.490 km and 10.317 km will be constructed using 2 Herrenknecht hard rock machines (TBM Shakti & TBM Shiv) with diameters of 9.1m.

TUMAS India Pvt. Ltd. - Altinok Musavirlik Muhenislik A.S (JV) is Package 4's detailed design consultant (DDC).

L&T is chasing a 60 month completion deadline. Per their old press release, this will be the biggest TBM to be deployed in the Himalayan region, and the TBM bored tunnel length of 20.807 km will be the longest for any project in the Himalayan region.

Source: themetrorailguy.com, 16.09.2022

Work in full swing, 13km long Zojila tunnel between J&K and Ladakh, India

In order to restore the road connectivity between Ladakh and Jammu and Kashmir, the work on the Zojila tunnel is going on in full swing, which is estimated to be completed by the end of 2026.

Harpal Singh, project head of the company, Megha Engineering and Infrastructure Constructions Limited (MIL) that is constructing the 13-km long Zojila Tunnel, said, "The construction of the tunnel is going on in full swing and is expected to be completed by the end of 2026." According to him, with the completion of the last tube of Zojila project, the 32-km distance between Sonmarg and Minamarg will be covered in less than 40 minutes instead of four hours. Apart from this, the all-weather connectivity will provide a lot of relief to the deployed forces and the local people.

He added, "Though the tunnel was announced in 2005, the project was later delayed. The company that had earlier got the job went bankrupt and the work was suspended for almost two years. The Central government then made some changes in the project and restarted the work in 2020 and awarded its tender to MIL."

Regarding the difficulties faced during the work of the tunnel, he said, “Despite Kashmir’s extremely cold weather, 1,000 people have been working day and night on the project.” He said necessary precautions are being taken.

Completion of the tunnel will restore the road connectivity throughout the year, which will help boost the economy of Ladakh and provide the people with essentials in all weather conditions.

Source: The Tribune, 29.09.2022

“India’s digital infra capability far ahead” says Chairman and Chief Executive of Microsoft Corp., Satya Nadella

“Oh, please don’t make me laugh. I’m the king of street food in Mumbai.” That’s the witty response that Satya Nadella, Chairman and Chief Executive of Microsoft Corp., got when he prompted artificial intelligence (AI)-powered ChatGPT to write a play, wherein Mumbai’s favourite street food – the vada pav – would argue its supremacy against competitors including Delhi’s bhel puri.

India-born Satya Nadella, who is on a four-day visit to India to meet the company’s customers and government officials, used the play to demonstrate how AI models such ChatGPT and Dall-E, both built by US firm OpenAI, are now the new ‘reasoning engines’ that can help knowledge workers enhance their performance. According to Nadella, who was addressing the media and some customers in Mumbai, large language model-based AI tools, including ChatGPT and Dall-E, will play increasingly important roles in the future of workers.

However, he said that these platforms will have to be used responsibly and people should consider the “displacement (of employees and business models)” that they can cause.

Nadella said while such generative AI tools have generated less than 1% of the world’s AI data sets in 2021, this can increase to a tenth of all data generated by 2025. “In future, the generative models will generate most of the data. We are right now seeing the emergence of a new reasoning engine. We’ll clearly have to talk about this reasoning engine – what are its responsible uses, what displacements will it cause, and so on. But on the other side, we should also think about how it can augment us in what we are doing today since it can have a huge impact on our future,” he said.

“Ultimately, these tools will accelerate human creativity, human ingenuity and human productivity across a range of tasks. It is going to be a golden age – the computer revolution created mass consumer behaviour change and productivity for knowledge workers. But, what if we could spread that productivity more evenly? To me, that is one of the biggest things to look forward to, and the way to achieve this is by building a robust data infrastructure.”

Nadella believes India will play a central role in the development of such AI-powered platforms. “One of the things that’s great to see is India leading in digital public goods. I mean, there’s India, and then there is daylight, when it comes to the enlightened way in which India is building out digital infrastructure.” he said.

Source: Hindustan Times, 4.1.2023

Trains on hydrogen fuel cells by the end of the year 2023 !

India will roll out trains running on hydrogen fuel cells on 8 heritage route services by the end of the year 2023 according to Union railway minister Ashwini Vaishnaw.

Hydrogen fuel cells are increasingly being tried as a clean energy technology in the transportation sector, with several countries having already begun running light capacity services that leave no emission apart from water.

“The first train under ‘Hydrogen for Heritage’ will commence operations from December 2023, implying that trains in the heritage routes will go green,” Vaishnav said, adding that the locomotives will still retain the look of a steam engine to stick to its heritage ethos.

The routes on which these trains will be rolled out are Kalka-Shimla, Matheran Hill, Darjeeling Himalayan, Kangra valley, Bilmora-Waghai, Mhow-Patalpani, Nilgiri Mountain and Marwar-Devgarh Madriya. Currently, trains on these routes largely runs on diesel.

Under the appearance, the new will be a completely different technology. Each of the coaches in the trains, which run on narrow gauges and are meant for leisure instead of transportation, will be powered by their own hydrogen cell motor, the minister explained. Vaishnav said each of the trains will have four coaches.

Prime Minister Narendra Modi on August 15, 2021, announced the launch of a National Hydrogen Mission to accelerate plans to generate the carbon-free fuel from renewables and had set a target of 2047 for India to achieve self-reliance in energy.

The transport sector is one of the largest sources of emissions of greenhouse gasses, and efforts are underway globally to include clean fuels such as hydrogen fuel cells.

Source: Extract from news item, Hindustan Times, 4.1.2023

Sweden makes huge rare earths discovery

Europe’s largest known deposits of rare earth elements, essential for the manufacturing of electrical vehicles, has been discovered in Sweden’s far north.

Swedish mining group LKAB said the newly explored deposit, found right next to its iron ore mine, contained more than one million tonne of rare earth oxides.

“This is the largest known deposit of rare earth elements in our part of the world, and it could become a significant building block for producing the critical raw materials that are absolutely crucial to enable the green transition,” LKAB’s chief executive Jan Mostrom said in a statement. “We face a supply problem. Without mines, there can be no electrical vehicles,” Mostrom added.

While the find is believed to be the biggest in Europe, it remains small on global scale, representing less than one percent of the 120 million tonne estimated worldwide by the US Geological Survey.

In 2021, the European Commission said that 98 percent of the rare earths used in the EU were imported from China, prompting Brussels to urge member states to develop their own extraction capacities.

LKAB’s find was presented as a delegation from the European Commission visited Sweden, which took over the rotating EU presidency at the start of the year.

“Today, the EU is way too dependent on other countries for these materials,” Swedish Energy Minister Ebba Busch told a press conference, pointing specifically to Russia and China.

“This must change. We must take responsibility for the raw material supply needed for the (green) transition,” she added.

Source: Hindustan Times, 13.1.2023

Nine tunnels are under construction in Arunachal Pradesh, India

India is reducing the huge “infrastructure differential” with China along the LAC. With the Army now deploying new-generation equipment such as heavy excavators, spider excavators and light weight crawler rock drills, the “capability and capacity of our combat engineers has gone up by three to four times in eastern Ladakh and elsewhere”, a top defence establishment source said.

Tunnels are another priority area, both for all-weather connectivity and swifter troop deployments in forward areas as well as underground storage of ammunition, missiles, fuel and other supplies.

Nine tunnels are under construction, which includes the strategic 2.5km Sela tunnel to Tawang in Arunachal being built for Rs 687 crore at an altitude of over 13,000 feet, while 11 more tunnels are planned, the sources said.

There are also multiple road projects under way. By 2026, for instance, there will be “alternate” connectivity to western Ladakh and the Zaskar Valley directly from the Manali axis through a 298 km NHDL (National Highway Double Lane) specification road. “The road includes the 4.1km twin tube Shinkun La tunnel. Around 65% of the work is done. With this alternate axis, there will be 365 days connectivity to Leh,” the source said.

Similarly, on the crucial Darbuk-Shyok-Daulat Beg Oldi (DS-DBO) road, which provides connectivity to the crucial advance landing ground and post near the LAC, 35 bridges are being upgraded to ‘Class-70’ specifications. “They are likely to be completed by the next working season,” he added.

Source: The Times of India, Bengaluru, 16.11.2022

Almonds can help cut calories during weight loss journey

A recent study from the University of South Australia revealed that a handful of almonds can assist in preventing weight gain, even though reducing weight can be a thankless task. Researchers, who studied how almonds can alter human appetite, discovered that a snack of 30-50 grams of almonds could encourage people to consume fewer kilojoules each day.

The study found that those who ate almonds instead of an energy-equivalent carbohydrate snack reduced their energy consumption by 300 kilojoules at the next meal, the majority of which came from junk food.

Dr. Sharayah Carter from UniSA’s Alliance for Research in Exercise, Nutrition and Activity (ARENA) research provides valuable insights into weight management. “Rates of overweight and obesity are a major public health concern, and modulating appetite through better hormonal response may be key to promoting weight management,” Dr Carter said. “Our research examined the hormones that regulate appetite and how nuts, specifically almonds, might contribute to appetite control,” he added. “We found that people who ate almonds experienced changes in their appetite-regulating hormones and that these may have contributed to reduced food intake,” he said.

Consumption of almonds was associated with lower levels of C-peptide responses (47% lower), higher level of the glucose dependent insulinotropic polypeptide (18% higher), glucagon (39% higher), and pancreatic polypeptide responses. C-peptide responses can improve insulin sensitivity and lower the risk of developing diabetes and cardiovascular disease.

Source : Bangalore Times, TOI, 24.12.2022

Small changes to make in your daily routine to boost your metabolism

We have often heard that a fast metabolism is a key to losing weight. Not only does fast metabolism help you lose weight but also help in keeping you healthy overall. The nutrients that you eat, whether they are absorbed by the body, if the calories you are eating are getting burned by exercising. It all depends on your metabolism. A healthy and fast metabolism is the basic step towards losing weight and staying healthy. Here are a few daily changes that can help boost your metabolism

Add protein and fibre to your meals

Protein and fibre-rich foods are good for your body. Protein helps in building muscles and fibre keeps you satiated for longer and thus stops you from binge eating. Increasing the amount of protein in your daily diet does not just stop your binge eating but also helps you lose weight.

Keep yourself hydrated

Keeping yourself hydrated is of paramount importance to stay healthy. A hydrated body helps in better absorption of nutrients. Thus, make sure to drink plenty of water throughout the day and include other drinks like coconut water, lemonade, vegetable juice and fruit juice to detox your body.

Workout

Sitting for long hours can shorten your lifespan. Yes, you read that right. One should do a physical activity of any form they like. Being physically active is not just good for your physical health but mental health too. Exercise at least five days a week for 40-45 minutes every day.

Sleep

Sleeping for 6-8 hours is important to rejuvenate your body. Sleep is the time when your body repairs itself. A good night's sleep gives you enough energy for the next day. Try to sleep early at night and get up early in the morning, as it helps to maintain a routine and is good for the circadian rhythm of the body.

Do high-intensity workout

High-intensity interval training involves quick and intense bursts of activity. It helps you burn more fat by increasing the metabolic rate, even after you are done doing the workout.

A study has shown that overweight men found that 13 weeks of high intensity exercise reduced their BMI by 2 kilos and belly fat by 17 percent.

Eat spicy foods

Peppers have capsaicin, a substance that can boost your metabolism. A study found that capsaicin in small doses can help you burn 10 more calories per meal.

Overall, the effect of adding spices to your meal is not that significant. Though it can lead to a slight advantage when combined with other metabolism-boosting strategies.

Replace cooking fat with coconut oil

Coconut oil is relatively high in medium-chain fats as compared to other saturated fats. Medium-chain fats can help boost your metabolism more than long-chain fats found in foods like butter.

A study found that medium-chain fats increased metabolism by 12 percent as compared to long-chain fats, which raised metabolism by only 4 percent.

Source: Times Health Survey, TOI, Bangalore Edition, 12.11.2022

Football lessons from the Bhagwad Gita

“You will be nearer to heaven playing football than studying the Bhagwad Gita.” This advice of Swami Vivekananda to a frail young boy who had come to him to study Vedanta has led many to presume that the Swamiji was actually talking of the need to be bodily strong even to pursue spiritual education.

In his memoir, *What I Talk About When I Talk About Running*, Japanese writer Haruki Murakami too says that he took to running to develop the tenacity and resilience needed for long hours of writing. In the process, Murakami became a prolific marathoner too. It is this need for physical resilience and strength that Swami Vivekananda was talking about. Spiritual study is like a marathon. It is like a FIFA World Cup. A series of them, one needs a high level of body fitness and mental balance to reach the global.

The 2022 FIFA World Cup in Qatar mirrored the Bhagwad Gita in many ways.

Inspiring captains like Lionel Messi of Argentina and Luka Modric of Croatia exemplify Gita's shlok 3:21: whatever a great person does, that other people also do, imitate; whatever they establish as the standard, that other people follow.

Rising high on scoring goals, sinking low on giving them away, team swayed to the cadence of the great dvandva, duality, of life. Kylian Mbappe's unrelenting remorse after losing the final was in stark contrast to Messi's all accepting smile when Mbappe scored 2 goals in 97 second to level the score at a time when Argentina was quite sure to win. Messi was a picture of equanimity even as his dream of winning the World Cup was being tossed about on the unpredictable waves of changes.

Krishn says in verse 2:38: Having made pleasure and pain, gain and loss, victory and defeat the same, engage in battle for the sake of battle; thus, you shall not incur sin.

The advice is clear. Equanimity in the face of all situation is the secret method of keeping the mind ever open and ever ready to take the right action. In the Gita shlok 2:28, Krishn advises: Perform action O' Dhananjay, abandoning attachment, being steadfast in yog and balanced in success and failure. Evenness of mind is called yog.

No game is played to lose. Krishn is simply driving home that it is the more equanimous and the more balanced ones who win the day. Equanimity is not possible when the mind gets clouded by duality. This duality of vision – seeing victory and defeat, happiness and sorrow, faith and doubt at the same time – shatters the single pointedness of vision needed to ensure success. And then, when it comes to the crunch of deciding the winner through penalty-kicks, like it did in the hard-fought

final between Argentina and France, it is the calmer, more balanced minds that zero in on the goal and take home the trophy.

To Mbappe and the French team one can quote the famous Gita verse 2:47: Your right is to your work only and never to its fruits; let not the fruit of action be your motive, nor let your attachment be to inaction.

Source: Shyam Banerji, Speaking Tree, The Times of India, 22.12.2022

Climate change threatens oases in Morocco

Residents of the oasis of Alnif say they can't remember a drought this bad: The land is dry. Some wells are empty. Palm groves that date back more than 100 years are barren. Home to centuries-old oases that have been a trademark of Morocco, this region about 170 miles southeast of Marrakesh is reeling from the effects of climate change, which has created an emergency for the kingdom's agriculture.

Among those affected is Hammou Ben Ady, a nomad in the Tinghir region who leads his flock of sheep and goats in search of grazing grass. The drought forced him to rely on government handouts of fodder.

November is usually a cold, wet month in Alnif, but when the rain failed to come, the king called for rain prayers across the country, and old Islamic tradition during desperately dry times. Children led the procession, holding wooden planks inscribed with Quranic verses, followed by local officials and residents. They gathered near a dead oasis as a religious leader declared that the drought was a man-made disaster and that the rains will come when people atone for their sins and the way they have "treated the planet."

Resident Mo'chi Ahmad said the oasis has provided a livelihood for this population for hundreds of years. Now the oasis is "threatened with extinction." And everyone notices the disappearing palm trees.

In the last three years, hundreds of people from oasis areas have fled toward cities and many young people have migrated toward Europe, mainly because of the drought, said Mohamed Bozama, another resident.

He also blames the digging of unauthorized wells and rising demand for water from existing wells for worsening the crisis.

But for Hassan Bouazza, some of the solution lies in the hands of the people of the Alnif region. He was the first to install solar panels on the region's ksar, or castle, and began relying on the energy produced to dig wells and irrigate his fellow farmers' lands. "We must learn to live with the situation we're in and think about ways to make the heat and drought work to our advantage," such as using new irrigation systems and solar power, he said. He called for oasis inhabitants to be provided with training to help them move away from traditional irrigation in favour of drip irrigation, which requires significantly less water.

But sometimes, Bouazza said, it's hard not to despair when climate warnings are ignored. "It is like a little child holds a dying bird in his hand, and all he does is laugh. This is how we are treating Mother Earth."

Source: The Times of India, 25.12.2022