



इस अंक में:

- नाभिकीय नारे
- तकनीकी सत्र
- नाभिकीय आंकड़ा
- नाभिकीय समाचार
- शब्द कोश
- आपको मालूम है?
- विशेष आलेख
- नाभिकीय सामान्य ज्ञान

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स्थल निदेशक,  
कुडनकुलम न्यूक्लियर  
पॉवर प्रोजेक्ट

प्रिय पाठकगण ,

हाल ही में संलयन पॉवर में प्रगति का संवेग देखा गया है और जेप इनर्जी द्वारा नई विकसित संलयन प्रौद्योगिकी अति आशाजनक है क्योंकि यह सुसंहत है एवं बड़े अतिचालक चुंबक एवं शक्तिशाली लेसर को वर्जित करता है। इस प्रगति के साथ , निवल शून्य के लक्ष्य की शीघ्र प्राप्ति व्यवहार्य है। पढ़कर आनंदित हों...

अध्यक्ष, जन जागरूकता समिति



### अक्टूबर 2024 के विशिष्ट बिंदु

1

केकेएनपीपी स्थल पर 32 और स्थल के बाहर 05 जन संपर्क कार्यक्रम आयोजित किए गए

2

1,548 घंटों का जन संपर्क, 4,165 लोगों से संपर्क

3

13,688 जन जागरूकता प्रकाशन वितरित किए गए



### केकेएनपीपी का जलवायु परिवर्तन के न्यूनकरण में योगदान

जलवायु परिवर्तन आज वैश्विक पर्यावरण मुद्दों में सर्वाधिक महत्वपूर्ण है। नाभिकीय विद्युत न्यूनतम कार्बन प्रौद्योगिकियों में से एक है जो बढ़ती हुई आबादी एवं सामाजिक-आर्थिक विकास के लिए विद्युत उत्पादन करते हुए ग्रीन हाउस गैसों (जीएचजी) के उत्सर्जन (अधिकतर CO<sub>2</sub>) में कमी लाती है। CO<sub>2</sub> के उत्सर्जन में कमी लाने में केकेएनपीपी का योगदान (दिनांक 31 अक्टूबर 2024 को) अब तक इस प्रकार है।



कुल उत्पादित विद्युत इकाई

104,694  
मिलियन यूनिट



केकेएनपीपी द्वारा कुल CO<sub>2</sub> उत्सर्जन में कमी

89,932,234  
टन

नोट: कोयले एवं नाभिकीय ऊर्जा के औसत जीवन चक्र ग्रीन हाउस गैस उत्सर्जन क्रमशः 888 एवं 29 (टन/गीगावाट घंटा) है।

# Public Awareness e-Newsletter

## Kudankulam Nuclear Power Project

October 2024

Issue -148

### In this issue:

- Nuclear Slogan
- Technical session
- Nuclear Database
- Nuclear News
- Lexicon
- Did you know?
- Feature article
- Nuclear Trivia



A glimpse of **Common flameback** at KKNPP premises

Photography by  
**Jashi KB**  
OIC, TLD Lab, KKNPP

### Scientific classification

Kingdom:	Animalia
Phylum:	Chordata
Class:	Aves
Order:	Piciformes
Family:	Picidae
Genus:	Dinopium
Species:	D. javanense

Binomial name:  
**Dinopium javanense**

Source: en.wikipedia.org

Dear Readers,

The advancement in fusion power has seen a momentum in the recent time and the newly developed Fusion technologies by Zap Energy is highly promising as it is compact and avoids large superconducting magnets and powerful lasers. With this progress, early achievement of the goal of Netzero target is viable.

Read on, happily!

-Chairman, PA Committee



### Spotlight of October 2024

1

32 on-site & 05 Off-site outreach programme organised

2

1,548 hours of Public Outreach, reached 4,165 people

3

13,688 PA Publications distributed



### KKNPP's contribution to climate change mitigation

Climate change is the foremost global environmental issue today. Nuclear power is one of the low carbon technologies that can contribute to reducing greenhouse gas (GHG) emissions (mostly CO<sub>2</sub>) while generating electricity for growing populations and socioeconomic development. KKNPP's contribution in preventing the CO<sub>2</sub> emissions till now (As on Oct 31, 2024) is given below.



No. of units of electricity generated **104,694** Million Units



Total CO<sub>2</sub> emissions avoided by KKNPP **89,932,234** Tonnes

Note: Average lifecycle GHG emissions for Coal & Nuclear is 888 & 29 (tonnes/GWh) respectively.

### SMRs becoming a reality

Small modular reactors are "one of the most promising, exciting and necessary technological developments" in recent times and are now becoming a reality. For those of us like me who have been working in this fascinating field for more than four decades, small and modular reactors have been mentioned and talked about for many, many years, considering them a possibility, something that could happen at some point in a not very clear future. Now, this is happening.



**Rafael Mariano Grossi**  
Director General, IAEA

Source: world-nuclear-news.org, Dir Gen at the agency's first international conference on SMRs dated 23 Oct 2024.

KKNPP tenders all possible support to the people in the neighbourhood with an aim of achieving inclusive growth of surrounding population. Notable programmes of Corporate social responsibility (CSR) are construction of schools, hospitals, Health camps supporting physically challenged persons, paving of roads and distribution of garbage collection vehicle.

### Construction of additional class room buildings to nearby Schools

As a part of CSR programme, a total of 9 nos of additional class rooms were Constructed at Nehru National Higher Secondary School, Vadakkankulam to accommodate 361 students.

Date : 05/09/2024

The building was handed over by CSR members in the presence of school children and teachers.

### Construction of Lavatory blocks to nearby Schools

As a part of CSR programme, Lavatory blocks were constructed to improve sanitary and hygienic condition in schools to benefit students of the following nearby schools:

- Concordia Higher Secondary School, Vadakkankulam
- Government High School, Mathaganeri
- Nehru National Higher Secondary School, Vadakkankulam.

A total of about 650 students will benefit from this project.



*Prospering together*



### Construction of additional class room buildings



### Construction of Lavatory blocks





Bhoomi pooja performed for construction of additional class room buildings to nearby schools

Bhoomi pooja was performed for construction of additional class room buildings to the following nearby schools during the month:

- Panchayat Union Primary School, Illaiyanainarkulam (2 nos.)
- MELIM Primary School, Ambalavanapuram (2 nos.)
- Panchayat Middle School, Vijayapathi (4 Nos)
- Government High School, Seelathikulam (4 nos.)
- Muslim Middle School, Thiruvambalapuram (4 nos.)

About 675 students will benefit from the above additional class room buildings.

**Bhoomi pooja performed for construction of additional class room buildings**







**NPCIL Mission:**

To develop nuclear power technology and to produce Nuclear Power as a safe, environmentally benign and economically viable source of electrical energy to meet the increasing needs of country.

**Amazon invests in X-energy, unveils SMR project plans**

“One of the fastest ways to address climate change is by transitioning our society to carbon-free energy sources, and nuclear energy is both carbon-free and able to scale - which is why it’s an important area of investment for Amazon. Our agreements will encourage the construction of new nuclear technologies that will generate energy for decades to come.”



**Matt Garman**  
CEO, Amazon Web Services

Source: World Nuclear News dated 16 Oct 2024, www.bizjournals.com



**Generation IV Nuclear Reactors**

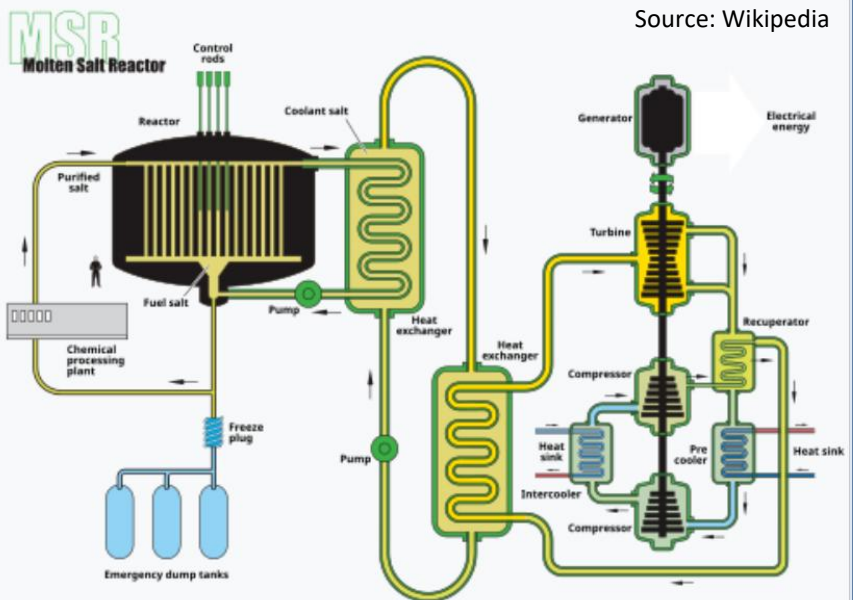
(Source: World Nuclear Association)

**GIF reactor technologies**

**Molten salt reactor (MSR) (now two variants): :**

- ▶ one a fast reactor with fissile material dissolved in the circulation fuel salt;
- ▶ the other with solid particle fuel in graphite and the salt functioning only as coolant.

In what is considered to be a normal MSR, the uranium fuel is dissolved in the fluoride salt coolant which circulates through graphite core channels to achieve some moderation and an epithermal neutron spectrum. The reference plant is up to 1000 MWe.



Fission products are removed continuously and the actinides are fully recycled, while plutonium and other actinides can be added along with U-238, without the need for fuel fabrication. Coolant temperature is 700°C at very low pressure, with 800°C envisaged. A secondary coolant system is used for electricity generation, and thermochemical hydrogen production is also feasible.



Updated as on Nov 06, 2024

Source: <https://pris.iaea.org/PRIS>

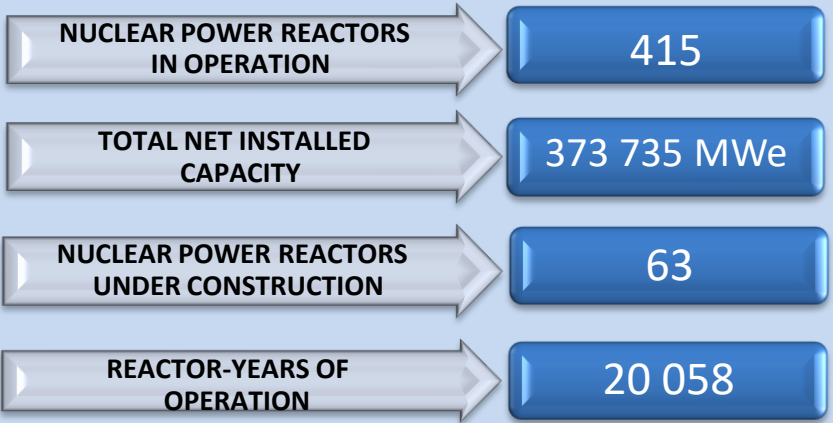
**OPERATIONAL  
REACTORS**

Country	MWe	No. of Reactors
ARGENTINA	1641	3
ARMENIA	416	1
BELARUS	2220	2
BELGIUM	3908	5
BRAZIL	1884	2
BULGARIA	2006	2
CANADA	13699	19
CHINA	54152	56
CZECH REP	3934	6
FINLAND	4394	5
FRANCE	61370	56
HUNGARY	1916	4
INDIA	6920	20
IRAN	915	1
JAPAN	11046	12
KOREA	25825	26
MEXICO	1552	2
NETHERLANDS	482	1
PAKISTAN	3262	6
ROMANIA	1300	2
RUSSIA	26802	36
SLOVAKIA	2308	5
SLOVENIA	688	1
SOUTH AFRICA	1854	2
SPAIN	7123	7
SWEDEN	6944	6
SWITZERLAND	2973	4
TAIWAN	938	1
UKRAINE	13107	15
UAE	5321	4
UK	5883	9
USA	96952	94
<b>Total</b>	<b>373735</b>	<b>415</b>

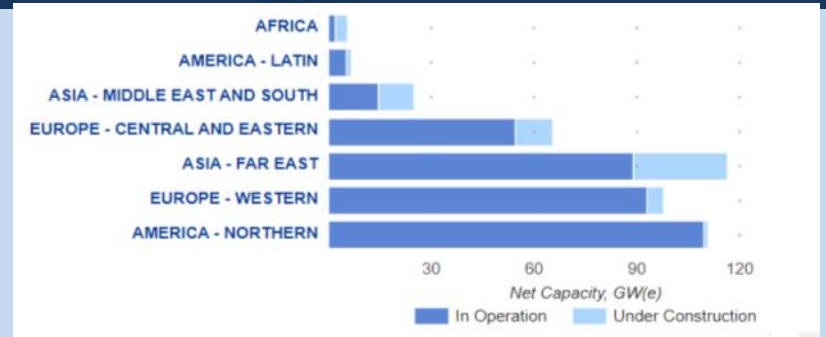
Source: <https://pris.iaea.org/PRIS>  
www.nucnet.org



**Current Status:**



**Regional Distribution of Nuclear Power Plants:**



**New connections to the grid: (Year 2024)**

**KAKRAPAR-4** (630 MW(e), PHWR, INDIA) on 20 Feb

- ❖ Construction Start Date : 22 Nov, 2010
- ❖ First Criticality Date : 17 Dec, 2023
- ❖ First Grid Connection : 20 Feb, 2024

**VOGTLE-4** (1117 MW(e), PWR, USA) on 6 March

- ❖ Construction Start Date : 19 Nov, 2013
- ❖ First Criticality Date : 14 Feb, 2024
- ❖ First Grid Connection : 06 Mar, 2024

**BARAKAH-4** (1310 MW(e), PWR, UAE) on 23 March

- ❖ Construction Start Date : 30 Jul, 2015
- ❖ First Criticality Date : 01 Mar, 2024
- ❖ First Grid Connection : 23 Mar, 2024

**FANGCHENGANG-4** (1000 MW(e), PWR, CHINA) on 9 April

- ❖ Construction Start Date : 23 Dec, 2016
- ❖ First Criticality Date : 03 Apr, 2024
- ❖ First Grid Connection : 09 Apr, 2024



**Hinkley Point C's second unit taking shape Oct 15**



The third and top steel ring for Hinkley Point C unit 2's containment building has been lifted into place. The 423-tonne, 11.6-metre high and 47-metre diameter steel was lifted into place on Monday by the site's giant crane. The steel ring is the final tier of the wall of the containment building, with its dome scheduled to be placed on top during 2025. The first unit's reactor is set to be installed in the next few weeks. When complete, the two EPR pressurised water reactors of 1630 MWe each at Hinkley Point C will produce enough carbon-free electricity for six million homes, and is expected to operate for as long as 80 years.

Source: [www.world-nuclear-news.org](http://www.world-nuclear-news.org)

**Reactor assembly completed for Bangladesh's first nuclear unit Oct 22**



The first unit at the Rooppur nuclear power plant in Bangladesh has had its reactor assembly completed. The Rooppur plant, 160 kilometres from the capital Dhaka, features two Russian VVER-1200 reactors. The reactor assembly process included the installation of reactor internals, such as the shaft and baffle, loading of dummy fuel and installation of a protective pipes unit. The next stage is hydraulic testing.

Source: [www.world-nuclear-news.org](http://www.world-nuclear-news.org)



**Argentina and El Salvador sign MoU on nuclear energy Oct 02**



The memorandum of understanding was signed by the President of the National Atomic Energy Commission (CNEA), Germán Guido Lavalle, and the Director of the Agency for the Implementation of the Nuclear Energy Program (OIPEN) of El Salvador, Daniel Alejandro Álvarez. Guido Lavalle said: "This is undoubtedly a great step in the development of nuclear energy for El Salvador, and we at CNEA are proud to be able to accompany and assist in this very important initial stage, which will undoubtedly bring concrete benefits to Salvadoran society. Our long tradition of training human resources in the Latin American region, through our academic institutes, will be made available once again within the framework of an inter-institutional understanding, with great impact to generate local capacities and strengthen the applications of nuclear technology for peaceful purposes."

Source: [www.world-nuclear-news.org](http://www.world-nuclear-news.org)

**First reactor launched for Yakutia nuclear icebreaker Oct 10**

The first of two RITM-200 reactors has been brought to a minimum controlled power level on the Yakutia nuclear icebreaker. The icebreaker Yakutia is the fourth nuclear-powered icebreaker from Russia's Project 22220 programme



and it is nearing the end of construction at the Baltic Shipyard, which is building three more similar vessels – Chukotka, Leningrad and Stalingrad. The RITM-200 is a pressurised water reactor with a thermal capacity of 175 MW, which converts to 30 MW at the propellers. It is 7.3 metres high with a diameter of 3.3 metres and an integral layout which its manufacturers say means it is lighter, more compact and 25 MW more powerful than previous generations used on nuclear-powered icebreakers. The service life is 40 years. Development of the Northern Sea Route is seen as a priority for Russia, with the distance from Murmansk to Japanese ports halved compared with journeys via the Suez Canal and the duration cut from 37 to 18 days. More than 35 million tonnes was transported along the Northern Sea Route in 2023.

Source: [www.world-nuclear-news.org](http://www.world-nuclear-news.org)

**Zap starts up demo fusion power plant system Oct 10**



Fusion power developer Zap Energy, based near Seattle, has begun operations of Century, its first fully-integrated demonstration of three major plant-relevant technologies operating at up to 100 kilowatts of input power. Zap Energy's fusion approach - known as a sheared-flow-stabilised Z-pinch - avoids large superconducting magnets and powerful lasers, and is far smaller than conventional systems. "Zap's fusion approach is pulsed, so ultimately it will run like an internal combustion engine with cylinders firing all day long to produce steady energy output. As you do that you also generate large neutron flux and heat loads in the system over time, which is exactly the energy output that you want, but requires unique engineering solutions. Century will test a lot of our assumptions and define the best path toward our first plant."

Source: [www.world-nuclear-news.org](http://www.world-nuclear-news.org)



**QUICK FACTS**

**\$125 Billion Annual Boost in Nuclear Power Needed to Hit Net Zero**

▮ The 2024 edition of the IAEA's Climate Change and Nuclear Power report emphasizes the need to significantly boost investments in nuclear energy to meet global climate goals.



▮ The report highlights that, to reach net zero emissions by mid-century, a rapid expansion of clean energy technologies is essential.

▮ The IAEA estimates that global investment in nuclear energy needs to increase to **\$125 billion annually**. This is up from the current investment of around \$50 billion per year between 2017 and 2023.

▮ The funding is necessary to build new reactors, upgrade existing infrastructure, and ensure safe operation.

Source: <https://carboncredits.com>



*Nuclear Slogan*

**“Nuclear energy: The key to preserving our future”**



Source: <https://aahsmountainecho.com/> , LinkedIn

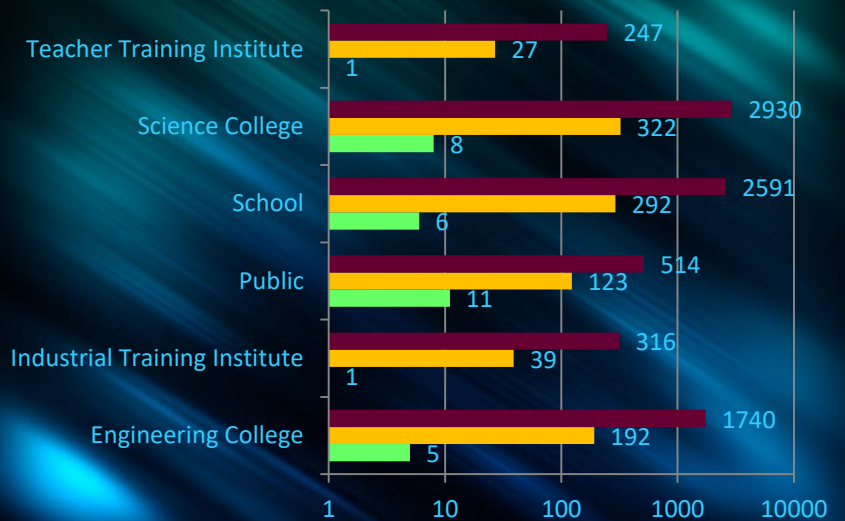


*PA activity conducted at KKNPP Site*

At site

As a part of public awareness programme, visits of Public from districts such as Tirunelveli, Kanyakumari and Tuticorin to KKNPP were organised. The visitors of KKNPP were provided with a detailed information on nuclear power generation and its safety principles.

■ Publications distributed ■ No. of participants ■ Progm organised





*Few glimpses from Site Visit*

At  
site

**V.V.Vanniaperumal  
College for Women  
(Oct 01)**



**Family members of  
KKNPP Staff,  
Anuvijay Township  
(Oct 01)**



**Mar Thoma  
College for Women,  
Kottayam  
(Oct 03)**



**Sri Parasakthi  
College for Women  
Courtallam  
(Oct 04)**





*Few glimpses from Site Visit*

At  
site

**Paramedical staffs from  
Government Hospitals  
around KKNPP  
Tirunelveli  
(Oct 04)**



**Members from  
Marthandam District  
Sunday School Union  
Kanyakumari  
(Oct 05)**



**The American College  
Madurai  
(Oct 07)**



**Lekshmipuram College of  
Arts and Science  
Neyyoor  
(Oct 07)**





*Few glimpses from Site Visit*

At  
site

**B.M.C.HSC School &  
Teacher Training Institute  
Millerpuram  
(Oct 08)**



**Sri Ramana Vidyalaya  
Montessori Matriculation  
Hr. Sec. School  
Rajapalayam (Oct 09)**



**Don Bosco  
Matric. Hr. Sec. School  
Tirunelveli  
(Oct 14)**



**Dr GR Public School  
Thiruvananthapuram  
(Oct 15)**





*Few glimpses from Site Visit*

At  
site



**St. Joseph  
College of Education  
Nanguneri  
(Oct 17)**



**Family members of  
KKNPP Staff  
Anuvijay Township  
(Oct 17)**



**Rajadhani Institute of  
Engineering and  
Technology  
Thiruvananthapuram  
(Oct 18)**





*Few glimpses from Site Visit*

At  
site

**College of Engineering  
Chengannur  
Alappuzha  
(Oct 19)**



**Friends ITI  
Mathicode  
(Oct 21)**



**St.Aloysius College  
Thrissur  
(Oct 22)**



**Marthandam College of  
Engineering and  
Technology, Kuttakuzhi  
(Oct 23)**





*Few glimpses from Site Visit*

At  
site

**V V College of Engineering  
Arasoor  
(Oct 23)**



**Bapuji Memorial Higher  
Secondary School  
Manavalakurichy  
(Oct 24)**



**Adhi College of Engineering  
and Technology  
Kanchipuram  
(Oct 25)**





*Few glimpses from Site Visit*

At  
site

**VTM NSS College  
Thiruvananthapuram  
(Oct 26)**



**Retired NPCIL Officials  
with their families  
Karnataka  
(Oct 29)**



**Officials and family from  
Intelligence bureau, Chennai  
(Oct 29)**



**Family members of KKNPP  
Staff, Anuvijay Township  
(Oct 30)**



**More on Blue Carbon**

Blue Carbon ecosystems help sustain the environment by mitigating climate change. Conversely, destroying and eroding coastal areas storing Blue Carbon could lead to the release of large quantities of sequestered carbon back to the atmosphere over a short period of time.

Scientists agree that the capacity of Blue Carbon ecosystems to sequester carbon has been drastically reduced over the past 70 years as a result of unsustainable coastal development, deforestation, environmental pollution and other destructive activities. In the last 50 years, the area covered by vegetated coastal habitat has shrunk between 25 and 50 per cent.

**The ocean carbon cycle**

Billions of tonnes of carbon are constantly moving through the atmosphere, land and oceans. The ocean carbon cycle is a set of vital processes that helps regulate the Earth's climate and support sustainable marine life.

Carbon sequestration occurs when carbon is removed from the carbon cycle and stored in marine sediment for long periods of time.

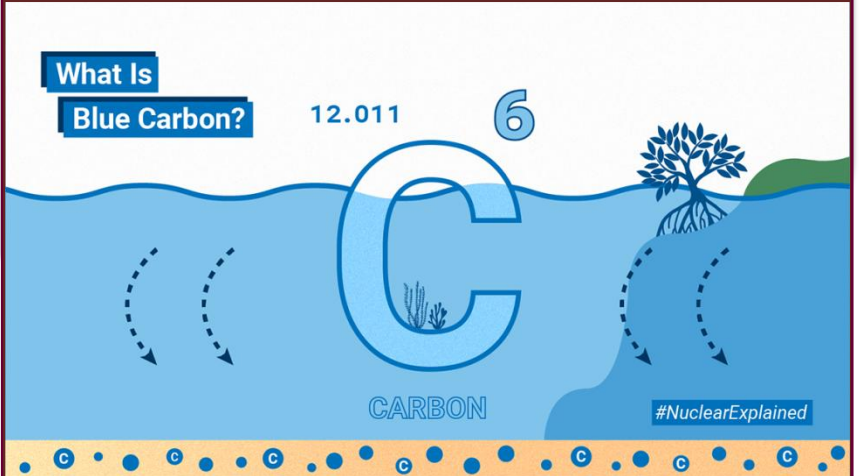
Blue Carbon can help to fight climate change by removing excess carbon from the atmosphere and storing it for hundreds or thousands of years.

Source: [www.iaea.org](http://www.iaea.org)



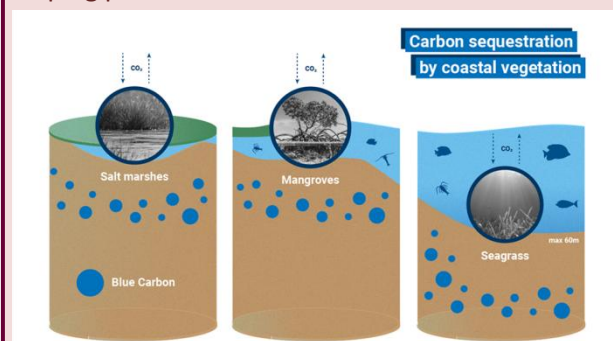
**Blue Carbon**

Blue Carbon refers to organic carbon captured and stored by the ocean in vegetated coastal ecosystems such as mangrove forests, saltmarshes or seagrass meadows. In these Blue Carbon ecosystems, organic carbon accumulates in sediment where it is stored. These ocean habitats are spread along our coasts, can be found on every continent except Antarctica and cover approximately 50 million hectares — a territory almost double the size of the United Kingdom.



(Illustration: A. Huescar Barber/IAEA)

Blue Carbon ecosystems have the potential to help people and coastal environments mitigate and adapt to climate change. This is not only because coastal ecosystems can sequester large amounts of carbon, they also play an important role in protecting coastlines from erosion and reducing the impacts of storm surges and rising sea-levels. Vegetation growing in coastal areas can help improve water quality by filtering pollutants; support biodiversity by providing habitat for a variety of species; and serve as nurseries for fish and shellfish. These factors show how vegetated coastal ecosystems help make people and communities more resilient in the face of climate change and related severe weather events, both by protecting coastal areas from climate change-related weather events and by helping protect marine life.



Organic carbon (C) is captured by coastal ecosystems organisms' roots, stems, and leaves of plants. (Infographic: A. Huescar Barber/IAEA)

See left

As a part of PA outreach activity, Seminars, Workshop, Lectures and exhibitions were conducted at Educational Institutions and Organizations.

**PA lecture  
At Sri Sarada  
College  
Tirunelveli**

Sh Vijayakumar B, OIC-ESL, KKNPP delivered a key note address during a national symposium at Sri Sarada College for women, Tirunelveli district on "solutions for current issues in the society, Environment, ethics, Health, Education, Bussiness, culture, Science & Technology".

**Date: Oct 01, 2024**

**No. of participants 270**

**PA Exhibition  
at Women's  
Christian College  
Nagercoil**

PA exhibition cum National conference on "Radiation protection in Nuclear power plants" was conducted for the students and teachers at WCC college, Nagercoil.

**Date: Oct 09, 2024**

Sh A V SATHISH, OIC-Nuclear Information center, KKNPP delivered guest lecture during the event.

**No. of participants 1450**

**Publications distributes 1500**



**PA outreach programme conducted outside KKNPP:**

**Outside  
KKNPP**

Date	Name of the Institution	No. of participants	Publications distributed
Oct 01	Sri Sarada College for Women	270	0
Oct 09	Women's Christian College	1450	1500
Oct 17	Sadakathullah Appa College	800	3850
Oct 18	Baliah Marthandam Matric Hr.Sec.School,	400	0
Oct 28	Christopher Arts & Science College (Women)	250	0
<b>Grand Total</b>		<b>3170</b>	<b>5350</b>

**Few glimpses**

**PA lecture at Sri Sarada College Tirunelveli district on Oct 01, 2024**



**PA lecture at Sri Sarada College Tirunelveli dist. on Oct 01, 2024**







*Few glimpses*

Outside  
KKNPP

**PA lecture at  
Baliah  
Marthandam  
Matric HSS  
Avaraikulam  
Tirunelveli**

Annual day function was celebrated at Baliah Marthandam Matric HSS, Avaraikulam, Tirunelveli district.

**Date: Oct 18, 2024**

Sh K. Kannadhasan, Scientific Officer-F, KKNPP delivered an inspiring lecture to the students during the celebrations.

No. of participants	400
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**PA lecture  
at Christopher Arts  
& Science College  
(Women)  
Soorangudi  
Tirunelveli**

State level Inter-School Science competition, Christos Sci-Fi "GENESIS 3.0" was organised at Christopher Arts & Science College (Women), Soorangudi, Tirunelveli district.

**Date: Oct 28, 2024**

Sh Vijayakumar B, OIC-ESL, KKNPP participated as resource person and delivered an awareness lecture on the role of Nuclear energy for the development of our country.

No. of participants	250
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**PA lecture at Baliah Marthandam Matric HSS  
Avaraikulam, Tirunelveli on Oct 18, 2024**



**PA lecture at Christopher Arts & Science College (Women)  
Soorangudi, Tirunelveli district on Oct 28, 2024**

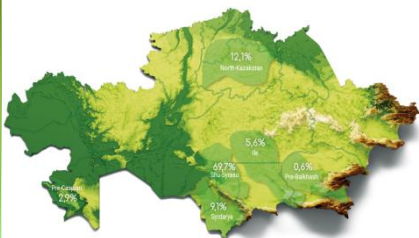




Did you know?

### Nuclear energy in Kazakhstan

➡ Kazakhstan is the world's leading producer of uranium.



Kazakhstan's uranium mineral resource base.  
Photo credit: Kazatomprom national company

➡ Although it does not currently use nuclear energy, it is not without nuclear experience:

➡ it has three operating research reactors, and a Russian-designed BN-350 sodium-cooled fast reactor operated near Aktau for 26 years, until 1999.

Source: [world-nuclear-news.org](http://world-nuclear-news.org) & <https://astanatimes.com/>



## Feature article

### Carbon Dioxide Emissions From Electricity

Source: World Nuclear Association



### Carbon Dioxide Emissions From Electricity

Over 40% of energy-related carbon dioxide (CO<sub>2</sub>) emissions are due to the burning of fossil fuels for electricity generation.

All electricity generation technologies emit greenhouse gases at some point in their life-cycle.

Nuclear fission does not produce any CO<sub>2</sub>. For both nuclear and renewable generation, emissions are produced indirectly, for example during the construction of the plant.

Over its life-cycle, nuclear produces about the same amount of CO<sub>2</sub>-equivalent emissions per unit of electricity as wind, and about one-third that of solar.

- Energy-related greenhouse gas emissions account for the majority of all anthropogenic emissions – about 80% in the USA and the European Union, for example. Just 20% of final energy consumption is in the form of electricity, but the generation of electricity is responsible for over 40% of all energy-related emissions.
- Worldwide emissions of carbon dioxide (CO<sub>2</sub>) from burning fossil fuels total about 34 billion tonnes (Gt) per year. About 45% of this is from coal, about 35% from oil and about 20% from gas.
- The impacts of electricity generation go beyond the emission of CO<sub>2</sub> and other greenhouse gases.

To be continued





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**How nuclear technology help to address climate change by studying blue carbon ecosystems?**

These techniques encompass radiochemical separation and measurements by alpha and gamma spectrometry adapted to each isotope. This is then combined with the measurement of organic carbon contents and its isotopes along the sedimentary record by mass spectrometry methods to assess the organic carbon stocks and burial rates.

These radionuclide-based techniques provide a unique assessment of whether natural or anthropogenic disturbances may have caused losses of carbon, for instance via sediment resuspension and erosion processes.

$^{234}\text{Th}$  and  $^{210}\text{Po}$  are also widely used for carbon cycle research to assess the efficiency of the process that transports carbon from the upper ocean to depth via sinking of particulate matter. The use of short-lived radionuclides such as  $^{228}\text{Th}$  and  $^7\text{Be}$  that can also be used as tracers of sedimentation dynamics to obtain accurate results at timescales of weeks, months, or even a few years.

Source: IAEA

Nuclear technology help to address climate change by studying blue carbon ecosystems:

**Measuring carbon storage**

Nuclear and isotopic techniques are used to measure the rates and origin of sediment accumulation, which helps determine how much carbon is stored.

Sediment that accumulates in the seagrasses, mangroves and marshes can be analysed to help indicate changes in the environment over periods of time, ranging from the past few years to millions of years ago. The capacity of vegetated coastal ecosystems to sequester and store carbon in their sediments can be measured by nuclear and isotopic techniques.



Sediment cores (pictured) are collected in a seagrass meadow in Zanzibar, Tanzania for assessment.

These elements are used to determine the rates at which organic carbon accumulates in marine sediments using sediment core samples from vegetated coastal ecosystems. Sediment cores are collected by using long plastic tubes that during sampling are able to preserve the layers of sediment accumulated over time.

Natural and anthropogenic carbon accumulation in sediment at millennial scale can be determined using the  $^{14}\text{C}$  technique. The naturally occurring radioactive isotope lead-210 ( $^{210}\text{Pb}$ ), in combination with some artificial radionuclides such as caesium-137 ( $^{137}\text{Cs}$ ) are used to determine the sedimentation rates in the sediments at timescales of decades – up to around 100 years, a period during which human induced impacts on the environment have dramatically increased.

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