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A Mortal Danger that Shakes the Resources from The Depth "Methane"

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Abstract: ***This paper examines the multifaceted dangers associated with methane, focusing on its environmental and health impacts. It discusses the risks of methane emissions from coal beds, with particular emphasis on the hazardous consequences of coal bed methane (CBM) extraction. The paper also addresses the potential dangers posed by the Sagar mala project, which involves significant coastal infrastructure development in India, potentially exacerbating methane release from natural deposits. Additionally, the environmental consequences of hydraulic fracturing (fracking) for methane extraction are explored, highlighting concerns over water contamination, air pollution, and induced seismicity. In contrast, the paper presents alternative, sustainable solutions for methane extraction, specifically in the Thanjavur region. These include innovative, non - invasive methods such as biogas production and the safe capture of methane from natural sources, offering a more environmentally responsible approach to methane utilization. The goal of this paper is to provide a comprehensive overview of the dangers associated with methane while proposing safer, more sustainable practices for its extraction.***

Keywords: methane emissions, coal bed methane, Sagar mala project, hydraulic fracturing, sustainable extraction

1. Introduction

Methane, a potent greenhouse gas, poses significant environmental and health risks due to its potential to contribute to climate change and its tendency to be released during various industrial activities. The dangers associated with methane are multifaceted, ranging from its emission in coal bed methane (CBM) extraction to the broader concerns surrounding large - scale infrastructure projects, such as India's Sagarmala initiative. These activities, which aim to boost coastal development, can inadvertently trigger the release of methane from natural deposits, further exacerbating the environmental challenges.

One of the most controversial methods of methane extraction is hydraulic fracturing (fracking), a process that has raised alarm due to its negative impact on water quality, air pollution, and the occurrence of induced seismicity. While fracking has become a widespread practice in methane extraction, its environmental cost has led to growing concerns, prompting the search for safer, more sustainable alternatives.

In this context, the paper shifts focus to Thanjavur, a region in India, to explore more environmentally friendly approaches to methane extraction. Innovative methods, such as biogas production and safe methane capture from natural sources, are gaining attention as viable alternatives to hydraulic fracturing. These non - invasive techniques offer the potential for reducing environmental harm while still harnessing methane for energy needs.

This paper seeks to explore these dangers in depth, from the risks associated with CBM emissions to the environmental consequences of the Sagar mala project and fracking. More importantly, it will examine the growing potential for sustainable and responsible methane extraction methods, particularly in the Thanjavur region, as a way to balance energy needs with environmental protection.

Know About Methane Gas (BASIS):

Methane (CH_4) is a colorless, odorless, and highly significant gas, both in industrial applications and environmental contexts. As a simple hydrocarbon, methane consists of one carbon atom bonded to four hydrogen atoms, making it a major component of natural gas. While it has various practical uses, such as being a fuel, its potential dangers in high concentrations and its environmental impact cannot be underestimated.

In confined spaces, methane presents serious safety risks because it is difficult to detect due to its lack of odor and color. Methane is toxic at high concentrations, as it displaces oxygen in the air. This reduction in oxygen can lead to suffocation, causing unconsciousness and, if exposure continues, death. Furthermore, methane is often present alongside other harmful gases, which can exacerbate its dangerous effects when inhaled.

The production of methane is primarily a result of the anaerobic digestion of organic matter by microorganisms, a process that occurs naturally in environments such as wetlands, landfills, and in the digestive systems of animals, particularly ruminants like cows and sheep. As these animals digest their food, methane is produced as a byproduct and released through their burps and waste. This process significantly contributes to methane emissions, with animal agriculture being one of the largest contributors to methane production. Additionally, methane is generated in landfills where organic waste decomposes without oxygen, further adding to the atmospheric methane levels.

One of the most notable characteristics of methane is its flammability. Due to its chemical structure, methane is highly combustible and forms explosive mixtures when combined with air. This property makes methane an essential biofuel used in various industrial applications. It is utilized for heating, cooking, and electricity generation, offering an efficient energy source. The growing reliance on methane as a fuel has been driven by its relatively low cost and high energy content compared to other hydrocarbons.

However, methane's flammability also poses significant safety hazards, especially in confined spaces, where even a small leak can lead to explosions. This is why strict safety protocols are essential in industries where methane is used or extracted, such as natural gas operations, mining, and agriculture.

From an environmental perspective, methane is a potent greenhouse gas. Although it exists in lower concentrations than carbon dioxide, methane is far more effective at trapping heat in the atmosphere, with a global warming potential many times greater than carbon dioxide over a short period. Methane emissions from landfills, agricultural practices, and natural gas extraction significantly contribute to global warming and climate change. As methane accumulates in the atmosphere, it exacerbates the already pressing challenges of rising global temperatures, extreme weather events, and shifting ecosystems.

In addition to its role as a greenhouse gas, methane also contributes to the depletion of the ozone layer. When methane interacts with other chemicals in the atmosphere, it can lead to the formation of compounds that break down ozone molecules, which are vital for protecting the Earth from harmful ultraviolet radiation. This degradation of the ozone layer further intensifies environmental challenges, such as increased risks of skin cancer and other health issues for humans and animals.

Despite its usefulness as a biofuel, methane's environmental and safety risks underscore the need for better management and mitigation strategies. Sustainable practices, such as capturing methane from landfills and agricultural waste to use as an energy source, can help minimize its harmful effects. Technologies that prevent methane leaks during extraction and storage, as well as reducing methane emissions from agriculture, are essential in addressing the gas's environmental impact. As we continue to explore and use methane for energy, it is critical to balance its benefits with responsible practices to protect both human health and the planet.

Reason Behind Why Central Government Gave Approve to this Project:

In 2010, the central government, as part of the Sagar mala project's hydrocarbon initiatives, signed a production sharing agreement (PSA) with Great Eastern Energy Corporation Limited, a private company, to exploit coal bed methane (CBM) resources in Tamil Nadu. This agreement covered an area of 691 square kilometers, specifically targeting the Thanjavur and Tiruvarur districts, known for their rich coal bed methane reserves. CBM is a form of natural gas found in coal seams, where methane is trapped by water and pressure. Extracting this methane can provide a valuable energy source, contributing to the nation's energy needs.

The extraction process involves drilling wells into coal beds and releasing methane, which can then be used as fuel for electricity generation, heating, and other purposes. While this resource is considered a cleaner alternative to other fossil fuels like coal or oil, it does pose significant environmental challenges. One major concern is methane emissions, which are potent greenhouse gases that can exacerbate global warming if not properly managed. Methane leaks from extraction sites or during transportation could worsen air quality and contribute to climate change.

Additionally, the extraction process can lead to land degradation, potentially affecting agricultural activities and local ecosystems. In the case of the Thanjavur and Tiruvarur districts, which are primarily rural and dependent on agriculture, there are concerns that the project could disrupt local communities. The disturbance from drilling activities, water usage, and the potential for pollution of nearby water resources could negatively impact both the environment and the livelihoods of the local population.

Furthermore, the project raises questions about the long - term sustainability of relying on CBM extraction. While it provides short - term economic and energy benefits, the environmental costs—such as water contamination, air pollution, and potential health risks—make it a contentious issue, highlighting the ongoing debate between energy production and environmental conservation.

Tamil Nadu Bans the Dangerous Desire:

The Tamil Nadu government has taken a significant step in halting the coal bed methane (CBM) exploration project proposed by Great Eastern Energy Corporation Limited (GEECL) in the delta districts of Thanjavur and Tiruvarur. On October 8, the state government issued Government Order No.186, under the Industries Department, which formally declared that no clearance would be granted for the exploration and associated activities in the Cauvery Delta region. This order was issued after the state government largely accepted the recommendations of the Expert Technical Committee, which had been constituted by the Tamil Nadu Pollution Control Board (TNPCB) to assess the project's potential environmental and social impacts.

The CBM exploration project, which spans 691 square kilometers in Tiruvarur and Thanjavur districts, was initially granted approval by the Centre in 2010. The Union government entered into a production sharing agreement with GEECL on July 29, 2010, and the previous DMK government, led by then - Chief Minister M. Karunanidhi, sanctioned the project on January 1, 2011. An MOU was signed between the state government and GEECL, with promises of support for infrastructure and licenses to help in pursuing the project.

However, the project has faced staunch opposition from local communities and farmers, particularly in the Cauvery Delta region, which is considered one of the most fertile and agriculturally productive areas in India. Farmers and local residents have expressed concerns that the CBM exploration would severely affect agriculture, jeopardizing their livelihoods and food security. The issue was raised during the public hearings in 2011, where stakeholders voiced their opposition to the project, citing potential adverse environmental impacts.

Despite these protests, the Union Ministry of Environment and Forests granted environmental clearance for the project in 2012. However, after the change of government in Tamil Nadu, the AIADMK - led state administration, under Chief

Minister J. Jayalalithaa, took a more cautious approach. In July 2013, the AIADMK government formed the Expert Technical Committee to evaluate the project's environmental and social ramifications.

The technical committee's findings highlighted several concerns related to the impact of the exploration on the region's agriculture and ecosystem. These recommendations, which were largely accepted by the state government, culminated in the recent government order, which calls for the discontinuation of the project in the Cauvery Delta. The state government has also urged the Centre to cease any further action related to CBM exploration in the entire Cauvery Delta region, ensuring that the agricultural integrity and environmental sustainability of the area are preserved.

A Quiet Wound Up by GEECL in Thanjavur:

In a significant development for eco - conservationists and farmers of the Cauvery Delta, Great Eastern Energy Corporation Limited (GEECL), a pioneer in coal bed methane (CBM) extraction, quietly closed its office in Thanjavur on Sunday. This marked the end of a contentious chapter that had drawn considerable opposition from local communities and environmentalists alike. The company's sudden and discreet exit mirrors the manner in which it had set up its operations in the region, with minimal fanfare but growing controversy over the years.

GEECL's CBM exploration project, which was initially granted approval by the Union government in 2010, has been a source of intense debate in the Cauvery Delta districts of Thanjavur and Tiruvarur. The project, which involved the extraction of coal bed methane from a large tract of land spanning 691 square kilometers, faced strong resistance from farmers and local communities. Many argued that the project posed a severe threat to the region's agriculture, which forms the backbone of the local economy and sustains the livelihoods of thousands of farmers. The Cauvery Delta is known for its rich soil and thriving agricultural activities, and there were widespread fears that the exploration would disrupt farming activities, contaminate water sources, and cause long - term environmental degradation.

The GEECL office in Thanjavur had been operational since 2012, overseeing the company's efforts to carry out the project. Despite the company receiving environmental clearance in 2012 from the Ministry of Environment and Forests, the project faced mounting opposition. Local residents, farmers, and environmental organizations raised alarms about the potential ecological and socio - economic consequences. Public hearings in 2011 and 2012 saw strong protests, with many pointing out the risks to agriculture and food security.

The Tamil Nadu government, under the leadership of the AIADMK, responded by constituting an Expert Technical Committee in 2013 to assess the impacts of the CBM exploration project. The committee's findings, which raised significant concerns about the project's effects on agriculture and the environment, eventually led to the state government's decision to halt the project. In October, the Tamil Nadu government issued an official order stating that no further clearances would be granted for CBM exploration in the Cauvery Delta, calling for the cessation of all activities related to the project.

GEECL's decision to close its Thanjavur office and withdraw from the region can be seen as a victory for the environmental and farming communities who had opposed the project from the outset. The quiet exit, after years of controversy, marks the end of a long struggle to protect the agricultural and ecological integrity of the Cauvery Delta.

Why there is so much Opposition to this Project?

Methane, a natural gas commonly used for cooking and heating, is primarily extracted from deep within the earth's crust, often in coal fields. As the demand for this resource increases, the supply of fossil fuels is dwindling, creating a pressing need for alternative methods of extraction. One such method involves tapping into coal bed methane (CBM), which has been identified in areas like the Cauvery Delta region of Tamil Nadu. The Indian government has drafted plans to extract methane from these coal fields to meet the growing demand. However, this extraction process presents several environmental and technical challenges, three of which are particularly significant.

1) **Wastewater and Soil Contamination:** To extract methane from coal beds, large volumes of water need to be pumped out through borewells. This water, however, is highly saline and contains minerals that can be harmful to the surrounding environment. The discharged wastewater can contaminate the soil if not managed properly. This poses a serious risk to agriculture, as the salts and minerals in the water can make the soil inhospitable for crops, preventing them from absorbing water effectively. Although the government has proposed storing the wastewater in polyethylene - lined ponds and evaporating it under the sun, the remaining salts would need to be treated according to solid waste management guidelines. However, the long - term impact of this method on soil health remains a concern.
2) **Impact on Groundwater Levels:** Another problem that arises from CBM extraction is the potential effect on local groundwater levels. The process of pumping out water from deep within the coal beds could lower the groundwater levels in nearby areas, especially in regions like Mannargudi, where the water table for irrigation and drinking purposes is already relatively shallow—ranging from 200 to 300 feet. The extraction of water from depths of 500 to 1, 800 feet could result in a decline in the water levels of bore wells in the surrounding area, making it harder for local communities to access fresh water for daily needs.
3) **Hydraulic Fracturing and Chemical Use:** To aid in methane extraction, a technique called hydraulic fracturing, or "fracking, " is being used internationally. This involves injecting a high - pressure mixture of water, sand, and various chemicals into the coal bed to create fractures that allow the methane to flow more easily to the surface. While effective, fracking raises significant environmental concerns. The chemicals used in this process can be hazardous, and if not managed carefully, they can contaminate surrounding water sources. Moreover, the high - pressure injection process itself can lead to subsurface instability, potentially

causing earthquakes or further disruption to local ecosystems.

The Project of Dangerous Destruction "Sargar Mala"

The "SAGARMALA, " also known as the project of destruction, was introduced by AtalBihari Vajpayee in 2003. Now, this project is being implemented under the BJP government. Some projects under "SAGAR MALA" are listed below**:**

1. Kumari District Protest against cargo port: On March 27, 2021, a massive protest took place in Keezhamanakudy, Kanyakumari, against the construction of a cargo port under the Sagarmala Project. The local population, including fishermen and farmers, has been protesting for years against the government's attempts to establish ports in the region, fearing the destruction of their livelihoods and the environment. The Kulachal Harbor expansion, initially proposed in 2017, was shelved due to public opposition. Similarly, attempts to set up a port in Inayam and other locations were met with strong resistance. The recent announcement of a port near Kanyakumari, intended to be developed in partnership with the Adani Group, has reignited protests. The people fear that this project will severely damage local natural resources, including coral reefs and groundwater, and harm agriculture and fishing industries. The government's push for the port is seen as catering to corporate interests rather than the welfare of the people, with many concerned it will turn the area into an uninhabitable desert.

2. The struggle of Naga fishermen People power: The fishermen of Tamil Nadu are fighting for their survival. Since October 3, 2018, Tamil Nadu's coastal fishermen have staged continuous protests, demanding the cancellation of the SAGAR MALA and Hydrocarbon projects, which they believe are threatening their livelihoods. These projects, alongside rising fuel costs, are pushing fishermen to the brink. Their four key demands include:

1) **Cancellation of SAGAR MALA and Hydrocarbon projects** which harm coastal communities.
2) **Return of boats seized by the Sri Lankan Army**.
3) **Reduction in the skyrocketing prices of diesel and petrol** that endanger the fishing industry.
4) **Protection from pirates** that attack their boats.

On October 12, hundreds of fishermen and supporters from Nagai and Karaikal gathered for a road blockade protest at the Anna statue roundabout in Nagai Puthur. Women and youth played an active role in the demonstration, which was met with police arrests. Despite being halted by authorities, the protesters' resolve remains strong.

The People's Empowerment Organization launched a campaign to raise awareness about these critical issues. These protests reflect broader concerns about the central and state government's neglect of Tamil Nadu's fishermen and their reliance on destructive projects. The fight is not just for the fishermen but for the entire working class, urging unity against policies that threaten livelihoods and communities. The struggle for people power is vital.

Methane Emissions in Thanjavur Will Come Under Which Sagar Mala's Project?

Hydrocarbons: Hydrocarbons are organic compounds primarily made up of hydrogen and carbon, commonly found in crude oil, natural gas, and coal. They serve as the raw materials for energy production and various industrial processes, but the extraction and use of hydrocarbons come with significant environmental and health risks. To extract hydrocarbons, methods such as drilling wells, hydraulic fracturing (fracking), and seismic surveys are used. While these methods are effective in accessing oil and gas reserves, they have detrimental effects on both the environment and public health. Methane, a potent greenhouse gas, is often released during extraction, contributing to global warming. Additionally, contamination of groundwater, air pollution, and destruction of local ecosystems are common concerns in areas affected by hydrocarbon extraction projects.

In India, the ruling class has increasingly set its sights on the Cauvery Delta—comprising districts such as Thanjavur, Tiruvarur, Nagapattinam, and Trichy, along with the adjoining Pudukkottai and Ramanathapuram districts—as a site for hydrocarbon extraction. This area, known for its rich agricultural land, is under threat as the government prioritizes energy demands over the well - being of local communities and the environment.

The Indian Public Sector Undertaking (PSU) first initiated hydrocarbon exploration activities in this region with test drilling in Narimanam, Adiyakkamangalam, Panangudi, Kanalapuram, and Narrilam. In 1993, test wells were drilled in Kottakkod, followed by further excavations in Vanukkankodu (1998) and Nadakadu and Punyaviduthi (2002). These efforts have stirred local resistance, as residents fear the potential destruction of fertile land and the adverse health impacts of increased industrial activity, including air and water pollution, soil degradation, and the risk of seismic activity.

The hydrocarbon projects in this region are not designed with the local population in mind; rather, they serve corporate and governmental interests, with little regard for the long - term consequences faced by local communities and the environment. This extraction push is part of a larger pattern of exploitation, where the economic benefits accrue to the ruling elite, while the local population bears the environmental and health burdens.

The Method that Destroy Our Wealth and Resources, "Hydralic Fracturing":

Hydraulic fracturing, commonly known as "fracking, " is a controversial method used to extract methane and other hydrocarbons from deep underground. This process involves drilling miles into the Earth's surface and injecting a mixture of water, chemicals, and sand at high pressure to break open rock formations. By fracturing the rock, methane and other gases are released and can be collected for use. While effective in extracting fossil fuels, hydraulic fracturing has serious environmental and health implications, making it one of the most harmful methods of resource extraction.

To begin the process, the rock beneath the Earth's surface must first be broken. This requires drilling several

kilometers deep into the ground to access shale or other rock layers that contain methane. Once drilling reaches the target area, a chemical solution—comprising water, sand, and potentially harmful chemicals—is injected at very high pressure. The purpose of the injection is to create fractures in the rock, allowing gas to flow out. Hydraulic fracturing is employed in approximately 40% of locations in large - scale hydrocarbon extraction projects.

For such projects to proceed, it is often necessary to completely drain groundwater reserves. This can cause significant water shortages for nearby communities and agriculture, leading to severe ecological consequences. In areas like the Cauvery Delta, where agriculture is heavily reliant on groundwater, this process threatens the livelihoods of millions of people.

The Indian government has signed contracts to extract 40 million tons of oil and 22 billion cubic meters of gas over the next 15 years from the Cauvery Delta region, extending all the way to the Kanyakumari front. This large - scale project will cover vast areas of Tamil Nadu, including regions already struggling with water scarcity and environmental degradation. The government's aggressive push to exploit these fossil fuel reserves raises concerns about the long - term health and environmental impacts on local communities.

While the government emphasizes the economic benefits of these projects, such as energy security and job creation, the real costs—pollution, depletion of natural resources, and irreversible damage to local ecosystems—are likely to outweigh any short - term gains. The Cauvery Delta, a vital agricultural and ecological region, is at serious risk of being irreparably damaged by this large - scale extraction project, which prioritizes corporate interests and short - term economic gain over the welfare of the local population and the environment.

Every Problem there is Always an Solution "Land Gem":

The present study focuses on a critical environmental and energy issue by examining methane and other landfill gas emissions through the use of the LANDGEM model. This research is conducted in the major district of Thanjavur, Tamil Nadu, which houses a substantial municipal solid waste management operation. Specifically, the Thanjavur Municipal Corporation manages a dumping site that covers an extensive area of 20.23 acres, strategically located at 10 degrees 47' N latitude and 79 degrees 7' E longitude.

Thanjavur produces a significant amount of waste, generating approximately 124 metric tons (MT) of garbage daily. Out of this, about 116 MT is collected by the municipal corporation, indicating a proactive waste collection system despite the increasing waste generation. The city is structured into 14 zones, containing a total of 51 wards, which helps manage waste distribution and collection effectively.

Geographically, Thanjavur experiences a moderate climate with an average temperature of 28.7 degrees Celsius and an annual rainfall averaging 1053 mm, conditions that can impact both waste decomposition processes and methane emissions. The dumpsite itself receives more than 200 - 250 tons of waste per day from the surrounding zones, reflecting the high volume of everyday refuse produced in the city.

One of the most alarming findings of the study is the absence of facilities to capture and utilize methane emissions from the landfill. In many cities like Thanjavur, open dumping remains a common practice, primarily due to a lack of awareness and information regarding the evaluation of methane gas emissions from municipal solid waste landfills. This oversight not only contributes to environmental pollution but also represents a lost opportunity for energy production. Methane, a potent greenhouse gas, has significant energy potential that, if harnessed, could contribute to sustainable energy solutions for the city and surrounding areas.

The study emphasizes the need for comprehensive strategies to assess the methane emissions from landfills, highlighting the importance of creating facilities for methane recovery. By understanding the emissions problem and recognizing the energy potential within municipal solid waste, Thanjavur can take significant steps toward improving its waste management practices, reducing greenhouse gas emissions, and harnessing renewable energy sources—ultimately contributing to a more sustainable future for the region.

What is LANDGEM?

The Landfill Gas Emissions Model (LANDGEM) was developed by the U. S. Environmental Protection Agency (EPA) as a vital tool in understanding and managing the emissions from municipal landfill sites. This automated emissions tool operates within a user - friendly Microsoft Excel interface, making it accessible for a wide range of stakeholders, including waste management authorities and environmental researchers. The primary function of the LANDGEM model is to calculate the emission rates of methane (CH_4), carbon dioxide (CO_2), and total landfill gas (LFG) generated from landfill sites, all through the application of a first - order decay equation.

To effectively utilize the LANDGEM model, users need to input several crucial parameters related to the specific landfill being analyzed. Key inputs include the year the landfill opened, the year it closed, the design capacity of the landfill, and the annual volume of waste deposited into the landfill. These parameters serve as the foundational data upon which the model bases its calculations.

The decay rate (K) and the methane potential (L0) of the landfill waste represent two vital factors that significantly influence the quantity of methane emissions. The decay rate (K) reflects the speed at which the organic material in the landfill decomposes, while the methane potential capacity indicates the maximum amount of methane that could theoretically be produced by the waste over time. Both these factors are influenced by the specific characteristics of the waste and the landfill environment.

Moreover, the prediction of landfill gas emissions involves various other interrelated factors that determine how effectively waste decomposes and emits gases. These factors

include waste biodegradability, which assesses the ease with which organic materials can be broken down by microbial activity; microbial usage rates, indicating the efficiency and activity levels of the microorganisms involved in decomposition; and volatile solids concentrations, which provide insight into the organic content available for degradation.

Additionally, the availability of micro and macro - nutrients is essential for microbial growth, significantly impacting biodegradation rates. The pH level of the waste influences microbial activity, as different microorganisms thrive at different pH levels. Similarly, moisture content is a critical factor; optimal moisture levels facilitate decomposition, while excessive water can create anaerobic conditions that alter gas production dynamics. Temperature also plays a key role, with warmer conditions generally enhancing microbial activity and gas production. Finally, the specific composition of the waste can determine both the types of gases emitted and the rates at which they are produced, as different waste types decompose at varying rates.

In conclusion, the LANDGEM model serves as an essential tool for estimating emissions from municipal landfills, enabling better management of landfill operations and contributing to efforts aimed at reducing greenhouse gas emissions. By understanding the many factors influencing landfill gas emissions, municipalities can develop strategies to mitigate these emissions and explore potential energy recovery options from landfill gases. This comprehensive approach not only aids in compliance with environmental regulations but also promotes sustainability and resource recovery in waste management practices.

2. Conclusion

The municipal solid waste (MSW) generated in Thanjavur predominantly consists of organic waste, which has significant implications for both environmental and energy concerns. Studies on the waste composition reveal that organic materials, such as food scraps, garden waste, and other biodegradable substances, make up the largest portion of the total waste generated in the region. This organic waste is a critical factor in the production of methane emissions from the local dumpsite, a potent greenhouse gas that significantly contributes to global warming.

Research has shown a strong correlation between the methane emission potential from the Thanjavur dumpsite and the degradable organic carbon fraction in the waste. As the organic fraction of the waste increases, methane emissions also rise, which underscores the role of organic waste in the generation of greenhouse gases. Specifically, the degradable organic carbon fraction in the waste composition of Thanjavur was found to be 11.50 percent, which is a substantial amount given the scale of waste generated. Methane, being a greenhouse gas with a global warming potential much higher than carbon dioxide, poses a serious environmental threat when it is released into the atmosphere. However, methane also presents an opportunity as a renewable energy source. If captured and utilized properly, methane can be converted into biogas, which can be used for electricity generation, heating, or even as a fuel source for vehicles. This duality—its role as both an environmental threat and a potential energy source—highlights the importance of managing organic waste more effectively in Thanjavur.

The findings emphasize the need for implementing better waste management practices, such as organic waste segregation and composting, to reduce methane emissions. Additionally, the development of biogas plants could help harness methane as a renewable energy source, contributing to both climate mitigation and sustainable energy solutions in the region.

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