

Implementation of ISO 14064 Standards for Greenhouse Gas Accounting in Smart Cities and Special Economic Zone: Scope 1, 2, 3 Emissions and Climate Mitigation Strategies

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INTRODUCTION

This Topic covers the importance of GHG accounting under scope 1,2,3 emissions and need apply, implementation, challenges, mitigation strategies, key performance indicators and key takeaways of ISO 14064 in smart city and special economic zone in a simple, precise and understanding manner. As per IPCC, there are 161 listed gases, out of which, 7 gases (CO₂, CH₄, N₂O, HFCs, PFCs, SF₆, NF₃) are major are GHG accounted and reporting frameworks such as the Kyoto Protocol and ISO 14064 Standards.

Why GHG Accounting is important for smart cities and SEZs

- Fast urbanization increases energy consumption and carbon emissions
- Industries in SEZs contributes significantly to industrial scope 1, 2, 3 emissions

Need of Implementation of ISO 14064

The implementation of ISO 14064 is essential for organizations and urban systems aiming to manage and reduce greenhouse gas (GHG) emissions effectively. It enables the development of an accurate GHG inventory, ensuring that emissions data is reliable and consistent. This standard enhances emissions transparency, allowing stakeholders to make informed decisions based on credible climate data. Furthermore, ISO 14064 supports structured climate mitigation planning by providing a framework to identify emission sources, set reduction targets, and track progress over time, ultimately aligning with global climate goals.

- Accurate GHG inventory
- Emissions Transparency
- Climate Mitigation planning

ISO 14064 explains

- ISO 14064 is divided into three parts, each addressing a specific level of GHG management.
- ISO 14064-1 focuses on the organizational level, guiding companies in quantifying and reporting their emissions.
- ISO 14064-2 addresses project-level activities, particularly those aimed at reducing emissions or enhancing removals.
- ISO 14064-3 deals with the validation and verification of GHG assertions, ensuring the credibility and accuracy of reported emissions.

Together, these standards form a comprehensive framework for robust carbon accounting and reporting:

Categories of Emissions

- 14064 - 1 : says organizational level
- 14064 - 2 : says Project level
- 14064 - 3 : says carbon emissions accounting, verifications/validation level

Scope 1 includes direct emissions from owned or controlled sources such as fuel combustion, LPG usage, and other greenhouse gases released onsite.

Scope 2 covers indirect emissions from the consumption of purchased energy, including electricity, heat, and steam.

Scope 3 encompasses all other indirect emissions across the value chain, including upstream and downstream activities such as raw material extraction, transportation, and product use.

Examples of Emissions in SEZ and Smart City

In Special Economic Zones (SEZs) and smart cities, emissions arise from diverse activities. Scope 1 emissions include sources such as diesel-powered buses and industrial boilers operating within the zone. Scope 2 emissions are primarily linked to energy consumption in buildings, street lighting systems, and

public infrastructure. Scope 3 emissions are more complex, involving construction materials, industrial raw materials, and logistics activities, including both inbound and outbound transportation across the supply chain.

The three emission categories significantly influence operational and environmental performance in SEZs and smart cities. Key contributors include municipal vehicle fleets, methane emissions from waste landfills, and industrial boilers. Electricity consumption in buildings and public lighting systems contributes heavily to Scope 2 emissions, while industrial manufacturing drives significant energy demand. Additionally, transportation of goods, raw material supply chains, construction activities, waste treatment processes, and employee commuting all contribute to Scope 3 emissions, highlighting the need for a holistic emissions management approach.

How these 3 Category of emissions influence in SEZ and Smart cities

1. Municipal vehicle fleets
2. Waste landfill methane
3. Industrial Boilers in SEZ
4. Electricity used in Building
5. Public lightings
6. Industrial manufacturing power consumption
7. Transportation of goods
8. Raw material supply chain
9. Construction materials
10. Waste treatment
11. Employee commuting

Climate Mitigation Strategies

Effective climate mitigation strategies are critical to reducing emissions and enhancing sustainability. Transitioning to renewable energy sources can significantly lower dependence on fossil fuels. Implementing low-carbon industrial processes helps reduce emissions intensity in manufacturing sectors. Promoting a circular economy, especially in plastics, minimizes waste and resource consumption. Sustainable supply chain management ensures emissions are addressed across the value chain. Additionally, encouraging public transport, carpooling, and cycling reduces transportation emissions, while afforestation initiatives contribute to carbon sequestration and ecological balance.

Environmental and Sustainability Benefits of Pollution Reduction

Reducing pollution leads to significant environmental and sustainability benefits. Lower CO₂ emissions contribute directly to climate change mitigation. Improved air quality enhances public health and reduces environmental degradation. Decreasing landfill methane emissions helps control one of the most potent greenhouse gases. Reduced reliance on fossil fuels supports energy security and sustainability. Moreover, these

efforts collectively improve urban resilience, enabling cities to better adapt to climate-related challenges.

Implementation of Digital Monitoring and Smart City Technologies

The integration of digital technologies plays a crucial role in modern emissions management. IoT sensors enable real-time monitoring of energy consumption and emissions, providing actionable insights. AI-driven traffic management systems optimize transportation flows, reducing congestion and fuel consumption. Carbon dashboards offer centralized platforms for tracking emissions data, supporting transparency and informed decision-making. These technologies enhance efficiency and enable data-driven sustainability strategies in smart cities.

Implementation Challenges

Despite its benefits, implementing ISO 14064 presents several challenges. Data availability and quality remain significant barriers, particularly for Scope 3 emissions. The complexity of measuring and accounting for value chain emissions requires advanced methodologies and tools. There is also a shortage of trained GHG professionals capable of executing accurate assessments. Additionally, limited financial resources can hinder the adoption of necessary technologies and infrastructure. Addressing these challenges is essential for successful and scalable implementation.

Pollution Reduction Impacts on Environmental Benefits and Sustainability Impacts

1. CO₂ emissions reduction
2. Improved air quality
3. Reduced landfill methane
4. Reduced fossil fuel dependence
5. Improved urban resilience

Implementation of Digital Monitoring and Smart City Technologies

1. Using IoT sensors for energy monitoring
2. AI traffic management
3. Carbon dashboards

Implementation Challenges

1. Data availability
2. Scope 3 measurements accounting complexity
3. Lack of trained GHG professionals
4. Limited Financial investments

KPIs to be focused

1. Digital carbon monitoring system
2. Supplier carbon reporting programme
3. Carbon neutrality for cities
4. Mandatory GHG inventory for SEZ industries
5. Capacity building for ISO 14064 professionals

Key Takeaways – ISO 14064 in Smart City and SEZs

1. Transparent Carbon accounting
2. Climate-informed policy decisions
3. Sustainable industrial development

CONCLUSION

The implementation of ISO 14064 in Smart cities and Special economic zones provides a structured approach for measuring, reporting, reducing greenhouse gas emissions. By applying the principles of ISO 14064-1, cities and industrial clusters can develop reliable GHG inventories and identify key emission sources.

Considering Scope 1, 2, 3 emissions ensure a comprehensive understanding of direct emissions, energy-related emissions, and supply chain impacts, consistent with the GHG Protocol Corporate Standard. This approach supports effective climate mitigation strategies such as renewable energy adoption, energy efficiency improvements, and sustainable supply chain management.

Overall, ISO 14064 implementation helps Smart cities and SEZs reduce emissions, improve environmental transparency, and contribute to global climate goals aligned with Paris Agreement.