Comprehensive Carbon Ecosystem

A Seamless Solution for Corporate Compliance

Symbiosis of governmental carbon protocol implementation and carbon management tools for corporate compliance in Querétaro, Mexico.

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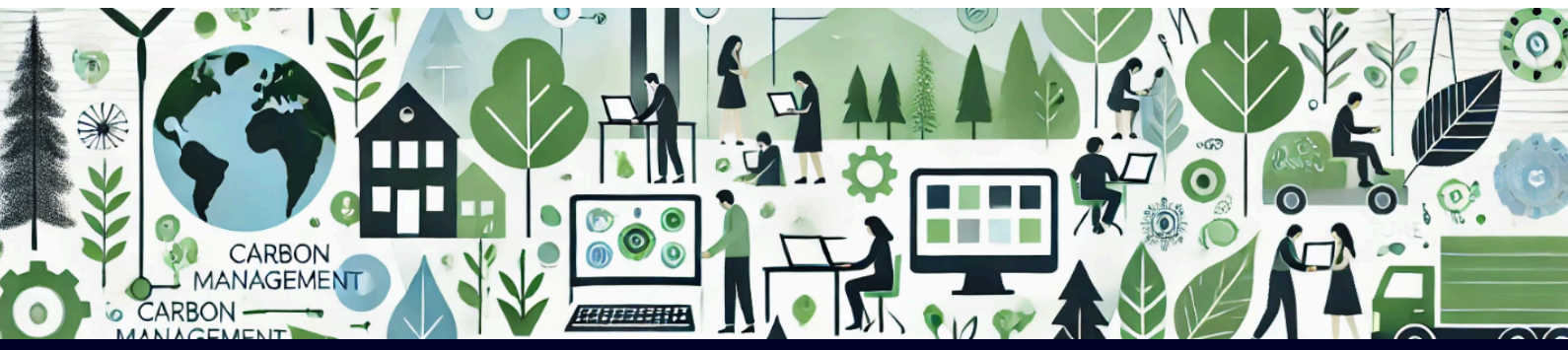

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Intro

This white paper introduces a comprehensive corporate decarbonization management and regulatory compliance solution. The Comprehensive Carbon Ecosystem (CCE) - already in operation - ensures reliable carbon tracking and compensating, aligning with governmental standards to meet regulatory requirements in Querétaro, Mexico, and beyond.

Let us imagine a seamless system - a Comprehensive Carbon Ecosystem - that automatically calculates a company's carbon footprint, helps to select and purchase high-quality carbon compensations, and guarantees legal compliance with a pragmatic governmental carbon protocol using tax incentives. The success of environmental compensation projects is continuously monitored to guarantee effectiveness and transparency.

While this may sound too good to be true, it is becoming a reality in Querétaro, Mexico. The Local Protocol for Subnational Actions for the Regeneration of Forests (TR-SEDESU-025) is being effectively implemented. Compared to international voluntary carbon credit systems, this sub-national level tax-based regulated and compliant carbon compensation mechanism provides a robust framework. A consortium of the state, industry, and compensation implementation partners is developing a technology stack designed for efficient and comprehensive carbon accounting and compensation.

The Comprehensive Carbon Ecosystem (CCE) builds on the successful collaboration between Grupo Ecológico Sierra Gorda (GESG) and the Secretariat of Sustainable Development of Querétaro (SEDESU). GESG, with over 37 years of community-based conservation and sustainable development experience in the Sierra Gorda Bioregion, and SEDESU, which has implemented a unique GHG tax and emission compensation system recognizing GESG's local carbon protocol, form the foundation of this initiative.

Problem statement

The Intergovernmental Panel on Climate Change (IPCC) reports that global carbon emissions must be reduced by approximately 45% from 2010 levels by 2030 to stabilize ecosystem functions and keep global warming below 1.5°C. To achieve this, supranational organizations, national, and sub-national governments have formulated climate goals and imposed environmental regulations on the private sector. These regulatory-imposed goals, along with pressure from clients, employees, and companies' sustainability objectives, drive the decarbonization of the industry.

Despite the voluntary carbon-offset market's expected growth from $2 billion in 2020 to around $250 billion by 2050, the global economy's carbon reduction potential still requires significant improvement. Industry-based carbon emissions continue to rise globally, highlighting a quantity problem where current efforts are insufficient to meet the necessary reductions (Morgan Stanley).

Nature-based Solutions (NbS) have the potential to account for approximately 30-40% of the total carbon sequestration needed to meet global climate targets by 2030 (Carbon Brief) (TracexTech), potentially sequestering between 10-12 billion tonnes of CO2 equivalent (GtCO2e) per year by 2050. These projects are crucial due to their dual benefits: they sequester carbon while enhancing biodiversity and supporting local communities through sustainable practices (CarbonCredits).

However, recent studies have revealed a quality problem within the carbon market. For example, The Guardian reported that 90% of rainforest carbon offsets by the biggest certifier are worthless, indicating that many projects fail to deliver their promised environmental benefits. This lack of effectiveness suggests a need for rigorous standards and reliable monitoring mechanisms to ensure the integrity of carbon offset projects.

To tackle these quantity and quality problems several barriers have been identified that prevent governments and industries from meeting their climate goals. Within this white paper, we are focusing on those problems that result from:

Fragmented Carbon Management Tools

Current tools for carbon management are often fragmented and disconnected, making it challenging to manage the entire process from carbon calculation to accessing quality compensation marketplaces, reporting emissions to state registries, and monitoring carbon compensation projects. According to a study by Verdantix, no single software provider offers a complete portfolio that covers all

necessary capabilities for carbon management. This fragmentation leads to discrepancies and undermines data credibility, as existing compensation marketplaces lack transparency and quality, eroding participant trust (Verdantix) (ITIF).

Furthermore, the absence of reliable monitoring mechanisms for local carbon compensation projects diminishes confidence in their effectiveness. There is also a gap in transparent information reporting across different tools used in the carbon compensation market, complicating the overall process and reducing reliability (Verdantix).

Misalignment of Carbon Tools and Regulations

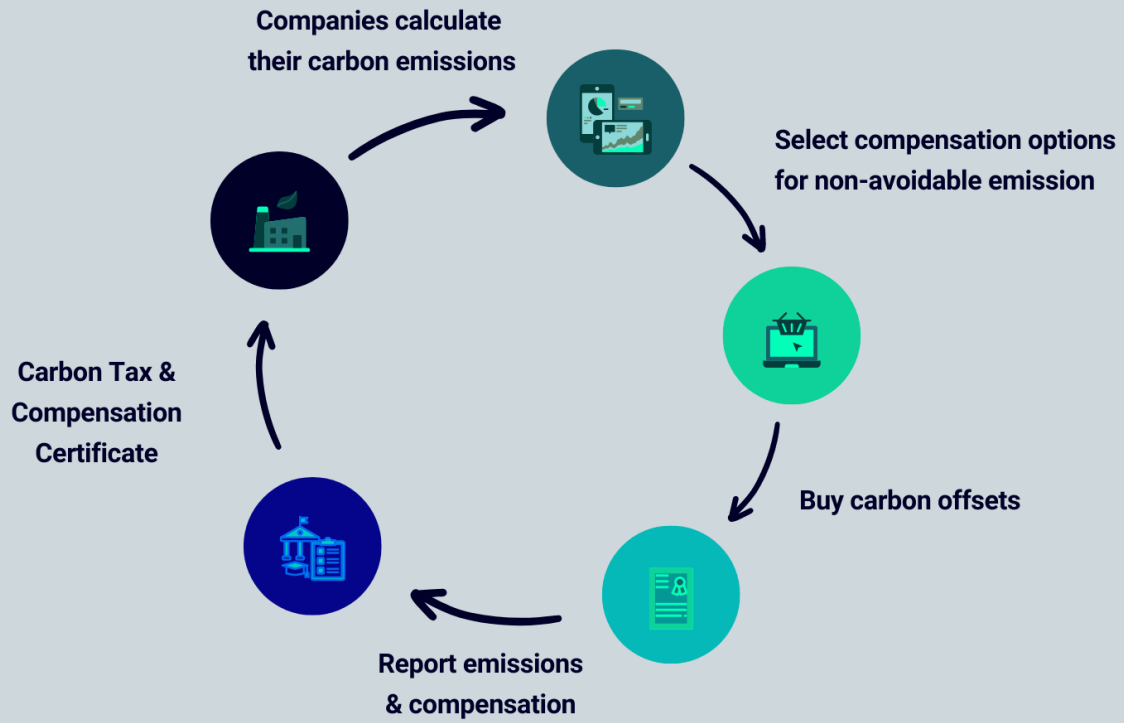
The International Energy Agency (IEA) confirms the misalignment between carbon management tools and regulatory frameworks significantly hinders effective carbon management. The lack of standardized and integrated tools makes it challenging to implement robust emission tracking, compensation, and reporting processes, which are essential for compliance with governmental regulations. This misalignment complicates efforts for both corporates and governments to manage and reduce carbon emissions effectively, highlighting the need for a comprehensive carbon ecosystem tailored to regulatory requirements (SpringerLink) .

Resources Not Reaching Local Communities

Nature-based carbon compensation projects often fail to adequately benefit local communities and forest owners. These projects are frequently managed by external consultants who lack on-the-ground experience and use protocols that do not consider the specific conditions of rural forest owners. As a result, substantial financial resources from carbon compensation transactions never reach the local communities and forest owners who are integral to these projects. According to BFA Global, 40 to 60% of the carbon credit price in the Voluntary Carbon Market (VCM) goes to intermediaries, leaving only a small fraction for the small land stewards in vulnerable communities who are producing the carbon solutions. This system disproportionately benefits intermediaries while marginalizing those most affected by and most crucial to effective carbon sequestration efforts

Solution statement

Governmental carbon protocols can be highly effective and play a crucial role in reducing emissions. However, their successful implementation within private sector industries requires a digital Comprehensive Carbon Ecosystem (CCE) that enables scalability and replication. Such a system seamlessly integrates and connects emission tracking, compensation, and reporting to governmental entities within a unified solution, ensuring efficient and consistent compliance across all sectors.



Components of the Comprehensive Carbon Ecosystem. Watch the video for more details.

Improved regulatory frameworks

Enhanced state regulatory frameworks and carbon protocols should mandate companies to calculate, report, reduce, and compensate for their carbon emissions. Tax incentives tied to carbon emission reduction and compensation encourage economic activities to shift towards regenerative business practices.

In Querétaro, the local protocol and project implementation ensure that 80% of resources reach forest owners. Conservation and carbon sequestration measures

are tailored to local ecological conditions, providing sufficient income for local communities to ensure long-term impact and sustainability. Local management also allows for continuous monitoring of carbon sequestration efforts, ensuring transparency and effectiveness.

Carbon Management Tech and Processes

Making a CCE work requires close collaboration between the state, private sector, and carbon compensation implementers. Essential is a digital infrastructure that enables all required processes.

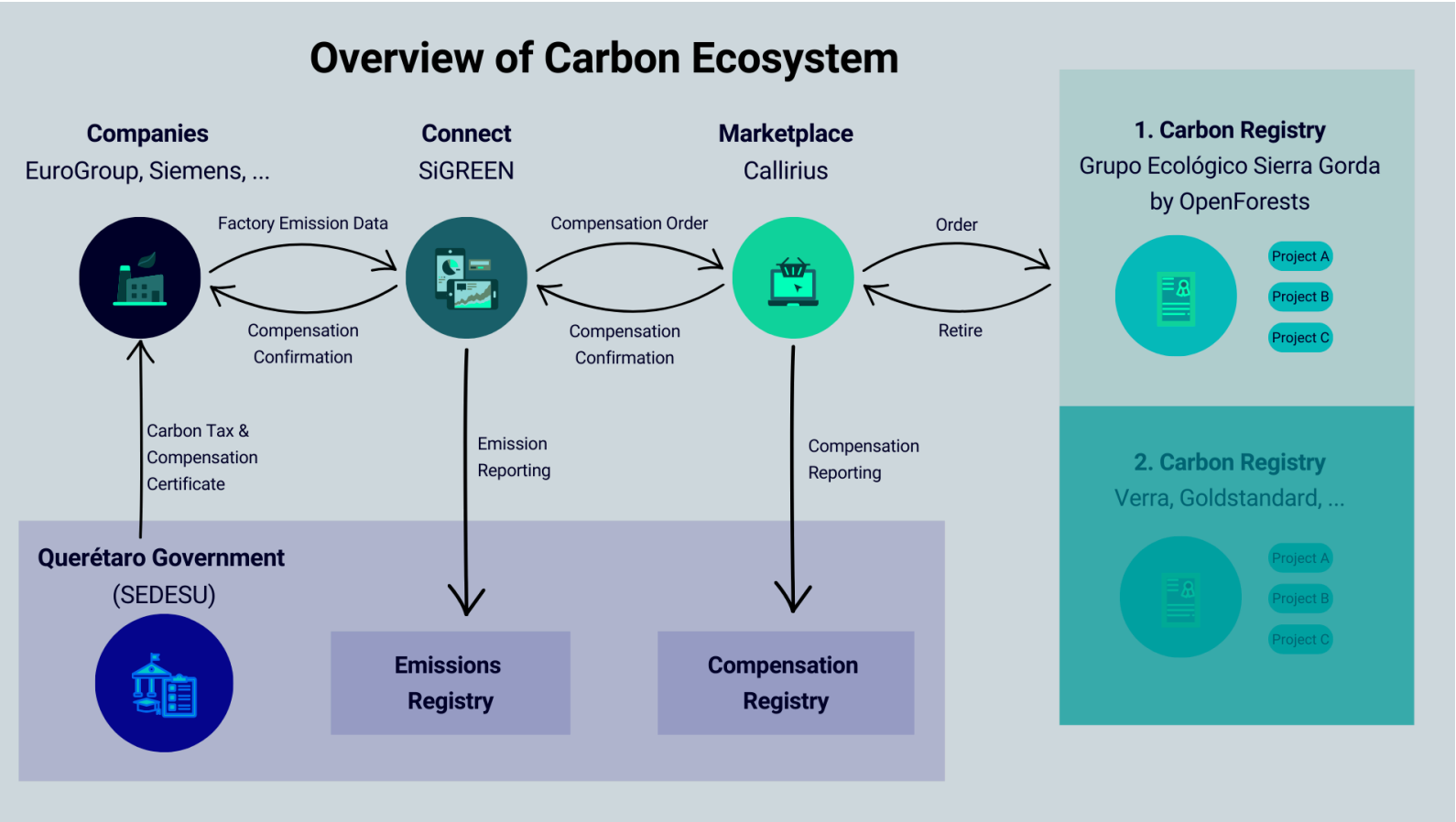
The CCE integrates various elements to create a robust carbon management system. It includes precise carbon emission calculations, high-quality compensation marketplaces, and science-based monitoring, leveraging advanced methodologies to ensure accuracy. This system provides a transparent and reliable platform for carbon compensation contributions.

Comprehensive Carbon Ecosystem Implementation

How it works

The implementation of the Comprehensive Carbon Ecosystem (CCE) in Querétaro, Mexico, is designed to enable effective compensation under the local carbon tax scheme that is subject to the Application for State Low Carbon Emissions Seal. Companies can compensate up to 20% of their carbon emissions by contributing to impactful local carbon projects. This system encourages businesses to reduce carbon emissions and provides tax incentives.

The CCE integrates various elements to create a robust carbon management system, including precise carbon emission calculations (Scope 1), high-quality compensation marketplaces, and standardized monitoring. The following chart describes the CCE stakeholders, components, processes, and data flow.



CCE detailed stakeholder and process flow chart, Watch the video for more details.

Leveraging advanced methodologies ensures accuracy and provides a transparent, reliable platform for carbon compensation contributions. In addition, there is the possibility to monitor the implementation impact of NbS projects on the ground and via satellite data (explorer.land). This is how it works:

1. **Carbon Footprint Calculation:** Companies begin by calculating their Company Carbon Footprint (CCF) using Siemens' SiGREEN software. This tool aggregates emission data across the supply chain, providing accurate carbon footprint calculations. Companies input their Scope 1 emission data, ensuring a comprehensive overview of their carbon emissions.

2. **Emission Reduction and Avoidance:** Before considering carbon compensation, companies focus on reducing their emissions. This step involves implementing internal measures to minimize their carbon footprint. By prioritizing reduction efforts, companies demonstrate their commitment to sustainability and reduce their tax expenses.

3. **Carbon Compensation:** Once reduction measures are in place, companies can address the remaining emissions through carbon compensation. According to the local carbon protocol defined by SEDESU, companies compensate up to 20% of their emissions. This regulation ensures that compensation is a supplementary measure rather than a primary strategy.

4. **Selection of Compensation Options:** SEDESU curates compensation options, including various NbSs and other climate-positive projects. These options include local projects within Querétaro and Mexico, as well as international projects. To encourage local investments, compensation options outside Querétaro are made more expensive, supporting the local climate sector and conservation movement.

5. **Ordering Carbon Compensations:** Companies select and order their carbon compensations directly or through the Callirius marketplace, integrated into SiGREEN. For the first CCE implementation, carbon compensations are sourced from the Carbono Biodiverso Registry operated by GESG. These compensations are nature-based. More than 80% of revenues from carbon compensations going to local forest owners, supporting the restoration of the Sierra Gorda Mountain Region, and benefiting both the environment and local communities.

6. **Monitoring and Documentation:** NbS project progress is monitored on the ground and in addition, there is the option of using satellite and drone imagery provided by OpenForests' explorer.land platform. These technologies ensure projects are transparently and accurately tracked,

providing accountability and data integrity, which is crucial for maintaining the trust and effectiveness of carbon compensation projects.

7. **Reporting and Certification:** Emission and compensation reports can be transmitted to the SEDESU Emission Registry and Compensation Registry. Companies that submit their reports receive a seal for the compensation through a carbon project, which serves as a tax reduction incentive for local Nature-based carbon offset projects. This carbon tax and compensation certificate can be included in their financial statements. This certification reflects their carbon tax and compensation activities, ensuring transparency and compliance with local regulations.

Key implementation partners

The term 'comprehensive' in the context of the Carbon Management Ecosystem means that all necessary aspects are thoroughly covered. This involves the active participation of all stakeholders, including the state, private sector, NGOs, and technology providers. Each of these entities contributes through regulations, processes, and the digital infrastructure necessary to operate the CCE.

Secretaría de Desarrollo Sustentable (SEDESU): In the context of the CCE, SEDESU is integral to the system's success. They ensure that the CCE complies with the regulatory framework. It facilitates collaboration between the state, private sector, NGOs, and technology providers to create a seamless and efficient carbon management system. By enforcing regulations, curating high-quality carbon compensation projects, and leveraging advanced monitoring technologies, SEDESU ensures transparency, accountability, and effectiveness in the carbon compensation process. This comprehensive approach by SEDESU helps to foster a sustainable environment in Querétaro, contributing to global efforts to combat climate change and promoting economic growth through sustainable practices.

Ricardo Javier Torres Hernández, SEDESU

"Local emissions need to be reduced and compensated locally. A Comprehensive Carbon Ecosystem is crucial because it integrates all necessary components and tools. This system can be tailored to our local sub-national tax-based regulated and compliant carbon compensation mechanism. It channels carbon taxes directly to local environmental carbon sequestration projects, ensuring effective and transparent compensation."

Siemens' SiGREEN: Aggregates emission data along the value chain, enabling companies to identify key areas for carbon reduction. It facilitates reliable and trustworthy carbon data exchange among supply chain participants through the Estainium network, enhancing data transparency and security using Distributed Ledger Technology (DLT).

Dr. Gunter Beitinger, Siemens

"This is carbon data flow without borders: The Comprehensive Carbon Ecosystem connects all tools from carbon emission aggregation to the purchase and retirement of carbon offsets in one transparent system. This aligned system enables industry and governments to work efficiently towards their decarbonization goals."

ESTAINIUM: Promotes transparency, measurability, and collaboration, enabling the secure exchange of verified carbon emissions data among manufacturers, suppliers, and partners globally. ESTAINIUM acts as a leader and advisor for the Comprehensive Carbon Ecosystem by fostering transparency, measurability, and collaboration in supply chains. It drives sustainable practices and supports organizations in understanding, reducing, and compensating their carbon footprints. ESTAINIUM's goal is to create a trusted ecosystem for verified environmental data, promoting sustainable decision-making and innovation for climate-positive supply chains globally.

Verena Colonna, ESTAINIUM Association

"Integrating precise carbon emission calculations, high-quality compensation marketplaces, and standardized monitoring, the Comprehensive Carbon Ecosystem (CCE) in Querétaro exemplifies effective corporate decarbonization and regulatory compliance. This model not only enhances transparency and accountability but also sets a benchmark for global efforts in carbon management and climate change mitigation."

Callirius: Empowers companies to seamlessly select and procure high-quality carbon compensations. Integrated into SiGREEN to effortlessly bring the carbon compensation market directly into sustainable business practices. Callirius prioritizes premium, biodiverse carbon compensations, sourced for the CCEs implementation via the Carbono Biodiverso Registry operated by GESG, while always adhering to the highest standards of transparency. These nature-based compensations not only contribute to environmental restoration but also generate revenue for local communities and forest owners, as exemplified by the efforts in the Sierra Gorda Mountain Region.

Michael Grohmann, Callirius

"Our Marketplace combines a cutting-edge platform for effective corporate carbon compensation and climate mitigation with funding solutions for nature-based climate projects. Integrated into the Comprehensive Carbon Ecosystem, our structured and accessible marketplace mobilizes corporate funds for both voluntary and compliant carbon markets. Our rigorous due diligence process significantly enhances the trust in the market, with providing crucially needed transparency. This integration enables corporate offsetting through diverse portfolios of high-quality projects, providing clear, reliable options for meeting climate goals."

Grupo Ecológico Sierra Gorda IAP (GESG): Provides verified biodiversity carbon compensations, supporting local environmental restoration efforts. GESG has developed a unique local protocol for the regeneration of forests that requires that projects be operated by NGOs with substantial experience in the project region and that at least 80% of proceeds from carbon compensation transactions reach local forest owners.

Martha Ruiz Corzo, GESG

"Our biodiverse carbon protocol directly supports local forest owners, ensuring more funding for conservation efforts. Unlike speculative carbon markets, our approach prohibits trading carbon offsets, making local emissions compensable through on-site Nature-based Solutions. This system, embedded with local experience and social fabric, is transparent and sustainable, setting a new standard for carbon management."

OpenForests: Plays a crucial role in the Comprehensive Carbon Ecosystem (CCE) as the software design architect, providing essential monitoring and documentation tools for NbS projects. Through its explorer.land platform, OpenForests leverages satellite and drone imagery to ensure transparency, accountability, and data integrity within the CCE. By using advanced technologies, OpenForests monitors NbS projects, verifies the effectiveness of carbon sequestration activities, and ensures that projects meet environmental goals. This transparent documentation builds trust among stakeholders, including governments, corporates, and local communities.

Alexander Watson, OpenForests

"Data creates transparency, which builds trust. By showing NbS progress with high-resolution satellite imagery and remote sensing data, we can overcome skepticism. This transparency unleashes the necessary funding to transform economies into climate-friendly systems, benefiting industry and biodiversity."

Conclusion

The implementation of the Comprehensive Carbon Ecosystem (CCE) in Querétaro highlights a successful model of corporate decarbonization management and regulatory compliance. This initiative showcases the effectiveness of integrating precise carbon emission calculations, high-quality compensation marketplaces, and standardized monitoring to create a robust and reliable carbon management system.

By leveraging advanced methodologies and remote sensing technologies, the CCE ensures the transparency and accountability of Nature-based Solutions (NbS) projects. The collaboration between state entities like SEDESU, the private sector, NGOs, and technology providers such as Siemens' SiGreen Connect, ESTAINIUM, Callirius marketplace, Grupo Ecológico Sierra Gorda IAP (GESG), and OpenForests' explorer.land, demonstrates the critical role each stakeholder plays in the ecosystem.

SEDESU's role in establishing a strong regulatory framework, curating high-quality carbon compensation projects, and enforcing compliance is crucial for the system's success. Siemens' SiGreen Connect facilitates accurate carbon footprint calculations and data exchange, while ESTAINIUM promotes transparency and collaboration across the supply chain. The Callirius marketplace and GESG provide reliable carbon compensations, and OpenForests' explorer.land ensures effective project monitoring.

The success of the CCE in Querétaro serves as a beacon for other regions and governments. By adopting comprehensive carbon management systems that integrate precise calculations, reliable compensation, and transparent monitoring, corporates and governments worldwide can work together to pave the way toward a carbon-neutral future. This model not only addresses the current barriers in carbon management but also fosters sustainable practices and economic growth, contributing significantly to global efforts to combat climate change.

How to get involved

The CCE model in Querétaro, Mexico, showcases effective corporate decarbonization and regulatory compliance. This model can support and guide other governments in developing similar systems tailored to their local legislation and environmental needs.

The CCE offers guidance on methodologies for accurate carbon footprint calculations, setting up high-quality compensation marketplaces, and implementing robust monitoring systems. Using tools like Siemens' SiGreen Connect and platforms like OpenForests' explorer.land ensures precise data aggregation and project transparency.

Governments can receive assistance in crafting customized regulatory frameworks aligned with local and international climate goals. This involves developing regulations that mandate carbon emission calculations, reporting, and compensation, supported by tax incentives to encourage sustainable practices.

To implement such systems, the CCE supports developing the necessary digital infrastructure. This includes tools for emission tracking, establishing compensation marketplaces, and utilizing remote sensing technologies for monitoring and reporting.

Continuous monitoring and evaluation are essential to assess the effectiveness of these systems. The CCE can provide ongoing support to ensure that data-driven improvements are made, enhancing the overall impact and compliance of the carbon management strategies.

By leveraging the expertise and resources of the CCE, other governments can establish tailored carbon management systems, enhancing local sustainability and contributing to global climate efforts. This collaboration fosters a network of efficient carbon ecosystems that drive environmental and economic benefits worldwide.

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Annex

1. Concept CCE Implementation
2. Overview article
3. Panel Messe Hannover Video
4. MVP Launch Video
