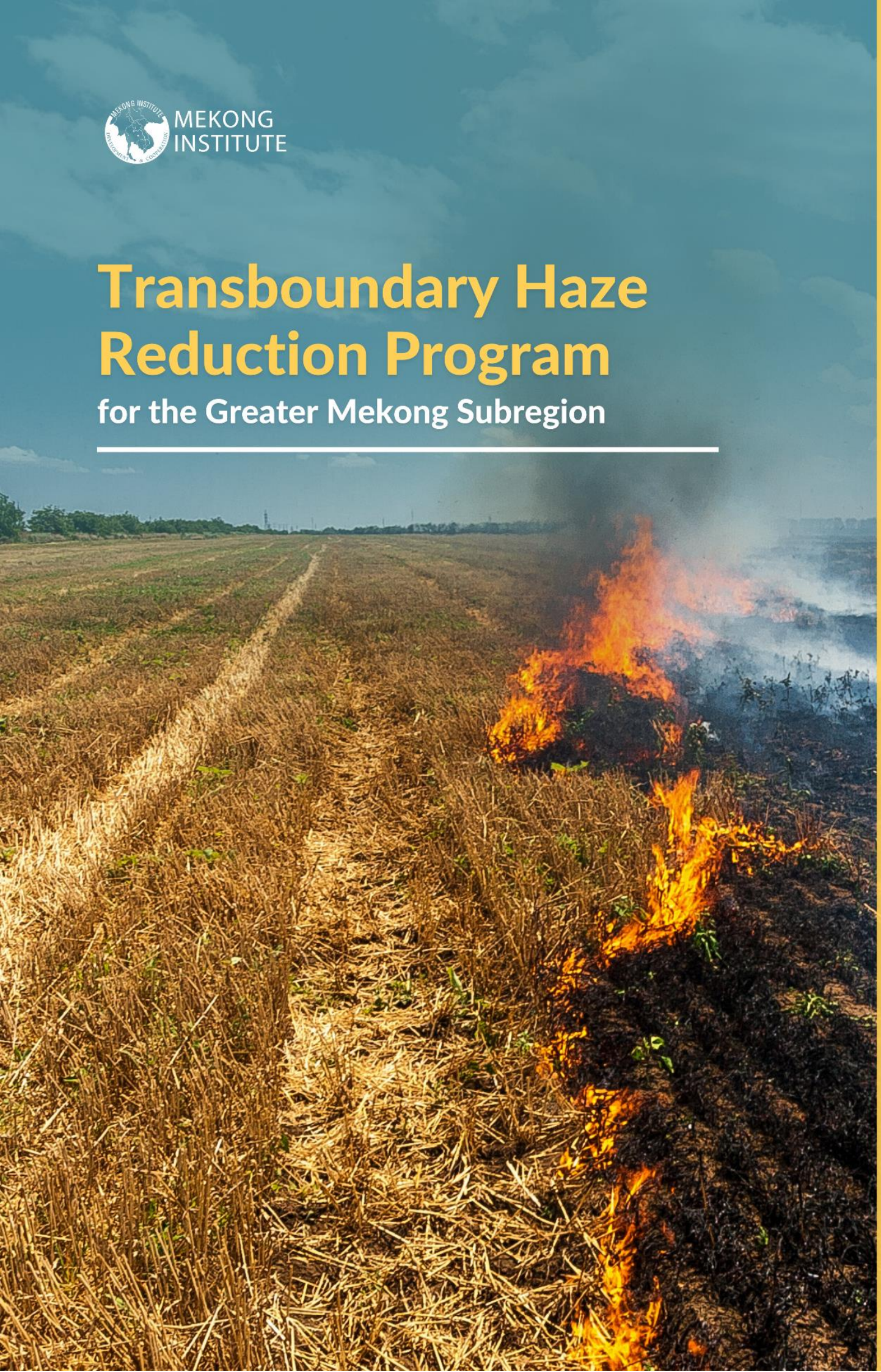
MEKONG INSTITUTE

Transboundary Haze Reduction Program

for the Greater Mekong Subregion



Concept Note

Executive Summary

The "**Transboundary Haze Reduction Program for the Greater Mekong Subregion**" addresses the issue of severe haze pollution caused by large-scale biomass burning which has wide-ranging health, economic, and environmental impacts. Building on existing frameworks such as the ASEAN Agreement on Transboundary Haze Pollution and national initiatives like Thailand's CLEAR Sky Strategy, the program adopts a strategic and integrated approach that combines policy, community engagement, and innovation to achieve sustainable haze reduction and enhance climate resilience across the region.

The program's key focus areas include **Sustainable Agriculture** which promotes alternatives to agricultural burning, such as mulching and composting, and offers targeted capacity-building to equip policymakers and farmers with essential skills for long-term success. The program highlights regional cooperation to ensure regional alignment of national policies, standardized guidelines, and reliable monitoring practices. The **Bioenergy Solutions** component aims to minimize the reliance on burning by converting agricultural waste into renewable energy, generating economic opportunities for smallholder farmers and rural communities. Through bioenergy initiatives like biogas digesters and biomass gasifiers, the program supports a circular economy that fully utilizes agricultural residues and maximizes their value. The **Green Market and Trade Facilitation** efforts encourage investment and expand market access for eco-friendly products, creating a sustainable marketplace that supports zero-burning agriculture and bioenergy solutions.

The program is designed to significantly reduce haze incidents by promoting zero-burning practices and bioenergy alternatives, improving air quality and fostering healthier communities. Strengthened regional cooperation among Mekong countries will align policies and open new markets for green products, creating economic opportunities centered on environmental sustainability. By integrating gender inclusion, community engagement, and digital tools, the program enhances local participation and strengthens monitoring efforts for haze reduction. Robust monitoring systems and a coordinated regional framework will ensure long-term, effective haze management in the region.

TRANSBOUNDARY HAZE REDUCTION PROGRAM FOR THE GREATER MEKONG SUBREGION

BACKGROUND

Context of Transboundary Haze

Transboundary haze pollution remains a major environmental challenge globally, driven primarily by large-scale biomass burning, such as slash-and-burn agriculture and open crop residue burning. This seasonal practice, often used by farmers to clear land for cultivation, releases harmful pollutants including fine particulate matter (PM2.5), carbon monoxide (CO), black carbon, and other toxins into the atmosphere. While these pollutants degrade local air quality, they are also carried over long distances by prevailing winds, creating haze that affects multiple countries across the region. The consequences of this pollution are far-reaching: it poses serious health risks, particularly to vulnerable populations like children and the elderly; reduces economic productivity due to work disruptions; and strains diplomatic relations between affected nations. Addressing the root causes of transboundary haze and mitigating its impacts requires a coordinated, regional approach that emphasizes both prevention and long-term solutions.

In Southeast Asia, transboundary haze has been a persistent issue for decades, with major haze crises highlighting the severity of the problem. The 1997-1998 haze crisis, one of the most devastating in recent history, had a profound impact on the region, prompting the establishment of regional frameworks like the 1997 ASEAN Regional Haze Action Plan (RHAP) and the 2002 ASEAN Agreement on Transboundary Haze Pollution (AATHP). The RHAP marked the region's first coordinated effort to develop a concrete action plan aimed at preventing future haze crises, focusing on long-term preventive measures to avoid a recurrence of such widespread environmental and health impacts. Five years later, the AATHP introduced the first legally binding agreement to combat transboundary haze, signaling a strengthened regional commitment to addressing the root causes of haze pollution. These initiatives have been instrumental in raising awareness, fostering cooperation, and providing the foundation for practical, region-wide solutions to address the issue.

Despite these efforts, transboundary haze pollution remains a persistent challenge, exacerbated by weak enforcement of regulations, a lack of economic incentives to discourage open burning, and insufficient support for sustainable agricultural practices. In 2023, the issue resurfaced as a major regional concern, triggered by the El Niño weather phenomenon, which intensified the frequency and severity of haze events. The public health impact of transboundary haze is severe, with elevated levels of PM2.5 linked to respiratory diseases, cardiovascular problems, and premature mortality. Vulnerable groups, including children, the elderly, and individuals with pre-existing health conditions, face heightened risks from prolonged exposure to haze. Beyond health, the economic toll is significant, particularly for sectors such as agriculture and tourism, which suffer from reduced productivity and declining air quality. Moreover, haze contributes to global warming by releasing greenhouse gases and black carbon into the atmosphere, further increasing the region's vulnerability to the broader effects of climate change.

Causes of Transboundary Haze

The primary cause of transboundary haze in the Greater Mekong Subregion (GMS) is agricultural burning, particularly the practice of burning crop residues after harvest. This

method of land-clearing is widespread, especially during the dry season from January to April, as it offers farmers a cost-effective and rapid way to prepare their fields for the next planting season. However, this practice releases substantial amounts of pollutants into the air, including high concentrations of PM2.5, PM10, carbon monoxide (CO), and other harmful substances. These pollutants contribute to air pollution and severely degrade air quality during peak haze periods. Agricultural burning is common across several GMS countries, including Thailand, Myanmar, Vietnam, and Laos, and is the leading cause of the region's seasonal haze.

In Northern Thailand, agricultural burning is one of the most significant sources of PM2.5 during the dry season, contributing up to 70% of total PM2.5 concentrations at the peak of the haze season. In 2020, satellite data revealed that over 50% of the hotspots in Thailand were linked to agricultural fires, with approximately 12 million tons of crop residues burned each year. Similarly, Myanmar, which has an extensive agricultural base, faces a significant pollution problem due to crop burning. Agricultural fires in Myanmar account for about 60% of PM2.5 emissions during the dry season, with an estimated 6 million tons of agricultural waste burned annually.

Vietnam, particularly the Mekong Delta region, is another hotspot for crop residue burning. Approximately 10 million tons of rice straw are burned annually in northern Vietnam, contributing up to 65% of the PM2.5 levels during the peak burning season. Laos and Cambodia also experience substantial haze episodes due to crop burning. In Laos, about 8 million tons of crop residues are burned annually, contributing to 55% of PM2.5 emissions during the dry season, while Cambodia sees around 7 million tons of agricultural waste burned each year.

In addition to crop residue burning, another significant source of haze pollution in the region is peatland or forest fires for the creation of large-scale monoculture plantations. The expansion of plantation crops, such as rubber, oil palm, sugarcane and corn, is one of the major causes of increasing emission of air pollutants in the Mekong countries as fire is used as a common method for clearing large tracts of land. This trend has contributed to a growing intensity and frequency of haze episodes in Southeast Asia, further aggravating air pollution levels. During peak burning periods in the region, PM2.5 concentrations often exceed 100 µg/m^3, far surpassing the World Health Organization (WHO) guideline of 25 µg/m^3. This severe increase in particulate matter reduces visibility and degrades air quality, impacting millions of people. Further, exposure to high levels of PM2.5 and PM10 can lead to severe health issues, including respiratory and cardiovascular diseases, reduced lung function and premature death. Haze pollution also exacerbates climate change by releasing greenhouse gasses and black carbon into the atmosphere, which have a warming effect.

Way Forward for the GMS

Mitigating transboundary haze pollution in the GMS requires a shift from reactive measures to a more proactive, preventive approach. The first critical step is strengthening enforcement mechanisms to reduce the widespread practice of agricultural burning. This will require better monitoring systems, more robust legislation, and greater political will to implement and enforce regulations effectively. While the role of regional frameworks remains crucial in setting the formal guidelines for countries in the region, governments should also recognize the diverse local contexts and the economic incentives driving farmers to burn land. This includes limited access to alternative land-clearing techniques and the lack of financial support for adopting new, sustainable agricultural practices. Engaging local communities and the private sector can complement strong legal enforcement mechanisms and cross-sectoral coordination to effectively address the issue.

The Mekong Institute (MI), with its strong mandate on regional cooperation and integration and its extensive experience in implementing regional programs, is uniquely positioned to play a key role in reducing transboundary haze. By promoting sustainable agricultural practices, raising public awareness, and fostering regional collaboration, MI's efforts align closely with the strategic objectives of the Second ASEAN Haze-Free Roadmap and initiatives like the CLEAR Sky Strategy which focus on reducing haze hotspots, strengthening air quality monitoring, and enhancing response strategies to address the ongoing challenge of transboundary air pollution.

Through its Agricultural Development and Commercialization (ADC) Department, MI can work with governments, agricultural stakeholders, and local communities to promote no-burn farming techniques and raise awareness about the long-term benefits of sustainable land management practices. This could involve establishing demonstration plots, organizing agricultural extension services, and offering training programs to educate farmers on effective no-burn crop residue management methods. By directly engaging with farmers, MI can help drive the adoption of these practices, reducing the environmental impact of agricultural burning while enhancing soil health and crop productivity in the region.

MI's Trade and Investment Facilitation (TIF) Department can play a key role in enhancing green trade and investments and creating market incentives for the adoption of eco-friendly farming practices. For instance, TIF can conduct policy research to assess the economic costs of transboundary haze and promote market access for sustainably-produced agricultural products that utilize no-burn farming methods. By doing so, TIF can encourage businesses and SMEs in the region to shift away from harmful practices like crop or peatland burning and incentivize them to adopt more environmentally sustainable alternatives. This approach will drive a market transformation towards greener, more resilient agricultural practices.

MI's Sustainable Energy and Environment (SEE) Department can advocate for bioenergy solutions that transform crop residues into valuable feedstock for renewable energy production. By integrating the principles of a bio-circular and green economy (BCG), the department can promote the collection and utilization of agrobiomass, creating a viable market demand for crop residues in sustainable energy sectors. This approach would incentivize farmers to retain their agricultural waste, providing them with an additional source of income. These solutions would reduce the environmental impact of agricultural waste, bolster regional energy security, and contribute to climate change mitigation efforts.

MI's role in fostering cross-border collaboration will be crucial in addressing the transboundary nature of the haze issue. By facilitating dialogue among governments, the private sector, and civil society, MI can ensure broad engagement in developing sustainable solutions. Through knowledge sharing and capacity building, MI will enhance the technical and institutional capabilities of governments in the GMS to manage haze pollution and mitigate its impact on public health and the environment. Through these efforts, MI can play a central role in driving regional solutions to one of Southeast Asia's most pressing environmental issues.

PROGRAM GOAL

To strengthen regional cooperation and integration in the Mekong Subregion for reducing transboundary haze by promoting sustainable, zero-burning agricultural practices, advancing bioenergy solutions, and enhancing greater investment in green technologies.

FOCUS AREAS

The program adopts a circular economy approach to address transboundary haze pollution. It focuses on converting agricultural waste, commonly burned and a major source of haze, into valuable resources like bioenergy, organic fertilizers, and other sustainable products. This approach reduces harmful emissions and promotes resource efficiency and environmental sustainability.

1. Sustainable Agriculture

Agricultural burning, particularly slash-and-burn practices, is a major contributor to transboundary haze in the Mekong Subregion. These traditional methods, while cost-effective for clearing land, release significant amounts of particulate matter and other pollutants that negatively impact air quality and public health. The sector's reliance on these practices heightens vulnerability to environmental and economic challenges, including climate change, soil degradation and reduced agricultural productivity.

This focus area aims to reduce transboundary haze pollution by promoting and implementing sustainable, zero-burning agricultural practices. It will emphasize minimizing hotspots caused by agricultural burning during the dry season. Key initiatives include:

- **Building Expertise on Zero-Burning Practices** - This involves training policymakers and agricultural extension officers on sustainable land management practices, providing technical guidance on alternatives to burning, such as mulching and composting, and facilitating knowledge exchange on best practices for residue management.
- **Strengthening Subregional Cooperation** - Banking on the Sub-regional Ministerial Steering Committee on Transboundary Haze Pollution in the Mekong Sub-region (MSC Mekong), a regional strategy for managing agricultural residues will be developed, aligning national policies and practices with regional goals. This strategy will include standardized guidelines for residue management, shared monitoring systems and collaborative efforts to enforce zero-burning regulations across borders.
- **Engaging Farming Communities** - Community-based monitoring programs will be established to enhance compliance with zero-burning policies, supported by digital tools for real-time reporting and data collection. Awareness campaigns and capacity-building workshops will also be conducted to educate farmers on the environmental and health impacts of burning and to promote sustainable alternatives.

2. Bioenergy Solutions

Agricultural waste, often discarded through open burning, is an untapped resource for smallholder farmers and agricultural cooperatives in the Mekong Subregion. By adopting a circular economy approach, this waste can be transformed into valuable bioenergy, closing the loop in resource use. The dual benefit reduces transboundary haze pollution and provides renewable energy while creating economic opportunities and enhancing sustainability in rural communities.

This focus area aims to advance the adoption of small-scale bioenergy technologies to transform agricultural waste into renewable energy, fostering a circular economy for

micro-, small- and medium enterprises (MSMEs) and agricultural cooperatives. Key initiatives include:

- **Investment in Small-Scale Bioenergy Projects** - This emphasizes investments in small-scale bioenergy solutions, such as biogas digesters, portable biomass gasifiers and small-scale waste-to-energy units, tailored for MSMEs and cooperatives. Public-Private Partnerships (PPPs) will be encouraged to mobilize resources and provide technical and financial support. These partnerships will focus on promoting circular economy models, where agricultural residues are repurposed into energy, reducing waste and creating a sustainable resource loop.
- **Technology Transfer and Innovation** - This involves the exchange of best practices and innovative small-scale bioenergy technologies across the region. Knowledge-sharing initiatives will demonstrate how to integrate bioenergy solutions into farming systems, turning agricultural by-products into energy and other valuable outputs like biofertilizers. Collaborations with local innovators and regional experts will ensure that technologies are adapted to the specific needs of small agribusinesses.
- **Building Technical Skills on Bioenergy Systems** - Training programs will focus on the installation, operation and maintenance of small-scale bioenergy technologies, with a strong emphasis on circular economy principles. Participants will learn how to maximize the utility of agricultural residues, creating value-added products and reducing dependency on external inputs. This will help key stakeholders close the loop in their production systems, enhancing both environmental and economic sustainability.

3. Green Market and Trade Facilitation

Adopting sustainable agricultural and bioenergy practices is essential for reducing haze emissions, but it requires efficient market mechanisms and trade facilitation to ensure successful transitions. Creating economic incentives for farmers and businesses to adopt greener practices is a priority. This involves opening access to markets that value sustainable, low-carbon products. It will also prioritize streamlining trade regulations, reducing barriers, and supporting micro, small, and medium enterprises (MSMEs) in accessing finance and market opportunities to support the adoption of sustainable practices and strengthen economic resilience.

This focus area aims to enhance trade and investment in green technologies and sustainable agricultural products to reduce haze emissions and support a circular economy. Key initiatives include:

- **Utilization of Market and Trade Measures** - This promotes trade policies and market incentives that encourage the reuse, recycling and repurposing of agricultural waste into valuable products such as bioenergy, organic fertilizers and other sustainable goods by integrating circular economy principles into trade measures.
- **Collaborative Action for Green Investments** - To attract capital for sustainable ventures, this will connect investors with innovators and entrepreneurs, fostering collaborations that promote the development of low-carbon products and services. It will also foster partnerships between governments, private companies and development agencies to drive investments in sustainable agriculture, bioenergy and green technologies. These partnerships will facilitate resource mobilization, share risks and promote

the development of projects that align with circular economy principles. Collaborative efforts will also support capacity building and innovation, helping to scale sustainable solutions in the subregion.

- **Market Access for Green Products** - Developing trade facilitation measures to increase market access for zero-burning and bioenergy-related products is crucial. This includes promoting recycled and value-added goods derived from agricultural waste, such as bioenergy products and eco-friendly materials. By supporting market entry for these products, it will help create demand for sustainable technologies and practices.
- **Regional Policy Harmonization** - This will align trade policies across the region to facilitate the cross-border flow of green technologies and sustainable products. It ensures a cohesive approach to promoting environmentally friendly goods and services, strengthening regional cooperation and economic integration.

CROSS-CUTTING THEMES

Gender Inclusion

Women play significant roles in agriculture and community development; thus, gender inclusion is a key cross-cutting theme. The framework promotes the integration of gender-sensitive approaches in all activities, ensuring that women are actively involved in decision-making processes related to sustainable agricultural practices and bioenergy solutions.

Community Engagement

The program emphasizes the importance of involving local communities in the planning, monitoring and implementation of sustainable agricultural and bioenergy practices. This participatory approach ensures that the interventions are well-adapted to local contexts and gain widespread acceptance. Key actions will include participatory planning, awareness campaigns and community-based monitoring.

Digital Tools Utilization

The use of digital tools is integral to modernizing the approach to transboundary haze management. The program promotes the adoption of technologies that facilitate real-time monitoring of agricultural burning, improve data accuracy and enhance communication among stakeholders. Key actions will include regional real-time monitoring systems and digital platforms for data sharing.

PROGRAM INTERVENTIONS

Capacity Development

Capacity development is a foundational intervention aimed at empowering stakeholders -- farmers, policymakers, community leaders and agribusinesses -- with the necessary expertise to adopt and promote sustainable practices. This intervention focuses on delivering targeted training, workshops and knowledge-sharing sessions that build technical skills in areas such as zero-burning agriculture, bioenergy technology operation and sustainable resource management.

Regional Cooperation and Integration (RCI)

Regional cooperation and integration are important for addressing the transboundary nature of haze pollution. This intervention promotes harmonized policies, joint action plans and coordinated responses to haze-related challenges. Regular regional dialogues, knowledge exchanges and joint monitoring initiatives are key activities to establish trust and mutual support among Mekong countries. This collaborative effort enhances the collective capacity to reduce haze pollution and supports the broader goal of regional integration.

Inter-Agency Collaboration

Inter-agency collaboration leverages the diverse expertise and resources of various stakeholders to create holistic solutions for transboundary haze. This intervention focuses on establishing multi-stakeholder platforms where government agencies, academic and research institutions, businesses and non-governmental organizations (NGOs) can work together. Collaborative efforts include joint policy development, coordinated implementation of projects and shared responsibilities in monitoring and enforcement. This approach ensures that interventions are well-coordinated, resource-efficient and aligned with the needs of different sectors.

Public-Private Partnerships (PPPs)

PPPs enable the pooling of resources, sharing of risks and promotion of innovative solutions. This intervention focuses on creating collaborative frameworks where the private sector can contribute technical expertise, investment capital and operational efficiencies, while the public sector provides regulatory support, policy alignment and capacity-building opportunities. Key activities include co-financing bioenergy projects, developing market incentives for sustainable products and enhancing access to green technologies. Through PPPs, the framework aims to accelerate the implementation of sustainable practices, stimulate economic growth and achieve long-term environmental benefits.

EXPECTED OUTCOMES

- Decrease in haze incidents due to the widespread adoption of zero-burning practices and bioenergy solutions
- Stronger policy alignment and collaborative actions across the Mekong Subregion
- Increased involvement of women and local communities in haze reduction efforts
- Growth in investments and trade of sustainable agricultural products and green technologies
- Effective regional monitoring systems and more accessible real-time information with usable regional digital platforms

THEORY OF CHANGE (ToC)

Goal	Strengthened regional cooperation and integration for transboundary haze reduction in the Mekong Subregion by promoting sustainable, zero-burning agricultural practices, advancing bioenergy solutions and enhancing trade and investments in green technologies		
Outcomes	1. Decrease in hotspots due to widespread adoption of zero-burning practices 2. Enhanced compliance driven by community monitoring and awareness 3. Better air quality and health outcomes due to lower levels of particulate matter 4. More coordinated efforts in the Mekong Subregion for sustainable residue management	1. Increased adoption of small-scale bioenergy systems by farmers and cooperatives 2. Rural communities provided with renewable energy sources and additional income streams 3. Agricultural residues repurposed into bioenergy, contributing to reduced haze pollution 4. Resource efficiency and sustainability fostered through the effective use of agricultural waste	1. Sustainable agricultural and bioenergy-related products gained greater acceptance in regional and global markets 2. Increased financial resources and technical support for green technologies and sustainable practices 3. Harmonized trade policies facilitate the seamless flow of sustainable goods 4. Widespread adoption of circular economy practices
Outputs	1. Increased knowledge and awareness among policymakers, agricultural extension officers, and farmers in zero-burning techniques and sustainable land management practices. 2. Improved knowledge and skills among local communities to monitor and report agricultural burning activities. 3. Enhanced awareness of farmers and stakeholders on the health and environmental impacts of burning and sustainable alternatives.	1. Increased investments in small-scale bioenergy solutions tailored for MSMEs and agricultural cooperatives. 2. Best practices and innovative bioenergy technologies promoted through knowledge-sharing events. 3. Increased knowledge and skills among farmers and cooperatives in operating and maintaining bioenergy systems. 4. More collaborative projects between governments and private sector entities initiated to scale bioenergy adoption.	1. Policies and incentives that encourage the reuse and recycling of agricultural waste into valuable products adopted. 2. Collaborative initiatives initiated between governments, private investors and development agencies to finance green projects. 3. Trade facilitation measures developed to improve market access for sustainable, low-carbon products. derived from agricultural waste. 4. Trade policies aligned to promote the cross-border flow of green technologies and sustainable products.

Objectives	Promote sustainable, zero-burning agricultural practices to reduce hotspots caused by agricultural burning	Advance the adoption of small-scale bioenergy technologies to transform agricultural waste into renewable energy	Enhance trade and investment in green technologies and sustainable agricultural products to support a circular economy and reduce haze emissions
Focus Areas	Sustainable Agriculture	Bioenergy Solutions	Green Market and Trade Facilitation
Cross-cutting Themes	• Ensure women's active participation in decision-making and implementation processes • Involve local communities in the planning, monitoring and implementation • Leverage digital technologies for monitoring of agricultural burning, information sharing and national and regional communication		
Interventions	Capacity Development -- RCI -- Inter-agency Collaboration -- PPP		

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