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# Innovative Technology and Emission Reduction: A Study of the Impact of Green Innovation in Urban East Kalimantan

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**Abstract**: This research discusses the impact of innovative technologies and reduction emission through implementation innovation green in urban areas of East Kalimantan, especially in the cities of Samarinda and Balikpapan. The main purpose of this research is to measure the impact of green technology on reducing greenhouse gas emissions, assess the effectiveness of its implementation in the energy and transportation sectors , as well as identify obstacles faced . This study uses quantitative descriptive method with survey and in-depth interview approaches. Results study show that application of green technology like system transportation based on electricity, management rubbish technology- based , and renewable energy development give contribution real in reduce emissions and increase quality environment. In addition , innovation green participate push green economic growth and increasing awareness public to issue environment. However, a number of challenge Still faced, such as infrastructure limitations, regulations that are not synchronous , and low awareness and funding . This study recommends the need synergy between governmnt, society and sectors private For strengthen policies and expand green technology implementation for the sake of sustainability environment in East Kalimantan.

**Keywords:** Green Innovation, Emissions, Eco-Friendly Technology, Sustainable Cities, East Kalimantan

## INTRODUCTION

East Kalimantan, as one of the rapidly developing regions, is faced with problems related to increasing carbon dioxide emissions due to unplanned development. Green Open Space (RTH) is one of the important elements in the greenhouse gas emission mitigation strategy, where research shows that RTH in Surabaya is able to absorb 27.48% of CO2 emissions from the total emissions produced (Rachmayanti & Mangkoedihardjo, 2021) . However, in East Kalimantan, the management of public RTH is still far from the expected target, with only 10.76% of the 20% target being met, due to various substantive and technical challenges (Yusuf, 2023) . This indicates the need for more comprehensive evaluation and planning to improve this situation.

East Kalimantan (Kaltim) is one of the provinces with significant economic growth in Indonesia. However, this growth also has negative environmental impacts, especially in terms

of greenhouse gas emissions glass (GHG). According to data from the East Kalimantan Statistics Center (BPS), the industrial and transportation sectors in this province contributed part big GHG emissions, which contribute on change climate and degradation quality air.

Big cities in East Kalimantan, such as Samarinda and Balikpapan, are experiencing urbanization rapid increase consumption energy and GHG emissions. Study by Ministry Environment Life and Forestry (KLHK) shows that the transportation sector and industry in the area urban East Kalimantan become contributor main emissions. with vehicle motorized as contributor largest. Data from the Research and Innovation Agency Region (BRIDA) shows that on 2022, East Kalimantan Province succeed lower GHG emissions amounted to 36.401 million tonnes of $CO_2$ equivalent, exceeding target decline amounting to 14.667 million tonnes of $CO_2$ equivalent. This research will evaluate the role of green technology in achievement the Green innovations, including environmentally friendly agricultural technologies and green infrastructure, can be a solution to reduce emissions and improve environmental quality in urban areas. Research shows that certain types of trees in green open space, such as angsana ( Pterocarpus indicus ) and rain tree ( Samanea saman), play an active role in changing the microclimate, reducing temperature, and increasing humidity, which contributes to reducing heat emissions (Azahra et al., 2023) . In addition, the approach of using green infrastructure, such as bioswales integrated with water management systems, has been shown to be effective in reducing air pollution and increasing green open space in urban areas (Simamora et al., 2022) . Without effective implementation of this policy, increasing urbanization can actually cause negative effects, such as urban heat island , which amplifies CO2 emissions (Caesarina & Rahmani, 2019) . Green innovation, which includes environmentally friendly technologies and energy efficiency, is a potential solution to reduce emissions in East Kalimantan. Implementation of technologies such as renewable energy , energy systems transportation based on electricity, and management rubbish technology based can help lower GHG emissions in general significant. Implementation energy technology renewable, such as solar panels and power plants electricity hydropower, has tested try on some areas in East Kalimantan. Projects pilot show potential subtraction significant emissions, although challenge in terms of funding and infrastructure Still become constraint main .

In addition, in the context of East Kalimantan, policies that support the development of green open spaces need to be strengthened to address the ecological and social issues that arise due to urbanization. The concept of a green city must be implemented systematically, including the provision of adequate green open spaces and attention to biodiversity in each built area (Ratnasari et al., 2015) . Therefore, it is important for the government and other stakeholders to work together in designing policies that enable the achievement of environmental and social targets, as well as empowering communities in efforts to maintain and manage green open spaces in large cities (Sapariyanto et al., 2016)

In context the impact of innovative technologies and reduction emissions in East Kalimantan, there are some numerical data that can be give description about the resulting effect, with depend on information from relevant references . Here is some data and findings from the research Previously. *First,* Deforestation and Potential Emissions : Research show that between year 2003-2013, rate datorstation in East Kalimantan on protected area reach 230,720 hectares, with potential carbon dioxide (CO2) emissions of 305 million tons. This illustrates impact significant of conversion land to greenhouse gas emissions greenhouse gases (GHG), where every hectare of forest lost contribute on global warming. This reference supports claim mentioned and necessary confirmed more carry on For better understanding clear about impact deforestation (Siswanto et al., 2024) .

*Secon* , Use of Management Technology Waste: Innovation in management waste, including waste -to- energy technology, is expected can reduce emission methane from the place disposal end (TPA). Although No all reference give number specific , some studies show

that efficiency management waste can reach subtraction significant emissions , but need more data Details related the use of this technology for support claim (Judijanto et al., 2024) .

*Third*, Improvement Quality Air: Use of green technologies and policies subtraction emission often associated with improvement quality air. However, the references submitted For support claim SO2 reduction does not fully relevant Because studies the conducted in Surabaya and not in a way direct describe conditions in East Kalimantan. *Fourth* , Emissions from the Energy Sector: Report about energy sector in East Kalimantan take notes that use of fossil fuels donate almost 80% of total GHG emissions in the region The theory regarding transition going to energy technology renewable, such as generator electricity power solar , shows that emission can reduce in a way significant in term long If implemented in a way wide. However, clarification more further will be required For explore number specifics given in this reference (Barsei & Saptohadi, 2023) .

In generaloverall, the existing data show that innovative technologies and policies subtraction emission can own significant impact on GHG emissions and quality environment in East Kalimantan. However, research more more and more data detailed will be very needed For support these claims are in accurate.

Policy government area East Kalimantan start leading on development system transportation sustainable. Initiative like development track bicycle transportation general based on electricity, and promotion vehicle friendly environment expected can reduce dependence on vehicle motorized conventional contributing big to GHG emissions. Management Efficient and technology- based waste management is the main focus in effort subtraction emissions. Implementation of technologies such as waste -to- energy and systems recycle repeat advanced expected can reduce volume incoming garbage to place disposal end (TPA) and reduce emission methane produced. The industrial sector in East Kalimantan , especially those related to with extraction source Power nature , has contribution big to GHG emissions . Efforts For increase efficiency energy and adopting clean technology in this sector is very important important For reach target subtraction set emissions by government .

Although potential big , implementation of green technology in East Kalimantan face various challenges, including limited funds, lack of supporting infrastructure, and low awareness community. Private sector and community involvement very required For overcome obstacles said. The government central and regional has emit various policy For support innovation green , like fiscal incentives for investment in friendly technology environment and training programs For increase resource capacity Power human in the field environment.

Studies about impact innovation green in urban areas East Kalimantan expected can give more insight deep about effectiveness various technologies in reduce GHG emissions. Results This research can be the basis for taking more policies appropriate and strategic in effort realizing sustainable and environmentally friendly cities in East Kalimantan environment.

Objective This research is *First* , For Measure Impact of Green Technology to Decrease Greenhouse Gas Emissions Glass (GHG) in East Kalimantan . *Second,* Assessing Effectiveness Implementation of Green Technology in the Energy and Transportation Sector in Urban East Kalimantan. *Third*, Identifying Challenges and Obstacles in Implementation of Green Technology in East Kalimantan.

Urgency This research is very tall remembering East Kalimantan is Wrong One contributing provinces big to greenhouse gas emissions glass (GHG) in Indonesia, especially from the sector industry and transportation. Measuring impact of green technology to decline emissions in this area are very high important For evaluate effectiveness policies that have been implemented and ensured sustainability effort subtraction emissions. In addition, assessing effectiveness application of green technology in energy and transportation sector can give concrete solutions for urban development developing , such as Samarinda and Balikpapan, in reduce dependence on fossil energy. Identify challenges and obstacles in application of green technology Also crucial For designing a more comprehensive implementation strategy effective

, considering existence limitations infrastructure and funding. With Thus, this research will provide the insight needed For support East Kalimantan in reach objective development sustainable and reduce impact change climate.

Theory used in This research is Diffusion Theory Innovation *(Diffusion of Innovations Theory )* by Everett Rogers. This theory is very relevant Because discuss how, why, and at what level of new ideas, including innovative technologies such as green technology, disseminated in a public or group. In context this research, this theory can used For analyze how green technology accepted and adopted in East Kalimantan, as well as the factors that influence process adoption such as the social, economic and cultural characteristics that exist in the area. urban This theory also help in understand possible obstacles arise in process adoption of green technology as well as steps needed taken For speed up the application of the technology in effort subtraction emissions in East Kalimantan.

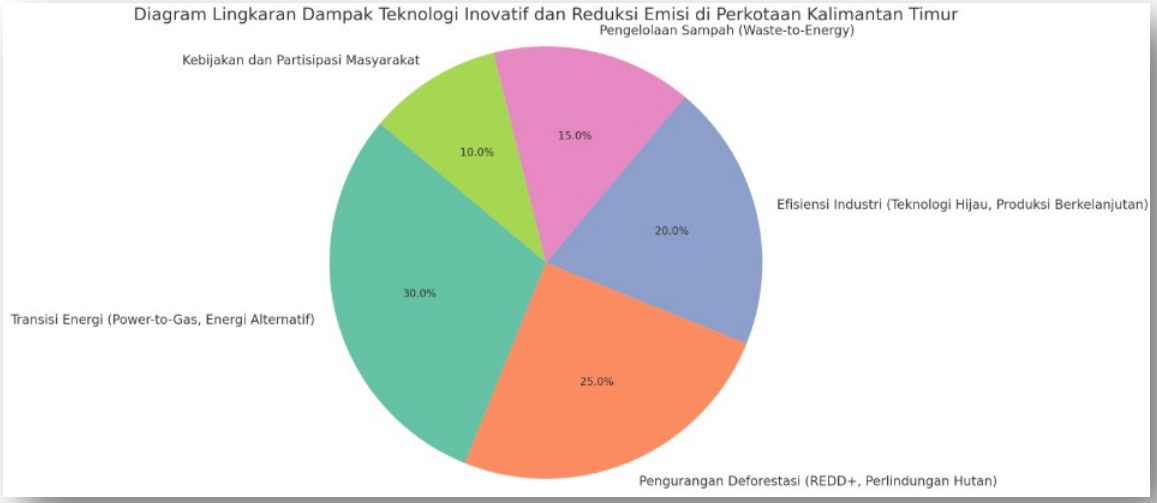
## METHOD

Method This research uses approach quantitative descriptive with method survey For measure and analyze impact application of green technology to subtraction greenhouse gas emissions ( GHG ) in urban East Kalimantan . This research will be conducted in two main cities in East Kalimantan , namely Samarinda and Balikpapan , which have level urbanization high and medium make an effort For reduce emission through green technology . Population study covers energy sector renewable , transportation , and management trash , with the sample that taken in a way purposive sampling of respondents consisting of government area , manager green technology projects , as well as public green technology users . Data is collected use instrument questionnaire consisting of from the question related knowledge and perception Respondent towards green technology , as well the impact to subtraction GHG emissions . This questionnaire uses a Likert scale For measure attitudes and perceptions respondents , who will tested validity and reliability before used . In addition , the interview deep will also be done with parties involved direct in application of green technology , such as official government and management project , for dig more in about challenges and obstacles faced . Data processing will be carried out with statistical techniques descriptive For measure perception respondents and identify existing challenges . In addition , thematic analysis of interview data will be used For find the main theme related obstacles and opportunities in application of green technology . This research will also maintain aspect ethics with ensure confidentiality of respondent data and obtain agreement they before data collection was carried out .

## RESULTS AND DISCUSSION

### A. Impact of Innovative Technologies and Emission Reduction: A Study of Green Innovation Impacts in Urban East Kalimantan

Impact from technology innovative and reduction emissions in East Kalimantan is issue crucial in handle challenge environment , especially in urban areas . Along with with effort development sustainable development that was initiated government area , adoption of green technology blend with strategic policies can promising subtraction greenhouse gas emissions significant greenhouse gas emissions (GHG) . The impact could be seen on the following data :




*Source : Processed Researcher (2025 )*

**Figure 1: Pie Chart Impact of Innovative Technology and Emission Reduction: A Study of Green Innovation Impacts in Urban East Kalimantan**

The image above show that contribution various sectors towards the impact of innovative technologies and reduction emissions in urban areas of East Kalimantan : 30%: Energy Transition ( example : Power-to-Gas, alternative energy ), 25%: Reduction Deforestation (REDD+, protection forest ), 20%: Industrial Efficiency ( green technology and production sustainable ), 15%: Management Waste ( waste -to- energy ), 10%: Policy and Participation Public

The energy sector in Indonesia, especially in East Kalimantan , is partly big Still depend on fossil fuels , especially coal , which contributes significant to CO2 emissions (Zaky & Sari, 2024) . Innovation such as Power-to-Gas technology can give alternative with change CO2 emissions become energy source , which helps lower emissions from power plants electricity fossil fuels . In the context of East Kalimantan , where the power plant electricity Still Lots depends on coal , transition towards alternative energy is step important for subtraction emission (Zaky & Sari, 2024) .

Apart from the energy sector, deforestation become Wrong One reason main increasing global temperatures in Indonesia, especially consequence activity logging the forest that is not controlled and activity mine (Wahyuni & Suranto, 2021) . The REDD+ ( Reducing Emissions from Deforestation and Forest Degradation) program has been proven effective in lower level deforestation and CO2 emissions , with existence approach and more cooperation in Wahyuni & Suranto . Policy based on protection forest protect Also potential big in lower carbon emissions , with monitor and protect forest areas that are rich in carbon reserves (Indrajaya, 2013) .

Effort subtraction CO2 emissions must be involving all over stakeholders interests , including industrial sectors that have big carbon footprint consequence extraction source Power natural (Sonny & Wardhana, 2020) . Solution like energy efficiency in the industrial sector and the development of green technologies has proven capable lower emission substantial . For example , technologies that integrate sustainability practices in process production very important For create a more industry friendly environment (Judijanto et al., 2023)

No only energy sector and industry , management efficient waste with using modern technology such as waste -to -energy Also contribute in reduce volume incoming garbage to place disposal end (TPA) and minimize emission methane produced from decomposition

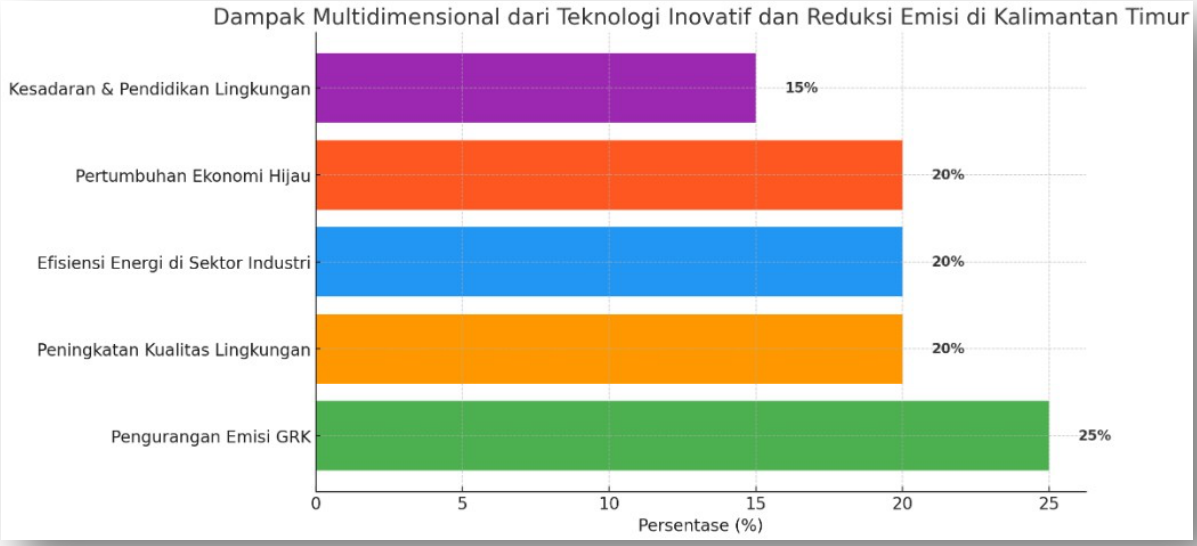
garbage . This approach is in line with hope government on management sustainable waste in the area urban ( Kotsis , 2024).

In general overall , impact from technology innovative and policy subtraction emission on environment urban areas in East Kalimantan become the main focus for development sustainable . Through synergy between technology, pro- environmental policies , and participation active society , it is hoped that it will be achieved subtraction significant emissions , which in its turn contribute on achievement global protection targets climate and sustainability environment in East Kalimantan Region .

Impact from technology innovative and reduction emission through innovation green in urban East Kalimantan very significant and multidimensional . In context sustainability environmental , social and economic , as follows is a number of impact main thing that can observed :

1. Subtraction Greenhouse Gas Emissions Glass (GHG)
   Innovation green , especially in the transportation and management sector waste , has help reduce GHG emissions in East Kalimantan . Implementation system transportation sustainable like transportation general based on electricity and lines bicycle potential reduce dependence public on vehicle motorized conventional . This is important considering the transportation sector is Wrong One contributor main CO2 emissions in urban areas (Judijanto et al., 2023) . In addition , the management technology rubbish like waste -to -energy can reduce volume trash sent to place disposal end (TPA) and reduce emission methane ( Judijanto et al., 2024).
2. Improvement Quality Environment
   Innovation green contribute on improvement quality environment living in urban areas . For example , greening and increasing room open green (RTH) can help absorb CO2 emissions . Designed green open space with Good capable reduce temperature air , fix quality air , and support diversity biological (Saputra et al., 2023) . With existence pro-environmental policies , East Kalimantan can to obtain benefit term long in management urban ecosystem .
3. Efficiency in the Industrial Sector
   The industrial sector in East Kalimantan , especially those related to with extraction source Power nature , become contributor big GHG emissions . Clean technologies applied in industrial processes show significant efficiency as well as reduce impact negative to environment ( Millenia & Murwaningsari , 2023). Use of renewable energy and sustainability practices in the industry can produce more emissions low and cost more operational efficient (Baety & Munandar, 2021) .
4. Driver Green Economic Growth
   Implementation of innovative technologies Also can trigger green economic growth . Investment in friendly technology environment potential create market new and open field work , the important thing for local economic growth (Rita et al., 2024) . Innovation in management source Power sustainable nature can increase performance business at a time support sustainability environment ( Millenia & Murwaningsari , 2023).
5. Awareness and Education Environment
   Programs that focus on innovation green will increase awareness society about the importance of protection and management environment . Education and training for community and stakeholders interest about benefits of green technology and sustainability support creation culture sustainability at the local level (Saputra et al., 2023). This will result in more commitment Strongest of all party For involved in a way active in ensure that permanent city environment healthy and sustainable .

The data above can be seen as following :




*Source : Processed Researcher (2025 )*

**Figure 2: Bar Chart Impact Multidimensional Innovative Technology and Emission Reduction in East Kalimantan**

The diagram above describe impact multidimensional from technology innovative and reduction emission through innovation Green in urban East Kalimantan : 25%: Reduction Greenhouse Gas Emissions Glass (GHG), 20%: Increase Quality Environment , 20%: Energy Efficiency in Industrial Sector, 20%: Green Economic Growth , 15%: Awareness & Education Environment . This diagram reflects relatedness between innovation green with aspect environmental , social and economic in a way balanced .

In general overall , innovation green and technology innovative in East Kalimantan give impact positive and expected Keep going to be continued along with effort government and society For reach objective sustainability environment and reduction more emissions Good .

Reference :

**B. Effectiveness of Innovative Technology and Reduction emissions : study innovation Green in East Kalimantan Urban**

Effectiveness application of green technology in energy and transportation sectors in big cities in East Kalimantan , such as Samarinda and Balikpapan . For example , the Samarinda City Transportation Agency is targeting electric bus procurement on 2025 for reduce carbon emissions by up to 81 percent . This study analyzes implementation and impact of policies The effectiveness of innovative technologies and efforts reduction emission through innovation green in the area East Kalimantan urban area can measured from several aspect important that indicates impact positive to environment and quality life public .

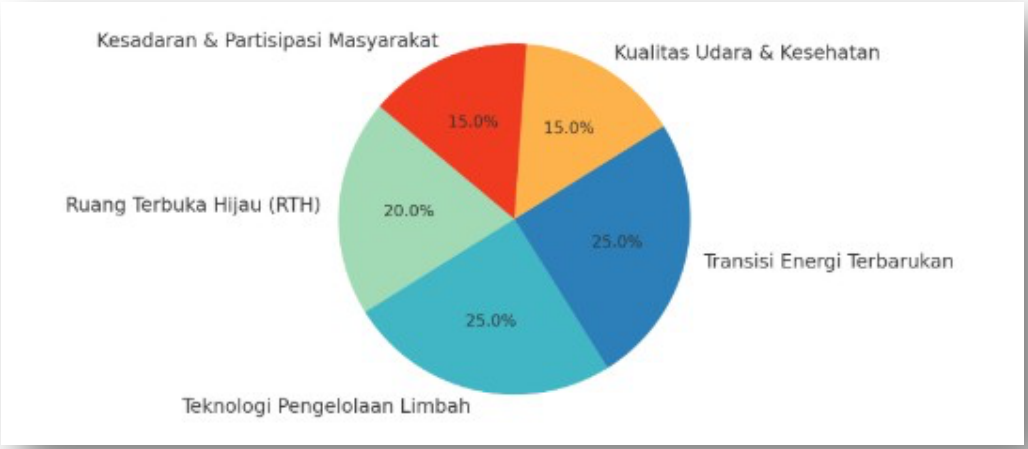
Following is analysis of several data and findings that can be explain this effectiveness :

1. Management Room Open Green (RTH)
   Study about development room open green in East Kalimantan show that although Currently only 10.76% of the 20% target has been achieved , the potential improvement quality environment and reduction CO2 emissions are clear there is . adequate green open space potential absorb emission carbon and increase quality air , which is important in give effect positive to health Yusuf community (2023). The existence of the planned green open space with Good own potential For reduce temperature air as

well as increase humidity in urban areas , which can impact direct on comfort life public .

2. Management Technology Waste
   Implementation of management technology waste like waste -to -energy show that processing efficient waste can reduce emission significant methane . With technological advancement in management trash , data provides indication that emissions from the place disposal end (TPA) can minus , which was previously become Wrong One contributor main pollution urban air (Mayasari et al., 2023) . The existence of this technology is expected can reduce amount waste received at the landfill up to 30 % in time five year to front , which is not only impact on decline emission but Also change paradigm management waste in a way overall .
3. Transition to Renewable Energy
   Energy sector in East Kalimantan Still depends on fossil fuels . However , the development and application of renewable energy technologies , such as generator electricity power solar and wind , showing potential For reduce emission in a way substantial (Margiyono, 2020) . Data from several project pilot show that if energy transition is carried out in a way area , CO2 emissions produced from the energy sector can reduce in a way significant , giving contribution on subtraction regional carbon footprint .
4. Quality Air and Health Public
   With implementation innovation green , quality air in East Kalimantan expected can increased . However , research more carry on required For ensure significant improvement in quality air and its impact to health society , including subtraction risk disease possible breathing There is as result of repair quality air (Widiyanti, 2021) .
5. Awareness and Participation Public
   Adoption innovation green and technology new in East Kalimantan Also contribute on improvement awareness environment society . Research show that community involved direct in initiative friendly environment experience improvement commitment and awareness For guard environment , including participation active in activity greening and management smart trash . However , it is necessary ensure that this participation data is accurate and sustainable along the walk time (Prabowo et al., 2023) .

In general The simple data above is displayed on picture following :




*Source : Processed Researcher (2025 )*

**Figure 3: Pie Chart Effectiveness of Innovative Technology and Emission Reduction in Urban Areas of East Kalimantan**

The image above show effectiveness application of innovative technologies and efforts reduction emissions in urban areas of East Kalimantan based on five aspect Main : 25%: Management Technology Waste ( waste -to- energy , landfill efficiency ), 25%: Renewable Energy Transition ( power solar , wind ), 20%: Space Open Green (RTH) and benefits environment , 15%: Quality Air & Health Community , 15%: Awareness & Participation Public

In general Overall , the effectiveness of innovative technologies and efforts reduction emissions in East Kalimantan show positive developments . Although there is challenge in implementation , results beginning show that pro- environmental action can produce impact significant in subtraction emissions , increase quality life , and sustainability environment .

**C. Challenges and Obstacles in Implementation of innovative technologies and reduction Emissions : Study innovation Green in Urban East Kalimantan**

Studies by Ministry Environment Life and Forestry show that the transportation sector and industry in the area urban East Kalimantan become contributor main emissions , with vehicle motorized as contributor the biggest . In application of innovative technologies and reduction emission through innovation green in urban East Kalimantan , there is a number of significant challenges and obstacles . The following is analysis more deep about challenge mentioned , which includes various potential aspects bother effectiveness implementation policy environment :

1. Infrastructure Limitations
   Lack infrastructure that support system transportation sustainable and energy renewable become Wrong One challenge main . The road that is not adequate and lacking public facilities such as track bike and station filling vehicle electricity limit adoption of green technology designed For reduce emissions . This problem becomes more complicated by the diverse geographical conditions of East Kalimantan , which may need local approach to infrastructure that friendly environment .
2. Regulations and Policies That Are Not Consistent
   Uncertainty in policies and regulations Also is obstacle big for innovation green . Policy government often No in harmony between local and national levels , resulting in confusion for the perpetrators business and society in implementing environmentally friendly technology environment . Research previously show that complex regulations and not consistent can make perpetrator business hesitate to do investment in sustainable green technologies .
3. Awareness The Low Society
   The low awareness public about the importance of innovative technologies and reduction emission Also become challenge significant . Many underprivileged citizens understand benefits of innovation green and tend to maintain old habits . This can hinder participation active public in environmental programs designed For protect and renovate environment them . Awareness This low social slows down adoption of green technology and practice sustainable needs .
4. Limited Funding
   Financing is Wrong One constraint main in development related initiatives with innovative technology and innovation green . Investment the beginning needed for green technology often enough height and return No always fast visible , so that interesting interest investors become a challenges . Challenges in funding covers scheme government funding and sectors private sector that has not fully optimized for support projects friendly environment .
5. Condition Diverse Socio -Economics
   East Kalimantan own diversity condition economy and broad social , which can to complicate equality in implementation innovation green . Some group public Possible own understanding or access to technology that more Good compared to with others ,

which can produce inequality in application of green technology . The existence of discrimination social and this economy is at risk create tensions between groups and hinder business collective in management environment .

6. Urban Heat Island Impact
   Increasing phenomenon island city heat due to rapid urbanization can to worsen impact of emissions others produced by industrial and transportation sectors . Evaluation thermal impacts resulting from construction infrastructure that heavy need done For ensure that intervention green can handle impact the in a way effective .

In general overall , challenges and obstacles in application of innovative technologies and reduction emissions in East Kalimantan very multidimensional . For overcome these issues , it is necessary approach collaborative between government , private sector , and society For optimize impact positive from innovation green and reduce greenhouse gas emissions glass in a way effective .

**Discussion**

The impact of implementing innovative technologies and emission reduction efforts through green innovation in urban East Kalimantan shows significant changes and covers various sectors, from energy to waste management. The application of green technology , especially in energy and transportation sectors , providing contribution big in subtraction greenhouse gas emissions glass (GHG) in this region . East Kalimantan , which is partly big Still depends on fossil fuels , especially coal , facing challenge big in transition towards renewable energy . However , innovative technologies such as Power-to-Gas which converts CO2 emissions become renewable energy sources offer solution For reduce dependence on generator electricity fossil fuels and reduce CO2 emissions ( Zaky & Sari, 2024). This is important Because energy sector in East Kalimantan Still contribute big to GHG emissions .

Besides energy sector , deforestation caused by activity logging forest illegal and exploitation source Power natural other contribute significant to improvement CO2 emissions in Indonesia. The REDD+ program has proven effective in reduce level deforestation and CO2 emissions with involving various stakeholders interest in effort conservation Forest ( Wahyuni & Suranto , 2021). Policy protection forest protected areas in East Kalimantan supported by monitoring technology Also show potential big For reduce emission carbon and repair quality environment .

In the industrial sector , the use of energy efficiency technology has proven lower emission in a way substantial . Industries that integrate sustainability practices in process production , such as use of renewable energy and technology friendly environment others , can reduce its carbon footprint . This sector, which is partly big relate with extraction source Power nature , become contributor big GHG emissions , so that the application of green technology in this sector is very crucial ( Judijanto et al., 2023).

Management rubbish with using waste -to -energy technology Also give impact positive in reduce volume incoming garbage to place disposal end (TPA) and minimize emission dangerous methane for environment . This technology becomes very relevant because of East Kalimantan face problem Serious in management trash , and with implementation this system , the emissions produced by TPA can minimized ( Kotsis , 2024).

In context social , application of green technology No only impact on environment but Also give opportunity for green economic growth . Investment in friendly technology environment can open market new , create field work , and support local economic development . This is very important for East Kalimantan , which is currently make an effort diversification economy from the extractive sector to the sector that more sustainable (Rita et al., 2024). In addition, education and training programs that focus on on awareness environment potential increase participation public in effort sustainability .

However , even though impact positive from innovation green Enough significant , there is a number of challenges that hinder its implementation . One of them is limitations infrastructure that support green technology . As example , lack of facility like track bike , station filling vehicle electricity , and renewable energy infrastructure become constraint main in adoption of green technology in East Kalimantan . In addition , the misalignment policy between local and national levels become obstacle for perpetrator business that wants invest in green technology . The rules are complex and not consistent often makes the perpetrators business hesitate to implement technology that friendly environment .

Other challenges is low awareness public about importance adoption of green technology . Some big public Still maintain old habits that have potential hinder application of friendly technology environment . In this case, funding limited Also become serious problem . Green technology need investment high start , and even though benefit term length significant , many reluctant investors For invest on technology that need long time to give results . This is getting aggravated by condition social and the diverse economy in East Kalimantan , which makes it difficult application of green technology in a way evenly distributed throughout layer public .

Although challenge the significant , development and application of green technology in East Kalimantan can become key For reach sustainability environment . With existence supportive policies , infrastructure that adequate , and improvement awareness community , East Kalimantan can leveraging innovative technologies For reduce GHG emissions , increasing quality air , and create sustainable green economic growth . Synergy between technology, policy and participation active society will be an important factor in realize vision development sustainable in East Kalimantan .

## CONCLUSION

*First* , the impact of implementing innovative technologies and efforts subtraction emission through innovation green in East Kalimantan give significant results in greenhouse gas reduction glass (GHG) and repair quality environment . Adoption of green technology in the energy , transportation and management sectors . rubbish potential big in reduce dependence on fossil fuels and minimize CO2 emissions . Programs such as REDD+ to protection forest and technology waste -to -energy show its effectiveness in reduce deforestation and emissions methane , and give solution for problem management waste . In addition , the application of energy efficiency technology in the industrial sector support subtraction carbon footprint , which is very important For realize development sustainable in this area . Impact positive from technology green Also seen in improvement quality air and the creation of a green economy , which encourages local economic growth and creating field Work new .

*Second* , Effectiveness application of innovative technology in reduce emissions in East Kalimantan proven on several sectors, such as management room open green (RTH), management waste , and transition to renewable energy . Development of green open space that is more wide can absorb more Lots emission carbon and increase quality air , even though achievement currently still far from the desired target . Management technology waste like waste -to -energy Also show positive results , with subtraction emission methane from the place disposal end (TPA). In addition , the transition towards renewable energy , although Still in stage early , have potential big For reduce CO2 emissions produced by generator electricity fossil fuels . The implementation of this technology is not only contribute on subtraction emissions , but Also on improvement quality life public through more air cleaner and better environment Healthy .

*Third* , the application of innovative technology and efforts reduction emissions in East Kalimantan face various significant challenges and obstacles . One of problem main is infrastructure limitations , such as lack of facility For transportation sustainable and filling vehicle electricity . In addition , policies that do not consistent between local and national levels hinder implementation of friendly technology environment , causing his confusion perpetrator

business and society . Awareness society that still low about importance innovation green and reduction emission Also become challenge big in adoption of this technology. The problem funding limited and diversity socio -economic in East Kalimantan make application of green technology No evenly distributed throughout layer society . For overcome this challenge , is needed collaboration between government , private sector , and society , as well as more policies consistent For support development and application of green technology in a way more wide and even .

Improvements made in the field of industrial engineering or science in general in this study include the application of green technology aimed at reducing greenhouse gas (GHG) emissions through more environmentally friendly innovations. This study contributes to providing new insights into the application of energy efficiency technology in the industrial sector, which has proven effective in reducing emissions and improving operational sustainability. In addition, innovations in waste management, such as the application of waste-to-energy technology , have shown great potential in reducing the negative impacts of waste and minimizing methane emissions, which were previously a major problem in landfills. In the energy sector, the transition to the use of renewable energy, although still in its early stages, has made an important contribution to reducing dependence on fossil fuels and reducing the carbon footprint. Overall, this study shows that the application of green technology not only has a positive impact on the environment, but also improves efficiency and sustainability in the industrial sector, which is in line with sustainable development goals.

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