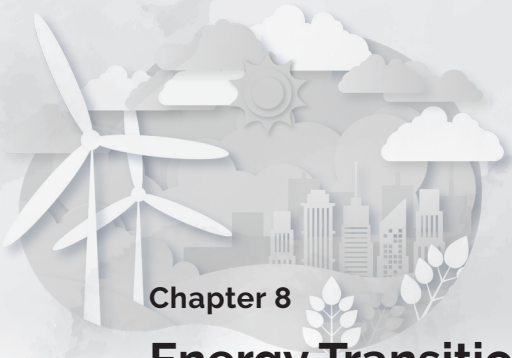

Chapter 8

Energy Transition at the Sub-national Level through Green Leadership

Beny Harjadi

A. Green leadership for sustainability

Transition in local levels through green leadership refers to the effort of leaders in managing their area with principles of sustainability and environment protection. This effort was made due to the increasing number of environmental problems faced by regions around the world, such as climate change, decreasing water and air quality, and destruction of natural habitats. All of this requires real action from the local government in protecting the environment so that it remains sustainable.

Green leadership is also considered as one of the solutions to achieve UN's sustainable development targets. This is because green leadership considers the balance of all factors in an integrated manner,

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namely social justice, economic growth, and environmental preservation. Conservation of water resistance and water in a watershed also considers the condition of urban slum settlements as a basis for economic growth (Surya et al., 2020). At the local level, green leadership can be done in various ways, such as reducing greenhouse gas emissions, developing renewable energy, implementing environmentally friendly waste management system, replanting forests, and so on.

Additionally, greens leadership can also be implemented through government policies and programs that support the use of renewable energy and environmentally friendly technologies. For example, technology such as remote sensing can monitor landscapes, land use, and land cover to monitor natural damage (Abdi, 2020). It can also estimate biomass and renewable energy (Kumar et al., 2015).

Green leadership may also encourage community participation in environmental conservation efforts. It refers to the collaborative effort between government, region, community, and private sector in creating sustainable environment. In regards to this, Grothmann et al. (2013) has analyzed the capacity of institutions to adapt to climate by integrating psychological dimensions.

Transition to a sustainable and environment-friendly energy system is an important step in overcoming climate change and ensuring the future with cleaner and safer energy. Indonesia needs to effectively handle climate change with adaptation programs at the local level (Rahayu, 2013). An example of region that can obtain huge benefit from green leadership is Central Java. Implementing green leadership in Central Java's energy transition projects involves a holistic approach that includes policy, infrastructure, education, and stakeholder engagement. By prioritizing sustainability and collaboration, Central Java paves way for a cleaner, more resilient, and prosperous energy future.

Developing green leadership in the region is not a simple task. There are many fundamental problems that must be resolved first before a region can implement green leadership strategies, strength-

ening the energy transition process. The issues could be illustrated through these questions.

1) What are the principles of green leadership, and how can they be applied at the local level?
2) What is the role of local government in leading the transition towards sustainability at the local level?
3) What are the programs and implementation of local government policies in the framework that supports the energy transition to sustainability?
4) How can public and private institution can participate in supporting green leadership at the local level?
5) What are the obstacles and challenges that will be faced in implementing green leadership at the local level, and how to overcome it?

The principle of green leadership refers to an approach that focuses on environmental sustainability and social responsibility. The main objective is to integrate environmentally friendly and sustainable practices into the decision-making and actions of leadership. The application of the principles of green leadership at the local level involves taking steps to generate positive impacts on the environment and society, while achieving social and economic goals.

These are some of the key principles in green leadership.

1) **Environmental Considerations**. Green leaders consider the environmental impact of their decisions and actions. They prioritize the maintenance of natural resources, reduce waste, and limit harmful emissions.
2) **Sustainable Innovation**. Green leaders drive innovation in renewable energy, green technology, and other sustainable solutions to reduce dependence on finite resources.
3) **Community Involvement**. Green leaders seek to involve the community in the decision-making process related to the en-

vironment. Community participation can help generate more inclusive and sustainable solutions.

4) **Education and Awareness**. Green leaders play a role in educating society about environmental issues and developing awareness of the importance of sustainable actions.
5) **Social Justice**. Green leaders recognize the link between environmental sustainability and social justice. They work to reduce social inequalities and ensure that environmental benefits are enjoyed by all levels of society.

The application of these principles at the local level can be done in various ways.

1) **Environmental Policies and Regulations**. Local leaders can encourage the adoption of policies and regulations that support sustainable practices, such as proper waste management, protection of green areas, and use of renewable energy.
2) **Green Infrastructure Projects**. The construction of environmentally friendly infrastructure projects, such as bicycle paths, city parks and energy-efficient buildings, can be real examples of the application of green leadership principles.
3) **Partnerships and Collaboration**. Local leaders can work with private institutions, NGOs and communities to develop sustainable solutions, such as recycling programs, tree planting and eco-conscious campaigns.
4) **Environmental Education**. Integrating education on environmental issues into the school curriculum and organizing environmental education campaigns can increase public awareness.
5) **Use of Local Resources**. Leaders can encourage sustainable use of local resources, such as local organic farming or the development of ecotourism-based industries.

The application of green leadership principles at the local level is an important step in creating an environmentally and socially sustainable

society. One way this can be done is by establishing green leadership standardization certification. It is a process by which an organization, project, or individual follows certain established standards to measure and ensure sustainable and environmentally friendly practices in their operations. So far, the government has yet to announce the plan to implement this certification to energy sources in Indonesia, such as solar power plants (PLTS), national power plants (PLN), or micro-hydro power plants in Central Java, Indonesia. However, there is general information regarding certification and standardization in the context of green energy. These are some of the standards frequently used in the green energy industry.

1) **ISO 14001**. This is an international standard for environmental management. By adopting this standard, organizations can identify and manage the environmental impacts of their operations and improve their overall environmental performance.
2) **Leadership in Energy and Environmental Design (LEED)**. This is a certification system used to measure the sustainable performance of buildings and their associated environment. Although more focused on buildings, LEED principles can also be applied to renewable energy projects.
3) **Green Energy Certification Schemes**. There are various green energy certification schemes that focus on energy production from renewable sources such as solar and micro-hydro. These examples may vary by country and region, and they assess the quality and sustainability of renewable energy projects.
4) **Renewable Energy Standards**. Many countries have specific standards to ensure that energy produced from renewable sources meets certain requirements. These standards can relate to electricity quality, conversion efficiency, and environmental impact.
5) **Local Regulations and Incentives**. Sometimes, local or national governments have regulations and incentives that support the development of renewable energy. This could include requirements for obtaining permits, tax incentives and other support programs.

Based on the principles, we should make a positive contribution to the development and implementation of green leadership policies and programs at the local level and help create a society that is more aware of the importance of protecting the environment and contributing to its conservation efforts. Furthermore, to support the development and implementation of green leadership policies and programs at the local level, the following are some concrete steps that can be taken.

1) **Education and Awareness Enhancement**. As individuals, we can continue to learn about environmental issues and share this knowledge with others. Educating ourselves and others about the impact our actions have on the environment is an important first step.
2) **Increasing the Level of Participation in Decision-Making Processes**. Getting involved in community discussions and forums regarding local environmental policies can contribute to sustainable decision-making.
3) **Intensify Collaboration and Partnership**. Working with local governments, non-profit organizations, local businesses, and communities can create synergies to develop and implement sustainable solutions.
4) **Adopt Sustainable Practices**. At the individual level, we can adopt sustainable practices such as recycling, energy saving and selection of eco-friendly products.
5) **Drive Sustainable Policy**. Provide support to local leaders who are committed to sustainable policies and programs through participating in elections, providing input, or organizing campaigns.
6) **Empower Community**. Encouraging communities to participate in environmental activities, such as environmental clean-ups or tree planting, can build collective awareness and a spirit of contribution.

7) **Share Knowledge and Resources**. Sharing information about sustainable practices, green technologies and successful initiatives can help inspire others to do more for the environment.
8) **Have a Sustainable Lifestyle**. An environmentally conscious lifestyle, such as reducing excessive consumption of goods, avoiding waste, and choosing public transportation or cycling, can set a real example for the surrounding community.

By taking these steps, we can have a significant positive impact on the development and implementation of green leadership policies and programs at the local level. This joint effort will help create a society that is more aware of the importance of protecting the environment and contributes to efforts to preserve it, so that we can leave a better planet to future generations.

B. Roles of local government

Green leadership is a leadership concept that aims to create positive changes in the environment and promote sustainable economic growth. Green leadership promotes the values of sustainability, innovation, collaboration, and public participation. For example, green leadership has been implemented around the affected areas of Mount Merapi after the 2010 eruption (Lestari et al., 2012). Green leadership pushes transition as the process of change towards a more sustainable society by reducing negative impacts on the environment, increasing resource efficiency, strengthening social welfare, and integrating the process into policy of climate change impact mitigation. Local government should be one of the green leaderships at a local level as the government agency responsible for the management and development of resources in its territory. Local governments have an important role in creating policies and programs that support the transition towards sustainability.

Local government must be able to drive society. As a group consisting of individuals who live and interact with each other in a

social environment, communities have an important role to play in supporting the transition to sustainability through participation in the implementation of local government policies and programs. Local and sectoral coordination is an important effort to increase climate change adaptation in Indonesia (Yoseph-Paulus & Hindmarsh, 2018).

In addition, local government must cooperate with private sector in their region. This sector has an important role to play in supporting the transition towards sustainability through sustainable business practices and collaboration with local governments and communities. An example to this is how private sector often implement digitalization analysis as a tool to achieve adaptation to climate change conditions and sustainable development growth (Balogun et al., 2020). The same tool can be utilized by local governments in the transition process, thus warranting a collaboration with private sector.

Within this theoretical framework, green leadership is considered as an effective approach to lead the transition towards sustainability at the local level. Local governments are considered to have a major role in leading the transition towards sustainability by developing sustainability-oriented policies and programs. Communities and the private sector are also considered to have an important role in supporting the transition towards sustainability through participation and sustainable business practices.

C. Applying Green Leadership in Energy Transition at the Local Level

The implementation of green leadership in the energy transition at the local level is critical to accelerate change towards a more sustainable society as a whole and reduce negative impacts on the environment. Related to that, there are several steps that can be taken in implementing green leadership in the energy transition at the regional level.

1) **Promote the Use of Renewable Energy**. Local governments can formulate policies and programs to encourage the use of renewable energy, such as wind, solar and biomass. In this regard,

green leadership can promote the development and investment of renewable energy and reduce dependence on unsustainable fossil fuels. The availability of water as a source of renewable energy can also be utilized for industry and agriculture (Singh et al., 2020).

2) **Develop Renewable Energy Infrastructure**. Local governments can build infrastructure that supports the use of renewable energy, such as grid electricity and electric vehicle charging. In this regard, green leadership can encourage collaboration between local governments, communities, and the private sector to build effective and efficient renewable energy infrastructure. Estimation of various economic impacts is a difficulty in measuring the benefits of mitigation (Piontek et al., 2021).
3) **Promoting Energy Efficiency**. Local governments can develop policies and programs to promote energy efficiency in the household, industrial and transportation sectors. In this regard, green leadership can encourage increased public awareness of the importance of efficient energy use and develop training and education programs. Modern healthcare facilities are capable of creating energy and technological solutions for more efficient cooling (Das & J., 2023).
4) **Fostering Collaboration between Local Government, Communities, and the Private Sector**. Green leadership can promote collaboration between local government, communities, and the private sector to build effective partnerships in developing policies and programs that support the energy transition. Such collaborations can involve developing new technologies, investing in renewable energy, and improving energy efficiency. An integrated approach to natural management is often out of sync with weak governance (Riggs et al., 2018).
5) **Increase Citizen Participation**. Green leadership can encourage citizen participation in the development of policies and programs that support the energy transition. In this regard, local governments can develop effective mechanisms for community participation, such as public forums, consultations, and surveys.

Integrating people's climate change adaptation with a holistic approach can reduce the impact of climate change and increase urban resilience (Wijaya et al., 2020).

In order to apply green leadership in the energy transition at the local level, it is important to develop policy and program frameworks that are sustainability oriented and based on green leadership principles. Furthermore, collaboration between local government, communities, and the private sector, as well as community involvement, is important in achieving the best results for the energy transition at the local level. This collaboration plays a role in:

1) strategies determination for implementing green leadership in the energy transition;
2) encouraging the role of regional heads in supporting green energy and leadership transitions; and
3) managing impacts of the energy transition resulting from green leadership at the local level.

D. Moving Towards Net Zero Waste: The Case of Central Java

Central Java is a province with an area of around 32,548.20 km^2, consisting of 35 regencies/cities. Besides its capital city of Semarang, it has several other important cities, such as Solo. Some of these areas have considerable natural resource potential, including mineral, forests and timber, ground water, as well as renewable energy sources such as geothermal energy and hydropower.

Central Java also has various tourism potentials, including historical and cultural sites, national parks, and beautiful beaches. Some popular tourist objects in Central Java include Borobudur Temple, Prambanan Temple, Merapi National Park, Merbabu National Park, and Parangtritis Beach (although administratively, this beach is part of Special Region of Yogyakarta). As an area that has a lot of potential, energy use is of particular concern to support all socio-economic

activities in Central Java. As a province that is committed to implementing green leadership in the energy transition at the regional level, Central Java has carried out various programs and projects to develop renewable energy and improve environmental quality. Several case studies reflecting green implementation leadership in Central Java has been described in the previous question. A number of laws regulate the green leadership in Central Java: Law No. 14 of 2018 concerning public openness, Government Regulation No. 41 of 1999 concerning air pollution control, Minister of Environment Decree No. 45 of 1997 concerning standard index of air pollution, and Minister of Environment Decree No. 115 of 2003 concerning guidelines for determination of water quality status. Ministry of Environment and Forestry (Kementerian Lingkungan Hidup dan Kehutanan [KLHK], 2019) inform that Central Java has Index Quality of Life = 60.97; Index Quality of Water = 51.64; Index Quality of Air = 84.81; and Index Quality of Land Cover = 50.08.

Central Java has become one of the provinces that is committed to implementing green leadership in the energy transition at the local level. Figure 8.1 shows a flow chart of energy production, from raw material until it reaches consumers, for PLTS, Microhydro, and PLN.

PLTS	MICROHYDRO	PLN
Raw Materials (Solar Panel)	Water Source (River Flow)	Reservoir
↓	↓	↓
Solar Panel Manufacturing	intakes (Water Collection Point)	Regulation of Water Flow by Dams
↓	↓	↓
PLTS Installation and Construction	Water Flow Pipe to the Powerhouse House	Water Intake Channel to Hydropower Turbine
↓	↓	↓
Connection with the Power Grid	Powerhouse House (Turbine and Generator)	Potential Energy Conversion Into Mechanical
↓	↓	↓
Converting Sunlight Into Electricity	Hydro Energy Transformation into Electrical Energy	Mechanical Conversion into Electrical Energy
↓	↓	↓
Energy Storage (Optional, Battery)	Voltage Regulation and Transformation	Voltage Regulation and Transformation
↓	↓	↓
Use of Electrical Energy by Consumers	Connection to the Power Grid	Connection to the Power Grid
	↓	↓
	Use of Electrical Energy by	Use of Electrical Energy by

Figure 8.1 Renewable Energy Flow Chart from Raw Materials to Its Use

1. Implementation of green leadership in transition energy at Central Java

The implementation of green leadership in Central Java looks quite advanced in the energy transition. Several strategies have been carried out local government to develop renewable energy and improve environmental quality in the province. These are some examples.

1) In 2016, Central Java launched a Biomass Energy program to promote the development of renewable energy and reduce carbon emissions in the province. The program includes the development of solar power plants, biomass energy, and the use of biofuels. One plant that is promoted for bioenergy is *nyamplung* (*Calophyllum inophyllum* L.). It is a type of coastal plant which can be extracted as an alternative source of bioenergy (Hani & Rachman, 2016). The local government is also trying to promote the use of environmentally friendly transportation, such as bicycles and public transportation.
2) In 2019, PT PLN (State Electricity Company) implemented a solar power plant (PLTS) construction project in Demak with a capacity of 10 MWp. This project is expected to increase clean energy production in Central Java and help reduce greenhouse gas emissions.
3) Regional Government of Banyumas, in cooperation with PT PLN, has built several micro-hydro power generating units in the area. This program is expected to utilize the potential of water energy to produce clean electricity and strengthen energy security in rural areas.
4) The Government of Central Java is collaborating with the private sector and non-governmental organizations (NGOs) to improve energy efficiency in small and medium industries (IKM). One example is in Dieng, which is a highland area with abundant water sources that are used for irrigation water needs (Hadi et al., 2013). The project includes installing energy-saving equipment, training workers, and developing an energy management system.

The examples above show Central Java's success in implementing green leadership in the energy transition at the regional level. Local governments and related parties work together to develop renewable energy, improve energy efficiency, and promote environmentally friendly transportation. This is a positive effort in overcoming environmental problems and improving the quality of life of the community.

The following are several case studies that further illustrate the application of green leadership in the energy transition in Central Java.

a. Construction of PLTS in Kandri Village, Kebumen

The Kebumen Regency Government, Central Java, has a solar power plant (PLTS) in Kandri Village with a capacity of 600 kWp. The PLTS provides a stable supply of electricity for around 3,000 households in the village. The project is the result of cooperation between the local government, village-owned enterprises (BUMDes), and the private sector. In addition, this project has also provided economic and social benefits for the local community, such as increased access to clean energy and business opportunities for BUMDes.

This PLTS is an outstanding example of sustainable development and collaboration. The project's multifaceted benefits extend beyond its capacity to supply stable electricity to local communities. Here are some notable results.

1) **Community Empowerment**. This project has empowered the local community by giving them access to a reliable and clean source of electricity. This not only improves their quality of life, but also allows them to carry out activities that were previously hindered by a lack of electricity.
2) **Economic Growth**. By collaborating with BUMDes and the private sector, this project has contributed to the local economy. The establishment and operation of the solar power plant has created jobs and stimulated economic activity in the village.
3) **Business Opportunities for BUMDes**. The partnership between BUMDes and the private sector highlights the potential for local businesses to actively participate in renewable energy initiatives. This collaboration not only generates revenue for BUMDes but also demonstrates the feasibility of the partnership for future sustainable projects.
4) **Reduced Environmental Impact**. Utilization of solar energy significantly reduces dependence on fossil fuels, thereby reducing greenhouse gas emissions and promoting a cleaner environment.

This is in line with global efforts to mitigate climate change and promote sustainable development.

5) **Community Resilience**. With a steady supply of electricity from solar power plants, communities are more resilient to power outages and interruptions, especially during adverse weather conditions or grid failures.
6) **Educational Opportunities**. Solar power plants serve as educational tools for communities, enabling them to learn about renewable energy, energy conservation and the importance of sustainability.
7) **Demonstration of Effect**. The successful implementation of the project can serve as a model for other areas in Central Java and its surroundings. It demonstrates the benefits of collaboration and adoption of renewable energy, inspiring similar initiatives in neighboring areas.
8) **Local Ownership and Pride**. The involvement of local government, BUMDes, and the private sector fosters a sense of ownership and pride among community members. They saw a direct impact from their collaboration in improving village infrastructure and overall well-being.
9) **Alignment with National Goals**. This project is in line with Indonesia's national goals to increase renewable energy capacity and reduce dependence on fossil fuels. This contributes to the country's efforts to transition towards a more sustainable energy landscape.
10) **Enhanced Social Structure**. Collaboration between various stakeholders strengthens social bonds within the community. Growing a sense of unity and shared responsibility for the progress of the village.

In conclusion, the PLTS in Kandri Village exemplifies the positive results that can emerge from collaboration between the local government, the private sector, and village-owned enterprises. By providing

clean energy, economic growth and multiple benefits to society, this project is a shining example of sustainable development and green leadership in Central Java.

b. "PLN Cares for the Environment" Program

PT PLN Main Unit as a distributor of electricity in Central Java and Special Region of Yogyakarta has launched the "PLN Cares for the Environment" program, which aims to encourage the use of efficient and renewable energy in Central Java. This program includes the construction of PLTS, the construction of a more efficient electricity grid, and energy saving education for PLN customers. In addition, this program also involves collaboration with the public and the private sector in developing sustainable solutions. Prevention of sedimentation in the Mrica Reservoir cooperate with the community so that the sedimentation rate is reduced, so that the function of the reservoir as a provider of water and electricity can last longer (Wulandari, 2007).

The program shows PLN's commitment to encourage the sustainability and adoption of renewable energy in the region. The program's multifaceted approach not only addresses energy efficiency but also emphasizes collaboration with various stakeholders for sustainable solutions. The main components of the program are outlined as follows.

1) **Promotion of Efficient and Renewable Energy**. This program aims to raise awareness about the importance of efficient and renewable energy sources. This could lead to reduced carbon emissions, less reliance on fossil fuels, and a more sustainable energy future for Central Java and DIY.
2) **Development of Solar Power Plants (PLTS)**. Establishment of PLTS contributes to the expansion of clean energy capacity. Solar energy is abundant and environmentally friendly, in line with the goal of reducing greenhouse gas emissions and promoting sustainability.
3) **Development of an Efficient Grid**. Building a more efficient grid will increase the reliability and resilience of the energy supply.

This can minimize energy loss during transmission and distribution, resulting in a more cost-effective and environmentally friendly system.

4) **Energy Saving Education for Customers**. Educating PLN customers about energy efficient practices empowers them to reduce energy consumption and contribute to a more sustainable energy ecosystem. This education is in line with the broader objective of achieving efficient use of resources.
5) **Community Collaboration: Prevention of Sedimentation in the Mrica Reservoir**. Collaborating with the community for the prevention of sedimentation in the Mrica Reservoir is a prime example of involving local stakeholders in environmental protection efforts. By decreasing the sedimentation rate, the life of the reservoir and its function as a provider of water and electricity will be longer.
6) **Private Sector Partnership**. Private sector involvement in the program demonstrates a multi-stakeholder approach to sustainability. Collaboration with private entities can facilitate expertise, resources, and innovation to drive sustainable solutions.
7) **Development of Sustainable Solutions**. Collaborating with communities and the private sector emphasizes the program's dedication to finding long-term solutions that benefit the environment and local communities.
8) **Preserving Water and Power Resources**. Sedimentation prevention efforts directly contribute to ensuring the continued function of the Mrica Reservoir as a reliable source of water and electricity. This is in line with the principle of responsible resource management.
9) **Positive Social Impact**. The program's community engagement increases social cohesion and engagement, as local residents participate in efforts to protect their environment and secure vital resources.

10) **Synergy with National Goals**. The program's focus on efficient and renewable energy aligns with Indonesia's broader goals of reducing carbon emissions and advancing sustainable development.

By combining these initiatives, the "PLN Cares for the Environment" program contributes to creating a more sustainable, efficient, and environmentally sound energy landscape in Central Java and Yogyakarta. Collaboration with various stakeholders underscores the importance of joint efforts in achieving long-term sustainability.

c. Development of electricity-based transportation in the city of Semarang

The Municipal Government of Semarang, Central Java, is developing a program to encourage the use of electricity-based transportation. This program includes developing electric vehicle charging infrastructure, procuring electric vehicles for bus fleets, and developing application-based transportation systems. This program also involves community participation in the development of sustainable transportation solutions. The program initiated by the Municipal Government of Semarang in Central Java to encourage the adoption of electricity-based transportation is a commendable step towards sustainable urban mobility. By addressing various aspects of the transportation system, the program presents a comprehensive approach to reducing carbon emissions and improving the quality of urban life. The main components of this program are as follows.

1) **Development of Electric Vehicle Charging Infrastructure**. Establishing a network of electric vehicle (EV) charging stations is essential to support the growth of electric transportation. By offering convenient charging options, the city is encouraging more individuals and businesses to adopt EVs, reducing dependence on fossil fuel-powered vehicles.
2) **Procurement of EVs for the Bus Fleet**. Introducing electric buses into the city's public transport system not only reduces air and noise pollution but also serves as a model of sustainable

urban mobility. Electric buses offer a cleaner and energy efficient alternative to traditional diesel-powered buses.

3) **Application-based Transportation Systems**. The development of application-based transportation systems, such as ride-sharing or ride-hailing platforms for electric vehicles, provides residents with comfortable and environmentally friendly transportation options. It promotes the use of EVs for everyday commuting.
4) **Community Involvement in Sustainable Transport**. Encouraging community participation in the development of sustainable transport solutions creates a sense of ownership and responsibility among citizens. Community input can help adapt the program to local needs and preferences.
5) **Reducing Carbon Emissions**. The program's focus on electric transport contributes to reducing a city's carbon footprint, which is critical to fighting air pollution and tackling climate change.
6) **Improving Air Quality**. Electric vehicles generate zero exhaust emissions, leading to improved air quality in cities. This has direct benefits for public health by reducing respiratory and cardiovascular problems related to air pollution.
7) **Noise Reduction**. Electric vehicles are quieter than vehicles with internal combustion engines, which leads to reduced noise pollution in urban areas and improves the overall quality of life of residents.
8) **Demonstration of Effect**. By introducing EV and charging infrastructure, the city is setting an example for other regions and cities to follow. This is driving a wider transition to electric transport.
9) **Economic Opportunities**. Developing charging infrastructure and embracing electric transportation can drive economic growth by attracting investment, creating jobs in related industries and supporting local businesses.

10) **Better Energy Security**. By reducing dependence on imported fossil fuels, the city increases its energy security and resilience against external energy supply disruptions.
11) **Technological Advances**. Embracing electric transport promotes the adoption of advanced technologies, contributing to innovation and technological progress in the transport sector.
12) **Urban Livability**. The shift towards electric transport increases the livability of cities by reducing traffic congestion, promoting active modes of transport, and creating cleaner and more pleasant urban environments.

The Semarang City Government's program to encourage electrified transportation reflects a forward-thinking approach to urban mobility and sustainability. By integrating charging infrastructure, electric buses, application-based systems and citizen participation, this program has the potential to change transportation patterns, reduce environmental impact and improve the city's overall quality of life.

In an effort to optimize the electric vehicle program in Central Java, an electric vehicle battery factory has been built in the Integrated Industrial Area (KIT) Batang Regency with an integrated concept between nickel mining, smelter construction, precursor cathode factory. Electric vehicles are one of the potential sources to rely on in an environmentally friendly energy transition amidst the ongoing climate crisis. Batteries, which are energy storage systems, are essential for electric vehicles, plug-in hybrid electric vehicles (PHEV), and hybrid electric vehicles (HEV).

There are important things that must be considered in implementing the battery usage policy for electric vehicles, namely battery life. This is important, because when the battery runs out, it will become waste that requires special handling, so it needs to be supported by policies and a monitoring system regulated by the local government. Battery life for electric vehicles, including electric bicycles, electric motorcycles and electric cars, may vary depending on several fac-

tors, including the type of battery used, how it is used, its operating environment, and the charging technology.

The reuse or recycling of electric batteries waste is very important as they reduce the negative environmental impact and minimize the accumulation of hazardous waste. Electric batteries contain chemicals that can pollute the environment if not managed properly. There are several actions that the Central Java Regional Government and other regions must take as part of battery waste management: collection and sorting, safe transport, processing, components recycling, processing of toxic materials, reuse or rehabilitation, energy recycling, and safe disposal.

It is important to note that electric battery recycling can be a complex process as it involves different types of batteries with different components and chemicals. Therefore, local governments need to maintain effective and safe recycling systems by developing adequate infrastructure and an understanding of the proper treatment of various types of batteries.

2. The results of the energy transition in Central Java

Through those case studies, it can be seen that Central Java has taken concrete steps in implementing green leadership in the energy transition at the regional level. Collaboration between local government, communities, and the private sector as well as community participation is a major factor in achieving optimal results. It is hoped that with the application of this green leadership, Central Java can reduce negative impacts on the environment and improve people's welfare in a sustainable manner. Although several efforts have been made in implementing green leadership and energy transition in Central Java, an in-depth evaluation of the results achieved still needs to be carried out in more depth.

The following are some things that need to be evaluated regarding the results of the energy transition in the Central Java region.

1) **The Contribution of Renewable Energy to Energy Supply in Central Java**. In recent years, the government of Central Java has

developed several renewable energy projects such as solar and micro-hydro power plants. However, how much the contribution of renewable energy to energy supply in Central Java needs to be evaluated in more detail.

2) **Reducing Greenhouse Gas Emissions**. It is hoped that the application of green leadership in Central Java can help reduce greenhouse gas emissions and have a positive impact on the environment. Evaluation of reducing greenhouse gas emissions in needs to be done to find out whether the set targets can be achieved.
3) **The Implementation of Green Leadership**. The effectiveness of the system must also be evaluated for social and economic impacts. Several things that need to be evaluated include whether there is a positive impact on people's welfare, how many jobs are created, and how big the economic impact is.
4) **Project Sustainability**. An evaluation of the sustainability of a renewable energy project in Central Java also needs to be carried out to find out whether the project can run sustainably and provide long-term benefits for the community.

By evaluating the progress of energy transition in Central Java, it can be identified how far the effort has gone, whether it has been successfully deliver benefits to society or not. It can also become a base development to improve existing programs, as well as developing new ones that are more effective in addressing environmental problems, thus improving the quality of life for people in Central Java.

Ultimately, evaluating the results of Central Java's energy transition efforts is critical to determining the effectiveness and impact of green leadership initiatives. These assessments provide valuable insights that can guide future decision-making, improve ongoing programs, and inform the development of new strategies. Here's how evaluating results can contribute to the overall success of the energy transition and green leadership in Central Java.

1) **Effectiveness Assessment**. Evaluation helps determine whether the implemented program is achieving its intended goals, such as increasing the adoption of renewable energy, reducing carbon emissions, improving air quality, and increasing energy security. It highlights which aspects of the green leadership approach are working well and which may need adjustments.
2) **Benefit Analysis**. By assessing the benefits that people experience—such as increased access to clean energy, job creation, economic growth, and improved quality of life—local governments can communicate the real impact of the energy transition to their constituents.
3) **Lessons Learned**. The evaluation identifies challenges, barriers, and lessons learned during the implementation of green leadership initiatives. This knowledge helps avoid repeating mistakes and provides insight into potential solutions.
4) **Program Improvement**. Identifying areas where the current program may be lacking or needs improvement allows local government to make necessary adjustments. This ensures that the programs are adaptive and responsive to changing circumstances.
5) **Expansion and Scaling**. Successful results can form the basis for upgrading or expanding existing programs to cover a wider area or cover more communities. Successful model replication can generate a greater impact across the region.
6) **Development of New Programs**. Evaluation results can guide the development of new and innovative programs that address emerging environmental challenges and align with changing societal needs. This promotes continuous progress and adaptation.
7) **Resource Allocation**. Evaluation helps the local government to allocate resources more efficiently by focusing on initiatives that have the highest impact. This allows them to prioritize investment in areas that bring significant positive change.

8) **Evidence-Based Decision Making**. Data and insights from evaluations provide a sound basis for evidence-based decision-making, ensuring that future actions are based on empirical evidence rather than assumptions.
9) **Stakeholder Engagement**. Sharing evaluation results with stakeholders, including communities, the private sector, and non-governmental organizations, promotes transparency and inclusiveness in decision-making processes.
10) **Sustainability and Accountability**. Regular evaluations ensure that energy transition efforts are sustainable over time and local governments remain accountable for the commitments made to promote green leadership.
11) **Policy Alignment**. Evaluation results can be used to adjust policies and regulations to better support the energy transition, ensuring alignment between green leadership initiatives and broader sustainability goals.
12) **Global Reporting and Recognition**. Positive evaluation results can be shared at regional, national, and international levels, demonstrating Central Java's commitment to sustainable development and contributing to its reputation as a leader in green initiatives.

Evaluating the results of energy transition efforts in Central Java provides a holistic understanding of the impact and effectiveness of green leadership initiatives. This empowers local governments to make informed decisions, optimize resources, and forge ahead towards a more sustainable and prosperous future for their region and people.

There are several factors supporting and inhibiting the implementation of green leadership in the energy transition at the regional level in Central Java. These are the supporting factors.

1) **Renewable Energy Resource Potential**. In Central Java, solar, wind, and biomass power is large enough to make it easier for the government to develop renewable energy in the region.

2) **National Policy**. The central government has set national targets to increase the use of renewable energy, thereby encouraging local governments to implement green energy policies.
3) **Availability of Funds**. The local government has provided substantial funds to support the development of renewable energy projects.
4) **Increasingly Advanced Technology**. Technology for the development of renewable energy is increasingly advanced and affordable, thus encouraging people and entrepreneurs to switch to renewable energy.

Meanwhile, these are the inhibiting factors.

1) **Limited Human Resources**. The limited number of experts and skilled workers in the field of renewable energy in Central Java is an obstacle in the development of renewable energy.
2) **Regulatory and Bureaucratic Issues**. The complicated and time-consuming process of permits and regulations in Indonesia is an obstacle in the development of renewable energy.
3) **Dependence on Fossil Energy**. The dependence of society and industry on fossil energy is still very high, making it difficult to switch to renewable energy.
4) **Lack of Public Awareness**. People are still not aware of the importance of renewable energy and the need to switch to energy that is more environmentally friendly.
5) **Funding Problems**. Renewable energy development requires a lot of money, making it difficult for those who are less financially able to do it.

To overcome those inhibitors in the implementation of green leadership for energy transition in Central Java, there are several coping strategies that can be taken by the local government.

1) **Training Experts and Skilled Workers**. To create more experts and skilled workers, local government may conduct training programs, courses, and certifications in the field renewable energy
2) **Simplification of Licensing and Regulatory Processes**. The process of licensing and regulation in the field of renewable energy must be eased to help the development of renewable energy projects in Central Java.
3) **Diversification of Energy**. This is important to reduce dependency on energy fossil. It can be done through campaign and social in a continuous manner. The campaign should be about the benefits of renewable energy and the dangers of fossil energy for the environment.
4) **Society Awareness Enhancement**. The people need to know about the importance of renewable energy and the benefits it brings for the environment and economy. This can be done through mass media, seminars, and activities that include society participation.
5) **More Funding Scheme**. Affordable loans, incentives, and development programs for projects in renewable energy renewable can push society and entrepreneurs to support and, ultimately, switch to renewable energy in Central Java.

E. Closing

From the analysis performed, it can be concluded that implementation of green leadership in transition energy in Central Java has brought a number of positive results. Several projects in renewable energy such as solar and micro-hydro power has been successfully developed and contributing in provision of energy in the Central Java region. Additionally, some policies and programs that have carried out also gives impact positive for environment and welfare of society. Nevertheless, there are still some obstacles in the implementation of green leadership in Central Java. These obstacles include limited funds, lack of

infrastructure, and low public awareness of the importance of using renewable energy.

For this reason, several recommendations are needed so that green leadership in Central Java can run more effectively and sustainably. Some of the recommendations that can be given are:

1) development of programs and policies that are more comprehensive and sustainable to increase the use of renewable energy in Central Java;
2) improved coordination between the government, the private sector and the community is needed in developing renewable energy projects;
3) increased public awareness through campaigns and socialization of the importance of using renewable energy;
4) increased investment in renewable energy infrastructure such as the construction of electricity networks that can support the development of renewable energy projects; and
5) development of cooperation with other regions to obtain technical and financial support in the development of renewable energy.

Thus, the application of green leadership in Central Java can be continuously improved and have a greater positive impact on the environment and people's welfare. As future suggestions, there are several steps that can be taken to develop transition at the local level through green leadership, especially in Central Java, such as:

1) further identifyy what factors influence the successful implementation of green leadership in the energy transition in other regions in Indonesia;
2) conduct more in-depth activities on the impact of energy transition on the environment and people's welfare in Central Java;
3) conduct comparative studies between regions that have successfully implemented green energy policies and regions that have

not been successful in order to find out what factors differentiate the two;

4) carry out further activities regarding the effect of changes in national policies on the implementation of green energy policies in the regions, especially in Central Java; and
5) conduct more specific activities on the role of local government in supporting the development of renewable energy projects in Central Java.

The steps mentioned above might provide more comprehensive and in-depth information as well as insights on the implementation of green leadership in the energy transition at the regional level, especially in Central Java. This is expected to assist the government and society in increasing the development of renewable energy and improving environmental quality and welfare of society as a whole.

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