Topic: Audit on Climate Change

BPK's Active Role in Alleviating Climate Change and Promoting Low-Carbon Development

I. Climate Change and Its Consequences

According to the law of thermodynamics, our earth is mostly considered a closed system because it can exchange energy (e.g. solar radiation) with its surroundings, but only a tiny fraction of matter enters and leaves earth's top atmosphere (NASA, no date). Thus short of expensively extracting materials from other planets, it can be inferred that resources on our earth is finite and irresponsible exploitation of natural resources place a natural limit on sustainable growth. Further, rapid and unchecked extraction of earth's resources may damage the environment, and this is harmful to humans as well as other species that inhabit our earth. Sound environmental management is crucial in order to fulfill the needs of current and future generations while maintaining the ecosystem in a good condition.

One of the prevalent environmental issue that we all are facing is climate change. As we already knew, climate change is one of the greatest challenges faced by humanity today. It affects every country and can have devastating effects on communities and individuals. Developing countries, especially Small Island Developing States, are the most impacted by climate change and the least able to afford its consequences. Climate change is a significant change on temperature, precipitation, and climate that leads to increasing sea level, warmer temperature, extended flooding or drought, and also gradual changes on species and other organism habitat. The aftermath of these changes includes: natural manner (such as increasing in natural disasters) and economic manner in terms of substantial disaster handling cost which was set to rise between 5% and 20% of global income (Stern, 2006). It is caused by the accumulation of heat-trapping greenhouse gases such as carbon dioxide and methane in the atmosphere, which is caused by the increased use of fossil fuel burning, urbanization, and land use change. Those activities adding more greenhouse gases to the atmosphere and in turns, enhanced the warming capability of the natural greenhouse effect.

Climate change has become global significant issues over the last decades and it attracts growing concern from the countries across the globe. In that period, they gathered to discuss the matter collectively to strengthen the global response so that the threat can be handled by the involved parties thoroughly. Below are some of related events that had been held throughout the years:

1) Montreal Protocol (1987)

   The treaty focal point is to protect ozone layer by controlling ozone depleting substances (ODSs), which include chlorofluorocarbons (CFCs) and hydro chlorofluorocarbons (HCFCs). The ultimate objective of their elimination on the basis of development in scientific knowledge, taking into account technical and economic considerations.

2) UN Framework Convention on Climate Change/UNFCCC (1992)

   The ultimate objective (Article 2) of this Convention is to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

3) Kyoto Protocol (1997)

The protocol oblige committed countries to ratify the agreement and to reduce certain gas emissions (Article 3) such as Carbon Dioxide (CO2), Methane (CH4), Nitrous Oxide (N20), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur Hexafluoride (SF6) with a view to reducing their overall emissions of such gases by at least 5% below 1990 levels in the commitment period 2008 to 2012.

4) Paris Agreement (2015)

Focus on greenhouse gas emission with goals (Article 2): (1) to prevent the global average temperature from rising 2°C above pre-industrial level and pursuing efforts to keep it below 1.5°C; (2) to increase the ability to adapt to the adverse impacts of climate change and low greenhouse gas emissions development, in a manner that does not threaten food production; (3) to make finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

On 25 September 2015, the General Assembly of United Nations adopted the 2030 Agenda for Sustainable Development. The 2030 Agenda includes 17 Sustainable Development Goals (SDGs), which establish quantitative and qualitative objectives across the social, economic, and environmental dimensions of sustainable development to be achieved by 2030. Sustainable Development Goals (SDGs) also specifically emphasizes the importance of climate action in one of the Goals, which is Goal 13. The targets can be concluded into four groups i.e. disaster management skills, integrating the issue to the national policy, improving human and institutional understanding on the issue and commitment in implementation and mobilize resources. The detailed targets and indicators of Goal 13 are as follows:

No.	Target	No.	Indicator
13.1	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	13.1.1	Number of deaths, missing persons and persons affected by disaster per 100,000 people
		13.1.2	Number of countries with national and local disaster risk reduction strategies
		13.1.3	Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies
13.2	Integrate climate change measures into national policies, strategies and planning	13.2.1	Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)
13.3	Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	13.3.1	Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
		13.3.2	Number of countries that have communicated the strengthening of institutional, systemic and individual capacity-building to implement adaptation, mitigation and technology transfer, and development actions
13.a	Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	13.a.1	Mobilized amount of United States dollars per year starting in 2020 accountable towards the $100 billion commitment

13.b	Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities * Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.	13.b.1	Number of least developed countries and small island developing States that are receiving specialized support, and amount of support, including finance, technology and capacity-building, for mechanisms for raising capacities for effective climate change-related planning and management, including focusing on women, youth and local and marginalized communities

II. Programs of the Government of Indonesia to Tackle Climate Change

Target 13.2 of the Sustainable Development Goals states that climate change measures should be integrated into national policies, strategies, and planning. The Government of Indonesia has already incorporate climate change mitigation and adaptation measures in the National Medium Term Development Plan. In the 2020-2024 National Medium Term Development Plan, one of the national priorities is low-carbon development. Low-carbon development is a development platform to maintain social and economic growth through low greenhouse gas emission programs and activities and minimizing natural resources exploitation.

Low-carbon development aims to support green investment and strengthen cross-sectoral integration in decision making. It is planned by the Ministry of National Development Planning, who acts as system integrator as well as think tank, through holistic, integrative, thematic, and spatial (HITS) approach. By applying this approach, trade-off between different sectors in low-carbon development implementation can be identified and mitigated. Programs that are parts of the low-carbon development include:

a. Sustainable Energy Development

Energy sector is the main contributor of the greenhouse gases accumulation in the atmosphere. According to World Resources Institute (2020), 76% of greenhouse gas emissions worldwide comes from energy consumption. This figure mainly consists of heat and electricity generation (31.9% of total emissions), transportation (14.2% of total emissions), and manufacturing and construction (12.6% of total emissions). This data is associated with the fact that fossil fuel such as coal and oil still widely utilized to power up the development of many countries. To mitigate the conditions, the Government of Indonesia is focusing on developing sustainable energy, mainly by improving the renewable energy in the national energy mix and improving energy efficiency and conservation.

b. Sustainable Land Rehabilitation

Another source of greenhouse gas emissions is land use change, mainly by converting forest area into other uses. Agriculture, forestry, and other land uses contribute to about 23% of global human-caused greenhouse gas emissions (WRI, 2019). In order to reduce the greenhouse gases emission from land use change, the Government of Indonesia implements several programs that include peatland restoration, land and forest rehabilitation and reforestation, deforestation reduction, and application of sustainable agriculture.

c. Waste Treatment

The Government of Indonesia encourages the municipal solid waste management by reduce, reuse, and recycle, as well as developing refuse-derived fuel from plastic waste. By improving waste management, the amount of waste that dumped into landfills would be heavily reduced, which will eventually reduce the greenhouse gas emissions, especially methane, that produced in landfills and released into the atmosphere.

d. Green Industry Development

The fastest-growing source of greenhouse gas emission is the industrial sector. The sector grew by 187% since 1990 (WRI, 2020). To mitigate the emission from the industrial sector, the Government of Indonesia establishes standards for industry to reduce the greenhouse gas emission from industrial processes and waste treatment. The standards include emission reduction from industrial processes and waste treatment, toxic and hazardous waste handling, and implementation of circular economy in industrial sector.

e. Low-carbon Coastal and Marine

In order to reduce greenhouse gas emissions from the coastal and marine sector, the Government of Indonesia implements programs to restore mangrove and marine ecosystem.

Aside from implementing programs that reduce the greenhouse gas emissions from several sectors, the Government of Indonesia also carries out several initiatives to adapt to the consequences of climate change in several sectors, namely:

a. Improving Resilience in Coastal and Marine Sector

Climate change consequences in coastal and ocean include may increase in sea level, sea acidity, and sea surface temperature as well as prevalence in coastal flooding. The initiatives taken by the Government of Indonesia in order to protect the coastal and marine environment include sea walls, breakwaters, and embankments construction, ocean dynamics and characteristics mapping, and mangrove rehabilitation.

b. Improving Water Security

One of the impacts of climate change is more frequent and severe drought and greater inter-annual variability of precipitation. These conditions lead to changes of hydrologic cycle that increase the prevalence of seasonal flood and water shortage. In order to adapt to the issues due to climate change, the Government's actions include real-time watershed information system development, land and forest rehabilitation in upstream area, raw water provision, and flood protection infrastructure development.

c. Improving Resilience in Agriculture Sector

Warmer air temperature and climate change induced drought causes declining agricultural productivity and increase the probability of plantation fires. To address the conditions, the programs of the Government of Indonesia include development of water conservation infrastructure for agriculture, land optimization, and plantation fires prevention.

d. Improving Resilience in Public and Environmental Health

Climate change may also have impact on the increase in water-borne diseases and diseases transmitted through insects, snails or other cold-blooded animal (WHO, 2018). The countermeasures prepared by the Government of Indonesia include disease control and health vigilance improvement.

The source of financing for the mentioned programs are state finance, public-private partnership, and other sources. Other sources include Official Development Assistance in the form of Green Climate Fund and Clean Technology Fund. Indonesia is also involved in Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries (REDD+) program. The Government of Indonesia and the Government of Norway are engaged in one of the world's largest performance-based payment schemes for

REDD+. The Memorandum of Understanding was signed in May 2010 and the Government of Norway has committed to USD 1 billion in performance-based profit sharing and other profit sharing (Ministry of Environment and Forestry, no date). In order to manage the fund for climate action, the Government of Indonesia has established Indonesia Climate Change Trust Fund (ICCTF) which aims to link international finance sources with national investment strategies. Its roles include attracting investment and implementing alternative financing mechanisms for programs that support climate change mitigation and adaptation. The Government of Indonesia has also established Environmental Fund Management Agency to manage the state revenue on reforestation fund levied on companies that utilize production forest areas. The fund managed by the Agency can finance land and forest rehabilitation programs as well as programs that reduce greenhouse gas emissions.

III. Environmental Audit in BPK

Supreme Audit Institutions (SAIs) has crucial role in promoting governance and accountability of environmental management, especially by providing recommendations that improve economy, effectiveness, and efficiency of government's programs on environmental protection and sustainable development (INTOSAI, 2004). The Audit Board of the Republic of Indonesia (BPK), as the supreme audit board in Indonesia, is also actively involved in encouraging good environmental governance and management in order to preserve environment as well as achieving balance between economy, social, and environment in the frame of sustainable development. In recent years, BPK have conducted several audits related to environmental protection and sustainable development. The audits include audit on toxic and hazardous waste, audit on illegal, unreported, and unregulated fishing, audit on renewable energy development, audit on sustainable palm oil management, and audit on watershed management and pollution control. The recommendations provided in the audits are expected to improve the environmental management of all pertinent stakeholders while still maintaining the social and economic development.

In the 2020-2024 Strategic Plan, BPK also includes Sustainable Development Goals (SDGs) as one of the considerations. BPK has designed audit strategy that expected to be able to address the implementation of SDGs (BPK, 2020). SDGs encompasses sustainability principle that manifested in each goal and target. By auditing the implementation of SDGs, BPK contributes to the achievement of national targets that related to SDGs, which eventually contributes to the improvement of environmental governance and management that will lead to enhancement of the quality of environment.

BPK also strive to lead by example by implementing measures that exhibit good environmental management and governance. For example, BPK have built Wastewater Treatment Plant (WTP) to remove contaminants and convert it into an effluent that is treated further, so that it can be reused for various purposes. This process is very beneficial to the environment as well as to the surrounding community. The various benefits include water conservation, reducing pollution in the surrounding community, and providing water for cleaning purposes. BPK will also install solar panel in order to provide clean and sustainable energy, which contributes to the greenhouse gas emission reduction. Ultimately, BPK also contributes to sustainable production and consumption by encouraging paperless office, applying space-saving office layout, and implementing sustainable procurement.

In the international level, BPK is actively engaged in Working Group on Environmental Audit (WGEA) in INTOSAI (global), ASOSAI (Asia), and ASEANSAI (South East Asia) level. In ASEANSAI level, BPK is actively involved in knowledge sharing activities related to environmental audit between SAIs of ASEAN countries. Recently, BPK successfully delivered Virtual Workshop on Performance Auditing on Modern

Fisheries: Knowledge Sharing for ASEANSAI. BPK also delegated subject-matter experts on environmental audit for Cooperative Environmental Audit on Water Management of Mekong River Basin that organized by SAI Vietnam. In ASOSAI level, BPK is always present in ASOSAI WGEA seminars. BPK also takes part in several cooperative environmental audit organized by ASOSAI WGEA. Currently, BPK is conducting audit on sustainable urban transport, which is part of the ASOSAI WGEA Cooperative Audit on Sustainable Transport. In INTOSAI level, BPK always takes part in work packages of INTOSAI WGEA's Work Plan. In previous work plan, BPK contributes to several guidance, research, and discussion paper on various topics, such as audit on biodiversity, smart cities, and forestry. Ultimately, BPK is the Chair of INTOSAI WGEA in two terms, 2014-2016 and 2017-2019.

IV. Audit on Climate Change

The crucial role of BPK in catalyzing a successful climate action is by providing recommendations that improve cross-sectoral coordination and policy coherence between actors that involved in the programs related to climate change mitigation and adaptation. In the past five years, BPK have conducted several audits on government programs that related to climate action. The audits are as follows:

a. Audit on Renewable Energy Development

One of the significant measures to reduce greenhouse gases is by shifting from fossil fuel to renewable energy to generate electricity. Indonesia has a lot of renewable energy potential ranging from geothermal, hydropower, solar power, wind power, and bioenergy. The Government of Indonesia has a target in the National Energy General Plan to increase the share of renewable energy in the national energy mix to 23% in 2025 and to 31% in 2050 (Government of Indonesia, 2017). In 2019, BPK conducted audit on renewable energy development in the electricity sector to assess the effectiveness of the government's efforts in developing renewable energy power plants. The focus of the audit is how the government provide investment climate for private sector to invest in renewable energy businesses because most of renewable energy are produced by Independent Power Producers (IPPs). Four aspects are considered in the audit, namely 1) policy and regulation, 2) renewable energy potential data, 3) finance and incentives, and 4) technology and infrastructure.

The methodology utilized in the audit include stakeholder analysis, policy review, document review, interview, site visit to several renewable energy power plants, focus group discussion with experts and relevant stakeholders, and confirmation in the form of online questionnaire to IPPs and regional energy agency. Stakeholder analysis is the prerequisite of the audit because renewable energy development is a complex activity and involves many stakeholders. Beside the Ministry of Energy and Mineral Resources as the main audited entity, the renewable energy development also involves National Energy Council, Ministry of National Development Planning, Ministry of Finance, Ministry of Environment and Forestry, Investment Coordinating Board, Local Governments, and other stakeholders. Mapping of the stakeholders involved is illustrated in figure below.

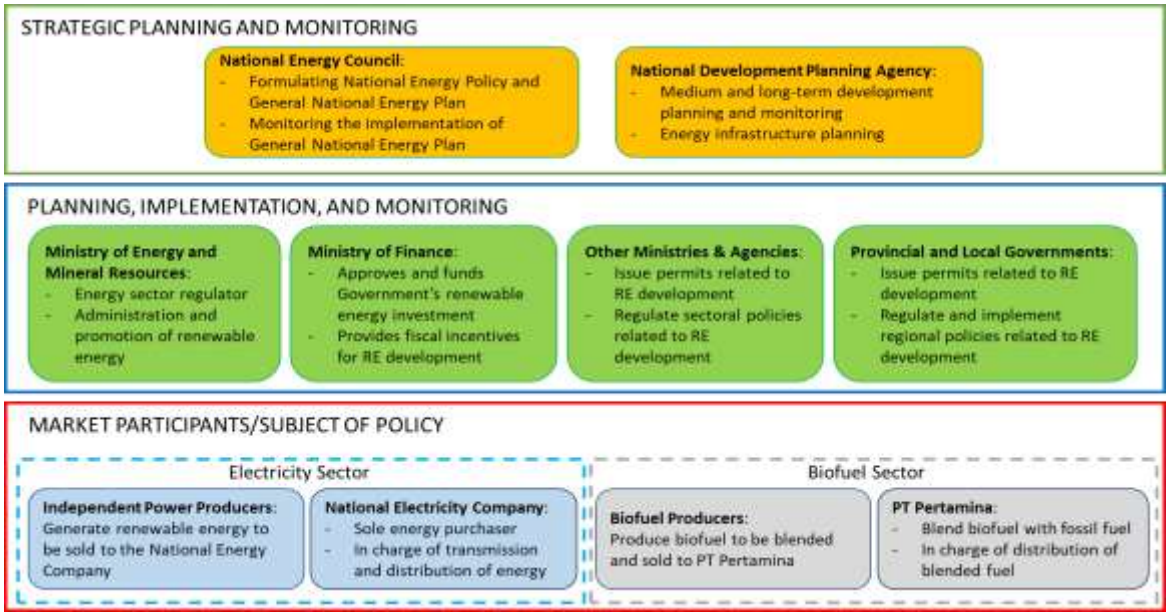

Figure 1. Stakeholder Mapping of Renewable Energy Development

Several achievements are noted in the audit, which include vertical coherence between central government and provincial governments which have set Regional Energy General Plan on each province in Indonesia. The Ministry of Finance has also issued several fiscal incentives for renewable energy businesses, such as tax holiday, tax allowance, and import facilities. However, rooms for improvement was also captured in this audit. The rooms for improvement and the respective recommendation include:

1) Policy and Regulation
    a. Incoherence between ministries and agencies' programs. The recommendation is to improve cross-sectoral coordination between stakeholders;
    b. Non-optimal One Stop Service (OSS) system for licensing process. The recommendation is to provide dedicated server and to improve the OSS system.
2) Renewable Energy Potential Data
    Renewable energy potential data still include inaccessible and unexploitable sources, such as those inside a conservation area. The recommendation is to review and update the potential data and present them in an online platform;
3) Finance and Incentives
    Ineffective pricing system and feed-in tariffs for Power Purchase Agreements. The recommendation is to review the regulation on pricing system;
4) Technology and Infrastructure
    a. Non-optimal implementation of supporting infrastructure and technology for intermittent power plant. The recommendation is to accelerate grid code revision and to implement smart grid and metering as well as the supporting provision;

b. Inadequate support in research and development of renewable energy technology. The recommendation is to propose new funding sources for research and development.

Figure 2. Site Visit to Solar Power Plant

Because the audit involves a lot of stakeholders, the challenge is how to gather all required information from all relevant stakeholders in the allocated time. Focus group discussion and online questionnaire are very useful in collecting many information in relatively short time.

b. Audit on Biodiesel Provision

Another measure to reduce greenhouse gases from energy sector is by substituting or blending the fuel with biofuel. This is particularly effective in reducing greenhouse gases from energy utilized for transportation. In the National Energy General Plan, it is stated that 75 percent of renewable energy is utilized for power plant and the rest 25 percent is directly utilized as biofuel. One of the sources of biofuel that are widely available in Indonesia is palm oil. Palm oil can be converted into biodiesel which is eventually blended with diesel oil. Based on the life cycle assessment of biodiesel from palm oil conducted by de Souza et al. (2010), avoided life cycle emissions associated with the use of biodiesel compared to diesel yield a net reduction of greenhouse gas emissions by 80 g CO_2e/MJ. Currently, the Government of Indonesia has a policy that requires diesel oil to be blended with biodiesel by 30 percent.

In 2020, BPK conducted audit on utilization of palm oil for provision of biodiesel. The audit focused on utilization of Palm Plantation Fund for improving biodiesel provision, especially in four areas, namely 1) establishment of fuel companies and biofuel companies and their distribution allocation, 2) calculation of realization of biodiesel distribution to fuel companies and its freight, 3) determination of Market Price Index for diesel oil and biodiesel, and 4) evaluation of biofuel distribution by biofuel companies. The methodology includes interview and discussion, external confirmation, site visit, document review, and walkthrough and observation. Due to the Covid-19 pandemic, most of the audit procedures were performed remotely using video conference.

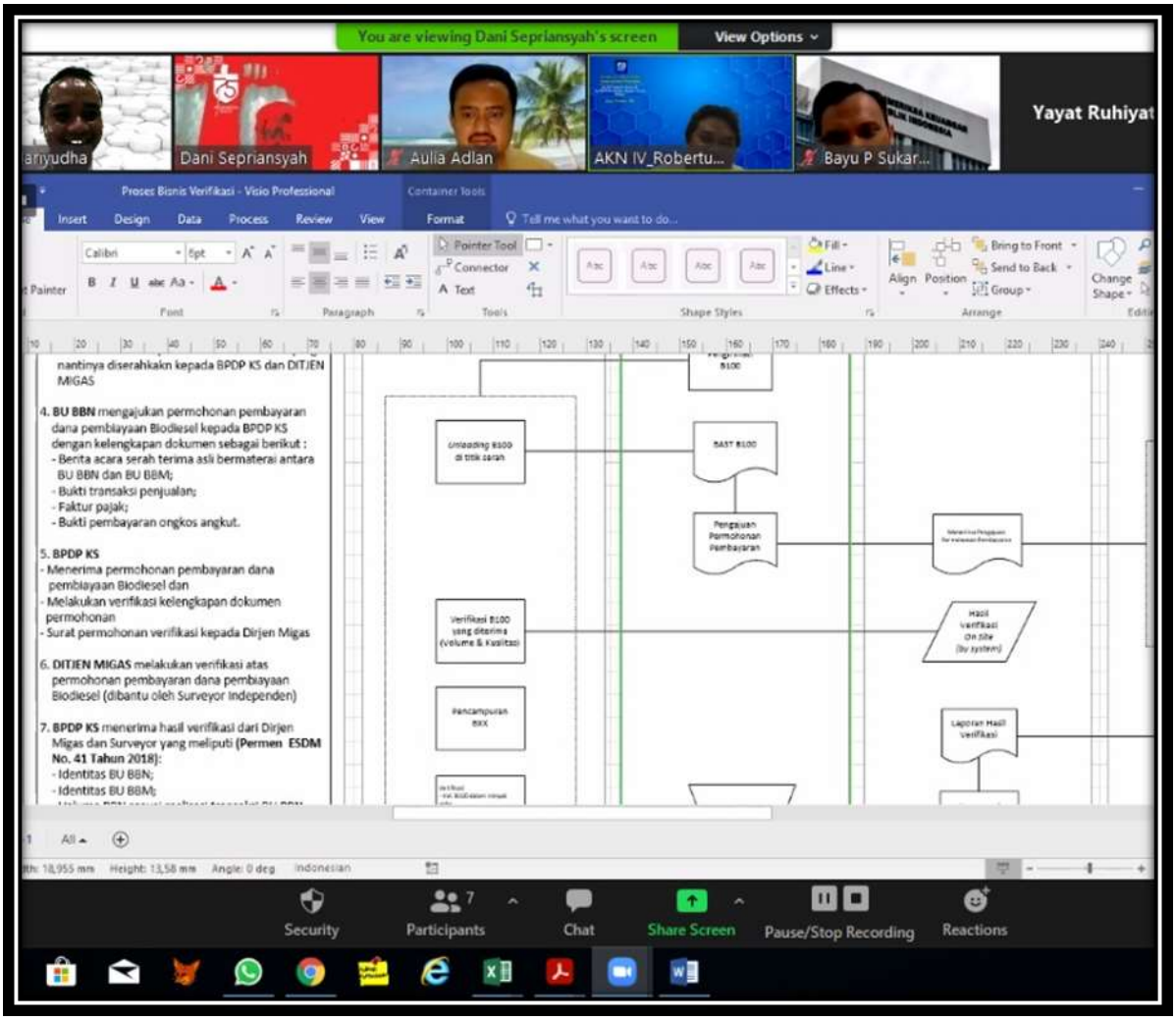

Figure 3. Remote Interview and Discussion

Two areas for improvement are administrative sanction in the form of fines related to distribution of biofuel and the distribution pattern and freight determination process that have not been able to guarantee quality, punctuality, stock availability, and more profitable price. The recommendations include:

1) Preparing the escrow account for fines deposit and deposit the fines to the state treasury;
2) Calculating and determining the potential fines;
3) Determining more favorable distribution pattern; and
4) Determining more profitable freight.

The challenges of the audit mainly related to the restricted mobility due to the Covid-19 Pandemic. To overcome the conditions, the audit team intensively communicated with related entities via email, phone, or video conference. The audit team also involved the internal control department in order to verify the audit documents and organizing virtual site visit.

c. Audit on City Gas Network Development

One of the strategies in low-carbon development is increasing household natural gas pipeline connections, also known as city gas network. The aim of the program is to convert the sources of energy for cooking from kerosene and liquefied petroleum gas (LPG) into natural gas. Natural gas emits less carbon dioxide emission compared to other fossil fuel. It produces about 117 pounds of carbon dioxide per million British thermal units (MMBtu) compared with more than 139 pounds of carbon dioxide per MMBtu of LPG (EIA, 2020). The program is expected to reduce the carbon dioxide emission from household sector.

BPK performed an audit on city gas network development in 2020 with the audit objective is to assess the effectiveness of city gas network development program in order to reduce greenhouse gas emission and support energy security. Because of the Covid-19 pandemic, most of the audit procedures were performed remotely via several means of communication, such as video conference, email, and phone. The methodology includes interview with relevant stakeholders, focus group discussion with city gas network operators as well as experts, online questionnaire to end-users, document review, virtual site visit, and content analysis.

Areas of improvement in the audit includes:

1) Incoherence with other sector in planning and implementation process;
2) Inadequate roadmap;
3) Insufficient monitoring and evaluation system.

The recommendations to overcome the issues found include:

1) Conducting comprehensive study on city gas network implementation and its impact on the decrease of LPG consumption;
2) Developing the roadmap of city gas network development;
3) Developing an integrated and comprehensive monitoring and evaluation system;
4) Improving coordination with relevant stakeholders.

Almost similar with the audit on biodiesel provision, the challenges faced also related to the consequences of Covid-19 pandemic, which is the mobility restriction.

d. Audit on Social Forestry Management

The role of forests in the environment include ecosystem regulation, biodiversity protection, supporting livelihoods, enhancement of carbon cycle, and supplying goods and services that can drive sustainable economic growth. One of the action that can be done in preserving forests is by enabling rights-based land use to ensure community involvement in land-use outcomes (IUCN, no date). In the National Medium Term Development Plan 2015-2019, one of the national priorities is the agrarian reform included assigning rights to the local communities on forest area.

In 2017, BPK carried performance audit related to the community involvement of forest management. One of the focus of the audit was access granting to community for managing the forest estate. The objectives of the audit are to assess the effectiveness of access granting of forest estate to local communities for managing the forest estate. The methodology includes interview and discussion, external confirmation, site visit, document review, and walkthrough and observation.

The activities requires adequate resources in terms of field execution unit, budget allocated, information system, and human resources. Problems will arise when this conditions cannot be met. Based on the

finding, the identified weaknesses are insufficient number of technical implementation units, minimal amount of the available budget compared to the target to be achieved, and existing human resources have not met the ideal number. The recommendations are to allocate sufficient resources to support the program, to provide assistance in the formation of working unit, and to ensure compliance with requirements.

e. Audit on Seawall Construction

To protect communities on the coastal area from sea level rise due to the climate change, the Government of Indonesia through the Ministry of Marine Affairs and Fisheries constructs several infrastructures such as sea walls, breakwaters, and embankments. In 2017, BPK conducted audit on seawall construction with the objective is to assess whether the seawall construction and climate change adaptation in Ministry of Marine Affairs and Fisheries has been supported by a proper internal control system. Seawall is a belt form construction which was made from pile of geotextile bags and has a function as a wave energy absorber, reducing erosion and retaining sediment. The accumulation of sediment can be used for environmental conservation activities and restore coastal usage.

The methodology employed in the audit includes interview and discussion, external confirmation, site visit, document review, and walkthrough and observation. Related findings are construction volume less than contract agreement and inadequate construction design. The recommendations set are construction cost refund, issuance of warning letter from the top management to agreement signing official and also, to consultant designer as a result of planning inaccuracy.

f. Audit on Citarum Watershed Pollution Control and Management

Climate change has also detrimental effects on watershed system. It can have a significant effect on streamflow, sediment yield timing and magnitude, and nutrient (nitrogen and phosphorus) loading which lead to water supply deficit during peak seasons, potential eutrophication increase, and fish migration change (Marshall & Randhir, 2008). Sound management is required to maintain the water security of the watershed. One of the watersheds that prone to the impact of climate change is Citarum watershed in West Java. The condition is exacerbated by excessive pollution as well as critical land in upstream area.

In 2018, BPK conducted audit on Citarum watershed pollution control and management. Citarum is one of the most important watershed in Indonesia because more than 28 million people in Jakarta capital area and West Java province depend on Citarum for clean water source. The audit focused on two main activities, namely river pollution control and land and forest rehabilitation on upstream area.

Beside the water conservation, the audit also contributes to several other climate change mitigation measures, include:

1) Municipal waste management of the communities along the watershed

Improving the waste management and promoting circular economy will greatly reduce the amount of waste to be landfilled, which leads to the reduction of methane produced from landfill. Methane is 25 times more potent greenhouse gas compared to carbon dioxide at trapping the heat in the atmosphere (EPA, no date).

2) Livestock waste management

Improving the livestock waste management will reduce the amount of greenhouse gases produced from manure storage and animal excrement. Manure storage release methane and nitrous oxide

which are greenhouse gases that have more potency than carbon dioxide. Nitrous oxide is a molecule with 265 times higher than carbon dioxide in global warming potential (Grossi et al., 2019).

3) Forest rehabilitation on upstream area

   Restoring the forest area plays crucial part in the carbon cycle, because it improves carbon sequestration from the atmosphere. Forest restoration can contribute up to one-third of the total climate change mitigation required by 2030 (IUCN, no date).

The objectives of the audit are to assess the government's effort in maintaining the water quality of Citarum River and in rehabilitating the land and forest in upstream area. The audit also assess the coordination between pertinent stakeholders in managing Citarum watershed. The stakeholders include Ministry of Environment and Forestry, Ministry of Public Works and Housing, Indonesian Army, provincial and local governments along the watershed, private sectors, and local communities. The framework of the audit adopts nested model sustainability principle where watershed ecosystem acts as a boundary in social and economic development along the watershed.

Figure 4. Domestic Wastewater Pollution on Citarum River

The methodology applied in the audit are interview and discussion, document review, policy review, site visit to several industries and waste treatment plants, and confirmation to local communities. Several other advanced methodology also utilized in the audit, such as spatial analysis, laboratory analysis, and monetizing the impact of river pollution. Spatial analysis using Geographic Information System (GIS) is employed to assess the effectiveness of forest and land and rehabilitation programs. Laboratory analysis is conducted to several point in water body and wastewater treatment plant effluent

to examine the water quality. Ultimately, a group of experts is hired to perform analysis on economic impacts of the water pollution to the local livelihood.

The rooms for improvement noted in the audit and the respective recommendation include:

1) Forest and land rehabilitation activities have not been effective. The recommendation is to improve cross-sectoral coordination in forest and land rehabilitation.
2) Low community participation in municipal solid waste management. The recommendation is to improve socialization and community engagement in solid waste management;
3) Sources and locations of livestock waste have not been identified. The recommendation is to identify all sources and locations of livestock waste along the watershed and establish the plan to mitigate them;
4) Integrated planning that involves all stakeholders was not in place. The recommendation is improving coordination and communication between all stakeholders in establishing integrated watershed management plan; and
5) Inadequate monitoring and evaluation mechanism and implementation. The recommendation is to establish and implement a sound monitoring and evaluation system.

The challenge faced in this audit is almost similar with audit on renewable energy that involves many stakeholders.

Figure 5. Degraded Land in Upstream Area

g. Audit on Swamp Land Optimization

To cope with the climate change consequences in agricultural sector, the Government of Indonesia initiates land optimization for agriculture, which include swamp land optimization. Optimization of swamp land as agricultural land will also provide benefits for farmers in the long term. Among them are optimized and revitalized irrigation and drainage network. Ministry of Agriculture has the responsibilities to carry out this activities.

In 2020, BPK carried out audit on the program with the aim to see the entity's compliance on expenditure management for optimization of swamp land. The compliance level will be compared with the applied provision and the existing mismatch will be improved by the recommendation. The methodology includes interview and discussion, external confirmation, site visit, document review, and

walkthrough and observation, which conducted mostly by remote audit due to the Covid-19 pandemic. The findings and the recommendations are:

1) Seeds procurement without considering quality test results, unclear seeds distribution and unclear contract termination. The recommendations are issuance of warning letter from the top management to agreement signing official and proxy of budget user and financial compensation on overpayment to third party.
2) Land modification process from planning through monitoring is not accordance with the provision. The recommendation is to evaluate the distribution mechanism of land modification particularly related to the components of costs and the data validity of the land provided for assistance.

V. Conclusion

The global climate negotiations have produced several agreements which intended for international cooperation on stabilizing atmospheric greenhouse gas concentrations at level that would prevent catastrophic interference with the climate system. These negotiations produce a consensus that requires participating countries ratifying the agreements in order to mitigate, to adapt action and to support financially.

The Government of Indonesia has adopted the SDG 13 in the national context by aligning it with the national strategic plan and by providing sustainable policy and resources support among its ministries. The government has developed framework focusing in policy, infrastructure, and monitoring and evaluation by addressing climate change mitigation and adaptation measures.

BPK plays an important role in addressing climate change by conducting both compliance and performance audits in the related areas such as energy, forestry, marine, waste, and land modification. The output are recommendations which expected will have an impact on policies made and the urge of improving coordination between ministries since the problem is a shared responsibility. There are also recommendations to improve regulations, planning, procedures, and monitoring and evaluation mechanism. Finally, audit on climate change involve several stakeholder that needs to be audited thoroughly, not only in output level but also in outcome level which requires specific audit examination by targeting 5 years cycle period of the National Medium Term Development Plan.

BIBLIOGRAPHY

BPK 2017. *Audit Report No. 39/LHP/XVII/12/2017*. Jakarta, Indonesia: BPK

BPK 2018. *Audit Report No. 5/LHP/XVII/01/2018*. Jakarta, Indonesia: BPK

BPK 2019. *Audit Report No. 5/LHP/XVII/02/2019*. Jakarta, Indonesia: BPK

BPK 2020. *Audit Report No. 3/LHP/XVII/01/2020*. Jakarta, Indonesia: BPK

BPK 2020. *Audit Report No. 36/LHP/XVII/12/2020*. Jakarta, Indonesia: BPK

BPK 2020. *Audit Report No. 38/LHP/XVII/12/2020*. Jakarta, Indonesia: BPK

BPK 2020. *Strategic Plan 2020-2024.* Jakarta, Indonesia: BPK

BPK 2021. *Audit Report No. 4/LHP/XVII/01/2021*. Jakarta, Indonesia: BPK

de Souza, S. P., Pacca, S., de Avila, M. T., and Borges, J. L. 2010. Greenhouse Gas Emissions and Energy Balance of Palm Oil Biofuel. *Renewable Energy*, 35(11), 2552-2561

Ge, M., Friedrich, J., and Vigna, L. 2020. *4 Charts Explain Greenhouse Gas Emissions by Countries and Sectors* [Online] World Resources Institute. Available at: https://www.wri.org/insights/4-charts-explain-greenhouse-gas-emissions-countries-and-sectors [Accessed August 20, 2021]

Government of Indonesia 2017. *National Energy General Plan.* Jakarta, Indonesia: Government of Indonesia.

Grossi, G., Goglio, P., Vitali, A., and Williams, A. G. 2019. Livestock and Climate Change: Impact of Livestock on Climate and Mitigation Strategies. *Animal Frontiers*, 9(1), 69-76.

INTOSAI 2004. *Performance Audit Guidelines: ISSAI 3000 – 3100*. Vienna, Austria: INTOSAI.

IUCN no date. *Forests and Climate Change* [Online] Available at: https://www.iucn.org/resources/issues-briefs/forests-and-climate-change [Accessed August 26, 2021]

Kyoto Protocol to the United Nations Framework Convention on Climate Change 1997.

Levin, K. and Parsons, S. 2019. 7 *Things to Know About the IPCC's Special Report on Climate Change and Land* [Online] World Resources Institute. Available at: https://www.wri.org/insights/7-things-know-about-ipccs-special-report-climate-change-and-land [Accessed September 13, 2021]

Marshall, E. and Randhir, T. 2008. Effect of Climate Change on Watershed System: A Regional Analysis. *Climatic Change*, 89, 263–280.

Ministry of Environment and Forestry no date. *Frequently Asked Question on REDD+ and REDD+ Implementation in Indonesia* [Online] Available at: http://ditjenppi.menlhk.go.id/berita-ppi/33-beranda/1804-faq.html [Accessed September 2, 2021]

Montreal Protocol on Substances that Deplete the Ozone Layer 1987.

My NASA Data no date. *Systems Thinking about the Earth System* [Online] Available at: https://mynasadata.larc.nasa.gov/basic-page/systems-thinking-about-earth-system [Accessed August 19, 2021]

Paris Agreement 2015.

Stern, N. 2006. *The Economics of Climate Change: The Stern Review*. London, UK: Government of the United Kingdom.

United Nations Framework Convention on Climate Change 1992.

U. S. Energy Information Administration 2020. *Natural Gas Explained – Natural Gas and the Environment* [Online] Available at: https://www.eia.gov/energyexplained/natural-gas/natural-gas-and-the-environment.php [Accessed August 25, 2021]

U. S. Environmental Protection Agency no date. *Importance of Methane* [Online] Available at: https://www.epa.gov/gmi/importance-methane [Accessed August 26, 2021]

World Health Organization 2018. *Climate Change and Health* [Online] Available at: https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health [Accessed September 1, 2021]