Chapter IX. ENVIRONMENTAL MANAGEMENT

Energy production and consumption produce greenhouse gas emission (GHG), which should be continuously balanced with sustainable development of a growing economy. As such, the energy sector takes into account a sound environmental management as an integral of the sector's strategic directions, specifically on strengthening consumer protection and promoting a low carbon future to achieve a sustainable development.

In support of President Duterte's "Build, Build, Build Program," sufficient energy supply must be ensured to meet the growing energy demand of the economy and achieve the government's economic goals. However, economic growth and rising energy requirement could result in greater environmental impacts if not managed properly. Such environmental impacts can be reduced to moderate levels through stakeholders' commitments to environmental protection. Following are the best practices on environmental management in the country's energy sector:

- Integration of environmental issues into business decisions through the use of management systems;
- Integration of health, safety and environmental management system;
- Consideration of all environmental components (air, water, land, people, biodiversity, etc.) in decision making at strategic and operational levels;
- Implementation of appropriate pollution prevention techniques including re-use and/or recycling of waste components;
- Evaluation of alternatives on a cost, benefit and risk bases to include environmental values;
- Minimization of resource inputs through efficiency measure; and,
- Innovation and improvement on environmental protection.

A. ASSESSMENT

1. *The Philippines Environmental Impact Statement System and Environmental Impact Assessment Reports of Energy Projects*

The Philippines Environmental Impact Statement System (PEISS), established in 1979 through the Presidential Decree (PD) 1586, requires project proponents to prepare and submit an Environmental Impact Statement (EIS) that describes the potential effects of a project on environment and the corresponding mitigating measures. It serves as a planning tool for incorporating environmental management measures in project design, as well as a means for

compliance with other environment laws – the Clean Air Act, Clean Water Act, Solid Waste Management Act, and Toxic Substances and Hazardous Waste Management Act, among others.

Under Department of Environment and Natural Resources (DENR) Administrative Oder (AO) 03-30[112] issued in August 2007, the PEISS categorizes projects or undertakings, including major expansion, rehabilitation and/or modification of existing projects, and resumption of projects that ceased operations for a long period based on the following:

- ***Category A*** projects or undertakings classified as Environmentally Critical Projects (ECPs), as they pose high risks or negative environmental impacts (e.g. energy facilities and infrastructure projects, power plants);

- ***Category B*** projects or undertakings classified as ECP under Category A, and significantly affect the quality of environment due to their location in an Environmentally Critical Area (ECA) – an ecologically, socially, or geologically sensitive area (e.g. renewable energy projects);

- ***Category C*** projects or undertakings, not classified under Category A or B, that intend to directly enhance the quality of environment or directly address existing environmental problems; and,

- ***Category D*** projects or undertakings that are deemed unlikely to cause significant adverse impact on the quality of environment. These projects are not covered by PEISS.

Categories A and B are required to secure an Environmental Compliance Certificate (ECC), which contains specific measures and conditions that must be met by the project proponent before and during operation of the project. All ECC applications should be accompanied by an Environmental Impact Assessment (EIA) Report in the form of an EIS, an Initial Environmental Examination (IEE) Checklist Report, an Environmental Performance Report and Management Plan (EPRMP), Programmatic EIS or Programmatic EPRMP. On the other hand, *Categories C and D* only need to obtain a Certificate of Non-Coverage (CNC) stating that the proposed project is not covered by the PEISS.

For the past 30 years of PEISS implementation, the DOE is actively participating in the continuous enhancement and/or improvement, specifically on the procedures and requirements in the conduct and review of EIA Studies and in the Environmental Compliance Monitoring and Validation Reporting. In the review and evaluation of the ECC application, the DENR-Energy Management Bureau (EMB) commissions experts who will form part of the EIA Review Committee, while the DOE expert serves as a resource person.

In 2018, ECCs were issued to 28 coal-fired power plants, 23 oil-based power plants, eight (8) natural gas-fired power plants, nine (9) geothermal power plants, 29 hydro plants, 13 biomass power plants, six (6) wind power, 18 solar, two (2) petroleum refineries, and one (1) gas processing plant.

2. *Environmental Compliance and Monitoring*

The DOE regularly conducts environmental compliance monitoring of energy projects and facilities to ensure that social and environmental safeguards are effectively applied. This is done through the Multi-partite Monitoring Team (MMT), a required mechanism under the PEISS. Under DENR

[112] This refers to DENR Administrative Order on the Revised Procedural Manual and Guidelines of PEISS under the PD 1586.

AO 2017-15, only Category A or environmentally critical projects are required to organize its MMT after its ECC is awarded, thus not all energy projects have MMTs.

The MMT aims to encourage public and/or stakeholders' participation and provide appropriate check and balance mechanisms in monitoring the development and implementation of projects. It is composed of representatives from the relevant government agencies, local government units (LGUs), non-government organizations (NGOs), and peoples' organizations (POs), the community, the women's sector, and whenever necessary, from the academe and other sectors. For some projects, the DOE has been nominated to solely lead or co-lead the MMTs.

The MMT activity is guided by the following objectives:

- Ensure compliance of project proponent with standards as stipulated in the Environmental Management Plan, Environmental Monitoring Plan, Social Development Plan, as well as other ECC conditions, and related permits;
- Share knowledge, experiences and provide recommendations to improve monitoring procedures;
- Assist in harmonizing the relationship of all stakeholders to ensure public and social acceptability of energy projects;
- Prepare, integrate and disseminate monitoring reports and submit recommendations to the DENR; and,
- Monitor Information, Education and Communication (IEC) activities.

The MMT is operationalized through the formulation of an annual monitoring plan that covers air and water quality, biophysical and socioeconomic monitoring activities. The DOE, as member of the MMT, participates in the environmental compliance monitoring and verification of various energy projects and facilities.

Table 60 shows the number of energy projects/facilities that have Environmental Management Plan (EMP), Environmental Monitoring Fund (EMF), Environmental Guarantee Fund (EGF), and the Environmental Management and Monitoring Plan (EMMOPs). The EMPs and EMMOPs cover four (4) segments – air quality, water quality, biodiversity and waste management, and people. Implementation of efficiency and conservation program is likewise incorporated in the EMPs and EMMOPs.

Table 60. ENERGY PROJECTS/FACILITIES with EMP, EMF, EGF and EMMOPs

Coal Power Plants	28
Oil Power Plants	23
Natural Gas Power Plants	8
Geothermal Power Plants	9
Hydro Power Plants	29
Biomass Power Plants	13
Wind Power Plants	6
Solar Power Plants	18
Petroleum Refineries	2
Gas Processing Plants	1
Coal Mines	5
Oil Exploration Companies	2
Gas Exploration Companies	1
Geothermal Production Companies	9

The EMF is a requirement upon the issuance of ECC to support the environmental management activities of the project, while EGF is the fund to cover potential public risk of the projects or undertakings, such as damage to life, health, property, and the environment requiring rehabilitation or restoration measures.

The DOE shall encourage energy projects that are not ECPs or those that do not have MMTs to take the initiative to establish multi-sectoral/multi-stakeholder activities to monitor their compliance to ECC conditions and permits. This is to promote a more transparent engagement of the energy sector to host communities. Likewise, it helps future energy projects to be supported and accepted by the stakeholders.

Energy projects and facilities are committed to integrate health, safety and environment management system (HSEMS) in their operations. These projects/facilities must also adopt existence international standards, such as the International Standards Organization (ISO) 9000 for quality management and the ISO 14000 for environmental management.

3. Pollution Control Technologies

The energy sector has been proactive in evaluating and introducing new engineering and operational techniques to prevent and reduce pollution. To prevent waste at its source, the energy facilities are equipped with the following pollution control systems and technologies, namely:

- Electrostatic precipitators and bag filters for particulate matter emissions (PM);
- Flue gas desulfurizer for sulfur oxides (SOx) emissions;
- Low Nitrogen Oxides (NOx) Burners/Dry Low NOx combustion technology/selective catalytic reduction technology for particulates NOx emissions;
- Waste water treatment facility, oil-water-gas separator, skimming/gas flotation, static hydrocyclones, mechanical centrifugation, gas stripping for treating wastewater; and,
- Ash disposal system, sedimentation basin, hazardous waste storage and disposal facility, materials recovery facility for reducing and removing solid wastes.

4. Addressing Climate Change

The energy sector is an important components of the National Climate Change Action Plan (NCCAP) under its Sustainable Energy Program Framework. The Framework identified both mitigation actions and adaptation measures to address climate change. With the country's positive economic outlook, the energy sector is mindful of the need to institutionalize policy and program mechanisms, and interventions to mitigate the effects of climate change and global warming.

The energy sector's component of the NCCAP is harmonized with the targets and timelines of the Philippine Energy Plan (PEP) in pushing for renewable energy (RE), alternative fuels and energy efficiency measures. These are considered as strategic elements of greening economic growth toward a sustainable low carbon future. Mainstreaming of RE increases the share of clean energy sources in the country's on-grid electricity supply. Moreover, the decentralized renewable system is crucial in addressing the energy demand and supply requirements of the communities in off-grid and isolated areas.

The attainment of the National Renewable Energy Program (NREP) target of additional 15,000 MW by 2030 of generating capacity from renewables is supported by the RE technology roadmap. To complement this, the renewable energy research and development agenda will be pursued in

collaboration with the state university-based Affiliated Renewable Energy Centers (ARECs) of the DOE, as well as the engagement with the science and technology community.

The nationwide implementation of the NEECP will be pursued and accelerated as it seeks to reduce fuel and electricity consumption of all the economic sectors of society: industrial, transport, commercial, residential, and agriculture. The passage of the Energy Efficiency and Conservation (EE&C) Act is seen to intensify the use of energy efficient technologies, including substantive values re-orientation campaign on the benefits of energy efficiency and conservation. To sustain and scale up promotional efforts, the NCCAP considers the tripartite partnership network among the government, private sector and civil society as a major strategy.

Under the sustainable energy component of the NCCAP, the energy sector is expected to contribute to the attainment of an environmentally sustainable transport system. Among the sector's programs to support this goal include: (1) use of alternative transport fuels sourced from compressed natural gas, liquefied petroleum gas, biofuels (CME and E10) and electricity; (2) conduct of research and studies on higher biofuel blends; and, (3) undertake a feasibility study on hybrid systems, such as fuel cells, among others. Likewise, energy efficiency standards and labeling for new vehicles will be implemented.

B. PLANS AND PROGRAMS

The energy sector is also facing the challenges brought about by climate change, thus, mitigation measures and adaptation strategies also needs to be implemented by the sector. It should be emphasized however that mitigation actions are being implemented as a function of adaptation strategies. These actions are primarily being implemented to address and achieve energy security, reliability, resiliency and environmental sustainability while at the same time reducing and/or avoiding the greenhouse gas emissions. This is also the approach being adopted for the development of the energy sector's share to the Nationally Determined Contribution (NDC) of the country.

1. Climate Change Mitigation

To successfully implement the mitigation measures to reduce the energy sector's GHG emissions, several issues and concerns have to be addressed such as: (1) development barriers on renewable energy (i.e., high capital cost, cost of transmission access, and off-take risks), which constrain commercial bank financing; (2) financing barriers on the implementation of energy efficiency programs/projects partly due to the invisibility of measures and difficulty in demonstrating and quantifying results; and (3) accounting and reporting actual emission level and emission reduction from contributing energy-consuming sectors.

Amid these challenges, the DOE will carry out the following within the planning horizon:

- Integration of climate change mitigation measures in energy policies, plans and strategies including laws and regulations;
- Development of guidelines on accounting and reporting of GHG emissions and emission reduction to cover capacity building for the establishment of reporting forms and database;
- Implementation of emission reduction programs and projects;
- Dissemination of knowledge, research and best practices on mitigation;
- Development and adoption of sustainable financing mechanisms; and,
- Monitoring, reporting and evaluation systems of mitigation policies and measures.

These actions are vital to achieve the initiatives outlined in the energy sector's NDC with the target GHG emission avoidance and/or reduction of 480.2 million tons of carbon dioxide equivalent (CO_2-e) in total primary energy supply (TPES) in the Clean Energy Scenario (CES), which is about 11.3 percent lower than the Reference/Business-as-Usual (BAU) Scenario from 2020 to 2040 *(Please Figures 36 and 37 in Chapter II)*. The transport sector is excluded from the total GHG emissions which the Department of Transportation (DOTr) shall lead per EO 174, "*Institutionalizing the Philippine Greenhouse Gas Inventory Management and Reporting System*."

Over the planning horizon, GHG emissions from coal and oil decrease by 14.0 percent to 15.0 percent (in TPES) with the increased utilization of renewable energy, improved efficiency of fossil-based technology and increased use of natural gas specifically for power generation.

2. *Climate Change Adaptation*

In recent years, the Philippines experienced a series of devastating natural disasters like extreme weather events and natural calamities that affected energy infrastructure and facilities. From these catastrophic events, the energy sector has been identified as among the most vulnerable sectors to climate change, and thus needs to develop suitable coping mechanisms and interventions focusing on energy supply security, particularly in off-grid areas. These areas are so remote that connection to the main grid is not an immediate option. Electricity in these areas is mainly sourced from diesel generators putting the supply at risk in times of energy disruptions. In view of environmental considerations and technology innovations, the use of renewables (i.e. such as solar, wind and hydro) provides alternative off-grid solutions.

However, adaptation measures are not only for high risk areas most affected by climate change since the whole energy system faces an equally daunting challenge on how to climate-proof the country's energy facilities. Improving the resiliency of energy facilities is a critical adaptation measure for energy infrastructures as it will help them endure the adverse impact of the changing patterns of climatic conditions.

Guided by previous adaptation actions, it is important that the planning process of energy projects/facilities embrace the principles of sustainable energy, disaster responsive power systems and environmental protection through the establishment of energy resilient infrastructures. The social and economic impacts of climate change-related consequences, such as energy supply disruptions/outages as results of extreme climatic events (e.g. typhoons, floods, landslides), also redounds to adverse economic losses for the country. As such, the long-term goal is to mainstream adaptation in energy development projects by climate proofing energy infrastructures and systems to withstand extreme weather events. Thus, the programs and activities to be identified in the Energy Resiliency Road Map and the formulation of the Energy Resiliency Standards are also vital to the climate change adaptation strategies of the energy sector.

To pursue climate change adaptation strategies in the energy sector, the following gaps and issues should be properly addressed: (1) assessment of energy infrastructures and systems' vulnerability, including pressures on energy demand and supply; and (2) development of models on climate change impacts of weather extremes, seasonal variability, changes in temperature and wind speeds to assess implications on energy supply resources (e.g. wind, solar and hydro), and on energy consumption patterns.

In view of the above, the climate change adaptation action plan will be implemented within the planning horizon:

- Conduct of impact and vulnerability assessments of the energy systems and infrastructures (i.e. power generation, transmission and distribution, fuel production and transport);
- Institutionalize the Energy Resiliency Policy and other measures such as: (1) integration of structural adaptations into the structural design/strengthening of energy infrastructures and, (2) implementation of infrastructure reinforcement measures on:
    - power transmission and distribution systems, underground cabling for power distribution system;
    - fuel distribution systems, underground fuel pipeline distribution system;
    - infrastructure intervention e.g. sea walls/coastal defense; and,
    - soil erosion control system.
- Mainstream climate change adaptation in energy policies, plans and programs including laws and regulations;
- Develop strategies on changing demand patterns focusing on:
    - Investments in technological change to address energy demand and supply options;
    - Establishment of sustainable financing mechanisms; and,
- Share and disseminate knowledge, research and best practices on adaptation.

To present a balanced energy sector approach, these adaptation strategies as well as the required estimated financial requirements to implement such responses will also be incorporated in the energy sector's NDC.

3. *National Framework Strategy on Climate Change*

The National Framework Strategy on Climate Change (NFSCC) serves as the foundation in addressing climate change, and identifies adaptation as the anchor strategy, while mitigation as a function of adaptation.

Table 61. DOE RESPONSIBILITIES FOR NCCAP OUTCOMES/OUTPUT AREAS

Strategic Priority/Outcome	Output	Responsibility
Sustainable Energy		
Energy efficiency and conservation promoted and implemented	Government Energy Management Program (GEMP) implemented	Co-lead with DOTr and DENR
	Private sector and community participation in energy Efficiency and conservation increased.	Co-lead with the Climate Change Commission (CCC)
Sustainable and renewable energy development enhanced	NREP and RE Technology Roadmap based on Renewable Energy Act of 2008 and its Implementing Rules and Regulations (IRR).	DOE as Lead Agency
	Off-grid, decentralized community-based renewable energy system to generate affordable electricity adopted.	DOE as Lead Agency
Environmentally sustainable Transport promoted and adopted	Environmentally sustainable transport strategies and fuel conservation measures integrated in development plans.	No explicit leadership role
Energy systems and infrastructure made climate resilient, rehabilitated and improved	Energy systems and infrastructures made climate resilient.	Co-lead with DOST, DENR
Knowledge and Capacity Development		
Knowledge on climate science Enhanced	GHG inventory completed.	DOE as Lead Agency (Energy sector Per EO No.174)
Water Sufficiency		
Water governance restructured toward a climate and gender responsive water sector	Enabling policy environment for Integrated Water Resource Management (IWRM) and climate change adaptation created.	Coordinating Agency

	Climate change adaptation and vulnerability reduction measures for water resources and infrastructure implemented.	Coordinating Agency

To achieve it, the NCCAP has identified the following strategies: (2) sustainable energy strategies (focusing on energy efficiency and conservation, renewable energy, and environmentally sustainable transport systems); (2) knowledge and capacity development strategies (knowledge of climate science, e.g. GHG inventory); and (3) water sufficiency strategies focusing on water governance restructured toward a climate and gender responsive water sector *(Table 61)*.

4. *Development of the National GHG Inventory Management and Reporting System*

As stipulated under EO 174, the DOE leads the GHG inventory of the energy sector. Specifically, the DOE is tasked to conduct, document, archive and monitor GHG inventory (accounting and reporting of GHG emissions from combustion of fossil fuels in stationary sources, mobile sources (though this will be accounted by the DOTr as the lead agency for transport sector's GHG inventory), and fugitive emissions. The inventory enables the government to define ways of reducing emissions and adopt low carbon pathways to support the NDC.

In 2018, the DOE submitted the 2010 GHG Emission Inventory Report of the Energy Sector to the Climate Change Commission. It was subjected to quality assurance (QA) by experts from the United Nations Framework Convention on Climate Change (UNFCCC) and was subsequently enhanced and integrated in the National GHG Inventory Report. The said report is the basis of the NDC and will also be incorporated in the Third National Communication (TNC).

The DOE, as a member of the Climate Change Database Keepers Committee, supports the development of the National Integrated Climate Change Database and Information Exchange System (NICCDIES) within the planning horizon. The NICCDIES is an integrated, comprehensive, and highly accessible national database with an information exchange facility to cater to climate change data clients or end-users.

5. *United Nations Frame Nations work Convention on Climate Change and the Paris Agreement (PA)*

The UNFCCC was adopted in 1992 as an international political response to climate change, which sets out a framework for action aimed at stabilizing atmospheric concentrations of GHG to avoid "dangerous anthropogenic interference" with the climate system. Meanwhile, the Kyoto Protocol adopted in 1997, commits industrialized countries and countries in transition to a market economy to achieve GHG emission reduction targets by an average of 5.2 percent (below the 1990 levels).

In 2015, Conference of Parties (COP) to the UNFCCC adopted the Paris Agreement (PA) as a new legally-binding framework for an internationally coordinated effort to tackle climate change. It recognizes the different responsibilities and actions that each Party can take to achieve the goal of limiting the increase of global temperature to below 2.0 degrees Celsius (°C).

The COP also adopted a decision that guides pre-2020 action and sets out implementation details for the PA before its entry into force, which contain the detail and guidance on how to develop and formulate NDCs.

The decision calls for enhanced action on mitigation including the second commitment period to Kyoto Protocol, mitigation pledge, technical examination process and cooperation with non-country stakeholders. On the other hand, technical examination focusing on lessons sharing and cooperative actions were identified for adaptation, while developed countries were urged to scale up the level of financial support.

6. Energy Sector NDC

As envisioned in Ambisyon 2040, the Philippine economy shall grow and expand, thus the energy sector will need to fuel and sustain country's progress and development while at the same time address GHG emissions. This will be achieved through policies, programs and projects focusing on renewable energy development and utilization, biofuels program, natural gas projects, energy efficiency and conservation programs and the use of highly efficient and emerging technology for generation.

The energy sector has transformed over the years as reflected in the country's energy mix. Total energy consumption has moved alongside economic development and population growth, which resulted in increased levels of GHG released into the atmosphere. GHG emissions from the energy sector is mainly from the combustion of fossil fuels and other activities related to the production of energy. This NDC includes all the all GHG-emitting sectors with 2010 as the base year for the GHG emission and projections until 2040. It is consistent with the Philippine Development Plan (PDP), NFSC, NCCAP and the PEP which utilized the gross domestic product (GDP) growth rates provided by the National Economic and Development Authority (NEDA) and the population growth rates from the Philippines Statistics Authority (PSA).

The DOE started its efforts on GHG inventory for the Initial National Communication (INC) with the 1994 GHG inventory, and was followed by the 2000 GHG Inventory for the Second National Communication (SNC) as part of the country's commitment to the UNFCCC. From then on, the energy sector has come up with annual GHG inventory using the 1996 IPCC Guidelines. For the base year GHG emission of the NDC (2010 GHG inventory), the 2006 IPCC Guidelines and software were used for both Top-Down or Reference Approach, and the Bottom-up or Sectoral Approach.

Table 62 shows the Reference Approach with a total of 76,823 gigagrams CO_2e ($GgCO_2e$) or 76.8 metric ton CO_2e ($MTCO_2e$) emitted by the energy sector, which also included the emissions from the use of fuels by the transport sector. Liquid fuels accounted for 54.5 percent, while solid fuels and gaseous fuels contributed 36.2 percent and 9.3 percent, respectively *(Figure 84)*. Liquid fuels include crude oil, motor gasoline, aviation gas, jet kerosene, other kerosene, diesel oil, residual fuel oil, liquefied petroleum products and other petroleum products, while coal and the natural gas from Malampaya are those considered in the solid and gaseous fuels.

Figure 84. 2010 GHG EMISSIONS PER FUEL

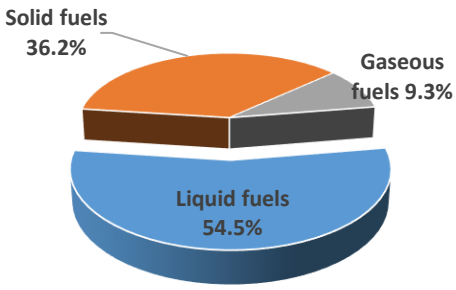

Table 62. TOP-DOWN OR REFERENCE APPROACH – 2010 GHG EMISSIONS OF THE ENERGY SECTOR

Fuel Type			2010 ($GgCO_2e$)
Liquid Fuels	Primary Fuels	Crude Oil	27,281
	Secondary Fuels	Motor Gasoline	4,436
		Avgas	8
		Jet Kerosene	(1,636)*
		Other Kerosene	15
		Gas/Diesel Oil	9,036
		Residual Fuel Oil	1,373
		LPG	2,084
		Other Petroleum Products	(732)**
Total Liquid Fuels			**41,865**
Solid Fuels	Secondary Fuels	Other Bituminous Coal	27,846
Total Solid Fuels			**27,846**
Gaseous Fuels	Primary Fuels	Natural Gas (Dry)	7,112
Total Gaseous Fuels			**7,112**
Total			**76,823**

**International Aviation*
*** Exported*

For the Sectoral Approach or Bottom-Up Approach, *Table 63* shows that fuel combustion and fugitive emissions from fuels emitted 77,289 $GgCO_2e$ or 77.3 MTCO2e. Energy industries accounted for more than 42.0 percent of the emissions followed by the transport sector at 31.3 percent, manufacturing industries and construction at 15.6 percent and other sectors at 10.3 percent. Fugitive emissions only accounted for 0.1 percent. The energy sector contributed 68.7 percent of the 2010 inventory or about for 53,107 Gg CO_2-e or 53.1 MTCO2e of GHG emissions.

Table 63. SUMMARY OF GHG EMISSIONS OF THE ENERGY SECTOR (Gg CO2-E), 2010

Source Categories		Carbon Dioxide (CO_2)	Methane (CH_4)	Nitrous Oxide (N_2O)	Total Emissions	
		GgCO2-e	GgCO2-e	GgCO2-e	GgCO2-e	%
1. Energy		**74,425**	**2,013**	**851**	**77,289**	**100.0**
A.	**Fuel Combustion**	**74,411**	**1,922**	**851**	**77,184**	**99.9**
1	**Energy Industries**	**32,803**	**49**	**168**	**33,020**	**42.7**
	Electricity Production	31,716	48	165	31,929	
	Petroleum Refining	1,087	1	2	1,091	
2	**Manufacturing Industries and Construction**	**11,887**	**55**	**95**	**12,038**	**15.6**
3	**Transport**	**23,725**	**125**	**332**	**24,182**	**31.3**
	Civil Aviation (Domestic)	706	0	6	712	
	Road Transportation	20,816	120	308	21,243	
	Railways	7	0	1	8	
	Water-borne Navigation (Domestic)	2,196	5	17	2,218	
4	**Other sectors**	**5995**	**1692**	**257**	**7,944**	**10.3**
	Commercial/Institutional	2,845	91	16	2,952	
	Residential	2,504	1599	239	4,342	
	Agriculture/Forestry/ Fishing/Fish Farms	645	2	2	649	
B.	**Fugitive Emissions from fuels**	**14**	**91**	**0**	**105**	**0.1**

Bulk of the energy industries' emissions came from electricity production equivalent to 96.7 percent of the total GHG emission. For transport, road use contributed 87.8 percent of the sector's emissions, while the residential utilization of fuel accounted more than half of the emissions of the "other sectors" followed by the commercial/institutional users at 37.2 percent.

With the energy sector's 2010 GHG emissions base year already determined together with the key parameters and macroeconomic assumptions used in the *Energy Supply and Demand Outlook*, the foundations of the energy sector's NDC have been defined. The NDC utilizes the results of the projections found on Total Final Energy Consumption, Power Supply and Demand Outlook, and the Total Final Energy Supply, excluding the transport sector (with separate sectoral NDC).

The Reference Scenario of the PEP serves as the Business-As-Usual (BAU) Scenario of the NDC, which incorporates existing policies and programs on renewable energy, alternative fuels, energy efficiency including the committed and indicative power projects. It also incorporates the Asia-Pacific Economic Cooperation's (APEC) aspirational target to reduce aggregate energy intensity by 25.0 percent in 2030 to 45.0 percent by 2035 from the 2005 level. Thus, the BAU Scenario already covers the unconditional targets of the energy sector's NDC.

Sustaining the said programs in the BAU scenario while improving energy security and enhancing the sector's resilience are the key drivers of the CES, which targets to maintain at least 35.0 percent of renewable energy share in the capacity and generation mix. The CES likewise allows the entry of highly efficient and emerging technologies, electric vehicles, and use of natural gas in other sectors.

Table 64. GHG EMISSIONS HIGHLIGHT YEARS

	2010	2020	2025	2030	2035	2040	Total
BAU	**76.8**	**109.1**	**148.6**	**187.5**	**246.2**	**339.5**	**4,242.6**
Natural Gas	7.1	7.8	6.4	5.6	15.7	26.3	226.9
Coal	27.8	81.7	116.6	149.2	188.2	257.3	3,292.0
Oil	41.9	19.5	25.5	32.6	42.3	55.9	723.8
CES	**76.8**	**108.0**	**150.6**	**182.0**	**207.0**	**246.7**	**3,762.4**
Natural Gas	7.1	7.1	7.9	9.1	15.5	37.2	292.0
Coal	27.8	82.6	119.5	143.7	153.7	159.4	2,819.0
Oil	41.9	18.4	23.2	29.2	37.7	50.1	651.4

Note: Exclude Transport Sector GHG emissions

From 2020 to 2040, the GHG emissions from CES reaches 3,762.4 MTCO2e, about 11.0 percent lower than BAU with 4,242.6 MTCO2e, an avoidance of 480.2 MTCO2-e. With increased utilization natural gas, its emission increases over the planning period, but being offset by the emission reduction from decreased coal and oil utilization. Most of the emission reduction comes from the decreased utilization of coal in the electricity generation.

The required build cost (capital investment) for additional generating capacity under the BAU amounts to USD 102.3 billion. A much higher investment is needed for CES with an average of USD 5.8 billion per year or a total of USD 121.1 billion for the generating capacity, up by 18.0 percent from BAU. About two-third of the CES investment is allotted for the installation of 44,761 MW of new renewable energy capacity from 2020-2040. System cost (i.e., reliability, transmission and storage costs) needs to be factored in to provide for a more complete investment requirement to achieve the said target. The cost of other mitigation actions included in energy efficiency and alternative fuels plans and programs also needs to be studied to determine the total mitigation cost of the NDC.

Table 65. BUILD COST OF THE SCENARIOS (in Billion USD)

	2020	2021-2025	2026-2030	2031-2035	2036-2040	Total
BAU/REF	7.0	13.8	34.0	20.6	27.0	**102.3**
CES	8.0	14.7	36.1	30.2	32.1	**121.1**

The GHG emission avoidance/reduction is aggregated for all mitigation measures to provide for flexibility in terms of implementation. The energy sector likewise maintains that the NDC targets can only be realized if the necessary financing, technology and capability are provided to the stakeholders together with new and enhanced policies, programs and projects, as well as the institutionalization of the necessary enabling environments. Thus, the energy sector's NDC target remains to be conditional. Further, the adaptation strategies of the energy sector should also be valued with estimated investment requirements to be incorporated in the NDC.