14. Standard indicator reference and typical lessons learned (Energy)

Mid-term sub-targets corresponding to models in this reference

Model name	Corresponding mid-term sub-targets
Model (1) Human resources development for operation and maintenance of power facilities	Human resources development for operation and maintenance of power facilities
Model (2) Establishment of electric power technical standards	Establishment of electric power technical standards
Model (3) Improvement of access to energy	・ Extension of power transmission and distribution lines ・ Off-grid electrification using renewable energy
Model (4) Geothermal development	Geothermal development
Model (5) Energy conservation on the demand side	Energy efficiency and conservation on the demand side

(Note) The above-listed models were defined in 2015. Meanwhile, it is desirable to take measures in line with the recent global trends of the SDGs and the Paris Agreement (climate change). Therefore, project officers should take into account the reference indicators written in blue when setting indicators for each project.

JICA standard indicator reference and typical lessons learned in technical cooperation projects (Energy)
Model (1) Human resources development for operation and maintenance of power facilities

Development strategic objective	Mid-term objective	Indicators at a program goal level / UN-SDG indicators (written in blue)	Mid-term sub-target	Overall goals/Project purposes and indicator examples	Methods/Policies for setting indicators	Typical lessons learned	Example of project purpose (image of projects)	Reference projects
Development strategic objective	**Development thematic issue level to which the cooperation program corresponds**	**Connection with the target years or indicators in sector/regional development plans by the recipient country's government**	**Level of thematic issue to solve in individual projects**	**By/through . . . (output) To . . . (outcome) Thereby contributing to (impact) Indicator examples**	**Ways of thinking, points to remember, and important points in setting indicators**	**Write in lessons and risks to be necessarily used or reflected in implementing projects corresponding to the "mid-term sub-targets" from the perspectives of 1) planning stages and 2) management.**	**Examples of project purpose (image of projects)**	**Project information with good practices to refer to**
Low-cost, low-carbon, and low-risk energy supply	Improve upper-level energy policies	(1) Availability factor (%) (2) Net Electric Energy Production (GWh/year) (3) Electrification Rate of Households (%) or number of electrified households (households) (4) System Average Interruption Frequency Index (SAIFI) or System Average Interruption Duration Index (SAIDI) (5) Distribution loss (%) [Reference] SDG Indicator 7.1.1 Proportion of population with access to electricity SDG Indicator 7.1.2 Proportion of population with primary reliance on clean fuels and technology SDG Indicator 7.2.1 Renewable energy share in the total final energy consumption SDG Indicator 7.3.1 Energy intensity measured in terms of primary energy and GDP	Human resources development for operation and maintenance of power facilities	(Example of logic models) To enhance the capacity of technical staff involved in operation and maintenance of power generation / transmission and distribution systems / <in the case of outsourcing maintenance work> to enhance capacity to contract out and monitor maintenance work, (Outcome) By establishing a systematic training system for XXX Electric Power Company / XXX Regional Electric Power Technical Training Center, (Output) Thereby contributing to improving the operation and maintenance of XXX Electric Power Company's / regional electrical infrastructure. (Impact)	Given both the high demand for operation and maintenance personnel in the power sector and the limited human and financial resources, support should be focused on developing regional hubs (e.g. regional training centers for electricity technicians). In some countries suffering from a chronic lack of human resources, such as sub-Saharan African countries and countries under reconstruction, it is desirable to outsource operation and maintenance instead of doing the work in-house, support should be focused on strengthening outsourcing and monitoring capacity.	・ Importance of establishing a systematic training system for organizational capacity development When a technical cooperation project is aimed at only organizational capacity development, training implemented by Japanese experts is not enough to achieve the project purpose since individual knowledge and skill development does not necessarily lead to organizational capacity development. Such projects should not focus on training for individuals but should work to establish a systematic training system, including training evaluation / feedback mechanisms to assess the effects of training on both individual and organizational performance. (Quoted from Reference Project 23. listed on the right)	By formulating systematic training methods for Energy, Water and Sanitation Authority (EWSA), building capacity to create and maintain the distribution system database, improving the capacity of power distribution technical staff, improving the capacity of power transmission technical staff, and improving the capacity of power generation technical staff, this project aims to improve the human resource development system for operation and maintenance of power facilities, thereby contributing to improving the operation and maintenance of power facilities of EWSA.	23. The Project for Capacity Building for Efficient Power System in Rwanda (Term of Cooperation: March 2011 – March 2014)

		[Reference] Japanese Government's SDGs Implementation Guiding Principles Indicator: (1) Over five years from fiscal 2017 to fiscal 2021, develop human resources (2,000 people) who can contribute to the stable supply of modern energy and to greater access to such energy in developing countries. (2) Number of projects made in consideration of SDGs (Note: the common indicator for all fields and thematic issues) [Reference] JICA's 4th Medium-term Objective Indicators: (1) Estimated number of beneficiaries from electrification, increased power supply, stable power supply, etc. (2) Number of quality training courses held in the energy sector (Of which the number of training courses held through the Kizuna Program) (3) Number of new projects for power development to supply low-cost, low-carbon, and low-risk electricity	(Standard indicator examples) 1. Examples of indicators for the overall goal (Basic) (1) Availability factor will increase by X% (2) The annual net electric energy production will increase by X GWh. (3) The number of electrified households will increase by X households. (4) The SAIFI / SAIDI will decrease by X interruptions / X hours. (5) The transmission and distribution losses will decrease by X%.			By analyzing the current situation of operation and maintenance of distribution systems and identifying training needs, improving training for Electricity Company of Ghana (ECG) and third-country technicians, implementing training for ECG and third-country engineers, and improving the monitoring and management capacity of ECG's training center, this project aims to strengthen training capacity for operation and maintenance of power distribution systems for ECG and third-country electric utilities, thereby contributing to improving operation and maintenance of power distribution systems by ECG and third-country electric utilities.	24. The Project on Electrical Engineers Training for African Countries (EETA) in Ghana (Term of Cooperation: November 2010 – July 2016)

				2. Examples of indicators for the project purpose (1) A training system (including curriculums, training materials, practical training equipment, instructors, and budgets) will be established for XXX Electric Power Company / XXX Regional Electric Power Technical Training Center. (2) XXX Electric Power Company will be able to develop an operation and maintenance plan by itself. (3) XXX Electric Power Company will be able to implement the operation and maintenance plan by itself. (4) <In the case of outsourcing maintenance work> XXX Electric Power Company will become able to contract out and monitor maintenance work by itself. (5) More than X trainers will be certified to train staff at XXX Electric Power Company / XXX Regional Electric Power Technical Training Center. (6) At least X% of the participants will be satisfied with training contents / materials. (7) Number of field technician staff trained (8) Number of training materials developed / improved (9) Number of training courses added / improved (10) Enhancement of knowledge, skills (to be measured through tests), and awareness (to be measured through questionnaires) of operation and maintenance among field technician staff (11) Application of training results on the workplace (several months after training; to be measured through questionnaires) (Supplementary) (1) Internal training on (the subject of) XXX will have been held at least X times by the end of the project. (2) Practical training / OJT on (the subject of) XXX will have been launched by the end of the project. (3) At least X evaluation reports will be made on the training subjects, and a mechanism will be established to apply feedback to future training programs.		Although it is important to conduct detailed investigations to develop a project plan prior to the commencement of the project, it is difficult to collect all the necessary information for project planning in advance. Therefore, projects should be implemented as planned and modified as needed to increase their effectiveness and impact. When there is a need to change the project plan and implementation process, all relevant parties should discuss and revise the project plan including the project design matrix (PDM). In this project, after the restructuring of the power sector, which had not been anticipated at the project planning stage, local consultants were hired to conduct an additional basic survey since it was determined that a new human resources development plan for the Electricity of Viet Nam (EVN) would be essential to the success of the project. It is essential to add and revise project inputs as needed to ensure the success of the project, instead of sticking to the original plan, as long as these changes are cost efficient. The basic survey in this project is a good example. (Quoted from Reference Project 7. listed on the right)	By establishing a project operation unit, developing training curriculums for Electrical Power College (EPC), developing training materials for EPC, training core instructors capable of instructing operation and maintenance in five technical areas, providing operation and maintenance staff with systematic training courses by core instructors, utilizing the training equipment provided based on the above-mentioned curriculums, and establishing a training system to sustain the above-mentioned outputs, this project aims to enable EPC to continue training for field engineers to provide them with systematic knowledge and skills related to operation and maintenance in five technical areas (thermal power generation, hydropower generation, power transmission, transformation, and distribution), thereby contributing to expanding the training courses developed through this project across the country and enhancing the capacity of field engineers to modernize operation and maintenance.	7. The Project on Instructor Training for Electric Power Sector in Vietnam (Term of Cooperation: March 2001 – March 2006)

						・ Stable electricity supply and economic growth (Please note that this project is intended to support post-conflict reconstruction.) Poverty and unemployment, which had been the structural causes of civil war, remained major challenges, and private sector development as a key driver of growth and employment was a national priority in Sierra Leone. In order to improve the quality of life of citizens and attract private investment including foreign direct investment, a quick recovery of access to stable and affordable electricity is needed, and power supply capacity should be strengthened as early as possible at the reconstruction stage. The recovery of power supply can also be a *visible* peace dividend that will help civil war victims realize that peace has been restored. (Quoted from Reference Project 2.5.) ・ Reduction of power generation costs and transmission and distribution losses Generally speaking, electricity businesses in post-conflict countries cannot raise the electricity tariff and have no choice but to use costly diesel power plants and deteriorated transmission and distribution facilities that cause large power losses. Unreliable supply with frequent power outages and voltage drops makes it even more difficult to collect electricity bills. In the case of national power authorities, this often results in structural deficits and forces the government to choose whether to cover the deficits with national subsidies or stop power supply. Although it is possible to allow independent power producers (IPPs) to sell power when the government-owned power company has limited supply capacity, IPPs have higher business risks and tend to charge much more for their services. Still, the electricity tariff can be kept low by covering the deficits with national subsidies, but it is not sustainable given the tough financial situation after civil war. At this reconstruction stage, priority should be given to financial improvement measures, such as reducing power generation costs and transmission and distribution losses, while covering the costs for operation and maintenance with national subsidies, in order to reduce the government's financial burden and improve the future investment climate. (Quoted from Reference Project 25. listed on the right)	By developing business infrastructure to conduct technical work for diesel power generation facilities and transmission and distribution systems in the Western Area, developing technical and management capacity to operate and maintain power generation facilities in the Western Area, developing technical and management capacity to operate and maintain transmission and distribution systems in the Western Area, and developing technical capacity to plan and manage operation and maintenance work for power generation, transmission, and distribution systems, this project aims to develop the capacity of National Power Authority (NPA) to operate and maintain power supply facilities (diesel power generation facilities and transmission and distribution systems), thereby contributing to improving the power supply service of NPA.	25. The Project for Capacity Development for Maintaining Power Supply Facilities in Sierra Leone (Term of Cooperation: March 2011 – September 2015)
							By establishing a project operation unit, continuing to implement the new curriculum created using the materials developed through past technical cooperation projects based on the needs of the power sector in Vietnam, and enabling the Advanced Center for Training (ACT) to perform tasks as planned in accordance with its management policy, this project aims to develop the ACT as an independent organization to provide training and consulting services in accordance with the human resources development policies and needs of the power sector in Vietnam, thereby contributing to enhancing the capacity of technical staff and managers to modernize operation and maintenance in Vietnam.	40. The Project for the Establishment of Energy Management Training Center (Stage 1) in Vietnam (Term of Cooperation: July 2011 – September 2012)

JICA standard indicator reference and typical lessons learned in technical cooperation projects (Energy)
Model (2) Establishment of electric power technical standards

Development strategic objective	Mid-term objective	Indicators at a program goal level / UN-SDG indicators (written in blue)	Mid-term sub-target	Overall goals/Project purposes and indicator examples	Methods/Policies for setting indicators	Typical lessons learned	Example of project purpose (image of projects)	Reference projects
Development strategic objective	**Development thematic issue level to which the cooperation program corresponds**	**Connection with the target years or indicators in sector/regional development plans by the recipient country's government**	**Level of thematic issue to solve in individual projects**	**By/through . . . (output) To . . . (outcome) Thereby contributing to (impact) Indicator examples**	**Ways of thinking, points to remember, and important points in setting indicators**	**Write in lessons and risks to be necessarily used or reflected in implementing projects corresponding to the "mid-term sub-targets" from the perspectives of 1) planning stages and 2) management.**	**Examples of project purpose (image of projects)**	**Project information with good practices to refer to**
Low-cost, low-carbon, and low-risk energy supply	Improve upper-level energy policies	(1) Maximum output (actual value) (MW) (2) Net electric energy production (annual) (GWh/year) (3) Availability factor (%) (4) Electrification Rate of Households (%) (5) Sales Volume of electricity sold (MWh) (6) Institutionalization of electric power technical standards (7) System Average Interruption Frequency Index (SAIFI) or System Average Interruption Duration Index (SAIDI) per customer [Reference] SDG Indicator 7.1.1 Proportion of population with access to electricity SDG Indicator 7.1.2 Proportion of population with primary reliance on clean fuels and technology SDG Indicator 7.2.1 Renewable energy share in the total final energy consumption SDG Indicator 7.3.1 Energy intensity measured in terms of primary energy and GDP	Establishment of electric power technical standards	(Example of logic models) To develop human resources to develop and implement electric power technical standards in XXX (Country) and to enforce the electric power technical standards on administrative authorities and electric utilities, (Outcome) By upgrading the knowledge and skills of staff of the electricity regulatory authority and the electric power company to provide appropriate training on the implementation of electric power technical standards, (Output) Thereby contributing to the institutionalization and implementation of the electric power technical standards in XXX (Country) and safe and stable power supply in XXX (Country) (Impact) (Standard indicator examples) 1. Examples of indicators for the overall goal (Basic) (1) The electric power technical standards will be institutionalized in XXX (Country). (2) The SAIFI / SAIDI per customer will decrease. (3) Total number of unplanned electricity outages (4) Number of 1MW or larger power plants to which the electric power technical standards have been applied and for which any necessary action has been taken (5) Number of accident databases developed and analyzed based on the electric power technical standards (The number of cities that have developed databases will increase from the target set for the project purpose) (Supplementary) (1) Total number of power facilities licensed by the energy management authority		・ Strong support from Japan The outcome of this project was largely attributed to close and intensive support from the Supporting Committee mainly consisting of Japanese electric power companies. Moreover, technical advice was provided by the Nuclear and Industrial Safety Agency of the Ministry of Economy, Trade and Industry. Japan Electric Power Information Center (JEPIC), which served as the secretariat of the Committee, coordinated stakeholders to support the implementation of the project. (Quoted from Reference Project 5. listed on the right) ・ The establishment of a new organization should not be used as an indicator for project evaluation. The establishment of a regulatory unit had been set as an indicator for the outputs of this project but could not be fully used because organizational restructuring involved personnel matters subject to the discretion of the recipient government. Consequently, this project wasted much time and energy on persuading the Lao Government and the Ministry of Energy and Mines (MEM) to establish the regulatory unit. According to the PCM manual of JICA, organizational restructuring should have been defined as an external factor that may affect the project. Based on the lesson learned from this project, it is recommended that even when there is a need to establish a new organization, the project scope should be limited to activities such as providing advice and suggestions. (Quoted from Reference Project 6. listed on the right)	By collecting necessary information for developing a Lao Electric Power Technical Standard (LEPTS), mastering the necessary techniques for establishing / maintaining the LEPTS, enabling administrative officers to understand the contents of the LEPTS as required, and raising awareness of the LEPTS, this project aims to develop human resources to establish / maintain the LEPTS, thereby contributing to enacting the LEPTS. By developing complementary guidelines and manuals relating to the Lao Electric Power Technical Standard (LETS), upgrading the knowledge and skills of staff of the Department of Electricity (DOE) and the Electricité du Laos (EDL) through on-the-job training to provide appropriate training on the implementation of the LETS, enabling DOE staff to obtain the knowledge and skills necessary to be an inspector and transfer the knowledge and skills to staff of the Provincial Department of Industry and Handicrafts (PDIH), enabling EDL engineers to obtain the knowledge and skills necessary to apply the LETS to their work, establishing a management structure for the LETS, and raising awareness of the LETS not only among administrative authorities and electric power utilities but also among other stakeholders in the power sector, this project aims to enforce the LETS in the public and private sectors, thereby contributing to improving the safety of activities and facilities in the power sector.	5. The Project on Electric Power Technical Standard Establishment Project in Laos (Term of Cooperation: May 2000 – April 2003) 6. The Project for Lao Electric Power Technical Standard Promotion in Laos (Term of Cooperation: January 2005 – January 2008)

		[Reference] Japanese Government's SDGs Implementation Guiding Principles Indicator: (1) Over five years from fiscal 2017 to fiscal 2021, develop human resources (2,000 people) who can contribute to the stable supply of modern energy and to greater access to such energy in developing countries. (2) Number of projects made in consideration of SDGs (Note: the common indicator for all fields and thematic issues)		2. Examples of indicators for the project purpose (Basic) (1) Electric power technical standards are in XXX (Country). (2) Number of newly developed power facilities that have met the electric power technical standards (3) Number of 2MW or larger existing power plants to which the electric power technical standards have been applied and for which any necessary action has been taken (3) Number of 115kV transmission lines and substations in the project area that have met the electric power technical standards (4) Number of distribution lines in the project area that have met the electric power technical standards (5) Number of accident databases developed and analyzed based on the electric power technical standards (Supplementary) (1) Guidelines for electric power technical standards will be submitted to the Ministry of XXX. (2) Technical guidance will be given (more often) to electric utilities. (3) The electric power technical standards of the Ministry of XXX will have been enacted as a ministerial ordinance by the year-end of XXXX. (4) New power facilities will be designed and approved in accordance with the electric power technical standards. (5) Completion inspections will be conducted for newly constructed power facilities in accordance with the electric power technical standards. (6) Regular inspections will be conducted by agents to review the operation and maintenance of power facilities in accordance with the electric power technical standards of the Ministry of XXX and reported to the Ministry of XXX.	・ Requirements for project implementing agencies This project was successfully implemented in accordance with the PDM, mainly because the implementing agency had the following characteristics. - Strong commitment of top management to the project - Devotion of project counterparts to the project activities - Sufficient budget to cover local costs - Sufficient budget to cover personnel costs for project counterparts to ensure their devotion to the project activities - High relevance between the project activities and daily work - Technically competent human resources - Well-developed ICT (information and communication technology) infrastructure The above-listed factors should be taken into account when planning / formulating a new project. (Quoted from Reference Project 4. listed on the right)	By clarifying rules regarding the General Requirements of the Electric Power Technical Standards, facilitating the authorization and licensing of power suppliers, and upgrading knowledge and skills to guide licensees, this project aims to have the Electric Power Technical Standards managed effectively and properly by the Electricity Authority of Cambodia (EAC), thereby contributing to stable and safe power supply in Cambodia.	4. The Project on Capacity and Institutional Building of the Electric Power Sector in Cambodia (Term of Cooperation: September 2004 – September 2007)
		[Reference] JICA's 4th Medium-term Objective Indicators: (1) Estimated number of beneficiaries from electrification, increased power supply, stable power supply, etc. (2) Number of quality training courses held in the energy sector (Of which the number of training courses held through the Kizuna Program) (3) Number of new projects for power development to supply low-cost, low-carbon, and low-risk electricity			・ Importance of the ownership-based approach to technical cooperation aimed at legal system development including technical standards / compulsory regulations In countries with an adequate pool of skilled labor, competent local human resources should be mobilized and used to ensure the effective implementation of technical cooperation aimed at legal system development including technical regulations. Moreover, in non-English speaking countries like Vietnam, legal documents are written in their official language, and it is often difficult for JICA to assign Japanese experts with sufficient knowledge of the local language to draft legal documents. On the other hand, local experts do not have enough knowledge or experience to introduce new technologies or systems. Therefore, it is preferable that Japanese experts provide technical advice and local experts, including local consultants, draft legal documents. Such effective mobilization of local human resources can not only enable the recipient government to take more advantage of technical support from Japanese experts but also enhance local ownership, which can maximize the effectiveness and sustainability of the technical cooperation project. (Quoted from Reference Project 20. listed on the right)	By developing a review report on the existing technical regulations, developing a draft of electric power technical standards, and developing a draft of guidelines for the electric power technical standards, this project aims to have the electric power technical standards and guidelines authorized by the Vietnamese authorities, thereby contributing to enforcing the electric power technical standards and guidelines to improve the reliability and safety of power supply in Vietnam.	20. The Electric Power Technical Standards Promotion Project in Vietnam (Term of Cooperation: March 2010 – June 2013)
					・ Technical cooperation approaches This project placed the most importance on strengthening the practical capacity of counterparts using the outcomes of previous projects. The JICA Expert Team confined themselves to developing an inspection framework and providing advice to their counterparts throughout the project period, which enhanced the ownership of the counterparts. On the other hand, there was room for improvement to build a trust relationship between Japanese experts and their counterparts. For example, due to personnel reassignment, the number of Japanese experts increased to 16, and they made a cumulative total of 87 trips. Though this was inevitable because these Japanese experts were assigned on a contract basis, it is desirable to prevent the recurrence of similar problems, for example by concluding a memorandum of understanding at the beginning of a project. (Quoted from Reference Project 22. listed on the right)	By enhancing the examination and inspection capacity of the Department of Energy Management (DEM), enhancing the capacity of the DEM to supervise the Provincial Department of Energy and Mines (PDEM), and improving the understanding of the Lao Electric Power Technical Standard (LEPTS) among stakeholders in target provinces, this project aims to strengthen the regulatory function of the electric power sector, thereby contributing to increasing the number of electric power facilities that meet the LEPTS and ensuring stable power supply.	22. The Project for the Improvement of Power Sector Management in Laos (Term of Cooperation: August 2010 – March 2013)

						・All project counterparts translated the draft of the Lao Electric Power Technical Standard (LEPTS) from English to Lao, which enhanced their understanding of the draft LEPTS. This resulted in the standardization of electrical terminology and the enactment of the LEPTS. ・Lesson learned 4 Technical cooperation for the development and implementation of electric power technical standards should be divided into two phases: enactment and enforcement. In the enactment phase, however, electrical power technical standards should be drafted with an eye towards enforcement. ・Lesson learned 7 Performance standards are not enough in many developing countries. (In countries that will develop electric power technical standards and improve technical levels, developing compulsory performance standards is not enough, unlike in developed countries. It is critical to develop and enact guidelines on these standards, including numerical limits, like Japan's Interpretation of Technical Standards for Electrical Facilities.) ・Lesson learned 8 In general, projects aimed to develop electric power technical standards include technical transfer through on-the-job training in parallel with drafting the standards. The most effective way is to have project counterparts explain the standards at internal and external briefings and seminars. However, because this approach is unlikely to be sufficient to put the standards into practice, additional technical transfer is needed in the enforcement phase. It is also essential to examine the necessity of developing a certification system based on the situation of each country. ・Lesson learned 9 As for technical transfer for enforcement of electric power technical standards, it can be effective to provide practical experience, such as practical training and field inspections to check compliance with the standards. ・Lesson learned 12 It is effective to involve all the three parties, the competent ministry, the regulatory authority, and the business operator, in the project, whether the project is in the enactment or enforcement phase. Especially, in the enforcement phase, it is preferable to involve the regulatory authority and business operator in the project. The existence (or establishment) of a regulatory authority can also enhance sustainability. (Quoted from the Report on the Comprehensive Analysis of Electric Power Technical Standards in the Asian Region (January 2008))		

JICA standard indicator reference and typical lessons learned in technical cooperation projects (Energy)
Model (3) Improvement of access to energy

Development strategic objective	Mid-term objective	Indicators at a program goal level / UN-SDG indicators (written in blue)	Mid-term sub-target	Overall goals/Project purposes and indicator examples	Methods/Policies for setting indicators	Typical lessons learned	Example of project purpose (image of projects)	Reference projects
Development strategic objective	**Development thematic issue level to which the cooperation program corresponds**	**Connection with the target years or indicators in sector/regional development plans by the recipient country's government**	**Level of thematic issue to solve in individual projects**	**By/through . . . (output) To . . . (outcome) Thereby contributing to (impact) Indicator examples**	**Ways of thinking, points to remember, and important points in setting indicators**	**Write in lessons and risks to be necessarily used or reflected in implementing projects corresponding to the "mid-term sub-targets" from the perspectives of 1) planning stages and 2) management.**	**Examples of project purpose (image of projects)**	**Project information with good practices to refer to**
Low-cost, low-carbon, and low-risk energy supply	Improve energy access	(1) Electrification Rate of Households (%) [Reference] SDG Indicator 7.1.1 Proportion of population with access to electricity SDG Indicator 7.1.2 Proportion of population with primary reliance on clean fuels and technology SDG Indicator 7.2.1 Renewable energy share in the total final energy consumption SDG Indicator 7.3.1 Energy intensity measured in terms of primary energy and GDP [Reference] Japanese Government's SDGs Implementation Guiding Principles Indicator: (1) Over five years from fiscal 2017 to fiscal 2021, develop human resources (2,000 people) who can contribute to the stable supply of modern energy and to greater access to such energy in developing countries. (2) Number of projects made in consideration of SDGs (Note: the common indicator for all fields and thematic issues) [Reference] JICA's 4th Medium-term Objective Indicators: (1) Estimated number of beneficiaries from electrification, increased power supply, stable power supply, etc. (2) Number of quality training courses held in the energy sector (Of which the number of training courses held through the Kizuna Program) (3) Number of new projects for power development to supply low-cost, low-carbon, and low-risk electricity	・ Extension of power transmission and distribution lines ・ Off-grid electrification using renewable energy	(Example of logic models) To enhance the capacity of relevant ministries to formulate and implement rural electrification programs in XXX (Country), (Outcome) By developing policies and procedures on the promotion of rural electrification by extending transmission and distribution lines and using renewable energy sources and enhancing their operation and maintenance and technical capacity, (Output) Thereby contributing to increasing the electrification rate by extending transmission and distribution lines and using renewable energy sources. (Impact) (Standard indicator examples) 1. Examples of indicators for the overall goal (Basic) (1) Electrification rate per community will reach X% by XXXX (Year) (2) Electrification rate of households will reach X% by XXXX (Year) (Supplementary) (1) At least XX micro-business hubs (e.g. public facilities and community centers) will gain access to electricity from renewable energy sources as a result of applying the model developed through this project.		・ When designing a project, it is important to take into full consideration the steps needed to take to achieve the overall goal and project purpose. More specifically, it is essential to (1) set a practical project purpose and overall goal as well as measurable indicators to evaluate their achievement; (2) validate the causal relationship between the project purpose and the overall goal; and (3) ensure consistency among the project activities (e.g. developing manuals). (Quoted from Reference Project 1. listed on the right)	By transferring and enhancing knowledge and skills on micro hydropower and photovoltaic technology, transferring and enhancing knowledge and skills on social preparation, and setting up policies and procedures to promote and manage renewable energy-based rural electrification projects, this project aims to enhance the capacity of the target group to promote and manage renewable energy-based village electrification projects, thereby contributing to successful implementation of village electrification under the Expanded Rural Electrification Program. By developing a practical model for photovoltaic electrification of health service institutions in non-electrified areas through pilot projects, developing a practical model for photovoltaic electrification of schools in non-electrified areas through pilot projects, developing a practical model for renewable energy-based electrification of micro-business hubs (facilities used for production activities), such as community centers, in non-electrified areas through pilot projects, and suggesting the policy and institutional frameworks necessary to promote the renewable energy-based rural electrification models in Kenya, this project aims to establish a rural electrification model using renewable energy in non-electrified areas and increase the electrification rate of public institutions, etc., thereby contributing to spreading the renewable energy-based rural electrification model across the country and increasing the electrification rate of public institutions to improve the quality of life of Kenyan people.	1. The Project on Sustainability Improvement of Renewable Energy Development in Village Electrification in the Philippines (Term of Cooperation: June 2004 – July 2009) 27. The Project for Establishment of Rural Electrification Model Using Renewable Energy in Kenya (Term of Cooperation: March 2012 – February 2015)

				2. Examples of indicators for the project purpose (Basic) (1) At least X% of the renewable energy power plants developed through this project will be in operation by the end of the project. (2) Annual operation plans developed by the competent ministry will be properly implemented, and the electrification rate targets of these plans will be achieved. (Supplementary) (1) The guidelines and manuals on the practical renewable energy-based rural electrification model will be adopted by the executive board of the rural electrification authority and the ministry of energy. (2) Advice will be provided to relevant organizations on policy and institutional framework development to promote the model. (3) The project outputs (e.g. the model established and the policies and systems proposed by this project) will be consolidated into the rural electrification master plan. (4) Energy costs for micro-business hubs (e.g. public facilities and community centers) in the pilot project areas and their communities will be reduced by XX%. (5) The satisfaction level of users of micro-business hubs (e.g. public facilities and community centers) with energy use in the pilot project areas and their communities will increase. (6) The renewable energy facilities and equipment installed through this project will be properly operated and maintained.	・ Importance of continuity and commitment The Government of Japan had been supporting rural electrification in Malawi for 10 years since 1999, using various schemes of cooperation (e.g. debt relief grants to support the Malawi Rural Electrification Programme (MAREP), long-term experts (rural electrification advisors), development studies to develop a rural electrification master plan, grant aid for grassroots human security projects to provide photovoltaic systems, senior volunteers to support the operation and maintenance of photovoltaic systems, training in Japan, and third-country training). The first long-term expert assigned in 1999 mainly focused on defining a course of action and specific approaches to power sector development. Based on his proposals, JICA continued to dispatch experts and use other cooperation schemes as necessary. The latest three-year technical cooperation project, launched in December 2006 as an extension of the continued support, fulfilled its role to bring all the support efforts to a successful completion. The 10-year support covered a wide range of activities needed for rural electrification, including policymaking, master plan development, feasibility studies, and specific technical guidance. This continued support is considered to have had a positive effect on the power sector. Some of the suggestions made through the master plan study and the following follow-up studies were incorporated into legal regulations to improve power sector governance and facilitate rural electrification in Malawi. At the same time, grant aid for grassroots projects and other support were provided to promote rural electrification in Malawi. Technical issues were identified through the grant aid project and solved through this technical cooperation project. Thus, the 10-year technical cooperation with Malawi was a good example that proved the positive effect of continued and comprehensive support combining soft and hard components on capacity building. (Quoted from Reference Project 13. listed on the right)	Through the Fifth Malawi Rural Electrification Programme (MAREP), improving capacity to manage the contract on the planning and implementation of the MAREP, improving the technical capacity of inspectors and trainers for photovoltaic systems, developing and maintaining the financial management capacity of the Renewable Energy Fund (REF), and developing and maintaining the administration and management capacity of the Rural Electrification Division (RED), the Department of Energy Affairs (DOE), the Ministry of Natural Resources, Energy and Environment (MNREE), this project aims to enhance and improve capacity to plan and implement the MAREP, thereby contributing to increasing the electrification rate of households by extending distribution lines and disseminating photovoltaic systems.	13. The Malawi Rural Electrification Promotion Project (Term of Cooperation: December 2006 – December 2009)

						・ Clear definition of roles and responsibilities of Japanese experts In this project, Japanese experts were assigned in a different way than in typical technical cooperation projects, which considerably compromised the efficiency of the project. The rural electrification advisor and the project coordinator were assigned based on separate contracts with JICA. The short-term experts were hired as a team under a single contract with JICA. There was no umbrella contract that covered these three contracts. This was a desperate measure resorted to in order to address the shortage of human resources in this sector. However, in this case, the roles and responsibilities of experts should have been defined clearly in written documents. Their roles and responsibilities should have been stipulated in detail in their contract specifications. This lesson learned should be applied to future projects. (Quoted from Reference Project 18. listed on the right)	By developing and enhancing the technical capacity of the Rural Electrification Authority (REA), the Department of Energy (DOE), the Ministry of Energy and Water Development (MEWD), to formulate annual rural electrification plans, enhancing the technical capacity of the REA to implement rural electrification projects, improving and strengthening the project management system of the REA, developing and enhancing the preparation and management capacity of the DOE and the REA to promote photovoltaic systems and the technical cooperation of public agencies and private technical service providers (e.g. Zambia Electricity Supply Corporation (ZESCO)) to install and maintain photovoltaic systems, and developing and enhancing the financial management capacity of the REA to operate the Rural Electrification Fund (REF), this project aims to strengthen the capacity of the DOE and the REA to implement and update the Rural Electrification Master Plan (REMP) of Zambia, thereby contributing to increasing access to electricity in rural areas in accordance with the REMP.	18. The Project for Capacity Development for Rural Electrification in Zambia (Term of Cooperation: August 2009 – December 2013)
						・ Project implementation structure Long-term expert, who served as a facilitator, collected and analyzed information on relevant organizations and then developed training programs and assigned trainers to meet the needs of counterparts. The project team consisting of a long-term expert and Japanese and third-country short-term experts facilitated needs-based activities and promoted the smooth implementation of the project as a whole. (Quoted from Reference Project 32. listed on the right)	By preparing a comprehensive training program with focus on rural power supply based on institutional assessment, improving training equipment for rural power supply, preparing guidelines and manuals for rural power supply, increasing the knowledge and skills of trainees for rural power supply, improving the capacity of training facility trainers for rural power supply, and developing a model scheme of local technical support for solar power systems, this project aims to develop the technical and institutional capacity of Bhutan Power Corporation (BPC) and the Department of Energy (DOE), the Ministry of Economic Affairs, to enhance efficiency in delivering rural power supply, thereby contributing to enhancing electricity service delivery in rural areas.	32. The Project for Improvement of Efficiency for Rural Power Supply in Bhutan (Term of Cooperation: June 2008 – June 2011)

						The project was implemented by a team consisting of one long-term expert (directly assigned by JICA) and 14 short-term experts (assigned on a contract basis). The long-term expert was stationed at Bhutan Power Corporation (BPC) throughout the project period to have close communications with BPC staff. On the other hand, the short-term experts worked on technical transfer at BPC for about two weeks every two months. As for the priority issue (PI) activities on which the project put a particular emphasis, BPC staff took the initiative in analyzing issues, developing plans, and drafting proposals while receiving guidance from short-term experts. Despite concerns that BPC staff's activities would be delayed while there were no short-term experts, the project turned out to be efficient because the long-term expert stationed at BPC got the activities done efficiently by frequently monitoring their progress, consulting short-term experts via email, and providing appropriate advice to BPC staff. (Quoted from Reference Project 39. listed on the right) Although there was no umbrella contract covering the long and short-term experts in either phase of the project, their contract specifications stated that they "shall work collaboratively [with each other]." Therefore, the long and short-term experts could understand their mutual roles, build a collaborative relationship through information sharing, and work in harmony. (Quoted from Reference Projects 32 and 39. listed on the right) ・ Input of third-country experts for solar power training (south-south cooperation) The contribution by Filipino experts specialized in solar power generation who were trained through a village electrification project implemented by JICA in the Philippines (Reference Project 1. listed on the right) was highly appreciated. Because photovoltaic systems used for rural electrification in developing countries are different from those used in Japan and other developed countries, it was appropriate to ask Filipino experts to provide training. In fact, these third-country experts dispatched from the Philippines to Bhutan through collaboration among several departments of JICA (Industrial Development Department, JICA Bhutan Office, and JICA Philippines Office) increased the effectiveness of the project in terms of technical aspects, instructional methods, and cost efficiency. This is a good practice to follow in similar projects. (Quoted from Reference Project 32. listed on the right)	By enhancing capacity to address priority issues related to the operation and maintenance of rural power supply equipment, preparing operation and maintenance manuals for rural power supply, and upgrading the training capacity of BPC Central Maintenance and Training Division (CMTD), Begana, to improve the operation and maintenance of power distribution systems, this project aims to enhance the operation and maintenance capacity of BPC for rural power supply, thereby contributing to enhancing the efficiency of rural power supply.	39. The Project for Improvement of Efficiency for Rural Power Supply Phase II in Bhutan (Term of Cooperation: March 2012 – September 2014)

							・ Commitment of the recipient government to the project One of the problems with the research and development (R&D) component was the limited participation of counterparts. This evaluation showed that because their department faculty were not informed that their participation in collaborative research would contribute to the university, the project was not fully understood or supported by the faculty. If counterparts had been approved by their department faculty to participate in collaborative research in advance, it would have been easier for them to participate in the project. Thus, a lesson was learned that not only the target department but also all the relevant departments, or the university as a whole, should be involved in the project at the planning stage in order to create a supportive environment for project implementation. ・ Capacity building for photovoltaic (PV) power generation in collaboration with industrial stakeholders As of January 2015, 372 engineers had received solar PV training by certified PV trainers at Technical Training Institute (TTI) and other training institutions. This figure was achieved within two years. This rapid increase in the number of trained engineers was attributed to collaboration with external stakeholders, such as industrial associations. In this partnership, the project provided trainers, training space, and training materials, and industrial associations recruited training participants through their networks. One of the major contributing factors was the networking of training institutions across the country through workshops held to share the results of training needs assessment and receive feedback from stakeholders including industrial associations. Moreover, constant discussions with a wide range of stakeholders allowed the project to deliver effective outcomes with a ripple effect. This is a good practice to follow in similar projects implemented in collaboration with external stakeholders. (Quoted from Reference Project 26. listed on the right) ・ There were cases where the operation of solar home systems (SHSs) ended in a stalemate when their batteries were depleted because their ownership and maintenance responsibilities were not clear. It is therefore recognized that the ownership and maintenance responsibilities of PV systems should be clarified to ensure their sustainability. ・ The PV systems provided by JICA vary in size, ranging from 20 Wp SHSs to several MWp level grid-connected PV power plants, but are always accompanied with intensive capacity building support. In order to ensure proper designing, installation, operation, and maintenance of PV systems, all stakeholders need to know their features. Despite the common belief that PV systems are easy to install, operate, and maintain, their sustainability is significantly compromised unless they and their batteries are properly designed and operated. ・ User education should be designed based on the actual situation of developing countries, such as literacy rates.	By improving the R&D capacity of the Jomo Kenyatta University of Agriculture and Technology (JKUAT) on renewable energy, improving the education activities (lectures, classes, student research activities, etc.) of the JKUAT related to renewable energy through collaborative research, enhancing the training capacity of the JKUAT on renewable energy for rural electrification, and enhancing industry, academia, and government collaboration in rural electrification using renewable energy, this project aims to strengthen the R&D, education, and training capacity of the JKUAT for rural electrification using renewable energy in collaboration with other stakeholders, thereby contributing to strengthening technologies and human resources for rural electrification using renewable energy.	26. The Project for Capacity Development for Promoting Rural Electrification Using Renewable Energy in Kenya (Term of Cooperation: August 2011 – January 2017)

						・When it is intended to install more than 10,000 sets of SHSs per month, the management system should be designed based on that assumption. It is desirable to establish a system that enables the SHS program implementing agency (supervising agency) to manage the database, including information on SHSs used by households, loan repayment, system failures and repairs, and SHS providers, by updating data on a monthly basis and a system to review it on a regular basis and modify the course of action as needed. ・By allowing SHS providers to offer financing services, information on household SHSs and loans can be managed in an integrated way. Moreover, these providers can serve two roles: collecting bills and repairing failures. ・In the case of fixed SHSs, it is necessary to provide systematic training and education programs for technicians and users. The frequency of training should be defined based on the target number of SHSs to be installed. ・The dealer credit model can be effective in disseminating SHSs across broad areas. Because SHS providers are private companies, the program should be designed to create a competitive environment with discretion as well as incentives for disseminating SHSs and providing proper managements services. To this end, the program design should take into account providers' business models and timeframes. Moreover, the combination of PV power supply and financing services can facilitate bill collection. The output-based system can be effective. ・It is desirable that SHS providers can select equipment to be used in the SHS program (in order to enhance their sense of ownership and competition). In order to promote quality management, the supervising agency should establish a technical committee (or outsource that role to a third party) to ensure that only approved equipment will be used. Moreover, the risk of users can be reduced by requiring SHS manufacturers to assure product quality to have their products certified by the program. ・JICA has installed grid-connected PV systems in some 30 countries since 2008. Unlike off-grid PV systems which require batteries, several hundred kWp PV systems were installed and connected to existing power grids, without batteries, and problems were dealt with as they arose. Some JICA projects developed guidelines on grid connection, contributing to infrastructure improvement. Because many of the recipient countries had never connected PV systems to a public grid, JICA assisted them in dealing with technical and institutional problems that hindered grid connection, and most problems, including reverse power flow, were actually solved. It is therefore expected that the privatization of the sector in the near future can go smoothly. (Quoted from the Lessons Learned by JICA on PV Assistance, February 2014)		

JICA standard indicator reference and typical lessons learned in technical cooperation projects (Energy)
Model (4) Geothermal development

Development strategic objective	Mid-term objective	Indicators at a program goal level / UN-SDG indicators (written in blue)	Mid-term sub-target	Overall goals/Project purposes and indicator examples	Methods/Policies for setting indicators	Typical lessons learned	Example of project purpose (image of projects)	Reference projects
Development strategic objective	**Development thematic issue level to which the cooperation program corresponds**	**Connection with the target years or indicators in sector/regional development plans by the recipient country's government**	**Level of thematic issue to solve in individual projects**	**By/through . . . (output) To . . . (outcome) Thereby contributing to (impact) Indicator examples**	**Ways of thinking, points to remember, and important points in setting indicators**	**Write in lessons and risks to be necessarily used or reflected in implementing projects corresponding to the "mid-term sub-targets" from the perspectives of 1) planning stages and 2) management.**	**Examples of project purpose (image of projects)**	**Project information with good practices to refer to**
Low-cost, low-carbon, and low-risk energy supply	Develop power sources to realize a low-carbon society	(1) Geothermal power output (MW) (2) Proved geothermal reserves (MW) (3) Drilling success rate (%) (4) Reduction in development times (hours) (5) Number of steam supply contracts (contracts) [Reference] SDG Indicator 7.1.1 Proportion of population with access to electricity SDG Indicator 7.1.2 Proportion of population with primary reliance on clean fuels and technology SDG Indicator 7.2.1 Renewable energy share in the total final energy consumption SDG Indicator 7.3.1 Energy intensity measured in terms of primary energy and GDP [Reference] Japanese Government's SDGs Implementation Guiding Principles Indicator: (1) Over five years from fiscal 2017 to fiscal 2021, develop human resources (2,000 people) who can contribute to the stable supply of modern energy and to greater access to such energy in developing countries. (2) Number of projects made in consideration of SDGs (Note: the common indicator for all fields and thematic issues) [Reference] JICA's 4th Medium-term Objective Indicators: (1) Estimated number of beneficiaries from electrification, increased power supply, stable power supply, etc. (2) Number of quality training courses held in the energy sector (Of which the number of training courses held through the Kizuna Program) (3) Number of new projects for power development to supply low-cost, low-carbon, and low-risk electricity	Geothermal development	(Example of logic models) To increase the internal rate of return from geothermal development projects, (Outcome) By enhancing the capacity of engineers of the geothermal development company (including accurate geothermal reservoir estimation, drilling success rates and times, geothermal reservoir assessment, steam supply contracts, and outsourcing (exploration, drilling, and assessment)) and the capacity of administrative officials of the ministry of energy to formulate and implement geothermal development policies (including the division of roles between the public and private sectors), (Output) Thereby contributing to promoting geothermal power development in XXX (Country). (Impact) (Standard indicator examples) 1. Examples of indicators for the overall goal (Basic) (1) Geothermal power generation capacity will increase by X MW. (2) X MW of geothermal reserves will have been proved. (3) The geothermal drilling success rate will increase by X%. (4) The time required for development will decrease by X months. (5) At least X steam supply contracts will be concluded.	The geothermal development process consists of surface surveying, test drilling, reservoir assessment, production well drilling / plant construction, and operation and maintenance. In some countries, a part or whole of the development process may be outsourced to private companies (though development tends to be delayed when the entire process is outsourced). It is important to strengthen capacity to contract out and monitor development activities in which the government is not directly involved.	This technical cooperation project focused on enhancing the capacity of Center for Geological Resources (CGR) to perform its regular task of exploring resources, which increased the effectiveness of the project and is expected to enhance its financial and technical sustainability. Thus, given that the counterpart organization has developed policies and budgets for its regular tasks, capacity building related to these tasks is considered to increase effectiveness and sustainability. (Quoted from Reference Project 35. listed on the right)	By empowering the capacity of scientists / engineers of Center for Geological Resources (CGR), Geological Agency (GA), for regional geothermal resource exploration to extract geothermal working areas (wilayah kerja pertambangan: WKP), empowering the capacity of CGR scientists / engineers for detailed geothermal resources exploration to set the WKP, empowering the capacity of CGR scientists / engineers for integrated interpretation, including geothermal modeling, and resource assessment, enabling CRG scientists / engineers to acquire knowledge and skills on geothermal resource exploration using exploratory wells (well drilling, logging, and testing), and understanding technologies and barriers for geothermal resource development through seminars for capacity development and technology sharing and workshops for reporting on the project activities, this project aims to enable GA/CGR to provide geothermal resource information to both the government and geothermal power development companies, thereby contributing to accelerating geothermal power development in Indonesia. (Technical Cooperation Project related to Japanese ODA Loan)	35. The Project for Capacity Building for Enhancement of the Geothermal Exploration Technologies in Indonesia (Term of Cooperation: October 2010 – September 2013) (Technical Cooperation Project related to Japanese ODA Loan)

				2. Examples of indicators for the project purpose (Basic) (1) A training system (including curriculums, training materials, instructors, and budgets) will be established for the geothermal development company. (2) Number of surface surveys conducted using scientific methods (3) Number of geothermal reservoir modeling analyses performed using scientific methods (4) Drilling success rate (5) Drilling time (6) <In the case of outsourcing part of the development work> The geothermal development company will become able to contract out and monitor surface surveys, test drilling, and reservoir assessment by itself. (Supplementary) (1) The relevant ministries and private companies involved in geothermal development will have a common understanding of risk allocation between the public and private sectors to promote geothermal development. (2) The roles and responsibilities of relevant ministries in private sector-led geothermal development schemes will be clearly defined. (3) A production test report will be prepared. (4) Number of accesses to the geothermal data of the geological resources authority (5) An environmental monitoring report will be prepared.		By establishing training programs to develop the capacity of Geothermal Development Company (GDC) staff, improving capacity to develop conceptual models of reservoirs and site successful drilling locations, improving capacity to identify and strike drilling targets, improving capacity to interpret wellbore data, establish calibrated reservoir models, and evaluate geothermal resources, enhancing capacity as a steam provider to prepare economically and environmentally viable business plans, enhancing capacity in multi-purpose use of geothermal energy, and establishing a system for continuous implementation and improvement of training within GDC, this project aims to develop human resources for GDC to mitigate technical risks in geothermal development, thereby contributing to enabling GDC to supply steam to power generation companies.	29. The Project for Capacity Strengthening for Geothermal Development in Kenya (Term of Cooperation: September 2013 – September 2017)
							By reviewing geothermal resources policies, establishing a sustainable management system for the Test Drilling Fund, and enhancing capacity to explore geothermal resources using data from surface surveys and test drilling (targeting and well drilling, logging, and testing), this project aims to validate the geothermal development scheme for private companies to participate in, thereby contributing to promoting medium and long-term geothermal development by the private sector.	28. The Project to Develop Medium and Long Term Geothermal Development Policy in Indonesia (Term of Cooperation: September 2014 – August 2018)

							By strengthening the capacity of National Electricity Company (Empresa Nacional de Electricidad: ENDE) staff for steam test supervision, strengthening the capacity of ENDE staff for environmental monitoring and supervision, promoting the understanding of geothermal development among the Ministry of Hydrocarbon and Energy (MHE) and ENDE, and promoting the understanding of construction of geothermal power plants among the MHE and ENDE, this project aims to strengthen the capacity of ENDE for steam testing and environmental data monitoring for construction of Laguna Colorada Geothermal Power Plant, thereby contributing to mitigating power shortage in Bolivia through the development of Laguna Colorada Geothermal Power Plant.	37. The Preparatory Project for Laguna Colorada Geothermal Power Plant Construction Project in Bolivia (Term of Cooperation: January 2011 – October 2013)

JICA standard indicator reference and typical lessons learned in technical cooperation projects (Energy)
Model (5) Energy conservation on the demand side

Development strategic objective	Mid-term objective	Indicators at a program goal level / UN-SDG indicators (written in blue)	Mid-term sub-target	Overall goals/Project purposes and indicator examples	Methods/Policies for setting indicators	Typical lessons learned	Example of project purpose (image of projects)	Reference projects
Development strategic objective	**Development thematic issue level to which the cooperation program corresponds**	**Connection with the target years or indicators in sector/regional development plans by the recipient country's government**	**Level of thematic issue to solve in individual projects**	**By/through . . . (output) To . . . (outcome) Thereby contributing to (impact) Indicator examples**	**Ways of thinking, points to remember, and important points in setting indicators**	**Write in lessons and risks to be necessarily used or reflected in implementing projects corresponding to the "mid-term sub-targets" from the perspectives of 1) planning stages and 2) management.**	**Examples of project purpose (image of projects)**	**Project information with good practices to refer to**
Low-cost, low-carbon, and low-risk energy supply	Energy efficiency and conservation	(1) Energy intensity (energy consumption per GDP) (2) Specific energy consumption (SEC) of each industrial sector (3) Energy intensity measured in total primary energy supply (X toe/100 million SDR) [Reference] SDG Indicator 7.1.1 Proportion of population with access to electricity SDG Indicator 7.1.2 Proportion of population with primary reliance on clean fuels and technology SDG Indicator 7.2.1 Renewable energy share in the total final energy consumption SDG Indicator 7.3.1 Energy intensity measured in terms of primary energy and GDP [Reference] Japanese Government's SDGs Implementation Guiding Principles Indicator: (1) Over five years from fiscal 2017 to fiscal 2021, develop human resources (2,000 people) who can contribute to the stable supply of modern energy and to greater access to such energy in developing countries. (2) Number of projects made in consideration of SDGs (Note: the common indicator for all fields and thematic issues) [Reference] JICA's 4th Medium-term Objective Indicators: (1) Estimated number of beneficiaries from electrification, increased power supply, stable power supply, etc. (2) Number of quality training courses held in the energy sector (Of which the number of training courses held through the Kizuna Program) (3) Number of new projects for power development to supply low-cost, low-carbon, and low-risk electricity	Energy conservation on the demand side	(Example of logic models) To enhance the capacity of the energy conservation center of XXX (Country) to provide energy audit, policymaking (recommendation and planning), and public relations services, (Outcome) By developing / improving the management and administration structure / training courses of the energy conservation center of XXX (Country) and enabling the energy conservation center of XXX (Country) to assist companies with energy efficiency improvements (Output) Thereby contributing to promoting energy conservation in the industrial sector in XXX (Country) (Impact) (Standard indicator examples) 1. Examples of indicators for the overall goal (Basic) (1) The energy intensity (energy consumption per GDP) of XXX (Country) will improve X% of the XXXX (Year) level by XXXX (Year). (2) Industrial sectors will achieve their specific energy consumption (SEC) reduction targets (X% reduction) by XXXX (Year). (3) The energy intensity of selected factories in priority sectors will decrease by X%. (4) The energy intensity of designated businesses will decrease by X%. (Supplementary) (1) The energy consumption efficiency measured in terms of primary energy will increase by X toe/100 million SDR* by XXXX (Year). * A toe represents the quantity of energy consumption (1 toe = 107 Kcal). SDR stands for Special Drawing Rights set by the IMF. SDR values are calculated as a weighted average of the US dollar, the pound sterling, the Euro, and the Japanese yen. The unit "toe/SDR" is commonly used to measure energy consumption efficiency.		・ Importance of providing long-term, continuous support This project's implementing agency, National Energy Conservation Center, General Directorate of Electrical Power Resources Survey and Development Administration (EIE/NECC), had received support for energy conservation from Japan and other bilateral donors as well as the World Bank, the European Union, and other multilateral donors. The cooperation with Japan dates back to the early 1990s, when EIE/NECC staff attended energy conservation training by the Energy Conservation Center, Japan (ECCJ). Japan carried out several cooperation projects, almost all of which consistently focused on the capacity building of EIE/NECC to strengthen and disseminate energy conservation technology in Turkey. JICA had been providing support to EIE/NECC for years using different cooperation schemes, such as country-focused and group training for EIE/NECC staff in 1995 and development studies. This not only built trust and ownership in EIE/NECC but also allowed all stakeholders to have a comprehensive and common understanding of energy conservation in Japan (in technical, institutional, and social terms including the commitment of industries). This resulted not only in individual capacity building in a narrow sense but also in institutional capacity development of EIE/NECC and system reforms in the country as a whole. (Quoted from Reference Project 10. listed on the right)	By developing an administration and management structure to implement energy conservation activities, enabling counterparts to operate and maintain training facilities and measuring equipment, enabling counterparts to acquire the knowledge and skills necessary for developing energy manager training, developing materials for theoretical and practical energy manager training courses, enabling counterparts to provide factory energy audit and building energy consultation services, and strengthening the capacity of National Energy Conservation Center, General Directorate of Electrical Power Resources Survey and Development Administration, (EIE/NECC) to provide information, public relations, and policy recommendations, this project aims to strengthen the function of EIE/NECC in training, auditing, information provision, public relations, and policy recommendations, thereby contributing to increasing energy efficiency in Turkey through promotion of rational use of energy.	10. The Project on Energy Conservation in Turkey (Term of Cooperation: August 2000 – July 2005)

						・ Legal framework as a prerequisite for implementation of technical cooperation projects JICA's experience in technical cooperation in this field indicates that a combination of regulatory enforcement and economic incentives is the key to energy efficiency and conservation. As mentioned above, energy efficiency and conservation training, which was the main component of this project, was carried out while such training was not legally required. Although the Government of Poland was deliberating on energy conservation legislation, including the establishment of a certification system for energy managers, they had not reached a conclusion before the project terminated. Therefore, considerable efforts were required to persuade many companies to receive training developed through the project. In the energy efficiency and conservation sector, technical cooperation projects aimed at capacity building of the recipient country can start with individual, organizational, and/or institutional/social capacity development. The results of this project reaffirmed that (1) individual capacity development based on the professional qualification system, (2) organizational capacity development through spread of energy audits and allocation of energy management engineers across the industry, and (3) legal framework development and public awareness raising of energy efficiency and conservation to accelerate individual and organizational capacity development should be pursued simultaneously. Thus, when designing similar technical cooperation projects, especially those including energy efficiency and conservation training, in other countries, it is essential to confirm whether the legal framework has been established for energy efficiency and conservation (including official qualification that can be obtained by completing the project's training). When implementing projects in countries without such laws or regulations, careful consideration should be given to whether the project outcomes will spread and take root in the country and whether a legal framework will be developed for energy efficiency and conservation. (Quoted from Reference Project 15. listed on the right)	By establishing the administration and management structure of Poland-Japan Energy Conservation Technology Centre (ECTC), enabling ECTC to implement training courses, enabling ECTC to provide follow-up support to trained trainees after the training courses, enabling ECTC to assist companies with energy efficiency improvements, and enabling ECTC to provide information on energy conservation for factories, this project aims to establish ECTC as a governmental structure for promotion of energy conservation in the Polish industrial sector, thereby contributing to promoting energy conservation in the Polish industrial sector.	15. The Project on the Poland-Japan Energy Conservation Technology Centre (ECTC) in Poland (Term of Cooperation: July 2004 – June 2008)
							By developing curriculums, textbooks, and practical training equipment for energy managers and energy auditors, and training instructors in Vietnam, this project aims to establish and operate Energy Management Training Center for training of energy managers and energy auditors, thereby contributing to enhancing energy management in designated enterprises.	38. The Project for the Establishment of Energy Management Training Center (Stage 2) in Vietnam (Technical Cooperation Project related to Japanese ODA Loan) (Term of Cooperation: July 2013 – December 2015)

				2. Examples of indicators for the project purpose (1) At least X% of the XX (Number) factories that are required by the energy conservation regulations to have a qualified person for energy management in place will have an energy manager in place. (2) The number of factories receiving energy audits will increase. (3) Training and certification systems will be established for qualified person for energy management and energy auditors. (4) The curriculums and textbooks will be designated by the Guiding Document of the Minister. (5) The percentage of designated factories and buildings having a qualified person for energy management in place will have reached X% by XXXX (Year). (6) The percentage of designated factories and buildings submitting biannual energy consumption / conservation reports will have reached X% by XXXX (Year). (Supplementary) (1) Energy audits, monitoring, and follow-up activities will have been completed at more than XX private companies and public organizations by the end of the project. (2) The sales of energy service companies (ESCOs*) will increase by more than X%. (3) All compact fluorescent lamps (CFLs; a more economical alternative to incandescent lamps), ballast lamps, and ceiling fans on the market will be labeled with an energy saving symbol. (4) The CFL use at home will increase to more than X%. * ESCOs are companies that provide clients (e.g. factory, building, and hotel owners) with energy conservation services by means of equipment improvement, ensure energy efficiency improvement, and make profits by reducing utility costs.	・ When planning a project, it is important to carefully investigate the surrounding environment of the project and make a practical plan based on the investigation. For smooth implementation, it is critical that all stakeholders have a common understanding of the project's context and the project's role in that context through careful policy analysis before the commencement of the project. ・ Even if project counterparts are not governmental officers, the project's sustainability can be secured by establishing an effective mechanism for continued technical transfer. In this case, the project should establish a sustainable technical transfer mechanism in the counterpart organization instead of a one-time-only technical transfer. Moreover, it is essential to foster a strong sense of ownership in the counterpart organization and encourage them to secure human and financial resources. (Quoted from Reference Project 2. listed on the right) ・ Project plan based on the careful analysis of stakeholders In this project, National Training Center for Energy Management (NTCEM) was established under an educational institute called Azerbaijan Higher Education and Research Complex (AHERC). The involvement of this educational institute in the project is considered to enhance sustainability. AHERC staff had expertise in education but lacked practical experience in energy efficiency and conservation. Energy conservation trainers should have practical knowledge and experience. However, the original project plan did not include practical components, such as factory energy audits. It is important to analyze the strengths and weaknesses of the target group before planning a project. (Quoted from Reference Project 8. listed on the right)	By establishing a management system for Practical Energy Management Training Center, preparing a state examination system for Persons Responsible for Energy (PRE), establishing PRE exam training courses, establishing an implementing structure for PRE-exam training, and establishing a follow-up system for PRE, this project aims to set up a high-quality PRE education system, thereby contributing to effective energy management in designated factories and buildings in accordance with the objective of the Energy Conservation Promotion (ENCON) Act. By coordinating relevant policies and administrative organizations to make the project effective, enabling project counterparts (instructors at National Training Centre for Energy Management (NTCEM)) to operate and maintain training facilities and equipment, and maintaining and managing theoretical and practical training for energy management engineers, this project aims to enable NTCEM to contribute to energy management in the industrial sector, thereby contributing to promoting energy management in the industrial sector in Iran through rational use of energy.	2. The Project on the Practical Energy Management Training Center in Thailand (Term of Cooperation: April 2002 – April 2005) 8. The Project on Energy Management Promotion in Iran (Term of Cooperation: March 2003 – March 2007)
					This project's outcomes were premised on energy conservation legislation. The JICA Expert Team mainly concentrated on preparation for law enforcement and transfer of law enforcement know-how, and the project was successful in this aspect. Meanwhile, the JICA Expert Team took a limited part in the legislation process. They merely checked the progress after the bill was submitted by Sri Lanka Sustainable Energy Authority (SLSEA) to the Ministry. In the case of projects whose outcomes were premised on legislation, it is desirable for the JICA Expert Team to support the entire legislation process, from negotiations with stakeholders including industry representatives to modification of the draft bill and explanation to higher authorities including the Minister and other officials, and these steps should be followed up as part of project management. (Quoted from Reference Project 17. listed on the right)	By preparing necessary resources (policies, human resources, equipment, and materials) for implementing the Sri Lanka Sustainable Energy Authority (SLSEA) Act that accelerates energy conservation and renewable energy development, repairing the incentive / disincentive mechanism for promoting energy efficiency, and raising awareness of energy efficiency among the public and private sectors and households, this project aims to enhance infrastructure (policies, human resources, incentive and disincentive mechanisms, and energy efficiency awareness) to promote energy-saving activities, thereby contributing to creating an energy efficient society.	17. The Project for Promoting Energy Efficiency Improvement in Sri Lanka (Term of Cooperation: May 2008 – April 2011)

							By facilitating policy-level discussions on the legal definition of practical training for energy managers and energy auditors, strengthening the capacity of counterparts to manage and statistically analyze energy data, and enhancing the knowledge of stakeholders on energy conservation policies and systems and relevant technologies in Vietnam and Japan, this project aims to establish a human resources development system for energy efficiency and conservation, thereby contributing to promoting energy management in designated businesses and factories to achieve the purpose of the Law on Energy Efficiency and Conservation.	40. The Project for the Establishment of Energy Management Training Center (Stage 1) in Vietnam (Term of Cooperation: July 2011 – September 2012)