

JICA Operation Indicator and Effect Indicator Reference in ODA Loan Projects

Evaluation Department

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- **“Operation indicator” and “Effect indicator”**

“Operation indicator” is used to quantitatively measure the operation of the project. “Effect indicator” is used to quantitatively measure the effects of the project. In other words, when equipment, facilities, etc. (outputs) were installed or established by the project, (1) operation indicator is used to measure whether or not the outputs are appropriately run and used, and (2) effect indicator is used to measure the effects which the outputs had on the recipients and the project area.

- **The Basic indicators & the Auxiliary indicators**

The Basic indicator is generally deemed necessary regardless of the characteristics of the project, for which data collection is deemed possible. The Auxiliary indicator is likely to be needed depending on the characteristics and components of the project, or they are indicators where data collection is difficult although they are deemed necessary indicators.

1.1 Thermal Power (Coal, Gas Combined Cycle, Geothermal, and Oil) Generation

Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target		Purpose	Remarks
Basic	Maximum Output (actual value) (MW)	As shown by the name of the indicator	Maximum output planned at the time of appraisal		To assess if the plant performance has been maintained and exhibited	
Basic	Plant Load Factor (%)	= Electricity generated per year / (rated output × hours per year) × 100	About 70-90%		To confirm the adequacy of the original operation plan	On the assumption that the plant is operated for base load
Auxiliary	Availability Factor (%)	= Operating hours per year / hours per year) × 100	About 83-90%		To confirm the adequacy of the original operation plan	On the assumption that the plant is operated for base load: 83% in the regular examination for 2 months Can be substituted for by the operating hours per year
Auxiliary	Auxiliary Power ratio (%)	= (Auxiliary electricity consumption per year / gross electricity generated) × 100	Coal	About 8%	To check the conditions for maintaining performance	
			Gas combined	About 3-5%		
			Geothermal	About 8%		
			Oil	About 6-8%		
Basic	Gross Thermal Efficiency (%)	= (Gross electricity generated per year × 860) / (fuel consumption per year × heat release value of the fuel) × 100	Coal	35-40%	To check the conditions for maintaining performance and energy conservation levels	1 kWh = 860 kcal
			Gas combined	45% and over		
			Geothermal	About 10%		
			Oil	35-40%		
Basic	Outage Hours for Every Cause (Hours/Year or Days/Year)	As shown by the name of the indicator	Human error	0	To check this as the operating condition of the plant	Classified according to the causes: human error, machine trouble, and planned outage
			Machine trouble	Discussion		
			Planned outage	Regular inspection		
Auxiliary	Outage Times for Every Cause (Times/Year)	As shown by the name of the indicator	Human error	0	To check this as the operating condition of the plant	Classified according to the causes: human error, machine trouble, and planned outage
			Machine trouble	Discussion		
			Planned outage	Regular inspection		

Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Maximum Output (actual value) (MW)	As shown by the name of the indicator	Maximum output planned at the time of appraisal	To assess if the plant performance has been maintained and exhibited	
Basic	Net Electric Energy Production (Gwh/Year)	As shown by the name of the indicator	Refer to the remarks	To check if the assumed electricity generated was actually produced	From the view that the fixed amount of electricity can be continuously generated, it is highly possible that this indicator is regarded as an operational indicator = Rated output × hours per year × plant load factor = Gross electricity generated - auxiliary electricity consumption

Environment Affect Indicator

1. Oil fired to a gas combined cycle power plant

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	CO ₂ Reduction Ratio (%) (per unit of electricity generated)	$= \frac{\text{Emissions in the existing plant} - \text{emissions after the project}}{\text{emissions in the existing plant}} \times 100$	CO ₂ reduction by 60% of the emissions of an oil-fired power plant	Assessment of environmental projects	Advanced measurement techniques (around 70% at normal gas-fired power) CO ₂ reduction effect changes according to constituents of the gas and crude oil. Amount of electricity generated in the existing plant and that after the project should be assumed to be the same.
Basic	SO ₂ Reduction Ratio (%) (per unit of electricity generated)	$= \frac{\text{Emissions in the existing plant} - \text{emissions after the project}}{\text{emissions in the existing plant}} \times 100$	Almost equal to 100%	Assessment of environmental projects	Advanced measurement techniques (around 70% at normal gas-fired power) Amount of electricity generated in the existing plant and that after the project should be assumed to be the same.
Auxiliary	Dust Reduction Ratio (%) (per unit of electricity generated)	$= \frac{\text{Emissions in the existing plant} - \text{emissions after the project}}{\text{emissions in the existing plant}} \times 100$	Almost equal to 100%	Assessment of environmental projects	
Auxiliary	Fuel Reduction Ratio (%) (per unit of electricity generated)	$= \frac{\text{Fuel consumption in the existing plant} - \text{fuel consumption after the project}}{\text{fuel consumption in the existing plant}} \times 100$	Refer to the remarks	Assessment of energy conservation	The ratio fluctuates according to the scale of the power generation, the efficiency of power generation, and fuel consumption. Amount of electricity generated in the existing plant and that after the project should be assumed to be the same.

1.2 Thermal Power Plant Rehabilitation

Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target		Purpose	Remarks
Basic	Plant Load Factor (%)	$= \text{Electricity generated per year} / (\text{rated output} \times \text{hours per year}) \times 100$	To be discussed with the executing agency		To confirm the adequacy of the original operation plan	Values vary depending on methods of operation. It is around 70 - 90% when the plant is operated for base load. Can be substituted by the operating hours per year.
Auxiliary	Availability Factor (%)	$= (\text{Operating hours per year} / \text{hours per year}) \times 100$	To be discussed with the executing agency		To confirm the adequacy of the original operation plan	Values vary depending on methods of operation. It is around 83 - 90% when the plant is operated for base load.
Auxiliary	Auxiliary Power Ratio (%)	$= \text{Auxiliary electricity consumption per year} / \text{gross electricity generated} \times 100$	To be discussed with the executing agency		To check the conditions for maintaining performance	Values vary depending on the kind of fuel used.
Auxiliary	Gross Thermal Efficiency (%)	$= (\text{Annual gross electricity generated per year} \times 860) / (\text{fuel consumption per year} \times \text{heat release value of the fuel}) \times 100$	To be discussed with the executing agency		To check the conditions for maintaining performance and energy conservation level	1kWh=860kcal Values vary depending on the initial performance and the level of rehabilitation.
Basic	Outage Hours for Every Cause (Hours/Year or Days/Year)	As shown by the name of the indicator	Human error	0	To check this as the operating condition of the plant	Classified according to the causes: human error, machine trouble, and planned outage.
			Machine trouble	Discussion		
			Planned outage	Regular inspection		
Auxiliary	Outage Times for Every Cause (Times/ Year)	As shown by the name of the indicator	Human error	0	To check this as the operating condition of the plant	Classified according to the causes: human error, machine trouble, and planned outage.
			Machine trouble	Discussion		
			Planned outage	Regular inspection		

Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Maximum Output (actual value) (MW)	As shown by the name of the indicator	To be discussed with the executing agency	To check the conditions for maintaining performance and past performance of power generation	Values vary depending on the level of rehabilitation. From the view that it contributes to the supply capability at the peak load, it is highly possible that this indicator is regarded as an effect indicator.
Basic	Net Electric Energy Production (Gwh/Year)	As shown by the name of the indicator	Refer to the remarks	To check past performance of power generation	=Rated output × hours per year × plant load factor = Gross electricity generated - auxiliary electricity consumption (Values vary depending on the level of rehabilitation.) From the view that the fixed amount of electricity can be continuously generated, it is highly possible that this indicator is regarded as an operational indicator.

Environment Affect Indicator

Adopt only when the following reduction is expected to be achieved

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	CO ₂ Reduction Ratio (%) (per unit of electricity generated)	= (Current emissions - emissions after the project)/ (emissions in the existing plant) × 100	Refer to the remarks	Assessment of environmental projects	Values vary depending on the level of rehabilitation. Advanced measurement techniques Amount of electricity generated in the existing plant and that after the project should be assumed to be the same.
Basic	SO ₂ Reduction Ratio (%) (per unit of electricity generated)	= (Current emissions - emissions after the project)/ (emissions in the existing plant) × 100	Refer to the remarks	Assessment of environmental projects	Values vary depending on the level of rehabilitation. Advanced measurement techniques Amount of electricity generated in the existing plant and that after the project should be assumed to be the same.
Auxiliary	Dust Reduction Ratio (%) (per unit of electricity generated)	= (Current emissions - emissions after the project)/ (emissions in the existing plant) × 100	Refer to the remarks	Assessment of environmental projects	Values vary depending on the level of rehabilitation. Amount of electricity generated in the existing plant and that after the project should be assumed to be the same.
Auxiliary	Fuel Reduction Ratio (%) (per unit of electricity generated)	= Current fuel consumption - fuel consumption after the project/ fuel consumption in the existing plant) × 100	Refer to the remarks	Assessment of energy conservation	Values vary depending on the level of rehabilitation. Amount of electricity generated in the existing plant and that after the project should be assumed to be the same.

1.3 Installation of Desulfurization Device

Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks	
Basic	SOx Emission Concentration at Rated Output (ppm or mg/m ³)	As shown by the name of the indicator	Within the standard range	To assess desulfurization achievement and the conditions for maintaining performance	From the viewpoint of reduction of emission concentration, it is highly possible that this indicator is regarded as an effect indicator.	
Basic	SOx Removal Efficiency (%)	$= (1 - \text{amount emitted from the funnel} / \text{amount emitted from the boiler}) \times 100$	Value designed	To assess the conditions for maintaining performance		
Basic	Desulfurization Availability to Generator Operation Hours (%)	$= (\text{Operating hours per year} / \text{hours per year}) \times 100$	Almost 100%	To confirm the adequacy of the original operation plan		
Basic	Outage Hours for Every Cause (Hours/Year or Days/Year)	As shown by the name of the indicator	Human error	0	To check this as the operating condition of the plant	Classified according to the causes: human error, machine trouble, and planned outage.
			Machine trouble	Discussion		
			Planned outage	Regular inspection		
Auxiliary	Outage Times for Every Cause (Times/Year)	As shown by the name of the indicator	Human error	0	To check this as the operating condition of the plant	Classified according to the causes: human error, machine trouble, and planned outage.
			Machine trouble	Discussion		
			Planned outage	Regular inspection		

Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Amount of SOx Reduction (t/Year)	$= \text{Amount emitted from the boiler} - \text{amount emitted from the funnel}$	Refer to the remarks	To assess desulfurization achievement	$= \text{Amount of SO}_2 \text{ emitted per unit amount of electricity generated} \times \text{SOx removal efficiency}$
Auxiliary	Amount of Dust Reduction (t/Year)	$= \text{Amount at the EP outlet} - \text{amount emitted from the funnel}$	Refer to the remarks	To assess collateral effect of desulfurization	

2. Hydraulic Power Generation (Conventional, Pumping-up)

Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Unplanned Outage Hours (Hours or Days/Year)	As shown by the name of the indicator	0	To assess if the power plant is adequately operated	Classified according to the causes: mechanical failure, human work, and natural disasters and others.
Basic	Capacity Factor (%)	Capacity Factor = (net electric energy)/ (maximum output × hours per year) × 100 (%)	Capacity factor planned at the time of appraisal	To assess if the power plant is adequately operated	Adopted only for conventional hydraulic power plant.
Basic	Comprehensive Circulating Efficiency (%)	Comprehensive Circulating Efficiency = (net electric energy)/ (electricity used for pumping) × 100(%)	Decide on 70 - 75% by discussion	To assess if the power plant performance of has been maintained	Adopted only for pumped storage power plant.
Auxiliary	Operating Hours (Hours)	As shown by the name of the indicator	Decide on 700 - 1000 hours by discussion	To confirm if the power plant is operated for a certain period	Adopted only for pumped storage power plant. Classified under the two categories of pumping and generating. Not reaching the target does not always lead to low evaluation.
Auxiliary	Hydro Utilization Factor (%)	Hydro Utilization Factor = (net electric energy)/ (possible power generation in a given year) × 100(%)	Decide on around 90% by discussion	To assess if the operation of the power plant is optimum, considering the annual volume of inflow	Adopted only for conventional hydraulic power plant. It is necessary to check if it is technically computable.
Auxiliary	Planned Outage Hours (Hours or Days/Year)		To be discussed with the executing agency	To assess the level of operation of the power plant	Not reaching the target does not always lead to low evaluation.
Auxiliary	Annual Total Volume of Inflow to the Reservoir (m ³ /Year)	Annual total volume of inflow to the dam reservoir from rivers	To be discussed with the executing agency	Basic indicator to show dam control and drought conditions	Adopt this indicator when a dam is included. However, goals of indicators that are related to dams, etc., should be represented by the value of the base year in the plan as a reference value. It is desirable to keep track of the years with probable drought based on precipitation data.
Auxiliary	Volume of Sedimentation in the Reservoir (m ³ /Year)	Volume of sedimentation in the reservoir	To be discussed with the executing agency	Important indicator in dam control	Adopt this indicator when a dam is included.

Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Net Electric Energy Production (GWh/Year)	As shown by the name of the indicator	Electricity generated per year planned at the time of the appraisal	To check if the assumed electricity generated was actually produced as planned	Can be adopted as an operation indicator. In the case of pumping-up power generation, not reaching the target does not always lead to low evaluation.
Basic	Maximum Output (MW)	As shown by the name of indicator Basically represented by instantaneous value	Maximum output planned at the time of the appraisal	To assess if performance of the power plant is maintained and fully executed	Can be adopted as an operation indicator.

* In general, operation indicators are not set separately for power supply transmission lines, because those lines are part of the power generation plant. Regarding transmission lines other than those for power supplying, adoption of operation indicators for power transmission and transformation projects should be considered.

3. Wind Power Generation

Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Plant Capacity Factor (%)	Plant Capacity Factor = {annual gross generated output (kWh)/ rated output (kW) × annual hours} × 100	Set the goal considering wind conditions (usually 30%)	To assess if the power plant is adequately operated	
Basic	Unplanned Outage Hours --Due to Mechanical Outage (Hours or Days)	Should be represented in hours as far as possible	0	To assess if the power plant is adequately operated	
Basic	Unplanned Outage Hours --Due to Other Factors; Natural Disasters, etc. (Hours or Days)	Same as above	Set the goal considering past performance	To assess the level of operation of the power plant	
Basic	Planned Outage Hours (Hours or Days)	Same as above	Set the goal considering past performance	To assess the level of operation of the power plant	
Auxiliary	Plant Availability Factor (%) or Operating Hours (Hours)	Plant Availability Factor = {annual Operating hours/ Annual hours} × 100	Set the goal considering past performance	To assess if the power plant is operated for a certain period	
Auxiliary	Maximum Output (MW)	Basically represented by instantaneous value	Maximum output planned at the time of the appraisal	To assess if performance of the power plant is maintained and fully executed	

Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Net Electric Energy Production (GWh/Year)	Net Electric Energy Production = gross electric energy production (kWh) – plant auxiliary electric consumption (kWh)	Annual Amount of Net Generated of Output planned at the time of the appraisal	To check if the assumed electricity generated was actually produced	

4. Transmission and Transformation of Electric Energy

Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Availability Factor (%)	Maximum load (MW)/ {Rated capacity of the facility (MVA) × power factor}	Within the range that operation is possible	To assess if the facility is properly operated	Adopted for the projects that will contribute to the quality of electricity and securing of power supply. The facility includes transmission line and transformers.
Basic	Forced Outage Hours per User (Min/Year)	Outage Hours per end user in the project's target area	0, in principle	To assess if the facility is properly operated	Adopted for the projects that will contribute to improvement of reliability. This indicator substitutes the Outage hours due to Machine trouble.
Auxiliary	Voltage Drop at End User -- adopted only when voltage drop prevention engineering works are included	Maximum voltage drop (V)/ standard voltage (V)	Within the standard range	To assess if the quality is maintained at the end user	Adopted only for voltage drop prevention engineering works that will contribute to the quality of electricity. Because of the large number of end users, measurement is probably highly difficult (instead, values can be calculated through simulation, etc.).
Auxiliary	Outage Times (Times/ Year)	Times of outage that lasted for 1 minute or longer in the project's target area	0, in principle	To assess if the facility is properly operated	Adopted for some of the projects that will contribute to the improvement of reliability.
Auxiliary	Electricity Supply (kWh)	Annual electric energy transmitted from the target electrical transformer	Predicted values by F/S	To confirm that transmission line and transformer station is adequately utilized	
Auxiliary	Transmission Loss (%)	{Electricity Supply (kWh) - electricity consumption in the substation (kWh) - receiving electric energy (kWh)}/ Electricity Supply (kWh)	Predicted values by F/S	To confirm that transmission line and substation is adequately utilized	When data on electricity consumption in the transformer station are not available, assume them to be 0.

* In general, operation indicators are not set separately for power supply transmission lines, because those lines are part of the power generation plant.

Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Availability Factor (%)	Maximum load (MW)/ {Rated capacity of the facility (MVA) × power factor}	Within the range that operation is possible	To assess if the availability factor has improved to a fair value after the project	Adopted for the projects that will contribute to the quality of electricity and securing of power supply. The facility includes transmission line and transformers.
Basic	Forced Outage Hours per User (Min/Year)	Outage Hours per end user in the project's target area	0, in principle	To assess the degree of improvement by comparing values of before and after the project	Adopted for the projects that will contribute to the improvement of reliability.
Auxiliary	Voltage Drop at End User -- adopted only when voltage drop prevention engineering works are included	Maximum voltage drop (V)/ standard voltage (V)	Within the standard range	To assess if the voltage drop at the end user is improved and an appropriate value is recovered after the project	Adopted only for voltage drop prevention engineering works that will contribute to the quality of electricity. Because of the large number of end users, measurement is probably highly difficult (instead, values can be calculated through simulation, etc.).
Auxiliary	Outage Times (Times/ Year)	Times of outage that lasted for 1 minute or longer in the project's target area	0, in principle	To assess the degree of improvement by comparing values of before and after the project	Adopted for some of the projects that will contribute to the improvement of reliability.
Auxiliary	Electricity Supply (kWh)	Annual electric energy transmitted from the target electrical transformer	Predicted values by F/S	To assess the increased electric energy	Can be adopted for the projects that will contribute to electrification projects. Because such projects usually include power distribution projects, it can be substituted by the sales volume, the effect indicator of power distribution projects.
Auxiliary	Transmission Loss (%)	{Electricity Supply at sending end (kWh) - electricity consumption in the substation (kWh) - receiving electric energy (kWh)}/ Electricity Supply at sending end (kWh)	Predicted values by F/S	To assess the degree of improvement by comparing values of before and after the project	Adopted for the projects that will contribute to the reduction of transmission loss. When data on electricity consumption in the substation are not available, assume them to be 0.

* As the effect of projects concerning transmission and transformation of electric energy highly depends on external factors such as the configuration and operating condition of the power network including power plants, it is difficult to measure the overall effect of the project. Effect indicators should be selected after setting preconditions for each project.

* In general, effect indicators are not set separately for power source transmission lines, because those lines are part of the power generation plant.

5. Power Distribution

Operation Indicator

Category	Name *1	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Peak Load (kW)	Maximum electricity in a certain area (adopted for supplying work)	Predicted values by F/S, etc.	To grasp the degree of improvement in power supply capacity	
Basic	System average interruption duration index (Min/Year)	Cumulative outage hours per year (minutes)/ Number of end-users (households) (Adopted for repair work)	0, in principle	To grasp the degree of reduction in number of accidents To grasp the degree of reduction in the hours for which interruption lasts	Can be adopted as an effect indicator depending on the contents of the project.

Effect Indicator

Category	Name *1	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Electrification Rate of Households (%)	Number of households electrified × 100/ number of total households (Adopted for supplying work)	100% in principle	To grasp the increased demand	Electrification rate (%) ^{*3} in the project's target area
Basic	Sales Volume (MWh)	As shown by the name of indicator (Adopted for supplying work)	Predicted values by F/S, etc.	To grasp the increased demand	
Auxiliary	Distribution Loss (%)	Distribution loss (kWh) × 100/ Electricity transmitted (kWh) (Adopted for supplying work)	Several percent	To grasp the degree of distribution loss reduction	
Auxiliary	Index of Progress of Distribution Network Automation	Set the indicator appropriately considering the staff who engage in the maintenance of distribution cables (number of persons) and personnel costs. (Adopted for automation work of distribution)	Predicted values by F/S, etc.	To grasp the degree of reduction in the number of staff and personnel cost	

*1: Indicator is set in every target area of the project.

*2: When works cover the transmission and transformation facility portion (installing transmission wires in the section from transmission transformer station to distribution transformer, and constructing of distribution transformer station), adoption of the operation indicators that are originally for the transmission and transformation project is applied to that portion separately.

*3: In many cases in this sector, project target areas correspond with administrative districts. However, when they do not correspond with administrative districts, or when the electrification rate of households is difficult to obtain, adoption of the rural electrification rate of households is considered in order to assess the contribution of the electrification rate to the percentage change in the administrative district that includes the project's target area.

6. Gas

Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Production or Transmission Volume of Gas by Kind of Product	Nm ³ / year Gas heating value (MJ/N m ³) Gas constituents (CH ₄ , C ₃ H ₈ , CO, H ₂ , etc.)	Planned value at the time of appraisal	To confirm how gas production and transmission facilities are operated	<p>This indicator is set assuming that the projects include installation of gas pipeline. Heating value and constituents vary depending on the methods of gas production and kind of product, and are to be described with the value. (Targets of the indicator are gas production facilities: Heating value and constituents are necessary when establishing environment indicators)</p> <p>Many gas projects facilitate conversion from other fossil fuels such as oil and coal to gas due to rising environmental concerns. Accordingly, it is desirable to continuously collect data on demand that is detailed to some degree, as well as data on energy consumption of the other fossil fuels. It is also necessary to collect detailed data on gas constituents because energy supply (heating value) varies depending on the gas constituent.</p>
Basic	Production, Transmission or Supply Interruption Duration (Hours) (According to the cause: human error, machine trouble, natural disaster, and planned outage)	As shown by the name of the indicator	To be discussed with the executing agency	To confirm adequate operation	Regarding gas production and transmission, not only supply interruption duration but also the duration for which the gas pressure is dropped is required to be monitored.

Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Gas Sales Volume by Type of Beneficiary (for household, industrial, or commercial use)	Nm ³ / Year	Planned value at the time of appraisal	To confirm gas sales volume by type of beneficiary (for household, industrial, or commercial use)	It is assumed that this indicator is adopted for the gas supply project.
Basic	Gas Dissemination Rate (%)	Number of beneficiary households/ total number of households	Number of households planned at the time of appraisal	To assess the level of dissemination of gas service for household use in the target areas	It is assumed that this indicator is adopted for the gas supply project for general households. When it is difficult to follow the continuous increase in the number of households due to urbanization, the numbers of beneficiary households in each year and dissemination rate can be used together.

Environment Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Auxiliary	Decreased Volume of Pollutant (decreased volume of SO _x , dust, CO ₂ , etc.)	t / Year	Planned value at the time of appraisal	To assess the effect of environmental improvement that accompanies energy conversion	It is worked out based on the volume of energy converted (for example, from coal to gas). However, it should be noted that the volume of pollutant emitted at the time of gas production is required to be considered.

7. Roads

Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Annual Average Daily Traffic (AADT) --Vehicles/Day or Vehicles/12 Hours	Annual average daily traffic at a certain point, or at a representative point of the whole section, or distance-weighted mean annual traffic Total number of full-size cars, compact cars, etc., or Passenger Car Unit (PCU) is used for counting volume of traffic. The duration is represented basically by units of days (24 hours). Representing the duration by 12-hour units is also acceptable.	To be discussed with the executing agency	To assess if the road transport demand is increasing as predicted, or if adequate traffic conversion is implemented	When new roads such as expressways and bypasses are constructed along existing roads, cross-sectional traffic volume of both roads combined should be measured as the traffic volume. In such cases, it is desirable to illustrate the predicted future traffic volume of the new road, and the effects of a reduction in traffic volume on the existing road.

Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Annual Average Daily Traffic (AADT) --Vehicles/Day or Vehicles/12 Hours	Annual average daily traffic at a certain point, or at a representative point of the whole section, or distance-weighted mean annual traffic Total number of full-size cars, compact cars, etc., or Passenger Car Unit (PCU) is used for counting volume of traffic. The duration is represented basically by units of days (24 hours). Representing the duration by 12-hour units is also acceptable.	To be discussed with the executing agency	To assess if the road transport demand is increasing as predicted, or if adequate traffic conversion is implemented	When new roads such as expressways and bypasses are constructed along existing roads, cross-sectional traffic volume of both roads combined should be measured as the traffic volume. In such cases, it is desirable to illustrate the predicted future traffic volume of the new road, and the effects of a reduction in traffic volume on the existing road.

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Time Saving (Time, Yen (or Local currency))/ Year	According to measurement survey on time required Basically, time units are adopted, but adopting monetary terms is also acceptable.	To be discussed with the executing agency	To assess the degree of reduction in driving time, comparing the road after development with that before development	In cases where it is not plausible to reduce the time, including the cases of disaster prevention projects, other indicators should be appropriately established.
Auxiliary	Vehicle Operation Cost Saving (Yen or Local currency/ Year)	According to some values used for EIRR computation as well as the standards of the country	To be discussed with the executing agency	To assess the degree of reduction in vehicle operation cost, comparing the road after development with that before development	As this indicator is represented by one of the values used for EIRR computation, it should be adopted as an auxiliary indicator.
Auxiliary	Average Velocity Increase (km/h)	Worked out using the above mentioned time required and the distance before and after the development	To be discussed with the executing agency	Worked out using the above mentioned time required and the distance before and after the development	This indicator is adopted when congestion or mixed traffic is occurring on the existing road and an average speed increase is plausible by constructing new roads.
Auxiliary	Number and Frequency of Traffic Accidents (Accidents/10,000 Vehicles, km, Number of accidents, Casualties, Yen (or Local currency))	Worked out using statistics on traffic accidents compiled by public safety agencies Monetary terms can be adopted when amount of human cost and property damage per accident are set.	To be discussed with the executing agency	To assess the change in number of traffic accidents after the road development compared with before the development	This indicator is adopted depending on the availability of the statistics on traffic accidents. It is necessary to check the consistency between the traffic accidents statistics section and the section that benefits from the project.
Auxiliary	Congestion Length Decrease and Time Saving (m, Hours)	According to the measurement survey on congestion length and time required at the peak time	To be discussed with the executing agency	To assess the degree of reduction in congestion length and time required to pass after the road development compared with before the development	
Auxiliary	Decrease of Annual Traffic Impassability Dates Due to Disaster (Days/ Year)	According to the statistics compiled by the road administrator	To be discussed with the executing agency	To assess the degree of reduction in annual traffic impassability dates after the road development compared with before the development	

8. Railroad

Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Volume of Transportation (Persons × km, t × km)	Volume of passenger transportation = passengers × distance which passengers are transported Volume of cargo transportation = weight of cargo × distance which cargo is transported To be indicated every year	Predicted demand value	This gives basic data in transportation planning obtained from the predicted demand value, etc., and it is to show the level of facility utilization.	
Basic	Number of Running Trains (Number of running trains/Day)	Annual average number of running trains per day is to be indicated across categories of passenger, cargo, or each operation section	To be decided from the predicted demand value, etc.	This gives most basic data on transportation capacity in transportation planning worked out from the number of passengers above and tons of cargo transported, and it is to show how the facility is utilized.	
Basic	Operating Rate (%) (Where rolling stocks are procured)	Operating rate = cumulative operating days per year/rolling stocks procured × (365 - average number of days out of operation due to inspection) × 100 %	About 80 - 90	This gives data on the amount of rolling stock that is running among those procured in the project.	
Basic	Running Distance (km) (Where rolling stocks are procured)	Running distance = amount of rolling stock passing between stations × distance (km) between stations	To be decided from the predicted demand value, etc.	This gives data to show how the rolling stock procured in the project is operated.	
Auxiliary	Maintenance Days at Maintenance factory--In the Case that Maintenance Factory is Built (Days/Train)	Annual average number of days in which rolling stock stays at maintenance factory for inspection	To be decided in each kind of checkup	This is an indicator to show the capacity of each inspection of rolling stock. Indicator of efficiency of maintenance in factory operation and completeness of the facility (including spare parts)	It is difficult to grasp the value because the number of days at the factory varies depending on the content of inspections. Accordingly, this is regarded as an auxiliary indicator because the operating rate can give the most information on the inspection capacity.

Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Volume of Transportation (Persons × km, t × km)	Volume of passenger transportation = Σ passenger × distance which passengers are transported Volume of cargo transportation = Σ weight of cargo × distance which cargo is transported To be indicated every month	Predicted demand value	This is an important indicator that is used for facilitating Economic Internal Rate of Return (EIRR), a method of economic analysis.	
Basic	Running Hours for Specific Section (Hours)	To be indicated every month by kinds of passenger and cargo	Set based on average speed and standing time at the station	This is an important indicator that is used for facilitating EIRR, but it is necessary to consider if a reduction of running hours is expected.	Because some improvement projects that focus on increasing the volume of transportation (lengthening, increasing and strengthening the formation of rolling stock) do not consider the effect of reducing running hours, this is regarded as a basic or auxiliary indicator.
Auxiliary	Maximum Speed (km/h)	Represent speed by actual measurement	50 and over	This is an indicator adopted for projects to set higher standards for rail tracks.	In order to produce an effect, reduction of time taken from the start to arrival is more important than improving maximum speed. Thinking of it as one of the indicators that affect running hours, the maximum speed should serve as an auxiliary indicator.
Auxiliary	Rush Ratio (%)	Rush Ratio per hour at the peak time = passengers transported per hour at the peak time / transportation capacity per hour at the peak time × 100	150 - 180 (Rush ratio worked out by Japanese method)	This is an indicator adopted only for urban railways, which have many users, in order to indicate the degree of rush alleviation. It is an indicator for urban railway projects.	As it is difficult to show the maximum number of passengers and transportation capacity and to actually measure rush ratio, it is adopted as an auxiliary indicator.

9. Aviation

Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Number of Passengers (Persons)	<ul style="list-style-type: none"> • Grasp numbers under the categories of international flight and domestic flight • Grasp numbers of annual total, in the peak month, or on the peak day <p>It is desirable to grasp data of the following three groups.</p> <ol style="list-style-type: none"> (1) Number of departing passengers (under the categories of foreign citizens and domestic citizens) (2) Number of arriving passengers (under the categories of foreign citizens and domestic citizens) (3) Number of transient passengers (under the categories of foreign citizens and domestic citizens) 	Predicted demand value	To assess if the airport (especially passenger service facilities) is properly operated	
Basic	Cargo Volume (t)	<ul style="list-style-type: none"> • Grasp numbers under the categories of international flight and domestic flight • Grasp numbers under the categories of volume of the cargo departing and volume of the cargo arriving 	Predicted demand value	To assess if the airport (esp. facilities that handle cargo) is properly operated	
Basic	Number of Takeoffs and Landings by Origin and Destination (Times)	<ul style="list-style-type: none"> • Grasp numbers under the categories of international line and domestic line • Grasp numbers of annual total, the peak month, and the peak day • Grasp number under the categories of regular and temporary (commercial) flights 	Predicted demand value	To assess if the airport (esp. facilities such as runway) is properly operated	
Basic	Air Traffic Volume (Aircrafts)	<ul style="list-style-type: none"> • Grasp numbers under the categories of international flight (over flight and others) and domestic flight • Annual total 	Predicted demand value	To assess if the aeronautical safety facilities related to air routes are properly operated based on the number of aircrafts that travel the air routes under air traffic control	

Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose
Basic	Number of Passengers (Persons)	<ul style="list-style-type: none"> Grasp numbers under the categories of international flight and domestic flight Grasp numbers of annual total, in the peak month, or on the peak day <p>It is desirable to grasp data of the following three groups.</p> <ol style="list-style-type: none"> Number of departing passengers (under the categories of foreign citizens and domestic citizens) Number of arriving passengers (under the categories of foreign citizens and domestic citizens) Number of transient passengers (under the categories of foreign citizens and domestic citizens) 	Predicted demand value	<p>The operation indicators of the number of passengers, cargo volume, and the number of takeoffs and landings can be adopted as important effect indicators in the following two cases because they can give quantitative measurement of project effects by comparing the conditions of before and after the project: (1) project is aiming at increasing handling capacity of airports (also includes the case of only terminal facilities) (refer to items 1,2,3 below) (2) project is aiming at maintaining airport functions (refer to item 4 below).</p> <p>【Reference】 Yen loan projects that have been conducted are grouped by content as follows:</p> <ol style="list-style-type: none"> Construction of new airports Expansion of airports (when development covers a whole airport including runways, and taxiway) Expansion of airports (when development target is limited to only terminals) Rehabilitation Development of air traffic control system (development of aeronautical safety facilities)
Basic	Cargo Volume (t)	<ul style="list-style-type: none"> Grasp numbers under the categories of international flight and domestic flight Grasp numbers under the categories of volume of the cargo departing and volume of the cargo arriving 	Predicted demand value	
Basic	Number of Takeoffs and Landings by Origin and Destination (Times)	<ul style="list-style-type: none"> Grasp numbers under the categories of international flight and domestic flight Grasp numbers of annual total, the peak month, and the peak day Grasp number under the categories of regular and temporary (commercial) flights 	Predicted demand value	
Basic	Air Traffic Volume (Aircrafts)	<ul style="list-style-type: none"> Grasp numbers under the categories of international flight (over flight and others) and domestic flight Annual total 	Predicted demand value	

Category	Name	Policy and method of establishing the indicator	Target	Purpose	
Auxiliary	Number of Tourists (Persons)	<ul style="list-style-type: none"> • Target international flights (number of passengers with foreign citizenship). • Grasp numbers under the categories of departing passengers and arriving passengers. <p>* Grasping the number of domestic tourists is difficult unless tourist movement research targeting passengers on domestic flights is conducted.</p>	Predicted demand value	To be adopted for projects to develop facilities related to airports in order to meet the demand for international flights	<p>It is desirable to adopt the main ways to represent economic effects as effect indicators based on a view that infrastructure concerning public transportation should focus on economic effects, considering that these indicators should be set as those required to calculate and show economic and financial effects in planning projects. At the same time they should be comprehensible and easy to grasp when assessing statistics.</p> <p>Accordingly, one of the values used for economic internal rate of return (EIRR) in economic analysis is</p>

Auxiliary	Number of Passengers for business (Persons)	<ul style="list-style-type: none"> • Target international flights (number of passengers with foreign citizenship). • Grasp numbers under the categories of departing passengers and arriving passengers. <p style="margin-left: 40px;">* Grasping the number of domestic tourists is difficult unless tourist movement research targeting passengers on domestic flights is conducted.</p>	Predicted demand value	To be adopted for projects to develop facilities related to airports in order to meet the demand for international flights	usually adopted as an effect indicator.
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10. Ports and Harbors

Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target		Purpose	Remarks
Basic	Total Cargoes (per year) (t) (1) Containerized cargo volume (t and TEU) (2) Bulk cargo volume (t) (3) General cargo volume (t)	Cargo volume = Containerized cargo volume + bulk cargo volume + general cargo volume It depends on the contents of each project whether to adopt total cargoes or any of the three kinds of cargo on the left. When gantry cranes are used as procured equipment, i), and when grain silos and oil tanks are used, ii), should be effective indicators. TEU represents the cargo volume available in a container 20 feet long.	Predicted demand value		To assess if cargoes suitable for the size of the port facilities are dealt with This indicator is effective as an effect indicator.	Indicators are defined through grouping total cargoes into containerized cargo, bulk cargo, and general cargo.
Basic	Total Passengers (per year) (Persons)	Total number of passengers who used ferries in a port in a year In cases where there is more than one route, it is possible to set up indicators for each route.	Predicted demand value		To assess if the number of passengers is suitable to the size of the berths and terminal in the case in which ferries are operated in the port This indicator is effective as an effect indicator.	
Basic	Total Gross Tonnage (per year) (GT)	Total gross tonnage = gross tonnage per vessel (GT/vessel) × number of vessels that arrive in port per year (vessels) GT (Gross Tonnage) represents the volume of a vessel, that is, it is the tonnage that represents largeness.	To be discussed with the executing agency		To assess if vessels that call at a port are suitable to the size of the port facilities This indicator is effective as an effect indicator.	
Basic	Berth Occupation Ratio (per year) (%)	Berth occupation ratio = duration that berth was occupied (Hours)/duration that berth was operated (Hours) Target should be decided based on the average waiting period that the client (shipping company) can bear. It varies depending on the number of berths.	1 Berth	0.26	To assess if berths are effectively used	
			2 Berth	0.46		
			3 Berth	0.59		
			4 Berth	0.66		
			5 Berth	0.70		
			6 Berth	0.74		

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Auxiliary	Berth Charge (Day) (Yen/Berth)	Use fees for a berth for a day	To be discussed with the executing agency	To assess if ports and harbors have a competitive edge When a berth charge is lower than that of other neighboring ports and harbors, the port is judged as having a competitive edge.	
Auxiliary	Maximum Dead Weight Tonnage (per year) (DWT)	Maximum dead weight tonnage (DWT) among the tonnage of the vessels that call at a port in a year Dead Weight Tonnage is the maximum tonnage of cargo that can be loaded on a vessel	To be discussed with the executing agency	To assess the appropriateness of the water depth of the berth and sea roads (usually, the water depth is decided based on the maximum DWT of the vessel)	
Auxiliary	Weekly Working Hours Ratio (per year) (%)	Weekly working hours / (7 days × 24 hours)	To be discussed with the executing agency	To assess labor productivity at the port or harbor	
Auxiliary	Weekly Crane Operating Ratio (per year) (%)	Crane operating hours / (7 days × 24 hours)	To be discussed with the executing agency	To assess utilization ratio of the crane	
Auxiliary	Dredged Amount (per year) (m ³)	Dredged amount in a year	To be discussed with the executing agency	To assess if the water depth required is secured at ports or harbors with sediment	

Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Total Cargoes (per year) (t) (1) Containerized cargo volume (t and TEU) (2) Bulk cargo volume (t) (3) General cargo volume (t)	Cargo volume = Containerized cargo volume + bulk cargo volume + general cargo volume It depends on the content of each project whether to adopt total cargoes or any of the three kinds of cargo on the left. When gantry cranes are used as procured equipment, i) should be an effective indicator, and when grain silos and oil tanks are used, ii) should be an effective indicator. TEU represents the cargo volume available in a container 20 feet long.	Predicted demand value	To assess if vessels that call at a port are suitable to the size of the port facilities This indicator is effective as an effect indicator	Indicators are defined through grouping total cargoes into containerized cargo, bulk cargo, and general cargo.

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Total Passengers (per year) (Persons)	Total number of passengers who used ferries in a port in a year In cases where there is more than one route, it is possible to set up indicators for each route.	Predicted demand value	To assess if the number of passengers is suitable to the size of the berths and terminal in the case in which ferries are operated in the port This indicator is effective as an effect indicator.	
Basic	Containerized Cargo Ratio (per year) (%)	Containerized cargo ratio = Containerized cargo volume (t)/possible containerized cargo volume (t)	80% - 90%	To assess if the loading efficiency of the cargo is improving	
Basic	Average Waiting Time (min) (1) Demurrage time (min/Vessel) (2) Waiting time for leaving a port (min/Person)	(1) represents the average waiting time of a vessel that is waiting in the waters off port until a berth is available. (2) represents the average waiting time of a passenger waiting to leave a port.	To be discussed with the executing agency	To assess if congestion at the port has been alleviated	

11. Communications

Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Telephone Main Lines in Operation--Exchange Capacity Ratio (%)	Rate of the number of lines in operation in a switching facility (N) to the capacity of the facility (N); (N/N)	To be discussed with the executing agency	To assess how switching facilities are operated by looking at the proportion of equipment that is actually used	
	Telephone Traffic--local, toll, or international (calls × min)	<p><Local traffic> Traffic that is exchanged within the area covered by the inner city switching facility</p> <p><Toll traffic> Traffic that is exchanged through a point outside the area covered by the inner city switching facility</p> <p><International traffic> Traffic that is transmitted from a given country to a foreign country and traffic that arrives from a foreign country into the country</p> <p><Telephone traffic> Telephone traffic = number of calls × average holding time</p>	Predicted demand value	To show telephone traffic that is actually provided by duration and number of calls that users make	
	Call Completion Rate (%)	Ratio of the number of calls connected (N) among the number of calls tried (N); (N/N)	To be discussed with the executing agency	To show capacity of the facility and maintenance condition by the quality of line connection	
Auxiliary	Fault Ratio (%)	Number of failed calls per 100 calls in a year	To be discussed with the executing agency	To show technical stability and maintenance condition by number of occurrences of failure	
	Faults Cleared by Next Working Day	Percentage of faults cleared by the next working day	To be discussed with the executing agency	To illustrate maintenance condition and maintenance ability based on time from occurrence of faults to their recovery	

Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Telephone Density (%)	Number of telephones installed per 100 population	Predicted demand value	To show how much the project contributes to the popularization rate of telephones	Indicator that shows the effect of facility development through the degree of popularization of the telephone
	Waiting List for Main Lines (Lines)	Number of lines that are applied for and are on the waiting list for service	To be discussed with the executing agency	To show how much the project contributes to eliminate back-log application	Indicator that shows the effect of facility development through the availability of telephone service for would-be users
	Telephone Traffic--local, toll, or international (calls × min)	(Same as the operation indicator)	Predicted demand value	To show how much the project contributes to the increase of traffic	Indicator that shows the effect of facility development through the increase in telecommunications
Auxiliary	Area/Population Ratio Who Can Use Telephone Services (m ² or Persons)	<Ratio of area in the district where telephone service is available> (N/N) Ratio of area where telephone service is available when applied for (N) to the area of a given district (N) <Ratio of population in the area where telephone service is available>(M/M) Ratio of people who live in the area where telephone service is available when applied for (M) to the population of a given district (M)	To be discussed with the executing agency	To show how much the project contributes to the expansion of the area where telephone service is available and the increase of people who can have telephone services installed in a given country (area)	Indicator that shows the increase in the number of places where it is possible to make a telephone call and the increase in the number of people who live in areas where it is possible to apply for telephone services
	Number of Internet Users/Providers	(As shown by the name of the indicator)	To be discussed with the executing agency	To show how much the project contributes to the popularization of the Internet	Indicator that shows the increase in the number of Internet users due to communication facility development

12. Irrigation and Agriculture

Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Area Benefited by the Project (ha)	Cultivated area in the district benefited by the project (In the case of an irrigation project, it is represented by the area that receives irrigation. However, the area of the district benefited by the project may not correspond to the irrigated area, when the project includes work categories such as farm road development, farmland development, land readjustment, etc. In such a case, the district should be marked off separating the irrigated district as clearly as possible.)		This is the most basic indicator of the project planning. At the same time, it is an important indicator to show how facilities function in the post project assessment.	It can be adopted by components other than irrigation. In some cases in farm road development projects, it is assumed to be difficult to clarify the area benefited by the project, clarification is not always necessary.
Basic	Cultivated Area by Crops (ha)	Annual total of cultivated area in the district benefited by the project (Total area of cultivated land should be worked out based on the whole cultivated area for any crop although the indicator “Cultivated area by crops” can cover only the area for each of the major crops. When areas benefited by the project differ depending on the project component, it is desirable to work out values separately.) When area of the cultivated land may vary according to the seasons, such as rainy season, dry season, etc., grasping the area by seasons should be considered.		This is the indicator that can show the change in the planting system by the project. It is also a basic indicator to represent crop yields. When the value of this indicator is divided by the area benefited by the project, land use rate can be worked out.	
Basic	Collection Rate of Irrigation Water Charge (%)	Collected irrigation water charge/ claimed irrigation water charge (%) (Grasp the standards of irrigation water charge)		This is an indicator for securing excellent Operation and Maintenance.	In the project in which water charge is not collected, “sufficiency rate of operation and maintenance cost” should be adopted.

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Auxiliary	Sufficiency Rate of Operation and Maintenance Cost (%)	Operation and maintenance cost/ planned operation and maintenance cost (Total of the charge on the administrative agencies and that on the farmhouses, such as water charge, etc.)		This is an indicator for securing excellent OM. It can be reflected on the cost achievement at the time of working out EIRR.	In the project in which water charge is not collected or the rate of irrigation water charge to the operation and maintenance cost is extremely low, adoption of this indicator should be considered.
Auxiliary	Rate of Water Users Groups Formulated (%)	Number of water users groups (or area)/planned number of water users groups (or area) Number of advanced water users groups (or area)/number of existing water users groups (or area)		This is an indicator for securing excellent OM.	Adoption of this indicator should be considered when promoting the formulation of a water users group is included in the project component. When the project is aiming at promoting an advanced water users group, (recovery of irrigation water charge, expansion of the facilities), setting the rate of advancement should be considered.
Auxiliary	Annual Total Volume of Inflow to the Reservoir (m ³ /Year)	Annual total volume of inflow from rivers to the reservoir		This is a basic indicator to show the maintenance condition of the dam and the degree of draught water flow.	This is set when the project includes dams. The target value of the operation indicators regarding dams, etc., should be of the base year in the plan. It is desirable to keep track of the years with probable drought based on precipitation data.
Auxiliary	Annual Total Volume of Water Release through Intake Facilities (m ³ /Year)	Annual total volume of water released from the reservoir for water utilization (volume released through intake facilities)		This is an important indicator to show how the dam is performing its function.	This is set when the project includes dams.
Auxiliary	Volume of Sedimentation in the Reservoir (m ³ /Year)	Volume of accumulated sediment in the reservoir		This is an important indicator in controlling the dam.	This is set when the project includes dams.
Auxiliary	Peak Intake Discharge: Dam/Headworks (m ³ /s)	Peak intake from dam or headworks		This is an important indicator to show maintenance condition and utilization of irrigation facilities.	Revision of “water intake” in the past reference (irrigation) To be checked annually when major water intake facilities are used

Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Production Volume of Major Crops (t/Year)	Annual yield of major crops in the district benefited by the project, by crop		This is the indicator that directly leads to the project goal such as improving earnings of farm households and increasing food production.	
Basic	Yield of Major Crops per Unit Area: Rainy season/Dry Season (t/ha)	Yield of major crops per unit area, by crop--adopting values of each season (rainy season/dry season)		This is the indicator that shows improvement effect of agricultural productivity.	
Basic	Gross Annual Average Farm Income (Yen/Year/Household)	Annual gross agricultural farm income per household that is worked out after introducing model farming Gross annual farm income = yield by crop × price by crop (farm income)		Indicator to show poverty alleviation effect and sustainability of the project	When it is possible to get data concerning production cost, it should be replaced by net annual average farm income.
Auxiliary	Net Annual Average Farm Income (Yen/Year/Household)	Annual farm income per household that is worked out after introducing model farming Farm income = gross agricultural farm income - (overall cost of production - labor cost of families - rental for home farm- interest for own capital)		Indicator to show poverty alleviation effect and sustainability of the project	Consider adopting this indicator when it is possible to get data concerning production cost. Overall cost of production includes irrigation water charge, land rent, interest, etc.
Auxiliary	Labor Requirement per Unit Area (Hours/10a)	Hours of labor spent for the unit area, by major crop (when employed labor is adopted, work it out separately)		To measure effect of farming cost reduction by land readjustment	This is excluded from the basic indicators because the desired effect or a significant effect of the project is not expected, and gathering statistics is difficult. When a major projects' effect is on farming cost reduction (land rearrangement, etc.), this indicator should be considered. When the effect other than that of reducing labor hours is large, consider the setting of production cost of major crops.

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Auxiliary	Operation and Maintenance Cost per Unit Area (Yen /Year/ha)	Annual cost for operation and maintenance of irrigation facilities in the area benefited by the project per unit area (It is acceptable to represent this by operation and maintenance costs limited to major facilities without working out the value per unit area.)		To measure effect of operation and maintenance cost reduction	When the cost reduction effect of operation and maintenance is expected to be a major effect (in rehabilitation projects, etc.), this indicator should be adopted.

13. River Improvement (Flood Control)

Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Annual Maximum Flow (m ³ /s)	Annual maximum flow at flood control datum point in the river improvement target area in a given project When flow measurement at the datum point for flood control is impossible due to flood damage caused by overflow or levee breach, adopt an estimated value worked out by using the flow model that is based on past record of rainfall and used at the time of planning or a revised flow model.	None (This indicator is only to be compared with the indicator “Discharge capacity” introduced below)	To assess if flood water is discharged safely at the flood control datum point after the river improvement project	Quantitative assessment of the project needs not only annual maximum flow but also maximum flow at each flood, which should be measured separately. As an operation and effect indicator, annual maximum flow is mainly adopted in order to also confirm that the above data are constantly collected. (Although defining “flooding” is difficult, it is adequate to regard it as overflow exceeding the flow that would have caused flood damage before the river improvement from a perspective of the project assessment.) As mentioned in the column for the policy and method of establishing the indicator, data collection is strongly demanded because rainfall data obtained at the precipitation station and used for the flow model are necessary for working out flow at the time of overflow and levee breach.
Basic	Annual Highest Water Level (m)	Annual highest water level at the flood control datum point in the river improvement target area in this project	Below the planned highest water level at given flood control datum points	To assess if flood water level is lower than the safety level at the flood control datum point after the river improvement project	Quantitative assessment of the project needs not only the annual highest water level but also the highest water level at each flood, which should be measured separately. As an operation and effect indicator, annual highest water level is mainly adopted in order to also confirm that the above data are constantly collected.
Basic	Discharge Capacity (m ³ /s)	Show the latest discharge capacity at the flood control datum point. (It is desirable to revise the value once a year, but it is acceptable to revise it according to the attitude of the borrowing country, executing agencies, etc., or funds.	Planned discharged-water level at the flood control datum points	To assess if an improved discharge capacity due to the river improvement project is maintained	It is targeting the discharge capacity of the river itself. This is a more direct indicator to confirm the flood control effect.

Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Annual Maximum Inundated Area by Levee Breach or Overflow (km ²)	Past record of inundated area due to levee breach or overflow in the river improvement target area in a given project When neither breach nor overflow of the levee occurs, the value should be 0.	Inundated area that is worked out in the simulation at the time of planning assuming that a flood of the target scale of the improvement plan occurs. The target scale of the improvement plan should also be stated by the probability year of exceeding the safe water level. (In most cases, the area value is 0.)	To show that the river improvement project is effectively reducing flood damage as planned	As a given project is aiming at reducing damage caused by levee breach or overflow, a different indicator is adopted from that of inland water damage. Quantitative assessment of the project needs not only annual maximum inundated area but also inundated area (and a prediction of inundated area) at the time of each flood, which should be separately gathered. As an operation and effect indicator, annual maximum inundated area is mainly adopted in order to also confirm that the above data are constantly collected. (Although defining “flooding” is difficult, it is adequate to regard it as overflow that exceeds the flow that would have caused flood damage before the river improvement from a perspective of the project assessment.)
Basic	Annual Maximum Number of Inundated Houses by Levee Breach or Overflow (Households)	Number of inundated houses due to levee breach or overflow in the river improvement target area in a given project When neither breach nor overflow of the levee occurs, the value should be 0.	Number of households in the inundated area that is worked out in the simulation at the time of planning assuming that a flood of the target scale of the improvement plan occurs. The target scale of the improvement plan should also be stated by the probability year of exceeding safe water level. (In most cases, the area value is 0.)	To show that the river improvement project is effectively reducing flood damage as planned	As a given project is aiming at reducing damage caused by levee breach or overflow, a different indicator is adopted from that of inland water damage. Quantitative assessment of the project needs not only annual maximum number of inundated houses as shown in the remarks of the original indicator but also the number of inundated households at the time of each flood (and a prediction of the number of inundated households), which should be separately gathered. As an operation and effect indicator, annual maximum number of inundated households is mainly adopted in order to also confirm that the above data are constantly collected. (Although defining “flooding” is difficult, it is adequate to regard it as overflow that exceeds the flow that would have caused flood damage before the river improvement from a perspective of the project assessment.)

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Annual Reduction in Number of Inundation by Levee Breach or Overflow (Times)	Annual reduction in the amount of flood damage due to levee breach or overflow in the river improvement target area in this project	Difference between target flood scale of the improvement plan (converted to the probability year of exceeding safe water level) in the simulation at the time of planning and discharge capacity before the project that is converted to the probability year of exceeding safe water level	To show that the river improvement project is effectively reducing flood damage as planned	In many river improvement projects, once target flood scale is planned, improvement is conducted according to the planned target flood scale. As target value is in many cases 0, the project effects are difficult to see at a glance. Consequently, the indicator "How much flood damage is prevented by the project per year" is newly established.
Auxiliary	Annual Maximum Damage by Levee Breach or Overflow (local currency; value converted to yen included)	Amount of damage in the inundated area by levee breach or overflow in the river improvement target area in a given project	Amount of damage in the inundated area that is worked out in the simulation at the time of planning assuming that a flood of the target scale of the improvement plan occurs. The target scale of the improvement plan should also be stated by the probability year of exceeding safe water level. (In most cases, the area value is 0.)	To show that the river improvement project is effectively reducing flood damage as planned	As a given project is aiming at reducing damage caused by levee breach or overflow, a different indicator is adopted from that of inland water damage. This is generally thought to be the most comprehensible indicator, but it is adopted as an auxiliary indicator for the following reasons: i) difference between values worked out at the time of planning and actual damage total (assumed to be based on declared value) is anticipated; ii) it will take considerable time to work out the actual amount (in Japan, 2 years).
Auxiliary	Annual Maximum Inundated Time by Levee Breach or Overflow (Hours)	Inundated time estimated by the relationship between water depth at the flood control datum point at the time of flooding due to levee breach or overflow and inland ground height in the river improvement target area in a given project	Maximum inundated time at a representative point that is worked out in the simulation at the time of planning assuming that a flood of the target scale of the improvement plan occurs. The target scale of the improvement plan should also be stated by the probability year of exceeding safe water level. (In most cases, the area value is 0.)	To show that the river improvement project is effectively reducing flood damage as planned	As a given project is aiming at reducing damage caused by levee breach or overflow, a different indicator is adopted from that of inland water damage. As it takes a lot of trouble to work out the amount of damage, it is adopted as an auxiliary indicator, that is, as an alternative indicator of the amount of damage.

14. Forestation

I. Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Forestation Area (ha), Quantity of Planting (Number)	Area (ha) and number of trees in the forestation project area by kinds of tree	To be discussed with the executing agency referring to the result of F/S etc.	To assess if the forestation is properly conducted	A project in a dry area may possibly include planting grass. It is acceptable to check the number of planted trees by sampling method.
Basic	Survival Rate (%)	Survival rate of seedlings after a certain length of time in the project area (%) (Usually around 5 years after planting)	Around 70 - 100%	To assess the extent that seedlings are surviving after planting	This is adopted as a basic indicator because it is important in properly assessing how the project is operated. This is worked out by sampling method. Targets vary depending on forestation area, number of trees, kinds of trees, and purposes for forestation.
Basic	Quantity of Complementary Planting / replanting (Number)	Number of trees planted in order to complement loss due to death in the project area	To be discussed with the executing agency referring to the result of F/S etc.	To assess if loss due to death, etc., is properly complemented	
Auxiliary	Quantity of Benefited Forest Owners (Households)	Number of households of forest owners that earn income from forest products in the forest established in the project	To be discussed with the executing agency referring to the result of F/S etc.	To assess if economic effect is properly yielded by the execution of the project	This is adopted as an auxiliary indicator because targets that are benefited by the project are not always limited to the forest owners that earn income from forestry products.
Auxiliary	Area of Nursery (ha), Production Capacity of Seedlings (Number)	Area of nursery field established or improved by the project (ha), number of seedlings that has become producible in that nursery field	To be discussed with the executing agency referring to the result of F/S etc.	To assess if nursery field is newly constructed or improved properly	This is adopted as an auxiliary indicator because it is necessary only when the contents of the project include establishment and improvement of nursery field.
Auxiliary	Production of Seedlings (Number)	Number of seedlings shipped from nursery field that is established or improved by the project	To be discussed with the executing agency referring to the result of F/S etc.	To assess if seedlings are shipped properly	This is adopted as an auxiliary indicator because it is necessary only when the contents of the project include establishment and improvement of nursery field.
Auxiliary	Activity of Community	Number of communities that take charge of creation and management of forest, number of community members, and contents of community activity	To be discussed with the executing agency referring to the result of F/S etc.	To assess if the communities that take charge of project execution are properly functioning	This may be adopted as a basic indicator when social forestry is involved.

II. Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Rate of Forest Cover (Rate of Tree Crown) (%)	Rate of forest cover after a certain length of time in the project area (%) (First assessment should be conducted within 7 years after the completion of the project, and later on, assessment should be conducted regularly.)	10 - 20 % or over (Definition of forest by FAO: 20% and over in developed countries; 10% and over in developing countries)	To assess if established forests are properly having effect	This is an important indicator in judging the effect of the project including the environmental perspective. It is the density that indicates the degree of growth of forest trees in a certain area of a forest. Usually, the density is worked out by setting about 20 m ³ of sample area and dividing the shaded area with crowns by the total sample area. In projects in dry lands, cover rate (%) of vegetation including not only forest but also herbage is sometimes measured.
Basic	Amount of Products Volume (m ³), Monetary Value (\$)	Volume (m ³) and value (\$) of forest products produced in the project area by product	To be discussed with the executing agency referring to the result of F/S etc.	To assess if established forests are properly having economic effect	It takes a long time until a forest (especially timber forest) comes to have economic value, there may be cases in which assessment within 7 years after completion of the project is impossible. In such a case, efforts should be made, such as establishing EIRR by predicting the amount of future growth based on the amount of growth at that time. (However, it should be noted that credibility of the predicted values varies depending on the degree of accumulation of basic data concerning growth rate by kinds of tree.)
Auxiliary	Average Annual Income per Household Regarding Benefited Forest Owners (\$)	Average annual income per household of benefited forest owners (\$)	To be discussed with the executing agency referring to the result of F/S etc.		This may be adopted as a basic indicator when social forestry is involved.
Auxiliary	Number of Employees (Persons)	Number of workers employed in the project (persons)	To be discussed with the executing agency referring to the result of F/S etc.	To assess if local people are directly and properly employed through execution of the project	
Auxiliary	Membership in Training Class (Persons)	Participants in the training provided in the project area (persons)	To be discussed with the executing agency referring to the result of F/S etc.	To assess if forest skills are properly disseminated to local people	It is necessary only when training is carried out in projects concerning social forestry.

* In the case of forestation projects, it takes a long time until established forests grow adequately. Accordingly, it is desirable to carry out a post project assessment a certain length of time after the project completion in order to confirm the project effect.

III. Environment Indicator (Future examination is required for measuring method.)

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Auxiliary	Amount of Forest Resources	Total volume (m ³), total weight (t), and carbon content (tC) of forest in the project area	To be discussed with the executing agency referring to the result of F/S etc.	To assess the economic effect and environment conservation effect (CO ₂ fixation volume, etc.) of the project	This will probably be an inevitable indicator in the future, as it is associated with the activities of the Conference of Parties to the U.N. Framework Convention on Climate Change (COP). CO ₂ fixation volume can be worked out by multiplying the total weight of the forest by a certain modulus. The condition for adopting this indicator is that the executing local agency has the human resources and techniques required for measurement. When the measurement is difficult, this indicator should be excluded from the assessment.
Auxiliary	Quantity of Water Outflow	Water outflow of rivers and ground water in the project area	To be discussed with the executing agency referring to the result of F/S etc.	To assess flood alleviation and water conservation effects that forests have	This indicator should be adopted in assessing the project effect only when it is inevitable and when it is possible to measure. The condition for adopting this indicator is that the executing local agency has the human resources and techniques required for measurement. When the measurement is difficult, this indicator should be excluded from the assessment. For example, when trees are going to be planted in a certain catchment area, verifying the effect of forestation to a certain degree is possible by continuously measuring water outflow at a fixed point in the downstream. (However, in many cases, grasping the cause and effect relationship and degree of contribution is difficult. It is necessary to deal with this indicator carefully.)

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Auxiliary	Quantity of Erosion	Volume of erosion in the project area	To be discussed with the executing agency referring to the result of F/S etc.	To assess landslide prevention effect of forest	This indicator should be adopted in assessing the project effect only when it is inevitable and when it is possible to measure. The condition for adopting this indicator is that the executing local agency has the human resources and techniques required for measurement. When the measurement is difficult, this indicator should be excluded from the assessment. For example, when trees are going to be planted in a certain catchment area and a dam, etc., is placed in the downstream, verifying the effect of forestation to a certain degree is possible by continuously measuring the volume of sediment deposit.
Auxiliary	Situation of Wild Animals	Number of wild animals inhabiting the project area, etc.	To be discussed with the executing agency referring to the result of F/S etc.	To assess the ecological conservation effect of the forest	When wildlife conservation is one of the objectives of the project, adoption of this indicator should be compulsory.

15. Water Supply

Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Regarding project target area					
Basic	Population Served (Persons)	Population that receives water supply services per year To be assessed yearly	To be discussed with the executing agency	To show the basic current status of operation of water supply project	This is also a basic effect indicator to grasp general effectiveness of water supply projects.
Basic	Amount of Water Supply (m ³ /Day)	Maximum daily water supply = (the maximum amount among daily water supplies in a year) Average daily water supply = (annual total water supply)/ (number of days in a year) To be assessed yearly	To be discussed with the executing agency	To show the basic current status of operation of water supply project	This is also a basic effect indicator to grasp general effectiveness of water supply projects.
	Rate of Facility Utilization (%)	Rate of Facility Utilization (maximum) = (maximum daily water supply)/ (capacity of the facility) × 100 Rate of Facility Utilization (average) = (average daily water supply)/ (capacity of the facility) × 100			In a project that includes development of water purification facilities, values for the water purification facilities should be incorporated.
Basic	Non-revenue(earning)Water Rate (%) Revenue (earning) Water Rate (%)	(Non-revenue water rate: water supply that is not to be charged)/ (water supply) × 100 (Revenue water rate: water supply that is to be charged)/ (water supply) × 100 To be assessed yearly	To be discussed with the executing agency	To show the basic current status of operation of water supply project	(Non-revenue water volume) + (Revenue water volume) = (water supply) (Non-revenue water rate) + (Revenue water rate) = 100% In projects that include measures to improve water rate collection and measures against leakage, this can be adopted as an effect indicator.
Auxiliary	Leakage Rate (%)	(Volume of leakage)/ (water supply) × 100 To be assessed yearly	To be discussed with the executing agency	To assess the current status of maintenance and operation of water supply facilities, etc.	In projects that include measures against leakage, this can be adopted as an effect indicator. When it is difficult to measure the value with a certain degree of precision, unaccounted-for water rate can be adopted as an alternative indicator.
Auxiliary	Amount of Water Intake (m ³ /Day)	Maximum water intake = (maximum amount among daily water intakes in a year) Average water intake = (annual total water intake)/ (number of days in a year) To be assessed yearly	To be discussed with the executing agency	To assess the current status of securing water resources	This should be an operation indicator for projects that engage in water resources development.

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Auxiliary	Water Quality	Value associated with water quality To be assessed yearly (when values are expected to fluctuate depending on seasons, seasonal assessment is necessary)	Meeting the water quality standards and maintaining the quality	To assess the current status of maintenance and operation of water purification plants	This can be adopted as an effect indicator in projects that engage in water quality improvement. Clarify places to be tested (for example, an exit of a water purification facility and a hydrant cock). According to the features of the project, adopt appropriate indicators such as the rate of meeting the standards on specific items, representative items, or each item.

Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Regarding project target area					
Basic	Percentage of Population Served (%)	(Population served)/ (population in the project area) × 100 To be assessed yearly	To be discussed with the executing agency	To grasp general effectiveness of water supply projects	Clarify the definition as it varies depending on countries and regions. Reference: In some cases, water supply other than from the city water, such as from well-water is also counted.
Auxiliary	Water Supply per Capita (L/Person and Day)	Maximum daily water supply per person = (maximum daily water supply)/ (population served) Average daily water supply per person = (average daily water supply)/ (population served) To be assessed yearly	To be discussed with the executing agency	To assess improvement of living standard and effectiveness of water conservation	In projects that engage in water conservation targeting household use, it is desirable to measure water supply used for everyday living per person if it is possible to measure the volume by purpose of use.
Auxiliary	Land Subsidence (cm/Year)	Amount of land subsidence accompanying ground water use To be assessed yearly	To be discussed with the executing agency	To assess effectiveness of prevention against land subsidence	
Auxiliary	Revenue on Water Supply	Income of the project executor through water rate collection To be assessed yearly	To be discussed with the executing agency	To assess effectiveness of measures to improve water rate collection	
Regarding whole administrative district					
Auxiliary	Percentage of Population Served (%)	(Population served)/(population of the administrative district) × 100 To be assessed yearly	To be discussed with the executing agency	To grasp general effectiveness of water supply projects	When population served in the area benefited by the project does not correspond to population in the administrative district, working out the rate of population served in the administrative district is desirable. Not reaching the target does not always lead to low evaluation. Note: In Japan, percentage of population served in the administrative district is defined as the percentage of population served, and percentage of population served in the water supply project area is defined as water supply rate. The two are assessed independently.

16. Sewage System ^{*1}

Operation Indicator

Regarding project target area					
Category	Name	Policy and method of establishing the indicator ^{*2}	Target	Purpose	Remarks
Basic	Population Treated (Persons)	Population treated = (population connected to sewage network) Yearly data	To be discussed with the executing agency	To assess if the sewage water operation is properly conducted	Values should be constantly improving when the project is effective. When the population connected to sewage network is unknown, adopt similar indicators (population served with water supply, population in the area sewage system is installed, etc.)
Basic	Amount of Wastewater Treated (m ³ /Day)	As shown by the name of the indicator Yearly data	To be discussed with the executing agency	To assess if the sewage water operation is properly conducted	Values should be constantly improving when the project is effective. (Indicator covers the treatment of industrial waste water as well)
	Rate of Facility Utilization (%)	Rate of Utilization = (daily average amount of treated waste water)/ (capacity of the facility) Yearly data	40% or over at the time of starting operation	To assess if the network improvement is properly conducted	This corresponds to rate of facility operation. It is desirable to indicate 40% or over three years after starting operation.
Basic	BOD Concentration—influent, effluent, reduction rate (mg/L; assessed monthly)	As shown by the name of the indicator Monthly data (monthly average of data obtained regularly)	Reduction rate: 80 - 95%	To assess if the treatment plant is properly operated	When the treated waste water is discharged into closed waters (lakes, inland sea, etc.), substitute the indicator by COD ^{*3} . Reduction rate: 70 - 85%
Auxiliary	Covered Ratio of Sewer Main (%)	Covered ratio = (length of sewage pipes covered)/ (planned total length) Yearly data	40% or over at the time of starting operation	To assess if the network improvement is properly conducted	Sewer main is referred to as sewage pipe that is directly connected to a treatment plant or pumping station.
Auxiliary	Suspended Solid Concentration ^{*3} --influent, effluent, reduction rate (mg/L; assessed monthly)	As shown by the name of the indicator Monthly data (monthly average of data obtained regularly)	Reduction rate: 80 - 95%	To assess if the treatment plant is properly operated	
Auxiliary	Form of Sludge Disposal (each form DS ^{*3} -T/Year)	Amount of sludge disposal by form of disposal ^{*4} Yearly data	To be discussed with the executing agency	To assess effect of environment burden reduction and resource recovery	Promotion of recycling should be strongly demanded as far as possible.
Auxiliary	Rate of Sludge Recycled (%)	Rate of Sludge recycled = (amount of sludge recycled)/ (amount of sludge) Yearly data	To be discussed with the executing agency	To assess effect of environment burden reduction and resource recovery	Promotion of recycling should be strongly demanded as far as possible.

Category	Name	Policy and method of establishing the indicator *2	Target	Purpose	Remarks
Auxiliary	Rate of Service Charge Recovery (%)	Rate of service charge recovery = (recovered service charge)/ (service charge claimed) Yearly data (annual average worked out from monthly data)	80% or over	To assess if guidance and dissemination to local residents are properly carried out	Management indicator: it is desirable to improve the rate closer to 100% as far as possible.

Effect Indicator

Regarding project target area					
Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Percentage of Population Served (%)	Percentage of Population Served = (population that is actually served with treatment)/ (target population of treatment service) Yearly data	In five years after starting operation, 60 - 80%	To assess if the sewage water operation is properly conducted	Indicator for the whole project plan
Basic	Improvement of Water Quality (BOD/COD)	As shown by the name of the indicator Monthly data (monthly average of data obtained regularly)	Environmental standard for water quality	To assess if sewage project is effective	When the treated waste water is discharged into closed waters (lakes, inland sea, etc.), substitute the indicator by COD ^{*3} .
Auxiliary	Percentage of Population Connected (%)	Percentage of Population connected = (population connected to sewage network)/ (target population of treatment service) Yearly data	80% of the proportion of the population served	To assess if the network improvement is properly conducted	Indicator for the whole project plan
Auxiliary	Improvement of Irrigation Water (BOD)	As shown by the name of the indicator Monthly data (monthly average of data obtained regularly)	Standard for recycling treated waste water	To assess if sewage project is effective	
Auxiliary	Ratio of Cost Recovery (%) ^{*5}	Ratio of cost recovery = (Amount of service charge collected)/ (cost of treatment service) Yearly data (annual average worked out from monthly data)	To be discussed with the executing agency	To assess if sewage project is properly managed	Management indicator: it should cover at least maintenance and operation costs.
Auxiliary	Reducing Ratio of Sludge Disposal (%) ^{*6}	(Volume recycled)/ (volume of sludge) Yearly data (annual average worked out from monthly data)	To be discussed with the executing agency	To assess if sewage project is properly managed	
Regarding whole administrative district					
Auxiliary	Percentage of Population Served (%) ^{*7}	Percentage of population served = (population that is actually served with treatment)/ (population in the administrative district) Yearly data	In the target year of the plan: 50% or over	To confirm the degree of contribution of the project to the whole administrative district (residents)	Not reaching the target does not always lead to low evaluation.
Auxiliary	Percentage of Wastewater Treatment (%)	Percentage of Wastewater Treatment = (volume of wastewater treatment)/ (total volume of sludge)	In the target year of the plan: 50% or over	To confirm the degree of contribution of the project to the whole administrative district (residents and industry)	Not reaching the target does not always lead to low evaluation.

*1 Basic concept of operation indicators: indicate how well the operation of a sewage project is carried out in order to have the above mentioned effects

Basic concept of effect indicators: indicate how comfortable the daily life of community people has become (percentage of population served) and how well the water environment is conserved (water

quality improvement)

- *2 “Yearly data” is referred to as the values at the end of the financial year, and “monthly data” as the values at the end of the month, and “data obtained regularly” as values obtained several times/week or daily.
- *3 Densities of Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and Suspended Solids (SS) indicate the degree of organic contamination. Dried Sludge (DS) indicates the volume of sludge that is converted to this value in the case of having 0% of moisture content.
In closed waters such as bays or lakes, the value of BOD is lower than the actual sludge volume. Accordingly it is desirable to indicate it by COD.
In a case in which the treated waste water is discharged into a general sea area, it is desirable to indicate the degree of water quality improvement by the number of coli-aerogenes group or COD measured at the adjacent seashore.
- *4 Forms of final disposal after sludge treatment at a treatment plant include landfill, recycled as construction material, recycled as compost, etc.
- *5 Basic cost includes operation and management cost of the treatment plants and sewage network. It should be decided through discussion with the executing agency if undistributed profits are to be included in preparation for the future. Even if self-support accounting is not attained, at least maintenance and operation cost should be paid by the service charge recovered.
- *6 Generally, sludge is disposed in landfill at a cost. Promoting recycling of sludge in green or farm land will reduce the cost.
- *7 As the most popular indicator in and out of Japan is percentage of population served at the autonomous community level, this indicator is established.

17. Education

Operational & Effective Indicator

Regarding pupils and students					
Category	Name	Methods of calculating	Target	Purpose	Remarks
Basic	Intake Rate	Intake rate = (number of new entrants in the first grade/ number of children who have reached the official age of the first grade) × 100	—	Basic indicator to show the size of population that is accepted in the education system in each school year and future prospects	When the number of new entrants in the first grade who are of the official first grader's age is put into the numerator, net intake ratio is obtained.
Basic	Enrollment Ratio	Enrollment ratio = (number of students who have enrolled in a given level of education/ number of children of the official age-group for that level of education)	—	Basic indicator to show population enrolled in schools of the whole education system in each school year	When the number of children who are of the official age-group for a given level of education and are actually enrolled in that level is put into the numerator, net enrolment ratio is obtained.
Basic	Male-Female Ratio	Numbers by sex concerning each indicator	—	Basic indicator to show accessibility to the education service	It is necessary to collect data by sex for each indicator according to the project goal.
Basic	Promotion Rate	Promotion rate = number of students in a given grade who will be promoted to a higher grade in (T+1) year/ number of students in the given grade who enrolled in (T) year	—	Basic indicator to show internal efficiency of the education system	
Basic	Completion Rate	Completion rate (assuming 6-year education) = number of new entrants in (T-6) year / number of students who have completed school in (T) year	—	Basic indicator to show internal efficiency of the education system	
Basic	Share of Students by Subject	Ratio of students in each major = number of students in a certain major/ total number of students	—	Basic indicator to show the importance of each subject majored at vocational schools and schools of higher education	
Basic	Student Test Scores	Values should be collected from the country's statistics on education	—	Basic indicator to show academic achievement of students and quality of education	It should be noted that there are three kinds of tests: Terminals (tests at the end of the term), National assessments (academic achievement tests), and Exams (competitive exams).
Auxiliary	Repetition Rate	Repetition rate = number of students in a certain grade who will repeat in (T + 1) year/ number of students in the same grade in (T) year	—	Basic indicator to show internal efficiency of the education system	Indicators can be substituted to measure the degree of advancement.

Category	Name	Methods of calculating	Target	Purpose	Remarks
Auxiliary	Drop-out Rate	Drop-out rate = number of students in a given grade who drop-out in (T + 1) year/ number of students in the same grade in (T) year	—	Basic indicator to show internal and external efficiency of the education system	It is effective in looking at the factors on the demand side such as family circumstances in addition to the quality of education.

Regarding teaching staff and classes					
Category	Name	Methods of calculating	Target	Purpose	Remarks
Basic	Student - Teacher Ratio	Student - teacher ratio = number of students/ number of teachers	—	Basic indicator to assess quality of education	Take notice if shift work system in which a teacher engages in more than one cycle a day is adopted.
Basic	Qualified Teacher Ratio	Qualified teacher ratio = number of qualified teachers/ number of teachers	—	Basic indicator to assess quality of education	
Basic	Teachers per Class	Teacher per Class = number of teachers/ number of classrooms	—	Basic indicator to assess quality of education	
Basic	Students per Classroom	Students per Classroom = number of students/ number of classrooms	—	Basic indicator to assess quality of education	
Auxiliary	Female Teacher Ratio	Female teacher ratio = number of female teachers/ number of teachers	—	Indicator to assess quality of education and gender-equality	It is necessary to collect data according to the project goal.
Regarding textbooks, teaching materials, and facilities					
Category	Name	Methods of calculating	Target	Purpose	Remarks
Basic	Classroom Area per Student (m ²)	Classroom Area per student = classroom area (m ²)/ number of students	—	Basic indicator to assess quality of education	Verify design on account of actual effect.
Auxiliary	Textbook - Student Ratio	Textbook - student ratio = number of textbooks/ number of students	—	Basic indicator to assess quality of education	Worked out for each subject.
Auxiliary	Distance from School (km)	—	—	Basic indicator to assess access methods to education	By obtaining data for this indicator before the appraisal, it is possible to know if the causes of the low school enrollment rate lie on the demand side or supply side.
Regarding educational expenses					
Category	Name	Methods of calculating	Target	Purpose	Remarks
Auxiliary	Public Education Expenditure Share of GNP	Public education expenditure share of GNP = public education expenditure/GNP	—	Basic indicator to show the scale of expenditure in the field of public education in the economy of a given country	It is desirable to collect data in chronological order (of the past five years).
Auxiliary	Public Education Expenditure Share of Total Government Expenditure	Public education expenditure share of total government expenditure = public education expenditure/ total government expenditure	—	Basic indicator to show the size of expenditure in the field of public education compared to the total expenditure of a given country's government	It is necessary to collect data on public education expenditure rate by level of education, current expenditure and investment expenditure.
Auxiliary	Teacher Salary Share of Total Education Expenditure	Teacher salary share of total education expenditure = teacher salary/ public education expenditure	—	Basic indicator to show the size of expenditure as teacher salary compared to that of the field of public education	It is necessary to collect data also on the rate of teacher salary to the current expenditure.

Category	Name	Methods of calculating	Target	Purpose	Remarks
Auxiliary	Education Expenditure per Student	Education expenditure per student = public education expenditure/number of students	—	Basic indicator to show the size of public education expenditure per student	Per student family expenditure is effective as an indicator to show income disparity, and regional disparity.
Auxiliary	Per Student Expenditure Between Primary and Tertiary Education	Per student expenditure between primary and tertiary education = per student expenditure of primary education/per student expenditure of tertiary education	—	Basic indicator to show the gap between public education expenditure per student for primary education and that for tertiary education	

Others					
Category	Name	Methods of calculating	Target	Purpose	Remarks
Auxiliary	Actual Annual Instruction Time	From data on educational statistics Ratio between Official Instruction Time and Actual Instruction Time	—	Basic indicator to assess quality of education	It is necessary to check not only total instruction hours but also instruction hours by subject.

Note: In the education sector, output indicators and indicators that compare the predicted level of using output and actual level of using output are adopted as operation indicators. The outcome of the project that meets the project goal and the impact are adopted as effect indicators. As indicators should correspond to the project goals, indicators adopted may vary and there may be more effective indicators depending on the project goals. When values that should be compared to, for example, base lines and control groups, are not fixed, effectiveness will be reduced.

18. Health Care

Operation Indicator*

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	Number of Examinations and Operations	Number of clinical examinations and operations that makes use of the given facilities and appliances during a specific period	To be discussed with the executing agency	To assess the function of provided healthcare facilities and appliances	To assess if the given facilities and appliances are operated properly as well as the level of operation Kinds of examinations and operations should also be clarified.
Basic	Number of Inpatients, Outpatients, and Emergency Patients (Persons)	Number of inpatients, outpatients, or emergency patients during a specific period	To be discussed with the executing agency	To assess the function of provided health care facilities	
Auxiliary	Bed Occupancy Rate (%)	(Number of beds occupied during a specific period)/ (total number of beds during the same period) × 100	To be discussed with the executing agency	To assess the function of provided health care facilities	
Auxiliary	Number of Patients treated, delivery, and Hospital Deaths (Persons)	Number of patients treated, delivery, or hospital deaths during a specific period	To be discussed with the executing agency	To assess the function of provided health care facilities	
Auxiliary	Number of Physicians, Nurses and Co-Medical Workers Trained (Persons)	Number of physicians, nurses, and co-medical workers who received training during a specific period	To be discussed with the executing agency	To assess the function of conducting upskilling activities by persons engaged in health care	
Regarding the whole administrative district					
Auxiliary	Number of Patients treated (Persons)	Number of patients treated during a specific period	To be discussed with the executing agency	To assess the function of using healthcare facilities in a given district	Will be measured in the administrative district that includes the project target area.

Effect Indicator *

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Regarding the whole administrative district					
Basic	Birth Rate and Mortality Rate (per 1,000 persons)	Annual number of births and deaths per 1000 persons (Mortality)/ (population) × 1,000	To be discussed with the executing agency	To assess effectiveness of improvement in healthcare standards in a given area	
Auxiliary	Under 5 Mortality Rate (per 1,000 births)	Annual number of deaths of children under age 5 per 1,000 live births (Mortality under 5)/ (number of births) × 1,000	To be discussed with the executing agency	To assess effectiveness of improvement in healthcare standards in a given area	
Auxiliary	Infant Mortality Rate (per 1,000 births)	Annual number of deaths of children under age 1 per 1,000 live births (Infant Mortality)/ (number of births) × 1,000	To be discussed with the executing agency	To assess effectiveness of improvement in healthcare standards in a given area	
Auxiliary	Maternal Mortality Rate (per 100,000 deliveries)	Annual number of material deaths due to pregnancy, etc., during the pregnancy, at the time of delivery, or in 42 hours after the delivery per 100,000 deliveries (Material mortality)/ (number of delivery) × 100,000	To be discussed with the executing agency	To assess effectiveness of improvement in healthcare standards in a given area	
Auxiliary	Mortality Rate by Diseases (per 100,000 persons)	Cause specific death rate due to infectious diseases, noninfectious diseases (cancers, heart diseases) per 100,000 persons (Mortality by disease)/ (population) × 100,000	To be discussed with the executing agency	To assess effectiveness of improvement in healthcare standards in a given area	
Auxiliary	Life Expectancy	Years of average expected years of life	To be discussed with the executing agency	To assess effectiveness of improvement in healthcare standards in a given area	
Auxiliary	Incidence Rate (per year; per 100,000 persons)**	Cases of infectious diseases, or food poisoning within a specified period of time per 100,000 persons (Annual number of patients)/ (population) × 100,000	To be discussed with the executing agency	To assess effectiveness of improvement in healthcare standards in a given area	
Auxiliary	Prevalence Rate (per 1,000 persons)	Cases of disease during a particular period per 1,000 persons (Cases of disease during a particular period of time)/ (population) × 1,000	To be discussed with the executing agency	To assess effectiveness of improvement in healthcare standards in a given area	

* In this category, projects are assumed to include construction of hospital wards, provision of medical materials and equipment, and training. In some cases, indicators that are not introduced here may be more effective. Accordingly, appropriate operation and effect indicators should be adopted depending on the content and features of the project. In order to show more direct effects of the project, effect indicators can be adopted rather than operation indicators.

** By adopting new medical facilities, new patients who have not been given diagnosis (not counted in data) are counted. As a result, this indicator will probably show an increase.

19. Tourism

I. Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Auxiliary	Operation indicators in the other sectors: Roads, Aviation, Ports and harbors, Water supply, Sewage system, and Forestation, etc., should be adopted.				
Auxiliary	Number of Visitors	Number of visitors that entered the target facilities Annual total and monthly total (It is desirable to show by foreign citizens and domestic citizens)	Predicted demand value	To assess if the target facilities are properly operated (utilized)	* It is appropriate to adopt this indicator when improving facilities that target tourists such as parks and museums in the sub-projects. * This indicator is important not only as an operation indicator but also as an effect indicator.
Auxiliary	Entrance Fee	Entrance fee to the target area Annual total (It is desirable to show by foreign citizens and domestic citizens)	Predicted demand value		

II. Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Auxiliary	Number of Tourists	In each whole region (prefecture or state) or whole country Annual total (It is desirable to show by foreign citizens and domestic citizens)	Predicted demand value	Most of tourism projects that are requested by developing countries aim at obtaining foreign currency. Sub-projects also have a wide range of goals. In such projects, adopting these indicators as priority goals in a political perspective is considered to be appropriate.	
Auxiliary	Income from Tourism	Income from tourism in national finance Annual total	Predicted demand value		
Auxiliary	Number of Hotel Guests	Number of hotel guests in the target area (separately or all together) Annual total and monthly total (It is desirable to show by foreign citizens and domestic citizens)	Predicted demand value	To assess the number of visitors to the project target area	Statistics on the number of tourists staying overnight are necessary when the project targets are established.

Notes: As shown by the cases in the past, most requests from developing countries are: (1) projects for promote and develop tourism with a wide range of project goals, such as obtaining foreign currency, employment creation, regional development; and (2) projects for attaining the goals in the above (1) consisting of many sub-projects with a wide range of improvement targets, from museums, infrastructure including roads, airports, ports, harbors, water supply, sewage system, to environment conservation (forestation). Accordingly, these circumstances should be taken into consideration when operation and effect indicators are established.

20. Solid Waste

Operation Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	The amount of waste collected (tons/day)	As shown by the name of the indicator	To be discussed with the executing agency	An indicator for measuring the expansion of the collection service area, the improvement in collection efficiency and service improvement	It can be used as an effect indicator. The value should be estimated from the number of trips and the capacity of the collection vehicles, if a weighbridge is not installed at the final disposal site.
Basic	The waste collection rate (%)	The annual amount of waste collected / the annual amount of waste generated	To be discussed with the executing agency	Same as above	It can be used as an effect indicator. The estimated amount of waste generated requires the demographic data, waste generation and composition data in the relevant area.
Basic	The amount of waste disposed of at final disposal sites (tons/year)	As shown by the name of the indicator	To be discussed with the executing agency	Same as above	It can be used as an effect indicator.
Auxiliary	The operating rate of a recyclables recovery facility (%)	The amount received by the facility (tons/day) / the design capacity of the facility (tons/day)	To be discussed with the executing agency	An indicator for measuring the waste reduction and recycling situation	The use of the operating rate as an indicator should be considered if the project includes an incineration facility, a composting facility and/or a transfer station.

Effect Indicator

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	The size of the population receiving collection services	As shown by the name of the indicator	To be discussed with the executing agency	An indicator for measuring the expansion of the collection service area, the improvement in collection efficiency and service improvement	It indicates the number of service beneficiaries and qualitative improvement (an indicator concerning service beneficiaries). The population coverage rate (%) (the population receiving the collection service / the total population in the area) can also be used.
Basic	A reduction in the number of illegal dumping sites	As shown by the name of the indicator	To be discussed with the executing agency	Same as above	It indicates the number of service beneficiaries and qualitative improvement (an indicator concerning service beneficiaries).
Auxiliary	Waste treatment costs (dollars/ton)	As shown by the name of the indicator	To be discussed with the executing agency	Same as above	This is the unit cost (per ton) of waste treatment including collection, intermediate treatment and disposal, etc. The cost decreases when collection efficiency improves. It is an indicator for measuring efficiency of operation from the financial aspect.
Auxiliary	The amount of recyclables recovered (tons/day)	As shown by the name of the indicator	To be discussed with the executing agency	An indicator for measuring the waste reduction and recycling situation	

Environment Affect Indicator

Adopt only when the following reduction is expected to be achieved

Category	Name	Policy and method of establishing the indicator	Target	Purpose	Remarks
Basic	The value of biochemical oxygen demand (BOD) of leachate after treatment (mg/L)	As shown by the name of the indicator	To be discussed with the executing agency	Assessment of environmental projects	
Auxiliary	The value of chemical oxygen demand (COD) of leachate after treatment (mg/L)	As shown by the name of the indicator	To be discussed with the executing agency	Assessment of environmental projects	