Climate project methodology No. 0019

Increased electricity generation from existing hydropower stations through decision support system optimization oroverhaul

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Version 3.0

29 September 2023

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1. Terms and definitions

1.1. The definitions and terms contained in Russian regulatory documents and national standards shall apply.

1.2. The climate project developer is encouraged to use the terms and definitions used in this methodology:

1.2.1. **Decision Support System (DSS)** is an integrated set of computer programs (modules) that use forecasting methods, as well as optimization and modeling methods to optimize long-term and short-term benefits from the operation of the power system. Thus, DSS supports the adoption of complex decisions in multidimensional situations and increases their effectiveness.

1.2.2. **Hydroelectric power plants (HPPs)** are a complex of electromechanical devices and equipment necessary to convert potential hydroelectric energy into electrical energy.

1.2.3. **A hydraulic power unit** is an aggregate consisting of a hydraulic turbine and a hydrogenerator[1].

1.2.4. **Crediting period** is the period in which verified and certified GHG emission reductions or increases in net anthropogenic GHG removals by sinks attributable to a climate project activity, as applicable, can result in the issuance of carbon units. The time period that applies to a crediting period for a climate project activity, and whether the crediting period is renewable or fixed, is determined in accordance with Section 4 *(Project crediting period)* of this methodology.

1.2.5. **Project Design Document (PDD)** is the principal document used by project developers to demonstrate and describe information about the proposed climate project for submission to the validation/verification authorities and the carbon units register.

1.2.6. **Reconstruction** is the reconstruction of existing fixed assets associated with the improvement of production and its technical and economic performance and carried out under the project of reconstruction of fixed assets in order to increase production capacity, improve quality and change the nomenclature of production[2]. The reconstruction of existing energy enterprises includes the reconstruction of existing workshops and main, auxiliary and maintenance facilities of power plants, thermal and electrical networks associated with the improvement of production, increasing the technical and economic level, changing the main technical and economic indicators. As a rule, the electrical network facilities subject to reconstruction have an unsatisfactory structural condition due

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[1] In accordance with GOST R 55260.4.1-2013. Technological Part of Hydroelectric Power Plants and Pumped Storage Power Plants.

[2] For the terms "Technical re-equipment", "Modernization", "Reconstruction" and "Overhaul", the definition of a single terminology in the regulatory documents of the Russian Federation is not established and there may be discrepancies depending on the facilities subject to these types of work. Terminology in reference methodologies also does not coincide in full (indicated for each specific term). The term "Technical re-equipment" in the sense of use in the methodology is close to the term "Modernization". However, the Russian legal field divides these concepts.

to the standard service life expiry or due to various natural disasters[3], and do not meet the requirements of sanitary and environmental standards.

1.2.7. **Modernization (fixed asset completion, equipping, replacement[4])** are works caused by a change in the technological or service purpose of equipment, buildings, structures or other objects of depreciable fixed assets, increased loads and/or other new qualities[5], i.e. it is the replacement of outdated equipment with new due to functional wear. Modernization of the electric power industry includes not only decommissioning of old, worn out and obsolete equipment, reconstruction of low-efficiency equipment and replacement of technologies with modern ones, but also the creation of fundamentally new equipment and energy technologies.

1.2.8. **Reservoir** is an artificial water body created by means of a water-retaining structure, or by filling a cavity or a dammed area with water for the purpose of storing water and/or regulating runoff with special structures, creating a backup[6] [7].

1.2.9. **Overhaul[8]** is repair in order to restore the usability (operability) of structures and equipment, as well as to maintain operational performance. During the overhaul of equipment, which is carried out to restore the usability and full or close to full service life of the facility including the replacement or restoration of any of its parts, a complete disassembly of the unit, repair of basic and body parts and assemblies, restoration or replacement of all worn-out parts and assemblies with new and more modern ones, assembly, regulation and testing of the unit can be carried out. During equipment overhaul, its functional purpose should not be changed. The purpose of the equipment overhaul is to restore its technical and economic characteristics to values close to the initial ones[9].

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[3] Reference methodologies developed within the framework of the Clean Development Mechanism (ACM0002) use the following interpretation for this term: **Rehabilitation (or refurbishment)** is an investment to restore the existing power plants/units that were severely damaged or destroyed due to foundation failure, excessive seepage, earthquake, liquefaction, or flood. The primary objective of rehabilitation or refurbishment is to restore the performance of the facilities. Rehabilitation may also lead to increase in efficiency, performance or power generation capacity of the power plants/units with/without adding new power plants/units.

[4] Reference methodologies developed within the framework of the Clean Development Mechanism (ACM0002) use the following interpretation for this term: **Replacement** is an investment in new power plants/units that replaces one or several existing units at the existing power plant. The new power plants/units have the same or a higher power generation capacity than the plants/units that were replaced.

[5] For the terms "Technical re-equipment", "Modernization", "Reconstruction" and "Overhaul", the definition of a single terminology in the regulatory documents of the Russian Federation is not established and there may be discrepancies depending on the facilities subject to these types of work. Terminology in reference methodologies also does not coincide in full (indicated for each specific term). The term "Technical re-equipment" in the sense of use in the methodology is close to the term "Modernization". However, the Russian legal field divides these concepts.

[6] GOST R 70214-2022. Hydraulic Engineering. Basic Concepts. Terms and Definitions.

[7] Reference methodologies developed within the framework of the Clean Development Mechanism (ACM0002) use the following interpretation for this term: **Reservoir** is a water body created in valleys to store water generally made by the construction of a dam.

[8] Reference methodologies developed within the framework of the Clean Development Mechanism (ACM0002) use the following interpretation for this term: **Retrofit** is an investment to repair or modify existing operating power plants/units, with the purpose to increase the efficiency, performance or power generation capacity of the plants/units, without adding new power plants/units. A retrofit restores the installed power generation capacity to or above its original level. Retrofits shall only include measures that involve capital investments and not regular maintenance or housekeeping measures.

[9] Order No. 1013 of the Ministry of Energy of the Russian Federation dated 25 October 2017 "On Approval of Requirements for Ensuring the Reliability of Electric Power Systems, Reliability and Safety of Electric Power Facilities and Power Receiving Installations "Rules for the Organization of Maintenance and Repair of Electric Power Facilities" (with amendments and additions).

2. Scope and applicability

2.1. This methodology has been prepared on the basis of the existing methodologies developed under the Clean Development Mechanism – AM0052 and ACM0002 – and includes their adaptation to the current Russian regulations and standards.

2.2. This methodology is applicable to two types of projects:

I. Projects of the first type, including existing grid-connected hydropower systems that may include multiple hydro generation units linked in a cascade, including both run of the river and reservoir-based units, where the project activity increases annual electricity generation through the introduction of a Decision Support System (DSS) that optimizes the operation of the existing hydropower facility/facilities.

II. Projects of the second type, including overhaul, reconstruction, modernization or capacity addition to an existing power plant that uses renewable energy sources and supplies electricity to the grid. The main type of GHG emissions mitigation action is renewable energy, e.g. displacement of electricity that would otherwise be provided to the grid by more-GHG-intensive means.

2.3. In case of changes in the GHG regulatory legal framework of the Russian Federation, this methodology is subject to revision in order to take into account the relevant changes.

2.4. The methodology is applicable under the following conditions in case of projects of the first type:

2.4.1 where the operation of hydropower systems is not currently optimized using a DSS, with optimization controls or modeling;

2.4.2 where, at a minimum, three complete years of recorded data are available to establish the baseline relationship between water flow and power generation;

2.4.3 where power generation units, covered under the project activity, have not undergone and will not undergo significant upgrades beyond basic maintenance that affect the generation capacity and/or expected operational efficiency levels during the crediting period;

2.4.4 where no major changes to reservoir size (e.g., increase of dam height) or to other key physical system elements (e.g. canals, spillways) that would affect water flows within the project boundary, have been implemented during the baseline data period or will be implemented during the crediting period;

2.4.5 where the project activity only includes the optimization of generation units that generated and supplied power to the electricity system during the year(s) for which historical data for the baseline was collected;

2.4.6 where either no additional hydro power units are located downstream of the last hydropower unit within the project boundary or the first hydropower unit downstream the project boundary has the capacity to regulate at least 24 hours of maximum flow from upstream.[10]

2.5 The methodology is applicable under the following conditions in the case of the second type of projects for the production of electricity from grid-connected renewable energy sources, which include:

2.5.1. Overhaul of the existing operating power plant;

[10] Twenty-four hour (24 hrs) capacity in cubic meters (m^3) = Maximum observed annual flow (m^3/s) *24 hr*3600 s/hr * 0.5. Note that the factor 0.5 reflects that the storage must be 50% of the flow volume to re-regulate the inflow to the average daily value.

2.5.2. Reconstruction of an existing power plant or modernization/technical re-equipment of an existing power plan.

2.5.3. The project is implemented at hydro power plant with or without reservoir.

2.5.4. The project activity is carried out in one or more reservoirs, without changing the volume of any of the reservoirs.

2.5.5. In the case of overhauls, reconstructions or modernizations, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".

2.5.6. In the case of overhauls, reconstructions or modernizations, the existing plant started commercial operation at least five years prior to the start of the project, which is a minimum historical reference period, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, overhaul, or reconstruction of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.

2.6 The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the project power plant is connected to.

2.7 For the baseline determination, project participants shall only account for CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The grid emission factor will be calculated according to Appendix 2. The summary of emission sources and GHGs is provided in Table 1.

Table 1. Emission sources included in or excluded from the project boundary

Source		Gas	Included	Justification/Explanation
Baseline scenario		CO_2	Yes	CO_2 is emitted when fossil fuels are burned to generate electricity. The project activity would displace those fossil fuels with enhanced hydropower output
		CH_4	No	-
		N_2O	No	-
Project scenario		CO_2	No	In terms of project emissions, the project is enhancing the use of existing hydropower capacity to generate additional hydropower. No fossil fuels will be used to generate this additional electricity and thus there will be no project emissions
		CH_4	No	-
		N_2O	No	-

3. Baseline methodology

3.1 The baseline[11] is set conservatively[12] for a business-as-usual activity, taking into account all existing policies and measures, but not considering additional project activities (Business-as-usual model). The project developer may use one of the approaches listed below. This requirement conforms to the recommendations from the resolution under article 6.4 of the Paris Agreement[13]. The project developer may use one of the following approaches (paragraphs 3.1.1-3.1.3) to determine the baseline with justification for the appropriateness of the choices:

3.1.1. Best available technologies that represent an economically feasible and environmentally sound course of action.

3.1.2. An ambitious benchmark approach where the baseline is set at least at the average emission level of the 20% best performing comparable activities providing similar outputs and services in a defined scope in similar social, economic, environmental and technological circumstances.

3.1.3. An approach based on existing actual or historical emissions, adjusted downwards by at least 5%, unless otherwise specified in the project methodology.

3.2. This methodology details the calculation of baseline emissions for approach 3.1.3 (current or historical emissions).

3.3. The following six steps are used to estimate baseline emissions. If generating units within the project site, where DSS is implemented, do not share a connected water source, the estimation of baseline emissions will be the sum of the baseline emissions estimated using Steps 1 through 6 for each water course separately (paras 3.5 – 3.17).

3.4. A Data Book shall be prepared prior to the implementation of the Decision Support System containing all functional relationships for each generating unit, including the flow-generation functions.

3.5. **Step 1:** Collect data for estimating the baseline flow-output relationship. The flow-output relationship is developed from baseline data collected for each generating unit and spillway within the project boundary, as described in the steps below. All data available within the most recent three calendar years must be collected and applied to the methodology below. In cases where less than three full years is used, the DOE must verify the unavailability of data. A minimum of one calendar year's data must be used, as required by the applicability conditions.

3.6. **Step 2:** Estimate weekly baseline flow for each week (generating units and spill). The weekly flow (Q_x) is the sum of the flow through generating unit(s) and the spillway(s), estimated on an hourly basis, calculated as follows:

$$Q_x = \sum_{hpu=1}^{N} \sum_{h=1}^{168} Q_{hpu,h} + \sum_{SW=1}^{M} \sum_{h=1}^{168} Q_{SW,h} \quad (1)$$

Where:

Q_x – Flow during week x for each generation site (m^3/week);

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[11] Greenhouse gas baseline, GHG baseline is a quantitative reference(s) of GHG emissions and/or GHG removals that would have occurred in the absence of a GHG project and provides the baseline scenario for comparison with project GHG emissions and/or GHG removals (ISO 14064-2:2019 Greenhouse gases - Part 2).

[12] Calculation of the baseline is considered conservative if the final estimate of emission reductions resulting from project activities will not be overestimated. If there is any doubt, the project developer should better understate the baseline projection.

[13] https://unfccc.int/sites/default/files/resource/cma2021_10a01E.pdf, p. 34, B – methodologies.

$Q_{hpu,h}$ – Flow through generation unit *hpu* during hour *h* in week *x* estimated using the relationship provided in equation 2 (m^3/hour);

$Q_{SW,h}$ – Flow over the spillway *SW* for hour *h* during week *x*, estimated using equation 3 (m^3/hour);

N – Total number of hydro power generation units *hpu* within the project site on the same water course (number);

M – Total number of spillways within the project site on the same water course (number).

3.7. **Step 2a:** Deduce flow through generating units. The hourly flow through each generating unit is determined using the records of measured power output for that hour and the characteristic specifications of the generating unit. A curve for each HPU known as a "Hill Diagram" will be constructed that accurately pinpoints its *power* versus *flow* and *head*. The form of the flow-generation curve for each generating unit is represented by a third order, polynomial equation that relates measured power output to measured head and flow, using equations 2-6:

$$EG_{hpu,h} = a + b \times Q_{hpu,h} + c \times Q_{hpu,h}^2 + d \times Q_{hpu,h}^3 \quad (2)$$

$$a = a_1 + a_2 \times H_{hpu} + a_3 \times {H_{hpu}}^2 \quad (3)$$

$$b = b_1 + b_2 \times H_{hpu} + b_3 \times {H_{hpu}}^2 \quad (4)$$

$$c = c_1 + c_2 \times H_{hpu} + c_3 \times {H_{hpu}}^2 \quad (5)$$

$$d = d_1 + d_2 \times H_{hpu} + d_3 \times {H_{hpu}}^2 \quad (6)$$

Where:

$EG_{hpu,h}$ – Observed power output of *hpu* unit for hour *h* during week *x* (MWh);

a, b, c, d – Coefficients that are a function of head, calculated as per equations above;

$Q_{hpu,h}$ – Flow through generation unit *hpu* during hour *h* (m^3/hour);

a_i, b_i, c_i, d_i– The power polynomial coefficients for each generating unit based on the "*hill diagram"* information provided by the owner or manufacturer;

H_{hpu} – Head acting on the generating unit *hpu* (headwater level less tail water level) for each hour *h* (m).

3.8 **Step 2b: Calculate spillway flows.** Spillway flows are calculated with the application of a "rating equation" which relates the flow through the spillway gate opening to monitored parameters – the water level and the gate opening.[14] Rating equation provided by the owner and/or equipment manufacturer shall be used for estimating the spillway flows. For example, a typical equation for spillway overflow with a radial gate partially open is:

$$Q_{SW,h} = C_o \times L_e \times O \times (WL_h - E_{sill})^E \times 3600 \quad (7)$$

Where:

$Q_{SW,h}$ –Hourly spillway flow (m^3/hour);

C_0 – Known coefficient taken from manufacturer/owner data;

L_e – Length of the gate measured as built (m);

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[14] Design of Small Dams, US Bureau of the Interior, Bureau of Reclamation, Chapter IX, Spillways Water Resources Engineering, Linsley and Franzini, McGraw Hill.

O – Vertical opening (m);
WL_h –Water level during hour *h* (m);
E_{sill} – Elevation of the sill measured as built (m);
E – Known coefficient taken from manufacturer/owner data.

3.9 Spillway flows will be calculated for each hour and aggregated weekly over the year. These values are used in Step 3.

3.10**Step 3: Establish the flow-output (generation) relationship.** Tabulate weekly total flow (generation flow and spillway flow) estimated in the previous step along with recorded power generation during the corresponding week of the baseline period[15]. The data plot shall be visually inspected to ensure that the data is uniformly distributed over the range of weekly total flow recorded. Estimate the relationship between *total weekly flow* and *total weekly generation* for the baseline through regression analysis using polynomial equation form.

3.11 The estimated equation should be of the form:

$$EG_x \ = f(Q_x) = a + b_1 x Q_x + b_2 x Q_x^2 + \ldots + b_n x Q_x^n \ (8)$$
$$EG_x = \sum_{hpu=1}^{N} \sum_{h=1}^{168} \left(EG_{hpu,h}\right) \ (9)$$

Where:
EG_x – Recorded value of power generation for week *x* estimated as the sum of recorded observations of power generation in each of the units *hpu* for hour *h* in the week *x* (MWh);
Q_x – Estimated value of flow in the week *x*, estimated as per Step 2 (m^3/week);
a, $b_1 \ldots b_n$ – Coefficients of the estimated regression equation.

3.12 The estimated relationship should be monotonous in nature, i.e. the slope of the function should be non-negative at all points of the function.[16] The criteria for determining the degree of polynomial *n* is as follows:

a) the value of *n* for which the adjusted R^2 of the equation is highest;

b) estimates of parameters a, $b_1, \ldots, b_n$ are significant at the 5 per cent confidence level.

3.13 **Step 4: Determine baseline power generation**. Use the flow-output relationship defined in Equation 4 to estimate baseline electricity output during each week of the project period ($EG_{Bl,x}$), and sum these numbers for each week of the year *y*.

$$EG_{BL,y} = \sum_{x=1}^{52} E\,G^{B1} \ (10)$$
$$EG_{BL,x} = f({Q_x}^{Pr}) + 1x96xSE(f({Q_x}^{Pr})) \ (11)$$

Where:
EG^{B1} – Estimated electricity that would have been generated corresponding

[15] The period before the implementation of the project activities. It is necessary to compare the data of one week. Weeks of the project period and the baseline period.

[16] The function *EG =f(Q)* is **monotone** if, whenever $Q_x \le Q_y$, then $EG_x \le EG_y$.

to flow Q_x^{Pr} estimated in the week x of project crediting period y (MWh);

${Q_x}^{Pr}$ – Flow for week x measured during the project year y (m^3/week);
SE – Standard error of the estimate. For more details, see the appendix of methodology AM0052.

3.14 Note that due to the inclusion of the second term in Equation 7, there is only a 5 per cent chance that the estimated baseline output would be understated by the equation. Therefore, there would only be a 5 per cent chance that weekly energy generation gains would be overestimated.

3.15 To be conservative, the project developer will not seek to claim credit for any weekly project results, in which the flow (${Q_x}^{Pr}$) falls outside the recorded boundaries of the baseline data. This gives the project developer incentives to use as many years of baseline data as possible. It also allows the baseline to conservatively and accurately normalize data in changing climates and in different withdrawal regimes.

3.16 Exclusion of any outlier data points should be documented with a clear rationale (atypical circumstances such as blackouts, major equipment malfunction and repair) and validated and/or verified by the DOE. In the project year, the project developer will not be able to claim any emission reductions in weeks where major atypical circumstances occur.

3.17 **Step 5: Calculation of project electricity generation**. The total electricity generation for the project EG_y in year y is calculated as follows:

$$EG_{Pr,y} = \sum_{x=1}^{52}\sum_{hpu=1}^{N} EG_{\mathrm{Pr},hpu,x} \quad (13)$$

Where:
$EG_{Pr,y}$ – Electricity generated during the project in year y (MWh);
$EG_{Pr,hpy,y}$ – Total electricity generated by unit *hpu* in week x of year y (MWh). It is assumed that there are 52 weeks on average in a year.

3.17 **Step 6: Baseline emissions.** Baseline emissions (BE) is calculated as follows:

$$BE = (EG_{Pr,y} - EG_{Bl,y}) \times EF_{grid,y} \quad (14)$$

Where:
$EF_{grid,y}$ – Grid CO_2 emission factor for the grid, to which the power plant is connected (see Appendix 2) (tCO_2/MWh).

3.18 If the project activity is overhaul or reconstruction or modernization of an existing plant, the following procedure to identify the baseline shall be applied (see paras 3.19-3.28):

3.19 Baseline emissions include only CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} \quad (15)$$

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2/yr)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year *y* (MWh/yr)
$EF_{grid,CM,y}$	=	CO_2 emission factor for grid-connected power generation in year *y* calculated using Appendix 2 (t CO_2/MWh)

3.20 If the project activity is an overhaul or reconstruction or modernization of an existing grid-connected renewable energy power plant, the methodology uses historical electricity generation data to determine the electricity generation by the existing plant in the baseline scenario, assuming that the historical situation observed prior to the implementation of the project activity would continue.

3.21 The power generation from renewable energy power projects can vary significantly from year to year, due to natural variations in the availability of the renewable source (e.g. varying rainfall, wind speed or solar radiation). The use of few historical years to establish the baseline electricity generation can therefore involve a significant uncertainty. The methodology addresses this uncertainty by adjusting the historical electricity generation by its standard deviation. This ensures that the baseline electricity generation is established in a conservative manner and that the calculated emission reductions are attributable to the project activity. Without this adjustment, the calculated emission reductions could mainly depend on the natural variability observed during the historical period rather than the effects of the project activity.

3.22 $EG_{PJ,y}$ is calculated as follows:

$$EG_{PJ,y} = EG_{facility,y} - (EG_{historical} + \sigma_{historical}); until\ DATE_{BaselineOverhaul} \quad (16)$$

and

$$EG_{PJ,y} = 0; on/after\ DATE_{BaselineOverhaul} \quad (17)$$

Where:

$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year *y* (MWh/yr)
$EG_{facility,y}$	=	Quantity of net electricity generation supplied by the project plants to the grid in year *y* (MWh/yr)
$EG_{historical}$	=	Annual average historical net electricity generation delivered to the grid by the existing renewable energy power plant that was operated at the project site prior to the implementation of the project activity (MWh/yr)

$\sigma_{historical}$	=	Standard deviation of the annual average historical net electricity generation delivered to the grid by the existing renewable energy power plant that was operated at the project site prior to the implementation of the project activity (MWh/yr)
$DATE_{BaselineOverhaul}$	=	Point in time when the existing equipment would need to be replaced in the absence of the project activity (date). This only applies to overhaul or modernization projects

3.23 In case $EG_{facility,y} < (EG_{historical} + \sigma_{historical})$ in a year y then:

$$EG_{PJ,y} = 0 \quad (18)$$

3.24 To determine $EG_{historical}$, project participants may choose between two historical periods. This allows some flexibility: the use of the longer time period may result in a lower standard deviation and the use of the shorter period may allow a better reflection of the (technical) circumstances observed during the more recent years.

3.25 Project participants may choose between the following two time spans of historical data to determine $EG_{historical}$:

(a) five most recent calendar years prior to the implementation of the project activity; or

(b) the time period from the calendar year following $DATE_{hist}$, up to the calendar year immediately preceding the implementation of the project, as long as this time span includes at least five calendar years, where $DATE_{hist}$ is the latest point in time between:

(i) the commissioning of the plant;

(ii) if applicable: the last capacity addition to the plant; or

(iii) if applicable: the last overhaul or reconstruction of the plant.

3.26 In case of reconstruction where the power plant did not operate for last five calendar years before the reconstruction starts, $EG_{historical}$ is equal to zero.

3.27 Calculation of $DATE_{BaselineOverhaul}$: In order to estimate the point in time when the existing equipment would need to be modernized/overhauled in the absence of the project activity ($DATE_{BaselineOverhaul}$), project participants may take into account the typical average lifetime of the relevant equipment type, which shall be determined and documented in accordance with Appendix 3.

3.28 The point in time when the existing equipment would need to be modernized/overhauled in the absence of the project activity should be chosen in a conservative manner, that is, if a range is identified, the earliest date should be chosen.

4. Project crediting period

4.1 The starting date of project activities is not regulated.

4.2 A crediting period for emission reduction projects is a maximum of 5 years with a maximum of two renewable periods of 5 years each, or a maximum of 10 years with no option of renewal.
4.3 The crediting period begins no earlier than 5 years prior to applying for validation for projects validated until 31 December 2025, and no earlier than 2 years prior to applying for validation for projects validated after 1 January 2026.
4.4 The additionality and baseline shall be evaluated at the beginning of the crediting period and confirmed or revised at the beginning of the next 5-year phase if the project is implemented in three 5-year phases.

5. Additionality

5.1. Additionality shall be demonstrated using Guidelines No. 001 "Demonstration of the additionality of the project activity".
5.2. The project developer needs to demonstrate the additionality of the project activity in the PDD. Paragraphs 5.3-5.4 provide explanatory information regarding this methodology and Guidelines No. 001 "Demonstration of the additionality of the project activity".
5.3. Project participants shall identify realistic and credible alternatives(s) to the project activity in line with applicable laws and regulations, including the following possible alternatives:

a) *Alternative a*: Status Quo. Continuation of the current water management practices.

b) *Alternative b*: Changes to the hydro system operation or facilities (other than the project), including dam height, turbine replacement, spillway dimensions, and other changes that would materially affect the flow-output relationship.

c) *Alternative c*: The proposed project activity, not undertaken as a project activity.

5.4 In order to demonstrate that the proposed project activity is not regarded as "common practice", a rationale must be provided. The project developer may interview electric utilities in the selected country or region, and the manufacturers of the DSS software/optimization technology to assess how common is the project activity.

5.5 In case of overhaul to an existing HPP, to assess the economic attractiveness of the project activity, the project participants shall use the highest possible tariff that they may receive by supplying electricity to the grid. Only in exceptional cases, where project participants can justify showing data on the load/consumption and generation pattern of the project activity, may other tariffs be applied.

5.6 To determine alternatives for project activities in accordance with applicable laws and regulations for projects involving modernization, overhaul and/or reconstruction of an existing hydroelectric power plant, the project developer should consider the following alternatives:

(a) *Alternative a*: Status Quo. Continuation of the HPP management with current equipment.

(b) *Alternative b*: All other plausible and credible alternatives to the project activity that provide an increase in the power generated at the site, which are technically feasible to implement. This includes, inter alia, different levels of modernization, overhaul and/or reconstruction at the power plants. Only alternatives available to project participants should be taken into account.

(c) *Alternative c*: The continuation of the current situation, that is to use all power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance. The additional power generated under the project would be generated in existing and new grid-connected power plants in the electricity system.

5.7 The alternatives proposed in this section are only indicative. Project proponents should propose other possible alternatives that are reasonably foreseeable.

6. Monitoring plan requirements

6.1 All data collected as part of monitoring of project emissions should be archived electronically and kept for at least two years after the end of the last crediting period. One hundred per cent (100%) of the data required for the quantitative evaluation of emissions should be monitored if not indicated otherwise in the tables below. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards. The list of parameters that need to be monitored is presented in the Tables 2-15.

6.2 The calculation of parameters and emission factors should be documented electronically and attached to the PDD. This should include all data used to calculate the emission factors and other parameters. The data should be presented in a manner that enables reproducing of the calculation.

6.3 The project developer should describe the Quality Assurance/Quality Control system in the PDD. For example, describe the procedures for conducting the data collection and/or field measurements including training of field personnel, provisions for maximizing response rates, documenting out-of-population cases, refusals and other sources of non-response, and related issues. An overall quality control and assurance strategy shall be documented in the plan. This shall include a procedure for defining outliers and under what circumstances outlier data/measurements may be excluded and/or replaced.

6.4 For projects related to the implementation of the DSS, paragraphs 6.5-6.8 should be additionally taken into account. The list of parameters that need to be monitored in implementation of DSS type of projects is presented in the tables 2-13.

6.5 The following data for estimating the baseline relationship between power generation and flow shall be archived:

a) all the water courses and corresponding hydro power generating units, included within the project site;

b) relevant parameters of each hydro power generation unit, reservoir dam and the spillway characteristics to verify the applicability conditions;

c) hourly power generation of each hydro power generation unit within the project site;

d) parameters for the rating equation to estimate flow over the spillways;

e) estimated parameters of power generation and flow relationship, as estimated in Step 3 of the *Baseline methodology* section.

6.6 The following data for estimating the baseline relationship between power generation and flow index shall be archived:

a) estimated flow for each hour of the crediting period;

b) projected estimate of baseline power generation corresponding to the project flow index;

c) project power generation.

6.7 In addition, various elements of the hydro system (changes to turbines, dams, etc.) need to be monitored to ensure continued adherence to the applicability conditions.

6.8 Furthermore, the project developer can apply the basic provisions of the CDM tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation".

Table 2. Data / Parameter monitored

Data / Parameter:	$\mathbf{EF_{grid,y}}$
Data unit:	kgCO2/MWh
Description:	Baseline emission factor of the grid, to which the project activity power plant is connected, in year *y*
Source of data:	Calculation method. See Appendix 2.
Measurement procedures (if any):	-
Monitoring frequency:	Aggregated at least annually
Any comment:	-

Table 3. Data / Parameter monitored

Data / Parameter:	**Headwater level**
Data unit:	m
Description:	Headwater level
Source of data:	Operations data log at project site. Measured at head water entering generating unit or in a serviceable location of the power plant structure
Measurement procedures (if any):	Hourly data records for each power generating unit in the project boundary for the year preceding the implementation of the project activity shall be used to characterize the baseline scenario. The data shall be stored until two years after the end of the crediting period
Monitoring frequency:	Hourly
QA/QC procedures:	The data monitoring system used for the DSS will gather and archive these highly accurate data. Meters shall be tested annually and calibrated as recommended by the manufacturer. Meters are typically accurate to plus or minus a tenth or hundredth of a percent. All measurements should use calibrated measurement equipment that is maintained and checked regularly

Any comment:	-

Table 4. Data / Parameter monitored

Data / Parameter:	**Tail water level**
Data unit:	m
Description:	Tail water level
Source of data:	Operations data log at project site. Measured at tail water leaving generation units
Measurement procedures (if any):	Hourly data records for each power generating unit in the project boundary for the year preceding the implementation of the project activity shall be used to characterize the baseline scenario. The data shall be stored until two years after the end of the crediting period
Monitoring frequency:	Hourly
QA/QC procedures:	The monitoring system used by the DSS will gather and archive these highly accurate data. Meters shall be tested annually and calibrated as recommended by the manufacturer. Meters are typically accurate to plus or minus a tenth or hundredth of a percent. All measurements should use calibrated measurement equipment that is maintained and checked regularly
Any comment:	-

Table 5. Data / Parameter monitored

Data / Parameter:	**N**
Data unit:	Units
Description:	Total number of hydro power generation units *hpu* within the project site on the same water course
Source of data:	Project site
Measurement procedures (if any):	Count the number of hydro power generation units within the project site on the same water course. The data shall be stored until two years after the end of the crediting period
Monitoring frequency:	This shall be checked yearly and compared with baseline data
QA/QC procedures:	-
Any comment:	-

Table 6. Data / Parameter monitored

Data / Parameter:	**M**
Data unit:	Units
Description:	Total number of spillways within the project site on the same water course
Source of data:	Project site
Measurement procedures (if any):	Count the number of spillways within the project site on the same water course. The data shall be stored until two years after the end of the crediting period
Monitoring frequency:	This shall be checked yearly and compared with baseline data
QA/QC procedures:	-
Any comment:	-

Table 7. Data / Parameter monitored

Data / Parameter:	**a_i, b_i, c_i and d_i**
Data unit:	
Description:	The power polynomial coefficients for each generating unit based on "Hill Diagram" information provided by the owner or manufacturer. The "Hill Diagram" defines the three dimensional relationship between power output, head and flow
Source of data:	Manufacturer/owner
Measurement procedures (if any):	A 'hill diagram' will be included in the data book for every generating unit in the project boundary. This essentially provides information derived in equation 2
Monitoring frequency:	This shall be checked yearly and compared with baseline data. Hill Diagrams for a generating unit are stationary and do not change measurably within the life of the project. Any changes, however unlikely, would be in the direction of deterioration of the unit and would make the results of the project more conservative (i.e. yield lower generation in project years)
QA/QC procedures:	-
Any comment:	-

Table 8. Data / Parameter monitored

Data / Parameter:	**C_o**
Data unit:	
Description:	Known coefficient taken from manufacturer/owner data
Source of data:	Manufacturer/owner data, design and or testing information for spillway
Measurement procedures (if any):	The equation given by the owner will provide accurate data
Monitoring frequency:	This shall be checked yearly and compared with baseline data
QA/QC procedures:	-
Any comment:	-

Table 9. Data / Parameter monitored

Data / Parameter:	**L_e**
Data unit:	m
Description:	Length of the gate measured as built
Source of data:	Manufacturer/owner data, design and or testing information for spillway
Measurement procedures (if any):	The equation given by the owner will provide accurate data
Monitoring frequency:	This shall be checked yearly and compared with baseline data
QA/QC procedures:	-
Any comment:	-

Table 10. Data / Parameter monitored

Data / Parameter:	**O**
Data unit:	m
Description:	Vertical opening
Source of data:	Measured during operations at the project site
Measurement procedures (if any):	Hourly data records for each spillway in the project boundary for the year preceding the implementation of the project activity shall be used to characterize the baseline scenario. The data shall be stored until two years after the end of the crediting period
Monitoring frequency:	Hourly

QA/QC procedures:	These measurements are very simple to make and accurate. More importantly, the measurements will be completely consistent between the baseline year and the project year. All measurements should use calibrated measurement equipment that is maintained and checked regularly
Any comment:	-

Table 11. Data / Parameter monitored

Data / Parameter:	$\mathbf{E_{sill}}$
Data unit:	m
Description:	Elevation of the sill measured as built
Source of data:	Manufacturer/owner data, design and or testing information for spillway
Measurement procedures (if any):	The equation given by the owner will provide accurate data
Monitoring frequency:	This shall be checked yearly and compared with baseline data
QA/QC procedures:	-
Any comment:	-

Table 12. Data / Parameter monitored

Data / Parameter:	**E**
Data unit:	-
Description:	Known coefficient taken from manufacturer/owner data
Source of data:	Manufacturer/owner data, design and or testing information for spillway
Measurement procedures (if any):	The equation given by the owner will provide accurate data
Monitoring frequency:	This shall be checked yearly and compared with baseline data
QA/QC procedures:	-
Any comment:	-

Table 13. Data / Parameter monitored

Data / Parameter:	$\mathbf{W_{Lh}}$
Data unit:	m
Description:	Water level in week *x*

Source of data:	Operations data log at project site
Measurement procedures (if any):	Hourly data records for each spillway in the project boundary for the year preceding the implementation of the project activity shall be used to characterize the baseline scenario. The data shall be stored until two years after the end of the crediting period
Monitoring frequency:	Hourly
QA/QC procedures:	Meters shall be tested annually and calibrated as recommended by the manufacturer. Meters are typically accurate to plus or minus a tenth or hundredth of a percent. All measurements should use calibrated measurement equipment that is maintained and checked regularly
Any comment:	-

6.9. For projects related to the overhaul, reconstruction or modernization of an existing HPP, the list of parameters that need to be monitored is presented in tables 14-15.

Table 14. Data / Parameter monitored

Data / Parameter:	$\mathbf{EF_{grid,CM,y}}$
Data unit:	kgCO2/MWh
Description:	CO2 emission factor for grid connected power generation in year *y*
Source of data:	Calculation method. See Appendix 2.
Measurement procedures (if any):	-
Monitoring frequency:	Aggregated at least annually
Any comment:	-

Table 15. Data / Parameter monitored

Data / Parameter:	$\boldsymbol{EG_{facility,y}}$
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plants to the grid in year y
Source of data:	On-site measurements
Measurement procedures (if any):	Use electricity meters
Monitoring frequency:	Continuously, aggregated at least annually

Any comment:	The metering results should be reflected in the forms of statistical observation 23-N and 6-TP (hydro). For more information see the CDM tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation”.

6.10.Data and parameters that are not monitored for projects with implementation of the DSS should be calculated once and remain fixed throughout the crediting period. The list of parameters that are not monitored is presented in tables 16-28. Data for all the variables mentioned below shall be based on 3 years of historic records prior to start of the project activity. It shall be ensured that the precipitation pattern in the watershed of the project area for the year does not represent either a DRY or WET year[17].

Table 16. Data / Parameter not monitored

Data / Parameter:	**M**
Data unit:	Units
Description:	Total number of spillways within the project site on the same water course, in the year preceding the implementation of the project activity
Source of data:	Project site
Measurement procedures (if any):	Count the number of spillways within the project site on the same water course in the year preceding the implementation of the project activity. The data shall be stored until two years after the end of the crediting period
Any comment:	-

Table 17. Data / Parameter not monitored

Data / Parameter:	**N**
Data unit:	Units
Description:	Total number of hydro power generation units within the project site on the same water course, in the year preceding the implementation of the project activity
Source of data:	Project site
Measurement procedures (if any):	Count the number of hydro power generation units within the project site on the same water course in the year preceding the implementation of the project activity. The data shall be stored until two years after the end of the crediting period
Any comment:	-

[17] This means that the average annual rainfall should be within one standard deviation for the normal average annual rainfall. Normal is defined as 30 year average of annual average rainfall.

Table 18. Data / Parameter not monitored

Data / Parameter:	**a_i, b_i, c_i and d_i**
Data unit:	Units
Description:	The power polynomial coefficients for each generating unit based on "hill diagram" information provided by the owner or manufacturer. The "hill diagram" is the one which defines the three dimensional relationship between power output, head and flow
Source of data:	Owner or manufacturer of the generating unit
Measurement procedures (if any):	The data shall be stored until two years after the end of the crediting period
Any comment:	-

Table 19. Data / Parameter not monitored

Data / Parameter:	**H**
Data unit:	m
Description:	Head acting on the generating unit (headwater level less tail water level)
Source of data:	Manufacturer/owner data, design and or testing information for spillway
Measurement procedures (if any):	Hourly data records for each hydropower generating unit in the project boundary for the year preceding the implementation of the project activity shall be used to characterize the baseline scenario. The data shall be stored until two years after the end of the crediting period
Any comment:	The equation given by the owner will provide accurate data. More importantly, the equation will give consistent results between baseline measurements and project year measurements

Table 20. Data / Parameter not monitored

Data / Parameter:	**C_o**
Data unit:	
Description:	Known coefficient taken from manufacturer/owner data

Source of data:	Manufacturer/owner data, design and or testing information for spillway
Measurement procedures (if any):	Obtain the value before validation for each spillway in the project boundary. The data shall be stored until two years after the end of the crediting period
Any comment:	The equation given by the owner will provide accurate data. More importantly, the equation will give consistent results between baseline measurements and project year measurements

Table 21. Data / Parameter not monitored

Data / Parameter:	**L_e**
Data unit:	m
Description:	Length of the gate measured as built
Source of data:	Manufacturer/owner data, design and or testing information for spillway
Measurement procedures (if any):	Obtain the value before validation for each spillway in the project boundary in order to characterize the baseline scenario. The data shall be stored until two years after the end of the crediting period
Any comment:	The equation given by the owner will provide accurate data. More importantly, the equation will give consistent results between baseline measurements and project year measurements

Table 22. Data / Parameter not monitored

Data / Parameter:	**O**
Data unit:	m
Description:	Vertical opening size of spillway
Source of data:	Measured during operations at the project site
Measurement procedures (if any):	Hourly data records for each spillway in the project boundary for the year preceding the implementation of the project activity shall be used to characterize the baseline scenario. The data shall be stored until two years after the end of the crediting period

Any comment:	These measurements are very simple to make and accurate. More importantly, the measurements will be completely consistent between the baseline year and the project year. All measurements should use calibrated measurement equipment that is maintained and checked regularly

Table 23. Data / Parameter not monitored

Data / Parameter:	**E**
Data unit:	-
Description:	Known coefficient taken from manufacturer/owner data
Source of data:	Manufacturer/owner data, design and or testing information for spillway
Measurement procedures (if any):	Obtain the coefficient before validation for each spillway in the project boundary in order to characterize the baseline scenario. The data shall be stored until two years after the end of the crediting period
Any comment:	The equation given by the owner will provide accurate data. More importantly, the equation will give consistent results between baseline measurements and project year measurements

Table 24. Data / Parameter not monitored

Data / Parameter:	$\mathbf{E_{sill}}$
Data unit:	m
Description:	Elevation of the sill measured as built
Source of data:	Manufacturer/owner data, design and or testing information for spillway
Measurement procedures (if any):	Obtain the coefficient before validation for each spillway in the project boundary in order to characterize the baseline scenario. The data shall be stored until two years after the end of the crediting period
Any comment:	The equation given by the owner will provide accurate data. More importantly, the equation will give consistent results between baseline measurements and project year measurements

Table 25. Data / Parameter not monitored

Data / Parameter:	**WLh**
Data unit:	m
Description:	Water level in week *x*
Source of data:	Operations data log at project site
Measurement procedures (if any):	Hourly data records for each spillway in the project boundary for the year preceding the implementation of the project activity shall be used to characterize the baseline scenario. The data shall be stored until two years after the end of the crediting period
Any comment:	Meters shall be tested annually and calibrated as recommended by the manufacturer. Meters are typically accurate to plus or minus a tenth or hundredth of a percent. All measurements should use calibrated measurement equipment that is maintained and checked regularly

Table 26. Data / Parameter not monitored

Data / Parameter:	**Headwater level**
Data unit:	m
Description:	Headwater level
Source of data:	Operations data log at project site. Measured at head water entering generating unit or in a serviceable location of the power plant structure
Measurement procedures (if any):	Hourly data records for each power generating unit in the project for the year preceding the implementation of the project activity shall be used to characterize the baseline scenario. The data shall be stored until two years after the end of the crediting period
Any comment:	Meters shall be tested annually and calibrated as recommended by the manufacturer. Meters are typically accurate to plus or minus a tenth or hundredth of a percent. All measurements should use calibrated measurement equipment that is maintained and checked regularly

Table 27. Data / Parameter not monitored

Data / Parameter:	**Tail water level**
Data unit:	m
Description:	Tail water level

Source of data:	Operations data log at project site. Measured at tail water leaving generation units
Measurement procedures (if any):	Hourly data records for each power generating unit in the project boundary for the year preceding the implementation of the project activity shall be used to characterize the baseline scenario. The data shall be stored until two years after the end of the crediting period
Any comment:	Meters shall be tested annually and calibrated as recommended by the manufacturer. Meters are typically accurate to plus or minus a tenth or hundredth of a percent. All measurements should use calibrated measurement equipment that is maintained and checked regularly

Table 28. Data / Parameter not monitored

Data / Parameter:	$\mathbf{EG_{hpu,h}}$
Data unit:	MWh
Description:	Observed power output of *hpu* unit for week *x*
Source of data:	Operations data log available at the project site
Measurement procedures (if any):	Hourly data records for each power generating unit in the project boundary for the year preceding the implementation of the project activity shall be used to characterize the baseline scenario. The data shall be stored until two years after the end of the crediting period
Any comment:	Meters shall be tested annually and calibrated as recommended by the manufacturer. All measurements should use calibrated measurement equipment that is maintained and checked regularly

6.11. Data and parameters that are not monitored for projects related to overhaul, reconstruction or modernization of an existing HPP should be calculated once and remain fixed throughout the crediting period. The list of parameters that are not monitored is presented in tables 29-32. Data for all the variables mentioned below shall be based on 3 years of historic records prior to start of the project activity.

Table 29. Data / Parameter not monitored

Data / Parameter:	$EG_{historical}$
Data unit:	MWh/yr

Description:	Annual average historical net electricity generation delivered to the grid by the existing renewable energy power plant that was operated at the project site prior to the implementation of the project activity
Source of data:	Project activity site
Measurement procedures (if any):	Electricity meters
Any comment:	-

Table 30. Data / Parameter not monitored

Data / Parameter:	$\sigma_{historical}$
Data unit:	MWh/yr
Description:	Standard deviation of the annual average historical net electricity generation delivered to the grid by the existing renewable energy power plant that was operated at the project site prior to the implementation of the project activity
Source of data:	Calculated from data used to establish $EG_{historical}$
Measurement procedures (if any):	Parameter to be calculated as the standard deviation of the annual generation data used to calculate $EG_{historical}$ for overhaul, or reconstruction or modernization project activities
Any comment:	-

Table 31. Data / Parameter not monitored

Data / Parameter:	$DATE_{BaselineOverhau}$
Data unit:	date
Description:	Point in time when the existing equipment would need to be replaced in the absence of the project activity
Source of data:	Project activity site
Measurement procedures (if any):	As per provisions in the methodology above
Any comment:	-

Table 32. Data / Parameter not monitored

Data / Parameter:	$DATE_{hist}$
Data unit:	date

Description:	Point in time from which the time span of historical date for overhaul, reconstruction or modernization project activities may start
Source of data:	Project activity site
Measurement procedures (if any):	*DATE_{hist}* is the latest point in time between: (a) the commercial commissioning of the plant; (b) if applicable: the last capacity addition to the plant; or (c) if applicable: the last overhaul or reconstruction of the plant
Any comment:	-

7. Project scenario

7.1. For most renewable energy power generation project activities, PEy = 0. However, some project activities may involve project emissions that can be significant.

7.1.1. For projects that are related to DSS implementation, project emissions are zero.

$$PE_y = 0$$

7.1.2. For projects related to overhaul, reconstruction or modernization of an existing HPP, emissions from the water reservoirs of hydro power plants need to be estimated.

7.2. The emissions reduction by the project activity during a given year *y* (ERy) is the difference between the baseline emissions (BEy) and the project emissions (PEy), as follows:

$$ER_y = BE_y - PE_y$$

where:

ERy – Emissions reduction by the project activity during the year *y* in t CO_2;

BE_y – Baseline emissions during the year *y* in t CO_2;

PEy – Project emissions during the year *y* in t CO_2.

7.3. In the process of implementing a climate project, project developers may face certain risks and barriers. To assess the risks, the project developer should develop a risk matrix. For more details, see Appendix 1.

7.4. It should be noted that if the actual generation is less than the baseline generation for a given week, it will be treated as a negative value and deducted from the total annual savings. If in the unlikely event a project activity temporarily results in a negative emission reduction, i.e. baseline emissions minus project emissions are negative, any further emission reductions will only be issued when the emissions increase has been compensated by subsequent emission reductions by the project activity.

8. Leakage assessment

8.1. According to Order No. 248 of the Ministry of Economic Development of Russia dated 11.05.2022, project activities should not lead to an aggregate increase in greenhouse gas emissions or reduce their absorption levels outside the scope of such activities. At the same time, it is necessary to consider and fully account for any leakage in the course of a project activity[18] in accordance with the methodology below.

8.1. Leaks are not typical for this type of projects, therefore they are not taken into account.

9. Non-permanence risk analysis

9.1. Not applicable for this type of project.

10. Methods to prevent double counting, negative impacts on the environment and society

10.1. The climate project should demonstrate its compliance with all legal requirements in the jurisdiction where it is located. The project developer needs to minimize the risk that the project might result in negative impacts for local communities, biodiversity and the environment. Projects should not cause an increase in atmosphere, soil, surface and ground water pollution or lead to any community conflicts, land tenure issues, forceful evictions, human rights violations, or worsened health and wellbeing due to restricted access to a forest or natural area.

10.2. The project developer should make efforts to avoid double counting[19] between project areas (project boundaries), between company reporting and reporting on the project, between the reporting of different companies, between the constituent entities of the Russian Federation and different countries in the case of international transfer of carbon credits. In the latter case, it is necessary to demonstrate that the carbon credits transferred at the international level are excluded from the accounting of the quantitative goals of the contribution of the Russian Federation defined at the national level.

11. Recommendations for updating or keeping the baseline unchanged at the renewal of the crediting period and project activity

11.1.At the renewal of crediting period, the project is subject to verification with elements of validation and a technical assessment by a validation and verification body to determine necessary updates to the baseline, the additionality and the quantification of emission reductions. In order to update the baseline, it is necessary to revise and update the main parameters and assumptions used in the established baseline approach (paras 3.2.1-3.2.3). The baseline shall be representative of the conditions at the beginning of a new crediting period

[18] Leakage (for a project activity) means the net change of anthropogenic emissions by sources of GHGs which occurs outside the project boundary, and which is measurable and attributable to the climate project activity, as applicable (CDM-EB07-A04-GLOS Glossary CDM terms. Version 11.0).

[19] Double counting: accounting for GHG emissions or removals more than once. Double counting can occur between organizations, i.e. two or more reporting organizations take ownership of the same GHG emissions or removals. Double counting can also occur inside an organization when GHG emissions or removals are taken into account in different categories (this type of double counting should not occur). (ISO/TR 14069:2013 Greenhouse gases - Quantification and reporting of greenhouse gas emissions for organizations - Guidance for the application of ISO 14064-1). See also GOST R ISO 14080-2021. National Standard of the Russian Federation. Greenhouse gas management and related activities. A system of approaches and methodological support for the implementation of climate projects.

and be valid for that period. The additionality at the renewal of the crediting period is checked for compliance to the criteria under Guidelines No. 1 as at the date of the beginning of the new crediting period.

11.2. The baseline approach established earlier (best available technologies; ambitious benchmark; or existing actual or historical emissions) may not be changed at the renewal of the crediting period.

12. References

1. Order No. 248 of the Ministry of Economic Development of Russia dated 11.05.2022 "On approval of the criteria and procedure for classifying projects implemented by legal entities, individual entrepreneurs or individuals, as climate projects, the form and procedure for reporting on the implementation of a climate project" (registered with the Ministry of Justice of Russia on 30.05.2022, No. 68642).
2. GOST R ISO 14064-1-2021. National Standard of the Russian Federation. Greenhouse Gases. Part 1. Requirements and Guidance for Quantification and Reporting of Greenhouse Gas Emissions and Absorption at the Organization Level (approved and enacted by Rosstandart Order No. 1029-st dated 30.09.2021).
3. GOST R ISO 14064-2-2021. National Standard of the Russian Federation. Greenhouse Gases. Part 2. Requirements and Guidelines for Quantification, Monitoring and Reporting Documents for Projects to Reduce Greenhouse Gas Emissions or Increase Their Absorption at the Project Level (approved and enacted by Rosstandart Order No. 1030-st dated 30.09.2021).
4. GOST R ISO 14064-3-2021. National Standard of the Russian Federation. Greenhouse Gases. Part 3. Requirements and Guidance for Validation and Verification of Greenhouse Gas Statements (approved and enacted by Rosstandart Order No. 1031-st dated 30.09.2021).
5. GOST R ISO 14065-2014 National Standard of the Russian Federation. Greenhouse Gases. Requirements for Greenhouse Gas Validation and Verification Bodies for Their Application in Accreditation or Other Forms of Recognition (approved and enacted by Rosstandart Order dated 26.11.2014, No. 1869-st).
6. GOST R ISO 14066-2013. National Standard of the Russian Federation. Greenhouse Gases. Requirements for Competence of Greenhouse Gas Validation and Verification Groups (approved and enacted by Rosstandart Order dated 17.12.2013, No. 2274-st).
7. GOST R ISO 14080-2021. National Standard of the Russian Federation. Greenhouse Gas Management and Related Activities. System of Approaches and Methodological Support for

the Implementation of Climate Projects (approved and enacted by Rosstandart Order No. 1033-st dated 30.09.2021).

8. Order No. 371 of the Ministry of Natural Resources and Environment of Russia dated 27.05.2022 “On approval of methods for quantitative determination of greenhouse gas emissions and greenhouse gas removals” (from 1 March 2023, with the exception of certain provisions that come into force from 1 March 2024).
9. IPCC 2006. Guidelines for National Greenhouse Gas Inventories of the Intergovernmental Panel on Climate Change, 2006 / Edited by S. Iggleston, L. Buendia, K. Miwa, T. Ngara and K. Tanabe. // T.1-5. - IGES// Hayyam. 2006.
10. AM0052 Large-scale methodology: Increased electricity generation from existing hydropower stations through Decision Support System optimization. Version 03.0.
11. ACM0002. Large-scale Consolidated Methodology. Grid-connected electricity generation from renewable sources. Version 21.0. CDM Methodology.
12. TOOL01 Methodological tool. Tool for the demonstration and assessment of additionality. Version 07.0.0. CDM Methodology.

Appendix 1. Risk management

As a part of the project implementation, it is recommended to develop a risk assessment system with a description of the most likely risks that may arise at all stages of the climate project. For such an assessment, the project developer should develop a detailed matrix with the following information, as a minimum:

(i) The main stages of the implementation of the climate project.

(ii) Description of the risks that may arise at each stage of the climate project.

(iii) Description of the probability of occurrence of risks. For this, the rating options "low, medium, high" or any other understandable numerical scales can be used.

(iv) Description of the impact of each risk on the results of the entire project. This can also be done using "low, medium, high" or any other understandable numerical scale.

(v) Description of the period of influence of each risk on the entire climate project.

(vi) Development of measures to minimize or avoid each type of risks;

(vii) The time for the implementation of each measure that reduces or prevents the occurrence of risks is indicated.

An example of a template with a risk matrix is shown in Table 1.

Table 1. Risk matrix template

Stage of climate project implementation	Description of risks	Probability of occurrence	Impact on the project	Impact period	Risk minimization methods	Implementation period
		low medium high	low medium high	Preparation period 1-2 years after the implementation The entire period of the climate project	Detailed description of mitigation measures for each risk	Description of the time frame for the implementation of these activities
		Scale from 1 to 5 or others	Scale from 1 to 5 or others			

Appendix 2. Recommended approach for calculation of grid emissions factor (emission factor for an electricity system)

1. Currently, there are no legislatively approved grid emission factors for greenhouse gases (GHG) in the Russian Federation.

2. If the initial data required to calculate the grid emission factor for the baseline and project scenarios is available, the climate project developer has the right to calculate it independently. In this case, it is recommended to use the Guidelines for the quantitative calculation of the volume of indirect energy emissions of greenhouse gases (Order No. 330 of the Ministry of Natural Resources and Environment dated 29.06.2017[20]) and the principles for calculating indirect energy emissions defined in GOST R ISO 14064-1-2021[21].

To determine the grid emission factor, a regional method for calculation of indirect energy emissions is used, which reflects the average intensity of greenhouse gas emissions at facilities generating electrical and thermal energy consumed by the organization (Order No. 330 of the Ministry of Natural Resources and Environment).

According to GOST R ISO 14064-1-2021 (Appendix E), emissions from imported electricity must be calculated by the project developer using a location-based approach[22] by applying an emission factor that best characterizes the relevant electric power system, i.e. leased transmission line, local, regional or national grid average emission factor. The grid-averaged emission factors should refer to the emissions of the reporting year, if available, or otherwise the latest available year. Grid-averaged emission factors for imported electricity should be based on the average consumption pattern from the electric power system from which the electricity is consumed.

Grid emission factors may also include other indirect emissions associated with electricity generation, such as transmission and distribution losses.

The requirements and guidance described in ISO 14064-1-2021 for electricity also apply to consumed and transferred heat, steam, cooling air and compressed air.

In case of energy from cogeneration facilities, it is necessary to use approaches to separate various forms of energy[23].

Association "NP Market Council" and JSC "TSA" have developed a concept for calculating and publishing greenhouse gas emission factors for the energy system of the Russian Federation[24]. Based on the results of the peer review, independent international auditors issued an assurance certificate, and

[20] Order No. 330 of the Ministry of Natural Resources and Environment of the Russian Federation dated 29.06.2017 "On approval of guidelines for quantifying the volume of indirect energy emissions of greenhouse gases".

[21] GOST R ISO 14064-1-2021. National Standard of the Russian Federation. Greenhouse Gases. Part 1. Requirements and Guidance for Quantification and Reporting of Greenhouse Gas Emissions and Absorption at the Organization Level (approved and enacted by Rosstandart Order No. 1029-st dated 30.09.2021).

[22] The location-based approach is a method for quantifying indirect energy emissions based on average emission factors from energy production for a given geographic location, including local, regional or national boundaries.

[23] For example, calculation of specific fuel consumption in accordance with the "Methodological Guidelines for the Distribution of the Specific Consumption of Reference Fuel in the Production of Electric and Thermal Energy in the Cogeneration Mode Used for Tariff Regulation in the Field of Heat Supply", legislatively approved by Order No. 952 of the Ministry of Energy of the Russian Federation dated 12.09.2016.

[24] The concept of calculation and publication of greenhouse gas emission factors for the energy system of the Russian Federation URL: https://www.np-sr.ru/sites/default/files/koncepciya_kev.pdf.

this concept received a validation report[25]. It is assumed that the implementation of this concept will lead to a more accurate calculation and publication of grid emission factors. The approaches outlined in the concept can also be used by the project developer to calculate the emission factor of the electric power system.

3. If it is impossible to calculate the grid emission factor on its own, the project developer can use grid emission factors from the following sources:

Source 1. In 2021, JSC "Trading System Administrator of Wholesale Electricity Market Transactions" launched (in test mode) an Internet resource that publishes the grid CO2 emission factor for the first synchronous zone of the Russian Federation for various time periods (hour, day, month, year) [26].

Source 2. Emission factors of the International Energy Agency (IEA). The data is updated annually for the entire energy system of the regions of presence (including the Russian Federation) and reflects the average carbon intensity of electricity and heat generation[27].

Source 3. Climate Transparency Global Partnership develops G20 climate indicators. The agency publishes annual reports from the G20[28] countries, including the average energy emission factor.

4. Methods and approaches applied to the calculation of the grid emission factor should be documented and specified in the PDD. It is necessary to justify the chosen calculation methodology, disclose information about the source of the initial data used, transparently and accurately document your own procedure for calculating the grid emission factor, or describe the properties of the selected and applied grid emission factor.

[25] As part of the validation procedure, a detailed verification of the Concept was carried out for its compliance with the requirements of the international standards in the field of accounting and reporting on greenhouse gas emissions (TÜV AUSTRIA). Based on the results of the audit, the Concept was recognized by international experts as complying with high international standards and best international practices for calculating energy system emission factors. URL: https://www.np-sr.ru/sites/default/files/zaklyuchenie_o_validacii_koncepcii.pdf.

[26] URL: https://www.atsenergo.ru/results/co2

[27] URL: https://www.iea.org/data-and-statistics/data-product/emissions-factors-2021

[28] URL: https://www.climate-transparency.org/g20-climate-performance/g20report2022#1531904804037-423d5c88-a7a7

Appendix 3. Determination of the remaining lifetime of equipment

1. The tool provides guidance to determine the remaining lifetime of baseline or project equipment. The tool may, for example, be used for project activities which involve the replacement of existing equipment with new equipment or which overhaul existing equipment as part of energy efficiency improvement activities.

2. This tool provides procedures to determine the following parameter: **Remaining lifetime (RL).** The remaining lifetime of the equipment is the time for which the existing equipment can continue to operate before it has to be replaced/discarded for technical reasons, such as the age of the equipment, safety reasons, or deteriorated performance. The remaining lifetime is expressed in years or hours of operation.

3. For project activities that involve several equipment types, project participants can either determine the remaining lifetime for each equipment type or determine the remaining lifetime as the most conservative of the individual remaining lifetimes of the equipment by applying any one of the options (a) to (c).

4. If the remaining lifetime of existing equipment, which would continue to operate in the baseline, is extended due to the implementation of a project activity, the crediting of emission reductions should be limited to the shortest estimated remaining lifetime of the baseline equipment. In other words, the earliest point in time when any of the existing equipment would need to be replaced or overhauled in the absence of the project activity should be used, unless the methodology specifies otherwise. Small equipment accessories/components such as small pumps, motors, valves etc. that are generally replaced as part of regular maintenance activities do not need to be included in the scope of determination of the remaining lifetime.

Option (a): Use manufacturer's information for the technical lifetime of equipment and compare to the date of first commissioning

5. In this option, the remaining lifetime is determined as a difference between the technical lifetime and the operational time.

6. This option can only be applied if:

   (a) the manufacturer's information on the technical lifetime of the equipment is available;

   (b) the project participants can demonstrate that the equipment has been operated and maintained according to the recommendations of the equipment supplier to ensure that the technical lifetime specified by the manufacturer is not reduced;

   (c) there are no periodic replacement schedules or scheduled replacement practices specific to the industrial facility, that require early replacement of equipment before the expiry of the technical lifetime; and

   (d) the equipment has no design fault or defect and did not have any industrial accident due to which the equipment cannot operate at rated performance levels.

7. Documentation supporting these conditions should be provided, for example information on the operational history of the equipment.

8. The operational time shall be determined based on the operational history of the equipment from the date of its first commissioning.

9. In cases where the equipment was overhauled prior to the implementation of the project activity or energy efficiency improvement measures were undertaken which increased the remaining lifetime, the technical lifetime provided by the equipment supplier may not be valid anymore. In this case, project participants should follow one of the following approaches:

   (a) If the overhaul was undertaken by the equipment manufacturer, the equipment manufacturer may provide a revised estimation of the technical lifetime.

(b) Apply the original technical lifetime provided by the equipment manufacturer at the time of equipment installation, as long as assuming a shorter lifetime is conservative (e.g. in the case of baseline equipment which is replaced under the project activity).

(c) Choose other options provided in this tool to determine the remaining lifetime.

10. In case of relocated equipment (equipment which was already in operation at another site and which is transferred to the site of the project activity where it continues to operate), the operation history at the previous site(s) should be considered when establishing the operational time.

Option (b): Obtain an expert evaluation

11. In this option, an independent expert having relevant experience in evaluating the remaining lifetime for the type of equipment can be requested to determine the remaining lifetime of the equipment. The information that could be evaluated includes an analysis of:

(a) the operational history of the equipment to identify the past performance, equipment overhauls, failures/accidents, capacity upgrades/degradations, replacements etc.;

(b) the current operation and maintenance practices;

(c) documented specific sectoral/industry practices for replacements;

(d) conducting tests on the equipment, such as magnetic particle examinations, ultrasonic testing, metallurgical analysis, etc.

12. The expert should document his methods and conclusions and provide an expert evaluation stating the estimated remaining lifetime of the equipment. All the relevant documentation should be presented to the DOE for validation.

Option (c): Use default values

13. In this option, project participants may use the following default values for the technical lifetime and determine the remaining lifetime as the difference of the technical lifetime and the operational time.

14. This option can only be applied if:

(a) the project participants can demonstrate that the equipment has been operated and maintained according to the recommendations of the equipment supplier;

(b) there are no periodic replacement schedules or scheduled replacement practices specific to the industrial facility, that require early replacement of equipment before the expiry of the technical lifetime; and

(c) the equipment has no design fault or defect and did not have any industrial accident due to which the equipment cannot operate at rated performance levels.

15. Documentation supporting these conditions should be provided, for example information on the operational history of the equipment.

16. The operational time shall be determined based on the operational history of the equipment from the date of its first commissioning. In case of relocated equipment (equipment which was already in operation at another site and which is transferred to the site of the project activity where it continues to operate), the operation history at the previous site(s) should be considered when establishing the operational time.

17. For the technical lifetime, the following default values apply:

Equipment	Default value for Technical lifetime
Boilers	25 years
Steam Turbines	25 years
Gas turbines, up to 50 MW capacity	150,000 hours
Gas turbines, above 50 MW capacity	200,000 hours
Hydro turbines	150,000 hours
Electric Generators, air cooled	25 years
Electric generators, hydrogen cooled or water cooled	30 years
Wind turbines, onshore	25 years
Wind turbines, offshore	20 years
Diesel/oil/gas fired generator sets	50,000 hours
Transformers	30 years
Heaters, chillers, pumps, etc. used in HVAC systems	15 years