PROJECT DESIGN DOCUMENT FORM
FOR CDM PROJECT ACTIVITIES (F-CDM-PDD)
Version 04.1

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Talimarjan Clean Energy Generation Project
Version number of the PDD	Version 4.7
Completion date of the PDD	30/06/2014
Project participant(s)	SJSC ”Uzbekenergo” Synecta a.s.
Host Party(ies)	Uzbekistan
Sectoral scope and selected methodology(ies)	Sectorial scope 1: “Energy Industries (renewable/ non-renewable sources)”. Applied methodology - AM0029, Version 3.0
Estimated amount of annual average GHG emission reductions	836 152 tCO2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The proposed CDM project activity consists of constructing two new Combined Cycle Gas Turbine Power Plants (CCGT) in the boundary of the existing Talimarjan thermal power station (TTPS) in Kashkadarya region of the Republic of Uzbekistan. The power plant is owned by SJSC "Uzbekenergo", the biggest electricity producer and distributor in Uzbekistan. The main project objective is assurance of reliable provision of electric energy to consumers of Samarkand-Bukhara region, Karshi steppe with seven pumping stations and others.

Scenario existing prior to the start of the implementation of the project activity

The installed generation capacity of the all power generation capacities in the Republic of Uzbekistan is about 12,400 MW, out of which 12,039 MW belong to SJSC "Uzbekenergo" and the remaining capacity belongs to other companies.[1] However, the current total available capacity of the power generation units is 9, 612 MW. The thermal power plants account for 8,416 MW and the hydro power plants account for 1,196.1 MW. Average net efficiency is about 31%. 90.8% of the total fuel, consumed by thermal power plants is natural gas, 3.9% is coal and the remaining portion is mazut[2].

Currently, one of the higher-priority tendencies in Uzbekistan is to increase coal's share in the structure of the country power balance.[3] In 2002, the government of Uzbekistan has adopted "the Program of Further Coal Industry Development" which includes 6 stages of technical re-equipment, modernization of enterprises, introduction of advanced resource-saving technologies, promoting the improvement of coal mining efficiency. Realization of planned measures on modernization and technical re-tooling of the coal industry will provide achievement of required expansion rate of production, covering the Republic's demand in solid fuel for the medium and long-term perspective, will allow to accept coal as prevailing fuel in the power production.[4]

At the site of existing Talimarjan TPS four generation units are currently located with the total capacity of 3200MW and station provided electricity to the South regions of Uzbekistan republic. The latest power unit was lunched in 2004 and constructed with the use of rankine-cycle technology. As described below new power units to be constructed in the framework of the project will be closed to existing ones and will be located within the territory of Talimarjan TPS. But they will be built on the vacant space and all required buildings and supportive infrastructure will be newly constructed. See details in in the Section A.3.

Project scenario

Talimarjan clean power project envisages construction of two combined cycle gas turbine units with total capacity of approximately 820 MW.[5] Each unit will be a multi-shaft gas turbine combined cycle power plant with one (1) gas turbine generating unit, one (1) unfired type heat recovery steam generator, one (1) steam turbine generating unit and two (2) generator step-up transformers completed with associated

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[1] ADB. 2010. Report and Recommendations of the President to the Board of Directors: Proposed loans and administration of loan Republic of Uzbekistan: Talimarjan Power Project: Sector Analysis. Available at: http://www2.adb.org/Documents/RRPs/UZB/43151/43151-02-uzb-ssa.pdf

[2] Source - official website of Uzbekenergo: Present situation and perspective development of power system http://www.uzbekenergo.uz/eng/present_situation_and_perspective_development_of_power_system/

[3] Source - official website of Uzbekenergo: http://www.uzbekenergo.uz/eng/coal_industry/

[4] Cabinet of Ministers of the Republic of Uzbekistan Resolution #196, June 4, 2002. www.uzbekenergo.uz/docs/pkm%20ruz196%20ot%2004.06.2002%20g..doc

[5] At the moment of decision making final technical solution for the project was not clear. Although the title of the project was construction of 2 unit of 450 MW capacity (900 MW in total) inside the project documentation is was stated that total capacity of the units will be between 740 MW and 900 MW.

Therefore, in order to be conservative for the purpose of the project calculations moderate 820 MW estimation (medium between 740 MW and 900 MW, 740 MW + 900 MW)/2) was assumed regardless of the fact that project always tend to have 900 MW of total capacity.

equipment and accessories. Fuel for the new power units will be natural gas from Shurtan gas field. The first unit is scheduled to start operation in July 2015 and the second unit by the 2016. The two CCGTs comprising the capacity of 820 MW will generate approximately 6,105.7 GWh assuming 85% of plant load factor.

Baseline scenario

Baseline scenario is considered to be construction of natural gas fired open-cycle gas turbine as demonstrated in details below in the Section B.4.

Outcome of project implementation

The project implementation will result in reduction of Green House Gas (GHG) emissions by utilizing more efficient CCGT technology instead of more carbon intensive electricity generation on a coal fired power plant. Expected annual average GHG emission reductions are estimated as 836,152 tCO2e/year.

As well as the project implementation will lead to reduction of SO2 and NOx emissions. In addition, construction of two power units will contribute to economic development of Kashkadarya region by increase of revenues and taxable income by means of creating new employment opportunities for local residents.

See more details regarding technology which lead to emission reductions SJSC "Uzbekenergo" system in in the section A 3.

Contribution to sustainable development

The implementation of the project is expected to reduce significantly emissions of greenhouse gasses over ten-years period, namely by 8,361,518 tCO2e (annual average 836,152 tCO2e/year).

Besides that project will result in the following contribution to sustainable development:

- Increasing efficiency of the power generation and reduction of natural gas consumption per kWh (from 310 g/kWh to 222-225 g/kWh);
- Preserving a finite resource such as natural gas and as a result more sustainable power supply to the consumers;
- Reduction of pollutants emission into atmosphere and water disposal to Karshinskiy water channel;
- Creating new job opportunities on Talimarjan thermal power station.

Therefore, constructing two new Combined Cycle Gas Turbine Power Plants (CCGT) in the boundary of the Talimarjan thermal power station in considered to be an important step of promoting clean energy in the Republic of Uzbekistan.

A.2. Location of project activity

A.2.1. Host Party(ies)

Uzbekistan.

A.2.2. Region/State/Province etc.

Kashkadarya region (Qashkadariyo region)[6]

A.2.3. City/Town/Community etc.

Nuristan village

A.2.4. Physical/Geographical location

The existing Talimarjan thermal power plant is located 7.0 km to the north from Talimarjan water reservoir on the right bank of the Karshi main water channel in Nishan district of Kashkadarya region of the Republic of Uzbekistan. The nearest housing settlement – village Nuristan is located on the right bank

[6] Note that spelling of the names may differ depending on who translate and based on Russian versus Uzbek spelling of the names (for instance, Kashkadarya (Russian) = Qashkadariyo (Uzbek), Talimarjan = Talimardzan etc.).

of Karshi main water channel, to the north from industrial site of Thermal power plant at the distance of more than 500 meters from the industrial site.

The geographical coordinates of the proposed project are:

Latitude 38°28’53.37”N
Longitude 65°37’48.34”E [7]

Figure 2. Kashkadarya region (province) on the map

Figure 3. Talimarjan project site in the map

A.3. Technologies and/or measures

The new power units apply technology of gas turbine combined cycle power plants. At the power station the chemical energy of the fuel (natural gas) is converted into heat in the gas turbine combustion chamber in the form of hot gases. Hot gas energy is converted into mechanical energy in the gas turbine which drives the electrical generator. The electrical generator converts the mechanical energy of the gas turbine into electricity. The heat recovery steam generator recovers heat from the exhaust gases that exit from the gas turbine and convert that heat into high pressure steam. That steam drives the steam turbine connected to a generator which produces electricity as mentioned in the case of the gas turbine.

The CCGT plant will have capacity to generate approximately 820 MW of electricity. Two units will be installed at the station. Each unit will consist of a gas turbine generator unit, a heat recovery steam generator, a steam turbine generator unit, and the balance of plant items. Typical lifetime of this type of equipment is about 40 years, but according to Uzbekistan industry standards it is possible to prolong this period after technical audit which will confirm that equipment is in a good condition.

At the moment of PDD development it there were no final decision regarding the manufacture of equipment to the installed in the framework of the project. Therefore there is a range for each performance due to final technical solution which will be implemented on site.

[7] Uzbekenergo Prior Consideration of the CDM Form. Posted on 14/12/2012. http://cdm.unfccc.int/Projects/PriorCDM/notifications/index_html

Estimation of all important performance indicators (including mass and energy flows) are provided in the Table below.

Table 1. CCGT Plant Performance Indicators

Parameter	Unit	Value	Reference source and comments
Natural gas flow (estimated)	mln. M3/year	1,152	Calculated as = Annual generation (6,105.7 MWh/yr) * 3.6 (GJ/MWh) / 0.574 (generation efficiency) / NCV of natural gas (0,03324 GJ/m^3)[8]
Nominal capacity	MW	820	As stated above at the moment of decision making final technical solution for the project was not clear. Therefore, in order to be conservative for the purpose of the project calculations moderate 820 MW estimation (medium between 740 MW and 900 MW, 740 MW + 900 MW)/2) was assumed regardless of the fact that project always tend to have 900 MW of total capacity.
Volume of electricity generation	GWh/year	6,105.7	Calculated as 820 MW (capacity) * 85% (efficiency load) * 8760 hours
Nominal efficiency	%	57.40%	Letter from Uzbekenergo #5145 from 15 December 2011
Internal electricity consumption and losses	%	3.45%	ADB, 'Financial analysis (Talimarjan power project)', page 1
Load factor	%	85%	Letter from Uzbekenergo #5145 from 15 December 2011
Annual hours of operation	hr/y	7,446	Letter from Uzbekenergo #5145 from 15 December 2011

Actual performance indicators will be monitored as described in the Section B.7. Main monitoring equipment will be Electricity meter and Gas flow meter. This equipment will be installed within the boundaries of the site of the power station which will be constructed.

Apart of turbines and generation equipment project will included construction/installation of the following buildings/equipment:

1. The main building, including:
- Engine shop;
- Deaerator shop;
- Boiler room;

[8] Net calorific value of the natural gas was converted from the value 7 939.2 kcal/m3 provided in the Preliminary feasibility study report for the project, page 51. The value was converted as follows:
7 939.2 kcal/m3 * 4,1868 J/cal / 1 000 000 = 0,03324 GJ/m^3

2. Gas compressor station;
3. Station of gas preparation;
4. Oil warehouse;
5. Electrical facilities, including power converter and all supporting equipment;
6. Hydrotechnic equipment including:
- Pumping station;
- Water tubes and drainage;
- Other supporting equipment.

Natural gas from Shurtan gas field will be the main and back up fuel. All installed equipment including gas turbines and auxiliary equipment require regular maintenance as according to the technical specification and will be maintained accordingly.

The plant will generate greenhouse gas which is mostly in the form of carbon dioxide. A small amount of GHG will be emitted from the plant in the form of unburnt gas and nitrogen oxides. See details in the Section B.3.

In the scenario prior the start of the implementation the same amount of the electric power will be supplied to Uzbekistan energy system by existing thermal power stations. See Annex 4 for more details, it includes the list of all power stations which are currently connected to the grid and would be supplying electricity under the baseline scenario (in the absence of the project activity). Renewable energy generation is not included into the consideration as it cannot provide the same level of services as they cannot provide the same capacity or cannot provide electricity in the peak mode. More details are provided in the Section B4.

Specifically on the site of Talimarjan TPS the following equipment exists prior to the implementation of the project activity:

- four generation units with the total capacity of 3200MW;
- necessary pumping equipment (water pumps, oil pumps etc.);
- ventilation equipment;
- and also heating boiler with all supporting equipment to heat the building of the station.

More details are provided in the feasibility study report for the project.

New two Combined Cycle Gas Turbines will be constructed in the boundaries of existing Talimarjan TPS but on the spare area close to existing units. All required buildings and supportive infrastructure (as listed above) will be newly constructed.

In the baseline scenario the same amount of the electric power will be supplied to Uzbekistan energy system by combination of existing thermal power stations and new constructed power stations (50% operating margin, 50% build margin), see more details in the Annex 4.

Technology and know-how transfer will be performed both by applying state-of-the –art equipment from one of the leading manufacturer.[9] Also there are plans to attract foreign technical consultants who will perform assembling and installation of the equipment.[10]

[9] Although final decision on technical solution is not decided yet according to Preliminary feasibility study report the only possible option is only foreign equipment and possible countries of the manufacturer are Japan, USA, Germany, Switzerland, Italy and India.

[10] At the moment of PDD development foreign consultants were not contracted yet.

A.4. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Uzbekistan (host)	SJSC ”Uzbekenergo”	No
Czech Republic	Synecta a.s.	No

A.5. Public funding of project activity

No public funding has been provided.

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

AM0029: Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas Version 3.0, valid from 30 May 2008.[11]

The above methodology refers to the following tools:

- Tool for the demonstration and assessment of additionality – Version 07.0.0[12]
- Tool to calculate the emission factor for an electricity system – Version 04.0[13]

B.2. Applicability of methodology

The project meets all conditions stated in the approved baseline methodology AM0029, Version 3.0 as follows.

Table 2. Applicability Conditions under AM0029 Methodology, Version 3.0

Applicability Condition	Applicability to the Project Activity
The project activity is the construction and operation of a new natural gas fired grid-connected electricity generation plant.	The project envisages construction of two new Combined Cycle Gas Turbine Power Plant (CCGT) in the boundary of the existing Talimarjan thermal power station (TTPS) in Kashkadarya region of the Republic of Uzbekistan (new turbines power plant will be constructed close to the existing capacities of the power plant. According to CDM terms (please see AM0087, page 1) **New power plant** is determined as: “a newly constructed power plant with no operational history”. Also it is stated that Power plant should defined as per the “Tool to calculate the emission factor for an electricity system”. In the “Tool to calculate the emission factor for an electricity system”.Power plan is defined as follows. **Power plant/unit**. A power plant/unit is a facility that generates electric power. Several power units at one site comprise one power plant, whereas a power

[11] http://cdm.unfccc.int/methodologies/DB/WW4I82DG7LJUQE5E5YGT1NZE4PNS60

[12] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

[13] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf

	unit is characterized by the fact that it can operate independently from other power units at the same site. Where several identical power units (i.e. with the same capacity, age and efficiency) are installed at one site, they may be considered as one single power unit. Accordingly there is requirement that New power plan should be greenfield, but requirement to have no operational history and to generate electricity independently from other power units. In the case of Talimarjan project: • 2 new turbines which will be constructed will have no operational history; • 2 new turbines can be considered as plant according to the power plan definition. “several power units at one site comprise power plan”; • New turbines will generate electricity from the exiting power units. Thus although project is not a greenfield, but existing site of Talimarjan thermal power station, new construction is considered to be a New power plant.
The geographical/physical boundaries of the baseline grid can be clearly identified and information pertaining to the grid and estimating baseline emissions is publicly available.	The geographical/physical boundaries of the Uzbekistan national grid can be clearly identified and information pertaining to the grid and related emission factor is published officially in the Uzbekistan’s DNA website.[14]
Natural gas is sufficiently available in the region or country, e.g. future natural gas based power capacity additions, comparable in size to the project activity, are not constrained by the use of natural gas in the project activity.	Natural gas reserves in Uzbekistan is 65.0 trillion cubic feet, ranked as 18th in the world as of May 2013.[15] Production of the natural gas (2011) was 2,226.26 billion cubic feet and ranked as 14 in the world.[16] Natural gas is supplied from the Shurtan gas field and processing facilities located about 30 km from the project site. As described above in the technical indicators of the plant estimated gas consumption is about 1,152 mln. m3 per year (40.7 billion cubic feet) which is far below volume of natural gas reverses and production in Uzbekistan. Hence, future natural gas based power capacity additions, comparable in size to the project activity, will not be constrained by the use of natural gas in the project activity.
Natural gas should be the primary fuel. Small amounts of other startup or auxiliary fuels can be used, but can comprise no more than 1% of	No other fuel besides natural gas is used as a feedstock.

[14] Website of Uzbekistan’s DNA. http://www.mineconomy.uz/cdm/en/node/139. Please also see Appendix 4.
[15] US Energy Information Administration. http://www.eia.gov/countries/country-data.cfm?fips=UZ#ng
[16] US Energy Information Administration. http://www.eia.gov/countries/country-data.cfm?fips=UZ#ng

total fuel use, on energy basis.	
In some situations, there could be price-inelastic supply constraints (e.g. limited resources without possibility of expansion during the crediting period) that could mean that a project activity displaces natural gas that would otherwise be used elsewhere in an economy, thus leading to possible leakage. Hence, it is important for the project proponent to document that supply limitations will not result in significant leakage as indicated here.	Uzbekistan has the proven and potential reserves of 1.84 trillion cubic meters of natural gas, which has been observed for more than past 10 years.[17] In 2011, total consumption of natural gas in Uzbekistan was 51.0 billion cubic meters. Hence, sufficient gas will continue to be available more than that of consumption from existing capacity of gas based power plants. Therefore, there are no price-inelastic supply constraints as far as natural gas is concerned and no leakage during the crediting period is expected

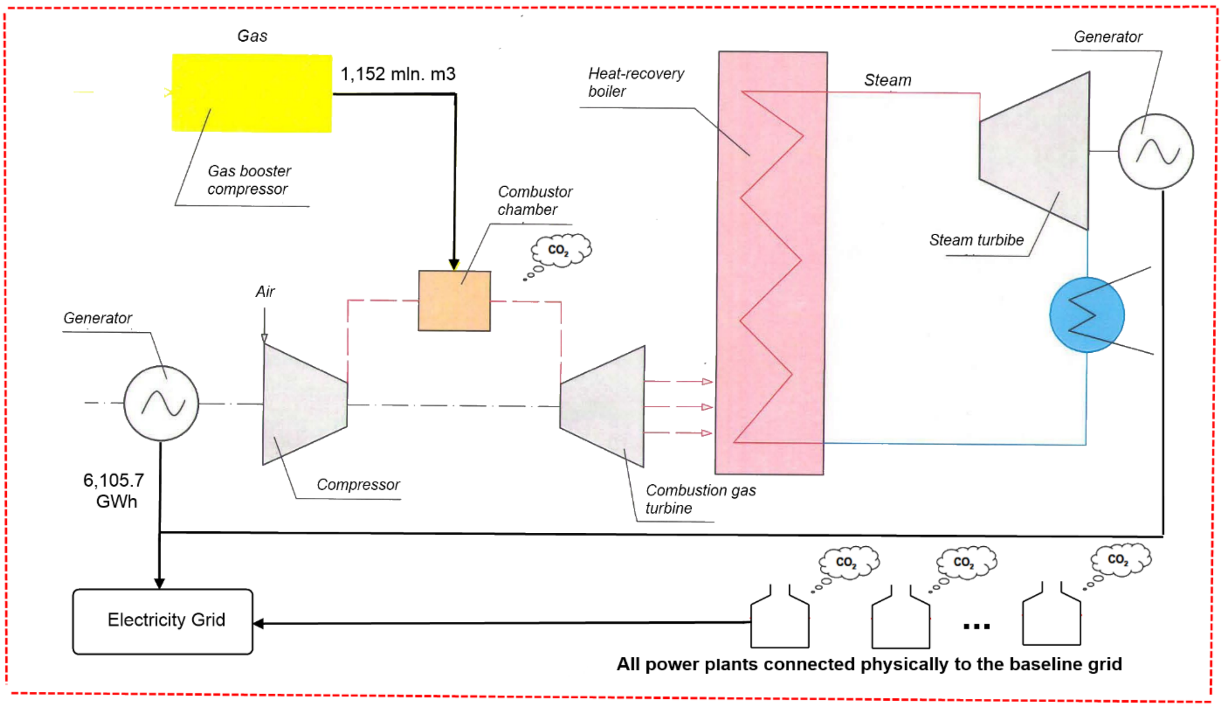
B.3. Project boundary

As per AM0029, Version 3.0, the spatial extent of the project boundary includes the project site and all power plants connected physically to the baseline grid as defined in "Tool to calculate emission factor for an electricity system ".

As per the above guidance, the project boundary for the project activity will include the project site which includes the power plant machinery and all the auxiliary equipment necessary to operate the power plant. All other power plants connected physically to the baseline grid are also included in the project boundary. A flowchart indicating the project boundary is presented below:

[17] US Energy Information Administration. Available at: http://www.eia.gov/countries/country-data.cfm?fips=UZ#ng

Figure 5. The project boundary (represented below by the red dotted line)



Emission sources
CO2 emissions from fossil fuels combustion

Data and parameters to be monitored
1. FCy Annual quantity of fuel consumed in the project activity
2. NCVy Net calorific value of the fuel
3. OXIDf Oxidation Factor
4. EFCO2,y Emission factor
5. COEFy y Emission factor
6. PEy Project emission due to combustion of fuel

As per AM0029, Version 3.0 in the calculation of project emissions, only CO2 emissions from fossil fuel combustion at the project plant are considered. In the calculation of baseline emissions, only CO2 emissions from fossil fuel combustion in power plant(s) in the baseline are considered. Overview of the greenhouse gases included in or excluded from the project boundary are shown in the table below.

Table 3. Overview of emission sources included in or excluded from project boundaries

	Source	Gas	Included?	Justification/ Explanation
Baseline	Power generation in baseline	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
Project Activity	On-site fuel combustion due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification

B.4. Establishment and description of baseline scenario

As per the AM0029, Version 3.0 the following steps have been followed in order to determine the plausible baseline scenario.

Step 1: Identify plausible baseline scenarios

All possible realistic and credible alternatives that provide outputs or services comparable with the proposed CDM project activity have been considered as per the methodology.

The methodology stipulates that alternatives to be analysed should include, *inter alia*:

- The project activity not implemented as a CDM project;
- Power generation using natural gas, but technologies other than the project activity;
- Power generation technologies using energy sources other than natural gas;
- Import of electricity from connected grids, including the possibility of new interconnections.

A. The project activity not implemented as a CDM project

Scenario A (Combined-cycle gas turbine) is a plausible baseline alternative which can deliver similar services as the proposed project and in compliance with all applicable legal and regulatory requirements.

B. Power generation using natural gas, but technologies other than the project activity

In 2008, Uzbekistan generated 50,254 GWh, imported 925 GWh from its neighbours, and exported approximately 630 GWh. The total installed capacity for power generation is 12,400 MW, out of which 9,612 MW are actually available.[18] Thermal power plants represent 86% and 94% of power from those thermal power plants is generated from natural gas based rankine-cycle technology. Hence, natural gas fired power generation using different type of technologies such as B (1): sub-critical power plant and B (2): super-critical power plant would be plausible baseline alternatives.

B (3): Natural gas fired open-cycle gas turbine (OCGT).
OCGT is a plausible option in countries where non market based pricing is practiced. In Uzbekistan, most thermal power plants (TPPs) have been operated for almost 40 to 50 years with a lower efficiency rate and it requires substantial replacement and/or rehabilitation in order to meet increasing demands.[19] TPPs account for between 84 and 92% of the country's total electricity capacity in Uzbekistan, depending on hydro power output.[20] Hence, more efficient OCGT would enable to supply energy in a more efficient way[21] and would be also a plausible option for Uzbekistan.

C. Power generation technologies using energy sources other than natural gas

Power generation technologies using energy sources other than natural gas may include a coal-fired power plant and renewable energy power plant.

Although the development of the coal industry in Uzbekistan has been slow, the government plans to increase power generation using coal from 4% in 2009 to 15% in 2020 in order to diversify energy resources available in the country.[22] Hence, more coal may be exportable and available in neighbouring countries. As coal-fired power plants can provide both base load and peak-load capacities, C (1): sub-critical and C (2): super critical coal-fired power plants are considered as a plausible scenario for comparison and further analysis.

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[18] ADB. 2010. Report and Recommendations of the President to the Board of Directors: Proposed loans and administration of loan Republic of Uzbekistan: Talimarjan Power Project: Sector Analysis. Available at: http://www2.adb.org/Documents/RRPs/UZB/43151/43151-02-uzb-ssa.pdf

[19] ADB. 2010. Report and Recommendations of the President to the Board of Directors: Proposed loans and administration of loan Republic of Uzbekistan: Talimarjan Power Project: Sector Analysis. Available at: http://www2.adb.org/Documents/RRPs/UZB/43151/43151-02-uzb-ssa.pdf

[20] UNDP. 2007. Chapter 1. Uzbekistan's energy sector. Available at: http://www.undp.uz/en/download/?type=publication&id=79&parent=1927&doc=8147&bcsi_scan_7823DFCE46415F3E=1

[21] IEA. 2009. Energy Technology System Analysis Program: Technology Brief E02; Gas-Fired Power. Available at: http://www.etsap.org/E-techDS/PDF/E02-gas_fired_power-GS-AD-gct.pdf

[22] Uzbekenergo official site: http://www.uzbekenergo.uz/rus/o_sovremennom_sostoyanii_iperspektivax_razvitiya_energetiki/

C (3): Renewable energy power plant

Renewable energy power plants could include technologies using hydro, biomass, wind or solar. In Uzbekistan, hydro power represents 11.5% of capacity for power generation in the country.[23] The government of Uzbekistan plans to construct small hydropower plants of about 420 MW of capacity by 2015.[24] However, such small hydropower plants, because of their low load factor, cannot provide similar services and output in order to correspond to energy demand. Additionally renewable energy sources cannot provide electricity in the peak mode comparing to thermal power generation. Hence, option C (3) is not a plausible baseline scenario given to the project activity.

D.Import of electricity from connected grids, including the possibility of new interconnections

The project boundary of this project activity considered in this PDD is the whole integrated national grid of Uzbekistan. Primary energy demand in Uzbekistan was 48.5 million tons of oil equivalent (MTOE) in 2006, and is projected to increase to 72.6 MTOE in 2030 (an annual growth rate of 1.8%). The country has about 1.8 trillion cubic meters of proven natural gas reserves, 590 million barrels of proven oil reserves, and about 3.0 billion tons of recoverable coal reserves.[25] Thus Uzbekistan has a substantial export potential and the government is seeking ways to augment its petroleum and natural gas output, to increase natural gas exports, and to draw direct foreign investment to the energy sector. According to the government strategy published in 2008[26], increase of energy exports on a commercial basis is one of the main strategies for Uzbekistan to correspond increasing energy demand at regional level. Electricity imports have been dramatically reduced after the collapse of the Soviet Union due to the focus on self-sufficiency. In 2000-2009 period the import of electricity declined from 2,237.2GWh to the level of 925 GWh. Therefore, import of electricity from connected grid is not considered a plausible alternative to the project activity.

In summary, the plausible baseline scenarios given to the project activity is summarised in the following table.

Table 4. Summary of Identified Plausible Baseline Scenarios

No.	Baseline Alternative
A	The project activity not implemented as a CDM project
B (1)	Construction of a natural gas-fired sub-critical power plant
B (2)	Construction of a natural gas-fired super-critical power plant
B (3)	Construction of an Open Cycle Gas Turbine (OCGT) power plant
C (1)	Construction of a coal fired sub-critical power plant
C (2)	Construction of a coal fired super-critical power plant

Step 2: Identify the economically most attractive baseline scenario alternative

Sub-step 1: Calculating levelized cost of electricity production for identified plausible baseline scenarios

According to the methodology, the remaining baseline scenario alternatives are identified using investment analysis for economically most attractive, and chosen the levelized cost of electricity production in US$/kWh as financial indicator for investment analysis. The calculation formula of the levelized cost of electricity Production (LCOE) is used based on the formula provided by International Energy Agency (IEA).[27]

[23] Uzbekenergo official site: http://www.uzbekenergo.uz/rus/texniko_ekonomicheskie_pokazateli/
[24] Uzbekenergo official site: http://www.uzbekenergo.uz/eng/present_situation_and_perspective_development_of_power_system
[25] ADB Sector Analysis. 2010. Available at: http://www2.adb.org/Documents/RRPs/UZB/43151/43151-02-uzb-ssa.pdf
[26] Republic of Uzbekistan:Strategy of Raising Well-being of Population of Republic of Uzbekistan http://www.carecinstitute.org/uploads/docs/UZB-Welfare-Improvement-Strategy-ru.pdf
[27] Projected costs of Generation Electricity, International Energy Agency, 2010 Edition, page 35

$$\text{LCOE} = \frac{\sum_t [(I_t + M_t + F_t)(1+r)^{-t}]}{\sum_t [E_t (1+r)^{-t}]}$$

Where,

It	Capital expenditures in year t
Mt	Operation and maintenance expenditures in year t
Ft	Fuel expenditures in year y
Et	Electricity generation in year y
r	Discount rate
$\sum_t$	The summary over the period including construction, operation during the economic lifetime and decommissioning of the plant as applicable

The relevant data for calculation of the remaining alternatives are tabulated below:

Table 5. Input data for the project activity scenario (The project activity not implemented as a CDM project)

Parameter	**Unit**	**Value**	**Reference source and comments**
Nominal capacity	MW	820	As stated above at the moment of decision making final technical solution for the project was not clear. Therefore, in order to be conservative for the purpose of the project calculations moderate 820 MW estimation (medium between 740 MW and 900 MW, 740 MW + 900 MW)/2) was assumed regardless of the fact that project always tend to have 900 MW of total capacity.
Nominal efficiency	%	57.40%	Letter from Uzbekenergo #5145 from 15 December 2011
Load factor	%	85%	Letter from Uzbekenergo #5145 from 15 December 2011
Internal electricity consumption and losses	%	3.45%	ADB, 'Financial analysis (Talimarjan power project)', page 1
Technical losses	%	13%	ADB, 'Financial analysis (Talimarjan power project)', page 1
Commercial losses	%	7%	ADB, 'Financial analysis (Talimarjan power project)', page 1

Table 6. Data for LCOE calculation for remaining alternatives

Item	Unit	A	B(1)	B(2)	B(3)	C(1)	C(2)	Source
Total rated capacity	MW	820	820	820	820	820	820	Letter from Uzbekenergo #5144 from 15 December 2011
Plant Load Factor	%	85	85	85	85	85	85	
Internal electricity consumption	%	3.45	2.42	2.99	2.73	8.00	8.00	
Efficiency of the plant	%	57.4	37.0	38.7	34.0	35.0	42.0	
Investment Cost	Million US$/MW	0.995	0.93	1.10	0.62	1.0	1.2	
Fuel cost	US$/kg or m3	0.053	0.053	0.053	0.053	0.040	0.040	
Water costs	Million US$	6.9	3.1	2.4	0.2	7.0	7.0	
Maintenance and management costs	Million US$	0.57	0.57	0.57	0.57	0.58	0.58	
Insurance	%	0.25	0.25	0.25	0.25	0.25	0.25	
Capital repair	Million US$	31.4	31.4	31.4	15.5	32.0	38.4	

Based on the above data, the levelized cost of electricity production (LCOE) of the identified plausible baseline alternatives can be calculated, and the calculation results are presented as below:

Table 7. LCOE calculation results for alternatives scenarios

No.	Plausible Baseline Scenarios	LCOE (US$/kWh)
A	The project activity not implemented as a CDM project	0.0291
B (1)	Construction of a natural gas-fired sub-critical power plant	0.0330
B (2)	Construction of a natural gas-fired super-critical power plant	0.0354
B (3)	Construction of an Open Cycle Gas Turbine (OCGT) power plant	0.0282
C (1)	Construction of a coal fired sub-critical power plant	0.0392
C (2)	Construction of a coal fired super-critical power plant	0.0396

Based on the above LCOE calculation results, LCOE of the construction of a natural gas-fired Open Cycle Gas Turbine (OCGT) power plant is the lowest among plausible baseline alternatives. Hence, the option B (3) is the most economically attractive scenario. According to the methodology, the following sensitivity analysis needs to be done to confirm whether this conclusion is robust.

Sub-step 2: Sensitivity analysis of identified plausible scenarios

A sensitivity analysis has been performed for both coal and natural gas alternatives to confirm that the above financial analysis is robust to reasonable variation in the critical assumptions. According to the calculation formula of LCOE, the parameters used for calculating LCOE are I_t, M_t, F_t, E_t and r, and the corresponding critical assumptions are the total investment capital, plant load factor, and the fuel price.

Please find below table with summary results for the Sensitivity analysis, where all critical assumptions were assumed to vary +/-10% as according to 'Guidance on the assessment of investment analysis', Version 05.

Table 8. Summary of sensitivity analysis, LCOE US$/kWh

	A	B(1)	B(2)	B(3)	C(1)	C(2)
Basic assumptions	0.0291	0.0330	0.0354	0.0282	0.0392	0.0396
-10% project costs	0.0274	0.0313	0.0335	0.0271	0.0375	0.0375
+10% project costs	0.0308	0.0346	0.0374	0.0293	0.0410	0.0417
-10% load factor	0.0312	0.0349	0.0377	0.0295	0.0413	0.0421
+10% load factor	0.0274	0.0314	0.0336	0.0272	0.0376	0.0376
-10% fuel costs	0.0281	0.0314	0.0340	0.0265	0.0373	0.0380
+10% fuel costs	0.0301	0.0345	0.0369	0.0299	0.0412	0.0413

As clearly demonstrated in the Table 7 in all cases B (3) scenario remains the most economically attractive scenario and therefore the most plausible scenario.

In summary, the above sensitivity analysis demonstrates that, the assumptions made above are robust to reasonable variations and the pre-selected baseline scenario, construction of the natural gas-fired OCGT power plant, is likely to remain the most economically attractive option.

B.5. Demonstration of additionality

Prior consideration of CDM

According to the "Guidelines on the Demonstration and Assessment of Prior Consideration of the CDM", Version 04, project activities with a starting date on or after 02 August 2008, the project participant must inform a Host Party DNA and the UNFCCC secretariat in writing of the commencement of the project activity and of their intention to seek CDM status.

CDM prior consideration form for the project was sent to the Host Party DNA and the UNFCCC secretariat on 14th of December 2012.

The table below shows the timeline for the project and illustrates that the possibility of additional revenue through the sale of CERs was a key factor for deciding to proceed with the project.

Table 9. Implementation timeline of the proposed CDM activity

Date	**Activity**
Mar 2010 – Nov 2011	Preliminary project consideration with ADB
Aug 2010	Development of preliminary FSR for the project
Dec 2011	Receiving documents from Uzbekenergo to perform CER and financial calculations for the project
Mar 2012	Completion of feasibility calculations showing that financial IRR is much lower than benchmark of power industry in Uzbekistan
June 2012	Signing Framework agreement between Uzbekenergo and Synecta a.s.
Dec 2012	CDM prior consideration form was sent to the Host Party DNA and the UNFCCC secretariat
Aug 2013	Start date of construction
July 2015	Expected commission date of 1st turbine
July 2016	Expected commission date of 2nd turbine

The assessment of the additionality of the project activity has been conducted as per the guidance given in the methodology AM0029, Version 3.0 using the following steps:

Step 1: Benchmark investment analysis

According to AM0029, Version 3.0, this step will demonstrate that the proposed CDM project activity is unlikely to be financially attractive by applying sub-step 2b (Option III: Apply Benchmark Analysis), sub-step 2c (Calculation and Comparison of Financial Indicators), and sub-step 2d (Sensitivity Analysis) of the "Tool for the Demonstration and Assessment of Additionality (Version 7.0.0).

Project participants decided to use equity IRR for the benchmark analysis. According as per 'Guidelines on the assessment of investment analysis', Version 05, default value of expected return on equity - 13.25% was used for benchmark investment analysis of Uzbekistan energy industry project. Details of expected terms of the loan financing are provided in Excel file with investment analysis. Calculated IRR is post-tax, the same as the default benchmark value provided in the 'Guidelines on the assessment of investment analysis', Version 05.

Calculation and comparison of financial indicators

The financial indicator chosen most appropriate for the project activity is project IRR. The underlying data is presented in the following table. As according to the 'Guidelines on the assessment of investment analysis' Version 05.0, paragraph 6, all assumption are valid and applicable at the moment of investment decision taken be the project participant. Also as according to 'Tool for the demonstration and assessment of additionality – Version 07.0.0' (paragraph 41) assumptions and input data for the investment analysis are consistent with data applied for baseline analysis and do not differ shall not differ across the project activity and its alternatives.

Table 10. Assumption of major parameters for financial analysis

Basic Assumption	**Unit**	**Value**	**Reference source and comments**
Nominal capacity	MW	820	As stated above at the moment of decision making final technical solution for the project was not clear. Therefore, in order to be conservative for the purpose of the project calculations moderate 820 MW estimation (medium between 740 MW and 900 MW, 740 MW + 900 MW)/2) was assumed regardless of the fact that project always tend to have 900 MW of total capacity.
Nominal efficiency	%	57.40%	Letter from Uzbekenergo #5145 from 15 December 2011
Plant load factor	%	85%	Letter from Uzbekenergo #5145 from 15 December 2011
Internal electricity consumption and losses	%	3.45%	ADB, 'Financial analysis (Talimarjan power project)', page 1
Technical losses	%	13%	ADB, 'Financial analysis (Talimarjan power project)', page 1
Commercial losses	%	7%	ADB, 'Financial analysis (Talimarjan power project)', page 1
Investment cost	Million US$/MW	0.995	Letter from Uzbekenergo #5144 from 15 December 2011
Fuel cost	US$/m^3	0.053	Letter from Uzbekenergo #5144 from 15 December 2011
Maintenance and management costs	Million US$	0.57	Letter from Uzbekenergo #5144 from 15 December 2011
Water costs	Million US$	6.9	Letter from Uzbekenergo #5144 from 15 December 2011
Capital repair	Million US$	31.4	Letter from Uzbekenergo #5144 from 15 December 2011

Insurance	%	0.25	Letter from Uzbekenergo #5144 from 15 December 2011
Equity IRR (without CDM revenue)		8.83%	

The calculation results indicate that the proposed project without CDM revenue is considered as financially unattractive due to its IRR is **8.83%** which is lower than the benchmark, and it with CDM revenue as financially attractive due to its IRR is **13.76%** which is higher than the benchmark.

Sensitivity analysis

A sensitivity analysis was performed using assumptions which are considered conservative. The 'best-case' conditions for the project IRR were assumed by altering the project cost, plant load factor, and fuel cost. Deviations of +10% have been taken into account in the above decisive assumptions. Summary results of the sensitivity analysis are provided in the table below.

Table 11. Summary of sensitivity analysis, project IRR without CDM revenue, %

Indicator	-10%	0%	+10%
Investments	12.29%	8.83%	6.09%
Power Output	5.39%	8.83%	12.37%
Fuel costs	10.84%	8.83%	6.86%

As illustrated in the table above, the IRR ranges from 5.39% to 12.37% when the economic parameters above are varied within the range of -10% to +10%. The best case scenario generates IRR (without CDM related income) of 12.37%, but even in this case this below the benchmark provided in the 'Guidance on the assessment of investment analysis', Version 05.

Therefore, it can be observed that the project activity is financially unattractive not only in the typical situation but also in the varying scenarios and hence the project activity is additional.

Step 2: Common practice analysis

According to AM0029,Version 3.0 the step will demonstrate that the proposed CDM project activity is not a common practice in the relevant country and sector by applying Step 4 (common practice analysis) of the Tool for the Demonstration and Assessment of Additionality (Version 7.0.0,).

As according to the latest version of the 'Guidelines on common practice', Version 02.0, common practice analysis assumes the following steps:

Step 1: Calculate applicable capacity or output range as +/-50% of the total design capacity or output of the project activity

The capacity of the proposed project is 820 MW, therefore similar projects identified for common practice analysis are within the range of 410 MW to 1,230 MW installed capacity which is equivalent to the range of 3,052.9 mln. kWh to 9,158.6 mln. kWh assuming 85% load factor.

Step 2: identify similar project (both CDM and non-CDM) which fulfill all of the following conditions:

(a) The projects are located in the applicable geographical area

In this case it is the Host party, Uzbekistan, as established by Tool for the Demonstration and Assessment of Additionality, Version 7.0.0.

(b) The projects apply the same measures as the proposed project activity

In this case all projects related to installation of new energy generation are considered.

(c) The projects use the same energy source/fuel and feedstock as the proposed project activity.

In this case it is a natural gas.

(d) The plant produce the services with comparable quality

In this case only natural gas thermal power stations are considered.

(e) The capacity or output of the project is within the applicable capacity or output range

calculated in Step 1

In this case it is the range of capacity of 410 MW to 1,230 MW or the range of the output of 3,052.9 mln. kWh to 9,158.6 mln. kWh.

(f) The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of the proposed project activity, whichever is earlier for the proposed project activity.

In this case the earliest date is 25/06/2012 – the start date of the project activity.

Please find below the list of the power stations which meet all the requirements listed above. All data is taken from the 'CO2 Emission Factor Calculation for the Uzbekistan National Grid (2010)' developed by Uzbekistan DNA, Version 2 dated 07/02/2012.

Table 12. List of natural gas thermal power stations in Uzbekistan comparable with the project activity

Power Station	Fuel	Electricity Output (million kWh)	Useful Heat Output (thousand gCal)	Ratio of Fuel spent, electricity/ heat	Year Commissioned
Tashkent TPP (existing turbines)	Natural gas/black oil	6,069.1	122.0	97.7%	1963
Novo Angren TPP	Natural gas/black oil/coal	5,430.4	121.1	97.5%	1985
Navoi TPP (existing turbines)	Natural gas	7,376.5	2,234.8	73.9%	1961
Talimarjan TPP	Natural gas	5,543.0	36.5	99.2%	2004

Please note that at the moment 2 other CDM projects related to construction of CCGT power plants are being implemented in Uzbekistan:

- CCGT in Navoi TPP, Karmana district, Navoi;[28]
- CCGT in Tashkent TPP, Tashkent city.[29]

But at the moment of project activity start they did not start commercial operation and therefore were not considered. This is confirmed by Uzbekistan DNA data (see Appendix 4) where all power plants which are currently operated are listed.

There are also other CDM projects which hare currently implemented by Uzbekenergo, but they are not related to construction of CCG turbines.[30]

Step 3. Identify the projects that are neither registered CDM project activities, project activities submitted for registration nor project activities undergoing validation.

None of the projects listed above are CDM project, therefore N_{all} is equal to 4.

[28] See Prior consideration details at UNFCCC website http://cdm.unfccc.int/Projects/PriorCDM/notifications/index_html Project name 'Construction of Combined Cycle Gas Turbine unit at Navoi TPP 2'

[29] See Prior consideration details at UNFCCC website http://cdm.unfccc.int/Projects/PriorCDM/notifications/index_html Project name 'Construction of combined cycled power plant 370 MW'

See also PDD published for the GSP http://cdm.unfccc.int/Projects/Validation/DB/D67FZW8U0CX0S5575JWDUKYM5CMD3G/view.html

[30] Please the list of CDM projects in Uzbekistan published for the GSP at UNFCCC site http://cdm.unfccc.int/Projects/Validation/index.html

Step 4. Identify the projects that apply technologies that are different to the technology applies in the proposed project activity.

None of the project listed above are related to implementation of CCGT technology. All the projects listed above are power generation with rankine-cycle technology. See Annex 4 for more details.
Therefore N_{diff} is equal to 4.

Step 5. Calculate factor F=1- $N_{diff//}$ N_{all} representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used for the project activity that deliver the same output or capacity as the project activity.

F=1-4/4=0
N_{all} - N_{diff} = 4-4 = 0

As according to the 'Guidelines on common practice', Version 02.0 the proposed project activity is a "common practice" if the factor F is greater than 0.2 and N_{all} - N_{diff} is greater than 3.

For the considered project factor F is less than 0.2 and N_{all} - N_{diff} is less than 3, therefore proposed project activity is not the common practice.

Step 3: Impact of CDM registration

If the proposed project activity can be registered as a CDM activity, its equity IRR shall be improved and it shall be considered as financially attractive and in operation normally, so the GHG emission reductions from the proposed project activity shall be achieved. Meanwhile, the successful registration of the proposed project shall further promote the popularization of the gas-fired combined cycle power technology, and then lead to further GHG emission reductions in Uzbekistan.

If the proposed project activity cannot be registered as a CDM activity, equity IRR will be lower than 13.25% of the benchmark, and it shall be considered as financially unattractive, the financial deficit will be occurred, and the normal construction or operation of the project will be impacted, and this further impact the projected GHG emission reductions from the proposed project.

Therefore as all steps of the additionality analysis prescribed by the methodology AM0029, Version 3.0, are satisfied and thus, the project activity demonstrated is additional.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

According to AM0029, Version 3.0, the procedure for estimation of the emission reductions from the project activity during the crediting period are stated as the following four steps:

Step 1: Project Emissions (*PEy*)

The project activity is on-site combustion of natural gas to generate electricity. According to the feasibility study report, natural gas will be the only type of fuel consumed in the proposed project. The CO_2 emissions from electricity generation (*PEy*) are calculated as follows:

$$PE_y = \sum_f FC_{f,y} * COEF_{f,y} \qquad \textbf{(1)}$$

Where:

$FC_{f,y}$:	=	Is the total volume of natural gas or other fuel 'f' combusted in the project plant or other startup fuel (m3 or similar) in year(s) y
$COEF_{f,y}$:	=	Is the CO_2 emission coefficient (tCO_2/m^3 or similar) in year(s) for each fuel and is obtained as:

$$COEF_{f,y} = \Sigma NCV_y * EF_{CO2f,f,y} * OXID_f \qquad \textbf{(2)}$$

Where:

$NCV_{f,y}$:	=	Is the net calorific value (energy content) per volume unit of natural gas in year *y* (GJ/m^3) as determined from the fuel supplier, wherever possible, otherwise from local or

national data

$EF_{CO2,f,y}$: = Is the CO_2 emission factor per unit of energy of natural gas in year *y* (tCO_2/GJ) as determined from the fuel supplier, wherever possible, otherwise from local or national data

$OXID_f$: = Is the oxidation factor of natural gas

Step 2: Baseline Emission (BE_y)

Baseline emissions are calculated by multiplying the electricity generated in the project plant ($EG_{PJ,y}$) with a baseline CO_2 emission factor ($EF_{BL,CO2,y}$), as follows:

$$BE_y = EG_{PJ,y} \cdot EF_{BL,CO2,y} \quad \textbf{(3)}$$

For construction of large new power capacity additions under the CDM, there is a considerable uncertainty relating to which type of other power generation is substituted by the power generation of the project plant. As a result of the project, the construction of an alternative power generation technology(s) could avoided, or the construction of a series of other power plants could simply be delayed. Furthermore if the project were installed sooner than these other projects might have been constructed, its near-term impact could be largely to reduce electricity generation in existing plants. This depends on many factors and assumptions (e.g. whether there is a supply deficit) that are difficult to determine and that change over time. In order to address this uncertainty in a conservative manner, project participants shall use for $EF_{BL,CO2,y}$ the lowest emission factor among the following three options:

For the first crediting period:

Option 1 The build margin, calculated according to "Tool to calculate emission factor for an electricity system"; and

Option 2 The combined margin, calculated according to "Tool to calculate emission factor for an electricity system", using a 50/50 OM/BM weight;

Option 3 The emission factor of the technology (and fuel) identified as the most likely baseline scenario under "Identification of the baseline scenario" above.

Option 1: Emission Factor from grid as Build Margin

The Uzbekistan DNA has publicly made available the grid emission factor by developing and registration in CDM EB of Standardized baseline 'Grid emission factor for the Republic of Uzbekistan', version 01.0, ABS 0003.

In this document Build Margin is established as:

$EF_{grid,\ BM}$ = 0.496 tCO2/MWh[31]

Option 2: Emission Factor from grid as Combined Margin

The Uzbekistan DNA has publicly made available the Combine Margin emission factor for the grid, whereby, the

$EF_{grid,\ CM}$ = 0.516 tCO2/MWh[32]

Option 3: The emission factor of the technology (and fuel) identified as the most likely baseline scenario under "Identification of the baseline scenario", in this natural gas (***$EF_{BL,CO2,natural\ gas}$***)

The calculation of $EF_{BL,CO2,natural}$ *gas is as follows:*

$$EF_{BL,CO2}(tco2/Mwh) = \frac{COEF_{BL}}{\eta_{BL}} * 3.6GJ/MWh \quad \textbf{(4)}$$

The following data is used for the ration calculation:

[31] Standardized baseline 'Grid emission factor for the Republic of Uzbekistan' https://cdm.unfccc.int/methodologies/standard_base/Standardized_Baseline_PSB005_ver01.0.pdf

[32] Standardized baseline 'Grid emission factor for the Republic of Uzbekistan' https://cdm.unfccc.int/methodologies/standard_base/Standardized_Baseline_PSB005_ver01.0.pdf

$COEF_{BL}$	tCO_2e/GJ	0.0561	IPCC 2006
h_{BL}	%	34%	Uzbekenergo, see Table 7 for B (3) scenario

The calculated $EF_{BL,CO2,natural\ gas}$ is 0.594 tCO_2/MWh.

As per AM0029, Version 03, the baseline emission factor (EFBL,CO2,y) is the lower emission factor between the combined margin emission factor, build margin emission factor calculated according to the "Tools to calculate emission factor for electricity system" and emission factor calculated for baseline scenario as discussed above in Option 1.

Table 13. Summary of EF calculation

Option	**Parameters**	**Values**	**Source**
Option 1	BM, Build Margin (tCO2/MWh)	0.496	DNA Uzbekistan
Option 2	CM, Combined Margin (tCO2/MWh)	0.516	DNA Uzbekistan
Option 3	Emission factor baseline Open Cycle Gas Turbine (tCO2/MWh)	0.594	Calculated

Since, the lowest emission factor among the three options is combined margin, the emission factor is chosen as Build Margin ($EF_{BL,CO2,y}$) = 0.496 tCO2/MWh.

This is ex ante assessment as defined in AM0023, Version 03. Ex post values of the National grid emission factor will be monitored for each reporting period and calculated in accordance with the latest version of the 'Tool to calculate the emission factor for an electricity system'. Each possible option of the grid emission factor (Build margin, Combined margin and Emission factor of the baseline technology) will be monitored separately as described in the Section B.7.2. The lowest among the options will be considered as the grid emission factor for the reporting period.

Step 3: Leakage (LE_y)

Leakage may result from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary. This includes mainly fugitive CH_4 emissions and CO_2 emissions from associated fuel combustion and flaring. In this methodology, the following leakage emission sources shall be considered:

- Fugitive CH_4 emissions associated with fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of natural gas used in the project plant and fossil fuels used in the grid in the absence of the project activity;
- In the case LNG is used in the project plant: CO_2 emissions from fuel combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression into a natural gas transmission or distribution system.

Thus, leakage emissions are calculated as follows:

$$LE_y = LE_{CH4,y} + LE_{LNG,CO2,y} \quad \textbf{(5)}$$

Where:

LE_y :	=	Leakage emissions during the year *y* in tCO_2e
$LE_{CH4,y}$:	=	Leakage emissions due to fugitive upstream CH_4 emissions in the year *y* in t CO_2e
$LE_{LNG,CO2,y}$:	=	Leakage emissions due to fossil fuel combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system during the year *y* in t CO_2e

Fugitive methane emissions

For the purpose of estimating fugitive CH_4 emissions, project participants should multiply the quantity of natural gas consumed by the project in year *y* with an emission factor for fugitive CH_4 emissions

($EF_{NG,upstream,CH4}$) from natural gas consumption and subtract the emissions occurring from fossil fuels used in the absence of the project activity, as follows:

$$LE_{CH4,y} = \left[FC_y \cdot NCV_y \cdot EF_{NG,upstream,CH4} - EG_{PJ,y} \cdot EF_{BL,upstream,CH4} \right] \cdot GWP_{CH4} \quad \textbf{(6)}$$

Where:

$LE_{CH4,y}$:	=	Leakage emissions due to fugitive upstream CH_4 emissions in the year *y* in t CO_2e
FC_y :	=	Quantity of natural gas combusted in the project plant during the year *y* in m³
$NCV_{NG,y}$:	=	Average net calorific value of the natural gas combusted during the year *y* in GJ/m³
$EF_{NG,upstream,CH4}$:	=	Emission factor for upstream fugitive methane emissions of natural gas from production, transportation, distribution, and, in the case of LNG, liquefaction, transportation, re-gasification and compression into a transmission or distribution system, in t CH_4 per GJ fuel supplied to final consumers
$EG_{PJ,y}$:	=	Electricity generation in the project plant during the year in MWh
$EF_{BL,upstream,CH4}$:	=	Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in t CH4 per MWh electricity generation in the project plant, as defined below
GWP_{CH4} :	=	Global warming potential of methane valid for the relevant commitment period

The emission factor for upstream fugitive CH_4 emissions occurring in the absence of the project activity ($EF_{BL,upstream,CH4}$) should be calculated consistent with the baseline emission factor ($EF_{BL,CO2}$), as follows:

Option 1: Build Margin:

$$EF_{BL,upstream,CH4} = \frac{\sum_j FF_{j,k} \cdot EF_{k,upstream,CH4}}{\sum_j EG_j} \quad \textbf{(7)}$$

Option 2: Combined Margin:

$$EF_{BL,upstream,CH4} = 0.5 \cdot \frac{\sum_j FF_{j,k} \cdot EF_{k,upstream,CH4}}{\sum_j EG_j} + 0.5 \cdot \frac{\sum_i FF_{i,k} \cdot EF_{k,upstream,CH4}}{\sum_i EG_i} \quad \textbf{(8)}$$

Option 3: Baseline technology:

$$\mathrm{EF_{BL,upstream,CH4}} = \frac{\mathrm{EF_{k,upstream,CH4}}}{\eta_{\mathrm{BL}}} * 3.6\mathrm{GJ/MWh} \quad \textbf{(9)}$$

Where:

$EF_{BL,upstream,CH:4}$	=	Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in t CH_4 per MWh electricity generation in the project plant
j :	=	Plants included in the build margin
$FF_{j,k}$:	=	Quantity of fuel type *k* (a coal or oil type) combusted in power plant *j* included in the build margin
$EF_{k,upstream,CH4}$:	=	Emission factor for upstream fugitive methane emissions from production of the fuel type *k* (a coal or oil type) in t CH_4 per MJ fuel produced
EG_j :	=	Electricity generation in the plant *j* included in the build margin in MWh/a
i:	1. =	2. Plants included in the operating margin
$FF_{i,k}$:	=	Quantity of fuel type *k* (a coal or oil type) combusted in power plant *i* included in the operating margin
EG_i:	=	Electricity generation in the plant *i* included in the operating margin in MWh/a

η_{BL} : = Energy efficiency of the most likely baseline technology

As baseline CO_2 emission factor for the project ($EF_{BL,CO2,y}$) was calculated as a combined margin, the same approach (Option 2) was applied for calculation of the emission factor for upstream fugitive CH_4 emissions ($EF_{BL,upstream,CH4}$).

Values for *FF* and *EG* were taken from the document 'CO2 Emission Factor Calculation for the Uzbekistan National Grid (2010)', Version 2 dated 07/02/2012, developed by Uzbekistan DNA, and consistent with the data which were used for calculation of baseline CO_2 emission factor ($EF_{BL,CO2,y}$). See Appendix 4 for more details.

As no reliable and accurate national data on fugitive CH_4 emissions were available, default values ($EF_{NG,upstream,CH4}$) provided in AM0029, Version 03, were applied. Full list of default values are provided below in the Table 13.

Table 14. Default emission factors for fugitive CH_4 upstream emissions

Activity	Unit	Default emission factor	Reference for the underlying emission factor range in Volume 3 of the *1996 Revised IPCC Guidelines*
Coal			
Underground mining	t CH4 / kt coal	13.4	Equations 1 and 4, p. 1.105 and 1.110
Surface mining	t CH4 / kt coal	0.8	Equations 2 and 4, p.1.108 and 1.110
Oil			
Production	t CH4 / PJ	2.5	Tables 1-60 to 1-64, p. 1.129 - 1.131
Transport, refining and storage	t CH4 / PJ	1.6	Tables 1-60 to 1-64, p. 1.129 - 1.131
Total	t CH4 / PJ	4.1	
Natural gas			
USA and Canada			
Production	t CH4 / PJ	72	Table 1-60, p. 1.129
Processing, transport and distribution	t CH4 / PJ	88	Table 1-60, p. 1.129
Total	t CH4 / PJ	160	
Eastern Europe and former USSR			
Production	t CH4 / PJ	393	Table 1-61, p. 1.129
Processing, transport and distribution	t CH4 / PJ	528	Table 1-61, p. 1.129
Total	t CH4 / PJ	921	
Western Europe			
Production	t CH4 / PJ	21	Table 1-62, p. 1.130
Processing, transport and distribution	t CH4 / PJ	85	Table 1-62, p. 1.130
Total	t CH4 / PJ	105	
Other oil exporting countries / Rest of world			
Production	t CH4 / PJ	68	Table 1-63 and 1-64, p. 1.130 and 1.131
Processing, transport and distribution	t CH4 / PJ	228	Table 1-63 and 1-64, p. 1.130 and 1.131
Total	t CH4 / PJ	296	

Note: The emission factors in this table have been derived from IPCC default Tier 1 emission factors provided in Volume 3 of the 1996 Revised IPCC Guidelines, by calculating the average of the provided default emission factor range.

According to the formula 8 and data mentioned above emission factor for upstream fugitive CH_4 emissions ($EF_{BL,upstream,CH4}$) was calculated as 0.00966 tCH4/MWh. More details are provided in the Excel file 'CER Volume Estimation for 'Talimarjan Clean Energy Project'.

Thus Fugitive methane emissions were calculated in accordance with the formula 6 with the use of the following data:

FC_y :	m^3	1,152,042,589	Calculated as: = Annual generation MWh/yr * 3.6 (GJ/MWh) / 0.574 (generation efficiency) / NCV

$NCV_{NG,y}$:	GJ/m^3	0.03324	Translated from 7 939.2 kcal/m3, provided by Uzbekenergo
$EF_{NG,upstream,CH4}$:	tCH4/PJ	921	As according to the Table 2 of AM0029, Version 03.
$EG_{PJ,y}$:	MWh	6,105,720	Calculated as: = 820MW (capacity) * 85% (efficiency load) * 8760 hours.
$EF_{BL,upstream,CH4}$:	tCH4/MWh	0.00966	Calculated in accordance with the formula 8, emission factor for upstream fugitive CH_4 emissions, combined margin.
GWP_{CH4} :	tCO2e/tCH4	21	As according to the latest data of IPCC 2007

Result of the $LE_{CH4,y}$:calculation is -498,116 tCO2e. More details of the calculation are provided in the Excel file 'CER Volume Estimation for 'Talimarjan Clean Energy Project'.

CO_2 emissions from LNG

Where applicable, CO_2 emissions from fuel combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system ($LE_{LNG,CO2,y}$) should be estimated by multiplying the quantity of natural gas combusted in the project with an appropriate emission factor, as follows:

$$LE_{LNG,CO2,y} = FC_y \cdot EF_{CO2,upstream,LNG}$$

Where:

$LE_{LNG,CO2,y}$: = Leakage emissions due to fossil fuel combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system during the year *y* in t CO_2e

FC_y : = Quantity of natural gas combusted in the project plant during the year *y* in m³

$EF_{CO2,upstream,LNG}$: = Emission factor for upstream CO_2 emissions due to fossil fuel combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system

Since LNG is not used in the proposed project activity, CO_2 emissions from LNG is considered as 0.

Accordingly total leakage emissions are calculated as (-498,116 + 0) = -498,116 tCO2e.

As according to AM0029, Version 03, where total net leakage effects are negative (LE_y < 0), project participants should assume LE_y = 0. Therefore in all further emission reduction calculations leakage emission were assumed as zero.

Step 4: Emission Reductions (ER_y)

To calculate the emission reductions the project participant shall apply the following equation:

ERy = BEy – PEy – LEy **(10)**

Where:

ERy: = Emissions reductions in year y (t CO_2e)

BEy: = Emissions in the baseline scenario in year y (t CO_2e)

PEy: = Emissions in the project scenario in year y (t CO_2e)

LEy: = Leakage in year y (t CO_2e)

B.6.2. Data and parameters fixed ex ante

Data / Parameter	**$EF_{CO2,f,y}$**
Unit	Kg CO_2/TJ
Description	CO_2 emission factor per unit of energy of natural gas
Source of data	IPCC
Value(s) applied	56,100
Choice of data or Measurement methods and procedures	IPCC 2006, Volume 2 (Energy) Chapter 2, Table 2.2
Purpose of data	Calculation of project emissions. Specifically calculation of natural gas CO_2 emission coefficient per m3.
Additional comment	-

Data / Parameter	**$OXID_f$**
Unit	%
Description	the oxidation factor of natural gas
Source of data	IPCC
Value(s) applied	100
Choice of data or Measurement methods and procedures	IPCC 2006, Volume 2 (Energy) Chapter 1, Table 1.4
Purpose of data	Calculation of project emissions. Specifically calculation of natural gas CO_2 emission coefficient per m3.
Additional comment	-
Data / Parameter	**$COEF_{BL}$**
Unit	Kg CO_2/TJ
Description	CO_2 emission factor per unit of energy for the fuel which is applied under the baseline technology (baseline scenario)
Source of data	IPCC
Value(s) applied	56,100
Choice of data or Measurement methods and procedures	IPCC 2006, Volume 2 (Energy) Chapter 2, Table 2.2
Purpose of data	Calculation of grid emission factor, Option 3, Emission factor of the technology (and fuel) identified as the most likely baseline scenario
Additional comment	-

Data / Parameter	**h_{BL}**
Unit	%
Description	Efficiency of electricity generation under the baseline technology (baseline scenario)
Source of data	Uzbekenergo
Value(s) applied	34%
Choice of data or Measurement methods and procedures	This data was reported by Uzbekenergo as efficiency of electricity generation for the technology which was identified as the baseline scenario.
Purpose of data	Calculation of grid emission factor, Option 3, Emission factor of the technology (and fuel) identified as the most likely baseline scenario.
Additional comment	-

Data / Parameter	**Conversion factor from MWh to GJ**
Unit	GJ/MWh
Description	Conversion factor from MWh to GJ
Source of data	Standard SI values
Value(s) applied	3.6
Choice of data or Measurement methods and procedures	According to the standard SI values. Please see: http://en.wikipedia.org/wiki/Conversion_of_units
Purpose of data	Calculation of project emissions
Additional comment	-

Data / Parameter	**$EF_{NG, upstream,y}$**
Unit	tCH_4/GJ
Description	Emission factor for upstream fugitive methane emissions of natural gas
Source of data	IPCC
Value(s) applied	0.000921
Choice of data or Measurement methods and procedures	Using the IPCC default, Table 2 of the methodology AM0029, Version 3.0
Purpose of data	Calculation of leakage.
Additional comment	

Data / Parameter	GWP_{CH4}
Unit	tCO_2e/tCH_4
Description	Global Warming Potential for CH_4
Source of data	IPCC default value
Value(s) applied	21 for the first commitment period
Choice of data or Measurement methods and procedures	The ratio applied according to the latest data of IPCC 2007 http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html
Purpose of data	Calculation of leakage
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

Ex-ante calculation of project emission (*PEy*):

Item	Unit	Value	Data Source
$FC_{f,y}$	m^3	1,152,042,589	Calculated
$COEF_{f,y}$	tCO_2/m^3	0.0019	Calculated
$NCV_{f,y}$	GJ/m^3	0.03324	Calculated
$EF_{CO2,f,y}$	tCO_2/GJ	0.0561	IPCC 2006, Volume 2 (Energy) Chapter 2, Table 2.2
$OXID_f$	%	100%	IPCC 2006, Volume 2 (Energy) Chapter 1, Table 1.4
PE_y	**tCO_2e**	**2,148,277**	**Calculated**

Ex-ante calculation of baseline emission (*BE_y*):

Item	Unit	Value	Data Source
$EG_{PJ,y}$	MWh/yr	6,105,720	Calculated
$EF_{BL,CO2,y}$	tCO_2e/MWh	0,496	DNA Uzbekistan
BE_y	**tCO_2e**	**3 028 437**	**Calculated**

Ex-ante calculation of leakage (*LE_y*):

Item	Unit	Value	Data Source
LE_y	tCO_2e	-498,116	Calculated
$LE_{CH4,y}$	tCO_2e	-498,116	Calculated
$LE_{LNG,CO2,y}$	tCO_2e	0	Not applicable as LNG is not used in the project
LE_y	**tCO_2e**	**0**	**Calculated**

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions ($t\ CO_2e$)	Project emissions ($t\ CO_2e$)	Leakage ($t\ CO_2e$)	Emission reductions ($t\ CO_2e$)
2015 (6 months)	757 109	537 069	0	220 040
2016	2 271 328	1 611 208	0	660 120
2017	3 028 437	2 148 277	0	880 160
2018	3 028 437	2 148 277	0	880 160
2019	3 028 437	2 148 277	0	880 160

2020	3 028 437	2 148 277	0	880 160
2021	3 028 437	2 148 277	0	880 160
2022	3 028 437	2 148 277	0	880 160
2023	3 028 437	2 148 277	0	880 160
2024	3 028 437	2 148 277	0	880 160
2025 (6 months)	1 514 219	1 074 139	0	440 080
Total	**28 770 153**	**20 408 635**	**0**	**8 361 518**
Total number of crediting years	**10 years**			
Annual average over the crediting period	**2 877 015**	**2 040 864**	**0**	**836 152**

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

The following data will be monitored as according to the latest version of the Methodology, Version 3.0 and approved monitoring methodology AM0029 'Grid connected Electricity Plants using Non-Renewable and Less GHG Intensive Fuel'.

Data / Parameter	**1. FCy Annual quantity of fuel consumed in the project activity**
Unit	m3
Description	Total volume of natural gas combusted in the project plant during the year y
Source of data	Plant records
Value(s) applied	1,152,042,589
Measurement methods and procedures	The total fuel consumption will be monitored both at supplier and project end for Cross-verification. At the project site volume of gas consumption will be monitored with the use of natural gas meter. This data with be cross checked by Uzbekenergo with the data from the supplier. The natural gas consumption will be aggregated automatically and recorded daily. Accuracy of the gas meter is provided in the Section B.7.3. Uzbekenergo (PMU manager, see details in the Section B.7.3) will be responsible for recording this information and providing it to the project investor on the monthly basis.
Monitoring frequency	Monthly
QA/QC procedures	Natural gas meter will be subject to regular maintenance and tested for accuracy once in six months as per the industry practice and prescribed standards. The meter reading as per the meter installed by natural gas supplier will be considered for CDM purposes and the meter installed by project proponent will be used to for cross checking the supplier's meter. At the project level data of natural gas meter will be cross-checked with accounting data. All information will be regularly requested from Uzbekenergo.
Purpose of data	Calculation of the project emissions. Please see Formula 1 in the Section B.6.1.
Additional comment	The data will be kept for the entire crediting period and at least 2 years after the end of the crediting period.

Data / Parameter	2. NCVy Net calorific value of the fuel
Unit	GJ/m^3
Description	Net Calorific Value of the natural gas
Source of data	Fuel Supplier, Local Authority, Country specific, IPCC in the order of preference
Value(s) applied	0.03324
Measurement methods and procedures	The calorific value of the gas would be provided by the supplier and recorded and verified by the project proponent through lab test. Local or country specific data or IPCC default value (in order of preference) will be used in case data from NG supplier is not accessible. Uzbekenergo (PMU manager, see details in the Section B.7.3) will be responsible for recording this information (certificate with laboratory test of the natural gas) and providing it to the project investor on the monthly basis. In case if this documentation will not be available than default vales will be applied.
Monitoring frequency	Daily
QA/QC procedures	No additional QA/QC procedures may be required
Purpose of data	Calculation of the project emissions. Specifically calculation of CO_2 emission coefficient as according to the Formula 2 provided in the Section B.6.1.
Additional comment	The data will be kept for the entire crediting period and at least 2 years after the end of the crediting period.

Data / Parameter	3. OXIDf Oxidation Factor
Unit	-
Description	Oxidation factor of natural gas used to estimate project emissions
Source of data	IPCC
Value(s) applied	1.0
Measurement methods and procedures	IPCC default value of the latest available year, 2006 Guidelines for National Greenhouse Gas Inventories.as of now. Please see “2006 IPCC Guidelines for National Greenhouse Gas Inventories’, Volume 2 “Energy”, Chapter 2 Stationary combustion, page 2.11.
Monitoring frequency	Monthly
QA/QC procedures	No additional QA/QC procedures may be required
Purpose of data	Calculation of the project emissions. Specifically calculation of CO_2 emission coefficient as according to the Formula 2 provided in the Section B.6.1.
Additional comment	Oxidation factor of the gas will be updated as per the latest guidelines available from IPCC on national greenhouse gas inventory on year to year basis. The data will be kept for the entire crediting period and at least 2 years after the end of the crediting period.

Data / Parameter	**4. $EF_{CO2,y}$ Emission factor**
Unit	tCO2/GJ
Description	Emission factor of natural gas
Source of data	IPCC default value in 2006 Guidelines for National Greenhouse Gas Inventories. Please see "2006 IPCC Guidelines for National Greenhouse Gas Inventories', Volume 2 "Energy", Chapter 2 Stationary combustion, page 2.16, Table 2.2.
Value(s) applied	0.0561
Measurement methods and procedures	In absence of country specific data; IPCC default value used as recommended in methodology.
Monitoring frequency	Monthly
QA/QC procedures	No additional QA/QC procedures may need to be planned.
Purpose of data	Calculation of the project emissions. Specifically calculation of CO_2 emission coefficient as according to the Formula 2 provided in the Section B.6.1
Additional comment	The data will be kept for the entire crediting period and at least 2 years after the end of the crediting period.

Data / Parameter	**5. COEFy y Emission factor**
Unit	tCO2/m3
Description	CO2 emission coefficient
Source of data	Calculated under the project activity
Value(s) applied	0.0019
Measurement methods and procedures	Will be calculated according to the formula: $COEF_{f,y} = \Sigma NCV_y * EF_{CO2f,f,y} * OXID_f$ Where NCVy - Net calorific value of the fuel $EF_{CO2,y}$ - Emission factor OXIDf - Oxidation Factor
Monitoring frequency	Monthly
QA/QC procedures	No additional QA/QC procedures may need to be planned.
Purpose of data	Calculation of the project emissions. Please see Formula 1 in the Section B.6.1.
Additional comment	The data will be kept for the entire crediting period and at least 2 years after the end of the crediting period.

Data / Parameter	6. PEy Project emission due to combustion of fuel
Unit	tCO_2
Description	CO_2 emissions due to natural gas combustion under the project activity
Source of data	Calculated under the project activity
Value(s) applied	2,148,277
Measurement methods and procedures	Will be calculated according to the formula: $$PE_y = \sum_f FC_{f,y} * COEF_{f,y}$$ Where FCy - Annual quantity of fuel consumed in the project activity; COEFy - Calculated emission factor for the project activity per m3 of consumed natural gas.
Monitoring frequency	Monthly
QA/QC procedures	No additional QA/QC procedures may need to be planned
Purpose of data	Calculation of the project emissions.
Additional comment	The data will be kept for the entire crediting period and at least 2 years after the end of the crediting period.

Data / Parameter	7. $EG_{PJ,y}$ Electricity generated at the project power plant
Unit	MWh/year
Description	Net electricity generation in the project plant (delivered to the grid) during year y.
Source of data	Data will be measured and recorded by the electricity meters installed at the plant complying with the regulatory requirements.
Value(s) applied	6,105,720
Measurement methods and procedures	Data will be measured and recorded by the electricity meters. The meters will be installed at all outgoing lines as per applicable regulatory requirements. The accuracy of the meters is provided below in the Section B.7.3. All meters will be calibrated with the frequency and according to the local regulatory requirements. 100% of the data will be monitored and archived both in the paper format electronic version. Uzbekenergo (PMU manager, see details in the Section B.7.3) will be responsible for recording this information and providing it to the project investor on the monthly basis.
Monitoring frequency	Daily
QA/QC procedures	The data will be cross-checked with the accounting data and reporting of SJSC ”Uzbekenergo”.
Purpose of data	Calculation of the baseline project emissions.
Additional comment	The data will be kept for the entire crediting period and at least 2 years after the end of the crediting period.

Data / Parameter	**8.** EF $_{grid, BM}$ **Build Margin, CO_2 emission factor**
Unit	tCO2e/MWh
Description	Build Margin, CO2 emission factor for Uzbekistan electricity grid calculated in accordance with the 'Tool to calculate the emission factor for an electricity system'.
Source of data	Standardized baseline 'Grid emission factor for the Republic of Uzbekistan', version 01.0, ABS 0003. Please see Appendix 4 and also CDM UNFCCC website.[33] If no data from UNFCCC website or Uzbekistan DNA will be available, then SJSC "Uzbekenergo" data or other best available data regarding Uzbekistan National grid will be used to calculated CO2 emission factor for Uzbekistan national grid and in accordance with the 'Tool to calculate the emission factor for an electricity system'.
Value(s) applied	0.496
Measurement methods and procedures	Will be calculated in accordance with the latest 'Tool to calculate the emission factor for an electricity system'.
Monitoring frequency	Annually
QA/QC procedures	No additional QA/QC procedures may need to be planned
Purpose of data	Calculation of baseline CO_2 emission factor.
Additional comment	The data will be kept for the entire crediting period and at least 2 years after the end of the crediting period.

[33] Standardized baseline 'Grid emission factor for the Republic of Uzbekistan' https://cdm.unfccc.int/methodologies/standard_base/Standardized_Baseline_PSB005_ver01.0.pdf

Data / Parameter	**9.** EF $_{grid, CM}$ **Combined Margin, CO_2 emission factor**
Unit	tCO2e/MWh
Description	Combined Margin, CO2 emission factor for Uzbekistan electricity grid calculated in accordance with the 'Tool to calculate the emission factor for an electricity system'.
Source of data	Standardized baseline 'Grid emission factor for the Republic of Uzbekistan', version 01.0, ABS 0003. Please see Appendix 4 and also CDM UNFCCC website.[34] If no data from UNFCCC website or Uzbekistan DNA will be available, then SJSC "Uzbekenergo" data or other best available data regarding Uzbekistan National grid will be used to calculated CO2 emission factor for Uzbekistan national grid and in accordance with the 'Tool to calculate the emission factor for an electricity system'.
Value(s) applied	0.516
Measurement methods and procedures	Will be calculated in accordance with the latest 'Tool to calculate the emission factor for an electricity system'.
Monitoring frequency	Annually
QA/QC procedures	No additional QA/QC procedures may need to be planned
Purpose of data	Calculation of baseline CO_2 emission factor.
Additional comment	The data will be kept for the entire crediting period and at least 2 years after the end of the crediting period.

[34] Standardized baseline 'Grid emission factor for the Republic of Uzbekistan'
https://cdm.unfccc.int/methodologies/standard_base/Standardized_Baseline_PSB005_ver01.0.pdf

Data / Parameter	**10. $EF_{BL,CO2,natural\ gas}$ Emission factor of the technology (and fuel) identified as the most likely baseline scenario**
Unit	tCO2e/MWh
Description	CO2 emission factor of the technology (and fuel) identified as the most likely baseline scenario. As described in the Section B.4 for the considered project baseline scenario was identified as ‘Construction of an Open Cycle Gas Turbine (OCGT) power plant’.
Source of data	Uzbekistan DNA data regarding national grid (if available). If no data from Uzbekistan DNA will be available, then SJSC ”Uzbekenergo” data or other the best available data regarding Uzbekistan National grid will be used to calculated CO2 emission factor of the technology (and fuel) identified as the most likely baseline scenario in accordance with the latest version AM0029.
Value(s) applied	0.594
Measurement methods and procedures	Will be monitored and calculated in accordance with requirements of the latest version of AM0029.
Monitoring frequency	Annually
QA/QC procedures	No additional QA/QC procedures may need to be planned
Purpose of data	Calculation of baseline CO_2 emission factor.
Additional comment	The data will be kept for the entire crediting period and at least 2 years after the end of the crediting period.

Data / Parameter	11. $EF_{BL,CO2,y}$ Baseline CO_2 emission factor
Unit	tCO2e/MWh
Description	Baseline CO2 emission factor for Uzbekistan electricity grid calculated in accordance with the 'Tool to calculate the emission factor for an electricity system'.
Source of data	Standardized baseline 'Grid emission factor for the Republic of Uzbekistan', version 01.0, ABS 0003. Please see Appendix 4 and also CDM UNFCCC website.[35] If no data from UNFCCC website or Uzbekistan DNA will be available, then SJSC "Uzbekenergo" data or other best available data regarding Uzbekistan National grid will be used to calculated CO2 emission factor for Uzbekistan national grid and in accordance with the 'Tool to calculate the emission factor for an electricity system'.
Value(s) applied	0.496
Measurement methods and procedures	Will be calculated in accordance with the latest 'Tool to calculate the emission factor for an electricity system'. In order to calculate Baseline CO_2 emission factor the following options will be monitored: Build Margin, Combined Margin, Emission factor of the technology (and fuel) identified as the most likely baseline scenario. The lowest among the options will be considered as the grid emission factor for the reporting period.
Monitoring frequency	Annually
QA/QC procedures	No additional QA/QC procedures may need to be planned
Purpose of data	Calculation of the baseline project emissions.
Additional comment	The data will be kept for the entire crediting period and at least 2 years after the end of the crediting period.

B.7.2. Sampling plan

Not applicable.

B.7.3. Other elements of monitoring plan

The monitoring plan for project activity describes management systems and procedures to be implemented by the Project Participant upon project implementation in order to ensure consistent project operation as well as monitoring, processing and reporting of data required for the calculation of emission reductions (ERs) taking into account the guidance provided in AM0029, Version 3.0, approved monitoring methodology AM0029 and the guidance presented in the Validation and Verification Standard.

1. Operation and Management Organization for the Monitoring Plan

SJSC Uzbekenergo established a dedicated full-time Project Management Unit (PMU) responsible for management of the proposed activity including monitoring plan. The PMU will be responsible to collect record and document all the related monitoring records. The operational and organizational structure as well as division of responsibilities for the monitoring process is shown in the organization structure

[35] Standardized baseline 'Grid emission factor for the Republic of Uzbekistan' https://cdm.unfccc.int/methodologies/standard_base/Standardized_Baseline_PSB005_ver01.0.pdf

below. This structure may be adjusted due to actual project implementation and distribution of responsibilities with Uzbekenergo.

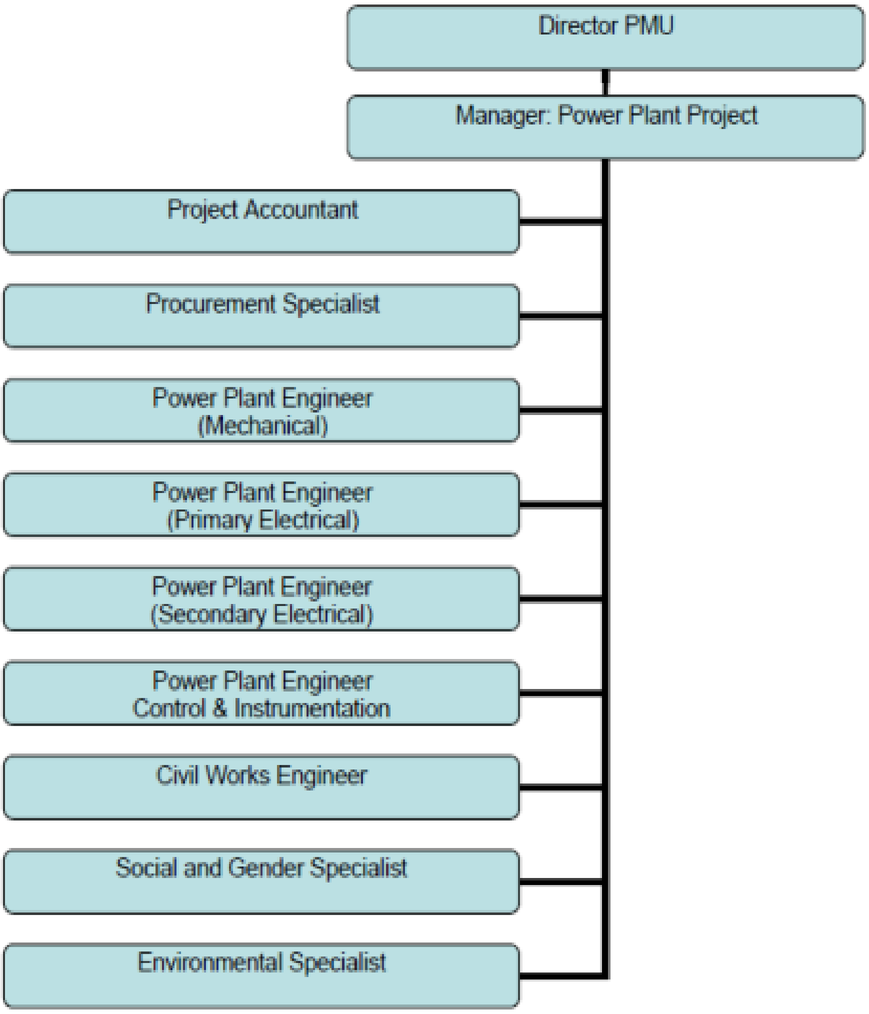

Figure 6. Organizational structure for the monitoring process

1.Measuring Instruments

The measuring instruments include the electricity meters and the natural gas flow meters. The installation location, monitoring objective and precision of these measuring instruments are as follows:

Instruments	Location	Objective	Precision
Gas flow meter	On the pipe of natural gas on site	$FC_{NG,y}$	±0.5
Electricity meter	At the high-voltage line after the main transformer	$EG_{,PJ,y}$	0.5S level

2. Staff Training

In order to ensure all the relevant personnel in the CDM monitoring working group has sufficient knowledge and capacity to perform the assigned tasks, Project Participants will provide relevant training for personnel, and the corresponding minutes and reports documented.

3. Quality Control and Quality Assurance

All meters and instruments will be installed, maintained and calibrated regularly as per industry practices and in accordance with the maintenance schedule programmed at the start of the operation and recalibrated according to the plants performance requirement.

The monthly measured quantity of the consumed natural gas and the electricity to the grid can be cross-checked by the monthly issued invoices.

4. Monitoring Report

All documentation required for drafting monitoring reports will be collected and provided by PMU established at Uzbekenergo. This information will be provided to the project investor on the monthly basis. All related records of calibration, reading and invoices will be readily accessible for the verification by the DOE.

Monitoring reports will be prepared by the project investor with the frequency agreed between the project participants. Monitoring reports will include all information used to calculate the emission reductions of the project activity, which reflect the real, measurable and long-term GHG reductions achieved by the project activity.

5. Data storage

All relevant paper-based information will be stored by the PMU and kept, at least with one hard copy.

Monitoring reports and scan of the documents used for calculation of emission reductions will be stored both at the level of PMU and project investor.

All documentation (initial paper documentation and monitoring reports) will be kept during all crediting period and at least 2 years after the end of the crediting period. Project Participants will establish procedures to prevent from accidental loss of data due to human errors, fire, etc.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

25/06/2012 – date of signing Framework agreement between Uzbekenergo and Synecta a.s for considered CDM project.

This is the date when Project Participants committed to expenditure and is therefore the date project activity began.

C.1.2. Expected operational lifetime of project activity

25 years (300 months).

C.2. Crediting period of project activity

C.2.1. Type of crediting period

Fixed.

C.2.2. Start date of crediting period

01/07/2015 (the date when the first CCGT unit is expected to be commissioned).

C.2.3. Length of crediting period

10 years (120 months, 01/07/2015 – 30/06/2025).

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

The EIA report[36] of the proposed project shows that the proposed project activity has no significant impact on environment. Details of the report are summarized below:

Major environmental impacts on soil erosion, dust, noise, waste water and solid wastes are studied for construction and operation phases.

Land

Majority of site preparation work for the construction of the CCGT units was completed as part of the construction of Unit 1 about 5 to 7 years ago. Only limited earthworks will therefore be required as part of the construction of the new CCGT units.

There is no on-going agricultural activity or widespread irrigation (other than landscaping activities) within the TPP site, and there is therefore unlikely to be any relevant impact on the nature or use of the soils in the area.

Ground Water / Surface Water

There is very little risk of any impact that can significantly affect the rate of infiltration of water into the surface soils of the area or to change the groundwater regime or moisture content of the soils.

Potential risks to surface water features from the installation of the new power plant are therefore low. Contamination with suspended solids in surface run-off generated during construction work will be minimized by sending run off to a temporary sedimentation basin before it is allowed to discharge to the existing site drainage system.

Capacity of existing waste water treatment plant is enough to treat all sewage generated during construction work and operation. Regular application of water to prevent the formation of dust during hot, dry and/or windy weather, or other dust suppression methods such as covering stockpiles and minimizing the area of disturbed land left exposed, will be used when appropriate to minimize the generation of dust.

Air

An air dispersion modelling exercise was carried out to determine likely impact of emission from plant. Conclusion of this exercise is that the maximum predicted ground level concentrations (GLCs) of NO2 and CO, from the TPP site, will not exceed any of the existing rules", beyond the boundary of the power station. Moreover the modelling analysis has shown that the proposed changes to the TPP site will lead to significant improvements in the dispersion of air pollutants from the site, with large reductions in the predicted contributions of NO2 and CO.

Solid Waste

All solid wastes generated during construction stage and operation will be removed from TPP site and will be disposal in accordance with existing local requirements.

In the framework of EIA it was considered that project has no significant transboundary effects; all concentrations occur within the site boundary (please see page 34 of EIA).

To conclude, the environmental impacts during the construction and operational periods are insignificant.

D.2. Environmental impact assessment

Uzbekenergo has prepared an EIA that has been reviewed and approved by the Glavgosecoexpertiza (department under State Nature Protection Committee). All other relevant permits, approvals and licenses needed to construct the new turbines will also need to be obtained after construction of the CCGT units

[36] Enviromental Assessment Report. Republic of Uzbekistan: Talimarjan Clean Power Project www.adb.org/Documents/Environment/UZB/43151/43151-UZB-EIA.pdf

start and before CCGT units start to operate. The permissions needed are already indicated in paragraph 41 (page 9) of the EIA.[37]

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

On January 8, 2010 the 2nd round of public consultation on construction new two CCGT units was held at Nuristan community centre in Nuristan city. Announcement about this event was published in local newspaper "Kashkadrya" (Issue #1) on 1 January 2010. Please see English translation of the announcement below (original of the announcement was provided to DOE during Validation process).

ATTENTION TO ALL INTERSTED PARTIES

SJSC 'Uzbekenergo' plan construct 2 Combined Cycle Gas Turbines and electric substation in the boundaries of Talimarjan TPP.

Group of Asia Development Bank consultants in November 2099 performed 1st round of stakeholder consultation in Nuristan village where construction plans were introduced to the project stakeholders. On 8th January 2010 at 15-00 2nd round of stakeholders consultations will be performed at the following address: Kashkadarya region, Nuristan village, 1st District, Amir Timur Culture Centre.

At this meeting result of the Environmental assessment performed by Asia Development Bank consultants will be presented.

All stakeholders are invited to take part in this stakeholders meeting. Please see below contact details to confirm your interest and receive any further information:

6 Horezmskaya str., Tashkent, 100000
Tel.: (8371) 233-98-21
Fax.: (99871) 236-22-62

Figure 7. Copy of the local advertisement for stakeholders consultation.

Also representatives from Province level Nature Protection Committee, District Government Authority and Health Protection department were invited during meetings on 7 January 2010. The purpose of the consultations was to introduce participants with main outputs of EIA of TPP and also introduce people with Clean Development Mechanism. Among 43 participants, there were representatives of Kashkadarya province Nature Protection Committee (2), farmers from neighbourhood area (3), Nuristan city medical centre (2), school (1), TPP's staff (28), local residents. 16 women have participated in this meeting. They represented TPP's staff, medicine service, farmers and local residents group. Main outputs of EIA report and information on Clean Development Mechanism were reported in power point presentation.

[37] ADB. 2010. Report and Recommendations of the President to the Board of Directors: Proposed loans and administration of loan Republic of Uzbekistan: Talimarjan Power Project: Sector Analysis.
Available at: http://www2.adb.org/Documents/RRPs/UZB/43151/43151-02-uzb-ssa.pdf

 

Figure 8. Photos of Stakeholder Consultation

E.2. Summary of comments received

Summary of the main questions and responses to them are provided below.

No.	Issues / Comments from the Participants	Responses from the Consultants
1	During the implementation of project more water will be taken from KMK and TPP will effect on the quality of water in canal. What efforts are planned to mitigate impact to the environmental (water resources)?	Answer was presented according Environmental mitigation and monitoring plan described in EIA report. Results of environmental assessment showed that additional water will be taken only for cooling during summer time and for drinking purpose. After installation of two new CCGT units the total loss of irrigation water is expected to be 0.8%. The loss of less than 1% of the flow of irrigation water in the KMK is not considered significant and the water requirements of all downstream users will be met. The increase in cooling water usage will also see an increase in the temperature of the discharge. Calculation during project design showed that the temperature increase in the canal resulting from the addition of cooling water from the new turbines will be an increase of $2.7^{o}C$ which is within acceptable guidelines. Regular water quality monitoring is included in EMP in points before water intake and after water outlet.
3	During construction and operation stages who will be hired as worker? Will our local people be involved?	Information from procurement procedure was given. It was mentioned that the policy is to provide local population with job and also it's mentioned in Environment Mitigation Plan in EIA report for TPP.
4	When project activity (construction of new CCGT) will start?	Talimarjan Clean Power Project Consultation Mission it will start in 2011 and will continue till 2014[38]
5	Equipment will be from which country?	Equipment will be from ADB member country. Procurement of goods and services will be carried out in accordance with Procurement Guidelines.

[38] Project implementation is delayed compared to the expectations at the Stakeholders meeting. At the moment of finalizing PDD (16/07/2012) technical implementation of the project did not started yet.

No.	Issues / Comments from the Participants	Responses from the Consultants
6	Was this technology applied in other areas?	For Uzbekistan CCGT technologies – it is a new technology, but in the world similar technology is used effectively. In Uzbekistan CCGT is planned for Tashkent and Navoi however, these plants are also supplying district heat whereas the plant of Talimarjan is having only electricity generation. This makes Talimarjan plant unique. Moreover, none of these plants are operational at present and are considered to be implemented only as CDM projects
8	Did you do a modeling of pollutants in air?	Yes, computer modelling of the emissions from the existing stacks and from the proposed configuration was carried out. The model takes into account the stack configurations, weather data, building profiles and emissions levels and is used to predict the ground level concentrations of pollutants as a result of the operation of the installation.
9	Will exhaust impact on surround area?	According conclusion of the air dispersion modeling exercise, the maximum predicted Ground Level Concentrations of NO2 and CO arising as a result of atmospheric emissions from the TPS site will generally not exceed any of the reference standards and guidelines for ambient air quality.

Following the open forum, the Representative from Nishan district government authority expressed their appreciation to Uzbekenergo for their support in improvement of energy supply to the region.

Participants of the meeting were informed that EIA report is available on ADB's website.[39] Also printed copies of EIA report were submitted to Talimarjan TTP, Kashkadrya province Nature Protection agency and Nishan district local government. Any issues could be addressed to TPP's environmental expert or directly to Project Implementation Unit under Uzbekenergo in Tashkent.[40]

E.3. Report on consideration of comments received

No negative comments were received which required further clarification.

SECTION F. Approval and authorization

Letters of approval for Uzbekistan DNA has been already received and presented to the validating DOE.

[39] ADB. 2010. Report and Recommendations of the President to the Board of Directors: Proposed loans and administration of loan Republic of Uzbekistan: Talimarjan Power Project: Sector Analysis. http://www.adb.org/Documents/Environment/UZB/43151/43151-UZB-EIA.pdf

[40] Address of PMU in Tashkent and contact phone number were given during public consultation (100000 Tashkent city, Khorezmaskaya str., 6, PMU's office, tel. +99871 236-22-62).

Appendix 1: Contact information of project participants

Organization name	"SJSC" Uzbekenergo
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Personal e-mail	ut.cdm@yandex.ru

Appendix 2: Affirmation regarding public funding

No public funds will be involved in this project activity.

Appendix 3: Applicability of selected methodology

No additional information. Please refer to the section B.2.

Appendix 4: Further background information on ex ante calculation of emission reductions Standardized baseline 'Grid emission factor for the Republic of Uzbekistan', Version 01.0, ASB0003[41]

ASB0003
Standardized baseline: Grid emission factor for the Republic of Uzbekistan
Version 01.0

1. Introduction

1. This standardized baseline provides the values of the CO_2 emission factors for the electricity system of the Republic of Uzbekistan.

2. Definitions

2. The definitions contained in the latest version of the "Tool to calculate the emission factor for an electricity system" shall apply.

3. For the purpose of this standardized baseline, the following definitions apply:

   (a) Project electricity system - the spatial extent of the power plants that are physically connected through transmission and distribution lines to supply electricity to the Uzbekistan national power grid;

   (b) Connected electricity systems – electricity systems of Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan.

3. Scope, applicability, entry into force and validity

3.1. Scope

4. This standardized baseline is based on the proposed new standardized baseline PSB0005 "Grid Emission Factor for the Uzbekistan National Grid" submitted by the DNA of the Republic of Uzbekistan.

5. This standardized baseline is derived from the version 03.0.0 of the "Tool to calculate the emission factor for an electricity system" (hereinafter referred to as the "tool").

6. For more information regarding the proposed new standardized baseline as well as their consideration by the CDM Executive Board please refer to <http://cdm.unfccc.int/methodologies/standard_base/index.html >.

7. This standardized baseline provides the values of the CO_2 emission factors for the project electricity system for the determination of baseline emissions, project emissions and leakage. The CO_2 emission factors are:

   (a) Combined margin emission factor;

   (b) Operating margin emission factor;

   (c) Build margin emission factor.

[41] Standardized baseline 'Grid emission factor for the Republic of Uzbekistan' https://cdm.unfccc.int/methodologies/standard_base/Standardized_Baseline_PSB005_ver01.0.pdf

3.2. Applicability

8. This standardized baseline is applicable to the CDM projects in the Republic of Uzbekistan.

9. The CDM project activities can apply this standardized baseline under the following conditions:

   (a) The CDM project activity is connected to the project electricity system;

   (b) The CDM approved methodology that is applied to the project activities, requires to determine CO_2 emission factor(s) for the project electricity system through the application of the "Tool to calculate the emission factor for an electricity system"

   (c) When applying the values of this standardized baseline to CDM project activity, the requirements below are to be followed:

      (i) In the case that the CDM project activity uses the ex ante option of data vintage, as per the tool, the latest approved values of Table 1 below shall be used for calculation of emission reduction for the entire first, or entire second or entire third crediting period;

      (ii) In the case that the CDM project activity uses the ex post option of data vintage as per the tool, the latest approved values of Table 2 below valid at the end of the monitoring period shall be used for calculation of emission reduction for that monitoring period. As per the tool, ex post values are required to be updated annually, however for ex post values approved under this Standardized baselines, the validity as prescribed in paragraph 12 below applies.

10. The latest approved and valid values of this standardized baseline are the only values of the CO_2 emission factor(s) that shall be applied for the project electricity system.

3.3. Entry into force

11. Immediately upon adoption of the standardized baseline by the CDM Executive Board on 07 October 2013.

3.4. Validity of this standardized baseline

12. The values are valid for three years from the date of adoption of standardized baseline by the CDM Executive Board.

13. The latest approved version of the tool shall be used to update the standardized baseline.

4. Parameters and values

14. This standardized baseline provides values for the following parameters:

ASB0003
Standardized baseline: Grid emission factor for the Republic of Uzbekistan
Version 01.0

Table 1. Grid Emission Factors for the CDM project activity that use ex ante option of the "Tool to calculate the emission factor for an electricity system"

Parameter	SI Unit	Description	Value
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system applicable to the wind and solar power generation	0.550
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system applicable to all project activities other than wind and solar for the first crediting period	0.532
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system applicable to all project activities other than wind and solar for the second and third crediting period	0.514
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system	0.496
$EF_{grid,OM,y}$	tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system	0.569

Table 2. Grid Emission Factors for the CDM project activity that use ex post option of the "Tool to calculate the emission factor for an electricity system"

Parameter	SI Unit	Description	Value
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system applicable to the wind and solar power generation	0.526
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system applicable to all project activities other than wind and solar for the first crediting period	0.516
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system applicable to all project activities other than wind and solar for the second and third crediting period	0.506
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system	0.496
$EF_{grid,OM,y}$	tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system	0.536

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Appendix 5: Further background information on monitoring plan

No additional information. Please refer to the sections B.7.1 and B.7.3.

Appendix 6: Summary of post registration changes

Not applicable.