ALKUMRU HYDROELECTRIC POWER PLANT PROJECT

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1 PROJECT DETAILS

1.1 Summary Description of the Project

The Alkumru Hydroelectric Power Plant (Alkumru HPP from this point onward) project constructed at the Eastern Anatolia Geographical district of Turkey over the Botan River that is one of the major tributaries of the Tigris. The purpose of the project is electricity production using the energy of Botan River as a renewable resource. Therefore, the electricity is produced without causing airborne pollutants or Green House Gas (GHG) emissions. The construction and operation of the Alkumru Hydro Electric Power Plant (HPP) are delaying the addition of conventional thermal power plants to the Turkish National Electricity Grid.

The Alkumru HPP is producing electricity by utilizing the energy of the Botan River, a major tributary to River Tigris. Energy produced using the head difference between the 647 m maximum water level and 541.80 m tail water levels. During the design phase of the project, there were different scenarios regarding the project and installed power capacity. Based on the Electricity Studies Institution's report dated 1991, the Alkumru HPP is initially proposed to be developed with 222 MW capacity and with an annual energy production capacity of 812.48 GWh, and after completion of the upstream Çetin and Pervari Hydroelectric Power plants the annual electricity production was envisaged to be 817.26 GWh.

Later, in a different scenario in design phase with a minor design change the and an adjustment in the turbines the project owner revealed that with the same amount of water flow, the project capacity could be increased to 261.27 MW and the annual electricity production is calculated to be 875.84 GWh. With these conditions project owner also presented a fish passage project so that the fish populations are not effected from the dam blocking the river, and it is agreed to release 14m^3/s of water at all times to the river bed to support aquatic life. However, the design of the project turbines are realized not to be suitable to release the required amount of water, therefore an other addition is made at the tail water part of the project and a new horizontal Francis turbine with 14.250 MWe capacity was added to the project which created the final version of the project.

In the last and implemented scenario, there are total of 4 units in the project. First and second unit were commissioned in 10/03/2011 which is also the start date of the project. Third unit

was commissioned in 12/04/2011. Last unit was commissioned in 17/01/2014 and the project is fully installed from then. There are 3×87.09 MWe units and 1×14.25 MWe unit in the project. Each unit has one main and one control meter. In total there are 8 two-way electricity measurement meters.

The Alkumru HPP have a reservoir area of 10.99 km² and a dam that is designed to be clay cored, sand, gravel rock filled. The project activity is constructed between the 611.80 minimum operation elevation and 647 m maximum operation elevation.

During the last monitoring period (01-12-2013 to 30-09-2020), the Alkumru project produced a total amount of 2,854,350 tCO2 of emission reductions and the total electricity production was 5,287,307 MWh. Based on this data and Turkey's Combined Margin Emission Factor of 0.4929 the project is expected to produce an annual amount of 773,752 MWh of electricity and 381,382 tonnes of emission reduction.

The Major milestones at the project development history can be summarized as shown in the following table (Table 1):

Table 1:Major Milestones of the Project

Date	Milestones	Reference
October-06	Feasibility Study Report	Feasibility Study Report
10 Sep. 2007	Water Usage Agreement signed with DSI	Water Usage Agreement
Sep. 27, 2007	Electricity Production License issued by Energy Market Regulatory Authority (EMRA) and the license modification	EMRA License
Jan., 2008	Project granted EIA Affirmative certification	EIA Affirmative certification
Aug. 15, 2008	Construction Started	Memorandum by Limak Insaat (owner: Limak Hidroelektrik / contractor: Limak Insaat)
Dec. 18, 2008	Signing of the E&M contract	The E&M contract
June 19, 2009	TEIAS system connection agreements signed	TEIAS Connection agreement
Aug. 19, 2009	The start of the construction of the TEIAS electricity transmission line	The subcontractor agreement for construction of the transmission line

April 13, 2010	EMRA Approved capacity upgrade	The updated special terms of license agreement
May 17, 2010	Water Usage Agreement Updated.	DSI agreement amendment
Dec. 14, 2010	TEIAS system agreements signed	TEIAS system usage agreement
16 Dec. 2010	Expropriation Moderation and Information Meeting 1 Held in the Project site	Summary of Expropriation by the Company Lawyers
Dec. 22, 2010	The completion of the construction of the TEIAS electricity transmission line and the preliminary acceptance by the Ministry of Energy	Substantial completion protocol-transmission line
Mar. 10, 2011	The preliminary acceptance of the Dam and the HEPP for two units and the start of the electricity generation	Alkumru Preliminary acceptance protocol for units 1 and 2
April 12, 2011	The preliminary acceptance of the Dam and the HEPP for the third unit	Alkumru Preliminary acceptance protocol for unit 3
12 May 2011	Expropriation Moderation and Information Meeting 2 Held in the Project site	Summary of Expropriation by the Company Lawyers
Oct. 1, 2012	Feasibility report finalized	FSR
Oct. 12, 2012	Ministry of Environment approved the design upgrade	Environment and Urban Planning Correspondence with Ministry of
Jan 17,2014	The preliminary acceptance of the Dam and the HEPP for the fourt unit	Alkumru Preliminary acceptance protocol for units 4

1.2 Sectoral Scope and Project Type

The project category is Sectoral Scope 1: Energy industries (renewable-/non -renewable sources). The project type is grid connected electricity generation from renewable sources. The project is a non-grouped, stand-alone project.

1.3 Project Eligibility

The Project is eligible to be a VCS Project because:

VCS v.3.3 has taken effect on 04.10.2012, accordingly the Project is eligible to use this version.

VCS v.3.3 requires project crediting period start date earliest to be 01.01.2002, besides, the Project must also complete the validation within two years of the Project Start Date, which is 10.March 2011. Both conditions are satisfied for the Projectactivity.

VCS v.3.3 accepts all six Kyoto Protocol gases. The Project aims to reduce CO2, which is one of

these six Kyoto Protocolgases.

VCS v.3.3 accepts all technologies supported by a VCS approved GHG program. The Project is a hydropower plant, the technology of which is included in the UNFCCC- CDM sectoral scope1.

VCS v.3.3 requires the use of one of the VCS program approved project methodologies. The Project activity uses the tools and methodologies of approved by UNFCCC CDM executive board, which is a VCS approvedprogram.

The project does not benefit from any kind of Official Development Assistance.

In addition to the above, the project is not a grouped project activity, nor de-bundled part of a grouped project activity

Project registered before the version 4 of the VCS published, so it is still eligible.

1.4 Project Design

The project has been designed to include a single installation of an activity.

Eligibility Criteria

The project is a non-grouped, stand-alone project.

1.5 Project Proponent

Organization name	Limak Hidroelektrik Santral Yatirimlari Anonim Sirketi
Contact person	Fatih Baydar
Title	Deputy Manager /Budget and Pricing, Limak Energy Trade,
Address	Hafta Sokak No:9 GOP 06700 Ankara,Turkey
Telephone	+90 533 051 68 77
Email	fbaydar@limak.com.tr

1.6 Other Entities Involved in the Project

Organization name	Ekobil Environmental Services and Consulting Ltd[1]
Role in the project	Preparation of the Project Description Document
Contact person	Dr. Aslı Sezer Özçelik
Title	Dr.
Address	Ahlatlıbel Mahallesi 1839 sokak no.56 Çankaya 06805 Ankara-Turkey
Telephone	+903124891338
Email	info@ekobil.com

1.7 Ownership

Ownership of the plant, equipment and electricity generation licence belongs to Limak Hidroelektrik Santral Yatırımları Anonim Şirketi and all emission reductions/removals are granted to the company. The production license and the operating certification of the company given by the Chamber of Commerce are provided to the validating DOE as proof of the Title.

1.8 Project Start Date

Project start date is: 10th of March, 2011.

1.9 Project Crediting Period

The first project crediting period is 10 years: 10.03.2011 to 09.03.2021 (both dates inclusive). The crediting period is renewable twice.

Since the project is in the renewable period the new crediting period is again 10 years: from 10/03/2021– 09/03/2031 (both days inclusive).

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	
Large project	**x**

[1] Registered to the Ankara Chamber of Trade, with the full name of "Ekobil Çevre Hizmetleri Danışmanlık Eğt.Tar.Hayv.Mad.İnş. İth.İhr.Tur.ve Tic.Ltd.Şti."

Year	Estimated GHG emission reductions or removals (tCO_2e)
2021 (from 10.03.2021 to 31.12.2021)	308,284
2022	381,382
2023	381,382
2024	381,382
2025	381,382
2026	381,382
2027	381,382
2028	381,382
2029	381,382
2030	381,382
2031 (01.01.2031 to 09.03.2031)	73,098
Total estimated ERs	3,813,820
Total number of crediting years	10
Average annual ERs	381,382

1.11 Description of the Project Activity

The main technical characteristics obtained from the DSI Approved, final feasibility report are provided below (Table 2):

Table 2:Technical Characteristics

Technical characteristics of Alkumru HPP		
Characteristics of the Dam		
Location	:	Siirt Province, near Taşbalta village at the 542 m thalweg elevation of Botan River.
Purpose	:	Energy Production
Dam Type	:	Clay core, rock filled

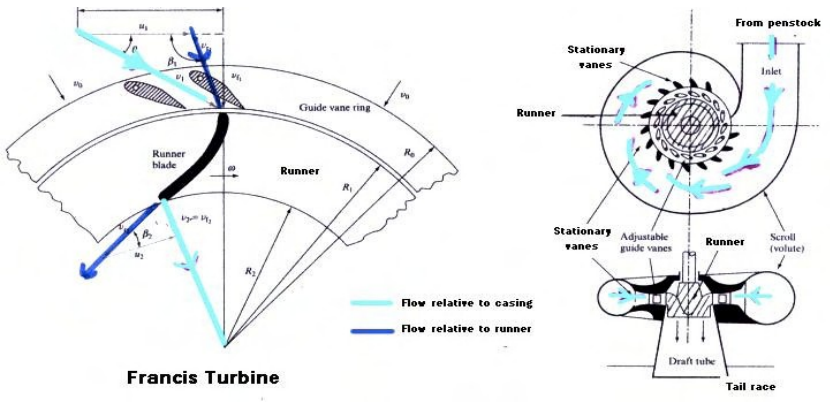
Drainage Area	:	7,562.50km^2
Annual average natural flow	:	4,067.81 hm^3
Annual Average Flow Rate	:	128.90m^3/s
Thalweg elevation	:	542 m
Base elevation	:	516 m
Height from thalweg	:	108 m
Height from the base	:	134 m
Maximum Flood Crest Water Level	:	648.66 m
Crest elevation	:	650 m
Crest length	:	909.05 m
Minimum operational water level	:	611.80 m
Normal operational water level	:	636.96 m
Maximum operational water level	:	647.00 m
Active reservoir volume	:	283.22 hm3
Maximum reservoir Area (at maximumoperational level of647 m)	:	10.99 km^2
Characteristics of the Spillway		
Location	:	Right bank
Type	:	frontal intake with radial gate
Inlet sill elevation	:	633.00 m
Approach canal elevation	:	629.00 m
Width	:	56 m (50.00 m net)
Number and dimensions of the gates	:	4 gates; w:12.75m X h:16.50 m
Discharge flow rate	:	7,119.00 m^3/s
Total Gross Energy (Maximum)	:	
Characteristics of the Derivation Tunnel		
Tunnel location	:	Right bank
Type and radius	:	2 horse shoe type with 9.50 m radius
Discharge flow rate	:	550.00 m^3/s
Tunnel slop	:	0.0041 and 0.00421
Tunnel entrance base elevation	:	546.75 m
Total tunnel length	:	(T1) 882.58 m and (T2) 935.07 m
Q_{25}	:	1,875.30 m^3/s
Q_{50}	:	2,081.70 m^3/s
Q_{100}	:	2,292.70 m^3/s
Bottom outlet		
Entrance shaft elevation	:	578.00 m
Penstock diameter	:	2.50 m
Total Length	:	337.84 m
Total discharge rate	:	24.74 m^3/s
Energy Tunnel		
Location	:	Left bank
Tunnel type	:	Horse shoe type
Tunnel entrance base elevation	:	591.225 m
Tunnel inner radius	:	8.40 m
Tunnel capacity	:	295.00 m^3/s
Total tunnel length	:	443.06 m
Tunnel exit elevation	:	585 m
Surge Chamber		

Type	:	circular
Radius	:	8.40 m at the bottom and 18.00 m at the top
Upper level	:	663.50 m
Base level	:	586.05 m
Penstock		
Number	:	1 with bottom trification
Inner radius	:	4.70 m
Total length	:	124.00 m
Average thickness	:	19.20 mm
Emergency and control	:	Butterfly valve
Power House		
Length	:	57.20 m
Width	:	41.15 m
Project flow rate (3+1)	:	295.00 m^3/s
Tail water elevation	:	541.80 m
Turbine center line elevation	:	536.30 m
Total Capacity	:	275.52 MW (after the design upgrade)
Number of turbines	:	3 +1
Turbine type	:	3 Vertical axis francis + 1 horizontal
Gross head	:	105.20 m
Turbine unit capacity	:	87.09 MW +14.25 MWe
Annual Electricity production	:	875,840 MWh Until end of 2013
		881,220 MWh After 2014

The project will be using three vertical Francis turbines and one additional horizontal francis turbine. The Francis type of turbine is a reaction type of turbine. In case of reaction turbines, the water approaches a set of curved blades mounted on a shaft and glides over them thereby changing direction and so imparting pressure on the blades due to centrifugal force, i.e. the force experienced by a passenger in a car when turning very fast. The water enters the blades nearly at a tangent and for the highest efficiency leaves the blades radially and at a reduced velocity.

Francis turbines was invented by an English engineer J.B.Francis (1815 – 1892) water is delivered into a volute casing which completely surrounds the runner and is under pressure as well as velocity. The water is guided through both fixed and adjustable veins in the casing and glides onto the runner blades at an angle. The water then turns in the runner to exit parallel with the axis of rotation. The adjustable vanes cater for load changes. A bypass valve or a surge tank deals with sudden load changes. In a Francis turbine the entire wheel assembly is immersed in water and surrounded by a pressure casing. In a Francis turbine the pressure casing is spiral shaped and is tapered to distribute water uniformly around the entire perimeter of the runner. It uses guide vanes to ensure that water is fed into the runners at the correct angle. See the below Figure (Figure 1), for a schematic explanation of working principles of a Francis Turbine.

Figure 1:Working Principles of Francis Turbine



The project owner is granted a production license for 49 years[2] including the 52 months of project design and construction phase. The economic life time of a hydro power plant investment is assumed to be about 50 years, based on the experts' committee report[3] on energy under the 8th development plan published by the State planning organization. Even if the facility can last for 50 years the major equipment needs to be replaced every 20 years[4].

The project is expected to produce an average of 875,840 MWh of electricity per year, for the first three years of the project life and by the addition of the tail water unit the production will increase to 881,210 MWh over the extent of the first crediting period. The annual electricity delivered to the grid by the project, would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources.

1.12 Project Location

The Project Activity is located on the Botan River in the Eastern Anatolia region of Turkey, within the Siirt city borders. It is located between the elevations of 647 m and 541.80 between 42o05'04''–42o05'54'' east latitudes and 37o57'0''–37o57'46'' North latitudes (Figure 2).

[2] According to the production licence dated 27/09/2007 and numbered EÜ/1325-5/964

[3] http://ekutup.dpt.gov.tr/enerji/oik585.pdf (page 4.25 –p72 of PDF document Last visited on 22/07/2012)

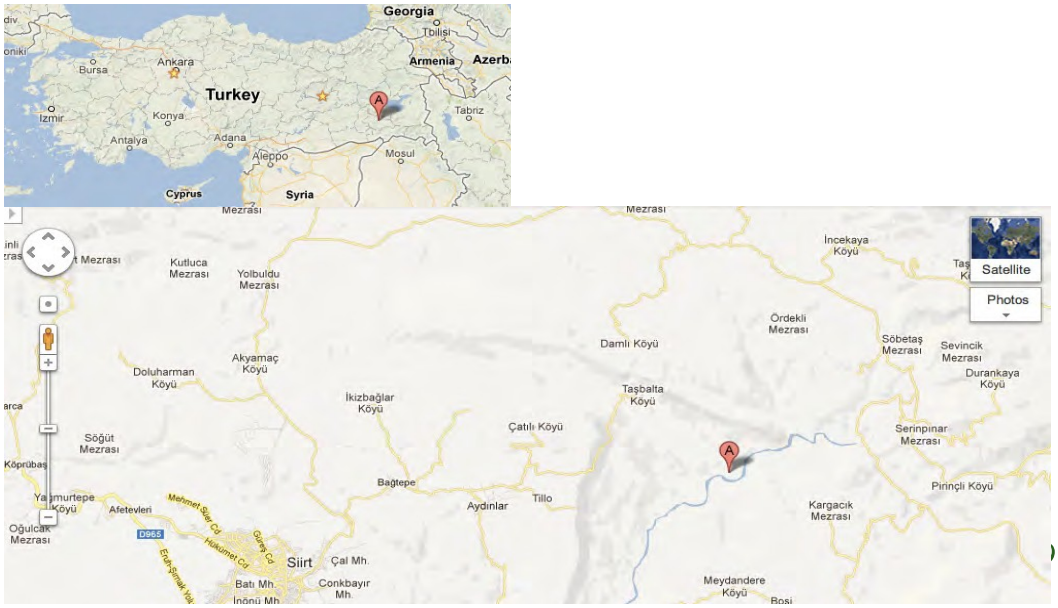
[4] http://ekutup.dpt.gov.tr/enerji/oik585.pdf (page 4.26 - p73 of PDF document Last visited on 22/07/2012)

The Following (Table 3) gives the coordinates of the Alkumru HPP Dam location and Power house location.

Table 3:Coordinates of the Weir and Power House

	Latitude	Longitude
Dam	37°57'36.94"N	42° 5'34.94"E
Powerhouse	37°57'25.24"N	42° 5'30.08"E

Figure 2:Project Location



1.13 Conditions Prior to Project Initiation

There was no other hydroelectric power plant installation at the project location. The project activity does not generate greenhouse gas emissions, so it can be excluded that the implementation has been made only in order to generate GHG emissions with their subsequent reduction.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

Addition of a new power generation capacity to the grid is regulated by Energy Market Regulatory Authority (EMRA) who issues the licenses for electricity generation and is responsible for ensuring that new capacity additions are in compliance with its rules and regulations. The list of the rules and regulations of the host country that a new electricity generation project has to comply with is given in Annex1.

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

Not applicable. The project is a voluntary project and the host country, Turkey cannot host CDM or JI projects. The project has not been registered under any other voluntary GHG program.

1.15.2 Projects Rejected by Other GHG Programs

Not applicable. The project has not been rejected by any other GHG programme.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

Not Applicable. The Project Activity is not embedded under any kind of Emission trading programs. Turkey is not an Annex-B country under Kyoto Protocol, neither has its set national emission reduction targets nor any related obligations.

1.16.2 Other Forms of Environmental Credit

Not Applicable. The project will not generate other form of environmental credits such as Green Power Certificates.

Leakage Management

Not Applicable as the project is a green field project.

Commercially Sensitive Information

A detailed excel workbook summarizing the financial analysis is provided to the validating DOE with relevant evidences that are commercially sensitive, these will not be disclosed to public.

Sustainable Development

The project aims to generate electricity by using hydroelectric power to supply the increasing national electricity demand in a cleaner and sustainable manner. It reduces the air pollution caused by the grid-connected power plants, which are mostly fossil fuel fired.

The following is a list of the project's contribution to the UN SDG:

SDG-7 on access to affordable, reliable, and sustainable energy, as the project is not relying on imported fossil fuels.

SDG-8 is to promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. In this project, occupational trainings and occupational health trainings were given regularly. The project providing decent and secure work environment.

SDG-13 on urgent action to combat climate change, as the project is replacing the fossil fuel based national grid and it is producing emission reductions.

Further Information

No further information to be added.

2 SAFEGUARDS

2.1 No Net Harm

The project has positive impact of the project to the social, economic and environmental situation is mentioned as:"...to support energy security, improved air quality, alternative sustainable energy, improved local source of income and sustainable renewable energy industry development. The specific benefits of the project are:

•Reducing greenhouse gas emissions in Turkey compared to the business-as-usual scenario,

•Helping stimulate private sector participation in hydro power industry in Turkey,

•Creating employment during the construction and the operation phase of the plant,

•Helping to reduce some other pollutants from power generation industry in Turkey, compared to a business-as-usual scenario,

•Helping to diminish Turkey's increasing energy deficit,

•Helping local people to make efficient agriculture by increasing the irrigation water.

•Diversify the electricity generation portfolio and reduce dependency on import of other energy sources."

2.2 Local Stakeholder Consultation

For the project activity a local stakeholders consultation meeting was held in Aydınlar town of Siirt Province, on October 25th, 2007, at 11:00 am, in the Public Educational Center Meeting Hall of Aydınlar Town, Siirt.

The meeting was announced at the bulletin boards of the governor house, municipality and at the village boards of Taşlı Village (via its muhtar Osman Çarp), Meydanderesi village (via its muhtar Ali Nur) Kılbasan Village (via its muhtar İzzettin Aygün), and Taşbalta Village (via Yılmaz Alanç). On the day of the meeting, Limak Hidroelektrik Santral Yatırımları A.Ş. has sent mini- busses to the villages and helped the stakeholders reach to the meeting hall.

The consultant company that prepared the EIA report, moderated the meeting and provided information about the project and its environmental impacts to the local stakeholders and answered their questions.

In general most of the questions were related to the expropriation process and the amount of compensation money. None of the attendants mentioned any doubts about the negative impacts of the project to the surrounding environment. Both the project owner company representatives and the environmental consultants answered these questions emphasizing that the expropriation process would be conducted in line with the host country rules and regulations.

The following is a translation of the meeting minutes:

Minutes of the Local Stake holder Consultation Meeting

The stakeholder consultation meeting was realized on 25th of October, 2007, at 11:00 o'clock at the public education centre of the Aydınlar Town of Siirt, with the presence of the people listed attached to this document.

During the meeting the spokesman of Selin İnş. Müh. Müş Ltd. Mr. Orkun Sarıfakıoğlu, have provided detailed information to the public about the planned project and its possible impacts to the environment. The information is provided in the form of a slide show and narration.

The contribution of the project to the economy of the country, to the province and town is explained and it is emphasized that the project implementers will keep their undertakings that are outlined within the context of the environmental impact assessment report. It is also mentioned that the possible environmental impacts were expected to occur mainly during the construction phase but no impact was expected for the operation phase.

Bedri Adar from Hürmüz village (An employee of the Park Elektrik) mentioned that there was work going on in their land, added that the village was stranded at the moment due to some sociological reasons, but the village inhabitants would come back and those that have their lands and those that does not have their lands registered due to zoning problems could find themselves downtrodden. He also mentioned lands tat belonged to their village was being used, and he added that he would like to see the employee to be chosen from the neighbouring villages during the construction and operation phases.

Orkun Sarıfakıoğlu (Selin Ltd) explained that in such projects the cadastral survey officers of the government would be organizing the expropriation, and it would not be possible to occupy anybody's land without paying any compensation. HE also explained that it was Limak A.Ş.'s company policy and priority to recruit employees from the surrounding towns and villages as long as they could find the appropriate persons to satisfy the needs.

The Akyayla Village inhabitant M.Salih Akgün asked if there would be any water tunnel related work on- going prior to expropriation.

Orkun Sarıfakıoğlu explained that the expropriation would start after the construction and would be an on going process that would be advancing part by part.

Seydan Altunç from Siirt Special Provincial Authority (SPA) asked the amount of sediments that the water would carry to the reservoir and the impact of the dam 50 years later.

It is explained that DSI was planning precautions to extend the life span of the Dam, establishment of the upstream weirs were planned. Upon an other question by Seydan Altunç, related to the materials that would be collected at the end of the life of the project activity, it is explained that it would be under the command and control of the DSI.

Murat Özdemir asked about the debt of the reservoir, and he is answered that the depth of the reservoir lake was 134 m.

The village head (muhtar) of Şirvan Taşlı village, Osman Can, asked the extent of the project area and to what degree their village would be affected.

Orkun Sarıfakıoğlu explained that all the relevant villagers and their inhabitants would be enlightened about the details of the expropriation, by the cadastral survey officers.

Aydınlar Mayor, Muhsin Çelebi, expressed his gratitude to those that are involved in this project and his wishes for the success of the project. He added that as the municipality

they would do their best to support the project and their only request was that the project management would consider helping unemployed.

Taşbalta Village head (Muhtar) Yılmaz Alanç asked the extent of impact related to their village and he asked from where he could get information. It is explained to him that for the forested areas Forestry Management could provide information and about the expropriation it was possible to get information from the cadastral offices.

Upon the question from Yılmaz Alanç related to the possibility of explosions affecting the settlements, it is explained that the drillings and surveys related to potential rock quarries were performed 1200 m away from settlements and it was very likely that those quarries were not suitable. As soon as complete results would be obtained, more information of the exact place, capacity and possibility to affect settlements would be provided to the village heads.

The audience is also informed that any kind of explosion would be performed under the control of the gendarme forces, and public would be informed, by announcements.

M. Salih Aygün asked weather it was possible to make use of the earth movers that belonged to the villagers.

It is explained that, if Limak would need, it would be possible to lease these vehicles, but the situation would be better clarified when the construction would start.

The town's Gendarme Commander Yener Güvercin, asked the possibility of the project activity to affect the climate and the vegetation (especially impact to the agricultural products such as pistachio and hackberry) .

It is explained that no harm to the existing vegetation and crop was expected, however, it was also possible that the reservoir lake would attract more wildlife and it would be possible to grow up crops that was not possible to grow in the area.

M.Salih Akgün asked if the project would affect the 50,000 young pistachio trees that were planted near the project area. It is explained that no negative impact was expected.

It is asked if there were new road constructions it is explained that a steel bridge would be constructed in addition to this the Dam crest would also be used as a road.

The National Education Town representation manager Mr. Sedat Özveren asked the life span of the project it is answered that it was 50 years.

Provincial Manager for Public Health Murat Özdemir asked about the studies done and allowed limits related to potential dust emissions that may happen due to explosions in the quarries and during the transportation of the materials. The impacts that are envisaged and the precautions to minimize dust is explained, and it is also mentioned that the mitigation measures could be reshaped based on the impacts. Bedri Adar asked who would take part in the security of the construction worksite. It is explained that those recruitments would be coordinated by the town GendarmeForces.

The questions asked can be grouped as expropriation related questions, employment opportunity related questions and environmental impact assessment related questions. The expropriation issues are followed up by an other series of meetings And one to one interaction with stakeholders. Regarding the employment issues there was temporary jobs created for the local inhabitants and the environmental impacts are studied and the project was granted all of its environmental permits.

2.3 Environmental Impact

In accordance with "Environmental Law" No. 2872 (Issued in 1983), Annex 2 of Environmental Impact Assessment (EIA) Regulation (issued in 1993 and revised in 2001), run-off river type Hydroelectric Power Plants with an installed capacity of 50 MW or more are subject to a full EIA process or report preparation. The project has gone trough a full EIA process and was granted an EIA Affirmative certification presented in Annex 2.

The EIA report outlines the major design parameters of the project activity, and explains how the project is going to be producing its cement, and how it is going to be utilizing the rock, clay and sand quarries.

The report summarizes that the cement that is needed will be acquired from the Cement factory at Kurtalan, Siirt, and the steel is going to be supplied from the İskenderun province. The report also outlines how these quarries are going to be remedied at the end of the construction stage.

Although expropriation process and stake holder consultations related to expropriation is held separately the EIA report also summarizes the number of houses (13 house) and public buildings (1 school and 2 Gendarme posts) that are going to be flooded as a result of the formation of the reservoir lake of the project activity.

Some of the environmental parameters discussed in this report can be summarized as follows:

Impact to local Traffic:

The project is mainly located in a rural area, the traffic activity that will be increased during the construction phase is not expected to disturb the baseline conditions of the traffic. During the operation phase there will be shuttle service up to Aydınlar town and this activity is considered as an insignificant addition to the baseline traffic.

Construction Waste

There will be a designated area to dump the construction waste. The dumped waste is to be compressed after the dumping will be completed and these parts will be forested. There will be no such waste during the operation phase.

Air quality

Modeling of dust flow and emissions predict no significant effect on air quality of the nearest residential areas, and the levels are in accordance with the “Regulations for Control of Air Pollution Caused by Industrial Facilities", announced in the Official Gazette No. 26236, on the 22/07/2006.

During the construction phase the operation of the concrete mixing stations, operational at the rock and clay quarries, excavation, backfilling, transportation, loading and unloading of the debriswill be causing dusting. The following are the preventive actions to avoid or minimize dust emissions:

- The work sites will be water sprayed periodically and will be kept dump to avoid dusting.
- At the sewing and grinding facilities, the material will be dampened pulverized water before the break up of the material. In addition to this the bunkers and the conveyor belts will be designed as closed systems and the emission permits of these facilities would be followed up.
- Dust holding filters would be installed at the bunkers of the concrete mixing stations.
- The work sites and the roads that are prone to dust formation will be regularly sprayed by water.
- Strict speed limits will be implemented at the work site, to avoid dusting

No dust emission is expected during the operation phase. There will be gas emissions due to the operation of the heaters during winter season. The emissions related to heaters will be below the emission limits allowed by the regulations.

Waste Waters

It is estimated that there will be about 1000 people working at the project site, and during the operation phase this number will be down to 80. During the construction

phase there will be a compacted waste water treatment facility to treat the household waste water that will be produced as a result of water that will be utilized by the workers for toiletry etc. For the operation stage there will be housings that will be built for the personnel and the waste water from these housings will also be discharged to the compacted waste water treatment facility. The waste water that will be discharged from the power house will be first collected in a sanitary tank and will than be transferred to the treatment facility nearby the housings.

Hazardous Substances and Wastes

The residue oils and fuels from the construction equipment, or the used batteries will be disposed of according to the Regulations for Control of Hazardous Wastes, announced in the Official Gazette No. 25755, on 14 of March 2005, and Regulations for Control of Waste Oils announced in the Official Gazette No. 25353, on 21 January 2004.

The explosive to be used in construction of the conveyance tunnel is ANFO. The explosives will be transported and used in accordance with the "Regulations of Measures to be Taken At Workplaces Operated Using Explosive, Combustive, Dangerous and Hazardous Substances" and the "Regulations Related to Procedures and Principles of Production, Import, Transportation, Preserving, Storing, Sales, Use, Disposal, Inspection of Explosive Substances, Hunting Materials and Similar Substances, Excluding Tekel", announced in the Official Gazette No. 19589 on 29 September 1987.

Hazardous waste such as rubber, batteries, cables, paints, barrels, contaminated ground by oil, oil binding filters, etc. shall be collected and sent to a licensed hazardous waste recycling or disposal plant, and treated according to the provisions given in the "Regulations for Control of Hazardous Wastes" announced in the Official Gazette No. 25755, dated 14 March 2005.

Solid Waste:

Both during the construction phase and operation phase there will be solid waste as a result of the presence of the workers that will be working at the project site. These wastes will be sorted and re-cycleable wastes will be collected separately and sent to the recycling facilities and the rest will be sent to the Aydınlar Towns waste disposal site.

Noise:

The noise levels on Alkumru Regulator site, tunneling system and HES site, were modeled. It was predicted that day and night time noise levels around the nearest residential areas will be within the standards of the "Day and night noise limits for Rural Areas and Settlement Areas" in accordance with the Article 25 of the Regulations for Evaluation and Management of Environmental Noise announced in the Official Gazette No. 25862 on 01.07.2005.

Water Flow and Lifeline Water

It is agreed by the water usage agreement between the project owner and the DSI that 14 m^3/s water will be released from the dam for wildlife year-round. And if under circumstances when the natural water flow will be less than the above mentioned flow the entire water will be released to the river.

River Water Quality

The Project is not expected to have a material effect on water quality. The power density of the project is greater than 10 W/m2, therefore, anaerobic conditions and decomposition are not expected to form and will not affect water quality and composition, or encourage methane production.

Ecology

The project area is not designated as an area for preservation. According to the available literature, there are no rare, endemic, endangered or protected species by national and/or international laws. Fauna and flora species, which are included in the Bern Convention or Red Data Book categories, were not found in the project area. A fish passage for fish species will be built, and once in operation, the project will not produce any air or water pollution to the surrounding environment. It is therefore concluded that the implementation of the project is expected to have only a minor impact on the surrounding environment and regional ecology.

The dam lake and its surrounding will be creating new habitat for waterfowl and other birds.There will be some public buildings (2 security buildings and one school) and 13 houses that are be relocated.

2.4 Public Comments

The public comments period has been conducted remotely due to the global pandemic. This group includes the headman, schoolteacher, tradesmen, general staff, employees, gendarmerieetc. in the region. This group was asked questions about the social, economic and environmental impacts of the project. The questions were shared with the target group in form, and the answers were shared with the DOE in written form. Generally, public comments period was really positive. Group tends to focus on the positive sides of the project such as creation of employment, new roads,increase in irrigation wateretc.

In the first question, we asked the group whether the project contributed to the social development of the area they live in.This question was answered positively by 100% of the group. The project has positive social impacts as job creation in the region.

The second question was about whether the project contributed to the economic development of the region.Everyone in the group answered this question positively.The projectcreated employment in the region, which was noted by stakeholders in the group. Employment was created both during the construction phase and during the operation of the power plant. At the same time, as mentioned above, it also provided support to the local economy by increasing tourism.

The third question was about the environmental impact of the project.100% of the groupthink that the project has a positive impact on the environment.The project provided an increase in irrigation water.

We also asked the group if they had any past or present concerns about the project.100% of the group stated that they have no problems with the project. Whole group stated that they could easily communicate with the project owners if they had any concerns about the project. The group usually prefers to communicate by phone or by visiting the power plant when they have any problem.

2.5 AFOLU-Specific Safeguards

The project is a non-AFOLU project

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The following UNFFCC methodology and its related tools are utilised:

Approved consolidated baseline and monitoring methodology ACM0002 “Large-scale consolidated baseline methodology for grid-connected electricity generation from renewable sources.” Version 20.0

Related Tools:

‘’Tool for the demonstration and assessment of additionality” (Version 05.2.1)

‘’Tool to calculate the emission factor for an electricity system” (Version 07.0).

“Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” (Version 03.0.1)

3.2 Applicability of Methodology

The choice of ACM0002 / Version 20.0 is justified as the proposed project activity meets relevant applicability criteria:

"If the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations.

- Alkumru Hydropower Plant Project is a grid connected renewable power generation project which adds electricity capacity from hydro power sources and which supplies electricity to a system that is supplied by at least one fossil fuel fired generating unit,

- The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid.

- The project does not involve switching from fossil fuels to renewable energy at the site of the project activity, The project involves construction of new units in a brand new plant, in other words the project does neither involve the addition of renewable energy generation units at an existing renewable power generation facility nor does it foresee to retrofit or modify an expired facility of renewable energy generation.

Table 4:Applicability Conditions

No.	Applicability conditions in Version 20.0 of ACM0002	Project Activity	Criterion Met
1	This methodology is applicable to grid-connected renewable energy power generation project activities that: a) Install a Greenfield power plant; b) Involve a capacity addition to (an) existing plant(s); c) Involve a retrofit of (an) existing operating plant(s)/unit(s); d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or e) Involve a replacement of (an) existing plant(s)/unit(s).	The Alkumru HPP project activity consists installation of a new grid connected renewable power plants at a site where no renewable power plant was operated prior to the implementation of the project activity (green field plant)	Yes
2	The methodology is applicable under the following conditions:	The project activity is the installation of a new hydropower plant.	Yes

	a) The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;		
	b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects) the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	The project activity is the installation of a new hydropower plant. It is not included capacity additions, retrofits, rehabilitations or replacements of the existing plant/unit.	N/A
3	In case of hydropower plants, one of the following conditions shall apply:		
	a) The project activity is implemented in an existing single or multiple reservoir, with no change in the volume of any of the reservoir; or	The project involves construction of a new reservoir.	N/A
	b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density, calculated using equation (7), is greater than 4 W/m^2; or	The project involves construction of a new reservoir.	N/A
	c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (7), is greater than 4 W/m^2; or	The project involves construction of a new single reservoir and the power density of the Alkumru HPP is 6.119 W/m^2, it is greater than 4 W/m^2.	Yes
	d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (7), is lower than or equal to 4 W/m^2, all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as per equation (8), is greater than 4 W/m^2; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;	The project activity is not an integrated hydropower plant	N/A

	(iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m^2 shall be: a. Lower than or equal to 15 MW; and b. Less than 10 percent of the installed capacity of integrated hydro power project.		
4	In the case of integrated hydro power projects, project proponent shall: (a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or (b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore, this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity	This project activity is not an integrated hydropower plant	N/A
5	This methodology is not applicable to: (a) Project activities that involve switching from fossil fuels to renewable energy at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site (b) Biomass fired power plants/ units	It is a renewable energy project with no fuel-switch and biomass fired power plant involved. The project activity is a hydropower plant.	Yes
6	In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	The Alkumru Hydro Power Plant Project activity is the installation of a new hydropower plant.	N/A

Table 5:Applicability Conditions of Tools

No	Applicability conditions to relevant tools	Project Activity	Criterion Met
1	**Tool for the demonstration and assessment of additionality" (Version 05.2.1)** This tool provides for step-wise approach to demonstrate and assess additionality. These steps include: • Identification of alternatives to the project activity. • Investment analysis to determine that the proposed project activity is either:1)not the most economically or financially attractive, or 2)not economically or financially feasible, • Barrier analysis, and • Common practice analysis	In the absence of the proposed project activity, plausible and credible project activities to the proposed project activity are presented. Benchmark Analysis is selected as the analysis method and the Equity IRR is selected as the financial indicator for the demonstration of the additionality of the project. Without the VER revenue the Internal Rate of Return of the project cannot get close to the benchmark of 12.50 %, with an equity internal rate of return of 9.04%. A fluctuation of ± 10% in the key parameters also does not make the project exceed the benchmark. Based on the barrier analysis, there are realistic and credible barriers that would prevent the implementation of the proposed project activity from being carried out if the project activity is not registered as a VCS activity. The low rate of completion of the projects and the low	Yes

		contribution privately held hydro projects confirm the barriers elaborated above and also proves that the electricity generation from HEPP business is not a common practice	
2	**Tool to calculate the emission factor for an electricity system" (Version 07.0).** This tool may be applied to estimate the OM,BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid. Under this tool, the emission factor for the project electricity can be calculated either for grid power plants only/or as an option can include off-grid power plants.	Although UNFCCC ACM0002 Version 20.0 refers to ''Tool to calculate the emission factor for an electricity system" (Version 07.0), the host country (Turkey) published the combined emission factor as 0.5706 tCO2/MWh on October 2021 by using ''Tool to calculate the emission factor for an electricity system" (Version 06.0). The only revision between these versions is to include monitoring requirements for parameters used to determine the emission factor of the isolated grid and Alkumru HPP is not an isolated grid.	Yes
3	**Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1)** This tool provides a stepwise procedure to asses the continued validity of the baseline and to update the baseline at the renewal of a crediting period,as required by paragraph 49(a) of the modalities and procedures of the CDM. The tool consists of two steps.The first step provides an approach to evaluate whether the	The current baseline scenario complies with all relevant mandatory national and or/sectoral policies. Thus, it can be concluded that the current baseline scenario is in compliance with relevant mandatory national and sectoral policies. The project received the production license from the Turkish Energy Market Regulatory	Yes

	current baseline is still valid for the next crediting period. The second step provides an approach to update the baseline in case that the current baseline in not valid anymore for the next crediting period.	Authority and this license ensures that the project complies with all national regulations. The term of the license is 40 years. There is no impact of circumstances existing at the time of requesting renewal of crediting period on the current baseline emissions for this project. The conditions used to determine the baseline emissions in the previous crediting period are still valid. The equipments and the technology of the project are still valid. Therefore this sub-step is not applicable for this project activity.	

3.3 Project Boundary

The project boundary includes net electricity generated and supplied to the Turkish national grid. The following figure (Figure 3) schematically summarizes how the project activity will be operating and what needs to be considered within the physical project boundary.

Figure 3:Project Boundary

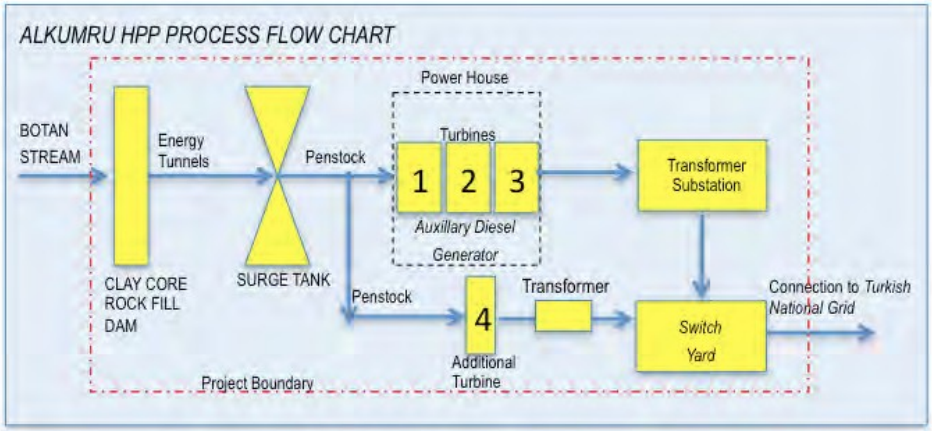


Table 6:Main Gasses included in the project boundary

Source		Gas	Included?	Justification/Explanation
Baseline	Electricity generation in baseline (Turkey's Grid)	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
		Other	N.A	N.A
Project	Emission from the reservoir of the proposed project	CO_2	No	Minor emission source
		CH_4	No	Minor emission source (Power density greater than 10W/M^2)
		N_2O	No	Minor emission source
		Other	N.A	N.A

3.4 Baseline Scenario

According to Verra Standard Version 4.1 section 3.8.9 when renewal of the project crediting period, the following shall apply with respect to the renewal of the project:

"The validity of the original baseline scenario shall be demonstrated, or where invalid a new baseline scenario shall be determined.''

In this project the baseline scenario is valid as follows:

Since the proposed project activity is the installation of a grid-connected hydroelectric, that is renewable power plant and therefore, the baseline scenario is defined as the following based on ACM0002 (Version 20.0):

"If the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations.

Since the proposed project activity is going to be connected to the Turkish national grid, the baseline scenario of the proposed project is the supply of the equivalent amount of annual power output by the existing Turkish national grid, which is the continued operation of existing power plants and the addition of new sources to meet electricity demand.

Based on ACM0002, baseline emissions are equal to power generated by the project activity that is delivered to the Turkish national grid, multiplied by the baseline emissions factor. This baseline emissions factor (EFy) is calculated as the Combined Margin (CM),by the Turkish Ministry of Energy and Natural Resources.

The steps to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period is conducted following methodological tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1, EB 66, Annex 47).

The validity of the current baseline is assessed using the following sub-steps:

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

In the absence of this project activity, electricity that is connected to the national grid would come from fossil fuel based power plants. The baseline scenario of the project is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected fossil fuel power plants and by the addition of new generation sources.

The current baseline scenario complies with all relevant mandatory national and or/sectoral policies. Thus, it can be concluded that the current baseline scenario is in compliance with relevant mandatory national and sectoral policies.The project received the production license from

the Turkish Energy Market Regulatory Authority on 27/09/2007.This license ensures that the project complies with all national regulations.The term of the license is 49years.

Step 1.2: Assess the impact of circumstances

There is no impact of circumstances existing at the time of requesting renewal of crediting period on the current baseline emissions for this project. The conditions used to determine the baseline emissions in the previous crediting period are still valid.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested

This sub-step should only be applied if the baseline scenario identified at the validation of the project activity was the continuation of use of the current equipment(s) without any investment and, the projects proponents or third party (or parties) would undertake an investment later due, for example, to the end of the technical lifetime of the equipment(s) before the end of the crediting period or the availability of a new technology.

The equipments and the technology of the project are still valid. Therefore this sub-step is not applicable for this project activity.

Step 1.4: Assessment of the validity of the data and parameter.

This step requires us to Assess whether data and parameters that were only determined at the start of the crediting period and not monitored during the crediting period are still valid or whether they should be updated. Updates should be undertaken in the following cases:

"Where IPCC default values are used, the values should be updated if any new default values have been adopted and published by the IPCC, for example, in guidelines for national GHG inventories, IPCC assessment report or special reports by the IPCC".

"Where emission factors, values or emission benchmarks are used and determined only once for the crediting period, they should be updated, except if the emission factors, values or emission benchmarks are based on the historical situation at the site of the project activity prior to the implementation of the project and cannot be updated because the historical situation does not exist anymore as a result of the CDM project activity".

In the registered PDD, the grid emission factor was calculated as per the combined margin approach described in the "Tool to calculate the emission factor for an electricity system" Version 02.2.1. The grid emission factor was calculated as the weighted average of OM & BM; and wasfixed ex-ante for the entire crediting period.

The emission factors that were determined at the start of the first crediting period are not valid anymore and the data and parameters have been updated accordingly for the second crediting period.

The whole data OM and BM was obtained from official data provided by Turkish Ministry of Energy and Natural Resources published on 06/10/2020. This is the most recent data available during the validation of renewal of crediting period.Considering the guidance provided under this step, calculation of emission factor and baseline emissions are updated for the next crediting period as requested in step 2.

Step 2: Update the current baseline and the data and parameters

Step 2.1: Update the current baseline.

The current baseline scenario is still valid.

Step 2.2: Update the data and parameters.

All parameters regarding the grid emission factor are updated in this crediting period.

3.5 Additionality

The proposed project activity reduces GHG emissions by substituting fossil fuel based electricity generation by renewable resources (hydro) based electricity generation.

Version 4.1 section 3.8.9 of the VCS Standard states that:

‘A full reassessment of additionality is not required when renewing the project crediting period.However,regulatory surplus shall be demonstrated in accordance with the requirements set out in the VCS Program rules and the project description shall be updated accordingly’

Since Alkumru HPP is a registered project, the reassessment of the additionality is not required for renewing crediting period. The following content is kept the same as the registered PDD.

Step 1:Regulatory Surplus:

The project shall not be mandated by any enforced law, statute or other regulatory framework, or for UNFCCC non-Annex 1 countries, any systematically enforced law, statute or other regulatory framework.

Outcome of Step 1: The project is not mandated by any enforced law, statute or other regulatory framework.

Step 2:Positive List: Conformance with the positive list is demonstrated in the Applicability of Methodology section below:

Step 1 - Identification of Alternatives to the project activity consistent with current laws and regulations

Sub-step 1a - Define alternatives to the project activity:

The tool notifies that "Project activities that apply this tool in context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity."

The project alternative can be defined as follows:

Continuation of the current situation (No project activity or other alternatives undertaken). This alternative is the most likely scenario, since there are no legal obligation to implement such a project and without VCS support the project implementation is financially not attractive.

Outcome of Step 1a: The only realistic and credible alternative scenario to the project activity is Continuation of the current situation, without any project undertaken .

Sub-step 1b. Consistency with mandatory laws and regulations:

The project alternative, the baseline scenario, which is the continuation of the existing situation, is in compliance with all mandatory applicable and legal and regulatory requirements. Also the alternative scenario of addition of a new power generation capacity to the grid is regulated by Energy Market Regulatory Authority (EMRA) who issues the licenses for electricity generation and is responsible for ensuring that new capacity applies with its rules and regulations. The list of the rules and regulations of the host country that a new electricity generation project has to comply with is given in Annex 1.

Outcome of Step 1b: The alternative scenario to the project activity is the supply of electricity by the existing grid with additional capacity is in compliance with mandatory legislation and regulations.

Step 2 - Investment analysis

At this step it will be demonstrated that "the proposed project activity is not the most economically and financially viable" option without the VER revenue. Please note that, at this step, the "Guidelines on the assessment of investment analysis" (EB 62 Report Annex 5) Version 05 is taken into account.

Sub-step 2a - Determine appropriate analysis method

There are three options for investment analysis method:

- Simple Cost Analysis
- Investment Comparison Analysis and
- Benchmark Analysis

"Simple Cost Analysis" is not applicable for this project activity as the project generates economic benefits from sale of electricity to the Turkish national grid". Investment Comparison Analysis is also eliminated since the baseline for the project is "the generation of electricity by the existing grid" and no similar investment alternatives exist. Therefore, Benchmark Analysis is the most appropriate approach for the evaluation of the project activity.

Sub-step 2b - Option III-Apply benchmark analysis

Internal Rate of Return (IRR) on equity is taken for this project to be the financial indicator for assessing the financial viability of the project activity..

Equity IRR is the cash flow return to equity shareholders after debt repayments. And therefore also takes into account the debt repayments. Equity IRR takes into consideration that you use debt for the project, so the inflows are the cash flows required minus any debt that was raised for the project. The outflows are cash flows from the project minus any interest and debt repayments.

To be able to assess the financial viability of the project a benchmark to compare the equity IRR is needed.

The Tool for the Demonstration and Assessment of Additionality Version 6.0.0 and the Guidelines issued at EB 62 state that "…Discount rates and benchmarks shall be derived from: Government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert or documented by official publicly available financial data"

The Guidelines issued at EB 62[5], provides the default values for the expected return on equity as an appendix, and Moody's index values of most of the CDM Countries. At the time of investment decision, Turkey's Moody's index (Ba2) was comparable to country's with the same Moody's index, and same default benchmark value from this point of view a reasonable and appropriate benchmark to compare the Equity IRR can be taken as 12.50 %.

Sub-step 2c - Calculation and comparison of financial indicators

[5] Annex 5 Guidelines on The Assessment of Investment Analysis (Version 05)

The following parameters are taken into account for the assessment of the investment (Table 5) and supplementary parameters are provided in the "AlkumruFinancialAnalysis" workbook and submitted to the validating DOE.

Table 7:Major Parameters taken into account for the financial analysis and determination of the Equity IRR of the Alkumru Project

Parameter	Value	Unit	References
Installed Capacity	240.00	MWe	Initial Feasibility Report that makes the basis for Investment Decision
Expected Annual Electricity Generation	822,130	MWh	Initial Feasibility Report that makes the basis for Investment Decision
Expected Average Annual Emission Reduction(ER)	*475,143*	tCO_2e	Calculated (see Chapter 3 for details) based on the post investment decision time electricity production values.
Total Investment	470,253,643	USD	Based on Cost values submitted to the crediting Banks
Annual Operation Costs	$10,439,915.89	USD	Based on FSR (2006, Table 9.2, maintenance & spare parts), EIA report (staff & labour) and 1% of the investment cost is chosen as the (insurance& security).
Loan	Confidential	USD	Loan Agreement
Loan Period	10	years	Loan Agreement
Electricity Sales Price	0.073	USD/KWh	Based on the guaranteed price by the "Renewable Energy Law" number 6094
VAT	18	%	V.A.T. Law No:3065
Income Tax	20	%	Income Tax Law number 5281

The value of the investment has been depreciated on a reducing balance basis over 20 years, plus the four years of construction phase. 70 % of the long lasting assets are depreciated over 45 years and the residual book value of $163,374,082.13 USD is added back to the cash flow. The economic life time of a hydro power plant investment is assumed to be about 50 years, based on the experts' committee report[6] on energy under the 8th development plan published by the State planning organization. Even if the facility can last for 50 years the major equipment needs to be replaced in every 20 years[7]. As a result the project lifetime is estimated to be about 20 years and the investment analysis is therefore done for a time frame of 20 years.

For the assessment of the viability of the project activity the Equity IRR is compared to the benchmark. The equity IRR is worked out as 9.04 %, which is below the benchmark of 12.50%.

Sub-step 2d - Sensitivity Analysis

[6] http://ekutup.dpt.gov.tr/enerji/oik585.pdf page 4.25 (Last visited on 3/3/2011)

[77] http://ekutup.dpt.gov.tr/enerji/oik585.pdf page 4.26 (Last visited on 3/3/2011)

To be able to conclude if the investment decision is the financially the most attractive alternative, a sensitivity analysis is performed. Three parameters that affect the equity IRR are examined for the sensitivity analysis:

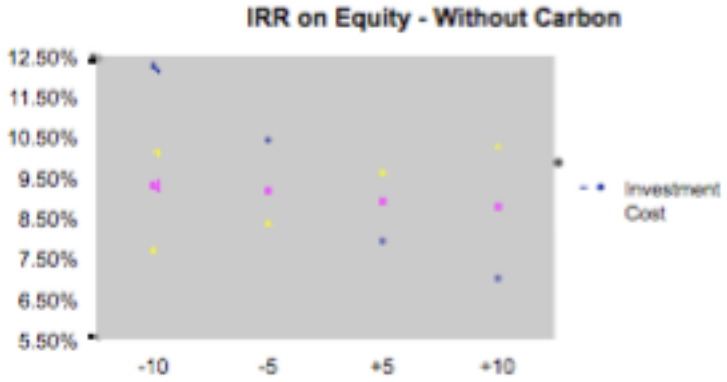
- Investment Cost
- Operating and Maintenance Cost
- Electricity Revenue

The sensitivity analysis is performed for a range of ±10% fluctuations in the above parameters. The figures in the following table (Table 6) are obtained. Following the "Guidelines on the assessment of investment analysis (Version 05)" of EB 62 Annex 5 when any of the key variables are increased or decreased by at least 10%, and the benchmark is not exceeded (also see Figure 4).

Table 8: Sensitivity analysis for the Equity IRR without carbon revenue for the project (Benchmark: 12.50%)

Change	-10%	-5%	5%	10%	Exceed Benchmark?
Investment Cost	12.24%	10.42%	7.94%	7.02%	No
Operating Cost	9.28%	9.16%	8.91%	8.79%	No
Electricity Revenue	7.72%	8.39%	9.66%	10.26%	No

Figure 2: Sensitivity analysis: Fluctuation of the Equity IRR without the carbon revenue, by changing major parameters that effect the Equity IRR by ±10%



To exceed the benchmark, the electricity revenue must increase by about 30.30% over the life of the project, or the investment cost must be reduced by about 10.60%. As the Renewable energy law only guaranties a minimum price of USD 0.073 per kWh, and since

the feasibility report and the design of the project is based on the maximum available capacity of the Botan river, and all our financial analysis is based on the maximum electricity output of the project, such an increase in increased amount of electricity generation is very unlikely. In addition to that as the availability of the water decreases due to the globally accepted results of global climate change, electricity production is very unlikely to reach to an increased generation amount of an additional 30.30%. In addition to this the climate change models indicate for the Mediterranean basin an increased drought and water scarcity that could even risk the project to reach the firm energy values.

The project involves particular design change decisions that are not considered at the investment decision stage when the above financial analysis was based on. Those changes improve the capacity and increase the amount of electricity production But the maximum amount of electricity expected to be produced after all of these changes are implemented is only 7.19% higher than the amount considered in the financial analysis. Besides, to be able to harvest that higher amount of electricity there needs to be an increase in the investment cost by about 20%.

The investment costs we have considered in our financial analysis are based on the numbers presented to the bank when the project developer was negotiating the terms of the bank loan. Therefore these numbers reasonable and reflect the average market conditions but are unlikely to go down, as the focus of the project developer is to secure and improve the electricity yield and therefore they will not be able to cut costs. Therefore it is very unlikely for the investment cost to finalize below the amounts estimated and shown in the financial analysis.

Outcome of Step 2:

Without the VER revenue the Internal Rate of Return of the project cannot get close to the benchmark of 12.50 %, with an equity internal rate of return of 9.04%. A fluctuation of ± 10% in the key parameters also does not make the project exceed the benchmark.

Step 3 - Barrier Analysis

As the investment analysis concludes that the proposed project activity is unlikely to be the most financially attractive option, the sub step 3- Barrier analysis is optional to be applied and barrier analysis is not considered for the Alkumru HPP.

Step 4: Common Practice Analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity

As per "Tool for the Demonstration and Assessment of Additionality", projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory frame-work, investment climate, access to technology, access to financing, etc. Although the tool does not consider the *Sectoral Scope 1: Energy industries (renewable-/non -renewable sources) projects* amongst the measures that can make use of the common practice guideline version 02, we preferred to utilise the same guideline to demonstrate that within the boundaries of the Tigris catchment there are no similar projects that are developed and operational without the assistance of the VER revenue. According to the Guidelines on Common Practice (version 02), common practice analysis is presented through the following 4 steps.

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

As a hydropower project, the installed capacity is chosen as an appropriate proxy for "similar scale". The power generation capacity of 275.52 MW of the proposed project is selected as the design capacity. Therefore, the range from 137.76MW to 413.28 is considered as applicable capacity.

Common Practice tool Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number N_{all}. Registered VER project activities shall not be included in this step:

Checking all the power plants within the capacity range determined in Step 1, and looking projects that have started commercial operation before the start date of the project, it is revealed that there are 12 power plants operational in the Turkish grid with a capacity ranging between 137.76MW to 413.28 (See Table:7). Therefore the number of N_{all} is 12.

Table 9: Projects that are commissioned before the project activity that can be considered to be included in the count of N_{all}.

Name	Developer	Capacity (MW)	(GWh)	Firm Production (GWh)	Location	Basin Number and Name	DSİ District	Year of Commissioning
Aslantaş	Government	138	569	320	80 Osmaniye	18 Seyhan	06 Adana	1984
Gezende	Government	159.4	528	130	33 İçel (Mersin)	17 Doğu Akdeniz	06 Adana	1990
Obruk I-II	Government	212.4	473	337	19-Çorum	15 Kızılırmak	05 Ankara	2009
Borçka	Government	300.6	1039	600	08 Artvin	23 Çoruh	26 Artvin	2006
Yedigöze - Sanibey HPP[8]	Private Licencee	320	1000	1000	01 Adana	20 Ceyhan	06 Adana	2011
Sarıyar-H.Polatkan	Government	160.00	400	328	06 Ankara	12 Sakarya	05 Ankara	1956
Çatalan	Government	168.90	596	270	01 Adana	18 Seyhan	06 Adana	1997
Özlüce-Peri	Government	170.00	413	290	12 Bingöl	21 Fırat	09 Elazığ	1999
Karkamış	Government	180.00	652	462	63 Urfa	21 Fırat	15 Urfa	1999
Batman	Government	198.00	483	196	21 Diyarbakır	26 Dicle	10 Diyarbakır	2003
Gökçekaya	Government	278.40	562	460	26 Eskişehir	12 Sakarya	03 Eskişehir	1973
Sır	Government	283.50	725	408	46 K. Maraş	20 Ceyhan	20 K.Maraş	1991

Common Practice tool Step 3: identify the different technologies delivered the same output and differ by at least one of the following aspects, Note their number N_{diff} :

(i) Energysource/fuel;

(ii) Feedstock

(iii) Size of installation (power capacity):

- Micro (as defined in paragraph 24 of Decision 2/CMP.5 and paragraph 39 of Decision3/CMP.6);
- Small (as defined in paragraph 28 of Decision1/CMP.2);
- Large;

(iv) Investment climate in the date of the investment decision, interalia:

- Access to technology;
- Subsidies or other financial flows;

[8] Upon our communication with the project owner we are informed that the project was under validation process to seek VCS certification.

- Promotional policies;
- Legal regulations

(v) Other features, inter alia:

- Unit cost of output (units costs are considered different if they differ by at least20%);

Common Practice tool Sub-step 3a:When we consider the project listed in Table 7, these projects are different from Alkumru HPP in the following aspects:

- All the projects except Yedigöze-Saniey HPP, were developed by government, and therefore since they were developed considering public benefit the conditions and economical motivations in developing them are very different than the project activity.
- Yedigöze-Sanibey HPP is developed by the private sector, and it is not yet listed in the VCS Project database or in any of the VCS registries however, the project owner stated that it was under validation to seek VCS certification.
- In addition to that the project was developed on Ceyhan Basin, within the jurisdiction of DSI 6th District of Adana, and therefore has different water flow characteristics than the project activity, which is located in the Tigris catchement.

Conclusion of Common Practice tool Sub- Step 3b is $N_{diff}=12$

Common Practice tool Step 4: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed projectactivity.

$F=1-N_{dif}/N_{all}$

$F=1-(12/12)$

$F=0$

Common Practice tool Step 5: Conclusion

The proposed project activity is a “common practice” within a sector in the applicable geographical area if the factor F is greater than 0.2 and $N_{all}-N_{diff}$ is greater than 3.

Factor F is calculated to be $0 < 0.2$

$N_{all}-N_{diff}$ =12-12=0 <3 in that case the Alkumru HPP is not common practice.

Conclusion of Step 4: In conclusion the proposed project is deemed to be additional according to ACM0002 and the tool and guideline for the demonstration and assessment of additionality.

3.6 Methodology Deviations

The UNFCCC methodology of ACM0002/ Version 20.0 and its related tools have been applied without any deviations.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Explanation of methodological choices:

Although UNFCCC ACM0002 Version 20.0 refers to ‘’Tool to calculate the emission factor for an electricity system” (Version 07.0), the host country (Turkey) published the combined emission factor as 0.5706 tCO2/MWh on October, 2021 by using ‘’Tool to calculate the emission factor for an electricity system” (Version 06.0). The only revision between these versions is to include monitoring requirements for parameters used to determine the emission factor of the isolated grid and Alkumru HPP is not an isolated grid. Hence there is no change between version 6 to 7 which will impact the emission factor calculation relevant for the project activity This methodological tool determines the CO2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the “combined margin” emission factor (CM) of the electricity system.

The Project therefore applies the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system” Version 06.0 as follows:

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$$

Where:

BE_y = Baseline emissions in year y (tCO2/yr)

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year y (MWh/yr)

$EF_{grid,CM,y}$ = Combined margin CO2 emissions factor in year y (tCO2/MWh)And

And

$$EG_{PJ,y} = EG_{Facility,y}$$

$EG_{Facility,y}$ = Quantity of net electricity generation supplied by the project plant to the grid in year y (MWh/y)

The Emission Factor of Turkey for 2019 was calculated and published by Turkish Ministry of Energy and Natural Resources on 06/10/2021[9] using Version 06.0 of TOOL 7:"Tool to calculate the emission factor for an electricity system". Both operating margin emission factor and build margin emission factor data are separately specified by the Turkish Ministry of Energy and Natural Resources. The document in which this data is written separately has been shared with the validated DOE. Data is as follows:

The operating margin emission factor: $EF_{grid,OM,y}$= 0.7258 tCO_2/MWh

And build margin emission factor: $EF_{grid,BM,y}$= 0.4153 tCO_2/MWh

The combined emission factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Where:

w_{OM}: Weighting of OM emission factor (%)

w_{BM}: Weighting of BM emission factor (%)

[9] https://enerji.enerji.gov.tr/Media/Dizin/BHIM/tr/Duyurular//Bilgi_Formu_Web_Sitesi_2019_202110071443.pdf

and

$$w_{OM} = 0.50$$

$$w_{BM} = 0.50$$

$$EF_{grid,CM,y} = 0.50 \times 0.7258 + 0.50 \times 0.4153 = 0,5706\ tCO_2/MWh$$

In the above report which is calculated by Turkish Ministry of Energy and Natural Resources applied the weighting factors of both OM and BM emission are 0.5, which is not applicable for the renewal crediting period according to both version 06.0 and 07.0 of "Tool to calculate the emission factor for an electricity system". According to the Version 07.0 of "Tool to calculate the emission factor for an electricity system", which the methodology referred the following default values have to be used in the renewal crediting period:

$$w_{OM} = 0.25 \text{ and } w_{BM} = 0.75$$

So, since this is the renewal of the period, the CM emissions factor is as follows:

$$EF_{grid,CM,y} = 0.25 \times 0.7258 + 0.75 \times 0.4153 = 0,4929\ tCO_2/MWh$$

Hence, the calculation of baseline emission is calculated as follows:

Where:

BEy	Baseline emissions in year y(tCO2/yr)
$EG_{facility,y}$	Electricity supplied by the Alkumru Hydropower Electricity Power Plant to the grid and equal to 773,752.00 MWh/yr
$EF_{grid,CM,y}$	Combined margin CO2 emission factor for the grid and equal to 0.4929 tCO2/MWh

Therefore:

BE_y= 773,752.00 x 0.4929 = 381,382(tCO_2/yr)

4.2 Project Emissions

As ACM0002, Version 20.0 para 31states for most renewable energy power generation project activities, PEy = 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

PE_y	=	Project emissions in year *y* (t CO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (t CO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of dry, flash steam or binary geothermal power plants in year *y* (t CO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (t CO_2e/yr)

In this case,

$PE_{FF,y}$= 0,

Since for all renewable energy power generation project activities, emissions due to the use of fossil fuels for the backup generator can be neglected according to the methodology.

$PE_{GP,y}$=0,

Since this is not a dry or flash steam geothermal project activity.

$PE_{HP,y}$=0,

Where: PEHP,y = Project emissions from water reservoirs (tCO2e/yr)

Since, the ACM0002, Version 20.0 para 38 states that if the power density of the project activity is greater than 10 W/m2 :

PEHP,y = 0, and the project has a power density of 52 W/m^2 calculated as follows:

Project Activity	Installed Capacity	/	Reservoir Area	=	Power Density
AlkumruHPP	275,520,000 W	/	10,990,000m^2	=	25.07W/m^2

As a result of the above information,

PE_y= 0

4.3 Leakage

The main emissions potentially giving rise to leakage are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport). However according to ACM0002 Version 20.0 para 53 ,these emission sources can be neglected, therefore ***$LE_y = 0$***. Hence,there are no leakage emissions related to project activity.

4.4 Net GHG Emission Reductions and Removals

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
2021(from 10.03.2021 to 31.12.2021)	308,284	0	0	308,284
2022	381,382	0	0	381,382
2023	381,382	0	0	381,382
2024	381,382	0	0	381,382
2025	381,382	0	0	381,382
2026	381,382	0	0	381,382
2027	381,382	0	0	381,382
2028	381,382	0	0	381,382
2029	381,382	0	0	381,382
2030	381,382	0	0	381,382
2031(01.01.2031 to 09.03.2031)	73,098	0	0	73,098
Total	3,813,820	0	0	3,813,820

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO_2/MWh

Description	Operating margin CO_2 emission factor for grid connected power generation in year *y* calculated using the "Tool to calculate the emission factor for an electricity system"
Source of data	Data published by Turkish Ministry of Energy and Natural Resources on 06/10/2021[10]
Value applied	0.7258
Justification of choice of data or description of measurement methods and procedures applied	The $EF_{grid,OM,y}$ was calculated and published by Turkish Ministry of Energy and Natural Resources on 06/10/2021 using Version 06.0 of TOOL 7:"Tool to calculate the emission factor for an electricity system",
Purpose of Data	For calculation of $EF_{grid,CM,y}$
Comments	-

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/MWh
Description	Building margin CO_2 emission factor for grid connected power generation in year *y* calculated using the "Tool to calculate the emission factor for an electricity system"
Source of data	Data published by Turkish Ministry of Energy and Natural Resources on 06/10/2021[11]
Value applied	0.4153
Justification of choice of data or description of measurement methods and procedures applied	$EF_{grid,BM,y}$ was calculated and published by Turkish Ministry of Energy and Natural Resources using Version 06.0 of TOOL 7:"Tool to calculate the emission factor for an electricity system".
Purpose of Data	For calculation of $EF_{grid,CM,y}$
Comments	-

[10] https://enerji.enerji.gov.tr/Media/Dizin/BHIM/tr/Duyurular//Bilgi_Formu_Web_Sitesi_2019_202110071443.pdf

[11] https://enerji.enerji.gov.tr/Media/Dizin/BHIM/tr/Duyurular//Bilgi_Formu_Web_Sitesi_2019_202110071443.pdf

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2/MWh
Description	Combined margin Emission Factor of Turkey
Source of data	Data published by Turkish Ministry of Energy and Natural Resources on 06/10/2021[12]
Value applied	0.4929
Justification of choice of data or description of measurement methods and procedures applied	$EF_{grid,CM,y}$ was calculated using the published databy Turkish Ministry of Energy and Natural Resources. Calculated data of $EF_{grid,OM,y}$and $EF_{grid,OM,y}$were used.
Purpose of Data	Calculation of baseline emission (BE_y).
Comments	-

5.2 Data and Parameters Monitored

Data / Parameter	Cap_{PJ}
Data unit	MhW
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Project site
Description of measurement methods and procedures to be applied	Turbine Supplier information on the equipment
Frequency of monitoring/recording	Yearly

[12] https://enerji.enerji.gov.tr/Media/Dizin/BHIM/tr/Duyurular//Bilgi_Formu_Web_Sitesi_2019_202110071443.pdf

Value applied	275,520,000
Monitoring equipment	*N/A*
QA/QC procedures to be applied	Supplier information on the related equipment and existence of the equipment are checked
Purpose of data	Data is used to calculate baseline emission.
Calculation method	*N/A*
Comments	-

Data / Parameter	A_{PJ}
Data unit	m^2
Description	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data	Project site
Description of measurement methods and procedures to be applied	The reservoir area corresponding to maximum operational level has been determined as a certain value according to the topographical maps. And a correlation graphic that exhibits the relationship between the water depth, reservoir area and the volume of the reservoir is plotted against a graphic. In order to make verification of the reservoir area, the monthly maximum water depth recordings will be taken and the corresponding reservoir area determined using the same graphic, Presented in Annex 3.
Frequency of monitoring/recording	*Once during each monitoring period*
Value applied	10,990,000
Monitoring equipment	*N/A*
QA/QC procedures to be applied	The depth readings will be done on daily basis from
Purpose of data	Data to be used for the calculation of Project Emissions.
Calculation method	N/A
Comments	N/A

Data / Parameter	$EG_{PP\text{-}Import,\ y}$
Data unit	MWh
Description	Quantity of electricity imported by the power plant from the Grid, in year y
Source of data	The Primary source of data will be the Main TEIAS meter recorded at the monthly reading protocols, the column related to electricity imported from the Grid.
Description of measurement methods and procedures to be applied	Measurements are to be made by electricity meters. That belong to the grid operator TEIAŞ. The meters are in compliance with the collected data. Data will be used to calculate the net electricity supplied to the grid.
Frequency of monitoring/recording	Recorded continuously, reported monthly on TEIAS Meter Reading Protocols, Reported annually on the VCS Monitoring Report.
Value applied	Will be determined at the monitoring stage.
Monitoring equipment	Calibrated between 2020-2030 EMH-LZQJ-XC 0.5 S 9798692-Measures generation by turbine I(main) 9798693-Measures generation by turbine I(control) 9798694- Measures generation by turbine II(main) 9798695- Measures generation by turbine II(control) 9798696- Measures generation by turbine III (main) 9798697- Measures generation by turbine III(control) 9798698- Measures generation by turbine IV (main) 9798699- Measures generation by turbine IV(control) All meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market. They have an accuracy class of Class 005 indicating an accuracy range of 0.5%.
QA/QC procedures to be applied	Meter readings will be cross checked with the PMUM/MFRC data obtained from the screen shots of the MFRAC System.

Purpose of data	Data will be used to calculate net electricity supplied to the grid.
Calculation method	Direct continuous measurement
Comments	-

Data / Parameter	$EG_{PP\text{-}export, y}$
Data unit	MWh
Description	Quantity of electricity exported by the power plant to the grid, in year y
Source of data	The Primary source of data will be the Main TEIAS meter recorded at the monthly reading protocols, the column related to electricity exported to the Grid.
Description of measurement methods and procedures to be applied	Measurements are to be made by electricity meters. That belong to the grid operator TEIAŞ. The meters are in compliance with the collected data. Data will be used to calculate the net electricity supplied to the grid.
Frequency of monitoring/recording	Recorded continuously, reported monthly on TEIAS Meter Reading Protocols, Reported annually on the VCS Monitoring Report.
Value applied	Will be determined at the monitoring stage.
Monitoring equipment	Calibrated between 2020-2030 EMH-LZQJ-XC 0.5 S 9798692-Measures generation by turbine I(main) 9798693-Measures generation by turbine I(control) 9798694- Measures generation by turbine II(main) 9798695- Measures generation by turbine II(control) 9798696- Measures generation by turbine III (main) 9798697- Measures generation by turbine III(control) 9798698- Measures generation by turbine IV (main)

	9798699- Measures generation by turbine IV(control) All meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market. They have an accuracy class of Class 005 indicating an accuracy range of 0.5%.
QA/QC procedures to be applied	Measurements are carried out in compliance with the communiqué for Metering Devices to be used in the Electricity Market. The minimum accuracy of the meters are Class02, that is to say should be within the ±0.5% (±0.005) range. The monthly reported readings will also be cross checked against the monthly PMUM/MFRC screen shots. The PMUM/MFRC data of electricity sales will also be a proof for quality and reliability of data.
Purpose of data	Data will be used to calculate net electricity supplied to the grid.
Calculation method	Direct continuous measurement
Comments	-

Data / Parameter	$EG_{PP\text{-}net,\ y}$
Data unit	MWh
Description	Quantity of the net electricity supplied to the grid by the power plant, in year y
Source of data	The Primary source of data will be the Main TEIAS meter recorded at the monthly reading protocols, the column related to electricity exported to the Grid.
Description of measurement methods and procedures to be applied	Measurements are to be made by electricity meters. That belong to the grid operator TEIAŞ. The meters are in compliance with the collected data. Data will be used to calculate the net electricity supplied to the grid.
Frequency of monitoring/recording	Recorded continuously, reported monthly on TEIAS Meter Reading Protocols, Reported annually on the VCS Monitoring Report.
Value applied	Will be determined at the monitoring stage.
Monitoring equipment	Calibrated between 2020-2030 EMH-LZQJ-XC

	0.5 S 9798692-Measures generation by turbine I(main) 9798693-Measures generation by turbine I(control) 9798694- Measures generation by turbine II(main) 9798695- Measures generation by turbine II(control) 9798696- Measures generation by turbine III (main) 9798697- Measures generation by turbine III(control) 9798698- Measures generation by turbine IV (main) 9798699- Measures generation by turbine IV(control) All meters are in compliance with the communiqué for Metering Devices to be used in the Electricity Market. They have an accuracy class of Class 005 indicating an accuracy range of 0.5%.
QA/QC procedures to be applied	Measurements are carried out in compliance with the communiqué for Metering Devices to be used in the Electricity Market. The minimum accuracy of the meters are Class05, that is to say should be within the ±0.5% (±0.005) range. The monthly reported readings will also be cross checked against the monthly PMUM/MFRC screen shots. The PMUM/MFRC data of electricity sales will also be a proof for quality and reliability of data.
Purpose of data	Data will be used to calculate emission reduction calculations.
Calculation method	$EG_{PP\text{-}net,\ y} = EG_{PP\text{-}export,\ y} - EG_{PP\text{-}import,\ y}$
Comments	-

5.3 Monitoring Plan

Objectives of the monitoring program

The Monitoring plan is developed to ensure that the Project Activity is well organized from the start in terms of the collection and archival of complete and reliable data that is needed to ensure reliable and accurate measurements of actual emission reductions.

Data to be monitored

Given that the emission factor is calculated on an ex-ante basis, the first data to be monitored is the electricity net supplied to the grid. This parameter is obtained indirectly as a subtraction of electricity imported from electricity exported to the grid.

The second data to be monitored is the installed capacity of the Project Activity. Using the SCADA system installed capacity will be measured automatically.

The third data to be monitored is the reservoir area of the Project Activity. The reservoir area corresponding to maximum operational level has been determined as a certain value according to the topographical maps. And a correlation graphic that exhibits the relationship between the water depth, reservoir area and the volume of the reservoir is plotted against a graphic. In order to make verification of the reservoir area, the monthly maximum water depth recordings will be taken and the corresponding reservoir area will be determined using the same graphic, Presented in Annex 3.

Monitoring procedures

The monitoring will be conducted by the Verified Emission Reduction (VER) Monitoring Team. The VER Team Members, and their position and duties for the monitoring is outlined in the following table (Table 9):

Table 10:Responsibilities of VER Team

Position	Responsibility
Alkumru HPP Manager	Day to day operation of the Alkumru HPP, Compliance of the project activity with the host country rules and regulations Coordination of the data collection and recording for the VCS monitoring report.
Chief Electrical Engineer	Day to day follow up of electrical equipment Recording and monitoring of the electricity generation data
Accounts Manager	Data keeping for power sales Keeping the track record of PMUM/MFRC data
Chief Mechanical Engineer	Day to day operation of the power plant Keeping records of malfunctions and repairs
Carbon Consultant	Emission reduction calculations Scripting of the periodic monitoring report Follow up of the verification process

The power generation meter readings are performed by using the main metering devices and the back-up metering devices that are used for accuracy checks only. Data from metering devices will be recorded by TEİAŞ on monthly agreed protocols and will form the basis for invoicing. In addition to the readings of the three metering devices, generation data of the Alkumru HPP can be cross checked, via the TEİAŞ – PMUM web site (http://pmum.teias.gov.tr) which is accessible by a password available to the electricity generation companies. The monthly screen shot print outs of the PMUM data will be available to the verifying DOE during the verification process for

cross checking. Electricity generation data at the Market Financial Reconciliation Centre (MFRC/PMUM) web page will exhibit the net electricity generated less transmission loss, to be able to produce comparable numbers, the figures taken from PMUM web site needs to be multiplied by the transmission loss factor of the grid.

The internal consumption data will be recorded by one TEDAS meter, and a meter that belongs to the project owner, The difference between this two gives the net internal consumption value which is than used to determine the net amount of electricity supplied to the grid. The internal consumption will be recorded this way until the commissioning of the 4th turbine that will be constructed to utilize the energy of the water discharged to support life in the river. As soon as the construction site will be removed the internal consumption will be recorded by two of the meters that measure the electricity export.

Monitoring equipment

Electricity meters

The main and back-up electricity meters are bi-directional for quantifying the electricity delivered by the Project Activity to the grid.The meters are be in compliance with the standards of the Turkish Standards Institute and will have obtained a "Type and System Approval" certificate from the Ministry of Trade and Industry. In case there are modifications to the standards, the modified standard shall be valid; and in casea valid standard is cancelled or abolished, the new standard shall be valid. The standards that will be used are TS-620 EN 60044-1 and TS718 IEC60044.2 for main and back-up meters, respectively. The sensitivity of the main and secondary meters are CI = 0.2 for active and reactive energy. The meters shall be factory calibrated by the manufacturer before installation. Records of the meter (type, made, model and calibration documentation) will be retained in the quality control system.

Data collecting and recording

*The net electricity generation by the project activity.*Based on the baseline scenario presented above, this amount of electricity would have been produced by the Turkish NationalGrid.

The electricity produced will be sold to TEİAŞ. Therefore, TEİAŞ measures the electricity produced by three main meters and three Back-up meters

A.Main Electricity Meters(calibrated between 2010-2020):

a.Unit 1 Main Meter: ELSTER A 1500: Serial Number: 00419607

b.Unit 2 Main Meter: ELSTER A 1500: Serial Number: 00419609

c.Unit 3 Main Meter: ELSTER A 1500: Serial Number: 00419611

d. Unit 4 Main Meter: ELSTER A 1500: Serial Number: 00480673

B.Back-up Electricity Meters:(calibrated between 2010-2020):

a.Unit 1 Back-up Meter: ELSTER A 1500: Serial Number: 00419608

b.Unit 2 Back-up Meter: ELSTER A 1500: Serial Number: 00419610

c.Unit 3 Back-up Meter: ELSTER A 1500: Serial Number: 00419612

d. Unit 4 Back-up Meter: ELSTER A 1500: Serial Number: 00480672

C. Electricity Meters dedicated to follow up internal consumption only:

a.Unit 1 Internal Consumption Meter: ELSTER A 1500: Serial Number: 00401585

b.Unit 3Internal Consumption Meter: ELSTER A 1500: Serial Number: 00401584

c.Unit 4Internal Consumption Meter: ELSTER A 1500: Serial Number: 00401587

A.Main Electricity Meters (calibrated between 2020-2030)

a.Unit 1 Main Meter: EMH LZQJ-XC Serial Number: 9798692

b.Unit 2 Main Meter: EMH LZQJ-XC: Serial Number:9798694

c.Unit 3 Main Meter: EMH LZQJ-XC: Serial Number: 9798696

d. Unit 4 Main Meter: EMH LZQJ-XC: Serial Number: 9798698

B.Back-up Electricity Meters:(calibrated between 2010-2020):

a.Unit 1 Back-up Meter: EMH LZQJ-XC: Serial Number: 9798693

b.Unit 2 Back-up Meter: EMH LZQJ-XC: Serial Number:9798695

c.Unit 3 Back-up Meter: EMH LZQJ-XC: Serial Number: 9798697

d. Unit 4 Back-up Meter: EMH LZQJ-XC: Serial Number: 9798699

These meters are placed at the Alkumru powerhouse where the power plant gets connected to the Turkish national grid. Those meters provide official data, which are read and recorded monthly by TEİAŞ officers for invoicing. TEİAŞ also conducts the calibration and maintenance of these meters and thus, ensures the accuracy and quality of the measurements. The quality standards that the meters need to comply is “The ICE/TSE 62053-22: Electricity metering equipment (a.c) – Particular requirements - Part 22: Static meters for active energy (Classes 0,2 S and 0,5 S)” The calibration of the meters is done and the meters will be checked continuously if there is a difference of 0.2 % in the readings of the main and the auxiliary meters, the calibration is repeated. At the end of each month, the monthly generation is read remotely and e-mailed to the project owner. In case of failure of the main meter, the control meter is used to determine the invoiced generation amount. These readings can be on site as well as remotely by the systems that will be put in place

by the grid operator TEIAS. The net electricity produced ($EG_{PP\text{-}net,y}$) in year y is calculated by subtracting the total electricity consumed by the hydroelectric power plant ($EG_{PP\text{-}selfconsumption,y}$) , from the gross electricity generation ($EG_{PP\text{-}gross,y}$) . After obtaining the net electricity production value, the emission reductions will be calculated by multiplying the net electricity with the Ex-ante Combined Margin Emission Factor calculated above.

Measuring Installed Capacity

By means of the SCADA system established in the plant all kinds of technical parameters related with turbines and generators including installed capacity will be measured and stored in the system on real time basis. The installed capacity of the plant will be measured from SCADA once a year while the plant is operated with full load and the related data will be stored as per the monitoring program.

Measuring Reservoir Area

The reservoir area corresponding to maximum operational level has been determined as a certain value according to the topographical maps. And a correlation graphic that exhibits the relationship between the water depth, reservoir area and the volume of the reservoir is plotted against a graphic. In order to make verification of the reservoir area, the monthly maximum water depth recordings will be taken and the corresponding reservoir area will be determined using the same graphic, Presented in Annex 3.

Data management

At the end of each month, electricity supplied to the grid will be entered into an electronic spread sheet. The data to be measured for installed capacity and reservoir area will be entered into an electronic spread sheet at the end of each year. The electronic files will be backed up on both hard drives and on a Compact Disc (CD).

Quality Control and Assurance (QC/QA)

All of the main and back-up meters are owned and installed by the grid operator, TEIAS. The Calibrations of the electricity meters are valid for the next 10 years after calibration,

The grid operator's Metering Officer should be notified of any failure of one of the meters. TEIAS is the only one entity, authorized to deal with fixing, calibrating, or changing the meters, which will be done either by the grid operator or by a company authorized by the grid operator. The Project Owner will keep electricity sale and purchase records, to which the recorded data will be compared.

All written documentation such as maps, drawings, the EIA and the Feasibility study, will be stored and will be made available to the verifier so that the reliability of the information may be checked.

All data records will be kept for at least 2 years from the last project credited year.

APPENDIX1 : LEGAL FRAMEWORK OF THE PROJECT

Turkish Environmental Legislation

The Environmental Law (No. 2872), which was published in Turkish Official Gazette No. 18132 dated August 11, 1983 and revised in Turkish Official Gazette No. 26167 dated May 13, 2006 (Law No. 5491) provides the legislative framework for the regulation of industries and their potential impact on the environment. Industrial projects are subject to varying levels of review that begin while projects are in the development and pre-operation phases. Additional regulations apply to facilities once they are in operation.

The Environmental Law authorized the promulgation of a number of regulations. Those that pertain to development and operation of renewable energy projects are the following:

- Environmental Impact Assessment Regulation, Official Gazette No. 26939 dated July 17, 2008.
- Water Pollution Control Regulation, Official Gazette No. 25687 dated December 31, 2004 and revised in Official Gazette No. 26786 dated February 13,2008;
- Regulation on Construction of Cesspits where there is no Wastewater Collection System, Official Gazette No. 13783 dated March 13,1971;
- Hazardous Chemicals Regulation, Official Gazette No.21634 dated July 11, 1993 and revised in Official Gazette No. 27092 dated December 26,2008;
- Regulation on General Principles of Waste Management, Official Gazette No. 26927 dated July 5, 2008;
- Hazardous Wastes Control Regulation, Official Gazette No. 25755 dated March 14,2005;
- Waste Oil Control Regulation, Official Gazette No. 26952 dated July 30, 2008 and revised Official Gazette No. 27304 dated July 31,2009;
- Vegetative Waste Oil Control Regulation, Official Gazette No. 25791 dated April 19, 2005; and revised Official Gazette No. 27305 dated July 31,2009
- Solid Waste Control Regulation, Official Gazette No. 20814 dated March 14, 1991 and revised in Official Gazette No. 25777 dated April 5,2005;
- Medical Waste Control Regulation, Official Gazette No. 25883 dated July 22,2005;
- Environmental Audit Regulation, Official Gazette No. 27061 dated November 21,2008;
- Packaging Waste Control Regulation, Official Gazette No. 26562 dated June 24, 2007 and revised in Official Gazette No. 27046 dated November 6, 2008;and
- Waste Batteries and Accumulators Control Regulation, Official Gazette No. 25569 dated August 31, 2004 and revised in Official Gazette No. 25744 dated March 03,2005;

- The Excavation, Construction and Demolition Waste Control Regulation, Official Gazette No. 25406 dated March 18,2004;
- Soil Pollution Control Regulation, Official Gazette No. 25831 dated May 31,2005;Regulation Related to Workplace Opening and Operation Permits, Official Gazette No. 25902 dated August 10, 2005 and revised in Official Gazette No. 26492 dated April 13,2007;
- Industrial Air Pollution Control Regulation, Official Gazette No.27277 dated July 3,2009
- Air Quality Assessment and Management Regulation, Official Gazette No. 26898 dated June 6, 2008 and revised in Official Gazette No. 27219 and dated May 5,2009;
- Air Pollution Control Regulation For Heating Sources, Official Gazette No. 25699 dated January 13, 2005 and revised in Official Gazette No. 27134 dated February 07,2009;
- Exhaust Gases Emission Control Regulation, Official Gazette No. 27190 dated April 04, 2009; and
- Regulation on Protection of Wetlands, Official Gazette No. 25818 dated May 17,2005.
- In addition to the Environmental Law and its associated regulations, there are several other laws that directly or indirectly include environmental review, and thus, are applicable to the proposed project. The project will comply with the 4857 numbered Labour Law and its regulations statedbelow:
- Occupational Health and Safety Statute, Official Gazette No. 14765 dated April 11,1974;
- Health and Safety Regulation for Construction Works, Official Gazette No. 25325 dated December 23, 2003;
- Regulation on Health and Safety Regarding Temporary Works, Official Gazette No. 25463 dated May 15,2004.

Other regulations that the project will comply with can be listed as follows:

- 5346 numbered Utilization of Renewable Energy Resources for the Purpose of Generating ElectricalEnergy;
- Regulation on Protection and Usage of Agricultural Lands, Official Gazette No. 25766 dated March 25, 2005;
- 2863 numbered Law on Protection of Cultural and Natural Heritage (revised by 5226 numberedLaw);
- 4342 numbered PastureLaw;
- 6831 numbered Forestry Law (amended by 5192 numbered Revision in ForestryLaw);

Regulation on Buildings located on the Disaster Areas, Official Gazette No. 26582 dated July 14, 2007;

APPENDIX2 :EIA AFFIRMATION CERTIFICATE

T.C.
ÇEVRE ve ORMAN BAKANLIĞI
Çevresel Etki Değerlendirmesi ve Planlama Genel Müdürlüğü

Karar Tarihi: 15.10.2008
Karar No : 1417

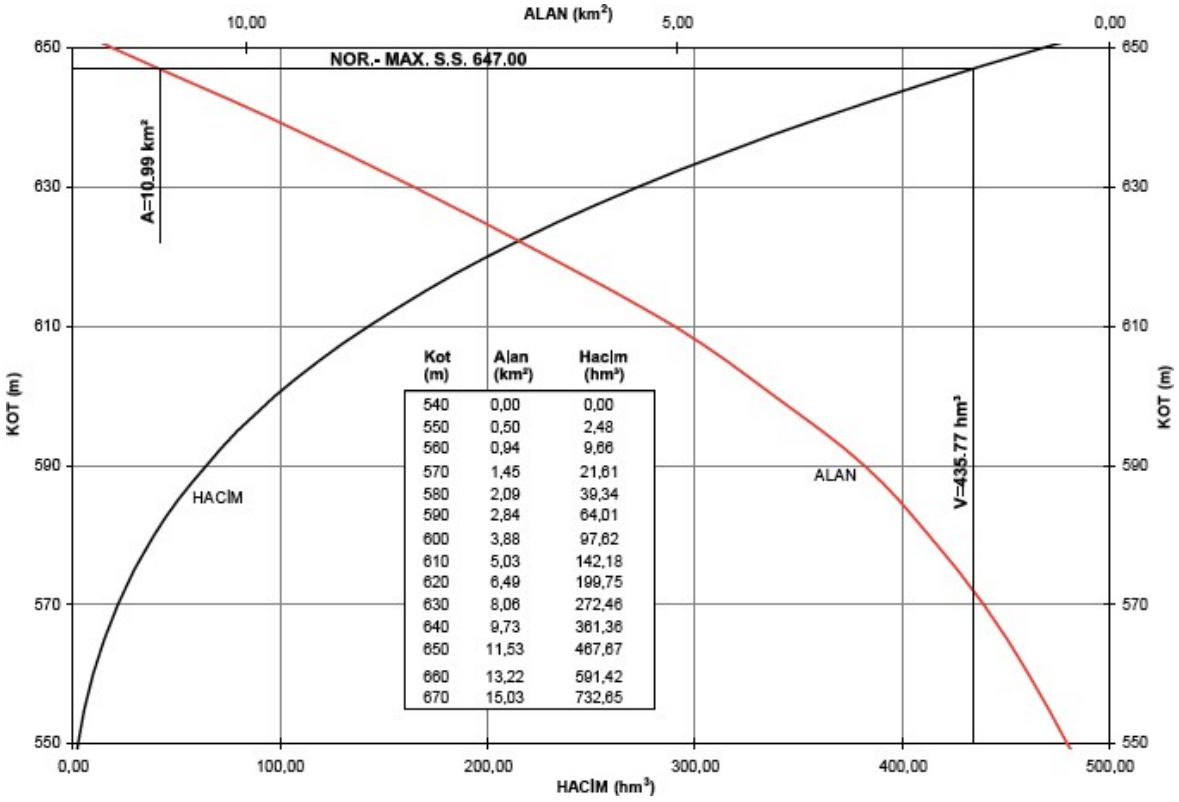
ÇED OLUMLU BELGESİ

16.12.2003 tarih ve 25318 sayılı Resmi Gazete'de yayımlanarak yürürlüğe giren Çevresel Etki Değerlendirmesi Yönetmeliği'nin 14.maddesi gereğince; "Alkumru Barajı, Hidroelektrik Santrali ve Malzeme Ocakları" projesi hakkında "*Çevresel Etki Değerlendirmesi Olumlu Kararı*" verilmiştir.

Fevzi İŞBİLİR
Bakan a.
Genel Müdür V.

Proje Sahibi : Limak Hidroelektrik Santral Yatırımları A.Ş.
Projenin Yeri : Siirt İli, Aydınlar İlçesi, Taşbalta Köyü Mevkii, Botan Çayı

APPENDIX3 :VOLUME VS AREA CURVE



Kot (m)	Alan (km²)	Hacim (hm³)
540	0,00	0,00
550	0,50	2,48
560	0,94	9,66
570	1,45	21,61
580	2,09	39,34
590	2,84	64,01
600	3,88	97,62
610	5,03	142,18
620	6,49	199,75
630	8,06	272,46
640	9,73	361,36
650	11,53	467,67
660	13,22	591,42
670	15,03	732,65