



**Monitoring report form for CDM project activity
(Version 08.0)**

Complete this form in accordance with the instructions attached at the end of this form.

MONITORING REPORT

Title of the project activity	Chacabuquito Hydroelectric Power Project		
UNFCCC reference number of the project activity	1052		
Version number of the PDD applicable to this monitoring report	05		
Version number of this monitoring report	1		
Completion date of this monitoring report	11/05/2021		
Monitoring period number	03		
Duration of this monitoring period	01/01/2014 – 03/11/2018		
Monitoring report number for this monitoring period	N/A		
Project participants	Chile: Colbun S.A.		
Host Party	Chile		
Applied methodologies and standardized baselines	AM0026 (v.3): "Methodology for zero-emissions grid-connected electricity generation from renewable sources in Chile or in countries with merit order based dispatch grid"		
Sectoral scopes	Sectoral Scope 1: Energy industries (renewable - / non-renewable sources).		
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013 until 31 December 2020	Amount achieved from 1 January 2021
	-	227,987 tCO ₂ e	N/A
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	400,592 tCO ₂ e		

SECTION A. Description of project activity

A.1. General description of project activity

>>The Chacabuquito Hydroelectric Power Project consists of a run-of-river power plant of 30 MW installed nameplate capacity that utilizes the waters of the Aconcagua river. It produces an average net annual generation of 170 GWh (with a 0.65 plant load factor, which is obtained through the division of net annual generation by the power plant installed capacity and total amount of hours of the year). The project connects to the 5th Region's at a 110 KV sub-system within the National Interconnected System (SEN¹) and energy is delivered to industrial and residential consumers in the area. In addition, it is important to note that the plant does not consider a dam.

This plant is in cascade with three other upstream existent plants, Los Quilos, Aconcagua and Hornitos, which have been successfully operated since 1939, 1994 and 2008 respectively. The project uses well-proven technologies for run-of-river power generation. The design consists of a diversion weir, a system of channels and tunnels, a penstock and a powerhouse with four turbine-generator kits. In addition, the project construction costs are about US\$ 37.0 million including contingencies but without financing charges. Of this, US\$ 34.0 million corresponds to the cost associated with the hydroelectric plant and related equipment and US\$ 3.0 million is required for the expansion of the current transmission lines that connects Los Quilos and Aconcagua plants.

This project contributes to sustainable development in Chile through:

- Use of local renewable energy resources (small hydro) to displace coal and natural gas thermal power generation in the SEN.
- Increased commercial activity through clean and renewable source of power.
- Employment generation in the 5th Region where the project is located.

The Chacabuquito Hydroelectric Power Project started its operations on July 1st, 2002 and began its construction on February 28th, 2001.

The total amount of emission reductions during this monitoring period is 227,987 tonnes of CO₂e.

Table A1. Implementation of the Project

Date	Key events
28/02/2001	The construction activities started
01/07/2002	Commissioning date
22/07/2002	Start of commercial operation
07/07/2007	Registration date
01/07/2002	Starting date of the first crediting period
04/11/2011	Starting date of the second crediting period

A.2. Location of project activity

>> Los Andes, 5th Region of Valparaíso, Chile.

Los Andes is located 100 km north from Santiago (capital of the country). The hydro power plant is located in a small valley surrounded by mountains (Aconcagua Valley). The Chacabuquito plant is in cascade with three existing upstream hydropower plants (Hornitos, Aconcagua and Los Quilos). The location of the project activity is illustrated in Figure A1.

¹ In November of 2017 the Central Interconnected System (SIC) and Grand North Interconnected System (SING) were interconnected, forming the new National Interconnected System (SEN).

Project coordinates are as follows:

32° 51' 12.35" S – 70° 30' 22.21" W Latitude: -32.853430555555555
 Longitude: -70.506169444444444



Figure A1. Project activity geographical location

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Chile (Host Party)	Colbun S.A	No

A.4. References to applied methodologies and standardized baselines

>>The applied methodology is: AM0026 (v.3): “Methodology for zero-emissions grid-connected electricity generation from renewable sources in Chile or in countries with merit order based dispatch grid” .

http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_IY3QJ5DOHLBPC0514FDE44V5MXIGVB

In order to estimate the emission factor for the grid, AM00026 (v.3) refers to the “Tool to calculate the emission factor for an electricity system (v 07).

<https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf>

A.5. Crediting period type and duration

>>Type: Renewable

Second crediting period: 04/11/11 – 03/11/18 (7 years).

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

>> The installed technology for the project activity implementation consists of a diversion weir, a system of canals (approximately 11 km) and tunnels (approximately 3 km), a pressure penstock, water fall of 137 m (134.58 m net water fall), a powerhouse and a high voltage line, and upgrade of existing transmission system. HGV has demonstrated a successful experience of construction, setting up and operating similar plants. The following Figure B2 shows the project design.

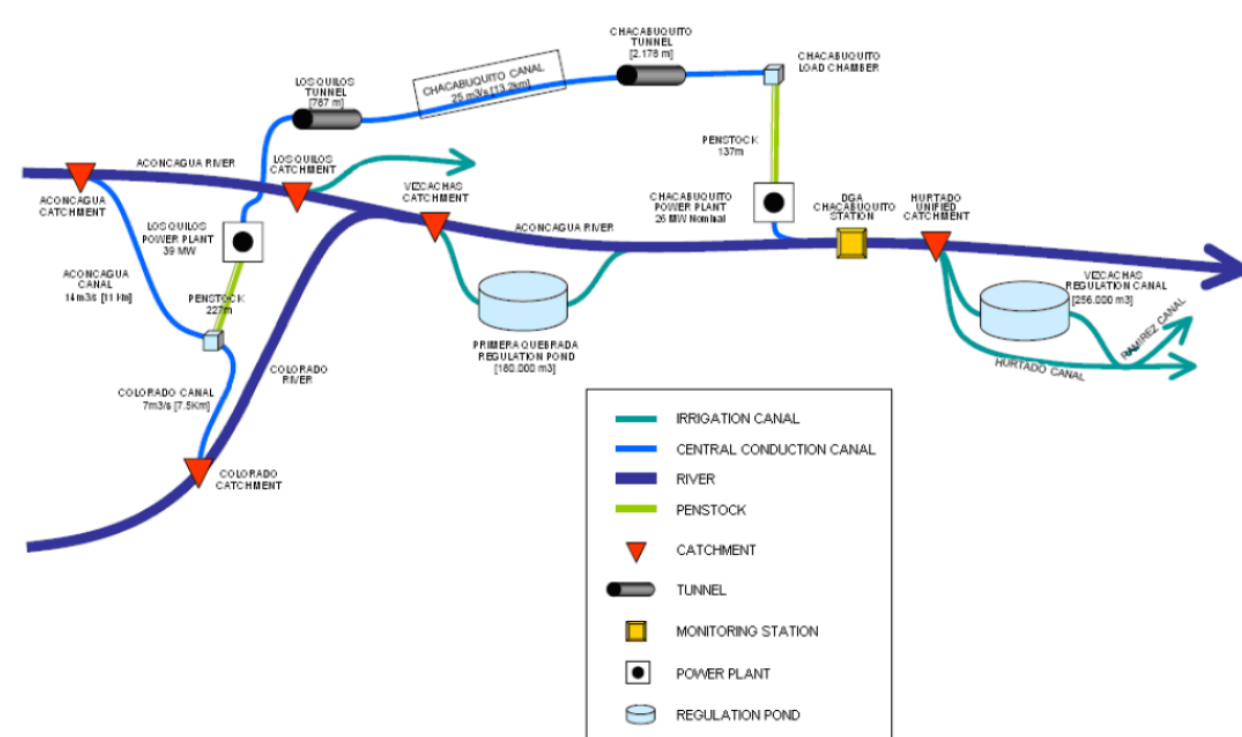


Figure B1. Diagram of the project activity.

Canals, tunnels and the penstock will take the water flow from the Los Quilos plant through a series of canals and tunnels over a distance of approximately 10 km and 137 meter of water fall (134.58 meter net head penstock). From the Chacabuco power house, the water used for energy generation will be discharged back to the Aconcagua River in order to fulfil all authority requirements regarding water flow.

Relevant dates and implementation status

The Chacabuquito Hydroelectric Power Project started its operations on July 1st, 2002 and began its construction around one year before.

During this monitoring period, Chacabuquito power plant has continuously operated with the following exceptions:

Table B1. Special events occurred during monitoring period

Year 2014					
U1	14:14	27/01/2014	15:20	27/01/2014	Low water level (scheduled)
U1	10:48	30/01/2014	13:02	30/01/2014	Scheduled Maintenance
U1	9:06	30/01/2014	10:48	30/01/2014	Scheduled Maintenance
U2	9:08	30/01/2014	11:31	30/01/2014	Scheduled Maintenance
U3	9:10	30/01/2014	10:40	30/01/2014	Scheduled Maintenance
U4	9:11	30/01/2014	10:47	30/01/2014	Scheduled Maintenance
U1	10:48	20/02/2014	10:56	20/02/2014	Scheduled Maintenance
U1	8:53	20/02/2014	10:55	20/02/2014	Scheduled Maintenance
U2	8:54	20/02/2014	10:53	20/02/2014	Scheduled Maintenance
U3	8:55	20/02/2014	10:14	20/02/2014	Scheduled Maintenance
U4	8:56	20/02/2014	10:17	20/02/2014	Scheduled Maintenance
U4	10:05	26/02/2014	20:27	28/02/2014	Low water level (scheduled)
U1	14:14	27/01/2014	15:20	27/01/2014	Low water level (scheduled)
U1	10:48	30/01/2014	13:02	30/01/2014	Scheduled Maintenance
U1	9:06	30/01/2014	10:48	30/01/2014	Scheduled Maintenance
U2	9:08	30/01/2014	11:31	30/01/2014	Scheduled Maintenance
U3	9:10	30/01/2014	10:40	30/01/2014	Scheduled Maintenance
U4	9:11	30/01/2014	10:47	30/01/2014	Scheduled Maintenance
U1	10:48	20/02/2014	10:56	20/02/2014	Scheduled Maintenance
U1	8:53	20/02/2014	10:55	20/02/2014	Scheduled Maintenance
U2	8:54	20/02/2014	10:53	20/02/2014	Scheduled Maintenance
U3	8:55	20/02/2014	10:14	20/02/2014	Scheduled Maintenance
U4	8:56	20/02/2014	10:17	20/02/2014	Scheduled Maintenance
U4	10:05	26/02/2014	20:27	28/02/2014	Low water level (scheduled)
U1	6:08	04/03/2014	9:04	19/03/2014	Low water level (scheduled)
U1	10:23	19/03/2014	7:11	28/03/2014	Low water level (scheduled)
U2	7:14	28/03/2014	7:40	31/03/2014	Low water level (scheduled)
U3	7:42	31/03/2014	23:59	31/03/2014	Low water level (scheduled)
U1	9:04	19/03/2014	10:23	19/03/2014	Scheduled Maintenance
U2	9:02	19/03/2014	10:39	19/03/2014	Scheduled Maintenance
U3	9:03	19/03/2014	10:58	19/03/2014	Scheduled Maintenance
U4	9:04	19/03/2014	10:23	19/03/2014	Scheduled Maintenance
U3	0:00	01/04/2014	9:41	03/04/2014	Low water level
U1	9:38	03/04/2014	11:25	03/04/2014	Scheduled Maintenance
U2	9:40	03/04/2014	11:34	03/04/2014	Scheduled Maintenance
U3	9:41	03/04/2014	11:25	03/04/2014	Scheduled Maintenance
U4	9:41	03/04/2014	11:39	03/04/2014	Scheduled Maintenance
U3	11:25	03/04/2014	7:08	04/04/2014	Low water level
U4	7:14	04/04/2014	7:07	07/04/2014	Low water level
U1	12:47	06/04/2014	13:17	06/04/2014	Failure

U2	12:47	06/04/2014	13:19	06/04/2014	Failure
U3	12:47	06/04/2014	13:28	06/04/2014	Failure
U1	7:09	07/04/2014	7:14	11/04/2014	Low water level
U4	7:20	11/04/2014	7:15	14/04/2014	Low water level
U3	7:16	14/04/2014	8:47	15/04/2014	Low water level
U3	8:47	15/04/2014	18:05	15/04/2014	Scheduled Maintenance
U4	18:05	15/04/2014	9:28	16/04/2014	Low water level
U4	9:28	16/04/2014	18:28	16/04/2014	Scheduled Maintenance
U2	18:31	14/04/2014	6:50	18/04/2014	Low water level
U1	2:07	17/04/2014	16:07	20/04/2014	Low water level
U4	14:04	18/04/2014	9:53	23/04/2014	Low water level
U1	5:51	21/04/2014	5:56	28/04/2014	Low water level
U2	9:55	23/04/2014	18:38	23/04/2014	Scheduled Maintenance
U3	6:40	25/04/2014	23:59	30/04/2014	Low water level
U4	6:02	28/04/2014	23:59	30/04/2014	Low water level
U3	0:00	01/05/2014	15:23	08/05/2014	Scheduled Maintenance
U4	0:00	01/05/2014	14:42	01/05/2014	Low water level
U1	1:06	02/05/2014	9:00	22/05/2014	Low water level
U4	15:25	08/05/2014	5:56	12/05/2014	Scheduled Maintenance
U3	5:58	08/05/2014	9:00	22/05/2014	Scheduled Maintenance
U4	7:38	22/05/2014	9:00	22/05/2014	Low water level
U1	9:00	22/05/2014	11:25	22/05/2014	Scheduled Maintenance
U2	9:07	22/05/2014	11:25	22/05/2014	Scheduled Maintenance
U3	9:00	22/05/2014	11:25	22/05/2014	Scheduled Maintenance
U4	9:00	22/05/2014	11:34	22/05/2014	Scheduled Maintenance
U1	11:25	22/05/2014	20:37	30/05/2014	Low water level
U3	11:25	22/05/2014	23:59	31/05/2014	Low water level
U4	14:54	22/05/2014	2:53	25/05/2014	Low water level
U4	11:34	27/05/2014	17:10	27/05/2014	Low water level
U4	8:20	28/05/2014	23:59	31/05/2014	Low water level
U1	2:02	31/05/2014	23:59	31/05/2014	Low water level
U1	0:00	01/06/2014	9:29	10/06/2014	Failure
U3	0:00	01/06/2014	9:29	10/06/2014	Low water level
U4	0:00	01/06/2014	20:44	02/06/2014	Low water level
U4	2:55	03/06/2014	20:20	09/06/2014	Low water level
U1	9:29	10/06/2014	11:19	10/06/2014	Scheduled Maintenance
U2	9:29	10/06/2014	11:19	10/06/2014	Scheduled Maintenance
U3	9:29	10/06/2014	11:19	10/06/2014	Scheduled Maintenance
U4	9:27	10/06/2014	11:19	10/06/2014	Scheduled Maintenance
U1	11:19	10/06/2014	20:28	10/06/2014	Low water level
U3	11:19	10/06/2014	7:31	30/06/2014	Low water level
U4	11:19	10/06/2014	15:17	14/06/2014	Low water level
U1	11:55	13/06/2014	17:22	28/06/2014	Low water level
U4	9:02	28/06/2014	20:15	29/06/2014	Low water level
U1	8:35	29/06/2014	7:31	30/06/2014	Low water level
U2	6:58	30/06/2014	7:31	30/06/2014	Low water level
U1	7:31	30/06/2014	23:59	30/06/2014	Failure
U2	7:31	30/06/2014	23:59	30/06/2014	Failure

U3	7:31	30/06/2014	23:59	30/06/2014	Failure
U4	7:31	30/06/2014	23:59	30/06/2014	Failure
U1	0:00	01/07/2014	20:56	14/07/2014	Failure
U2	0:00	01/07/2014	20:32	14/07/2014	Failure
U3	0:00	01/07/2014	19:58	14/07/2014	Failure
U4	0:00	01/07/2014	21:42	14/07/2014	Failure
U1	21:10	14/07/2014	23:59	31/07/2014	Low water level
U2	20:52	14/07/2014	20:53	28/07/2014	Low water level
U4	3:02	15/07/2014	20:43	15/07/2014	Low water level
U4	2:57	16/07/2014	13:50	16/07/2014	Low water level
U4	4:43	17/07/2014	14:10	17/07/2014	Low water level
U4	5:01	18/07/2014	11:11	18/07/2014	Low water level
U4	8:42	22/07/2014	0:45	24/07/2014	Low water level
U4	5:24	24/07/2014	16:15	24/07/2014	Low water level
U4	2:10	25/07/2014	19:28	25/07/2014	Low water level
U4	3:03	26/07/2014	23:59	31/07/2014	Low water level
U3	10:14	30/07/2014	21:08	30/07/2014	Low water level
U1	0:00	01/08/2014	19:25	08/08/2014	Low water level
U4	0:00	01/08/2014	20:17	03/08/2014	Low water level
U3	21:32	01/08/2014	9:39	14/08/2014	Low water level
U4	5:20	04/08/2014	15:45	04/08/2014	Low water level
U4	21:14	05/08/2014	9:20	06/08/2014	Low water level
U4	5:56	07/08/2014	20:35	07/08/2014	Low water level
U2	7:32	08/08/2014	8:54	10/08/2014	Low water level
U1	12:19	09/08/2014	8:25	18/08/2014	Low water level
U2	12:14	11/08/2014	21:08	13/08/2014	Low water level
U3	9:39	14/08/2014	11:18	14/08/2014	Scheduled Maintenance
U4	11:20	14/08/2014	23:59	31/08/2014	Low water level
U2	11:22	15/08/2014	20:24	15/08/2014	Low water level
U1	8:25	18/08/2014	13:07	28/08/2014	Scheduled Maintenance
U2	13:13	28/08/2014	23:59	31/08/2014	Low water level
U3	2:01	29/08/2014	13:31	29/08/2014	Low water level
U3	6:15	31/08/2014	18:47	31/08/2014	Low water level
U2	10:23	01/09/2014	15:40	09/09/2014	Scheduled Maintenance
U3	7:40	04/09/2014	11:10	04/09/2014	Low water level
U3	8:22	05/09/2014	11:15	05/09/2014	Low water level
U3	14:35	07/09/2014	18:05	07/09/2014	Low water level
U3	9:43	09/09/2014	23:59	30/09/2014	Low water level
U4	0:00	01/09/2014	23:59	30/09/2014	Low water level
U4	0:00	01/10/2014	12:11	05/10/2014	Scheduled Maintenance
U3	0:00	01/10/2014	1:44	03/10/2014	Low water level
U3	12:08	05/10/2014	11:57	06/10/2014	Scheduled Maintenance
U4	9:42	06/10/2014	22:05	06/10/2014	Low water level
U3	11:57	06/10/2014	20:27	07/10/2014	Scheduled Maintenance
U4	20:32	07/10/2014	9:25	08/10/2014	Scheduled Maintenance
U4	9:25	08/10/2014	16:47	09/10/2014	Scheduled Maintenance
U2	17:23	08/10/2014	16:59	10/10/2014	Low water level
U3	16:47	10/10/2014	21:08	10/10/2014	Failure

U2	21:13	10/10/2014	2:09	20/10/2014	Low water level
U4	6:30	14/10/2014	17:48	21/10/2014	Low water level
U1	17:45	21/10/2014	20:16	21/10/2014	Failure
U4	20:50	21/10/2014	0:31	24/10/2014	Low water level
U4	8:02	03/11/2014	12:34	08/11/2014	Low water level
U2	9:39	17/11/2014	19:01	18/11/2014	Scheduled Maintenance
U1	9:36	27/11/2014	15:09	28/11/2014	Scheduled Maintenance
U4	22:04	30/11/2014	23:59	30/11/2014	Low water level
U4	0:00	01/12/2014	14:29	05/12/2014	Low water level
U1	21:00	17/12/2014	9:43	19/12/2014	Low water level
U4	21:19	19/12/2014	9:58	23/12/2014	Low water level
U3	10:02	23/12/2014	12:32	23/12/2014	Scheduled Maintenance
U1	12:28	23/12/2014	16:35	23/12/2014	Failure
U2	12:30	23/12/2014	14:45	23/12/2014	Failure
U3	12:32	23/12/2014	14:39	23/12/2014	Failure
U4	12:32	23/12/2014	14:39	23/12/2014	Failure
U4	14:39	23/12/2014	23:59	31/12/2014	Low water level
Year 2015					
U3	10:33	27/01/2015	11:35	27/01/2015	Scheduled Maintenance
U2	9:10	16/02/2015	12:06	16/02/2015	Failure
U1	9:10	16/02/2015	11:25	16/02/2015	Failure
U2	10:20	26/02/2015	12:45	26/02/2015	Scheduled Maintenance
U2	10:33	11/03/2015	11:09	11/03/2015	Scheduled Maintenance
U2	3:22	17/04/2015	3:43	17/04/2015	Failure
U4	3:22	17/04/2015	3:43	17/04/2015	Failure
U1	15:06	06/05/2015	17:02	06/05/2015	Scheduled Maintenance
U2	15:06	06/05/2015	17:02	06/05/2015	Scheduled Maintenance
U3	15:06	06/05/2015	17:02	06/05/2015	Scheduled Maintenance
U4	15:06	06/05/2015	17:02	06/05/2015	Scheduled Maintenance
U4	7:25	22/06/2015	15:10	22/06/2015	Scheduled Maintenance
U1	9:58	25/06/2015	19:00	26/06/2015	Scheduled Maintenance
U2	9:58	25/06/2015	19:00	26/06/2015	Scheduled Maintenance
U3	9:58	25/06/2015	19:00	26/06/2015	Scheduled Maintenance
U4	9:58	25/06/2015	19:00	26/06/2015	Scheduled Maintenance
U1	6:53	06/07/2015	13:40	15/07/2015	Scheduled Maintenance
U3	6:53	06/07/2015	19:53	15/07/2015	Scheduled Maintenance
U2	10:30	20/07/2015	12:20	29/07/2015	Scheduled Maintenance
U3	23:41	20/07/2015	20:45	21/07/2015	Failure
U1	2:30	10/08/2015	16:40	21/08/2015	Scheduled Maintenance
U2	2:30	10/08/2015	16:40	21/08/2015	Scheduled Maintenance
U3	2:30	10/08/2015	16:40	21/08/2015	Scheduled Maintenance
U4	2:30	10/08/2015	16:40	21/08/2015	Scheduled Maintenance
U1	19:04	03/09/2015	21:00	03/09/2015	
U3	10:12	24/09/2015	17:58	24/09/2015	Scheduled Maintenance
U1	15:06	01/10/2015	17:53	1/10/2015	Scheduled Maintenance
U2	15:06	01/10/2015	17:53	1/10/2015	Scheduled Maintenance
U3	15:06	01/10/2015	17:53	1/10/2015	Scheduled Maintenance
U4	15:06	01/10/2015	17:53	1/10/2015	Scheduled Maintenance

U4	9:15	01/10/2015	21:20	01/10/2015	Scheduled Maintenance
U3	10:11	04/10/2015	20:15	04/10/2015	Failure
U3	10:12	08/10/2015	16:52	08/10/2015	Scheduled Maintenance
U2	14:32	16/10/2015	18:00	20/10/2015	Failure
U3	14:32	16/10/2015	18:00	20/10/2015	Failure
U4	14:32	16/10/2015	18:00	20/10/2015	Failure
U1	0:00	16/10/2015	18:00	20/10/2015	Failure
U1	9:02	13/10/2015	23:59	16/10/2015	Scheduled Maintenance
U3	16:28	09/10/2015	0:25	10/10/2015	Failure
U3	1:50	10/10/2015	2:07	10/10/2015	Failure
U3	7:38	15/10/2015	22:49	15/10/2015	Failure
U1	10:08	28/12/2015	18:49	28/12/2015	Scheduled Maintenance
U2	10:08	28/12/2015	18:49	28/12/2015	Scheduled Maintenance
U3	10:08	28/12/2015	18:49	28/12/2015	Scheduled Maintenance
U4	10:08	28/12/2015	18:49	28/12/2015	Scheduled Maintenance
Year 2016					
U1	10:01	26/01/2016	1:00	29/01/2016	Scheduled Maintenance
U2	10:01	26/01/2016	1:00	29/01/2016	Scheduled Maintenance
U3	10:01	26/01/2016	1:00	29/01/2016	Scheduled Maintenance
U4	10:01	26/01/2016	1:00	29/01/2016	Scheduled Maintenance
U1	14:06	13/04/2016	11:17	14/04/2016	Scheduled Maintenance
U2	14:06	13/04/2016	11:17	14/04/2016	Scheduled Maintenance
U3	14:06	13/04/2016	11:17	14/04/2016	Scheduled Maintenance
U4	14:06	13/04/2016	11:17	14/04/2016	Scheduled Maintenance
U2	14:22	03/06/2016	15:08	03/06/2016	Failure
U4	14:2	03/06/2016	15:08	03/06/2016	Failure
U4	19:28	09/06/2016	22:17	21/06/2016	Scheduled Maintenance
U1	15:00	14/06/2016	17:38	14/06/2016	Scheduled Maintenance
U2	15:00	14/06/2016	17:38	14/06/2016	Scheduled Maintenance
U3	15:00	14/06/2016	17:38	14/06/2016	Scheduled Maintenance
U4	15:00	14/06/2016	17:38	14/06/2016	Scheduled Maintenance
U1	9:45	10/06/2016	14:42	10/06/2016	Scheduled Maintenance
U2	9:45	10/06/2016	14:42	10/06/2016	Scheduled Maintenance
U3	9:45	10/06/2016	14:42	10/06/2016	Scheduled Maintenance
U4	9:45	10/06/2016	14:42	10/06/2016	Scheduled Maintenance
U1	9:55	22/06/2016	16:09	22/06/2016	Scheduled Maintenance
U2	9:55	22/06/2016	16:09	22/06/2016	Scheduled Maintenance
U3	9:55	22/06/2016	16:09	22/06/2016	Scheduled Maintenance
U4	9:55	22/06/2016	16:09	22/06/2016	Scheduled Maintenance
U1	10:38	07/07/2016	19:40	07/07/2016	Failure
U1	10:27	13/07/2016	16:14	13/07/2016	Scheduled Maintenance
U2	10:27	13/07/2016	16:14	13/07/2016	Scheduled Maintenance
U3	10:27	13/07/2016	16:14	13/07/2016	Scheduled Maintenance
U4	10:27	13/07/2016	16:14	13/07/2016	Scheduled Maintenance
U1	14:29	21/07/2016	18:07	21/07/2016	Scheduled Maintenance
U2	14:29	21/07/2016	18:07	21/07/2016	Scheduled Maintenance
U2	14:29	21/07/2016	18:07	21/07/2016	Scheduled Maintenance
U3	14:29	21/07/2016	18:07	21/07/2016	Scheduled Maintenance

U4	7:38	02/08/2016	15:44	02/08/2016	Failure
U1	9:49	05/08/2016	13:31	05/08/2016	Scheduled Maintenance
U1	10:43	10/08/2016	12:31	10/08/2016	Scheduled Maintenance
U2	10:43	10/08/2016	12:31	10/08/2016	Scheduled Maintenance
U3	10:43	10/08/2016	12:31	10/08/2016	Scheduled Maintenance
U4	10:43	10/08/2016	12:31	10/08/2016	Scheduled Maintenance
U1	9:21	18/08/2016	16:36	18/08/2016	Scheduled Maintenance
U2	9:21	18/08/2016	16:36	18/08/2016	Scheduled Maintenance
U3	9:21	18/08/2016	16:36	18/08/2016	Scheduled Maintenance
U4	9:21	18/08/2016	16:36	18/08/2016	Scheduled Maintenance
U1	9:31	25/08/2016	11:51	25/08/2016	Scheduled Maintenance
U1	14:45	6/09/2016	15:46	6/09/2016	Scheduled Maintenance
U2	14:45	6/09/2016	15:46	6/09/2016	Scheduled Maintenance
U3	14:45	6/09/2016	15:46	6/09/2016	Scheduled Maintenance
U4	14:45	6/09/2016	15:46	6/09/2016	Scheduled Maintenance
U1	9:24	07/09/2016	17:32	08/09/2016	Scheduled Maintenance
U2	9:24	07/09/2016	17:32	08/09/2016	Scheduled Maintenance
U3	9:24	07/09/2016	17:32	08/09/2016	Scheduled Maintenance
U4	9:24	07/09/2016	17:32	08/09/2016	Scheduled Maintenance
U4	9:19	23/09/2016	13:05	23/09/2016	Failure
U3	9:47	21/09/2016	8:16	21/09/2016	Scheduled Maintenance
U1	9:47	21/09/2016	13:29	21/09/2016	Scheduled Maintenance
U3	13:26	20/09/2016	14:58	20/09/2016	Failure
U4	16:39	21/09/2016	19:18	21/09/2016	Failure
U1	10:40	12/09/2016	16:15	12/09/2016	Scheduled Maintenance
U2	10:40	12/09/2016	16:15	12/09/2016	Scheduled Maintenance
U3	10:40	12/09/2016	16:15	12/09/2016	Scheduled Maintenance
U4	10:40	12/09/2016	16:15	12/09/2016	Scheduled Maintenance
U1	9:01	13/09/2016	16:05	13/09/2016	Scheduled Maintenance
U4	6:37	24/10/2016	16:39	27/10/2016	Scheduled Maintenance
U4	9:42	12/10/2016	16:39	12/10/2016	Scheduled Maintenance
U1	18:01	24/10/2016	16:25	26/10/2016	Scheduled Maintenance
U2	18:01	24/10/2016	16:25	26/10/2016	Scheduled Maintenance
U3	18:01	24/10/2016	16:25	26/10/2016	Scheduled Maintenance
U4	18:01	24/10/2016	16:25	26/10/2016	Scheduled Maintenance
U1	6:30	07/11/2016	22:16	10/11/2016	Scheduled Maintenance
U2	5:56	14/11/2016	22:21	16/11/2016	Scheduled Maintenance
U3	6:24	21/11/2016	15:49	24/11/2016	Scheduled Maintenance
U3	3:01	18/11/2016	8:35	18/11/2016	Failure
U3	15:43	18/11/2016	6:23	19/11/2016	Scheduled Maintenance
U4	13:34	24/11/2016	15:49	24/11/2016	Scheduled Maintenance
U1	17:24	21/11/2016	23:08	21/11/2016	Failure
U1	15:44	17/11/2016	16:07	17/11/2016	Failure
U2	15:44	17/11/2016	16:07	17/11/2016	Failure
U3	15:44	17/11/2016	16:12	17/11/2016	Failure
U1	3:01	18/11/2016	5:40	18/11/2016	Failure
U2	3:01	18/11/2016	8:32	18/11/2016	Failure
U1	8:36	13/11/2016	11:32	13/11/2016	Scheduled Maintenance

U2	8:36	13/11/2016	11:32	13/11/2016	Scheduled Maintenance
U3	8:36	13/11/2016	11:32	13/11/2016	Scheduled Maintenance
U4	8:36	13/11/2016	11:32	13/11/2016	Scheduled Maintenance
U4	15:49	15/11/2016	0:06	21/11/2016	Scheduled Maintenance
U1	10:00	01/12/2016	15:23	01/12/2016	Scheduled Maintenance
U2	10:00	01/12/2016	15:23	01/12/2016	Scheduled Maintenance
U3	10:00	01/12/2016	15:23	01/12/2016	Scheduled Maintenance
U4	10:00	01/12/2016	15:23	01/12/2016	Scheduled Maintenance
U2	10:00	01/12/2016	19:17	01/12/2016	Scheduled Maintenance
U1	8:52	02/12/2016	18:58	02/12/2016	Scheduled Maintenance
U2	8:52	02/12/2016	18:58	02/12/2016	Scheduled Maintenance
U3	8:52	02/12/2016	18:58	02/12/2016	Scheduled Maintenance
U4	8:52	02/12/2016	18:58	02/12/2016	Scheduled Maintenance
U1	9:25	27/12/2016	19:18	27/12/2016	Scheduled Maintenance
U2	9:25	27/12/2016	19:18	27/12/2016	Scheduled Maintenance
U3	9:25	27/12/2016	19:18	27/12/2016	Scheduled Maintenance
U4	9:25	27/12/2016	19:18	27/12/2016	Scheduled Maintenance
U1	22:15	29/12/2016	2:28	30/12/2016	Failure
U2	22:15	29/12/2016	2:28	30/12/2016	Failure
U3	22:15	29/12/2016	2:28	30/12/2016	Failure
U4	22:15	29/12/2016	2:28	30/12/2016	Failure
U3	2:30	30/12/2016	13:26	30/12/2016	Failure
U2	16:11	30/12/2016	17:41	30/12/2016	Emergency
U1	14:51	23/12/2016	18:36	23/12/2016	Scheduled Maintenance
U2	14:51	23/12/2016	18:36	23/12/2016	Scheduled Maintenance
U3	14:51	23/12/2016	18:36	23/12/2016	Scheduled Maintenance
U4	14:51	23/12/2016	18:36	23/12/2016	Scheduled Maintenance
U2	9:35	22/12/2016	11:31	22/12/2016	Scheduled Maintenance
U1	10:59	29/12/2016	20:48	30/12/2016	Scheduled Maintenance
U2	10:59	29/12/2016	20:48	30/12/2016	Scheduled Maintenance
U3	10:59	29/12/2016	20:48	30/12/2016	Scheduled Maintenance
U4	10:59	29/12/2016	20:48	30/12/2016	Scheduled Maintenance
U1	3:12	29/12/2016	1:58	13/12/2016	Scheduled Maintenance
U2	3:12	13/12/2016	1:58	13/12/2016	Scheduled Maintenance
U3	3:12	13/12/2016	1:58	13/12/2016	Scheduled Maintenance
U4	3:12	13/12/2016	1:58	13/12/2016	Scheduled Maintenance
U1	14:58	13/12/2016	11:30	16/12/2016	Scheduled Maintenance
U2	14:58	13/12/2016	11:30	16/12/2016	Scheduled Maintenance
U3	14:58	13/12/2016	11:30	16/12/2016	Scheduled Maintenance
U4	14:58	13/12/2016	11:30	16/12/2016	Scheduled Maintenance
U1	2:02	13/12/2016	19:30	14/12/2016	Scheduled Maintenance
U2	2:02	13/12/2016	19:30	14/12/2016	Scheduled Maintenance
U3	2:02	13/12/2016	19:30	14/12/2016	Scheduled Maintenance
U4	2:02	13/12/2016	19:30	14/12/2016	Scheduled Maintenance
Year 2017					
U2	15:28	05/01/2017	17:00	05/01/2017	Emergency
U1	14:29	11/01/2017	15:57	11/01/2017	Scheduled Maintenance
U2	14:29	11/01/2017	15:57	11/01/2017	Scheduled Maintenance

U3	14:29	11/01/2017	15:57	11/01/2017	Scheduled Maintenance
U4	14:29	11/01/2017	15:57	11/01/2017	Scheduled Maintenance
U1	8:52	9/01/2017	17:35	9/01/2017	Maintenance
U2	8:52	9/01/2017	17:35	9/01/2017	Maintenance
U3	8:52	9/01/2017	17:35	9/01/2017	Maintenance
U4	8:52	9/01/2017	17:35	9/01/2017	Maintenance
U1	10:28	12/01/2017	14:07	13/01/2017	Failure
U2	10:28	12/01/2017	14:07	13/01/2017	Failure
U3	10:28	12/01/2017	14:07	13/01/2017	Failure
U4	10:28	12/01/2017	14:07	13/01/2017	Failure
U1	9:17	12/01/2017	12:17	12/01/2017	Failure
U2	9:17	12/01/2017	12:17	12/01/2017	Failure
U3	9:17	12/01/2017	12:17	12/01/2017	Failure
U4	9:17	12/01/2017	12:17	12/01/2017	Failure
U1	13:19	26/01/2017	18:00	31/01/2017	Failure
U2	13:19	26/01/2017	18:00	31/01/2017	Failure
U3	13:19	26/01/2017	18:00	31/01/2017	Failure
U4	13:19	26/01/2017	18:00	31/01/2017	Failure
U1	15:56	25/01/2017	17:03	25/01/2017	Scheduled Maintenance
U2	15:56	25/01/2017	17:03	25/01/2017	Scheduled Maintenance
U3	15:56	25/01/2017	17:03	25/01/2017	Scheduled Maintenance
U4	15:56	25/01/2017	17:03	25/01/2017	Scheduled Maintenance
U1	15:56	25/01/2017	17:03	25/01/2017	Scheduled Maintenance
U2	15:56	25/01/2017	17:03	25/01/2017	Scheduled Maintenance
U3	15:56	25/01/2017	17:03	25/01/2017	Scheduled Maintenance
U4	15:56	25/01/2017	17:03	25/01/2017	Scheduled Maintenance
U3	7:51	14/02/2017	13:44	14/02/2017	Scheduled Maintenance
U1	14:46	02/02/2017	17:39	02/02/2017	Scheduled Maintenance
U2	14:46	02/02/2017	17:39	02/02/2017	Scheduled Maintenance
U3	14:46	02/02/2017	17:39	02/02/2017	Scheduled Maintenance
U4	14:46	02/02/2017	17:39	02/02/2017	Scheduled Maintenance
U1	13:51	02/02/2017	15:30	02/02/2017	Scheduled Maintenance
U2	13:51	02/02/2017	15:30	02/02/2017	Scheduled Maintenance
U3	13:51	02/02/2017	15:30	02/02/2017	Scheduled Maintenance
U4	13:51	02/02/2017	15:30	02/02/2017	Scheduled Maintenance
U1	15:07	06/02/2017	18:00	31/02/2017	Scheduled Maintenance
U2	15:07	06/02/2017	18:00	31/02/2017	Scheduled Maintenance
U3	15:07	06/02/2017	18:00	31/02/2017	Scheduled Maintenance
U4	15:07	06/02/2017	18:00	31/02/2017	Scheduled Maintenance
U1	7:52	08/02/2017	14:04	08/02/2017	Scheduled Maintenance
U1	9:30	10/02/2017	10:19	10/02/2017	Scheduled Maintenance
U2	9:30	10/02/2017	10:19	10/02/2017	Scheduled Maintenance
U3	9:30	10/02/2017	10:19	10/02/2017	Scheduled Maintenance
U4	9:30	10/02/2017	10:19	10/02/2017	Scheduled Maintenance
U1	17:11	15/02/2017	18:00	28/02/2017	Maintenance
U2	17:11	15/02/2017	18:00	28/02/2017	Maintenance
U3	17:11	15/02/2017	18:00	28/02/2017	Maintenance
U4	17:11	15/02/2017	18:00	28/02/2017	Maintenance

U2	8:05	28/02/2017	16:05	28/02/2017	Scheduled Maintenance
U4	8:02	01/03/2017	16:41	01/03/2017	Scheduled Maintenance
U1	9:31	15/03/2017	16:27	15/03/2017	Maintenance
U2	9:31	15/03/2017	16:27	15/03/2017	Maintenance
U3	9:31	15/03/2017	16:27	15/03/2017	Maintenance
U4	9:31	15/03/2017	16:27	15/03/2017	Maintenance
U1	9:32	16/03/2017	11:40	17/03/2017	Scheduled Maintenance
U2	9:32	16/03/2017	11:40	17/03/2017	Scheduled Maintenance
U3	9:32	16/03/2017	11:40	17/03/2017	Scheduled Maintenance
U4	9:32	16/03/2017	11:40	17/03/2017	Scheduled Maintenance
U1	10:09	24/03/2017	12:06	24/03/2017	Scheduled Maintenance
U2	10:09	24/03/2017	12:06	24/03/2017	Scheduled Maintenance
U3	10:09	24/03/2017	12:06	24/03/2017	Scheduled Maintenance
U4	10:09	24/03/2017	12:06	24/03/2017	Scheduled Maintenance
U2	9:02	10/04/2017	12:30	12/04/2017	Scheduled Maintenance
U1	9:23	13/04/2017	15:00	13/04/2017	Scheduled Maintenance
U1	10:27	17/04/2017	19:16	18/04/2017	Scheduled Maintenance
U3	8:51	06/04/2017	21:50	08/04/2017	Scheduled Maintenance
U4	9:18	03/04/2017	0:28	06/04/2017	Scheduled Maintenance
U1	6:08	20/04/2017	0:49	23/04/2017	Scheduled Maintenance
U2	6:08	20/04/2017	0:49	23/04/2017	Scheduled Maintenance
U3	6:08	20/04/2017	0:49	23/04/2017	Scheduled Maintenance
U4	6:08	20/04/2017	0:49	23/04/2017	Scheduled Maintenance
U4	16:39	07/04/2017	17:21	07/04/2017	Failure
U1	10:17	18/04/2017	12:06	18/04/2017	Maintenance
U1	13:50	20/04/2017	1:31	23/04/2017	Scheduled Maintenance
U2	13:50	20/04/2017	1:31	23/04/2017	Scheduled Maintenance
U3	13:50	20/04/2017	1:31	23/04/2017	Scheduled Maintenance
U4	13:50	20/04/2017	1:31	23/04/2017	Scheduled Maintenance
U1	22:18	21/04/2017	8:00	22/04/2017	Maintenance/ Failure
U2	22:18	21/04/2017	8:00	22/04/2017	Maintenance/ Failure
U3	22:18	21/04/2017	8:00	22/04/2017	Maintenance/ Failure
U4	22:18	21/04/2017	8:00	22/04/2017	Maintenance/ Failure
U1	9:18	03/04/2017	0:49	23/04/2017	Maintenance
U2	9:18	03/04/2017	0:49	23/04/2017	Maintenance
U3	9:18	03/04/2017	0:49	23/04/2017	Maintenance
U4	9:18	03/04/2017	0:49	23/04/2017	Maintenance
U1	9:30	11/04/2017	10:22	17/04/2017	Maintenance
U2	9:30	11/04/2017	10:22	17/04/2017	Maintenance
U3	9:30	11/04/2017	10:22	17/04/2017	Maintenance
U4	9:30	11/04/2017	10:22	17/04/2017	Maintenance
U1	16:39	07/04/2017	17:22	07/04/2017	Maintenance
U1	17:06	08/05/2017	12:16	12/05/2017	Maintenance
U2	17:06	08/05/2017	12:16	12/05/2017	Maintenance
U3	17:06	08/05/2017	12:16	12/05/2017	Maintenance
U4	17:06	08/05/2017	12:16	12/05/2017	Maintenance
U2	9:21	09/05/2017	11:49	09/05/2017	Maintenance
U1	9:02	10/05/2017	15:54	10/05/2017	Scheduled Maintenance

U2	9:02	10/05/2017	15:54	10/05/2017	Scheduled Maintenance
U3	9:02	10/05/2017	15:54	10/05/2017	Scheduled Maintenance
U4	9:02	10/05/2017	15:54	10/05/2017	Scheduled Maintenance
U1	15:55	10/05/2017	17:13	10/05/2017	Scheduled Maintenance
U2	15:55	10/05/2017	17:13	10/05/2017	Scheduled Maintenance
U3	15:55	10/05/2017	17:13	10/05/2017	Scheduled Maintenance
U4	15:55	10/05/2017	17:13	10/05/2017	Scheduled Maintenance
U4	9:30	16/05/2017	11:35	16/05/2017	Scheduled Maintenance
U1	5:25	16/05/2017	21:44	16/05/2017	Failure
U2	5:25	16/05/2017	21:44	16/05/2017	Failure
U3	5:25	16/05/2017	21:44	16/05/2017	Failure
U4	5:25	16/05/2017	21:44	16/05/2017	Failure
U1	9:38	25/05/2017	11:15	25/05/2017	Maintenance
U2	9:38	25/05/2017	11:15	25/05/2017	Maintenance
U3	9:38	25/05/2017	11:15	25/05/2017	Maintenance
U4	9:38	25/05/2017	11:15	25/05/2017	Maintenance
U3	8:46	21/06/2017	19:22	21/06/2017	Failure
U1	11:40	13/07/2017	16:22	13/07/2017	Maintenance
U2	11:40	13/07/2017	16:22	13/07/2017	Maintenance
U3	11:40	13/07/2017	16:22	13/07/2017	Maintenance
U4	11:40	13/07/2017	16:22	13/07/2017	Maintenance
U1	10:40	27/07/2017	17:26	27/07/2017	Scheduled Maintenance
U2	10:40	27/07/2017	17:26	27/07/2017	Scheduled Maintenance
U3	10:40	27/07/2017	17:26	27/07/2017	Scheduled Maintenance
U4	10:40	27/07/2017	17:26	27/07/2017	Scheduled Maintenance
U3	12:07	01/08/2017	9:35	07/08/2017	Scheduled Maintenance
U1	9:15	11/08/2017	13:37	11/08/2017	Scheduled Maintenance
U2	9:15	11/08/2017	13:37	11/08/2017	Scheduled Maintenance
U3	9:15	11/08/2017	13:37	11/08/2017	Scheduled Maintenance
U4	9:15	11/08/2017	13:37	11/08/2017	Scheduled Maintenance
U1	11:11	16/08/2017	16:41	16/08/2017	Scheduled Maintenance
U2	11:11	16/08/2017	16:41	16/08/2017	Scheduled Maintenance
U3	11:11	16/08/2017	16:41	16/08/2017	Scheduled Maintenance
U4	11:11	16/08/2017	16:41	16/08/2017	Scheduled Maintenance
U1	10:52	24/08/2017	14:00	24/08/2017	Scheduled Maintenance
U3	14:45	24/08/2017	16:36	24/08/2017	Scheduled Maintenance
U4	16:40	24/08/2017	18:39	24/08/2017	Scheduled Maintenance
U4	9:06	05/09/2017	16:04	05/09/2017	Scheduled Maintenance
U2	10:11	27/09/2017	18:25	27/09/2017	Scheduled Maintenance
U1	15:22	05/10/2017	17:56	05/10/2017	Scheduled Maintenance
U2	15:22	05/10/2017	17:56	05/10/2017	Scheduled Maintenance
U3	15:22	05/10/2017	17:56	05/10/2017	Scheduled Maintenance
U4	15:22	05/10/2017	17:56	05/10/2017	Scheduled Maintenance
U4	12:29	12/10/2017	20:22	12/10/2017	Scheduled Maintenance
U3	11:17	11/10/2017	19:52	11/10/2017	Scheduled Maintenance
U1	9:58	14/10/2017	14:05	14/10/2017	Scheduled Maintenance
U2	20:33	12/10/2017	22:04	12/10/2017	Failure
U3	20:33	12/10/2017	22:04	12/10/2017	Failure

U1	10:31	31/10/2017	12:32	31/10/2017	Maintenance
U2	10:31	31/10/2017	12:32	31/10/2017	Maintenance
U3	10:31	31/10/2017	12:32	31/10/2017	Maintenance
U4	10:31	31/10/2017	12:32	31/10/2017	Maintenance
U2	10:44	15/11/2017	18:46	15/11/2017	Scheduled Maintenance
U1	11:15	20/11/2017	15:42	20/11/2017	Scheduled Maintenance
U2	11:15	20/11/2017	15:42	20/11/2017	Scheduled Maintenance
U3	11:15	20/11/2017	15:42	20/11/2017	Scheduled Maintenance
U4	11:15	20/11/2017	15:42	20/11/2017	Scheduled Maintenance
U1	13:13	23/11/2017	15:24	23/11/2017	Maintenance
U1	8:46	04/12/2017	18:13	04/12/2017	Scheduled Maintenance
U2	8:46	04/12/2017	18:13	04/12/2017	Scheduled Maintenance
U3	8:46	04/12/2017	18:13	04/12/2017	Scheduled Maintenance
U4	8:46	04/12/2017	18:13	04/12/2017	Scheduled Maintenance
U2	8:26	06/12/2017	12:51	06/12/2017	Scheduled Maintenance
U1	12:34	20/12/2017	15:45	20/12/2017	Scheduled Maintenance
U2	12:34	20/12/2017	15:45	20/12/2017	Scheduled Maintenance
U3	12:34	20/12/2017	15:45	20/12/2017	Scheduled Maintenance
U4	12:34	20/12/2017	15:45	20/12/2017	Scheduled Maintenance
U1	15:24	26/12/2017	18:26	31/12/2017	Scheduled Maintenance
U2	15:24	26/12/2017	18:26	31/12/2017	Scheduled Maintenance
U3	15:24	26/12/2017	18:26	31/12/2017	Scheduled Maintenance
U4	15:24	26/12/2017	18:26	31/12/2017	Scheduled Maintenance
U4	9:46	28/12/2017	11:36	28/12/2017	Maintenance
Year 2018 (01/01/2018 – 03/11/2018)					
U1	9:49	11/01/2018	16:42	11/01/2018	Maintenance
U2	9:49	11/01/2018	16:42	11/01/2018	Maintenance
U3	9:49	11/01/2018	16:42	11/01/2018	Maintenance
U4	9:49	11/01/2018	16:42	11/01/2018	Maintenance
u3	13:52	08/01/2018	15:13	08/01/2018	Failure
U1	10:32	5/01/2018	17:44	5/01/2018	Scheduled Maintenance
U2	10:32	5/01/2018	17:44	5/01/2018	Scheduled Maintenance
U3	10:32	5/01/2018	17:44	5/01/2018	Scheduled Maintenance
U4	10:32	5/01/2018	17:44	5/01/2018	Scheduled Maintenance
U1	15:10	18/01/2018	20:05	29/01/2018	Scheduled Maintenance
U1	2:04	12/02/2018	17:33	12/02/2018	Scheduled Maintenance
U2	5:10	13/02/2018	15:58	13/02/2018	Scheduled Maintenance
U3	8:56	14/02/2018	16:49	14/02/2018	Scheduled Maintenance
U4	8:17	15/02/2018	17:19	15/02/2018	Scheduled Maintenance
U1	13:22	08/02/2018	15:20	08/02/2018	Scheduled Maintenance
U2	13:22	08/02/2018	15:20	08/02/2018	Scheduled Maintenance
U3	13:22	08/02/2018	15:20	08/02/2018	Scheduled Maintenance
U4	13:22	08/02/2018	15:20	08/02/2018	Scheduled Maintenance
U3	9:06	07/02/2018	17:03	07/02/2018	Scheduled Maintenance
U4	9:20	14/02/2018	9:29	14/02/2018	Failure
U1	9:44	05/03/2018	23:48	07/03/2018	Scheduled Maintenance
U2	9:44	05/03/2018	23:48	07/03/2018	Scheduled Maintenance
U3	9:44	05/03/2018	23:48	07/03/2018	Scheduled Maintenance

U4	9:44	05/03/2018	23:48	07/03/2018	Scheduled Maintenance
U1	10:02	01/03/2018	11:57	01/03/2018	Scheduled Maintenance
U2	10:02	01/03/2018	11:57	01/03/2018	Scheduled Maintenance
U3	10:02	01/03/2018	11:57	01/03/2018	Scheduled Maintenance
U4	10:02	01/03/2018	11:57	01/03/2018	Scheduled Maintenance
U3	11:40	05/03/2018	22:11	05/03/2018	Failure
U4	12:00	05/03/2018	15:35	05/03/2018	Failure
U1	9:05	14/03/2018	17:56	14/03/2018	Scheduled Maintenance
U2	9:02	15/03/2018	14:25	15/03/2018	Scheduled Maintenance
U4	9:05	19/03/2018	12:48	19/03/2018	Scheduled Maintenance
U1	15:49	15/03/2018	18:40	15/03/2018	Scheduled Maintenance
U2	15:49	15/03/2018	18:40	15/03/2018	Scheduled Maintenance
U3	15:49	15/03/2018	18:40	15/03/2018	Scheduled Maintenance
U4	15:49	15/03/2018	18:40	15/03/2018	Scheduled Maintenance
U3	9:55	13/03/2018	19:42	13/03/2018	Scheduled Maintenance
U1	9:55	13/03/2018	19:42	13/03/2018	Scheduled Maintenance
U2	9:55	13/03/2018	19:42	13/03/2018	Scheduled Maintenance
U4	9:55	13/03/2018	19:42	13/03/2018	Scheduled Maintenance
U1	10:06	04/04/2018	12:00	04/04/2018	Scheduled Maintenance
U2	10:06	04/04/2018	12:00	04/04/2018	Scheduled Maintenance
U3	10:06	04/04/2018	12:00	04/04/2018	Scheduled Maintenance
U4	10:06	04/04/2018	12:00	04/04/2018	Scheduled Maintenance
U1	9:23	11/04/2018	17:24	13/04/2018	Scheduled Maintenance
U2	9:23	11/04/2018	17:24	13/04/2018	Scheduled Maintenance
U1	15:30	19/04/2018	17:14	19/04/2018	Scheduled Maintenance
U2	15:30	19/04/2018	17:14	19/04/2018	Scheduled Maintenance
U3	15:30	19/04/2018	17:14	19/04/2018	Scheduled Maintenance
U4	15:30	19/04/2018	17:14	19/04/2018	Scheduled Maintenance
U1	13:11	18/04/2018	17:34	18/04/2018	Scheduled Maintenance
U2	13:11	18/04/2018	17:34	18/04/2018	Scheduled Maintenance
U3	13:11	18/04/2018	17:34	18/04/2018	Scheduled Maintenance
U4	13:11	18/04/2018	17:34	18/04/2018	Scheduled Maintenance
U1	12:00	08/05/2018	18:16	08/05/2018	-
U2	12:00	08/05/2018	18:16	08/05/2018	-
U3	12:00	08/05/2018	18:16	08/05/2018	-
U4	12:00	08/05/2018	18:16	08/05/2018	-
U1	16:31	16/05/2018	1:00	17/05/2018	Failure
U1	16:35	28/05/2018	18:00	01/06/2018	-
U2	16:35	28/05/2018	18:00	01/06/2018	-
U3	16:35	28/05/2018	18:00	01/06/2018	-
U4	16:35	28/05/2018	18:00	01/06/2018	-
U1	13:47	29/05/2018	16:17	29/05/2018	-
U2	13:47	29/05/2018	16:17	29/05/2018	-
U3	13:47	29/05/2018	16:17	29/05/2018	-
U4	13:47	29/05/2018	16:17	29/05/2018	-
U1	7:36	30/05/2018	9:39	30/05/2018	Failure
U2	7:36	30/05/2018	9:39	30/05/2018	Failure
U1	7:56	10/06/2018	14:03	10/06/2018	Failure

U1	10:32	28/06/2018	17:20	8/06/2018	Scheduled Maintenance
U2	10:32	28/06/2018	17:20	8/06/2018	Scheduled Maintenance
U3	10:32	28/06/2018	17:20	8/06/2018	Scheduled Maintenance
U4	10:32	28/06/2018	17:20	8/06/2018	Scheduled Maintenance
U4	6:04	30/07/2018	23:59	10/08/2018	-
U1	9:41	03/07/2018	16:23	03/07/2018	Maintenance
U2	9:41	03/07/2018	16:23	03/07/2018	Maintenance
U3	9:41	03/07/2018	16:23	03/07/2018	Maintenance
U4	9:41	03/07/2018	16:23	03/07/2018	Maintenance
U1	9:55	06/07/2018	12:46	06/07/2018	Scheduled Maintenance
U2	9:55	06/07/2018	12:46	06/07/2018	Scheduled Maintenance
U3	9:55	06/07/2018	12:46	06/07/2018	Scheduled Maintenance
U4	9:55	06/07/2018	12:46	06/07/2018	Scheduled Maintenance
U1	9:11	13/07/2018	14:10	13/07/2018	Scheduled Maintenance
U2	9:11	13/07/2018	14:10	13/07/2018	Scheduled Maintenance
U3	9:11	13/07/2018	14:10	13/07/2018	Scheduled Maintenance
U4	9:11	13/07/2018	14:10	13/07/2018	Scheduled Maintenance
U1	14:50	26/07/2018	17:04	26/07/2018	Scheduled Maintenance
U2	14:50	26/07/2018	17:04	26/07/2018	Scheduled Maintenance
U3	14:50	26/07/2018	17:04	26/07/2018	Scheduled Maintenance
U4	14:50	26/07/2018	17:04	26/07/2018	Scheduled Maintenance
U1	13:49	24/07/2018	16:20	24/07/2018	Scheduled Maintenance
U2	13:49	24/07/2018	16:20	24/07/2018	Scheduled Maintenance
U3	13:49	24/07/2018	16:20	24/07/2018	Scheduled Maintenance
U4	13:49	24/07/2018	16:20	24/07/2018	Scheduled Maintenance
U3	8:50	02/08/2018	15:20	02/08/2018	Scheduled Maintenance
U2	13:01	07/08/2018	13:25	07/08/2018	Scheduled Maintenance
U1	9:11	09/08/2018	16:09	09/08/2018	Scheduled Maintenance
U1	4:02	03/09/2018	23:30	07/09/2018	-
U2	4:02	03/09/2018	23:30	07/09/2018	-
U3	4:02	03/09/2018	23:30	07/09/2018	-
U4	4:02	03/09/2018	23:30	07/09/2018	-
U1	9:55	07/09/2018	11:19	07/09/2018	Scheduled Maintenance
U2	9:55	07/09/2018	11:19	07/09/2018	Scheduled Maintenance
U3	9:55	07/09/2018	11:19	07/09/2018	Scheduled Maintenance
U4	9:55	07/09/2018	11:19	07/09/2018	Scheduled Maintenance
U1	9:35	21/09/2018	19:43	21/09/2018	Maintenance
U2	9:35	21/09/2018	19:43	21/09/2018	Maintenance
U3	9:35	21/09/2018	19:43	21/09/2018	Maintenance
U4	9:35	21/09/2018	19:43	21/09/2018	Maintenance
U3	2:11	16/10/2018	14:00	26/10/2018	-
U1	4:01	03/11/2018	14:00	03/11/2018	Failure

Events reported in Table B2 don't have any impact on the applicability of the applied methodology.

In addition to these events, there was a failure in the power plant that caused it to be out of service from October 2015 to March 2016. No generation was recorded during this period.

B.2. Post-registration changes**B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents**

>>N/A

B.2.2. Corrections

>>N/A

B.2.3. Changes to the start date of the crediting period

>>N/A

B.2.4. Inclusion of monitoring plan

>>N/A

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

>>N/A

B.2.6. Changes to project design

>>N/A

B.2.7. Changes specific to afforestation or reforestation project activity

>>N/A

SECTION C. Description of monitoring system

During year 2005, Colbun S.A. merged with Hidroelectrica Ceneleca S.A., including the assets that belonged to this company, which considered the set of hydroelectric power plants owned by Hidroelectrica Guardia Vieja S.A.

Consequently, the administration, operation, maintenance, commercial aspects and environmental management of the Chacabuquito Power Plant is currently conducted by Colbun S.A.

In order to fulfil the commitments established in the Chacabuquito Project Design Document, and the ones associated to the related Emission Reduction Purchase Agreement, Colbun S.A. has the following general management structure:

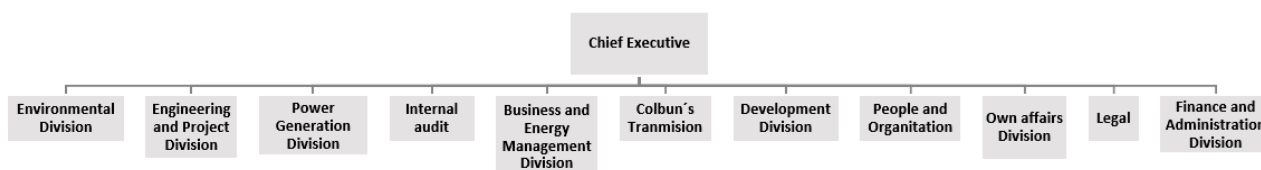


Figure C1. General Management structure

In addition, Colbun S.A. has the following structure inside the Generation and Environmental Departments:

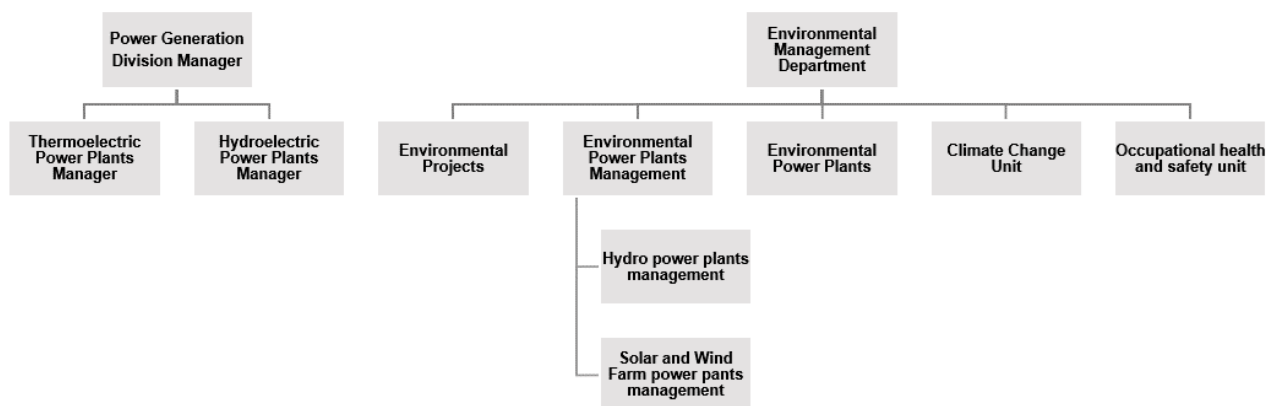


Figure C2. Generation and Environmental Department structures

Under this structure CDM related responsibilities are accomplished as follows:

- Internal training:
 - I. Trainings related to specific operational procedures such as PO.17 Verification and replacement of electricity meters and PO.18 Data collection from energy meters, established in Corporate Procedures within the Management System and CDM topics are executed by the Climate Change Unit (as a part of Environmental Management).
 - II. Operator trainings are performed by a staff which is established by the Power Plant Manager (from the Hydroelectric Power Plants Manager department).
- CER's trading: The responsible for this activity is the Climate Change Unit (as a part of Environmental Management).
- Monitoring (data recording, measurements, etc): The responsible for monitoring data related to the CER's calculation are the Power Plant Staff (Operations), TI Management (from Finance and Administration Division), Climate Change Unit (as part of the Environmental Management).
- CERs calculation: This is performed by the Climate Change Unit (as a part of Environmental Management).

Monitoring System

Emission Factor Parameters:

The monitoring methodology involves the monitoring of the following:

- Net electricity generated and fed into the grid by the proposed CDM project, and other CDM registered projects (data available at CEN).
- Public data on dispatch of electricity and other relevant information from the CEN. This data is used to calculate the emission factor for the operating margin based on a dispatch increment analysis.
- Additional data needed to calculate the operating margin emission factor consistent with the AM0026 approved methodology.

The project participant has developed a Management System in order to establish all the procedures and responsibilities related to the fulfilment of the CDM related issues. This System includes all the procedures related to the monitoring plan, such as the monitoring and verification procedures, in order to assure the proper development of the activities of the monitoring plan.

Electricity delivered to the grid by the project activity:

Chacabuquito project has three electricity meters, M1, M2 and M3. The electricity meter M1, which is located between the generation bar and the power transformer, measures the electricity from the four units. The meters M2 and M3 (main meters for the CDM monitoring plan) measure the electricity at the injection point.

As result, M1 measurements are regularly M3 sent and validated by CEN (see Energy Generation Data Capture Procedure section below). These measurements are used as quality assurance procedure for CDM purposes.

It bears mentioning that energy meters are bidirectional and therefore net electricity is monitored.

Net electricity delivered to the grid by the project activity is calculated as the difference between net electricity measurements from M2 and M3 (please refer to Figure C3):

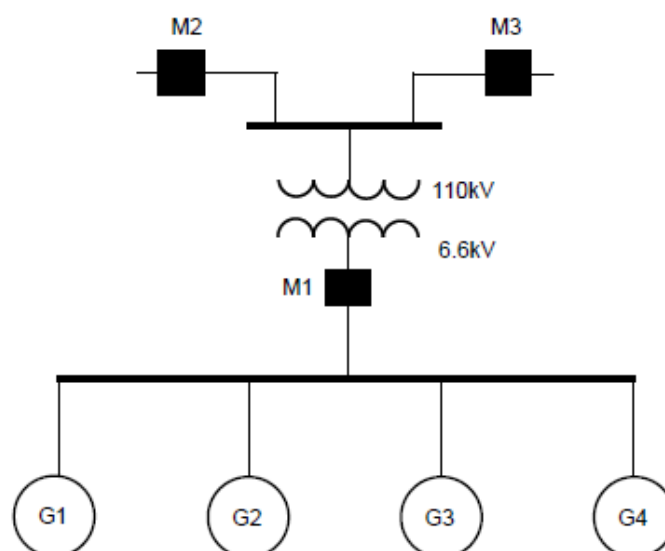


Figure C3. Metering System

The operator is responsible for the data acquisition system and its maintenance (measurement equipments, data capture and to send it to the company's personnel). This person also coordinates the dispatch of the power plant with the SEN and periodically sends it's hourly power generation data.

An automatic data acquisition and measuring equipment management system operates for Chacabuquito power plant, monitoring, capturing and storing the data continuously. Then, the data is downloaded and an excel file is generated, which is sent to the operator. This spreadsheet received by the operator contains generation data acquired by the measuring system every 15 minutes. Once the data is received, it is integrated for calculating the hourly energy generation of the plant as an average of the four measurements taken each 15 minutes for each hour of the year. Finally, the hourly energy generation from M2 and M3 is sent to the Sustainability Department and M1 is sent to the SEN.

Emergency procedure

In case of failure of the main electricity meters, the secondary meter measurements are validated by the S and used for CDM purposes. In case of failure of the secondary electricity meter, the sum of energy measured by M2 and M3 meters is directly sent and validated by the CEN.

Energy Measurement Equipment Periodic Calibration:

The meter shall be verified every two years by a qualified and competent certifier, authorized by the national official organism. The verification procedure consists in comparing the measurement equipment with a higher precision reference meter, to certify the meter precision. If the equipment does not fulfil the Class 02, it is replaced.

During this monitoring period, the calibration of the meters was performed by CAM. Calibration dates of monitoring equipment are reported in the following table:

Table C1. Calibration Dates

M1 (Generator)			
Calibration Dates	Certifier	Equipment	Serial Number
27/05/2014	CAM	ION 8600	PT-0809A131-01
26/05/2015	CAM	ION 8600	PT-0809A131-01
05/12/2016	CAM	ION 8600	PT-0809A131-01
01/12/2017	CAM	ION 8600	PT-0809A131-01
04/09/2018	CAM	ION 8600	PT-0809A131-01
M2 (Totoralillo Substation)			
Calibration Dates	Certifier	Equipment	Serial Number
28/05/2014	CAM	ION 8500	PQ-0502A188-03
19/05/2015	CAM	ION 8500	PQ-0502A188-03
24/05/2016	CAM	ION 8500	PQ-0502A188-03
16/10/2017	CAM	ION 8500	PQ-0502A188-03
03/09/2018	CAM	ION 8500	PQ-0502A188-03
M3 (Totoralillo Substation)			
Calibration Dates	Certifier	Equipment	Serial Number
28/05/2014	CAM	ION 8500	PQ-0502A117-03
19/05/2015	CAM	ION 8500	PQ-0502A117-03
24/05/2016	CAM	ION 8500	PQ-0502A117-03
16/10/2017	CAM	ION 8500	PQ-0502A117-03
03/09/2018	CAM	ION 8500	PQ-0502A117-03

SECTION D. Data and parameters**D.1. Data and parameters fixed ex ante**

Data/Parameter	$EF_{BM,y}$
Unit	tCO _{2e} /MWh
Description	Build margin emission factor
Source of data	PDD (ex-ante value)
Value(s) applied	0.44810

Choice of data or measurement methods and procedures	N/A
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

Data/Parameter	W_{BM}
Unit	Fraction (%)
Description	Weight for Build Margin emission factor
Source of data	Tool to calculate the emission factor for an electricity system (v 04.0)
Value(s) applied	0.75
Choice of data or measurement methods and procedures	Value for the second crediting period as per the applicable methodology AM0026 v.3.0 and the referred tool.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

Data/Parameter	W_{OM}
Unit	Fraction (%)
Description	Weight for Operating Margin emission factor
Source of data	Tool to calculate the emission factor for an electricity system (v 04)
Value(s) applied	0.25
Choice of data or measurement methods and procedures	Value for the second crediting period as per the applicable methodology AM0026 v.3.0 and the referred tool.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

D.2. Data and parameters monitored

Data/Parameter	EF_y												
Unit	tCO ₂ e/MWh												
Description	CO ₂ e Emission factor of the displaced energy from the grid												
Measured/calculated/default	Calculated												
Source of data	Calculation based on CEN, CNE and IPCC data, as weighted sum of build margin (EF _{BM}) and operating margin (EF _{OM,y}) emission factors and in accordance to the methodology procedures described in PDD.												
Value(s) of monitored parameter	<table border="1"> <thead> <tr> <th>Year</th><th>EF_y (tCO₂/MWh)</th></tr> </thead> <tbody> <tr> <td>2014</td><td>0.43566</td></tr> <tr> <td>2015</td><td>0.44859</td></tr> <tr> <td>2016</td><td>0.51120</td></tr> <tr> <td>2017</td><td>0.46613</td></tr> <tr> <td>2018(up to November 3th)</td><td>0.47904</td></tr> </tbody> </table>	Year	EF _y (tCO ₂ /MWh)	2014	0.43566	2015	0.44859	2016	0.51120	2017	0.46613	2018(up to November 3 th)	0.47904
Year	EF _y (tCO ₂ /MWh)												
2014	0.43566												
2015	0.44859												
2016	0.51120												
2017	0.46613												
2018(up to November 3 th)	0.47904												
Monitoring equipment	N/A												
Measuring/reading/recording frequency	Yearly												
Calculation method (if applicable)	Calculation based on official data from CNE's Node Price Report and AM0026 procedures.												

QA/QC procedures	
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

Data/Parameter	EF_{OM,y}												
Unit	tCO ₂ /MWh												
Description	Operating margin emission factor for year y												
Measured/calculated/default	Calculated												
Source of data	Calculation based on CEN, CNE and IPCC data												
Value(s) of monitored parameter	<table border="1"> <thead> <tr> <th>Year</th><th>EF_{OM,y} (tCO₂/MWh)</th></tr> </thead> <tbody> <tr> <td>2014</td><td>0.39835</td></tr> <tr> <td>2015</td><td>0.45006</td></tr> <tr> <td>2016</td><td>0.70050</td></tr> <tr> <td>2017</td><td>0.52022</td></tr> <tr> <td>2018(up to November 3th)</td><td>0.57185</td></tr> </tbody> </table>	Year	EF _{OM,y} (tCO ₂ /MWh)	2014	0.39835	2015	0.45006	2016	0.70050	2017	0.52022	2018(up to November 3 th)	0.57185
Year	EF _{OM,y} (tCO ₂ /MWh)												
2014	0.39835												
2015	0.45006												
2016	0.70050												
2017	0.52022												
2018(up to November 3 th)	0.57185												
Monitoring equipment	N/A												
Measuring/reading/recording frequency	Yearly												
Calculation method (if applicable)	N/A (this parameter is not measured but calculated)												
QA/QC procedures	Automatic calculation. Calculation should be done after CEN makes the data official (validation).												
Purpose of data/parameter	Calculation of baseline emissions												
Additional comments	N/A												

Data/Parameter	EF_{i,h}
Unit	tCO ₂ e/MWh
Description	Operating margin emission factor for hour h
Measured/calculated/default	Calculated
Source of data	Calculation based on CEN, CNE and IPCC data, as per formula (f5)
Value(s) of monitored parameter	Please refer to the ex-post emission factor spreadsheet calculation (EF Calc 2014 Chacabuquito.xls, EF Calc 2015 Chacabuquito.xls, EF Calc 2016 Chacabuquito.xls, EF Calc 2017 Chacabuquito.xls and EF Calc 2018 Chacabuquito.xls).
Monitoring equipment	N/A
Measuring/reading/recording frequency	Hourly
Calculation method (if applicable)	Calculated based on equation f4 of this monitoring report using CEN data
QA/QC procedures	Automatic calculation. Calculation should be done after CEN makes the data official (validation).
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

Data/Parameter	Generation_y
Unit	MWh
Description	Electricity exported to the grid by proposed CDM project, in year y

Measured/calculated/default	Measured																																													
Source of data	Onsite metering system																																													
Value(s) of monitored parameter	<table border="1"> <thead> <tr> <th>Year</th><th>Generation (MWh)</th></tr> </thead> <tbody> <tr> <td>2014</td><td>122,270.24</td></tr> <tr> <td>2015</td><td>72,139.24</td></tr> <tr> <td>2016</td><td>98,277.66</td></tr> <tr> <td>2017</td><td>130,845.04</td></tr> <tr> <td>2018 (Up to November 3th)</td><td>74,126.15</td></tr> <tr> <td>Total</td><td>487,615.55</td></tr> </tbody> </table>	Year	Generation (MWh)	2014	122,270.24	2015	72,139.24	2016	98,277.66	2017	130,845.04	2018 (Up to November 3 th)	74,126.15	Total	487,615.55																															
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2017	130,845.04																																													
2018 (Up to November 3 th)	74,126.15																																													
Total	487,615.55																																													
Monitoring equipment	<p>During this monitoring period, energy was monitored using the following equipment:</p> <p>Meter M1:</p> <ul style="list-style-type: none"> Type: ION 8600 Accuracy class: 0.2% Serial number: PT-0809A131-01 Calibration frequency: Every two years <table border="1"> <thead> <tr> <th>Meter</th><th>Serial Number</th><th>Verification Dates</th></tr> </thead> <tbody> <tr> <td>M1</td><td>PT-0809A131-01</td><td>27/05/2014</td></tr> <tr> <td>M1</td><td>PT-0809A131-01</td><td>26/05/2015</td></tr> <tr> <td>M1</td><td>PT-0809A131-01</td><td>05/12/2016</td></tr> <tr> <td>M1</td><td>PT-0809A131-01</td><td>01/12/2017</td></tr> </tbody> </table> <p>Meter M2:</p> <ul style="list-style-type: none"> Type: ION 8500 Accuracy class: 0.2% Serial number: PQ-0502A188-03 Calibration frequency: Every two years <table border="1"> <thead> <tr> <th>Meter</th><th>Serial Number</th><th>Verification Dates</th></tr> </thead> <tbody> <tr> <td>M2</td><td>PQ-0502A188-03</td><td>28/05/2014</td></tr> <tr> <td>M2</td><td>PQ-0502A188-03</td><td>19/05/2015</td></tr> <tr> <td>M2</td><td>PQ-0502A188-03</td><td>24/05/2016</td></tr> <tr> <td>M2</td><td>PQ-0502A188-03</td><td>16/10/2017</td></tr> </tbody> </table> <p>Meter M3:</p> <ul style="list-style-type: none"> Type: ION 8500 Accuracy class: 0.2% Serial number: PQ-0502A117-03 Calibration frequency: Every two years <table border="1"> <thead> <tr> <th>Meter</th><th>Serial Number</th><th>Verification Dates</th></tr> </thead> <tbody> <tr> <td>M3</td><td>PQ-0502A117-03</td><td>28/05/2014</td></tr> <tr> <td>M3</td><td>PQ-0502A117-03</td><td>19/05/2015</td></tr> <tr> <td>M3</td><td>PQ-0502A117-03</td><td>24/05/2016</td></tr> <tr> <td>M3</td><td>PQ-0502A117-03</td><td>16/10/2017</td></tr> </tbody> </table>	Meter	Serial Number	Verification Dates	M1	PT-0809A131-01	27/05/2014	M1	PT-0809A131-01	26/05/2015	M1	PT-0809A131-01	05/12/2016	M1	PT-0809A131-01	01/12/2017	Meter	Serial Number	Verification Dates	M2	PQ-0502A188-03	28/05/2014	M2	PQ-0502A188-03	19/05/2015	M2	PQ-0502A188-03	24/05/2016	M2	PQ-0502A188-03	16/10/2017	Meter	Serial Number	Verification Dates	M3	PQ-0502A117-03	28/05/2014	M3	PQ-0502A117-03	19/05/2015	M3	PQ-0502A117-03	24/05/2016	M3	PQ-0502A117-03	16/10/2017
Meter	Serial Number	Verification Dates																																												
M1	PT-0809A131-01	27/05/2014																																												
M1	PT-0809A131-01	26/05/2015																																												
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M2	PQ-0502A188-03	28/05/2014																																												
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M2	PQ-0502A188-03	16/10/2017																																												
Meter	Serial Number	Verification Dates																																												
M3	PQ-0502A117-03	28/05/2014																																												
M3	PQ-0502A117-03	19/05/2015																																												
M3	PQ-0502A117-03	24/05/2016																																												
M3	PQ-0502A117-03	16/10/2017																																												
Measuring/reading/recording frequency	Hourly measurement and daily recording.																																													

Calculation method (if applicable)	Electricity measurements are taken automatically every 15 minutes. Then the hourly total is calculated. Electricity delivered to the grid is calculated as per net electricity measurements from e-meters located at Totoralillo substation (as the sum from M2 + M3).
QA/QC procedures	Meter should have a maximum error of 0.2% and be calibrated every one or two years according to local standards for electricity transactions in CEN. Monitored data is cross checked against records for sold electricity which are publicly available at the CEN web page (Sistema Eléctrico Nacional Coordinador Eléctrico Nacional).
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

Data/Parameter	D(j,i)
Unit	MWh
Description	Electricity displaced by j th CDM project from i th marginal plant in the system
Measured/calculated/default	Calculated
Source of data	CEN-SEN data
Value(s) of monitored parameter	Please refer to the ex-post emission factor spreadsheet calculation (EF Calc 2014 Chacabuquito.xls, EF Calc 2015 Chacabuquito.xls, EF Calc 2016 Chacabuquito.xls, EF Calc 2017 Chacabuquito.xls and EF Calc 2018 Chacabuquito.xls).
Monitoring equipment	N/A
Measuring/reading/recording frequency	Hourly
Calculation method (if applicable)	Calculated based on equation f6 using CEN-SEN data
QA/QC procedures	Automatically calculated from CEN databases and AM0026 procedures. Calculation should be done after CEN energy balance to ensure data validity.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

Data/Parameter	d_i
Unit	tCO ₂ /MWh
Description	Emission factor for electricity displaced D(j,i)
Measured/calculated/default	Calculated
Source of data	IPCC Guidelines and CNE node price report
Value(s) of monitored parameter	Please refer to the ex-post emission factor spreadsheet calculation (EF Calc 2014 Chacabuquito.xls, EF Calc 2015 Chacabuquito.xls, EF Calc 2016 Chacabuquito.xls, EF Calc 2017 Chacabuquito.xls and EF Calc 2018 Chacabuquito.xls).
Monitoring equipment	N/A
Measuring/reading/recording frequency	Hourly
Calculation method (if applicable)	Calculated based on equation f7 using CEN, CNE and IPCC data
QA/QC procedures	Calculation based on official data.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

Data/Parameter	SFC_i
Unit	TJ/MWh
Description	Specific fuel consumption per unit of electricity produced in i th marginal plant

Measured/calculated/default	Default
Source of data	CEN Annual Report and CNE node price report
Value(s) of monitored parameter	Please refer to the ex-post emission factor spreadsheet calculation (EF Calc 2014 Chacabuquito.xls, EF Calc 2015 Chacabuquito.xls, EF Calc 2016 Chacabuquito.xls, EF Calc 2017 Chacabuquito.xls and EF Calc 2018 Chacabuquito.xls).
Monitoring equipment	N/A
Measuring/reading/recording frequency	Yearly
Calculation method (if applicable)	This parameter is obtained by the Yearly Fuel Consumption and the Annual Generation of each power source (information available in CEN databases). If this information is not available, the Specific Fuel Consumption is used, which is presented in CNE node price report. Estimated based on official data from CNE's Node Price Report. Verification procedure shall be applied based on historical data per fuel type.
QA/QC procedures	Data is obtained from official reports. Historic comparison of each unit can provide data validation for existing and new units in the system.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Values from official sources may be reported in other units, for example m ³ /MWh, kg/MWh, or others. As the data unit needed for the calculation is [TJ/MWh], the net calorific value of fossil fuel type i in year y (NCVi,y) may be used for unit conversion, if deemed necessary.

Data/Parameter	NCV_{i,y}
Unit	TJ/mass or volume unit
Description	Net calorific value of fossil fuel type i in year y
Measured/calculated/default	Default
Source of data	The CNE Energy Balance Report includes Gross Calorific Values for the different fuels, these values were corrected to Net Calorific Values based on the IPCC 2006 assumption that for liquid fuels, Net Calorific Value is 5% lower than its Gross Calorific Value and for Gas fuels; Net Calorific Value is 10% lower than its Gross Calorific Value
Value(s) of monitored parameter	Please refer to the ex-post emission factor spreadsheet calculation (EF Calc 2014 Chacabuquito.xls, EF Calc 2015 Chacabuquito.xls, EF Calc 2016 Chacabuquito.xls, EF Calc 2017 Chacabuquito.xls and EF Calc 2018 Chacabuquito.xls).
Monitoring equipment	N/A
Measuring/reading/recording frequency	Yearly
Calculation method (if applicable)	Conversion is made from Gross calorific values to Net calorific values as according to the IPCC approach mentioned above (in "source of data").
QA/QC procedures	N/A
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

Data/Parameter	CEF_{OM,i}
Unit	tCO ₂ /GJ
Description	CO ₂ emission factor of fuel used in ith marginal power plant
Measured/calculated/default	Default
Source of data	IPCC default values at the lower limit of the uncertainty at 95% confidence interval as provided in Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.

Value(s) of monitored parameter	Please refer to the ex-post emission factor spreadsheet calculation (EF Calc 2014 Chacabuquito.xls, EF Calc 2015 Chacabuquito.xls, EF Calc 2016 Chacabuquito.xls, EF Calc 2017 Chacabuquito.xls and EF Calc 2018 Chacabuquito.xls).
Monitoring equipment	N/A
Measuring/reading/recording frequency	Yearly
Calculation method (if applicable)	N/A
QA/QC procedures	N/A
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

Data/Parameter	M
Unit	Number
Description	Number of electricity generation plants on margin, that would supply to the system in the absence of the CDM projects in the system
Measured/calculated/default	Calculated
Source of data	CEN data
Value(s) of monitored parameter	Please refer to the ex-post emission factor spreadsheet calculation (EF Calc 2014 Chacabuquito.xls, EF Calc 2015 Chacabuquito.xls, EF Calc 2016 Chacabuquito.xls, EF Calc 2017 Chacabuquito.xls and EF Calc 2018 Chacabuquito.xls).
Monitoring equipment	N/A
Measuring/reading/recording frequency	Hourly
Calculation method (if applicable)	Calculated based on equation f5 using CEN data
QA/QC procedures	Electronic worksheet should be implemented to deliver automatic calculations
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

Data/Parameter	N												
Unit	Number												
Description	Total number of CDM projects in the system.												
Measured/calculated/default	<table border="1"> <thead> <tr> <th>Year</th><th>N</th></tr> </thead> <tbody> <tr> <td>2014</td><td>45</td></tr> <tr> <td>2015</td><td>46</td></tr> <tr> <td>2016</td><td>46</td></tr> <tr> <td>2017</td><td>52</td></tr> <tr> <td>2018</td><td>56</td></tr> </tbody> </table>	Year	N	2014	45	2015	46	2016	46	2017	52	2018	56
Year	N												
2014	45												
2015	46												
2016	46												
2017	52												
2018	56												
Source of data	CEN and UNFCCC data												
Value(s) of monitored parameter	Please refer to the ex-post emission factor spreadsheet calculation (EF Calc 2014 Chacabuquito.xls, EF Calc 2015 Chacabuquito.xls, EF Calc 2016 Chacabuquito.xls, EF Calc 2017 Chacabuquito.xls and EF Calc 2018 Chacabuquito.xls).												
Monitoring equipment	N/A												
Measuring/reading/recording frequency	As required												
Calculation method (if applicable)	N/A												

QA/QC procedures	Data is obtained from official reports.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

Data/Parameter	C_j
Unit	MWh
Description	Generation capacity of i th plant on margin during hour h
Measured/calculated/default	N/A
Source of data	CEN
Value(s) of monitored parameter	Please refer to the ex-post emission factor spreadsheet calculation (EF Calc 2014 Chacabuquito.xls, EF Calc 2015 Chacabuquito.xls, EF Calc 2016 Chacabuquito.xls, EF Calc 2017 Chacabuquito.xls and EF Calc 2018 Chacabuquito.xls).
Monitoring equipment	N/A
Measuring/reading/recording frequency	Hourly
Calculation method (if applicable)	N/A
QA/QC procedures	Automatic calculation procedure. Calculation should be done after CEN makes the data official (validation).
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

Data/Parameter	A_i
Unit	MWh
Description	Generation capacity of i th plant on margin during hour h
Measured/calculated/default	N/A
Source of data	CEN
Value(s) of monitored parameter	Please refer to the ex-post emission factor spreadsheet calculation (EF Calc 2014 Chacabuquito.xls, EF Calc 2015 Chacabuquito.xls, EF Calc 2016 Chacabuquito.xls, EF Calc 2017 Chacabuquito.xls and EF Calc 2018 Chacabuquito.xls).
Monitoring equipment	N/A
Measuring/reading/recording frequency	Hourly
Calculation method (if applicable)	N/A
QA/QC procedures	Data is obtained from official CEN databases.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

Data/Parameter	B_i
Unit	MWh
Description	Electricity generated of the i th plant on margin during hour h
Measured/calculated/default	N/A
Source of data	CEN
Value(s) of monitored parameter	Please refer to Marginal Plants Data Base_mm.xls spreadsheets (one file per month, where “mm” refers to the specific month).

Monitoring equipment	N/A
Measuring/reading/recording frequency	Hourly
Calculation method (if applicable)	N/A
QA/QC procedures	Data is obtained from official CEN databases
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	N/A

Data/Parameter	Oxid_i
Unit	fraction
Description	Fraction of fuel oxidized on combustion.
Measured/calculated/default	Default
Source of data	IPCC Guidelines (2006)
Value(s) of monitored parameter	Please refer to the ex-post emission factor spreadsheet calculation (EF Calc 2014 Chacabuquito.xls, EF Calc 2015 Chacabuquito.xls, EF Calc 2016 Chacabuquito.xls, EF Calc 2017 Chacabuquito.xls and EF Calc 2018 Chacabuquito.xls).
Monitoring equipment	N/A
Measuring/reading/recording frequency	IPCC publications will be checked annually in order to confirm the values of the parameter
Calculation method (if applicable)	N/A
QA/QC procedures	Official data is used
Purpose of data/parameter	
Additional comments	IPCC 2006 was used. Because parameter is monitored ex-post, another version of IPCC might be available in the future.

D.3. Implementation of sampling plan

>>N/A

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

>> The baseline emissions for the project are calculated as follows using the emission factor estimated and the energy generated by the project activity:

$$BE_y = EF_y * Generation_y \quad (f1)$$

Where,

EF_y Baseline emission factor, in tCO₂/MWh;

$Generation_y$ Electricity generated by the proposed CDM Project in year y, in MWh.

The baseline emission factor (EF_y) is calculated as a combined margin. For Chacabuquito project, according to AM0026 (v.3.0), this combined margin (CM) is calculated considering the weighted average for both the Operating Margin (OM) and the Build Margin (BM) emission factors, as follows:

$$EF_y = w_{OM} * EF_{OM,y} + w_{BM} * EF_{BM} \quad (f2)$$

Where,

$EF_{OM,y}$	Emission factor for operating margin power generation sources, in tCO ₂ /MWh;
w_{OM}	0.25, Weight for operating margin emission factor;
EF_{BM}	Emission factor for build margin power generation sources, in tCO ₂ /MWh;
w_{BM}	0.75, Weight for build margin emission factor.

The AM0026 (v.3.0) methodology determines the w_{BM} and w_{OM} by using the “Tool to calculate the emission factor for an electricity system” v.07.0 which states that for the second crediting period a value of 0.75 and 0.25 should be used for the build margin and operating margin emission factors weight respectively for estimating the combined emission factor. The calculation of the project emissions reductions requires gathering and analysing a considerable quantity of data primarily for the estimation of the emission factor.

According to the applied methodology for this second crediting period the BM was fixed ex-ante in the registered PDD. The ex-ante BM is as follows:

Table E1. Ex-ante Build Margin

Unit	$EF_{BM,y}$
tCO ₂ /MWh	0.44810

Operating Margin Emission Factor Estimation

The OM emission factor from the project activity will depend on the actual generation data from the CEN. The dispatch data, to be provided ex-post by the CEN, will conclusively indicate the type of generation displaced by the addition of Chacabuquito in the generation mix in the SEN.

The monitoring and verification plan for the project utilizes the data provided by CEN, CNE and IPCC.

The next diagram shows the complete process for calculating and assigning the operating emission factors for the Chacabuquito Hydroelectric Power Project:

Net Hourly Generator output from other CDM Projects and Chacabuquito (CEN and Projects participant hourly energy generation data (MWh)



Analysis of hourly dispatch from all units of the SEN to determine the Marginal Plant (s) that would be dispatched if the system is operated without all the CDM projects in the system.
(CEN)



Calculation of emission factor of all operational thermal units of the system (CEN, CNE report and 2006 IPCC manual) (tonnes CO₂e/MWh)



Determination of the marginal plants and energy being displaced due to the operation of the Chacabuquito CDM Project (MWh and tonnes CO₂e/MWh)



Determination of EF_{OM} of each CDM Project as the weighted average emission factor of the Marginal Plant (s) not dispatched (or displaced) by the Project (tonnes CO₂e/MWh)

The Emission Factor of the operating margin is calculated by the Emissions Factor Estimation Mathematical Tool as explained above and in accordance with the following equations:

$$EF_{OM,y} = \frac{\sum_{h=1}^{8760} EF_{j,h} \times Generation_{j,h}}{\sum_{i=1}^{8760} Generation_{i,h}} \quad (f3)$$

Where,

$EF_{j,h}$ Operating margin emission factor for proposed CDM project activity 'j' for hour 'h', expressed in tCO₂/MWh;

$Generation_{j,h}$ Generation of proposed CDM project 'j' during hour 'h', expressed in MWh.

The emission factor for the proposed CDM project 'j', in a system with N CDM projects, for a hour 'h' is based on identification of the marginal plant(s) that would be operated to meet the electricity supplied by the proposed CDM project 'j'. The identification of marginal plant(s) displaced by proposed CDM project 'j' is based on the "first-built first served" principle. "Date of built" is defined as the date when the plant begins the dispatch of energy to the grid. In the case of the Chacabuquito project, it was the first power plant in operation in the SEN to be commissioned as a CDM project activity.

The emission factor for any hour 'h' for a CDM project 'j' in system is estimated as weighted average of emission factor of the identified marginal plant(s) that would have supplied electricity to the grid in absence of the jth CDM plant. The emission factor is estimated as follows:

$$EF_{j,h} = \sum_{i=1}^M D(j,i) * d_i / \sum D(j,i) \quad (f4)$$

Where,

- $D(j,i)$ Energy displacement of the marginal plant 'i' due to the proposed CDM project 'j', in MWh;
- d_i Emission factor of the marginal plant 'i', expressed in tCO₂/MWh;
- M **M** is the total number of marginal plants that would be dispatched if the system is operated without the **N** CDM projects.

M is such that:

$$\sum_{j=1}^N C_j \leq \sum_{i=1}^M (A_i - B_i) \quad (f5)$$

- C_j Energy generation of the CDM project 'j' expressed in MWh/h;
- N Total number of CDM projects in the system;
- A_i Maximum energy generation of the marginal plant 'i', expressed in MWh/h (equivalent to plant capacity in MW);
- B_i Actual Energy generation of the marginal plant 'i', expressed in MWh/h.

The difference $(A_i - B_i)$ represents the maximum possible additional electric energy that can be supplied by the i^{th} marginal plant.

Energy displacement of the marginal plant 'i' due to the proposed CDM project 'j', is calculated as follows:

$$D(j,i) = \text{Min}\{C_j - \sum_{l=1}^{i-1} D(j,l); (A_i - B_i) - \sum_{k=j+1}^N D(k,i)\} \quad (f6)$$

Where,

- " k " Represents group of CDM plants that were built before the "j" CDM plant;
- $D(j,i)$ Energy displacement of the marginal plant 'i' due to the CDM project 'j', expressed in MWh;
- A_i Maximum energy generation of the marginal plant 'i' expressed in MWh/h (equivalent to plant capacity in MW);
- B_i Actual Energy generation of the CDM marginal plant 'i' expressed in MWh/h;
- C_j Energy generation of the CDM project 'j' expressed in MWh/h;
- N Total number of CDM projects in the system;
- M Total number of additional marginal plants that should be dispatched if the system is operated without the N CDM projects.

Where:

$$D(j,0) = 0 \text{ and } D(N+1, i) = 0$$

$$D(j,i) = 0 \text{ for all } i < m, \text{ s.t. } \sum_{i=1}^m (A_i - B_i) > \sum_{k=j+1}^N C_k$$

$$D(j,i) = 0 \text{ for all } i > m^*, \text{ s.t. } \sum_{i=1}^{m^*} (A_i - B_i) > \sum_{k=j+1}^N C_k + C_j$$

d_i , the emission factor for displaced marginal plant, is estimated as follows:

$$d_i = SFC_i * CEF_{OM,i} * Oxid_i \quad (f7)$$

Where,

SFC_i Specific fuel consumption of i^{th} marginal power plant, expressed as (ton of fuel or TJ)/MWh;

$CEF_{OM,i}$ CO₂ emission factor of fuel used in i^{th} marginal power plant, expressed as tCO₂/(ton of fuel or TJ);

$Oxid_i$ Fraction of carbon in fuel, used in i^{th} marginal plant, oxidized during combustion.

The marginal plant(s) are those power plant listed in the top of the grid system dispatch order during hour 'h' needed to meet the electricity demand at the hour "h" without the generation of CDM project(s). If no thermal power plants are needed to meet the demand without the CDM projects, then the emission factor of the marginal plant is zero.

The generation of Chacabucuito is obtained from the metering system which follows a national standard of 0.2% error allowed on a kWh base. Hourly energy data obtained from the metering system is periodically submitted to CEN as for all other generating units of the system.

The Semi-annual Node Price Report and the 2006 IPCC Good Practice Guidance provide all the information to calculate the emission factors for all the power plants within the Chilean grids. Node Price Reports inform about the specific fuel consumption for every power plant, which are used together with the carbon content of the different fuels as reported by the IPCC.

Finally, the values for the Operating Margin emission factor are:

Table E2. Operating Margin (OM) Emission Factor

Year	EF _{OM,y}	Unit
2014	0.39835	tCO ₂ /MWh
2015	0.45006	tCO ₂ /MWh
2016	0.70050	tCO ₂ /MWh
2017	0.52022	tCO ₂ /MWh
2018	0.57185	tCO ₂ /MWh

Combined Emission Factor

The combined margin emission factor for the proposed Chacabucuito project, according to AM0026, is calculated by the Emissions Factor Estimation Mathematical Tool considering the weighted average for both the Operating Margin (OM) and the Build Margin (BM) as follows:

$$EF_y = w_{OM} * EF_{OM,y} + w_{BM} * EF_{BM}$$

Where,

$EF_{OM,y}$	Emission factor for operating margin power generation sources, in tCO ₂ /MWh;
W_{OM}	0.25 Weight for operating margin emission factor;
EF_{BM}	Emission factor for build margin power generation sources, in tCO ₂ /MWh;
W_{BM}	0.75 Weight for build margin emission factor.

Using the calculated values for OM and BM and weight values exposed above, the combined margin estimation is summarized in the table below:

Table E3. Combined emission factor results

Year	EF _{OM}	W _{OM}	EF _{BM}	W _{BM}	EF _y (CM)
2014	0.39835	0.25	0.44810	0.75	0.43566
2015	0.45006	0.25	0.44810	0.75	0.44859
2016	0.70050	0.25	0.44810	0.75	0.51120
2017	0.52022	0.25	0.44810	0.75	0.46613
2018	0.57185	0.25	0.44810	0.75	0.47904

Electricity Generation calculation

The electricity generation of the project for the monitoring period corresponds to:

Table E4. Net Generation

Year	Generation (MWh)
2014	122,270.24
2015	72,139.24
2016	98,227.66
2017	130,845.04
2018	74,126.15
Total	487,615.55

For further details on electricity generation calculation please refer to the emission reductions calculation spreadsheet for Chacabuquito (Generation and ER Chacabuquito _v1.xls).

Baseline emissions calculation

Following the equation f1, the baseline emissions correspond to:

$$BE_{2014} = 0.43566 \frac{tCO_2}{MWh} \times 122,270 MWh = 48,911 tCO_2$$

$$BE_{2015} = 0.45006 \frac{tCO_2}{MWh} \times 72,139 MWh = 32,469.94 tCO_2$$

$$BE_{2016} = \frac{0.5112 tCO_2}{MWh} \times 98,227.66 MWh = 50,213.98 tCO_2$$

$$BE_{2017} = \frac{0.46613 tCO_2}{MWh} \times 130,845 MWh = 60,990 tCO_2$$

$$BE_{2018} = \frac{0.47903 tCO_2}{MWh} \times 74,126.15 MWh = 35,509.39 tCO_2$$

Table E5. Total Baseline emissions

Unit	BE _y
tCO ₂	227,986.76

E.2. Calculation of project emissions or actual net removals

>> The project does not consider any emissions during the project activity.

E.3. Calculation of leakage emissions

>> The project does not consider any leakage.

E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or baseline net GHG removals (t CO ₂ e)	Project GHG emissions or actual net GHG removals (t CO ₂ e)	Leakage GHG emissions (t CO ₂ e)	GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e)			
				Before 01/01/2013	From 01/01/2013 until 31/12/2020	From 01/01/2021	Total amount
Total	227,987	0	0	-	227,987	-	227,987

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO ₂ e)	Amount estimated ex ante for this monitoring period in the PDD (t CO ₂ e)
227,987	400,592

E.5.1. Explanation of calculation of “amount estimated ex ante for this monitoring period in the PDD”

>> The estimates of emission reduction are provided to facilitate evaluation of emission reduction from the project.

For the second period:

Table E6. Annual estimation of emission reductions

Year	Annual estimation of emission reductions in tonnes of CO ₂ e
2014	82,746
2015	82,746
2016	82,746
2017	82,746

Year	Annual estimation of emission reductions in tonnes of CO ₂ e
2018 (up to November 3 th)	69,608
Total	400,592

E.6. Remarks on increase in achieved emission reductions

>>N/A. The emission reductions achieved during this monitoring period are lower than the estimate in the registered PDD for years 2014, 2015, 2016, 2017 and 2018 (up to November 3th).

E.7. Remarks on scale of small-scale project activity

>>N/A

Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
08.0	6 April 2021	Revision to: <ul style="list-style-type: none"> • Reflect the "Clarification: Regulatory requirements under temporary measures for post-2020 cases" (CDM-EB109-A01-CLAR).
07.0	31 May 2019	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 01.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: <ul style="list-style-type: none"> • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report		