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January 30, 2023

By electronic service

Attn: Tom Kirk
Executive Director
Desert Community Energy
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RE: Capacity Factor Engineering Report for the CPUC

To Whom it May Concern,

Please find attached a redacted version of a July 28, 2022 performance report for Cape Station geothermal plant. The report discusses costs and performance estimates for two projects. Our development plan consists of building out multiple identical modules depending on project size, these sizes are very likely to change in the final design. The performance characteristics of these plants will be indicative of the performance of the final design.

To calculate our capacity factors we rely on the Energy Information Agency's method according to the following formula[1]:

Average Capacity Factors

This section describes the methodology for calculating capacity factors by fuel and technology type for operating electric power plants. Capacity factor is a measure (expressed as a percent) of how often an electric generator operates over a specific period of time, using a ratio of the actual output to the maximum possible output over that period.

The capacity factor calculation only includes operating electric generators in the Electric Power Sector (sectors 1,2, and 3) using the net generation reported on the Form EIA-923 and the net summer capacity reported on the form EIA-860. The capacity factor for a particular fuel/technology type is given by:

$$Capacity\ Factor_{x,m} = \left(\frac{\sum Generation_{x,m}}{\sum Capacity_{x,m} \times Available\ Time_{x,m}}\right)$$

The net summer capacity is defined as the maximum output, commonly expressed in megawatts (MW), that generating equipment can supply to system load, as demonstrated by a multi-hour test, at the time of summer peak demand (period of June 1 through September 30.) This output reflects a reduction in capacity due to electricity use for station service or auxiliaries.

[1]US Energy Information Agency, "Appendix C. Technical Notes" *US DOE.* https://www.eia.gov/electricity/monthly/pdf/technotes.pdf.

- For Cape Station, the maximum output between June 1 through September 30 is 132 MW.[2]

Location	Net Available Annual Generation (GWh)[3]	Net Summer Capacity x Available Time (GWh)	Capacity Factor
Cape Station	1,036	132 MW x 8,760 = 1,156	90%

Sincerely,

Dawn Owens
VP, Head of Development and Commercial Markets
Fervo Energy

CC: David Freedman

[2] See attached portion of our Turboden provided 8760 showing the highest production between June 1 and September 30, file: "Fervo_Cape_MaxSummerOutputCape_Redacted.pdf".
[3] See page 19 in the attached performance report from Turboden, file: "Fervo_Cape_P20053-ENG.ICS-1100-rev.0_01262023_Redacted.pdf".

CAPE STATION						
Net Electric power output takes into account both ORC parasitic loads and ESPs consumption as indicated by the Buyer.						
month	day	hour	Ambient Temperature [°C]	Net electric power [MW]	Net electric power [MW]	Net electric power [MW]
9	30	7	6.6	[redacted]	[redacted]	131.9

Performance report

- Cape Station and Corsac Station Geothermal Plants -

Rev.	Description	Author	Controlled by	Approved by	Date
0	First release	AB0386	CP0128	MD0098	28/07/2022

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PARTIES

Seller: Turboden S.p.A.

Seller's registered office: Via Cernaia, 10 – 25124 Brescia, Italy

Buyer: Fervo Energy

1 SCOPE

The scope of this document is to provide the performances of the ORC turbogenerator for Cape Station and Corsac Station Geothermal Plant. Correction curves to calculate the electric power production depending on the air ambient temperature will be provided, together with expected annual energy production.

2 DEFINITIONS

- ACC: Air Cooled Condenser.
- MNEP: Measured Net Electric Power.
- ATD: Ambient Air Dry Bulb Temperature.
- COSPHI: Measured power factor of the generator.
- DCS: Distributed Control System.
- F: Overall correction factor, sum of the single parameter correction factors.
- F.S.O.: Full Scale Output.
- GBCP: Geothermal Brine Heat Capacity (at average temperature between inlet and outlet).
- GBD: Geothermal Brine Density.
- GBF: Geothermal Brine Flowrate.
- GBIT: Geothermal Brine Temperature at ORC inlet.
- GBOT: Geothermal Brine Temperature at ORC outlet.
- MAXGEP: Maximum electric power output of the generator, as per generator datasheet.
- NNEP: Nominal Net Electric Power.

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-	ORC:	Organic Rankine Cycle.
-	V:	Measured Voltage of the generator.
-	GNEP:	Guaranteed Net Electric Power.

Please note that the point "." denotes the thousands separator, while the comma "," denotes the decimal separator.

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3 GUARANTEED PERFORMANCE DATA

The guaranteed electric power and the relevant heating and cooling conditions are defined as Nominal.

The nominal performance data are calculated according to the following "Design specification data" in three alternative design scenarios, both for Cape and Corsac Station:

CAPE STATION - Properties	Unit	[redacted]
Geothermal Brine Temperature at ORC inlet	°C	
Geothermal Brine Fluid Flow Rate	kg/s	
Geothermal Brine Inlet Pressure	bara	
Ambient Dry Bulb Temperature	°C	
Geothermal Brine Temperature at ORC outlet @ nominal condition	°C	
Geothermal Brine Temperature at ORC outlet @ winter condition	°C	
Thermal power input	MW th	
Geothermal Brine Density at ORC inlet	kg/m^3	
Geothermal Brine Heat Capacity at ORC inlet	kJ/(kg K)	
Geothermal Brine Average Heat Capacity	kJ/(kg K)	
Geothermal Brine Heat Capacity at ORC outlet	kJ/(kg K)	

Table 1

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CORSAC STATION - Properties	Unit
Geothermal Brine Temperature at ORC inlet	°C
Geothermal Brine Fluid Flow Rate	kg/s
Geothermal Brine Inlet Pressure	bara
Ambient Dry Bulb Temperature	°C
Geothermal Brine Temperature at ORC outlet @ nominal condition	°C
Geothermal Brine Temperature at ORC outlet @ winter condition	°C
Thermal power input	MW th
Geothermal Brine Density at ORC inlet	kg/m^3
Geothermal Brine Heat Capacity at ORC inlet	kJ/(kg K)
Geothermal Brine Average Heat Capacity	kJ/(kg K)
Geothermal Brine Heat Capacity at ORC outlet	kJ/(kg K)

Table 2

[redacted] Therefore, the nominal thermodynamic properties of the geothermal water assumed as basis of the guaranteed performance calculation are reported in Table 1 and in Table 2, respectively for Cape Station and Corsac Station.

[redacted]

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[redacted]

4 PERFORMANCE CORRECTION FACTOR

[redacted]

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[redacted]

The following correction factor curves are provided on the basis of the Ambient Air Dry Bulb Temperature (ADT):

- Correction Factor F_1: Ambient Air Dry Bulb Temperature

[redacted]

These curves are developed varying the Ambient Air Dry Bulb Temperature (ATD) and considering constant:

- Geothermal Brine Temperature at ORC inlet (GBIT)
- Geothermal Brine Flowrate (GBF)

For each reported case, the annual energy production has been computed on the basis of the provided hourly temperature of a significative mean year provided by Buyer, by applying the aforementioned correction curves.

[redacted]

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5 PERFORMANCE CALCULATION

[redacted]

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6 CORRECTION CURVES AND ANNUAL ENERGY PRODUCTION

In this Section, correction curves and expected electric and thermal annual energy production will be reported for each of the three design Scenarios.

[redacted]

Geothermal water design specification data are summarized [redacted]

Properties	Unit
Geothermal Brine Temperature at ORC inlet	°C
Geothermal Brine Fluid Flow Rate	
Cape Station	kg/s
Corsac Station	kg/s
Geothermal Brine Inlet Pressure	bara

Table 4

6.1.1 Ambient Air Dry Bulb Temperature (ATD) Correction Factor F_1 for Cape Station

Properties	Unit
Ambient Dry Bulb Temperature	°C
Net Power (ORC and ESPs consumption)	kW
ESPs own consumption	kW
Electrical Net Power (ESPs consumption excluded)	kW
Electrical Net Power Correction Factor	-
ORC own consumption	kW

Table 5

The correction factor curve F_1 for Cape Station is shown in Figure 1 and corresponds to the following formula:

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[redacted]

6.1.2 Ambient Air Dry Bulb Temperature (ATD) Correction Factor F_1 for Corsac Station

Properties	Unit	[redacted]
Ambient Dry Bulb Temperature	°C	
Net Power (ORC and ESPs consumption)	kW	
ESPs own consumption	kW	
Electrical Net Power (ESPs consumption excluded)	kW	
Electrical Net Power Correction Factor	-	
ORC own consumption	kW	

Table 6

The correction factor curve F_1 for Corsac Station is shown in Figure 2 and corresponds to the following formula:

[redacted]

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[redacted]

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[redacted]

[redacted]

Properties	Unit	[redacted]		
Geothermal Brine Temperature at ORC inlet	°C			
Geothermal Brine Fluid Flow Rate				
Cape Station	kg/s			
Corsac Station	kg/s			
Geothermal Brine Inlet Pressure	bara			

Table 7

6.2.1 Ambient Air Dry Bulb Temperature (ATD) Correction Factor F_1 for Cape Station

Properties	Unit	[redacted]		
Ambient Dry Bulb Temperature	°C			
Net Power (ORC and ESPs consumption)	kW			
ESPs own consumption	kW			
Electrical Net Power (ESPs consumption excluded)	kW			
Electrical Net Power Correction Factor	-			
ORC own consumption	kW			

Table 8

[redacted]

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[redacted]

6.2.2 Ambient Air Dry Bulb Temperature (ATD) Correction Factor F_1 for Corsac Station

Properties	Unit	[redacted]		
Ambient Dry Bulb Temperature	°C			
Net Power (ORC and ESPs consumption)	kW			
ESPs own consumption	kW			
Electrical Net Power (ESPs consumption excluded)	kW			
Electrical Net Power Correction Factor	-			
ORC own consumption	kW			

Table 9

[redacted]

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[redacted]

Figure 4

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[redacted]

Properties	Unit	[redacted]
Geothermal Brine Temperature at ORC inlet	°C	[redacted]
Geothermal Brine Fluid Flow Rate		[redacted]
Cape Station	kg/s	[redacted]
Corsac Station	kg/s	[redacted]
Geothermal Brine Inlet Pressure	bara	[redacted]

Table 10

6.3.1 Ambient Air Dry Bulb Temperature (ATD) Correction Factor F_1 for Cape Station

Properties	Unit	[redacted]
Ambient Dry Bulb Temperature	°C	[redacted]
Net Power (ORC and ESPs consumption)	kW	[redacted]
ESPs own consumption	kW	[redacted]
Electrical Net Power (ESPs consumption excluded)	kW	[redacted]
Electrical Net Power Correction Factor	-	[redacted]
ORC own consumption	kW	[redacted]

Table 11

[redacted]

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[redacted]

Figure 5

6.3.2 Ambient Air Dry Bulb Temperature (ATD) Correction Factor F_1 for Corsac Station

Properties	Unit	[redacted]
Ambient Dry Bulb Temperature	°C	
Net Power (ORC and ESPs consumption)	kW	
ESPs own consumption	kW	
Electrical Net Power (ESPs consumption excluded)	kW	
Electrical Net Power Correction Factor	-	
ORC own consumption	kW	

Table 12

[redacted]

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[redacted]

Figure 6

6.4 EXPECTED ELECTRIC ANNUAL ENERGY PRODUCTION

In this Section the expected electric annual energy production is reported for the three analysed Scenarios, both for Cape and Corsac Station.

The electric energy production is calculated considering the correction curves reported in Section 6.1 to 6.3 and an overall plant availability of 95%, which is an indicative but reasonable value. The guaranteed availability, if requested, will be carefully evaluated at later stage.

The annual energy production for the three Scenarios for Cape and Corsac Station is reported in Table 3.

Scenario	Electric energy [GWh / year]	
	Cape Station	Corsac Station
[redacted]	[redacted]	[redacted]
[redacted]	1.036	781

Table 13

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[redacted]

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[redacted]

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