






Validation opinion

Combined notification / request for approval of changes from the project activity as described in the registered project design document and request for revision of the monitoring plan

Title of project activity:			
5 MW Debal Grid-connected Hydroelectric Project in Uttarakhand, India			
CDM reference number:		DNV project No.:	
2965		PRJC-324782-2011-CCS-IND	
Type of request of changes from the project activity as described in the registered PDD:	<input checked="" type="checkbox"/> Notification of changes from project activity as described in the registered PDD (i.e. changes do not raise any concerns with regard to i) additionality, ii) the scale of CDM project activity and/or iii) the applicability and application of baseline methodology <input type="checkbox"/> Request for approval of changes from project activity as described in the registered PDD		
Type of revision for revision of monitoring plan:	<input type="checkbox"/> Proposed revision only includes the request by the CDM EB <input type="checkbox"/> Proposed revision includes not only the request by the CDM EB but also additional revisions proposed by the PP/DOE <input checked="" type="checkbox"/> Proposed revision includes revisions proposed by the PP/DOE		
Date	Work carried out by:	Work verified by:	Approved by:
31 January 2012	 Gaurav Srivastava	 K.V. Raman	 Ole A. Flagstad

1 Description of the changes as compared to the description in the registered PDD and description of the changes to the monitoring plan

We refer to the the EB's 'procedure for notifying and requesting approval of changes from the project activity as described in the registered project design document' adopted at EB 48 (Annex 66) and the 'procedure for revising monitoring plans' adopted at EB 49 (Annex-28) which allows for the project participants to revise the monitoring plans in order to improve accuracy and/or completeness of information.

We further refer to the clarification provided by CDM EB in its 59 meeting (refer paragraph 66 of EB 59 meeting report), where a DOE identifies both changes from the project activity, as described in the registered PDD, and changes to the registered monitoring plan, those changes may be included in one submission under these procedures.

The changes from the project activity as described in the registered PDD are as below:

Changes in design

Sl. No.	Parameter as per the registered PDD	Proposed change / correction	Section of the registered PDD where change is made
1	Rated capacity of generator – The project activity uses two synchronous generators with a rated capacity of 2500 <u>KVA</u> each coupled to two horizontal Francis turbines with capacity 2500 KW each.	The unit of generator capacity corrected from KVA to KW. The project activity will use two synchronous generators with a rated capacity of 2500 <u>KW</u> (3125 KVA x 0.8 PF) each coupled to two horizontal Francis turbines with capacity 2500 KW each.	Section A.4.2
2	Net (Design) Head: 45.0 m	Net (Design) Head: 42.6 m	Section A.4.2

Changes in the Data and Parameters available at the time of validation

Serial No.	Data/Parameter	Value as per registered PDD	Revision in Data/Parameter
1	EF _{CO₂,i} (CO ₂ emission coefficient of fuel type i)	74.1 t CO ₂ /TJ	74.8 t CO ₂ /TJ
2	NCV _{Diesel} (Net calorific value of diesel)	43 TJ/Gg	43.3 TJ/Gg
3	Density _i (Density of the fossil fuel used for the project site (Diesel))	0.82 kg/Lit	0.845 kg/Lit

The proposed revisions to the monitoring plan under section B.7.1 of the registered PDD are as below:

1. Corrections in the “Description of measurement methods and procedures to be applied” and related changes in the “QA/QC procedures to be applied (if any)” along with additional clarifications under “Any comment” for the parameter **EG_{gross,y}**

As per description of the measurement method in the monitoring plan of the registered PDD, the parameter **EG_{gross,y}** (Total electricity generated by the project) is measured at the interconnection point with the grid using one set of main meter and check meter. The PP has sought to correct the same as ‘continuous monitoring by calibrated energy meter located in the plant. Measured daily and aggregated monthly’.

Further, as per the QA/QC procedure in the monitoring plan of the registered PDD, the energy meters used for measuring the total energy generated will be of 0.5 accuracy class and will be calibrated every six month. As part of revision of the monitoring plan, the PP has proposed to correct the accuracy class as 1.0 as per the energy meter installed at site, and revise the frequency of calibration from six monthly to industrial standards for energy meters, but at least once in three years.

Relevant changes have been made under “Any comments”

2. Corrections in the “Description of measurement methods and procedures to be applied” and related changes in the “QA/QC procedures to be applied (if any)” along with additional clarifications under “Any comment” in the table of monitoring parameter **EG_{Auxiliary}**

As per the monitoring plan of the registered PDD, the parameter **EG_{Auxiliary}** (Auxiliary electricity consumption of the project) is calculated as the difference between the gross energy generation and the net electricity export to the grid system. The PP has sought to correct the same as ‘continuous monitoring by calibrated energy meter located in the plant. Measured daily and aggregated monthly’. A separate auxiliary energy meter connected to the auxiliary transformer at the hydro power plant has been installed which directly measures the auxiliary consumption of the project plant.

Further, the QA/QC procedure in the monitoring plan of the registered PDD has been revised to cover the accuracy class and calibration frequency of auxiliary meter installed at site. The auxiliary meter installed at project site is of 1.0 accuracy class. The auxiliary meter will be calibrated as per industrial standards of energy meters, but at least once in three years.

3. Correction in the “Source of data to be used” and “Description of measurement methods and procedures to be applied” with related changes in the “QA/QC procedures to be applied (if any)” for the monitoring parameters “**EG_{export,y}**” and **EG_{import,y}**

As stated in the monitoring plan of the registered PDD, the source of data to be used for measuring this parameter is ‘on site measurement’ and the method of measurement involves ‘measuring the delivery/import of energy using one set of main meter and check meter installed at the interconnection point’.

Through the revision of the monitoring plan, the PP has sought to clearly identify the source of data for verification of electricity exported and imported to/from grid. In the revised monitoring plan the project proponent clearly mentioned that the electricity exported and imported to/from grid will be sourced from joint meter reading certificates issued by Uttarakhand Power Corporation Ltd. (UPCL). The method of measurement of electricity exported and imported to/from grid is revised as ‘continuous measurement by one set of 0.2S accuracy class main and check meter installed at grid interconnection point. As per the revised monitoring plan electricity exported and imported to/from grid will be measured continuously by one set of main and check meter installed at grid interconnection point and

will be recorded on monthly basis in the form of joint meter reading certificates. The energy meters will be calibrated at a frequency of once in six months as per the provision of valid PPA or at least once in a 3 year period as required by general guidance on small scale projects.

4. Correction in the “Data unit”, “Source of data to be used” and “Description of measurement methods and procedures to be applied” along with related changes in the “QA/QC procedures to be applied (if any)” for the monitoring parameter $F_{i,y}$

As per the monitoring plan of the registered PDD, this parameter ($F_{i,y}$ - Quantity of fossil fuel type i combusted in the project plant during year y) is monitored to calculate the project emissions based on the quantity of fossil fuel (diesel) consumed during operation of the DG set at the site. The PP has sought to revise the unit of measurement of the parameter to litres from tonnes/kilo litres as stated in the monitoring plan of the registered PDD.

As per the registered PDD, diesel consumption in the DG set is to be measured using a weighbridge and cross checked against the fuel purchase receipts. The description of measurement method in the monitoring plan has now been revised to measurement of diesel consumption using level gauge and requires cross checking of the DG fuel consumption data against the receipts of fuel purchase and stock balance.

Assessment of reason(s): These corrections are required to ensure that the description of measurement and QA/QC procedures for measuring the parameters are as per the power purchase agreement signed between the project proponent and the State Utility and the actual monitoring and measurement practices implemented at site.

2 Assessment of the changes to the project design

Assessment of when the changes occurred

The change in the design head of the project has occurred at the time of construction of the project due to changes in the alignment of the penstock to suit the hill side contours. The final net head available was 42.5 m and the same is verified from the station arrangement elevation drawing issued by the equipment supplier Boving Fouress Ltd (Drawing No. 2240201).

The change in rated capacity of the generator is only a correction of the typographical error in the unit of generator capacity from KVA to kW in the PDD while there is no change in the equipment itself or its capacity. It is evidenced from the purchase agreement for the generators dated 31 May 2006 and the commissioning certificate dated 23 July 2007, the generators as procured and installed at the site were of the rating of 2500 kW (3125 kVA). This was verified by the DNV team from the technical specifications of the generators provided by the supplier Boving Fouress Limited and also from the name plates of the generators installed at site during their visit to the hydro power plant on 12 August 2011.

The data and parameters available at the time of validation for calculation of project emissions in section B.6.2 of the registered PDD are based on the IPCC 2006 default values. However the methodological tool “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion” version 02 requires that in case if the project emissions are calculated based on IPCC values, the upper bound value at 95% confidence interval should be used. This was pointed by DNV during the course of initial verification. Hence DNV requested project proponent to revise the same.

Similarly the “density of fossil fuel” at the time of validation of the project activity (0.82 kg/Lit) was sourced from the “Society of Indian Automobile Manufacturers” value. During the course of initial verification, DNV found that more relevant value for parameter “density of fossil fuel” is available. Hence DNV requested project proponent to revise the source of “density of fossil fuel” to value provided by published by the Indian Oil Corporation Limited (one of the major manufacturer and supplier of diesel in India).

DNV accepted these revisions in value and source as the proposed revision in data and parameters available at the time of validation will result in conservative CER estimation.

Assessment of the reasons for these changes taking place

The change in design head has resulted from changes in the alignment of the penstock to suit the site conditions which is a hilly area. The penstock alignment required re-arrangement to match the hill side contours and minimise the number of bends. This is a common technical issue while designing the water conductor system of a hydropower plant.

The change in rated capacity of the generator is a correction required due to the typographical error in the unit from KVA to kW in the PDD. The generators procured by the project proponent were of the capacity of 2500 kW (3125 KVA) as evident from the technical specifications by the original equipment supplier Boving Fouress Limited and the commissioning certificate dated 23 July 2007. This was further verified by the DNV team from the name plate capacities during their visit to the power plant on 12 August 2011.

The data and parameters available at the time of validation for calculation of project emissions in section B.6.2 of the registered PDD are based on the IPCC 2006 default values. However the methodological tool “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion” version 02 requires that in case if the project emissions are calculated based on IPCC values, the upper bound value at 95% confidence interval should be used. Hence in line with requirement of the “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion” version 02, project proponent has now used the IPCC 2006 upper bound value at 95% confidence interval for emission factor of diesel (EF_{CO₂, i}) and net calorific value of diesel (NCV_{Diesel}). DNV confirms that the value of emission factor of diesel (EF_{CO₂, i}) and net calorific value of diesel (NCV_{Diesel}) provided in revised PDD are based on the IPCC 2006 upper bound value at 95% confidence interval as provided respectively in table 1.4 and table 1.2 of Chapter 1 of Volume 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.

Further, the value of the “density of fossil fuel” at the time of validation of the project activity (0.82 kg/Lit) was sourced from the “Society of Indian Automobile Manufacturers” value. The revised value (0.845 kg/Lit) is based on the fuel characteristics published by the Indian Oil Corporation Limited (one of the major manufacturer and supplier of diesel in India). In DNV’s opinion the revised value is more conservative and accurate as it is sourced from a more relevant source.

As per the registered PDD, the project emissions are calculated by using the above factors. Thus the revised higher values of the parameters will result into higher project emissions. Since the net CERs are calculated by subtracting the project emissions from the baseline emissions, in DNV’s opinion the above corrections will result in conservative CERs. DNV confirms that the corrections are in line with the approved monitoring methodology applicable to the project activity and that the corrections will improve the accuracy of the emission reduction calculations.

Assessment of whether the changes would have been known to the project participants prior to registration of the project activity

The project activity was registered as a CDM project on 15 March 2010 whereas the project activity was commissioned on 23 July 2007. The design head of 45m in the PDD was taken from the project DPR, which was considered as main source of input parameters for the preparation of the PDD. The DPR was prepared before the construction stage. The values taken in the DPR were based on the available data at the project location, which were directly reflected in registered PDD.

Thus, though the project participant was aware of the change in the design head prior to the registration of the project activity, it was not included in the PDD as the PDD was prepared based on the DPR as the main source of input parameters.

Assessment of how the changes may impact the overall operation/ability of the project activity to deliver emission reductions as stated in the PDD

The power generation in a hydro power plant is directly proportional to the available head. The decrease in design head of the project activity from 45 m in the registered PDD to 42.6 m is therefore likely to reduce the electricity generation, though insignificantly. As stated in the registered PDD, the emission reductions are calculated by multiplying the net electricity generated by the project activity with the grid emission factor. Hence, the emission reductions are likely to marginally reduce due to the decrease in the design head.

The correction in the unit of the generator capacity from KVA to kW will not have any impact on the operation/ability of the project activity to deliver emission reductions as stated in the registered PDD as the actual capacity of the generator remains unchanged.

Assessment of the revision of the Data and Parameters available at the time of validation: The changes proposed in source of data and values were applicable at the time of registration of project activity. However this was overlooked at the time of registration was only identified during the course of initial verification and hence same has been revised now.

Correction of Emission reduction estimate provided on UNFCCC Project View Page: The request for registration for the project activity was submitted on 15 September 2009 (initially) and the emission reductions were estimated based on 29.465 GWh of net electricity exported figure (ex post parameter value used only for CER estimation) and combined margin emission factor of northern grid 760.43 tCO₂/GWh (latest value available at the time of webhosting of PDD for global stakeholder consultation process). In the PDD for simplification of CER estimation project emission was considered as zero. Hence based on

the 29.465 GWh of net electricity exported figure and combined margin emission factor of northern grid 760.43 tCO₂/GWh (value available at the time of webhosting of PDD for global stakeholder consultation process), the emission reduction was estimated to be 22 406 tCO₂e per year.

However during the completeness check stage the project activity had received an incompleteness message from UNFCCC secretariat on 14 January 2010 stating “*the grid emission factor in the PDD submitted for request for registration is based on data published in November 2006. Most recent data at the start of validation (09/05/2008), which is the at commencement of the second GSC, should be employed. Please note that in cases of two GSCs being carried out, commencement of the second GSC is considered as the commencement of validation*”. Hence based on the guidance provided by UNFCCC secretariat the project proponent has corrected the combined margin emission factor of northern grid to 810.46 tCO₂/GWh (latest value available at the time of re-webhosting of PDD for global stakeholder consultation process) and CER estimate (23 880 tCO₂e per year) in the revised PDD. DNV has also corrected the same in its revised validation report and based on the revised documents a request for registration was again submitted on 08 February 2010. Both the revised/corrected validation report and PDD submitted on 08 February 2010, indicate the emission reduction at 23 880 tCO₂e per year. The project activity was registered based on the revised PDD and validation report on 15 March 2010.

Hence, as a conclusion, DNV considers that the correct estimation of emission reduction provided on project view page on UNFCCC website should be 23 880 tCO₂e per year.

3 Assessment of the impact of the changes to the project design

Do the changes raise concerns with regard to any of the following aspects?

- ☐ Additionality
- ☐ Scale of CDM project activity
- ☐ Applicability and application of baseline methodology
- ☒ Not applicable (the changes do not raise any concerns)

Assessment of impacts of the changes on additionality

As per the registered PDD, the project additionality is demonstrated based on the investment analysis. The decrease in the design head of the project activity is likely to reduce the net electricity generation, though marginally, and hence the revenue from sale of power which may further decrease the project IRR in comparison to the benchmark. Thus, the reduction in the design head is likely to strengthen the additionality of the project.

The change in the generator capacity is only a correction of the typographical error in the unit of the generator capacity while there is no change in the equipment itself. This was verified by DNV based on the equipment purchase order, commissioning certificate and visit to the power plant on 12 August 2011. Hence, the correction in generator capacity from 2500 KVA to 2500 kW (3125 KVA) will not have any impact on the additionality of the project.

Thus, the changes have no impact on the additionality of the project as the all critical parameters to assess the additionality remain unchanged. Furthermore, these changes do not impact the input values envisaged in registered CDM-PDD.

Assessment of impacts of the changes on the scale of the CDM project activity

As per the registered PDD, the project activity is a small scale renewable (hydro power) generation unit with an installed capacity of 5 MW. The power generation in a hydro power plant is directly proportional to the available head. For the project activity the reduction in the design head from 45 m to 42.6 m may marginally reduce the power generation due to reduced potential energy of water from the stream. Hence, with the decrease in the design head, the project capacity will not cross the installed capacity of 5 MW and the specified limit of 15 MW for type (i) small-scale projects as per the ‘simplified modalities and procedures for small-scale CDM project activities’.

The change in the generator capacity is only a correction due to typographical error in the unit of the generator capacity while there is no change in the equipment itself, which is verified from the purchase agreement dated 10 November 2006, and name plate capacities during the site visit on 12 August 2011 by DNV team. Hence, the correction in generator capacity from 2500 KVA to 2500 kW (3125 KVA) is not likely to change the scale of the project activity.

Thus, the above changes in project activity to that described in the registered PDD are not likely to affect the scale of the project activity and despite the above change/correction the project remains as small scale activity.

Assessment of impacts of the changes on the applicability and application of baseline methodology

As per the registered PDD, the project activity applies the simplified baseline methodology AMS I.D. ‘Grid connected renewable electricity generation’, version 13. The project activity is a hydro power generation unit and the change in the design head and correction in the unit of the generator capacity do not alter the nature and scale of the project activity. Hence there is no impact on the applicability and application of the baseline methodology.

4 Assessment of the revision of the monitoring plan

The proposed revision of the monitoring plan ensures that the level of accuracy or completeness in the monitoring and verification process is not reduced as a result of the revisions.

1. Corrections in the “Description of measurement methods and procedures to be applied” and related changes in the “QA/QC procedures to be applied (if any)” along with additional clarifications under “Any comment” for the parameter $EG_{gross,y}$
 - DNV has verified during the site visit on 12 August 2011 that the metering arrangement implemented at the site for monitoring this parameter ($EG_{gross,y}$ - total electricity generated by the project) involves a separate energy meter of accuracy class 1.0, connected to the generator terminals. It is confirmed that this parameter is monitored only for internal accounting of electricity generated by the project activity and this parameter is not involved in calculation of the emission reductions. Hence accuracy class and frequency of calibration of the same do not have any impact on calculation of emission reductions. DNV can also confirm that the accuracy class of the meter (1.0) is as per the standard industry practice for non-interface connected meters.
 - DNV also confirms that the revised frequency of calibration of the meter meets the requirement of calibration of once in three years as per Para 17(c) of the CDM EB ‘General Guidelines to SSC CDM methodologies’, and is conservative when

compared with the frequency of at least once in five years as per the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006 in India.

Hence, in DNV's opinion the above corrections will not result in any increase in the CERs and the corrections are in line with the approved monitoring methodology applicable to the project activity. Also, the corrections in no way affect the accuracy of the data (CERs) as the parameter is not used in calculation of the CERs.

2. Corrections in the "Description of measurement methods and procedures to be applied" and related changes in the "QA/QC procedures to be applied (if any)" along with additional clarifications under "Any comment" in the table of monitoring parameter **EG_{Auxiliary}**

- DNV has verified during the site visit on 12 August 2011 that the auxiliary electricity consumption is measured using a separate energy meter of 1.0 accuracy connected to the auxiliary transformer.
- DNV can confirm that the accuracy class of the meter (1.0) installed at the site is as per the standard industry practice for non-interface connected meters.
- It is also confirmed that the revised frequency of meter calibration of once in three years meets the requirement of Para 17(c) of the CDM EB 'General Guidelines to SSC CDM methodologies', and is conservative when compared with the frequency of at least once in five years as per the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006.
- As evident from the registered PDD, this parameter (auxiliary consumption) is used only for internal accounting/monitoring of auxiliary electricity consumption by the project and is not used in calculation of the emission reductions. Further, the parameter is not required to be monitored as per the applied methodology AMS I.D, version 13.

Hence, in DNV's opinion the above corrections will not result in any increase in the CERs and the corrections are in line with the approved monitoring methodology applicable to the project activity. Also, the corrections in no way affect the accuracy of the data (CERs) as the parameter is not used in calculation of the CERs.

3. Corrections in the "Source of data to be used" and "Description of measurement methods and procedures to be applied" with related changes in the "QA/QC procedures to be applied (if any)" for the monitoring parameter "**EG_{export,y}** and **EG_{import,y}**"

- DNV confirms that the source of data identified as the 'joint meter readings certificates issued by Uttarakhand Power Corporation Ltd (UPCL) Officials based on the main meter and check meter readings located at grid interconnection point' is in line with the power purchase agreement (PPA) dated 10 November 2006 signed between the project participant and UPCL, and the current monitoring practice.
- DNV confirms that the accuracy class of the main and check meters installed at site was verified as 0.2S.
- As per the definition of different accuracy classes by ANSI C12.20-1998 standard, the percentage error limit for a 0.2 accuracy class energy meter is $\pm 0.2\%$ whereas that for a 0.5 accuracy class energy meter is $\pm 0.5\%$. Thus, the 0.2 accuracy class meters installed at site are more accurate than the 0.5 class meters considered in the registered PDD. The accuracy class of the meters installed at site is also in line with

the standards for interface meters defined under the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006 and as per the current best practices in the industry.

- DNV confirms that the frequency of calibration of the meters is as per the PPA dated 10 November 2006 and conservative when compared with the requirements of the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006 and Para 17(c) of the CDM EB 'General Guidelines to SSC CDM methodologies'.
- DNV considers the sales records as source of cross verification of the export and import electricity will improve completeness of the reported export and import electricity in the joint monitoring report.

In DNV's opinion the additional information provided in the revised monitoring plan on method of data measurement and recording, and accuracy and calibration of the meters, presents more clarity and is confirmed to be in line with the PPA signed between the project proponent and the UPCL.

Hence in DNV's opinion while these parameters are directly linked to the calculation of the CERs, the additional clarifications on the source of data and details on method of measurement will improve the accuracy and completeness of the monitored data. The additional details provided are conservative and will not result in increase in the CERs. The revisions are appropriate and in accordance with the applied methodology.

4. Correction in the "Data unit", "Source of data to be used" and "Description of measurement methods and procedures to be applied" along with related changes in the "QA/QC procedures to be applied (if any)" for the monitoring parameter $F_{i,y}$

- In DNV's opinion the change in unit of measurement of diesel from tonnes/kilo litres to litres is in line with the CDM EB 'Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion' and will improve the accuracy of the data.
- Also, the source of data identified as 'DG set log book' and the revised method of measurement provide more clarity.
- As per the monitoring plan of the registered PDD, fuel consumption in the DG is measured using a weigh bridge and cross checked against the fuel purchase receipts. However as evidenced by DNV during the site visit on 12 August 2011, in practice the fuel (diesel) is procured by the PP from a local fuel station near the project site and there is no provision for weigh bridge at the site. Hence the monitoring plan has now been revised to measurement using level gauge of the diesel tank, which will be calibrated as per national standards, but at least once in three years as per Para 17(c) of the CDM EB 'General Guidelines to SSC CDM methodologies', and requires cross checking of the DG fuel consumption data against the receipts of fuel purchase and stock balance to account for the actual consumption in DG.

Hence in DNV's opinion while this parameter is directly linked to the calculation of the CERs, the corrections in the unit of measurement, the source of data and the QA/QC procedure will improve the accuracy, traceability, completeness and conservativeness of the monitored data. The proposed revision does not alter any of the monitoring parameters that are necessary for the calculation of the ERs. The corrections are conservative and will not result in increase in the CERs. The revisions are in accordance with the applied methodology.

DNV confirms that the above revision proposed above improves the accuracy of emission reduction calculations and ensures completeness in the monitoring plan.

The proposed revision of the monitoring plan is in accordance with the approved monitoring methodology applicable to the project activity whilst ensuring the conservativeness of the emission reductions calculation

The revisions proposed are included to reflect the actual monitoring practiced at site and to make the calculations more transparent. The proposed revision made for the calculation of emission reductions is in accordance with the approved monitoring methodology AMS I.D “Grid connected renewable electricity generation” version 13.

The findings of previous verification reports, if any, have been taken into account

This is the first verification for the project activity and during the site visit the above mentioned differences were observed in the monitoring plan of the registered PDD and the monitoring practice practiced at site. Hence a revision of monitoring plan has been sought.

5 Validation opinion

DNV recommends the approval of the revised monitoring plan submitted by the project participants.

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