



Mekong River Commission

For Sustainable Development

UPDATED REVIEW REPORT ON THE EXTENSION OF THE DON SAHONG HYDROPOWER PROJECT TO INCLUDE AN ADDITIONAL TURBINE TO GENERATE CAPACITY IN THE WET SEASON (05 September 2023)

I. BACKGROUND

Original prior consultation process

On 30 September 2013, Lao PDR submitted the Don Sahong Hydropower Project (DSHPP), for “*Notification*” under the MRC Procedures for Notification, Prior Consultation and Agreement (PNPCA). In pursuance of the provisions of the MRC’s PNPCA and its Technical Guidelines, the MRC Secretariat forwarded this submission and all supporting documents to the other three Member Countries on 3 October 2013.

The other Member Countries expressed their opinion that the DSHPP should be submitted for *Prior Consultation*. At a Special Session, the Joint Committee agreed to refer the matter to the MRC Council. At the 20th Meeting of the MRC Council on 26 June 2014, Lao PDR stated that the DSHPP would be re-submitted for the Prior Consultation process under the PNPCA. A letter to this effect was received by the Secretariat from the Lao National Mekong Committee (LNMC) on 30 June 2014, along with confirmation of the list of relevant documents originally submitted in September 2013. The Secretariat submitted the letter and list to the JC members from the other three Member Countries on 3 July 2014.

The Joint Committee at its 40th Meeting on 1 October 2014 agreed that the formal starting date for Prior Consultation for DSNHPP would be 25 July 2014, and the six-month PC process would consequently end on 24 January 2015. The JC could not reach a consensus agreement on the proposed use under Article 5.4.3 of the PNPCA at its Special Session on 28 January 2015. The JC nonetheless agreed that the MRC Secretariat should prepare necessary documents for the JC Chairperson to report the outcome of the Special Session to the MRC Council for information and further guidance. Furthermore, each respective Country Delegation may inform their respective governments. During the PC process, the Technical Review Report (TRR) was formulated to support the JC for their decision toward the proposed use and its PC process. The JC agreed to make the TRR available to the public during its Special Session.

The construction of DSHPP started in January 2016. Commercial operations commenced in October 2020. The DSHPP has been operated with an installed capacity of 260 MW as mentioned in the documents originally submitted for Notification and Prior Consultation. This 260MW installed capacity comprises of 4 units of turbines, each with 65MW.

Joint monitoring

Following national and regional consultation under MRC, a Joint Environment Monitoring (JEM) Programme was designed in May 2019. With agreement and cooperation from Lao PDR, it was piloted with two projects including DSHPP. The JEM at DSHPP has been jointly conducted by MRCS, relevant Lao national agencies and DSHPP fisheries and environmental experts in 2020-2021 using the regional JEM protocols to monitor changes in hydrology and hydraulics, sediment and river morphology, water quality, aquatic ecology and fish and fisheries. In addition, fish pass monitoring part of the JEM protocols is being conducted using advanced technology acoustic tagging and receivers to monitor fish migration up and downstream of some key modified channels as natural fish bypass to look at their effectiveness and efficiency.

Together, monitoring information collected by developers, by the JEM Programme, and regular MRC monitoring programmes, can be used to increase understanding about the changes and impacts of hydropower, and for developing mitigation and management measures.

DSHPP developer has taken mitigation measures to mitigate fisheries impacts by removing large illegal gears and by improving natural channels to allow fish migration.

Notification of extension of the DSHPP

On 2 June 2022, Lao PDR via the LNMC sent an official letter No. 0470/MoNRE.LNMCS submitting an extension of the DSHPP for *Notification* under the PNPCA. This included the inclusion of an additional turbine increasing the generating capacity from four to five turbine-generator units. The additional turbine is to be used to provide additional power *during the wet season* (between June to November), while also providing for spare capacity during routine maintenance of the turbines. Based on the information provided, the additional power is for export to Cambodia.

The Secretariat shared this notification together with the submitted "*Brief Description of the Design for Don Sahong Modification Hydropower Project*" to the JC delegations of the notified Member Countries on 10 June 2022. Cambodia has subsequently sent a letter, (No. CNMC:856/22) dated 26 July 2022, noting that the MRCS should carefully review the relevant provisions of the PNPCA, and recommending that the Prior Consultation process should be applied to this extension.

The report on review of the extension of the DSHPP formulated by the MRCS was shared with Member Countries and presented at the 54th Meeting of the Joint Committee in which the JC requested additional documents on this extension. Following request from the JC and official communication by the MRCS (through letter No. L-MRCS (PD) 633/22 dated 31 October 2022),

Lao PDR provided additional documents namely: 1) Feasibility Report of the DSHPP Extension; 2) Executive Summary Amendment of the Environmental and Social Management and Monitoring Plan; 3) Amendment to the Environmental and Social Impact Assessment; and 4) Amendment to the Environmental and Social Management and Monitoring Plan. These documents were then forwarded to Member Countries in December 2022. With these additional documents, the MRCS have updated its review as this document.

II. DESCRIPTION OF THE EXTENSION OF THE DSHPP

The information from the document submitted for Notification (*Brief Description of the Design for Don Sahong Modification Hydropower Project*) and additional documents indicate that the intention is to add one more turbine-generator unit to the existing four units (each unit capacity is 65MW). The total installed capacity of the project will be 325 MW (5 x 65 MW) and the average annual energy generation will increase by 234 GWh. This will be used to provide additional power during the wet season (between June to November) and for spare capacity during routine turbines maintenance. The construction phase is planned for approximately 30 months originally planned from 01 December 2021 to 30 June 2024. The operational phase was due to commence on 01 October 2024.

The additional turbine will be located on the right bank of DSHPP, at the dam site. The powerhouse for the new turbine is about 70 m away from the first phase powerhouse. The project consists of the left-bank non-overflow embankment, the right-bank non-overflow embankment, headrace, the powerhouse annex, the auxiliary powerhouse annex, the erection bay, and the switchyard annex. The installed capacity of the additional turbine will be 65MW. The design discharge is 400m³/s. The total design flow after the modifications would be 5 x 400 m³/s = 2000 m³/s. The modification project will utilise the existing 230-kV transmission line for dispatching the energy. The additional unit has no sluicing mode requirement. (Further details on the design are available from the document submitted).

Two new concrete gravity embankments connected to the existing embankment will be constructed forming a headrace channel. The embankment on the left side will be 94 m long and the embankment on the right side will be 65 m long. The maximum height of the embankments is 25.9 m.

III. OBJECTIVES OF THE REVIEW

The objectives of this review are to:

1. Provide a basis for discussion of the appropriate process to follow under the PNPCA (i.e., Notification or Prior Consultation);
2. Assess whether the findings of the original TRR may change in the light of the inclusion of the new turbine. In particular;

- whether the guaranteed requirement for 800m³/s to flow over the Khone Phapheng falls will still hold.
 - whether the flows in any of the other distributaries during peak fish migration seasons may be reduced;
 - whether fisheries and / or other ecological aspects may be additionally impacted by the proposed new turbine operations or construction process; and
3. Make recommendations to the Joint Committee on the appropriate consultation process to apply or any additional mitigation or monitoring measures that must be applied.

This review will be presented to the Joint Committee and possibly made available to stakeholders during the national and regional consultation events.

IV. METHODOLOGY FOR THE REVIEW

The review considers the submitted documents, namely the Notification Form, and the Brief Description of the Design for the Don Sahong Modification Hydropower Project and additional documents on the DSHPP extension submitted in December 2022. The review also looks at the Technical Review Report produced in February 2015, together with the documents submitted for the Prior Consultation Process for Don Sahong Hydropower Project (DSHPP).

V. REVIEW OF ADDITIONAL TURBINE AGAINST KEY FINDINGS OF THE TECHNICAL REVIEW REPORT IN 2015

This section presents the key findings extracted from Section 7.2 of the Don Sahong TRR dated 6 February 2015. A comment is then provided on each, indicating whether the construction and operation of the additional turbine is likely to exacerbate or alleviate the potential risks. Some recommendations are then made with respect to providing additional data and information to support the conclusions.

The original TRR for the Don Sahong HPP indicated that the potential impacts were associated with the following issues:

- 1) TRR 2015: *The extent to which the modified (flow and morphology) Hou Sadam and Hou Xang Pheuak channels compensate for the lost fish passage in the Hou Sahong is uncertain and is not based on supporting evidence. This may have upstream and downstream impacts on fisheries, have transboundary socio-economic impacts, and affect the availability of prey for the dolphin population.***

Review's Comment:

With the completion of the DSHPP Hou Sahong is likely to have lost most of its fish migration capacity. This is particularly a problem in the dry season. To compensate for this

loss, the Hou Sadam and Hou Xang Pheuak channels were modified to make them more suitable for fish passage. In 2015, it was uncertain as to how effective these modifications of Hou Sadam and Hou Xang Pheuak channels would be. Diverting more water into the Hou Sahong channel to drive the additional turbine would further limit the potential for these other channels for fish passage.

However, the hydrological information provided in the submitted document for the extension indicates that the minimum flow requirement of 800 m³/s for the Khone Phapheng Falls will be retained (Table 5.1-4 pg. 28), and that the new turbine will only be in use in the wet season.

The loss in flow in the other channels due to the new turbine in the wet season is negligible. Similarly, the attraction flows from the other channels would not change substantially. The additional turbine will therefore have small impacts, over and above those already occurring.

Review's Recommendation:

In 2015, little was known about the potential impacts on fish migration. Since then, there has been intensive monitoring, and the DSHPP has been included in the Joint Environmental Monitoring (JEM) programme. It is recommended that these data are provided to the MRCS for review, and to recommend potential changes to the operating rule for the Khone Phapheng Falls in the light of the proposed additional turbine. Changes to the 800 m³/s rule are likely to also affect flows in the modified channels. This may be important at the start of the wet season where delays in the increased flows, or climate change may affect flows at Pakse. This is addressed in more detail below.

- 2) ***TRR 2015: The plausibility, although remote, of sedimentation of the deep pool straddling the boundary with Cambodia. This may occur due to a local increase in sediment load resulting from amplified sediment discharge through DSHPP, if drawdown flushing is undertaken.***

Review's Comment:

Most of the annual sediment load will be carried in the wet season in the other channels and as such the impacts on transboundary sediment transport will be negligible. However, the concern was that sediment flushing operations for the DSHPP head pool *may* increase sedimentation in the downstream dolphin pool.

However, the proposed new turbine does not include sediment flushing facilities and as such will have no further impact on sedimentation of the deep pool.

- 3) *TRR 2015: The loss of important (and locally unique) aquatic habitat in the channels that will be affected by increased or decreased flows and engineering works.*

Review's Comment:

The shifting of flows between the multiple distributary channels is required to maintain fish passage in the modified channels as well as the minimum flows over the Khone Phapheng Falls. This will alter the habitats, and the times those habitats are available over the annual cycle. However, as highlighted in 1) above the changes in flows in the wet season will be negligible and impacts over and above those already in place are unlikely.

Review's Recommendation:

Maintaining a minimum flow of 800 m³/s over the Khone Phapheng Falls is critical to minimising the impacts on habitat availability and fish passage in the other distributary channels, particularly in the dry season and the start of the wet season. It is therefore important that this requirement is maintained and monitored, and that the data are shared with the MRCS on a regular basis.

- 4) *TRR 2015: The reduced flow over the Khone Phapheng, particularly in the dry season and the possible loss of tourism amenity value.*

Review's Comment:

As above, the minimum flows of 800 m³/s over the falls must be retained. This has been included in hydrological calculations outlined in the report submitted by Lao PDR, and it is noted that the additional turbine can still be operated for some 40% of the time.

Review's Recommendation: Given the extreme low flows in the mainstream noted recently, it is important that the viability of additional turbine is assessed against the expected development of the upstream basin as well as for climate change. Any Power Purchase Agreements must similarly consider the risks posed by the delayed start of the wet season flows.

- 5) *TRR 2015: The extent to which flows in the other channels can be regulated only by turbine operations.*

Review's Comment:

During the original Prior Consultation process, the concern was expressed that regulation of the flows through the turbines would not be sufficient to guarantee the minimum flows over the Khone Phapheng Falls.

Review's Recommendation:

It is recommended that the DSHPP operator shares data on the turbine flows, the flows over the Khone Phapheng Falls and the modified distributary channels to demonstrate that management of the turbine flows after the inclusion of the new turbine can be used

to maintain minimum flows in the other channels and over the falls, even during very low flow periods.

VI. REVIEW AND COMMENT ON THE ADDITIONAL TURBINE

This section provides comment on the report provided by Lao PDR against the MRC's main thematic areas for Prior Consultation (hydrology, sediment, and environment and social impacts). Recommendations are then made with respect to providing additional data and information to support the developer's conclusions.

Description of the Extension (Additional turbine)

The Reports submitted by Lao PDR indicated that a comprehensive analysis of the power load, seasonal grid prices and the costs of the transmission line, revealed that there was potential to provide additional power, which would be supplied to Cambodia. Additional wet season flows could be used to generate power by lowering the water level in the head pond during the wet season. Hydraulic calculation results also showed that the Project would use an **additional 400 m³/s** for more than 40% of the time throughout the year inflow. Also, the power generation with surplus water during the flood season would be fully utilized after the extension.

Review on Hydrology

Drawdown of the head pond will lead to a reduction in water levels at the Khone Phapheng Falls, and potentially at the modified fish passage channels. However, little information has been provided regarding the hydraulics of these channels, especially during very low flow periods which have been recently observed in the Mekong mainstream.

The addition of the new turbine represents a 25% expansion of an existing power plant, which will only operate during the wet season. The developer states that this will not affect upstream and downstream water levels, that there will be no diversion of water from or to the Mekong mainstream, or changes in active storage or the need for further resettlements. While this may be true for those times when the additional turbine is not in use, during the wet season more water may have to be diverted away from the Khone Phapheng Falls, and potentially also from the modified fish passage channels. This is unlikely to be a concern during higher flows but may be an issue with the delayed start of the wet season flows due to upstream developments and climate change. It is therefore recommended that the operational rules for the additional turbine are based on the maintenance of flows over the Khone Phapheng Falls *and not on a specified calendar period for the wet season*.

Table 5.1-4 in the submitted report indicates that, after extension, 50% of flow exceeding natural flow in Khone Phapheng is 2,225 m³/s. However, the design discharge is only 800 m³/s, implying that a substantial amount of flow (1,425 m³/s) will be diverted to Hou Sahong for hydropower generation. This diversion of 64% of natural flow after extension is relatively higher than that of

53% before extension. **This may have a significant impact on the Khon Phapheng waterfall, particularly during low flow periods (exceeding 50% flow).**

The inflow design flood analysis for the spillway should not only show the flood frequencies at the Pakse station, but also the local flood frequencies in all the distributary channels. The flows in the distributary channels can be obtained from the hydraulic model, as well as monitoring undertaken during the construction and operation of the DSHPP to date. This data should be shared with the MRCS.

In Table 6.1-2, the water levels at AR-5 should be provided. This information can be used to determine the marginal magnitude of backwater affecting the location. It is unclear from the documents whether the backwater level of Hou Sahong (5km upstream) will change. The operator should demonstrate this, and possible impacts should be described. The backwater calculation should be provided as backwater areas/extensions, particularly in those without embankments, which could be useful information for impact assessment. This information should be available from the MIKE3 simulation as a hydrodynamic model.

Below are key review based on the additional documents provided:

- **Change in flow regime:** the impacts of the flow regime should be analysed with a clear picture of hydrograph analysis for sites, where are sensitive to the potential impacts of the extension project. The impacts of the flow regime cannot be characterized only by the need of the minimum requirement, but also by significant changes in flow magnitude and its transitions (onset and offset of the wet season).
- **Change in water level:** Although it is a run-off river type, the report should mention that the sub-daily hydropeaking is not operated, as it plays a significant role in rapid water level fluctuation, which significantly impacts to local communities.
- **Turbine Emergency Shutdown:** the emergency shutdown may increase the water level of approximately 1.0 m within 4 hours with a maximum rising rate of 0.25 m/30min. This exceeds the MRC Guideline for water level change of 0.05 m/hr (5 cm/hr). The developer should provide any feasible mitigation measures to minimize these impacts.

Review on Sediment

The reports provided shows that 8% of the total annual water volume flows through the Hou Sahong Chanel, and that sedimentation over few years of operation has only amounted to 0.1%. In addition, the report provides information on the general sediment transport rates at the Pakse station.

By using more water with an additional turbine during the wet season, it will increase water velocities in the head pond which will reduce sedimentation. However, no additional sedimentation modelling has been reported, although the presentation provided indicates that these have been undertaken. In case there is the monitoring of sediment before the extension phase, sediment data might be representative for this analysis at the project site. The sediment

analysis should contain information on how much sediment will yield into the Hou Sahong and Khon Phapheng channels and how much it will be trapped in the impoundment.

There was no any sediment study reported in the updated reports including the impacts and its mitigation measures.

Regarding the **ESMMP** on flow control and monitoring plan, the correlation between Pakse station and flow measurement at Hou Sahong and Hou Phapheng may not be possibly used for the flow monitoring plan. Direct flow measurements are required, particularly for automatic stations developed by DSPC (AR1-AR5) to be fully and daily operated. The high frequencies of modelling (sub-daily) need to be stated to ensure the confirmation of non-operation of hydropeaking in a day. Moreover, not only the minimum flow requirement needs to be monitored but also the flow regime indicated by the hydrograph, including the onset and offset of the flow must be closely monitored at key stations.

There was no sediment monitoring plan in the reports including the sediment flushing from the impoundment, although the project is considered as run-of-river type.

Review on Environmental and social impact and ESMMP

The Report submitted by Lao PDR provides descriptions of the engineering designs, sediment analysis, geological and geotechnical studies, and the hydrology/hydraulics with respect to the inclusion of the additional turbine. However, there is no information on possible environmental and social impacts. In this regard, the developer has indicated that no additional environmental and social impacts, over and above the existing impacts, will occur.

While there may be no significant transboundary impact with respect to cross-border flows and the need for relocation of people, changes in the habitats and flows within the Siphandone (4000 islands) Area in Lao PDR may occur. Similarly, flows in the channels modified for fish passage may change, especially at the onset of the wet season.

The additional submitted documents highlight that all the identified environmental aspects, the risks and impacts are well-known and generally of moderate significance. With proper management and mitigation as outlined in the relevant Environmental and Social Management and Monitoring Subplans and as demonstrated during the course of the construction phase for the existing project, these risks and impacts can be managed and mitigated to an acceptable level in compliance with DSPC's compliance obligations.

The main potential impacts during the construction period include:

- Generation of noise and dust from powerhouse excavation (incl. limited control blasting), aggregate crushing, concrete batching and heavy vehicle movement,
- Generation of sediment-laden surface water runoff and effluents with elevated PH, and
- Increased traffic.

The potential construction phase environmental and social impacts are transient and localized and will be mitigated through strict implementation of well-proven engineering measures and close inspection and monitoring to document compliance with applicable standards and identify any unanticipated impacts.

In terms of impacts on fisheries, the increase in flow through the plant and reduced flow down Hou Phapheng during the wet season will attract more upstream-migrating fish towards the Sahong discharge, where they can then enter Hou Xang Pheuak as an upstream fish passage route. The submitted reports mentioned that the approach to monitoring and mitigation set out in the ESMMP will not change as a result of the extension, and fisheries impacts will continue to be mitigated by removing large illegal gears and by improving natural channels to allow fish migration. During each dry season there will be little or no diversion of any additional water into Sahong Channel, so fish migration patterns are unlikely to vary from those prior to the modification.

The DSHPP extension will cause some local physical and water quality effects near the construction site, but these will all be very minor compared to similar effects during the construction phase, and if managed to minimise negative impacts are unlikely to cause any significant effects on fish or fish migration.

The DSHPP has been included in the Joint Environmental Monitoring programme, and there was extensive monitoring of fisheries and fish passage during the final design, construction and operational phases of the HPP. These data, in conjunction with the hydraulic modelling undertaken, should be used to assess possible impacts on water quality, habitats, fisheries and fish migration.

VII. NOTIFICATION vs PRIOR CONSULTATION

It is noted that Article 5 of the 1995 Mekong Agreement, on reasonable and equitable use, and on which the PNPCA is based, was one of the most difficult to negotiate. This Article aims at balancing the Member States' desire to minimise interventions through the MRC in the development of their national water resources, with the need *for increasing levels of discussion and agreement where there are risks of transboundary adverse effects*. This is the basis for the three levels of inter-state discussion: Notification, Prior Consultation, and Agreement. Each of these represents a need for greater engagement and discussion and a greater say over the proposed development.

Thus, developments on the tributaries and on the mainstream in the wet season are only subject to Notification, while developments on the mainstream in the dry season are subject and inter-basin diversions in the wet season are subject to Prior Consultation. Inter-basin diversions in the dry season are subject to Agreement. Given these provisions, **Notification of the proposed additional turbine to be used only in the wet season would be consistent with the provisions of the Mekong Agreement and PNPCA.**

However, it may be argued that if it was part of the larger DSHPP from the start, it would have been made subject to Prior Consultation. Therefore, the principle that should be considered is consequently: *“Will the addition of the additional turbine result in potential significant transboundary impacts not considered in the original Prior Consultation process?”*

The information outlined in the previous sections suggests that the answer to this would be: *“Potentially, small additional impacts are possible, especially at the start of the wet season when increases in flows are delayed.”* This largely depends on the hydraulics of the whole Siphandone Area at the end of the dry season, whether the commitment to the minimum flow of 800 m³/s over the Khone Phapheng Falls is retained (irrespective of the calendar timing of the wet and dry season), and whether the flows in the channels modified for fish passage are unaffected especially during peak fish migration periods.

The DSHPP has been included in the JEM and has been intensively monitored throughout the design, construction and operational phases to date. Detailed data to address the aforementioned issues must be shared at a minimum.

VIII CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The purpose of the proposed expansion of the generation capacity at the DSHPP in the wet season is to provide additional power to Cambodia and while the additional turbine is not likely to result in large impacts, neither can it be considered completely benign.

Therefore, the following recommendations are made:

Recommendations on the Technical Aspect

Taking into account the need to balance and consider the right of the notifying country, the high costs associated with a formal Prior Consultation process, and the aforementioned issues, the following recommendations are addressed to the notifying country, developer, and operator:

- More information regarding **hydraulic analyses** should be shared, specifically concerning flows in all the distributary channels. The developer should particularly demonstrate that any changes in flows over the Khone Phapheng Falls (or changes to the period of minimum flow) are negligible. Additionally, the developer should demonstrate that any alterations to flows in the channels modified for fish passage are also deemed negligible.
- The proposed **operating rules for the commencement and cessation of operations for the additional turbine** should be based on flows in all distributary channels rather than calendar dates.

- The **data collected on sediments, fish passage and fisheries** throughout the design, construction and operational phases should be shared and utilised to strengthen the conclusions that any impacts will indeed be negligible. Fish tracking is recommended as one of data collection needs for the fish passage monitoring programme.

Recommendations on the PNPCA Process

It was requested during the 56th Meeting of the MRC Joint Committee that based on the submitted reports on the DSHPP extension and the updated review by the MRC Secretariat (this document), Member Countries could conduct national consultation or information sharing, if necessary, in their country to provide the update to their national stakeholders as well as collect from them their comments or view. There will be the MRC Regional Stakeholder Forum scheduled on 5th October 2023 in Luang Prabang in which an update on this Don Sahong Extension will be also provided.

The comments and views will be recorded and reported to Lao PDR (and developer) and JC for their consideration.