

ベトナム「ダイニン水力発電所建設事業 (1)(2)(3)」の一次評価結果に係る
二次評価報告書

二次評価者：原口 孝子（株式会社国際開発アソシエイツ）

一次評価対象事業の概要

事業名	ダイニン水力発電所建設事業(1)(2)(3)
事業目的	本事業は、ベトナム南部に水力発電所及び関連施設の建設及び事業により影響を受ける少数民族に対する開発プログラム（IPDP）を実施することにより、増加する電力需要への対応とともにビントゥアン省における灌漑農業の推進と少数民族の生活向上を図り、もって地域の経済社会開発に資することを目的とする。
縁者間承諾額／実行額	(1) 4,030 百万円 / 2,956 百万円 (2) 10,000 百万円 / 8,924 百万円 (3) 19,142 百万円 / 16,691 百万円
借款契約調印	(1) 1999 年 3 月、(2) 2001 年 3 月、(3) 2004 年 3 月
事業完了	2008 年 4 月
実施機関	ベトナム電力公社（EVN）

一次評価の概要

評価の種類	プロジェクト事後評価
評価者	計画投資省、商工省、EVN（第 6 水力発電事業実施委員会（HPPMB 6）およびダイニン水力発電所を含む）およびベトナム人評価コンサルタントにより構成される合同評価チーム
調査期間	2010 年 11 月～2011 年 7 月（フィールド調査期間：2011 年 3 月）
評価結果 （レーティング）	総合レーティング＝非常に高い(A) サブ・レーティング：妥当性＝③高い、効率性＝②中程度、有効性＝③高い、インパクト＝③高い ¹ 、持続性＝③高い

1. 二次評価の枠組み

1.1 背景および二次評価の目的

国際協力機構（JICA）とベトナム計画投資省（MPI）はベトナム政府の評価能力向上支援のための取組として、2007 年より日越合同評価プログラムを実施しており、日本側およびベトナム側の評価者から構成される合同評価チームにより円借款事業の事後評価を行ってきた。この合同評価プログラムでは、年を追うごとに評価におけるベトナム側評価者の責任・役割の範囲を拡大してきており、2010 年度の合同評価プログラムでは、さらにベトナム側のオーナーシップを強めたかたちでの評価を行うこととなった。すなわち 2010 年度の合同評価プログラムでは、評価計画、評価マネジメント、評価の実施、評価結果の活用（フ

¹ JICA の評価枠組みでは、有効性とインパクトをあわせてサブ・レーティングを付与するが、本件評価チームはそれぞれの視点に別個にレーティングを付することとした。

ードバック)のすべての過程において、ベトナム側評価者が全面的に責任を持って実施することが期待されていた。そのため、2010年度の合同評価では以下の2段階(ステップ)に分けて評価を行った。

ステップ1 一次評価。対象事業関係機関およびベトナム人外部評価者(評価コンサルタント)からなるベトナム側評価チームが一次評価を行う。日本人外部評価者は二次評価者としてベトナム人評価チームが行う一次評価に対して助言や指導を行う。

ステップ2 二次評価。ベトナム人評価チームが行った一次評価に対して日本人外部評価者が二次評価者として評価を行う。

二次評価の主たる目的は以下の二つである。

- (1) 一次評価の評価プロセスおよび報告書の中身を検証することにより、ベトナム政府職員およびベトナム人コンサルタントの評価能力向上を支援すること。
- (2) 一次評価でなされた価値判断を JICA の評価クライテリアの観点から検証・確認することにより、評価対象事業のドナーである JICA としてアカウンタビリティの確保を行うこと。

1.2 二次評価の対象範囲

本二次評価の対象は、円借款事業「ダイニン水力発電所建設事業(1)(2)(3)」の一次評価(事後評価)である。

1.3 二次評価の方法論²

上記の二つの二次評価の目的を達成するため、本二次評価では以下の二つの主要設問を基礎に方法論が設計された。

- (1) 一次評価の評価プロセスおよび評価結果は有効であるか?(品質の管理)
- (2) 証拠(エビデンス)に基づく価値判断がなされているか?(アカウンタビリティの確保)

品質の管理については、予め準備したチェックリストに基づいて二次評価者が一次評価の評価プロセスおよび報告書のレビューを行った。価値判断の検証については、JICA の円借款および無償資金協力の評価基準・評価リファレンスを参考に、一次評価報告書に記載されている分析結果のレビューを行った。二次評価者は一次評価者が行った現地調査にも同行した。

二次評価者による一次評価報告書のレビューは、一回目は初稿の段階、二回目は最終稿の段階と合計二回行った。初稿の段階の評価報告書に対する一回目レビュー結果は、ベトナム側一次評価チームにも共有し、彼らが報告書の最終回作業を行う段階で、必要に応じて反映された。

² チェックリスト作成にあたり次の資料を参考にした。JICA 事後評価関連資料、Western Michigan University, Evaluation Checklists (<http://www.wmich.edu/evalctr/checklists/>); Secondary Evaluation by the Advisory Committee on Evaluation (http://www.jica.go.jp/english/operations/evaluation/reports/2007/pdf/2007_04_01.pdf)

評価プロセスおよび評価結果の品質管理のためのチェックリスト

一次評価報告書が以下の各項目を適切に扱っているかどうかをチェックする。

I 評価プロセス	1. スケジュール、予算、業務範囲(TOR) (1) スケジュールの適切性、(2) スケジュールの順守、(3) 予算、(4) 業務範囲の適切性、(5) 業務範囲の順守
	2. 評価設計(評価デザイン) (1) ロジックモデル、(2) 評価設問、(3) データ収集、(4) 情報・データ管理
II. 評価報告書	3. 背景 (1) 評価の目的、評価手法、(2) 評価者、(3) プロジェクトの必要性、(4) アウトプット、アウトカム、インパクト
	4. 妥当性の評価 評価報告書の質:(1) 国家開発計画、(2) セクター政策、(3) 比較可能性、(4) 事業に対するニーズ、(5) 日本の ODA 政策 価値判断に対するコメント
	5. 効率性の評価 評価報告書の質:(1) アウトプット、事業期間、事業費の詳細、(2) アウトプット、(3) 事業期間、(4) 事業費 価値判断に対するコメント
	6. 有効性の評価 評価報告書の質:(1) 証拠(エビデンス)、(2) 証拠(エビデンス)の選択、(3) 要因分析、(4) IRR 価値判断に対するコメント
	7. インパクトの評価 評価報告書の質:(1) 証拠(エビデンス)、(2) 受益者、(3) 環境、(4) 用地取得および住民移転 価値判断に対するコメント
	8. 持続性の評価 評価報告書の質:(1) 制度・組織、(2) 人材配置、(3) 技術レベル、(4) 運営・維持管理予算の財源、(5) 運営・維持管理費および予算、(6) メンテナンス活動 価値判断に対するコメント
	9. 結論、提言、教訓 評価報告書の質:(1) 説明、(2) 提言の実行可能性、(3) 提言の具体性、(4) 提言の妥当性、(5) 教訓の実行可能性、(6) 教訓の妥当性
	10. 総評 評価報告書の質:(1) 章ごとの一貫性・整合性、(2) 図表、グラフ、写真、(3) 収集データの出所、(4) 社会調査の記述、(5) 評価の制約、(6) レーティング基準の逸脱・片寄、(7) 個人情報の保護

1.4 本二次評価の実施に当たっての制約

なし

2. 二次評価者

原口 孝子 (株式会社国際開発アソシエイツ)

3. 一次評価結果の要約

(1) 妥当性：本事業の実施はベトナムの開発政策、開発ニーズ、日本の援助政策と十分に合致しており、妥当性は高い。

(2) 効率性：本事業は事業費については計画内に収まったものの、事業期間が計画を上回ったため、効率性は中程度である。

(3) 有効性：本事業の実施により概ね計画通りの効果発現が得られ、有効性は高い。出力300MWのダイニン水力発電所は、2008年に運転を開始して以来、年平均1,183GWhを発電しているが、これは計画値(1,178GWh)をやや上回る。ダイニン水力発電所で使用された水は、その下流にEVNが自己負担で建設した(本事業の範囲外)出力30MWのバクビン水力発電所に送られ、年114GWhを発電したのち、ビントゥアン省バクビン郡にて農業用水として用いられている。同郡では、本事業後に2,000ヘクタールの灌漑農地が新たに開墾された。事業対象地の居住者(少数民族)は、本事業実施のIPDPによるインフラや公共サービス(学校、医療施設、市場)へのアクセス改善という便益を受けた。本事業の財務的内部収益率を再計算したところ11.25%で、審査時計画値の11.9%とほぼ同じであった。

(4) インパクト：多くのプラスのインパクトとともに若干のマイナスのインパクトが観察された。プラスのインパクトとしては、電源開発によるベトナムの急速な経済成長の下支え、およびビントゥアン省の農業生産増大(本事業後水稲生産量が年率20~30%で増加)への貢献が挙げられる。また、本事業の建設工事のために敷設された道路および橋梁がラムドン省とビントゥアン省を結ぶ幹線道路となり、人や物資の輸送が改善した。マイナス面としては、EVNまたは地方政府の環境対策が不十分である状況が観察された。すなわち、ダム(洪水吐)からの夜間の放流の不足、省による植林プログラムの遅れ、雨季の洪水時における発電所からの無規制な放水、といった問題である。

(5) 持続性：本事業の維持管理は体制、技術、財務状況ともに問題なく、本事業によって発現した効果の持続性は高い。

(6) 結論：以上より、本事業の評価は(A)非常に高い。

(7) 提言：①未完成の事業コンポーネントへの対応(ダイニン水力発電所は通信システムの問題を解決する。ラムドン省政府は、貯水池周辺の植生回復エリアに設置後未使用の灌漑ポンプの問題を解決する)、②マイナスのインパクトへの対策(ダイニン水力発電所はダム下流ラムドン省ドゥックチョン郡方面への毎秒0.7m³の放流を24時間厳守する、EVNの中央給電指令所は発電所下流地域洪水時の発電量を調整する、ビントゥアン省は再植林プログラムを推進する)。

(8) 教訓：①本事業の住民移転グッドプラクティスからの学び(関係者間の連携、地方政府の協力、持続的な少数民族支援(補償のみならず、生活の変化に対応できるようにするための社会開発支援を実施)、②運営維持管理機関の事業実施への関与(事業の持続性を高

めるため)、③事業完成後運転開始時期の、事業実施部局、運営維持管理機関およびコントラクター間の連携。

4. 二次評価結果の要約および提言

上記チェックポイントの幾つかで若干の懸念があったもののほとんどのポイントを満たしたことから、一次評価のプロセスおよび報告書は「満足」と判断できる。スケジュール管理、読み手を意識した報告書の作成（編集、専門的な記述の解説等）については改善の余地が認められる。

一次評価における価値判断（レーティング）は、妥当性「高い（③）」、効率性「中程度（②）」、有効性「高い（③）」、インパクト「高い（③）」、持続性「高い（③）」、総合評価「非常に満足（A）」で、エビデンスと照らし合わせて適切と判断される。

5. 一次評価の評価プロセスおよび評価報告書に対する分析結果

評価プロセスの検証

5.1 スケジュール、予算、業務範囲（TOR）

評価スケジュールは、日本人二次評価者がまず大まかな全体スケジュール案を作成し、ベトナム人一次評価チームがこれを精緻化するとともに、各作業段階の締め切りを付した詳細活動計画を策定した。一次評価期間全体は2010年11月から2011年7月までの約8ヵ月間であった。一次評価に割り当てた期間は十分なものだったが、作業締め切りはチームメンバーの多忙等により守られないこともあった。特に、2011年7月の最終フィードバック・ワークショップにて評価結果を報告した後の、一次評価報告書原稿の最終化作業は、事業実施部局を除く一部メンバーの本件完成への集中力が薄れた結果、非常に長い期間を要した。ベトナム側評価マネジメント体制の不備（後述）も遅れの一因であった。

一次評価の費用負担は、日本側（コンサルタント人件費、トレーニング・会議・ワークショップ開催費およびフィールド調査中の車両費）とベトナム側（トレーニング・会議・ワークショップ等に参加するための旅費）とで分担した。一次評価予算について大きな問題はみられない。

上述の通り、ベトナム側評価チームは一次評価の実施のみでなくマネジメントを行うことが期待されていた。ベトナム側の作業責任の増大に伴い、ベトナム側評価チームを「評価マネジメントチーム」と「評価実施チーム」の二つに分けるという新たな役割分担を試み、それぞれのチームのTORを別個に作成した。評価実施チームのTORは政府機関からのメンバーおよびベトナム人コンサルタントいずれにおいても明確であったのに対し、評価マネジメントチームの作業内容は政府機関メンバーの十分な理解を得るに至らなかった（すなわち、政府機関メンバーは、マネジメントチームの役割を数回のワークショップに出席することと評価報告書案を確認すること、といった程度にとらえており、スケジュール管理および品質管理のためのさまざまな役割については認識していなかった）。このような理解不足は、2006年政令第131号等にて評価の外部評価者への委託が規定されているものの、その際に政府の発注者が行うべき「評価マネジメント」は、ベトナムにおいてまだ

新しいものであることに起因していると思われる。

5.2 評価設計（評価デザイン）

評価デザイン段階では、一次評価チームはまず対象事業のロジックモデルを作成し、次に評価設問とそれに答えるためのデータ収集方針を、評価計画フレームワークのフォームを用いて設定した。

評価計画フレームワークの第一案においては事業のアウトカムとアウトプットの整理に混乱がみられたが、その後チームの理解も進み、ロジックモデルは満足できるレベルまで改善された。同様に、二次評価者の助言も受けつつチーム内の議論を繰り返すうち、評価設問もよりの確なものとなっていった。

対象事業を熟知した実施部門および水力発電所からのメンバーがチームに含まれていたため、情報収集源の設定（必要な情報はどこから得られるかの計画）は非常に詳細行われ、現実性の高いものとなった。これは、本件一次評価が部分的ではあるが内部評価であることのメリットであったといえる。

評価報告書の検証

5.3 事業の背景

一次評価報告書の章立ては JICA の個別プロジェクト評価で用いられているものを踏襲したが、その JICA のフォーマットでは、個別の評価報告部分に評価の目的や評価手法を記載するようにはなっていない（年次評価報告書にて全プロジェクト評価に共通の情報として掲載）。ベトナム側が今回の一次評価報告書を単独の文書として公表する場合は、評価目的と手法についての記述を含めるべきである。

評価者や評価対象事業の概要といった、その他の重要な背景情報は盛り込まれている。

5.4 妥当性

妥当性に関する記述は満足できるものである。

政策面につき、一次評価報告書は、対象事業事前評価段階、事後評価段階それぞれにおけるベトナム社会経済開発計画および電力セクターマスタープランの中から、対象事業との整合性がわかる記述を示している。

ニーズ面については、報告書は急速な GDP 成長率およびそれに伴う高い電力需要を、対象事業前後の比較とともに記述しており、電源開発の継続的な必要性を示している。

5.5 効率性

効率性に関する記述は満足できる部分もあるが、特に事業アウトプットにつき改善の余地がある。

対象事業のアウトプットの項は、事業実施部局が執筆を担当したことから緻密な記述となっている。本文では可能な限り簡潔にまとめ、詳細は巻末に記述しようとした執筆者の相当な努力が認められる。一次評価報告書第一稿では記述内容は専門知識を持たない読者には理解しづらいものだったが、後に専門用語の解説等が付け加えられ、改善された。

5.6 有効性

有効性に関する記述は満足できるものである。

一次評価チームが用いたエビデンスには、発電量の計画・実績比較、発電所からの農業用水供給量、発電所下流の灌漑面積といったアウトカム指標および、フォーカスグループ・ディスカッションや質問紙調査にて収集した、少数民族の生活水準改善にかかる定性情報があったが、これらはいずれもプロジェクト目標（中間アウトカム）を検証するのに直接かつ適切なものであった。

報告書はまた、これらの指標の推移に影響する要因を明確に説明している（例：降雨量が発電量に影響を与えているなど）。

財務的内部収益率（FIRR）および経済的内部収益率（EIRR）の再計算および計画値との比較も、本件一次評価のような評価（経済・財務分析に特化するのではなくさまざまな項目を包括的に含める）におけるものとしては十分なレベルであった。計画と実績の差異の理由も分析・説明されている。

日本の ODA 事業の視点からは、対象事業と他の JICA 事業の相乗効果についても指摘できる。すなわち、二つの関連 JICA 事業「ファンリ・ファンティエット灌漑事業」（円借款事業。借款契約締結は 2008 年）および「ファンリー・ファンティエット農業開発プロジェクト」（技術協力、2011 年開始）がダイニン水力発電所およびバクビン水力発電所からの放水を利用してバクビン郡に約 10,000 ヘクタールの灌漑農地を開発することを図っている。灌漑施設の建設は 2012 年に完成予定である。

5.7 インパクト

インパクトに関する記述は初期の原稿から比較すると大きく改善し、プラス、マイナスそれぞれの調査結果がエビデンスとともに示されている。しかし、評価チームが観察した事象の分析や分析結果の提示には依然として改善の余地がある。全体としては、インパクトの記述は部分的に満足できるものとなった。

一次評価チームが用いたエビデンスには、GDP 成長率、電力需給ギャップ、米生産量、貧困層の所得および定性的情報があった。報告書で示せるのは、これらの指標が示すプラスの変化に対象事業は部分的に貢献した、ということまで（すなわち、事業と経済社会の変化との間の因果関係の特定は本合同評価の枠組み内では困難）であったものの、指標の選定・利用は事業の意図した効果を検証するのに適切であったといえる。

報告書は明示的に対象事業の受益者を特定していないが、①電力供給を受ける需要家すべて、②灌漑用水供給を受けるビントゥアン省バクビン郡農家、③少数民族開発プログラムの受益者であるラムドン省ドゥックチョン郡の少数民族、が含まれることは読み取れる。もしこれら受益者の概数が記載され、また③の受益者はドゥックチョン郡の少数民族人口全体なのか対象事業に直接影響を受ける一部なのか明らかにされていけばなおよかつたと思われる。

環境へのインパクトは本件において多くの関心の集まる場所であるが、報告書では幾つかのマイナス面（下流への放水および森林減少にかかる問題）が示されている。これらの問題点は、プラスのインパクトの大きさと比べると小さいものであるため、インパクトの評価判断は「高い (③)」のままである。また、対象事業と問題点との因果関係はデータが不十分で特定できない。一次評価チームはこの点を十分理解しつつ、度重なる議論を経

て、問題点を報告書に明記することを決めている。その理由は実施機関および関連地方政府のこれらの点に対する関心を喚起し、事態を改善しようという意図によるものである。このような、単に完成プロジェクトを採点するだけでなく、評価の機会を利用してプロジェクトの効果を高めようとする評価チームの真摯な取り組みは特筆すべきである。

用地取得・住民移転へのインパクトも高い関心が想定されるが、これは本件の場合には事業の直接アウトカムとみなされ、有効性の記述に含められた。対象事業が用地取得・住民移転の影響を受けた住民に行った支援は、同事業の注目点の一つである。

5.8 持続性

持続性に関する記述は満足できる部分もあるが、情報が不足している面もある。

一次評価報告書は事業が整備した施設の運営・維持管理体制を明確に説明している。運営・維持管理要員の技術レベルに関する記述も適切である。しかし、財政面および現在の運営・維持管理状況に関する記述はこれらに比べると弱い。

財務面につき、報告書はダイニン水力発電所の現在の収支状況を要約しているが、「営業収入でまかなわれている」とされている運営・維持管理費用の必要額と実績額の分析が合わせて行われていれば、よりよい分析となったと思われる。

運営・維持管理状況については、現在の維持管理作業の種類や頻度といった情報が示されていれば、評価判断の説得力が増したと思われる。

5.9 結論、提言、教訓

提言および教訓は全般的には同意できるものであったが、次のような留意点も指摘できる。

まず提言は、概ね具体的で実行可能であり、評価結果の項に記述されたエビデンスに裏付けられている。しかし、ラムドン省に対して提言している灌漑ポンプ未使用問題の解決は困難が予想される。すなわち、過去にポンプ場の監視員を務めていた男性によると、ポンプ利用料を徴収し共同利用するためのユーザーグループ設置等の対策が過去に試みられたが、ポンプの使用が利用者のニーズに合っていなかったため成功しなかったとのことである。そのような状況で、かつ何年も機材が放置されている状況で実現可能な対策を見つけるのは非常に困難と思われる。

教訓（少数民族プログラムの意義）については、非自発的な住民移転を伴うすべての事業にて本事業のような開発プログラムを実施すべきか、またどの程度まで開発支援を行うべきかは明確に読み取れない。一事例から得られた結果を一般化し、どのような場合にその教訓を適用すべきかを特定するのは困難であるため、このような状況は仕方のないものであるが、本件報告書は一つのグッドプラクティスを具体的に示しており、他事業の計画担当者がケーススタディとして参照するのには値すると思われる。

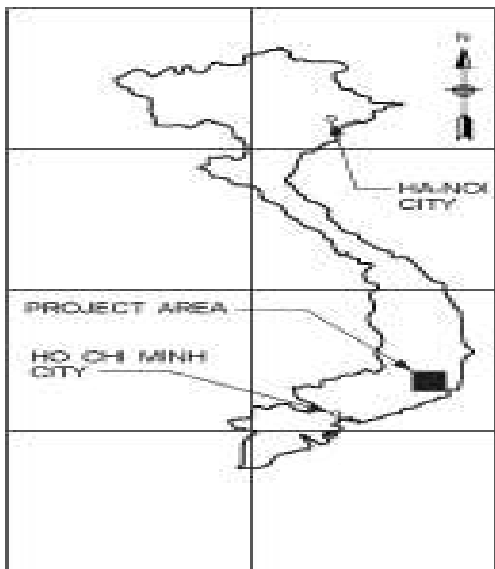
5.10 総評

背景説明部分、評価結果本体部分、巻末の計画・実績比較の表を通し、提示情報の内容や数値は一貫しており齟齬はみられない。データ表やグラフ、写真も記載事項を裏付けるものとなっている。ただし、表記や文法、レイアウトについてはさらなる編集により、報告書の質を向上させる余地がみられた。

6. 添付資料

ダイニン水力発電所建設事業(1)(2)(3) 一次評価報告書

1. Project Profile



Project Site



Dai Ninh Power house

Dai Ninh Hydropower Project has the capacity of 300MW with the average output annually of 1.2 billion kWh, after more than two years of operation it has been made 2.9 billion kWh.

The project was constructed under fund of the ODA Loan from Japan (75%) and Vietnam Government’s portion (25%).

The Employer of the Project was Electricity of Viet Nam (EVN) who representative by Hydropower Project Management No.6 (HPMB6).

1.1 Background

In Vietnam, demands for electricity have been increasing rapidly along with economic development since the instruction of the “*Doi moi*” Policy in 1986. At the time of the project appraisal power shortages had already become a serious problem in Viet Nam, especially in Southern Vietnam. It was projected that during period till 2005, the power demand would increase by 11.7-14.1% p.a. in the entire country which was a very high rate requiring more installed capacity of power plants..

The installed generation capacity as of 1998 was 5,233MW (2,390MW thermal, 2,834MW hydro and 9MW other) as a whole. To meet the demand mentioned above, a minimum output of 12,357MW in Vietnam was required in 2006.

In 1994, a 500kV transmission line to connect the north and south was commissioned so that power shortage in the South could be alleviated by supply from the north. Nevertheless, it was projected that northern Vietnam would also run short of power in the near future due to rapid economic development. In sum, even with power supply from other areas, the development of large-scale power resources was necessary in the South.

In addition, about 40,000 cultivated hectares in Binh Thuan Province are in danger of becoming desert as a shortage of irrigated water. Hydropower plant located in Lam Dong and Binh Thuan on the one hand can supply additional power to ease the shortage of electricity, on the other hand, to rescue a huge land for agriculture.

1.2 Project Outline

The objective of this project is to meet the increasing power demand in the Southern region of Vietnam. Dai Ninh Hydropower Project (HPP) is power generation and provision of water for irrigation for forest, agriculture development in downstream areas, and at the same time help improvement of environment, ecology creating ideal tourist resorts. What is special here is that after commissioning, water discharged from power generation will be further utilized for Bac Binh Hydropower Plant of 33 MW in capacity, and then water being discharged to Song Luy Reservoir of Phan Ri-Phan Thiet Irrigation Project. It helps reclamation of 40,000 hectares of agricultural land that is under serious water problem and in danger of a desert in North Phan Thiet, Bac Binh District and part of Tuy Phong District, Binh Thuan Province. In addition, support the improvement of living standard of indigenous people in the project site by implementing environmental preservation; the indigenous people development plan (IPDP) and resettlement and rehabilitation action plan (RRAP).

Logical Framework

Goal	Support socio-economic development of Vietnam in general and of Southern region in particular.
Purpose	<ol style="list-style-type: none"> 1. To meet the increasing power demand in the Southern region of Vietnam 2. To enhance irrigation agriculture in Binh Thuan Province 3. To support the improvement of living standard of indigenous people in the project site
Outcomes	<ol style="list-style-type: none"> 1. Increase in power supply to the Southern region 2. Supply irrigation water to Binh Thuan province 3. Better living condition and livelihood of indigenous people in the project site
Outputs	<ol style="list-style-type: none"> 1. Dai Ninh hydropower plant (300MW) 2. Transmission lines (from Dai Ninh HP to Di Linh and Phan Ri substation) 3. Substations (110kV and 550 kV) 4. Consulting services 5. Indigenous People Development Program (IPDP) 6. Development of Resettlement and Rehabilitation Action Plan (RRAP)
Inputs	<ol style="list-style-type: none"> 1. Total cost: 49,270.989 million Yen (JICA loan: 33,171.814 million Yen; Gov't portion: 16,099.175 million Yen)

Outline of Loan Agreement

	L/A 1	L/A 2	L/A 3
Approved Amount/ Disbursed Amount	4,030 million Yen / 2,956 Million Yen	10,000 million Yen / 8,924 Million Yen	19,142 million Yen / 16,691 Million Yen
Exchange of Notes Date/ Loan Agreement Signing Date	03 29, 99 / 03 30, 99	03 30, 01/ 03 30, 01	03 31, 04/ 03 31, 04
Terms and Conditions - Interest rate - Repayment period - Grace period - Procurement	0.75% p.a. 30 years 10 years General Untied	0.75% p.a. 30 years 10 years General Untied	0.75% p.a. 30 years 10 years General Untied
Borrower / Executing Agency	The Government of the Socialist Republic of Vietnam (GOVN)/Electricity of Vietnam (EVN)	GOVN/ EVN	GOVN/EVN
Final Disbursement Date	MM DD, YY 07/18/2006	MM DD, YY 07/18/2006	MM DD, YY 08/11/2010
Main Contractor (Over 1 billion yen)	Kajima-Kumagai-Song Da Joint Venture (KKS), Hazama Corporation, IHI-Sakai Joint Venture, Consortium Toshiba-Sojitz, Consortium Sumitomo-Japan AE Power		
Main Consultant (Over 100 million yen)	JV of SOGREAH Ingenierie & SNC Lavalin International Inc JV of NIPPON KOEI Co, Ltd & EPDC Ltd		
Feasibility Studies, etc.	EVN, feasibility studies, 1994.		
Related Projects	Resettlement and rehabilitation action plan (RRAP) Indigenous People Development Plan (IPDP)		

2. Outline of the Evaluation Study

2.1 External Evaluator

The primary evaluation was solely done by Vietnamese Evaluator, Dai Ninh Hydropower Joint-evaluation Group with suggestions by Japanese secondary evaluator.

The Vietnam-Japan Joint Evaluation Team 2010 consisted of the two Working Groups each of which evaluated different projects. This project was evaluated by the Dai Ninh Hydropower Joint-evaluation Group joined by the following members:

1. Luong Lan Dung, National Power Transmission Corporation (National adviser)
2. Bui Duc Tho, National Economics University (National consultant)
3. Mai The Cuong, National Economics University (National consultant)
4. Banh Thi Bich Ngoc, Hydropower Project Management Board No 6 (core team member)
5. Nguyen Thi Lan Dai, Hydropower Project Management Board No 6 (core team member)
6. Nguyen Thi Hong Thuy, Hydropower Project Management Board No 6 (core team member)
7. Nguyen Hong Hai, Hydropower Project Management Board No 6 (core team member)
8. Nguyen Dinh Vinh, Dai Ninh Hydropower Plant (core team member)
9. Do Phuoc Dung, Ministry of Industry & Trade (core team member)

10. Cao Thanh Phu, Ministry of Planning & Investment (core team member)
11. Pham Minh Hung, Ministry of Planning & Investment (core team member)
12. Nguyen Minh Hai, EVN (core team member)

Management team includes:

1. Le Huu Phuc, Ministry of Industry & Trade
2. Luong Thi An, EVN
3. Luong Van Ket, Ministry of Planning & Investment
4. Cao Manh Cuong, Ministry of Planning & Investment

2.2 Duration of Evaluation Study

Duration of the Study: November 22, 2010 – July 14, 2011

Duration of the Field Study: December 13, 2010 – March 19, 2011

2.3 Constraints during the Evaluation Study

Nether Binh Thuan nor Lam Dong Natural Resource and Environment Department can provide any information on the types and number of wild animals in the project area, the study has no evidence to evaluate this aspect.

3. Results of the Evaluation (Overall Rating: A)

3.1 Relevance (Rating: 3)

3.1.1 Relevance with the Development Plan of Vietnam

A high priority on power sector development is continuously seen in the Socio-Economic Development Plan (SEDP) of both before and after the project. SEDP 1996-2000 (at the appraisal or ex-ante evaluation stage) emphasized adding to and upgrading power resources and networks in the Industrial Development Program and the Infrastructure Development Program. SEDP 2006-2010 (at the ex-post evaluation stage) gives an even higher priority to power sector development. A priority on hydropower development, which can utilize Vietnam's natural resources and save generation costs, is also stressed.

At the lower level of development plan of EVN, the Master Plan IV 1996-2000 Perspective up to 2010 plans to increase generation capacity from 4,435MW to 19,000MW in 1994-2010. Increasing power generation capacity is again mentioned in the current Master Plan VII 2010-2020, which plans to increase generation capacity up to 54,294 MW, and to construct 50 hydropower plants.

3.1.2 Relevance with the Development Needs of Vietnam

In the period of 1996-2000, Vietnam experienced a high GDP growth rate, an average of 7%¹. This fast economic development required a rapid increase in electricity demand with an average 14.4% p.a. consumption growth (countrywide) in 1998-2005, higher than estimated at the time of appraisal -- 11.7-14.1% p.a. consumption growth forecast till 2005. GDP of Vietnam continues to grow at a high rate in the period of 2001-2010, an average of 7.2%. This development leads to a high demand forecast, an average of 13.1% p.a. consumption growth forecast till 2020.

Table 1 shows basic indicators of power demand and supply at the ex-ante and ex-post evaluation stage. High demand for power both before and after the project completion can justify the necessity for the development of power resources in the South.

¹ Calculate from Statistical year books 1997-2009, GSO.

Table 1: Basic power indicators

Indicator	Ex-ante evaluation stage	Ex-post evaluation stage
Power consumption and growth rate		
Vietnam	Average 18.1% p.a. consumption growth in 1995-1997	Average 14.4% p.a. consumption growth in 1998-2005 and an average of 13.5% p.a in the period of 2006-2010.
Southern of Vietnam	Average 18.27% p.a. consumption growth in 1995-1997	Average 14.74% p.a. consumption growth in 1998-2010 and an average of 12.73% p.a in the period of 2006-2010.
Installed generation capacity		
Vietnam	20,854 million kWh (1998)	59,088 million kWh (2010)
Demand forecasts		
Vietnam	11.7-14.1% p.a. consumption growth forecast till 2005	Average of 13.1% p.a. consumption growth forecast till 2020
Southern of Vietnam		Average of 13.97% p.a. consumption growth forecast till 2020

Source: EVN and A2

3.1.3 Relevance with Japan's ODA Policy

The ODA Charter of Japan (1992), which defined the overall aid framework at the time of the appraisal of this project, gave priority to assistance in infrastructure development as a prerequisite to socio-economic development. Based on such framework, the Japan's Country Aid Principles for Vietnam (1994-1999) identified five major priority sectors for the implementation of ODA, namely, (i) human resource development/ institutional building, (ii) rehabilitation/ construction of economic infrastructures in the areas of electricity and transport, (iii) agricultural development, (iv) improvement in social services and education, public health and medicine, and (v) environmental protection. The objectives of this project serve (ii) and (iii) above. Also, the Indigenous People Development Program (IPDP) integrated in this project was to serve (iv) and (v) as well.

This project has been highly relevant with the Vietnam development plan, development needs, as well as Japan's ODA policy; therefore its relevance is high.

3.2 Efficiency (Rating: 2)

3.2.1 Project Outputs

The project output was produced mostly as planned (see "Comparison of Original and Actual Scope" on the last page of this report). This consisted of six main components: (1) Construction of the Dai Ninh Hydropower Plant with two reservoir and dams; (2) Construction of 500kV substation and expansion of 110kV substation; (3) Construction of 220kV and 110kV transmission lines; (4) Consulting services; (5) Development of resettlement sites and Indigenous People Development Program (IPDP); and (6) Development of Resettlement and Rehabilitation Action Plan (RRAP). The summary of the output produced is as follows:

Specification of major project outputs:

- Hydropower plants with 300MW (150MW x 2 units)
- Two reservoirs with total volume of 251 million m³: Da Nhim reservoir with 66 million m³; Da Queyon reservoir with 185 million m³ and a connecting channel.
- Two main dams (earth-fill dams): Da Nhim main dam with height of 56m; Da Queyon main dam with height of 58m.

- Transmission lines: total 90km (44km of 220kV lines and 46km of 110kV lines)
- Substations: New construction of 220/500kV Di Linh Substation (3 x 150MVA) and Extension 110kV Phan Ri Substation 1x16MVA² Scope of transmission lines (T/L) and substations (S/S) of the Project are changed due to the adjustment of electric connecting system by the revised Master Power Plan No.V. The new 500kV Di Linh S/S was replaced with extension 2 S/S (Bao Loc, Long Binh) and 2 x 220kV Transmission lines (Dai Ninh-Bao Loc 70.3km and Bao Loc-Long Binh 136.5km)

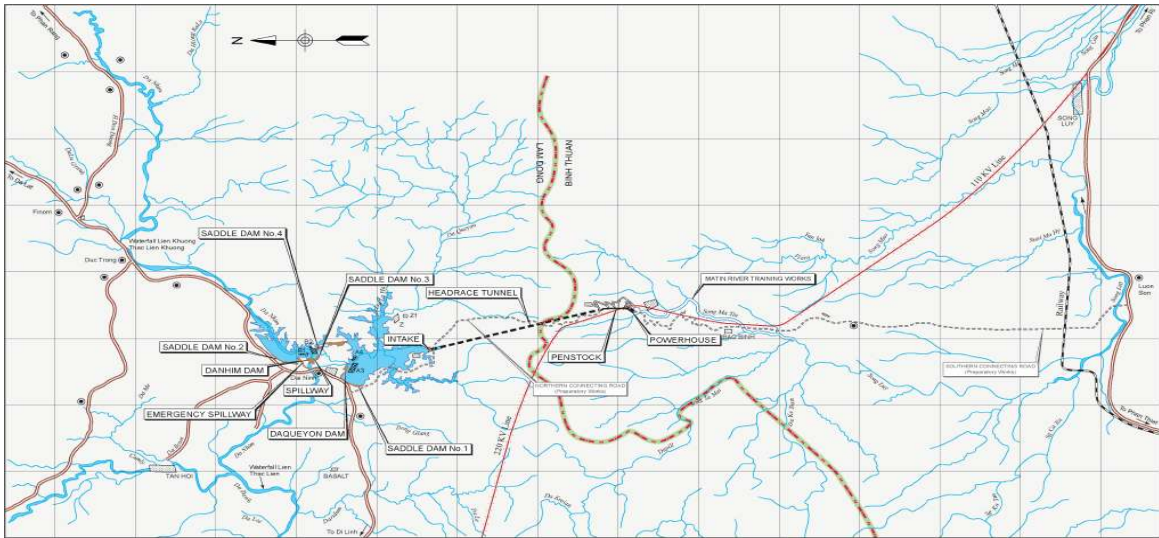


Figure 1: Project general layout



Photo 1: Di Linh Substation



Photo 2: Hydropower plants with 300MW (150MW x 2)

² The 16 MVA transformer installed by the Dai Ninh hydropower project is not in use until April 2011. It is in use after experts from Siemen came and fixed the problem of compatibility between the transformer and the circus breaker in March 2011.

After the completion of the facilities and equipment of the power plants (as of April 2008), there were some minor problems found (i) Over heating and cracking of cap insulators of generators unit 1&2 (The temperature of cap insulator had been increased to 150-160⁰C, so the cover of caps have been cracked). (ii) Loose-spacer; (generator's spacers have been loose when the generators operating) (iii) Turbine shaft Coupling (Coupling bolts of turbine shaft and generator shaft has been designed by the Contractor was not compatible with technical requirements); (iv) The communication system between Spillway, intake and Powerhouse (This system had not been yet made commissioning since completed of installation work due to interface between equipment of Hydro-mechanical Equipment (ME1) and Electrical Equipment (ME2) contractor and one Ultra- high frequency (UHF) radio equipment on belong to ME2 contractor was damaged). The Contractor has carried out the repairing works and the deduction of contract price. Up to now, the above captioned outstanding works have been settled by the relative parties as follows:

(i) and (ii): Overheating and cracking of cap insulators of generators Unit 1&2 and loose-spacers have been repaired by the Operation Unit, Dai Ninh Hydropower Company in occasion of yearly overhaul. The Contractor has been agreed to make the compensation fee for this works. Up to now, the Generators Unit 1&2 have been being in the good condition of operation.

(iii): Turbine shaft coupling: EVN hired an Independence Organization named National Research Institute of Mechanical Engineering (Narime), to evaluate the impact of the turbine shaft coupling problems. The existing design of the turbine shaft coupling is sufficient to ensure for endurance and shaft coupling's straight for long-term operation as Narime's review. Besides, 2 set of bolts (20 bolts) for standby were supplied by the Contractor and the Contract price was deducted for this. Up to the stage of this Ex-post evaluation, the turbine has been being in the smooth operation condition.

(iv): The UHF (Ultra high frequency) equipment was repaired by the Contractor however the installation works for this equipment have been not carried out yet by the Contractor until now. The consulting services were provided mostly as planned. The major tasks were review the detailed designs; assistance in tender and construction supervision. No big problem is reported about the performance of the consultants. The whole actual Man-month (M/M) of the Consultants was 415 M/M for foreigners and 560 M/M for local staff while the planned ones were 336 M/M for foreigners and 554 M/M for local staff.

The IPDP is carried out mostly as planned with 5 development programs namely: Forestry program; Agriculture program; Education Program; Medical program; and Culture program. Detail figures on the output of the IPDP are described in the table "Comparison of the Original and Actual Scope of the Project" at the end of the report.

Development of resettlement sites included 48 houses in Ninh Gia commune, 7 houses in Ta In Commune and 1 house in Phu Hoi commute. Each household has a 400 m² parcel with a 56m² house, a well and a rest-room. The resettlement site is well designed with accessing roads, a public welfare house and a local clinic.

Rehabilitation (Agriculture resettlement) areas at Ninh Gia, Ta In and Phu Hoi communes included 220 hectares of reclaiming area with its 3 pump systems (pumps, operation control houses, tanks (100 and 200m³) and connection pipes) and road in production section.



Photo 3: Resettlement site



Photo 4: Phan Ri substation



Photo 5: Pump for irrigation

3.2.2 Project Inputs

3.2.2.1 Project Period

Using LA1 as the baseline for evaluation, the overall project period was delayed by 39 months (57% of the planned period)³ in which the period of each packages is such as 40months of Consulting service, 13 months of preparatory works, 8 months of Civil works for waterway and powerhouse (CW1) package, 8 months of Civil works for Head-works (CW2) package, 13 months of Hydro-mechanical Equipment (ME1) package, 21 months of Electrical Equipment (ME2) package, 28 months of Supply of Equipment and Material for Transmission Lines (TL1) package, 39 months of Erection for Equipment and Material for Transmission Lines (TL2) package and 28 months of Supply and Erection for Substations and Communication system (TL3) package. The reasons of the delay are as followings:

- The approval procedure and duration by Ministry of Industry (MOI) and relative organizations for results of bidding of consultancy service package, detailed design and additional design, bidding documents and results of negotiation of contracts were long and complicated. As a result these, the subsequence activities for project such as detailed review, additional design, bidding and construction... were shift accordingly.
- Revision of master plan such as adjustment of electric network system due to revision of Power Master Plan V, the scope of works of the project was changed accordingly.

³ Total project period stated in LA 1 was 70 months, from March 1999 to December 2004. The starting date is the signing LA1 date and the completion date is the starting of the operation of the power plant. However, according to LA 3, the completion date is expected in December 2008.

- The planning schedule in the appraisal stage (time of discussion for Loan Agreement) was based on the Basic detail Design such as the planned schedule for packages of civil works was 47 months in the appraisal stage (L/A) but in the actual these schedules were adjusted to 51 months after detailed design reviewed and bidding document issued.
- During the construction stage, the performance of the Contractor such as ME2, TL3 and TL2 Contractor was not good as expected due to weak of ability in technical and organizational.

3.2.2.2 Project cost

The total actual cost of the project was 38,215 million Yen, which was 23,358 million Yen lower than estimated cost of the project (save 38% of the estimated cost). In which, 19,839 million Yen from JICA portion was saved.

Table 2: Project estimated and actual cost

Unit: Japanese Yen

	Total Estimated Project Cost (LA VN XI-1)	Total Actual Project Cost	Balance
Total	61,573 million	38,215 million*	23,358 million
JICA Portion	48,439 million	28,600 million	19,839 million
Gov. Portion	13,134 million	9,615 million	3,519 million

Source: HPMB No.6

Note: (*): This amount included the estimated costs for some remaining issues such as Contractor's claim

Reasons of differences:

- Due to international and local competition bidding helps reducing project costs of some packages such as in the L/A estimated amount for the packages of civil works was 29,552 million JPY and equipments was 12,591 million JPY...but decreased to 17,550 million JPY and 7,378 million JPY, respectively after bidding.
- Fluctuation of exchange rate between JPY and VND in which JPY rate was increased remarkably. While some Contract Prices were calculated by VND so the actual disbursement amounts were lower much than the planned one. The exchange rate in the appraisal stage was 1JPY= 100VND, but in the construction stage was about 1JPY=130VND, that mean the JPY rate increased 30%.
- The cancellation of the first International Competition bidding (IBC) for TL1 package to change to the Local Competition bidding (LBC) and direct appointment and purchase helped to decrease the cost for this package (the first IBC bidding price was 1,123 million JPY but the actual cost was 591 million JPY after this package was divided into 8 small packages and carried out the re-bidding by method of LBC and direct appointment and purchase).

Although the project period extended by 157% as comparison with plan stated in LA1, project cost was saved by 38%, therefore efficiency of the project is fair.

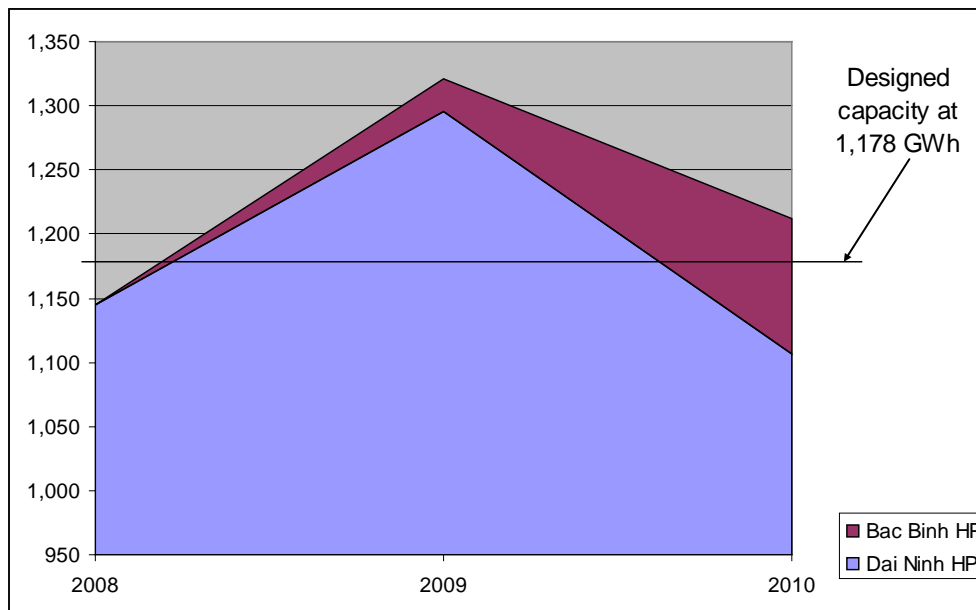
3.3 Effectiveness (Rating: 3)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

+ Increase power supply

Dai Ninh HP achieves its full capacity as planned, 300MW, with two 150 MW generators. After three years of operation, the average annual energy output of Dai Ninh HP is 1,183 GWh/year which is slightly higher than targeted 1,178 GWh/year. The water used at Dai Ninh HP is sent to Bac Binh HP, which EVN constructed on its own resources after this project, for additional power generation (see 3.4 Impact).



Source: Dai Ninh HP

Figure 2: Annual energy output of Dai Ninh and Bac Binh HP as comparison with target

Table 3 shows that even there is a fluctuation of energy output of Dai Ninh HP, the three year average output is higher than targeted. The fluctuation of energy output is mostly due to the amount of rainfall. The two generators of Dai Ninh HP are now in a good condition and expected to work as planned for stable energy output.

Table 3: Target and actual annual energy output of Dai Ninh HP (GWh)

GWh/year	Target annual average as guarantee	Target annual average as design	Actual			Actual average
			2008	2009	2010	
Dai Ninh HP	862.9	1,178	1,145	1,296	1,107	1,183

Source: Dai Ninh report to the questionnaire

+ Enhancing irrigation agriculture in Binh Thuan Province mainly in Bac Binh district

The water used for generation at the Dai Ninh HP was flowed to Bac Binh HP reservoir and then was supplied for irrigation to Binh Thuan province. On average from 2008 to 2010, Dai Ninh supplied 768 million m³/year for irrigation in Binh Thuan which is slightly higher than designed, 766 million m³/year.⁴ According to the report from Bac Binh Division for Agriculture

⁴ As designed, quantity of irrigation water supply = 0.65 m³/kWh * 862.9 GWh.

and Rural Development, using water from Dai Ninh HP, the number of irrigated hectares increased from the baseline of 7,576 ha in 2007 to 9,372 ha in 2010. The number of irrigated hectares may increase more as the district has planned to develop the channel system to utilize the best of the water resources.

Table 4: Water flow from Dai Ninh to Bac Binh and irrigated hectares in Bac Binh district

	2007	2008	2009	2010
Water supplying from Dai Ninh HPP (mil m ³)	0	746,25	830,21	727,25
Irrigated hectares for agriculture (ha)	7,576	8,032	8,733	9,372

Source: Report of Dai Ninh HP and report of Bac Binh Department for Agriculture and Rural Development

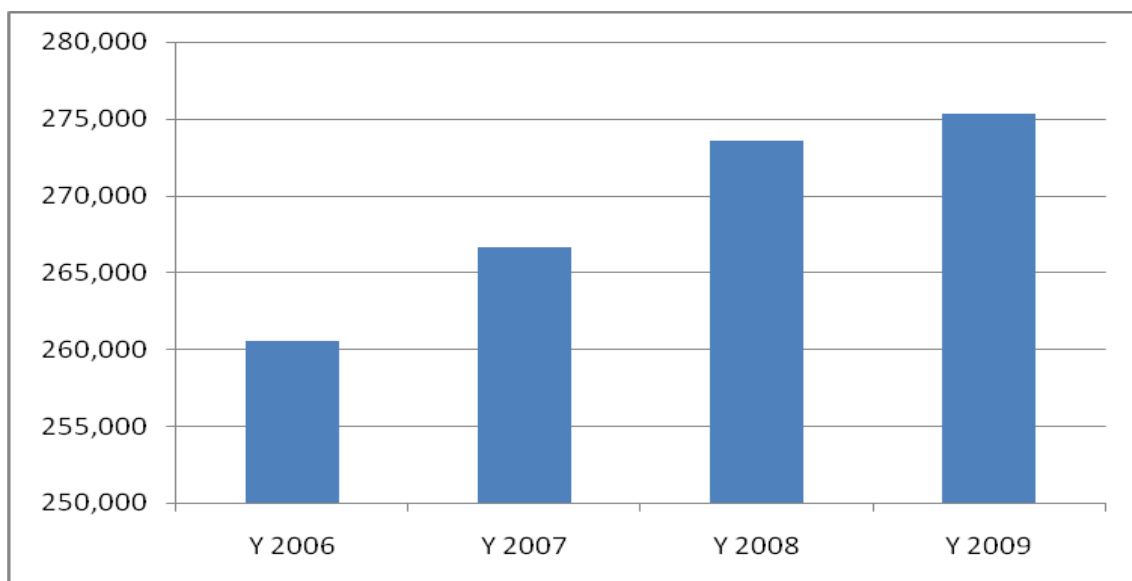
In addition to the amount of water supplying, Dai Ninh HP can help to control the flow of water for not only electric generation but also for irrigation in Binh Thuan. That is the reason why after the project completion, Bac Binh can switch from 1 or 2 crops/year (before the project completion) to 3 crops/year.

The above statistical figures imply that the project has successfully enhance irrigation agriculture in Binh Thuan Province

+ Reclaimed land for agriculture

Using water from Dai Ninh HP, Binh Thuan has been rehabilitated its unused land for agriculture. In Bac Binh district, according to the report of Bac Binh Department for Agriculture and Rural Development, there are 360 ha of rehabilitated land using water from Dai Ninh HP. And according to Binh Thuan Department for Agriculture and Rural Development, they are developing more canals to rehabilitate more land not only for agriculture but also for tourist development. In this aspect, the project achieved its primary purpose and even gets more benefit from the use of water.

Figure 3 shows that the planted area of Binh Thuan has increase sharply right after the project completion in the end of 2007. With a supply of about 768 million m³ water annually to Binh Thuan, Dai Ninh HP project has directly increased rehabilitated land for agriculture in Binh Thuan.



Source: Binh Thuan Year Book 2009.

Figure 3: Planted area of crops in Binh Thuan (ha)

3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)

At the appraisal stage, the financial internal rate of return (FIRR) of the project was calculated at 11.9%. The financial costs consist of construction costs, replacement expenses, and operation and maintenance cost (O&M). Financial benefit is the revenue from the amount of electricity generated and sold. For the ex-post evaluation, FIRR was 10.68% which was re-calculated using the actual figures of cost and benefit. This decrease was mainly because of a lower tariff than estimated at appraisal⁵. Although the recalculated FIRR was lower than the FIRR at appraisal, the project was still effective with FIRR greater than 10%.

Economic analysis was made to compare with the replaced thermal power plant. The costs for replaced unit price of the thermal power plant was to be seen that power benefit of the hydropower plant. The re-calculation for Economic Internal Rate of Return (EIRR) was carried out based on the actual conditions which changed such as the increase of investment rate for the thermal power. The result of calculation for actual EIRR is 17.89% while the designed EIRR is 16.15%. In addition, there were other visible benefits such as the road system, especially the benefit from irrigation water for agriculture and forestry which was not included in the above actual calculated figures of EIRR.

3.3.2 Qualitative Effects

+ Improve living standard of indigenous people in the project site

The livelihood of the indigenous people is better as they can participate in the afforestation and forestry protection to get permanent income. They are also guided techniques on breeding chicken, planting rice so that they can get extra income from farming. According to the survey of 75 indigenous people affected by the project, 81% of them believe that they have better livelihood than before the project. In addition, according to Duc Trong People Committee's comments, the IPDP with five programs of forestry, agriculture, health, culture and education brought many positive factors such as better fertilizer, better breeding animal and plant, better varieties and better farming tools helped indigenous people to have better livelihood. And if they have enough irrigation water in the dry season, the indigenous people even can have better income. In addition,, the program of health, culture and education created the better conditions to support the indigenous people in health, culture and condition to improve education.

The result of the survey shows that the indigenous people have better infrastructures, better access to public service, including school, hospital, and market. Before the project, they had a bigger land but a very poor house, often made of low quality wood. They now have much better house with a suitable private toilet and a well for clean water. At the time of site observation, in the middle of dry season, the well has enough clean water for their daily life.

In general, 83% of the indigenous people participating in the survey are satisfied with the IPDP and 71% of them satisfied with the Dai Ninh Hydropower Project. Because of the project they have better living condition.

⁵ At the appraisal stage, tariff was assumed to be 7 cent/kWh in 2005 and expected to be 7.9 cent/kWh in 2010. However, the actual tariff was 6.0 cent/kWh in 2010. If the selling price estimated at the appraisal stage were applied, the re-calculated FIRR would have been 14.6%. It cannot be said that the appraisal overestimated the selling price because other similar studies also apply similar rates (around 7 cent/kWh). Electricity prices are under control of the government.

At the appraisal stage, the distribution loss was assumed at 19%, but the actual distribution loss was reduced sharply to 8.5% in 2010. If the distribution loss at 19% was applied, the FIRR would be 10.19%.

Another factor affected the actual FIRR is the financial project cost. It was planned at 396.54 million USD but the actual cost was 321.48 million USD.

Although the recalculated FIRR was lower than the FIRR at appraisal, the project was still effective with FIRR greater than 10%

Box 1: Beneficiary survey

(75 indigenous people representative of their households participate in the survey)

1. Date and place of survey: 18 April, Ninh Gia, Phu Hoi and Tahine commute
2. Objective of the survey: to collect information on the living standard of the indigenous people
3. Survey method: the survey is conducted in two stages
 - 1) A focus group of 13 indigenous to explore the major impacts of the project to the life
 - 2) Base on the findings from the focus group interview, a more detailed questionnaire is designed for a larger survey of 75 indigenous from Ninh Gia, Phu Hoi and Tahine.
4. Result of the survey:
 - 1) How is the current situation in comparison with the situation before the project?

How is the current situation in comparison with the situation before the project?	Totally agree	Agree	No ideal	Disagree	Totally disagree
Have a better house	24.0%	61.3%	8.0%	4.0%	2.7%
Have better infrastructure	69.3%	14.7%	16.0%	0.0%	0.0%
Lack of water for irrigation in dry season	57.3%	8.0%	20.0%	9.3%	5.3%
Lack of clean water for daily life	8.0%	6.7%	12.0%	45.3%	28.0%
Difficult to divide the resettlement parcel for married sons/daughter	61.3%	21.3%	9.3%	8.0%	0.0%
Better access to public service (school, hospital, market)	52.0%	36.0%	5.3%	6.7%	0.0%
Better community activities	88.0%	12.0%	0.0%	0.0%	0.0%
Better livelihood	64.0%	17.3%	16.0%	2.7%	0.0%

- 2) How do you satisfied with the IPDP?

Very satisfied	37 (49.3%)
Satisfied	25 (33.3%)
No ideal	5 (6.7%)
Dissatisfied	6 (8.0%)
Very dissatisfied	2 (2.7%)
- 3) How do you satisfied with the Dai Ninh Hydropower Project?

Very satisfied	27 (36.0%)
Satisfied	26 (34.7%)
No ideal	19 (25.3%)
Dissatisfied	2 (2.7%)
Very dissatisfied	1 (1.3%)

The above analysis shows evidence for the improvement in living standard of indigenous people in the project site

One small issue with effectiveness is the use of the pump system for rehabilitation. The pump systems have never been in used for irrigation with two main reasons: 1) No budget for operation and maintenance of the pump systems 2) The design of the pump system was not convenient for farmers uses. In the last part of the report, recommendations are drawn to best utilize this output of the project.



Photo 6: Getting clean water from the well at resettlement site

This project has largely achieved its objectives; therefore its effectiveness is high.

3.4 Impact (Rating: 3)

3.4.1 Impact on economic development

Table 5: GDP growth rate of Vietnam and Binh Thuan, Lam Dong province

GDP growth rate (%)	2005	2006	2007	2008	2009	2010
Binh Thuan	13.40	13.90	12.10	16.20	10.07	11.95
Lam Dong	20.78	18.17	14.35	13.89	12.88	13.3
Vietnam	8.44	8.23	8.46	6.31	5.32	6.78

As described in the table 5 above, GDP of Vietnam and the Southern region of Vietnam have experienced high growth rates. This rapid economic development required a higher energy supply and Dai Ninh HP is considered as a motivated factor to the economic development. Although the project contributes a very small portion directly to GDP of Vietnam, its indirect contribution is high. Electricity is an irreplaceable input for other industries' operation. As a result of the project, electricity supply is increased by 1,226 GWh/year. This increase supports the development of other industries, and indirectly contributes to GDP growth rate of Southern region and of Vietnam. In addition, the project has a strong positive impact on agriculture production of Binh Thuan (ref. + Impact on agriculture development of Binh Thuan and Lam Dong). This is also an indirect contribution to GDP growth of Binh Thuan and Vietnam.

According to people committee of Lam Dong and Binh Thuan, the project can be seen as a key factor supporting the economic development of Lam Dong and Binh Thuan, as well as GDP of Vietnam. The project supported and pushed the process of industrialization and modernization of the two provinces.

3.4.2 Impact on power supply in Vietnam

With the average annual output of 1,226 GWh, the project has contributed to narrow down the gap between demand and supply of electricity of Vietnam. Table 6 shows that the demand site increases sharply, as a result the gap is widened. Thanks to the operation of the Dai Ninh HPP, the electricity demand and supply gap was narrow down by 5% in 2008. In addition to the energy output of Dai Ninh HP, Bac Binh HP⁶ with the capacity of 33MW started to supply

⁶ Bac Binh HP is the HP which utilizes the water from Dai Ninh HP. Without Dai Ninh HP, there is no reservoir for Bac Binh HP.

electricity in 2009. It supplied an addition of 104.7 GWh in 2010.

From this finding, it can be said that the project has contributed toward a more stable power supply in Vietnam.

Table 6: Gaps between demand and supply before and after project (million kWh)

	2005	2006	2007	2008	2009	2010
Vietnam demand	51,769	59,014	66,773	74,226	84,756	97,349
Vietnam supply	41,186	46,465	50,001	53,093	57,002	59,088
Vietnam supply without Dai Ninh HPP	41,186	46,465	50,001	51,943	55,702	57,978
Gap without Dai Ninh HPP	10,583	12,549	16,772	21,133	27,754	38,261
Annual power generation by Dai Ninh HPP				1,150	1,300	1,110
Gap with Dai Ninh HPP	10,583	12,549	16,772	19,983	26,454	37,151

3.4.3 Impact on agriculture development of Binh Thuan

As a result of providing more and controlable irrigation water to Binh Thuan, especially to Bac Binh district, Bac Binh paddy production has increase sharply since the operation of Dai Ninh HPP. Table 7 shows that Bac Binh paddy production increase at a very high rate of 31.5% in 2008, the year Dai Ninh HPP started is operation.

Table 7: Bac Binh Paddy production (ton)

Year	2005	2006	2007	2008	2009
Paddy	57,896	59,111	70,934	93,267	113,576
Growth rate	-	2.1%	20%	31.5%	21.8%

Source: Binh Thuan Year Book 2009

With irrigation water, not only paddy but also other agriculture products were benefited. Although there was no quantitative evidence on the impact of the project to agriculture products of Binh Thuan, according to the interviews with Bac Binh people committee and Binh Thuan people committee, they all agree that the project has pushed up the growth of agriculture in the province. Table 8 showing a constant growth in gross output of agriculture in Binh Thuan.

Table 8: Gross output of agriculture in Binh Thuan

	2005	2006	2007	2008	2009
Gross output of agriculture at constant 1994 prices					
Binh Thuan	2,015,369	2,007,199	2,222,686	2,367,801	2,460,381

Unit: Mil. VND

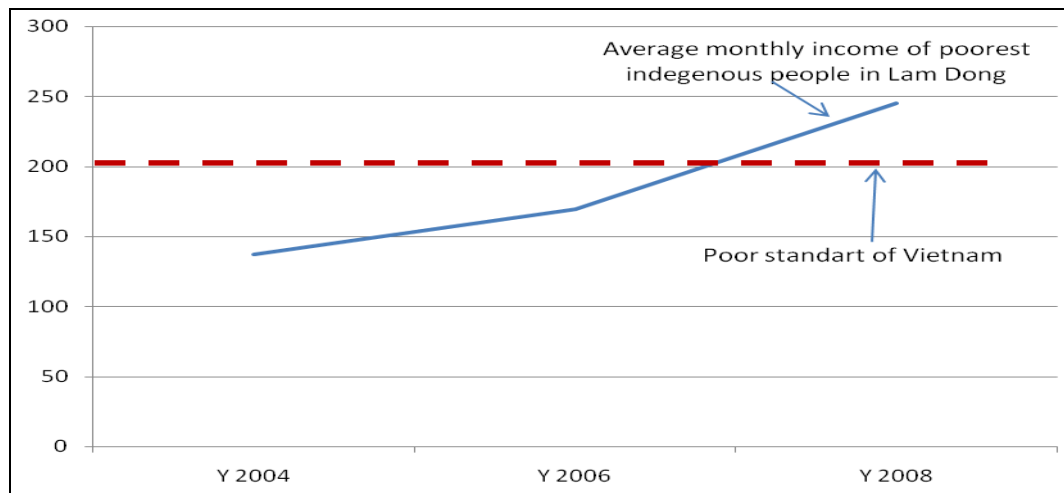
Source: Lam Dong and Binh Thuan Year Book 2009

Besides, the discharge water of Dai Ninh Hydropower Plant will be supplied to:

- (1) The Bac Binh Hydropower Project has the design capacity of 33MW and annual power generation of 114 million kWh/year. Bac Binh HP has completed in 2009.
- (2) The Phan Ri-Phan Thiet Irrigation Project which has been under construction and it is expected to be completed in 2012. This irrigation project funded by Japan ODA serves approximately 15,000 ha of farm in Binh Thuan province.

3.4.4 Impact on living standard of the indigenous people

In order to improve the living standard of the indigenous people in the project site, the project included IPDP and RRAP. According to the report of Lam Dong People Committee, and the report of Hydropower Project Management Board No.6 on compensation and resettlement works, the program attracted almost all the eligibilities, 96,1% indigenous people participate in the program in 2003.



Source: Lam Dong year book 2009

Figure 4: Average monthly income of the poorest (most are indigenous people) in Lam Dong

Figure 4 shows that the average monthly income of most indigenous people in Lam Dong has increased since the implementation of the IPDP in Lam Dong. As a result, their monthly income was higher than national poor standard in 2007.

3.4.5 Environmental Impact

The environmental impact assessment (EIA) for this project was approved by GOV in Dec. 30 1998. According to EIA, the project site was not located in the protected area and no endangered species existed in the area. During construction, the Vietnam Institute for Tropical Technology and Environmental Protection (VIPTEP) who performed monitoring water quality, air quality, noise level and vibration level once a month. After the hand-over, Dai Ninh Hydropower Company performed monitoring water, air, noise and vibration once a year. According to those monitoring results and interviews with the provincial governments and Dai Ninh Hydropower Company, no environmental problem is seen.

Accident Prevention Measures:

- As provided in the contracts, there will be safety team, the member of which is from Employer, Consultant and Contractors. This team shall do frequent safety patrol at project construction sites.
- A few days before flood discharging is to be operated, the notification in writing shall be informed to local inhabitants living in and vicinity. Before flood discharging, the warning shall be made directly by site in 3 times.

3.4.6 Improvement of Transportation (Impact of Road Construction)

- The infrastructures built for the construction of the project such as roads, bridges contribute much to the development of local area. Ninh Gia, a commune in Duc Trong district, used to be a poor commune but now it develops very fast and the district has a plan to build Ninh Gia as a city within the district. The Luy river bridge and the accessing road (70 km) have reduced traveling time between Lam Dong and Binh Thuan. It becomes a key road connecting Lam Dong and Binh Thuan.



Photo 7: Luy river bridge

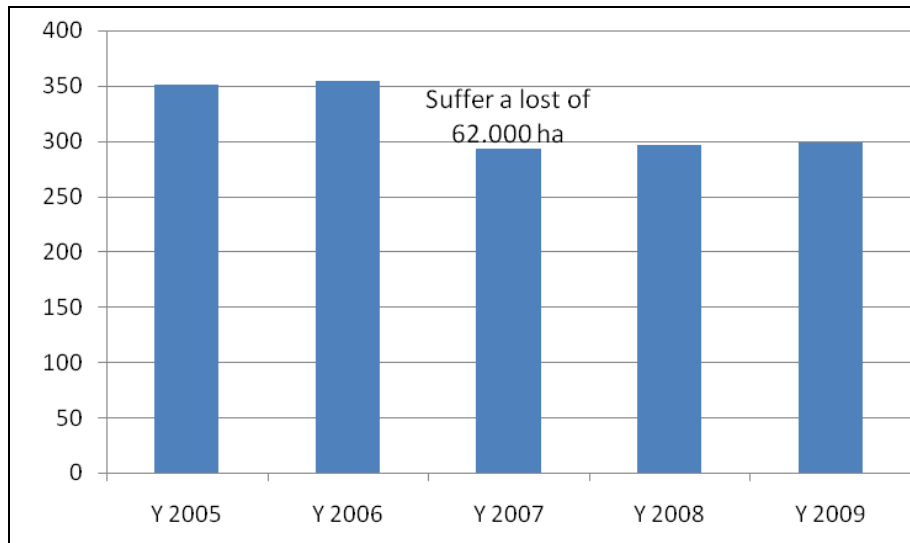
- Before the project, local residents had to cross the river by boat, and no car can run on the road. Luy river bridge belong Binh Thuan Province has been constructed by the project.

3.4.7 Land Acquisition and Resettlement Rehabilitation Action Plan (RRAP)

Positive impacts, as discussed in 3.3.2, the indigenous people are better due to the project with five programs of forestry, agriculture, health, culture and education . The major positive impacts are: better living standard, better house and infrastructure, easy access to public service and clean water. Although compensation was provided in accordance with the agreed resettlement plan but the resettlement people complaint about the negative impacts which are lack of water for irrigation in dry season ($0,7\text{m}^3/\text{s}$) and smaller parcel for their children (40m^2 house built in 400m^2 land)

3.4.8 Unintended negative impact

After the construction of dams had been completed and impounding of reservoirs commenced, the flow regime has been changed considerably. To protect the eco-system and agricultural production of the downstream, the project designed to keep the minimum flow to downstream to be $0.7\text{m}^3/\text{s}$. However, the Dai Ninh HP Company has discharged of $0.7\text{m}^3/\text{s}$ to downstream only in the daytime and stop discharging in the night time. As a result, the volume of discharging water is not always sufficient especially in the night time of dry season. It might possible cause the reduction of agricultural production in some area such as Duc Trong and the water shortage of Pongour waterfall.



Source: Binh Thuan year book 2009

Figure 5: Area of forest in Binh Thuan (1.000 ha)

According to Binh Thuan people committee, it was allowed to deforest 400 ha forest to construct Dai Ninh HPP and related facilities. Binh Thuan has its own afforestation program to recover the area of forest loss by the Project. However, the figure 5 shows a huge loss of forest in 2006-2007 in Binh Thuan and it was not recovered yet. This huge loss of forest is not due to the Dai Ninh HPP but insufficient implementation of afforestation program and forest protection programs in Binh Thuan. This large-scale deforestation can be considered as one of the reason that caused flood in Binh Thuan in 2009 and 2010 which caused the agricultural and human damages in the area.

According to Bac Binh People committee, when it was flooding, Dai Ninh HPP kept to operate at its full capacity which discharged $55\text{m}^3/\text{s}$ to Bac Binh. This full capacity operation might make the flood in Bac Binh being more harmful. In 2010, Bac Binh people committee had more experience in preventing flood and the damages reduced.

3.5 Sustainability (Rating: 3)

3.5.1 Structural Aspects of Operation and Maintenance

The operation and maintenance of the hydropower plant including reservoir and dams is under responsible of Dai Ninh HP. Dai Ninh HP is a member company of EVN. Its financial and personnel management are depend on the management of EVN. Dai Ninh HP has 6 departments which cover all the activities of the plant. The department of operation has 5 generator operation teams and one dam operation team. These team are well organized to operate the plant 24 hours/day and 365 days/year. In addition, EVN may support personnel and financial if the plant has any problem in operation. Figure 6 shows the organization chart of Dai Ninh HP. In the aspect of structure, it is highly sustainable.

3.5.2 Technical Aspects of Operation and Maintenance

Dai Ninh HP has 116 well trained staff and it is enough for operation and maintenance.

All the equipment has its owned manual and it is operated and maintained as stated in the manual. Although there were some technical problems with the two generators and other facilities, all the problems have been solved. During the process of repairing and maintaining The equipments and facilities of the contractors, Dai Ninh HP technical staff learnt the know-how and technique. Now they can repair the equipment and facilities by themselves.

For example, they learnt the technique to joint cracks on.

Dams in 2008. In 2009, a crack appeared in a dam and they have successfully applied the similar technique to fill in the crack.

Di Linh substation also has enough qualified staff for O&M. Its current 23 staff is well trained and can operate effectively the substation 24 hours/day. The O&M manual is well established and used.



Photo 8: Spare part is under maintenance

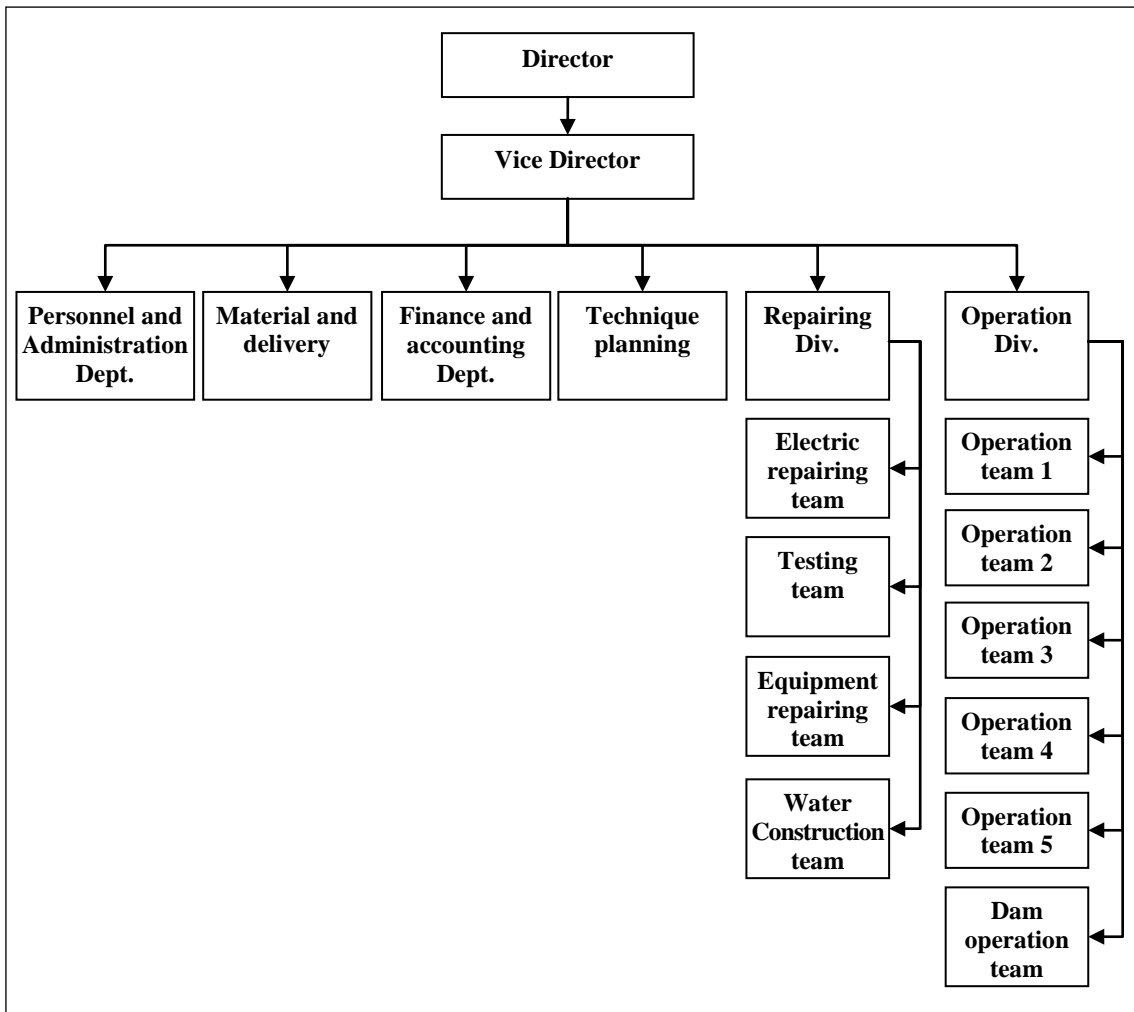


Figure 6: Organization chart of Dai Ninh HP

3.5.3 Financial Aspects of Operation and Maintenance

Dai Ninh HPP yielding a positive profit since operation. Table 9 shows that revenues of Dai Ninh HPP can cover all expenses including O&M cost. It gained 18,516 million. VND profit in 2009 and 136,841 million VND profit in 2010. This earning means that the project has a sustainable financial aspect.

Table 9: Main items in income statement for financial year 2009-2010 of Dai Ninh

Items	Unit: mil. VND	
	2009	2010
Total revenues	331,639	1,175,157
Total cost of good sold	306,952	992,703
Net profit from operation	24,687	182,455
Gross profit before tax	24,687	182,455
Profit after tax	18,516	136,841

Source: Dai Ninh income statement for financial year 2009-2010, provided by EVN

3.5.4 Current Status of Operation and Maintenance

As a result of the site observation and report of Dai Ninh HP, Phan Ri and Di Linh substation, all the equipments are in good condition. They have enough qualified staff for operation and maintenance. All the equipments, facilities are maintained regularly in accordance with the O&M manual. The plant, the dams and substations are operating properly.

3.5.5 Current status of using the houses and agriculture land of settlement

Infrastructures of the houses in resettlement site are in good condition. The access road to the existed houses in resettlement site is much better than the access road to their houses which they had before the project. The agriculture resettlement areas at Ninh Gia, Ta In and Phu Hoi communes of Lam Dong Provinces were handed over to the affected households and now it has been used mainly to plant the coffee trees.

No major problems have been observed in the operation and maintenance system, therefore sustainability of the project is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

In light of the above, this project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Completion of all project components

* The relative parties such as Dai Ninh HPP Company, the Contractor and HPMB No.6 should continue measures to solve the problems of the communication system between Spillway, intake and Powerhouse as captioned in the Item 3.2.1 above.

* The local authorities of Lam Dong Province should check and solve problem of the pump systems at rehabilitation sites in Ninh Gia, Ta In and Phu Hoi communes seeking advice from HPMB6 as mentioned above.

4.2.2 Improvement of the operation system

* It was found that in the dry season, downstream of dam lacked of irrigation water. Therefore, it is recommended that the Dai Ninh HP should strictly commit to discharge 0.7m³/s or higher in full time basis (24 hours/day) to the downstream. In addition, Duc Trong People committee need to built a reservoir at downstream of the dam to save water for irrigation.

- * When it is flooding in Binh Thuan at warning level 2 or above, Dai Ninh HP should report to National Load Dispart Center (NLDC-A0) to ask for lower operation capacity.
- * Binh Thuan People committee should invest more on afforestation program and forest protection program to recover the forest to prevent flood.

4.3 Lessons Learned

4.3.1 Project preparation

a) Land acquisition, compensation and resettlement

- In this project, the land acquisition, compensation, resettlement stage 1 except reservoir, T/L & 500kV Di Linh S/S completed in April 2003 before requesting JICA concurrence and commencement of construction of the contract of civil works. Due to this convenience, the lots of civil works had been implemented smoothly and had no claim which relative with land acquisition occurred. Future project could follow this good practice as a means to improve effectiveness and impact.
- Land acquisition and compensation carried out well due to support of local authority and related agencies. The following considerations that the project took could be good practices for future projects:
 - Encourage people to understand government policies on hydropower construction;
 - Create all the favorable conditions in land acquisition as follows:
 - + A Land acquisition and compensation Council was established at the affected Districts in Project site for managing the land acquisition and compensation process.
 - + A task force was established to handle the forest tree issue to acquire land in a timely manner for construction.
 - + The compensation and support scheme was quickly appraised and approved to speed-up the disbursement to the local people.
 - + All the obstacles had been solved in a timely manner by the local authorities.
 - Maintenance of a regular good relationship with the province, district and commune People Committees, in a spirit of cooperation and collaboration to fulfill the tasks.
 - All the obstacles should be discussed and solved with mutual understanding and concerns based upon the government's policies and regulations.

b) In this project, indigenous people got a sustainable support to compensate for their change of life due to the project. As a result, the project gets much consensus from both local government and residents. Therefore, similar projects on hydropower plant should support indigenous or affected people in a sustainable way—not only compensate them by other land, resettlement site, money but also support them in education, health care, culture... so that they can get on well with the changing life.

c) The design and construction works for rehabilitation areas with its facilities such as pumps systems, tanks and control houses should taken in account with respect of the habit of doing in agriculture production and the convenience in use of the affected local residents and farmers, so that the effectiveness for the rehabilitation areas could be improved more.

4.3.2 Implementation

With the participation of operation agencies in the soon construction stage (i.e. as a

member of the interim operation management board), experience was enriched for O&M. Future Projects could follow this good practice as a means to improve sustainability.

4.3.3 Operation and maintenance

In the early operation stage, there often occur technical problems, so the coordination between the Employer (including Management Unit and Operation Unit) and the Contractor should be closely to solve the problem better. It is necessary to present the Contractor's engineers in the early operation stage at the site even the installation works were completed in order to have a smooth operation and commissioning.

Comparison of the Original and Actual Scope of the Project

Items	Unit	Plan (I/A dated March 30, 1999)	Actual
1. Outputs			
(1) CIVIL WORKS			
<u>a) Waterways</u>			
Inlet Canal Length	m	1600	1789
Headrace Tunnel Length	m	10 795	11 258
Surge Tank Height	m	129.45	<u>130</u>
Powerhouse		Surface	Surface
Tailrace Gallery Length	m	682	<u>715</u>
Tailrace Canal Length	m	247.5	<u>184</u>
River Training Length *	m	-	<u>9800 *</u>
<u>b) Head works</u>			
Connecting Canal Length	m	2550	<u>2530</u>
Da Nhim Dam			
Type		Earth fill	Earth fill
Crest Length	m	415	<u>420</u>
Height	m	56	56
Da Queyon Dam			
Type		Earth fill	Earth fill
Crest Length	m	1725	<u>1688</u>
Height	m	58	58
Spillway			
Gated	unit	3	3
Height	m	18	18.5
Width	m	15	15
Emergency Spillway			
Type		Fuse dykes	Fuse dykes
Crest Length	m	82.8	82.8
Bottom Width	m	17	32
Height	m	12.7	12.7
Saddle Dam No.1			
Type		Earth fill	Earth fill
Crest Length	m	1200	<u>1217</u>
Height	m	19.3	22
Saddle Dam No.2			
Type		Earth fill	Earth fill
Crest Length	m	2090	2096
Height	m	15	17
Saddle Dam No.3			
Type		Earth fill	Earth fill
Crest Length	m	520	<u>517</u>
Height	m	30	31
Saddle Dam No.4			
Type		Earth fill	Earth fill
Crest Length	m	185	<u>186</u>
Height	m	32	<u>35</u>

Items	Unit	Plan (L/A dated March 30, 1999)	Actual
(2) EQUIPMENT			
<u>a) Hydro mechanical Equipment</u>			
Penstock			
Diameter	m	3.2	3.2
Length	m	1787	<u>1820</u>
<u>b) Electromechanical Equipment</u>			
Turbine Type		Pelton 6 Nozzles x 2	Pelton 6 Nozzles x 2
Generator	MW	150 x 2	150 x 2
Main Transformer			13.8/242kV, 180MVA
Transformer Switchyard Equipment			
(3) TRANSMISSION LINES AND SUBSTATIONS			
<u>a) 220kV Transmission Lines:</u>			
Construction of	km	Dai Ninh Powerhouse-Dai Ninh Switchyard, 2xACSR330, 2xS/C 1.2km	Dai Ninh Powerhouse-Dai Ninh Switchyard, 1cct x ACSR330, 0.6km x 2 routes
Construction of	km	Dai Ninh Switchyard - Bao Loc Substation, D/C 2xACSR330, 70.3km	Dai Ninh Switchyard - 220kV Di Linh S/S, 1x ACSR330, 40.8km
Construction of	km	Bao Loc Substation - Long Binh Substation, S/C 2xACSR330, 136.5km	Connection section for existing line (220kV Da Nhim S/S - Bao Loc S/S) 2cct x ACSR 410, 2.1km
<u>b) 220kV Substation</u>			
Extension		Bao Loc Substation 220kV feeder bay 3cct	
Extension		Long Binh Substation 220kV feeder bay 1cct	
<u>c) 110kV Transmission Line</u>			
Construction of	km	Dai Ninh Switchyard - Phan Ri Substation S/C 1xACSR185, 12.2km	Dai Ninh Switchyard - Phan Ri Substation S/C 1xACSR185, 46km
<u>d) 110kV Substation</u>			
Extension		Phan Ri S/S	
		110kV feeder bay, 1cct	110kV feeder bay, 1cct
		110kV transformer bay, 1 cct	110kV transformer bay, 1 cct
		Transformer 110/22kV 3 phase x 1 x 16 MVA	Transformer 110/22kV 3 phase x 1 x 16 MVA
		22kV feeder bay, 4cct	22kV feeder bay, 4cct
<u>e) 500kV Substation (New construction)</u>			<u>500kV Di Linh Substation</u>
Main Transformer 500/220/22kV			1phase x 3 x 150/150/50MVA x 1 banks
Outdoor type bus - bar			Double bus-bar system with transfer bus-bar
500kV			(i) 2 bays for line to Pleiku S/S and Tan Dinh S/S. (ii) 1 bay for 500/220kV Main Transformer
220kV			(i) 2 bays for line to Dai Ninh HPP

Items	Unit	Plan (L/A dated March 30, 1999)	Actual
			(ii) 2 bay for line from Da Nhim HPP and Bao Loc S/S. (iii) 1 bay for 500/220 kV main transformer. (iv) 1 bay for the connecting breaker.
f) <u>Communication System:</u>			
		PLC equipment and the related facilities	PLC equipment and the related facilities
(4) CONSULTING SERVICE			Review of Detail Design, RRAP, IPDP and Tender Documents
			Review of Feasibility Study for Transmission Line and Substation, preparation of Detail Design and Tender Documents
			Additional design
			Additional design was prepared on basis of the review of Detail Design and Tender Document
			Revision of design and Bidding document for Transmission Lines
			Support for procurement
(5) INDIGENOUS PEOPLE DEVELOPMENT PROGRAMS (IPDP): IPDP have had 5 programs:		Implementation of IPDP follows the updated schedule and contents in closed collaboration with the relative Local Compensation Councils and authorities	Contract supervision 1. Forestry program: - Afforesting program: 1983ha - Protecting Forests: 28560ha 2. Agriculture program: - Experiment of Chinese high quality Khang Dan 18 rice: 440kgs - Experiment of Chinese chicken of Luong Phuong: 900 chickens - New Corn planting: 84kgs - Sind Cow : 52 3. Education Program: - Awards: 2370 students - Scholarships: 1890 students - Training for the Ethnic Minority teachers: 165 teachers - King Teachers study K'ho language: 153 teachers 4. Medical program: Provide the protein medicine free for: - Malnourished children: 1406 children - For Pregnant and lactation women: 1729 women 5. Culture program: Build up - 2 Cultural centers at the 2 communes of Ninh gia and Tahine - 3 traditional houses at 3 schools at the 3 communes of

Items	Unit	Plan (L/A dated March 30, 1999)	Actual
			Ninh Gia, Tahine and Phu Hoi.
(6) DEVELOPMENT OF RESETTLEMENT AND REHABILITATION ACTION PLAN		The number of PAHs, crops and areas affected by the Project must be re-counted by the Local compensation Councils before land acquisition and compensation implementation	- Resettlement: 255 households (HHs), including to 139HHs received money, 57HHs resettlement, 67HHs land to built. - Rehabilitation: 220hectares
2. Project Period		March 1999 – December 2004 (69 months)	March 1999 – April 2008 (109 months)
3. Project Cost			
Amount paid in Foreign currency		40,126 million yen	28,600 million yen
Amount paid in Local currency		2,144,663 million dong (equivalent 21,447 million yen)	1,250,000 million dong (9,615 million yen)
Total		61,573 million yen	38,215 million yen
Japanese ODA loan portion		48,439 million yen	28,600 million yen
Exchange rate		dong 1= yen 0.01 (October, 1998)	Dong 1 = yen 0.013 (Average between 1999 and 2008)

Note: (*) The scope of work for Matin River Training changed much due to additional design.