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The World Bank

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Report No: PAD1728

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT PAPER

ON A

PROPOSED ADDITIONAL LOAN

IN THE AMOUNT OF US\$390 MILLION

TO THE

ISLAMIC REPUBLIC OF PAKISTAN

FOR THE

TARBELA FOURTH EXTENSION HYDROPOWER PROJECT ( P157372 )

August 25, 2016

Energy & Extractives  
SOUTH ASIA REGION

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## CURRENCY EQUIVALENTS

(Exchange Rate Effective December 21, 2015)

Currency Unit = Pakistan Rupees (PKR)

PKR 105.00 = US\$1

## FISCAL YEAR

July 1 – June 30

## Weight and Measures

### Metric System

1 meter (m)	=	3.280 feet	1 hectare (ha)	=	2.470 acres
1 Kilometer (km)	=	0.620 miles	1 cubic meter (m)	=	35.310 cubic feet
1 million acre feet (MAF)	=	1.234 billion cubic meters			
1 cubic foot/second (cfs)	=	0.0283 cubic meters/sec (m <sup>3</sup> /sec)			

## ABBREVIATIONS AND ACRONYMS

AF	Additional Financing	FO	Fuel Oil
AIB	Asian Infrastructure Investment Bank	FVR	Feasibility Verification Report
AOI	Area of Influence	FY	Fiscal Year
CAS	Country Assistance Strategy	GBHPP	Ghazi Barotha Hydropower Project
CASA 1000	Central Asia South Asia Electricity Transmission and Trade Project	GBTI	Ghazi Barotha Tarqati Idara
CBO	Community Based Organizations	GDP	Gross Domestic Product
CCGT	Combined Cycle Gas Turbine	GHG	Greenhouse Gas
cms	Cubic Meters Per Second	GM	General Manager
CNY	Chinese Yuan	GoP	Government of Pakistan
CO2	Carbon dioxide	GPN	General Procurement Notice
CPPA	Central Power Purchasing Agency	GRC	Grievance Redress Committee
CPPA-G	Central Power Purchasing Agency Guarantee Limited	GRM	Grievance Redress Mechanism
CPS	Country Partnership Strategy	GRS	Grievance Redress Service
CSCs	Construction Supervision Consultants	GSC	Grid Station Construction
DHP	Dasu Hydropower Project	GWh	Gigawatt hour
DISCO	Distribution Company	HPP	Hydropower Project
E&M	Electrical and Mechanical	HSD	High Speed Diesel
EA	Environmental Assessment	IBRD	International Bank for Reconstruction and Development
EAD	Economic Affairs Division	ICB	International Competitive Bidding
EIA	Environmental Impact Assessment	IDA	International Development Association
EMP	Environmental Management Plan	IDC	Interest During Construction
ERR	Economic Rate of Return	IFRS	International Financial Reporting Standards
ESA	Environmental and Social Assessment		
ESMP	Environmental and Social Management Plan	IMF	International Monetary Fund
ESIU	Environment and Social Impact Unit	IPCC	Intergovernmental Panel on Climate Change
EUR	Euro		
FDI	Foreign Direct Investment		
FM	Financial Management		

IPOE	Independent Panel of Experts	SBD	Standard Bidding Document
IPPs	Independent Power Producers	SCF	Standard Correction Factor
KPI	Key Performance Indicators	SDR	Special Drawing Rights
KP	Khyber Pakhtunkhwa	SLA	Subsidiary Loan Agreement
kV	Kilo Volt	SOPs	Standard Operating Procedures
kWh	Kilowatt hour	SORT	Systematic Operations Risk Rating Tool
LARF	Land Acquisition and Resettlement Framework	SRMP	Social Resettlement Management Plan
LLO	Low Level Outlet	SSESA	Strategic Sectoral Environmental and Social Assessment
LNG	Liquefied Natural Gas	T&D	Transmission and Distribution
M&E	Monitoring & Evaluation	T4HP	Tarbela Fourth Extension Hydropower Project
MAF	Million acre feet	T5HP	Tarbela Fifth Extension Hydropower Project
mmbtu	million British Thermal Unit	TA	Technical Assistance
MOWP	Ministry of Water and Power	TL	Transmission Line
MW	Megawatt	TOR	Terms of Reference
NEPRA	National Electric Power Regulatory Authority	USD	United States Dollars
NGO	Non Governmental Organization	VECs	Valued Environmental & Social Components
NPV	Net Present Value	WAPDA	Water and Power Development Authority
NTDC	National Transmission and Dispatch Company Limited	WBG	World Bank Group
O&M	Operation and Maintenance	WTP	Willingness to Pay
OP	Operational Policy		
PD	Project Director		
PDO	Project Development Objectives		
PKR	Pakistan Rupees		
PM&EC	Project Management Support and Monitoring & Evaluation Consultants		
PMF	Probable Maximum Flood		
PMU	Project Management Unit		
PP	Project Paper		
PSC	Project Steering Committee		
ROW	Right of Way		
RAP	Resettlement Action Plan		
RTI	Right to information		
SAP	Social Action Plan		

Vice President:	Annette Dixon
Country Director:	Patchamuthu Illangovan
Senior Global Practice Director:	Anna Bjerde
Practice Manager:	Demetrios Papathanasiou
Task Team Leader:	Masood Ahmad
Co-Task Team Leader:	Mohammad Saqib

**PAKISTAN**  
**ADDITIONAL FINANCING TO TARBELA 4TH EXTENSION HYDROPOWER**  
**PROJECT (P157372)**

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**ADDITIONAL FINANCING DATA SHEET**

**Pakistan**

**Additional Financing to Tarbela 4th Extension Hydropower Project ( P157372 )**

**SOUTH ASIA**

**GEE06**

<b>Basic Information – Parent</b>									
Parent Project ID:	P115893	Original EA Category:	A - Full Assessment						
Current Closing Date:	31-Dec-2018								
<b>Basic Information – Additional Financing (AF)</b>									
Project ID:	P157372	Additional Financing Type (from AUS):	Scale Up						
Regional Vice President:	Annette Dixon	Proposed EA Category:	A						
Country Director:	Patchamuthu Illangovan	Expected Effectiveness Date:	31-Oct-2016						
Senior Global Practice Director:	Anna Bjerde	Expected Closing Date:	30-Jun-2022						
Practice Manager/Manager:	Demetrios Papathanasiou	Report No:	PAD1728						
Team Leader(s):	Masood Ahmad								
Co-Team Leader	Mohammad Saqib								
<b>Borrower</b>									
Organization Name	Contact	Title	Telephone	Email					
Economic Affairs Division, Government of Pakistan	Omar Hamid Khan	Additional Secretary	92519202429	homar363@gmail.com					
<b>Project Financing Data - Parent ( Tarbela Fourth Extension Hydropower Project-P115893 )</b>									
<b>Key Dates</b>									
Project	Ln/Cr/TF	Status	Approval Date	Signing Date	Effectiveness Date	Original Closing Date	Revised Closing Date		
P115893	IBRD-81440	Effective	20-Mar-2012	12-Apr-2012	27-Apr-2012	31-Dec-2018	31-Dec-2019		
P115893	IDA-50790	Effective	20-Mar-2012	12-Apr-2012	27-Apr-2012	31-Dec-2018	31-Dec-2019		
<b>Disbursements in US\$ Millions</b>									
Project	Ln/Cr/TF	Status	Currency	Original	Revised	Cancelled	Disbursed	Undisbursed	% Disbursed
P115893	IBRD-81440	Effective	USD	400.00	400.00	0.00	141.3	258.7	35
P115893	IDA-50790	Effective	USD	440.00	325.00	115.00	128.41	161.86	40

<b>Project Financing Data - Additional Financing to PK: Tarbela 4th Extension Hydropower Project ( P157372 )(in US\$ Million)</b>					
<input checked="" type="checkbox"/>	Loan	<input type="checkbox"/>	Grant	<input type="checkbox"/>	IDA Grant
<input type="checkbox"/>	Credit	<input type="checkbox"/>	Guarantee	<input type="checkbox"/>	Other
Total Project Cost:		US\$823.50 millions		Total Bank Financing: US\$390.00 millions	
Financing Gap:		0.00			
<b>Financing Source – Additional Financing (AF)</b>				<b>Amount</b>	
Borrower				133.50	
International Bank for Reconstruction and Development (IBRD)				390.00	
Asian Infrastructure Investment Bank (AIIB)				300.00	
<b>Total</b>				<b>823.50</b>	
<b>Policy Waivers</b>					
Does the project depart from the CAS in content or in other significant respects?					No
Does the project require any policy waiver(s)?					No
<b>Team Composition</b>					
<b>Bank Staff</b>					
<b>Name</b>	<b>Role</b>	<b>Title</b>	<b>Specialization</b>	<b>Unit</b>	
Masood Ahmad	Team Leader (ADM Responsible)	Lead Hydropower Specialist	Water and Hydropower	GEE06	
Mohammad Saqib	Co-Team Leader	Senior Energy Specialist	Economic and Financial Analysis	GEE06	
Uzma Sadaf	Procurement Specialist (ADM Responsible)	Senior Procurement Specialist	Procurement and contract management	GGO06	
Syed Waseem Abbas Kazmi	Financial Management	Sr Financial Management Specialist	Financial Management	GGO24	
Chaohua Zhang	Social Review	Lead Social Development Specialist	Social	GSU06	
Javaid Afzal	Safeguards Specialist	Senior Environmental Specialist	Environment	GEN06	
Anh Nguyet Pham	Transmission Line and power evacuation	Senior energy Specialist	Power evacuation and transmission line	GEE06	
Maged Mahmoud Hamed	Safeguards Review	Regional Safeguards Adviser	Safeguard compliance	OPSPF	

Zia Al Jalaly	Safeguards Review	Senior Social Development Specialist	Safeguard Compliance	OPSPF
Helene Bertaud	Legal	Senior Counsel	Operational Lawyer	LEGSG
Chau Ching Shen	Disbursements	Senior Finance Officer	Disbursements	WFALN
Salma Omar	Social Review	Senior Social Development Specialist	Social	GSU06
Shabir Ahmad	Team Member	Senior Program Assistant	Operational support	SACPK
Venkatakrishnan Ramachandran	Team Member	Program Assistant	Operational support	GFA12
Shaukat Javed	Team Member	Program Assistant	Operational support	GEE06

#### Locations

Country	First Administrative Division	Location	Planned	Actual	Comments
Pakistan	Khyber Pakhtunkhwa Province	Haripur and		X	Tarbela Dam is situated on the Indus River in the province of Khyber Pakhtunkhwa (KP) at a distance of about 70 kilometers (km) North-West of Islamabad and about 50 km upstream of the city of Attock. Islamabad West substation is located in Attock district of Punjab Province.
	Punjab Province	Attock Districts			

#### Institutional Data

**Parent ( Tarbela Fourth Extension Hydropower Project-P115893 )**

**Practice Area (Lead):** Energy & Extractives

**Contributing Practice Areas:** Water

**Additional Financing to PK: Tarbela 4th Extension Hydropower Project ( P157372 )**

**Practice Area (Lead):** Energy and Extractive Services

**Contributing Practice Areas:**

#### Cross Cutting Topics

- Climate Change
- Fragile, Conflict & Violence
- Gender
- Jobs
- Public Private Partnership

<b>Sectors / Climate Change</b>				
Sector (Maximum 5 and total % must equal 100)				
<b>Major Sector</b>	<b>Sector</b>	<b>%</b>	<b>Adaptation Co-benefits %</b>	<b>Mitigation Co-benefits %</b>
Energy and mining	Hydropower	85	85	
Energy and mining	Other Renewable Energy	3	3	
Energy and mining	Transmission and Distribution of Electricity	6	6	
Water, sanitation and flood protection.	General water, sanitation and flood protection sector	6	6	
<b>Total</b>		<b>100</b>	<b>100</b>	
<input type="checkbox"/> I certify that there is no Adaptation and Mitigation Climate Change Co-benefits information applicable to this project.				
<b>Green House Gas Accounting</b>				
<b>Net Emissions</b>	Net Reduction of 20 million tons of Carbon dioxide	<b>Gross:</b>	1.1 million tons of Carbon dioxide	
<b>Themes</b>				
Theme (Maximum 5 and total % must equal 100)				
Major theme	Theme	%		
Economic management	Other economic management	33		
Environment and natural resources management	Water resource management	67		
Total			100	
<b>Consultants (Will be disclosed in the Monthly Operational Summary)</b>				
<b>Consultants Required?</b>				
Consultants are being selected for construction supervision. Consulting services would also be required for monitoring and evaluation and supervision of social and environmental management programs.				



## I. Introduction

1. This Project Paper (PP) seeks the approval of the Executive Directors to provide Additional Financing (AF) in an amount of US\$390 million to Pakistan Tarbela Fourth Extension Hydropower Project (T4HP) P115893 (IBRD Loan 8144-PAK and IDA Credit 5079-PAK) for installation of a power house on the fifth tunnel (T5HP) at the Tarbela Hydropower Project that was constructed in 1970s under the Indus Treaty Fund.

2. The proposed AF to Tarbela Fourth Extension Hydropower Project would support the scaling up of project activities under all components. Key activities are: (i) construction of power house and modification to the existing Tunnel 5 (Component A) to house the power plant; (ii) power units and ancillary equipment for the power house on Tunnel number 5 (Component B1, and B2) to generate power; (iii) transmission line (a new sub-component under Component B3) to evacuate power; (iii) continued support to social and environmental management plans and dams monitoring (component C); (iv) construction supervision and implementation support (Component D); development of a pilot project to install a floating solar power plant in Tarbela reservoir and Project management support technical assistance and training etc. (component E). Proposed additional/expanded activities are expected to be completed by March 2022. The closing date for the original project would be extended from December 31, 2018 to December 31, 2019 for proper completion of all works and warranty and defect liability period of all structures and plants. Closing date for the proposed AF would be June 30, 2022. The construction period for Tarbela Fifth Extension Hydropower Project (T5HP) is estimated to be about 39 months considering logistical and technical constraints that require proper sequencing of the construction activities on Tunnel number 3, 4 and 5 to meet the irrigation requirements. If the contracts can be awarded in 2016 (under an advance procurement method) then the generation could start from the high flow season of 2020 summer<sup>1</sup> about 2 years after the expected commissioning of T4HP. An intake work on Tunnel number 5 (T5) can be completed later by May 2021 without disrupting the generation.

3. The proposed project would help in further development of Pakistan's hydropower potential along the Indus River Cascade which is a cornerstone of the World Bank Group (WBG) strategy and Government's energy policy to reduce load-shedding, reduce cost of electricity production, and improve financial sustainability of the power sector. It is a low hanging fruit that would provide low cost clean renewable energy in a short period of time, and thus would help alleviate severe blackouts and expensive, unhealthy and polluting self-generation with small gasoline and diesel run generators. The Project with AF (T4HP plus T5HP) would add a capacity of 2,820 Megawatt (MW) with clean renewable low cost annual electricity generation of over 4,800 Gigawatt-hours (GWh) primarily during summer season when demand is highest. The total capacity at Tarbela with induction of T4 and T5 HPPs will become 6,298 MW and annual average generation is expected to increase from 14,175 to 19,000 GWh.

4. T5HP will add 1,410 MW to an existing tunnel number 5 of Tarbela Dam on Indus River, presently being used to release water for irrigation only when the reservoir level is below the minimum spillway operating level and water releases from the existing power units is not adequate. With power house installed it would continue to carry out the same function and in addition water released from spillway would be diverted through Tunnel 5 to generate 1,800 GWh. This would maximize use of the existing facilities and serve the critically needed power for the country. The pilot project to float a solar power plant under the AF in the reservoir area would help expand in future over the rest of the area leading to a capacity of about 5,000 MW.

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<sup>1</sup> A few months delay would mean that generation from T5HP would be realized in the high flow season of 2020.

## II. Background and Rationale for Additional Financing

5. **Country Context.** Pakistan's economic performance is improving. Real GDP growth posted an increase of 0.7 percentage point to 4.7 percent in fiscal year 2015-2016 (FY16) from the previous year. The growth was driven by large scale manufacturing, services sector and private consumption supported by remittances. While growth in the agriculture sector fell to -0.2 percent compared to 2.5 percent last year because of poor cotton harvest. The threat of a balance of payments crisis, severe few years ago, has receded. Foreign exchange reserves had risen to over 4 months of imports by end December 2015. Pakistan's fiscal balance is improving. The fiscal deficit of the consolidated government during first half of FY16 stood at 1.7 percent of GDP – the smallest half year deficit in the last three years. Inflation remained low at 2.08 percent on average during the first nine months of FY16, helped by lower energy prices. The IMF's Extended Fund Facility (EFF) program is on track, and will end in September 2016. The outlook is for moderately higher growth, nevertheless, the economy is still vulnerable to shortages of energy, natural disasters, large increase in oil prices and to lower than expected inflows of remittances, foreign direct investment (FDI) and taxes.

6. **Sector Context.** Energy sector performance has improved but challenges remain. Subsidies to the sector were reduced in FY15 to about 0.6 percent of GDP (including adjustments for prior years), down from 1.5 percent in FY12/13. Falling oil prices have reduced input costs for electricity generation enabling tariffs to be adjusted downwards. A gap between costs and revenues including subsidies of about PKR 2.5/kWh remains, however, and the sector continues to suffer acute liquidity shortages. As a result, accumulated arrears of payment by the public electricity distribution companies (DISCOS) to their suppliers, commonly known as the circular debt, reached an estimated PKR 321 billion, at the end of June 2016 about one percent of FY15/16 GDP. Targeting of subsidies towards the poorest remains an issue, as does the need to ensure that the sector develops in a socially and environmentally sustainable way. Cheaper clean electricity from Tarbela would help in reducing the sector deficit and save foreign exchange.

7. **Relation to Country Partnership Strategy.** The proposed AF supports the World Bank's twin goals of poverty reduction and shared prosperity. The Country Partnership Strategy (CPS) for 2015-2019 (84645-PK dated April 4, 2014, discussed at the Board on May 1, 2014) recognizes the importance of energy by devoting one pillar exclusively to it. The shortages of energy are widely recognized to have held back Pakistan's economic performance. The project will support generation of low-cost renewable energy during the peak demand period of summer months when shortages are at their worse. Increased supply at competitive prices from T5HP would support economic growth for all enterprises that use electricity, regardless of size or sector. In addition to increasing the supply thus reducing load shedding it will also supplement government's reform program to reduce power sector subsidies and improve its financial viability by reducing the dependence on imported fuels and lowering the cost of supply.

8. **The Project Development Objective (PDO)** of the proposed AF would remain the same which is: "To facilitate a sustainable expansion of Pakistan's electricity generation capacity." The design of the project would also remain unchanged from the original project components. However, a transmission part will be added under Component B for evacuation of power from T5HP.

9. **Key Indicators.** Proposed scaled-up operation would lead to changes in the project key performance indicators (KPIs) and costs. The key changes in the results framework and KPI targets are described in Annex 1. Key changes include: (i) an increase in the electricity supply from about 3,000 GWh from T4HP to 4,800 GWh (T4HP and T5HP) for total annual supply of 19,000 GWh from Tarbela; (ii) availability of additional generation capacity during summer months from 1,410 MW to 2,820 MW for a total installed capacity of 6,298 MW at Tarbela; (iii) reduction in overall production cost of energy by 2.4 percent from PKR 7.02 to 6.85 per kWh; and (iv) successful pilot of installing floating solar plant leading to expansion of solar generation from Tarbela reservoir. The intermediate results indicators for T5HP are also listed in Annex 1.

## **Rationale for Additional Financing**

10. T4HP (Original/Parent Project) was approved in March 2012 and became effective on April 27, 2012. Financing included an IBRD Loan of US\$ 400 million and IDA Credit of US\$ 440 million. All major contracts have been awarded and work is on schedule. Implementation progress has been rated as satisfactory since effectiveness. Except for proper functioning of the Escrow Account<sup>2</sup> WAPDA is in compliance with legal covenants and fiduciary and safeguards performance is rated as satisfactory.

11. Disbursements as of August 22, 2016 are about US\$269.7 million (37 percent), about US\$128.4 from IDA and US\$141.3 million from IBRD. This is less than the original projections for disbursements due to more time taken in award of the contracts and because the contract prices were less than the initial cost estimates/committed funds. Consequently, substantial savings of about US\$115 million (See Annex 2) were cancelled from the project's IDA allocation as of June 2, 2016 leaving an IDA amount of US\$325 million. There is also substantial loss in IDA credit due to SDR to USD exchange rate, it is estimated around US\$33 million equivalent. This loss has been partly offset due to strengthening of dollar against contract currencies that include PKR, EUR and CNY besides USD. All contracts under the parent project have been awarded and are under implementation. The disbursements would accelerate during 2016 and 2017 when major shipments for electro-mechanical contract are expected to arrive on site.

12. Given T4HP's overall satisfactory performance and the need for low cost generation to address sector's financial and energy issues in the shortest possible timeframe, investment in T5HP is well justified. T5HP will generate approximately an additional 1,800 GWh utilizing the same flows<sup>3</sup> at a very low cost compared to alternative generation from thermal or other hydropower projects, that is because all other infrastructure such as dam and tunnel are already constructed with minimal environmental and social impact and other safeguard implications. Most importantly the gestation period of the project is short (39 months from the start of construction). This would help alleviate the severe black outs and highly costly self-generation. Project Designs have been reviewed by an Independent Panel of Experts, draft bidding documents have been prepared and the project is ready for implementation.

13. The primary reason for proposing AF of US\$390 million for these scale-up activities is to (i) utilize the experience gained from implementation of T4HP as the WAPDA team (PMU) is already functional and most of the PMU staff in particular environmental and social unit and procurement and financial management unit will be common for both the projects, (ii) address the issues that are common to both T4HP and T5HP more efficiently e.g. the transmission line proposed under AF is not only going to serve T5 but will be providing required contingencies for T4, (iii) have better coordination in dealing with technical and logistical constraints associated with simultaneous implementation of T4HP and T5HP, (iv) provide flexibility in allocating resources between T4HP and T5HP more efficiently e.g. through proposed AF financial and technical resources would be available to address any unforeseen technical or aftercare issues that may emerge post commissioning of T4HP. In summary, there are substantial efficiency and procedural gains in doing T5HP through a proposed AF as opposed to a new operation.

14. Asian Infrastructure Investment Bank (AIIB) would co-finance US\$300 million for T5HP. AIIB funds would be used to fund Component A works and Component B1 and B2 electro-mechanical equipment for the hydropower plant for T5HP. These contracts (works and electro-mechanical equipment) would be procured using World Bank procurement guidelines and procedures.

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<sup>2</sup> Since the establishment of Escrow Account WAPDA's cash flow position has improved and overdue receivables have declined substantially. However, there is still some lag in payments to WAPDA by CPPA because sector revenues fall short to cover total cost. Therefore, the covenant related to Escrow Account is partially complied with.

<sup>3</sup> During the high flow months of July-October the flow in the Indus River is much higher than can be passed through the existing generation facilities and the remainder is discharged over the spillways and therefore does not provide any power benefits.

### III. Proposed Changes

<b>Summary of Proposed Changes</b>	
The PDO of the project and the component structure will remain the same. However, components are scaled up to allow construction of another power plant on Tunnel number 5, and one additional sub-component for construction of the transmission line—component B3 have been added which is to be implemented by NTDC. The loan closing date of the parent project is extended for proper completion of all works and warranty and defect liability period.	
Change in Implementing Agency	Yes [ ] No [ X ]
Change in Project's Development Objectives	Yes [ ] No [ X ]
Change in Results Framework	Yes [ X ] No [ ]
Change in Safeguard Policies Triggered	Yes [ ] No [ X ]
Change of EA category	Yes [ ] No [ X ]
Other Changes to Safeguards	Yes [ ] No [ X ]
Change in Legal Covenants	Yes [ X ] No [ ]
Change in Loan Closing Date(s)	Yes [ X ] No [ ]
Cancellations Proposed	Yes [ ] No [ X ]
Change in Disbursement Arrangements	Yes [ X ] No [ ]
Reallocation between Disbursement Categories	Yes [ ] No [ X ]
Change in Disbursement Estimates	Yes [ X ] No [ ]
Change to Components and Cost	Yes [ X ] No [ ]
Change in Institutional Arrangements	Yes [ X ] No [ ]
Change in Financial Management	Yes [ X ] No [ ]
Change in Procurement	Yes [ ] No [ X ]
Change in Implementation Schedule	Yes [ X ] No [ ]
Other Change(s)	Yes [ ] No [ X ]
<b>Development Objective/Results</b>	
<b>Project's Development Objectives</b>	
Original PDO	
The overall project development objective is to facilitate a sustainable expansion of Pakistan's electricity generation capacity.	
<b>Change in Results Framework</b>	
Explanation:	
The scaled-up operation will change the target values of the PDO level results indicators. Intermediate results indicators will be added to review the progress of additional activities such as installation of solar	

panels on the Tarbela reservoir under a pilot program. Indicators for Citizen Engagement and Gender have also been added.

**Compliance**

**Covenants - Additional Financing ( Additional Financing to PK: Tarbela 4th Extension Hydropower Project - P157372 )**

Source of Funds	FA Reference	Description of Covenants	Date Due	Recurrent	Frequency	Action
IBRD	LA Sch 2 I.A.2	The Borrower shall maintain a project steering committee (PSC) Chaired by Secretary of Ministry of Water and Power with membership and terms of reference satisfactory to the Bank.		<input checked="" type="checkbox"/>	CONTINUOUS	New
IBRD	LA Sch 2 IA.3(c)	GoP to ensure that: the Escrow Account Agreement, shall be amended, in order to (A) provide that CPPA-G shall maintain a balance in the Escrow Account (as defined in the Escrow Account Agreement) equivalent to a period of billing by WAPDA acceptable to the Bank, not to exceed two (2) months; and (B) to extend its term to a date not earlier than the Closing Date.	10 months after the Effective Date	<input checked="" type="checkbox"/>	CONTINUOUS	New
IBRD	LA Sch 2 I.B.	GoP to enter into subsidiary agreements with WAPDA and NTDC, under terms and conditions agreed with the Bank for the transfer of Loan proceeds for the carrying out of their respective parts of the Project.		<input checked="" type="checkbox"/>	CONTINUOUS	New
IBRD	LA Sch 2 I.D.1 & 2 WAPDA PA's and NTDC PA's Sch I.D.1&2	GoP, WAPDA and NTDC carry out Project activities in accordance with the safeguard documents (i.e. ESMP, RPF & RAP) and ensure that all ToRs for technical assistance or studies are consistent with		<input checked="" type="checkbox"/>	CONTINUOUS	New

		the Bank's safeguard policies.				
IBRD	LA Sch 2 I.D.3 WAPDA PA's and NTDC PA's Sch I.D.3	GoP, WAPDA and NTDC to ensure that prior to commencing any civil works under the Project that require land taking and the resettlement of Displaced Persons, all resettlement measures set forth in the applicable Safeguard Documents shall have been fully executed as per entitlements.		<input checked="" type="checkbox"/>	CONTINUOUS	New
IBRD	LA Sch 2 I.D.5 WAPDA PA's and NTDC PA's Sch I.D.5	GoP to cause WAPDA and NTDC to regularly collect, compile and submit to the Bank, report on the status of compliance with the safeguard documents.	Semi-annual	<input checked="" type="checkbox"/>	CONTINUOUS	New
IBRD	LA Sch 2 I.D.6 WAPDA PA's and NTDC PA's Sch I.D.6	GoP to cause WAPDA and NTDC to strengthen, maintain and continue operation the grievance redress mechanism established under the original Project (i.e. Tarbela IV).		<input checked="" type="checkbox"/>	CONTINUOUS	New
IBRD	WAPDA PA I.A.1(a) and I.A.4	Water and Power Development Authority (WAPDA) to appoint Project Director/GM Tarbela, staff of the PMU and independent panel of experts (IPOE) in consultation with and according to the terms acceptable to the World Bank and maintain the PMU and IPOE till completion of the Project.		<input checked="" type="checkbox"/>	CONTINUOUS	New
IBRD	NTDC PA I.A(b)	NTDC to appoint Project Director of Transmission line and staff of PMU for the construction of the transmission line in consultation with and according to the terms acceptable to the World		<input checked="" type="checkbox"/>	CONTINUOUS	New

		Bank and maintain PMU till completion of the Project.				
IBRD	WAPDA PA Sch I.A.1(b)	WAPDA to maintain the construction supervision consultant and monitoring and evaluation consultants.		<input checked="" type="checkbox"/>	CONTINUOUS	New
IBRD	WAPDA PA Sch. I.A.2	WAPDA to maintain a Resettlement Claims Settlement Commission, with TORs and composition satisfactory to the Bank to settle all claims related to the economic and social impact of activities implemented under for the Tarbela Dam and Ghazi Barotha Hydro Projects.		<input checked="" type="checkbox"/>	CONTINUOUS	New
IBRD	WAPDA PA's and NTDC PA's Sch I.C	WAPDA and NTDC to prepare annual work plans and budget for their respective parts of the Project in such scope and detail as reasonably requested by the Bank.	Oct. 31 of each year (first one within 1 month of the Effective Date)	<input checked="" type="checkbox"/>	CONTINUOUS	New
IBRD	WAPDA PA Sch I.A.3	WAPDA to be responsible for implementation of dam safety monitoring systems (including upgrading monitoring instrumentation) through the Tarbela Dam Monitoring Organization		<input checked="" type="checkbox"/>	CONTINUOUS	New
IBRD	LA Sch 2 II.A WAPDA PA II.A. NTDC PA II.A.	GOP to ensure that WAPDA and NTDC: (i) prepare Project Report on quarterly basis on the basis of agreed indicators and (ii) carry out semi-annual and annual reviews jointly with the Bank.	Quarterly (45 days after the end of the quarter, semi-annual and annual (by Oct. 31, of each	<input checked="" type="checkbox"/>	CONTINUOUS	New

			year) reports			
IBRD	WAPDA PA's and NTDC PA's Sch. Section III 2	WAPDA and NTDC to maintain: (i) a fully operational procurement documentation and record keeping systems, including a website showing the status of procurement of various contracts and their performance; and (ii) a system for the handling of procurement complaints, including recourse to a second tier appeal mechanism.		<input checked="" type="checkbox"/>	CONTINUOUS	New

**Covenants - Parent (Tarbela Fourth Extension Hydropower Project - P115893)**

Ln/Cr/TF	FA Referenc e	Description of Covenants	Dat e Due	Status	Recurr ent	Frequenc y	Action
IBRD- 81440	Section II E4	Government of Pakistan (GoP) would ensure that Central Power Purchase Agency (CPPA) of National Transmission and Dispatch Company (NTDC) Limited or such statutory agency responsible for purchase of electricity from WAPDA Hydel shall maintain a balance in an escrow account equivalent to a period of billing by WAPDA, as agreed by the Bank, and not to exceed two months.		Partially complied with	<input checked="" type="checkbox"/>	CONTIN UOUS	Revised
IBRD- 81440		Government of Pakistan (GoP) would ensure that Central Power Purchasing Agency Guarantee Limited (CPPA-G) or such statutory agency responsible for purchase of electricity from WAPDA Hydel shall maintain a balance in an escrow account equivalent to a period of billing by WAPDA, as agreed by the		Partially complied with	<input checked="" type="checkbox"/>	CONTIN UOUS	Proposed



		Bank, and not to exceed two months.					
<b>Conditions</b>							
<b>Source Of Fund</b>		<b>Name</b>			<b>Type</b>		
IBRD		On-lending of Loan Proceeds			Effectiveness		
<b>Description of Condition</b>							
<p>(i) The subsidiary loan agreements (SLAs) between GoP and WAPDA, and among GoP, WAPDA and NTDC have been executed; and</p> <p>(ii) The Co-Financing Agreement between AIIB and GoP has been executed and all condition precedents for disbursements of funds thereunder (other than the effectiveness of the IBRD Loan) have been met.</p>							
<b>Risk</b>							
<b>Risk Category</b>					<b>Rating (H, S, M, L)</b>		
1. Political and Governance					Substantial		
2. Macroeconomic					Moderate		
3. Sector Strategies and Policies					Substantial		
4. Technical Design of Project or Program					Substantial		
5. Institutional Capacity for Implementation and Sustainability					Moderate		
6. Fiduciary					Substantial		
7. Environment and Social					Substantial		
8. Stakeholders					Substantial		
9. Other							
OVERALL					Substantial		
<b>Finance</b>							
<b>Loan Closing Date - Additional Financing ( Additional Financing to PK: Tarbela 4th Extension Hydropower Project - P157372 )</b>							
<b>Source of Funds</b>				<b>Proposed Additional Financing Loan Closing Date</b>			
International Bank for Reconstruction and Development				30-Jun-2022			
<b>Loan Closing Date(s) - Parent ( Tarbela Fourth Extension Hydropower Project - P115893 )</b>							
All activities for the parent project are expected to be completed by the original closing date. However, closing date would be extended by twelve months from December 31, 2018 to December 31, 2019 to ensure proper completion of all works, warranty and defect liabilities are completed properly and to ensure smooth operation of the project also allowing greater flexibility in reallocation of resources more efficiently, if needed between the parent project and AF.							
<b>Ln/Cr/TF</b>	<b>Status</b>	<b>Original Closing Date</b>	<b>Current Closing Date</b>	<b>Proposed Closing Date</b>	<b>Previous Closing Date(s)</b>		

IBRD-81440	Effective	31-Dec-2018	31-Dec-2018	31-Dec-2019	
IDA-50790	Effective	31-Dec-2018	31-Dec-2018	31-Dec-2019	

### Change in Disbursement Arrangements

Disbursement Arrangements will remain the same except that NTDC will be the implementing entity for the transmission component B3. For AF, the PMU WAPDA will open a new segregated designated account to receive the funds from the Bank. The loan amount for the transmission line would be relented to NTDC under a tri-partite subsidiary loan agreement (SLA) among GOP, WAPDA and NTDC, under terms and conditions approved by the World Bank. WAPDA would pass on the loan proceeds of the transmission line sub-component to NTDC and NTDC will be responsible for repayment according to the SLA. The PMU WAPDA would advance NTDC an amount equal to the budgeted expenditures related to the project over a 90-day period, and replenish the account at the end of each quarter on a revolving basis. A simplified imprest account shall be maintained by NTDC in a manner sufficient to render the classified account to PMU WAPDA on monthly basis for preparation/consolidation of the project financial reports.

### Expected Disbursements (in USD Million)(including all Sources of Financing)

Fiscal Year	2017	2018	2019	2020	2021	2022				
Annual	20.0	30.0	150.0	220.0	300.0	103.5				
Cumulative	20.0	50.0	200.0	420.0	720.0	823.5				

### Allocations – AF to PK: Tarbela 4th Extension Hydropower Project - P157372

Source of Fund	Currency	Category of Expenditure	Allocation	Disbursement % (Type Total)
			Proposed	Proposed
IBRD	USD	1. Works for Part A	100,000,000.00	36 a/
IBRD	USD	2. Goods and Works for Part B1 and B2	120,000,000.00	36 a/
IBRD	USD	3. Goods and works for Part B3	48,000,000.00	80
IBRD	USD	4. Land and Involuntary Resettlement Compensation for Part B.3 and C.1	2,000,000.00	100
IBRD	USD	5. Goods and works under Component C, D and E	28,000,000.00	100
IBRD	USD	6. Consulting Services including Audits	40,000,000.00	100
IBRD	USD	7. Incremental Operating Cost and Training	12,000,000.00	100
IBRD	USD	8. FEF: Front End Fee	975,000.00	-

IBRD	USD	9. Interest During Construction	27,000,000.00	-
IBRD	USD	10. Commitment Fee	3,500,000	
IBRD	USD	11. Unallocated	8,525,000.00	-
		<b>Total:</b>	<b>390,000,000.00</b>	
AIIB	USD	1. Works for Part A	150,000,000.00	44 a/
AIIB	USD	2. Goods and Works for Part B1 and B2	125,000,000.00	44a/
AIIB		3. FEF: Front End Fee	750,000.00	
AIIB		4. Interest During Construction and commitment fee	24,250,000.00	
		<b>Total:</b>	<b>300,000,000.00</b>	

a/ The works under component A and installation of equipment under component B, each contracted through a single ICB contract would be financed by IBRD and AIIB, and using WAPDA/GoP contributions.

<b>Components</b>				
<b>Change to Components and Cost</b>				
Proposed cost gives combined cost of parent as well as Additional Financing.				
<b>Current Component Name</b>	<b>Proposed Component Name</b>	<b>Current Cost (US\$M)</b>	<b>Proposed Cost (US\$M)</b>	<b>Action</b>
Component A: Construction of Power House and Modification to the Tunnel	Component A: Construction of Power House and Modification to the Tunnel	309.60	586.80	Revised
Component B: Power Units and Ancillary Equipment	Component B: Power Units, Switchyard, Transmission Line and Ancillary Equipment	431.50	719.50	Revised
Component C: Social Action and Environmental Management Plans, Dam Monitoring and Surveillance	Component C: Social Action and Environmental Management Plans, Dam Monitoring and Surveillance	29.00	30.00	Revised
Component D: Construction Supervision, Monitoring and Evaluation of the Project Impacts and Social Action and Environmental Management Plans	Component D: Construction Supervision, Monitoring and Evaluation of the Project Impacts and Social Action and Environmental Management Plans	26.40	67.00	Revised

Component E: Project Management Support, Capacity Building of WAPDA, Technical Assistance and Training	Component E: Project Management Support, Capacity Building of WAPDA, Technical Assistance, Training and Pilot Solar Project	34.00	69.56	Revised
	<b>Sub-Total:</b>	830.50	1,472.9	
Fees and IDC		83.50	106.0	Revised
<b>Total Cost</b>		<b>914.00</b>	<b>1,578.9</b>	<b>Revised</b>

**Other Change(s)**

**Change in Institutional Arrangements**

The project implementation arrangements would remain the same as in case of the parent project except that project management, administration and procurement and contract management would be decentralized in WAPDA more to the Project Director /General Manager level and Project Director of NTDC. This is being done based on the experience gained in implementation of T4HP and Dasu Hydropower projects.

The Project Steering Committee (PSC) established under Dasu Hydro power Project (DHP) with required modification would provide planning and strategic guidance for project implementation as well as facilitate inter-agency coordination at the highest level.

Also for the transmission line component B3 NTDC is added as implementing agency. Details are provided in Annex 3.

**Change in Financial Management**

NTDC will be the implementing entity for transmission line sub-component of AF and was not part of the parent project. A separate PMU at NTDC with adequate staffing will manage the project's financial management matters. The existing FM staffing capacity at PMU of the parent project will also be augmented to manage the additional workload. Agreed FM arrangements are detailed in Annex 3.

**IV. Appraisal Summary**

**Economic and Financial Analysis**

The Project Economic Rate of return (ERR, combined for T4HP and T5HP) is estimated to be about 28 percent, excluding substantial environmental benefits of these two hydropower schemes. Accounting for environmental benefits will raise the combined ERR by 4-6 percent. The ERR for T5HP (excluding environmental benefits) ranges from about 31-21 percent depending upon whether peaking energy is optimized or not and will be about 3 percent higher with environmental benefits. The strong returns reflect the fact that T5HP like T4HP is an extension scheme (focusing mainly on adding extra turbine capacity) to an already substantial hydro scheme, rather than a green-field scheme with front-end civil works and associated impacts. Despite the decline in crude oil prices the revised economic return for T4HP is estimated to remain steady above 30 percent because of lower actual cost and earlier completion. And also because in the absence of actual LNG import prices for Pakistan T4HP appraisal conservatively assumed delivered price of gas at 68percent parity to crude oil price in energy terms. The recent LNG imports and possible long-term LNG supply contracts are expected to yield higher price of gas. The revised economic analysis for T4HP assumes 80 percent parity to crude oil price for gas delivered at thermal power station. Based on these assumptions and revised costs the ERR for T4HP is estimated to be about 30 percent (compared to 33 percent at appraisal). Detailed economic analysis is given in Annex 4.

## Technical Analysis

Considering that it is a hydropower project the works included in this Project like its predecessors (power house installation on Tunnel 3 in 1992 and ongoing work on Tunnel 4) though challenging to execute on an operational dam without any interruption they are not overly complex or extraordinarily challenging and experience has been gained recently in executing such works under T4HP. The works have been designed and would be supervised by highly competent international consultants and overviewed by an Independent Panel of Experts (IPOE). The turbines, generator and other related equipment are large and would be designed and supplied by a world leading manufacturer. Modifying the tunnel intake and constructing the raised intake involve complexities and are therefore being carefully designed and thoroughly examined. Constructability is a major consideration in designing the intake structure. A bulkhead gate would be installed in the connecting tunnel to allow the intake to be completed without disrupting generation from T5HP.

A critical challenge is to execute the construction work according to the planned schedule without any impact on the operation of the dam. Start of work on Tunnel 5 would not be affected by any delays in completion of power house on Tunnel 4 and raising of intake of Tunnel 3. Work on Tunnel 5 would start in parallel to Tunnel 4 and it will be done in a manner that it remains operational till after Tunnel 3 and 4 are back in operation. After Tunnel 3 and 4 become available only then would Tunnel 5 be closed and made available for connection to the powerhouse and/or intake raised so that discharge capacity at Tarbela Dam remains available to meet irrigation requirements.

The civil works are packaged into one large contract which would help in attracting competent international contractors with capacity to carry out such works on a timely basis. It would also help avoid any coordination issues with the equipment supply and installation contractor. The contract management and supervision would be carried out by international consultants to ensure proper coordination.

**See Annex 2 for detailed description of project activities.**

## Social Analysis

The Project will utilize an existing tunnel 5 and the Tarbela reservoir for generation of hydropower. The power plant construction works would be entirely within WAPDA zone, cordoned off from the public with a fence and security arrangements. All the physical works, whether new or upgrading of existing ones, will require no new land acquisition for the power generation aspects. Under the parent Project, there was no land acquisition or resettlement and no specific resettlement-related instruments were produced or implemented.

The transmission line (TL) will span over 52 km with about 160 towers. The exact siting of towers will be finalized during the construction phase. Hence exact compensation and resettlement impacts are not known at this stage. An Environmental and Social Assessment was carried out within a one-kilometer wide corridor of the identified alignment to understand the socioeconomic conditions, likely project impacts and feedback from local communities. Nearly 80 percent of the people who own the tower locations are farmers (for 50 percent farming is primary source of income and for remaining 30 percent it is secondary source of income). Possible impacts associated with the transmission line include land taking for towers, crop and tree losses within the Right of Way (ROW). No physical resettlement is expected. A Land Acquisition and Resettlement Framework (LARF) has been prepared as a separate document to guide the preparation of Resettlement Action Plan (RAP) during the detailed design stage prior to start of the construction. For cash compensation under the project US\$2 million are allocated out of component B3.2 and C1 that is related to implementation of environment and social management plans. The Regional Vice President has provided approval for cash compensation up to US\$2 million.

Key benefits include employment opportunities during construction that will mostly use local labor. Other social issues will include labor employment conditions and safety issues. A tripartite Grievance Redress

Committee (GRC) on labor issues has been operational during T4 and will continue to address labor complaints and employment issues. Health hazards to labor will be managed through comprehensive training, recruitment of Labor Officers and provision of protective equipment. Further, labor camps required during the construction phase will be carefully built or existing sites will be upgraded to ensure that living conditions are healthy and do not lead to any conflicts. A Labor Monitoring Plan will also be in place to ensure that suitable working conditions are in place.

An outreach social assistance program (SAP) is included under the project to support communities in the Project's immediate vicinity in their community social infrastructure development. The SAP will include interventions complementing the ESA and RAP. It will build on the experience of the earlier version under the parent Project. A new SAP will be developed and implemented under the AF project along with resources, to guide future planning efforts to address such potential impacts and deliver the recommended community assistance schemes. The new SAP will be implemented not only in the settlements close to Tarbela but also benefit communities located in the vicinity of the TL. In particular, the SAP will include close consultations with women, ensure that schemes provide specific benefits to them and are seen by them as beneficial. Beneficiary feedback surveys will assess the level of satisfaction felt by local communities with SAP implementation.

The SAP under T4HP included a number of community schemes identified through a collaborative process with local settlements. It was implemented successfully and provided several benefits to local communities such as water supply and sanitation schemes, road construction, assistance to health facilities and construction of schools for boys and girls. All community schemes under SAP for the parent Project were completed on time and received favorable feedback from communities.

Tarbela Hydropower Project has a long history of resettlement legacy issues. The past few decades saw continuous efforts to address them. A Resettlement Commission was set up under Tarbela 4 to facilitate a faster resolution of cases pending in various courts. This Commission will be reconstituted to continue to work on the remaining resettlement cases.

Detailed consultations have been undertaken with local communities during project preparation at Tunnel 5 (power generation) and along the TL. The consultations included focus group discussions with women in particular. The consultations sessions highlighted their hopes, concerns and expectations from the Project and these views have been included in the development of mitigation measures under ESA. Consultations with the local communities, particularly the immediately affected population and women, will continue through the SAP, under RAP implementation and as communication initiatives.

A Project-specific Grievance Redress Mechanism (GRM) will be operational. It will address any complaints from the community during the implementation phase. A labor-related GRC has been addressing employment issues and will continue to operate under the AF.

WAPDA would be responsible for ensuring implementation of the ESMP through consultants and contractor(s). The Project staff, the Construction Supervision consultants, the Monitoring and Evaluation (M&E) consultants and the Contractor will be responsible for ensuring the implementation of the ESMP and each party shall be required to have the capability and capacity to manage safeguard obligations. Training and workshops shall be arranged involving the Project Proponent, consultant and contractor to share Project experience and best practice. Under Tarbela 4, WAPDA has appointed staff to oversee the implementation of safeguards issues.

Within NTDC/PMU, an Environment and Social Impact Unit (ESIU) will oversee the RAP preparation and implementation for the TL. The performance of the parent project in terms of compliance with social safeguards is satisfactory. The social action plan of the parent project was also successfully implemented.

The Environment and Social Assessment (ESA) report prepared and disclosed on March 3, 2016 in the Bank's Infoshop and also included land acquisition for the Islamabad West substation to which the transmission line would be connected from Tarbela. However, this would now be financed from the proposed Transmission System Modernization Project instead of AF to Tarbela 4<sup>th</sup> Extension. Therefore, an Addendum to the ESA has been prepared reflecting this change that is being disclosed in the Infoshop as well.

**Gender:** Under the Social Assistance Program, a strong gender-based approach will be taken. Community Based Organizations (CBO) will be formed at village/settlement level to hold consultations with beneficiary communities and involve them in the identification, implementation and monitoring of schemes. Several CBOs already exist in the Project area and will be used for SAP implementation also. CBOs will be required to include women as members and as office holders. Consultations will be carried out with women as well as men to identify schemes and at least 50 percent of schemes will be based on priorities identified by women. Further, at least one woman office bearer will be part of each CBO Management Committee to ensure that women's voices are heard in decisions. Women's views will also be captured separately in each annual Beneficiary Feedback survey and used to fine tune the SAP and its implementation as appropriate.

**See Annex 5 for more details.**

#### **Environmental Analysis:**

This Project will reduce net Greenhouse Gas emissions by 20 million tons of carbon dioxide equivalent (CO<sub>2</sub>e) over its projected lifetime. The calculations were done using the Bank's Guidance Note: Greenhouse Gas Accounting for Energy Investment Operations, 2013 and IPCC 2006 guidelines. The emissions from the project are estimated about 1.1 million tons of CO<sub>2</sub>e – from hydropower component about 0.2 million tons of CO<sub>2</sub>e and from transmission line about 0.9 million tons. The Project provides significant environmental benefits in the long run by providing renewable, low-carbon energy without the major environmental and social impacts normally associated with hydro schemes. The Project would also help utilize more efficiently the scarce water resources of the Indus Basin by installing modern and more efficient turbines and machines for generation of electricity.

The Project involves large scale construction at Tarbela Dam on the Indus River and is located close to the Ghazi Barotha Project, which had social safeguards related issues in the past. Given the fact that this is a large undertaking by WAPDA in conjunction with the on-going construction of Bank funded Tarbela 4th Hydropower project, the AF is also categorized as Environmental Category "A". This categorization, which requires full assessment and consultations with stakeholders, helps demonstrate the application of best standards for environmental and social issues in the Project and greater transparency to all stakeholders. The environmental assessment of the Project prepared jointly by WAPDA and NTDC considers adverse environmental issues likely to arise during the complete project cycle; i.e., pre-construction, construction and operation phases of the project. The Environmental Assessment shows that major adverse environmental impacts, primarily limited to design and construction stage, are likely to be temporary and reversible in nature and would be managed locally.

Extensive work has been done in the environmental and social assessment (ESA) study for the proposed AF. The power generation element of the project will be implemented on the left bank of the Indus River in a limited area concentrated around the inlet and outlet of Tunnel 5 of the Tarbela Dam. The proposed transmission line for power evacuation will be about 50 km long. To understand the impacts of proposed developments, the Area of Influence (AoI) of the project covers an area of about 5km upstream, 10km downstream of the dam and 2km on each side of the Indus River (right and left banks), and also the length of

the power evacuation route plus a 500m buffer from the center line. Direct and indirect impacts of the project will mainly occur in the immediate surrounding (few km) of the power generation facility and along the transmission line corridor with the exception of some borrow areas and quarries for construction materials situated at longer distance. Negative impacts during operation and maintenance of the project will be very limited. The project is also not expected to contribute to any cumulative impacts since the operational regime of Tarbela will not change by the T5HP. However, the positive impacts of the Project will be very substantial due to production of clean and low-carbon hydro power.

T5HP including TL component does not impact any natural habitat or forest in anyway. Similarly project will not use and does not promote use of pesticide as a result of any activity. NTDC does not use the chemicals/pesticides for clearing of vegetation under the TL. The project is located on International Waterways, however, the Project falls within the exception to the notification requirements of OP 7.50, set forth in paragraph 7(a) of OP 7.50. The Regional Vice President has approved the exception to notification under the parent project as well as under the AF. The Project is not located in any 'Disputed Areas' as defined in OP 7.60.

The ESA shows that the environmental impacts are primarily limited to the construction stage. In Project design, a number of project alternatives have also been analyzed in terms of location and layout of the powerhouse, intake options, routing of transmission line and location of substation. For each of the proposed alternatives, both technical and environmental and social considerations were weighed before deciding on a preferred option. The ESA report presents analyses of cumulative impacts, induced impacts, and risks for the Project against natural disasters like earthquake, extreme flooding and those associated with climate change.

The project will be implemented by WAPDA and NTDC and both entities have extensive experience in implementing Bank funded projects in the past. WAPDA is currently implementing T4HP and NTDC is responsible for the implementation of CASA 1000 Regional energy development project. Both agencies have varying levels of experience in the implementation of environmental safeguards and therefore the ESA presents lessons learnt from other Bank funded projects by these agencies and proposes a capacity development program. The ESA presents an elaborate institutional responsibilities for safeguards implementation at all three levels including the implementing agencies, supervision consultants and contractors.

The construction on Tunnel 5 would proceed in parallel to the construction on Tunnel 4 and it would be done in a manner such that Tunnel 5 would remain operational until the construction of Tunnel 4 is completed and available for water releases for irrigation purposes.

The ESA report also presents analysis on cumulative impacts. The analysis has been carried out in continuation to the analysis done for T4HP and considers Ghazi Barotha (immediately downstream of the proposed project) and Tarbela projects, and proposed hydropower developments on Indus over the next twenty years. The most significant valued environmental and social components (VECs) considered are river hydrology, morphology, irrigation and biodiversity. The analysis of cumulative impacts presented in the ESA concludes that T5HP's contribution to the hydrological regime will be negligible as the project will not alter the reservoir capacity or downstream water flows. Similarly, cumulative impacts are limited on biodiversity present in the project area. **See Annex 5 for more Details.**

The performance of the parent project in terms of compliance with environmental safeguards is satisfactory. The performance of the environmental unit of project management unit and contractors in implementation of environmental management plans was also satisfactory.



## Risk

WAPDA is presently implementing two large projects being financed by the World Bank and is largely in compliance with legal covenants, fiduciary performance is rated satisfactory, and risk management measures are being followed. T5HP is to be implemented under similar arrangements and would further strengthen WAPDA's capacity to plan, develop and manage hydropower infrastructure in the long run. Based on the lessons learned during implementation of T4HP decision making would be decentralized more to the Project Director level. However, considering the operating environment and large contracts involved the overall risk rating of the operation is considered to be Substantial. Therefore, ensuring efficiency and transparency in procurement, financial, environmental and social management is crucial for successful implementation of the Project.

Project implementation, procurement and contract management would be supervised by a reputable internationally recruited firm which would also be designated as the engineer in the civil works contract. The Bank Team would place a staff and/or a consultant in the country who would visit the Project site on a regular basis, particularly in the first two years, to monitor the Project planning, implementation program for construction activities, communication strategy, and EMP and SAP activities.

As with any large infrastructure project, there are risks of inadequate technical designs and engineering works, leading to failure or poor performance. The sheer scale of the operation represents a risk and, indeed, the Project is a large undertaking for WAPDA. However, WAPDA has previous experience in such undertakings and WAPDA staff would be drawing on such past knowledge and experience. To provide additional comfort in ensuring the design of the hydropower plant is robust, an internationally renowned company has been recruited competitively to design the works. To mitigate implementation risks, a multi-disciplinary IPOE would be involved throughout the Project to provide the technical advice regarding designs and engineering issues. In addition, the turbines, generators and other related equipment would be designed and supplied by a world leading manufacturer.

There was an accident at T4HP construction site on July 2, 2016 that unfortunately caused four fatalities. The contractor was largely in compliance with Health and Safety Management Plan which is updated periodically in light of findings and recommendations of various audit reports, site experiences and corrective actions. Learning from this accident additional safety measures will be undertaken to improve safety and accident free implementation of T4HP and AF.

The hydropower plant would be installed on an existing dam with an already constructed tunnel, which reduces the exposure to the many social and environmental challenges often associated with large dam projects. However, the poor implementation of the Tarbela resettlement program, dating back over 30 years, left behind difficult outstanding resettlement issues which WAPDA has been trying to address ever since. T5HP will continue to provide the support to WAPDA to settle the outstanding court cases as delineated in Social Action Plan for T4HP.

Considering the above issues, although the risks associated with most large infrastructure works remain substantial, given that this Project is using an existing dam and reservoir, overall risks are considered to be manageable after the risk mitigation measures outlined in Annex 6 have been put in place. The risks also should be considered in the context of the substantial benefits of providing 1,410 MW of low cost, low carbon renewable energy during the summer peak demand period. If the pilot for floating solar power is successful it would open the possibility of over 5,000 MW of installation of alternative climate smart capacity with minimal adverse social and environment affects. **See Annex 6 for System Operations Risk Assessment.**

## **V. World Bank Grievance Redress**

**8.** Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit <http://www.worldbank.org/GRS>. For information on how to submit complaints to the World Bank Inspection Panel, please visit [www.inspectionpanel.org](http://www.inspectionpanel.org).

### Annex 1: Results Framework

Project Name:	Additional Financing to PK: Tarbela 4th Extension Hydropower Project (P157372)	Project Stage:	Additional Financing	Status:	
Team Leader(s):	Masood Ahmad	Requesting Unit:	SACPK	Created by:	Mohammad Saqib on 25-Nov-2015
Product Line:	IBRD/IDA	Responsible Unit:	GEE06	Modified by:	Mohammad Saqib on 11-Aug-2016
Country:	Pakistan	Approval FY:	2017		
Region:	SOUTH ASIA	Lending Instrument:	Investment Project Financing		
Parent Project ID:	P115893	Parent Project Name:	Tarbela Fourth Extension Hydropower Project (P115893)		

#### Project Development Objectives

Original Project Development Objective - Parent:

The overall project development objective is to facilitate a sustainable expansion of Pakistan's electricity generation capacity.

Proposed Project Development Objective - Additional Financing (AF):

#### Results

Core sector indicators are considered: Yes

Results reporting level: Project Level

#### Project Development Objective Indicators

Status	Indicator Name	Core	Unit of Measure		Baseline	Actual(Current)	End Target
Revised			Megawatt	Value	0.00	0.00	2820.00

	Generation Capacity of Hydropower constructed or rehabilitated under the project	<input checked="" type="checkbox"/>		Date	30-Jun-2012	30-Sep-2015	30-Jun-2022
				Comment			
Revised	Generation Capacity of Hydropower constructed under the project	<input checked="" type="checkbox"/>	Megawatt	Value	0.00	0.00	2820.00
			Sub Type	Date	30-Jun-2012	30-Sep-2015	30-Jun-2022
			Breakdown	Comment			
Revised	Energy Supply	<input type="checkbox"/>	Gigawatt-hour (GWh)	Value	14175.00	14758.51	19000.00
				Date	30-Jun-2012	30-Jun-2015	30-Jun-2022
				Comment			
Revised	Generation Capacity	<input type="checkbox"/>	Megawatt	Value	3478.00	3478.00	6298.00
				Date	30-Jun-2012	30-Sep-2015	30-Jun-2022
				Comment			
New	Reduction in production cost of energy	<input type="checkbox"/>	PKR/kWh	Value	7.02		6.85
				Date	30-Jun-2012		30-Jun-2022
				Comment			At 2012 cost and generation mix
Revised	Preparation of hydro project completion of pilot solar project and capacity building program	<input type="checkbox"/>	Percentage	Value	0.00	50.00	100.00
				Date	30-Jun-2012	30-Sep-2015	30-Jun-2022
				Comment			

### Intermediate Results Indicators

Status	Indicator Name	Core	Unit of Measure		Baseline	Actual(Current)	End Target
No Change			Percentage	Value	0.00	40.00	100.00

	Component A Powerhouse construction for Tunnel 4 (T4)	<input type="checkbox"/>		Date	30-Jun-2012	30-Sep-2015	30-Jun-2018
				Comment	T4 power house and connection to tunnel 4		
No Change	Component A Construction of intake modification to T4 (and T3)	<input type="checkbox"/>	Percentage	Value	0.00	40.00	100.00
				Date	30-Jun-2012	30-Sep-2015	30-Jun-2019
				Comment	For T3 and T4		
New	Component A Construction of T5 Power House and Connection to Tunnel 5	<input type="checkbox"/>	Percentage	Value	0.00		100.00
				Date	31-Dec-2015		30-Jun-2021
				Comment			
New	Component A Construction of Intake modification for Tunnel 5	<input type="checkbox"/>	Percentage	Value	0.00		100.00
				Date	31-Dec-2015		30-Mar-2022
				Comment			
Revised	Component B Installation of number of power units at T4 and T5	<input type="checkbox"/>	Number	Value	0.00	0.00	6.00
				Date	30-Jun-2012	30-Sep-2015	30-Jun-2021
				Comment			
No Change	Component B Installation of transformers and electrical connection	<input type="checkbox"/>	Percentage	Value	0.00	40.00	100.00
				Date	30-Jun-2012	30-Sep-2015	30-Jun-2018
				Comment	Existing Switchyard		
New			Percentage	Value	0.00		100.00

	Component B Construction of T5 Switchyard	<input type="checkbox"/>		Date	30-Jun-2016		30-Jun-2021
				Comment			
New	Component B Transmission Line for Power Evacuation	<input type="checkbox"/>	Percentage	Value	0.00		100.00
				Date	30-Jun-2016		30-Jun-2021
				Comment			
Revised	Component C-1 Implementation of SAP and EMP	<input type="checkbox"/>	Percentage	Value	0.00	40.00	100.00
				Date	30-Jun-2012	30-Sep-2015	30-Jun-2022
				Comment			
Revised	Component C-2 Operation of dams monitoring system	<input type="checkbox"/>	Percentage	Value	0.00	5.00	100.00
				Date	30-Jun-2012	30-Sep-2015	30-Jun-2022
				Comment			
New	Component C-3 SAP schemes to include consultation with women and reflect their priorities.		Text	Value	No consultation with women reported		50% of the schemes are based on priorities identified by women
				Date	30-Jun-2016		30-Jun-2022
				Comment			
New	Component C-4 Percentage of CBOs functioning under the Project must have at least 25% women members and at least one female office bearer		Percentage	Value	0		100%
				Date	30-June-2016		30-Jun-2022
				Comment			

Revised	Component D-1 Construction supervision and implementation support (CSC Consultants)	<input type="checkbox"/>	Text	Value	Constant support and supervision by the CSC	CSC for T5 are providing implementation support	Constant support and supervision by the CSCs for T5
				Date	30-Jun-2012	30-Dec-2016	30-Jun-2022
				Comment			
Revised	Component D-2 Independent M&E of Project impact of SAP and EMP	<input type="checkbox"/>	Text	Value	Regular Support and monitoring	Regular Support and monitoring for T5	Regular Support and monitoring for T5
				Date	30-Jun-2012	30-Dec-2016	30-Jun-2022
				Comment			
New	Component D-3 Annual Beneficiary feedback surveys to be conducted as part of M&E		Text	Value	No feedback survey has been done		Respondents report overall satisfaction with the implementation of RAP and SAP
				Date	30-Jun-2016		30-Jun-2022
				Comment			
Revised	Component E-1 Effectiveness of PMU	<input type="checkbox"/>	Text	Value	Recruitment of CSC and MSC on time and award of works contracts	T5 PMU is fully staffed and functional.	Completion of project on time, smooth transition to O&M arrangements
				Date	30-Jun-2012	30-Dec-2016	30-Jun-2022

				Comment			
Revised	Component E-2 Capacity Building of WAPDA	<input type="checkbox"/>	Percentage	Value	0.00	25.00	100.00
				Date	30-Jun-2012	30-Sep-2015	30-Jun-2022
				Comment	Preparation of one large hydropower project on River Indus and strengthening of WAPDA to carry out such projects.		
New	Component E-3 Pilot Solar Project	<input type="checkbox"/>	Percentage	Value	0.00		100.00
				Date	30-Jun-2016		30-Jun-2019
				Comment	Completion of a pilot project and other essential studies for possible expansion.		



## Annex 2: Detailed Description of Additional Financing Activities

2.1 T5HP because of its similarities with T4HP and already existing infrastructure can be developed at a rapid pace to meet the current debilitating power shortages that are occurring in the country. It will add 1,410 MW to an existing tunnel number 5 of Tarbela Dam on Indus River, presently being used to release water for irrigation only when the reservoir level is below the minimum spillway operating level. As shown in Figure 2.1, Tunnel 5 is located on the left bank between the two spillways whereas all other four tunnels are on the right bank. The detailed project description is provided below.

2.2 **Component A: Construction of Power House and Modification to the Tunnel (US\$302.7 million of AF).** This component would primarily cover civil works required for T5HP under a single contract, including constructing the T5 power house and a penstock connecting Tunnel 5 to the power units. It would also include modifications to the tunnel intake by constructing a raised intake that would connect to the existing tunnel. The construction of the raised intake would prolong the life of the power house operation and safeguard against intake closure because of sudden movement of sediment. WAPDA has started the pre-qualification process and draft bidding documents have been prepared. AF is proposed for this component to continue support for ongoing activities under original loan and IDA credit for T4HP and to undertake required civil works for T5HP. Further details regarding the connection of the power house to the tunnel 5, and options for disposal of water below to the Ghazi-Barotha pond are described below.

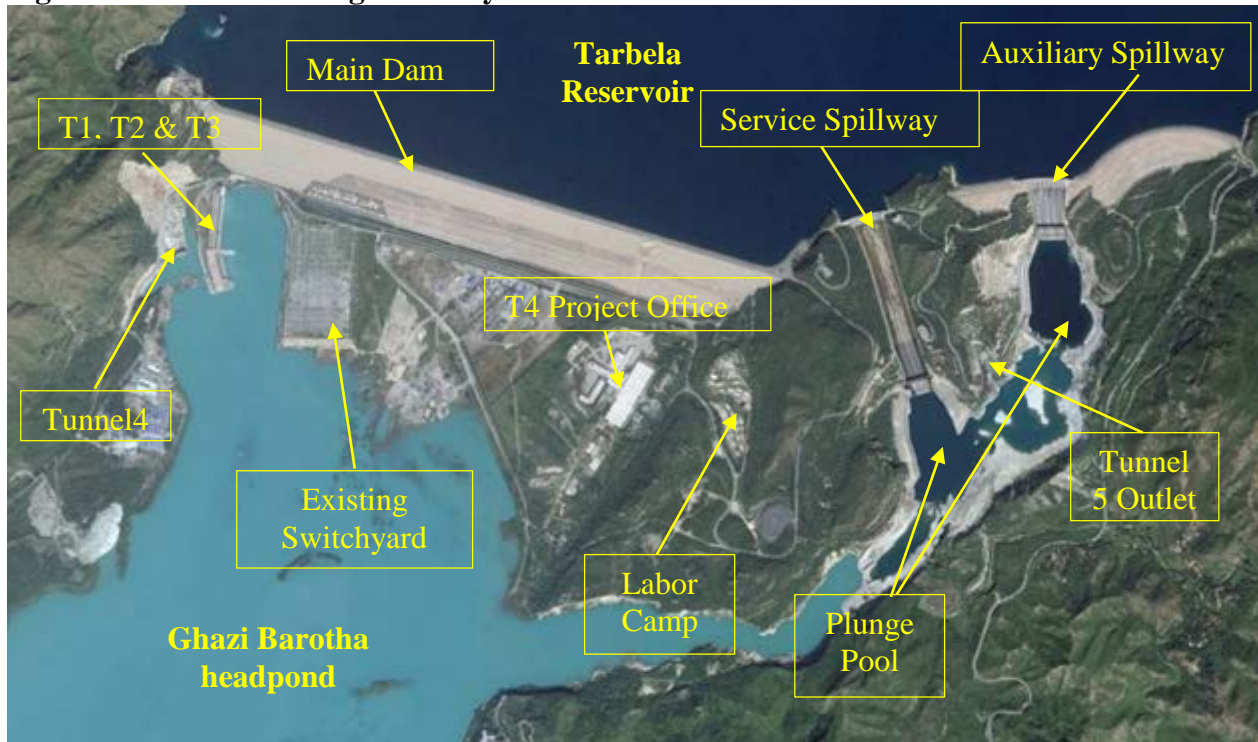
2.3 **Project options and layouts.** Unlike Tunnels 1 to 3, it was never expected that there would be a requirement to install generating plant onto Tunnel 5 and no facilities have been provided for subsequent development. Therefore, the complete waterway system from intake to tailrace was examined to evaluate options for intake, connection to tunnel, powerhouse location/type and tailrace. The project design and cost estimates also took into account key geotechnical and geological risk. The project design has also considered the issues that sediment<sup>4</sup> and the encroaching delta may pose to the development and operation of T5 including blockage of the tunnel, sediment passing through the turbine and loss of storage in the relatively flat Ghazi-Barotha head-pond. The preferred option consists of (see Figure 2.1 and Figure 2.2):

- (i) Raised intake (similar to T4 raised intake, but with a sill level of 420m – 5m higher than T4 – and a short section of inclined tunnel joining the drop shaft to the existing T5 tunnel);
- (ii) The connecting penstock consists of: cutting back the existing tunnel by 29m; sleeve lining a 36m section of existing tunnel; an expansion and bend immediately after the new portal; followed by two connections to the existing LLO; an inclined section of penstock and a manifold type connection to the powerhouse;
- (iii) The powerhouse is to be situated beside the Dal Dara channel between the existing LLO structure and the Service Spillway (no new LLO are required since this arrangement utilises the existing LLO)
- (iv) A tailrace culvert and canal option has been selected that connects the turbine draft tubes to the lower water level in the Dal Dara channel below the Dal Dara weir (providing approximately 11m extra head than discharging directly into the plunge pools). In order for the tailwater level in the canal to be lower than the adjacent water level in the Dal Dara channel, the tailwater flow must to be hydraulically separate from the channel flow by a dividing wall which runs alongside the right-hand side of the canal.

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<sup>4</sup> Modelling has indicated that the likely arrival of the foreset at the existing T5 intake will be within 10 to 30 years (depending upon the operating regime being adopted). It is expected that within this period upstream storage projects will be constructed that will reduce the sediment flows into Tarbela until these reservoirs are flushed or become full e.g. DHP-1 with its limited storage is also expected to increase the storage life of Tarbela.

**Figure 2.1: Tarbela dam general layout**

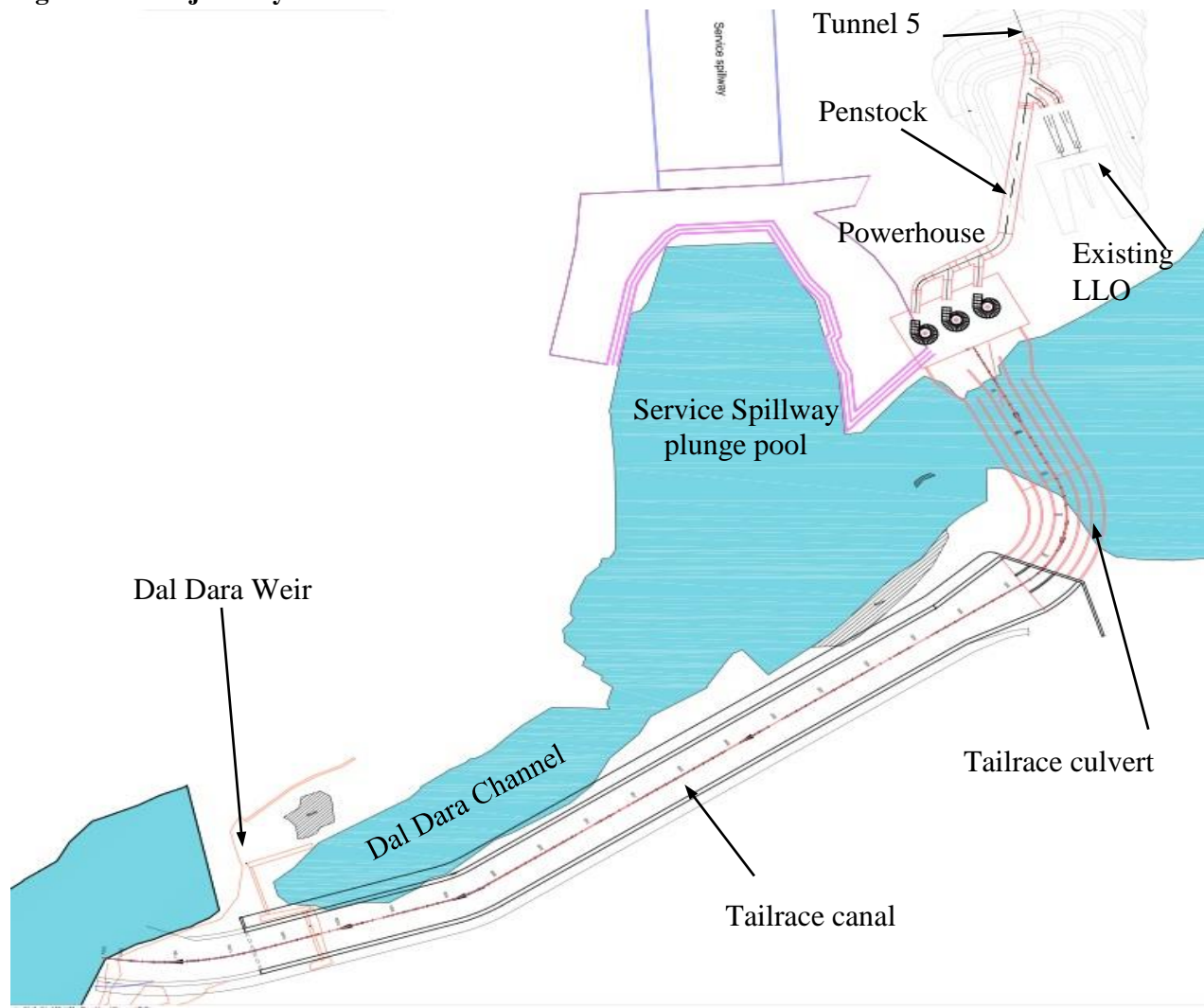


2.4 **Intake.** Although works to create a raised intake at T5 could be delayed for 10 years or more (depending upon how the reservoir is operated), however it would be raised now while a competent contractor with substantial capacity is mobilized on the site for construction of power house and connection of the tunnel to the powerhouse. So this work would be included in the works contract and the component A. The following design developments for the raised intake have been made: (i) 3D numerical modelling of the intake was undertaken; (ii) A suitable excavation methodology was defined; and (iii) the intake type and location has been finalized considering results of the hydraulic modelling and proposed construction methodology.

2.5 In addition to above, construction risks have been assessed with particular attention to issues that have been experienced during the construction of the raised intake of the T4 Extension Project. The resulting design for the new intake is a radial, concrete structure allowing water to pass from a bell-mouth-shaped approach through a trash-rack into the shaft. The structure would be located at an excavation bed level of El 420m (1,378ft) in an excavated section of the left bank slope. The excavation will require the removal of about 1.3 million cubic meters of rock, from above via access roads and truck, and will feature sloping benches to facilitate effective access and drainage

2.6 **Penstock and LLO connection.** The penstock is similar to that being constructed for T4HP being a 13m diameter pipeline with branches to the three turbines, a spare relief valve and two branches to LLO gates. Unlike the T4HP design, the majority of the existing LLOs are being retained with new connecting branches connecting the new penstock to the beginning of the existing circular to rectangular transition section upstream of the gates.

**Figure 2.2: Project Layout**



Source: T5CJV

2.7 The base case design proposes the majority of the new penstock to be buried in a deep trench that runs from a new cut-back Tunnel 5 outlet portal to the rear of the powerhouse. An alternative proposal with a similar estimated cost places the majority of the penstock within a tunnel excavated upstream of the powerhouse. The tunneled arrangement reduces excavation quantities and the thickness of the powerhouse rear wall but due to complexity of works is not currently preferred.

2.8 **Powerhouse.** The generating units for T5HP will be similar to those for T4HP, as a result the general internal layout of the mechanical and electrical equipment will be broadly similar. However there are several notable design differences that will affect the overall structure.

2.9 The installation of the tailrace culvert and canal (to maximize available head) results in a unit setting elevation that is similar to T4HP. However, the required flood protection level to isolate the T5HP powerhouse from the Dal Dara channel, will require a structure which is significantly deeper (68m from

access level to foundation). Accordingly, there are more floors within the powerhouse. This allow greater flexibility in the location of auxiliary and balance of plant and means the offices and admin blocks and workshop to be located within the powerhouse structure below the access level at EL 371m.

2.10 Due to the depth of the powerhouse an additional transfer crane has been specified to bring equipment from a loading floor at EL 371m to the upstream side of the main powerhouse and lower it onto a more standard loading bay at floor level EL 347m. To reduce the length of the powerhouse, the transfer crane rails will run perpendicular to the main station crane, with loading bays on either side of the erection bay.

2.11 The tailrace culvert also requires a downstream surge chamber which will be located immediately downstream of the draft tubes and integral with the powerhouse structure. This will result in a large access platform above the surge chamber on the downstream side of the powerhouse structure.

2.12 **Tailrace.** The proposed powerhouse is located on Dal Dara channel between the service spillway and existing LLOs upstream of the Dal Dara weir. The weir acts as the main hydraulic control in this section of the channel to ensure adequate water levels in the spillway plunge pools. Consequently, water levels upstream of the weir are significantly higher than those immediately downstream. A tailrace is proposed that hydraulically connect the T5HP turbine draft tubes to Ghazi-Barotha headpond downstream of Dal Dara weir utilizing this additional head to provide additional generation. The main components of the tailrace are a buried reinforced concrete box culvert leading from the powerhouse underneath the Dal Dara channel to the left bank, a concrete lined canal connecting to the culvert to the Ghazi-Barotha headpond and a dividing wall that runs along the right bank of the canal, hydraulically separating canal flows from the main channel.

2.13 It is estimated that the proposed tailrace culvert and canal will provide up to an additional 11.3m of head resulting in on average 236 GWh of energy annually when compared to a scheme without these tailrace structures – more than justifying the additional cost.

2.14 **Component B: Power Units and Ancillary Equipment (US\$369.7 million of AF).** This component would cover the cost and installation of: (B1) turbines, generators, transformers, ancillary and electro- mechanical equipment (US\$251.4 million); (B2) transformers and equipment for the switch yard to connect generation to the transmission line (US\$68.4 million); and (B3) a new sub-component added to the Project for construction of a new double circuit transmission line from Tarbela to new substation Islamabad West (US\$50 million including cost of management and social and environmental management plans of about US\$5 million). The generating units for T5HP will be similar to those for T4HP i.e. three vertical Francis generating units each of 470MW rated capacity; as a result the general internal layout of the mechanical and electrical equipment will be broadly similar.

2.15 **Sub-component B1: Electrical and mechanical.** As the available flow and head are similar to that of the T4HP, the specification of generating units is similar; three vertical Francis generating units each of 470MW rated capacity. Auxiliary equipment and balance of plant, along with parameters such as unit synchronous speed, generator voltage, turbine regulation and control will all be similar to that of T4HP. To limit the upstream pressure transients, pressure relief (flow bypass) valves will be installed on the spiral case of each unit, with an additional common valve on a separate dedicated penstock branch.

2.16 **Sub-component B2 Transformers and Switch Yard Equipment:** Each generator will connect via isolated phase bus ducts to three single phase banked transformers located outside on the powerhouse downstream platform. Overhead lines will then connect to the outdoor switchyard on the opposite bank of the Dal Dara channel. When T5HP is complete, the total installed capacity at Tarbela will be about 6,300MW. Studies already completed by NTDC show that there is a deficit in transmission capacity from

Tarbela and further modifications and expansion will be required. The proposed location of the T5HP powerhouse is about 3 km from the existing Tarbela switchyard between the main and auxiliary spillways so a separate switch yard would be constructed for T5HP and the two switchyards would be connected through an in and out arrangements.

**2.17 Sub-Component B3 Evacuation of Power.** Decision regarding best and least cost option to evacuate additional power to be generated from T5HP through a double circuit 500 kV line from Tarbela to Islamabad west has been made by NTDC considering several alternatives. US\$50 million are allocated in the project for the transmission line component with following break-up – US\$45 million for construction of the line and associated connection to the substation and US\$5 million for social and environmental cost and/or any compensation required for the transmission line, and other costs. The design of Islamabad west substation and transmission line would be done by the consultants that are being recruited by WAPDA for construction supervision (CSCs) of T5HP. For the purpose of design and construction supervision for the system of power evacuation including Islamabad west substation CSC will report to NTDC that would be fully responsible for implementation of the transmission component.

**2.18** Islamabad west substation would be common for both Tarbela (500 kV line) and Dasu Hydropower (765 kV line) projects and it would be an important hub of energy in the northern side of the grid serving Islamabad and northern Punjab. The substation itself and all equipment, 765 kV, 500 kV, and 220kV/132 kV equipment, buss bars and control station etc., would be funded from the proposed Transmission Modernization project that is in the pipeline to be approved this fiscal year.

**2.19** The T5HP is expected to start generating power in year 2020/21 in about 4 to 5 years from now. The Islamabad west substation is at preliminary stage and can be completed prior to start of generation from T5HP though it would be a challenging task for NTDC. In case it appears by next year i.e. June 2017 that the Islamabad west cannot be developed in due time to connect generation from T5HP the option of connecting Rawat to T5HP by upgrading a 500 kV line to a double circuit line would be considered.

**2.20 Component C: Social Action and Environmental Management Plans (US\$13 million of AF).** Sub-Component C1 (US\$4.2 million) and C2 (US\$3.0 million) would support implementation of Social Action Plan (SAP) and Environment Management Plan (EMP) respectively.

**2.21** About US\$5.8 million would be allocated for Sub-Components C3: Dam Safety and Monitoring Program. There is additional funding (about US\$12 million) available from KfW for sub-component C4 on Glacier Monitoring. Therefore additional funds are not needed for C4.

**2.22 Component D: Construction Supervision Monitoring and Evaluation (US\$32 million of AF).** Sub-component D1: Construction Supervision and Implementation Support (US\$28.5 million). This sub-component covers the cost of consulting and other services for Project implementation, including construction supervision and Project management support. It would also cover implementation of all activities under the Project, including: procurement, contract administration, quality control, certification of payments, financial management, preparation of any additional designs, and bidding documents, etc. WAPDA has already shortlisted Construction Supervision consultants through the Expression of Interests received and RFP documents have been issued to the short-listed firms.

**2.23** Component D2: Monitoring and Evaluation of the Project Impacts and Social and Environmental Management Plans (US\$3.5 million). The monitoring and evaluation (M&E) activities would provide continuous feedback to the Government of Pakistan (GoP), Ministry of Water and Power (MoWP) and WAPDA on the Project's performance and impact of its various components, so that corrective actions could be undertaken in a timely manner. The monitoring would be carried out by independent M&E consultants (M&ECs). They would also supervise implementation of the RAP, SAP and EMP and provide

independent monitoring of various activities, assess positive and negative impacts and propose alternatives to address any long-term or, during construction, social and environmental issues.

**2.24 Component E: Project Management Support, Pilots, Capacity Building, Technical Assistance and Training (US\$42.6 million of AF).** The ongoing project has financed significant capacity building activities and TA for project preparation and strategic studies. The amount allocated under the three sub-components E1: Project Management Support and Audits (US\$8.8 million); E2: Strengthening of WAPDA, Independent Panel of Experts and Technical Assistance (US\$6.2 million); and E3: Pilots, Future Project Preparation and Strategic Studies (US\$27.6 million) is to finance the continuation of the project management support, capacity building and training programs for WAPDA officials.

**2.25 Pilot for Floating Solar Panels in Tarbela Reservoir (US\$20 million of AF).** Key constraints for the development of solar power plants around the world, and in Pakistan as well, are related with: (i) land availability; and (ii) access to the grid for energy evacuation (see “A Solar Developer’s Guide to Pakistan”, IFC 2015). The Tarbela hydropower plant provides the opportunity to: (i) use the surface of the reservoir for installation of floating photovoltaic panels, avoiding land issues; and (ii) take advantage of the underutilized capacity of the transmission lines during daytime for the evacuation of solar power. Based on available data, it may be possible to install several thousands of MW at the Tarbela lake to significantly increase the power generation of the plant. Global experience with the floating panels approach is fairly limited, so rather than advancing immediately with major installed capacities, WAPDA may start with a pilot project to acquire design and operational experience with this type of installations.

**2.26** It was agreed that the CSC that will be employed for the T5HP, would prepare a preliminary feasibility study to examine the various options including using the Ghazi-Barotha pond or even covering the south facing surface of the dam itself, and then assist with the preparation of appropriate design and bidding documents for the pilot installation. To facilitate the work of the consultant and obtain more accurate estimates of power production, it is recommended that WAPDA procures and installs, as soon as possible, a small number of pyranometers at the powerhouse, or other key locations.

**2.27** Based on success of the pilot Tarbela reservoir area offers huge potential for installation of a floating solar power plant, about 5,000 MW, as surface area is available (already acquired by the Government) as well as the transmission line is available and if needed can be strengthened easily. Generally, during most of the year Tarbela is operated as a peaking plant for four hours in the evening and if more water is available only then additional generation is done during other parts of the day. A combination of solar and hydel generation from Tarbela can be synchronized providing constant flow of electricity to the grid all day long during most part of the year. The expansion of transmission capacity under the AF would accommodate significant generation by floating solar plant as well.

**2.28** Solar irradiance levels in parts of Pakistan, particularly in the southwest, are on par with the best in the world with annual global horizontal irradiance (GHI) values over 1500 kWh/m<sup>2</sup> in over 90 percent of the country’s land area. The annual mean value of GHI for the whole of Pakistan, based on preliminary analysis, is about 2071 kWh/m<sup>2</sup>. A comprehensive resource assessment and mapping project covering biomass, solar and wind is currently ongoing, with a final Solar Atlas expected in early 2017. The project is being implemented by the World Bank in cooperation with the Alternative Energy Development Board (AEDB), with funding from the Energy Sector Management Assistance Program (ESMAP) and the Asia Sustainable and Alternative Energy Program (ASTAE). The solar mapping component includes up to two years of high quality, ground-based solar measurements taken from nine sites across Pakistan. The Islamabad solar measuring station indicates a GHI of 1845 to 1946 kWh/m<sup>2</sup>/yr, while preliminary estimates for the Tarbela Dam area range from 1580 to 1720 kWh/m<sup>2</sup>/yr. Assuming a prudent solar panel efficiency of about 10 percent, one square meter of solar photovoltaic panels would generate annually about 165 kWh

and an acre of surface covered by solar panels should generate annually more than 650 MWh/yr. It should be noted that construction time for solar power plants for capacities of several tens of MW are comparatively short, at about 12 months.

2.29 Ground mounted installation costs for Pakistan are estimated by the National Electric Power Regulatory Authority at about \$1,200/kW, which result to a tariff of about US\$0.11/kWh (on the basis of commercial financing). The proposed pilot project would provide actual cost estimates for the floating panels, assess the ability of the power plant to operate and dispatch the power efficiently, and an opportunity to better assess the actual economic value of the approach. It will also explore concessional financing and other options for future expansion.

2.30 The design and supervision consultants would prepare the detailed design of the floating solar plant and prepare the bidding documents. In addition to the technical studies, environmental and social assessment and management plans would also be prepared. The construction of the pilot floating solar plant would proceed only after the review and clearance of technical, environment, social and related safeguard documents.

2.31 **Project Cost and Financing.** Cost of AF i.e. for development of T5HP and source of financing is provided in Table 2.1. T5HP would cost about US\$823.5 million. WAPDA would finance about US\$124.5 million and NTDC about US\$9 million covering 20 percent of the main contracts cost. IBRD would provide US\$390 million and AIIB US\$300 million.

2.32 Saving in IDA credit for T4HP estimated around US\$115 million have been cancelled as of June 2, 2016. For T4HP US\$400 million of IBRD and US\$325 million of IDA are required, a total of US\$725 million including SDR to USD loss of US\$33 million (Table 2.2). Table 2.3 gives the combined cost of T4HP and T5HP by component and with breakdown from each financier.

2.33 **Timeline and Project Completion timetable.** Timetable for gestation of power plants under T4HP and T5HP and the loan/credit closing date is given in the table below.

<b>T4HP</b> – completion of installation three units with total capacity of 1410 MW and their gestation.	June 2018
<b>T4HP</b> -- Completion and finishing of works around tunnel connections, intakes and refurbishment of gates etc. and final finishing etc.	June 2019
<b>T4HP</b> – Completion of warranty period and loan closing	December 2019
<b>T5HP</b> -- Start construction on Tunnel 5	January 2017
<b>T5HP</b> -- Completion of three units with total capacity of 1410 MW and their gestation etc.	June 2020
<b>T5HP</b> -- Complete raising of Tunnel 5 intake	June 2021
<b>T5HP</b> -- Completion and finishing of works around intake etc.	March 2022
<b>TH5P</b> – Loan Closing	June 2022

**Note:** As Tarbela is operational dam working period during a year in particular on the reservoir side is from November to June when reservoir level is low.

**Table 2.1: Estimated Cost of T5HP and Financing Plan (US\$ Million)**

	<b>Total</b>	<b>WB IBRD AF</b>	<b>AIIB</b>	<b>WAPDA /GoP</b>	<b>NTDC /GOP</b>
<b>A. Power House and Tunnel Works</b>	<b>302.7</b>	<b>109.0</b>	<b>133.2</b>	<b>60.5</b>	
<b>B. Turbines, generators and auxiliaries</b>					
B1. Turbines generators and related equipment,	251.4	90.5	110.6	50.3	
B2. Transformers, switchyard electrical. connection	68.4	24.6	30.1	13.7	
B3.1 Transmission Line to Islamabad West	45.0	36.0			9.0
B3.2 EAP and SAP cost of Transmisison line	5.0	5.0		-	
<b>Sub-total B</b>	<b>369.7</b>	<b>156.1</b>	<b>140.7</b>	<b>63.9</b>	<b>9.0</b>
<b>C. Implementation of SAP and EMP, Dam Monitoring</b>					
C1. Social Action Plan (SAP) for legacy issues	4.2	4.2		-	
C2. Environmental Management Plan (EMP)	3.0	3.0		-	
C3. Dam saftey and monitoring program	5.8	5.8		-	
<b>Sub-Total C</b>	<b>13.0</b>	<b>13.0</b>		<b>-</b>	
<b>D. Consultancies for Supervision</b>					
D1. Construction Supervision consulting services	28.5	28.5		-	
D2. M&E, supervision of EMP and SAP	3.5	3.5		-	
<b>Sub-total D</b>	<b>32.0</b>	<b>32.0</b>		<b>-</b>	
<b>E. Project Management, TA, Training</b>					
E1. PMU support and audits	8.8	8.8		-	
E2. Capacity building TA, POE, training	6.2	6.2		-	
E3. Strategic studies, pilots and future project preparation	27.6	27.6		-	
<b>Sub-total E</b>	<b>42.6</b>	<b>42.6</b>		<b>-</b>	
<b>Fees and IDC</b>	<b>63.5</b>	<b>37.4</b>	<b>26.1</b>	<b>-</b>	<b>-</b>
<b>Total Project Cost</b>	<b>823.5</b>	<b>390.0</b>	<b>300.0</b>	<b>124.5</b>	<b>9.0</b>
<b>Share as percentage of Total Cost</b>		47%	36%	15%	1%
a/ WAPDA/GOP share - Component A, And B: 20%, AIIB 44% and WB 36%					
Tax Content at 19%	144.4				

**Notes:** The above cost estimate include: (a) physical contingencies of 10 percent for all works and 5 percent for electro-mechanical plant and equipment; and (b) price contingencies estimated based on international (USD) inflation of 2 percent annually over the project period.



**Table 2.2: Revised Cost of T4HP and IBRD IDA allocation (US\$ Million)**

	<b>Original Cost 2012</b>	<b>Estimated Cost Mar 2016</b>	<b>IBRD/IDA</b>
<b>A. Power House and Tunnel Works</b>	309.6	284.1	255.7
<b>B. Turbines, generators and auxiliaries</b>	431.5	349.8	314.8
<b>C. Impl of SAP and EMP, Dam Monitoring</b>	29.0	17.0	17.0
<b>D. Consultancies for Supervision</b>	26.4	35.0	35.0
<b>E. Project Management, TA, Training</b>	34.0	27.0	27.0
IBRD Upfront fee	1.0	1.0	1.0
IBRD IDC	53.8	22.5	22.5
IDA IDC	28.7	19.0	19.0
SDR to USD Exchange Loss		33.0	33.0
<b>Total Project Cost</b>	<b>914.0</b>	<b>788.4</b>	<b>725</b>
		IBRD	400
		IDA	325

**Table 2.3: Total Project Cost by Component (T4HP plus T5HP, US\$ Million)**

Project Components	Project Cost			Financing Arrangement			
	T4HP	T5HP	Total	World Bank	AIIB	WAPDA	NTDC
A. Power House and Tunnel Works	284.1	302.7	<b>586.8</b>	364.7	133.2	89.0	-
B. Turbines, generators, auxiliaries and Transmission Line	349.8	369.7	<b>719.5</b>	470.9	140.7	98.9	9.0
C. Implementation of SAP and EMP, Dam Monitoring	17.0	13.0	<b>30.0</b>	30.0	-	-	-
D. Consultancies for Supervision	35.0	32.0	<b>67.0</b>	67.0	-	-	-
E. Project Management, TA, Training	27.0	42.6	<b>69.6</b>	69.6	-	-	-
Fees and IDC	42.5	63.5	<b>106.0</b>	79.9	26.1	-	-
SDR to USD Exchange rate loss	33.0			33.0			
<b>Total Project Cost</b>	<b>788.4</b>	<b>823.5</b>	<b>1,578.9</b>	<b>1,115.0</b>	<b>300.0</b>	<b>187.9</b>	<b>9.0</b>
Percentage Share of Total Project Cost				71%	19%	12%	1%
<b>World Bank Financing</b>	<b>T4HP</b>	<b>T5HP</b>	<b>Total</b>				
IDA	325.0		325.0				
IBRD	400.0	390.0	790.0				
<b>Total</b>	<b>725.0</b>	<b>390.0</b>	<b>1,115.0</b>				

### **Annex 3: Implementation Arrangements and Support**

3.1 The implementation arrangements would remain the same as in case of the parent project and shown in Figures 3.1 and 3.2. Except that project management, administration and procurement and contract management would be decentralized in WAPDA more to the Project Director level which in this case would be General Manager of Tarbela dam and similarly for NTDC. The details are provided below.

3.2 **Project Steering Committee.** The Project Steering Committee (PSC) established under Dasu Hydropower Project (DHP) with required modification would provide planning and strategic guidance for project implementation as well as facilitate inter-agency coordination at the highest level. The PSC would be chaired by the Secretary, Ministry of Water and Power, with Secretaries of Planning, Finance, Economic Affairs Division (EAD), Chairman WAPDA, MD NTDC, Chief Secretary KP, Additional Chief Secretary Development KP, Commissioner of Haripur and Rawalpindi Divisions, Deputy Commissioner of Haripur and Attock and associated districts as its members. The PD of the T5HP would be the Member-Secretary of the PSC. PSC would meet every month during first two years of project implementation and then every quarterly when all contracts are awarded and project implementation is under way. However, PSC meeting can be called whenever there is an issue to be addressed requiring PSC intervention.

3.3 **Independent Panel of Experts (IPOEs).** The international social and environment as well as technical panels of experts would continue to oversee the project during the construction phase and advise WAPDA and Government of Pakistan on the project issues that may arise during construction and/or project implementation period. The technical panel would be supplemented by a procurement and contract management specialist who would advise on procurement and contract management issues. The panel would continue to work during implementation of the project, commencement of operation as well as during the warranty period of the major works, and meet as often as needed, but at least every six months.

3.4 **Water and Power Development Authority (WAPDA)** created in 1958 through an Act as an independent authority would be the main implementing entity for the project. The implementation arrangements under the AF will remain the same as for the ongoing T4HP. The implementation and coordination of additional activities shall be actively managed by the Project Management Unit for T5HP (PMU-T5) which will work in close coordination with existing PMU for T4HP (PMU-T4) both under the General Manager (GM) Tarbela. GM Tarbela would also be the Project Director of T5HP. The procurement, contract management, financial management and environmental and social units and fiduciary staff will be common for both the units.

3.5 **National Transmission and Despatch Company (NTDC)** will implement the transmission sub-component. NTDC is now involved in four World Bank funded projects: (i) T5HP Transmission line; (ii) Dasu Transmission line; (iii) proposed Transmission System Modernization Project; and (iv) CASA 1000. NTDC would establish an entity to deal with all these projects headed by a Head of Project Management Organization (PMO) with a project management unit for each project and a common, procurement and contract management, financial management and environment and social units. For each Project there would be a Project Director and technical staff that would also be supported by consultants. See Figure 3.2

3.6 For T5HP Transmission line NTDC would establish a dedicated PMU and a Project Director for the implementation of this component, the incremental cost of this unit would also be met from the B3 component of the project. However, WAPDA will continue to be the recipient of this loan and will transfer the funds to NTDC through a tripartite subsidiary loan agreement. This arrangement has also been adopted for Bank's Dasu Hydropower Stage-1 project with WAPDA in which funds to NTDC are being forwarded by WAPDA to carry out the activities associated with transmission component.

3.7 **PMU for implementation of T5HP Transmission Line.** NTDC would establish a PMU for implementation of the Tarbela transmission line. To start with the procurement, financial management, environmental and social staff of Dasu Transmission Line PMU would support the T5HP PMU and PMO of the NTDC. On start of implementation of Tarbela Transmission line technical team for implementation would be strengthened and a full time Project Director would be appointed by NTDC for T5HP Transmission line. Procurement, financial management and environment and social staff of Dasu PMU would continue to work for and provide support to the T5HP Transmission Line implementation as well as for implementation of the proposed Transmission Modernization Project.

3.8 **Project supervision and Monitoring.** WAPDA and NTDC PMUs would be supported by two sets of consultants recruited by WAPDA – Construction Supervision Consultants (CSCs) and Project Management Support and Monitoring and Evaluation Consultants (PM&ECs). The CSCs would help in construction supervision, contract management, and other management aspects of the Project and design and construction supervision of the Islamabad West Substation and transmission line from Tarbela to Islamabad West or alternative to Rawat if that option is selected finally. For civil works contracts, the Project Director (PD) would serve as the Employer’s Representative, and the CSCs’ supervising consultant would serve as the Engineer for construction supervision. At the site, Resident Engineers, appointed by the CSCs, together with a team of specialists and inspectors, would supervise the contractor. The PM&ECs would assist in Project Management and in carrying out the role of the employer in the works contracts, and monitoring and evaluation. The PM&ECs would also supervise the implementation of the SRMP and EMP, and carry out independent M&E for Project activities and implementation.

**Procurement Protocols – Decentralization of powers to Project Director/General Manager Tarbela (WAPDA) and PD for Tarbela Transmission Line (NTDC)**

3.9 Based on the experience and lessons learnt from implementation of T4HP and Dasu Hydropower Project and with the aim to expediting and improving implementation of projects the decision making process in WAPDA and NTDC would be decentralized with decision making by the Project Directors. For this purpose adjustments would be made in the implementation arrangement:

3.10 **Approval of Procurement Plan and Strategy.** For implementation of all World Bank funded Projects, WAPDA authority as well as NTDC would decentralize powers to the GM Tarbela who is also designated as Project Director (PD) and PD Tarbela Transmission Line of NTDC. The overall procurement plan for the project would be approved by the WAPDA Authority and MD NTDC. Such plan would be updated and approved time to time during project implementation. The overall plan for project implementation would include the procurement plan with procurement methods, number of contracts, nature of contracts, type of bidding procedure, and approximate cost estimate at the time of bidding, any special conditions etc. that would be approved by the WAPDA Authority and MD NTDC. The procurement of contracts, and contract management including the changes, variation orders, and technical and administrative decisions would be undertaken by the PD/GM and PD of Transmission line (NTDC). Details are provided below.

3.11 Two tables below contain the applicable thresholds for review and approval by the PD/GM, Member (Water) and Water and Power Development Authority (WAPDA) and similar tiers of NTDC that is PD T5HP Transmission Line, GM Grid Station Construction (GSC) and MD NTDC. Table 3.11 set up the thresholds for review and approval requirements by type of procurement and type of contract, and Table 3.2 by type of activity. Category A contract are those which are within the powers of PD/GM, Category B contract are within the powers of Member (Water) or GM GSC and the Category C are those that are to be approved by WAPDA Authority and /or MD NTDC.

3.12 These prior review thresholds are the ceiling amounts that are mandatory and may be reviewed and revised by WAPDA in consultation with the World Bank. As an exception, the WAPDA Authority, in consultation with World Bank, may lower the thresholds for specific contract when special circumstances require more intensive review. Such reductions are established in consultation with the PD/GM.

3.13 The PD/GM reviews and approves contracts whose values are within the PD/GM thresholds. The PD/GM may request the Member (Water) or GM GSC to review and approve contracts whose values are within the PD/GM thresholds. Member (Water) or GM GSC may review and approve contracts whose values are below the applicable Member (Water) or GM GSC threshold, including, inter alia, direct and single-source contracts, when warranted by special circumstances, such as complexity, need for policy interpretation, or deviations from standard procedures.

**Table 3.1: Mandatory Prior Review and Approval Thresholds for PD/GM Member (Water), and Authority (US\$ Millions Equivalent) and NTDC**

Type of Procurement and Type of Contract.	Category A	Category B	Category C
	Project Director/GM and PD PMU NTDC	Member (Water) and GM Grid Station NTDC	WAPDA Authority and MD NTDC
Works, Turnkey and Supply and Install of Plant and Equipment	Upto 50	> 50 and < 100	>100
Goods	Upto 15	>15 and < 50	> 50
IT systems and Non-consulting services	Upto 10	>10 and < 50	> 50
Consulting Services	Upto 5	>5 and <10	>10
All Direct contracting and Single Source Contracts with the Consultants (Firms)	Upto 0.5	>0.5 and <2	> 2
Single Sources Contract Individual Consultants	Upto 0.3	>0.3 and <0.5	> 0.5

**Table 3.2: Mandatory Prior Reviews by type of Procurement Activity**

Type of Activity	PD/GM Thresholds	Member (Water) Thresholds GM GSC	WAPDA Authority Thresholds MD
Negotiations with the lowest bidder	The PD/GM, Member Water, or Authority clears the request in accordance with the respective applicable thresholds.		
Cancellation of procurement/selection process and/or re-bidding	The PD/GM, Member (Water) or Authority clears the request in accordance with the respective applicable thresholds.		
Variation Orders for works and non-consulting services and Amendments for goods which, combined with all Variation Orders, or Amendments, previously issued increase the original contract amount by not more than 15%	PD/GM of the Project.		
Variation Orders for works and non-consulting services and			

Amendments for goods which, combined with all Variation Orders, or Amendments, previously issued increase the original contract amount by more than 15%	Once accumulative value of VOs increases the 15% of the original contract value, approval of Member/GM GSC, and WAPDA Authority/MD where the amount of modified contract falls within the application level of authority of Member/GM GSC and Authority/MD as in Table 3 above		
Other modifications to the signed contract.	All such modifications where the amount of the modified contract falls within the applicable PD/GM threshold.	All such modifications where the amount of the modified contract falls within the applicable Member (Water) or GM GSC threshold.	All such modifications where the amount of the modified contract falls above the applicable Authority threshold.

3.14 The procurement of works, good, and services under the project would be according to the World Bank Guidelines and World Bank Standard Bidding Documents (SBDs) would be used for procurement under the project. For category A, contracts which are within the powers of PD/GM all procurement and contract management actions would be taken by the PD/GM such as issuing of invitation of bids and/or expression of interest, use of bidding documents, evaluation of bids/proposals, award of contract, signing of the contract, etc. In addition the PD/GM would provide all administrative, technical and financial approvals for contract management of such contracts including the approval of variation orders as outlined in the Table 3.2. For Category B contracts and Category C contracts which are within the power of Member (Water), and WAPDA Authority the PD/GM would undertake all actions as in case of Category A contracts accept the evaluation reports and the award of contracts would be approved by the Member (Water) in case of Category B contracts and Full Authority in case of Category C contracts. Similarly variation orders would be approved as outlined in the Table 3.2.

3.15 Same process would apply in case of the NTDC, where powers of PD would be similar to the PD/GM of WAPDA, powers of GM GSC would be similar to Member (Water) and powers of MD NTDC would be equivalent to WAPDA Authority.

### **Financial Management (FM)**

3.16 The ongoing project has been rated ‘Satisfactory’ regarding FM arrangements during the last review mission. The same financial management arrangements being used in the parent project, which are satisfactory to the Bank, will be used under the proposed AF.

3.17 However, National Transmission and Despatch Company (NTDC) will be a new implementing entity for this Project for the transmission line sub-component. NTDC has been an implementing entity of the Bank financed ongoing Dasu Hydro Power Stage I Project (P121507) and the closed Electricity Distribution and Transmission Improvement Project (P095982). The financial management performance of NTDC in respect of the above projects has been “Satisfactory” except delayed submission of audited financial statements. Following weaknesses were noted in the financial management system of NTDC:

- (i) The Bank received the NTDC’s audited financial statements for the year ended June 30, 2014 in respect of closed Electricity Distribution and Transmission Improvement Project in January 2016, about one year after the due date.
- (ii) Internal audit department though headed by a professional accountant but is short of staff by 55 percent.
- (iii) Accounting/Internal Audit Manuals and Financial rules are outdated and needs revision to align with the International Best Practices.
- (iv) Preparation and finalization of financial statements take about 8 months as Books of Accounts are maintained manually at 140 accounting units across the country.

(v) Inventory and Asset management records are also manual and compilation of information takes significant time. As consolidated information is not readily available procurement decisions are made based on inventory and assets at individual spending unit.

3.18 The Bank is preparing National Transmission Modernization Phase I Project (P154987) that includes a technical assistance component to address the governance and financial management weaknesses of NTDC.

3.19 For the purpose of additional financing, financial management arrangements at NTDC will be similar to ongoing Dasu Hydro Power Stage I Project (DHP I Project) as summarized in the table below:

Area	NTDC
<b>Staffing</b>	<ul style="list-style-type: none"> <li>• Full time FM staff reporting to the Project Director of PMU established for this project.</li> </ul>
<b>Budgeting</b>	<ul style="list-style-type: none"> <li>• Prepare annual budget for the sub-component based on work plan of the activities to be carried out during the year.</li> <li>• Prepare a detailed Project Plan for the entire project duration with quarterly breakup of activities and estimated funds utilization.</li> </ul>
<b>Funds Flow</b>	<ul style="list-style-type: none"> <li>• Open a separate bank account for the project.</li> <li>• Receive funds from WAPDA's PMU WAPDA equivalent to 90 days forecasted expenditure. WAPDA's PMU of T4HP will manage the designated account of the project.</li> </ul>
<b>Accounting</b>	<ul style="list-style-type: none"> <li>• Maintain accounts on accrual basis in compliance with International Financial Reporting Standards (IFRS) and accounting policies of NTDC.</li> </ul>
<b>Financial Reporting</b>	<ul style="list-style-type: none"> <li>• Prepare monthly financial report and share with WAPDA's PMU. These reports will serve as the basis of future advance and adjustment of earlier advance.</li> <li>• Prepare and submit quarterly financial reports to WAPDA's PMU of to prepare project level consolidated Interim Financial Reports.</li> <li>• Prepare and submit annual statement of receipt and expenditure with WAPDA's PMU.</li> </ul>
<b>Internal Control Framework</b>	<ul style="list-style-type: none"> <li>• NTDC's accounting manual and financial rules.</li> <li>• <i>For land acquisition and resettlement payments, the SOPs prepared for land acquisition and resettlement payments under DHP I Project will be revised and adopted.</i></li> </ul>
<b>Audit</b>	<ul style="list-style-type: none"> <li>• Provide access to project financial records and information to WAPDA's external auditor. There will be a note in the audited financial statements of WAPDA Hydroelectric audited financial statements providing details of receipts and payments related to the project.</li> </ul>

3.20 The PMU WAPDA is maintaining satisfactory FM arrangements for the parent project and the same arrangement will continue for AF. However, the financial management team needs to be augmented to manage the workload of AF. FM Unit of the PMU will have 2 Budget and Accounts Officers, 2 Assistant Budget and Accounts Officers and Account Assistants depending upon the load of transactions at various stages of the project.

### **Disbursement Arrangements**

3.21 For AF, the PMU WAPDA will open a new segregated designated account to receive the funds from the Bank. Disbursements will be made quarterly using the report-based principle. The PMU will prepare and submit Interim Financial Reports (IFRs) within 45 days of the end of each quarter. Advances will be provided for the following six months based on the forecasted expenditure for that period.

Subsequent IFRs will document expenditures against the advance received and provide forecast expenditures for the further six months on the basis of which the amount of funds to be disbursed will be determined. For large foreign currency payment, the project will use Direct Payment method.

3.22 The loan amount for the transmission line would be relented to NTDC under a tri-partite subsidiary loan agreement (SLA) between GOP, WAPDA and NTDC, under terms and conditions approved by the World Bank. WAPDA would pass on the loan proceeds of the transmission line sub-component to NTDC and NTDC will be responsible for repayment according to the SLA.

3.23 The PMU WAPDA would advance NTDC an amount equal to the budgeted expenditures related to the project over a 90-day period, and replenish the account at the end of each quarter on a revolving basis. A simplified imprest account shall be maintained by NTDC in a manner sufficient to render the classified account to PMU WAPDA on monthly basis for preparation/ consolidation of the project financial reports.

3.24 **Allocation of IBRD Loan to AF T4HP for construction of T5HP.** The T5HP would be co-financed by IBRD and AIIB Loans and allocation of loan amounts from these loans is given in Table 3.3. These two loans combined would fund 80 percent of component A and B cost and costs of other components would be funded by IBRD alone.

3.25 **Retroactive financing** of up to US\$30 million for payments made against eligible expenditures and for the mobilization advance paid to the contractors incurred from January 1, 2016 to the loan signing date shall be allowed provided that procurement procedures are acceptable to the Bank. These funds would also be available for meeting the implementation cost by WAPDA and NTDC.

3.26 **Designated Account and Subsidiary Lending Arrangements.** Tarbela Fourth Extension Hydropower Project (T4HP) was approved in March 2012 with following disbursement and subsidiary lending arrangements.

3.27 **Disbursement:** WAPDA maintained two Revolving Fund Accounts to receive funds from the Bank and make payments as per the Revised Accounting Procedure for Revolving Fund Account (Foreign Currency Assignment Account) issued by the Ministry of Finance.

3.28 **Subsidiary Lending Arrangements:** Government of Pakistan (GoP) and WAPDA entered into a Subsidiary Loan Agreement where GoP relented the loan and credit to WAPDA in equivalent Pak Rupees at interest rate of 15 percent. The foreign currency risk was borne by GoP.

**Table 3.3: Allocation of Additional Financing IBRD and AIIB Loans for T5HP (US\$ million)**

Expenditure Category	Total Amount	IBRD Amount b/	AIIB c/	IBRD Financing Percentage	AIIB Financing Percentage
1. Works for Part A	302.75	100.00	150.00	36%	44%
2. Goods and Works for Part B1 and B2	319.73	120.00	125.00	36%	44%
3. Goods and Works for Part B3	49.00	48.00		80%	
4. Cash Compensation under Parts B & C	2.00	2.00	-	100%	
5. Goods Works under comp C, D, and E	31.53	28.00	-	100%	
6. Consulting Services	42.71	40.00	-	100%	
7. Incremental Operating cost and training	12.28	12.00	-	100%	
8. FEF: Front end Fee	1.775	0.975	0.75	Amount payable pursuant to Section 2.03 of the Loan Agreement	Amount payable pursuant to AIIB Loan Agreement
9. Interest During Construction	55.425	27.00	24.25	Amount payable pursuant to Section 2.05 of the Loan Agreement	Amount payable pursuant to AIIB Loan Agreement
10. Commitment Charges	6.30	3.50		Amount payable pursuant to Section 2.04 of the Loan Agreement	
11. Unallocated		8.525			
<b>Total</b>	<b>823.50</b>	<b>390.000</b>	<b>300.00</b>		

a/ The works under component A and installation of equipment under component B, each contracted through a single ICB contract would be financed by IBRD and AIIB, and using WAPDA/GoP contributions.

b/ Part of the IBRD loan for each component is allocated to the unallocated category so there would not be an exact match between the project cost/financing table figures and the loan allocated to the expenditures categories – the difference is in the unallocated category.

c/ Category 9 Interest During construction also includes Commitment Charges.

3.29 **Procurement** for the proposed additional financing would be carried out in accordance with the World Bank’s “Guidelines: Procurement under IBRD Loans and IDA Credits” dated January 2011 (Revised July 2014); and “Guidelines: Selection and Employment of Consultants by World Bank Borrowers” dated January 2011 (Revised July 2014), and the provisions stipulated in the Legal Agreement. The procurement performance as rated in the last ISR is Satisfactory.

3.30 The project would have five major contracts: (i) works contract for construction of powerhouse, connection to the tunnel, culvert and disposal channel to Ghazi Barotha pond below natural Daldara weir, and construction of switch yard etc. T5HP Works -1 i.e. component A of the AF; (ii) supply and install of generators turbines and associated equipment and machines and transformers and other equipment for the switch yard T5HP-E&M-01 i.e. component B1 and B2 of the AF; (iii) construction of 500 KV double circuit transmission from Tabela T5HP-Trans-1 contract i.e. component B3 of the AF; (iv) construction of pilot floating solar power plant; and (v) consultancy services for construction supervision and project



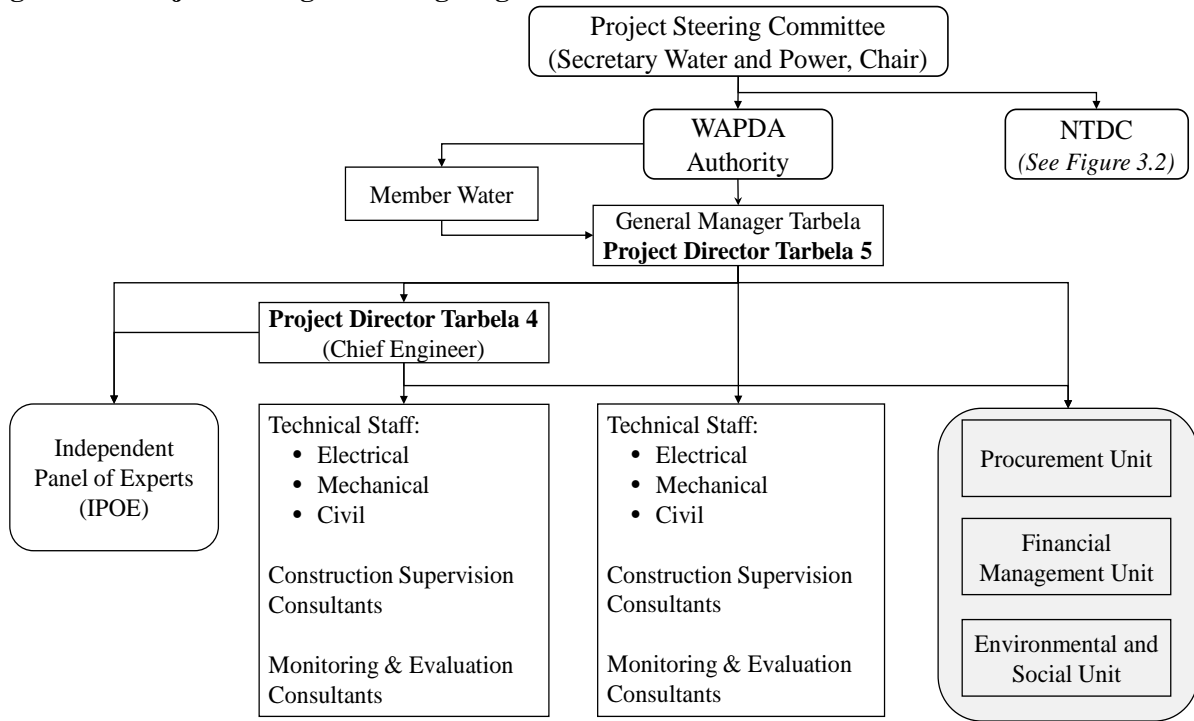
implementation etc. The implementation of SAP may have small works contracts that would be procured using NTC procedures.

3.31 WAPDA has procurement capacity and has gained experience from implementation of T4HP. Project implementation arrangements with NTDC will be finalized and training would be carried out for NTDC in World Bank guidelines and procedures.

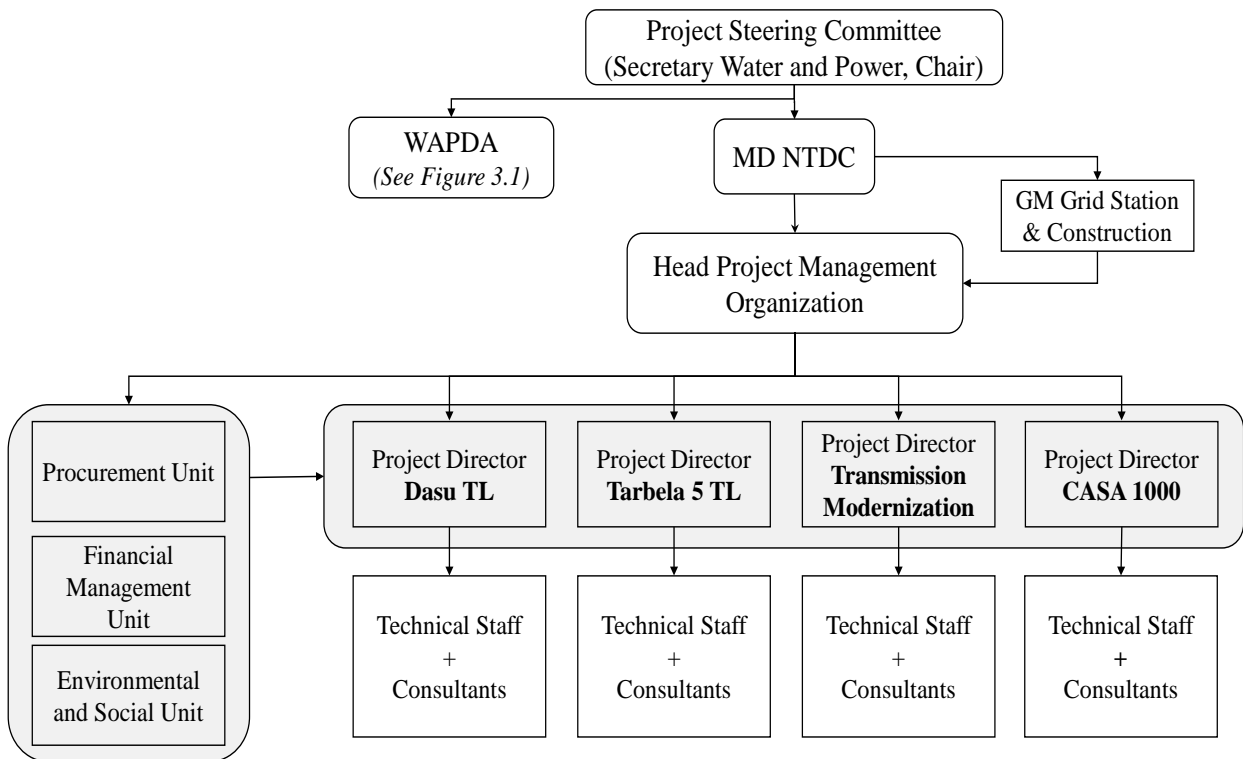
3.32 Assurances were obtained that:

- (i) The Borrower shall maintain a project steering committee (PSC) Chaired by Secretary of Ministry of Water and Power with membership and terms of reference satisfactory to the Bank;
- (ii) Water and Power Development Authority (WAPDA) would, till completion of the Project, appoint Project Director/GM Tarbela and staff of the PMU in consultation with and according to the terms acceptable to the World Bank and maintain the PMU and independent panel of experts (IPOE).
- (iii) NTDC would, till completion of the project, appoint Project Director of Transmission line and staff of PMU for the construction of the transmission line in consultation with and according to the terms acceptable to the World Bank
- (iv) the powers for implementation of the project would be decentralized to PD/GM WAPDA and PD PMU NTDC as outlined above.
- (v) Government of Pakistan (GoP) would ensure that Central Power Purchasing Agency (CPPA) of National Transmission and Despatch Company (NTDC) Limited or such statutory agency responsible for purchase of electricity from WAPDA Hydel shall maintain a balance in an escrow account equivalent to a period of billing by WAPDA, as agreed by the Bank, and not to exceed two months.
- (vi) GoP shall on-lend the proceeds of the IBRD Loan to WAPDA under a subsidiary agreement to be entered into between the GoP and WAPDA, under terms and conditions approved by the Bank, which should include inter alia that:
  - (a) WAPDA would be authorized to withdraw proceeds of the loan and proceeds withdrawn by WAPDA would be considered withdrawn by GoP; and
  - (b) The proceeds of the Loan and Credit shall be re-lent to WAPDA on the same terms and conditions of the Loan and at the maximum interest rate of 15 percent.
- (vii) WAPDA would establish on-site and maintain a Grievance Redress Committee (GRC) throughout the Project implementation period with TORs and composition satisfactory to the Bank.
- (viii) WAPDA would maintain a Resettlement Claims Commission, with TORs and composition satisfactory to the Bank to deal with unresolved resettlement court cases for the Tarbela Dam and Ghazi Barotha Hydro Projects.

**Figure 3.1: Project Management Organogram – WAPDA**



**Figure 3.2: Project Management Organogram – NTDC**



## Annex 4: Project Economic and Financial Analysis

4.1 This section presents an economic evaluation of the Tarbela Fifth Extension Hydropower Project (T5HP), considering: (i) the cost effectiveness of this Project vis-à-vis the relevant alternatives, and (ii) comparing the discounted costs and benefits of the Project to arrive at the net present value (NPV) and economic internal rate of return (ERR). The methodology for economic evaluation is similar to T4HP and Dasu Hydropower Project in which benefits were calculated based on avoided cost of thermal generation assumed to be CCGT-LNG as the next best alternative. The analysis also presents sensitivity analysis and worst case scenario for key risk factors<sup>5</sup>.

4.2 The Project will provide additional generation capacity of 1,410 MW from Tunnel number 5 at Tarbela Dam where 3,478 MW is already installed on Tunnels 1-3 and 1,410 MW is currently being added on Tunnel 4. Tunnel 4 and 5 were never expected to be used for generation but were to allow for water releases for irrigation purposes when the reservoir level was below the minimum spillway operating level and water releases from the existing power units was not adequate. With power house installed on Tunnel 5 it would continue to carry out the same function and in addition water from spillway would be diverted through the tunnel and only remaining water would be passed over the spillway. This would maximize use of the existing facilities and serve the critically needed power for the country.

4.3 Detailed modeling was carried out to optimize flow distribution between the tunnels for maximum generation rather than spilled flows only. This more efficient use of water is estimated to contribute 5 percent additional generation. As a result 1,800 GWh per annum incremental generation from Tarbela Dam can be attributed to T5HP utilizing the same flows<sup>6</sup> at a very low cost compared to alternative generation from thermal or other hydropower projects, that is because all other infrastructure such as dam and tunnel are already constructed. Main benefit of the project, however, is its short gestation period which would help alleviate the severe black outs and highly costly self-generation. The construction period is estimated to be about 39 months and can be completed before the high flow season of 2019 considering logistical and technical constraints involve with parallel activities on Tunnel 3, 4 and 5 including meeting the irrigation requirements.

4.4 The project will also include construction of a switch yard and a transmission line to connect to the national grid because the existing transmission capacity at Tarbela is not sufficient to evacuate additional power from T5HP. NTDC has decided to construct a 500kV double circuit transmission line to be newly constructed Islamabad west substation. The Islamabad West substation is proposed to be financed through World Bank's Transmission Modernization Project. Some initial costs for Islamabad West substation including land acquisition and other site development expenses, however, can be financed through T5HP. The progress on development of site will be assessed periodically and in case it seems that Islamabad west substation could not be completed in time for T5HP then one of the existing lines e.g. Tarbela-Rawat 500kV single-circuit will be upgraded to double circuit.

4.5 The ERR for T5HP (excluding environmental benefits) ranges from about 31-21 percent depending upon whether peaking energy is optimized or not. Accounting for environmental benefits will raise the EIRR by 3 percent. In terms of GHG emissions from the project, since the project is expected to displace gas based thermal generation (CCGT), it would result in net reduction of 20.6 million tons of CO<sub>2</sub> over its 30 years life. When evaluated against diesel based self-generation the avoided emissions are 33.9 million tons of CO<sub>2</sub>.

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<sup>5</sup> This economic analysis rests largely on Feasibility Verification Report (FVR) prepared by the WAPDA's design consultants Mott MacDonald and Coyne Et Bellier dated July 2015.

<sup>6</sup> During the high flow months of July-October the flow in the Indus River is much higher than can be passed through the existing generation facilities and the remainder is discharged over the spillways and therefore does not provide any power benefits.

4.6 The strong returns reflect the fact that T5HP like its predecessor T4HP is an extension scheme (focusing mainly on adding extra turbine capacity) to an already substantial hydro scheme, rather than a green-field scheme with front-end civil works and associated impacts. The sensitivity analysis shows the returns to be remarkably robust against unfavorable outcomes: for example, construction costs could be 110 percent higher and the construction delays resulting in a postponement of revenue stream could continue for 6 years before the ERR falls to the hurdle rate of 12 percent. The robustness of economic returns is also tested in a scenario analysis, in which the outcome of plausible worst case is examined and shows that economic return does not fall below the hurdle rate.

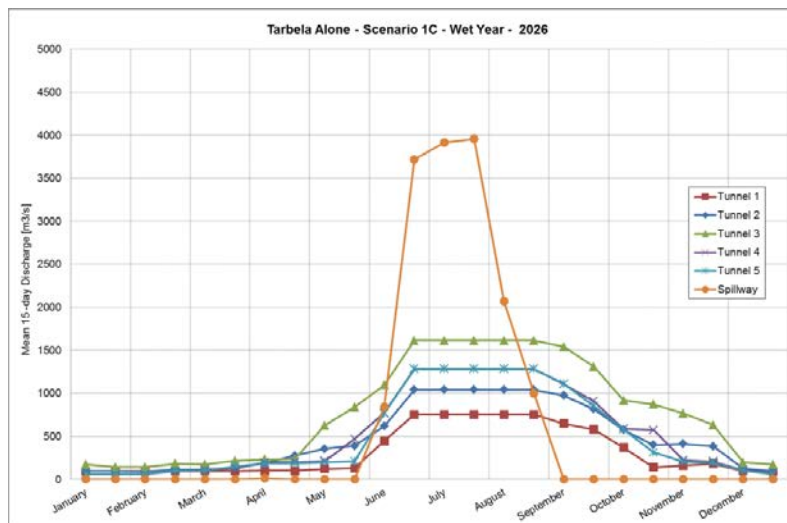
#### A. Cost effectiveness of T5HP

4.7 The installation of an additional powerhouse at the Tarbela reservoir is the most cost-effective hydropower project in Pakistan’s remaining inventory of undeveloped hydro projects (and indeed among all power generation options). This is so for several reasons.

4.8 **First, the Project does not need expensive civil works associated with dam construction** (or raising dam height), which therefore avoids the many environmental and social impacts associated with greenfield hydro projects. With rapidly growing power demands and serious power shortages, the ability to add a powerhouse to Tunnel 5 without major civil works therefore makes for a potentially attractive hydropower project: the proposed 1,410 MW T5HP would increase the total installed capacity at Tarbela to 6,300 MW.

4.9 **Second, the Project makes use of water that would otherwise be spilled, and therefore has no impact on downstream irrigation requirements.** On average, 78 percent of the inflow is used for power generation from Tunnel 1 to 3. With T4HP, usage will increase to 83 percent and with T5HP 87 percent of the inflow would be used for power generation. By installing a powerhouse on Tunnel 5, additional power can be generated at Tarbela without any change in reservoir operating rules. The design of the T5HP is based on an optimization of flows across the various tunnels in such a way as to maximize power generation at no cost to other objectives such as irrigation. From the standpoint of the aggregate water balances (that define the irrigation releases), the only impact of Tunnel 5 is to reduce the amount of water not used for power generation by reducing the spill. As shown in Figure 4.1, Tunnel 5 falls in the middle of the other tunnels in terms of generated flow and as expected Tunnel 5 cannot take all the available flow that is available in the mid-late Kharif period (July – September), which is a result of the higher irrigation demand and the monsoon season.

**Figure 4.1: Daily flow distribution in the Tunnels for a Typical Average Year**



Source: Mott MacDonald, FVR

4.10 **Third, the Project has no impact on downstream irrigation requirements during construction.** Tunnel 5 would be required to meet the downstream irrigation requirement while work is going on Tunnel 4. Therefore, to ensure there are no disruptions to irrigation demands, such work on Tunnel 5 that could interrupt its operation will start after Tunnel 4 becomes available for water releases expected by 2017. In the absence of Tunnel 5, combined capacity of Tunnels 1, 2, 3 and 4 is sufficient to release the entire downstream irrigation requirements.

4.11 **Fourth, the project’s generation profile matches exactly the seasonal load peak during summer.** T5HP uses water that would otherwise be spilled, which means that the bulk of generation occurs in June to September and this is precisely the time when the seasonal load is at its peak. The load fluctuations across the hours of the day are much smaller than the seasonal variations; the difference between the summer peak and the winter peak is 5,600 MW, whereas the difference between the hours of highest and lowest demand is less than 4,000 MW. Consequently a project that generates mainly during these summer months is ideally matched to system requirements.

#### B. Least cost comparison – T5HP versus various hydro and non-hydro alternatives

4.12 **Comparison with various Hydro Projects –** T5HP is one of the least cost options to supply electricity in the shortest possible timeframe. Except for T4HP, T5HP cost is comparable/less than other ongoing and planned hydro schemes in the country (Table 4.1) with similar amount of generation but would have longer gestation period of 5 – 6 years compared to less than 4 years for T5HP.

4.13 The capital costs are based on latest available estimates and therefore do not represent the actual cost of these projects which would have changed over time. For comparative purpose unit rates (US cents/kWh) are calculated based on certain assumptions (i.e. 10 percent discount and 30 years life) applied uniformly to all projects. The levelized capital costs (US cents/kWh) given in the Table 4.1 do not include O&M cost. For hydro projects O&M costs would be less than 5 percent of the tariff - for Tarbela it would be lesser than other full scale projects because it would be shared with other tunnels and power units. Compared to other hydro projects, it is evident that T5HP is the least cost option for expansion of electricity generation in Pakistan in the shortest possible timeframe. The cost of installed capacity of T5HP (approx. US\$570/kW) is about the same as T4HP which is much lower than other projects that range from US\$1,500 - US\$3,000 per MW. The cost is low because most of the infrastructure is available and associated environmental and social costs are very less compared to other green-field hydropower schemes. Levelized capital cost per kWh, because of 40 percent lower generation than T4HP, is estimated to be higher but is still less or close to other planned projects. The main advantage of T5HP, however, is its low gestation period which will give the maximum NPV because benefits will start accruing from the fourth year of operation whereas for other planned projects it could take more than 5 years to complete.

**Table 4.1: Estimated levelized capital cost of various Hydropower Projects**

Name	Owner	Capacity MW	Generation GWh	Unit Costs		River System
				USD/kW	US¢/kWh	
Tarbela 5th Extension	WAPDA	1,410	1,800	570	4.74	Indus
Tarbela 4th Extensions	WAPDA	1,410	3,000	560	2.79	Indus
Neelum Jhelum	WAPDA	969	5,150	2,838	5.66	Jhelum
Lower Palas valley	WAPDA	665	2,590	1,662	4.53	Indus
Lower Spat Gah	WAPDA	496	2,007	2,060	5.40	Indus
Kohala Hydropower Project	IPP	1,100	4,800	2,179	5.30	Jhelum
Sukhi Kinari	IPP	861	3,048	1,813	5.43	Kunhar
Karot	IPP	720	3,250	1,972	4.63	Jhelum

4.14 At about US¢5/kWh the levelized financial cost of T5HP is about the same as cost of generation based on domestic gas price for power sector at US\$5.6/mmbtu. However, when comparing with imported fuels, that are most likely substitutes, T5HP average generation cost is about 30 percent less than HSFO at US\$ 280/tonne (as of December 1, 2015) and one-third of HSD at PKR 52/liter (US\$0.50/liter, as of December 1, 2015) excluding taxes and at 85 percent plant factor conservatively assumed for thermal plants. At lower plant factors differential would increase. Comparison with CCGT-LNG by varying the plant factor and input fuel cost is given in Table 4.2. The results show that at 80 percent parity to crude oil price T5HP remains the cheapest option for prices above US\$35/bbl. Moreover, these cost comparisons do not include the environmental externalities of thermal generation (both local environmental and GHG emissions). For hydro projects involving new dams, these may be offset by the negative social and environmental externalities associated with large reservoirs, but these do not apply to T5HP (since the Project involves mainly the addition of a powerhouse).

**Table 4.2: CCGT cost (US¢/kWh) at varying plant factor and fuel input cost**

Crude Price \$/bbl	LNG-Delivered Price @80% parity \$/mmbtu	Plant Factors, %				
		20	40	60	80	100
30	4.08	11.4	7.1	5.7	5.0	4.5
35	4.76	11.9	7.6	6.1	5.4	5.0
40	5.44	12.3	8.0	6.6	5.9	5.4
45	6.12	12.7	8.4	7.0	6.3	5.9
50	6.80	13.2	8.9	7.4	6.7	6.3

4.15 The cost advantages of T5HP with respect to all of the other candidate hydro options, and to all of the thermal options, are so substantial that there can be little doubt that:

- The entry of T5HP into the expansion plan at its earliest possible in-service date is clearly least cost;
- The need for T5HP is robust with respect to the demand forecast: clearly it is the most expensive thermal plants that are delayed under low demand growth. Moreover, even if load growth were zero, the reserve margin is so low that additional capacity is required just to alleviate the present level of shortages, and T5HP is the least cost option for doing so (particularly in light of the match of its output to summer load shortages); and
- For the purpose of the economic analysis, use of CCGT as the next best thermal alternative is reasonable (and likely to be conservative).

### C. Project costs and benefits

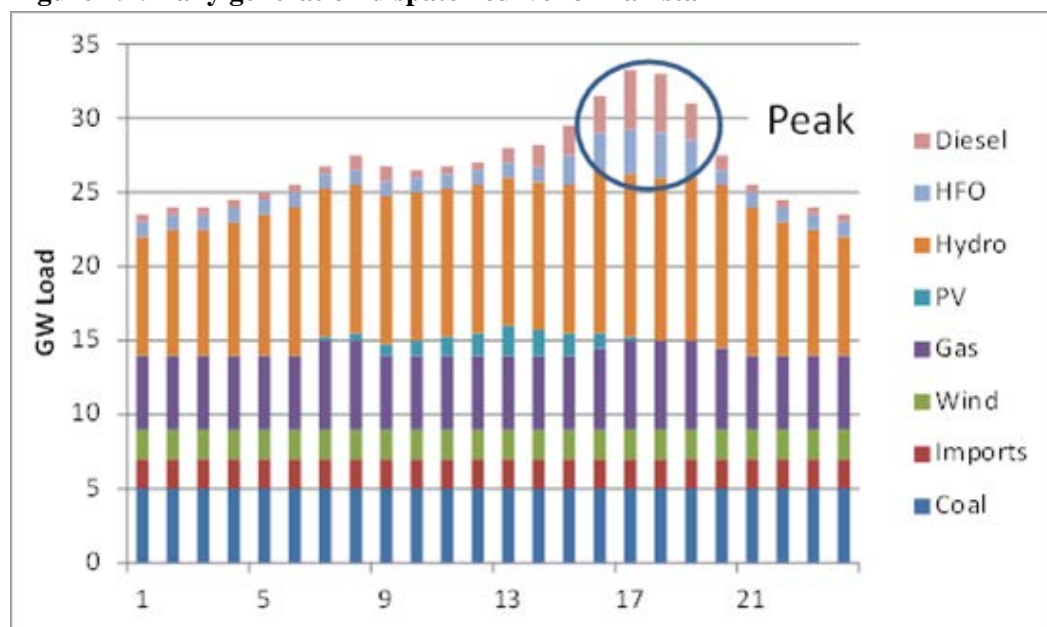
4.16 **Costs.** The total Project (financial) cost is US\$ 826.1 million. The economic cost is estimated by subtracting price contingencies, interest during construction (IDC), taxes and duties and applying standard correction factor (SCF) of 0.9 to the domestic component of the cost. The economic cost is US\$550 million. The capital cost would be spread over the years 2017 to 2022 (at 20, 30, 30, 10, 5 and 5 percent respectively). The annual operation and maintenance (O&M) costs are estimated at 1 percent of capital expenditure (equivalent to US¢ 0.31/kWh).

4.17 None of the negative externalities normally associated with large hydro projects – which constitute costs in the economic analysis – arise in the case of the T5HP Project. The addition of power generation to an existing tunnel, does not change the size of the reservoir, the operating rules, or the downstream flow regime and irrigation demands. GHG emissions from the reservoir do not change. The mitigation of any

socio-economic and environmental impacts during the construction phase is included as a direct project cost. These impacts are temporary and reversible by the measures proposed in the EMP and SAP.

**4.18 Project Alternatives.** Several options were considered for intake, connection to the tunnel, powerhouse location/type, and tailrace. According to FVR, the selected option – penstock with existing LLO and tailrace culvert - gives highest NPV and ERR and poses minimal risks and thus can be completed in shortest time. The economic analysis presented here is based on this preferred option. If the Project is operated to maximize total energy, the expected value of average annual generation at T5HP would be 1,885 GWh. However, if the Project is operated to maximize peak hour production, energy is slightly lower at 1,826 GWh/year but economic returns would be higher because about 50 percent (or 9,940 GWh) would be generated during the four peak hours mostly displacing diesel or fuel oil based generation (Figure 4.2). Maximization of peak hour generation entails higher discharge rates during these hours, and hence higher head losses and lower generation than if the daily discharge is equalized across all hours of the day. For conservative estimates, 1,800 GWh of electricity supply (net of transmission and auxiliary losses) is assumed for base case as well as prioritizing peak generation scenario.

**Figure 4.2: Daily generation dispatch curve for Pakistan**



Source: Mott MacDonald, FVR

**4.19 Non-incremental benefits.** Pakistan’s need for power makes it certain that in the absence of T5HP some other alternative would be built. Non-incremental benefits are computed based on avoided cost of thermal generation from CCGT-LNG which is expected to be cheapest of all thermal sources and can be built within the same time frame. In practice, T5HP will be operated as a peaking plant and therefore for a peaking scenario about 50 percent of its generation is assumed to displace diesel generation.

**4.20 Incremental benefits.** The relevant measure of benefits is the willingness to pay (WTP) for non-grid electricity alternatives. WTP is the area under the demand curve to the point of the quantity consumed, a curve that is difficult to establish reliably. In the absence of grid electricity what is most easily observed for most consuming sectors (industry, commercial, agriculture and residential) is simply the cost of self-generation on diesel. The cost of diesel generation used as a proxy for WTP is applied to the electricity sold at consumer level by adjusting net electrical output for transmission and distribution losses assumed to be

20 percent based on FY15 actual performance. A significant portion of this loss is due to pilferage and therefore the adjustment for the total T&D loss rate is also conservative, because it implies a zero economic benefit to that portion of the T&D loss which is attributable to pilferage. Furthermore T&D cost of US¢1.40/kWh is added to estimate total cost of supply from T5HP and its comparison with cost of self-generation.

4.21 **Key Assumptions.** Key inputs to determine cost of generation from alternative thermal sources considered for economic analysis are given in Table 4.3. A lower plant factor is assumed for GE to cover the period of outages in case of self-generation or for peak time generation. A discount rate of 12 percent is applied for NPV calculation and as a hurdle rate. This discount rate is on the higher side but is consistent with past practices (including T4HP) and would give a conservative estimate for NPV.

**Table 4.3: Key assumptions for thermal generation options**

Technology	Fuel	Investment <i>US\$/kW</i>	Life <i>Years</i>	Plant Factor, %	Efficiency, %	Fixed O&M <i>\$/kW/year</i>	Variable O&M <i>US¢/kWh</i>
CCGT	RLNG	900	25	85	53	30	0.20
GE	HSD	650	15	20	34	18	0.20

4.22 Fuel input prices is an important factor in determining the Project benefits based on avoided cost of thermal generation. Prices of liquid fuels are directly correlated with international crude oil prices. Long-term LNG supply contracts for Pakistan are also expected to have some linkage with crude oil prices/liquid fuels. Therefore, for economic analysis, based on historic trend price of fuel oil (FO) and high speed diesel (HSD) delivered at plant and/or to the consumer for self-generation (excluding taxes and duties) is assumed to be 90 percent and 120 percent of crude oil price in energy terms respectively. Current price of gas for power at PKR 600 per mmbtu (equivalent to US\$ 5.6/mmbtu) is below its economic value or opportunity cost. Therefore, relevant economic gas price could be the price of imported LNG (for short- to medium-term) and price offered for new on- and off-shore discoveries (for medium- to long-term). In the absence of actual reference data the LNG is also assumed to be linked to crude oil prices and, at 80 percent parity, would be cheaper than Fuel Oil. Assuming average of US\$ 58/bbl in 2015, the economic price of gas at 80 percent parity would be about US\$ 8/mmbtu. According to World Bank Commodity Price Forecast of July 2015 (adjusted to 2015 cost) average crude oil price (of Brent, WTI and Dubai Crude in real terms) is expected to increase from US\$58/bbl in 2015 to US\$ 75/bbl by 2025 at annual average increase of about 2.5 percent. For conservative estimate, base case scenario, assumes that after 2025 real crude oil prices will increase at a slightly lower rate of 2 percent per annum reaching US\$ 100/bbl by 2040. A lower crude oil prices scenario assumes 1 percent increase and a higher scenario assumes 3-4 percent increase per annum.

4.23 Based on the given assumptions including diesel price at 120 percent of crude oil, cost of diesel generation during peak hours starts at about US¢ 19 (2015) and increases at the rate of about 1.5 percent to reach US¢ 32/kWh (2049) towards the end of the project life . At current price of diesel i.e. PKR 84/liter (inclusive of taxes) or US\$22/mmbtu the cost of self-generation is estimated to be around US¢30/kWh and is a relevant measure for WTP. Therefore incremental benefits are measured assuming WTP equal to US¢30/kWh.

4.24 **Avoided global externalities:** Avoided global externalities constitute a significant benefit of the T5HP, given that it replaces the GHG emissions of thermal power generation (in the case of the Project alternatives), and the emissions associated with diesel self-generation (industrial, agriculture and commercial sectors) in the no Project alternative. In the case of the thermal project alternatives, GHG emissions are based on the emissions associated with gas-fired CCGT. This is the most conservative assumption because as a peaking plant T5HP is most likely to displace fuel oil and diesel based generation



accounting for higher GHG emissions than natural gas – by virtue both of the carbon content of the liquid fuels as well as the higher efficiencies achievable by CCGT.

4.25 The analysis mainly considers emissions from thermal generation. GHG emissions from T5HP are only 0.2 because the project does not increase the reservoir level or its flows. Emissions from construction activities are expected to be higher than a green-field thermal option but would be insignificant when converted over life-cycle and therefore have been ignored. On the other hand, upstream emissions because of leakages in the fuel supply chain (in the form of CH<sub>4</sub> rather than CO<sub>2</sub> as produced in combustion) are expected to be higher for LNG, and can be significant. The magnitude of downstream emissions is expected to be relatively small, and is about the same as baseline. There is a net increase of 0.2 million tons of CO<sub>2</sub> for downstream transmission part.

4.26 Default emission factors (TCO<sub>2</sub> per TeraJoule) for various fuels are taken from Intergovernmental Panel on Climate Change (IPCC) guidelines 2006. These emission factors were converted into per kWh on the basis of plant efficiencies. Social Cost of Carbon is according to the World Bank guidelines (2014), with base case starting at US\$30 per metric tonne in 2015 and increasing to US\$80 per metric tonne in real terms by 2050. The low, base and high scenarios are presented in Table 4.4. Net emissions calculation is given in Table 4.5. T5HP would result in net reduction of 20.2 million tons of CO<sub>2</sub> over 30 years.

4.27 Reduction in GHG emissions in the case of non-project counter-factual (GE with diesel) are estimated to be about 33.9 million tons of CO<sub>2</sub>. The reduction is much higher than in the gas CCGT alternative because: (i) self-generation is based on liquid fuels which have higher carbon emissions per unit of heat value; and (ii) the efficiency of self-generation is lower than in a highly efficient CCGT. The emission factor for small diesel self-generation units is 785gm/kWh as opposed to 381gm/kWh for gas CCGT using default emission factors for combustion (diesel: 74.1 t CO<sub>2</sub> per terajoule and gas: 56.1 tCO<sub>2</sub> per terajoule) and efficiency of 34 percent for diesel Gas Engine and 53 percent for gas CCGT.

4.28 In addition to reduction in GHG emission project is also expected to improve local air quality by avoiding NOX emissions associated with gas fired generation. In the case of the counter-factual NOX and particulate emissions from diesel self-generation and kerosene combustion for lighting are expected to be much higher and likely to occur in densely populated areas with low stacks, and are rarely fitted with pollution controls. Moreover, particulate emissions, are particularly damaging to human health: the impact of kerosene use for lighting in confined indoor spaces is comparable to that of smoking. Moreover, in addition to the problems associated with kerosene combustion to produce light, the simple wick lamps used by poor households are a major source of accidents and fires.

**Table 4.4: Social value of carbon, US\$ per metric tonne of CO<sub>2</sub>**

	2015	2020	2030	2040	2050
Low	15	20	30	40	50
Base	30	35	50	65	80
High	50	60	90	120	150

**Table 4.5: Generation Emissions, million tons of CO<sub>2</sub>**

	Baseline	Project	Net
Upstream	0	0	0
Generation Combustion	20.6	0.2	-20.4
Downstream	0.7	0.9	0.2
Total Emissions	21.3	1.1	-20.2

## D. Economic rate of return

4.29 The combined ERR for T4HP and T5HP is estimated to be about 28 percent, excluding substantial environmental benefits of these two hydropower schemes. Accounting for environmental benefits will raise the ERR by 4-6 percent. The ERR for T5HP (excluding environmental benefits) ranges from about 31-21 percent depending upon whether peaking energy is optimized or not. The strong returns reflect the fact that T5HP like T4HP is an extension scheme (focusing mainly on adding extra turbine capacity) to an already substantial hydro scheme, rather than a green-field scheme with front-end civil works and associated impacts. Despite a sharp decline in crude oil prices the revised economic return for T4HP fell by 3 percentage points only. The economic return remained stable because of lower actual cost and earlier completion. And also because in the absence of actual LNG import prices for Pakistan T4HP appraisal conservatively assumed delivered price of gas at 68 percent parity to crude oil price in energy terms. The recent LNG imports and possible long-term LNG supply contracts are expected to yield higher price of gas. The revised economic analysis for T4HP assumes 80 percent parity to crude oil price for gas delivered at thermal power station. Based on these assumption and revised costs ERR for T4 is estimated to be about 30 percent (compared to 33 percent at appraisal).

4.30 The baseline economic rate of return (ERR) for T5HP assessed against the next best alternative (CCGT) is 21 percent (NPV US\$413 million). The payback period is reasonable – the hurdle rate of 12 percent is reached in the seventh year of operation in 2027. When the benefit of avoided GHG emissions are included in the economic flows, the ERR increases to 24 percent (NPV \$580 million). The ERR (NPV) for the peaking scenario is 31 percent (1,038) without environmental benefits and 35 percent (1,293) with environmental benefits. Despite the reduction in cost of generation from thermal alternatives due to lower fuel prices the Project still gives significantly high economic returns.

4.31 Against the no project alternative, where the net energy (adjusted for T & D losses) is valued at a WTP of US¢30/kwh, the ERR is significantly higher at 42 percent (NPV US\$1,668 million). Because self-generation (and lighting from kerosene) incurs significant health damage from NOx and PM-10, avoided local environmental costs account for a larger share of the total benefits, and the value of avoided GHG emissions is also higher than CCGT because the avoided emissions are based on oil. The ERR including environmental premium is estimated at 45 percent (NPV US\$1,943 million). The results for these scenarios are presented in Table 4.7.

## Project's Viability

4.32 This section analyzes the risk factors that could adversely affect project's ERR to show whether project remains viable with respect to changes in the underlying assumptions and other factors. These are:

4.33 **Construction cost overruns** are the bane of hydro projects. An analysis of cost overruns in World Bank projects<sup>7</sup> as well as a similar analysis in the Report of the World Commission on Dams<sup>8</sup> documents significant issues. In the World Bank study of 71 hydro projects, the average cost overrun was 27 percent, and the average schedule slip 28 percent. The cost ratios showed an extremely high standard deviation of 38 percent. However, the Bank's experience in Pakistan appears to be better than average. The 2004 Implementation Completion Report for the Ghazi Barotha project<sup>9</sup> showed that actual project costs (US\$2,068million at 2003 prices) were slightly *below* those estimated at appraisal (US\$2,250million). In

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<sup>7</sup> Bacon, R.W., J.E. Besant-Jones, and J. Heidarian *Estimating Construction Costs and Schedules: Experience with Power Generation Projects in Developing Countries*. World Bank Technical Paper No. 325, Energy Series, 1996., and Besant-Jones, J. E. "Assigning Probabilities to Scenarios for Risk Analysis - The Case of Hydropower Project Construction Costs, World Bank, May 2003.

<sup>8</sup> World Commission on Dams, 2000. *Final Report on Dams and Development A New Framework for Decision-making to the Framework Convention on Climate Change*.

<sup>9</sup> World Bank, *Implementation Completion Report, Ghazi Barotha Hydro-project*, Report 28781, June 2004.

case of T4HP the bids came out to be less than the appraisal estimates and project commissioning has been advanced by about 9 months. The switching value (i.e. the value at which the ERR falls to the hurdle rate of 12 percent and NPV is zero) is more than 100 percent (or US\$782/kW). In light of the fact that there is no dam construction, and only relatively little tunneling work, cost overruns of this magnitude must be considered extremely unlikely.

**4.34 Construction/Operational delays.** Related to construction cost overruns are the risks of construction delays. Depending on the nature of the delay, these may be highly correlated. And if these delays occur after a significant portion of the investment cost has been spent, economic returns will also fall. On the other hand, where these delays occur at the beginning of the project, before significant expenditure is incurred, the effect on ERR is minimal. Assuming that the bulk of the construction expenditure has been incurred, but operation is prevented (e.g., due to transmission constraints) making capital investment stand idle, with no economic benefits realized, the switching value under such a worst case scenario is 7 and 9 years for with and without environmental benefits respectively. This much delay in commercial operation date (after all investment has been incurred) seems extremely unlikely because this gives ample time to resolve any associated technical, commercial or operational issues. Any foreseeable delay in start of generation after project has been completed, therefore, would not make the project unviable.

**4.35 Cost of Alternate Generation.** The valuation is dependent on the price of LNG and oil. The extent to which LNG prices will remain linked to world oil prices is uncertain, as is the *level* of oil and LNG prices. The level of LNG price is important, since it governs the benefit of avoided thermal generation: the higher the price, the greater is the benefit. The switching value for the avoided cost of CCGT generation is US¢ 4.80/kWh, which is below the current cost and corresponds to a world oil price of around US\$29/bbl. A return to oil prices below US\$30/bbl as a long-term average is not very plausible. Therefore, it is reasonable to conclude that economic returns of the project are secured with respect to change in oil prices.

**4.36 Willingness to pay.** The economic returns against the no project alternative are dependent upon the avoided costs of self- generation (assumed to be single cycle gas engines running on HSD). The switching value is US¢7.4/kWh, about *one fourth* of the baseline estimate which is significantly below the price paid by industrial, commercial and many other consumers.

**4.37 Cost of Carbon.** Main benefits of the project are derived from avoided emissions from burning fossil fuels. Assuming a low path for social cost of carbon, ERR with environmental benefits reduces from 24 percent to 23 percent. As ERR of the project without environmental benefits is about 21 percent reducing the social cost of carbon to zero would not make the project unviable.

**4.38 River Inflows and Reduction in Generation.** The analysis done for T4HP appraisal using inflow series from 1962 to 2009 (48 years) show stable inflows – coefficient of variation is only 0.119, the mean inflows are 2,480 cubic meters per second (cms) and standard deviation is only 296 cms. This is because Indus River is predominantly fed by glacial melt and consequently has high serial correlation between year to year, month to month and between the two periods. Noticeable dry years were 1974, 1982, 2001 and 2004 and significant wet years were 1973, 1988, 1990 and 1994. According to the 5-year moving average, it seems that no trend affects the yearly inflows at Tarbela. Tunnel 5 would be operated in summer when flows in the river are very high and water is spilled through the spillway (even after generation at Tunnel 5). Thus low variation in flows combined with higher discharge in summer results in very minimal hydrologic risk of an extraordinary reduction in electricity generation from Tunnel 5.

**4.39** The gauging station data from upstream of Tarbela Dam is considered to be reliable and has been used for the base case. The switching value for annual average generation is 928 GWh, or about 50 percent of the baseline estimate of 1,800 GWh. In other words, the Project is robust with respect to as much as a 50 percent decline in total annual generation. That is very much greater than the lower bound based on inflow/outflow data of Tarbela Dam Project that gives lower inflow and energy output of 1,460 GWh. If 1,460GWh is assumed to be the annual average generation over the entire lifetime, the ERR falls from 21

percent to just 18 percent. One may reasonably conclude that the economic returns of T5HP are robust to prolonged droughts.

4.40 **Unforeseen Risks.** The question for the economic analysis is the extent to which the economic returns are likely to be affected by force majeure events (or indeed by other catastrophic accidents of whatever the cause). However it may be noted that the risk to a hydro project in this regard is not demonstrably greater than to the thermal project that it would replace. These main risk factors as described in Annex 6 could be related to technical, managerial, and/or governance issues. These risks generally imply delay in operation and/or additional cost. One such risk factor though extremely unlikely is the flooding of the power house. The additional cost of refurbishing the power house following such an unforeseen event is estimated to be about US\$ 57 million (roughly equivalent to 20 percent of the E&M equipment) and loss of one generation season reducing the ERR from 21 percent to 18 percent and NPV by US\$ 112 million if it occurs during the first year of operation.

4.41 **Risk assessment.** The switching value analysis by changing one variable at a time shows that the project is robust to the major risk factors, and to the main input assumptions. This however provides no insight about the outcome of the project when more than one input assumption combines unfavorably. For the risk assessment, plausible worst case scenario is constructed that combine unfavorable outcomes across the range of variables identified above – 20 percent cost overrun associated with one year delay in operation, reduced generation, 25 percent increase in O&M cost, lower crude oil price scenario and cost of carbon. Results of risk assessment (Table 4.6) show the economic returns against CCGT would remain above the hurdle rate by combining plausible unfavorable outcomes.

**Table 4.6: Scenario definition**

	Plausible worst case	Baseline	Plausible best Case
Generation	1,460 GWh (19 percent reduction)	1,800 GWh	No change
Major maintenance	25% increase in O&M	As per FVR	No change
Construction cost overrun	20% increase	None	No change
Construction schedule	1 year delay	39 months	No change
World oil price by 2050	US\$81/bbl	US\$123/bbl	US\$178/bbl
Cost of Carbon (see Table 4.4)	Low Case	Base Case	High Case
<i>ERR without Environmental Externalities</i>			
Vs. CCGT	12.2	21.0	22.6
Vs. Peaking Scenario	19.2	31.4	32.9
Vs. Willingness to Pay	27.0	41.9	41.9
<i>ERR with Environmental Externalities</i>			
Vs. CCGT	13.6	23.8	27.2
Vs. Peaking Scenario	20.7	34.7	38.3
Vs. Willingness to Pay	28.2	44.8	46.9

**Table 4.7: Economic Returns**

Year Ending June	Capital Cost	O&M cost	Generation (GWh)	Against CCGT-LNG						Against 50% CCGT-LNG & 50% GE-HSD (Peaking Scenario)								Willingness to Pay/Avoided Cost of Self-Generation									
				Value of Energy	Net Benefits	ERR	Avoided Emissions (MTCO2)	Env Benefits	Total Net Benefits	ERR	Value of Energy	Net Benefits	ERR	Avoided Emissions (MTCO2)	Env Benefits	Total Benefits	ERR	Units Sold (GWh)	T&D Margin	Cost of Supply	Avoided cost	Net Benefit	IRR	Avoided Emissions (MTCO2)	Env Benefits	Total Net Benefits	ERR
2017	110	0	0	0	-110		0.0	0	-110		0	-110		0.0	0	-110		0	0	110	0	-110		0.0	0	-110	
2018	165	0	0	0	-165		0.0	0	-165		0	-165		0.0	0	-165		0	0	165	0	-165		0.0	0	-165	
2019	165	0	0	0	-165		0.0	0	-165		0	-165		0.0	0	-165		0	0	165	0	-165		0.0	0	-165	
2020	55	0	0	0	-55		0.0	0	-55		0	-55		0.0	0	-55		0	0	55	0	-55		0.0	0	-55	
2021	28	6	1,800	147	114		0.7	25	139	-41%	256	223	-27%	1.0	38	262	-22%	1,440	20	53	432	379	-10%	1.1	41	420	-6%
2022	28	6	1,800	150	117	-22%	0.7	26	143	-17%	261	227	-3%	1.0	40	267	2%	1,440	20	53	432	379	14%	1.1	43	422	18%
2023		6	1,800	152	147	-7%	0.7	27	174	-2%	265	259	10%	1.0	41	301	15%	1,440	20	26	432	406	26%	1.1	45	451	29%
2024		6	1,800	155	150	1%	0.7	28	178	6%	269	264	17%	1.0	43	307	22%	1,440	20	26	432	406	32%	1.1	46	453	35%
2025		6	1,800	158	153	7%	0.7	29	182	11%	274	269	22%	1.0	45	313	26%	1,440	20	26	432	406	36%	1.1	48	454	39%
2026		6	1,800	160	155	10%	0.7	30	185	14%	278	273	25%	1.0	46	319	29%	1,440	20	26	432	406	38%	1.1	50	456	41%
2027		6	1,800	163	157	13%	0.7	31	189	17%	283	277	27%	1.0	48	325	31%	1,440	20	26	432	406	39%	1.1	51	458	42%
2028		6	1,800	165	160	15%	0.7	32	192	18%	287	281	28%	1.0	49	331	32%	1,440	20	26	432	406	40%	1.1	53	459	43%
2029		6	1,800	168	162	16%	0.7	33	196	20%	291	286	29%	1.0	51	336	33%	1,440	20	26	432	406	41%	1.1	55	461	44%
2030		6	1,800	170	165	17%	0.7	34	199	21%	295	290	29%	1.0	52	342	33%	1,440	20	26	432	406	41%	1.1	56	463	44%
2031		6	1,800	173	167	18%	0.7	35	203	21%	299	294	30%	1.0	54	348	34%	1,440	20	26	432	406	41%	1.1	58	465	44%
2032		6	1,800	176	170	19%	0.7	36	206	22%	304	298	30%	1.0	56	354	34%	1,440	20	26	432	406	41%	1.1	60	466	44%
2033		6	1,800	178	173	19%	0.7	37	210	22%	308	303	31%	1.0	57	360	34%	1,440	20	26	432	406	42%	1.1	62	468	45%
2034		6	1,800	181	176	19%	0.7	38	214	23%	313	307	31%	1.0	59	366	34%	1,440	20	26	432	406	42%	1.1	63	470	45%
2035		6	1,800	184	178	20%	0.7	39	218	23%	317	312	31%	1.0	60	372	34%	1,440	20	26	432	406	42%	1.1	65	471	45%
2036		6	1,800	187	181	20%	0.7	40	222	23%	322	316	31%	1.0	62	378	34%	1,440	20	26	432	406	42%	1.1	67	473	45%
2037		6	1,800	190	184	20%	0.7	41	226	23%	327	321	31%	1.0	63	385	35%	1,440	20	26	432	406	42%	1.1	68	475	45%
2038		6	1,800	193	187	20%	0.7	43	230	23%	331	326	31%	1.0	65	391	35%	1,440	20	26	432	406	42%	1.1	70	476	45%
2039		6	1,800	196	190	20%	0.7	44	234	23%	336	331	31%	1.0	67	398	35%	1,440	20	26	432	406	42%	1.1	72	478	45%
2040		6	1,800	199	193	21%	0.7	45	238	24%	342	336	31%	1.0	68	404	35%	1,440	20	26	432	406	42%	1.1	73	480	45%
2041		6	1,800	202	197	21%	0.7	46	242	24%	347	341	31%	1.0	70	411	35%	1,440	20	26	432	406	42%	1.1	75	481	45%
2042		6	1,800	205	200	21%	0.7	47	246	24%	352	346	31%	1.0	71	418	35%	1,440	20	26	432	406	42%	1.1	77	483	45%
2043		6	1,800	209	203	21%	0.7	48	251	24%	357	352	31%	1.0	73	425	35%	1,440	20	26	432	406	42%	1.1	79	485	45%
2044		6	1,800	212	206	21%	0.7	49	255	24%	363	357	31%	1.0	74	432	35%	1,440	20	26	432	406	42%	1.1	80	487	45%
2045		6	1,800	215	210	21%	0.7	50	260	24%	368	363	31%	1.0	76	439	35%	1,440	20	26	432	406	42%	1.1	82	488	45%
2046		6	1,800	219	213	21%	0.7	51	264	24%	374	369	31%	1.0	78	446	35%	1,440	20	26	432	406	42%	1.1	84	490	45%
2047		6	1,800	222	217	21%	0.7	52	269	24%	380	374	31%	1.0	79	454	35%	1,440	20	26	432	406	42%	1.1	85	492	45%
2048		6	1,800	226	221	21%	0.7	53	273	24%	386	380	31%	1.0	81	461	35%	1,440	20	26	432	406	42%	1.1	87	493	45%
2049		6	1,800	230	224	21%	0.7	54	278	24%	392	386	31%	1.0	82	469	35%	1,440	20	26	432	406	42%	1.1	89	495	45%
2050		6	1,800	234	228	21%	0.7	55	283	24%	398	392	31%	1.0	84	476	35%	1,440	20	26	432	406	42%	1.1	90	497	45%
<b>Total</b>	550	165	54,000	5,619	4,904		20.6	1,199	6,102		9,675	8,960		31.5	1,833	10,793		43,200	605	1,320	12,960	11,640		33.9	1,974	13,614	
<b>NPV</b>	412	28	9,215	853	413		3.5	167	580		1,478	1,038		5.4	255	1,293		7,372	103	543	2,212	1,668		5.8	274	1,943	
<b>ERR</b>					<b>21.0%</b>				<b>23.8%</b>			<b>31.4%</b>				<b>34.7%</b>						<b>41.9%</b>				<b>44.8%</b>	

## E. Sectoral Impact and Distribution of Benefits.

4.42 The induction of T5HP into the power system would reduce the average generation cost. For consistency and fair comparison base case costs and generation mix is kept the same as for T4HP appraisal which was based on FY11 NEPRA tariff determinations. T4HP average generation cost, however, remained the same because of lower bid value. Based on revised assumptions, T4 will reduce the generation cost by 1.8 percent (instead of 2.3 percent estimated at appraisal). T5HP will reduce the cost by another 0.5 percent for a combined reduction of 2.3 percent in average generation cost. When evaluated based on FY15 cost structure the reduction in generation cost with the induction of T4 and T5 is estimated to be 2.9 percent. The estimated reduction in cost of generation after the induction of T4HP and T5HP into the system based on FY11 and FY15 cost structures given in NEPRA annual tariff determinations is estimated in Table 4.8.

**Table 4.8: Estimating Impact of T4HP and T5HP on generation cost**

	FY11 Cost Structure			FY15 Cost Structure		
	Generation	T. Cost	Rate	Generation	T. Cost	Rate
	<i>GWh</i>	<i>PKR mln</i>	<i>PKR/kWh</i>	<i>GWh</i>	<i>PKR mln</i>	<i>PKR/kWh</i>
Base Cost	91,540	642,293	7.02	95,892	929,645	9.69
+T4HP	3,000	9,000	3.00	3,000	9,000	3.00
+T5HP	1,800	9,000	5.00	1,800	9,000	5.00
<b>Total</b>	<b>96,340</b>	<b>660,293</b>	<b>6.85</b>	<b>100,692</b>	<b>947,645</b>	<b>9.41</b>
Estimated Change	5.2%	2.8%	<b>-2.3%</b>	5.0%	1.9%	<b>-2.9%</b>

4.43 This reduction in cost would be incorporated in the base tariffs as opposed to monthly Fuel Price Adjustments because 95 percent of WAPDA costs are covered through fixed capacity charges. Provided that other things remain constant 3,800 GWh incremental generation from Tarbela would, therefore, reduce the current average determined rates by about PKR 0.20/kWh after adjusting for 20 percent T&D losses. This implies PKR15 billion reduction in tariff differential subsidies, again assuming annual sales of 76 TWh provided other things remain constant. In case tariff differential subsidies are eliminated (as GoP is considering various options to reduce subsidy burden on the budget) it would result in lesser consumer tariff compared to a scenario without these two hydropower projects.

4.44 In the absence of these projects, it is reasonable to assume that 4,800 GWh would be provided through thermal generation fueled by imported FO and/or natural gas. Therefore, T4HP (3,000GWh) and T5HP (1,800GWh) could potentially result in foreign exchange savings for the GoP of US\$200 to US\$250 million per year for natural gas and fuel oil respectively at crude oil price of around US\$50/bbl.

4.45 In addition to the above benefits, induction of low cost hydropower generation would reduce the sector deficit to some extent because units lost as a result of non-collection or higher losses are going to cost less.

## F. An Update on WAPDA Hydel Financial Analysis

4.46 Detailed financial assessment of WAPDA Hydel was carried out for the appraisal of T4HP (in 2012) and DHP (in 2014). The financial assessment for T4HP and DHP included investment in Tarbela Fifth Extension along with other planned projects and concluded that NEPRA tariff methodology provides adequate return to WAPDA Hydel to fulfill its financial obligations including generation of internal cash for its equity contribution in the development of hydropower assets. Therefore, timely determination/notification of tariffs and payments by the power purchaser were found to be the two major factors to ensure WAPDA Hydel's financial viability.

4.47 FY2013-14 tariff petition was filed by WAPDA on April 1, 2013 (prior to start of the fiscal year). NEPRA issued its determination on December 18, 2014 and tariffs were notified by GOP on February 27, 2014. Though NEPRA tariff determination process covers any financial loss/gain due to these delays in its subsequent determinations, an 11 month cycle from petition to notification could cause significant cash-flow issues for WAPDA particularly when its costs directly proportional to investments are rising.

4.48 FY2015-16 petition was admitted on May 26, 2015<sup>10</sup> and determination was issued by NEPRA on November 13, 2015. WAPDA, however, has filed for review motion and therefore WAPDA Hydel tariff has not been notified. The difference between the effective average tariff (PKR 1.74/kWh) currently applicable and tariff sought by WAPDA for FY2015-16 (PKR 3.85/kWh) in its review motion is PKR 2.11/kWh. WAPDA has assessed that this difference if not notified will result in shortfall of about PKR 67 billion in FY2016 with following break-up – Net Hydel Profit/Water Usage Charges (PKR 28 billion), return on investment (PKR 20 billion), O&M expenses (PKR 4 billion), depreciation & Ijara rental (PKR 4 billion) and prior years adjustment (PKR 11 billion).

4.49 Despite these shortcomings WAPDA Hydel has remained a profitable entity and is in a good financial position with a total equity of PKR 221 billion financing more than 50 percent of its total net assets of PKR 408 billion. Key financial indicators for past five years derived from the audited financial statements of WAPDA Hydel are given in Table 4.9. The indicators show steady growth in its asset base and only 40 percent of its PKR 310 billion revalued net fixed assets including work-in-progress are financed through long-term debt. The trade debts came down significantly in 2013 after government cleared the entire outstanding liabilities and increased by PKR 11 and 17 billion in FY14 and FY15 respectively. The net profit increased at a rate of 36 percent from PKR 10 billion in 2011 to PKR 22 billion in FY14 and PKR 34 billion in FY15. The analysis of past five years audited financial statements show that WAPDA is in a good financial position. Timely notification of tariffs and proper functioning of the escrow account will further improve its cash-flows which will enable WAPDA to raise financing in the amount required to fast track the development of Pakistan's large hydropower projects.

**Table 4.9: Key Financial & Operational Data of WAPDA Hydel (regulated business only)**

		FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
		Actual				Provisional
Capacity	MW	6,516	6,516	6,612	6,902	6,902
Net Electrical Output	TWh	31.7	28.2	29.3	31.3	31.8
Plant Utilization Factor	%	56%	49%	51%	52%	53%
Average Tariff	Rs/kWh	1.06	1.41	1.46	1.66	2.14
<i>Income Statement</i>						
Sales Revenue	Rs. Billion	33.5	39.9	42.9	52.1	68.1
Operating Cost*	"	19.9	26.0	27.2	27.6	29.4
Operating Profit	"	13.6	13.8	15.7	24.4	38.7
Net Profit	"	8.4	10.0	11.9	21.5	33.8
<i>Balance Sheet</i>						
Net Fixed Assets in Operations	Rs. Billion	126.6	187.0	216.0	231.9	225.5
Work-in-progress	"	60.2	64.9	52.4	60.0	83.8
Other non-current assets	"	0.3	0.3	0.4	0.4	0.5
Long-term Liabilities	"	61.1	66.3	77.6	120.7	148.0
Net Working Capital	"	19.9	30.0	17.0	30.1	62.8
<i>Financial Ratios</i>						
Operating Margin		41%	35%	37%	47%	57%
Net Margin		25%	25%	28%	41%	50%
Current Ratio		1.37	1.40	1.65	2.29	2.79
Interest Coverage Ratio		2.7	3.4	4.3	7.0	5.4
Debt Service Coverage Ratio		1.17	1.38	0.93	2.29	2.55
Return on Equity		3.3%	5.5%	5.7%	10.6%	16.1%

<sup>10</sup> WAPDA did not file the tariff petition for FY2014-15.

## **Annex 5: Environmental and Social Assessments and Action Plans**

5.1 WAPDA and NTDC have undertaken an environmental and social assessment (ESA) for T5HP. The ESA report presents main aspects of ESA process, and define key management, mitigation and enhancement measures for predicted impacts. The ESA study complies with the KP Environmental and Protection Act of 2014 and World Bank's standards for undertaking ESA for category 'A' projects.

5.2 Tunnel 5 at the existing Tarbela dam is currently used to release water for irrigation only when the reservoir level is below the minimum spillway operating level and water releases from the existing power units is not adequate. With powerhouse installed at Tunnel 5, it would continue to perform the same function but will also provide critically needed power for the country. It will generate approximately additional 1,800 GWh of electricity by using the same flows at a very low cost compared to alternate generation from thermal or other sources. The project has two main components: (i) power generation, and (ii) power evacuation. The power generation facilities (intake, powerhouse, tailrace and switchyard) will be implemented by WAPDA while power transmission line for power evacuation will be implemented by NTDC.

5.3 To understand the impacts of proposed development, an area of 5 km upstream and 10 km downstream of the centerline of dam was studied during the ESA, while for the Transmission Line (TL), a 1km wide corridor along the proposed TL route was studied. This corridor is collectively called as project study area. However, the study area is further characterized as Area of Direct Impact and Area of Influence – that is larger than the study area.

5.4 T5HP provides significant environmental benefits in the long run by providing renewable, low-carbon energy without the major environmental and social impacts normally associated with hydro schemes. The Project would also help utilize more efficiently the scarce water resources of the Indus Basin by installing modern and more efficient turbines and machines for generation of electricity. Net Greenhouse Gas Emissions from implementation of T5HP are minus 20 million tons of CO<sub>2e</sub> using Bank's Guidance Note: Greenhouse Gas Accounting for Energy Investment Operations, 2013 and IPCC 2006 guidelines.

5.5 Tarbela dam and storage reservoir are located near to the end of narrow valley of Indus cutting through Hazara hills. The Tarbela dam project stretches over two different administrative districts; Swabi and Haripur. Transmission line also falls under two districts; Haripur and Attock, while substation is located in district Attock. The Indus River is one of the largest sediment producing river in the world. The study team collected primary and secondary data for baseline data analysis, and included but not limited to ground and surface water quality, air quality, hydrology, flooding, physiography, land use, noise levels, traffic count, analysis of biological diversity including identification of any protected areas, important forests, reptiles, human-wildlife interaction, migration pattern and routes of birds particularly from collision with transmission lines perspective and an analysis of aquatic fauna. The study also presents detailed account of socio-economic baseline of the study area. The main conclusion of the chapter on baseline conditions of the study area is that majority of the environmental elements are already under heavy human influence with little adverse impact predicted. Power generation component of the project is confined within existing facilities owned by WAPDA and heavily human-disturbed environment exists there. Transmission line and substation component, on the other hand, pass through mainly agricultural lands with no major environmental resource base located under the direct project impact area.

5.6 T5HP including TL component does not impact any natural habitat or forest in anyway. Similarly project will not and does not promote use of pesticide as a result of any activity. NTDC does not use chemicals/pesticides for clearing of vegetation under the TL. The project is located on International Waterways however, it is not located in any 'Disputed Areas' as defined in OP 7.60.

5.7 The ESA report presents analysis of various alternatives considered during planning and design of Tarbela 5<sup>th</sup> HP project, routing of TL and siting of substation. This includes (i) alternatives to the proposed project, including against thermal and renewable sources; (ii) alternatives to the project layout and design, including Intake options, connection options from T5 to powerhouse and low-level outlet, powerhouse



locations and tailrace option; (iii) alternatives to switchyards; and (iv) alternatives to power evacuation; The final option for T5HP has been selected based on the study of combination of various alternatives and valued in terms of their technical, economic, environmental and social impacts.

### **Environmental Assessment**

5.8 The ESA report presents analysis for climatic change impacts and other risks including earthquake. Analysis therein suggests that 60 percent of the discharge in the Indus catchment is fed by melting of glaciers and snow. In a likely scenario of global warming based on IPCC predictions the reduction of share of melt-water in the Indus discharge has been estimated at 8.4 percent. However, this could be compensated by an expected increase of precipitation in the downstream areas, which are under influence of monsoon. Tarbela dam has been designed to withstand a probable maximum flood (PMF) event which was assumed to include maximum snow melt, maximum storm flood and simultaneous natural dam breach, and had a spillway design discharge of 42,000 cumecs. Based on the historical record of last 85 years, the maximum flow records so far at Tarbela site is 23, 645 cumecs in 2010. Seismicity of the region was studied for as part of Tarbela 4<sup>th</sup> Extension project. The results of T4 were reviewed and included in T5HP design also. An international panel of experts recruited by WAPDA have reviewed and approved T5HP design. This was done in accordance with Bank's policy OP 4.37.

5.9 The ESA shows that the environmental impacts are primarily limited to the construction stage. The potential impacts of the project have been identified on geology, landslides, seismicity, water resources including analysis on variations in releases, supplies and quality, air quality, noise and vibration, traffic and transport, waste and material handling, terrestrial and aquatic ecology, and impacts on socioeconomic settings. The analysis projects that waste handling will remain a challenge particularly from the management of finite number of landfill sites. The study also presents analysis on electromagnetic fields, and concludes that during the operational phase these are limited to public and occupational health effects and potential interference with electronic equipment. The impact analysis also concludes that significant beneficial social and community impacts are anticipated in relation to construction related employment and provision of electricity.

5.10 Construction on Tunnel 5 would start in parallel to construction on Tunnel 4 and it would be carried out in a manner that connection of power house to the Tunnel 5 would be done in a manner that it remains available for releasing water for irrigation till construction on Tunnel 4 is completed after which time the Tunnel 4 would become available for releasing irrigation water.

5.11 The Environment and Social Assessment (ESA) report prepared and disclosed on March 3, 2016 in Bank's Infoshop also included land acquisition for the Islamabad West station to which the transmission line would be connected from Tarbela. However, this would now be financed from the proposed Transmission System Modernization Project instead of AF to Tarbela 4<sup>th</sup> Extension. Therefore, an Addendum to the ESA has been prepared reflecting this change that is being disclosed on the Infoshop as well.

5.12 **Cumulative impact assessment** for T5HP has also been carried out, which is in continuation to similar studies done for Dasu HP and Sindh barrages Improvement project. The projects considered for this study were (i) existing Ghazi Barotha and Tarbela projects, (ii) proposed development on Indus over the next twenty years, until 2035. Valued environmental and social components (VECs) considered for the study were river hydrology and morphology, irrigation and biodiversity. The analysis done for T5HP also considers some studies done in the past including Bank funded under WCAP, 'Strategic Sectoral Environmental and Social Assessment (SSESA) of 2015. For the purpose of T5HP, cumulative impact assessment study considers Indus Cascade Hydropower developmental plan which includes five projects; Diamir-Bhasha HP, Dasu HP, Pattan HP, Thakot HP and Tarbela 4<sup>th</sup> and 5<sup>th</sup> HPs. This study also considers for analysis existing and planned power evacuation system for the existing and future projects.

5.13 The impact assessment confirms that incremental impacts by T5HP alone on the hydrological regime of Indus are negligible. However, due to raise in the intake level of T5, the life of T5 will be increased by another 10-15 years from the risk of blocking of intake by sedimentation. In terms of impacts on aquatic biodiversity, T5HP will not introduce any new barrier to fish movement and will not influence the low-season releases from Tarbela since it will be operated only in high flow season. Cumulative impacts of transmission lines will impact agricultural lands, livelihood of farmers, real-estate value of property through which these lines will pass through, and community health and social safety hazards. Considering that Indus valley is a flyway for migratory birds from Central Asia to Indian subcontinent, development of many transmission lines will impact birds through collision and electrocution. As part of recommendations to address cumulative impacts, the ESA study recommends a detailed ecological baseline study for the 54 km section of Indus downstream of Tarbela. Besides, it builds up on the recommendations of the previous studies and include (i) early flood warning and climate monitoring program, (ii) fish hatchery and stocking, (iii) sediment management plan for the basin and Tarbela, and (iv) capacity assessment and assistance in capacity building of local and provincial institutions, WAPDA and NTDC; and implementation of capacity development program.

### **Social Assessment**

5.14 Socioeconomic surveys were carried in the project area through structured questionnaire interviews of 49 households and focus group discussions. The project area falls in to Haripur District of KP province and Attock district of Punjab province. According to the latest Census (1998) Haripur District had a population of 0.7 million and Attock had 1.3 million. Annual growth rate of the population is high with 2.1 percent and 2.3 percent respectively. In both districts the population is mainly engaged in agriculture and livestock holding. Unemployment, lack of potable water, absence of basic health and education facilities, weak electricity supply and poorly maintained roads are major issues in the area. The archaeological department has indicated that there are no designated or known historical, archaeological or cultural resources within the project area.

5.15 The NGO sector has made large contributions to the socio- economic development in Pakistan. The Ghazi Barotha Tarqiati Idara (GBTI) and Sungi Development Foundation have both worked in the Tarbela Project area. GBTI was active as NGO in the GBHPP. They are still involved in working with communities in the health and education sector.

### **Environmental and Social Management Plan**

5.16 The environmental and social management plan (ESMP) in the ESA study builds up on the experience gained in the implementation of T4HP. The ESMP provides a framework to ensure transparent and effective monitoring, prevention, minimization, mitigation, off-setting and enhancement measures to address environmental and social impacts associated with the project. The ESMP eludes on: (i) organizational responsibilities and communications, (ii) management and monitoring activities, (iii) training and awareness, (iv) record keeping, (v) performance monitoring, reporting and auditing, and (vi) grievance mechanism. Experience from the implementation of T4 ESMP implementation indicates: lack of adequate staffing, inadequate compliance by contractor with the ESMP requirements, inadequate compliance with the labor laws in terms of labor rights and working conditions. The ESMP developed for T5HP specifically look into these aspects and strengthens relevant sections

5.17 ESMU created for the implementation of T4HP will be expanded to implement T5HP as well. Unlike for T4HP, ESMP will be made integral part of the contract documents and payments would be linked to completion of the prescribed environmental and social mitigation measures. Both WAPDA and NTDC have been made responsible for the overall implementation of relevant components of the project through Environmental and Social Management Unit (ESMU) of the PMU. While WAPDA and NTDC Environment Cell will provide technical backstopping.

5.18 A Land Acquisition and Resettlement Framework (LARF) was prepared to guide the preparation of the RAP. The LARF was developed by NTDC to address any compensation issues arising from TL construction in Bank supported projects. A resettlement action plan will be developed in line with LARF once the TL tower locations and final footprint of the line is established. This route will cross a mixed use area (although mostly agricultural land). Cumulative impacts of transmission lines will include impact on agricultural lands, loss of property value and life safety issues. Livelihood of the farmers will be affected if there is a reduced access to the lands occupied by the towers. Under a RAP, any losses to the land owners will be compensated for the construction and continued operation of the TL. No population is expected to be relocated/resettled due to the TL construction but losses to land owners and tenants are foreseen e.g. crop losses. Based on the Land Acquisition and Resettlement Framework estimated cost of compensation for the installation of TL towers has been included in the project. For cash compensation under the project US\$2 million are allocated out of component B3.2 that is related to implementation of environment and social management plans. RVP approval has been obtained for cash compensation up to US\$2 million.

5.19 **Addressing Resettlement Legacy Issues of TDP and GBHPP.** Under T4HP an Independent Commission (Resettlement Claims Committee) was instituted to facilitate faster resolution of resettlement legacy cases pending in courts. This commission will be reconstituted under the AF to help address remaining resettlement legacy cases pending in courts. The Commission has three members and it is headed by a retired Judge. Social mobilizers will work with the communities and people who have outstanding cases in the court related to original Tarbela and Ghazi Barotha settlement and convince them for out of court settlement under the auspices of Commission established under T4HP. The Commission had two sessions and so far it has settled 15 cases related to Tarbela and Ghazi Barotha (against 450 cases received) and beneficiaries have subsequently relinquished legal cases. The Commission will be reestablished under the AF to continue this process; and the cost of the commission and the settlement would be met from the component C1 of the Project.

5.20 **Social Assistance Program (SAP).** Under T4HP WAPDA has implemented a social assistance program among communities in the vicinity of Tarbela and Ghazi Barotha area. Most of these communities are from old Tarbela reservoir area and WAPDA hopes to extend further support to improve their living standard through T4HP. The T5HP would continue to support a list of community schemes as requested from these communities themselves. At the same time, WAPDA would extend the social and community programs to the communities within the ROW of the T5 transmission line. This program will be fully developed once the ROW and the tower locations are finalized. Planning of the TL SAP will start once the impact zones of the TL are finalized and demarcated so that the communities to be covered can be determined. Both programs will follow CDD approach in their development and implementation, to be designed and implemented entirely by the participating communities, based on full community participation, including women. WAPDA is exploring options of its delivering mechanisms, including contracting local NGOs. These will be further discussed and finalized in consultation with local communities. The cost of these schemes would be met from component C1 of the project.

5.21 **Grievance Redress Mechanism (GRM):** A GRM will be operational during the construction phase of the Project. The local community will be able to submit complaints through the Community Liaison Officer who will be responsible for ensuring that project authorities discuss and resolve complaints within the stipulated period. A tripartite Grievance Redress committee on labor issues has been operational under Tarbela 4 and has acted as a successful platform to address any employment-related issues. This mechanism will also continue during Tarbela 5.

### **Implementation and Monitoring**

5.22 The monitoring plan is designed to: (a) monitor the Contractor's work during project implementation in order to check contractual compliance with specified mitigation measures; and subsequently (b) to assess the actual environmental and social impacts of the project over the years following completion of the various project components. The first type of monitoring will be carried out by

the Engineering Consultant and supervised by an independent environmental and social management consultant or firms. The second type of monitoring will be commissioned by WAPDA and carried out by a local organization or consultant with sufficient experience in environmental and social monitoring. The monitoring indicators of the RAP and SAPs, including gender indicators, will be developed and included in their programs themselves, and will be used to track and assess the programs implementation.

5.23 The project will be implemented by WAPDA and NTDC and both the entities have extensive experience in implementing Bank funded projects in the past. WAPDA is currently implementing Tarbela 4<sup>th</sup> HP project and NTDC is responsible for the implementation of CASA 1000 Regional energy development project. Both the agencies have varying level of experience in the implementation of environmental safeguards and therefore ESA presents lessons learnt from other Bank funded projects by these agencies and proposes capacity development program. The ESA presents an elaborate institutional responsibilities for safeguards implementation at all three levels including the implementing agencies, supervision consultants and contractors. WAPDA will engage qualified consultants to conduct third party monitoring initially on six-monthly basis. The purpose of this monitoring will be to carry out an independent assessment and validation of ESMP implementation.

### Cost of ESMP

5.24 The total cost for the environmental management and monitoring activities has been estimated to be US\$21.4 million. In addition, US\$5million will be used for implementation of compensation related to the Transmission line component. The cost of implementing ESMP and RAP is shown in Tables 5.1.

**Table 5.1: ESMP Cost Estimates**

<b>Description</b>	<b>Generation Component, USD million</b>	<b>Evacuation Component, USD million</b>	<b>Project Component</b>
Implementing the suite of environmental and social management plans set out in ESA	5.2	1.1	Component A and B
Environmental and social Management and monitoring as set out in ESMP	2.2	0.6	Component C
Environmental staff (PMU, CSC, M&E Consultants)	3.2	1.1	Component D and E
Establishing and maintaining EHSS plans, procedures and management systems	0.3	0.3	Component C
Environmental and social enhancement measures*	2.2	0.6	Component C
E&S training and capacity building	2.1	0.6	Component E
Contingency	1.7	0.2	
<b>TOTAL</b>	<b>16.9</b>	<b>4.5</b>	
<b>Compensations for the Transmission line</b>		5.0	Component B3

### Stakeholder Consultations

5.25 Extensive consultations were carried out by both social and environmental study teams during the project preparation. Initial consultations, as part of scoping study, were held during December 2014 to January 2015 for power generation facilities and October/November 2015 for power evacuation facilities

to share the project objectives and terms of references of the proposed EIA study. Formal public consultations were held on 31 December 2015 and 1 January 2016 in the project area to disclose the results of ESA. Advertisements were given in the local newspapers and formal invitations were sent to relevant stakeholders for the public consultations. Consultations involved multiple methods – for example, key informant interviews, village wise meetings, focus group discussions and workshops. Details on number participants consulted are given in Table 5.2 and they include (i) affected communities and population around the project area, including women (ii) universities, consultants and contractors working for T4HP (iii) national and local government authorities responsible for district administration, wildlife and environmental protection, and (iv) nongovernmental organizations. The main issues discussed with affected persons and communities, and how these issues are addressed and incorporated are shown in Table 5.3.

**Table5.2: Number of Persons Covered in Various Consultation Meetings**

	<b>Activities</b>	<b>No. of participants</b>
1.	Village wise meetings during scoping for power generation component (December 2014)	117
2.	Village wise meetings during design for power generation component (January 2015)	335
3.	Focus group meetings with women for power generation component (January 2015)	52
4.	Village wise meetings for power evacuation component (November 2015)	202
5.	Public consultations (at Ghazi on 31 <sup>st</sup> December 2015 and near the substation site on 1 <sup>st</sup> January 2016)	209
<b>Total</b>		<b>915</b>

**Table 5.3: Key issues raised during the consultations and plans to address these issues**

<b>Issues raised</b>	<b>Main comments</b>	<b>Stakeholders who raised comments</b>	<b>How they have been addressed in the ESA</b>
Job preference to local people	Job preference shall be given to local people. Hiring process shall be open and transparent and hiring committee shall include participants from every village nearby.	People of Kukar Chawa, Ghari Mera, Ghazi Hamlet, Gala Hamlet, Pontian, Batakra and WAPDA Left, Right Bank Colonies, Kamal Pur Mayian, Bahtar Mehra, Pakki Ban, Noorabad and, Dhoke Khaliq Dad.	This recommendation is included in the ESMP. The contractor will be contractually bound to disclose the “Recruitment Policy” that specifically includes a requirement to prioritise local employment for unskilled and semi-skilled positions that become available.
Lack of health and educational facilities in the area	WAPDA should help in the up gradation of educational and health facilities in nearby villages.	People of Kukar Chawa, Ghari Mera Ghazi, Dhoke Khaliq Dad, Qutab Bandi Kamal Pur Mayian and, Bahtar Mehra,	T4HP is currently implementing a community development programme focusing on health and education. Similar programs will be continued in T5HP.
Polluted drinking water	WAPDA should arrange clean drinking water in nearby villages.	People of Kukar Chawa, Ghari Mera and Ghazi.	The T4 community development programme includes installing drinking water schemes (filtration plants) at Darra Mohat, Kukar Chawa, Ghazi Hamlet and Topi Area. It also is installing sewage equipment at Ghazi, Pehure, and

<b>Issues raised</b>	<b>Main comments</b>	<b>Stakeholders who raised comments</b>	<b>How they have been addressed in the ESA</b>
			Topi. Similar programs will be carried out under T5HP.
Risk of traffic accidents during construction phase of the project	WAPDA should rehabilitate the old roads to be used during construction phase to avoid traffic hazards to local community	People of Ghazi Hamlet.	Traffic management plan will be implemented during construction. The access roads damaged by the construction activities will be restored.
Access to Villages	WAPDA should allow easy access to villagers living in Kukur Chawa and Ghari Mera by providing them the security passes. Especially relaxation should be given in case of emergency.	People of Kukar Chawa, Ghari Mera, Minar Kot and Ghazi.	Tarbela is not able to change access issues because of security reasons.
Payment of land compensation	Compensation should be provided for the affected land of both substation and transmission line	People of Kamalpur Manyan, Burhan, Qila Bandi, Dhoke Khaliq, Umer Khana, and Bharwasa	Compensation will be paid for all the affected land
Transmission line should avoid settlements	The design of transmission line should be such that the houses and settlement should not be affected	People of Kamal Pur Burhan, Qila Bandi, Hamlet Colony	The transmission line alignment will be designed to avoid settlements to the maximum extent possible.
Electrocution concerns	People were concerned regarding electric shocks especially during rainy season.	People of Kamal pur Manyan, Burhan, Ghaara, hamlet Colony, Piplian, Umar Khana, Noorabad	The height of the transmission lines will have a clearance of 9.0m when passing over any structure in order to avoid potential damage from electric fields.
Substation site should be changed	There are many other sites available for substation	People of Kamalpur Manyan	The substation site has been selected after evaluation of three potential options
Existing transmission line should be used	At present there are existing four transmission lines which could be used for electricity evacuation without having to construct a new one.	People of Kamal pur Manyan, Burhan, Ghaara, hamlet Colony, Umar Khana, Noorabad	The option of using existing transmission lines were also studied, but this option is selected based on technical feasibility and also considering the overall power sector development in the country (development of a new substation at Islamabad for Dasu and other hydropower projects).
Impacts from Tarbela and Ghazi Barotha projects	Agricultural lands were affected by Ghazi Barotha canal. On the left bank water logging is the problem, and on the right bank there is water scarcity. Sewerages from WAPDA colonies are polluting the river water	Public consultation	ESA has recommended further studies to understand the impacts of downstream impacts of Tarbela and Ghazi Barotha, and to develop appropriate mitigation plans.

<b>Issues raised</b>	<b>Main comments</b>	<b>Stakeholders who raised comments</b>	<b>How they have been addressed in the ESA</b>
Support for development of local area	Roads, drinking water and sewerage facilities, hospitals, parks, access to Sui gas facility, schools, job opportunities, training and skill development,	Public consultations	Social development activities will be continued under T5HP.
Pending Claims	Many cases of compensation are still remaining unresolved. The land acquired originally for Tarbela for borrow areas are no longer in use and should be returned to affectees	Public consultations	Resettlement Claims Committee will be re-established under T5HP.
Compensation for land acquisition	Adequate compensation should be paid to local people to re-establish their livelihoods. Compensation should also be paid to the transmission line towers.	Public consultations	Adequate compensation will be paid covering all the losses,

## Annex 6: Systematic Operations Risk- Rating Tool (SORT)

1. The following matrix describes the rationale for the proposed rating for each risk and the mitigation plans.

<b>1. Political and Governance</b>	<b>Rating</b>	<b>Substantial</b>
<b>Description</b>	<b>Risk Management</b>	
<p>Pakistan's political and governance risks are substantial due to:</p> <ul style="list-style-type: none"> <li>a) Political pressures related to reforms in the sector could challenge continued progress and undermine governance</li> <li>b) While progress in RTI has been made, challenges to enforcement and continued transparency and accountability remain</li> <li>c) Weak legal framework for corporate governance and public sector regulation, poor performance, and taking advantage of office are common in the public sector</li> </ul>	<p>The following are considered for risk mitigation:</p> <ul style="list-style-type: none"> <li>a) Regular dialogue with government and officials from the WAPDA, and EAD to ensure client ownership, transparency, and accountability</li> <li>b) The PMUs will ensure compliance with the GAAP to minimize adverse outcomes of political uncertainties and any 'early warning' indicators of governance and accountability risks will be monitored regularly so that corrective measures could be carried out promptly</li> <li>c) Project will emphasize information dissemination and transparency through disclosure of project documents according to the Bank's Policy on Access to Information and the GoP's Right to Information Act</li> </ul>	
<b>2. Macroeconomic</b>	<b>Rating</b>	<b>Moderate</b>
<b>Description</b>	<b>Risk Management</b>	
<ul style="list-style-type: none"> <li>a) While the current macroeconomic position of the GoP is good with sustained GDP growth, continued efforts to improve fiscal deficits and balance of payments will be necessary</li> </ul>	<ul style="list-style-type: none"> <li>a) Sustained engagement is planned throughout the project to ensure proactive engagement with the Government to support continued and coordinated economic growth</li> </ul>	
<b>3. Sector strategies and policies</b>	<b>Rating</b>	<b>Substantial</b>
<b>Description</b>	<b>Risk Management</b>	
<ul style="list-style-type: none"> <li>a) Challenges to implementing reforms result in acute liquidity shortages</li> <li>b) Continued payment arrears and challenges to distribution companies increase the circular debt</li> </ul>	<ul style="list-style-type: none"> <li>a) Support through project interventions to continue reforms, in a coordinated effort with IMF and through other program interventions</li> <li>b) Support through project interventions the continued expansion and development of inexpensive electricity generation options</li> </ul>	
<b>4. Technical design of project or program</b>	<b>Rating</b>	<b>Substantial</b>
<b>Description</b>	<b>Risk Management</b>	
<ul style="list-style-type: none"> <li>a) The project design is rated substantial as it expands and further develops an existing hydropower dam which is in operation with limited time slot for construction during the year. As with any large infrastructure project, there are risks of poor designs and engineering works, leading to failure or poor performance.</li> </ul>	<ul style="list-style-type: none"> <li>a) Design risk is through a phased construction approach, and building on past efforts to systematically develop Tarbela for hydropower generation. A detailed design by a reputable engineering company presents design options that have been assessed and reviewed, and found to be appropriate</li> <li>b) The turbines, generators and other related equipment are large and will be designed and supplied by a world leading manufacturer</li> </ul>	



<p>b) Timely completion of Islamabad West station to connect to Tarbela for power evacuation from Tunnel 5 can be a challenge.</p>	<p>c) WAPDA has sufficient experience in design, construction and operation of such facilities.</p> <p>d) Construction of Islamabad West substation under proposed Transmission Modernization Project in a timely manner is likely, in case there are delays by June 2017 decision would be made to make a double circuit line from Tarbela to Rawat.</p>	
<p><b>5. Institutional capacity for implementation and sustainability</b></p>	<p><b>Rating</b></p>	<p><b>Moderate</b></p>
<p><b>Description</b></p>	<p><b>Risk Management</b></p>	
<p>(a) WAPDA has developed significant institutional capacity for implementation of the project activities, through several Bank financed interventions.</p>	<p>a) Project implementation will be supported by additional staff in the PMU responsible for the additional financing scope. This will include additional fiduciary and safeguards staff.</p> <p>b) There are several checks and balances and internal controls established in the decision making under this Project. This includes the PMU, WAPDA, IPOE, and international consultants. Major decisions need approval from all Members of the Authority</p>	
<p><b>6. Fiduciary</b></p>	<p><b>Rating</b></p>	<p><b>Substantial</b></p>
<p><b>Description</b></p>	<p><b>Risk Management</b></p>	
<p>(a) The project will include the procurement of large civil works contracts, which could lead to collusion or governance challenges in procurement</p> <p>(b) Financial management risks are considered low, as WAPDA has a well-established, functioning and well equipped internal control mechanisms and staff</p>	<p>a) WAPDA has conducted a number of large civil works projects using ICB procedures of various funding agencies. The staff in general is well versed with good procurement and contract management practices. The PMU staffed by the Director of Procurement and contract management, with support of the CSCs, shall also: (i) develop a procurement website which would be managed and updated; (ii) develop a credible system for handling procurement related complaints; and (iii) develop and maintain a system of procurement documentation, filing systems and procurement database</p> <p>b) The project will be audited by independent chartered accountants</p>	
<p><b>7. Environment and social</b></p>	<p><b>Rating</b></p>	<p><b>Substantial</b></p>
<p><b>Description</b></p>	<p><b>Risk Management</b></p>	
<p>a) The hydropower plant will be installed on an existing dam with an already constructed tunnel, which reduces the exposure to the many social and environmental challenges often associated with large dam projects.</p> <p>b) <b>Social:</b> The Tarbela resettlement program was implemented over 30 years ago and left behind difficult legacy issues. These legacy issues pose a substantial risk on continued issues in resettlement. The Project may also attract public attention, particularly from NGOs, media, etc. who are aware of the legacy issues.</p>	<p>a) Continued support to address any outstanding resettlement legacy issues will be provided under the project, and will further strengthen and expand the work of social mobilizers and uses clear communication to affected families</p> <p>b) Environmental issues will be addressed through a comprehensive environmental monitoring and mitigation program, including a clear delineation of roles and responsibilities. These will be further strengthened under the project.</p> <p>c) Monitoring of the implementation of the SAP and EMP will be carried out by an independent team of consultants, the M&amp;ECs.</p>	

<p>c) <b>Environmental</b> impacts are primarily limited to the construction period, and they would be temporary and reversible in nature; they are mostly due to (a) transporting construction material; (b) noise levels during construction; and (c) air quality during construction.</p> <p>d) It should be noted that the Project would provide significant environmental benefits in the long run by providing renewable, low carbon energy without the environmental and social impacts/costs normally associated with large hydro schemes</p>	<p>d) A Public Information Center will be further strengthened by WAPDA and have a section where complaints and grievances can be registered and addressed.</p>	
<p><b>8. Stakeholders</b></p>	<p><b>Rating</b></p>	<p><b>Substantial</b></p>
<p><b>Description</b></p>	<p><b>Risk Management</b></p>	
<p>(a) Consumers are largely interested in low-cost energy supply while the Government has to balance this interest with its own fiscal constraints and its need to have consumers carry the cost of energy supply to avoid unaffordable subsidies.</p> <p>(b) Opposition to the Project by those with outstanding resettlement issues from the Tarbela and Ghazi Barotha Hydropower projects (NGOs included).</p>	<p>a) The Bank will support the Government and WAPDA in generating positive messages on the advantages of adding renewable, low-cost hydropower to the energy mix.</p> <p>b) Continued consultations and dialogue will be held to maintain a broad consensus among key stakeholders – government officials, private sector, development partners, etc. – that the Project is highly beneficial to the national economy.</p>	