



# **Luhri Hydro Electric Project**

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# India's development needs are massive and challenges in the power sector are significant ...

456 million living at \$1.25 a day (in 2005, U.S. dollars at PPP).

## Increase Access

Two thirds of households rely on biomass for cooking  
34% villages un/de-electrified (RGGVY, MoP)/400 million in 2011) w/o electricity access (IEA-2010) (20 million China - 2008)

## Improve Efficiency & Governance of Distribution Sector

40% Aggregate Technical & Commercial (AT&C) losses. Reducing to 15% => \$4.4B addl. revenues/year  
Fin. Losses Discoms > US\$ 14-15B – FY11)

## Expand & Diversify Power Generation

Inst. Capacity of 170 GW (2011) (vs. China's 800 GW in 2008)  
Biggest bottleneck to industrial growth and new investment:

- 60% of firms rely on captive power (21% in China)
- Peak Deficit (Apr. 2011) at 10.8%, Energy Deficit at 7.6%
- Econ. Cost of Shortages estimated at 7% of GDP

## Growing CO<sub>2</sub> Emissions

Energy Mix – Coal-fired (54.3 % - Inst. Capacity & 70-80 % generation)  
Power Sector represents 50% of India's CO<sub>2</sub> (energy) emissions (0.5 bt/yr - > 2.3 bt/yr by 2031)

# Key Challenges facing India/Gov. in Power Sector

- CROSS-CUTTING:
  - Need to create many capable organizations/institutions to implement policies, roll-out technology innovations, and provide effective feedback/M&E to Government/policies
- EXPAND GENERATION CAPACITY
  - Speed & Magnitude versus Costs & environmental externalities
    - If successful, ultra-mega coal plants may dominate market share relative to costlier renewables and riskier hydro
    - Relatively weak cooperation across borders could hamper optimal development of renewable, gas and large hydro
    - Realizing full benefits of demand-side EE requires competent executing entities and effective policies (e.g. free and unmeasured power supply to agriculture)
- IMPROVE QUALITY OF SUPPLY AND SERVICE
  - Powerful vested interests associated with prevailing subsidies and leakages
- EXPAND ACCESS TO REACH ALL BY 2012
  - Sustainable pricing policies and regulatory mechanisms
- COMPLY WITH ENVIRONMENTAL AND SOCIAL SAFEGUARDS
  - Trade-offs between access and basic services and local and global sustainability

# Why is the Bank involved in Hydropower in India?

- Hydropower – key to greening strategy of energy mix of India. With a potential of 150 GW, only about 37.6 GW is currently developed.
- As for the power sector, the Gol and States have taken several initiatives to boost the contribution of hydro to the energy mix of India.
- But, unless a decisive implementation push is made on hydro, UMPP (coal) may dominate market share relative to costlier renewables and riskier hydro.

INDIA - INSTALLED GENERATION CAPACITY (MW) AT END OF APRIL 2011											
Sources: MoP, MNRE											
	THERMAL										
	Coal		Gas	Diesel	Total	Nuclear	Hydro		RES (MNRE)	TOTAL	
	<b>53.7%</b>					<b>2.9%</b>	<b>26.2%</b>		<b>5.9%</b>	<b>100.0%</b>	
End of 10th Plan (31.03.07)	71,121	100.0%	13,692	1,202	86,015	3,900	34,654	100.0%	7,761	132,329	100.0%
March, 2008	76,049		14,656	1,202	91,907	4,120	35,909		11,125	143,061	
April, 2011	94,653	133.1%	17,706	1,200	113,559	4,780	37,567	108.4%	19,974	175,881	132.9%
	<b>53.8%</b>					<b>2.7%</b>	<b>21.4%</b>		<b>11.4%</b>	<b>100.0%</b>	

# How is the Bank involved in Hydropower in India?

- Building on PowerGrid and NTPC successful Long Term Partnership model, Focus on 2 states with high hydro potential (Himachal Pradesh and Uttarakhand) and on 2 river basins (Satluj in HP and Alaknanda in UK)
- Investment finance (for 1,500 MW on-line after 2012) is “seat at the table” for policy dialogue with Gol and capacity-building for developers (SJVNL and THDC)
  - Technical & Contracting
  - Social & Environmental Practice, Communications
- Engagement supported with a varied set of analytical activities
  - River Basin Optimization Study for Satluj and Alaknanda River (completed)
  - Reducing Barriers to Sustainable Hydropower Development in South Asia (completed)
  - Developing Approaches for Successful use of Tunnel Boring Machines (TBMs) in the Himalayas (ongoing)
  - Understanding Private Sector Participation in Hydropower Development (ongoing)
  - Good Practices of Environment and Social Management in Hydropower Projects (ongoing)
- Work with State Governments on planning and regulation – and increasingly MOEF/GOI
- Civil society (as appropriate)

# SJVNL central to Bank's Engagement In Hydro in India

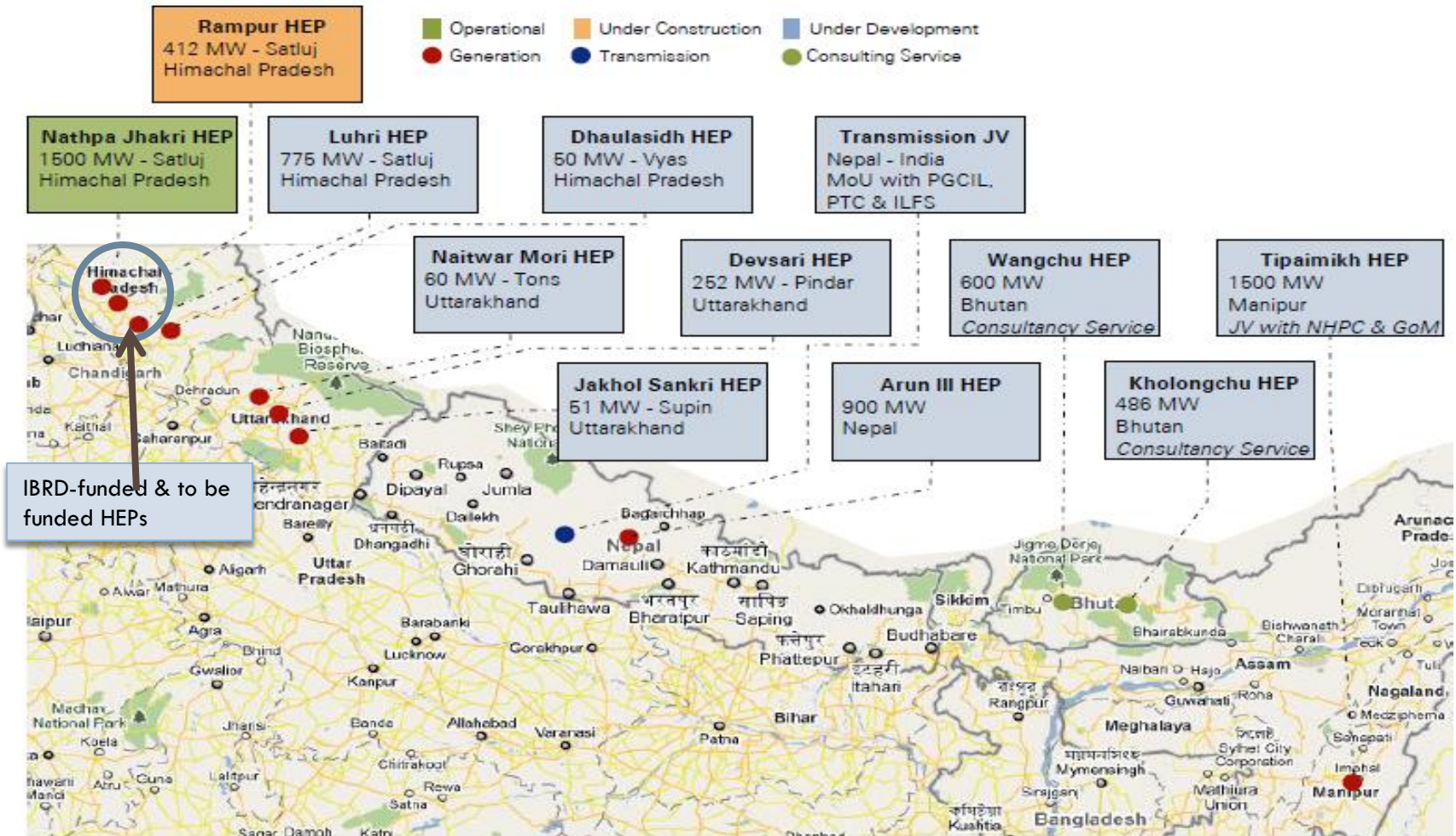
## In context of SJVNL

- ❑ Partnership with SJVNL started with Nathpa Jhakri Hydro Project (NJHP), is ongoing under Rampur project and proposed to be continued under the Luhri project; each project has helped raise the bar of SJVNL on various aspects [and target is to have SJVNL qualify for the use of country systems for E&S practices].
- ❑ Recently launched 2 year Institutional Development Plan for the organization
- ❑ Discussion underway for Luhri co-financing in collaboration with Treasury

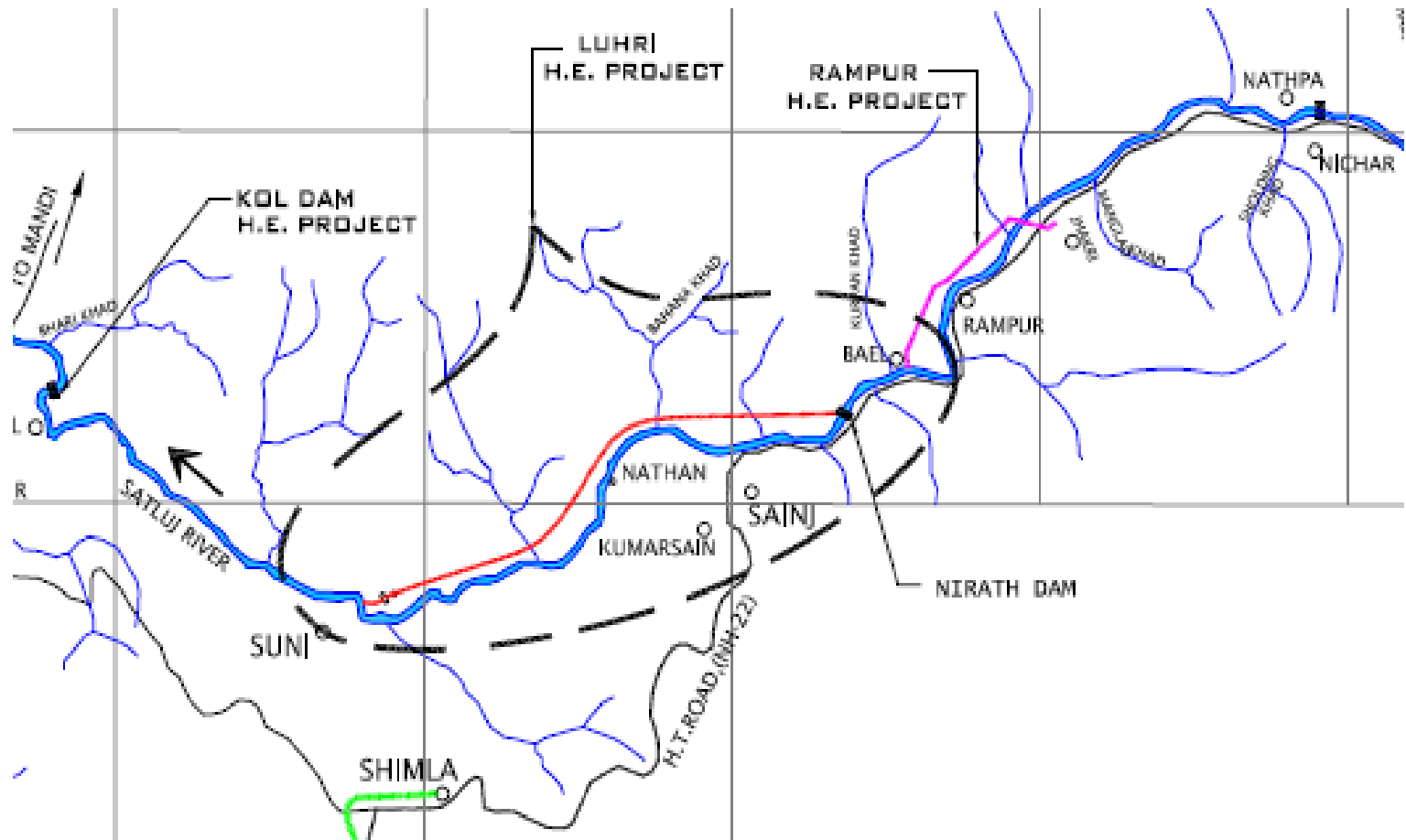
## In context of Himachal Pradesh

- ❑ Through SJVNL engagement, fiscal dialogue with State on improving policy environment e.g. adopting integrating basin management approach
  - ❑ First Himachal Pradesh DPL (approved in September 2007) had sustainable hydropower development as one of the key pillars;
    - Achievements include operationalization of basin level forum on Satluj, preparation of an integrated CAT plan for Satluj Basin (first in State and Country)
  - ❑ Proposed HP Environmentally Sustainable DPL is also going to have a strategic focus on Hydropower (promoting integrated basin approach, implementation of muck and debris disposal, and assessment of cumulative impacts, monitoring of environment flows)
- Through SJVNL engagement, strategic collaboration in HP with the Forum of Hydropower Producers on the Satluj Basin , moving forward the agenda of adopting integrated basin development approach.

# SJVNL – on the Move



# Luhri Hydroelectric Project (LHP)



## Key Project Features - Technical

	Luhri	Rampur	VPHEP
Installed Capacity (MW)	775 (4X193.75 F)	412	444
Gross/Net Head	221/181 m		
Energy Output (MU/yr)	3152	1770	1665
Length of Head Race Tunnel (Km)	Twin tunnels, 38.14 km each of 9 m dia each	15.18 km	13.4 km
Height of Dam (Gravity)	86 m	-	65 m
Gross Storage Capacity	35 million cu.m.	-	3.63 million cu.m.
Power House	Underground	Surface	Underground
Tunneling Method	Yet to be finalized	Drill and Blast	TBM
Estimated Implementation Period	8 Years ?	6.5 Years	4.5 years

# Project Preparation – Technical

Detailed Project Report (DPR) – Initially prepared by Consultants Mott MacDonald

- Final DPR submitted to CEA in March 2011 for Techno Economic Clearance (TEC).
- In a meeting held with CEA on June 24, 2011, CEA has agreed to review the project configuration with a single stage and twin tunnel option. Formal minutes issued
- TEC from CEA expected by Jan 2012

## Additional Studies

- + Geotechnical Baseline Report (GBR) update and other investigations.
- + Risk Register
- = Tunneling Risk Study (**will also determine the procurement strategy**)

- Vendor/ Contractor workshop with TBM users undertaken (08/2010)
- Initial comparative study for excavation methodology (done by SJVNL).
- Consultant engaged for the risk management study and recommendations shared with SJVNL
- SJVNL drawing up action plan to undertake additional investigations to finalize GBR and Tunnel Excavation Strategy (work will take 6-12 months)

## Project Preparation – Technical (Contd.)

<p><b>Geotechnical Baseline Report (GBR)</b></p>	<ul style="list-style-type: none"> <li>- Draft GBR prepared. Report reviewed by international expert (engaged by SJVNL)</li> <li>- will feed into tunneling risk study</li> </ul>
<p>Dynamic analysis of Dam</p>	<p>Being done by IIT Roorkee. Draft report will be available in November 2011</p>
<p>Dam Break Analysis</p>	<p>-Completed by Mott Mac Donald</p>
<p>Hydraulic Model Studies and Sediment Handling Optimization</p>	<p>- Being done by Central Water and Power Research Station (CWPRS), Pune. Physical model expected to be ready by November 2011</p>
<p>Independent Project Review Panel</p> <ul style="list-style-type: none"> <li>-Sedimentation Management</li> <li>-Rock Engineering</li> <li>-Underground Works/ Tunneling</li> <li>-Hydropower</li> <li>-Power House</li> <li>-Geo Technical</li> <li>- Seismic Analysis of Dam</li> </ul>	<p>-Experts identified and process for contracting underway (expected to be completed by Oct 2011)</p> <ul style="list-style-type: none"> <li>Sultan Alam</li> <li>Laurie Richards</li> <li>Harald Wagner</li> <li>M.S. Reddy</li> <li>Ranjodh Singh</li> <li>S.K. Shome</li> <li>Jost Studder</li> </ul>

# Project Preparation – Technical (End)

## Large Associated Infrastructure Works

- Road widening of State Highway (Sainj to Sunni – 51 km) and realignment of 2 km of National Highway (NH22) at dam site in Nirath (to be done thru the State PWD) – Plan is to take up this work in phases focusing on critical stretches first.
  - SJVNL releasing Rs. 50 lakh to State PWD the week of October 17 for undertaking EIA/ SIA preparation and initiating Land acquisition for widening of 8.8 km of road in first phase;
  - Proposal for realignment of NH 22 approved by Ministry of Road Transport and work will be taken up once the forest clearance is available.
- Several (32) approach roads to be constructed (total length – 26.2 km
- Several (10) bridges to be built (total combined span of 918m) to provide access to project facilities (power house and adits) – The bridges will also facilitate easier connectivity to the villages on the right bank to the left bank area.
  - NIT for 2 bridges (one at dam site and one at power house site already floated and award will be made as soon as TEC from CEA is available);
  - NIT for four more bridges to be floated on receipt of TEC.
- SJVNL anticipates that all these infrastructure works would be completed by December 31, 2013 (2 years from now).

# Project Preparation - Environment

Environment Impact Assessment (EIA)/ Environment Management Plan (EMP)	- EIA/ EMP prepared by Centre for Inter-Disciplinary Studies of Mountain & Hill Environment, University of Delhi.
Project Review Panel	John Ambrose (International Env expert) - Appointed Rakesh Sood (Domestic Env expert) – Appointed Social expert – Identified and contracting process being initiated (To be completed by Nov 2011)
<b>Additional Studies</b>	
Archeological and cultural Heritage Study	- Study underway - Inception report shared

## Project Preparation – Environment (Contd.)

Cumulative Impact Assessment (CIA)  
- to be coordinated with Satluj Basin level CIA undertaken by State Gov. thru FHPP

- Study will cover stretch between Nathpa Jhakri & Luhri under SJVNL's control.
- Includes additional baseline studies on the drinking water sources and quality in the Project Influence Area (PIA), ambient air quality and noise levels in PIA, flora and fauna, Fish diversity at the upstream and downstream of the dam and likely impacts.
- Also includes Lean Flow Management involving assessment of flows in the river and streams in the river stretch in the project area and changes that are anticipated due to the project, and recommending adaptive management strategies.
- As per the current policy of the State, the project design incorporates **in-stream flow of a minimum of 15% of the lean season flow downstream of the dam**
- Will prepare a **CIA and Consolidated EA Reports** for Bank's Due Diligence
- Study EOI floated and award expected in Dec. 2011

## Key Project Features – R&R Impacts

	SJVN			THDC	Narmada River Development
	Nathpa Jhakri HEP (Operating)	Rampur HP (Construction)	Luhri HP (Preparation)	VPHEP	
<b>Installed Capacity</b>	1500 MW	412 MW	775 MW	444 MW	1450 MW
<b>Land Required</b>					
Total	562 ha	79 ha	302 ha	141 ha	37,000 ha
Government	322 ha	49 ha	181 ha	110 ha	
Private	224	30 ha	121 ha	31 ha	
<b>Impacts</b>					
PAFs losing land/structures	480	143	2337 [2]	773	
PAFs getting displaced	137[1]	19	37 [2]	265[3]	19,851

*Note: The Narmada River projects were conceived as a series of 30 projects to be developed in the Narmada River Basin. Bank support consisted of financing for two companion projects involving four states (Gujarat, Madhya Pradesh, Maharashtra, Rajasthan): (i) Narmada River Development – Gujarat Sardar Sarovar Dam and Power Project (1985-93); and (ii) Water Delivery and Drainage (1985-92). The purpose of the project was electricity generation, irrigation and municipal and industrial water supply.*

[1] includes 78 shopkeepers who were displaced and were provided shop plots

[2] Provisional figures. Final figures will be available after census and finalization of road widening component

[3] includes 242 PAFs who voluntarily opted to sell their land to the developer and relocate

## Project Preparation – Social

**Social Impact Assessment (SIA), Resettlement Action Plan (RAP) and Community Development Plan (CDP)**

- Revised Plan, incorporating Bank team comments, prepared by consultants and shared
- Next Steps include:
  - Technical review to further minimize LA impact;
  - Socio-economic census and household impact survey of PAPs (to be started once TEC is available);
  - Detailed consultations with PAPs on entitlements, resettlement and community plan;

# Project Preparation – Consultations with PAPs & Other Stakeholders

## Consultations with PAPs & other stakeholders

SJVNL has initiated an ongoing program of consultations in affected villages

SJVNL has set up two Public Information Centres (PICs) in the Project area, and equipped each PIC with all the project information including copies of EIA Reports and 3-D model of the project.

- As part of the environmental clearance requirements of GOI, the State Pollution Control Board carried out public hearings on May 5, 6, 7 (not concluded) in the project area.
- SJVNL undertook additional consultations with the communities to understand and address the concerns.
- Subsequently the public hearing was held on August 9, 2011 and successfully concluded
- Case has been forwarded by State Pollution Control Board to MOEF for Environment Clearance

## Project Preparation – Implementation Arrangements

As per Oct. 2008 MoU signed between SJVNL and the State Government,

Project is to be implemented by a Special Purpose Vehicle (SPV).

SPV will be a subsidiary of SJVNL in the form of a Joint venture (JV) with 49% equity share of GoHP and 51% of Gol through SJVNL.

BUT

**DISCUSSIONS UNDERWAY ON BEST IMPLEMENTATION MODEL.**

## Project Preparation – Project Costs and Proposed Financing (October 2011 Status)

In US\$ million	Luhri	Rampur	VPHEP
Estimated Capital Costs, US\$ million	1,600	677	912
<i>Proposed Financing Arrangements</i>			
- Equity, US\$ million	480	282	274
- IBRD Loan (excl TA component), US\$ million	650	395	638
- Co Financing (FIs/ Banks), US\$ million	470	-	-

## Project Preparation – Project Milestones

Milestones on the Client Side	Optimistic	Realistic
TEC from CEA on DPR	Jan 2012	March 2012
Environment Clearance from MOEF	March 2012	September 2012
Forest Clearance from MOEF	March 2012	September 2012
Award of Infrastructure Works	Feb 2012	April 2012
Finalization of Tunneling & Procurement Strategy	September 2012	December 2012
Issue of PQ document	October 2012	February 2013
Issue of IFB	March 2013	August 2013
Award of main contract	December 2013	May 2014



# **Luhri Hydro Electric Project**

**THANK YOU – QUESTIONS WELCOME**

**24 October 2011**