



UNION ENERGY GROUP



**PERUVIAN HYDROPOWER PROJECTS CANCHAYLLO,  
EL CARMEN, 8 DE AGOSTO AND KARPA**

JANUARY 2016

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## POWER GENERATION FOOTPRINT

- + 5 MW operating hydropower plant Canchayllo
- + 27 MW in comissioning phase projects Generacion Andina
- + 20 MW in pre construction phase hydropower Project Karpa



# IMPLEMENTATION SCHEDULE



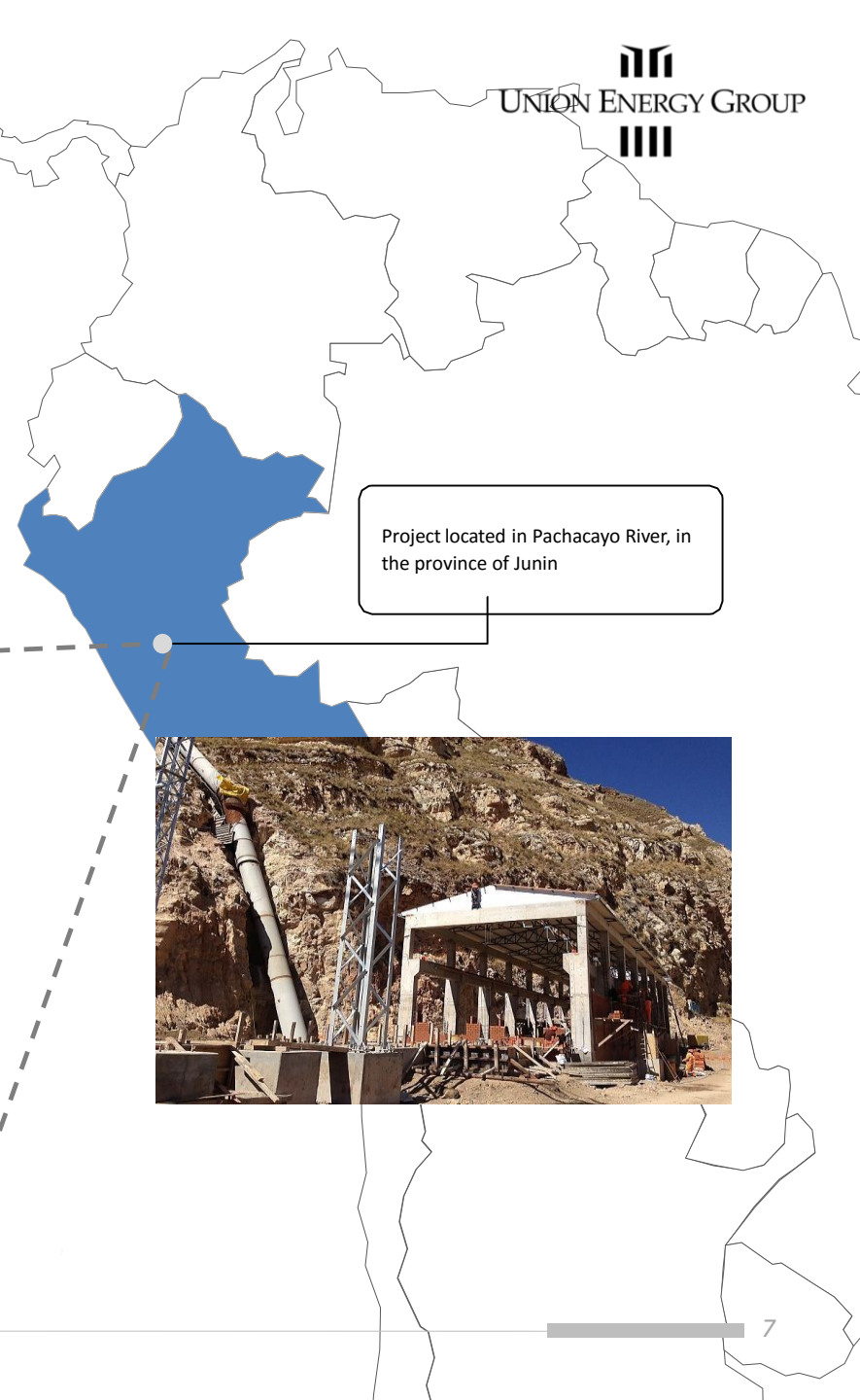
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PROJECTS UNDER OPERATION

CANCHAYLLO IS THE FIRST OPERATING A HYDROPOWER PLANT (5.3MW) OF UEG

- + **Run-of-river hydropower plant in operating phase** located in the region of Junin in central Peru
- + **5.3 MW** combined installed capacity with **73% average load factor**
- + Underpinned by ownership of **20-year, dollar-denominated, inflation indexed Power Purchase Agreements** awarded in the 2011 renewable energy auction
- + Connection to the national grid using a dedicated **1 km transmission line**
- + **Total US\$16 million** investment, 60% financed by the Inter-American Investment Corporation (IIC) on a non-recourse project finance basis
- + In Operation since **January 2015** and the generation is about **19GWh** in between **May 2015** and **December 2015**





Overview of Peruvian hydropower opportunities - Strictly Confidential

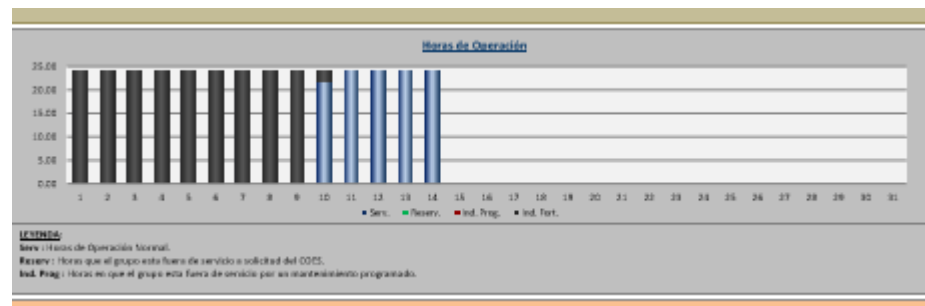
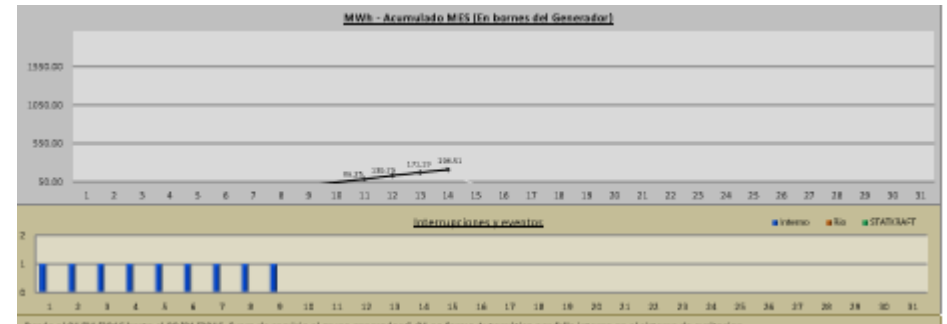
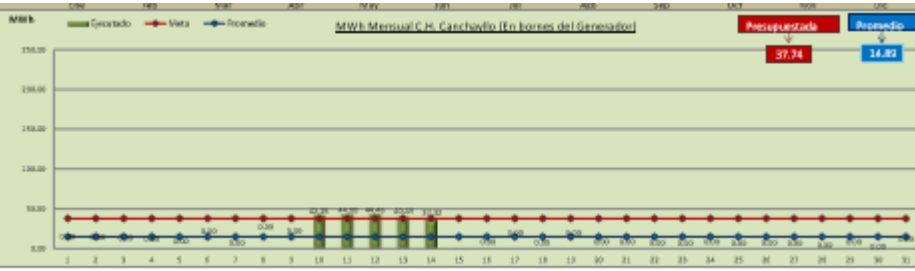
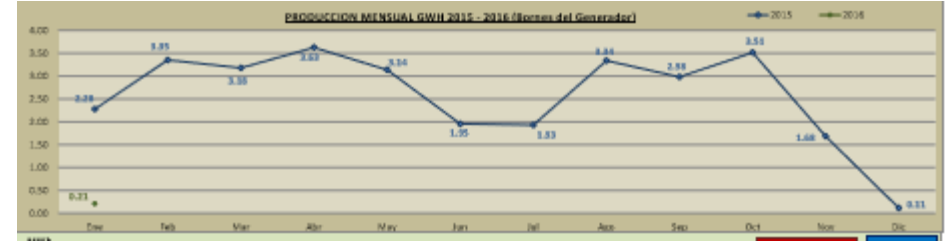
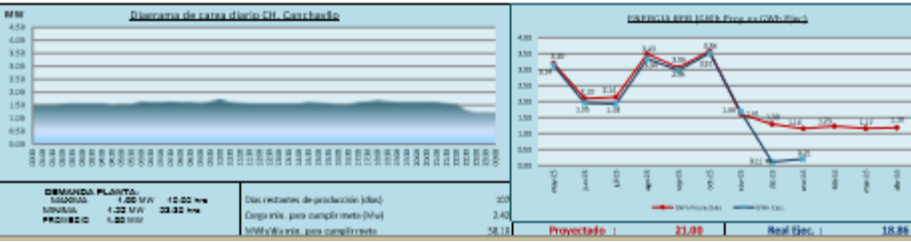


PROJECTS UNDER OPERATION  
 CANCHAYLLO 5.3 MW – REPORT OF OPERATIONS



REPORTE DIARIO DE O y M C.H. CANCHAYLLO  
 Jueves, 14 de Enero de 2016

CÓDIGO	000-000-001
SERIE	1
FECHA	10/enero/16



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PROJECTS UNDER CONSTRUCTION

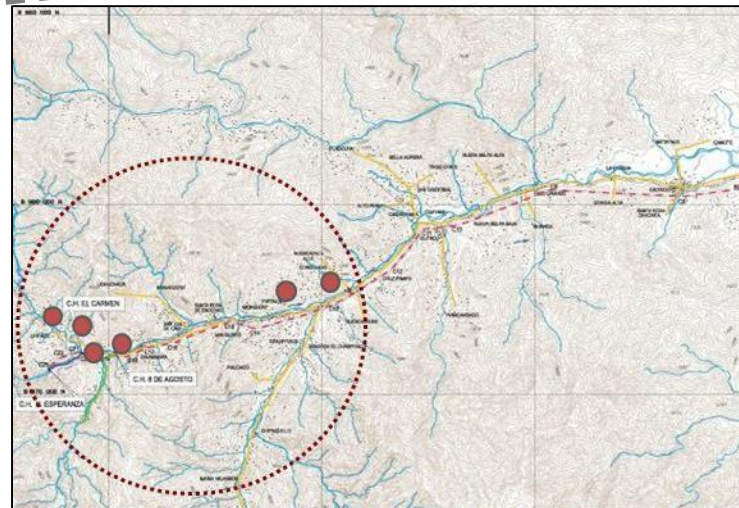
GENERACION ANDINA IS BUILDING 2 HYDROPOWER PLANTS (27MW) IN CENTRAL PERU



- + **2 run-of-river hydropower plants under construction** located in the El Carmen Complex in the district of Monzon in central Peru
- + **27 MW** combined installed capacity with **86% average load factor**
- + 2 of only 7 projects with **20-year, dollar-denominated, inflation indexed Power Purchase Agreements** awarded in the 2011 renewable energy auction
- + Connection to the national grid using a dedicated **60 km transmission line**
- + **Total US\$88 million** investment, 70% financed by a consortium of lenders on a non-recourse project finance basis
- + Phase 1 of the **115 MW El Carmen Complex** developed by Union Group in the Monzon Valley



Projects located in the district of Monzon, Huamales Province, in the region of Huanuco





**TECHNICAL INFORMATION**

Capacity	8.4 MW
Load factor	76.6%
Flow rate	4.3 m <sup>3</sup> /s
Head (gross / net)	228.1 m / 239.1 m
Design discharge	4.5 m <sup>3</sup> /s
Average annual generation	59 GWh / year
Turbines	2 Pelton turbines
Transmission line	22.9kv

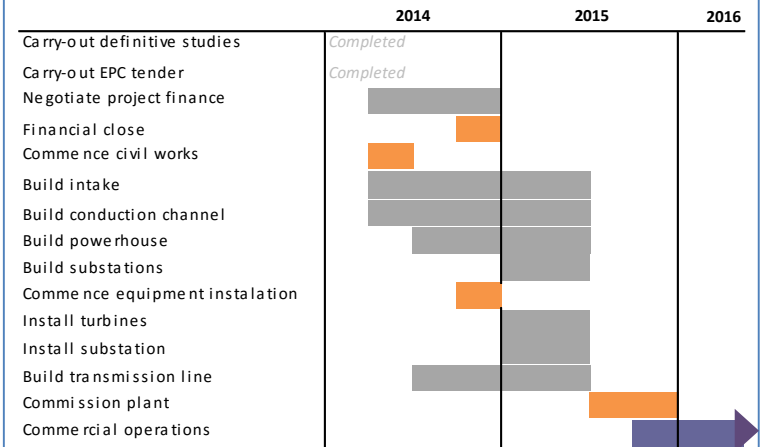
**DEVELOPMENT STAGE**

Definitive concession	Approved
Land and water rights	Approved
Environmental Impact Assessment	Approved
Interconnection	Approved
Engineering	Completed
Turnkey EPC contract	Completed
Power Purchase Agreement	20-year PPA (US\$55.9 / MWh)
Project financing	Work-in-progress

**ECONOMICS**

Total project cost	US\$26.7 million
Development cost	US\$1.9 million (7%)
Construction cost	US\$20.8 million (78%)
Financial cost	US\$4.0 million (15%)
Equity	US\$8.0 million (30%)
Debt	US\$18.7 million (70%)
Interest rate	7.5%
Debt term	16 years

**WORKPLAN**



## DESIGN HIGHLIGHTS

Derivation work & intake: 7.0m damper

Desander: 40.0m length, 3.8/2.4m

Load chamber: 15.0m weir length

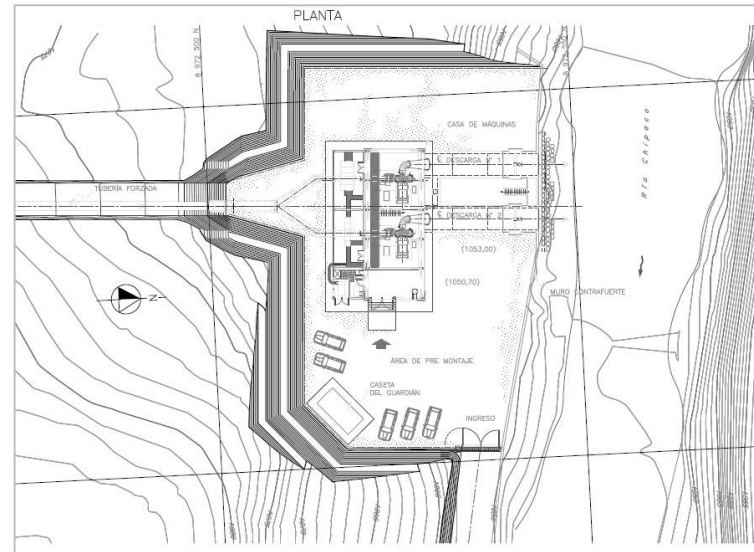
Low pressure pipe: 1.95km, 1.3/1.4m diam.

Tunnel: N/A

Surge shaft: 206.0m / 1.1m diam.

Penstock: 200.0m / 0.7m-1.2m diam.

Outside powerhouse: 8.3m x 20.0m x 9.2m







**TECHNICAL INFORMATION**

Capacity	19.0 MW
Load factor	90.0%
Flow rate	22.8 m <sup>3</sup> /s
Head (gross / net)	145 m / 130 m
Design discharge	18 m <sup>3</sup> /s
Average annual generation	155 GWh / year
Turbines	2 Francis turbines
Transmission line	22.9k and 138kv to substation

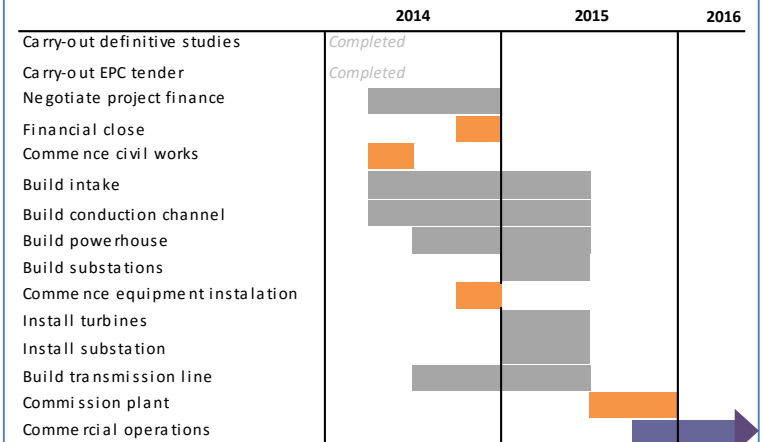
**DEVELOPMENT STAGE**

Definitive concession	Approved
Land and water rights	Approved
Environmental Impact Assessment	Approved
Interconnection	Approved
Engineering	Completed
Turnkey EPC contract	Completed
Power Purchase Agreement	20-year PPA (US\$53.9 / MWh)
Project financing	Work-in-progress

**ECONOMICS**

Total project cost	US\$60.3 million
Development cost	US\$4.4 million (7%)
Construction cost	US\$46.7 million (77%)
Financial cost	US\$9.2 million (15%)
Equity	US\$18.9 million (30%)
Debt	US\$42.2 million (70%)
Interest rate	7.5%
Debt term	16 years

**WORKPLAN**



Derivation work & intake: 21.0m mobil damper

Desander: 70.0m length, 5/3.4

Load chamber: 20.0m weir length

Buried low pressure pipe: 3.2km / 2.0m diam.

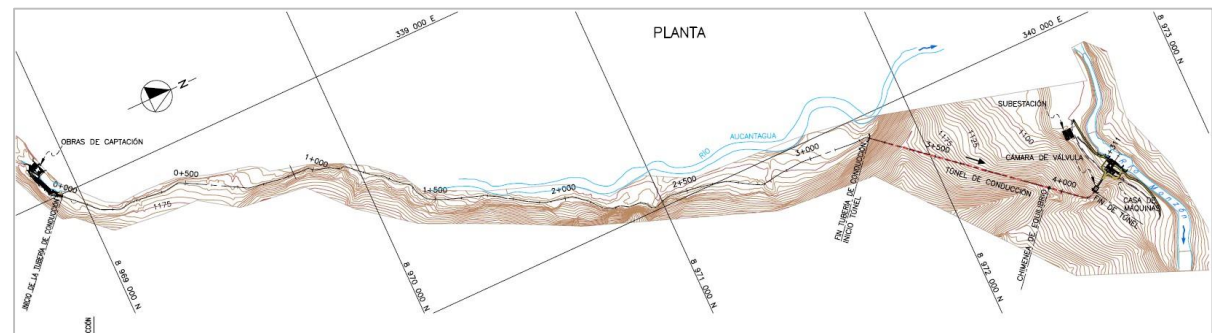
Tunnel: 1,111.5m / 2.5 x 2.5m

Surge shaft: 109.0m / 2.5-7.5m diam.

Penstock: 128.6m / 2.3-2.5m diam.

Outside powerhouse: 13.6m x 36.7m x 10.7m

## DESIGN HIGHLIGHTS

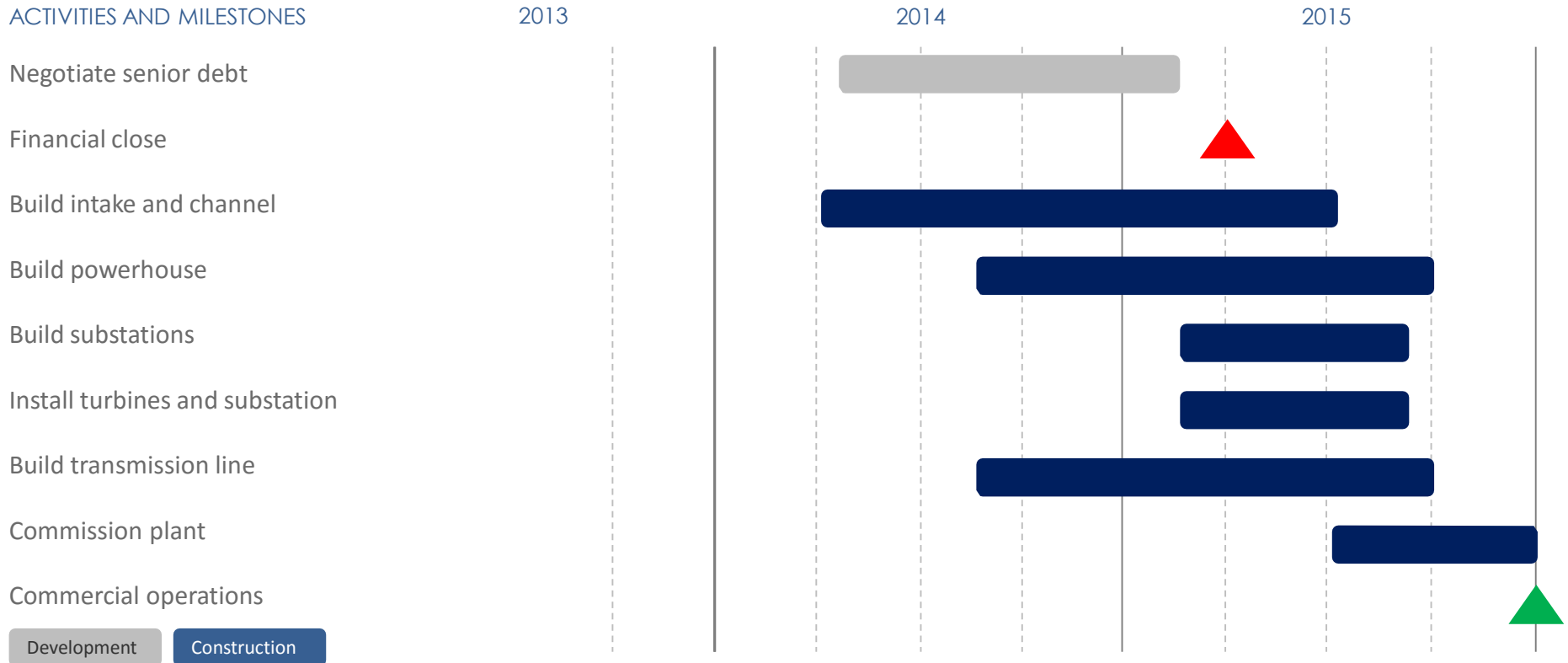






Overview of Peruvian hydropower opportunities - Strictly Confidential

# IMPLEMENTATION SCHEDULE



EPC Contract	
Contract Cost	66 USD Mio
Final Cost	70 USD Mio
<b>Deviation</b>	<b>6%</b>

Time Implementation	
Commercial Operation Date expected	December 2015
Commercial Operation Date expected	March 2016
<b>Deviation</b>	<b>3 months</b>

Definitive Concession	
El Carmen	Granted
8 de Agosto	Granted

COD according to Osinergmin date	
El Carmen	15-may
8 de Agosto	15-may

Hidromechanical Equipment	
El Carmen	At project site
8 de Agosto	At project site

Electromechanical Equipment	
El Carmen	At project site
8 de Agosto	At project site

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- + **POWER PLANTS:** KARPA
- + **INSTALLED CAPACITY:** 20 MW
- + **CAPACITY FACTOR:** 74%
- + **PRODUCTION:** 130 GWH P.A.
- + **TRANSMISSION LINE:** 67 KM / 60 KV
- + **DEVELOPMENT STAGE:** NEARLY FULLY PERMITTED
- + **PPA:** 20-YEAR; GOVERNMENT-BACKED; U\$55.7/MWH
- + **COMMERCIAL OPERATIONS DATE:** JUNE 2018

DESSAU

RUBIO  
LEGUIA  
NORMAND

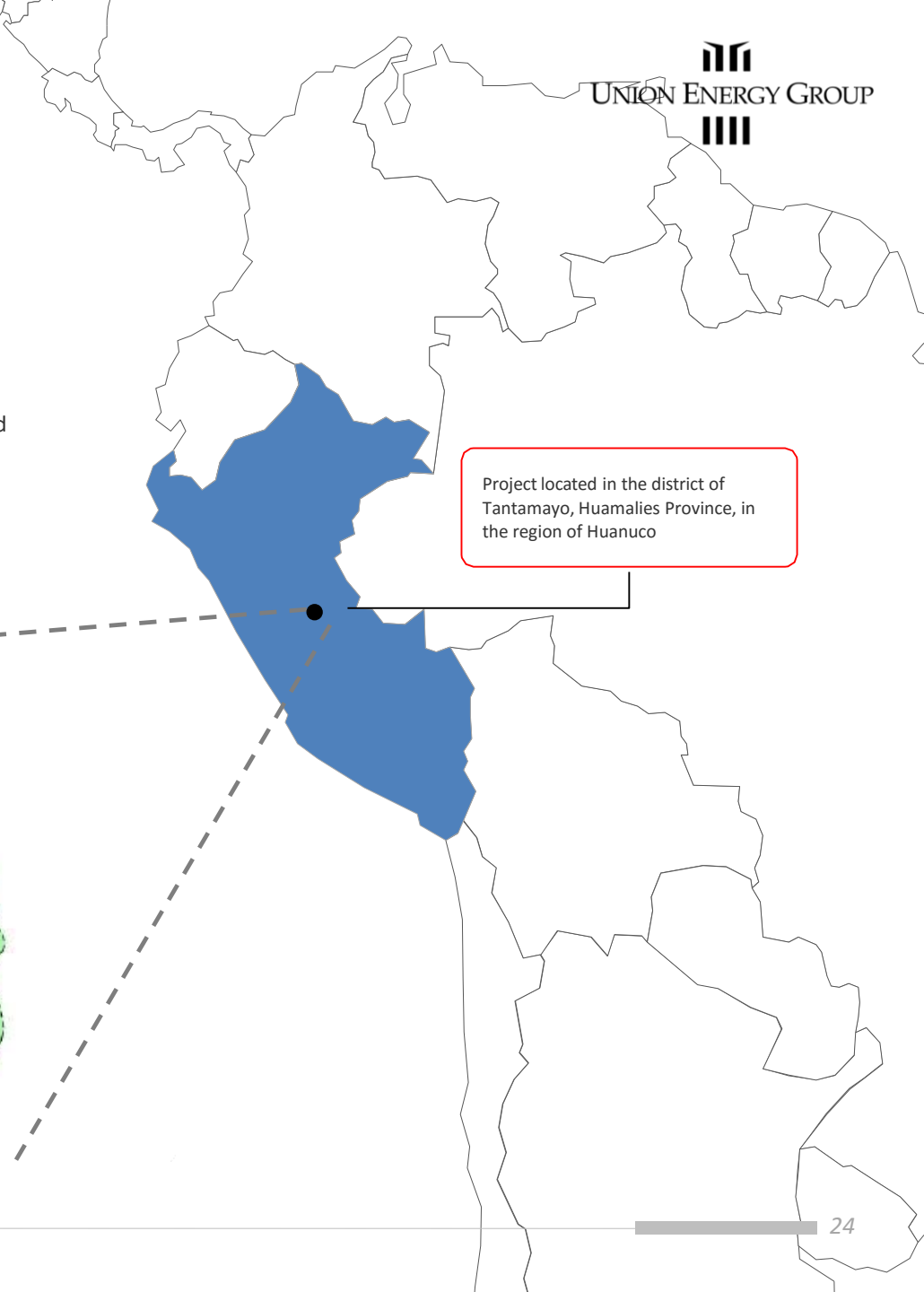
RODRIGO,  
ELIAS  
& MEDRANO  
ABOGADOS

 Grant Thornton

  
pwc



- + **Near fully developed hydropower project**, ready to initiate construction in the next 6 months
- + **20 MW** installed capacity with **74% load factor**
- + **20-year, dollar-denominated, inflation indexed Power Purchase Agreements** awarded in the 2013 renewable energy auction
- + Connection to the national grid using the dedicated **67 km / 60 KV transmission line**
- + **Total US\$45 million** investment, 70% financed on a non-recourse project finance basis
- + Construction will commence in **Q3 2016** and completed in Q2 2018, with first power delivered to the grid in Q3 2018





### TECHNICAL INFORMATION

Capacity	20 MW
Load factor	74.0%
Flow rate	4.2 m <sup>3</sup> /s
Head (net)	810.0m
Design discharge	3.0 m <sup>3</sup> /s
Average annual generation	130 GWh / year
Turbines	2 Pelton turbines
Transmission line	67 km / 60 KV

### DEVELOPMENT STAGE

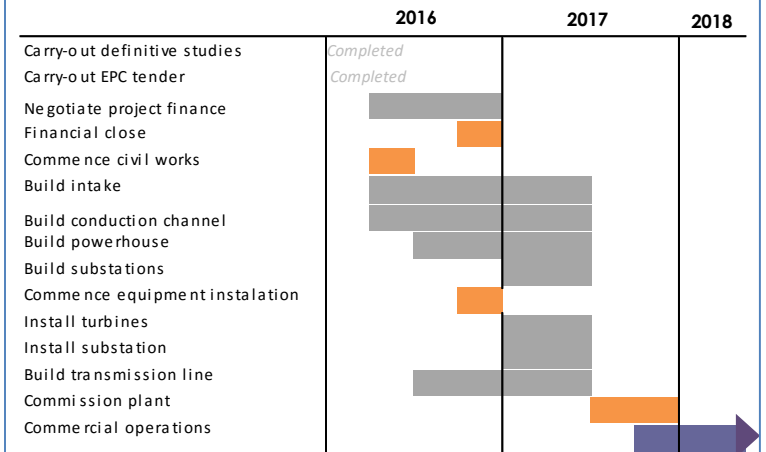
Concession	November 2014
Land and water rights	Approved
EIA	December 2014
Interconnection	Approved
Engineering	Completed
EPC	In negotiation
PPA	Awarded
Project financing	In negotiation

*NB: CDM project registered with UNFCCC*

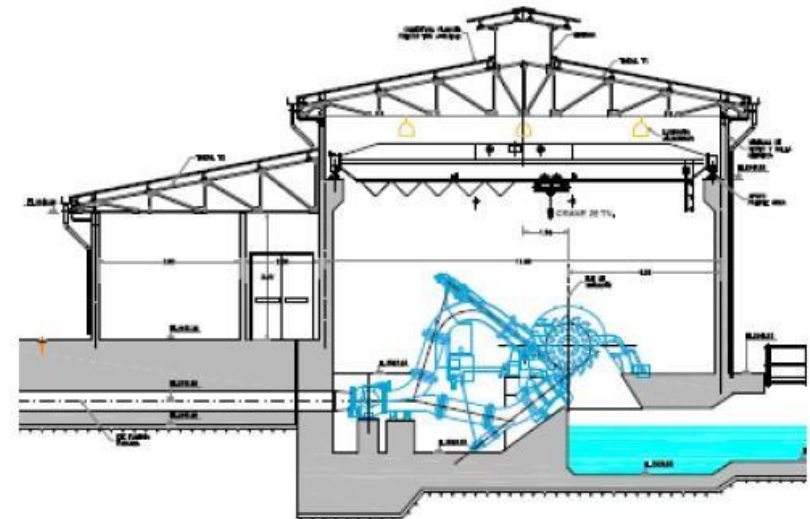
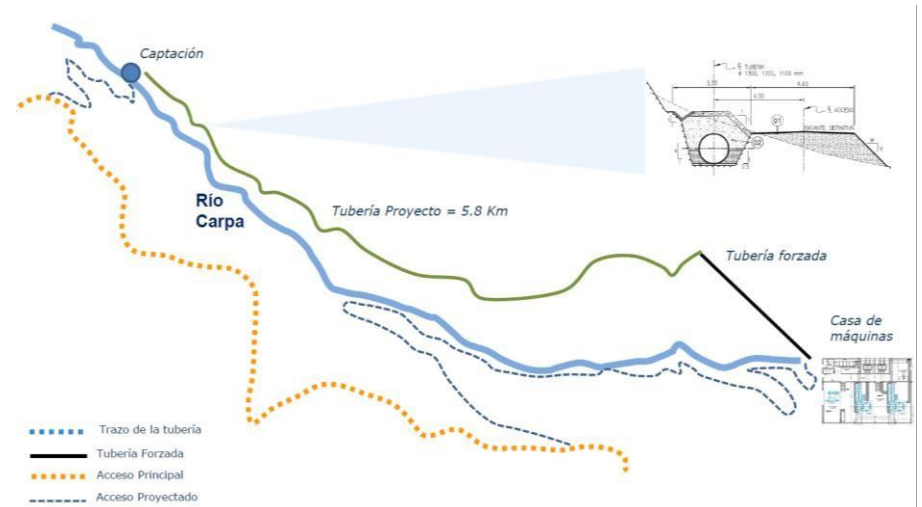
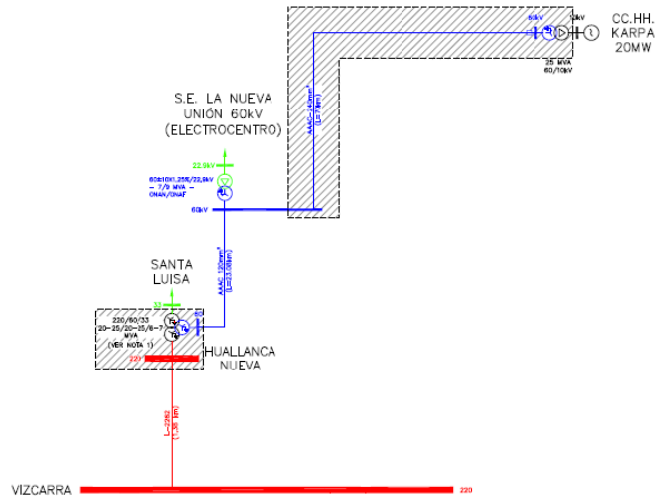
### ECONOMICS

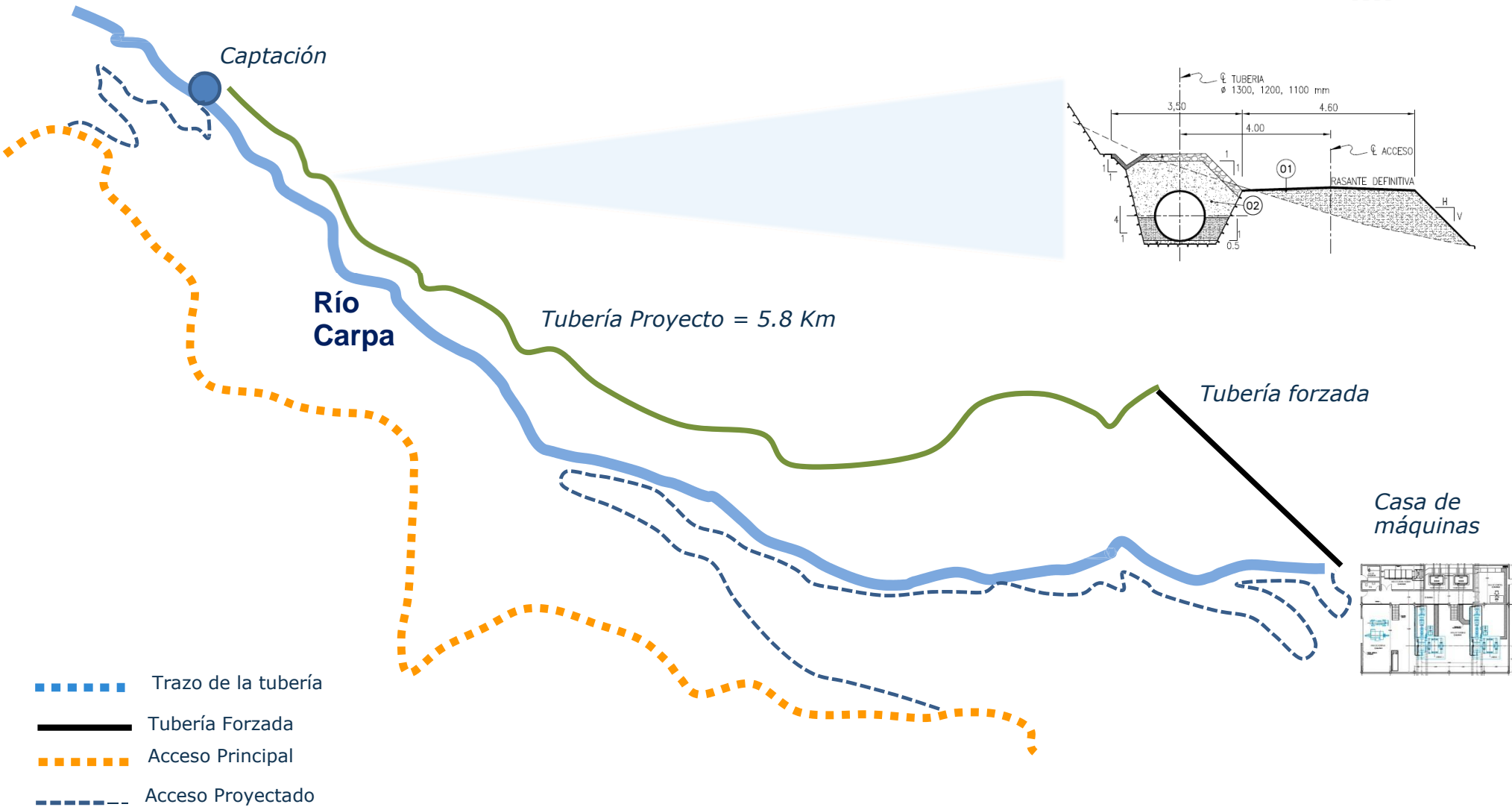
Total project cost	US\$45.0 million
Development cost	US\$4.5 million (10%)
Construction cost	US\$36.9 million (82%)
Financial cost	US\$3.6 million (8%)
Equity	US\$13.5 million (30%)
Debt	US\$31.5 million (70%)
Interest rate	8.0%* (average)
Debt term	13 years* (average)

### WORKPLAN



*\*to be confirmed by lenders*





EPC Contract	
EPC	Quotation
Owners Engineer	Quotation
<b>Deviation</b>	<b>NA</b>

Time Implementation	
Commercial Operation Date	June 2018
Commercial Operation Date expected	June 2018
<b>Deviation</b>	<b>NA</b>

Definitive Concession	
Hydropower Plant	Granted
Transmission Line	Permitting phase

COD according to Osinergmin date	
Hydropower Plant	30 – June - 2018
Transmission Line	30 – June - 2018

Hidromechanical Equipment	
Hydropower Plant	Quotation

Electromechanical Equipment	
Hydropower Plant	Negotiations
Transmission Line	Quotation

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