

# **Construction of Small HPPs on steel pipe along the initial 8 km section of Left Bank Tartarchay Main Canal**

## **1. General Information**

Left Bank Tartarchay Main Canal starts from the 52 + 25th picket of Right Bank Tartarchay Main Canal.

The first half of the Left Bank Tartarchay Main Canal works mainly in the execution mode, as it passes through a relief with a large slope. For this reason, it is planned to lay a steel pipe along the initial 8 km section of the canal and build 3 small HPPs with a total capacity of 20.7 MW.

The project is intended to be used as an independent power producer (IPG), in which case the investors build and operate the plant, and the Government guarantees the purchase of electricity generated for 20 years (can be reviewed on the basis of the investor's proposal).

The main selection criterion is the price of electricity offered by the investor.

## **2. Scope of Construction Services**

The scope of work related to the construction of the new power plant includes hydro turbines (HT), generators and electrical systems, necessary technological systems, automation, protection and measurement systems, construction, ventilation and air conditioning (HVAC) and fire protection systems, comfort and sanitation design, household appliances, safety and lighting, on-site roads and appropriate storage areas to ensure the full functionality of small hydropower plants.

The project works shall also include complete design, engineering, permitting and licensing, materials and equipment procurement, construction and installation, transportation, importing of goods, quality assurance, start-up and commissioning, trial run and performance testing, training of personnel, documentation, and other necessary services for a fully operational small hydropower plants..

External communications (power supply, communication line, road, etc.) other than water supply (refrigeration, technical, sewage, etc.) are provided by the Customer, not included in the construction volume, and the Investor submits only internal proposals for the fence where the project work will be carried out.

## **3. Construction Location**

The Left Bank Tartarchay Main Canal, which starts from the 52 + 25th picket of the Right Bank Tartarchay Main Canal, is selected to implement the project. The construction of small hydropower plants is planned on a steel pipe to be laid along the initial 8 km section of the Left Bank Tartarchay Main Canal. However, the relief of the project site, including the height of the area, the degree of inclination, tectonic condition, etc. should be investigated.

## **4. Parameters and Technical Concept**

### Pipe System Parameters

At the beginning of the Left Bank Tartarchay Main Canal, the water distribution system regulates the flow of water between the concrete-lined canal and the steel pipes. Water taken from the Canal is discharged from hydropower plants through 3 consecutive pipes with a total length of 8 km and later transferred to the Left Bank Tartarchay Main Canal.

The construction of the Canal is not included in the project parameters and is performed by the customer.

Additional connection points between the hydropower plants and the Canal can be discussed in later stages..

**Parameters of HPPs:**

The profile of the Left Coast Tartarchay Main Canal was studied and it was determined that it is possible to build 3 hydropower plants on it:

1<sup>st</sup> HPP estimated to have discharge rate of 20.0 m<sup>3</sup>/s, water head of 26.0 m, and pipe length of ~2.75 km. Maximum power for the HPP is estimated to be 4.59 MW.

2<sup>nd</sup> HPP estimated to have discharge rate of 18.4 m<sup>3</sup>/s, water head of 84 m, and pipe length of ~4.2 km. Maximum power for the HPP is estimated to be 13.65 MW.

3<sup>rd</sup> HPP estimated to have discharge rate of 13.25 m<sup>3</sup>/s, water head of 21.0 m, and pipe length of ~1 km. Maximum power for the HPP is estimated to be 2.46 MW.

The total capacity of hydropower plants is a maximum of 20.7 MW, and the estimated annual electricity production is 81,939.00 MWh..

The exact operating capacity of HPPs depends on the proposed HT technology and will be offered by potential investors.

The capacity of the HPPs and the estimated annual energy production are shown in the table below

**Table 1. Estimated power and Energy Production of 1<sup>st</sup> HPP**

Month	Irrigation		1 <sup>st</sup> HPP				Electricity Production, MWh
	Term	Time	Discharge rate, m <sup>3</sup> /s	Water head, m	Eff	Power, MW	
February	21.02/28.02	8	5.755	26.0	0.9	1.321	253.6
March	01.03/10.03	10	5.755	26.0	0.9	1.321	317.0
	11.03/20.03	10	4.386	26.0	0.9	1.007	241.7
April	01.04/20.04	20	5.751	26.0	0.9	1.321	634.1
	21.04/30.04	10	18.405	26.0	0.9	4.225	1014

May	01.05/15.05	15	18.405	26.0	0.9	4.225	1521
	16.05/20.05	5	19.625	26.0	0.9	4.505	540.6
	21.05/31.05	11	20.0	26.0	0.9	4.591	1197
June	01.06/05.06	5	6.902	26.0	0.9	1.584	190.1
	06.06/15.06	10	6.462	26.0	0.9	1.483	355.9
	16.06/30.06	15	14.073	26.0	0.9	3.23	1162.8
July	01.07/05.07	5	20.0	26.0	0.9	4.591	551
	06.07/20.07	15	20.0	26.0	0.9	4.591	1653
	21.07/31.07	11	20.0	26.0	0.9	4.591	1212
August	01.08/10.08	10	20,0	26.0	0.9	4.591	1102
	11.08/20.08	10	20.0	26.0	0.9	4.591	1102
	21.08/31.08	11	16.544	26.0	0.9	3.798	1002.7
September	01.09/15.09	15	13.292	26.0	0.9	3.051	1098.4
	16.09/25.09	10	9.645	26.0	0.9	2.214	531.4
	26.09/30.09	5	2.316	26.0	0.9	0.532	63.8
November	01.11/30.11	30	8.645	26.0	0.9	1.984	1428.5
<b>Total</b>							17188

Table 2. Estimated power and Energy Production of 2<sup>nd</sup> HPP

Month	Irrigation		2 <sup>nd</sup> HPP				Electricity Production, MWh
	Term	Time	Discharge rate, m <sup>3</sup> /s	Water head, m	Eff	Power, MW	
February	21.02/28.02	8	5.755	84.0	0.9	4.268	819.5
March	01.03/10.03	10	5.755	84.0	0.9	4.268	1024.3
	11.03/20.03	10	4.386	84.0	0.9	3.253	780.7
April	01.04/20.04	20	5.751	84.0	0.9	4.268	2048.6

	21.04/30.04	10	18.405	84.0	0.9	13.650	3276.0
May	01.05/15.05	15	18.405	84.0	0.9	13.650	4914.0
	16.05/20.05	5	18.4	84.0	0.9	13.65	1638
	21.05/31.05	11	18.4	84.0	0.9	13.65	3604
June	01.06/05.06	5	6.902	84.0	0.9	5.119	614.3
	06.06/15.06	10	6.462	84.0	0.9	4.792	1150.1
	16.06/30.06	15	14.073	84.0	0.9	10.437	3757.3
July	01.07/05.07	5	18.4	84.0	0.9	13.65	1638
	06.07/20.07	15	18.4	84.0	0.9	13.65	4914
	21.07/31.07	11	18.4	84.0	0.9	13.65	3604
August	01.08/10.08	10	18.4	84.0	0.9	13.65	3276
	11.08/20.08	10	18.4	84.0	0.9	13.65	3276
	21.08/31.08	11	16.544	84.0	0.9	12.270	3239.3
September	01.09/15.09	15	13.292	84.0	0.9	9.858	3548.9
	16.09/25.09	10	9.645	84.0	0.9	7.153	1716.7
	26.09/30.09	5	2.316	84.0	0.9	1.718	206.2
November	01.11/30.11	30	8.645	84.0	0.9	6.411	4615.9
<b>Total</b>							53662

Table 3. Estimated power and Energy Production of 3<sup>rd</sup> HPP

Month	Irrigation		3 <sup>rd</sup> HPP				Electricity Production, MWh
	Term	Time	Discharge rate, m <sup>3</sup> /s	Water head, m	Eff	Power, MW	
February	21.02/28.02	8	5.755	21.0	0.9	1.067	205
March	01.03/10.03	10	5.755	21.0	0.9	1.067	256
	11.03/20.03	10	4.386	21.0	0.9	0.813	195
April	01.04/20.04	20	5.751	21.0	0.9	1.066	512

	21.04/30.04	10	13.25	21.0	0.9	2.457	589.7
May	01.05/15.05	15	13.25	21.0	0.9	2.457	884.5
	16.05/20.05	5	13.25	21.0	0.9	2.457	294.8
	21.05/31.05	11	13.25	21.0	0.9	2.457	648.6
June	01.06/05.06	5	6.902	21.0	0.9	1.280	153.6
	06.06/15.06	10	6.462	21.0	0.9	1.198	287.5
	16.06/30.06	15	13.25	21.0	0.9	2.457	884.5
July	01.07/05.07	5	13.25	21.0	0.9	2.457	294.8
	06.07/20.07	15	13.25	21.0	0.9	2.457	884.5
	21.07/31.07	11	13.25	21.0	0.9	2.457	648.6
August	01.08/10.08	10	13.25	21.0	0.9	2.457	589.7
	11.08/20.08	10	13.25	21.0	0.9	2.457	589.7
	21.08/31.08	11	13.25	21.0	0.9	2.457	648.6
September	01.09/15.09	15	13.292	21.0	0.9	2.464	887.0
	16.09/25.09	10	9.645	21.0	0.9	1.788	429
	26.09/30.09	5	2.316	21.0	0.9	0.429	51.5
November	01.11/30.11	30	8.645	21.0	0.9	1.603	1154
<b>Total</b>							11089

### Power Plant Distribution Facilities

Power plants must be connected to the power grid via overhead lines.

The station switchgear will be closed. A 35 kV output overhead line is envisaged for the design of the station distribution facility.

The construction of high-voltage overhead lines and their connection to the distribution facility is not the responsibility of the investor. The connection scheme and relevant parameters will be specified in next steps.

Required interface protocol, security concept, etc. must comply with the requirements of Azereneji OJSC (Transmission System Operator / TSO).

## **5. Design Criteria**

Small hydropower plants (Small HPPs) must be designed, manufactured, and constructed for 100% operation in the future environment, as well as for thorough and uninterrupted operation in partial load modes.

Small hydropower plants should use new, unused components and systems approved by the project..

The small hydropower plant must be built in accordance with relevant, internationally accepted standards, as well as all existing local norms and standards.

The design process will take into account European environmental legislation and local environmental legislation (whichever is stricter).

Electricity generated under the Power Purchase Agreement (PPA) will be procured for the first 20 years of the project by the government. In accordance with the agreement reached in the next period, a new PPA can be signed or the generated electricity can be sold on the open market.

## **6. Operating Modes of the Power Plants**

Small hydropower plants should be designed for flexible operation during possible daily and seasonal changes in water availability.

Power plants shall also be capable of continuous partial load operation in the range of 0% to 100%..

Possibility for participation in the primary frequency control shall be provided.