



Presentation to IENE

November 2010

General Information

Elpedison Power S.A. (formerly named T-Power S.A.) is a company jointly established by the groups of EDISON (Italy) HELLENIC PETROLEUM, ELLAKTOR and HALCOR, which represent distinguished groups of companies being leaders in their fields of activation, with a remarkable financial strength and know-how that enables Elpedison Power S.A. to develop, finance, construct and operate large scale Power generation Plants.

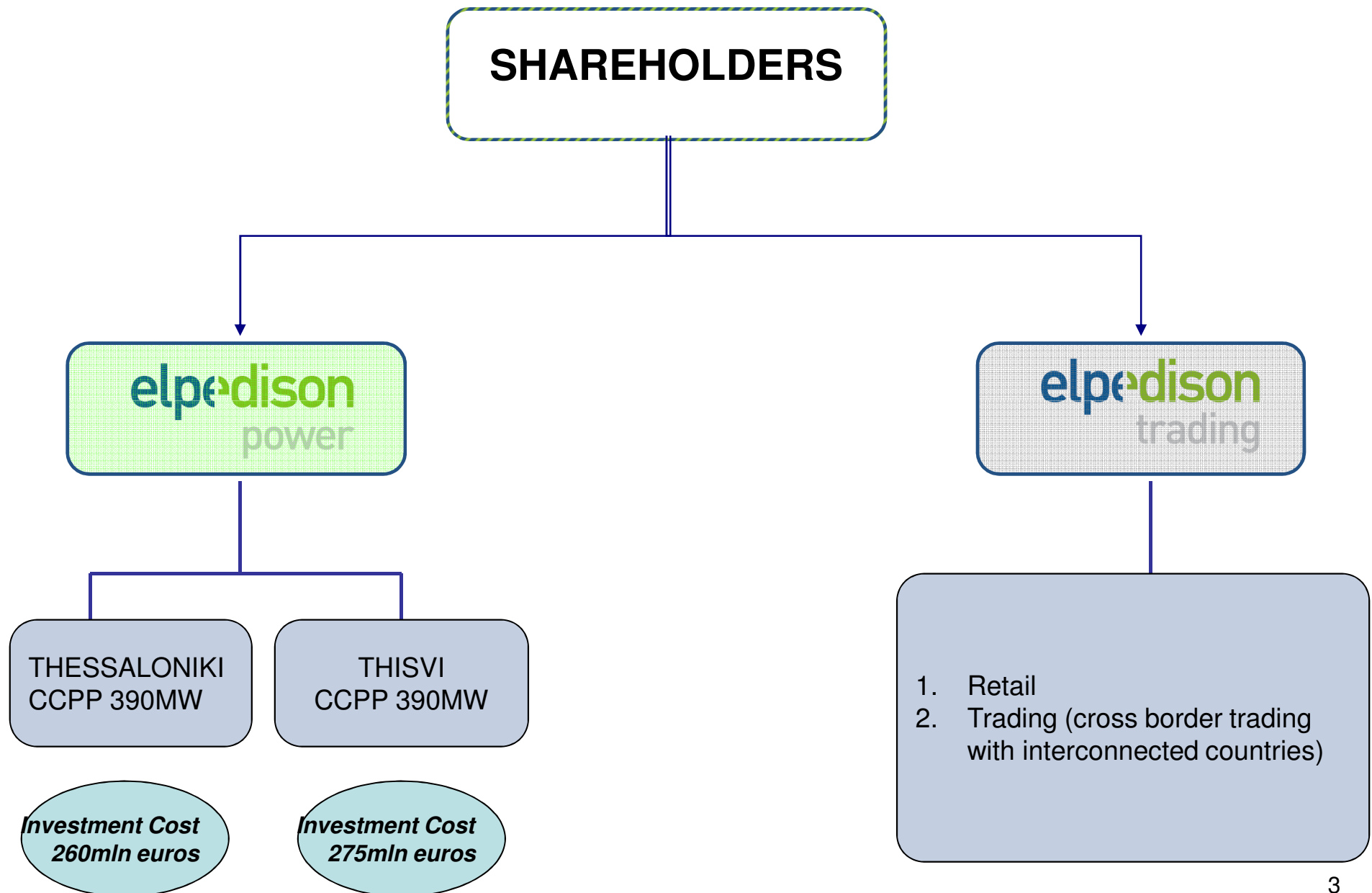
Elpedison Power S.A. already possesses and operates **Thessaloniki** CCGT Power Plant since 2006. T-Power is the first independent producer of electrical energy in Greece with an installed capacity of approximately 390 MW. The Power Plant uses the proven Combined Cycle Gas Turbine technology, it uses natural gas as fuel, and also implements innovative technology in the areas of control and production automation.

Additionally the company has finalized the commissioning of **Thisvi** CCGT Power Plant in the Industrial Zone of Thisvi, in Viotia Prefecture. The Power Plant has an installed capacity of approximately 420 MW and use the CCGT technology . The commencement of commercial operation of the Plant is planned for December 2010.

General Information

- The total investment cost of both power plants had reached the amount of 500mln euros around
- Thessaloniki plant was in operational since 2005 (December) and Thisvi's plant COD is expected within December 2010
- Headcount: 62
 - HQ: 7
 - Thessaloniki: 33
 - Thisvi: 22

General Information



Thessaloniki Power Plant 390MW



CC Power Plant Details & Description: Gas Turbine and Generator

- The primary energy source for power generation is a single 250 MW GE 9FA Gas Turbine normally fired on natural gas, but also with the capability of burning diesel.
- The power output shaft is solidly coupled to a hydrogen cooled generator rated at 50 Hz / 15.75 kV / 324 MVA / 0.85 pf.
- Power output from the generator is routed to the common generator step-up transformer.
- The turbine and the generator are fully enclosed within acoustic enclosures with CO₂ gas flood protection, forced ventilation and gas and heat detection systems.

Gas Turbine and Generator



CC Power Plant Details & Description: Heat Recovery Steam Generator

- The gas turbine exhausts into a triple pressure, vertical gas flow, heat recovery steam generator manufactured by CMI.
- There is no exhaust gas bypass facility but the steam turbine can be bypassed to the condenser for short periods during start up, thus simple cycle operation is not possible.

Steam Conditions:

		Temp °C	Pressure Bar	Flow
tn/hr				
	HP	566.7	124.51	272.5
	IP	566.7	26.10	319.0
	LP	277.2	4.60	337.0

CC Power Plant Details & Description: Steam Turbine and Generator

- Steam, generated in the HRSG, is supplied to a separate, 3 stage 140MW steam turbine manufactured by Franco Tossi. Steam from LP stage exhausts to a twin pass condenser. Condenser has titanium tubes and is fitted with a circulating ball tube cleaning system.
- The steam turbine is solidly coupled to an air cooled generator rated at 50Hz/15kV/166MVA/0.85pF.

CC Power Plant Details & Description: Transformer and Electric System

- The output from both generators is connected to a common 3 winding, oil filled, step-up transformer manufactured by ELIN.
- The transformer steps up the generated voltage to 400 kV and is rated at 460/295/165MVA.
- The transformer is equipped with a water deluge protection system.

Transformer and Electric System



CC Power Plant Details & Description: Cooling Water System

- Cooling water system consists of a 10 cell forced draught cooling tower and 3 vertical pumps that circulate cooling water to the condenser.
- Sea water is used as make-up at a rate of 1450 m³/h. 1200 m³/h is required to replace salinity control blow-down and 250 m³/h to replace evaporative loss.
- An on-shore pump station located 7.5 km from the power plant supplies sea water to the cooling system through a 600 mm GRP intake line. Blow-down is returned to the sea through a 600 mm outfall line.

CC Power Plant Details & Description: Water Treatment System

- A vapor compression sea water desalination plant produces distilled water.
- Distilled water is used as service water, fire fighting water and feed to the water treatment plant that produces boiler make-up water.
- Water treatment plant is a conventional anion / cation mixed bed exchanger system with acidic and caustic regeneration systems.

CC Power Plant Details & Description: Fuel Supplies

- Natural gas is taken from the national gas grid which is owned and operate by DEPA.
- The metering station located at the power plant, consists of two x 100% duty metering trains. Each train includes filter-separator, heater, pressure regulator, turbine meter and on line gas chromatography system.
- The plant has also the capability to operate on liquid fuel (diesel).

CC Power Plant Details & Description: Cable Connection to the 400 KV grid

- Electrical power, at 400kV, is exported from the on site switch yard to the national power grid 4,5 km away, via 3 underground XLPE cables laid in PVC cable ducts
- The 400 kV XLPE cable system is the first cable system ever installed in Greece, and it proved to be a challenging project due to the innovative technology applied
- The underground cable system was designed and installed by ABB-SUEDKABEL

Thisvi Power Plant 420MW



Thisvi Power Plant 420MW



CC Power Plant Details & Description: Gas Turbine and Generator

- The primary energy source for power generation is a single 275 MW Ansaldo Energia type 94.3A4 Gas Turbine normally fired on natural gas, but also with the capability of burning diesel.
- The power output shaft is solidly coupled to an Ansaldo type TRY-L56 air cooled generator rated at 50 Hz / 18 kV / 325 MVA / 0.85 pf.
- Power output from the generator is routed to a dedicated step-up transformer(T2) manufacturer by Tamini, rated 340MVA at 15°C ambient.
- The turbine and the generator are fully enclosed within acoustic enclosures with CO₂ gas flood protection, forced ventilation and gas and heat detection systems.

CC Power Plant Details & Description: Heat Recovery Steam Generator

- The gas turbine exhausts into a triple pressure, horizontal gas flow and natural circulation, heat recovery steam generator (HRSG) manufactured by Nooter Eriksen.
- HRSG is equipped with hot/cold reheat circuit and with two element post firing burner, using natural gas to increase the plant output of 14MW, at 15°C ambient temperature.
- There is no exhaust gas bypass facility but there are 3 by-pass station, which allow to by-pass 100% the steam turbine. This protects the gas turbine by tripping if steam turbines trips.

Steam Conditions:

	Temp °C	Pressure Bar	Flow tn/hr
HP	568	135.8	283.6
CRH	369.9	34.5	276.6
IP	306.5	34.5	56.1
HRH	568	32.9	336.2
LP	300	4.63	45.9

CC Power Plant Details & Description: Steam Turbine – Generator and Air Cooled Condenser

- Steam, generated in the HRSG, is supplied to a separate, 3 stage 145MW steam turbine manufactured by Ansaldo Energia, type RH-TCSF 43.
- Steam from LP exhaust pass to an air cooled condenser (ACC), by GEA Energie-technik GmbH. Condenser is equipped with 21 cell, in an arrangement of 3 row. ACC is equipped also with an external tube cleaning system.
- The steam turbine is solidly coupled to an Ansaldo type WY21Z-092 air cooled generator rated at 50Hz /16kV /192MVA /0.85pF.
- Power output from the generator is routed to a dedicated step-up transformer(T1) manufacturer by Tamini, rated 190MVA at 15°C ambient.

CC Power Plant Details & Description: Transformer and Electric System

- The transformers (T1 and T2) step up the generated voltages to 400 kV.
- Each transformer is connected with independent over head lines to the PPC substation.
- Both transformers are equipped with a water deluge fire protection system.

CC Power Plant Details & Description: Closed Cooling Water System

- Closed cooling water system consists of a 14 cell forced air cooling tower, 2 main pumps and an emergency DC pump for circulating cooling water to users.
- Tower is arranged in two rows, each of 7 fans in row

CC Power Plant Details & Description: Water Treatment System

- Water from Mornos channel feeds the plant for its needs. First treatment is done by passing through sand filters.
- Demineralization plant consist of 2x100% production lines with capacity of 10m³/h. Each consists of a cation tower, de-carbonization tower , anion tower, mix bed and final ultra filtration system.

CC Power Plant Details & Description: Fuel Supplies

- Natural gas is taken from the national gas grid which is owned and operate by DEPA.
- Plant gas station consists of double filtering lines, single metering station, and double pressure regulation lines for gas turbine and aux.boiler.
- A gas chromatograph system is installed after the pressure reduction station and before the gas turbine.
- The plant has also the capability to operate on liquid fuel (diesel), using propane as ignition gas.

CC Power Plant Details & Description: Cable Connection to the 400 KV grid

- Electrical power, at 400kV, is exported through the on site switch yard to the national power grid. Plant switchyard is a tie-in tie-out configuration.
- A power line has been constructed for the purpose to extend the grid network and reach Thisvi substation. Total number of towers are 65.