SNC000057

Overview of Units

Referenced in JTI000038

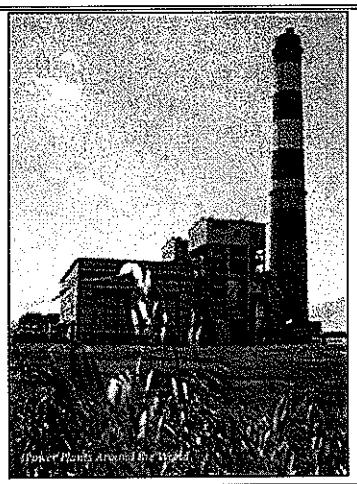
Overview of Units Described in Exhibit JTI000038

Name	Unit Capacity	Number of Units	Total Capacity[1]
Shahid Rajai TPP	250 MW	4 units	1000 MW
Old Razdan PS[2] 200 MW 210 MW		 3 units 1 unit	800 MW
Razdan Extension	300 MW	1 unit	620 MW
Al Zara	200 MW	3 units	660 MW
Gebze-Adapazari Gebze Adapazari	 700 MW 700 MW	 2 units 1 unit	2335 MW
Újpest	150 MW	1 unit	150 MW
Matra	100 MW 212 MW	2 units 3 units	800 MW
Can	160 MW	2 units	320 MW

[1] Total Capacity based on JTI000038.

[2] Also known as Hrazdan or Razdanskaya TPP. Facilities in the non-block part of the facility are not included in this table: two co-generation turbines with a capacity of 50 MW each and two T-100-130 turbines with a capacity of 100 MW each.

Gas- and Oil-Fired Plants in Iran

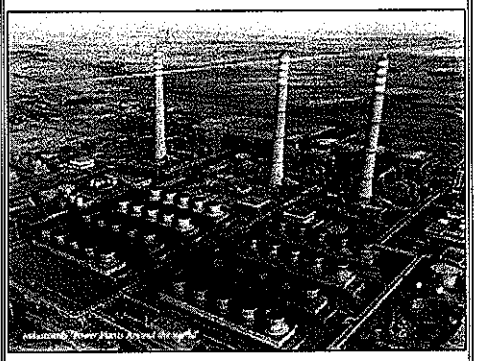


Bistoun
Location: Kermanshah
Operator: Bistoun Power Generation Management Co
Configuration: 2 X 320 MW
Operation: 1994-1995
Fuel: natural gas, heavy fuel oil
Boiler supplier: Tosi
T/G supplier: Tosi, Ansaldo
EPC: Ghods Niroo, Ansaldo
Quick facts: Two more units are planned for service in 2013.

Photograph courtesy of Bistoun PGMC
Posted 10 Jan 2006

Iranshahr
Location: Sistan & Baluchestan
Operator: Iranshahr Power Generation Management Co
Configuration: 4 X 64 MW
Operation: 1997-2004
Fuel: light fuel oil, heavy fuel oil
Boiler supplier: Brno
T/G supplier: Skoda
EPC: Moshanir, Pilecar Group-Harrison, Azarab
Quick facts: In Jun 2004, the four unit at Iranshahr power plant was commissioned. The project originated in 1989 when PBS signed the main equipment supply contract and worked with Ceska Exportni Banka to arrange financing. This plant has air cooling.

Photograph courtesy of Azarab Energy
Posted 9 Nov 2008



Ramin
Location: Khuzestan
Operator: Ahwaz Power Generation Management Co
Configuration: 6 X 315 MW
Operation: 1977-2002
Fuel: natural gas, oil
Boiler supplier: Taganrog
T/G supplier: LMZ, Electrosila
Quick facts: Ramin is in Ahvaz, the capital city of Khuzestan.

Photograph courtesy of Khuzestan Water & Power Auth
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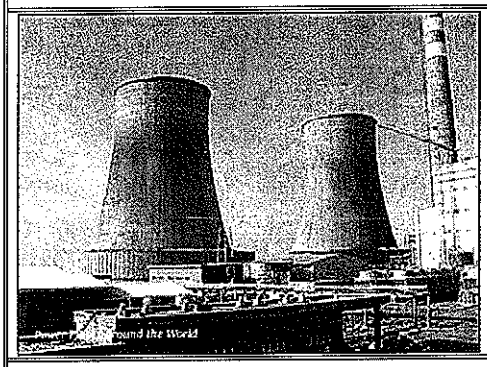
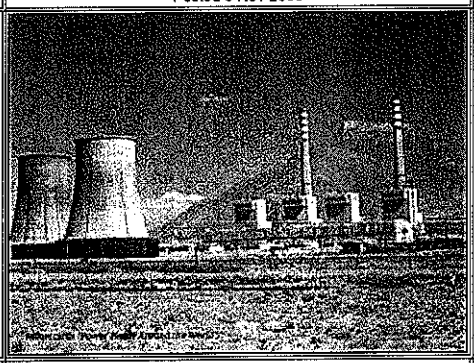
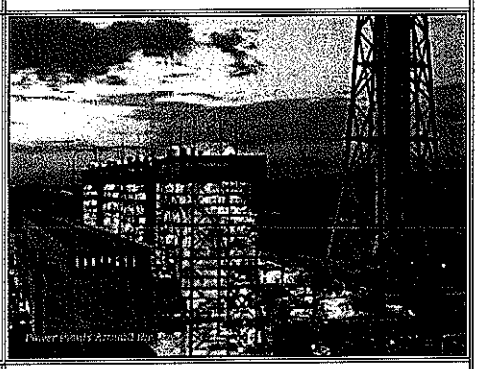


Sahand
Location: East Azarbayjan
Operator: Tavanir
Configuration: 2 X 325 MW
Operation: 2004-2005
Fuel: oil, natural gas, residual oil
Boiler supplier: Shanghai
T/G supplier: Shanghai
EPC: Mapna
Quick facts: The first unit was synchronized within 55 months from site mobilization.

Photograph courtesy of Mapna



Shazand (Arak)
Location: Markazi
Operator: Shazand Electricity Production Management Co
Configuration: 4 X 325 MW
Operation: 2000-2002
Fuel: heavy oil, natural gas
Boiler supplier: Dongfang
T/G supplier: Dongfang
EPC: Ghods Niroo, Mapna, Southwest Electric Power Design Institute
Quick facts: Construction was approved in Nov 1994. The plant is connected at 230kV to the grid of Western Regional Electricity Co. The dry cooling Heller towers are 130m tall. Heavy oil is supplied by pipeline from the nearby Shazand Refinery. Auxiliary boilers are used to preheat the heavy



Shahid Rajaee
Location: Tehran
Operator: Ravanir
Configuration: 4 X 250 MW
Operation: 1992-1994
Fuel: natural gas, heavy oil
Boiler supplier: IHI, Azab
T/G supplier: MHI, Melco
EPC: Ghods Niroos, Daelim, Monenco Iran
Quick facts: Thhis site is 100km west of Tehran city in Qazvin. It is connected to the 400kV grid. The steel chimney structure is 220m high.

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Gazprom takes control in ArmRosgaz

Gazprom and the Armenian government have signed a 25-year-term agreement, which defines a strategic cooperation in gas-energy projects in the territory of the Republic of Armenia. Gazprom takes control over all gas pipeline projects of the country. In return, Armenia will get the guaranteed volume of gas supply for the next 25 years and a fixed gas price of $110 per 1,000 m3 for the next three years.

Gazprom is to increase its share in ArmRosgaz, the joint venture controlling all gas transportation in Armenia, from 45 to 82 percent. The Armenian government is currently holding 45 percent in the company and 10 percent is owned by Itera. Under the agreement, Gazprom will bring funds to the Armenian budget which will make up for the price hike for local consumers.

ArmRosgaz acquires Armenian government's 40-kilometer-long Iran-Armenia pipeline, which is under construction now, and 5th energy unit of Hrazdan Thermal Power Plant (TPP), Hrazdan–5. ArmRosgaz is also in charge of the construction of second section of the 197-kilometer-long Iran-Armenia pipeline. Preliminary agreements of buying-selling must be concluded till 12 April 2006, and final owner right will be transferred till January 1, 2007.

Gazprom renewed gas supply to Armenia in June 2003, and it is now the country's single gas supplier. OOO Gazexport (100% daughter enterprise of OAO Gazprom) supplies gas till Armenian border, and at the border ZAO ArmRosgazprom buys the gas. Gazprom supplied for Armenian consumers 1.7 billion m3 in 2005.

Hrazdan TPP is biggest thermoelectric power station in Armenian energy complex. Hrazdan TPP's capacity is 1100 MW, up to 800 MW of which are used during winter peak time. The ownership of TPP was transferred to Russia to pay off a state debt of Republic of Armenia. In order to attract investments for modernization of Armenian power engineering, the republican government declared its intention in 2004 to sell unfinished 5th energy unit of Hrazdan TPP of 300 MW.

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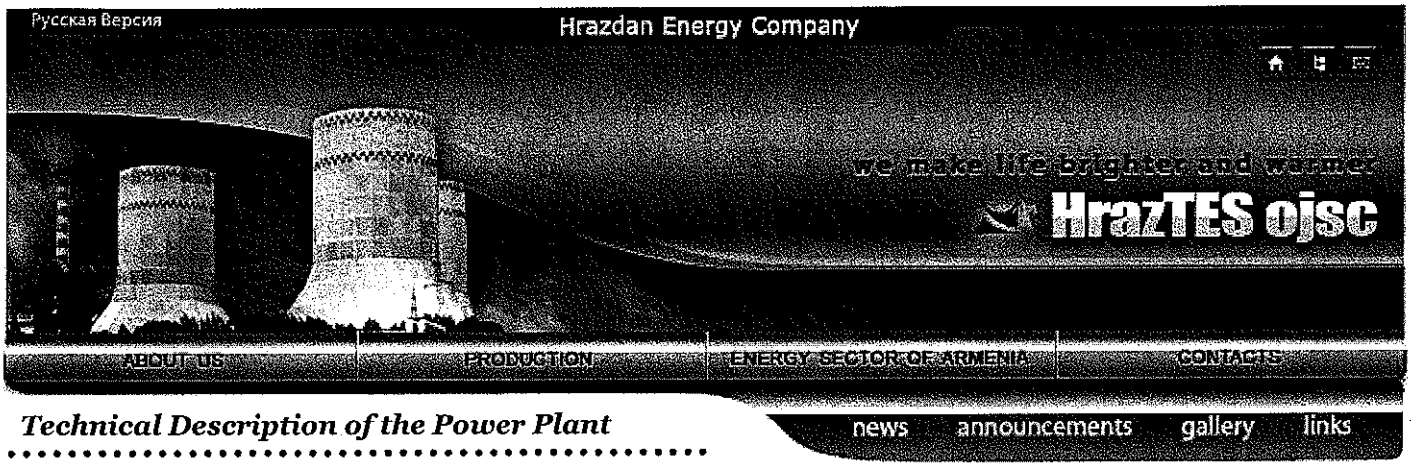

Technical Description of the Power Plant

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In the non-block part of the power plant there are five gas and oil boilers of the model BKZ-320-140 GM, each with an output capacity of 321 t/h. They feed two co-generation turbines (model PT-50-130/7) each with a capacity of 50 MW and two other T-100-130 turbines, each with a 100 MW capacity. There are six feed pumps and a cooling system of condensers with five evaporative cooling towers.

In the blocks of the plant there are four power generating units with a total capacity of 810 MW (the gross capacity of power generating unit No 4 is 210 MW). The power generating units are comprised of gas and oil boilers of the type TFM-104C with an output capacity of 670 t/h and K-200-130 turbines. Turbo-generators of the TGV-200-2MUZ (Block No. 1) and TGV-200M (Blocks No. 2, 3, 4) types with 15.75 kV of voltage are connected to the 220 kV voltage circuit with the help of TDC-250000/220 transformers with an output capacity of 250,000 kVA.

For cooling the condensers in the four blocks, the air-condensing specifications of the HELLER System are used, which were developed in Hungry. They exclude the possibility of water loss connected with evaporation and give an opportunity to use less natural water. The air-condensing settings of the Heller System have closed water circuit.

Circulating water, which heats up in the condensers, cools off in aluminum heat exchangers, which are located along the perimeter of the cooling tower. The supply of cooling air in towers No. 1, 2, 3 and 4 is done through natural draft/traction of the 120 meter-high towers. The use of chemically desalinated water in the closed circuit of cooling allows for using mixing condensers instead of surface condensers. The first is more economical, since it has a minor temperature pressure of about 0.5 °C and does not require frequent cleansing and renovation.

Before 1993 the major type of fuel for the Hrazdan Thermal Power Plant was oil (mazut) and gas was used as a reserve. However, since 1993 the primary fuel has been natural gas and oil has become a reserve fuel. The supply of gas is carried out through a gas distributing station and gas grid. From the gas grid the gas is distributed to gas control points at the station blocks and non-block sections and further to the boilers.

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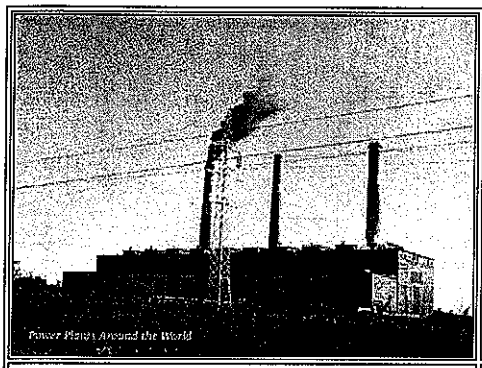
Coal- and Lignite-Fired Plants in Hungary



Borsod
Location: Hungary
Operator: AES-Tisza Eromu Kft
Configuration: 4 X 30 MW, 1 X 4 MW, 1 X 12.5 MW, 1 X 21 MW, 1 X 5 MW, 1 X 10 MW
Fuel: brown coal, wood
Operation: 1955-1968
Boiler supplier: Borsig, Ganz
T/G supplier: Ganz, Lang
Quick facts: The first phase of this CHP plant was built from 1951-1957. Starting in 2002, one of the boilers was modified for firing wood and other biomass and eventually, two boilers were retrofit with CFB equipment for 100% biomass consumption. The remaining sets were taken out of service in 2003 with the expiration of power and heat supply contracts with Kazincbarcika city and nearby industrial concerns. A pair of 250-MW CFB units are planned for operation in 2011.

Photograph by Andrzej Grudzien and courtesy of www.elektrownie.ovh.org
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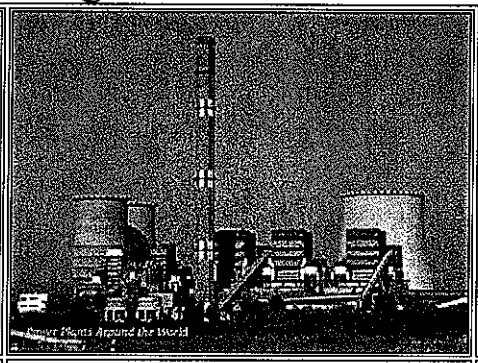
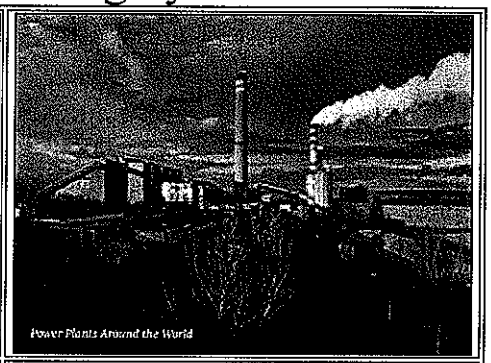


Matra
Location: Hungary
Operator: Matra Kraftwerk
Configuration: 2 X 100 MW, 3 X 212 MW
Fuel: lignite
Operation: 1978-1980
Boiler supplier: Danubius
T/G supplier: Lang, LMZ, Ganz
Quick facts: In 2002, the 212-MW units were retrofit with wet limestone FGD systems from Babcock Borsig. Units 1, 2 4 & 5 have Heller-type dry cooling systems while Unit-3 uses conventional natural draft towers. The addition of 29-MW Hitachi topping gas turbines is planned for two of the larger sets.

Photograph courtesy of ostkohle
Posted 2 Sep 2005



Oroszlany
Location: Hungary
Operator: Vertesi Eromu Rt
Configuration: 4 X 65 MW
Fuel: lignite
Operation: 1961-1963
Boiler supplier: Rafako
T/G supplier: Skoda, Ganz
Quick facts: Vertesi Eromu was formed in Jan 1992 and is owned by state power company MVM. Fuel for Vertesi's two plants is from mines in the Oroszlany and Tatabanya regions including Markushegy, Hungary's largest and most modern underground mine. The mines became part of Vertesi Eromu in 1994. In 2004, Oroszlany was retrofit with a Lurgi FGD scrubber.

Photograph courtesy of Vertesei Eromu Rt
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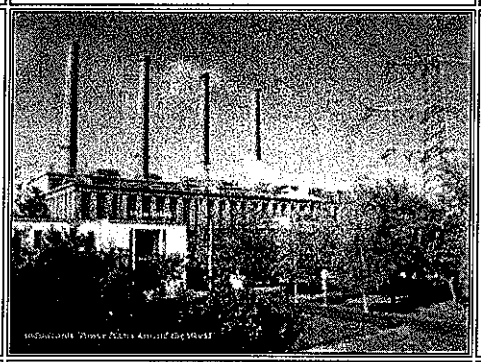

Tiszapalkonya
Location: Hungary
Operator: AES-Tisza Eromu Kft
Configuration: 3 X 55 MW, 1 X 15 MW, 1 X 13 MW, 1 X 7 MW
Fuel: lignite
Operation: 1954-1980
Boiler supplier: ??
T/G supplier: Ganz, Lang, Skoda

Photograph courtesy of Tiszai Eromu Rt
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Start-up challenge

Start-up during 2002 of the Gebze, Adapazari and Izmir combined cycle power plants in Turkey revealed over-pressure at the boiler feedwater pump discharge. The over-pressure was caused by grid over-frequency and cold water used at start-up and required an innovative solution to ensure that the plants could continue to operate reliably.

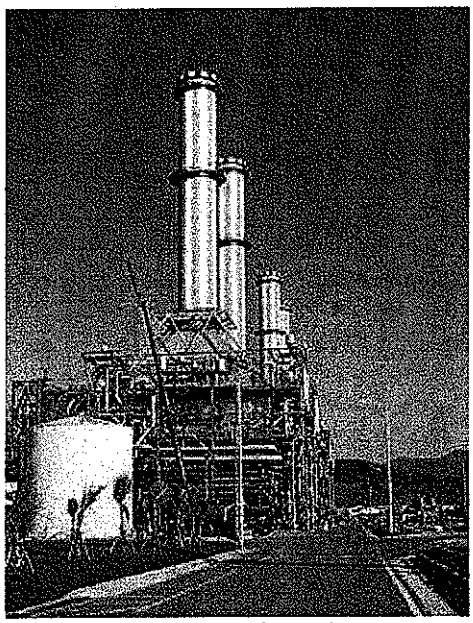
S.Zaheer Akhtar, Bechtel Power Corp., USA

During 2002, three gas turbine combined cycle plants together rated for a total of 3850 MW were commissioned in Turkey at the Gebze, Adapazari and Izmir sites by the Intergen-ENKA partnership. The plants are based on 770 MW power blocks each featuring two 9FA gas turbines, two vertical heat recovery steam generators (HRSGs) and one 260 MW steam turbine. The Gebze and Izmir plants consist of two power blocks each whereas the Adapazari plant consists of one power block.

The Izmir plant is located near the coast which enables the use of wet cooling towers with sea water as the cooling medium. The Gebze and Adapazari plants are located inland in an arid region and use indirect dry cooling towers also known as the Heller technology system.

During start-up of these plants, over-pressure at the boiler feedwater (BFW) pump discharge was noticed when the piping relief valves lifted. The over-pressure was caused by the combination of:

- Over-frequency at power grid which supplied power to the plant motors
- Cold water used at start-up to fill the boiler drums and piping.



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Overview of the vertical heat recovery steam generators and stacks at the Izmir combined cycle plant site in Turkey

Feedwater pumps

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Turkey needs $4.5 bn per annum until 2010 for new generating capacity, the maintenance of existing plants and efforts to stop illegal usage. Most of the money will have to be invested by the private sector, including foreign companies. The Energy Ministry has launched over 15 tenders for about 170 new power projects since 1996. In July 1997, after long delays, parliament passed a new BOO law to overcome legal obstacles to IPPs. This paved the way for five BOO ventures with a total capacity of 5,200 MW, to cost about $4.6 bn, to be awarded by the Energy Ministry. Of these, four are gas-fired plants to be built in Ankara (700 MW), Adapazari (700 MW), Gebze (2x700 MW) and Izmir (1,400 MW). These will require 4 BCM/year of gas when they start up by 2001/02. Another 5,850 MW BOT ventures will need a further 4.5 BCM/year by 2002/04.

A breakthrough came on Aug. 13, 1999 as parliament approved long-awaited amendments to the constitution clearing the way for privatisations and allowing foreign investors to seek international arbitration in disputes. That was four days before an earthquake in north-western Turkey killed tens of thousands of people. But IPP investors again had to await a new national energy policy and lengthy procedures to modify contracts for generation and distribution. The amendments went into effect on Jan. 21.

The new energy policy gives top priority to a BOO model under which power plants remain in private hands, second priority to BOT projects which are to revert to the state, and third priority to transfer of operating rights (TOR) for Teas-owned plants and distribution networks to private operators. Planned for years to ensure new generating capacity matches energy needs, the policy calls for 55 bn kWh to be on stream by 2005, far less than forecast previously, with BOO plants to provide 48 bn KWh. Contracted BOO plants account for 39 bn kWh, which means up to 1,600 MW of additional BOO capacity should be tendered. Would-be financiers for 14 BOT ventures were encouraged by the development, but more than 100 less advanced BOT projects may face minimal returns in the short term.

Previously, legal disputes over the BOO and BOT ventures had stalled the process. The main argument

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