Contractors:

Boiler set
– Foster Wheeler Polska and Foster Wheeler Energia OY consortium

Turbine set
– Alstom Power

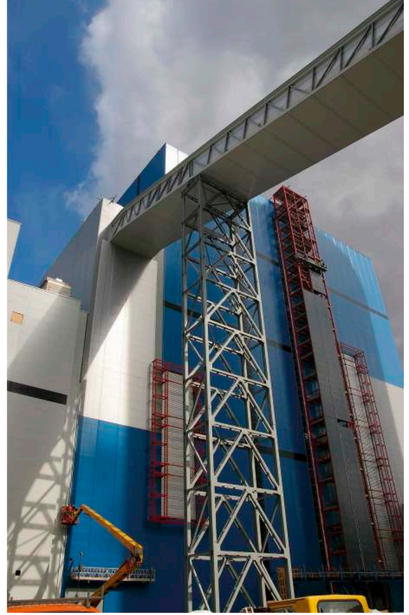
Electric set
– Elektrobudowa S.A. Katowice

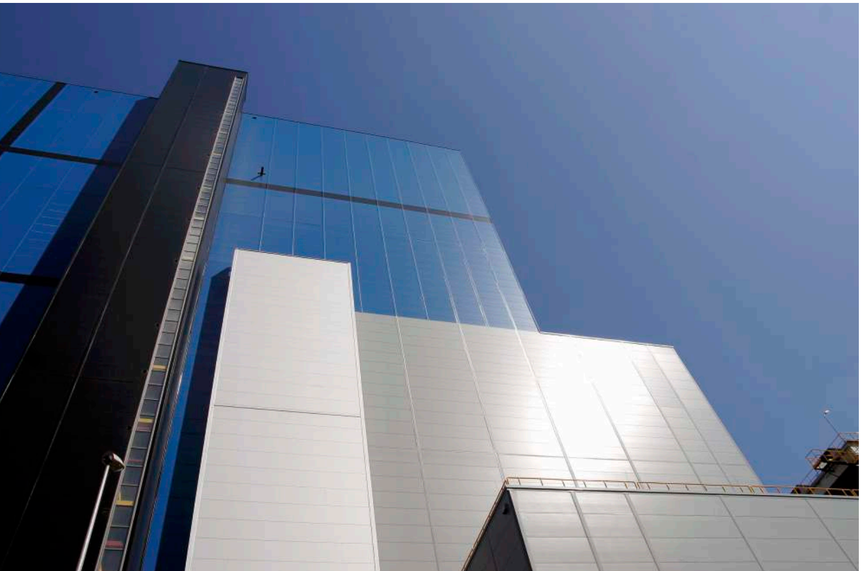
Deashing and sorbent systems
– Mostostal Kraków and Energo – Eko-System Katowice consortium

Coal-feed system
– Cieplo – Serwis Będzin and PURE Jaworzno consortium

Primary automation system
– Metso Automation Finlandia and Metso Automation Polska consortium

- 460 MW_e power unit operates in TAURON Wytwarzanie Spółka Akcyjna Division Łagisza Power Plant in Będzin and is the cutting edge generation unit of the type operated by TAURON Wytwarzanie S.A.
- Three other generation units 120 MW each are in operation in Łagisza Power Plant in a classical line-up with pulverized-coal boilers and desulphurizing installation applying the semi-dry Drypac technology.
- In line with TAURON Wytwarzanie S.A. repowering investment program, these power units are to be replaced with state-of-the-art generation units inclusive of 400 MW_e combined cycle cogeneration power unit.





Interesting facts...

- Coal is fed into the boiler in the form of circa 1 cm diameter lumps. About four thousand tons of coal is fed into the boiler by means of 14 screw feeders and consumed every 24 hours (on average 40 – 50 kg/s).
- Fluidized-bed weighs circa 300 tons and is composed of fuel mix, ashes, sand, sorbents and desulphurizing products.
- Fluidized-bed boilers do not require auxiliary infrastructure in the form of flue gas desulphurizing installation and nitrogen oxides (NO_x) reduction installation as the lime sorbent fed into the bed fixes the sulphur already inside the bed and the relatively low combustion temperature results in less nitrogen compounds than in a classic pulverized-coal boiler.
- The power unit is characterized by significant output range from 184 MW_e to 460 MW_e.
- Circa 15,000 parameters are under constant control during the unit operation.
- Flue gases are ejected through the cooling tower and introduced into higher layers of the atmosphere and are rarefied to a larger extent compared to a traditional emitter (smokestack).

For further information please go to:

www.tauron-pe.pl

www.tauron-wytwarzanie.pl

publications of TAURON Polska Energia S.A.,
TAURON Wytwarzanie S.A. and TAURON Group.

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ENERGY • ECOLOGY • ECONOMY

460 MW_e Power Unit with Circulating Fluidized-Bed Boiler with Supercritical Parameters

First in the World

TAURON WYTWARZANIE

First in the World

Decision concerning the construction of the 460 MW_e power unit equipped with circulating fluidized-bed boiler (CFB boiler) with supercritical parameters was made back in 2001 within the repowering program framework. The power unit replaced five small units put out of operation (3 x 120 MW_e and 2 x 50 MW_e) significantly increasing the generation efficiency and cutting down total dust and gas emissions – the effect of which was lower environmental and social burden and additionally improved economic efficiency.

Selection of the circulating fluidized-bed boiler was made based on the recommendations put forward by expert teams comprising of, among others: Prof. T. Chmielniak, D.Engr. M. Pronobis (Silesian Technical University), Prof. W. Gajewski, Prof. W. Nowak, D.Engr. Z. Bis (Technical University of Czestochowa), Prof. W. Rybak (Technical University of Wroclaw), D.Engr. T. Golec (Silesian Technical University) and the experts from Energoprojekt Katowice and Południowy Koncern Energetyczny S.A.

- CFB technology is recommended in EU reference materials for large combustion plants as it meets BAT requirements (Best Available Technology) concerning high efficiency, ecological cleanliness, energy and fuel consumption rationalization.
- Research on hard coal combustion in fluidized beds at oxygen-enriched atmosphere was carried out as part of the EU Seventh Framework Program in the field of power industry lasting from 2009 to 2011 within the project framework entitled 'Development of High efficiency CFB Technology to Provide Flexible Air/Oxy Operation for Power Plant with CCS'.
- Łagisza Power unit was listed by IEA (the International Energy Agency) as the model reference unit.

(*) Similar units are currently under construction in South Korea (4 x 500 MW_e).

Power Unit Description

CFB boiler for Łagisza power unit was designed and constructed by Foster Wheeler Energy Polska and Foster Wheeler Energia OY consortium.

Application of vertical Benson tubing and SIEMENS supercritical steam flow technology resulted in the expected steady operation of the boiler at variable load conditions.

Boiler efficiency was additionally increased by means of the application of flue gas heat recovery system (flue gases are ejected via the cooling tower)

The applied solutions resulted in a boiler characterized by significant fuel flexibility (coal mix, slack), low combustion chamber temperature which in turn enabled the elimination of numerous burdensome phenomena (e.g. screen tube slagging, high-temperature corrosion) and brought forward the required low emissions of SO_2, NO_x and dust.

The entire investment project was also considerably less expensive (by 15%) compared to a classical pulverized-coal boiler – flue gas desulphurizing installation solution.

The turbine unit consists of the reaction turbine 28K460 and the generator 50WT23E-104 supplied by Alstom Power. Major advantages of the applied solution are: compact construction (only 5 support bearings), helical steam supply system, high-performance flow system equipped with 3D vanes, low heat consumption per unit (less than 7500kJ/kWh), and electro hydraulic turbine control system with the power forcing system in accordance with UCTE terms.

Cooling Stack (height 133.2 m) fulfills its standard role yet it is also used to ejest flue gases into the atmosphere. Such a solution brought about lower investment cost (there was no need to erect a smokestack) as well as better conditions for the flue gas out-flow.

Power Take off is carried out by means of lines: 400 kV Łagisza – Tucznawa and Łagisza – Rokitnica.

Auxiliary infrastructure was constructed with main elements of the power unit or in some cases existent facilities underwent relevant adjustments and retrofitting (e.g. coal feeders, water treatment plant) on the power plant premises after the obsolete infrastructure had been pulled down (cooling tower).

Basic parameters

Power unit electrical output – 460 MW_e

Gross generation efficiency – 45%

Steam flow – 361 kg/s

Steam pressure on the turbine inlet – 27.5 MPa

Primary steam temperature on the turbine inlet – 560 °C

Secondary steam temperature on the turbine inlet – 580 °C

Emissions:

Dust – 0.09 kg/MW (< 30 mg/Nm^3)

SO_2 – 0.6 kg/MW (< 200 mg/Nm^3)

NO_x - 0.6 kg/MW (< 200 mg/Nm^3)

Major events

Final decision concerning the construction, design commencement
– September 2001

Construction permit
– September 2004

Handing over of the construction site to the contractors
– January 2006

Boiler water test
– February 2008

Feeding steam to the turbine, first synchronization
– February 2009

Test run – May 12
– June 26, 2009

Power unit commissioning
– June 27, 2009