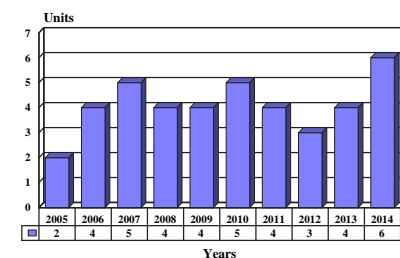


Babcock-Hitachi Europe Steam Turbines - Archived 4/2006

Outlook

- Activity is on combined-cycle power plants especially for 50 MW and larger steam turbines
- Moderate number of power generation installations in Asia should create a popular base for combined-cycle plants in that region; Africa and the Middle East expected to become important marketing targets, but Europe will continue to be top priority
- Full takeover by Hitachi could lead to increased sales in Asia

10 Year Unit Production Forecast
2005 - 2014



Orientation

Description. The steam turbine product line of Babcock-Hitachi Europe GmbH (BHE) (formerly Babcock Borsig Power GmbH) includes backpressure steam turbines, extraction backpressure steam turbines, condensing steam turbines, and extraction condensing steam turbines. The steam turbines are in the output range of 3 to 210 MW.

Sponsor. The BHE line of steam turbines was developed by the prime contractor, as identified in the **Contractors** section below.

Power Class. BHE manufactures steam turbines with a power output in the range of 3 to 70 MW. It should be noted that for industrial plants, BHE identifies the machines' power output for simple-cycle and combined-cycle processes as being up to 210 MW.

Status. In production.

Total Produced. As of the start of 2005, BHE is estimated to have produced over 650 steam turbines for

industrial/utility applications, including combined-cycle power plants. At least 12 steam turbines had been manufactured for combined-cycle installation (*excluding* two units under 10 MW).

Application. BHE steam turbines have found applications in such industries as the paper and pulp industry, the chemical industry, district heating power plants, waste-to-energy plants, and combined-cycle power plants.

Price Range. BHE has not provided pricing information for its steam turbines, choosing to discuss pricing directly with customers.

Competition. With steam turbine machines for combined-cycle installations in the range 3 to 70 MW, steam turbine machines from several manufacturers worldwide compete with the BHE line of steam turbines.

Contractors

Babcock-Hitachi Europe GmbH, <http://www.babcock-hitachi.de>, Duisburger-Strasse 375, Oberhausen, 46049 Germany, Tel: 49 0 208 833 0, Fax: 49 0 208 833 1809, Prime (Steam Turbine Production)

Technical Data

Design Features

Modular System. The steam turbines are manufactured using fixed casing sections for the steam inlet,

extension, and extraction, exhaust steam backpressure, and exhaust steam. As such, a variety of adaptations can be selected to optimize performance for many applications.

Casing. In all turbines, the outer casing is horizontally split at the level of the shaft center line.

Blades and Blade Carriers. The blade system offers many variations with regard to sectional dimensions, angle to foot, mean diameter, length, and foot forms. In order to achieve maximum efficiency, blades are manufactured with or without integral shrouds; all are of a resonance-free design. Twisted rotor blades for the last stage of condensing turbines are available with double T-root or finger pin roots; cylindrical rotor

blades are available with integral shrouds and inverted T-roots. Transonic blades are inserted in the turbines' exhaust parts.

Controls. Since 1976, BHE steam turbines have been fitted with the Turboglog system, a product from the Austrian Energy & Environment (AE) division's joint development project with MAN-GHH and Voith. Turboglog is a fully electronic turbine control and protection system. To keep pace with the progress being made in electronic measurement and control technology, AE has further developed the system and has incorporated a new digital control system.

Dimensions. The overall dimensions/weights of the BHE steam turbines were not available at press time.

Performance. The BHE line of steam turbines has the following performance parameters (selected optional performance data, supplied by BHE, are provided):

	STANDARD		OPTIONAL	
	Metric Units	English Units	Metric Units	English Units
Power Output	3-70 MW	3-70 MW	3-207 MW	3-207 MW
Rated Speed Range	3000-3600 rpm	3,000-3,600 rpm		
Live Steam Pressure	90 bar	1,305 psi	140 bar	2,030 psi
Superheated Steam Temperature	510°C	950°F	540°C	1,004°F
Extraction Pressure	1-16 bar	14.5-232 psi		
Exhaust Pressure	0.05-1 bar	0.725-14.5 psi		
Back Pressure	1-16 bar	14.5-232 psi		

Variants/Upgrades

BHE fabricates backpressure steam turbines, extraction backpressure steam turbines, condensing steam turbines, and extraction condensing steam turbines. No upgrades

or variants of the four steam-turbine types have been announced in the past year. Current material lists steam turbines of 207 MW.

Program Review

Background. Babcock Borsig Power GmbH (BBP) was the name for the group that arose from the merger of five major European companies: Babcock Kraftwerkstechnik, L. & C. Steinmüller, Deutsche Babcock Anlagen, AE Energietechnik GmbH, and Noell-KRC-Energie- und Umwelttechnik. Within the international Babcock Borsig Power Group, AE Energietechnik GmbH (BBP/AE) had worldwide responsibility for steam turbines, boilers/components and systems engineering. Together with the NEM (headquartered in the Netherlands) and Vogt-NEM (in the U.S.) subsidiaries, BBP was one of the leading firms in the global market for HRSGs.

Hitachi is now the sole shareholder in Babcock Power Engineering, operating as Babcock-Hitachi Europe.

At the end of 2003, the Japanese Hitachi group took over the remaining 10 percent of the shares in Babcock

Borsig PowerSystems/Babcock Borsig Power GmbH from insolvent Babcock Borsig AG, an arrangement that had been agreed to in the spring of 2003 when the Hitachi group took over a 90-percent share in Babcock Borsig PowerSystems. The complete Hitachi takeover has been accompanied by a name change to Babcock-Hitachi Europe GmbH (BHE). With head offices in Oberhausen, Babcock-Hitachi Europe is not only the main contact address for customers from Europe, the former CIS countries, Turkey, the Middle East, India, and Africa, but also for all questions concerning power and environmental engineering in fossil fuel-fired power plants.

Production Location. The steam turbines are manufactured by BHE's entity Austrian Energy & Environment, Austrian Energy (AE Energietechnik GmbH), Vienna, Austria. BHE's steam turbines are

produced primarily by AE Energietechnik GmbH, Vienna, Austria.

BHE has been fabricating steam turbines since 1927; at that time, the company's manufacturing plant was referred to as the Paukerwerk. That plant supplied most of the leading companies in Austria with Bauart Brünn-model steam turbines until the 1940s. After 1945, the Paukerwerk was integrated into the (then) newly formed Simmering-Graz-Pauker AG (SGP) company, and SGP-designed turbines were produced for the first time.

In 1952, production of steam turbines in the 3 to 210 MW range for industry and power-supply companies was started via a license agreement with GHH. In 1992, the licensing contract with the successor to GHH, MAN-GHH, was changed into a cooperative agreement. It should be noted that in 1992, SGP-VA Energie und Umwelttechnik and Waagner-Biro Energy & Environment formed AE Energietechnik GmbH (Austrian Energy & Environment). In February 1999, VA Technologie AG, Austria's largest technology group

and owner of AE Energietechnik, and Babcock Borsig AG agreed to cooperate in the fields of conventional power stations and environmental engineering. With the exception of the Water Technologies Division of Austrian Energy (which is now VA Technologie Wabag), Austrian Energy has been integrated into Babcock Borsig Power. In return, VA Technologie AG now holds a 10-percent stake in Babcock Borsig Power.

Combined-Cycle Power Plants. BHE's combined-cycle power plants are considered to be highly economical and highly efficient. The combined-cycle plants, solely for utility use, have a power range of up to 1,360 MW and can burn gas or oil.

When standardizing combined-cycle power plants, key aspects are as follows: the concentration on plant capabilities in line with market requirements; standard plant outputs of 110, 200, and 400 MW; optimization of plant processes; short construction periods; safeguarded guarantees; and long-term cooperation with partners in the supply of key components of both gas turbines and steam turbines.

Funding

The current BHE steam turbine product line has benefited from a relationship with GHH and later MAN-GHH, and later MAN TURBO.

Recent Contracts

Note that no major identifiable military contracts pertaining to the BHE line of steam turbines have been awarded.

<u>Contractor</u>	<u>Award (in millions)</u>	<u>Date/Description</u>
ADWEA (UAE)	AED800	Jan 2001 – BHE (then BBP/AE) was part of an order for five GE GTs, eight HRSGs, and three STs for the Al Taweelah A1 P/P modernization in Abu Dhabi, UAE. Power increase is 1,000 MW. Work at Al Taweelah began in January 2001. The plant was handed over in the second quarter of 2003.
Siemens Power (Turkey)	\$157.4	Jul 2000 – Two steam turbine generators for a 1,300 MW power plant in Turkey.

Recent Activity

Hitachi Fully Acquires Babcock Borsig PowerSystems/Babcock Borsig Power GmbH. At the end of 2003, the Japanese Hitachi Group took over the remaining 10 percent of the shares in Babcock Borsig PowerSystems/Babcock Borsig Power GmbH from insolvent Babcock Borsig AG. The arrangement had been agreed to in the spring of 2003, when the Hitachi group took over a 90 percent share in Babcock Borsig PowerSystems. The complete Hitachi takeover has been accompanied by a name change to Babcock-Hitachi Europe GmbH (BHE).

Babcock-Hitachi KK Acquires Babcock Borsig Power Systems. On February 6, 2003, Babcock-Hitachi Kabushiki Kaisha (Babcock-Hitachi KK) (BHK) of Japan and Babcock Borsig AG of Germany signed an agreement allowing the acquisition of 90 percent of Babcock Borsig Power Systems GmbH (BBPS) by BHK. The transaction was finalized in the second quarter of 2003.

FISIA of Italy the New Shareholder of Babcock Borsig Power Systems. In May 2002, it was announced that FISIA Italimpianti SpA had become the first investor for Babcock Borsig Power Systems GmbH, which was established at the beginning of October 2001 with around 2,600 employees as the rescue company of Babcock Borsig AG. The

company concentrates on the core activities of technical service, power engineering, and environmental engineering. FISIA initially takes on 5 percent from Babcock Borsig AG in Babcock Borsig Power Systems, with an option on a further 19.9 percent.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1927	Steam turbine production begun
	1945	SGP formed
	1952	Steam turbine production begun under GHH license agreement
	1976	All AE Energietechnik steam turbines fitted with Turbolog system
	1992	AE Energietechnik formed
	1992	Deutsche Babcock begins manufacturing activities in UAE
	1999	Babcock Borsig Power established
	1999	First steam turbine installed in Asia
	2000	AE Energietechnik integrated into Babcock Borsig Power
Feb	2000	Babcock Borsig AG acquires privatized section of Babcock & Wilcox Española
Jul	2000	Balcke Dürr AG bundles the Babcock Borsig Group power systems
Jan	2001	DEM800 million order placed for BBP/AE equipment from Abu Dhabi
May	2002	FISIA Italmimpianti SpA becomes the first investor for Babcock Borsig Power Systems GmbH
Feb	2003	Babcock-Hitachi KK of Japan and Babcock Borsig AG of Germany sign agreement allowing the acquisition of 90 percent of Babcock Borsig Power Systems GmbH by BHK
Dec	2003	Hitachi acquires all remaining shares of Babcock Borsig Power Systems GmbH; entity renamed Babcock-Hitachi Europe GmbH
Thru	2014	Continued BHE steam turbine machine production projected

Worldwide Distribution

At of the start of 2005, more than 650 BHE steam turbines of all types had been fabricated and installed for power duty, including combined-cycle power plants. As of that time, at least 12 steam turbines of 20 MW and larger had been installed in combined-cycle power plants in **Germany, Hungary, Poland, Spain, Turkey**, and the **UAE**.

Forecast Rationale

Given the overall strength of Babcock-Hitachi Europe GmbH and the breadth of its overall power product line (as well as that of its parent's), BHE steam turbines should be able to take advantage of the worldwide synergy with Hitachi in combined-cycle projects. Projects should arise in the Middle East and Asia – particularly in China, India, and Indonesia, where the company is already known for its steam turbines for the fertilizer, pulp and paper, chemicals, and finishing industries – and in Europe, most notably in Spain, Germany, Hungary, and Turkey.

We believe that large BHE-produced turbines machines – machines of 50 Mw and larger – will sell relatively well in the forecast period extending through the year 2014.

We project that BHE will fabricate a total of 41 steam turbines in the decade 2005-2014, all for use in combined-cycle power generation duty. Other than for the 20- to 49-MW power band, steam turbine production is projected to be about the same total for each of the other three power bands.

Note: *BHE documentation indicates that at least 12 steam turbines have been built for installation in combined-cycle plants. Approximate totals are used in the individual power bands in the “thru 2004” column in the forecast chart below because exact production totals were not available at press time.*

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

Engine/Machine	Application	thru 2004	High Confidence Level			Good Confidence Level			Speculative Level			Total 2005-2014	
			2005	2006	2007	2008	2009	2010	2011	2012	2013		2014
BABCOCK-HITACHI EUROPE GmbH													
20-49 MW STEAM TURBINES	COMBINED-CYCLE GENERATION	> 6	0	1	1	0	0	1	0	0	0	0	3
50-124 MW STEAM TURBINES	COMBINED-CYCLE GENERATION	> 1	1	2	1	1	0	1	2	1	1	2	12
125-199 MW STEAM TURBINES	COMBINED-CYCLE GENERATION	> 2	0	1	2	1	2	2	1	1	1	2	13
200+ MW STEAM TURBINES	COMBINED-CYCLE GENERATION	> 3	1	0	1	2	2	1	1	1	2	2	13
TOTAL PRODUCTION		> 12	2	4	5	4	4	5	4	3	4	6	41