

APPENDIX V INDEPENDENT INDUSTRY REPORT ON THE GLOBAL BOILER INDUSTRY

Top Level Analysis

Economisers

Globally the market for economisers is segmented into two competing technologies—plain steel and extended surface. The economic downturn will have an impact in the short-term, as falling boiler orders will impact economiser sales for new build boilers. However the retrofit market will cushion the impact to a large extent, and the market is expected to rebound substantially in 2010. The market fundamentals remain strong in the medium-to-long term for both new build and retrofit, with the relatively high cost of combustion fuels used in power generation, such as natural gas and coal a key factor. The high fuel cost and the growing environmental pressures are key drivers in the need to achieve maximum efficiency throughout the combustion process in a boiler. This means that economisers are now a standard product for all boilers globally and there is a strong incentive to retrofit any plants that do not have them, and to replace aging economisers with newer, improved technology. This analysis is primarily focused on utility boilers, hence the market potential for economisers could be greater than forecast in this research. Greens, who are a leading supplier of key heat transfer products and services designed to enhance the thermal efficiency, are a leading player in this industry.

Plain Steel

Plain steel economisers accounted for approximately 69.1% of all economisers sold, based on tonnage in 2008. The market for plain steel has good growth prospects, despite the emergence of extended surface economisers as a viable alternative. Plain steel economisers have historically always been favoured by the boiler manufacturers themselves, who have always had the internal capabilities to produce the economisers they need.

The market for plain steel economisers in the four key regions analysed was 107,260 tonnes in 2008, having increased by a CAGR of 9.6% since 2004. The market is forecast to decrease in size by a CAGR of 3.9% from 2008 to reach 124,804 tonnes in 2012. Orders are expected to dip in 2009, but are expected to recover in 2010 up 7.1% based on tonnage. Plain steel's growth prospects going forward are expected to be reduced by the growing preference for extended surface economisers. In revenue terms, the value of the market is expected to increase from \$266.9 million in 2008 to \$322.9 million in 2012, as the market recovers and raw material prices begin to increase again.

Plain Steel Economisers—Selected Key Regions

Year	Europe & the CIS	Rest of Asia	China	North America	Global (Tonnes)	Europe & the CIS	Rest of Asia	China	North America	Global (Revenues \$US, millions)
2004 ...	7,866	25,432	34,990	6,178	74,466	\$23.9	\$ 46.9	\$ 58.7	\$14.7	\$144.3
2005 ...	8,417	27,721	38,664	6,796	81,598	\$28.1	\$ 53.9	\$ 68.3	\$18.0	\$168.3
2006 ...	9,174	30,493	47,170	7,407	94,245	\$32.3	\$ 61.7	\$ 86.8	\$22.3	\$203.1
2007 ...	10,000	34,000	50,000	8,000	102,000	\$40.0	\$ 74.8	\$100.0	\$28.0	\$242.8
2008 ...	10,400	35,700	53,000	8,160	107,260	\$43.7	\$ 82.5	\$111.3	\$29.4	\$266.9
2009 ...	8,840	31,915	50,880	6,773	100,408	\$31.6	\$ 70.5	\$ 94.0	\$20.8	\$216.8
2010 ...	9,017	35,661	55,968	6,908	107,504	\$32.8	\$ 77.0	\$107.6	\$21.6	\$239.0
2011 ...	9,468	38,460	58,766	7,392	114,085	\$36.2	\$ 89.0	\$120.9	\$25.0	\$271.0
2012 ...	10,130	43,075	63,468	8,131	124,804	\$41.8	\$108.6	\$142.3	\$30.2	\$322.9

Key Market Players

The boiler manufacturers dominate the market, in particular Chinese boiler manufacturers including Shanghai Boilers, Dongfang Boiler and Harbin Xinbeiyuan. These players were market leaders in 2008, with 16%, 12% and 10% market share respectively, based on tonnage. The leading non-Chinese boiler manufacturer is Alstom, who, like Harbin Xinbeiyuan, had a 10% share of the market based on tonnage in 2008. The other main participants are BHEL, Mitsubishi Heavy Industries, Doosan Heavy Industries and Hitachi Power.

Extended Surface Economisers

Extended surface economisers accounted for 30.9% of all economiser sales in 2008 based on tonnage, but this percentage is expected rise significantly over the forecast period, to reach 37.6% by 2012. Extended surface

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economisers share the same economic drivers as plain steel, but the drivers have more impact because extended surface economisers deliver more benefit. The cost per tonne is higher, but overall project costs are approximately 30%-50% lower. Lifecycle costs are also much lower, as extended surface economisers last longer and need less servicing than plain steel. As customer awareness increases, extended surface economisers are well positioned for growth, particularly in key markets such as India, where market penetration is currently particularly low.

The market for extended surface economisers in the four key regions analysed was 47,940 tonnes in 2008, having increased by 18.9% per year since 2004. As with plain steel economisers, the economic slowdown has had an impact and order volumes fell by 3.9% in 2009. After this the market is expected to recover, increasing at a CAGR of 12.0% to reach 75,361 tonnes in 2012 from 2008 level. In revenue terms, the value of the market is expected to increase from \$170.0 million in 2008 to \$288.4 million in 2012, as prices rise again and orders are higher.

Extended Surface Economisers—Selected Key Regions

Year	Europe & the CIS	Rest of Asia	China	North America	Global (Tonnes)	Europe & the CIS	Rest of Asia	China	North America	Global (Revenues \$US, millions)
2004	3,146	5,547	11,379	3,933	24,006	\$14.4	\$12.6	\$ 28.0	\$12.1	\$ 67.1
2005	3,367	7,212	14,941	4,247	29,766	\$16.9	\$17.5	\$ 39.0	\$14.5	\$ 87.8
2006	3,670	9,375	18,676	4,587	36,308	\$19.4	\$23.9	\$ 51.0	\$17.8	\$112.0
2007	4,000	15,000	22,000	5,000	46,000	\$24.0	\$42.0	\$ 66.0	\$22.5	\$154.5
2008	4,200	16,200	22,440	5,100	47,940	\$26.7	\$48.1	\$ 71.4	\$23.9	\$170.0
2009	3,906	15,390	22,440	4,335	46,071	\$21.9	\$40.2	\$ 64.2	\$17.9	\$144.1
2010	4,101	16,929	28,050	4,552	53,632	\$23.9	\$46.9	\$ 85.9	\$19.5	\$176.1
2011	4,716	18,960	33,099	5,235	62,010	\$28.8	\$55.6	\$109.5	\$24.0	\$217.9
2012	5,660	23,701	39,719	6,281	75,361	\$37.4	\$75.1	\$144.5	\$31.4	\$288.4

Key Market Players

Greens was the global leader for extended surface economisers in 2008, with approximately 37.5% of the total market in terms of tonnage, principally from China and then the U.K. Greens switched their manufacturing capabilities to China in 2003 and this has meant they are well positioned to meet surging Chinese demand. Being located in China gives them a low cost manufacturing base, whilst allowing them to retain a European brand profile and reputation. The rest of the market is highly fragmented; smaller Chinese players such as Shanghai Boilers and Beijing Bozhaofeng along with BHEL of India and traditional boiler manufacturers such as Alstom, Mitsubishi Heavy Industries and Doosan Heavy Industries.

HRSG Market (50MW+)

Heat Recovery Steam Generators are an integral part of a CCGT plant and play an important role in ensuring efficient energy generation. A CCGT plant involves gas being passed through a gas turbine, so that electricity can be generated. After this process has taken place, the waste heat that has been produced is recovered by an HRSG and then converted into steam which is passed through a steam turbine, creating more electricity. The benefits of this are substantial; a single gas turbine plant has a thermal efficiency of around 40%, whereas a CCGT plant can achieve thermal efficiencies of 55%, 15% more. This means more electricity, which translates into more revenue from the same amount of natural gas. Although gas prices have fallen back from their extraordinary peak in the summer of 2008, the long-term price trend for gas is expected to be much higher than the price levels of the past 10-20 years. Gas is now a tradable commodity and used extensively in power generation in a number of important regions. Even countries in the Middle East with abundant gas supplies are investing in CCGT plants to maximise the gas they have for export for future generations. The other drivers for HRSGs are generally those attributed to gas-fired plants, of which they are a vital component—the efficiencies that can be achieved, the relatively low capital cost and construction time and the operational flexibility.

The market for HRSGs in the five key markets selected (which represents approximately 90% of global demand) was 147 units in 2008, having increased at a CAGR of 5.8% per year since 2004. The Middle East and

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Europe are the two key markets, and accounted for 79 units combined in 2008. North American demand has recovered after the 2001-2002 crash in gas-fired investment. China's demand is relatively low as the country relies more on coal-fired power generation. Going forward, the immediate short-term outlook is weak, with 92 units forecast to be ordered in 2009 and the revenues are expected to fall, largely reflecting the reduction in raw material costs since summer 2008. The global financial crisis and the ensuing recession have not left the market unscathed. Projects have been delayed, as utilities review investment programs and have to work harder to secure financing. But the situation is expected to start to improve in 2010 and the market is forecast to continue to grow for the remainder of the forecast period, with delayed projects being brought forward for tender. From 2008, the overall market is forecast to increase in size by a CAGR of 4.9% per year until 2012 to reach 178 units. In revenue terms the market value is forecast to increase from \$5.9 billion to \$7.1 billion.

HRSG Market—Selected Key Regions

Year	Units						Revenues (\$bn)					
	Europe & the CIS	Middle East	Rest of Asia	China	North America	Global (Units)	Europe & the CIS	Middle East	Rest of Asia	China	North America	Global (Revenues \$USbn)
2004	20	25	11	38	23	117	\$0.6	\$0.8	\$0.3	\$0.7	\$0.5	\$2.9
2005	32	34	23	13	24	127	\$1.0	\$1.1	\$0.7	\$0.3	\$0.6	\$3.6
2006	37	20	16	11	25	110	\$1.3	\$0.7	\$0.5	\$0.3	\$0.7	\$3.5
2007	48	50	29	13	27	167	\$1.8	\$2.0	\$1.0	\$0.3	\$0.9	\$6.1
2008	44	35	28	10	30	147	\$1.9	\$1.6	\$1.1	\$0.3	\$1.1	\$5.9
2009	22	25	18	7	20	92	\$0.8	\$1.0	\$0.6	\$0.2	\$0.7	\$3.2
2010	26	35	22	12	22	117	\$0.9	\$1.3	\$0.8	\$0.3	\$0.7	\$4.0
2011	35	30	23	14	28	130	\$1.4	\$1.2	\$0.8	\$0.4	\$1.0	\$4.7
2012	50	45	34	16	33	178	\$2.1	\$2.0	\$1.3	\$0.5	\$1.2	\$7.1

Key Market Players

The market for HRSGs above 50MW+ in 2008 was led by Doosan Heavy Industries, which represented 23% of the global market in terms of units in 2008. Doosan Heavy Industries was the market leader in the Middle East by a considerable margin in 2008 and is also a notable player in Europe, North America and the Rest of Asia. Doosan's key strategic advantage is its ability to offer a complete turnkey solution, which is particularly attractive to Middle Eastern customers.

Nooter Eriksen is the second largest player, with an 18% market share, based on units sold in 2008. Nooter Eriksen was also the joint market leader in North America and lead the market in Europe in 2008. They also have a presence in China, working in partnership with Hangzhou Boilers.

Based on units sold in 2008, Vogt was the joint leader in the North American market, along with NEM. BHEL and Alstom both had 7.5% of the market. BHEL dominated the Indian market with 14.7% market share, while Alstom features as a tier 2 player in a number of regions. Alstom will supply the HRSG when it is offering a turnkey solution. Other notable players include Bumwoo of Korea, a recent newcomer to the market, Zio Podolsk of Russia, Hangzhou Boiler, the market leader in China, CMI of France and STF of Italy. Greens' role in this market is one-step down the supply chain; Greens would supply the modules that make up 40% of the project value of the HRSGs and these would be delivered to Nooter Eriksen or CMI, for example. The system designer, as Nooter Eriksen etc. are sometimes known, does the design and engineering and then subcontracts out the manufacturing. From the client's perspective, they only deal with the designer and are generally unaware of the intricacies of the manufacturing process. Greens was the largest China-based supplier of HRSG modules to HRSG system designers worldwide based on 2008 revenue.

HRSG Market (3-50MW)

HRSGs between 3MW and 50MW would principally be used for industrial applications, but also for smaller power generation plants. The market for HRSGs in the five key markets selected (which, as with larger HRSGs, represents approximately 90% of global demand) was 87 units in 2008, having decreased at a CAGR of 3.4% since 2004. The market contracted in 2008, as industrial companies, concerned over the uncertain impact of the global economic crisis, delayed orders they were planning to make in the last quarter of 2008. 2009 will be a

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weak year for new orders, with volumes down by approximately 44.8%, but the market is forecast to start to recover from 2010. However it is expected to be 2011 before the market conditions start to improve significantly. By 2012, the market is forecast to have returned to pre-crisis levels, largely because of higher demand from developing market such as Asia and the Middle East, but also because of economic recovery in Western Europe and North America. The market is forecast to increase in size at a CAGR of 6.3% per year to reach 111 units in 2012. In revenue terms, the market value is expected to increase from \$642.4 million to \$806.4 million between 2008 and 2012.

HRSG Market—Selected Key Markets

Year	Units						Revenues (\$mn)					
	Europe & the CIS	Middle East	Rest of Asia	China	North America	Global (Units)	Europe & the CIS	Middle East	Rest of Asia	China	North America	Global (Revenues \$USmn)
2004	22	15	16	9	38	100	\$124.8	\$ 91.2	\$ 91.0	\$28.0	\$166.2	\$501.2
2005	20	25	21	10	39	115	\$117.0	\$158.4	\$126.1	\$32.9	\$196.4	\$630.8
2006	26	8	12	12	42	99	\$172.8	\$ 57.6	\$ 71.5	\$41.4	\$231.3	\$574.6
2007	32	10	11	13	45	111	\$240.0	\$ 80.0	\$ 71.5	\$52.0	\$292.5	\$736.0
2008	26	10	12	9	30	87	\$214.5	\$ 88.0	\$ 85.8	\$39.6	\$214.5	\$642.4
2009	14	5	8	6	15	48	\$ 94.7	\$ 37.4	\$ 50.3	\$23.2	\$ 87.9	\$293.6
2010	15	6	11	10	18	60	\$ 99.4	\$ 44.9	\$ 69.2	\$40.3	\$103.4	\$357.2
2011	20	12	15	14	24	85	\$144.5	\$ 96.0	\$103.8	\$62.0	\$150.3	\$556.7
2012	30	14	18	17	32	111	\$242.8	\$123.3	\$134.5	\$81.3	\$224.5	\$806.4

Key Market Players

The market has four key participants, who between them accounted for 57% of units sold in the overall market in 2008. Innovative Steam Technologies was the market leader with 23% in 2008 based on number of units sold, having grown market share strongly in the past two years. Innovative Steam Technologies offers a heat exchanger style HRSG that has higher raw material costs, but much lower engineering costs. The company has managed to remain competitive, despite the high raw material prices in 2008, and with costs now significantly lower, Innovative Steam Technologies is well placed to remain the market leader in the future. Austrian Energy & Environment was the second largest market player in 2008. They have become increasingly active in the market in the past few years and had a 12% market share in 2008 based on number of units. Nooter Eriksen and Vogt International, who are owned by Babcock Power, were joint third with 10% of the market each; both are very strong in North America, which is the most important market for the smaller sized HRSGs. Nooter Eriksen's presence in the market is actually greater than the figures suggest; it has licenced its technology to EM Alliance and works in partnership with Hangzhou Boilers, the market leader in China. Other notable players include NEM, Foster Wheeler, BHEL and Thermax.

Waste Heat Boilers Market

Waste Heat Boilers are used to maximise the efficiency of power plants, by using the waste heat that is given off by the combustion process to generate further electricity—in this way they are similar to HRSGs. Waste heat boilers can also be used for a variety of applications such as biomass (wood & other biogenous fuels) and residues (household and industrial waste). In these situations, the waste can be burnt in the boiler to produce energy. For this study only boilers above 5MW in size have been included, so what is not shown in this report is the greater potential market for small size industrial boilers.

The economic slowdown is the major restraint for the waste heat boiler market in the short-term. The falling industrial output and financial constraints is expected to have a major impact on new orders; Frost & Sullivan Limited expects order levels in 2009 to be 5.9% lower than 2008. However the market is expected to recover in 2010, to exceed 2008 levels, due to the need for new generating capacity, the need for higher efficiency in plants, and the global growth in waste incineration and biomass plants. Demand is particularly strong in China, (which accounted for approximately 50% of all units sold in 2008, a figure that is set to increase to 64% by 2012), where small waste heat boilers are used extensively, thanks to Chinese government support for their use in industrial applications. China is determined to improve its level of energy efficiency and this was demonstrated by President Hu Jintao's September 2009 announcement on curbing emissions. The market for waste heat boilers in

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the five key markets selected (which represent approximately 90% of global demand) was 363 units in 2008 based on tonnage, having increased at a CAGR of 3.7% for the years from 2004 to 2008. The market is forecast to increase in size by a CAGR of 15.2% for the years 2008 to 2012, to reach 640 units by 2012. In revenue terms the size of the market is expected to increase from \$3.0 billion in 2008 to \$5.0 billion in 2012, as a result of the surging demand from China and a recovery in prices.

Waste Heat Boilers Market—Selected Key Markets

Year	Units					Revenues (\$bn)				
	Europe & the CIS	Rest of Asia	China	North America	Global (Units)	Europe & the CIS	Rest of Asia	China	North America	Global (Revenues \$USbn)
2004	33	99	139	44	315	\$0.5	\$0.5	\$0.5	\$0.6	\$2.1
2005	36	102	155	45	339	\$0.6	\$0.5	\$0.6	\$0.6	\$2.4
2006	39	106	179	48	371	\$0.7	\$0.6	\$0.8	\$0.7	\$2.8
2007	41	112	200	50	403	\$0.8	\$0.7	\$1.0	\$0.8	\$3.3
2008	31	95	200	38	363	\$0.6	\$0.6	\$1.1	\$0.6	\$3.0
2009	23	81	210	28	342	\$0.4	\$0.5	\$1.0	\$0.4	\$2.3
2010	24	81	273	32	410	\$0.4	\$0.5	\$1.4	\$0.5	\$2.8
2011	30	105	328	36	499	\$0.6	\$0.7	\$1.7	\$0.6	\$3.6
2012	40	147	410	43	640	\$0.8	\$1.0	\$2.4	\$0.8	\$5.0

Key Market Players

Given China's dominance of units sold, it is unsurprising that Chinese companies are the leading players in the market at a global level. The clear leader globally was Suzhou Hailu Heavy Industry with 21% of the market in terms of units sold in 2008. The next largest player, Yancheng Boiler, is far behind with 9.4% of the market. The highest ranked non-Chinese company is BHEL, which had a 6.9% market share in 2008, followed by Hangzhou Boiler with 6.3% market share and Handan Boiler with 6% market share. All the Chinese companies sell almost exclusively within China. Other players of note include Sumitomo Heavy Industries (Japan), BHEL (India), and Cleaver- Brooks and Rentech, both based in North America. Beyond this, 40% of the market is split between a whole host of local players. Greens are one of these players, but Greens are a waste heat specialist and compete at the top end of the market, offering comprehensive waste heat solutions, rather than just the boiler. Both HRSGs and Waste Heat Boilers are complex technologies in their own right; HRSGs are seen as higher technology, but this is largely because of the challenges associated with their size and handling. Waste Heat Boilers are not so complex, but they still require high technology skills and experience. Of the two, though, Waste Heat Boilers are generally seen as the natural entry point into the boiler market.

Marine Boilers

The marine boilers considered for this report are those that weigh between 10 tonnes and 120 tonnes, and these are mainly be used by oil and chemical tankers, cruise ships and bulk cargo carriers. They represent a relatively small, but high value segment of the overall marine boiler market. Demand for marine boilers has increased strongly in the past decade as global shipping volumes have increased with the economic growth that has been taking place, principally in China, but also in many other parts of Asia. These countries have enjoyed strong manufacturing booms with goods that have principally been consumed in Europe and the United States and this has boosted demand for large shipping vessels. At the same time, high levels of oil demand and the emergence of liquefied natural gas as a traded commodity have increased the need for large carrier ships. Demand from the oil industry has also come in the form of FPSO vessels, floating platforms that are used to enable oil extraction. There are a number of major factors that have negatively impacted on the market, including: the volatility in the price of transportation, lower global trade volumes, falling industrial output, lower oil prices, financial constraints and over-supply of bulk carriers. Shipping orders (directly linked to marine boiler orders) had been at historic highs prior to 2008 and even before the economic crisis there was a belief that the market was saturated and that demand would have to fall for a few years. As a result, global marine orders declined by 36.6% in 2008, and Frost & Sullivan Limited forecasts a further decline of approximately 52.9% in 2009.

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The Rest of Asia has been by far the largest market, and accounted for 169 of the 280 boilers manufactured in 2008. The reason for this lies with South Korea, which is home to most of the world's largest shipbuilding yards. China was the second largest market with 80 vessels manufactured in 2008, almost doubled that produced there in 2004. Europe and the Commonwealth of Independent States (CIS) were the smallest of the three, with 47 units manufactured in 2008. These three regions accounted for 100% of the production of marine boilers for these applications. The market for marine boilers in 2008 was 280 units, having fallen by a CAGR of 7.8% for the period between 2004 and 2008, due to the global economic situation. The vast majority of these boilers are auxiliary boilers, but a small percentage are LNG propulsion boilers and a few are FPSO boilers. The market is forecast to decline by a CAGR of 1.1% from 2008 to 2012 to reach 269 units, having peaked in 2007 at 442 units. In revenue terms, the market value is expected to decrease at a CAGR of 5.9% a year to fall from \$169 million in 2008 to \$130 million in 2012.

Marine Boilers Market—Selected Key Markets

Year	Units				Revenues (\$mn)			
	Europe & the CIS	Rest of Asia	China	Global (Units)	Europe & the CIS	Rest of Asia	China	Global (Revenues \$USmn)
2004	36	309	42	387	\$21.9	\$130.8	\$11.4	\$164.1
2005	41	337	56	434	\$23.1	\$150.2	\$18.9	\$192.1
2006	45	279	75	399	\$31.4	\$148.1	\$23.9	\$203.5
2007	47	305	90	442	\$38.8	\$155.6	\$32.8	\$227.3
2008	31	169	80	280	\$24.4	\$104.6	\$37.6	\$166.7
2009	8	92	32	132	\$ 5.0	\$ 34.8	\$10.2	\$ 49.9
2010	15	126	39	180	\$ 8.1	\$ 49.2	\$12.6	\$ 69.9
2011	25	158	54	237	\$15.9	\$ 69.7	\$20.5	\$106.1
2012	33	176	60	269	\$25.1	\$ 81.8	\$23.8	\$130.7

Key Market Players

For auxiliary boilers, Aalborg of Norway was the market leader in 2008, with a 45% share of units sold, although many of these boilers are produced in Asia. Second is Mitsubishi Heavy Industries with 15% of the market and third is Kangrim with 13% of the market. Other notable players include Greens, Osaka, Miura and Hailu. For LNG propulsion boilers, Mitsubishi was the market leader with 64% in 2008, based on units sold. The only other players was Kawasaki with 36% of the market in 2008. For FPSO boilers, Aalborg was the dominant player with 67.5%, while Mitsubishi Heavy Industries was the only other notable player with 11.5% of the market.

Boiler Components

The boiler components section of this report comprises super-heaters, re-heaters, membrane walls and steam drums, all integral parts of a coal-fired boiler, in ensuring that maximum efficiencies can be achieved. The potential market for boiler components is huge, but for the purposes of this report only two key regions have been considered—China and North America.

The market for boiler components was approximately 702,075 tonnes in 2008, having increased at a CAGR of 10.0% since 2004. China accounted for approximately 90.7% of all tonnage sold in 2008. The market is forecast to increase in size by a CAGR of 3.0% from 2008 to 2012, to reach approximately 791,655 tonnes. In revenue terms, the market value is expected to increase to \$2.6 billion by 2012. In the short-term, the market is forecast to be hit because of the global slowdown, but Chinese domestic demand is expected to be less affected than falling demand from other markets. In the longer-term, demand is forecast to recover as although China has made significant inroads into closing the gap between the size of the installed base and power demand, new boilers will continue to be required to ensure installed capacity adequately meets demand. Crucially, China is looking to upgrade or simply replace obsolete plants in order to improve energy efficiency and this is an important factor in the demand for boiler components.

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Boiler Components Market—Selected Key Markets

Year	Tonnes			Revenues		
	China	North America	Global (Tonnes)	China	North America	Global (Revenues \$USbn)
2004	431,607	48,270	479,876	\$1.0	\$0.2	\$1.1
2005	476,062	53,241	529,304	\$1.1	\$0.2	\$1.4
2006	582,224	65,114	647,338	\$1.5	\$0.3	\$1.8
2007	612,500	68,500	681,000	\$1.7	\$0.4	\$2.1
2008	637,000	65,075	702,075	\$2.1	\$0.4	\$2.5
2009	560,560	45,553	606,113	\$1.5	\$0.2	\$1.7
2010	582,982	40,997	623,980	\$1.6	\$0.2	\$1.8
2011	670,430	45,917	716,347	\$1.9	\$0.2	\$2.1
2012	737,473	54,182	791,655	\$2.3	\$0.3	\$2.6

Key Market Players

Given China's dominance of tonnage sold, it is unsurprising that Chinese boiler manufacturers dominate the market. Based on tonnage in 2008, Shanghai Boiler had 22% of the market, while Dongfang Boiler had a 20% market share and Harbin Boiler had a 20% market share. The next player after that was Jinan Boilers with 6.3% of the market. Other notable players include Beijing Boilers, Wuxi Boilers, Foster Wheeler, Alstom, Babcock & Wilcox and Babcock Power.

Regional Analysis

Economisers

Europe & CIS

The total economiser market in Europe & the CIS grew at a CAGR of 7.3% between 2004 and 2008, to reach 14,600 tonnes or \$70.4 million in revenues in 2008. Growth for extended surface economisers was at a CAGR of 7.5% in tonnage as opposed to 7.2% for plain steel for the period from 2004 to 2008. The recession in Europe is expected to impact on economiser demand, as orders for power generation equipment are forecast to be much lower than industry expectations for both 2009 and 2010. The economiser market is however, expected to perform better than the overall boiler market, due to the use of economisers in older plants for upgrades, and efficiency improvements. Europe has an ageing fleet of power plants and economiser upgrades offer excellent growth prospects to partially offset the slump in new demand. The demand for plain steel economisers is expected to decrease at a CAGR of 0.7% on tonnage up to 2012, as opposed to 7.7% increase per year for extended surface economisers. It is estimated that extended surface economisers are more likely to find greater application in the boiler upgrades at power plants for efficiency improvements and life extension services.

European & CIS Economiser Market

Year	Plain Steel			Extended Surface			Total	
	Tonnage	Price per Tonne	Revenue (\$m)	Tonnage	Price per Tonne	Revenue (\$m)	Tonnage	Revenue (\$m)
2004	7,866	\$3,043	\$23.9	3,146	\$4,565	\$14.4	11,013	\$38.3
2005	8,417	\$3,344	\$28.1	3,367	\$5,016	\$16.9	11,784	\$45.0
2006	9,174	\$3,520	\$32.3	3,670	\$5,280	\$19.4	12,844	\$51.7
2007	10,000	\$4,000	\$40.0	4,000	\$6,000	\$24.0	14,000	\$64.0
2008	10,400	\$4,200	\$43.7	4,200	\$6,360	\$26.7	14,600	\$70.4
2009	8,840	\$3,570	\$31.6	3,906	\$5,597	\$21.9	12,746	\$53.4
2010	9,017	\$3,641	\$32.8	4,101	\$5,821	\$23.9	13,118	\$56.7
2011	9,468	\$3,823	\$36.2	4,716	\$6,112	\$28.8	14,184	\$65.0
2012	10,130	\$4,129	\$41.8	5,660	\$6,601	\$37.4	15,790	\$79.2

Europe and the CIS have the highest prices of the regions analysed, with plain steel economisers costing \$4,200 per tonne for plain steel and \$6,360 per tonne for the extended surface. Prices of plain steel are expected

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to decrease at a CAGR of 0.4% from 2008 to 2012, but extended surface economiser prices are expected to increase at a CAGR of 0.9% in the same period. Prices for both dip sharply in 2009 and then make up ground over the next three years. Plain steel is more affected than extended surface, as the extended surface economiser requires more workmanship and involves greater labour.

Hitachi Power and Alstom, the two largest boiler companies in Europe, dominate the plain steel segment. In 2008, the extended surface economiser segment was led by Ekstroms, with 33% of the market based on tonnage, Greens was second with 26% of the market and Rosink was third with 19% of the market. The remaining 22% included players such as Clyde Bergmann and Alstom (who manufacture both types).

Rest of Asia

Demand for economisers in the Rest of Asia increased sharply between 2004 and 2008, principally driven by a huge increase in demand from India, but also Indonesia and Vietnam; all of which have been enjoying strong economic growth and surging power investments. The market size increased from 30,980 tonnes to 2004 to 51,900 tonnes in 2008, a CAGR of 13.8%. Plain steel economisers dominated in 2008, and accounted for 35,700 or 69% of all tonnage sold. The economic slowdown is a restraint for the market in the short term, although many countries in this region have not been substantially affected. The market is expected to fall by 5.0% in 2009, before recovering by 5.0% in 2010. The Indian government recently announced a drive toward greater energy efficiency and this is expected to become an increasingly important factor in the market. The low quality of the coal in India is also a concern and utilities are looking to counter this by replacing existing plain steel economisers with the extended surface ones. From 2012 and beyond, the market is expected to be further driven by India's 12th five year power generation plan, which is expected to add almost 100GW to the country's generation capacity. Frost & Sullivan Limited forecasts the total economiser market to increase at a CAGR of 6.5% to reach 66,775 tonnes from 2008 to 2012.

Rest of Asia Economiser Market

Year	Plain Steel			Extended Surface			Total	
	Tonnage	Price per Tonne	Revenue (\$m)	Tonnage	Price per Tonne	Revenue (\$m)	Tonnage	Revenue (\$m)
2004	25,432	\$1,846	\$46.9	5,547	\$2,275	\$12.6	30,980	\$ 59.6
2005	27,721	\$1,943	\$ 53.9	7,212	\$2,421	\$17.5	34,933	\$ 71.3
2006	30,493	\$2,024	\$ 61.7	9,375	\$2,548	\$23.9	39,868	\$ 85.6
2007	34,000	\$2,200	\$ 74.8	15,000	\$2,800	\$42.0	49,000	\$116.8
2008	35,700	\$2,310	\$ 82.5	16,200	\$2,968	\$48.1	51,900	\$130.5
2009	33,915	\$2,079	\$ 70.5	15,390	\$2,612	\$40.2	49,305	\$110.7
2010	35,611	\$2,162	\$ 77.0	16,929	\$2,769	\$46.9	52,540	\$123.9
2011	38,460	\$2,314	\$ 89.0	18,960	\$2,935	\$55.6	57,420	\$144.6
2012	43,075	\$2,522	\$108.6	23,701	\$3,169	\$75.1	66,775	\$183.7

Prices in the rest of Asia are low, comparable to China, but this is skewed by strong demand from India. In countries such as Japan, Korea and Australia, prices are much more comparable with the European levels. Prices in Asia are forecast increase for plain steel at a CAGR of 2.2% per year from \$2,310 per tonne in 2008 to \$2,522 per tonne in 2012. For extended surface, the price is expected to increase from \$3,169 per tonne in 2008 to reach \$3,169 per tonne by 2012.

In 2008 based on tonnage, BHEL was the market leader for both the plain steel and the extended surface economiser segments with approximately 25% market share. Alstom was second for extended surface and third for plain steel, with 17% and 15% respectively. Mitsubishi Heavy Industries accounted for 15% of the plain steel market and 20% of the extended surface market, with Japan and Korea as core markets. Greens had approximately 10% of the extended surface market in this region.

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China

The Chinese economiser market is the largest market globally, unsurprising given the massive investment in power generation that has been on-going since 2003. China has substantial coal reserves, making it an attractive fuel for power generation coupled with a desperate need for power to meet the needs of an increasingly urbanised population. China is also rapidly becoming aware of the benefits of energy efficiency, as a way of helping meet the demand for power. The Chinese President Hu Jintao recently announced a massive drive to increase both coal-fired capacity in China, but also to increase energy efficiency and therefore slow the rate at which carbon emissions are increasing. This is specifically boosting demand for economisers. The total economiser market was estimated to be 75,440 tonnes in 2008. Looking ahead, the total Chinese economiser market is expected to grow at a CAGR of 8.1% to reach 103,187 tonnes by 2012. The market is expected to decline slightly by 2.8% in 2009 based on tonnage, but power back strongly in 2010, increasing by 14.6%. The market size for plain steel economisers was 53,000 tonnes in 2008 and is expected to increase to 63,468 by 2012, at a CAGR of 4.6%. The market for extended surface economisers is forecast to grow faster, due to the increased adoption of this technology. The market is expected to grow at a CAGR of 15.3% to reach 39,719 tonnes in 2012, up from 22,440 in 2008.

Chinese Economiser Market

Year	Plain Steel			Extended Surface			Total	
	Tonnage	Price per Tonne	Revenue (\$m)	Tonnage	Price per Tonne	Revenue (\$m)	Tonnage	Revenue (\$m)
2004	34,990	\$1,678	\$ 58.7	11,379	\$2,464	\$ 28.0	46,369	\$ 86.8
2005	38,664	\$1,766	\$ 68.3	14,941	\$2,607	\$ 39.0	53,604	\$107.2
2006	47,170	\$1,840	\$ 86.8	18,676	\$2,730	\$ 51.0	65,846	\$137.8
2007	50,000	\$2,000	\$100.0	22,000	\$3,000	\$ 66.0	72,000	\$166.0
2008	53,000	\$2,100	\$111.3	22,440	\$3,180	\$ 71.4	75,440	\$182.7
2009	50,880	\$1,848	\$ 94.0	22,440	\$2,862	\$ 64.2	73,320	\$158.2
2010	55,968	\$1,922	\$107.6	28,050	\$3,062	\$ 85.9	84,018	\$193.5
2011	58,766	\$2,056	\$120.9	33,099	\$3,307	\$109.5	91,865	\$230.3
2012	63,468	\$2,242	\$142.3	39,719	\$3,638	\$144.5	103,187	\$286.8

Prices in China are the lowest in the world, reflecting the low manufacturing cost and lower raw material costs. As such, this gives companies that manufacture in China a competitive advantage. The forecast is for prices to increase at a CAGR of 1.6% for plain steel and a CAGR of 3.4% for extended surface economisers. Plain steel is expected increase from \$2,100 per tonne in 2008 to reach \$2,242 per tonne in 2012; while extended surface is expected to increase from \$3,180 per tonne in 2008 to \$3,638 per tonne in 2012.

For plain steel economisers, the three major boiler manufacturers dominate the market in China, Shanghai Boilers with 33%, Dongfang with 25% and Harbin Xinbeiyuan with 20%. For extended surface economisers, Greens was the dominant player with 66% market share in 2008 based on tonnage, having entered the market in 2003 and quickly established themselves as the recognised key supplier of the equipment. The Chinese strictly control who can start manufacturing in China and, with the low cost benefits achieved through manufacturing in China, this provides a significant barrier to entry for foreign competition. Behind Greens comes Shanghai Boilers and Beijing Bozhaofeng with 15% each and Harbin Xinbeiyuan with 4%. Greens market share includes the work it carries out for Harbin Xinbeiyuan; Greens manufactures approximately 90% of the extended surface economisers that Harbin Xinbeiyuan uses.

North America

The North American economiser market grew at a CAGR of 7% between 2004 and 2008, to reach 13,260 tonnes in 2008. The recession is expected to affect market demand, but for new build, the uncertainty over how carbon emissions will be addressed in the US is a major concern. Legislation to create a cap and trade system is currently being debated and this is creating uncertainty for large coal-fired plants that use economisers. Fortunately there is massive potential for economisers to upgrade existing power generation boilers and large industrial boilers and the potential for increased energy efficiency investment in the US, which the Obama administration is keen to encourage. The North American market is likely to be hit badly in 2009, with the

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market expected to fall 16.2% in 2009 by tonnage, but will recover significantly post-2010. Overall, Frost & Sullivan Limited forecasts an increase at a CAGR of 2.1% from 2008 to 2012, to reach 14,412 tonnes. The plain steel economiser market is expected to decline at a CAGR of 0.1% from a 2008 level of 8,160 tonnes to reach 8,131 tonnes by 2012, whereas the extended surface economiser market is expected to increase at a CAGR of 5.3% from a 2008 level of 5,100 tonnes to reach 6,281 tonnes by 2012, as utilities and industrial companies switch from plain steel to extended surface economisers.

North American Economiser Market

Year	Plain Steel			Extended Surface			Total	
	Tonnage	Price per Tonne	Revenue (\$m)	Tonnage	Price per Tonne	Revenue (\$m)	Tonnage	Revenue (\$m)
2004	6,178	\$2,384	\$14.7	3,933	3,065	\$12.1	10,111	\$26.8
2005	6,796	\$2,649	\$18.0	4,247	3,406	\$14.5	11,043	\$32.5
2006	7,407	\$3,010	\$22.3	4,587	3,870	\$17.8	11,995	\$40.0
2007	8,000	\$3,500	\$28.0	5,000	4,500	\$22.5	13,000	\$50.5
2008	8,160	\$3,605	\$29.4	5,100	4,680	\$23.9	13,260	\$53.3
2009	6,773	\$3,064	\$20.8	4,335	4,118	\$17.9	11,108	\$38.6
2010	6,908	\$3,126	\$21.6	4,552	4,283	\$19.5	11,460	\$41.1
2011	7,392	\$3,376	\$25.0	5,235	4,583	\$24.0	12,626	\$48.9
2012	8,131	\$3,713	\$30.2	6,281	4,995	\$31.4	14,412	\$61.6

Prices in North America are forecast to increase at a CAGR of 0.7% up from 2008 to 2012 for plain steel and a CAGR of 1.6% for extended surface for the same period. From 2008 price levels of approximately \$3,605 per tonne, plain steel economiser prices are expected to increase to \$3,713 per tonne by 2012, while extended surface economiser prices are expected to increase from 2008 levels of \$4,680 per tonne to \$4,995 per tonne by 2012.

The plain steel market in North America is dominated by the big boiler manufacturers, such as Alstom, Babcock & Wilcox and Foster Wheeler. Based on tonnage in 2008, the extended surface economiser market was led by ECO with 30% market share, E-tech 25% with market share and a combination of the boiler manufacturers and small manufacturers accounted for the remaining 45% market share.

HRSGs (50MW+)

Europe & the CIS

The 50MW+ HRSG market in Europe & the CIS grew at a CAGR of 21.7% between 2004 and 2008 to be worth 44 units or \$1.9 billion in revenue. The market conditions are expected to worsen substantially in 2009, as the recession negatively impacts on investment levels and new projects. Europe has been hard hit by the financial crisis, particularly smaller utilities and independent power producers, who have tended to invest in gas-fired plants. As a result, demand is forecast to fall by 50% in 2009 to 22 units. But from this low point, the market is forecast to start to improve, growing by 18.2% in 2010 and strengthening further in 2011 and 2012, as the fundamentals of investing in power generation remain strong. Demand will increase by a CAGR of 3.2% per year to reach 50 units in 2012. In revenue terms, the market is expected to grow at a CAGR of 3% from 2008 to be worth \$2.1 billion in 2012. Revenues will lag behind market growth because of the fall in raw material prices from the August 2008 peak, causing a sharp decline in prices in 2009.

European & CIS HRSG Market

Year	Units	Price per 150MW HRSG (\$m)	Revenue (\$bn)
2004	20	\$28.9	\$0.6
2005	32	\$30.1	\$1.0
2006	37	\$34.2	\$1.3
2007	48	\$38.0	\$1.8
2008	44	\$42.6	\$1.9
2009	22	\$36.2	\$0.8
2010	26	\$36.2	\$0.9
2011	35	\$38.7	\$1.4
2012	50	\$42.2	\$2.1

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Europe and the CIS have the second highest prices in the region, after the Middle East, with a 150MW HRSG unit costing \$42.6 million in 2008, at a CAGR of 10.2% since 2004. Prices are expected to fall by 15% in 2009, partially because of lower demand, but mainly because raw material costs have fallen sharply since the peak reached in 2008. Prices are forecast to fall at a CAGR of 0.2%, so that a unit is expected to cost \$42.2 million by 2012. Prices are expected to be flat in 2010, before recovering in 2011 and 2012.

Based on units in 2008, Nooter Eriksen was the market leader in Europe, with 25% of the market. Nooter Eriksen has traditionally been more focused on the North American market, but is increasingly seeking to diversify into new geographies. Doosan Heavy Industries was second with a 16% market share by units in 2008; Doosan Heavy Industries is aggressively targeting the power generation market, having identified it as a key growth area for the future. STF and NEM both had 11% of the market; STF concentrates purely on Europe, whereas NEM competes globally. Zio Podolsk and CMI each had 9% each; CMI's market share fell in the past year, as the company won a number of big orders in 2007 and its sub-suppliers had reached capacity themselves. Alstom, with 7%, faced a similar challenge, having been a market leader in previous years. Other notable players include Austrian Energy & Environment and Ansaldo Caldaie.

Middle East

The 50MW+ HRSG market in the Middle East grew at a CAGR of 8.8% based on units between 2004 and 2008 to reach 35 units, or \$1.6 billion in revenues. The market in the Middle East has benefited from massive investment in power generation, with funding coming from oil receipts and a sharp increase in awareness in the region about the benefits of energy efficiency. 2007 was the peak year for investment; since then, the market conditions have worsened in the face of the economic crisis, but also because the installed base in some key markets in the Gulf has caught up with demand. This is not expected to last though and new round of investments in the region is expected to start in 2010. Overall, demand is forecast to increase at a CAGR of 6.5% from 2008 to reach 45 units in 2012. In revenue terms, the market is expected to grow at a CAGR of 6.3% from 2008 to be worth \$2.0 billion in 2012.

Middle East HRSG Market

Year	Units	Price per 150MW HRSG (\$m)	Revenue (\$bn)
2004	25	\$30.4	\$0.8
2005	34	\$31.7	\$1.1
2006	20	\$36.0	\$0.7
2007	50	\$40.0	\$2.0
2008	35	\$44.8	\$1.6
2009	25	\$38.1	\$1.0
2010	35	\$38.1	\$1.3
2011	30	\$40.7	\$1.2
2012	45	\$44.4	\$2.0

The Middle East is the most expensive market, with a 150MW HRSG unit costing \$44.8 million in 2008, which represents a CAGR of 10.2% since 2004. Prices are expected to fall in 2009 because of falling raw material costs, but are forecast to start to increase again in 2011. Overall, prices are expected to decline by a CAGR of 0.2% from 2008, with a unit costing \$44.4 million in 2012.

In 2008 based on number of units, Doosan Heavy Industries was the dominant player in the Middle East, with 60% of the market. The company has been aggressively building share there for the past three years and the ability to offer a turnkey solution is a major factor in succeeding in this market. NEM is second with 14% of the market and Nooter Eriksen is third with 9% of the market. Other notable players include Alstom and CMI.

Rest of Asia

The 50MW+ HRSG market in the Rest of Asia increased at a CAGR of 26.3% by units between 2004 and 2008, to reach 28 units or \$1.1 billion in revenues. Demand is expected to fall in 2009, as a result of the global

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economic crisis, but most Asian states have been far less affected than Europe and North America, and are expected to recover much more quickly. Overall the market is forecast to grow at a CAGR of 5% per year from 2008 to reach 34 units by 2012. In revenue terms, the market is expected to grow at a CAGR of 5.5% per year from 2008 to be worth \$1.3 billion in 2012.

Rest of Asia HRSG Market

<u>Year</u>	<u>Units</u>	<u>Price per 150MW HRSG (\$m)</u>	<u>Revenue (\$bn)</u>
2004	11	\$29.2	\$0.3
2005	23	\$30.8	\$0.7
2006	16	\$32.6	\$0.5
2007	29	\$35.0	\$1.0
2008	28	\$38.2	\$1.1
2009	18	\$33.6	\$0.6
2010	22	\$34.6	\$0.8
2011	23	\$36.3	\$0.8
2012	34	\$38.8	\$1.3

Prices vary quite substantially between countries, with Malaysian and Japanese customers paying a premium and other countries such as India and Vietnam charging substantially less. Overall though, a 150MW HRSG unit cost \$38.2 million in 2008, which represents a CAGR of 6.9% since 2004. Prices are expected to increase at a CAGR of 0.5% between 2008 and 2012, with reductions lower than the global average due to strong demand. A unit is forecast to cost \$38.8 million by 2012.

In 2008 based on the number of units sold, BHEL was the market leader in the Rest of Asia, with 40% of the market, the result of a high volume of orders from India. Bumwoo, of Korea, a recently emerged competitor (the company has been a module manufacturer for some time) had 21% of the market. Alstom and Doosan Heavy Industries both had 14% market share, with those orders coming from Indonesia and South Korea respectively. Other notable players include Babcock Hitachi and Hangzhou Boilers.

China

The 50MW+ HRSG market in China declined at a CAGR of 28.4% per year in units between 2004 and 2008, to be worth 10 units or \$0.3 billion in revenues. China had a massive surge in investment in CCGT plants in 2003 and 2004 following the 2002 and 2003 energy crisis, when massive blackouts affected many cities of China. CCGT plants are relatively quick to build and a good solution for dealing with power shortages and HRSGs are essential components for these. China has now embarked on a massive coal-fired expansion programme, so CCGT development has slowed. However with increasing availability of LNG and a desire to preserve a balanced fuel mix, China is likely to expand the number of CCGT plants it builds over the next five years. Demand is expected to increase at a CAGR of 12.5% from 2008, with 16 units required in 2012. In revenue terms, the market is expected to grow at a CAGR of 14.3% from 2008 to be worth approximately \$0.5 billion in 2012.

Chinese HRSG Market

<u>Year</u>	<u>Units</u>	<u>Price per 150MW HRSG (\$m)</u>	<u>Revenue (\$bn)</u>
2004	38	\$19.3	\$0.7
2005	13	\$20.7	\$0.3
2006	11	\$22.5	\$0.3
2007	13	\$25.0	\$0.3
2008	10	\$27.3	\$0.3
2009	7	\$24.0	\$0.2
2010	12	\$24.7	\$0.3
2011	14	\$26.4	\$0.4
2012	16	\$29.1	\$0.5

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China's prices are the lowest in the region with a 150MW costing \$27.3 million in 2008, which represents a CAGR of 9.1% since 2004. Prices are expected to continue increasing at a CAGR of 1.6% from 2008, so that a unit is expected to cost \$29.1 million by 2012.

As China is keen to promote domestic manufacturers, and given the relatively low prices of HRSGs compared to the global market, Chinese companies dominate. Hangzhou Boilers was the largest with 50% of the market in terms of units sold in 2008, although it works in partnership with Nooter Eriksen on units that are for export. Wuxi Huaguang follows with 20% market share and Wuhan Boilers has 10% of the market. Both companies play a more prominent role in the global market by the fact that they are major module manufacturers for some of the leading systems designers.

North America

The 50MW+ HRSG market in North America grew at a CAGR of 6.5% between 2004 and 2008, to be worth 30 units or \$1.1 billion in revenues. The North American market was buoyant in the late 1990s, with massive levels of gas-fired capacity investment, but this demand fell dramatically in 2001. The market is forecast to increase at a CAGR of 2.4% from 2008, to reach 33 units by 2012. However, the market size is forecast to shrink in 2009. Uncertainty over the regulation of coal-fired plants in the United States is driving utilities to invest in gas-fired plants as an alternative. In revenue terms, the market is forecast to grow at a CAGR of 2.6% from 2008 to be worth \$1.2 billion in 2012; lower raw material costs and reduced short-term demand are the key reasons.

North American HRSG Market

<u>Year</u>	<u>Units</u>	<u>Price per 150MW HRSG (\$m)</u>	<u>Revenue (\$bn)</u>
2004	23	\$22.2	\$0.5
2005	24	\$25.2	\$0.6
2006	25	\$28.1	\$0.7
2007	27	\$33.0	\$0.9
2008	30	\$37.0	\$1.1
2009	20	\$32.5	\$0.7
2010	22	\$32.5	\$0.7
2011	28	\$34.5	\$1.0
2012	33	\$37.2	\$1.2

A 150MW HRSG unit cost \$37 million in 2008, which represents an increase at a CAGR of 13.6% since 2004. Prices are forecast to increase at a CAGR of 0.2% from 2008, so that a unit is expected to cost \$37.2 million by 2012. Prices are forecast to fall steepest in 2008, a decline of 12%, before gradually starting to recover in 2011.

In 2008 based on units sold, Nooter Eriksen and Vogt dominated the market with a 40% market share. Alstom and Doosan Heavy Industries lagged behind, with a market share of 7% each, also based on number of units in 2008.

HRSGs (3MW-50MW)

Europe & the CIS

The 3MW-50MW HRSG market in Europe & the CIS grew at CAGR of 4.4% between 2004 and 2008, to reach 26 units or \$214.5 million in revenue. This is set to continue, with demand rising at a CAGR of 3.6% from 2008, to reach 30 units by 2012. In revenue terms, the market is expected to grow at a CAGR of 3.1% from 2008, to be worth \$242.8 million in 2012.

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European & CIS HRSG Market

<u>Year</u>	<u>Units</u>	<u>Price per 35MW HRSG (\$m)</u>	<u>Revenue (\$m)</u>
2004	22	\$5.7	\$124.8
2005	20	\$5.9	\$117.0
2006	26	\$6.8	\$172.8
2007	32	\$7.5	\$240.0
2008	26	\$8.3	\$214.5
2009	14	\$6.8	\$ 94.7
2010	15	\$6.6	\$ 99.4
2011	20	\$7.2	\$144.5
2012	30	\$8.1	\$242.8

Europe and the CIS have the second highest prices in the region, after the Middle East, with a 35MW HRSG unit costing \$8.3 million in 2008, which represents a CAGR of 9.7% since 2004. Prices are set to decline at a CAGR of 0.5% from 2008, so that a unit is forecast to cost \$8.1 million by 2012. Prices are expected to fall by approximately 20% during 2009 and 2010, but recover by a similar amount by 2012.

In 2008, Innovative Steam Technologies was the market leader in Europe with a 30% market share, based on number of units sold. EM Alliance was the second largest player, with a 25% share of the market, with all sales from Russia. EM Alliance is now offering Nooter Eriksen licenced technology. Foster Wheeler was third with 20% of the market, with Austrian Energy & Environment close behind with 17%, again from sales in Russia, a key market in 2008. NEM accounted for 8% of the market, having chosen to focus on larger sized machines in the past year.

Middle East

The 3MW-50MW HRSG market in the Middle East fell by a CAGR of 9.6% per year from 15 units in 2004 to 10 units in 2008, or \$88 million in revenues. Demand in the Middle East has historically been low because of a lack of industrial demand as HRSGs have not traditionally been used with small gas turbines. Demand is expected to increase by a CAGR of 8.8% per year from 2008, to reach 14 units by 2012. In revenue terms, the market is expected to grow at a CAGR of 8.8% per year from 2008, to be worth \$123.3 million in 2012.

Middle East HRSG Market

<u>Year</u>	<u>Units</u>	<u>Price per 35MW HRSG (\$m)</u>	<u>Revenue (\$m)</u>
2004	15	\$6.1	\$ 91.2
2005	25	\$6.3	\$158.4
2006	8	\$7.2	\$ 57.6
2007	10	\$8.0	\$ 80.0
2008	10	\$8.8	\$ 88.0
2009	5	\$7.5	\$ 37.4
2010	12	\$7.5	\$ 44.9
2011	20	\$8.0	\$ 96.0
2012	14	\$8.8	\$123.3

The Middle East is the most expensive market in the region, with a 35MW HRSG unit costing \$8.8 million in 2008, representing a CAGR of 9.7% a year since 2004. Prices are expected to remain flat over the period, so that a unit is expected to cost \$8.8 million in 2012.

In 2008 based on units sold, Innovative Steam Technologies and Thermax were the joint market leaders, with 30% of the market each. After these two players Nooter Eriksen and NEM both had 20% of the market. The Middle East is a much smaller market than for larger HRSG units, so many companies do not target the market aggressively.

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Rest of Asia

The 3MW-50MW HRSG market in the Rest of Asia declined at a CAGR of 6.7% between 2004 and 2008, to be worth 12 units or \$85.8 million in revenues. Long delays in getting project approvals in 2006 and 2007 have impacted strongly on demand for this market. Malaysia is the key country market, with Japan, India and Thailand also rating as important. This decline in growth is expected to be reversed from 2008 onwards, with demand rising at a CAGR of 10.3% from 2008, to reach 18 units by 2012. In revenue terms, the market is expected to grow at a CAGR of 10.5% from 2008, to be worth \$127.8 million in 2012.

Rest of Asia HRSG Market

<u>Year</u>	<u>Units</u>	<u>Price per 35MW HRSG (\$m)</u>	<u>Revenue (\$m)</u>
2004	16	\$5.8	\$ 91.0
2005	21	\$6.0	\$126.1
2006	12	\$6.2	\$ 71.5
2007	11	\$6.5	\$ 71.5
2008	12	\$7.2	\$ 85.8
2009	8	\$6.3	\$ 50.3
2010	11	\$6.3	\$ 69.2
2011	15	\$6.9	\$103.8
2012	18	\$7.5	\$134.5

As with larger sized units, prices vary quite substantially between countries, with Malaysian and Japanese customers paying a premium and other countries such as India and Vietnam charging substantially less. Overall though, the price for a 35MW HRSG unit cost \$7.2 million in 2008, which represents a CAGR of 5.6% since 2004. Prices are expected to increase modestly over the period, at a CAGR of 1.1% a year, such that a unit is expected to cost \$7.5 million by 2012.

In 2008 based on units sold, Austrian Energy & Environment was the clear market leader with 50% market share, having secured a number of orders in Australia in 2008. This takes the company ahead of BHEL who had a 35% share, all of which originated from sales within India, a key market for the future. Nooter Eriksen and Mitsubishi Heavy Industries accounted for the remainder of the market with 8% each.

China

The 3MW-50MW HRSG market in China grew from a low base, but fell back in 2008, so the overall impact was a negative CAGR of 0.2% between 2004 and 2008. In 2008, the market was worth \$39.6 million in revenues. Energy efficiency in China is still at its infancy for smaller projects and in many cases traditional waste heat boilers are preferred because, and although less efficient, they are cheaper. Demand is expected to increase at a CAGR of 17.2% from 2008, with 17 units required in 2012. In revenue terms, the market is expected to grow at a CAGR of 19.7% from 2008, to be worth approximately \$81.3 million in 2012.

Chinese HRSG Market

<u>Year</u>	<u>Units</u>	<u>Price per 35MW HRSG (\$m)</u>	<u>Revenue (\$m)</u>
2004	9	\$3.1	\$28.0
2005	10	\$3.3	\$32.9
2006	12	\$3.6	\$41.4
2007	13	\$4.0	\$52.0
2008	9	\$4.4	\$39.6
2009	6	\$3.9	\$23.2
2010	10	\$4.0	\$40.3
2011	14	\$4.4	\$62.0
2012	17	\$4.8	\$81.3

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China's prices are the lowest in the region with 3MW-50MW HRSG costing on average \$4.4 million in 2008, which represents a CAGR of 9.3% since 2004. Prices are forecast to decline in 2009, but are expected to start to recover in 2010 and increase at a CAGR of 2.1% from 2008, to reach \$4.8 million in 2012.

As with large HRSGs, the same players feature in this segment of the market. Based on units sold in 2008, Hangzhou Boiler dominated with 45% market share. Wuxi Huaguang was the second largest player with 33% market share, while Wuhan Boilers and the 703 Institute accounted for the remainder of the market with 11% each.

North America

The 3MW-50MW HRSG market in North America declined at a CAGR of 5.7% between 2004 and 2008, based on number of units, to be worth 30 units, or \$214.5 million in revenues. The North American market has declined because of the recession, with orders tailing off significantly in 2008. Demand is expected to fall by 50% in 2009, to 15 units, continuing the 2008 trend. However the market is expected to start to recover in 2010 and increase sharply in 2011, growing at a CAGR of 1.6% from 2008, to reach 32 units in 2012. In revenue terms, the market is expected to increase at a CAGR of 1.1% from 2008, to be worth \$224.5 million in 2012.

North American HRSG Market

<u>Year</u>	<u>Units</u>	<u>Price per 35MW HRSG (\$m)</u>	<u>Revenue (\$m)</u>
2004	38	\$4.4	\$166.2
2005	39	\$5.0	\$196.4
2006	42	\$5.5	\$231.3
2007	45	\$6.5	\$292.5
2008	30	\$7.2	\$214.5
2009	15	\$5.9	\$ 87.9
2010	18	\$5.7	\$103.4
2011	24	\$6.3	\$150.3
2012	32	\$7.0	\$224.5

As with larger sizes, North American prices are slightly below those in Europe and Asia, with a 35MW HRSG unit costing \$7.2 million in 2008, which represents a CAGR of 13.1% since 2004. Prices are set to fall at a CAGR of 0.5% a year from 2008, so that a unit is expected to cost \$7.0 million by 2012.

Based on units sold in 2008, Vogt and Innovative Steam Technologies both had 30% of the market in North America, with 20% being held by Nooter Eriksen and the remaining 20% accounted for by companies such as Kentube and Cleaver Brooks. There are more than three players in North America, but many of them did not make sales in 2008, preferring to focus on other regions or product ranges.

Waste Heat Boilers

Europe & the CIS

The waste heat boiler market for Europe & the CIS declined by 33% in 2008 to reach 31 units and \$646 million in revenues. Falling industrial output and financial constraints on industrial customers has impacted severely on this market. Consistently increasing demand levels seen prior to 2008 are expected to give way to lower order volumes, with a fall in orders forecast for 2009, to 23 units. The market is expected to start to recover in 2010 and further improve in 2011, based on the strong fundamentals of the market. Overall, the market is expected to increase at a CAGR of 6.8% between 2008 and 2012. In revenue terms, the market is expected to increase at a CAGR of 6.1% for same period.

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European & CIS Waste Heat Boiler Market

<u>Year</u>	<u>Units</u>	<u>Price per 20MW WHB (\$m)</u>	<u>Revenues (\$mn)</u>
2004	33	\$15.1	\$495.3
2005	36	\$16.4	\$586.8
2006	39	\$18.2	\$710.7
2007	41	\$20.0	\$820.0
2008	31	\$21.0	\$645.8
2009	23	\$17.9	\$411.7
2010	24	\$18.2	\$440.9
2011	30	\$19.1	\$578.7
2012	40	\$20.5	\$817.3

Europe and the CIS has the highest price levels of all the regions after the Middle East, with a 20MW waste heat boiler unit costing an average of \$21 million in 2008. Prices are expected to decrease over the forecast period at a CAGR of 0.7% from 2008, due to lower demand and lower commodity prices, with a boiler costing \$20.5 million in 2012.

The market leader in this segment was Austrian Energy & Environment in 2008, with 21% of the market, in terms of units sold. Greens has worked with Austrian Energy & Environment in the past and has supplied components and boiler modules for projects that the company has won. The next player was Martin GmbH, with an 11% share of the market and joint third was Fisia Babcock and Zio Podolosc with 9% of the market each.

Rest of Asia

The waste heat boiler market in the Rest of Asia declined by 15% in 2008 from 2007 to reach 95 units and \$617 million in revenues. The economic slowdown has had an impact here, although not as severe as Europe or North America. Going forward, demand is expected to fall in 2009, remain flat in 2010 and then rebound strongly in 2011 and 2012. India has signaled a determination to tackle the issue of energy efficiency, particularly energy that is wasted in the combustion process. Overall the market is expected to grow at a CAGR of 11.5% from 2008 to 2012, the result of the strong recovery. In revenue terms, the market is expected to increase at a CAGR of 13.2% from 2008, to be worth \$1 billion in 2012.

Rest of Asia Waste Heat Boiler Market

<u>Year</u>	<u>Units</u>	<u>Price per 10MW WHB (\$m)</u>	<u>Revenues (\$mn)</u>
2004	99	\$5.1	\$ 509.8
2005	102	\$5.4	\$ 547.0
2006	106	\$5.6	\$ 595.9
2007	112	\$6.0	\$ 672.0
2008	95	\$6.5	\$ 616.9
2009	81	\$5.8	\$ 471.9
2010	81	\$6.1	\$ 490.8
2011	105	\$6.4	\$ 676.3
2012	147	\$6.9	\$1,013.1

The average price in the Rest of Asia is based on a 10MW boiler, which is the popular size for the region. Prices grew at a CAGR of 5.9% between 2004 and 2008, to reach \$6.5 million in 2008. Prices are forecast to increase at a CAGR of 1.5% from 2008, so that a unit is expected to cost \$6.9 million by 2012.

In 2008, based on units sold, BHEL was the market leader with 25% of the market, due to strong order volumes in India. Foster Wheeler, in partnership with ISGEC Thompson, was second with 16% of the market,

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followed closely by Sumitomo Heavy Industries, who is strong in Japan, with 14% of the market. Other notable players are Babcock Hitachi and Thermax.

China

The waste heat boiler market in China grew at a CAGR of 9.6% between 2004 and 2008, to reach 200 units or \$1.1 billion in revenues. China has been strongly promoting the use of waste heat boilers for energy efficiency. In the short term, the economic situation has affected demand, with flat growth in 2008 and only 5% expected in 2009. However from 2010, the market is set to explode with growth of 30% in 2010 and similar levels in 2011 and 2012. This is expected to result in a CAGR of 19.6% between 2008 and 2012, with the market reaching 410 units in 2012. In revenue terms, the market is forecast to increase by a CAGR of 21.6% from 2008, to be worth approximately \$2.4 billion in 2012, with the extra demand offsetting lower unit costs.

Chinese Waste Heat Boiler Market

<u>Year</u>	<u>Units</u>	<u>Price per 10MW WHB (\$m)</u>	<u>Revenues (\$mn)</u>
2004	139	\$3.6	\$ 499.4
2005	155	\$3.9	\$ 607.9
2006	179	\$4.5	\$ 803.6
2007	200	\$5.0	\$1,000.0
2008	200	\$5.4	\$1,080.0
2009	210	\$4.8	\$ 997.9
2010	273	\$5.0	\$1,375.1
2011	328	\$5.3	\$1,749.2
2012	410	\$5.8	\$2,361.4

China's prices are the lowest in the region with a 10MW costing \$5.4 million in 2008, having grown at a CAGR of 10.7% since 2004. Prices are expected to increase at a CAGR of 1.7% between 2008 and 2012, so that a unit is expected to cost \$5.8 million in 2012.

Based on the units sold in 2008, Suzhou Hailu Heavy Industry was the market leader with 40% of the market. The next largest player was Yancheng Boiler with 18% of the market, followed by Hangzhou Boiler, with 12% of the market. Hangzhou Boiler was traditionally stronger in the more technologically advanced HRSG segment. Other notable players are Handan Boiler, Anshan Boiler, Wuxi Taihu Boiler and Greens.

North America

The waste heat boiler market in North America declined at a CAGR of 3.9% between 2004 and 2008, to be worth 38 units or \$636 million in revenues. Falling industrial output in the present economic scenario and the credit crunch are the main restraints for the market in the short term. The economic slowdown has affected both the market and the region, resulting in a decline in orders for 2008 of 25%, and Frost & Sullivan Limited forecasts a further decline of about 25% in 2009. The market is expected to recover and grow from 2010 onwards, up 15% in that year. The new US Administration is committed to improving the US's energy situation, both through improving efficiency and curbing demand. Overall, the market is expected to increase at a CAGR of 3.8% from 2008, to reach 43 units by 2012, and in revenue terms the market value is expected to increase by a CAGR of 5.1% from 2008, to reach \$774.8 million by 2012.

North American Waste Heat Boiler Market

<u>Year</u>	<u>Units</u>	<u>Price per 20MW WHB (\$m)</u>	<u>Revenues (\$mn)</u>
2004	44	\$13.1	\$578.8
2005	45	\$13.8	\$627.5
2006	48	\$14.7	\$701.0
2007	50	\$16.0	\$800.0
2008	38	\$17.0	\$636.0
2009	28	\$15.3	\$429.3
2010	32	\$15.6	\$503.6
2011	36	\$16.5	\$597.8
2012	43	\$17.8	\$774.8

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North American prices are approximately 80% of European ones at \$17 million for a 20MW unit, having risen at a CAGR of 6.6% since 2004. Prices are expected to increase growing by at a CAGR of 1.2% between 2008 and 2012, and average price of a waste heat boiler is expected to have reached \$17.8 million by 2012.

In 2008 based on units sold, Cleaver Brooks was the market leader in North America with a 30% share of the market. They were closely followed by Rentech with a 25% share of the market. Babcock & Wilcox were third with a 15% share of the market. The other notable participant is Indec; beyond that the market is fragmented between a number of small localised players.

Marine Boilers

Europe & the CIS

The marine boiler market in Europe & the CIS declined in 2008 by 33%, as the region plunged into recession. The market size in 2008 was 31 units and \$24 million in revenues. Lower oil prices, falling global trade and financial constraints associated with the credit crunch have severely impacted the market and are major restraints in the short term. Frost & Sullivan Limited forecasts that the market is expected to decline by approximately 75% in 2009. From 2011 and beyond, it is expected that the market is expected to recover based on improved economic prospects and the gradual recovery in global trade. Looking ahead, the market is forecast to grow at a CAGR of 0.9% from 2008, to reach 33 units by 2012 and \$25 million in revenues.

European & CIS Marine Boiler Market

Year	Units	Price Range of Boilers (\$m)	Revenues (\$'000)
2004	36	\$0.5-1.5	\$21,931
2005	41	\$0.5-1.6	\$23,062
2006	45	\$0.5-1.8	\$31,440
2007	47	\$0.6-2	\$38,800
2008	31	\$0.6-2.1	\$24,440
2009	8	\$0.5-1.6	\$ 4,975
2010	15	\$0.48-1.6	\$ 8,101
2011	25	\$0.5-1.6	\$15,914
2012	33	\$0.5-1.7	\$25,092

Europe and the CIS have the highest price levels, with marine boiler prices ranging from \$600,000 for an auxiliary boiler to \$2 million for an FPSO boiler. These prices are set to decrease due to the impact of the economic crisis, resulting in lower demand and lower commodity prices. Prices are expected to decline at a CAGR of 3.4% from 2008, to \$550,000 for an auxiliary boiler, \$1.5 million for a LNG propulsion boiler and \$1.8 million for an FPSO boiler by 2012.

Based on units in 2008, Aalborg dominated the market in Europe, while Saacke was in second place with 15% of the market.

Rest of Asia

The marine boiler market in the Rest of Asia declined at a CAGR of 14% per year between 2004 and 2008 to be worth 169 units or \$105 million in revenues. The economic crisis is severely impacting the market, with a significant reduction in new sales in 2008 and 2009, resulting in a decline in 2008 of about 45% and an estimated further drop of 45% in 2009. The market in the Rest of Asia was at peak levels in 2004 and 2005, but the present economic situation is expected to really hurt the market in the short-term. Overall though, the market size is forecast to improve, increasing at a CAGR of 1% from 2008, to reach 176 units and \$82 million in revenues by 2012.

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Rest of Asia Marine Boiler Market

<u>Year</u>	<u>Units</u>	<u>Price Range of Boilers (\$m)</u>	<u>Revenues (\$'000)</u>
2004	309	\$0.3-1.5	\$130,769
2005	337	\$0.3-1.5	\$150,150
2006	279	\$0.3-1.6	\$148,143
2007	305	\$0.4-1.8	\$155,647
2008	169	\$0.4-1.9	\$104,647
2009	92	\$0.3-1.5	\$ 34,777
2010	126	\$0.3-1.5	\$ 49,182
2011	158	\$0.3-1.5	\$ 69,683
2012	176	\$0.3-1.7	\$ 81,788

The average price for a marine boiler in the Rest of Asia in 2008 varied from \$0.4 million for an auxiliary boiler to \$1.9 million for an FPSO one. Prices are forecast to decrease in the present economic scenario due to reduced demand and lower raw material prices. Looking ahead prices are expected to decline by a CAGR of 3.6% from 2008 to reach about \$365,000 for an auxiliary boiler, \$1.4 million for a LNG propulsion boiler and \$1.7 million for a FPSO boiler by 2012.

Based on units sold in 2008, Aalborg dominated the market in the Rest of Asia with 50% of market share, ahead of Mitsubishi with 20% of the market. Kawasaki is third with a 10% share of the market. Other notable players include Osaka and Miura.

China

The marine boiler market in China grew at a CAGR of 17.5% per year between 2004 and 2008, to be worth 80 units or \$38 million in revenues. China has been keen to challenge the dominance of South Korea in this market. However the current economic slowdown has impacted the market severely and has resulted in a decline of 11.1% in 2008 and an estimated further decline of 60.0% in 2009. The fall in global trade, financing issues and lower investments in oil & gas, due to reduced oil prices, are major restraints in the short term. Looking ahead the market is expected to decline at a CAGR of 6.9% from 2008, to reach 60 units in 2012 and \$24 million in revenues.

Chinese Marine Boiler Market

<u>Year</u>	<u>Units</u>	<u>Price Range of Boilers (\$m)</u>	<u>Revenues (\$'000)</u>
2004	42	\$0.3-1.5	\$11,417
2005	56	\$0.3-1.5	\$18,878
2006	75	\$0.3-1.6	\$23,930
2007	90	\$0.4-1.8	\$32,807
2008	80	\$0.4-1.9	\$37,634
2009	32	\$0.3-1.5	\$10,176
2010	39	\$0.3-1.5	\$12,620
2011	54	\$0.3-1.5	\$20,518
2012	60	\$0.3-1.7	\$23,785

The average price for a marine boiler in China in 2008 varied from \$400,000 for an auxiliary boiler to \$1.9 million for an FPSO boiler. Prices are forecast to decrease due to declining demand and lower raw material prices. Looking ahead, prices are expected to decline at a CAGR of 3.6% from 2008 to \$365,000 for an auxiliary boiler, \$1.3 million for a LNG propulsion boiler and \$1.7 million for a FPSO boiler by 2012.

Based on units in 2008, Aalborg dominated the market in China with 60% of market share, ahead of Saacke which held 18% market share and Hailu which had a 9% share of the market. Other notable players include Greens and Kangrim.

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Boiler Components

China

The boiler components market in China grew at a CAGR of 10.2% per year between 2004 and 2008, to reach approximately 637,000 tonnes or \$2.1 billion in revenues. Demand is expected to increase by a CAGR of 3.7% from 2008 to 2012, with approximately 737,473 tonnes sold in 2012. In revenue terms, the market is expected to grow at a CAGR of 2% from 2008, to be worth approximately \$2.3 billion in 2012.

Chinese Boiler Components Market

<u>Year</u>	<u>Tonnes</u>	<u>Average Price Per Tonne (\$)</u>	<u>Revenues (\$bn)</u>
2004	431,607	\$2,361	\$1.0
2005	476,062	\$2,539	\$1.1
2006	582,224	\$2,730	\$1.5
2007	612,500	\$3,000	\$1.7
2008	637,000	\$3,450	\$2.1
2009	560,560	\$2,760	\$1.5
2010	582,982	\$2,843	\$1.6
2011	670,430	\$2,985	\$1.9
2012	737,473	\$3,224	\$2.3

The average price for a Chinese boiler component was \$3,450 per tonne in 2008, when raw material costs were at their peak. Going forward the price is expected to decline sharply in the short-term, with a 20% fall in 2009, but the price is expected to start recovering in 2010, as the Chinese market conditions improve. Overall, the price per tonne is forecast to decline by a CAGR of 1.7% per year to \$3,224, from 2008 to 2012.

Based on tonnes of components sold in 2008, Shanghai Boilers was the market leader with a 25% share of the market, followed by Dongfang Boilers, which had a 24% share of the market and Harbin Boilers, which had a 23% share of the market.

North America

The boiler components market in North America grew at a CAGR of 7.8% between 2004 and 2008 to be worth 65,075 tonnes or \$400 million in revenues. Going forward, the situation in North America is set to deteriorate sharply, with a lack of new boiler orders from either utilities or industrial customers. Industrial customers have been hit by the recession; the utilities are suffering some issues with financing, but the continued uncertainty over legislation to cap carbon emission and create a trading system is deterring investment. Demand is forecast to come instead from customers upgrading and retrofitting existing boilers. The market is expected to decline at a CAGR of 4.5% from 2008, to be worth 54,182 tonnes in 2012, although a partial recovery is expected to be staged in 2011 and 2012. In revenue terms, the market is forecast to fall at a CAGR of 6.1% from 2008, to be worth \$300 million in 2012.

North American Boiler Components Market

<u>Year</u>	<u>Tonnes</u>	<u>Average Price Per Tonne (\$)</u>	<u>Revenues (\$bn)</u>
2004	48,270	\$3,576	\$0.2
2005	53,241	\$3,973	\$0.2
2006	65,114	\$4,515	\$0.3
2007	68,500	\$5,250	\$0.4
2008	65,075	\$6,038	\$0.4
2009	45,553	\$4,830	\$0.2
2010	40,997	\$4,975	\$0.2
2011	45,917	\$5,224	\$0.2
2012	54,182	\$5,642	\$0.3

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The average price for a North American boiler component was \$6,038 per tonne in 2008. This is forecast to decline by a CAGR of 1.7% from 2008, to 5,642 per tonne in 2012.

Based on tonnes of components sold in 2008, Alstom was the market leader with a 30% share of the market, while Babcock & Wilcox had a 17% share of the market and Foster Wheeler had a 16% share of the market. The other notable player in the market is Babcock Power.