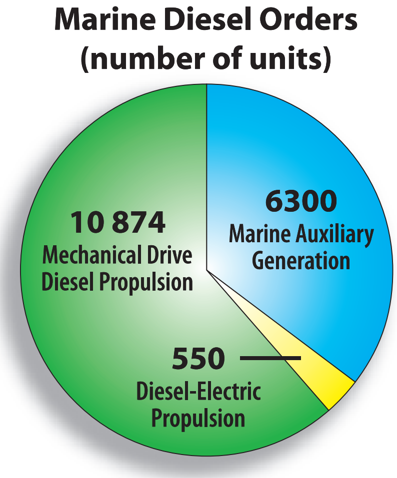
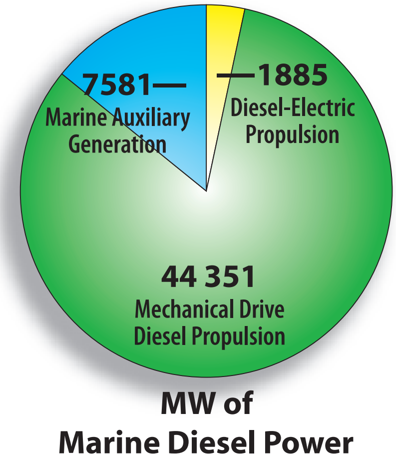
2007

MARINE PROPULSION ORDER SURVEY

DIESEL & GAS TURBINE WORLDWIDE

The Marine and Stationary Power Authority





Marine Engines Remain Strong, with Largest Units Resurging

Smallest engine orders decrease, but all other categories show super growth

This year marks *Diesel & Gas Turbine Worldwide's* 10th annual survey of mechanical drive marine propulsion engine orders. Engine order volumes are high for the year, as they have been for several years running. There has been a slight decrease in small engine orders, but all of the other engine output categories have shown healthy increases, especially in the largest MW outputs.

Mechanical drive output increased to 44 351 MW this year over last year's 30 585 MW, a 45% increase driven mostly by a surge in orders for the largest marine engines. And due to the increase in large engines, engine order volume increased only slightly (4.5%) over 2006, with 10 874 units this year versus 10 405 units in 2006. As with last year's large increase, this unit volume increase still represents tremendous marine order activity, including everything from offshore vessels to ferries to patrol boats to feeders to VLCCs to bulkers. Diesel auxiliary generating unit orders were up again this year, with increases corresponding somewhat to the increases in the mechanical drive sector. Diesel-electric marine propulsion orders were again a bright spot this year, continuing growth in that sector with a unit increase of 17%.

As *D&GTW* has conducted in the past, the year's surveys also includes the 16th consecutive year in reporting orders for marine auxiliary generation engines, as well as the 11th year in recording orders for diesel-electric marine propulsion units.

As in previous reports, the survey period covers engine orders from a June 1 to May 31 timeframe and covers various output categories from 0.5 MW (500 kW) and above. Most of the world's marine engine builders, and their licensees, have participated in all facets of this survey, so that the information provided should be useful for comparison purposes and trend analysis.

The mechanical drive unit orders are up 4.5% over 2006, from 10 405 to 10 874. Overall engine output, however, increased by 45%, from 30 585 to 44 351 MW. Marine auxiliary generator engine orders and output increased, with unit orders up 42% over 2006 and engine output up 36%. Diesel-electric engine orders were also up, increasing 17% from 2006 and total diesel-electric output increasing 31%.

The combined output for all engines from the three surveys increased by 43%, from 37 608 to 53 817 MW, while total units ordered are up by nearly 16% (the same percentage increase as 2006) — from 15 300 to 17 724 units. Unit order increases were seen in all three areas, the mechanical drive, auxiliary gen-set and diesel-electric engine categories. The 2007 results certainly reflect vigorous activity in larger vessel orders across all marine sectors.

In terms of geographic location of the engines at the shipbuilder's site, there were increases and decreases among the world's major shipbuilding centers, although the Far East (which includes Japan, South Korea and China) showed increases in all three of the marine engine surveys. The Far East was again a leader for the largest engine output ranges, accounting for 538 of the 573 engine orders above 15 MW. Other large volume areas, including Europe and North America, also posted strong increases.

Mechanical Drive Orders

Total mechanical drive propulsion orders increased by only 469 units this year, but total output increased by a whopping 13 766 MW. The increase in output numbers reflects substantial unit order increases in all three of the largest output ranges, 15 to 30 MW, 30 to 50 MW and 50 MW and above. As for individual categories, the largest unit increases were recorded in the all three of the largest output categories. Likewise, all of the categories from 1.0 to 15 MW grew respectably, each with double-digit percentage increases. Only the smallest output category, from 500 kW to 1.0 MW, decreased about 15% from 4447 units in 2006 to 3793 units in 2007.

In the engine speed ranges, there were mixed results. Due to the large increase in the biggest engines, the

MECHANICAL DRIVE DIESEL MARINE PROPULSION ORDERS, June 2006 – May 2007

Output Range (MW)	Number of Engines	Total Output (MW)	Engine Speed (r/min) Below 300	300-600	720-1000	Above 1000	Fuel (Units) Diesel Oil	Heavy Fuel	Natural Gas	Western Europe	Eastern Europe & Russia	Middle East	Far East	Southeast Asia/ Australasia	Central Asia	North Africa	Central, W., E. & S. Africa	North America	Central America	South America
0.5 - 1.0	3793	2596	0	2	32	3759	3781	12	0	1515	10	77	578	726	10	0	16	825	26	10
1.01 - 2.0	3768	5383	7	17	451	3293	3532	236	0	1876	86	102	408	291	77	2	2	886	5	33
2.01 - 3.5	968	2430	13	84	452	419	623	345	0	245	38	86	242	187	63	0	0	101	0	6
3.51 - 5.0	438	1781	114	112	174	38	112	326	0	77	14	50	195	51	28	0	0	20	0	3
5.01 - 7.5	374	2285	195	79	70	30	59	315	0	47	3	7	287	22	6	0	0	2	0	0
7.51 - 15.0	960	9856	845	80	29	6	24	936	0	77	0	7	839	29	6	0	0	2	0	0
15.01 - 30.0	267	5074	258	8	0	1	0	266	1	10	3	1	253	0	0	0	0	0	0	0
30.01 - 50.0	156	5882	156	0	0	0	0	156	0	6	10	0	139	1	0	0	0	0	0	0
50.0 + above	150	9064	150	0	0	0	0	150	0	0	0	0	146	4	0	0	0	0	0	0
Totals	10 874	44 351	1738	382	1208	7546	8131	2742	1	3853	164	330	3087	1311	190	2	18	1836	31	52

*Geographic location is at the shipbuilding site

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0.5 - 1.0	4447	2974		7	86	4354	4439	8		1564	22	101	650	1163	33	12	15	813	8	66
1.01 - 2.0	3398	4832	10	201	545	2642	3193	205		1384	131	94	462	412	34	7	3	789	1	81
2.01 - 3.5	854	2213	76	147	345	286	547	304	3	242	27	74	159	197	85			57		13
3.51 - 5.0	308	1256	148	2	142	16	69	239		62	19	30	114	31	24			24		4
5.01 - 7.5	274	1743	167	59	28	20	31	227	16	30	10	31	171	26	4			2		
7.51 - 15.0	863	8524	606	222	7	28	34	813	16	177	36	46	562	17	8			12	2	3
15.01 - 30.0	130	2908	128	2				130		7	3		117	3						
30.01 - 50.0	80	2918	80					80					70	10						
50.0 + above	51	3217	51					51					51							
Totals	10 405	30 585	1266	640	1153	7346	8313	2057	35	3466	248	376	2356	1859	188	19	18	1697	11	167

*Geographic location is at the shipbuilding site

<300 r/min category increased by 37% — 1738 units in 2007 vs. 1266 in 2006 — and nearly all of the engines above 15 MW fall into this category. The 300 to 600 r/min category decreased by 40% this year, while the higher speed ranges remained relatively unchanged.

With the decrease in the smallest output range, fuel usage for mechanical drive diesels naturally reflected a slight 2% decrease in diesel fuel. Conversely, heavy fuel engines posted a big increase of 33%. There also would seem to be a continued shift from diesel to heavy fuel engines in the output categories below 15 MW. All of the units above 15 MW were heavy fuel engines. Finally, in the recently added category of "natural gas" fueled engines this year there was only one engine reported in the 15 to 30 MW category.

With regard to the geographic location of the shipbuilding site, the Far East, with an overwhelmingly dominant position in large engine production, reflected the respective increases and decreases in engines in all of the output categories. This somewhat reflects the major manufacturer's licensee activities. One noteworthy contradictory figure is a 30% decrease in the high volume region encompassing Southeast Asia/Australasia, which had shown increases in previous years. Western Europe was up 11% over 2006, with a significant increase of 492 units in the 1.0 to 2.0 MW output range. North America reflected an increase of 8% with 1836 units. South America decreased 69% over 2006 to 52 units.

Marine Auxiliary Gen-Sets

Despite last year's increase in auxiliary drive engine orders, this year's unit orders increased even more, up by 36% in total output, while increasing in units ordered by 42%. This increase was primarily a result of increases in all three of the output categories up to 3.5 MW. And although the 3.5 to 5.0 MW category remained unchanged at 145 units, there were noteworthy orders of 14 units in

MARINE AUXILIARY GENERATING SET ORDERS, June 2006 – May 2007

Output Range (MW)	Number Auxiliary Units	Total Output (MW)	Engine Speed (r/min) 300-600	720-1000	Above 1000	Fuel (Units) Diesel Oil	Heavy Fuel	Western Europe	Eastern Europe & Russia	Middle East	Far East	Southeast Asia/ Australasia	Central Asia	North Africa	Central, W., E. & S. Africa	North America	Central America & Caribbean	South America
0.5 - 1.0	3754	2676	0	2484	1270	1958	1796	388	47	65	2739	230	93	0	0	143	7	42
1.01 - 2.0	1605	2223	0	1345	260	505	1100	200	54	39	1161	37	21	5	0	64	12	12
2.01 - 3.5	782	1971	3	650	129	235	547	153	17	4	586	10	0	0	0	5	1	6
3.51 - 5.0	145	619	0	145	0	4	141	2	0	0	143	0	0	0	0	0	0	0
5.01 & above	14	92	0	10	4	6	8	0	0	0	8	4	0	0	0	0	0	2
Totals	6300	7581	3	4634	1663	2708	3592	743	118	108	4637	281	114	5	0	212	20	62

*Geographic location is at the shipbuilding site

MARINE AUXILIARY GENERATING SET ORDERS, June 2005 – May 2006

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0.5 - 1.0	2390	1707		1686	704	1479	911	265	14	99	1577	150	153	8	5	91	8	20
1.01 - 2.0	1354	1933		1079	275	480	874	356	56	34	715	47	72	3		57	1	13
2.01 - 3.5	531	1357	3	507	21	135	396	79			431	1			1	15		4
3.51 - 5.0	149	587	20	129		4	145	18			131							
5.01 & above																		
Totals	4424	5584	23	3401	1000	2098	2326	718	70	133	2854	198	225	11	6	163	9	37

*Geographic location is at the shipbuilding site

DIESEL-ELECTRIC MARINE PROPULSION ORDERS, June 2006 – May 2007																		
Output Range (MW)	Number of Diesel-Electric Propulsion Units	Total Output (MW)	Engine Speed (r/min)			Fuel (Units)		Western Europe	Eastern Europe & Russia	Middle East	Far East	Southeast Asia/ Australasia	Central Asia	North Africa	Central, W., E. & S. Africa	North America	Central America & Caribbean	South America
			300-600	720-1000	Above 1000	Diesel Oil	Heavy Fuel											
0.5 - 1.0	40	33	0	0	40	40	0	15	2	17	0	6	0	0	0	0	0	0
1.01 - 2.0	141	228	0	64	77	119	22	49	0	1	18	14	10	5	0	44	0	0
2.01 - 3.5	152	366	0	93	59	125	27	89	0	0	9	8	11	0	0	33	2	0
3.51 - 5.0	79	357	2	77	0	47	32	46	0	2	19	8	0	4	0	0	0	0
5.01 - 7.5	119	731	33	86	0	27	92	31	8	0	80	0	0	0	0	0	0	0
7.51 & above	19	176	19	0	0	13	6	6	0	0	5	0	0	0	0	8	0	0
Totals	550	1885	54	320	169	364	179	229	10	20	131	36	21	9	0	85	2	0

*Geographic location is at the shipbuilding site

DIESEL-ELECTRIC MARINE PROPULSION ORDERS, June 2005 – May 2006																		
Output Range (MW)	Number of Diesel-Electric Propulsion Units	Total Output (MW)	Engine Speed (r/min)			Fuel (Units)		Western Europe	Eastern Europe & Russia	Middle East	Far East	Southeast Asia/ Australasia	Central Asia	North Africa	Central, W., E. & S. Africa	North America	Central America & Caribbean	South America
			300-600	720-1000	Above 1000	Diesel Oil	Heavy Fuel											
0.5 - 1.0	85	44			85	85		64			15					6		
1.01 - 2.0	84	127		41	43	55	29	21	3		22	14		2		21		1
2.01 - 3.5	134	337	12	93	29	109	25	100			8	12	2		2	10		
3.51 - 5.0	98	430	7	91		48	50	10	2	12	38	23				12	1	
5.01 - 7.5	52	319	8	44		13	39	14	2		30	4				2		
7.51 & above	18	182	18			8	10	10								8		
Totals	471	1439	45	269	157	318	153	219	7	12	113	53	2	2	2	59	1	1

*Geographic location is at the shipbuilding site

the >5.0 MW range — something not reported since the 2004 survey.

Again, as with mechanical drive engine orders, fuel choice this year was skewed toward heavy fuel, with an increase of 54% over 2006. In the smallest output category — 500 kW to 1.0 MW — heavy fuel engines increased by 97% (1796 units vs. 911 in 2006). With regard to engine speed, it is interesting to note that engines reported in the speed range from 300 to 600 r/min dropped again, accounting for only three engines this year. Medium- and high-speed engines increased by approximately 36% and 66%, respectively.

From the geographic location standpoint, engine orders remained relatively unchanged in most regions except for the Far East, which was up by 62% to 4637 units. In some of the lower volume regions, Eastern Europe/Russia posted an increase of 68%, Southeast Asia/Australasia increased by 42% and Central Asia decreased by almost 50%.

Diesel-Electric Propulsion

Continuing to shine as a bright spot over the years, diesel-electric propulsion again demonstrated growth in both units and output, increasing by 17% and 31%, respectively. Accounting for this increase is continued use of electric propulsors across several vessel types, including the traditional cruise and survey ship markets, but also increased usage in coastal/offshore and ropax ships.

Diesel-electric engine orders were mixed — up significantly in two of the six output categories, while decreasing in two categories. The 1.0 to 2.0 MW output range increased by 68%, to 141 units vs. 84 in 2006. The 5.0 to 7.5 MW output range increased by 129%, to 119 units vs. 52 in 2006. Decreases were reflected in both output ranges of 500 kW to 1.0 MW and 3.5 to 5.0 MW, at -53% and -20%, respectively. The largest category of >7.5 MW remained unchanged.

With regard to fuel type, both diesel fuel and heavy fuel increased (14% and 17%). Whereas diesel-fueled engine orders have accounted for roughly two-thirds of the total engine orders, this year the heavy fuel engines account for nearly one-half of the orders.

The geographic locations for these engines either posted increases or remained unchanged. Most of the higher volume regions posted gains, including Western Europe and the Far East, which had increases of 4.5% and 16%, respectively. Interestingly, the Far East continues to increase its reported diesel-electric engines each year. North American engine orders increased by 44% (85 units vs. 59 in 2006). Other noteworthy regions include an increase of 19 orders from Central Asia versus two in 2006. Southeast Asia/Australasia decreased by 32% to 36 units.

Engine operating speeds reflect the mixed increases and decreases of four categories, thus keeping the lowest and highest speed ranges unchanged. The 720 to 1000 r/min range, however, increased by 19% to 320 units.

Overall Results

In 2004, marine engine order activity hit a record level, especially for the largest oceangoing vessels. Worldwide shipbuilding, however, is now in the eighth year of a construction boom. Here's the "tale of the tape:" in 2004 combined output reached 45 030 MW, while this year's output reached 53 817 MW; and in 2004, units ordered were 11 340, while 2007 engine orders reached 17 724. Engine output and orders remain at historically high levels.

Among the factors continuing to influence this building boom are the strong economies in Asia, Europe and the Americas, which have fueled the need for cargo and general bulk carriers, as well as containerships and feeders. There is also influence coming from the large megayacht sector. Also, the whole petroleum industry continues to drive the requirement for newer, faster and bigger support vessels for offshore activities of all types. And specialty military and coastal defense vessels continue to be ordered. Finally, from about 1999 onward there has been increased usage of diesel-electric propulsion systems, extending beyond traditional vessel applications.

It will bear watching the continuing

Mechanical Drive Marine Propulsion Manufacturers Participating and Reporting Orders in this Survey

- Caterpillar Engine Division (including Caterpillar Marine Power Systems)
- Cummins Marine
- Daihatsu Diesel Mfg.
- Electro-Motive Diesel
- Fairbanks Morse Engine
- GE Transportation
- Guascor
- Hyundai Heavy Industries
- MAN Diesel Group (including Augsburg, Copenhagen, Frederikshavn, St. Nazaire and licensees):
  - CXZ Shanghai Xinzhong Power Machine Plant, China;
  - Dalian Marine Diesel Works, China;
  - Hudong Heavy Machinery Co. Ltd., China;
  - SXD Shaanxi Diesel Engine, China;
  - Yichang Marine Diesel Works, China;
  - ZJCME Zhenjiang Marine Diesel Works, China;
  - Adria d.d., Croatia;
  - Brodosplit – Diesel Engine Factory d.o.o., Croatia;
  - Uljanik Strojogradnja d.d., Croatia;
  - Hitachi Zosen Corporation, Japan;
  - Kawasaki Heavy Industries Ltd., Japan;
  - Mitsui Engineering & Shipbuilding Co. Ltd., Japan;
  - Doosan Engine Co. Ltd., Korea;
  - Hyundai Heavy Industries Co. Ltd., Korea;
  - STX Engine Co. Ltd., Korea;
  - Vietnam Shipbuilding, Vietnam;
  - H. Cegielski, Poland;
  - Bryansk Engineering Works, Russia;
  - Fairbanks Morse Engine, U.S.A
- MTU Friedrichshafen (including Detroit Diesel)
- Mitsubishi Heavy Industries
- Rolls-Royce Bergen
- Vericor Power Systems
- Wärtsilä Corporation (including):
  - Wärtsilä Italia, Italy;
  - Dalian Marine Diesel, China;
  - Hudong Heavy Machinery Co. Ltd., China;
  - Yichang Marine Diesel Works, China;
  - “3.Maj”, Croatia;
  - Diesel United Ltd., Japan;
  - Hitachi Zosen Corp., Japan;
  - Mitsubishi Heavy Industries, Japan;
  - NKK Corp., Japan;
  - Doosan Engine Co. Ltd., Korea;
  - Hyundai Heavy Industries, Korea;
  - H. Cegielski-Pozań, Poland
- Yanmar Diesel Engine

Marine Auxiliary Generating Unit Engine Manufacturers Participating and Reporting Orders in this Survey

- Caterpillar Engine Division (including Caterpillar Marine Power Systems)
- Cummins Marine
- Daihatsu Diesel Mfg.
- GE Transportation
- Guascor
- Hyundai Heavy Industries
- Isotta Fraschini Motori
- MAN Diesel Group (including licensees)
- MTU Friedrichshafen (including Detroit Diesel)
- Mitsubishi Heavy Industries
- Niigata Power Systems Co. Ltd.
- Scania
- Wärtsilä Corporation (including licensees)
- Yanmar Diesel Engine

Diesel-Electric Marine Propulsion Manufacturers Participating and Reporting Orders in this Survey

- Caterpillar Engine Division (including Caterpillar Marine Power Systems)
- Cummins Marine
- GE Transportation
- Hyundai Heavy Industries
- Isotta Fraschina Motori
- Kawasaki Heavy Industries Ltd.
- MAN Diesel Group (including licensees)
- MTU Friedrichshafen (including Detroit Diesel)
- Wärtsilä Corporation (including licensees)

trend toward an increased use of heavy fuel engines, as fuel costs continue to squeeze operators of every type of marine vessel.

It must also be noted again this year that the Far East — including South Korea, Japan and China — continues to strengthen its position as the center for shipbuilding activities. Order volumes also continue to grow in North America.

The marine surveys, combined with our 31st Annual Power Generation Order Survey (see *D&GTW*, October 2007), provide a fairly complete synopsis of the large reciprocating engine building business. There was record-setting engine order activity this year in the power generation sector and the marine marketplace continues to be strong. Add to this a robust marketplace for mechanical drive engines for applications such as pumps and compressors. With this, we are continuing our 2nd Annual Mechanical Drive Engine Order Survey with the December issue of *D&GTW*.

For the engine builders and suppliers serving all three industries, this situation creates its own set of challenges as to how and where to best allocate development funds, sales resources and manufacturing capacity.

As always, our sincere thanks go to the engine manufacturers who invest time and effort in completing these marine order surveys. It is the mechanical drive marine survey, along with the auxiliary generator set and diesel-electric propulsion order surveys, that give the most complete and accurate picture of the marine diesel market above 0.5 MW.