

Industry Profile for Small Nonroad Spark-Ignition Engines and Equipment

REVISED DRAFT REPORT

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SECTION 1

INTRODUCTION AND OVERVIEW

The nonroad spark-ignition (SI) industry includes a wide variety of handheld and nonhandheld equipment. Nonhandheld equipment is powered mainly by four-stroke gasoline engines; handheld equipment is powered mainly by two-stroke gasoline engines. Comprising much of what the general public considers “lawn and garden (L&G) equipment,” this industry also produces significant numbers of generators, compressors, and construction and maintenance equipment. The industry often refers to itself as the “outdoor power equipment” industry.

This profile provides background information on the engines and equipment that make up the small nonroad SI industry, defined as those products rated less than or equal to 19 kilowatt (kW) (roughly equivalent to 25 horsepower [hp]). This profile describes markets for engines and equipment, and discusses their use in both consumer and commercial applications. In each market, producers and consumers are described, along with product attributes and the effect of those attributes on production cost and demand. The market analysis emphasizes assessing suppliers’ cost of production and industry structure, along with demanders’ price responsiveness and consumption alternatives.

The information presented in this profile regarding sales comes primarily from a database developed by Power Systems Research (PSR). The latest PSR data available at the time this profile was initiated were for 2002. The PSR database appears to be the only one available that provides information on engines and equipment that allows for such a detailed characterization of the small SI industry. While information on quantities used for operationalizing the EIA economic model are taken from EPA’s NONROAD model (which does not provide the level of detail available from the PSR database, especially on engine manufacturer and equipment manufacturer details), we believe the PSR information provides a good basis for characterizing the small SI engine and equipment industry.

The variety of products in this industry is usefully partitioned by both application categories and engine type. Figure 1-1 illustrates the links between the market segments of the small SI engine supply chain included in the profile, from engine manufacturing and sale to equipment production, and on to purchase by consumers and commercial customers. Although more than 98 percent of total unit sales in the L&G equipment sector go to households

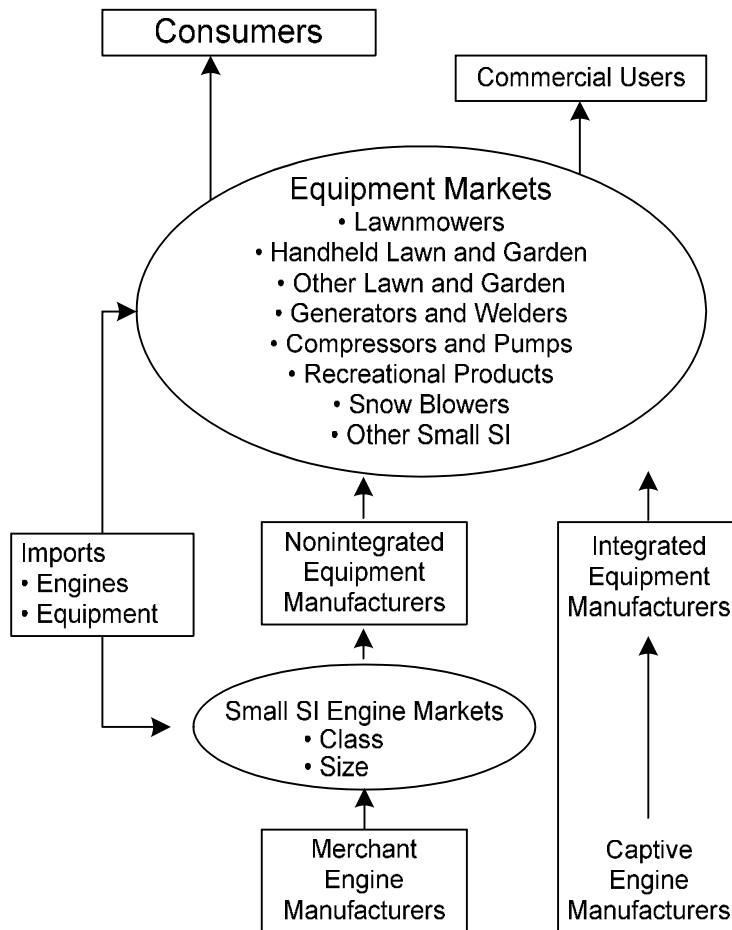


Figure 1-1. The Small Nonroad SI Industry

(OPEESA, 2004), other sectors’ sales are dominated by commercial equipment. Because of the significantly higher prices of commercial units, commercial sales represent a considerable share of the total value of production (U.S. Census Bureau, 2003).

It should be noted that there is a fair amount of vertical integration in the handheld industry, with the same parent firm making both engines and the equipment in which those engines are used. Handheld equipment includes string trimmers, leaf blowers, and chainsaws. This situation is known as “captive” engine production; data on internal consumption of engines and transfer prices are typically not available outside the firm. The makers of nonhandheld engines typically sell their engines to independent equipment manufacturers in a merchant engine market, where prices and quantities exchanged can be directly observed.

Engines in this profile are classified primarily by size and function, using categories previously defined by existing EPA regulations. Manufacturers of these engines are required to obtain certification from EPA in one or more categories prior to offering them for sale in the

United States. For purposes of this study, engines used for handheld (HH) applications are included in a single category, while engines for nonhandheld (NHH) applications are further divided by engine displacement:

- Class IA—engines with displacement less than 80 cubic centimeters (cc)
- Class I—NHH engines with displacement of 80 cc or greater, but less than 225 cc
- Class II—NHH engines with displacement greater than or equal to 225 cc

Small SI equipment can be further partitioned by application category and segment; this cannot usefully be done for engines because the same model of engine is often used for equipment in several application categories. To match key data sources, this profile groups equipment into seven equipment markets, differentiated by the type of customer or by equipment technology:

- Lawn mowing—including consumer and commercial mowers, riding mowers, tractors, and commercial turf equipment
- Handheld lawn and garden—including string trimmers, leaf blowers, and chain saws
- Other lawn and garden—including tillers, shredders, edgers, and larger (wheeled) trimmers and blowers
- Welders and generators—including gensets, welders, and marine auxiliary power units
- Pumps and compressors—including pressure washers, air compressors, and pumps
- Utility recreational products—including golf cars, go karts, and utility vehicles
- Other small SI equipment—including a large variety of units used in construction, materials handling, agriculture, and general industrial applications

In view of the large number of equipment types and low unit sales in this last category, other small SI equipment will not be profiled in depth here, although the units produced and sold are included in the aggregate totals.

In Section 2, information is presented on product characteristics, supply-side considerations, consumer demand, and market structure for small nonroad SI engines. Section 3 includes similar types of information on equipment markets, broken down by application category. Considerations related to consumer and commercial markets are included in the demand subsection of that section.

SECTION 2

SMALL NONROAD SI ENGINE MARKETS

Internal combustion engines, including both compression ignition (CI) and SI engines, convert the chemical potential energy contained in a fuel into mechanical energy. This energy can then be used to do work, to provide locomotion, and/or to generate electricity. These engines are inherently portable because they carry their power sources with them in fuel tanks that require refueling only occasionally. In contrast, electric motors, which are capable of performing many of the same tasks as internal combustion engines, must be connected to a power grid (or supplied with batteries that require frequent recharging). In contrast with CI engines that operate on diesel fuel, SI engines most often run on gasoline, although a small number of models are designed to use liquified petroleum gas (LPG) or natural gas.

Large numbers of SI engines are used to power transportation equipment, including automobiles, light trucks, motorcycles, and recreational boats. Advantages of SI engines include low initial cost; widespread availability of fuel, parts, and repair services; and reliable operation even with extended use. CI diesel engines, on the other hand, have higher initial prices balanced out by lower operating costs. Because SI engines' low price becomes less important as the size of the engine increases, diesel engines are most often found in medium and large engine application markets; in the low horsepower ranges, SI engines are dominant. This is especially true of household power equipment, including L&G products and the other application categories considered in this profile.

According to PSR¹ data, nearly 20 million pieces of small SI equipment (i.e., with engines of less than or equal to 25 hp) were produced in the United States in 2002, the most recent year for which data are available (PSR, 2004). Of those, about 17.7 million were in the lawn and garden (L&G) application category, equally divided between handheld and nonhandheld items. Census Bureau data for the same year shows a value of shipments of a little more than \$8 billion for similarly defined categories of products: Lawn & Garden Equipment Manufacturing—NAICS 333112 and Commercial Turf and Grounds Care Equipment—NAICS 333111J (U.S. Census Bureau, 2004a, 2004b). This yields an average price across all equipment categories of around \$450.

It is interesting to compare these data with the much larger automobile and light truck SI engine markets. During 2002, the automotive industry produced slightly more than 5 million cars

¹ Power Systems Research

and 7.2 million light trucks in the United States, out of a total North American production of 16.7 million units (Automotive News, 2003). This means that there were actually more small SI engines produced in the United States than automotive engines, a trend which continues to the present. However, the Census reports the total value of automobile and light truck production at \$222 billion, or approximately 28 times the value of small SI equipment, which reveals an average selling price of around \$18,000 per vehicle in that year, far above the \$450 noted above.

For the purposes of this profile, the U.S. market for small SI engines is defined as all nonmarine SI engines of less than or equal to 25 hp incorporated into nonroad equipment sold in the United States. This includes engines made domestically, engines imported for use in U.S.-produced equipment, and those imported as a part of equipment made overseas. U.S. exports are excluded from our definition of the small SI engine market. Because exported engines are designed to comply with foreign environmental regulations, they are not potential substitutes for engines used by U.S. equipment manufacturers. In addition, any costs incurred by exporters specifically to meet overseas regulations are not associated with this proposed regulation. As a result, domestic exports are considered a separate market and are not included in our analysis.

2.1 Engine Categories and Characteristics

Table 2-1 details the number of engines produced in 2002 in each of the engine categories noted earlier and the major applications categories. Out of a total of 19.8 million engines, about 8.7 million, or 44 percent, were to be used in handheld equipment. In addition, there were almost 7.4 million Class I engines produced (37 percent) and nearly 2.7 million Class II engines (13 percent). The under-80 cc category of NHH engines accounted for 400,000 units, or about 2 percent of the total. Snowblowers were separated out from other NHH engines because of different emissions requirements; they made up almost 700,000 units, or about 3.5 percent of total 2002 production.

Partitioning of this data by application categories is not as helpful, in view of the commonality of use across applications. Nonetheless, it is useful to note that a little more than one-third of all these engines, or about 7.3 million, were destined for lawn mowing applications (including walk-behind mowers, riding mowers, and tractors). About 5.8 million of this total fall into the Class I group. In terms of unit sales, the next most important Class I application categories were pumps and compressors and NHH L&G equipment, each with around 560,000 units sold. Generators and welders form an important share of Class II NHH engines, accounting for more than 500,000 pieces of equipment. A more detailed analysis of each of the equipment markets appears in Section 3.

Table 2-1. Small SI Engine Production for 2002 by Class and Application Category

Application Category	HH	Class IA	Class I	Class II	Snowblowers	Total
Lawn Mowers	—	863	5,820,136	1,558,212	—	7,379,211
HH L&G	9,191,998	—	—	—	—	9,191,998
NHH L&G	—	—	385,589	69,589	—	455,178
Welders and Generators	—	334	267,913	542,272	—	810,519
Pumps and Compressors	—	64,449	572,344	225,830	—	862,623
Utility/Recreational Vehicles	—	—	80,656	81,726	—	162,382
Snowblowers	—	—	—	—	682,860	682,860
Other Small SI	54,946	27,430	63,301	129,345	—	275,022
Total	9,246,944	93,076	7,189,939	2,606,974	682,860	19,819,793

Source: PSR, 2004.

2.2 The Supply Side

This section describes the supply side of the small SI engine industry, beginning with an overview of current engine design and production processes, including raw materials used. This overview is followed by a description of production costs.

2.2.1 Engine Design and Production Processes

First, engine blocks are die cast in a foundry, most often from aluminum. Smaller, more complex parts, including cylinder heads and exhaust manifolds made from aluminum or plastic/polymer; cylinder liners, if used, are often cast iron.

Next, the cast block, cylinder head, and cylinder liners, along with crankshafts, gears, connecting rods, and other engine parts, are machined in a machining center. Holes are drilled, parts reshaped, excess metal removed, and the metal surfaces polished. The operation of the finished engine depends on precision at this stage.

The third major step in engine manufacturing is assembly. This area is usually physically isolated from the dirty upstream operations so that contaminants are not introduced into the completed engines, a problem that could affect their operation or shorten engine life. In a typical plant, subassemblies are first put together on separate lines or in separate bays, and then the subassemblies are brought together for final assembly. The completed engines are visually

inspected and then evaluated on-line, on a test bench, or in a test cell to ensure their performance will meet expectations.

2.2.2 Costs of Production

Costs of production are divided into major input categories of labor, materials, and capital expenditures. Of these categories, purchased materials account for the largest share of total costs. Based on data for all nonautomotive gasoline engines from the most recent Economic Census, costs of materials represent about 71.0 percent of the value of shipments, followed by labor at about 12.6 percent, and capital expenditures at about 2.4 percent (see Table 2-2). All of these percentages are slightly higher for gasoline engines than for the entire nonautomotive engine category, which also includes diesel engines.

Table 2-2. Engine Costs of Production in 2002

NAICS	Value of Shipments (\$10 ⁶)	Labor (\$10 ⁶) ^a	Cost of Materials (\$10 ⁶) ^a	Capital Expenditures (\$10 ⁶) ^a
333618 Other engine equipment manufacturing	\$18,585.9	2,144.8	11,800.0	729.9
		11.5%	63.5%	3.9%
3336181 Gasoline and gas-gasoline engines (except aircraft, automobile, highway truck, bus, tank, and outboard marine)	\$2,429.6	305.6	1,724.5	58.0
		12.6%	71.0%	2.4%
		Share of Total Materials Cost		
Materials Consumed by 333618	Cost (\$10⁶)	(%)		
Iron and steel ^b	\$1,442.3	12.2%		
Aluminum ^c	\$746.7	6.3%		

^a Percentages in parentheses refer to percentage of the total value of shipments.

^b NAICS codes 33211101, 33151001, 33120007, and 33120016.

^c NAICS code 33152005.

Source: U.S. Census Bureau. 2004c. *2002 Economic Census Manufacturing Industry Series*. EC02-31I-333618, Tables 1, 5, and 7.

Table 2-3 lists the primary materials used in engine components. No breakdown of materials used in production is available from the 2002 Economic Census for the specific category of nonroad gasoline engines (NAICS 333618). The table is based on the broader engine equipment manufacturing category (NAICS 333618). The data at the bottom of Table 2-2 show that iron/steel and aluminum are the most important raw materials, accounting for 12 percent and

Table 2-3. Engine Component Materials

Component	Primary Materials	Primary Process
Block	Aluminum	Casting
Cylinder Head	Aluminum	Casting, machining
Intake Manifold	Plastic, aluminum	Casting, machining
Connecting Rods	Powdered metal, steel	Molding, forging, machining
Pistons	Aluminum	Forging, machining
Crankshaft	Plastic, powdered metal	Molding, forging, machining
Valves	Steel, magnesium	Stamping, machining
Exhaust Systems	Plastic, aluminum	Extruding, stamping

Source: U.S. Environmental Protection Agency (EPA). 1995. EPA Office of Compliance Sector Notebook Project: Profile of the Motor Vehicle Assembly Industry. EPA310-R-95-009. Washington, DC: U.S. EPA.

6 percent of total materials cost; no other raw materials contributed more than 1 percent of material costs.

2.3 The Demand Side

This section describes the aggregate demand for the various classes of small SI engines and considers the substitution possibilities available within each of these markets. The demand characteristics of individual applications sectors (e.g., lawn mowers, generators and welders) are described as part of the equipment manufacturers' market discussion in Section 3.

2.3.1 Derived Demand for Engines

Engines are an input into the production of small SI equipment, which are in turn sold to households as final consumption goods or to commercial firms to be used in their production of goods and services. As a result, the demand for engines is linked through this supply chain to the final demand for consumer and industrial goods. Since there is generally a one-to-one correspondence between engines and small SI equipment, it is possible to derive the demand for engines directly from final demands in the equipment markets.

2.3.2 Substitution Possibilities in Consumption

A second factor that influences demand for engines is the potential for substitution throughout the supply chain. If a diesel engine or electric motor can be used as a power source for a piece of equipment instead of a small SI engine, the demand response to regulation-induced prices change may be affected. Further along the supply chain, the ability to substitute a technologically dissimilar type of equipment in an application normally supported by gasoline-

powered equipment affects demand in the equipment markets. This section discusses substitution possibilities in the engine market, while equipment issues are addressed in later sections.

Low initial cost, along with ease of use and convenience of gasoline refueling, has made gasoline-powered engines dominant in both HH and NHH equipment for household applications and for the smallest commercial equipment covered by this profile (specifically, those under 25 hp). Several application categories, including L&G care equipment, pumps and compressors, materials handling equipment, and generators and welders, show high percentages of gasoline power in the small engine segment.

Faced with a potential price increase in gasoline-powered engines from new regulation, it is possible that equipment manufacturers could consider replacement with a diesel engine or a battery-powered electric motor. In fact, there are small diesel gensets as well as corded or cordless electric chainsaws, string trimmers, leaf blowers, and lawnmowers. However, the expense and complexity of such a modification compared with the minor cost increase associated with the regulatory program seems to make substitution unlikely in such a mature, competitive industry as small SI equipment.

2.4 Industry Organization of Small SI Engine Suppliers

To model the economic impact of the proposed regulation, it is important to characterize the overall small SI engine industry structure. Based on the PSR database, 36 parent companies were involved in manufacturing small nonroad SI engines in 2002. They include 15 U.S. companies such as Briggs and Stratton, Cummins, MTD, Kohler, and Wisconsin Motor.

2.4.1 Firm Characteristics

In general, the small SI engine manufacturers are usually owned by larger firms, in both NHH and HH markets. As shown in Figures 2-1 and 2-2, about 70 percent of the NHH engine firms employ more than 1,000 people, and about 65 percent have annual revenues above \$1 billion. Because these figures relate to parent company size, they include revenue and employment from gasoline-powered engines as well as other products the companies produce. Several of these companies are vertically integrated, producing both small SI engines and equipment; a few are also producers of diesel engines. At the other end of the size scale, five of the firms have fewer than 100 employees, and six have corporate sales below \$50 million per year.

Figures 2-3 and 2-4 include information on sales and employment for firms that make HH engines. Once again, the data show that large firms predominate. In this case, however, there are no firms with fewer than 500 employees or with sales under \$100 million.

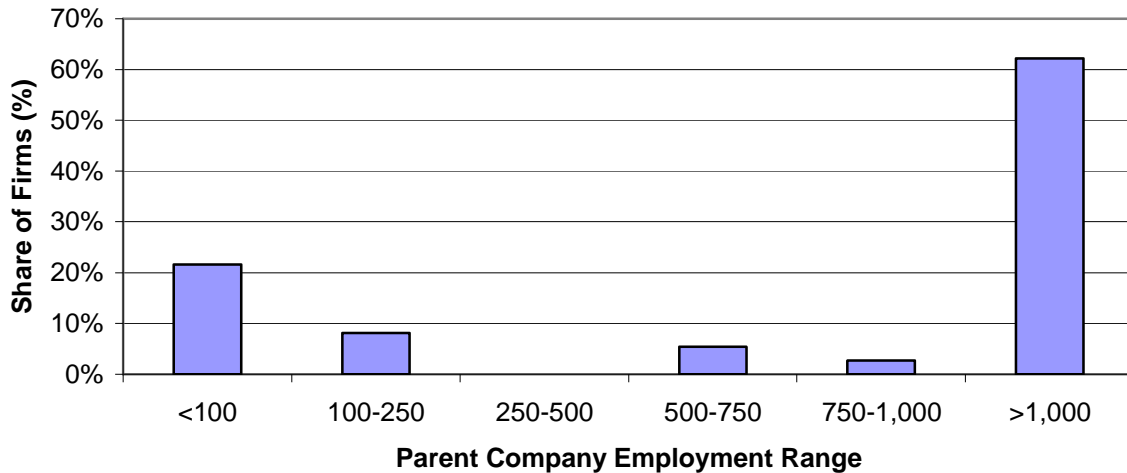


Figure 2-1. Employment Distribution of NHH Engine Manufacturers in 2004 (N=35)

Source: Hoover's Online <<http://www.hoovers.com>>; W&D Partners Worldscope through LexisNexis; Dun & Bradstreet Small Business Solutions <<http://smallbusiness.dnb.com/default.asp?bhcd2=1107465546>>; Graham & Whiteside Major Companies Database through LexisNexis.

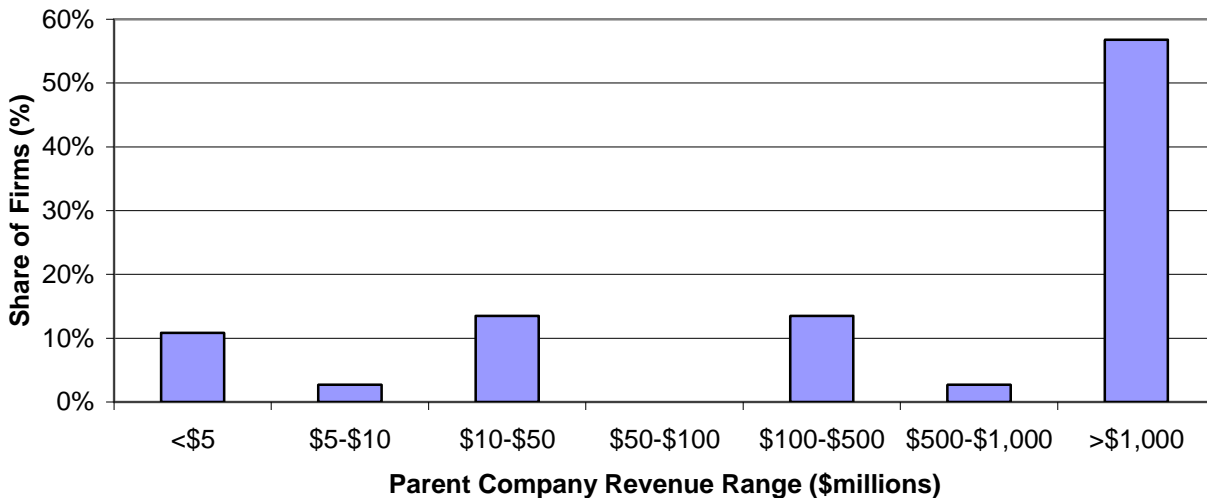


Figure 2-2. Sales Distribution of NHH Engine Manufacturers in 2004 (N=35)

Source: Hoover's Online <<http://www.hoovers.com>>; W&D Partners Worldscope through LexisNexis; Dun & Bradstreet Small Business Solutions <<http://smallbusiness.dnb.com/default.asp?bhcd2=1107465546>>; Graham & Whiteside Major Companies Database through LexisNexis.

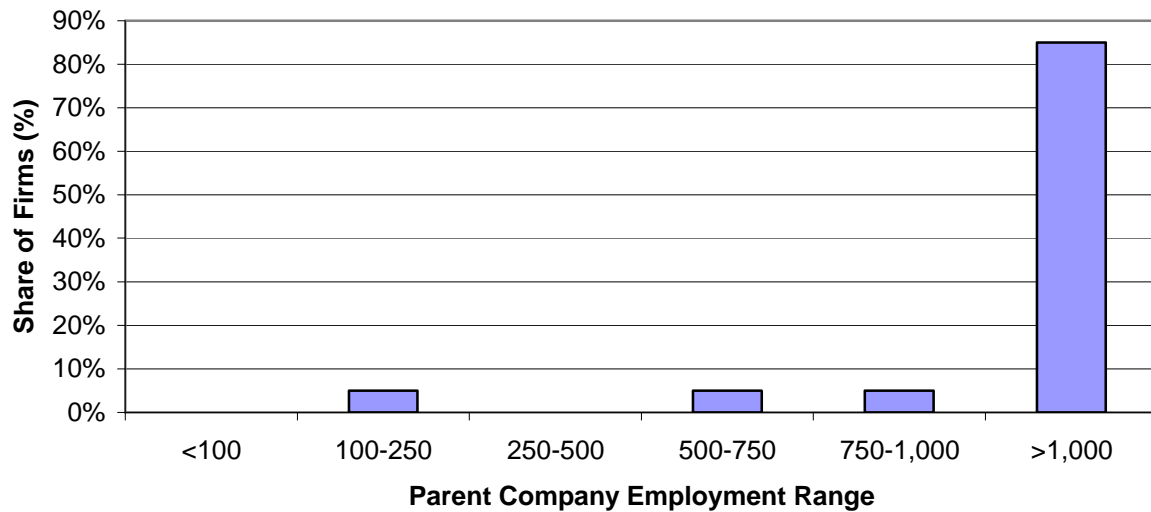


Figure 2-3. Employment Distribution of HH Engine Manufacturers in 2004 (N=18)

Source: Hoover's Online <<http://www.hoovers.com>>; W&D Partners Worldscope through LexisNexis; Dun & Bradstreet Small Business Solutions <<http://smallbusiness.dnb.com/default.asp?bhcd2=1107465546>>; Graham & Whiteside Major Companies Database through LexisNexis.

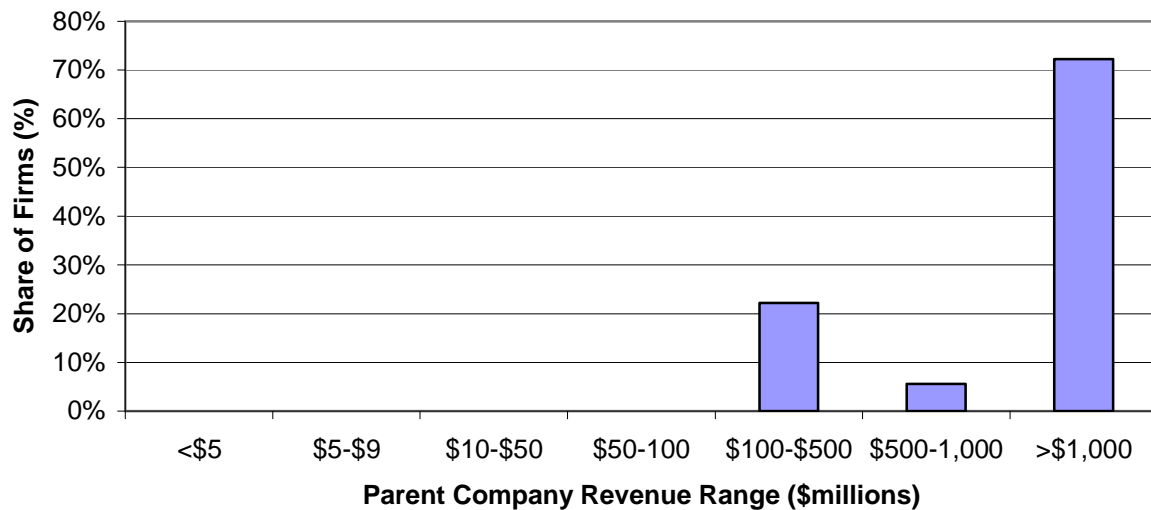


Figure 2-4. Sales Distribution of HH Engine Manufacturers in 2004 (N=18)

Source: Hoover's Online <<http://www.hoovers.com>>; W&D Partners Worldscope through LexisNexis; Dun & Bradstreet Small Business Solutions <<http://smallbusiness.dnb.com/default.asp?bhcd2=1107465546>>; Graham & Whiteside Major Companies Database through LexisNexis.

2.4.2 *Integrated vs. Merchant Engine Manufacturers*

The U.S. small SI engine industry can be divided into two producing sectors: integrated manufacturers and merchant-engine manufacturers. Integrated firms produce both small SI engines and equipment that encompasses those engines, while merchant-market firms sell all of the units they make to equipment-producing firms. As Table 2-4 shows, only about 8 percent of NHH are consumed internally. This implies the majority of NHH equipment producers buy their engines in the market. In contrast, 90 percent of HH engines were incorporated in the equipment by the same company.

Tables 2-5 and 2-6 provide information on the major domestic integrated and merchant engine producers of NHH and HH engines, respectively. The engine production figures here exclude foreign owned producers and units made outside the United States by domestic firms; for example, Tecumseh produces some tiller engines in Italy, while Briggs & Stratton imports some engines for pressure washers and gensets from Japan. The employment and sales figures shown in the table are those of the parent companies and therefore include information for all of the parent companies' business units. Honda is the largest of these firms, with almost 132,000 employees and \$78 billion in 2004 sales revenues.

2.4.3 *Market Structure*

The small SI NHH and HH engine markets are quite distinct, with different leading competitors and relative market shares. The structure of the NHH market is shown in Figure 2-5, based on 2002 production data. Briggs & Stratton engines made up a little more than half the market in that year, based on the number of units sold, while Tecumseh products comprised almost one-quarter. Honda produced almost 10 percent of the units sold in 2002, and more recent evidence suggests that this share is growing. In all, the 10 largest producers supplied more than 98 percent of the NHH engines incorporated into equipment sold in the United States.

Table 2-4. Supply Side of Small SI Engine Market (2002)

Engine Class	Equipment Type	Domestic Production			Imports		Total U.S. Market
		Integrated		Merchant ^a Market	Consumed Internally	Supplied to Market	
		Consumed Internally	Supplied to Market				
Class I	Ag/Const/GI/MH	7,650	754	20,988	5,583	35,788	70,763
	Lawn Mowers	306,775	153,320	5,335,047	—	24,994	5,820,136
	Other L&G	—	2,613	363,565	350	19,061	385,589
	Pumps & Comp	—	95,252	312,975	5,980	158,137	572,344
	Rec Vehicles	—	356	72,067	—	8,233	80,656
	Welders & Generators	—	189	127,749	115,352	24,623	267,913
Class I Total		314,425	252,484	6,232,391	127,265	270,836	7,197,401
Class IA	Ag/Const/GI/MH	2,853	74	661	55,896	4,656	64,140
	Lawn Mowers	—	—	863	—	—	863
	Other L&G	60,305	181	19,447	5,948	—	85,881
	Pumps & Comp	1,740	2,694	73	55,607	4,335	64,449
	Welders & Generators	—	—	—	334	—	334
Class IA Total		64,898	2,949	21,044	117,785	8,991	215,667
Class II	Ag/Const/GI/MH	12,777	16,041	36,694	6,674	67,933	140,119
	Lawn Mowers	8,085	473,655	1,002,330	7,836	66,306	1,558,212
	Other L&G	—	431	59,151	—	10,007	69,589
	Pumps & Comp	—	20,786	43,102	—	161,942	225,830
	Rec Vehicles	—	—	29,770	22,166	29,790	81,726
	Welders & Generators	32,659	10,288	283,484	49,757	166,084	542,272
Class II Total		53,521	521,201	1,454,531	86,433	502,062	2,617,748
NHH Total		432,844	776,634	7,707,966	331,483	781,889	10,030,816
HH Total		6,754,211	20,421	282,743	1,471,794	576,948	9,106,117
Snowblowers Total		32,342	—	650,518	—	—	682,860
Grand Total		7,219,397	797,055	8,641,227	1,803,277	1,358,837	19,819,793

Source: PSR, 2004.

^a For the small SI business analysis, EPA engineers identified four companies as nonintegrated engine manufacturers. The remaining companies were assumed to be integrated.

Table 2-5. Major Domestic Integrated and Merchant NHH Small SI Engine Producers 2004

Parent Company	Employment	Parent Company Sales (\$millions)	Total Units ^a Produced in 2002	Class I	Class II	Snow-blowers
Integrated						
Briggs & Stratton Corp.	7,732	3,200	5,387,896	4,336,242	1,020,616	31,038
Honda	131,600	78,222	311,372	296,377	—	14,995
Kohler	3,432	3,200	413,992	2,486	411,506	—
Kawasaki	29,306	10,983	248,866	126,325	122,541	—
Toro	5,071	1,653	149,742	132,395	—	17,347
Sum of Top 5 Manufacturers' Production			6,511,868	4,893,825	1,554,663	63,380
Merchant						
Fuji Heavy	27,296	13,626	136,899	95,011	41,888	—
Tecumseh	20,700	1,819	2,515,961	1,716,258	180,223	619,480
Sum of Top 5 Manufacturers' Production			2,652,860	1,811,269	222,111	619,480

^a Totals may not include HH models manufactured by these manufacturers.

Sources: Hoover's Online <<http://www.hoovers.com>>; W&D Partners Worldscope through LexisNexis; Dun & Bradstreet Small Business Solutions <<http://smallbusiness.dnb.com/default.asp?bhcd2=1107465546>>; Graham & Whiteside Major Companies Database through LexisNexis; and PSR 2004.

Table 2-6. Major Domestic Integrated and Merchant HH Small SI Engine Producers 2004

Parent Company	Employment	Parent Company Sales (\$millions)	Total Units Produced for 2002
Integrated			
Electrolux	77,140	17,247	2,233,572
Stihl	7,539	1,530	1,684,395
MTD	6,600	1,000	1,402,349
Techtronic	16,000	1,698	1,088,195
Kioritz (Echo)	1,710	606	420,126
Sum of Top 5 Manufacturers' Production			6,828,637

Sources: Hoover's Online <<http://www.hoovers.com>>; W&D Partners Worldscope through LexisNexis; Dun & Bradstreet Small Business Solutions <<http://smallbusiness.dnb.com/default.asp?bhcd2=1107465546>>; Graham & Whiteside Major Companies Database through LexisNexis; and PSR 2004.

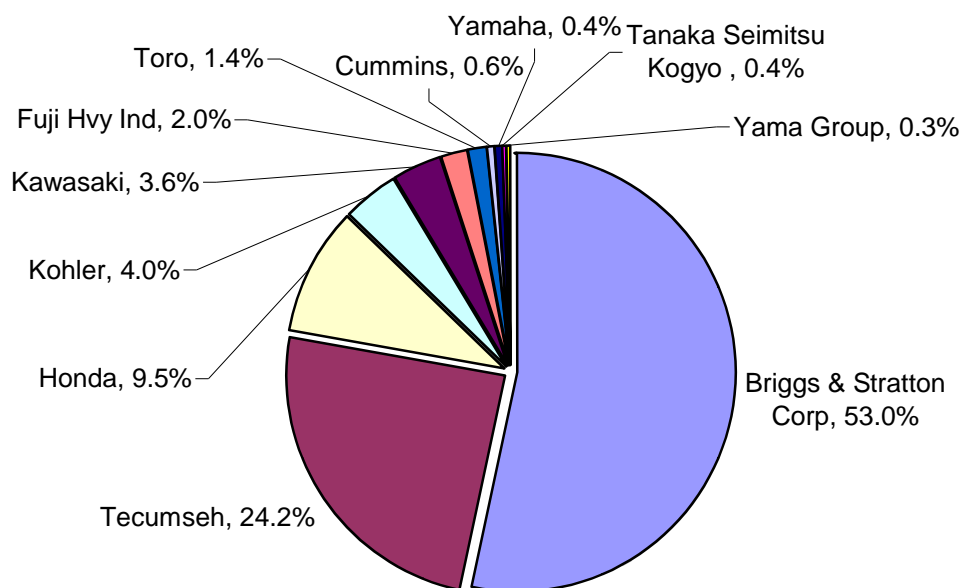


Figure 2-5. Top 10 NHH Small SI Engine Manufacturers by Units Sold (2002)^a

^a Includes snowblowers

Figure 2-6 shows the market shares for HH engine producers for the same year. Electrolux led the market with a 32.8 percent share, most sold under its Poulan, Husqvarna, and Jonsered product lines. Stihl, MTD Products, and Techtronic (Homelite) also had market shares in excess of 10 percent. The top 10 producers in the HH category provided the engines for almost 95 percent of the equipment sold in the country in 2002.

This separation of competition in the engine market is further illustrated in Table 2-7, which lists the five firms with the highest numbers of units sold within each engine category. In every segment, the two largest engine manufacturers produced more than half of the engines used by U.S. small SI equipment manufacturers. Electrolux produced more than one-third of the country's handheld engines. Briggs & Stratton had the largest share of both Class I and Class II NHH engines, but was not one of the largest producers of HH units. Tecumseh, which produced the second largest number of Class I NHH engines, also dominated the market for snowblowers.

Despite the relatively large market shares enjoyed by the largest firms in each of these engine categories, there are a number of reasons to believe that the small SI engines market can reasonably be described as competitive. First of all, markets for gasoline engines are mature as evidenced by unit sales growing at the rate of population increases. Pricing power in such markets is typically limited both by substitution possibilities in consumption and potential entrants in production. Secondly, significant excess capacity exists in the small SI engine

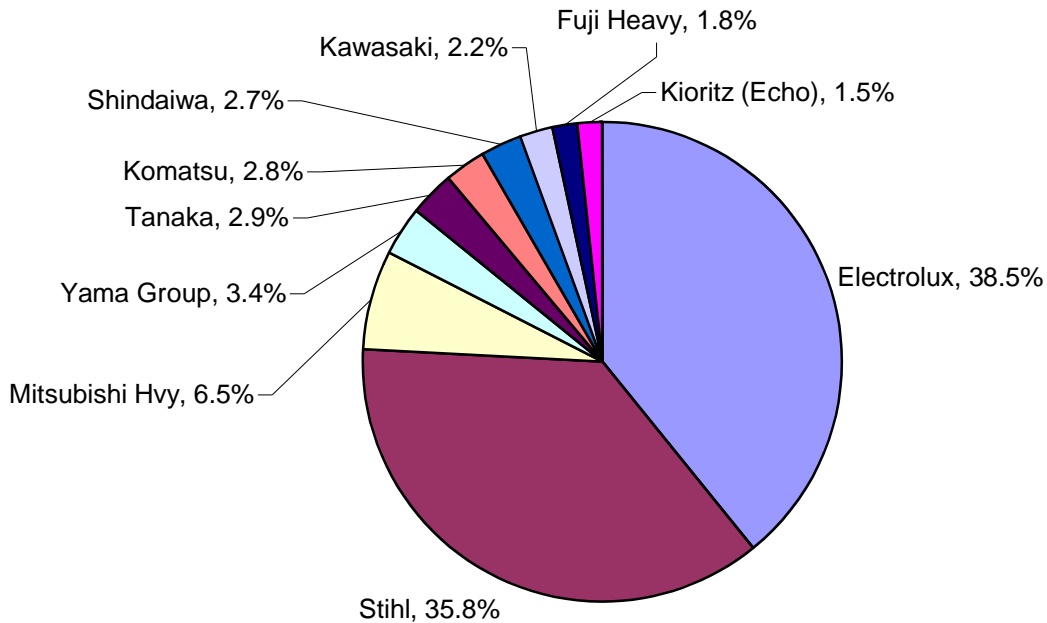


Figure 2-6. Top 10 HH Small SI Engine Manufacturers by Units Sold (2002)

industry, in part due to improved productivity and efficiency in current plants. Finally, domestic producers face substantial competition from foreign manufacturers, as the data in Table 2-5 indicate. These overseas firms may have strong incentives to compete vigorously on price with the more well-established U.S. firms.

2.5 Historical Market Data and Trends

The historical market statistics are presented as a means to assess the future of small SI engine production. Information on production, consumption, and domestic prices is provided in this section, as well as a comparison of foreign production (imports) versus domestic production. Domestic production of small SI engines declined steadily from 1998 to 2002, a trend that was only partly offset by increases in exports. Domestic consumption data are not readily available, so apparent consumption was calculated from the known domestic production, import, and export data. As shown in Table 2-8, apparent consumption shows a similar downward trend to that of domestic production. During this recent 5-year period, exports have increased as a percentage of production from 11 percent to about 17 percent; imports have increased only slightly as a fraction of apparent consumption, and in 2002 were still at a relatively modest 21 percent.

Table 2-7. Market Share of Top Five Small SI Engine Manufacturers by Certification Class in 2002

HH	Production (2002)	% Share of Market (2002)
Electrolux	3,033,310	32.8%
Stihl Group	1,795,181	19.4%
MTD Products	1,402,349	15.2%
Techtronic	1,088,195	11.8%
Kioritz	495,594	5.4%
Class IA		
Tanaka Seimitsu Kogyo	40,891	43.9%
Yama Group	23,547	25.3%
Maruyama	7,078	7.6%
Honda	4,654	5.0%
Komatsu	4,335	4.7%
Class I		
Briggs & Stratton	4,348,645	60.5%
Tecumseh	1,731,885	24.1%
Honda	626,200	8.7%
Fuji Hvy Ind	151,386	2.1%
Kawasaki	146,814	2.0%
Class II		
Briggs & Stratton	1,219,056	46.8%
Kohler	416,728	16.0%
Honda	360,244	13.8%
Kawasaki	230,226	8.8%
Tecumseh	206,029	7.9%
Snowblowers		
Tecumseh	619,480	90.7%
Briggs & Stratton	31,038	4.5%
Toro	17,347	2.5%
Honda	14,995	2.2%

Source: PSR, 2004.

Price trends for the small SI engine manufacturing industry are shown in Figure 2-7. Data are available for both nonautomotive gasoline engines and for L&G equipment; they are compared to a composite index for all U.S. manufacturing. Over the past decade, prices for gasoline engines have risen at about the same rate as the general aggregate, with a notable slowdown in price increases since 2000. In contrast, L&G equipment prices have been completely flat.

Table 2-8. Small SI Engine Market Trends (1998–2002)

Year	Domestic Production		Exports as % of Domestic Production	Apparent Domestic Consumption	Imports ^a	Imports as % of Domestic Consumption
	Consumed Domestically	Exported ^a				
2002	13,458,771	2,808,700	17.3%	17,011,093	3,552,322	20.9%
2001	14,253,075	2,320,779	14.0%	17,976,259	3,723,184	20.7%
2000	14,747,277	2,606,036	15.0%	19,767,783	5,020,506	25.4%
1999	16,632,721	2,188,861	11.6%	20,550,061	3,917,340	19.1%
1998	15,263,334	1,877,824	11.0%	18,289,980	3,026,646	16.5%

^a Includes engines over 25 hp.

Sources: PSR, 2004.

U.S. Census Bureau. 1999, 2000, 2001, 2002, 2003. "Internal Combustion Engines." Current Industrial Reports (CIR).

Note: Export and import data from Census Bureau's CIRs. Apparent domestic consumption is calculated by subtracting exports from PSR production totals. Domestic production consumed domestically is calculated by subtracting imports from apparent consumption.

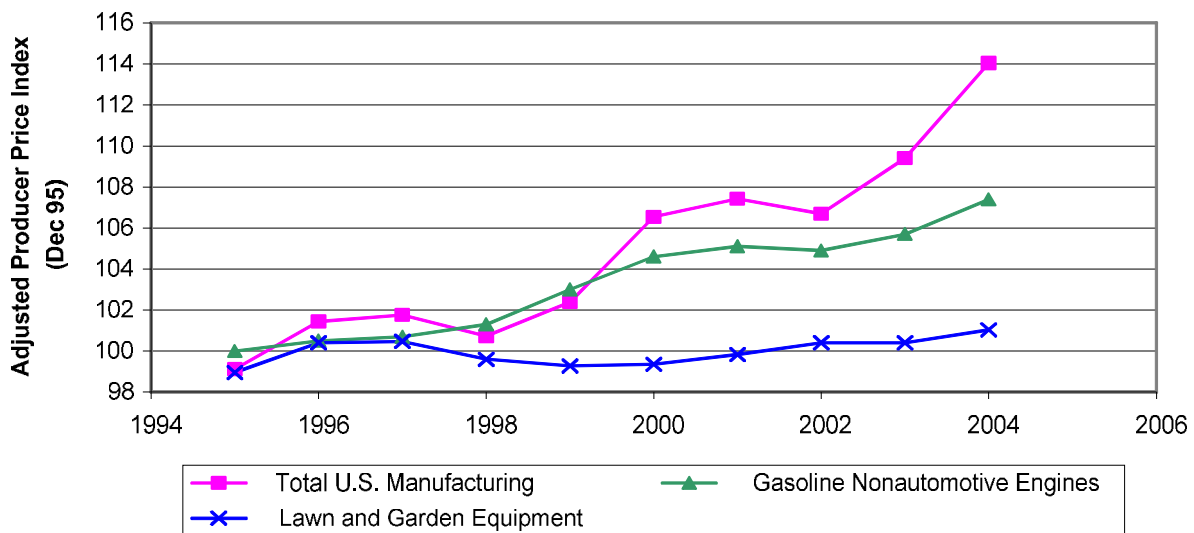


Figure 2-7. Price Indices of Gasoline Engines and Lawn and Garden Equipment: 1995 to 2004

Source: U.S. Bureau of Labor Statistics. 2005. Series PCU3336183336181, PCU333112333112, PCUOMFG—OMFG.

SECTION 3

EQUIPMENT MANUFACTURERS

This section describes general characteristics of the industries that produce nonroad equipment powered by small SI engines. The largest application category to be considered is L&G equipment, which is sold into both consumer and commercial markets. In view of the importance of lawn mowing and handheld equipment in terms of unit sales and annual dollar spending, these segments are separated out from the rest of L&G equipment in this profile. The “other L&G” market therefore consists of large (wheeled) trimmers and leaf blowers, as well as edgers and shredders. Snowblowers are profiled in this category for convenience. Data limitations do not permit a clean separation between consumer and commercial units, so they are considered together in this category, as well as in the lawn mowing segment. Although some models of L&G equipment are exclusively sold to commercial firms and are thus categorized in a separate segment by PSR (e.g., commercial mowers), a large number of mowers, tillers, tractors, trimmers, and other products are sold to both commercial and professional users.

In addition to these L&G categories, small SI equipment is also sold into three other major consumer markets: generators and welders, pumps and compressors, and recreational/utility vehicles. For these six defined market categories, this profile presents supply and demand-side considerations, followed by an overview of the industrial organization and market trends. As noted previously, the construction, agriculture, general industrial, and materials handling markets are not separated out for detailed analysis as there are relatively few pieces of small SI equipment sold into these markets, i.e., less than 1% of total unit sales.

3.1 General Firm Characteristics

In comparison with the firms that manufacture small SI engines, the equipment manufacturers tend to be much smaller. The firms listed in the PSR database represent 382 parent companies across all application categories; of these, only 68 firms, or about 18 percent, employ more than 1,000 people. In terms of sales revenues, only 22.5 percent of equipment manufacturers have sales revenues of more than \$100 million and only 11 percent exceed \$1 billion in sales. As the determinations of engine and equipment manufacturers are calculated separately, both sets of numbers include integrated equipment manufacturers that have captive engine production. Figures 3-1 and 3-2 show employment and sale distributions for the 363 firms that make NHH equipment in 2002. More than 200 of these firms employed fewer than 100 people, and three-quarters of the total would be considered small businesses by the SBA definitions. Figures 3-3 and 3-4 show similar distributions for the 49 firms that make HH equipment in 2002. Almost two-thirds of these manufacturers also fall into the small business category.

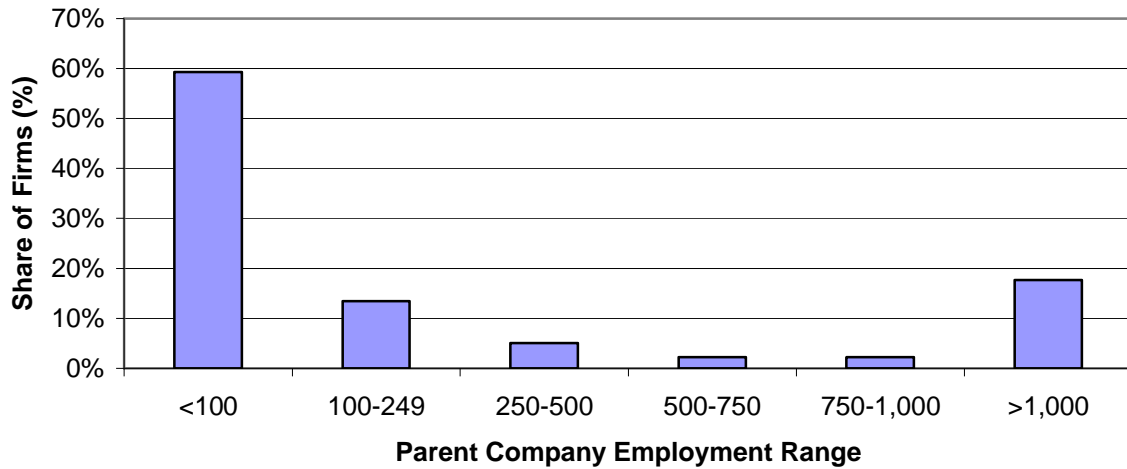


Figure 3-1. Employment Distribution of NHH Equipment Manufacturers in 2004 (N=363)

Source: Hoover's Online <<http://www.hoovers.com>>; W&D Partners Worldscope through LexisNexis; Dun & Bradstreet Small Business Solutions <<http://smallbusiness.dnb.com/default.asp?bhcd2=1107465546>>; Graham & Whiteside Major Companies Database through LexisNexis.

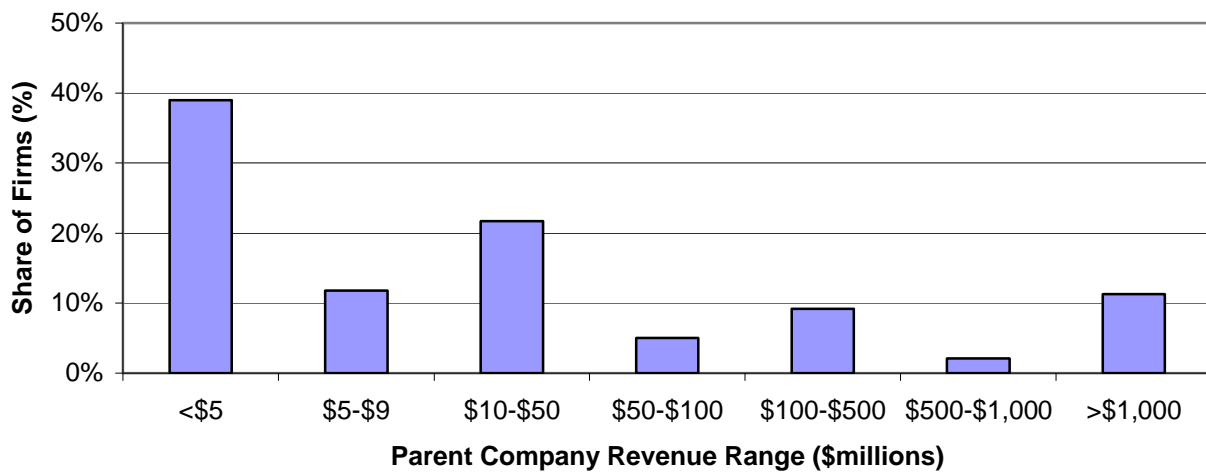


Figure 3-2. Sales Distribution of NHH Equipment Manufacturers in 2004 (N=363)

Source: Hoover's Online <<http://www.hoovers.com>>; W&D Partners Worldscope through LexisNexis; Dun & Bradstreet Small Business Solutions <<http://smallbusiness.dnb.com/default.asp?bhcd2=1107465546>>; Graham & Whiteside Major Companies Database through LexisNexis.

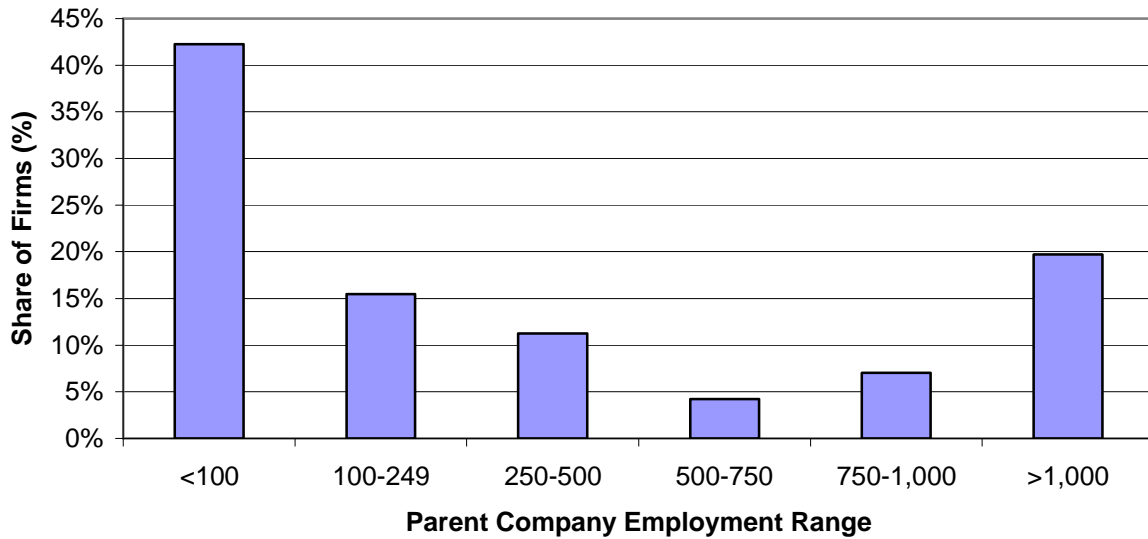


Figure 3-3. Employment Distribution of HH Equipment Manufacturers in 2004 (N=49)

Source: Hoover's Online <<http://www.hoovers.com>>; W&D Partners Worldscope through LexisNexis; Dun & Bradstreet Small Business Solutions <<http://smallbusiness.dnb.com/default.asp?bhcd2=1107465546>>; Graham & Whiteside Major Companies Database through LexisNexis.

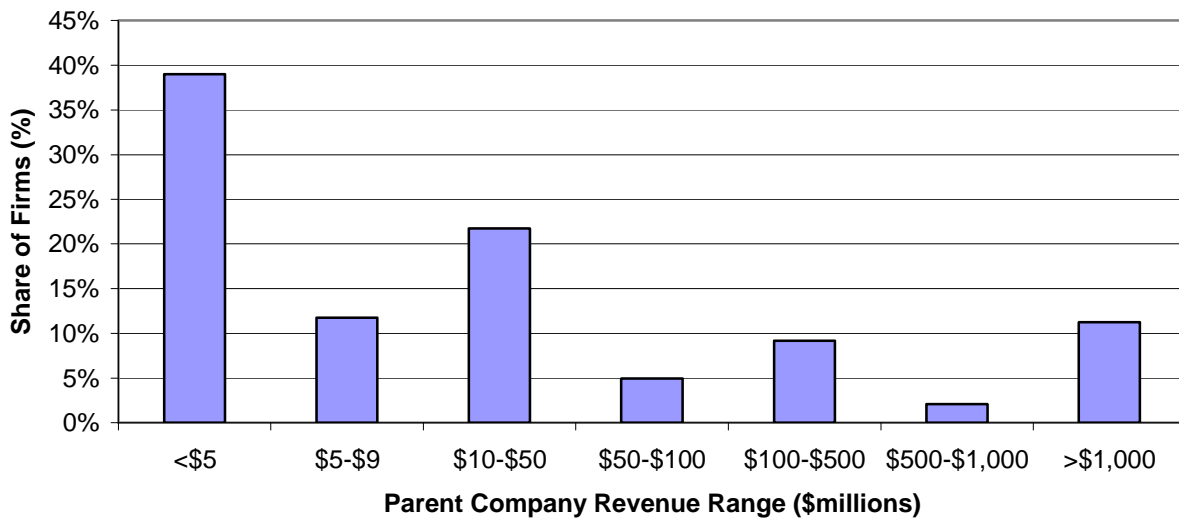


Figure 3-4. Sales Distribution of HH Equipment Manufacturers in 2004 (N=49)

Source: Hoover's Online <<http://www.hoovers.com>>; W&D Partners Worldscope through LexisNexis; Dun & Bradstreet Small Business Solutions <<http://smallbusiness.dnb.com/default.asp?bhcd2=1107465546>>; Graham & Whiteside Major Companies Database through LexisNexis.

3.2 Lawn Mowing Equipment

The lawn mowing equipment application group detailed here includes all equipment used to cut grass by households, commercial lawn services, businesses, and institutions. This is the largest of the small SI categories in terms of the value of production, although there are larger unit volumes of handheld products. Walk-behind lawnmowers represent a majority of this category's unit sales, with almost 5.8 million machines sold in 2002. Other equipment segments considered as lawn mowing equipment include commercial mowers, commercial turf, rear-engine riders, and L&G tractors. Table 3-1 details production of these products separated out by application segment and certification class.

Table 3-1. Small SI Lawn Mowing Equipment by Engine Class (2002)

Engine Class	Application	Small SI Engines Purchased	Percentage Share of Total
Class IA	Lawn Mowers	863	100.0%
	Total	863	
Class I	Commercial Mowers	13,115	0.2%
	Lawn Mowers	5,785,560	99.4%
	Rear Engine Riders	1,091	0.0%
	Commercial Turf	20,370	0.3%
	Total	5,820,136	
Class II	Commercial Mowers	141,224	9.1%
	L&G Tractors	1,291,031	82.9%
	Rear Engine Riders	106,123	6.8%
	Commercial Turf	19,834	1.3%
	Total	1,558,212	

Source: PSR, 2004.

3.2.1 Lawn Mowing Equipment Categories and Characteristics

Of the 19.8 million small SI nonroad engines incorporated into equipment in the year 2002, about 7.4 million were used for lawn mowing products, or slightly more than 37 percent. Almost all of the Class I machines were lawn mowers, along with a handful of units powered by engines below 80 cc. The Class II category was dominated by L&G tractors, with almost 1.3 million produced in 2002. These data show the difficulty of separating out household and commercial consumption of small SI equipment. Relatively few machines are identified as commercial mowers, and the rear-engine rider segment includes models that are promoted for households as well as lawn care firms. Likewise, PSR's lawn mower category includes many equipment models that are used either exclusively or mainly by commercial lawn care operators.

The machines classified by PSR as lawn mowers have some characteristics in common, including single cylinders, air-cooled engines, and power ratings at or below 11 hp. Despite these similarities, there are number of features that differentiate units and allow a fairly wide range of prices. According to the Census Bureau's Current Industrial Report for 2002, the average value of a push-type reel or rotary mower made in that year was \$148, while the value of the average self-propelled model was 50 percent higher at ~\$238 (Census Bureau, 2003). More recent anecdotal data supports the observation that many consumers are willing to pay for a number of features that facilitate ease of operation or reliability.

Across the entire lawn mowing category, the horsepower range in 2002 was much wider, with some models operating at the maximum 25 hp. Most of the engines were 4-stroke models, although about 2.5 percent or 174,000 units were 2-stroke lawn mowers (these engines are no longer produced). Almost 90 percent of the machines, or 6.6 million units, operated on one cylinder, while around 680,000 2-cylinder and 2,000 3-cylinder units were also produced. These engines were overwhelmingly air-cooled; only about 100,000 machines featured water-cooled engines, all of them 2- or 3-cylinder models.

3.2.2 Supply-Side Considerations

Costs of Production. According to information presented in the 2002 Economic Census for all L&G equipment, materials costs comprised 62.6 percent of the value of shipments, with labor and capital adding 10.4 percent and 2.7 percent, respectively (U.S. Census Bureau, 2004b). There is no break-out of costs for lawnmowers themselves, but it is reasonable to assume, based on technological similarity, that the cost shares would likely be similar across the L&G category. Gasoline engines made up the largest component of purchased materials, accounting for 21.4 percent in 2002. Other important materials included sheet steel, fluid power pumps, metal stampings, transmissions, and pneumatic tires, each making up between 2 and 3 percent of total materials costs.

Substitution Possibilities. There is not any realistic potential for substitution away from lawn mowing equipment in response to regulation-induced price increases. Such a substitution would need to involve selection of a novel technology to cut grass or perhaps a choice by consumers to replace their grass lawns with some other materials (low-maintenance ground cover and/or native plants, as well as artificial turf and gravel are all seen occasionally across the country). Because a mower price increase would constitute such a small change in the typical household budget, it is not reasonable to expect widespread move away from gasoline-powered mowers and tractors.

It is possible, of course, that homeowners could recapture leisure hours by hiring a commercial lawn service rather than choosing to pay a few more dollars for a new lawn mower. Households commonly make this decision as time pressures and income opportunities change over time, but it is not obvious that regulation-induced price increases would provide a similar driving force for this change. Because all lawn care equipment would be similarly affected by potential new regulation, it is most likely that the costs of commercial lawn service would increase proportionately to rising equipment prices. There would be no incentive to substitute as a result.

3.2.3 Demand-Side Considerations

Demand for lawn mowing equipment shows a pronounced seasonal pattern, with highest sales in the spring and summer months; it also varies with the state of the economy, like most other durable equipment purchased by households. Long-term demand for lawn mowing equipment is driven by the creation of new households through population growth, changes in new home lot sizes, and deterioration and obsolescence of existing models. Although new convenience and performance features may impact potential consumers' selection of one model versus another, basic mower and tractor technology is not changing rapidly, and the market is quite mature. The most important technological changes in both engine and equipment design over the past several years have been driven by increasingly stringent governmental safety and emissions regulations.

3.2.4 Industry Organization

Table 3-2 shows the leading producers of lawn mowing equipment in the three NHH size classes. Aside from the tiny under-80 cc class, the data shows very even market shares among the three largest producers of Class I and II equipment. Electrolux, MTD Holdings, and Briggs & Stratton are market leaders in both segments, followed by John Deere and Toro. Briggs & Stratton has the highest share in Class I, thanks in large part to its recent purchases of the Murray and Simplicity/Snapper product lines. In a mature market such as lawn care, industrial organization theory suggests that this type of industry structure may lead to intense price competition; the major players have claimed that this situation already exists.

3.2.5 Markets and Trends

As Table 3-3 shows, the entire lawn mowing category did not grow over the period from 1998 to 2002, with the important L&G tractor segment actually declining by 7 percent in unit volume. The overall trend masks a significant increase in volumes from 1998 to 2000, followed by an equal decline over the next two years. Because of the segment's cyclical behavior, it is quite possible that growth continued in the years after 2002.

Table 3-2. Small SI Lawn Mowing Equipment Manufacturers' Market Shares by Engine Class (2002)

Class IA	Small SI Engines Purchased	Percentage Share of Market (2002)
Eastman Industries	863	100.0%
Total	863	
Class I		
Briggs & Stratton	1,518,885	26.1%
Electrolux	1,434,994	24.7%
MTD	1,308,185	22.5%
Toro Company	832,673	14.3%
Deere & Company	302,602	5.2%
Sum of Top 5 Manufacturers	5,397,339	92.7%
Total of All Manufacturers	5,820,136	
Class II		
Electrolux	452,123	29.0%
Briggs & Stratton	363,749	23.3%
MTD	350,454	22.5%
Deere & Company	206,931	13.3%
Toro Company	61,440	3.9%
Sum of Top 5 Manufacturers	1,434,697	92.1%
Total of All Manufacturers	1,558,212	

Source: PSR, 2004.

Table 3-3. Production Trends for Small SI Lawn Mowing Equipment Manufacturing (2002)

	2002	2001	2000	1999	1998	Percentage Change 1998-2002
Commercial Mowers	154,339	159,877	151,304	140,542	133,834	15.3%
Lawn Mowers	5,786,423	5,631,463	6,214,189	5,930,577	5,771,313	0.3%
Lawn/Gdn Tractors	1,291,031	1,387,521	1,556,907	1,463,467	1,387,671	-7.0%
Rear Engine Riders	107,214	129,206	142,782	132,355	119,813	-10.5%
Commercial Turf	40,204	39,924	42,956	39,304	38,444	4.6%

Source: PSR, 2004.

3.3 HH Lawn and Garden Equipment

The HH L&G equipment industry manufactures a very large quantity of handheld equipment: primarily trimmers and edgers, leaf blowers, and chain saws.

3.3.1 *HH Lawn and Garden Categories and Characteristics*

Approximately 9 million pieces of equipment were produced for sale in the United States in 2002, of which more than 80 percent were handheld models powered by 2-stroke gasoline engines. String trimmers and edgers are the most important segment within the HH certification class, which also includes more than 2.3 million chain saws (Table 3-4).

Table 3-4. Small SI HH Lawn and Garden Equipment by Engine Class (2002)

Engine Class	Application	Small SI Engines Purchased	Percentage Share of Total
HH	Trimmer/Edger/Cutter	4,923,501	53.6%
	Chainsaws	2,338,563	25.4%
	Leaf Blowers/Vacs	1,657,110	18.0%
	Other Lawn & Garden	186,943	2.0%
	Tillers	85,881	0.9%
	Total	9,191,998	

Source: PSR, 2004.

3.3.2 *Supply-Side Considerations*

The costs of production in this segment are comparable to lawn mowers and other L&G equipment in Section 3.2.2. Bought-in materials comprise more than 60 percent of the value of production, and gasoline engines make up the largest fraction (> 20 percent) of this material cost. The substitution issues here are also similar to those found in the lawn mowing section. With stable demand and few technological alternatives, substitution is very unlikely in the face of even significant increases in equipment cost.

3.3.3 *Demand-Side Considerations*

Although no industry-specific analyses are available, it is expected that demand for the services provided by HH L&G equipment will increase in proportion to the level of general economic activity. Households, firms, institutions, and governmental entities need to care for their trees, shrubs, and landscape areas regardless of the state of the economy.

3.3.4 *Industry Organization*

Table 3-5 details the leading manufacturers in HH class. Electrolux, the parent firm of Poulan/Weed Eater and Husqvarna brands, produced about one-third of the total number of units, while Stihl, Techtronic (owner of Homelite brand chain saws), and MTD Holdings each maintained between a 15 and 20 percent share.

Table 3-5. Small SI HH Lawn and Garden Equipment Manufacturers by Engine Class (2002)

HH	Small SI Engines Purchased	Percentage Share of Market (2002)
Electrolux	3,015,187	32.8%
Stihl Group	1,795,181	19.5%
MTD	1,521,978	16.6%
Techtronic Industries	1,409,610	15.3%
Kioritz Corporation	487,726	5.3%
Sum of Top 5 Manufacturers	8,229,682	89.5%
Total of All Manufacturers	9,191,998	

Source: PSR, 2004.

3.3.5 Markets and Trends

Chainsaws and tillers saw double digit increase in unit sales between 1998 and 2002 (see Table 3-6). The largest category, trimmers, followed the cyclical pattern noted for lawn mowers. Leaf blowers, vacuums, and other L&G equipment sales exhibited similar but stronger cyclical changes in sales.

Table 3-6. Production Trends for Small SI HH Lawn and Garden Equipment Manufacturing (2002)

	2002	2001	2000	1999	1998	Percentage Change 1998-2002
Trimmer/Edger/Cutter	4,923,501	5,284,468	5,972,700	5,580,040	5,016,409	-1.9%
Chainsaws	2,338,563	2,359,409	2,337,136	2,218,869	2,056,041	13.7%
Leaf Blowers/Vacs	1,657,110	1,757,377	1,938,959	2,011,343	1,814,849	-8.7%
Other Lawn & Garden	186,943	206,922	233,379	227,540	226,147	-17.3%
Tillers	85,881	69,663	71,365	73,646	64,923	32.3%

Source: PSR, 2004.

3.4 NHH Lawn and Garden Equipment

The NHH L&G equipment industry manufacturing firms produce equipment in the following application segments: tillers; shredders; wheeled trimmers, edgers, and cutters; and wheeled blowers and vacuums.

3.4.1 *NHH Lawn and Garden Categories and Characteristics*

About 1.1 million NHH L&G machines were produced in 2002. In the Class I category, tillers are the most important segment, while Class II contains approximately equal numbers of several different types of equipment. Table 3-7 shows a breakdown of production by size class and application segment. As was mentioned above, snowblowers are included in this application category for completeness, although they are regulated separately by EPA.

Table 3-7. Small SI NHH Lawn and Garden Equipment by Engine Class (2002)

Engine Class	Application	Small SI Engines Purchased	Percentage Share of Total
Class I	Tillers	245,381	63.6%
	Shredders	98,922	25.7%
	Other Lawn & Garden	41,286	10.7%
	Total	385,589	
Class II	Other Lawn & Garden	28,503	41.0%
	Shredders	28,558	41.0%
	Tillers	12,528	18.0%
	Total	69,589	
Snowblowers	Snowblowers	682,860	
Total		1,138,038	

Source: PSR, 2004.

3.4.2 *Supply-Side Considerations*

Because lawn mowers and other L&G equipment are included in the same report by the Census Bureau, the cost of production information introduced in Section 3.2.2 would apply to this category of equipment as well. Bought-in materials comprise more than 60 percent of the value of production, and gasoline engines make up the largest fraction (> 20 percent) of this material cost. The substitution issues here are also similar to those found in the lawn mowing section. With stable demand and few technological alternatives, substitution is very unlikely in the face of even significant increases in equipment cost.

3.4.3 *Demand-Side Considerations*

Although no industry-specific analyses are available, it is expected that demand for the services provided by L&G equipment will increase in proportion to the level of general economic activity. Aside from the seasonal and cyclical factors noted above, demand should be expected to be stable.

3.4.4 Industry Organization

Table 3-8 details the leading manufacturers in each of the engine categories. MTD has the largest share among Class I and Class II products, trailed by Electrolux and Streator Dependable Manufacturing in each class respectively. Briggs and Stratton and MTD between them accounted for about 70 percent of snowblower production in 2002.

Table 3-8. Small SI NHH Lawn and Garden Equipment Manufacturers by Engine Class (2002)

	Small SI Engines Purchased	Percentage Share of Market (2002)
Class I		
MTD Holdings Inc	135,822	35.2%
Electrolux	108,160	28.1%
Inductotherm Industries, Inc.	31,805	8.2%
Briggs & Stratton Corp	28,541	7.4%
Ariens Company	25,012	6.5%
Sum of Top 5 Manufacturers	329,340	85.4%
Total of All Manufacturers	385,589	
Class II		
MTD Holdings Inc.	21,070	30.3%
Streator Dependable Mfg.	16,432	23.6%
Northern Tool and Equipment	8,426	12.1%
Ariens Company	6,278	9.0%
Electrolux	3,674	5.3%
Sum of Top 5 Manufacturers	55,880	80.3%
Total of All Manufacturers	69,589	
Snowblowers		
Briggs & Stratton Corp.	302,670	44.3%
MTD Holdings Inc	181,976	26.6%
Toro Company	124,324	18.2%
Ariens Company	58,895	8.6%
Honda Motor Company Ltd.	14,995	2.2%
Sum of Top 5 Manufacturers	682,860	100.0%
Total of All Manufacturers	682,860	

Source: PSR, 2004.

3.4.5 Markets and Trends

As opposed to the lawn mowing category, several segments in the other NHH L&G markets grew strongly over the 1998 to 2002 period. Shredders and snowblowers saw 40 and above percent increase in unit sales throughout the period (see Table 3-9). In contrast, tillers and other L&G equipment growth rates followed a cyclical growth pattern and an overall decline between 1998 and 2002.

Table 3-9. Production Trends for Small SI NHH Other Lawn and Garden Equipment Manufacturing (2002)

	2002	2001	2000	1999	1998	Percentage Change
						1998–2002
Other Lawn and Garden	69,789	76,106	92,637	82,715	76,337	–8.6%
Shredders	127,480	85,742	94,327	95,607	90,815	40.4%
Tillers	257,909	277,876	307,085	313,274	297,419	–13.3%
Snowblowers	682,860	718,800	627,097	774,874	406,295	68.1%

Source: PSR, 2004.

3.5 Generators and Welders

Generators and welding machines are considerably different in many respects than the nonroad equipment discussed up to this point. The primary role of a generator is to convert chemical potential energy from a fuel into electrical potential, which can then be used to drive any electrical equipment desired. As a result, generators do not perform useful work directly. A welding machine is merely a generator with an apparatus attached to create a high temperature electric arc. Although these machines are portable, they are not self propelled, nor is it usually desirable for them to move while in operation. Finally, generators do not require an operator, except for starting and stopping, refueling, and maintenance activities.

3.5.1 *Generators and Welders Categories and Characteristics*

Generator sets and welders are one of the minor application categories among the small SI equipment markets included in the analysis, with a little more than 800,000 units produced in the year 2002. Table 3-10 shows the distribution of generators by NHH Class and application category. Due to their technological similarity, marine auxiliary generators are included in this profile with their terrestrial counterparts. About two-thirds of the units in this category are Class II units, with displacement at or above 225 cc. This includes all of the welders and marine auxiliary units in the database.

Table 3-10. Generators and Welding Equipment by Engine Class (2002)

Application	Class IA	Class I	Class II	Total
Generator Sets	334	267,913	508,294	776,541
Marine Auxiliary	—	—	3,319	3,319
Welders	—	—	30,659	30,659
Total	334	267,913	542,272	810,519

Source: PSR, 2004.

3.5.2 Supply-Side Considerations

Costs of Production. The Economic Census [EC02-31I 335312] includes generators and welders as part of the very large motor and generator manufacturing industry, which also includes electric motors, land transportation motors, and other prime movers (U.S. Census Bureau, 2004d). The Census does not provide information on the purchase of gasoline engines by this industry. As a result, there is little information on cost share of engines for generators and welders. Still, the nature of these products suggests that engines must be a substantial fraction of the total cost of materials, which are about one half of the value of shipments across motor and generator manufacturing.

Substitution Possibilities. Because generators are devices for converting liquid fuel to electrical power, supply side substitution would not be likely if small SI engine prices increased substantially. Alternative fuels such as diesel fuel, compressed natural gas (CNG), or LPG could in principle be used to fuel generators or welders, but at a significantly higher cost.

3.5.3 Demand-Side Considerations

Unlike the large diesel generators, which are widely used for stand-by or emergency power in industrial setting, gasoline-powered gensets are used to a greater extent by households. Their choice of gasoline is most likely due to the convenience of being able to use a fuel source that is already present in the house, as well as readily available when needed. Demand for generators often peaks after natural disasters or widespread power outages, but overall should be expected to grow no faster than the rate of population growth.

3.5.4 Industry Organization

Gensets and welders are generally regulated as NHH equipment, and almost all in the PSR database are large enough to be included in Class I or Class II. Sales for the leading manufacturers in the three engine size segments are presented in Table 3-11. Briggs & Stratton, Black & Decker, Sunbeam, and Cummins are all leading producers in both classes, although Honda actually produced the most Class I units in 2002. Illinois Tool Works has a top five share in the Class II segment, due to its production of gasoline-powered welders.

3.5.5 Markets and Trends

Explosive growth in production of Small SI generator sets in the late 1990s, fueled by a series of natural disasters and Y2K, was reversed over the period from 1999 to 2002. The welders and marine auxiliary markets did not fare much better, with 10 percent declines in unit production over the period. The data on the most recent 5-year period for which unit volumes are available appears here as Table 3-12.

Table 3-11. Top Five Small SI Generator Sets and Welding Equipment Manufacturers by Engine Class (2002)

Engine Class	Parent Company Name	Small SI Engines Purchased	Percentage Share of Total
Class IA	Suzuki Motor	334	100.0%
	Total	334	
Class I	Honda Motor	87,033	32.5%
	Briggs & Stratton	66,259	24.7%
	Sunbeam	49,093	18.3%
	Black & Decker	29,508	11.0%
	Cummins	9,855	3.7%
	Sum of Top 5 Manufacturers	241,748	90.2%
	Total of All Manufacturers	267,913	
Class II	Briggs & Stratton	139,689	25.8%
	Black & Decker	130,749	24.1%
	Sunbeam	119,408	22.0%
	Cummins	48,413	8.9%
	Illinois Tool Works	20,339	3.8%
	Sum of Top 5 Manufacturers	458,598	84.6%
	Total of All Manufacturers	542,272	
Grand Total		810,519	

Source: PSR, 2004.

Table 3-12. Production Trends for Small SI Generator Sets and Welding Equipment

	2002	2001	2000	1999	1998	Percentage Change
						1998-2002
Generator Sets	776,541	696,676	978,807	2,189,879	1,254,044	-38.1%
Marine Auxiliary	3,319	2,874	3,162	3,554	3,677	-9.7%
Welders	30,659	30,805	32,792	39,613	34,077	-10.0%

Source: PSR, 2004.

3.6 Pumps and Compressors

Pumps and compressors are similar to generators in complexity and function. Both use energy to pressurize a fluid, which then can do work in an application. In the case of pumps and pressure washers, the pressure of a liquid is increased to move it through a piping or processing system, or simply to lift it to a more useful level. In the case of air and gas compressors, the fluid can be used to drive pneumatic equipment, circulate in an enclosed system, or to clean or cool applications. As with generators, pumps and compressors are designed to be stationary when in operation, although the units covered by this profile are all portable, or at least moveable. Most

of these units are designed to function without an operator, although a person may manipulate the pressurized fluid.

3.6.1 Pumps and Compressors Categories and Characteristics

Table 3-13 lists the types of equipment included in the pumps and compressor industry in 2002. Pressure washers account for more than 80 percent of the units in both Class I and Class II NHH segments, with a total of 650,000 produced that year. Portable pumps represented the second most important category in each of the NHH segments, including around 64,000 of the under-80 cc class. About 31,000 air compressors spread across the categories made up most of the remaining pieces of equipment.

3.6.2 Supply-Side Considerations

Costs of Production. Small SI powered pumps and compressors are each part of a larger industry as defined in the 2002 Economic Census. The pump and pumping equipment manufacturing sector [EC02-31I 333911] includes liquid-fuel operated pumps along with those powered by an electric motor or generator (U.S. Census Bureau, 2004e). Although this is broader a classification than is ideal for this analysis, the data that is available for the category reveals that purchased materials are about 48 percent of the value of shipments. Labor and capital account for about 20 percent and 2 percent of the value of shipments, respectively. In comparison with L&G equipment, then, pumps and compressor manufacturing is more labor intensive and therefore has a higher value-added than L&G production.

3.6.3 Demand-Side Considerations

Pressure washers and air compressors are used widely by consumers and commercial firms in home and industrial maintenance activities. Portable pumps are also used in industrial maintenance activities, as well as in construction and some chemical process operations. It is expected that demand for all types of units in this industry would fluctuate with the overall level of economic activity and would tend to grow in proportion to the population.

3.6.4 Industry Organization

Sales in 2002 for the leading manufacturers in the three NHH size classes are shown in Table 3-14. Black & Decker and Briggs & Stratton are the leaders in Class I; Black & Decker also had the highest market share in the Class II segment. As with several other applications areas, pumps and compressors has a number of firms with substantial but not dominant market share. In these mature markets with relatively low growth potential, that amount of rivalry should be more than adequate to maintain competitive behavior.

Table 3-13. Small SI Pump and Compressor Equipment by Engine Class (2002)

Engine Class	Application	Small SI Engines Purchased	Percent Share of Total
Class IA	Hyd Power Units	73	0.1%
	Pumps	64,376	99.9%
	Total	64,449	
Class I	Pressure Washers	462,218	80.8%
	Pumps	94,100	16.4%
	Air Compressors	15,017	2.6%
	Hyd Power Units	902	0.2%
	Irrigation Sets	107	0.0%
	Total	572,344	
Class II	Air Compressors	16,629	7.4%
	Hyd Power Units	4,531	2.0%
	Irrigation Sets	55	0.0%
	Pressure Washers	190,558	84.4%
	Pumps	14,057	6.2%
	Total	225,830	

Source: PSR, 2004.

3.6.5 Markets and Trends

The growth trend has been mixed in production of pumps and compressors, with two application segments increasing shipments between 1998 and 2002, and three experiencing production declines. Pressure washers experienced the cyclical increase and decrease over the 5 years in question; pumps did as well, but their growth up to 2000 was sufficient to create an increase between the terminal dates. Gasoline-powered air compressors suffered declining unit volumes throughout the period, falling more than 11 percent to 2002. Table 3-15 has details of the growth trends in this category.

3.7 Utility/Recreational Products Equipment

This final application area includes a diverse set of three product lines united by technological similarity: go karts, golf carts, and small utility vehicles. The equipment in this segment consists of wheeled vehicles, where the primary function of the engine is propulsion.

Table 3-14. Top Five Pump and Compressor Manufacturers by Engine Class (2002)

Engine Class	Parent	Small SI Engines Purchased	Share of Total
Class IA	Tanaka Seimitsu Kogyo	29,786	46.2%
	Yama Group	15,758	24.5%
	Shindaiwa Kogyo	8,428	13.1%
	Maruyama Manufacturing	5,970	9.3%
	Deere & Company	2,694	4.2%
	Sum of Top Five Manufacturers	62,636	97.2%
	Total of All Manufacturers	64,449	
Class I	Black & Decker	159,191	27.8%
	Briggs & Stratton	139,502	24.4%
	Karcher Germany	73,751	12.9%
	ASM Industries	59,228	10.3%
	Scott Fetzer	51,277	9.0%
	Sum of Top Five Manufacturers	482,949	84.4%
	Total of All Manufacturers	572,344	
Class II	Black & Decker	60,625	26.8%
	MI-T-M Corporation	33,308	14.7%
	Karcher Germany	33,091	14.7%
	Briggs & Stratton	29,233	12.9%
	Scott Fetzer	13,115	5.8%
	Sum of Top Five Manufacturers	169,372	75.0%
	Total of All Manufacturers	225,830	

Source: PSR, 2004.

Table 3-15. Production Trends for Pump and Compressor Manufacturing

	2002	2001	2000	1999	1998	Percentage Change 1998-2002
Air Compressors	31,646	32,928	35,242	36,597	35,710	-11.4%
Hyd Power Units	5,506	5,580	5,880	5,409	4,989	10.4%
Irrigation Sets	162	134	164	160	176	-8.0%
Pressure Washers	652,776	665,882	777,994	708,144	675,651	-3.4%
Pumps	172,533	193,859	207,190	149,929	149,431	15.5%

Source: PSR, 2004.

Utility vehicles find use in both household and commercial applications; one of the most significant growth markets for these products is in transporting L&G and maintenance items for outdoor household use.

3.7.1 Utility/Recreational Products Categories and Characteristics

Table 3-16 lists the types of equipment produced in this application area in 2002. More than 90 percent of the go karts manufactured fall into the Class I NHH segment, with the remainder in Class II. All of the golf carts and utility vehicles are in the larger Class II segment; approximately equal numbers of each product were produced in 2002. The total of 230,000 units makes it the smallest of the categories considered in this profile.

3.7.2 Supply-Side Considerations

Small SI powered utility/recreational products do not fit into any well defined category in the Economic Census, but instead belong to the heterogeneous All Other Transportation Equipment Manufacturing Category (NAICS 336999), which also includes ATVs, personal watercraft (PWC), snowmobiles, race cars, and similar vehicles. For these products, the most recent Census data reveal that material costs constitute 60 percent of the value of shipments. Labor costs equal approximately 10 percent, capital expenditures comprise 3 percent of the value of shipments. These factor shares are similar to those found for other categories of equipment contained in this profile

Table 3-16. Small SI Utility/Recreational Equipment by Engine Class (2002)

Engine Class	Application	Small SI Engines Purchased	Percentage Share of Total
Class I	Go Karts	80,656	100.0%
	Total	80,656	
Class II	Go Karts	6,702	4.3%
	Golf Carts	75,024	48.5%
	Utility Vehicles	72,976	47.2%
	Total	154,702	

Source: PSR, 2004.

3.7.3 Demand-Side Considerations

As the three product lines detailed in this section are exchanged in different types of markets, the demand for each is likely to respond differently to potential price increases. Go karts are low-cost recreational products; thus, they compete with a wide variety of other

inexpensive recreational vehicles and devices, including off-road motorcycles, ATVs, and PWC. These machines are also purchased by operators of amusement establishments and become a part of their capital stock. Golf carts, likewise, are bought by the operators of golf courses for their patrons to use. This commercial use of both types of equipment may serve to mitigate the high price responsiveness that would result from purely recreational buyers. Unfortunately, no existing studies were available to further explore the nature of these markets.

In a similar manner, demand for utility vehicles is likely to depend on both household and commercial purchasers, with the corporate demand tending to mitigate the responsiveness of household consumers to changes in equipment prices. With no information available that suggests otherwise, it is reasonable to expect that demand for all types of units in this industry would fluctuate with the overall level of economic activity and would tend to grow along with population.

3.7.4 Industry Organization

Sales in 2002 for the leading manufacturers are shown in Table 3-17. There are a total of 42 manufacturers of go karts listed in the PSR database, all of which produce equipment with Class I engines. About half of those firms also make go karts in the larger class. Hedstrom, Manco Products, and Carter Brothers have the largest market shares.

The producers of golf carts and utility vehicles dominate in NHH utility/recreational equipment with Class II engines category. The leading golf cart makers—Ingersoll-Rand, Textron, and Yamaha—produced more than 20,000 units in 2002. Of that group, only Textron also makes significant numbers of utility vehicles. John Deere and Kawasaki compete with Textron in that market, producing about a 10 percent share in the overall segment. In all, eight firms are listed by PSR as makers of golf carts, while 28 firms are competing in the utility vehicle business.

3.7.5 Markets and Trends

The 5-year growth trend has been mixed in terms of the production of recreational equipment, as the data in Table 3-18 illustrate. Go kart production has fallen off dramatically since 1998, with a decrease of about 44 percent. Golf carts have grown at a moderate 11 percent during the same time period. Utility vehicles, which seem to be gaining popularity for homeowners and small businesses, saw an increase of more than 50 percent during the 1998 to 2002 time period.

Table 3-17. Top Five Small SI Utility/Recreational Product Manufacturers by Engine Class (2002)

Engine Class	Parent	Small SI Engines Purchased	Percentage Share of Total
Class I	Hedstrom Corporation	16,624	20.6%
	Manco Products	15,521	19.2%
	Carter Brothers Mfg.	13,417	16.6%
	World Karting Association	10,045	12.5%
	Briggs & Stratton	8,812	10.9%
	Sum of Top Five Manufacturers	64,419	79.9%
Total of All Manufacturers		80,656	
Class II	Ingersoll-Rand	42,790	27.7%
	Textron Inc.	39,541	25.6%
	Yamaha Motor	23,455	15.2%
	Kawasaki Heavy Industries	16,462	10.6%
	Deere & Company	16,299	10.5%
	Sum of Top Five Manufacturers	138,547	89.6%
Total of All Manufacturers		154,702	

Source: PSR, 2004.

Table 3-18. Production Trends for Small SI Utility/Recreational Equipment Manufacturing (2002)

	2002	2001	2000	1999	1998	Percentage Change 1998-2002
Go Karts	87,358	93,039	149,581	156,816	155,929	-44.0%
Golf Carts	75,024	73,738	71,693	69,070	67,417	11.3%
Utility Vehicles	72,976	69,742	63,957	58,109	47,988	52.1%

Source: PSR, 2004.

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