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# Well Stimulation Materials

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US Industry Study with Forecasts for **2012 & 2017**

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#### INDUSTRY STRUCTURE

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*Essentially all important types of stimulation materials are expected to register strong growth as US oilfield operators struggle to sustain production levels from declining wells.*

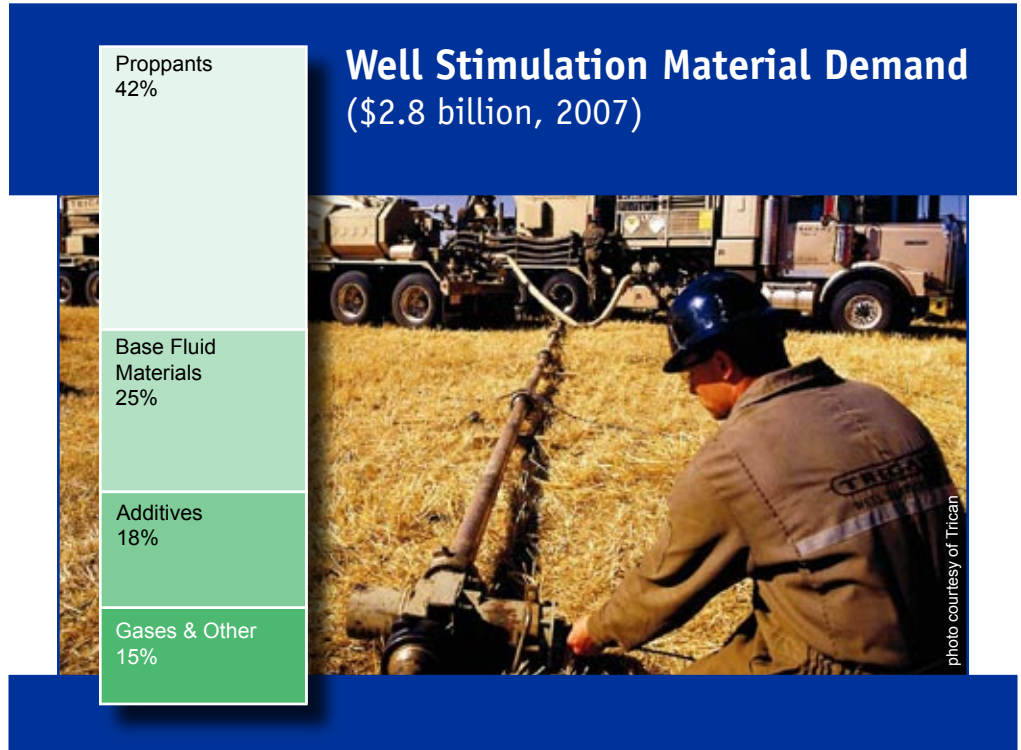
## US demand to rise 14% annually through 2012

Buoyed by historically high price levels for oil and gas, demand for well stimulation materials in the US is projected to increase 14 percent annually to \$5.35 billion in 2012. Although there will be some variation within product categories due to changes in the product mix, essentially all important product types are expected to register strong growth as US oilfield operators struggle to sustain production levels. Proppants, the largest product category, has surpassed the \$1 billion mark, and is expected to double in market value again by 2012.

Increasingly, operators are turning to well stimulation techniques such as hydraulic fracturing to boost output from wells that are considered past their prime, and also to maximize production from newer wells. At lower oil and gas price points, the cost of stimulation operations is often not justified. However, oil prices have risen sharply in recent years, and the range of oil and gas wells for which stimulation becomes an attractive option has broadened demonstrably, driving demand for proppants, gases and other stimulation materials.

## Most types to benefit from well production efforts

Although areas with declining production are a key segment for well stimulation materials, a substantial share of stimula-



tion activity will be focused on less fully exploited reserves, such as deepwater areas in the Gulf of Mexico and coal beds in the Rocky Mountain states. The harsher environment of the Gulf, which requires drilling several miles through rock thousands of feet below the water's surface, will boost demand for ceramic proppants designed to withstand the greater levels of pressure at such depths. In contrast, coal beds are typically shallow, and can often be developed and made more productive using lower-cost materials such as raw frac sand and slickwater, low-viscosity water-based fluids.

Across the board, nearly every possibility for increases in oil and gas production --

old wells and new, conventional and unconventional reservoirs, in shallow coal beds and in deep waters far offshore -- will present growth opportunities for well stimulation materials. Products range from exceedingly high-performance materials for the harshest conditions to economical alternatives able to deliver adequate performance in comparatively low-stress, cost-sensitive environments. Companies offering stimulation services are able to fine tune the formulation of these products to boost production in a wide variety of formations with varying conductivity, permeability, temperature, pressure, pH level and environmental requirements.

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## Sample Text, Table & Chart

### PRODUCTS

#### Proppants

Proppants are materials -- typically either sand or ceramic -- that are deposited in fractures generated by hydraulic fracturing. Fractures are first formed by the hydraulic fracturing fluid stage. Then, proppants are added to the stimulation fluid and flow into the fracture. The proppants remain in the fracture after the hydraulic pressure to prop the fracture open. Proppants are the single largest class of materials used in the stimulation of oil and gas wells, accounting for more than 40 percent of market value and nearly half of volume in 2007.

Demand for proppants is projected to increase nearly 20 percent from 2007 to 2012. Proppant volume is expected to reach 1.2 billion pounds in 2012. Growth is expected to be driven by the increase in the use of well stimulation, as well as by the use of coated and/or ceramic proppants in deepwater wells. Although raw sand will remain the largest proppant type, as well depths increase, the overbearing load that must be overcome increases as well, requiring higher hydraulic fracturing pressures and stronger materials such as ceramics in place of traditional "frac" sand to withstand the higher loading applied by the collapsing fracture.

The various types of proppants available to the market include coated and uncoated ceramic proppants based on kaolin clay and sintered bauxite; raw "frac" sand and coated sand; and other proppants, including lightweight proppants (often made of walnut hulls or plastic resin) more recently introduced to the market. The coating applied to individual proppant grains is usually based on phenolic resin. Coating the proppant grains performs several functions. First, it helps to reduce stress concentrations by acting as a cushion between grains. Second, it helps to

TABLE IV-15

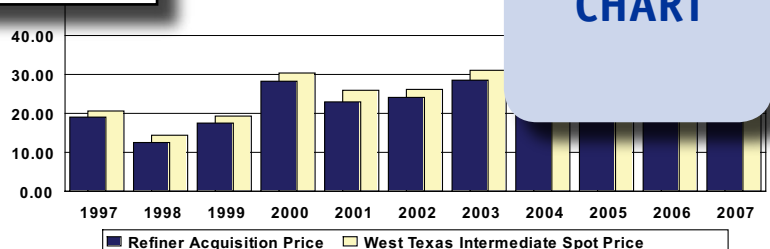
GELLING AGENT DEMAND BY TYPE  
(million dollars)

Item	1997	2002	2007	2012	2017
Producing Wells (000)	88	117	150	164	170
lb/well					
\$/well					
Base Fluid Material Demand (mil lb)					
% gelling agent					
Gelling Agent Demand (mil lb)					
\$/lb					
Gelling Agent Demand					
Guar Gum					
Surfactant					
Other					
% gelling agent					
Base Fluid Material Demand	197	221	278	320	310

SAMPLE TABLE

CHART II-4

PETROLEUM PRICES, 1997-2007  
(dollars per barrel)

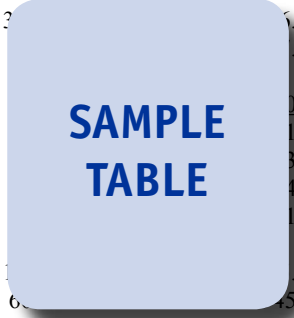


SAMPLE CHART

## Sample Profile, Table & Chart

**TABLE V-9**  
**WESTERN REGION WELL STIMULATION MATERIAL DEMAND**  
 (million dollars)

Item	1997	2002	2007	2012	2017
High Output Wells -- West (000) 000\$ material/well	2				4 8
Stimulation Material Demand					00
Wyoming					5
California					30
Colorado					40
Other Western Areas					5
% Western Region Well Stimulation Material Demand	6				4 50



**COMPANY PROFILES**

**Badger Mining Corporation**  
 409 South Church Street  
 Berlin, WI 54923  
 920-361-2388  
 http://www.ba

Annual Sales:  
 Employment:

Key Products: packing sand  
 proppants

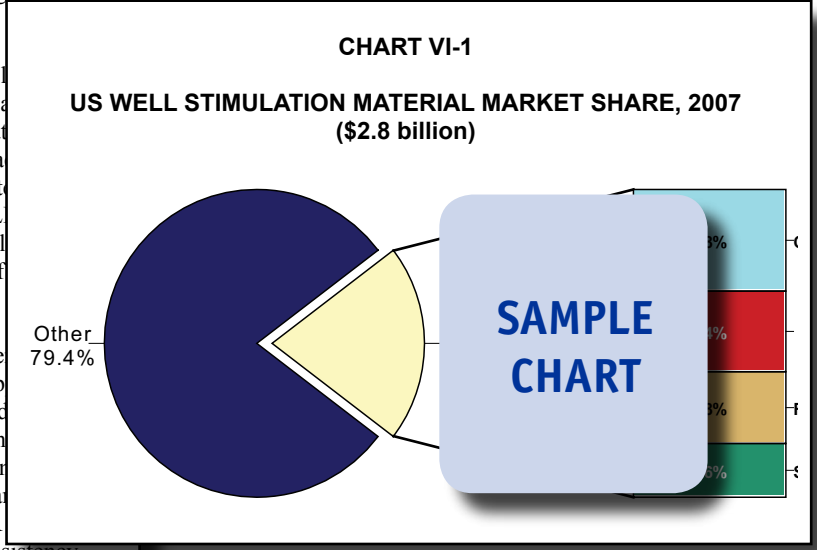
**SAMPLE PROFILE**

Badger Mining is an international producer of industrial sil sand, limestone and other mineral aggregates. These materials are used primarily to serve the industrial, environmental and recreation markets, for such applications as hydraulic fracturing, gravel pack water filtration and sewage treatment. Operations for the private company include two wholly owned subsidiaries: LogicHaul LLC and Badger Mining Poland Limited. In July 2007, the Company sold its former Ash Meadows LLC subsidiary, a miner and processor of lithium products, to Zeox Corporation (Canada).

The Company participates in the US well stimulation material industry through the production of industrial sands used as proppant in well stimulation operations. For the oil and gas industry, Badger Mining supplies BADGER FRAC hydraulic fracturing sands and BADGER PAC resieved gravel packing sands. These products encompass Ottawa-type, Northern White raw sands that have mesh sizes ranging from 12/20 to 70/140. According to Badger Mining, BADGER FRAC and BADGER PAC natural proppants provide high quality, consistency and long-term conductivity properties without the high costs associated with synthetic proppants.

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**OTHER STUDIES**

**Lubricants**

This study analyzes the US lubricant industry. It presents historical demand data for the years 1997, 2002 and 2007 and forecasts to 2012 and 2017 by lubricant base oil, product (e.g., engine oils, process oils, hydraulic fluids, turbine oils, automatic transmission fluids, power steering fluids, metalworking fluids, gear oils, greases) and market. The study also considers market environment factors, details industry structure and competitive strategies, evaluates company market share and profiles industry players.

#2384 ..... 08/2008..... \$4700

**Mining Chemicals**

US mining chemicals demand will reach \$2.5 billion in 2011 based on gains in key markets such as coal mining and aggregate quarrying, which will boost demand for blasting agents. Explosives are the most important chemicals used in the mining industry and will provide the best opportunities. This study analyzes the 21 billion pound US mining chemical industry, with forecasts for 2011 and 2016 by product, function, application and market. It also evaluates company market share and profiles major producers.

#2267 ..... 11/2007..... \$4500

**Oilfield Chemicals**

US oilfield chemical demand will rise 4.3% per year through 2011. Gains will be driven by a rise in rig counts, more use of well stimulation and enhanced oil recovery (EOR) methods and more deepwater drilling and production. Best prospects include EOR chemicals, drilling fluids and well stimulation chemicals. This study analyzes the \$6 billion US oilfield chemical industry, with forecasts for 2011 and 2016 for formulated products and their raw materials. It also details market share and profiles major players.

#2253 ..... 10/2007..... \$4500

**World Oilfield Chemicals**

Global demand for oilfield chemicals will rise 5.9% annually through 2010, driven by sustained growth in drilling activity. The dominant North American market will register healthy gains as producers strive to maintain production. Drilling fluids will remain the largest type while well stimulation chemicals will lead gains. This study analyzes the \$10.9 billion world oilfield chemical industry for 2010 and 2015 by type, world region and for 25 countries. It also evaluates market share and profiles major players.

#2162 ..... 03/2007..... \$5400

**World Well Stimulation Materials**

Global demand for well stimulation materials is forecast to increase 11.3% annually through 2010. Gains will be driven by high oil and gas prices coupled with maturing wells. Among the leading markets, China, Canada and Russia hold stronger prospects than the US. Proppants will be the largest and fastest growing product. This study analyzes the \$2.5 billion world well stimulation material industry for 2010 and 2015 by product, key country and world region. It also evaluates market share and profiles major players.

#2161 ..... 03/2007..... \$5400

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