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Abbreviations

API: American Petroleum Institute

ASME: American Society of Manufacturing Engineers

b: billions

Bpd: barrels per day

Bbl: barrel of crude oil

BTU: British Thermal Unit

Capex: capital expenditure

CCGT: Combined Cycle Gas Turbine

CHP: Combined Heat and Power

Cfm: cubic feet per minute

E&P: Exploration and Production

EPC: Engineering, Procurement, and Construction

FPSO: floating production, storage and offloading

GPM: gallons per minute

GW: gigawatts

k: thousands

kW: kilowatts

m: millions

MW: megawatts

M&A: Merger and Acquisition

MENA: Middle East and North Africa

Mmbtu: one million BTUs

MRO: maintenance, repair and operating

NGL: Natural Gas Liquids

Nm: Newton-meter

PCP: Progressing Cavity Pump

Psi: pounds per square inch

ROP: Rate of Penetration

t: trillion

Tonnes=metric tons

Tons: short tons

Tpy: tons per year

WTI: West Texas Intermediate crude oil

YOY: year over year

YTD: year to date

Alerts:

Yellow Alert (applies to any time period)

- Capacity margin < $150 million per year
- Capacity Utilization > 85%
- Important news

Red Alert (applies to next year only)

- Prices change 5%+
- Capacity margin < $100 million per year
- Capacity Utilization > 90%

Chart Symbols:

≡ Stable, ▲= Increasing, ▼ = Decreasing, LO = Low supplier concentration, ► = Moderate supplier concentration, HI= High supplier concentration

1 Scope

This study focuses on engineered units for use in upstream and downstream oil production and refining. It examines the following equipment types:

- Centrifugal Engineered Pumps, focusing on those built to API 610 specifications
- Progressing Cavity Pumps (a.k.a. screw pumps), focusing on those built to API 676 specifications
- Multiphase Pumps, also built to API 676
- Electric Submersible Pumps

Not included in this study are other types of positive displacement pumps (e.g. reciprocating, gear, lobe, and diaphragm).

1. Centrifugal Engineered

Centrifugal pumps use a rotating impeller to impart energy to a fluid, maintain flow by creating lower pressure on the inlet side of the impeller, and higher pressure on the outlet side. The term "Engineered" differentiates pumps designed for a particular end user application in a particular environment from those that can be purchased "off the shelf." Although they are made to a set of specifications, the specifications cover a broad range of design characteristics and nearly every engineered pump is unique.

API 610 specifies minimum requirements for centrifugal pumps used in the oil & gas, chemical industries, and power generation industries, for applications including oil & gas production, processing, refining, and transfer, as well as boiler feed pumps used in power stations or cogeneration applications. The standard addresses specifications for components such as casing, rotors, seals, bearings, drivers, and baseplates, with the requirement that the pump is designed and built for a minimum service life of 20 years, with at least three years of uninterrupted operation.

Pump variations include vertical and horizontal units, radially or horizontally-split casing units, and single or double casing. Pumps can be single or multi-stage (as many as 10-12 stages are used for high pressure applications), which refers to the number of impellers for a centrifugal pump.

2. Progressing Cavity

Progressing Cavity Pumps (PCPs, also referred to as "screw pumps") use a helical rotor or rotors turning inside a double-helical stator to push fluid through a series of cavities formed between the rotating elements and the stator. Rotors are typically chrome-plated to reduce abrasion, while the stator is typically elastomer-coated to maintain a seal with the rotor and to withstand corrosion or abrasion by the process fluid.

Similar to API 610, API standard 676 defines the minimum requirements for rotary positive displacement pumps used in the oil & gas and petrochemical industries. It covers specifications for major components including rotors, elastomers, gears, bearings, seals, coupling, and flanges typically required to ensure at least 20 years of service life and three years of uninterrupted operation.

PCPs are typically used for viscous fluids, environments with pressure or volume fluctuations that would lead to irregular flow with centrifugal pumps, and fluids that require low shear (turbulence within the fluid).

3. Multiphase

Multiphase Pumps are units designed to pump more than one state of matter simultaneously, at least gas and liquids, and often including solids such as sand or bitumen. Multiphase Pumps are most often a twin-screw design because of this design's ability to cope with high viscosities, variable pressures, and highly variable gas content (referred to as Gas Void Fraction, or GVF). API 676 standards cover Multiphase Pumps as well as Progressing Cavity Pumps. Multiphase Pumps are used to eliminate wellhead flaring (burning of co-produced natural gas) because they can pump the gas and the oil simultaneously. With traditional pumps, the gas must be separated at the wellhead and if the operator does not install separate infrastructure to gather the gas, it is simply flared. Using multiphase pumps also reduces total equipment costs by eliminating the need for separation equipment at each wellhead. The operator can separate streams from multiple wells served by the same multiphase pump at a central location at lower cost.

Multiphase Pumps typically use more advanced metallurgy (such as stainless or super duplex steel) than screw pumps designed for liquids service, to withstand both abrasion from higher solids content, and pressure fluctuations due to varying fluid composition.

4. Electric submersible Pumps (ESPs)

Submersible Pumps: Submersible pumps, as defined in this study, are part of a family of artificial lift tools and technologies. Artificial lift includes:

- Hydraulic pumps (such as jet pumps), which may be used in conditions of relatively high solids
- Gas lift pumps, which may be used in conditions of abrasive elements, including sand
- Rod Lift pumps, which are used downhole but are actuated by surface power rather than downhole power
- Plunger pumps, which are usually used for small amounts of liquid or short distances to the surface
- ESPs, which are actuated by a motor directly beneath (usually) or above (sometimes) the pump

Since ESPs are used specifically for downhole oil and gas pumping, the scoped pumps fall more in the category of downhole drilling tools than in the category of submersible pumps. Their suppliers also make other specialized drilling equipment, such as hangers and fishing tools, rather than other

pumps. This being said, the types of submersible pumps in this study are all vertical and have the following characterics:

- Motor integral with the pump, and typically but not necessarily below the pump
- Single stage and multi-stage, although most are multi-stage due to the pressure and volume requirements
- Centrifugal (multiphase submersible pumps are included in the Multiphase chapter)

This study excludes general submersible pumps, whose specifications are significantly lighter in duty compared to the severe and specific requirements of pumping heavy crude from the bottom of an oil well.

- Pumps for lifting seawater
- Pumping out cargo holds
- Pumps for pumping drainage

It also excludes highly other specialized submersible pumps such as;

- API standard rod drawn, downhole pumps
    - API Tubing Pumps
    - Bottom Hold-Down Insert Pumps, Thin Wall and Heavy Wall
    - Top Hold-Down Insert Pumps, Thin Wall and Heavy Wall
    - Traveling Barrel Insert Pumps, Thin Wall and Heavy Wall
- Hydraulic jet pump
- Gas lift pumps
- Rod Lift pumps
- Plunger pumps

2 Methodological Notes

1. Demand is nominal (not real, inflation-adjusted), and is based on Sales excluding backlog that has not yet been recognized as revenue.
2. Prices are for new commitments. Average market prices typically lag the index based on the time it takes for pre-existing contracts to end or roll over. Price changes are nominal (not real, inflation-adjusted). Price changes are net of the cost of quality improvements, so actual market prices may exceed the amounts indicated.
3. Capacity includes base production capability plus plant openings and temporary capacity increases such as extra shifts, minus plant closings and temporary capacity reductions such as reductions of working hours or suspension of operations. Capacity estimates are unadjusted for possible efficiencies from process improvements. Capacity is adjusted for productivity improvements.
4. Capacity utilization means output as a percent of possible production, given no major investment. Capacity utilization rates are either self-reported or estimated. Orders above capacity to produce are considered backlog and do not result in capacity utilization rates above 100%. Overtime increases the capacity utilization rate and could make capacity utilization rates exceed 100%, whereas extra shifts count toward capacity and would not normally result in capacity utilization rates exceeding 100%.
5. Capacity Margin is the aggregate amount of available (unutilized) capacity based on utilization rates and total capacity. It is not adjusted for capacity that suppliers may have reserved for specific customers, so actual available capacity may be lower.
6. Order Lead Time is for Configure-to-Order (also called Assemble-to-Order), Make-to-Order, and where specified, Engineered-to-Order items, not for stocked/inventories items (for which lead time is very short). If categories consist only of stocked/inventoried items, lead time is not tracked. The basis is ex-works (from the time the order is placed until it is ready for shipping). Where there is a choice, Order Lead Time is based on oil and gas applications of higher-value items within each category (e.g., stainless steel rather than carbon steel, or with customizations such as ceramic coating).

3 Vital Statistics

Table 1: Demand, Order Lead Time, Capacity Utilization, and Prices

Metric	Time Horizon	Centrifugal Engineered		Progressing Cavity		Multiphase		Electric Submersible Pumps
Demand ($M, per quarter)	Q2 2013		1,795		288		37	1,034
	Q2 2015	▲	1,948	▲	311	▲	40	▲ 1,119
	Q2 2020	▲	2,558	▲	402	▲	49	▲ 1,442
	'13-'15	▲	8.5%	▲	8.1%	▲	8.0%	▲ 8.2%
	'13-'20	▲	42.5%	▲	39.6%	▲	34.9%	▲ 39.5%
Order Lead Time (Weeks)	Q2 2013		30		15		20	8.0
	Q2 2015	▲	31	▲	16	▲	20	▲ 8.5
	Q2 2020	▲	38	≡	18	▼	19	▲ 9.0
	'13-'15	▲	3.3%	▲	6.7%	▲	-2.5%	▲ 6.8%
	'13-'20	▲	27%	≡	18%	≡	-5%	≡ 12.5%
Capacity Utilization (%)	Q2 2013		84%		83%		84%	90%
	Q2 2015	▲	87%	▲	85%	▼	82%	▲ 92%
	Q2 2020	▲	89%	▲	85%	▼	82%	▲ 91%
	'13-'15	▲	2.9%	▲	1.6%	▼	-1.6%	▲ 2.0%
	'13-'20	▲	5.5%	▲	2.1%	▼	-2.1%	≡ 0.5%
Prices (Index 2005Q1 =100)	Q2 2013		131.8		140		133	138
	Q2 2015	▲	140	▲	149	▲	141	▲ 147
	Q2 2020	▲	158	▲	167	▲	155	▲ 167
	'13-'15	▲	6.3%	▲	6%	▲	5.6%	▲ 6.5%
	'13-'20	▲	19.6%	▲	19.0%	▲	16.5%	▲ 21.1%

4 Centrifugal Engineered

4.1 Market Overview

Table 2: Key Indicators for Centrifugal Engineered

(Total Change over Each Period)

Key Indicators	Q1 2013 – Q1 2015		Q1 2013 – Q1 2020	
Demand Growth	▲	8.5%	▲	42.5%
Demand ($m)	▲	1,795-1,948	▲	1,795-2,558
Capacity Utilization	▲	3.1%	▲	5.7%
Prices	▲	6.3%	▲	19.6%

1. Demand

Demand growth will accelerate from 2% in 2013 to 6% annually through 2020 as oil price growth picks up from a slight drop in 2013 to 3-4% annually.

Demand for Centrifugal Engineered Pumps comes primarily from the oil & gas (upstream and downstream), chemicals, and power industries, as well as municipal water treatment and flood control to a lesser extent.

Global demand was stable in Q1, as a temporary dip in North American orders balanced out growth in Asian spending.

Asian demand rose 2% last quarter, as capital purchases in the chemical industry increased 2.6%, upstream oil & gas spending rose 1.7%, and downstream oil & gas purchases rose 1.2%. Orders that contributed to this increase include:

- PetroChina ordered 40 pumps from Sulzer in 2012 Q4, progress payments on which will continue until final delivery in 2014. The pumps, all to API 610 specifications, consist of 12 for the residue hydrodesulfurization unit, 18 for the hydrotreater and a total of 10 for the oil storage, transportation, and utility units.
- Shell ordered 11 API 610 pumps from Weir for a petrochemical plant in Australia. This order was also placed in 2012 Q4, with delivery scheduled for 2014 Q1.
- Petronas took delivery of four API 610 units from Amarinth in March, to transfer crude oil at its Kebabangan field off the cost of Malaysia.

In the Americas, demand shrank slightly (1%) on a 2% drop in North American upstream oil & gas spending. This decline is due to two factors – prolonged low natural gas prices in the US and the annual “spring breakup” in Canada. Chemical industry spending growth of 1% last quarter slowed the regional decline.

Low wellhead natural gas prices in the US last year have curtailed rig counts and upstream spending. US natural gas prices remained below $3/mmbtu for virtually all of 2012, causing an 11% decline in US rig counts last year. The slide continued into Q1, when US rig counts dropped another 2%, although this is primarily due to the execution of spending reduction plans made during the gas price slump, as natural gas prices have risen to approximately $4/mmbtu.

In Canada, hundreds of rigs are idled every year as the ground thaws in spring, making the soil too soft for drilling. This decline is short-term to some extent, as many of these rigs are redeployed to sites that are suitable for year-round drilling within a few months. For perspective, Canadian Rig counts typically fall from 500-700 active rigs in February to 100-200 by April, then resurge to 350-500 until the next winter. The decline in pump spending is not proportional with rig counts, however, as many wells drilled during the winter are completed afterward, and production and transfer pumps installed during the downtime.

EMEA demand was steady in Q1, as a 2.5% dip in upstream oil & gas spending (driven by a $10/bbl dip in Brent crude oil prices over the quarter) canceled out a 2.5% increase in chemical industry spending.

Demand growth will accelerate to 0.7% per quarter for the rest of 2013, for full year growth of 2%, driven by continued growth in Asia and the Middle East and an uptick in US upstream oil & gas spending. Oil prices, which will dip slightly on a global basis this year due to a decline in Brent crude, will grow at 3-4% per year through 2020, supporting investment in both upstream and downstream oil & gas.

In Asia, where demand will grow nearly 9% this year, Chinese NOCs will drive much of the growth. PetroChina and Sinopec are both raising their capital expenditures by double-digit percentages for 2013, much of it on shale gas developments. CNOOC plans to spend approximately $13b on offshore projects this year, up from $11b last year.

In EMEA, overall demand will increase 1.5% in 2013. Most of the 2% regional upstream spending growth will be driven by oil & gas programs in Abu Dhabi, where ADNOC is increasing its upstream spending by 33% this year, Oman with a 17% planned increase, and Saudi Arabia with a 4% increase.

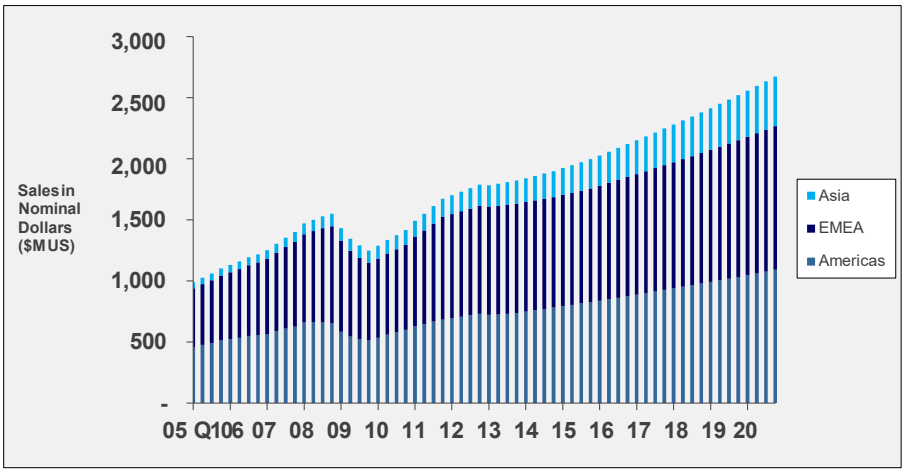
In the Americas, overall demand for Centrifugal Engineered pumps will grow just 1%, the slowest of any region due to the drop in Q1 orders. In North America, a 3% increase in overall oil & gas industry spending for the year will outweigh a 1% drop in capital expenditures in the power generation industry. Most of the growth in US upstream activity will be in the shale sector, particularly ones rich in crude oil and NGLs such as the Barnett Shale. In addition, US natural gas prices have rebounded to just over $4/mmbtu, up from as low as $2.25/mmbtu in 2012.

Expansions in Latin America will also contribute to the upstream growth, as PDVSA is budgeting a 46% increase in overall upstream spending this year, while Petrobras is planning to increase upstream investments by 8%.

Global demand growth will accelerate to 4% in 2014 and 6%% annually beginning in 2015, again primarily driven by Asian investments in oil & gas, petrochemical, and utility infrastructure.

- Asian demand will grow by 10-14% annually. Downstream capital spending will grow fastest, at annual rates of 11-15% as refiners in China, India, and Vietnam struggle to gain self-sufficiency in fuel production and to meet global fuel quality standards such as Euro-6. Chemical industry spending will trail refining slightly at 9-12% annually, and upstream oil & gas spending growth will be slowest (although still aggressive) at 6-9% every year.
- Americas demand growth will remain between 5-6% annually on steady increases for regional refinery spending growth of 6-7% and 3-4% for the chemicals industry. Upstream demand growth will be more volatile at rates of 4-8% per year, hinging to a large degree on gas prices, which fluctuate wildly and rapidly.
- Oil & gas spending in the Middle East, West Africa, and the North Sea will be the strongest driver of EMEA demand growth (4-5% annually through 2020). Exploration and production spending in Saudi Arabia, Iraq, Iran, Nigeria, Angola, the UK, and Norway will drive regional upstream expenditures up 5% annually. Chemical industry spending will grow slightly slower, at 3-4%.

Figure 1: Demand for Centrifugal Engineered Pumps



2. Supply (Capacity)

ITT, Sulzer, Ruhrpumpen, KSB, and Deep Blue opened enough capacity in late 2012 and early 2013 to prevent major lead time increases, but rapid demand growth beginning in 2014 creates the risk of expanding lead times and the loss of bargaining leverage for buyers.

The top Centrifugal Engineered Pump manufacturers are:

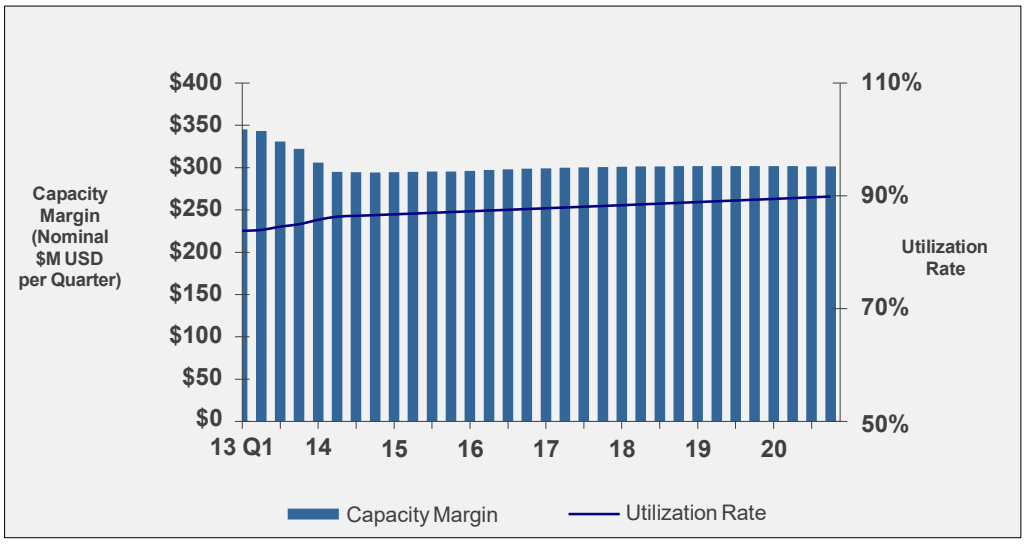
- Sulzer
- Flowserve

- ITT
- Weir
- KSB
- SPX
- Ebara
- Kirloskar Brothers, Limited
- Grundfos
- Torishima

ITT, Sulzer, and Chinese suppliers Deep Blue and Fonda Pump all opened new Asian capacity in 2012 or 2013 Q1 to keep up with order growth. Ruhrpumpen also added capacity, opening a new plant in Argentina. Cumulatively, the new capacity added approximately $200m worth of capacity for API 610 pumps to the market and reduced utilization rates from 89% in mid-2012 to 84% in 2013 Q1.

- ITT opened a new plant near Busan in South Korea in 2012 Q4. The old one, although not far away, was too small and had poor access to transportation infrastructure. This one is half again as large, and represents an overall capacity expansion of about 10% for ITT's products for the oil & gas industry.
- Fonda Pump expanded its Shenyang plant in 2012 Q4, reducing its utilization rate abruptly from 85% to 60%.
- Deep Blue Pump expanded its assembly plant in Houston and its main factory in Dalian, China in 2012.
- Sulzer opened a new plant in 2013 Q1, in Kunshan, China. The $10.3m plant will initially employ 70 workers, ramping up to nearly double that over the course of 2013.
- Ruhrpumpen opened a new factory in Buenos Aires, Argentina in March 2013. The 25k square foot plant will manufacture primarily two-stage API 610 units to begin with, adding units with more stages as additional staff is trained.

Figure 2: Capacity Margin - Centrifugal Engineered Pumps



KSB opened another factory in early Q2. The new unit is a $19.35m, 300k square foot plant in Jundiai, Brazil. It opened in April, with a staff of 123. The plant adds to KSB's existing factory in Várzea Paulista and a foundry in Americana. The factory will make both pumps and valves, primarily for the oil & gas and power generation industries.

The addition of the above new plants has temporarily averted major lead time increases for API 610 pumps, keeping industry utilization rates at 84%. However, capacity utilization is high enough, especially for the bigger units, to create the risk of lead time inflation and price distortions.

- ITT is 95% utilized in the US and Mexico for API 610 units with more than one stage, primarily on orders from US shale plays and petrochemical plants. The machinery for finishing casings and impellers is the bottleneck, and an order for 10 two-stage units would take about a month longer than ITT's typical lead time for these units (30 weeks). Its Korean operations are only 85% utilized due to its recent expansion, but at current order rates the plant will be 90% utilized within a year.
- Sulzer is 90% utilized. It expects to maintain that utilization rate with further expansions in China and more workers in the US, but major orders ($5m or more) are already subject to higher than normal lead times.
- Deep Blue Pump Company, a multinational manufacturer with production in the US, Belgium, Dubai, and China, is only 75% utilized, because it just expanded in both Dalian, China and Houston, US.
- Sundyne is 80-85% utilized. This level is not yet cause for concern, but it's on the edge of it, and one or two major orders, such as a major petrochemical plant overhaul it is bidding on in Texas, could cause lead time increases for some product lines.
- O'Drill MCM, a smaller player limited mostly to US orders, is 90-95% utilized on orders from the Barnett and Eagle Ford shale play in Texas.

- Dragon Pumps, another small US-centric player, is 75-80% utilized, lower than the industry average because it keeps most components in stock and assembles to order.

Table 3: Reported or Estimated Capacity Utilization Rates at Selected Centrifugal Engineered Pump Suppliers

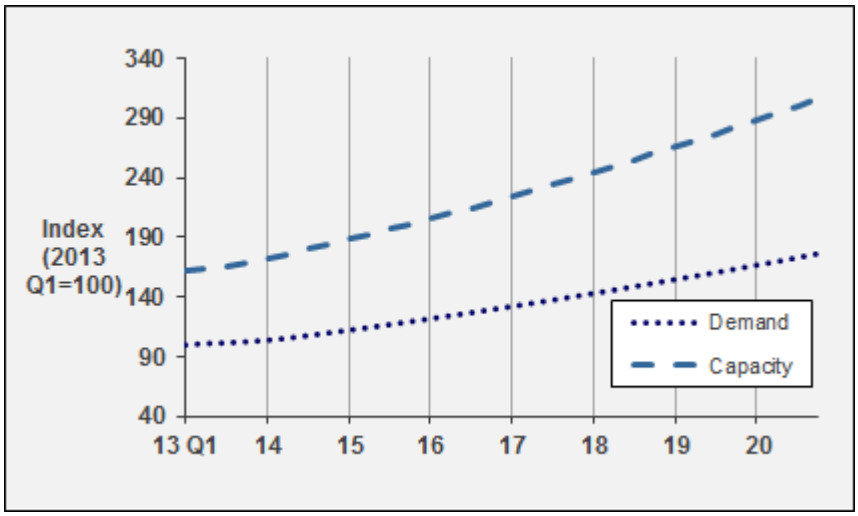
Company	Country	Current Level	12-Month Forecast
ITT Goulds	US/Mexico	95%	95%
ITT Goulds	Germany	85%	90%
ITT Goulds	Korea	85%	90%
Sulzer	US	90%	90%
Amarinth	UK	85%	80%
Amarinth	Malaysia	80%	80%
Fonda Pump	China	65%	70%
Dragon	US	75%	80%
Sundyne	US	85%	85-90%
Deep Blue	China	75%	80%
Deep Blue	Belgium	85	85%

As indicated above, most of the available capacity is with less well-known manufacturers in Asia, which are not on the approved vendor lists of most E&P companies. Lead times with the traditional oil & gas pump manufacturers (such as ITT, Sulzer, and Flowserve) will climb before most customers turn to new suppliers, and buyers with urgent needs should reserve capacity before demand growth picks up in 2014.

The industry looks set to repeat one of its historical cycles of lead time increase. In the past, periods of booming oil and gas expansion have led to large lead time increases that have caused bottlenecks at operators. These bottlenecks have the potential to cripple capital projects. Examples of lead time pressure in the recent past include:

- A major petrochemical plant in Houston recently invited Sundyne to quote on replacement pumps for existing ITT units as part of a $1b overhaul scheduled for this year, as ITT's lead times were unsatisfactorily high.
- Sundyne has also missed deliveries this year, however. EP Energy dropped the suppliers from its vendor list for operations in the Barnett Shale earlier this month after the firm missed a delivery by more than four weeks.
- Torishima's overall backlog ended 22% higher in 2012 than it was in 2011, at approximately $200m, and its lead times for the reference unit are 32 weeks, compared to 28-30 last year.

Figure 3: Demand vs. Capacity - Centrifugal Engineered



The cast housing and the motor are the bottleneck components for most pumping systems, and wait times for these items are almost certain to push lead times up for centrifugal pumps with flow rates of over 5k gpm. ITT has only three qualified suppliers of cast housing for pumps with four or more stages, Olympic Foundry in the US, and one foundry each in Canada and Korea. As a result of this small pool of suppliers, its lead times are already expanding.

Motor sizes over 500 hp are also certain to drive up lead times, and the minimum lead time for the motor alone at this size is six months.

Industry capacity utilization will rise to 85% by the end of the year, held down to some extent by continuing expansions at recently opened factories.
demand growth in 2014, and capacity utilization will reach 90% by 2020, indicating a significant risk of lead time inflation and giving suppliers pricing leverage, especially for urgent orders.

3. New contracts

Sulzer, Flowserve, and ITT won major upstream and downstream contracts; Colfax booked major petrochemical orders. Amarinth won a series of smaller orders, many of them in Asia.

Sulzer, Flowserve, and ITT, dominated major orders for the oil & gas industry. Examples in the upstream sector include:

- Sulzer won an order from Petrobras for a total of 20 pumps for an FPSO to be deployed at its Iracema Norte project. The three largest pumps are for seawater injection, 5.8 MW, five stage units worth just under $2m each (including the motors). The remaining units, all of them designed to API 610 specifications, range in value from $250k to $500k. They will perform a variety of crude oil processing and transfer functions when they are delivered in

2014. To comply with Brazil's stringent local content requirements, the units will be designed and manufactured at Sulzer's plant in Jundiai, Brazil.

- Flowserve also won a major order from Petrobras recently, for a total of 33 vertical centrifugal pumps worth a total of $18.4m. The order is Flowserve's largest in Brazil to date. The units are now being used at crude oil transfer terminals in Rio De Janeiro and Vitoria.
- ITT booked an order for three of its 5-stage, 3600-series pumps from a US shale operator. Ordered in Q1 of this year, the units are scheduled for delivery in May 2014. The ongoing casting and machining activity to make these units will keep ITT's North American capacity (in Mexico and the US state of New York) busy until late 2013.

Major recent downstream contracts include:

- Sulzer booked an order for refinery pumps from PetroChina in December of 2012, a $19m deal for a total of 40 pumps. The hydrotreating unit will account for 18 of the motor-driven pumps, while 12 more will service the hydrodesulfurization unit. The oil storage, and utility units, along with product transfer, will require another 10 pumps. Deliveries will extend over 2013 and into 2014.
- Flowserve booked an order from Lukoil for its Bulgarian refinery – a $25m deal for ebullating pump systems and intake and offtake pumps for the new hydrocracking unit. The total contract is for $31m, but a substantial portion of the contract value is for valves, controls not related to the pumps, and piping. On average, the pumps are worth just over $3m each.
- ITT shipped a major order for Oman's Sohar refinery in Q1, eight motor-driven units worth $250-300k each.

Colfax, which does most of its upstream business through its IMO screw pump unit, booked major order wins in the petrochemical sector:

- The Sadara petrochemical project in Saudi Arabia ordered five pumps from Colfax's Allweiler unit for $1.18m in March of this year. The units are designed for flow rates of approximately 22k gpm, and 20 feet of head.
- In January, Colfax delivered a total of 168 pumps to a polyester pant in Wujang. Eight of the pumps are for main polyethylene feed, while 140 are much smaller, designed to circulating cooling fluid. The remaining 20 are for lubricant circulation. The total order is worth $2.2m.

Amarinth, a smaller but heavily oil industry-focused supplier based in the UK, won multiple orders from Asia and the Middle East, partially due to its ability to compete on cost and fast service from a recently-opened factory and repair shop in Malaysia.

- Abu Dhabi Marine Operating Company (ADMOC) ordered 30 API 610 pumps from Amarinth, which were delivered in Q1. The pump shafts and impellers are made of Inconel, to withstand the extremely corrosive fluid produced at the Zakum field. As a result, the pumps cost $1.83 per unit.

- Prior to ADMOC's order, Amarinth delivered 41 pumps for the ASAB project (Petrofac was the EPC). The order value was $4m, for 33 4-stage vertical pumps and eight two-stage horizontal pumps.
- Amarinth also won orders from Petronas and Indian Oil Company (IOC) for upstream applications. The order from Petronas was delivered in March of this year, four stainless, two-stage units for a total of $410k. The units for IOC were sent in Q4 of 2012, four carbon steel units for a total of $260k.

Table 4: Summary of New Contracts and Estimated Values for Centrifugal Engineered Pumps

Buyer	Country of Installation	Supplier	Product	Estimated Value ($k)	Estimated Cost/Unit ($k)
TransCanada - Keystone	Canada	Siemens	104 motor-driven pumps for 38 pumping stations	$105,000	$1,010
Indian National Energy Authority	India	KSB	4 turbine-driven boiler feed pumps, 4 motor-driven standby pumps, 8 booster pumps	$56,000	$2,800
SNC Lavalin	Peru	Torishima	4 feedwater, 2 condensate, 2 circulating, 2 aux. cooling	$30,900	$3,090
Lukoil	Bulgaria	Flowserve	8 ebullating pumps for FCC	$25,000	$3,125
PetroChina	China	Sulzer	40 total refinery pumps	$19,100	$478
Petrobras	Brazil	Flowserve	33 pumps for crude oil transfer	$18,400	$558
Petrobras	Brazil	Sulzer	20 API 610 pumps for FPSO	$10,800	$540
Shell Malaysia	Malaysia	Flowserve	3 barrel pumps for water injection	$8,000	$2,667
Transneft	Russia	HMS	2 pipeline pumps for the Purpe-Samotlor and ESPO-2 pipelines	$5,800	$2,900
ADMOC - Zakum	Abu Dhabi	Amarinth	30 API 610 pumps with Inconel shafts	$5,500	$183
Petrofac - ASAB	Abu Dhabi	Amarinth	33 vertical, 8 horizontal pumps	$4,000	$98
Shell	Australia	Weir	11 API 610 pumps, 2 and 3 stage, for a petrochemical plant	$3,410	$310
Novo Petrochemical	Russia	HMS	2 12-stage barrel pumps	$2,300	$1,150
Wujang Polyster	China	Colfax	8 for PET, 140 for glycol, and 20 for thermal oil	$2,193	$13
Saudi Aramco (Sadara)	Saudi Arabia	Colfax	5 units for petrochemical service. 22k gpm, 20' of head.	$1,177	$235
Sakhalin	Russia	Amarinth	6 duplex units for produced water	$850	$106
BP - Quad 204 FPSO	UK	Amarinth	5 API 610 super duplex pumps for production and re-injection	$840	$168
Petronas - Kebabangan	Malaysia	Amarinth	4 2-stage 610 pumps	$410	$103
IOC	India	Amarinth	4 API 610 units	$255	$64

4.2 Analysis

4.2.1 Costs

Labor, energy, and cast housing costs will drive overall pump costs up 2.5% in 2013 and 13% by 2020 Q1.

Labor and benefits comprise nearly half of the cost structure for Centrifugal Engineered pumps. Engineering and management salaries are the largest single component, accounting for 18.5% of the total. Shop floor labor (machinists, welders, and assembly workers) accounts for another 15%. Benefits, such as health care, pensions, training, and incentive bonuses make up another 12.5%.

Motors are the next largest cost component, at 19%. Pump manufacturers buy their pump motors from another manufacturer, rather than making them in-house, so motors are segregated as an independent cost category. Changing the motor size can also drastically change the percentage of the overall cost it represents. For instance, upgrading from a 300 hp motor to a 500 hp motor to handle high viscosities adds 10% to the cost of the entire unit, all of which is from the motor.

Metals make up 16% of the overall cost structure (assuming carbon steel construction). Metallurgies range from extremely simple (cast steel) to moderately specialized (carbon steel) to stainless or even super duplex stainless steel (for high pressure and highly corrosive environments. As metallurgy becomes more complex, the percentage of cost attributable to metals increases, and can reach as much as 35-40% for super duplex.

Machinery costs (cutting, grinding, welding, and casting equipment) account for most of the rest of the cost structure, 14%.

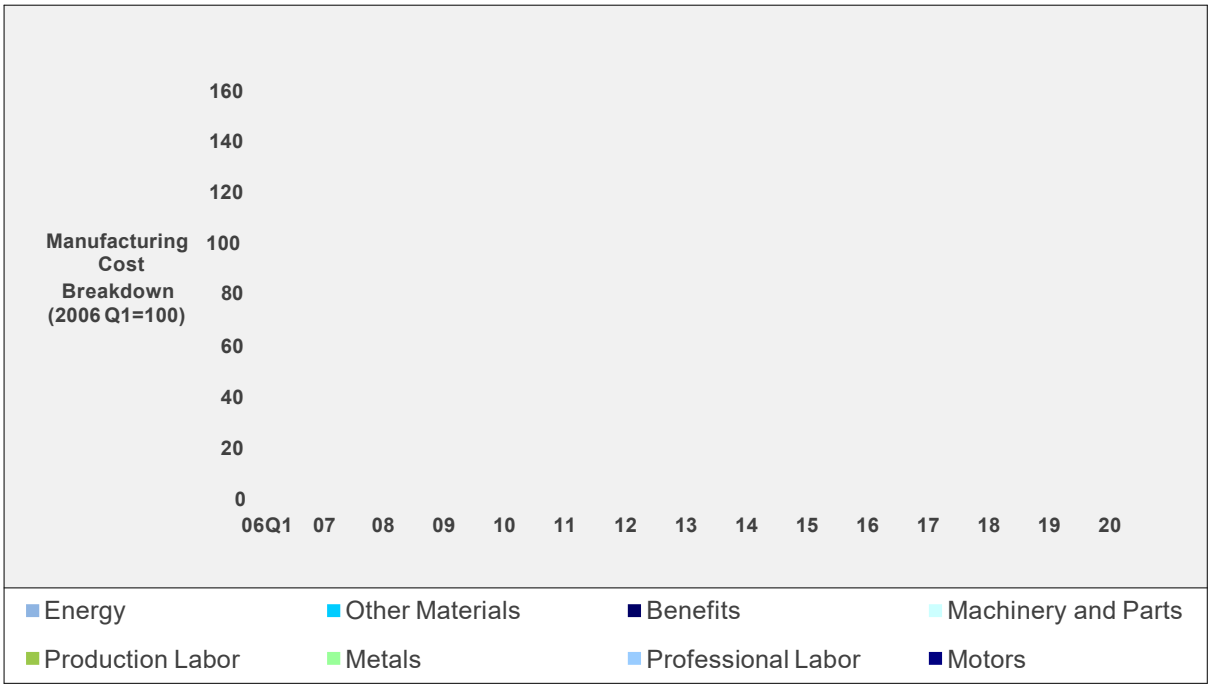
Global costs rose slightly less than 1% in Q1, driven mostly by Asian labor cost inflation. Asian management and engineering labor costs rose 2% in Q1, driven by rising standards and costs of living in most urban areas, as well as a regional shortage of qualified engineers. Overall costs rose only fractionally in the Americas and EMEA, increasing just 0.25% on slight metals and labor cost increases.

Overall costs will rise another 0.5% in Q2 and 2.5% for the year, again driven primarily by Asian labor costs. Labor costs in Asia, both for shop floor workers and engineers, will maintain quarterly growth of 1-2%, due to the factors discussed above. In contrast, labor markets in EMEA and the Americas are oversupplied with labor due to slow economic growth, and labor costs there will only rise by 0.2%-0.3% per quarter.

Global Centrifugal Engineered pump cost levels will rise approximately 2% annually, for a cumulative total of 13% from 2013 Q1-2020 Q1, driven by energy, labor, and costs for cast components. The cost increase will be fastest in Asia (15% vs. 12% in the other two regions), again due to faster labor cost increases.

- Labor costs will rise 1.5% annually in the Americas and EMEA, on average, and 2-3% annually in Asia.
- Energy costs will increase 1.5-2% per year globally, driven by rising production costs for fossil fuels, as well as regulations that mandate more expensive renewable technologies.
- Costs for cast components such as pump housings will rise at an average rate of 2%, faster than overall metal costs (1.5% annual increases) because these components are a bottleneck, and the specialized foundries that produce them will raise prices as demand growth accelerates.

Figure 4: Cost Structure for Centrifugal Engineered Pumps



Note: Prices are ex-works.

4.2.2 Profit Margins

Pump manufacturers make operating margins of 10% and net margins of 5% on average. Margins are higher for suppliers that specialize in oil & gas equipment, and lower for Asian suppliers.

Operating margins for Centrifugal Engineered pump manufacturers average 10%, and net margins average 5% on a global basis. These average levels are low for suppliers of engineered equipment, pulled down somewhat by dilution with semi-standard pumps, and low margins at Asian suppliers.

Suppliers that specialize in oil & gas markets make the highest margins of any in the pumps business. Flowserve, Weir, and NOV, firms that focus almost entirely on oil & gas and minerals customers have operating margins of 24%, 19%, and 22%, respectively. Their respective net margins are 9%, 10%, and 12%. By comparison, ITT, although it has a strong share in the oil & gas

industry, is highly diversified into the water treatment and industrial markets. ITT's operating and net margin for 2012 were 7% and 6%, respectively.

Asian suppliers accept lower margins. Japanese and Korean firms because they have higher cost bases than their neighbors China and India and they have the choice of accepting lower margins or pricing themselves out of the market. Ebara, Torishima, Tsurumi, and Nikkiso (the major Japanese suppliers) have average operating margins of 5%, and net margins of 3%.

Kirloskar Brothers, the largest Indian supplier of pumps, secures operating margins of 9%, only slightly below the industry average, but just 2% net margin.

By equipment type, margins are higher for equipment featuring advanced metallurgies, largely due to the absence of competition from lower cost Asian suppliers. Working with super duplex stainless alloys requires advanced equipment and certifications, and selling the units requires a strong reputation, eliminating many manufacturers and reducing the level of competitive pressure on prices. ITT and Sundyne both admit to making substantially higher margins on stainless steel units, while Sulzer went so far as to quantify the margin increase at as much as 70% higher than that for a carbon steel unit.

Rising demand and tightening industry utilization rates beginning in 2014 will give suppliers leverage to increase margins by as much as six percentage points by 2020. Market leaders such as Flowserve, ITT, and Sulzer are the most likely to lead this increase. They have established patterns of annual pricing increases that smaller suppliers emulate. They are also the first suppliers that many buyers approach, and are the most commonly included on bidder lists, giving them more flexibility to choose projects that should bring higher margins.

3. Prices

Prices will rise just under 3% in 2013, matching cost growth. Demand will drive prices more than costs beginning in 2014, and price will rise a total of 19% by 2020 Q1.

Prices for Centrifugal Engineered pumps rose 1% in 2013 Q1, after a 4% increase in 2012, driven by cost dynamics (explained above). Prices will closely mirror costs for the remainder of 2013, increasing slightly less than 3%, while industry capacity utilization rates remain under 85% for most of the year.

- ITT plans to raise prices by 3% this year, a consistent pattern for the supplier over the past several years.
- Flowserve intends to raise list prices by 3-5% this year, reflecting its heavy concentration on the oil & gas industry, where customers are more tolerant of price increases.
- Sundyne is focused on gaining market share in the oil & gas industry, content to make up margin in the future, and plans to raise average prices by only 1-2% this year.

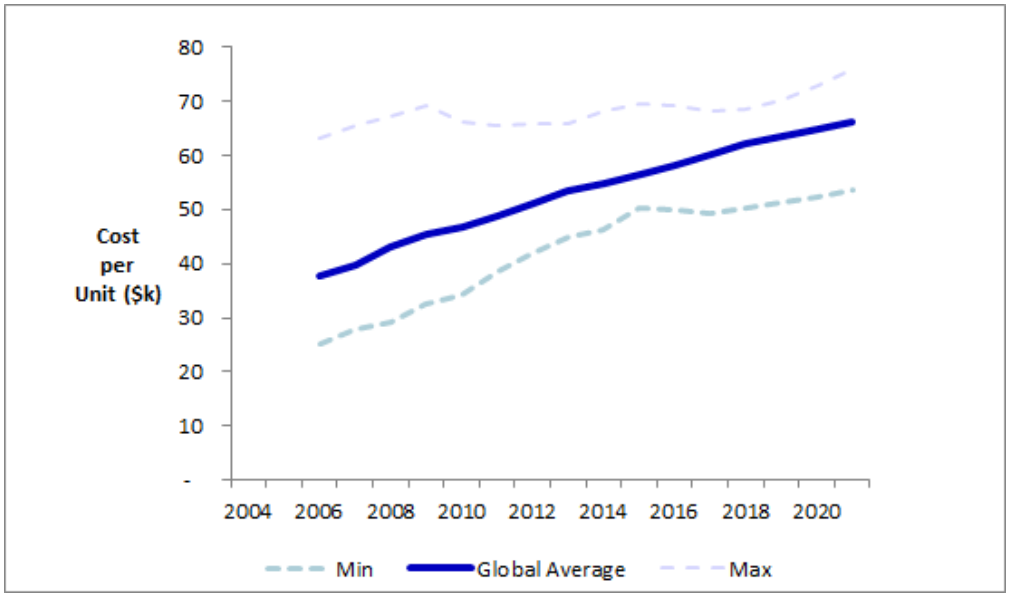
Price growth will begin to outpace cost increases in 2014, as capacity utilization rates rise 2% during the year (to 87%). While costs will only increase 2%, prices will rise 2.8% as suppliers take advantage of competition for manufacturing space.

Placing orders early and obtaining separate quotes for the pump motor will help buyers avoid price premia for last-minute buys.

- Manufacturers can raise prices rapidly when buyers approach them with urgent requirements. Beginning the procurement process early gives buyers flexibility between suppliers and allows the manufacturers to plan order fulfillment cost-effectively.
- Many manufacturers add a substantial markup to motor cost for units with drive horsepower over 500. However, if buyers obtain independent motor cost quotes, and require that the pump manufacturer break out the cost of the driver from the overall skid, they can avoid the large markups.
- Testing manufacturer lead time will be a good gauge of pricing flexibility in the future. If manufacturers quote lead times close to 30 weeks for the reference product, they are likely to have enough spare capacity that they will be eager to fill it. At lead time levels of 36 weeks or more, the firm will probably have enough business that it will give little up in price negotiations.

Overall prices will rise a total of 19.6% by 2020 Q1, driven to a large extent by tight supply, rather than cost increases. Cost growth, as explained in the costs section, will only amount to just over 13% over the same period. Capacity utilization rates will rise to 90% by 2020, giving manufacturers significant pricing power.

Figure 5: Overall Price Forecast for Centrifugal Engineered Pumps



The reference unit for Centrifugal Engineered is an 8" x 6" (these dimensions refer to the inner dimensions of the pump casing), API 610, two-stage, horizontally-split unit, with 500' of head, a flow

rate of 5k gpm, and a motor horsepower of 300 hp. At benchmark US price levels, this unit would cost approximately $61k.

Pump prices are lowest in India, Russia, and China due to a combination of lower labor and materials costs and an expectation on the part of regional buyers of lower prices, for index price levels of 80, 81, and 82, respectively.

- Average labor costs in these countries are approximately 25-30% lower than in the US, even factoring in the lower labor productivity in these regions.
- Hot rolled steel prices are $490 per ton in China and $520 in India, compared to $540 in the US.
- Steel plate costs in China and India are $600 per ton, compared to $700 in Germany and just under $800 in the US.

Pump prices are highest in Japan – 11% higher than benchmark prices in the US due to higher costs for labor, power, and steel. According to Japanese suppliers Torishima and Ebara, this cost difference is the driving factor behind average pump prices of $67-69k for the reference unit.

- Average salary levels in the Japanese manufacturing sector, including benefits such as training, bonuses, and paid leave, are approximately $157k per year. In comparison, US workers total compensation averages $125k per year.
- Japanese power costs are substantially higher than most other regions, especially following the nuclear power crisis there resulting from the Fukushima disaster. Japanese industrial electricity rates are $0.11-0.12 per kWh, compared to $0.068 in the US. This impacts the cost of cast pump housings especially, as well as cutting and welding.
- Steel costs are also slightly higher in Japan – $570 per tonne for hot rolled steel vs. $540 in the US and $490 in China. Chrome steel costs are also 10-12% higher than the global average in Japan.

The impact of geographic differences is muted by the fact that most major pump manufacturers are multi-national, and make or source specific components from a variety of locations. For example, ITT sources precision cast housings for its larger pumps (e.g. the 3600 models) from Korea. For the 3610 models, it does the castings in Mexico, which is 25-30% cheaper than buying from Korea. However, for US customers, final assembly and testing is done in the US no matter where the parts come from, imparting US labor costs for a substantial portion of the process.

However, quoted prices can be substantially lower for units that are manufactured entirely in Asia.

- Deep Blue Pump quotes 15-17% higher for comparable units from its Belgium facility vs. its plant in Dalian, China.
- Fonda Pump, a Chinese manufacturer, quoted as much as 20% less than Western manufacturers for smaller units. This is, in part, an effort to fill plant capacity after a recent expansion in Shenyang that left the firm only 60% utilized.

- Amarinth Pumps supplied four two-stage, stainless steel API 610 pumps for Petronas' Kebabangan field off the coast of Malaysia. The units were manufactured in Malaysia and sold for a unit price of just over $100k, approximately 20% less than ITT's price quoted for a comparable unit manufactured in the US.
- In contrast, Amarinth sold four two-stage units made of carbon steel to Indian Oil Company, these ones manufactured in the UK. The units cost approximately $65k each, slightly higher (6%) than an average of quotes from US plants.

Buyers in the oil & gas industry, such as ExxonMobil, caution that, to take advantage of these low regional prices, the end user must reserve the right to observe the manufacturing process and inspect the units periodically, or risk unsatisfactory quality. One source mentioned buying five pumps to move refined products from a Chinese manufacturer, only to reject the units on delivery because they were not manufactured to specification (the manufacturer had used substandard bearings and couplings).

Table 5: Regional Price Variations over Time for Centrifugal Engineered Pumps

Region/Country	Today	2014	2015	2020
North America	1.00	1.01	1.00	1.07
Latin America	0.95	0.99	1.01	1.16
Europe	0.97	0.98	0.98	1.05
Africa	N/A	N/A	N/A	N/A
India	0.80	0.82	0.83	0.97
Russia	0.81	0.84	0.86	1.02
China	0.82	0.82	0.81	0.88
Japan	1.11	1.13	1.13	1.15
Other Asia	0.84	0.85	0.84	0.91

4.3.1 Price Differences by Technology, Model, and Feature

Pump size and metallurgy are the main determinants of unit cost.

Upgrading from carbon steel to stainless steel roughly doubles the cost of the unit. Not only is the material more expensive, but it is more difficult to work, requiring more labor and machining time. To mitigate cost increases, manufacturers including Sundyne and Dragon Pumps recommend using electroless nickel plating instead of stainless steel if corrosion is the main consideration, rather than high pressures. This only increases unit cost by 25-30%, instead of doubling it.

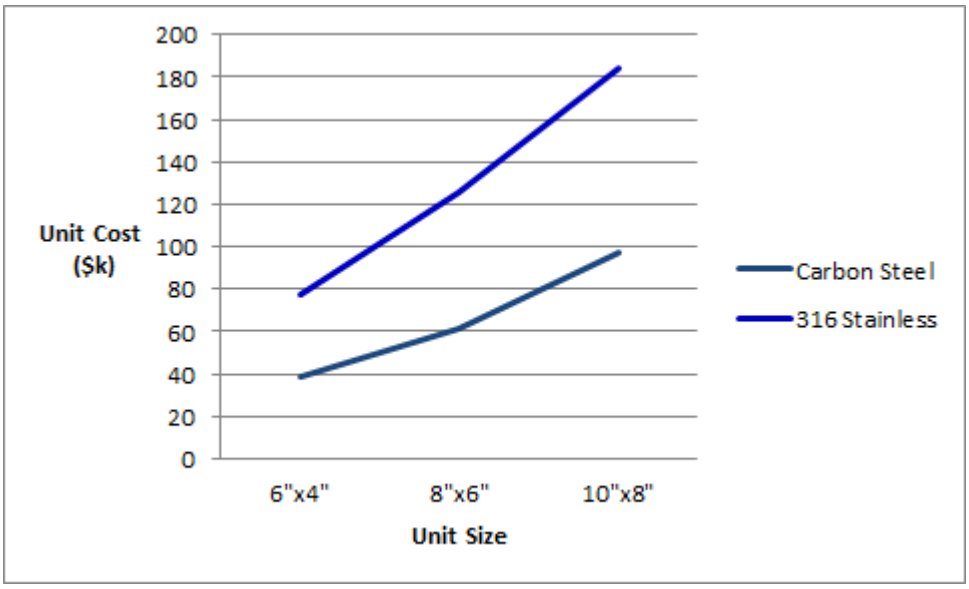
Table 6: Incremental Cost per Extra Parameter or Feature for a Centrifugal Engineered Pump
(Reference unit is 8" x6", API 610, two-stage, horizontally-split, 500' of head, 5k gpm, 300 hp horsepower motor)

Parameter or Feature	Unit of Measure	Indicative Cost Impact	Notes / Comments
Pump Size	Inches (8"x6" as reference point)	Reducing pump size from 8"x6" to 6"x4" cuts cost by $23k (37%). Increasing to 10"x8" adds $36k (58%).	Cost increases accelerate with size due to higher metal volume, as well as concurrent increases to motor, bearing, and shaft specifications.
Motor Size	Horsepower (300 hp as reference point)	Stepping down to a 100 hp motor costs 5% less. Upgrading to a 500 hp motor costs 10% more.	Costs rise faster for a larger motor size on higher engineering costs and more exacting materials requirements.
Material	Carbon steel as reference point	Upgrading to stainless steel doubles the cost of the unit.	Stainless is primarily used to combat heavy corrosion (high salt or CO_2 content)

Note: Changing one parameter usually involves changing others, and the cost impact may not be additive or linear.

Increasing the size of the motor raises the price of a pump unit rapidly, even while holding the size of the pump itself constant. Raising motor size from 300 hp to 500 hp (to handle heavier crude oil) would add 10% to the cost of the entire unit. For example, the reference unit would only need a 300 horsepower motor to pump crude oil with a specific gravity of approximately API 20, while heavier crude oil (API 13-15) would need as much as a 500 hp motor.

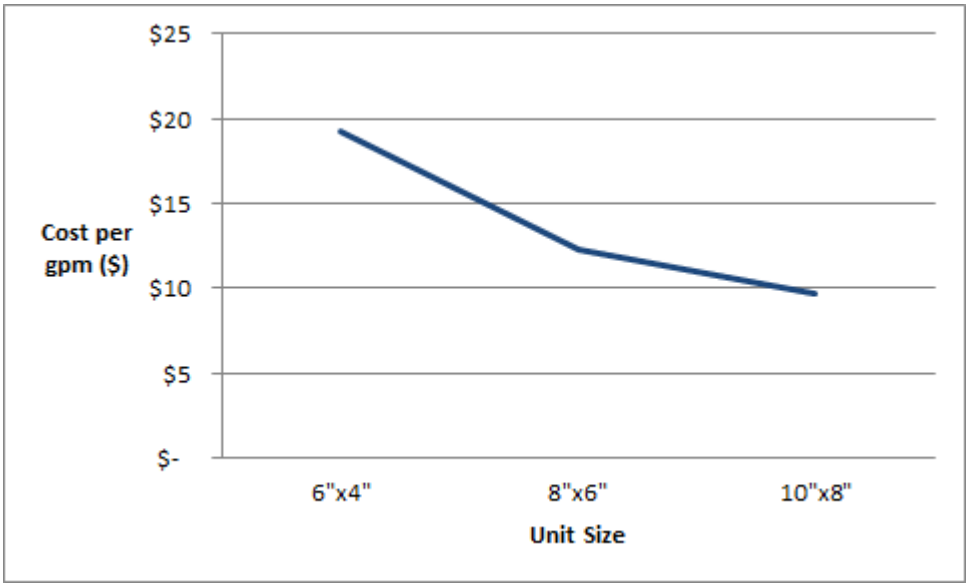
Figure 6: Centrifugal Engineered Pump (300 HP Motor) Size vs. Cost - By Material



*Dimensions in inches refer to the internal diameter and width of the pump casing

Cost per gallon per minute of flow falls rapidly as the size of the unit increases. For an 8" x 6" unit, with a flow rate of 5k gpm, the cost per gpm of pump capacity is $12.25. This falls to $9.68 per gpm for a 10" x 8" unit with a flowrate of 10k gpm.

Figure 7: Cost per unit of Output



Buyers can achieve manufacturing economies of scale by placing large orders, even if deliveries are spaced out to match installation requirements (by months or years). This can even make the order more attractive for a manufacturer, because it can use the committed order volume to smooth capacity utilization over time.

Manufacturers indicate that they are willing to give discounts of up to 10% for medium-sized orders (10 pumps), and 20% off of the unit price for large orders (20 or more pumps).

Figure 8: Economies of Scale in Centrifugal Engineered



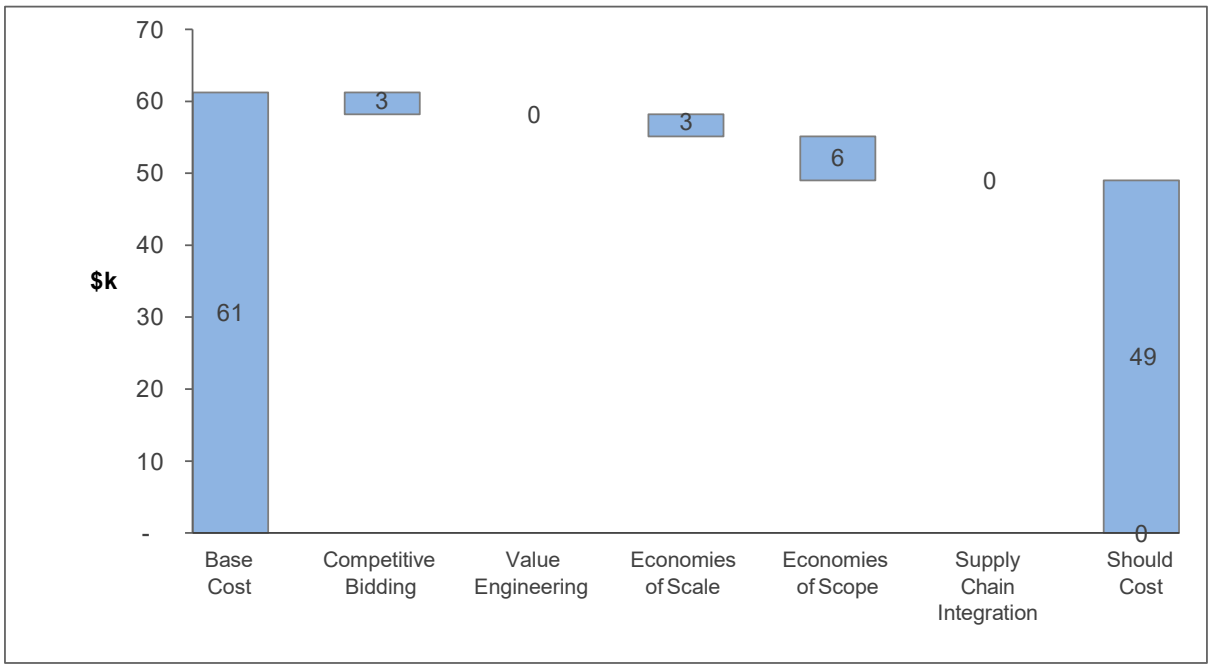
4.3.2 Should-Cost Analysis

Economies of scale are the biggest lever buyers have on prices. Manufacturers including Flowerve, ITT, Sundyne, and Kirloskar Brothers indicate that ordering more units can achieve an order discount of up to 20%. At the reference quantity of 10 units, economies of scale of 10-15% should be achievable, depending on the manufacturer and its current backlog.

Competitive bidding and economies of scope can also be sources of savings. Including Asian suppliers on bids can be especially effective, as they have a reputation as low-cost suppliers and this incents other bidders to reduce the cost differential. Many of the Centrifugal Engineered Pump manufacturers also make other types of Pumps, and will give up some margin for volume on orders for multiple pump types. Combining these two factors can save up to another 10%.

Supply chain integration is not a source of savings for most buyers, but can be on the order of another 10% in the case of a strategic partnership. Manufacturers including KSB, Sulzer, and Flowserve have, given sufficient order volume from a major NOC such as Saudi Aramco or Petrobras, established manufacturing operations situated to better serve major clients. This is a long process that involves significant relationship-building, and is not available on a transactional basis though, and so the savings are not considered to be readily available. Each pump order is unique, and therefore there is little opportunity for holding buyer-specific inventory on the part of the supplier.

Figure 9: Should-Cost for Centrifugal Engineered Pumps



4.4 Price Negotiation Strategies

1. Check with suppliers on lead time before asking about price. If the supplier can begin manufacturing immediately, it has slots open and will be more willing to give ground on price.
2. Commit to program-scale orders as early as possible and schedule deliveries to match construction requirements. This will secure the benefit of economies of scale (up to 15%) and give the manufacturer enough time to schedule capacity appropriately – which will be a key consideration as lead times extend in 2014.
3. Tie any lead time commitments to financial incentives for suppliers. ITT and Sundyne have both missed delivery quotes in recent months, causing buyers to look for possible replacements.
4. On contracts signed with Chinese manufacturers, schedule site visits to maintain the relationship and ensure that the work is being performed to specification. Feedback from other buyers indicates that Chinese pumps can be made to global standards, at lower cost, but that quality is not always reliable unless the buyer maintains a presence.

5 Progressing Cavity

5.1 Market Overview

Table 7: Key Indicators for Progressing Cavity

(Total Change over Each Period)

Key Indicators	Q1 2013 – Q1 2015		Q1 2013 – Q1 2020	
Demand Growth	▲	8.1%	▲	39.6%
Demand ($m)	▲	288-311	▲	288-402
Capacity Utilization	▲	1.6%	▲	2.1%
Prices	▲	6.1%	▲	19.0%

1. Demand

Demand contracted slightly in Q1 on falling North American rig counts. Growth will accelerate to 0.7% in Q2 as North American oil & gas activity picks up on recovering natural gas prices, then increase to annual rates of 4-6% from 2014-2020.

The upstream oil & gas, mining, and wastewater industries are the main sources of demand for Progressing Cavity Pumps (PCPs). These industries use the pumps for viscous fluids, slurries, and sludges including heavy oil and bitumen. PCPs are also used in petrochemical applications where low shear (turbulence within the fluid) is required, and pipelines used to transport heavy hydrocarbons, or ones with variable flow rates that make centrifugal pumps inefficient.

Global demand contracted 0.3% in Q1, as declining rig counts in North America outweighed a 2% increase in Asian oil & gas extraction and mining industry capital spending.

- Low natural gas prices in the US last year and a drop in Brent crude oil prices in Europe drove declines in upstream spending of 1% and 0.5%, respectively. In the US, rig counts fell 2% in Q1, following an 11% drop in 2012, as natural gas prices remained below $3/mmbtu for most of 2012. Canada's "spring breakup" also contributed to the drop in upstream spending (explained in the Centrifugal Engineered chapter). In EMEA, prices for Brent crude oil fell by $10/bbl in Q1, driving a 2% drop in regional rig counts.
- Rising fuel demand in China and India is driving much of the Asian increase in upstream spending. Chinese demand for gasoline is growing at a rate of 5% in 2013, while fuel demand India is growing at an annual rate of 4%. This underlying increase in demand pushed Asian oil & gas capital spending up 2% for the quarter, and regional rig counts rose 4% in Q1.

Demand growth will rise to 0.7%% globally in Q2, and 1.7% for the year, as increasing oil & gas prices in Europe and the US stimulate upstream spending there, joining Asia's continued positive growth.

Asian demand will grow fastest at 2.3% per quarter, driven by 2.5-3% quarterly growth in upstream capital spending to satisfy the abovementioned increase in fuel demand, and a 7% annual increase in overall energy demand. Examples of orders that will fuel this demand growth include:

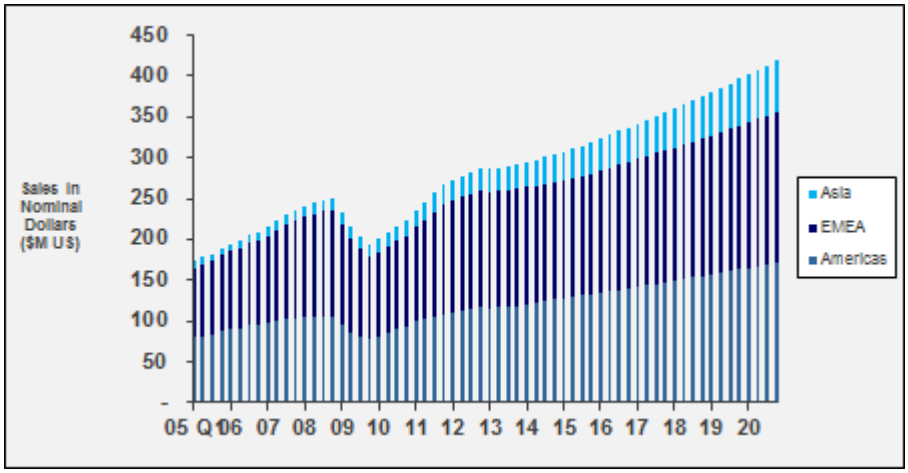
- BASF ordered 12 units from Colfax for petrochemical service in 2012 Q4, but progress payments will continue in 2013 until delivery in 2014. The total order is worth just over $1m.
- Hindustan Petroleum ordered eight progressing cavity pumps worth a total of $480k for transferring refined petroleum products from Kirloskar Brothers, Limited (KBL).
- Also in India, Balmer Lawrie, an oilfield service company, ordered two heavy-duty progressing cavity pumps worth $250k from Weir in April, for pumping heavy oil.

Demand will grow by just under one percent per quarter for the remainder of the year in the Americas, where gas prices, now over $4/mmbtu will drive overall oil & gas spending up a total of 5% for the year. Orders fueling this increase include:

- ExxonMobil will take delivery of six progressing cavity pumps from NOV's Mono unit in Q2, with average flow rates of 20k bpd, an order worth just under $2m.
- Alcan Gove ordered five diesel transfer pumps, collectively worth $300k.
- In the US, Plains All American ordered four progressing cavity pumps from Colfax for its Mesa pipeline.

EMEA demand will grow slowest, where heavy oil pumping is uncommon, and upstream oil & gas spending will grow slowly outside of the Middle East.

Figure 10: Demand for Progressing Cavity Pumps



Global demand growth rates will accelerate to 4-6% annually beginning in 2014, driven largely by oil & gas extraction spending in Asia and the Americas. In Asia, upstream spending will continue to grow at a clip of nearly 10% annually on aggressive economic growth and the resulting continuing

expansion in energy demand. This will offset slower upstream spending growth in the Americas (4-6% annually) and EMEA (3-4% annually).

2. Supply (Capacity)

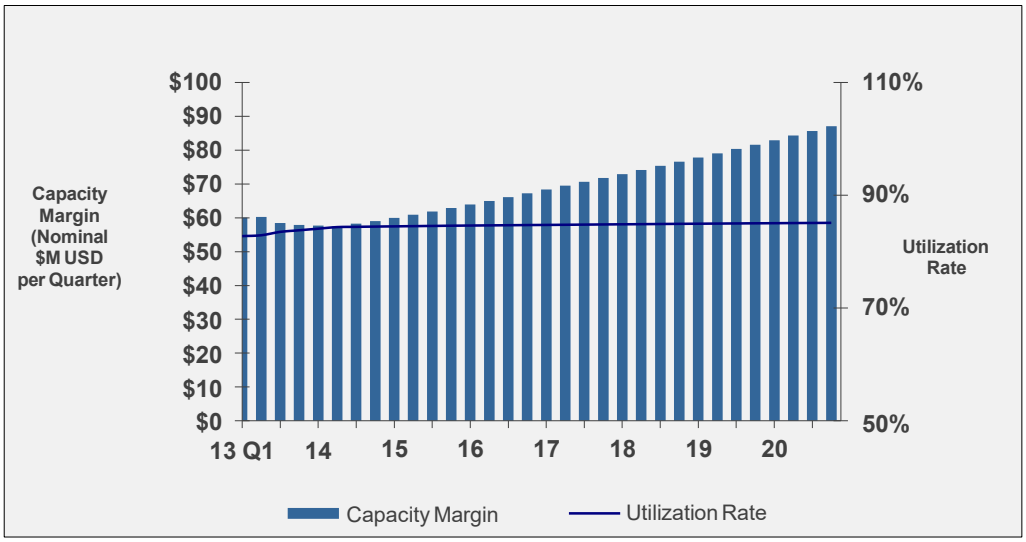
Capacity additions by NOV and PCM in late 2012 and further additions by Bornemann, Leistritz, and Netzsch in 2013 will keep utilization levels at or under 85% and avoid major backlog buildup for all but the largest units.

The top Progressing Cavity Pump manufacturers are:

- Colfax
- NOV
- Bornemann (ITT)
- Flowserve
- Europump
- PCM Pumps
- Weir
- Netzsch
- Leistritz
- Shengli Oilfield Highland

NOV and PCM added capacity for bottleneck components in late 2012, rotors and nitrile stators for NOV and rotors alone for PCM. Both expansions were in Texas. NOV's rotor capacity expansion took place in Marble Falls, while its Houston plant makes the stators. PCM's rotor machining plant (which also does assembly for US orders), is also in Houston. While the capacity additions themselves were small, these are typically the components that add lead time.

Figure 11: Capacity Margin - Progressing Cavity Pumps



Industry utilization rates are 83% in 2013, overall low enough to avoid substantial wait times in queue for all but the largest orders (more than 20 units).

- NOV's Mono unit, the one that makes progressing cavity pumps, is 80% utilized. Prior to adding rotor and stator lining capacity, that section of the unit's operations was 90% utilized, compared to about 80% for assembly, but the expansion aligned the two operations.
- Colfax is 85% utilized, a rate that has risen gradually from 80% in late 2011 on major new orders. The firm targets utilization rates within a band of 80-90%, and plans to add capacity before utilization rates reach 90%.
- Bornemann's US operations are 85% utilized, higher than the 80% utilization rate at its German facilities due to an influx of orders from US shale plays.
- For Leistritz, the gap is even greater. It is 90% utilized in the US and 80% utilized in Germany.
- Chinese suppliers generally have more capacity available. Shengli Highland Oilfield Equipment is 80% utilized, on par with the lower range for Western manufacturers, while Lilin, a smaller Chinese manufacturer that makes mostly downhole units for artificial lift, is currently only 65% utilized.

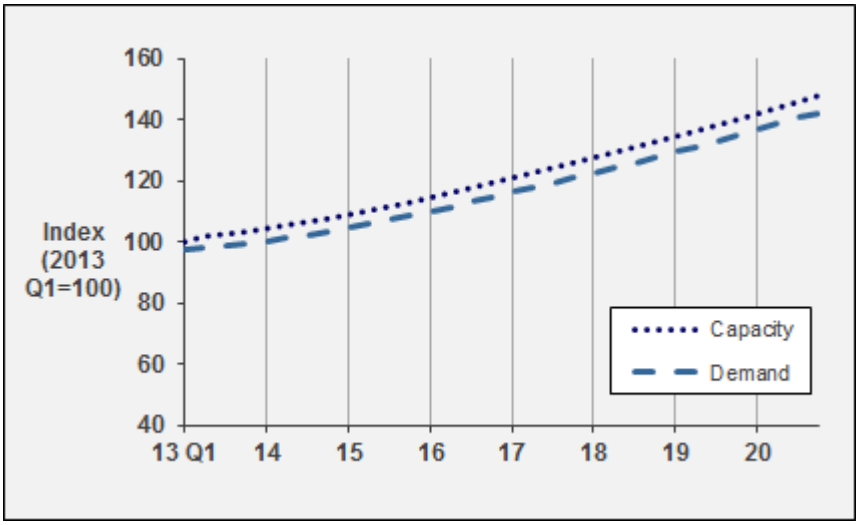
Table 8: Reported or Estimated Capacity Utilization Rates at Selected Progressing Cavity Pump Suppliers

Company	Country	Current Level	12-Month Forecast
NOV	Malaysia	80%	80%
Bornemann	Germany	80%	75%
Bornemann	US	85%	80%
Colfax	Sweden	85%	85%
Weir	US	85%	85%
PCM	France	85-90%	90%
Leistritz	Germany	80%	80%
Leistritz	US	90%	80%
Europump	Canada	85%	80-85%
Shengli	China	80%	85%
Lilin	China	65%	70%

Bornemann, Leistritz, and Netzsch are adding more capacity in 2013, which will prevent industry utilization rates from rising dramatically in the near term.

- Bornemann, now part of ITT, is adding headcount in Germany and expanding its plant in China. The headcount addition is ongoing and will help keep up with new orders throughout the year. The Chinese expansion will add approximately 5% to the firm's overall capacity for PCPs when it is complete in Q3.
- Leistritz is adding 20k feet of manufacturing and warehouse space in New Jersey (US), to cope with an influx of orders from US shale plays, particularly the Marcellus and Barnett. It is also hiring machinists in Germany.
- Netzsch is adding capacity in Brazil and India, specifically to support oil & gas orders. The Brazilian expansion consists of hiring more staff and adding three machines. In India, it's adding roofline and expanding the plant's capacity by 25-30%.

Figure 12: Demand vs. Capacity - Progressing Cavity



Accelerating demand growth in 2014 will push utilization rates up to 84% next year, and eventually to 85% before 2020. Most manufacturers regard this level as high enough to amortize machinery investments, but low enough to keep lead times from rising to uncompetitive levels.

5.1.3 New contracts

Colfax and NOV won major contracts for heavy oil, fuel, and petrochemical applications, Weir booked high-value contracts from the mining industry.

Colfax won multiple orders for tanker and terminal pumps used to transfer crude oil or refined products from tanks for transportation. PCPs are good for these applications because they do not induce turbulence in the process fluid, which causes hydrocarbon products to foam and creates pressure fluctuations. These orders include:

- Chinese tanker operator Brightoil placed an order worth more than $7m. The contract is for 180 two-screw pumps used on tankers. While the number of units is large, they are not specified for harsh duty and the unit cost is low at approximately $70k.
- BASF ordered 12 three-screw units for its 400k metric tpy petrochemical plant, currently under construction in Chongqing. The super-duplex pumps will be the plant's main circulation units, magnetically driven to prevent leakage. Due to the unit's size, specialized construction, and engineered drive systems, they cost approximately $125k each.
- Saudi Arabia's Yanbu II power plant will take delivery of 21 progressing cavity pumps from Colfax in June. The 14 of these smaller units are to feed heavy fuel oil to the power plants gas turbines. The remaining seven will pump lubricating oil.

Kirloskar brother limited also landed a major order for product transfer pumps, eight twin-screw units to pump diesel at HPCL's Visakh refinery. The units are scheduled for delivery in 2013 Q4.

Colfax booked major upstream and midstream orders as well.

- Lukoil ordered 14 screw pumps from Colfax for heavy oil production in 2012 Q4. The deal is worth $1m, for a unit price of $70k. These pumps are smaller, single-screw units, designed to increase production at one well each.
- US Pipeline operator Plains All American ordered four large twin-screw units for its 80-mile Mesa pipeline, which were delivered late last year. The pumps cost $145k each due to their large size and stainless steel construction (to combat corrosion). The units will allow Mesa to increase the pipeline's throughput by 100k bpd, to 420k.

NOV won a major order from ExxonMobil in Canada, six units scheduled for delivery this quarter. The pumps are designed for flow rates of 20k bpd. The units include electric motors, electronic drives, and explosion-proof cabinets for offshore platform use.

Weir booked most of its new contracts from the mining industry, but it is still a recognized player in the oilfield pumps sector.

- Swedish Mining company Boliden ordered 34 small PCPs from Weir for an expansion project at a zinc mine and processing plant in Sweden. The units will carry viscous slurry containing water, minerals, and other crushed rock for processing. Boliden placed the order in Q1, and the units are scheduled for delivery in Q4.
- African mining firm Kenmare Resources took delivery of 32 PCPs from Weir in 2012 Q4, also for mining slurry, at the Moma titanium mine in Mozambique. The pumps will carry mineral sands and water from the mining operations to the nearby separation and processing plant. The pumps will allow Kenmare to increase production at the mine by 50%.
- Weir also won an order for upstream pumps in Q2, from Indian EPC firm Balmer Lawrie. The units, two progressing cavity pumps, are highly specified for abrasive, corrosive heavy crude, featuring a tool steel rotor, 410 stainless shaft, and a high nitrile stator.

Table 9: Summary of New Contracts and Estimated Values for Progressing Cavity Pumps

Buyer	Country of Installation	Supplier	Product	Estimated Value ($k)	Estimated Cost/Unit ($k)
Brightoil	China	Colfax	180 two-screw pumps for tanker product transfer	$7,353	$41
Kenmare – Moma	Mozambique	Weir	32 units to pump slurry	$4,000	$125
Naftan JSC	Russia	HMS	18 units with VSDs for heavy oil	$3,060	$170
Boliden	Sweden	Weir	33 units for slurry pumping at a titanium mine	$2,000	$59
ExxonMobil	Canada	NOV	6 screw pumps averaging 20k bpd and 50 hp, including motors and instrumentation	$1,830	$305
BASF	China	Colfax	12 units for petrochemical service	$1,800	$150
Brunei Shell - Seria Terminal	Brunei	Colfax	4 Houttuin twin-screw pumps and 5 VFD control panels	$1,290	$323
Lukoil	Russia	Colfax	14 screw units for bitumen production	$980	$70
Al-Kut Water Treatment	Iraq	Landustrie	17 pumps, ranging from 25-70 hp	$595	$35
Plains All American – Mesa	US	Colfax	4 units for the Mesa pipeline	$580	$145
HPCL	India	Kirloskar	8 product transfer pumps	$480	$60
Shell – Pearl	Qatar	Landustrie	4 units for NGL transfer	$420	$105
Yanbu II Power plant	Saudi Arabia	Colfax	21 pumps for moving heavy fuel oil and lubricating oil	$387	$18
ExxonMobil - Banyu Urip	Indonesia	Gardner Denver	3 units for pipeline service	$375	$125
Alcan Gove	Canada	Pump Power	5 diesel transfer screw pumps	$275	$55
Balmer Lawrie	India	Weir	2 units, tool steel rotor, SS 410 shaft, high nitrile stator	$250	$125

5.2 Analysis

5.2.1 Costs

Rising metal, energy, and labor costs, particularly in Asia, will drive costs up 1.5-2% annually through 2020.

Labor and benefits are the largest single cost category for Progressing Cavity pumps, occupying 35% of the total cost structure. Production labor – welders, machinists, shop hands, and assembly workers – accounts for 13% of the overall cost structure. Salaries for engineers and management typically make up another 12%, with benefits such as health care, training, and paid leave accounting for another 10%. Labor costs are lower for PCPs than they are for Centrifugal Engineered pumps because progressing cavity pumps are typically less complicated to engineer and manufacture. PCPs are able to handle a wider range of fluid compositions and pressures with less engineering, allowing labor costs to remain somewhat lower than for centrifugal units.

Motors typically make up 25% of the overall unit cost. This is higher than for centrifugal pumps because of the lower materials cost for the pump body, which, outside of the stator, is simply a metal cylinder. This percentage is highly variable, however, and depends to a large degree on how many rotors are used in the pump (which increases the materials cost and lowers the motor's percentage of the total) as well as the horsepower of the motor.

Metals make up 23% of the overall cost structure (assuming carbon steel construction). The metal used varies according to the abrasiveness and corrosivity of the fluid being pumped, as well as the differential pressure the unit is required to handle. Chrome, stainless, or even super duplex stainless steel are used in high pressure, highly corrosive environments.

Rubber-based material for the stator makes up an additional 5-10% of the cost structure. For basic rubber, the figure is closer to 5%, while for high nitrile formulations or specially engineered grades (which can occur if the fluid being pumped requires a special rubber to avoid a chemical reaction) it is closer to 10%.

Manufacturing costs for pump makers rose roughly 0.5% in Q1, after a 2% increase in 2012, primarily on increasing labor costs in Asia and a global increase in motor costs.

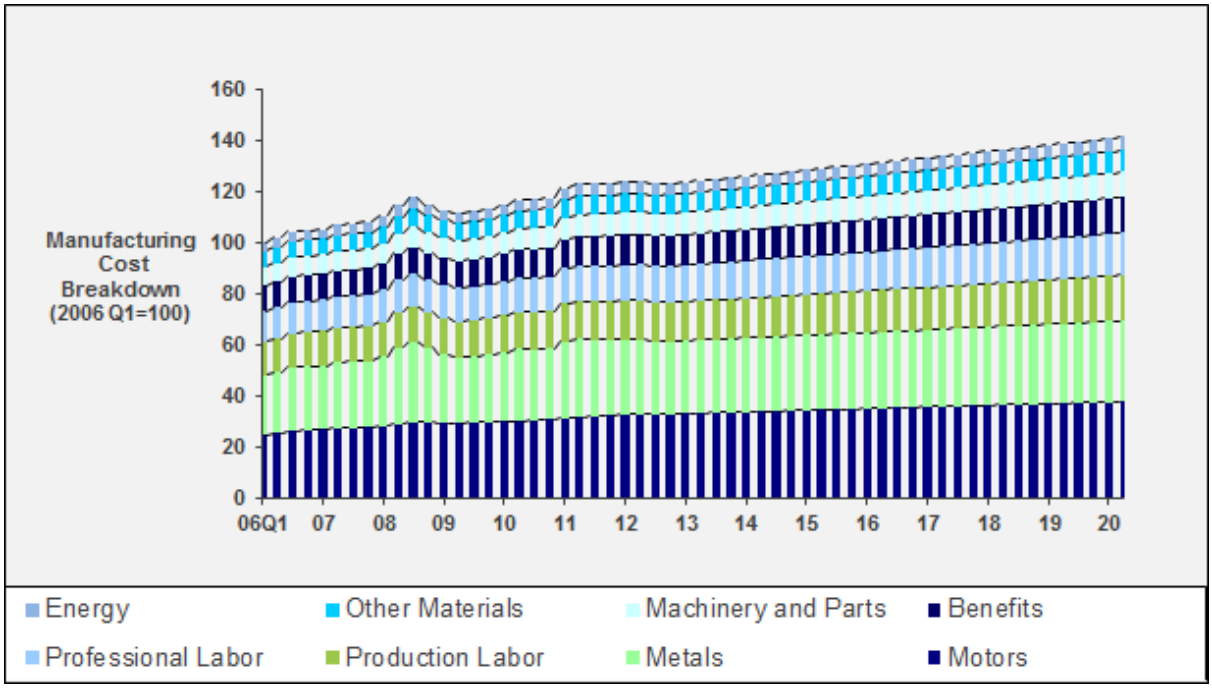
In Major Asian manufacturing areas, urban sectors with access to transportation infrastructure, costs of living are rising rapidly. Combined with aggressive hiring in the region on the part of many pump manufacturers (which are still using it as a low cost production base) that is driving hiring costs up for trained engineers and skilled machinists, this is driving Asian labor costs up more than twice as fast as in other regions. In Q1, professional labor costs rose 2% in Asia, compared to less than 0.5% in EMEA and the Americas. Asian production labor costs rose about 1%. This disparity in labor cost growth drove Asian costs up almost 1% for the quarter, vs. 0.25% growth in the other two regions.

Global motors prices rose 0.5% for the quarter, due in large part to increasing costs for copper winding material. Spot prices for copper rose nearly 10% from December 2012 to mid-February 2013 driving up costs for motor windings last quarter.

Overall costs will rise a total of 2% for the year, again driven primarily by Asian labor costs. With no major disruption to the current pattern of labor cost growth, Asian salaries and wages will continue to grow 0.5%-1% per quarter, offsetting slower increases in the other regions.

Prices for metals, energy, and labor will push manufacturing cost levels up 1.5-2% annually through 2020, for a cumulative total of just over 12% from 2013 Q2-2020 Q2. The cost increase will be fastest in Asia (14% vs. 12% in the other two regions), again due to faster labor cost increases of 2-3% annually vs. 1.5%. Energy costs will increase 1.5-2% per year globally, driven by rising production costs for fossil fuels, as well as regulations that mandate more expensive renewable technologies. Metal costs will also play a role in the gradual swell of cost levels, as carbon steel costs rise a total of 15% over the forecast period, offset by slower growth (10%) for hot rolled sheet and strip.

Figure 13: Cost Structure for Progressing Cavity Pumps



Note: Prices are ex-works.

5.2.2 Profit Margins

The leading PCP manufacturers have average net margins of 8% and operating margins of 15.5% due to their focus on high-value oil & gas applications and a lack of major competitors that manufacture solely in Asia.

PCP manufacturers earn higher margins for their relevant divisions than Centrifugal Pump makers, 8% net margin on average and 15.5% operating margin. This is primarily due to their almost exclusive focus on end users in the oil & gas and mining industries, which have higher specification requirements, as well as the fact that few manufacturers entirely based in Asia compete in this market, and therefore do not exert the same level of competitive pressure.

Kirloskar Brothers in India and Shengli Highland are among the few recognizable suppliers based in Asia, and their presence outside of their home markets is limited. Kirloskar is still trying to penetrate the global market in this segment, and its margins reflect a strategy of 'buying its way in,' with net margins of 2% and operating margins of 9%. Shengli is relying on its partnership with Weir to lend it credibility as an international supplier but most of its oilfield business is still in China.

Suppliers that sell mostly to oil & gas market vs. mining make even higher margins. For example, NOV's Petroleum Services and Supplies Division earns net and operating margins of 12.5% and 22.5%, respectively, while Flowserve's comparable figures are 9.5% and 23.5%. In contrast, Colfax's net margin was 7.5% in 2012, and its operating margin was 10.7%.

Pumps with more advanced metallurgy and rubber stator chemistry also make higher margins. According to Bornemann, in addition to charging about 50% more for a stainless steel PCP, it makes about 50% more on it. Bornemann's overall margin levels are currently close to its competitors that specialize in the oil & gas industry, at 9% and 18%, respectively. However, these margin levels may be in jeopardy as ITT integrates Bornemann more completely into its operations. ITT is accustomed to the centrifugal pump business, and Bornemann executives are concerned that the all of the company's practices, including pricing, will be absorbed. This represents an opportunity for buyers, however, as it's prices will tend to rise more slowly than most competitors as ITT exerts more control.

The above lack of low-cost competition and the focus on oil & gas and mining applications will let PCP manufacturers raise their prices as much as Centrifugal Pump makers by 2020 Q2, for an overall increase of 20%, and margin growth of as much as 7-8 percentage points.

3. *Prices*

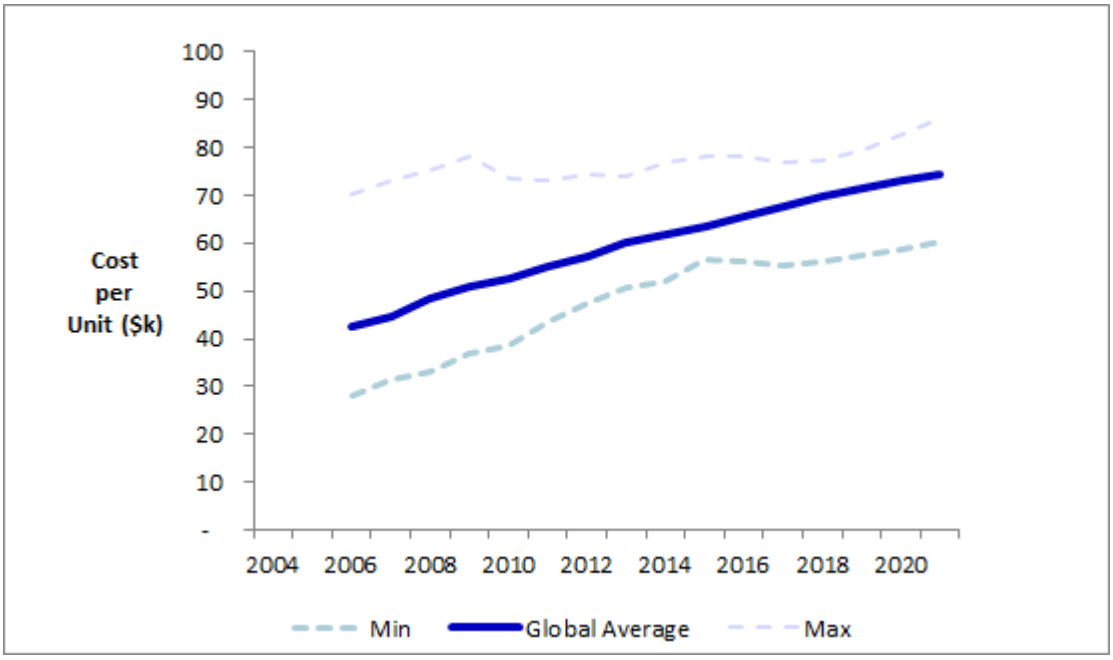
Prices will rise just under 3% in 2013, matching cost growth. Demand will drive prices more than costs beginning in 2014, and price will rise a total of 19% by 2020 Q1.

Prices rose 0.5% in 2013 Q1, after a 3.5% increase in 2012, driven up by costs for motors and an increase in Asian labor costs (explained in the costs section). PCP prices will rise 2.5% in total for 2013, growing slightly faster than costs as manufacturers price more aggressively due to accelerating demand growth.

- Flowserve intends to raise list prices by 3-5% this year, although list price changes are always subject to discounts during negotiations.
- ITT typically aims for annual price increases of 3%, a pattern it intends to continue this year.
- French PCM is only planning to raise prices by 1-2% this year, citing long term materials contracts that keep its own level of cost increases down.

Prices will continue to grow slightly faster than costs through 2020, at 2.5-3.5% annually as suppliers leverage strong demand growth to increase margins. Overall prices will rise a total of 20% by 2020 Q1, driven to a large extent growth in supplier margins, rather than cost increases.

Figure 14: Overall Price Forecast for Progressing Cavity Pumps



The reference unit for Progressing Cavity is a single-screw, carbon steel unit with outlet diameter of 4.5” and a 100 hp motor. At benchmark US price levels, this unit would cost approximately $69k.

The regional pricing dynamics for PCPs are similar to those for Centrifugal Engineered Pumps. They use mostly the same materials, although in slightly different proportions. The comparatively lower percentage of labor costs in the overall cost structure narrows the regional price gap slightly.

Japanese prices are only 10% higher than the US benchmark rates, while prices in India, Russia, and China, are about 1% higher than Centrifugal Engineered on a relative basis.

Examples of regional pricing differences include:

- Shengli Highland Oilfield Equipment (China) quoted $57.5k for a unit made to the reference specifications, compared to approximately $69k from NOV (US) and Bornemann (Germany).
- Gardner Denver sold three screw pumps to ExxonMobil in Indonesia for $125k each, made primarily in China. The units were comparable in size to four units that Colfax sold to Plains All American, which were made in Sweden and sold for $145k each.
- Kirloskar Brothers also stated that the reference unit should cost about $58k.
- Colfax responded with a list price of $68k for the reference unit, as manufactured at its main plant in Sweden.
- Japanese supplier Kosaka offered prices for the reference unit of $75-80k.

Pure regional prices are even more difficult to achieve as a buyer than for Centrifugal Engineered Pumps, however, due to the lack of globally recognized suppliers. Low-cost Chinese suppliers exist (such as Shengli and Lilin), but they are not considered viable bidders by most oil companies. The major manufacturers do conduct at least partial manufacturing in low cost regions however. Bornemann makes components in China. NOV has global manufacturing operations, including facilities in Malaysia. Flowserve and Weir manufacture in China as well as other low-cost regions.

Buyers can wring more of this cost advantage out of the final price if they understand the cost structure of each major bidder for major orders, and demand to know details on the supply chains for their pumps.

Table 10: Regional Price Variations over Time for Progressing Cavity Pumps

Region/Country	Today	2014	2015	2020
North America	1.00	1.01	1.00	1.07
Latin America	0.95	0.99	1.01	1.16
Europe	0.97	0.98	0.98	1.05
Africa	N/A	N/A	N/A	N/A
India	0.81	0.82	0.83	0.97
Russia	0.82	0.84	0.86	1.02
China	0.83	0.82	0.81	0.88
Japan	1.10	1.13	1.13	1.15
Other Asia	0.84	0.85	0.84	0.91

5.3.1 Price Differences by Technology, Model, and Feature

Pump metallurgy is the biggest factor in determining unit cost, followed by the pump's size.

Upgrading from carbon steel to stainless steel increases the cost of a pump by approximately 50%. This is substantially lower than for centrifugal pumps (it usually doubles the cost of the unit), because the pump casing uses less metal.

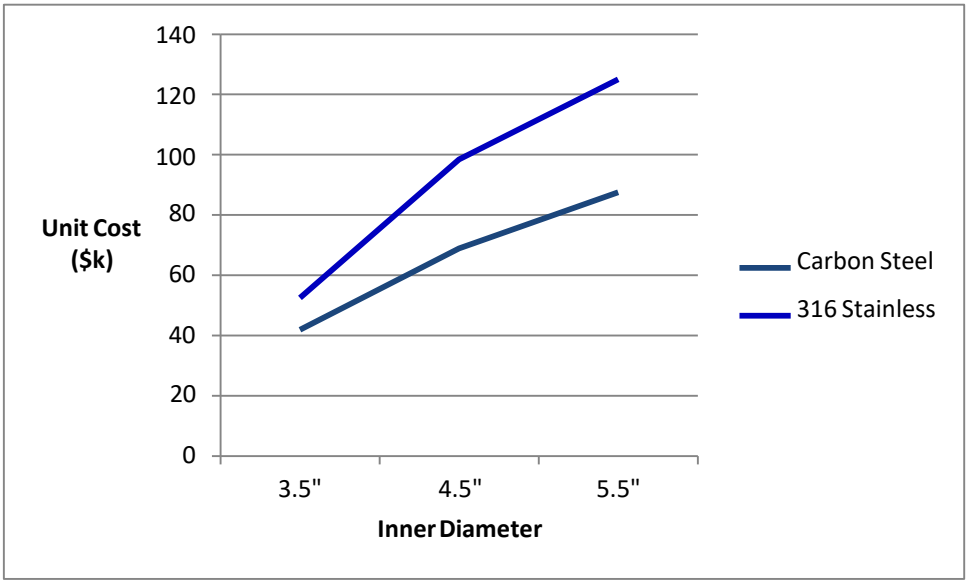
Table 11: Incremental Cost per Extra Parameter or Feature for a Progressing Cavity Pump
(Reference unit is 8" x6" (skid dimensions), API 610, two-stage, horizontally-split, 500' of head, 5k gpm, 300 hp horsepower motor)

Parameter or Feature	Unit of Measure	Indicative Cost Impact	Notes / Comments
Pump Inner Diameter (ID)	Inches (4.5" as reference point)	Reducing ID to 3.5" cuts cost by $27k, increasing to 5.5" adds $19k.	Cost increases decelerate with ID because the thin screw shaft adds proportionally little material volume compared to the diameter.
Motor Size	100 hp as reference point	Stepping down to a 50 hp motor costs 15% less. Upgrading to a 150 hp motor costs 20% more.	The motor is a higher percentage of overall cost for PCPs than for Centrifugal units.
Material	Carbon steel as reference point	+43% for stainless steel 316	Cost increase is not as dramatic as for Centrifugal units due to lower material cost percentage.

Note: Changing one parameter usually involves changing others, and the cost impact may not be additive or linear.

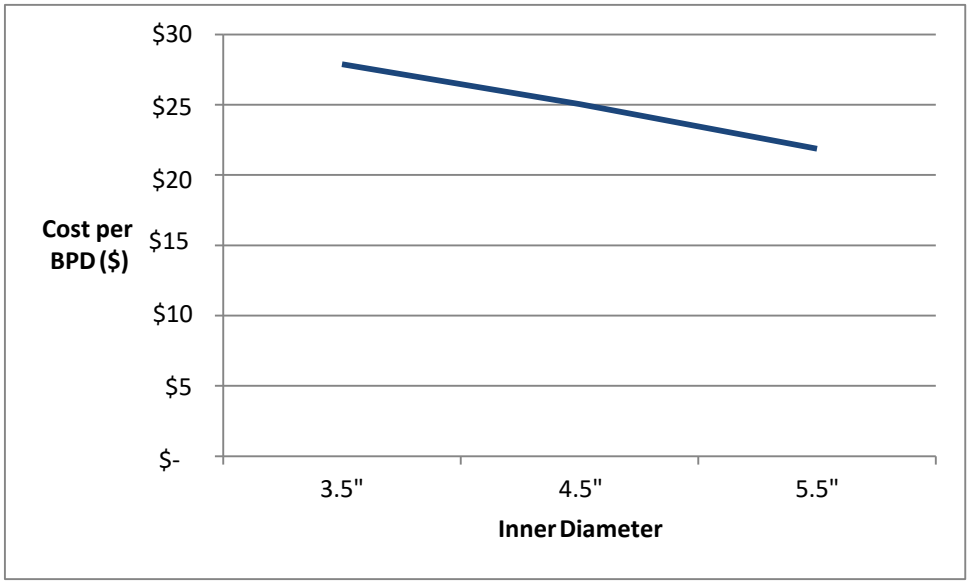
Pump size is the next most important determinant of the overall unit cost. Increasing the size of the outlet diameter by 1" (to 5.5") raises the cost of the reference unit by 27%.Increasing the size of the unit often also involves increasing the size of the motor, which adds 20% to the cost of the reference unit for an additional 50 hp.

Figure 15: Progressing Cavity Pump (100 HP Motor) Size vs. Cost - By Material



Cost per barrel per day of flow falls gradually as the size of the unit grows. For a 4.5” inner diameter unit, with a flow rate of 2,750 bpd, the cost per bpd of pump capacity is $25. This falls to $22 per bpd for a 5.5” diameter unit with a flowrate of 4k bpd.

Figure 16: Cost per unit of Output



Manufacturers such as Bornemann, Leistritz, and Weir give substantial discounts in exchange for order volume. These discounts are even more substantial than for Centrifugal Engineered Pumps, largely because of the higher margins in this segment. Volume-based discounts are on the order of 10% for 15 units and as much as 25% for 25 or more units.

Figure 17: Economies of Scale in Progressing Cavity



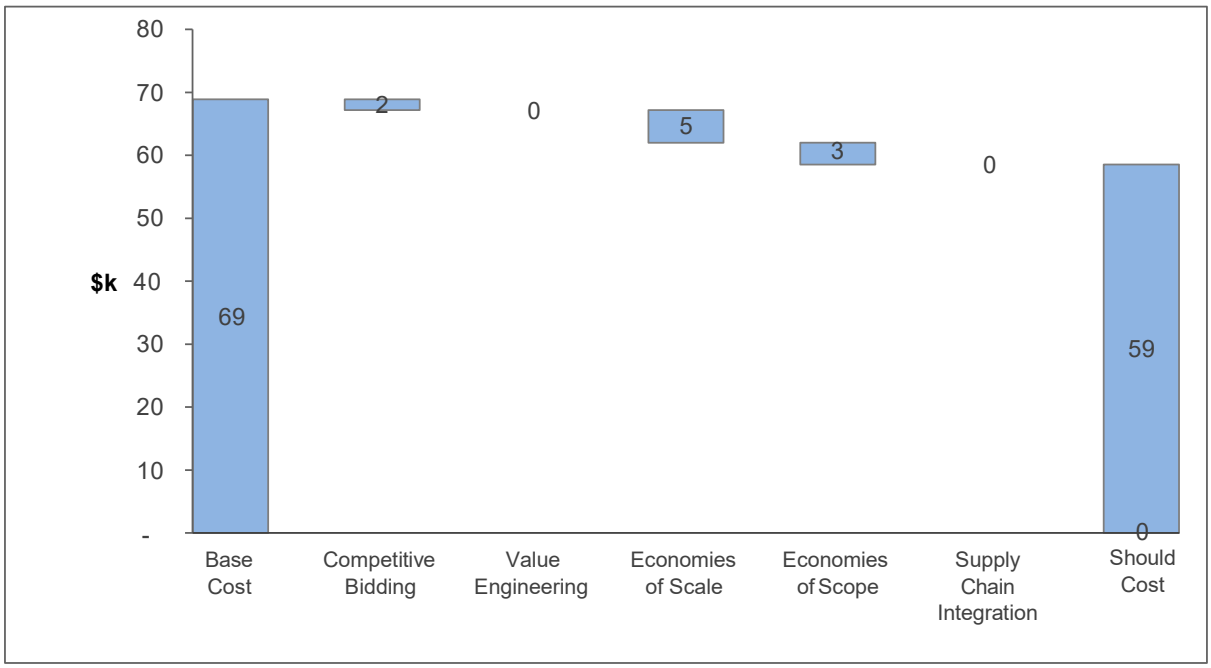
5.3.2 Should-Cost Analysis

As with other pump categories, economies of scale are the most effective way for buyers to reduce prices. As indicated above, manufacturers are willing to reduce unit prices by as much as 25% to win orders, if the order is large enough. At the reference quantity for PCPs (10 units) this discount will be about 5-10%, depending on the client (and its likelihood of placing further major orders) and the units being ordered. By increasing the order quantity to 25 pumps, manufacturers indicate that the discount on the overall order could be as much as 25%.

Competitive bidding is less effective for PCPs, mostly due to the limited list of bidders and the homogenous cost structures of those bidders. Still, it yields savings compared to single-sourcing, in the range of 3-5%. Manufacturers such as NOV, Flowserve, Weir, and Colfax, which have product offerings in other pump categories, are also willing to offer discounts for orders that include multiple categories, as much as 5%.

Metrics such as value engineering are already factored into prices. All of the pumps are designed to order for the end-user's application. Similar to Centrifugal Engineered, the opportunity for supply chain integration exists, and suppliers can certainly hold MRO inventory to reduce lifecycle costs, but significant integration benefits would only come with a partnership agreement.

Figure 18: Should-Cost for Progressing Cavity Pumps



5.4 Price Negotiation Strategies

1. Encourage Asian suppliers Kirloskar Brothers and Shengli Highland to become mainstream global suppliers by including them on all bids. The currently dominant suppliers of PCPs are all Western, and without low cost competition from credible Asian competitors they have higher margins than centrifugal pump manufacturers. These relatively high margins are a good place to target cost reductions.
2. Accelerate Bornemann's integration into ITT, and by extension its pricing structure, into its new parent company's, by approaching ITT with contracts, instead of Bornemann. Bringing Bornemann's margin levels into line with ITT's would reduce its PCP pump prices by 5-7%.

6 Multiphase

6.1 Market Overview

Table 12: Key Indicators for Multiphase Pumps

(Total Change over Each Period)

Key Indicators	Q1 2013 – Q1 2015		Q1 2013 – Q1 2020	
Demand Growth	▲	8.0%	▲	35%
Demand ($m)	▲	37-40	▲	37-49
Capacity Utilization	▼	-1.6%	▼	-2.1%
Prices	▲	5.6%	▲	16.5%

6.1.1 Demand

Multiphase Pump orders from US shale plays, aging fields and tight gas formations in Asia, and subsea booting projects in EMEA will drive demand growth of 4% in 2013, and 5% annually from 2014 through 2020.

Demand for Multiphase Pumps hinges entirely on orders from the upstream oil & gas industry. "Multiphase" refers to the multiple states of matter (solids, liquids, and gas) that the pumps are capable of moving. The pumps are used especially on wells or series' of wells that produce a high fraction of gas. Traditionally, this gas must be separated from the liquid stream at the wellhead (adding another expensive piece of production equipment per well), and then processed or transported separately, or flared. Operators are increasingly using multiphase pumps to avoid the capital cost of installing separators at each well.

The technology is relatively new to commercial operation, the first successful installations were in the mid-1990s, and a "winning" technology has yet to definitively emerge. Twin-screw units are currently the most prevalent for onshore operations, having taken over from single-screw units in the mid-2000s as operators began to use the units to handle wells with higher gas fractions (up to 90% on a sustained basis). Helico-axial designs are the most prevalent for the few subsea multiphase installations to date, as twin-screw units have mostly failed due to high-temperature shutdown in an average of 1.25 years at three fields, Prezioso, Lyell, and King.

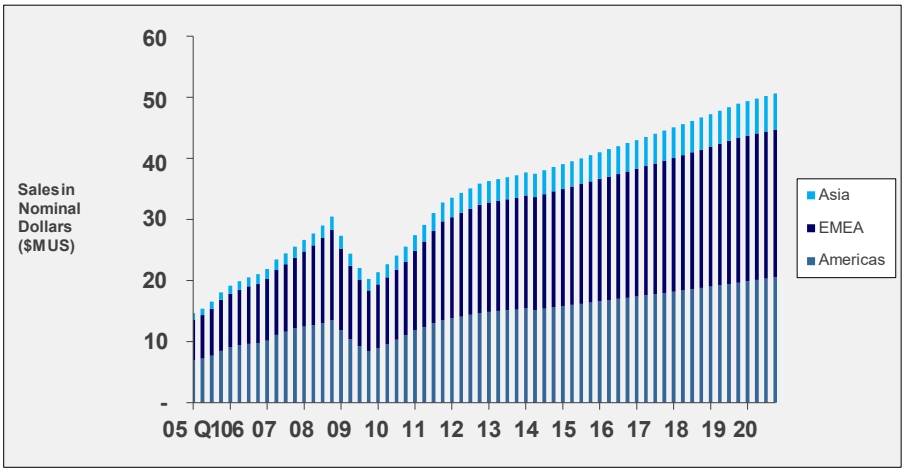
Multiphase Pump demand grew 1% in Q1, driven by sales to shale and tight gas plays in the US and China, and ongoing payments for subsea multiphase systems in European and African waters.

Demand growth was fastest in Asia at 1.8%, as PetroChina and CNPC ordered multiphase units to help increase production at aging Chinese oilfields. Petrochina ordered 18 units for its Xinjiang Tahe oilfield, while CNPC ordered eight multiphase pumps for the Daqing oilfield.

Demand growth was slightly slower, but still aggressive, in the Americas, at 1.4%. Multiphase demand growth has escaped the early 2013 dip associated with most oilfield equipment due to low gas prices last year because shale operators are buying them to avoid higher capital costs for wellhead separation equipment. For example, Leistritz installed a unit in the Barnett shale in 2013 Q1 that increased field production by 30%, paying for the pump in less than a month. Kodiak Oil & Gas received a 300 horsepower unit from Leistritz in Q1, designed to serve 17 wells in the Bakken shale. EOG resources also ordered multiple smaller units from Leistritz for operations in the Barnett shale, while Chesapeake ordered several new units from Bornemann last quarter, for installation in the Marcellus Shale.

Demand growth in EMEA, 0.8%, came mostly from ongoing subsea projects that include multiphase pumps. In late 2012, August and November, respectively, Shell and Total ordered subsea multiphase pumping systems from Frank Mohn, and made progress payments on them in Q1. Both systems are scheduled for delivery in 2014. While these contracts include fewer pumps than most onshore orders (a total of nine), the pumps are larger and require higher pressure tolerances than their onshore counterparts (up to 5k psi).

Figure 19: Demand for Multiphase Pumps



Multiphase Pump demand will continue to grow at 1% per quarter in 2013, for overall growth of 4% in this year, driven by a continuation of the above factors as Q1. Additional orders that will support this demand growth include:

- Canadian Natural Resources Limited (CNRL) and Lukoil both have framework agreements with Bornemann, with 148 and 100 total pumps delivered under each contract, respectively, as of Q1. Combined, the orders total approximately $25m in multiphase pump revenue for Bornemann since 2005. The operators are still ordering pumps under these agreements to support their respective bitumen and heavy oil production operations.
- Suncor ordered six multiphase units for its Fort Hills oil sands project in April, from Canadian supplier CAN-K, worth just under $600k.

- CNPC ordered additional multiphase pumps for its Shixi field in China from Shengli Highland, six units worth a total of almost $500k.

Global demand growth will accelerate slightly beginning in 2014, to 5% annually, as operators including Chevron and ExxonMobil ramp up operations at shale plays in Eastern Europe. The shale activity may even extend into Western Europe within this time frame, but fracturing bans have so far ensured that shale plays in Western Europe are not drilled. Annual increases in Asian upstream spending growth of 10% will fuel much of the increase, although growth will be slowed somewhat by overall upstream spending growth of only 3-4% annually in EMEA.

2. Supply (Capacity)

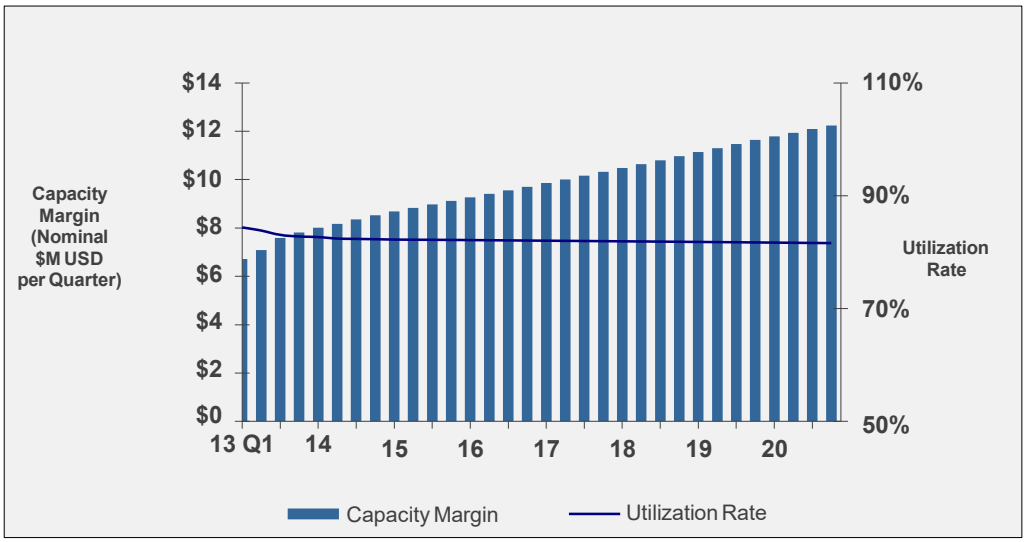
PCM and Seepex added capacity in late 2012 and early 2013. Bornemann, Leistritz, Netzsch, Flowserve, HMS, and Shengli will all add capacity in 2013 and 2014, reducing utilization rates from 84-85% in 2012 to 82% by 2012 and ensuring capacity availability for most projects.

The top Multiphase Pump manufacturers are:

- Bornemann (ITT)
- Flowserve
- Leistritz
- Rosscor (Colfax)
- Netzsch
- PCM Pumps
- Tianjin Pumps and Machinery
- Shengli Highland
- CAN-K
- HMS Group

Many of the capacity additions that impact the market for Progressing Cavity Pumps also impact Multiphase pumps, as both the rotors and the housings are similar and can use common machines. For example, PCM's capacity addition in late 2012 will support both markets. The firm expanded its US plant in Houston for rotor machining and pump assembly. German Seepex also expanded its plant in Texas to handle an increase in orders from shale operations, completing construction in 2013 Q1. The new 15k square foot plant replaces an older one about half that size. Together, these additions reduced industry capacity utilization from 85% in 2012 Q4 to just over 84% in 2013 Q1.

Figure 20: Capacity Margin - Multiphase Pumps



As of 2013 Q2, average capacity utilization for Multiphase pumps is slightly less than 84%. This level is high enough to cause elevated lead times for large orders (more than 10-15 units) or orders for large units (motor sizes over 500 hp).

- Bornemann's US operations are currently 85% utilized on orders from shale plays and oil sands projects in the US and Canada.
- Leistritz is 90% utilized in the US, where orders from shale fields have flooded operations, but only 80% utilized in Germany.
- Colfax, which sells multiphase pumps under its Rosscor brand, is 80-85% utilized, depending on the factory. Its operations in the US are at the high end of that range, while plants in the Netherlands and India are at the lower end.
- CAN-K, a smaller supplier that has so far been limited in scope to Canadian orders, is 95% utilized working on an order for Suncor.
- Framo is 90% utilized due to multiple orders for subsea multiphase systems, a rate that will fall to 80-85% next year when the orders will be mostly completed. Framo only makes subsea systems, though, so this figure is not relevant for the much larger onshore market.
- Tianjin Pumps and Machinery, which licenses multiphase pump technology from Colfax, is only 75% utilized, with plenty of available machinery at its Chinese plant.
- Shengli Highland is similarly 75-80% utilized.

Table 13: Reported or Estimated Capacity Utilization Rates at Selected Multiphase Pump Suppliers

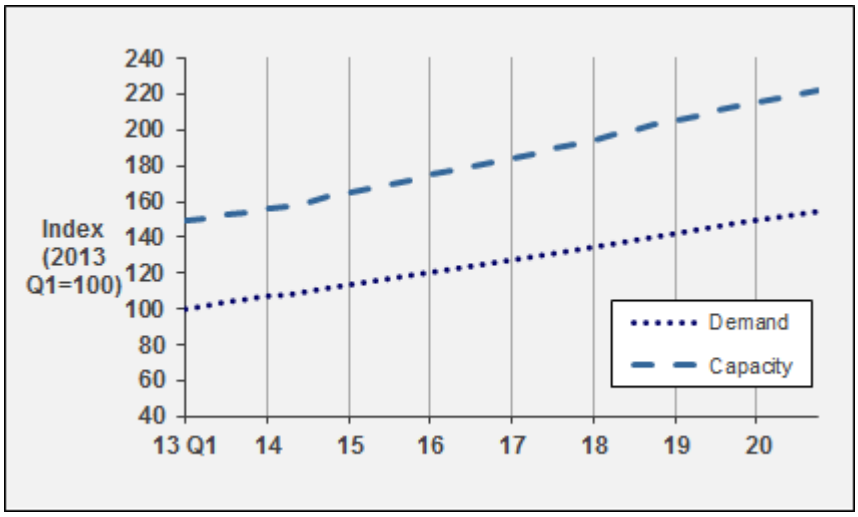
Company	Country	Current Level	12-Month Forecast
Flowserve	China	85%	80%
Leistritz	Germany	80%	80%
Leistritz	US	90%	80%
Netszch	Germany	85%	80%
Bornemann	US	85%	80%
Tianjin Pumps & Machinery	China	75%	75%
Framo	Norway	90%	85%
PCM	France	85%	90%
CAN-K	Canada	95%	85%
Colfax	US	85%	85%
Colfax	Netherlands	80%	85%
Colfax	India	80%	80%
Shengli	China	75-80%	80%

Bornemann, Flowserve, Leistritz, Netzsch, and Shengli will all add capacity over 2013 and 2014. The additions will begin a trend of falling capacity utilization that is likely to continue as manufacturers work to stay ahead of rapid demand growth. The Multiphase Pump market is immature, and if a supplier loses an order because it is out of capacity, or worse, gains a reputation for being too busy to handle major orders, it risks missing out on long term growth opportunities. As a result, industry utilization rates will fall from 84% in 2013 Q1 to 82% by 2020.

- Bornemann is expanding in China and Germany this year. When the Chinese expansion comes online in Q3, it will feature new plant space and machinery. The additions in Germany consist mainly of additional workers and will continue throughout the year.
- Flowserve is also expanding in China, adding space and machinery for casting, machining, and packaging. The program will increase Flowserve's overall multiphase capacity by approximately 10% and reduce the firm's utilization rates from 85% to 80%, net of expected order bookings between now and then.
- Leistritz is adding 20k feet of manufacturing and warehouse space in New Jersey (US), to cope with an influx of orders from US shale plays, particularly the Marcellus and Barnett. It is also hiring machinists in Germany.

- Netzsch is adding capacity in Brazil and India, specifically to support oil & gas orders. The Brazilian expansion consists of hiring more staff and adding three machines. In India, it's adding roofline and expanding the plant's capacity by 25-30%.
- Shengli Highland Oilfield Machinery (which gained twin-screw technology by partnering with Weir) is installing new machinery and hiring workers at its main plant in Dongying, where it has 20k square feet of unused floor space.

Figure 21: Demand vs. Capacity – Multiphase Pumps



The above capacity expansions will increase capacity for multiphase pumps to $45m per quarter by the end of the year. Continuing additions in 2014 will drive utilization rates down to approximately 82% by 2015, which will keep lead times competitive for most manufacturers.

6.1.3 New contracts

Lukoil and CNRL use framework agreements with Bornemann to ensure availability and bring down unit prices. CNPC and PetroChina direct most orders toward domestic suppliers Tianjin Pumps and Shengli. Framo is the main supplier for subsea multiphase systems.

The biggest contracts in the Multiphase Pump market to date, aside from orders for comparatively expensive subsea systems, are the framework agreements Bornemann has with Canadian Natural Resources Limited (CNRL) and Lukoil. The aims of both agreements are to ensure that the buyer has access to enough capacity and to bring down cost by committing to volume.

The relationship with CNRL began with 34 units for the Primrose oil sands in Alberta Canada, beginning in 2002. As CNRL expanded its oil sands operations, it formed the framework agreement to cover its needs for another 40 units over the next five years. Follow-up orders through 2012 brought the total up to almost 150 multiphase pumps. The agreement covers a wide range of sizes,

with unit prices ranging from $65k to $150k. At flowrates of 2.5k bpd on the low end of the pumps in that range, this implies a discount of approximately 20-25% per unit.

Lukoil began placing major orders with Bornemann in 2005 and, as of 2012, had installed 100 total multiphase units in Siberia. Lukoil's relationship is certainly not exclusive though, as it ordered two large units ($130k each) from HMS Group in late 2011.

The main Chinese onshore operators, PetroChina and CNPC, favor domestic suppliers Tianjin Pumps and Shengli. PetroChina ordered 18 units from Tianjin Pumps in Q1 (an order worth $1.3m), to boost production at the Tahe field. CNPC has ordered from both suppliers recently, ordering eight units from Tianjin Pumps for its aging Daqing field from Tianjin Pumps in 2012 Q4 and five units from Shengli for the Shixi field in late 2011. These orders were individually relatively small, approximately $600k and $400k, respectively, partially due to the low unit prices (about $75k per pump). CNPC also ordered units from German Seepex, breaking its habit of ordering from domestic suppliers due to the complexity of the order. The two pumps from Seepex (worth about $105k each) required specialized heating jackets to keep oil viscosity low at temperatures of up to -45 C.

Framo is the main supplier for subsea multiphase systems, followed by Leistritz and Sulzer. The pumps used for subsea applications are typically larger and much higher pressure than onshore units (up to 5k psi vs. typical pressures up to 600-700 psi for onshore pumps), and are therefore usually about twice as expensive for the pumps, drivers, and control systems, and as much as 20 times more expensive at the project scale when including production manifolds, risers, and flow systems.

- Framo (Frank Mohn) is the leading supplier of subsea, helico-axial multiphase pumps, using a design it co-developed with multiple oil companies as part of the Poseidon joint research project. The firm's recent order wins in this category include pumps worth $3.8m from Petrobras' Barracuda project (delivered in 2012), a $10m order from Shell in Norway, and an $8m order from Total in Angolan waters.
- Leistritz delivered 16 multiphase pumps for subsea operation to PEMEX in 2011, for the Ku-Maloob offshore field in an order worth $21.5m. The 2,500 hp units were manufactured in Germany, then packaged in the US, designed to pump 12k bpd of oil and 13m cubic feet of gas per day. These units are the only large twin-screw units currently operating subsea.
- Sulzer is a viable supplier in the subsea market, supplying a $1.5m subsea unit to ConocoPhillips in 2012 for use at its Bohai offshore operations.

Table 14: Summary of New Contracts and Estimated Values for Multiphase Pumps

Buyer	Country of Installation	Supplier	Product	Estimated Value ($k)	Estimated Cost/Unit ($k)
PEMEX - KuMaloob	Mexico	Leistritz	16 subsea units	$21,500	$134
CNRL	Canada	Bornemann	148 pumps for heavy oil. Unit prices from $65k to $150k,	$12,580	$85
Shell	Norway	Framo	5 subsea units	$10,000	$200
Lukoil	Russia	Bornemann	100 total units operating in Siberia, order dates range from 2005-2012	$9,300	$90
Total E&P - Girassol	Angola	Framo	4 subsea units	$8,420	$210
Petrobras - Barracuda	Brazil	Framo	2 8k bpd units	$3,800	$190
ADCO	UAE	Flowserve	2 super duplex units	$1,880	$94
ConocoPhillips - Bohai	China	Sulzer	2 subsea units	$1,500	$75
Petrochina - Tahe	China	Tianjin Pumps	18 units	$1,260	$70
CNPC - Daqing	China	Tianjin Pumps	8 units	$590	$74
Suncor - Fort Hills	Canada	CAN-K	6 units for the Fort Hills bitumen project	$570	$95
CNPC - Shixi	China	Shengli	5 units	$380	$80
Chevron - Liaohe	China	PCM	4 units for crude oil transfer, 3k bpd each	$360	$90
Cairn India	India	Colfax	4 units, rated for 175 psi	$300	$75
Lukoil - Menzilinskoye	Russia	HMS	2 units up to 90% GVF (100% for short periods)	$250	$125
CNPC - Karamay	China	Seepex	2 units for up to 30% GVF	$210	$105
Qatargas	Qatar	PCM	Mobile skid	$130	$130
Kodiak - Bakken	USA	Leistritz	1 300 hp unit servicing 17 wells	$175	$175

6.2 Analysis

6.2.1 Costs

Global cost levels will rise 2% in 2013 and a total of 15.5% by 2020 Q2 on increases in labor and metal costs, fastest in Asia.

Costs for labor and benefits are the largest category in the cost structure for Multiphase Pumps, accounting for 40% of the total. “Professional” labor costs alone make up 20%, higher than the other categories due to the amount of custom engineering required for each multiphase system. In order to specify and build a multiphase pump, numerous variables must be determined exactly, including; average gas void fraction (GVF) and standard deviation, gas composition, particulate percentage and composition, maximum particle size and distribution, fluid viscosity, temperature, pressure (suction and discharge), flow rate, and whether or not slug flow is a possibility for the well or wells. Production labor and benefits each make up about 20% of the total cost structure.

Metals account for 23% of total costs, higher than for Centrifugal Pumps because, on average, multiphase pumps require upgraded metallurgy such as stainless steel or even superalloys such as hastelloy more frequently.

Motors make up approximately 20% of the overall cost structure although, as with the other pump categories, this is one of the most highly variable inputs in terms of relative percentage. Motor horsepower is one of the most frequently changed variables, depending mostly on flowrate and viscosity, and changing the motor size can as much as double the motors cost in relation to the same pump size.

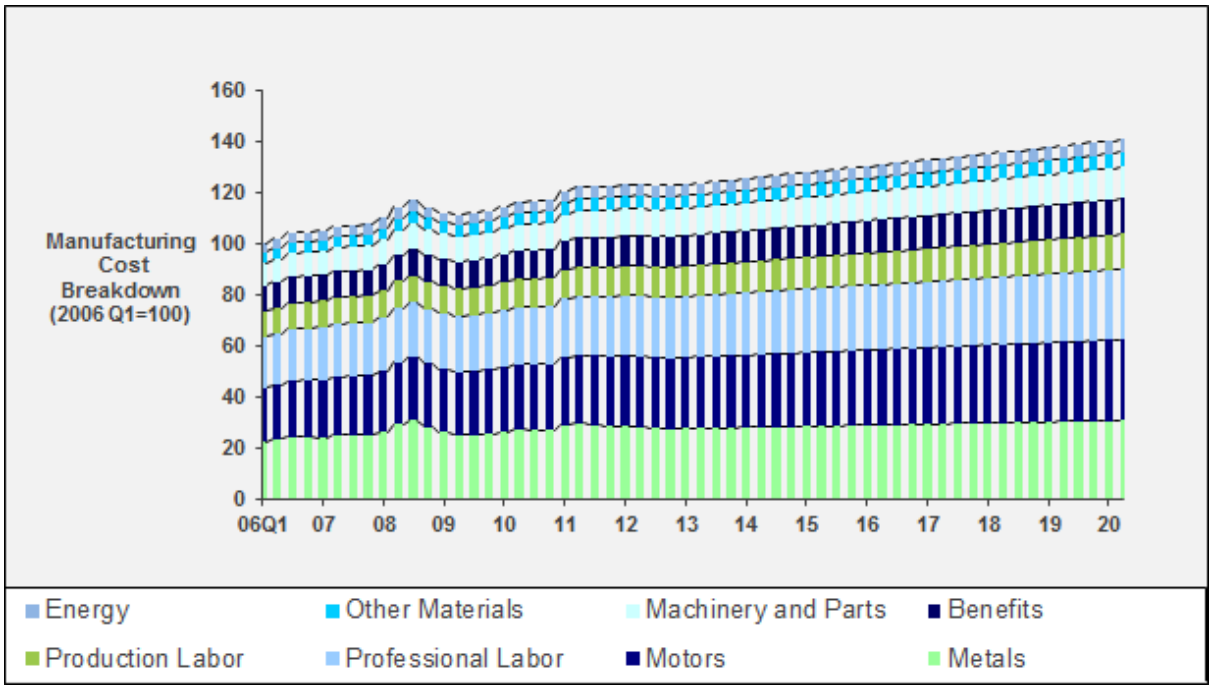
Capital costs for machinery, including lathes, milling machines, grinders, and welding machinery, as well as costs for component parts such as bearings, couplings, and gaskets, make up most of the remainder of the cost structure – about 15%.

Overall global cost levels rose 0.5% in Q1. The increase was driven by, as with the other pump categories, increases in labor cost growth in Asia – due to rapidly rising standards of living there and a comparative shortage of engineering graduates – and rising motor prices – partially due to higher costs for copper windings. Due to the rapid pace of Asian labor cost growth, cost levels rose nearly 1% in Asia, compared to just 0.25% in the other two regions.

Asian labor costs will continue to be the main driver of overall cost inflation, rising approximately 1% per quarter and pushing global cost levels up 2% for the year.

Costs for labor and metals will drive cost levels for Multiphase Pumps up 2-2.5% per year from 2013-2020, for a total of 15.5% globally, slightly faster than PCPs due to the higher percentage of labor in the cost structure. Asian costs will, again, grow fastest at a cumulative 17% by 2020 Q2 on rapid labor cost growth. In contrast, costs will rise 14% in the Americas and 12% in EMEA.

Figure 22: Cost Structure for Multiphase Pumps



Note: Prices are ex-works.

6.2.2 Profit Margins

The leading PCP manufacturers have average net margins of 8% and operating margins of 15.5% due to their focus on high-value oil & gas applications and a lack of major competitors that manufacture solely in Asia.

Margin levels for Multiphase Pumps are less transparent than for most pump types. This is partially because the market for these pumps is small, so fluctuations in margins on individual projects can have an impact on the overall industry. Margin levels vary widely by project depending on the complexity of the system, the eagerness of the manufacturer to win a given order, and the cost performance of the individual project. For example, cost overruns and design changes during the course of the Barracuda project cut into Framo's margins for multiphase systems for both 2011 and 2012. Also due to the small size of the market, margins for multiphase projects are difficult to separate from margins for the much larger divisions that encompass pump manufacturing. In addition, many of the key suppliers, such as Leistritz, Netzsch, PCM, and CAN-K are private companies that do not disclose financial data.

Multiphase Pump projects typically make slightly higher margins than average for PCP suppliers, already fairly high due to their focus on the oil & gas industry. Of the companies that report the data (Flowserve, Colfax, Sulzer, and GE), net margins for the relevant divisions average 9%, with operating margins of just over 15%.

Margin for multiphase projects levels at private companies are consistent with this average.

- Bornemann generates a net margin of approximately 10%, and operating margins close to 20%. It cites the high level of billable engineering hours for each project as the main reason for its healthy margins. These margins may be in danger to Bornemann's acquisition by ITT, as ITT is accustomed to the market structure and pricing patterns of the centrifugal pump market – where lower margins are the rule.
- Leistritz makes slightly lower margins than Bornemann, 8% and 15% respectively, due to an intentional move on Leistritz's part to undercut Bornemann's prices. It regards the other German firm as its main competitor in terms of product line match and target markets.
- Netzsch, another German manufacturer, also typically earns net margin of 10% on multiphase projects.

Larger units, with higher pressure and GVF tolerance, are generally more lucrative for manufacturers, due to the higher percentage of engineering involved – which is predictable in terms of engineering billing rates. However, higher margins for more highly specified pumps are not guaranteed, as installation-stage customizations and reengineering can end up being costs that the manufacturer has to eat to maintain customer relationships.

Margins are also heavily customer-dependent. Multiphase technology is a fairly recent commercial adoption for most companies, and because the market is so small suppliers are willing to give up margin for major order wins, especially from an end-user that is just beginning to use multiphase pumps.

Going forward, rising demand and a rapidly increasing market size will give suppliers the opportunity to raise average margin levels by approximately 3%. This is not as much as in the other pump categories because suppliers are competing to maintain market share in this relatively immature sector.

3. Prices

Prices will rise 2.5% in 2013, slightly faster than costs increase as rapid demand growth gives suppliers pricing leverage. This pattern will continue through 2020, and prices will increase a total of 18% by 2020 Q2.

Global prices increased 0.5% in 2013 Q1, following price increases of 4% last year. The growth was driven by rising Asian labor costs and motor prices, as described in the costs section. Prices will rise a total of 2.5% for the year, only slightly higher than cost growth levels as aggressive demand growth gives suppliers some pricing leverage.

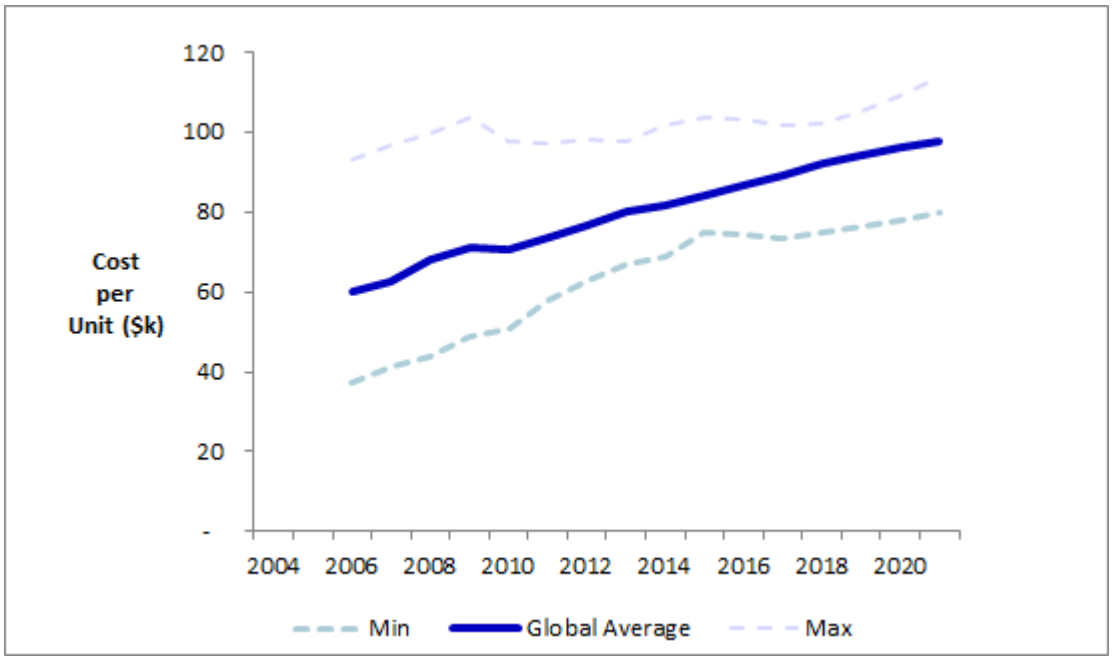
- Suppliers that are fully utilized, notably Framo and CAN-K, are quoting higher on new projects, simply because they do not fear losing orders as much as competitors with lower utilization rates.
- Colfax is pushing slight price increases to fund capacity expansions in Sweden and India.

- Shengli and Tianjin Pumps are pointing to labor cost increases to justify slight price increases.

Price growth will continue to outpace cost increases through 2020 as suppliers leverage strong demand growth and the revenue stability that will come with a larger market size. As explained in the margins section, this practice will be limited by suppliers' desire to encourage more end users to adopt multiphase technology and gain new customers. Overall prices will rise a total of 18% by 2020 Q1, compared to global cost increases of 15.5%.

The price increases will be fastest in Asia (19%), due to faster labor cost growth there. Prices will grow about 16% in the other two regions.

Figure 23: Overall Price Forecast for Multiphase Pumps



The reference unit for Multiphase Pumps is an API 676 twin-screw design, with tool steel screws and a carbon steel housing, designed for maximum pressure of 600 psi and a flow rate of 3k bpd, with a 150 hp motor. At benchmark US price levels, this unit would cost approximately $91.5k.

Regional price variations for Multiphase Pumps are fairly consistent with those in other categories, although the regional price advantage for the traditionally low-cost regions is smaller because of the higher percentage of engineering labor. This narrows the price advantage for India, China, and Russia by one to two percentage points.

As with the other pump categories, most pumps include components from a mix of regions. For example, Leistritz manufactures critical components such as rotors in Germany, and conducts packaging and assembly operations in the US for orders from the Western Hemisphere. Colfax's pumps are a mix of components manufactured in Sweden, the Netherlands, the US, and India. Flowserve and Sulzer manufacture globally as well. Tianjin Pumps and Shengli Highland offer

pumps made exclusively in China, but they have yet to gain acceptance outside of their home country.

Examples of contract price differences based on regional manufacturing patterns include:

- Colfax sold four units to Cairn India for its Rajasthan field, which it manufactured in India at a unit price of approximately $75k. The pumps were close to the reference unit in specification, implying a discount of 80-85% from the reference unit price of $91k, not adjusting for any economies of scale.
- Tianjin Pumps sold 18 multiphase pumps to PetroChina for approximately $70k each, which included a volume discount.
- Tianjin also sold eight comparable units to CNPC for $74k a piece.
- PCM, based in France, sold four multiphase units to Chevron for $90k each.

Table 15: Regional Price Variations over Time for Multiphase Pumps

Region/Country	Today	2014	2015	2020
North America	1.00	1.02	1.01	1.09
Latin America	0.95	0.99	1.01	1.16
Europe	0.97	0.98	0.98	1.05
Africa	N/A	N/A	N/A	N/A
India	0.83	0.85	0.86	1.01
Russia	0.84	0.88	0.89	1.06
China	0.84	0.85	0.84	0.90
Japan	1.11	1.13	1.13	1.16
Other Asia	0.84	0.84	0.84	0.90

6.3.1 Price Differences by Technology, Model, and Feature

Pump size is the most important cost determinant, followed by metallurgy.

Pump size is the most important factor in determining the cost of the unit. Increasing outlet diameter from 6" to 7" raises the cost of the unit by $44k, (nearly 50%). Multiphase pumps are comparatively metal-intensive, because they use two rotors and have a heavier casing.

Table 16: Incremental Cost per Extra Parameter or Feature for a Multiphase Pump
(Reference unit is an API 676 twin-screw design, with tool steel screws and a carbon steel housing, designed for maximum pressure of 600 psi and a flow rate of 3k bpd, with a 150 hp motor)

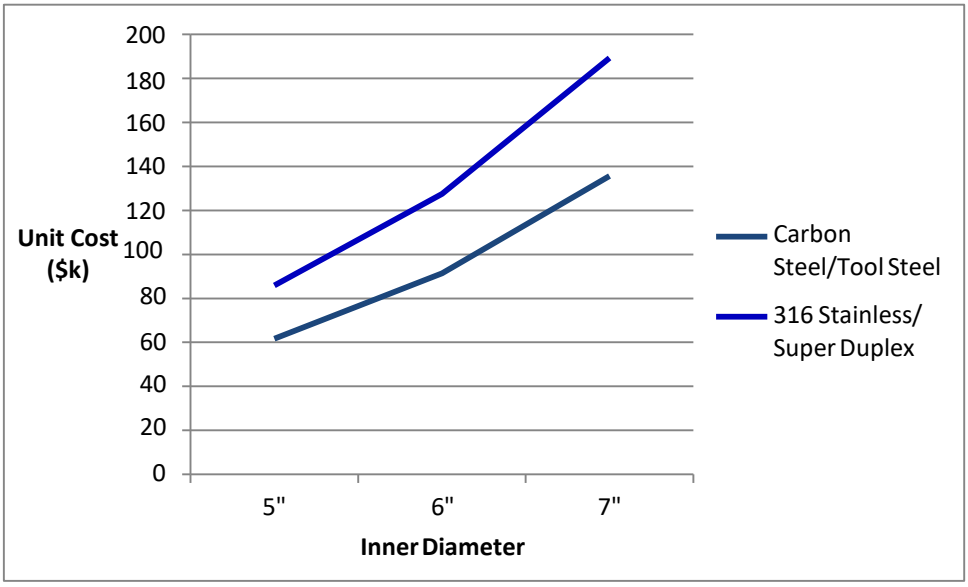
Parameter or Feature	Unit of Measure	Indicative Cost Impact	Notes / Comments
Pump Inner Diameter(ID)	Inches (6" as reference point)	Reducing ID to 5" cuts cost by $30k, raising it to 7" adds $44k.	Cost increases accelerate slightly with diameter.
Motor Size	150 hp as reference point	Stepping down to 100 hp costs 10% less. Upgrading to 200 hp costs 15% more.	Required motor size increases with viscosity (API gravity).
Material	Carbon steel as reference point	+40% for stainless steel 316	Cost increase for stainless is less than the other categories due to the already higher screw specification.

Note: Changing one parameter usually involves changing others, and the cost impact may not be additive or linear.

Upgrading from carbon steel to stainless steel increases the cost of a pump by approximately 40%. This is lower than for any other category because the reference unit already has upgraded metallurgy (tool steel).

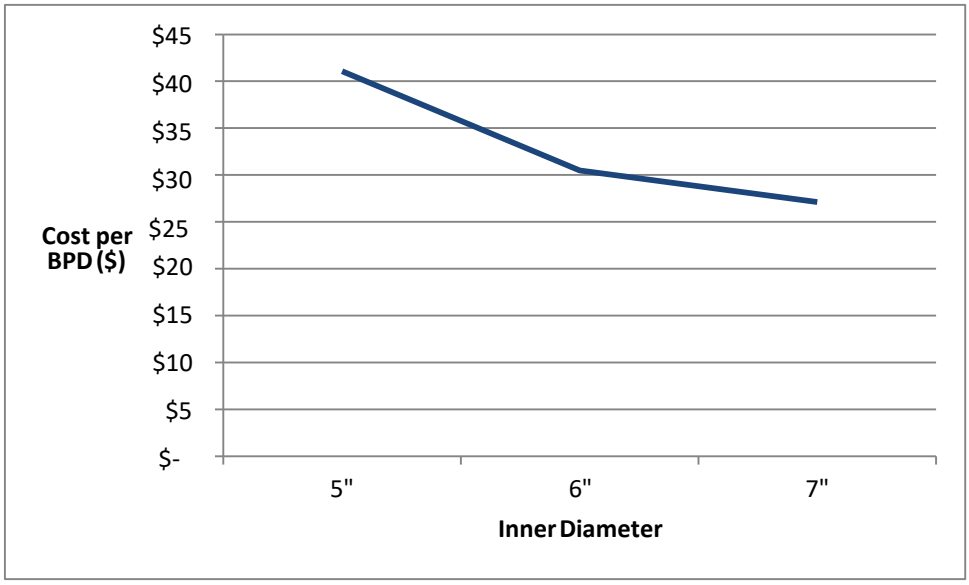
Increasing the size of the motor from 150 hp to 200 hp typically costs about 15% more. For the reference unit, this would equate to an additional $14k. This number is highly variable depending on motor specifications though, such as efficiency rating, however, and could be a much larger percent increase.

Figure 24: Multiphase Pump (150 HP Motor) Size vs. Cost - By Material



Cost per barrel per day of flow falls gradually as the size of the unit increases. For the reference unit, with a flow rate of 3k barrels per day, the cost per barrel per day is $30. Increasing the unit's outlet diameter reduces that cost to $27.

Figure 25: Cost per unit of Output



Economies of scale can reduce the unit cost of an order by as much as 25%, according to manufacturers such as Colfax, Leistritz, Bornemann, and Netzsch. Ordering similar units amortizes the cost of engineering hours over multiple pumps, although each unit typically requires some customization at installation. Long production runs also minimize lost time due to machinery setups and scrappage.

Figure 26: Economies of Scale in Multiphase



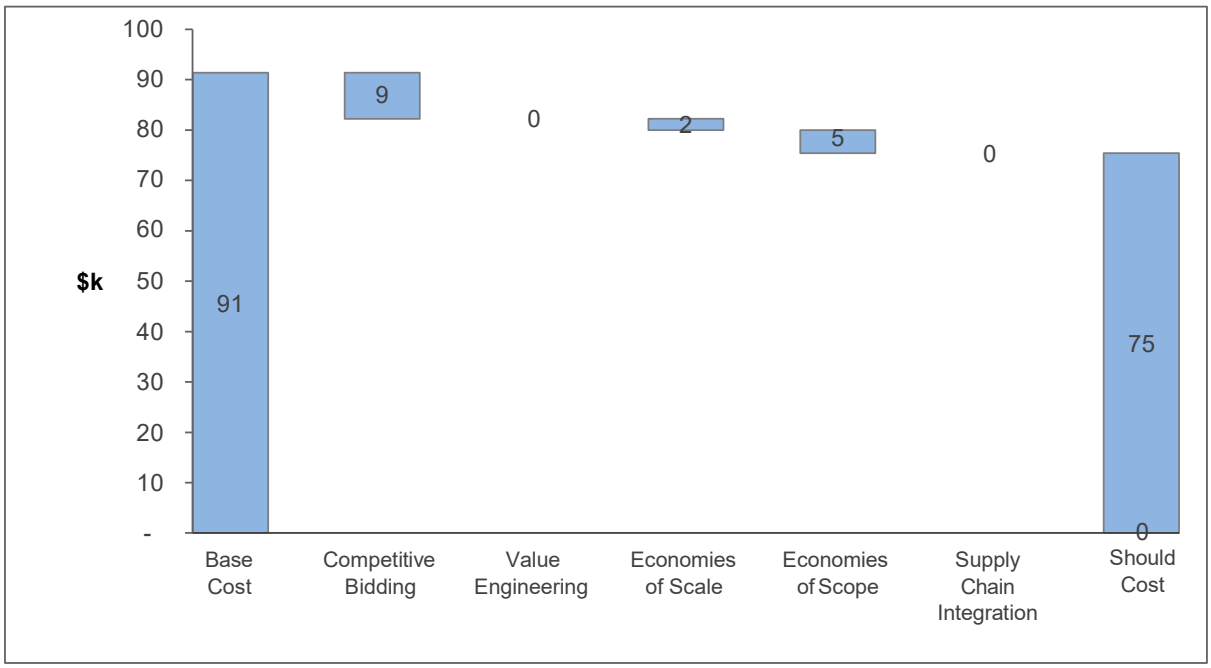
6.3.2 Should-Cost Analysis

As indicated above, manufacturers are willing to reduce unit prices by as much as 25-30% to win major orders. This level of discount is only available for extremely large orders of 50 or more units though. As a result, most buyers do not realize cost reductions that substantial. At the reference order quantity of five, any discount is likely to be in the range of 2-3%.

Competitive bidding is a stronger lever for Multiphase Pumps than for most categories. Due to the small market size, most suppliers bid aggressively for each order, as each new customer is one that is more likely to stay with them for future orders. Competitive bidding can reduce unit prices by as much as 10% if the order comes from a large end user that is likely to place follow-up orders.

As with the other pump categories, economies of scope are also a potential lever for buyers to bring down prices. Tendering multiple categories of pumps together can yield savings consistent with the average for Pumps, about 5%.

Figure 27: Should-Cost for Multiphase Pumps



6.4 Price Negotiation Strategies

1. Approach Flowserve and Leistritz with framework agreements similar to the ones Bornemann has instituted with Canadian Natural Resources Limited (CNRL) and Lukoil. Bornmeann has delivered approximately 250 multiphase pumps under these agreements, at apparent discounts of up to 30%. The other major suppliers will be willing to trade discounts for committed volume, and eager to match Bornemann's stable order book.
2. Bornemann margins can be targeted for Multiphase Pumps as well as for PCP by accelerating its integration into ITT, and its pricing structure into its new parent company's. ITT typically makes net margins of only 5-6% for its Centrifugal Pump operations, while Bornemann's net margin is approximately twice as high. According to Bornemann, ITT is forcing organizational changes at its new subsidiary, and pricing methods are one of them. Bringing Bornemann's margin levels into line with ITT's would reduce pump prices by 5-7%.

7 Electric Submersible Pumps (ESPs)

7.1 Market Overview

Table 17: Key Indicators for ESPs

(Total Change over Each Period)

Key Indicators	Q1 2013 – Q1 2015		Q1 2013 – Q1 2020	
Demand Growth	▲	8.2%	▲	39.5%
Demand ($m)	▲	1,034-1,119	▲	1,047-1,442
Capacity Utilization	▲	1.7%	▲	0.5%
Prices	▲	6.5%	▲	21.1%

7.1.1 Demand

The market for ESPs is strong due to the boom in drilling and their versatility in many different types of wells.

ESPs are used in about 15-20% of wells worldwide. ESPs are more cost-effective at creating artificial lift for most deep wells than hydraulic lift sucker rod pumps, which are powered by an energy source at the surface. Given their widespread advantages over other modes of artificial lift, as the number of wells drilled increases rapidly, the demand for ESPs rises also. Gas lift involves less infrastructure cost, but requires more engineering and preparation than sinking an ESP down a hole. Capillary lift is an alternative, but requires monitoring and control.

Although overall rig count has not changed significantly on balance (despite monthly swings of up to 10% up and down, the total rig count is down 8% on a 12-month basis), increase drilling for heavy oil and in deeper wells is driving growth in demand for ESPs.

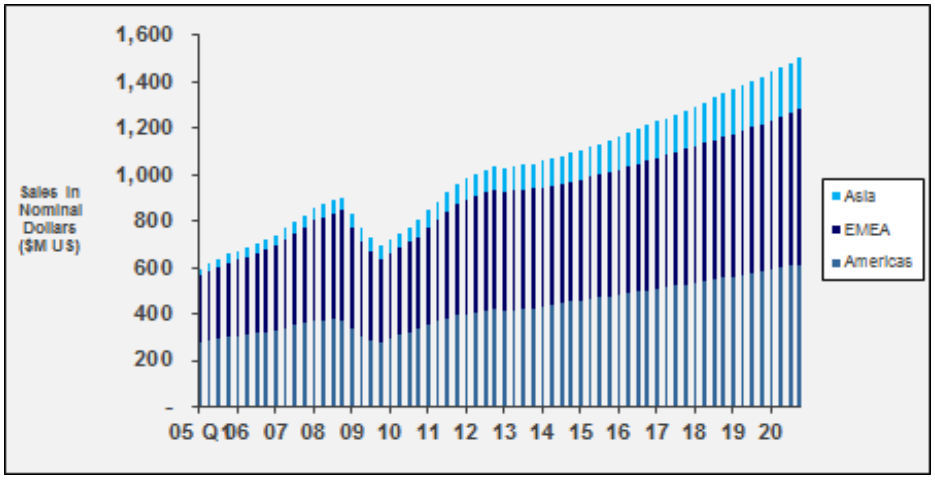
An increasing number of heavy oil environments such as Venezuela and Canada is driving demand for ESPs. Venezuelan extra heavy oil production will grow at a 6.6% compound annual rate through 2035, compared to 1.2% annual growth rate for conventional oil during the same period, according to the IEA. Heavy crude will grow from representing 1.4% of OPEC production to 12.9% of OPEC production by 2035, according to the IEA.

ESPs are a preferred tool for pumping heavy crude, not only because of the near-universal ability to drop an ESP down a wide variety of wells, but also due to their ability to pump heavy oil up from deep wells (with the right motors and design parameters). ESPs can require less capital cost to set up than rod lift pumps ("rod suckers"), which are the most prevalent type of artificial lift; hydraulic jet pump; gas lift pumps; and plunger pumps.

ESPs may also be the only effective solution for creating lift in deep and deviated wells. In these wells, other tools become jammed and/or can't operate horizontally, whereas ESPs can. The number of deep wells is growing rapidly. In the US, the average depth of crude oil, natural gas, and dry exploratory and developmental wells drilled increased by 24% between 2000 and 2008, and the depth of natural gas exploratory wells increased by 36%.

ESPs, however, are not suitable for many offshore applications, which means they are not strongly affected by the rapid growth seen in the offshore oil & gas exploration and production. The total non-US offshore rig count rose by 4.7% in April, compared to only 1.9% for onshore rigs. This tempers their growth somewhat, as a large share of drilling activity is currently offshore. Deepwater offshore pumping is better suited to progressing cavity pumps, which can handle the high head rates inherent in deepwater drilling.

Figure 28: Demand for ESPs



After a slow start in Q1 due to the seasonal breakup and declining rig count in Canada, ESP demand will grow at marginally over 1% in the last three quarters of 2013, for overall growth of 2.8% this year.

Global demand growth will accelerate beginning in 2014, to 4% in 2014 as aggressive capital expansion programs at national oil companies like Saudi Aramco and PdVSA's convert into actual drilling and production activity.

Demand will increase to 5.0-6.2% throughout 2015-2018 as the emergence and gradual acceptance of Asian-sourced, low-cost ESPs and components reduces the relative cost of ESPs to alternative methods of artificial lift.

During the 2018-2020 period demand for ESPs will hold steady at 5-6% per year as the underlying fundamentals remain stable.

2. Supply (Capacity)

GE/Wood Group, Borets/Weatherford, and Halliburton have invested in ESP capabilities and competitive advantage.

In 2008, Borets International (Russia) acquired 62% the ESP division of Weatherford International. Weatherford International, particularly for its Coal Bed Methane (CBM) group (the ESP division).

In 2011, GE (US) bought Wood Group's ESP business to offer complete solutions, as it has done in many other areas, such as motors and downhole drilling tools.

In 2011 (Q4), Halliburton (US) entered the ESP business.

Today, the top suppliers are:

- Baker Hughes (Centrlift and SmithLift brands) (US)
- Schlumberger (REDA brand) (French-owned but Houston-headquartered)
- GE Oil & Gas Artificial Lift (along with its acquisition of Wood Group ESP Inc.) (US)
- Flowserve (US)
- Borets (Russia)
- Novomet (Russia)
- Weatherford Artificial Lift (US)
- Canadian Advanced (Canada)
- Flotek Pump Services (US)
- Halliburton Artificial Lift (US)
- Summit ESP (US)
- Al Khorayef Petroleum (Saudi Arabia)
- Alnas (complete ESPs, Russia)

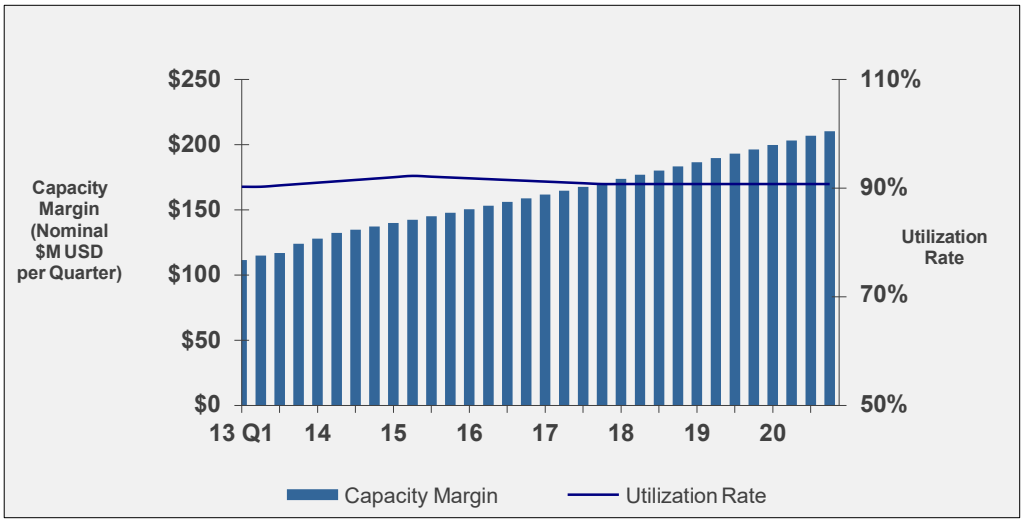
There is tightening capacity in the industry to handle major project requirements. In aggregate, there is approximately $120m of available capacity per quarter, or $480m per year. Based on the number of wells drilled per year, and the percent of them that will deploy ESPs, this amounts to the ability to service several thousand unplanned, unexpected wells that are not factored into the ESP manufacturers' baseline business planning. While this is a sizable buffer, an accumulation of large projects could stretch the capacity of the major, preferred, suppliers for such projects.

In event of a supply crunch, oil companies can tap smaller suppliers and suppliers in emerging economies. There is a large number of suppliers of smaller ESPs, as well as components and accessories, which could expand to fill requirements. These include, for example:

- Artificial Lift Company, a Houston-based company that makes ESP motors
- ILI Technologies, a Calgary (Canada) company that makes small ESPs
- ZEiTECS, a Houston-based company that makes shuttles and retrieval tools
- DynaFlo Artificial Lift Systems , an Oklahoma (US)-based company that makes ESPs and artificial lift solutions

- Ebara, a Japanese pump company that makes some smaller sizes of ESPs
- Tianjin Fulanke Electric Motor, a Chinese ESP motor supplier that also offers some full ESPs
- Rentzel, a US submersible motor supplier that offers some ESPs for downhole oil and gas applications
- RMS PumpTools, a UK-based company that makes ESP bypasses and accessories

Figure 29: Capacity Margin – ESPs



The leading suppliers are the most in demand, and some are operating around the clock, while broader pump manufacturers are about 80-90% utilized, and smaller suppliers and suppliers in developing economies have abundant excess capacity.

The top, leading and recognized ESP suppliers (Baker Hughes, Schlumberger, and GE-Wood Group) are or were recently operating at 90-100% of capacity. Baker Hughes, the market leader, is working around the clock (5 days per week, 24 hours a day). Flotek is working 12 hours per day, 5-7 days per week.

More diversified suppliers that make ESPs as well as a broad range of other pumps are slightly less in demand. Flowserve is operating at about 85-90% of capacity. Since it stocks its motors, it can operate at high utilization rates and still not develop extended lead times.

Suppliers in emerging economies, especially China and Russia, have abundant capacity. Novomet is 70% utilized, and Chinese suppliers are collectively operating at about 50% utilization rates. In addition, as mentioned, smaller suppliers and component suppliers can increase capacity to fill requirements.

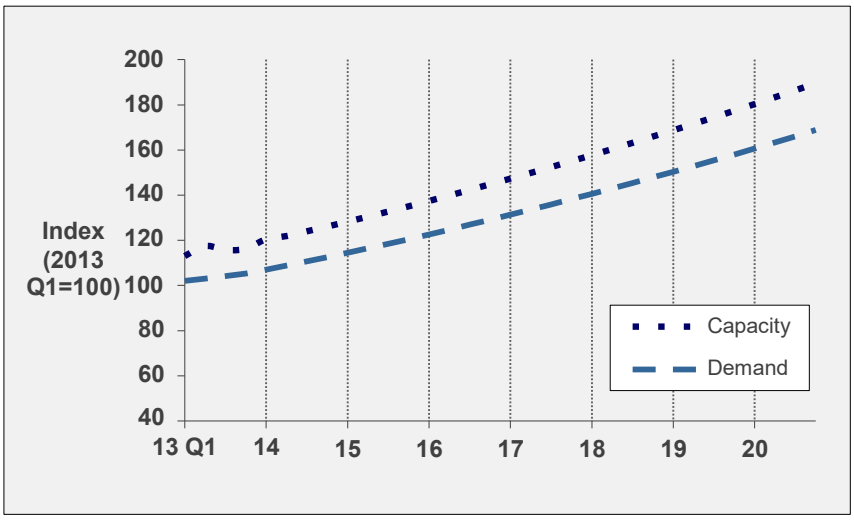
Table 18: Reported or Estimated Capacity Recent Utilization Rates at Selected ESP Suppliers

Company	Country	Current Level	12-Month Forecast
Baker Hughes	USA	90%	91%
Schlumberger	USA	90%	94%
Wood Group	USA	90%	90%
Flowserve	USA	90%	90%
Novomet	Russia	70%	80%
Dongying Huahao	China	50%	55%

Order lead times range from several days (for stocked ESPs) to 8-10 weeks for orders of up to about 10 units. Larger orders require planning and could take several months, depending on the quantity and the complexity of the specifications.

- Baker Hughes (Centrilift) is offering lead times of 2-7 days for standard ESPs from stock, and eight weeks for non-standard (stainless steel, etc.).
- Flotek also takes only 1-2 days to have standard units ready.
- Novomet is quoting 8-10 weeks for an order of 10 ESPs, and 14-16 weeks for an order of 50. An order of 100 units would take 30 weeks or more.

Figure 30: Demand vs. Capacity – ESPs



3. New contracts

Total and BP awarded several large ESP contracts to Schlumberger and Baker Hughes in the 2010-2012 period:

- In October 2012, Total signed a $200m contract with Framo Engineering, a Schlumberger company, to deliver ESPs for its Girassol Resources Initiatives project off Angola. The multiphase pump system, which will operate at 1,350 m water depth, will boost flow from two production flow loops. The contract covers a complete system of topside power and control and two subsea pump modules. The pump system is a follow-up to two other systems installed for Total off of Angola. It is based on a helico-axial technology capable of a record differential pressure of up to 120 bar. The system will be assembled and tested at Framo in Horsoy, Norway, and will be delivered in the summer of 2014. The price was not revealed. Due to the location of installation and the subsea requirements, we assumed each ESP was sold for about twice the normal price.
- BP also signed a notable high-value ESP contract for its Rumaila (Iraq) operations (in 2010). BP awarded, in a clearly managed competitive bid to prevent corruption, two two- year ESP contracts together worth approximately $100 million. The contract covers the pumps and their installation. The award went to Baker Hughes Centrilift and Al-Khorayef Petroleum. Contracts in Iraq are often delivered at multiple times accepted benchmark rates due to the paucity of suppliers willing to perform installation; for purposes of the table below we assumed a 200% markup above market rates.

More recent contracts include ones contracted by CNOOC, Xcite Energy, and others.

CNOOC ordered ESPs from Schlumberger for 144 wells over a six-year contract for delivery in South Sumatra, Indonesia. The contract was valued at $8.7m.

Xcite Energy ordered 20 ESPs from Schlumberger for its Bentley field in the North Sea. The contract covers not only the ESPs, but also Schlumberger's IntelliZone* zonal management and a surface-controlled isolation valve system, which allows flow control of two horizontal wellbores. The ESPs have variable speed drives to generate the required amount of lift. 14 control lines were installed. For purposes of the table below, the estimated ESP cost is separated from the zonal management and associated valve system and management services.

Petrobras signed a 5-year contract for artificial lift services from Schlumberger. The contract includes 23 electrical submersible pumps, 8 of which will operate on subsea wellheads. Four pump configurations will be installed using REDA Maximus* electrical submersible pump. For purposes of the values in the table below, the subsea units are assumed to be priced significantly above the benchmark ESP price due to their subsea requirements. It is further assume that the artificial lift services are equal in value to the price of the pumps themselves.

Chevron ordered 1200 hp ESPs from Baker Hughes for seven wells, plus mud line packers for three injection wells for its Gulf of Mexico deepwater Big Foot Project. The units' extra large hp motors and mud line packers are factored into the estimated cost in the table below.

Geovol ordered a 30 meters long ESP from Canadian Advanced. The value of the contract was not disclosed; the amount in the table below is an estimate. The contract was a large one for Canadian Advanced, a relatively small supplier based in Edmonton, Canada.

Exxaro, the South African mining company, ordered 14 artificial lift pumping systems from Franklin Electric, a supplier of pumping systems for alternative energy companies. Franklin Electric has been developing and testing artificial lift products for application in coalbed methane, shale gas, and oil-stripper fields. The order from Exxaro was a major success for the supplier.

Table 19: Summary of New Contracts and Estimated Values for ESPs

Buyer	Country of Installation	Supplier	Product	Estimated Value ($m)	Estimated Cost/Unit ($m)
Total E&P	Angola	Schlumberger	Multiphase submersible pumps	$200.0	$ 219
BP	Iraq (Rumaila) (2010)	Baker Hughes/ Al Khorayef	ESPs and associated services	$100.0	$ 328
CNOOC	Indonesia	Schlumberger	6 years electrical submersible pump contract on 144 wells	$ 8.7	$ 60
Xcite Energy	Mexico	Schlumberger	20 units of submersible pumps	$ 2.2	$ 109
Petrobras	Brazil (2012)	Schlumberger	5-year contract for artificial lift services, including 23 electrical submersible pumps, 8 of which will operate on subsea wellheads. Four pump configurations will be installed using REDA Maximus* electrical submersible pump technology.	$ 7.2	$ 157
Chevron	USA GoM (2011)	Baker Hughes	1200 hp ESPs for 7 producing wells, plus mud line packers for three injection wells for their Gulf of Mexico deepwater Big Foot Project	$ 2.1	$ 300
Geovol	Germany	Canadian Advanced ESP	1 ESP, 30 metres long and less than 20 centimetres in diameter	$1.7	$1,740
Exxaro	South Africa	Franklin Electric	14 artificial lift pumping systems	$ 1.5	$ 109

7.2 Analysis

7.2.1 Costs

Costs are expected to rise 3.6% this year due to a large increase in motors costs in Q1, after which they will taper back to 1.8% per year for 2014-2017

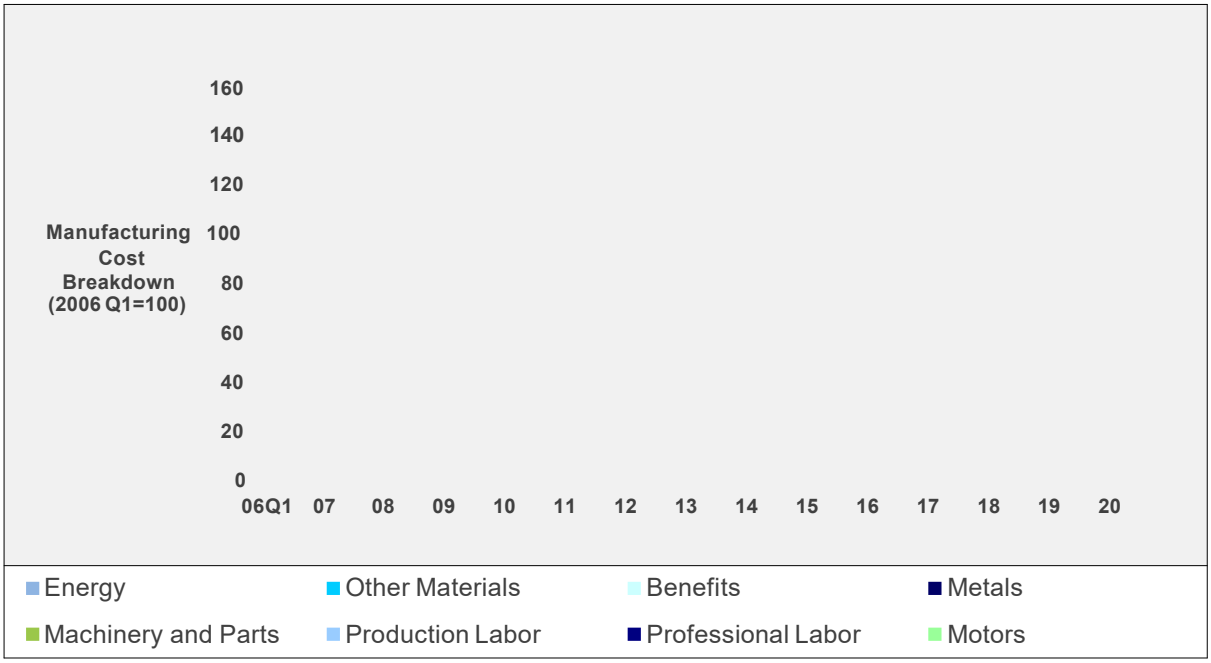
Labor makes up the largest part of ESP costs, at 31%, including both professional labor and production labor. Both types of labor costs are relatively stable, with the exception of fast-rising Chinese labor costs. Globally, wages have been rising at 2-3% per year and will continue to do so, globally, although European wages are growing slower than Asian wages. Benefits, another significant cost component of ESPs, typically increase proportionally with labor costs.

Motors are the largest cost component of ESPs, at 20% of the total cost. Since most motor components, and many motors themselves, are made in Asia, rising Asian labor costs caused an increase in motors costs during Q1.

Machinery and Parts, metals, and other materials constitute the rest of ESP costs.

Overall, ESP costs will rise 3.6% this year due to the increase in motors costs in Q1, then will fall back to 1.8% per year growth during 2014-2017.

Figure 31: Cost Structure for ESPs



Note: Prices are ex-works.

2. Profit Margins

The leading ESP suppliers earn an average of 11.4% operating margin and 6.1% net profit margin.

Schlumberger and Halliburton earn higher margins than the other suppliers due to their value-added artificial lift services and bundling of ESP prices in the total.

- Baker Hughes earned an operating margin of 10.3% and a net margin of 6.1%.
- Flowserve earned an operating margin of 23.7% and a net margin of 9.4%.
- GE earned an operating margin of 12.6% and a net margin of 9.4%.
- Halliburton earned an operating margin of 14.6% and a net margin 9.3%.
- Schlumberger earned an operating margin of 15.9% and a net margin of 13.0%.

- Weatherford earned an operating margin of only 2.0%, and lost 5.1% on its bottom line (net margin), due to a combination of factors, including the devaluation of the Venezuelan bolivar, accountancy fees, and slower-than expected growth in international operations.

Most other ESP suppliers earn about 9% net margin on a 12-15% operating margin.

ESP suppliers earn higher margins than industrial pump companies. Ebara, which sells some ESPs but only competes marginally in this area and is primarily and industrial pump supplier, only earns an operating margin of 5.6% and a net margin of 0.7%.

It is well-recognized in the ESP industry that suppliers charge what the market will bear. If oil prices rise, this gives them the ability to push through higher prices with embedded higher profit margins.

3. Prices

ESP prices vary widely, depending on dozens of engineering parameters. They are among the most non-transparent of any oilfield equipment, often being embedded in total artificial lift services costs. Sometimes ESPs are priced on the basis of amount of oil pumped.

Suppliers prefer to avoid breaking out ESP prices, partly due to the complexity of the artificial lift solution, and partly to prevent buyers from negotiating on the price of the equipment independent of the services.

Total installation cost can vary from $30-300k, depending on depth, temperature, viscosity, density, head, and numerous other parameters.

The ESP only represents about a quarter of the total installation required. The equipment, including the various auxiliaries, costs, in rough proportion:

- ESP (24%)
- Drive (17%)
- Cable (14%)
- Motor (9%)
- Skid (7%)
- Step-up transformer (6%)
- Phase shift transformer (5%)
- Seals (4%)
- Sensor (4%)
- Charge pump (4%)
- Gas separator (3%)
- Communications equipment (2%)

In addition to the many cost drivers inherent in the 'system installation costs,' the choice of actual pump, and hence its cost, can vary widely, depending on a large number of technical factors, such as:

- Whether the well is drilled vertically or horizontally
- Head, which is determined by depth and down-hole static pressure
- Productivity index (PI) (the ratio of liquid flow to pressure drawdown)
- Casing size
- Perforation depth
- Desired production rate
- Gas oil ratio (GOR)
- Crude oil density
- Crude oil viscosity
- Gas density
- Water cut
- Reservoir Temperature
- Bubble point pressure
- Sand presence and composition
- H2S and CO2 presence
- Paraffin and scale
- Supply voltage and power frequency (50 vs. 60 Hz)
- Metallic composition (carbon steel vs. stainless steel or super duplex)

The pricing structure is so complex that some suppliers like GE are said to be offering all-inclusive prices on a per-barrel pumped basis.

Others like Schlumberger and Baker Hughes bury it in total bundled services prices. Operators have been relatively receptive to all-in pricing because it helps them focus on their overriding goals, and allows them to align with the suppliers on how to maximize output rather than how to reduce cost.

At the high end, Baker Hughes Centrilift (in Texas) offers a list price of $200,000 for a carbon steel ESP suitable for 1000 foot water depth, with 2 7/8" tubing and a 10.75"casing. It charges $25,000 to replace just the pump, and $10,000 for the motor, cable leads, and seal with refurbished parts.

Flotek charges $100,000 for a Monel-coated standard pump and standard motor. A stainless steel motor would increase the price to $150,000. Both prices are based on a supply chain of parts from various locations in China, assembled in US.

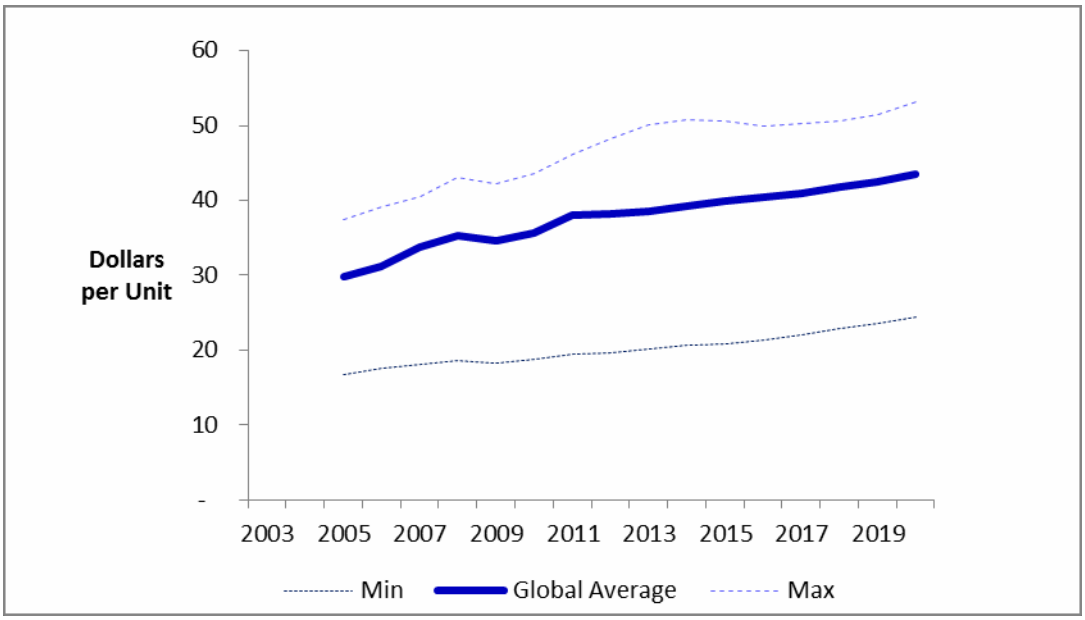
Flotek offers a lower-cost version of the product that is sourced from various locations in China, then assembled in the US. In this configuration, the pump itself costs $10-15,000 and the motor costs $15-20,000, for a total pump and motor cost of $25-35,000. Rebuilding costs about half of that.

Novomet, a Russian manufacturer, charges $10k for a basic single-stage pump (carbon steel construction) of 5.62” outside diameter with a 200 hp motor (this is only 1-1.5k bpd, the smallest variant of the reference product). It then adds $20k for a permanent magnet motor, for a total of $30,000. Then it adds $2k for stainless pump internals, which just covers the impeller and cladding on the inside of the casing, not the outside of the casing.

Many Chinese and Indian suppliers claim to be able to supply the product. However, their products rarely meet the required minimum specifications. For example:

- Shijiazhuang Naipu Pump Co., Ltd., a Chinese manufacturer, charges $6000/each for 10 units, but the units are not API-compliant.
- Xian Aoneng Oil Equipment Co., Ltd. offers a price of $3000 each. However, it is unlikely that that the pump meets the specifications expected by major oil companies, and communication gaps make it difficult to confirm this without substantial dialogue.
- India R Mech, an Indian supplier, can supply ESPs of the variety in the scope of this chapter, but not to API specifications and not for heavy oil (API 10-15 grade).
- Shengli Highland Petroleum Equipment quotes an ESP for $4-6k, but said this requires clarification by email, and then did not provide any clarification. Their largest only has a 100 hp motor, and it has been difficult to qualify their offer as meeting the criteria.

Figure 32: Overall Price Forecast for ESPs



The reference unit for ESPs is as follows:

- 5.5” inlet (10” alternate)
- 1000 bpd (2,000 & 4,000 bpd alternate)
- 200 hp motor (100 hp alternate)

- 316 stainless steel (super duplex stainless alternate)
- For downhole oil pumping, particularly for heavy crude (10-15 API)

At benchmark US price levels, this unit, including pump and motor, costs approximately $48k.

International prices can vary widely, depending on local availability (or not) in the country of installation. International costs are charged to what the market will bear, and are frequently 50-100% more or even more than domestic price, if the market allows.

Japan is the most expensive market for ESPs, However, the only manufacturer that makes them in Japan is Ebara, and Ebara has a tiny share of this market.

North America, home to many ESP manufacturers, is the next most expensive market for them. Driven by high domestic demand and a market that buys technology-rich solutions, American suppliers like Baker Hughes generally have both higher costs and higher prices.

Europe is slightly less expensive, but prices vary significantly by manufacturer. Schlumberger's profit margins are higher than industry average, and prices often benefit from 'what-the-market-will-bear' pricing behavior in difficult-to-serve markets such as Iraq and Indonesia. Smaller manufacturers offer lower prices.

Russia offers steep discounts to the prevailing Western prices. However, most Western buyers are wary about Russian quality. Russian suppliers like Novomet eagerly try to prove that they have comparable quality.

Chinese and Indian prices are orders of magnitude below prices in the more developed markets. However, as mentioned, it is difficult to validate that the equipment is comparable, even in specification, let alone quality and performance. Most frequently there are some specific reasons why the equipment cannot match up. For example, one Indian supplier could make the entire reference product, but could not provide certifications that proved its quality was comparable (such as API or ISO certifications).

Elsewhere, in Southeast Asia, Latin America, and Africa, there no globally recognized suppliers have been identified during this study. To the extent that manufacturers are available, their costs can be expected to be 10-22% lower than American benchmark cost levels, based on regional cost analyses.

Table 20: Regional Price Variations over Time for ESPs

Region/Country	Today	2014	2015	2020
North America	1.00	1.00	0.99	1.05
Latin America	0.89	0.94	0.97	1.22
Europe	0.91	0.92	0.92	0.98
Africa	N/A	N/A	N/A	N/A
India	0.47	0.48	0.49	0.57
Russia	0.70	0.73	0.74	0.88
China	0.55	0.55	0.54	0.58
Japan	1.09	1.10	1.10	1.13
Other Asia	0.78	0.79	0.79	0.83

7.3.1 Price Differences by Technology, Model, and Feature

Pump size, motor horsepower, and material drive ESP costs and prices. Many of these factors are correlated with the complex list of parameters cited earlier, such as depth, head, viscosity, etc.

Table 21: Incremental Cost per Extra Parameter or Feature for ESPs

(Reference unit is a carbon steel ESP for artificial lift (downhole) applications pumping crude oil under 65 meters of head, with a 5" inner inlet diameter and including a 200 hp motor, delivering 1000 bpd output)

Parameter or Feature	Unit of Measure	Indicative Cost Impact	Notes / Comments
Pump Inner Diameter (ID)	Inches	Increasing ID by 2" (from5" to 7") costs an additional $32.7k	Further increases after 7" increase price disproportionately
Motor Size	Hp	Decreasing hp from 200 hp to 150 hp reduces price by $8.3k	Further decreases below 150 hp decrease price disproportionately
Material	Carbon steel as the reference point; stainless steel as the premium option	Upgrading from carbon steel to stainless steel costs 45% more, on average	The incremental cost for stainless steel is relatively consistent across pump sizes

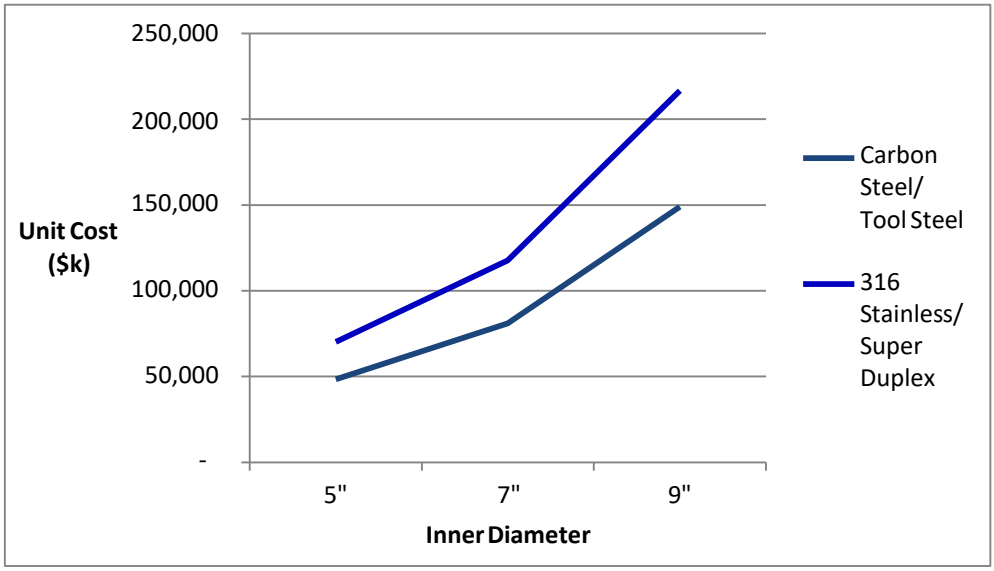
Note: Changing one parameter usually involves changing others, and the cost impact may not be additive or linear.

Upgrading from carbon steel to stainless steel increases the cost of a pump by approximately 45%. Upgrading to Monel is more expensive still.

Decreasing the size of the motor from 200 hp to 150 hp typically saves about 17%. For the reference unit, this would equate to an additional $8.3k.

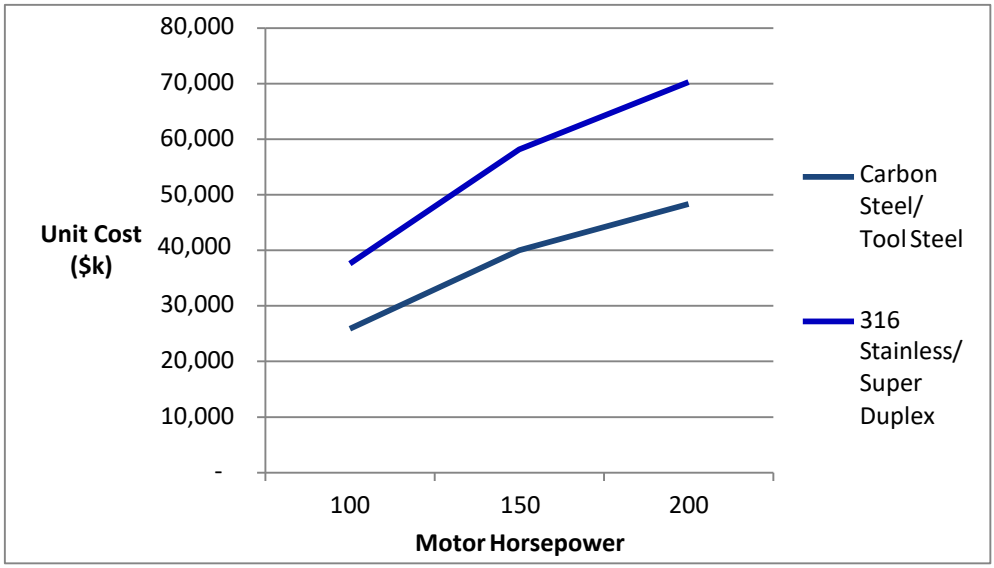
Increasing the inner diameter of the pump increase the unit cost of the pump (by 68% from 5" to 7 and 141% between 5" and 9")..

Figure 33: ESP (200 HP Motor) Size vs. Cost - By Material



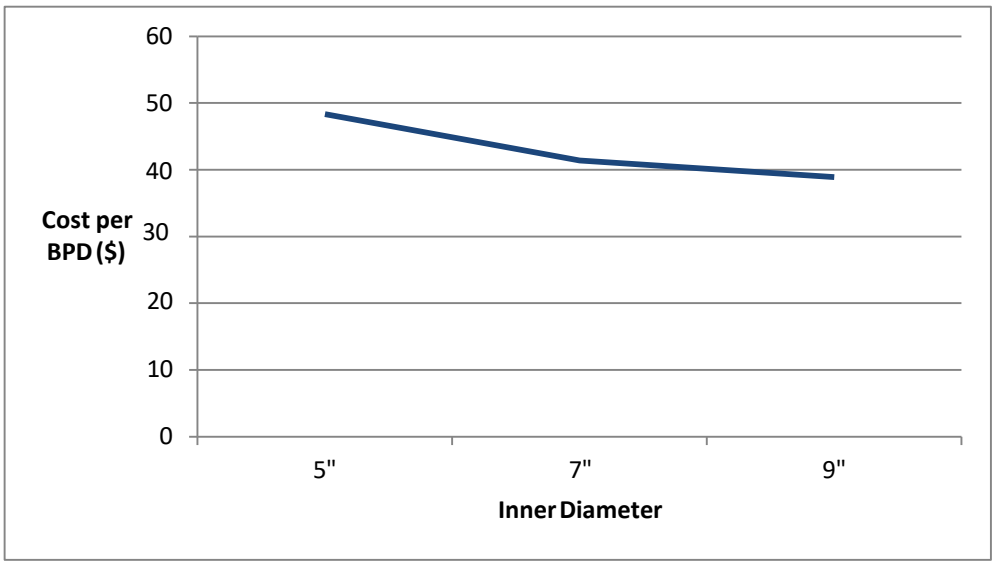
Increasing the motor horsepower also increases the cost of the pump, but decreasingly so after 150 hp.

Figure 34: ESP (200 HP Motor) Size vs. Cost - By Motor Size



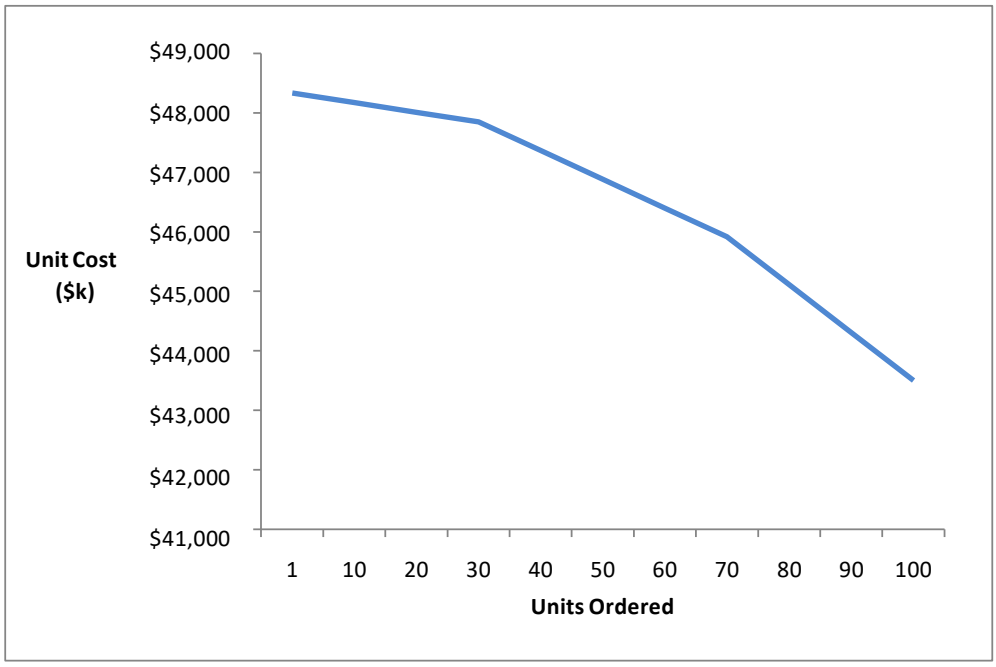
Cost per barrel per day of flow falls gradually as the size of the unit increases. For the reference unit, with a flow rate of 1k barrels per day, the cost per barrel per day is $48.3. Increasing the unit's outlet diameter reduces that cost by 14% ($6.9k).

Figure 35: Cost per unit of Output – ESPs



There are economies of scale in ordering in bulk, somewhat above 10 units and especially above 70 units, according to supplier interviews and actual price quotes obtained. Economies of scale are less than for other pump types and oil and gas equipment types, but discounts of 10% are frequently encountered, and discounts of 20% can be negotiated as parts of large integrated product-service contracts.

Figure 36: Economies of Scale in ESPs



2. Should-Cost Analysis

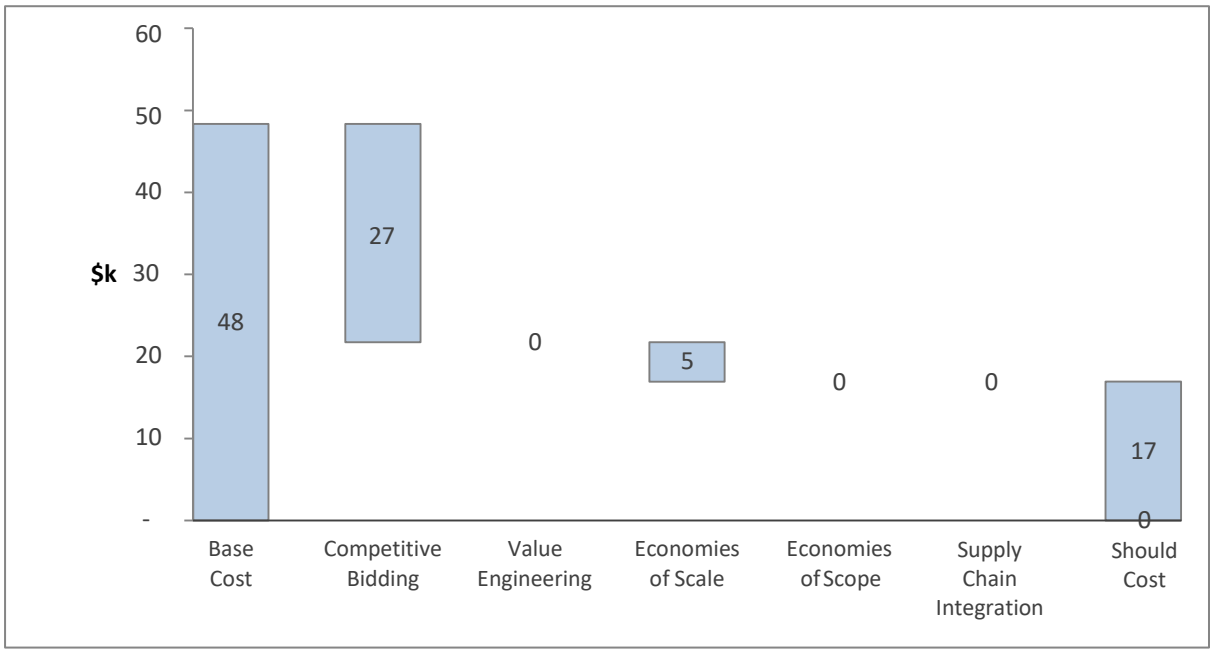
Strategic sourcing would emphasize negotiated, bundled, solution pricing with an emphasis on leveraging suppliers' engineering and technology capabilities. However, the main source of cost reduction potential for ESPs is competitive bidding, especially by using suppliers from low-cost countries as negotiating levers.

The most effective way to procure ESPs is through a solution bundle, as the major suppliers such as Schlumberger emphasize. This enables large buyers to take advantage of the full research and development, and technological product innovation, of these large and capable suppliers. This is especially effective for getting the most value from suppliers for complex fields requiring advanced solutions.

If, however, the goal is to reduce unit cost, several measures should be effectively taken:

- Competitive bidding can reduce cost by up to 55%, based on a sample of bids received. Most of this reduction potential comes from suppliers in low-cost countries that can capably produce the specified equipment. Discerning which suppliers can and which cannot is a time-consuming and costly task. However, the benefits are clear. They are also inevitable. Even the major ESP suppliers are using low-cost suppliers in their supply chains.
- Economies of scale can save 10-11%, assuming sufficient demand can generate orders of 70 or more. Smaller orders can save less, and smaller suppliers typically offer steeper discounts for bulk orders.

Figure 37: Should-Cost for ESPs



7.4 Price Negotiation Strategies

Bundling ESPs with the purchase of other products and services from ESP manufacturers can achieve non-price benefits such as technological innovation, production efficiency, as well as economies of scope savings on other artificial lift products and services – if those are needed to begin with.

Otherwise, low-cost country sourcing, particularly from Russia, which has a large number of experienced suppliers, should be maximized to achieve maximum savings on per-unit pricing.

Also, ordering in bulk for major projects can save substantially on price.

8 Reference product definitions and scope

1. Electric Submersible Pumps (ESPs)

- Application: heavy crude (10-15 API)
- 5.5” inlet (10” alt)
- 1k bpd (2k & 4k alt)
- 200 hp motor
- 316 stainless steel (Super duplex stainless alt)
- For downhole oil pumping

9 Reference product definitions and scope

1. Centrifugal Engineered

- API 610
- Application: crude oil
- 2-stage
- Horizontally split case
- Head: 500
- Flow: 5,000 gpm
- 300 hp motor
- Carbon steel casing, chrome steel impeller

2. Progressing Cavity

- API 676
- Application: heavy crude (10-15 API)
- Single stage
- Carbon steel
- Standard nitrile
- Single screw
- 1.5k bpd
- 150 hp motor

3. Multiphase

- Application: heavy crude (10-15 API)
- Twin Screw
- Carbon steel casing and liner
- 1.5k bpd

- 200 hp motor

4. Electric Submersible Pumps (ESPs)

- 5.5” inlet (10” alternate)
- 1k bpd (2000k & 4000k bpd alternate)
- 200 hp motor
- 316 stainless steel (Super duplex stainless alternate)
- Application: pumping heavy crude (10-15 API) under 65 meters of head

10 Notes

The suppliers who were contacted directly for this study include, but are not limited to:

- Afton Pumps
- Amarinth
- Axflow
- Baker Hughes
- Bornemann
- Colfax
- Deep Blue Pump Co.
- Dragon Pump
- Flowserve
- Godwin Pumps
- Hyosung
- ITT
- Kirloskar Brothers, Limited
- KSB
- Leistritz
- Netzsch
- Novomet
- Novomet
- O'Drill MCM
- PCM
- Ruhrpumpen
- Shengli Highland Petroleum Equipment
- SPX
- Sulzer
- Sundyne
- Torishima
- Weir