Compressor Technology Selection Trends

Gas / Electric Partnership 2018
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Uday Turaga, Founder & CEO of ADI Analytics

- Brings 20+ years industry and consulting experience in oil and gas, energy, and chemicals across the value chain
- Led 100+ market research, sizing, and segmentation projects across a wide range of niche, opaque market segments
- Worked at ConocoPhillips, ExxonMobil, and Booz Allen in oil and gas and chemicals strategy, markets, and technology

Experience

- ADI Analytics, 2009—Present
- Booz & Company, 2007-2008
- ConocoPhillips Company, 2002-2007
- Energy Institute, PSU, 1998-2002

Education

- Delhi University – B.S. & M.S., Chemistry
- Penn State University – PhD, Fuel Science
- University of Texas at Austin – MBA

Fun facts

- Went to Penn State and the University of Texas at Austin …
- … but still doesn't get football

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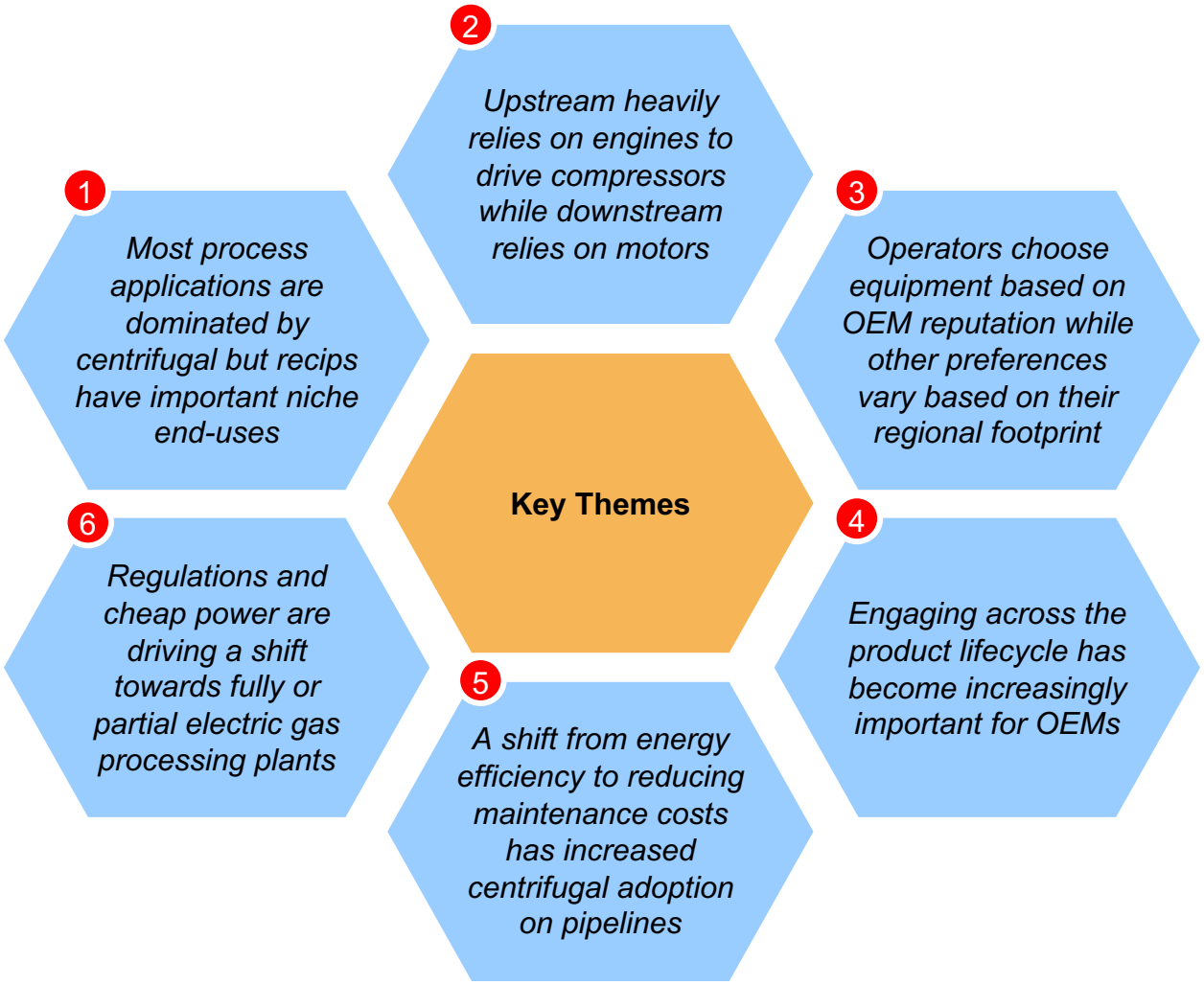
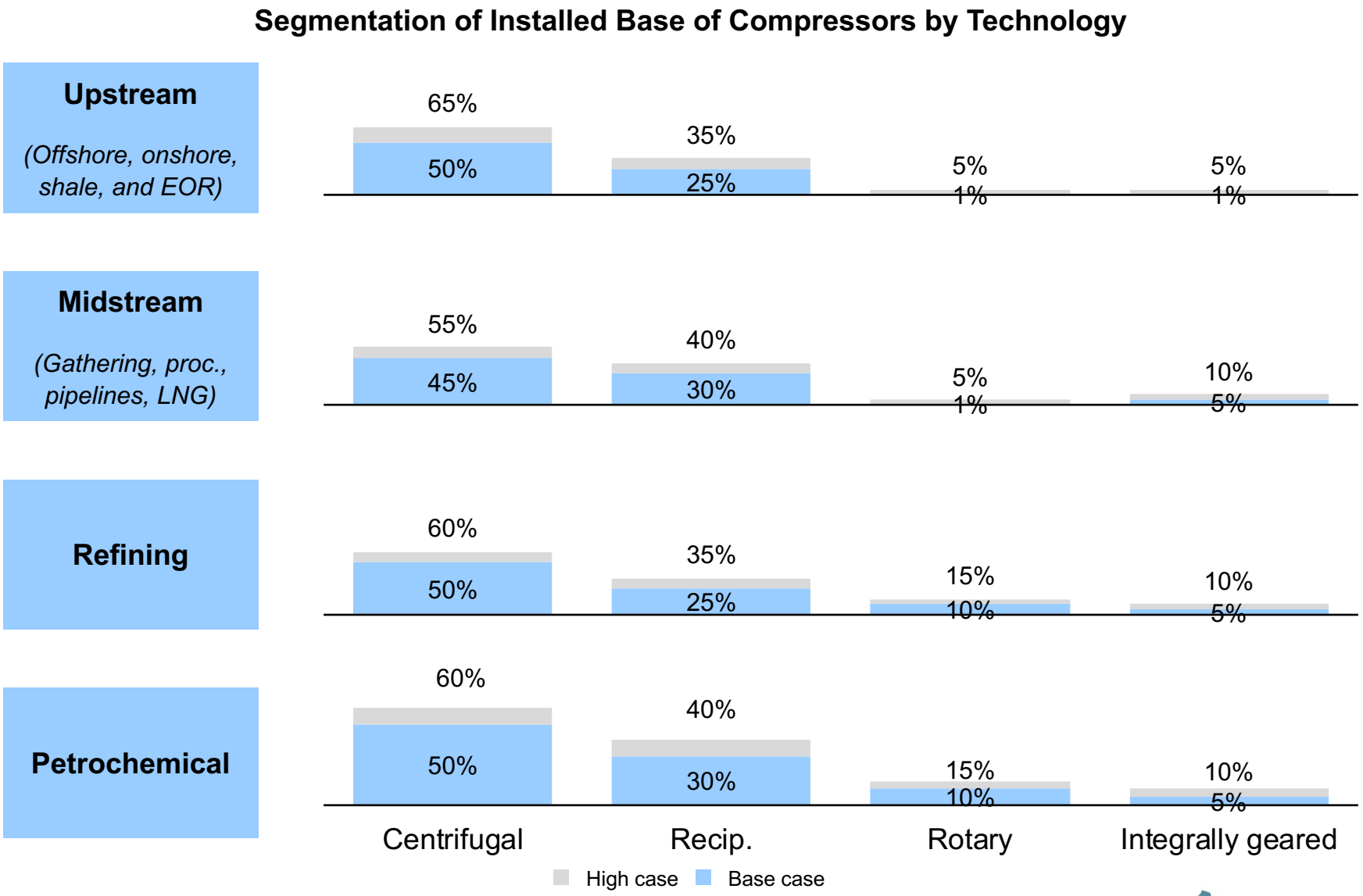
Our research into compressor and equipment selection drivers at operators has yielded six key themes

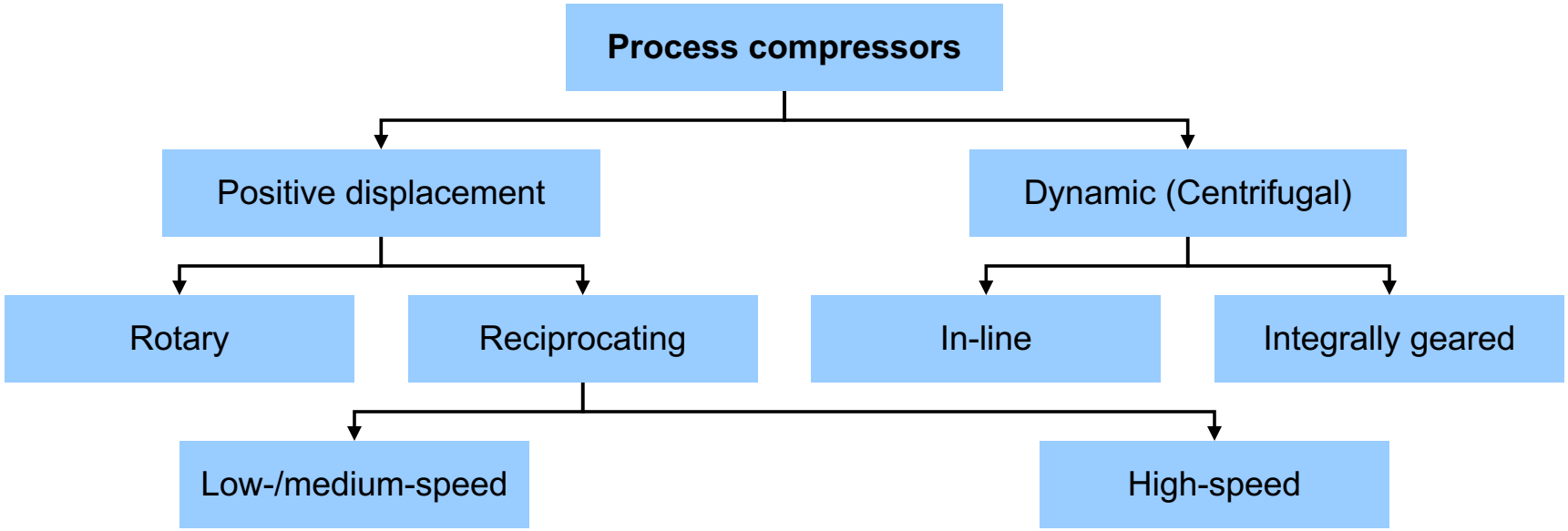


The installed base in the oil and gas industry is dominated by centrifugal units followed by reciprocating compressors



Four technologies are found in the process compressors market with centrifugals and recips being the most dominant

Compressor Market Segmentation by Technology

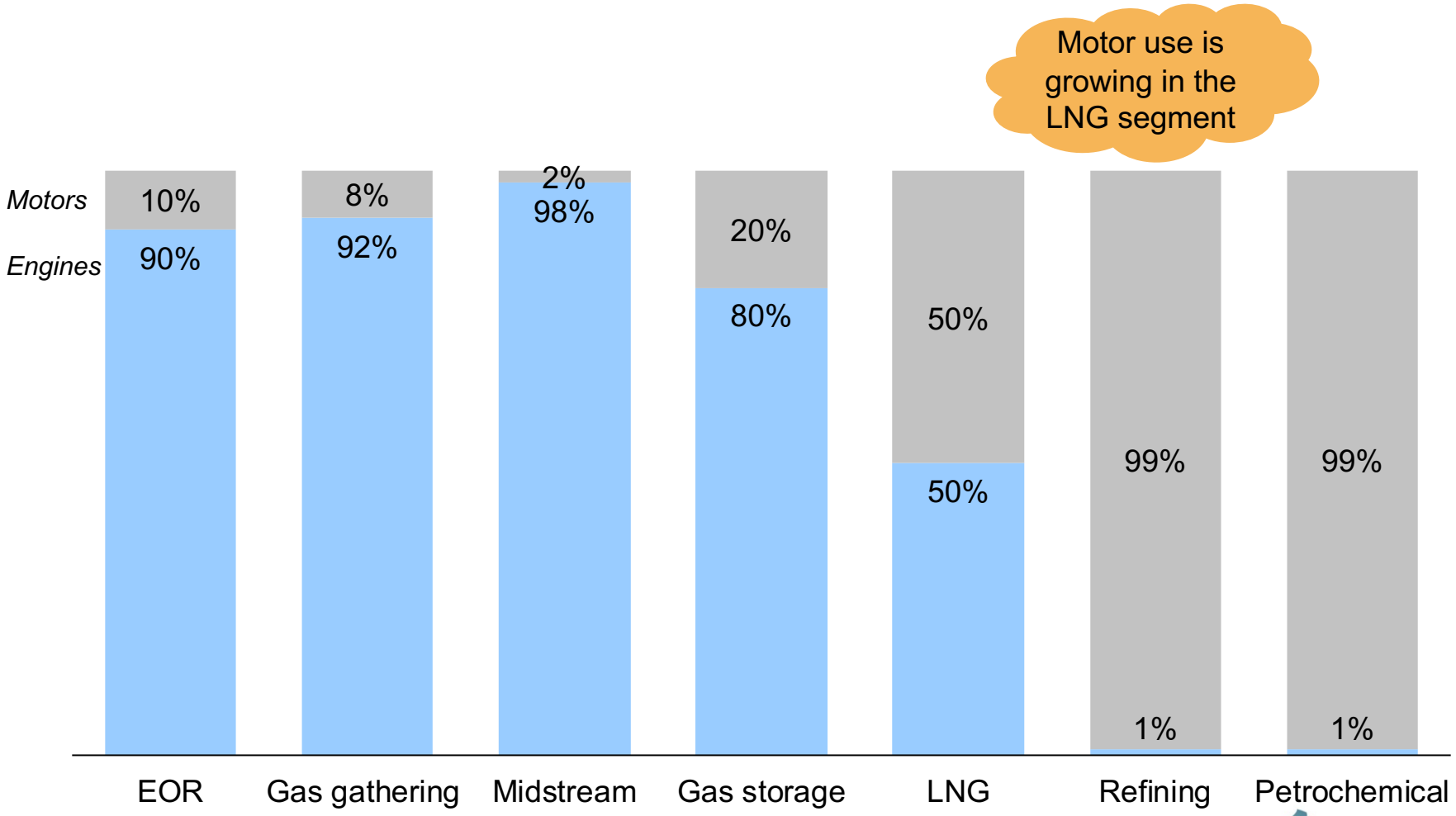


- Low-speed units run at 200 to 600 rpm and med.-speed units at 400 to 1,000 rpm and are typically run using an electric motor
- Best suited for applications where fuel efficiency and long life are necessary
- Must be field-erected with heavy foundations
- Low speed process recips are governed by API 618 specifications

- High-speed units run at 900 to 1,800 rpm and are run by either an engine or an electric motor
- Known as separable compressors as the compressor is separate from their driver
- Require higher levels of maintenance
- Typically skid-mounted, self contained, and portable with easy installation
- Governed by API 11P specifications

Broadly, upstream and midstream segments use more engines while downstream segments rely on motors

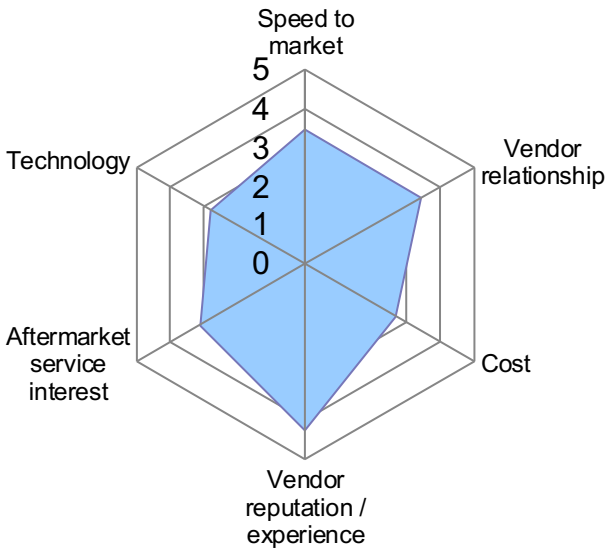
Compressor Drivers by Segment
(Percentage)



Operators choose equipment based on OEM reputation while other preferences vary based on their regional footprint

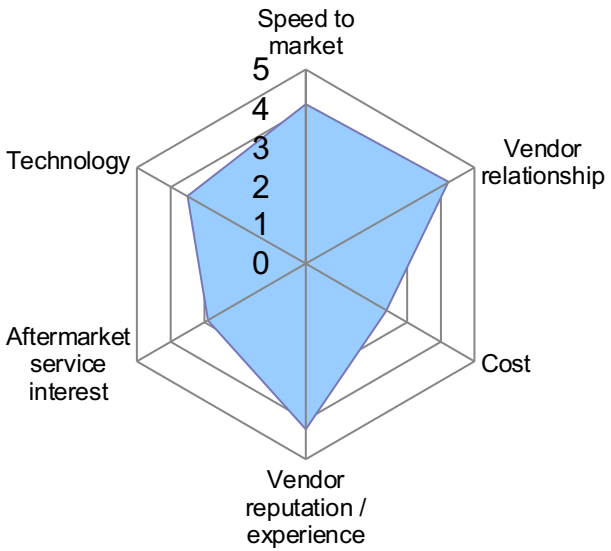
Customer Preference

All



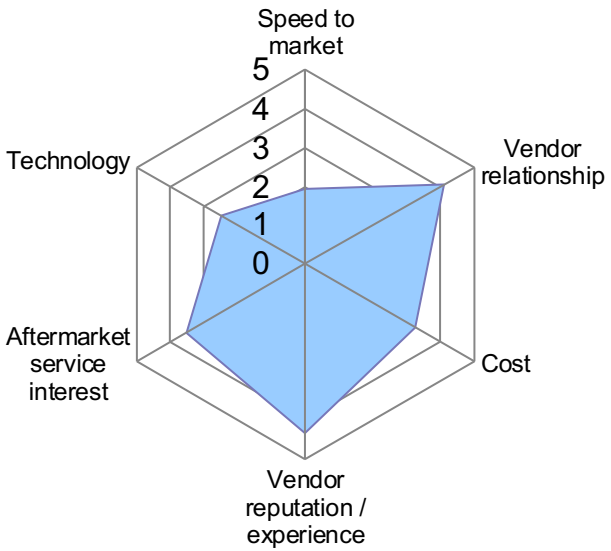
- Globally relationships and vendor experience drive the selection process
- Preferences on speed to market, modular offerings, aftermarket services

North America



- Operators and packagers in North America are under immense pressure to deliver projects as quickly as possible …
- … Increasing the value placed on delivery times relative to cost

International



- Proven vendors have an advantage but cost also matters and is taken into consideration
- Greater interest in aftermarket services and maintenance

The need for OEM-provided aftermarket services varies by segment with the most interest in upstream-offshore

Segment	Discussion and interview insights
Upstream	▪ Offshore needs and values aftermarket services preferring to source services from OEMs for high-pressure compressors ▪ Onshore has limited interest in services and prefers local, third-party service firms ▪ NOCs procure services with equipment, while IOCs source services separately
Midstream	▪ Source maintenance and aftermarket services locally from third parties ▪ Prefer to source services from system providers versus compressor OEMs directly
Refining and chemicals	▪ Higher level of interest than midstream in sourcing high-end aftermarket services … ▪ … But focus is also on the entire package ▪ Greater interest in maintaining safety and API standards around the overall system

Region	Services interest
North America	
Europe	
Asia-Pacific	
Middle East	
South America	
Africa	

Typical service needs

Frequent needs
- Compressor alignments
- Vibration analysis
- Installations
- Commissioning

Other needs
- Compressor calibrations
- Controls maintenance
- System troubleshooting

The high-speed and low-speed reciprocating compressor service markets are very different

	High-Speed Recip Services	Low-Speed Recip Services
Customers	▪ Midstream operators and E&P companies ▪ Decide based primarily on price, location and relationships	▪ Refiners, petchem, and EOR operators ▪ Decide based on engg. capability, prior experience, and options that reduce risk
Growth outlook	▪ Moderate to high ▪ Concentrated in North America, Asia, and Latin America	▪ Low to medium ▪ Diversified across Asia, North America, Middle East, and Latin America
Competitive landscape	▪ Highly fragmented ▪ Hundreds of owner – operators in North America and China	▪ Concentrated among OEMs in Europe, ME, and LA and… ▪ … Service companies in NA and Asia
Barriers to entry	▪ Low … ▪ …although larger players are trying to raise them with technology based offerings	▪ High as operator confidence is key to winning business ▪ Limited turnover in customers ▪ Incumbent has a huge advantage
Supply chain	▪ Relationship with Ariel is key to success and growth ▪ Other OEMs have a very small base	▪ OEM relationships are not critical here ▪ Field service capabilities are critical to growth

Operators are increasingly opting to drive compressors with motors and are utilizing centrifugal on pipelines

1 Push towards fully or partial electric plants	▪ The push to fully or partial electric gas processing plants is due to regulations and faster permitting (standard permit, not title V) ▪ Environmental regulations are pushing partial / fully electric plants which is driving the use of motors for compressors as they are cheaper than engines ▪ Going electric makes sense if power is available and if electricity continues to be cheap
2 Centrifugal compressor use on pipelines is increasing	▪ Historically midstream operators chose to use low-speed reciprocating compressors on main haul pipelines due to their low energy costs ▪ Centrifugal compressors are replacing low-speed reciprocating compressors due to abundant and cheap natural gas, … ▪ … And an increased operator focus on reducing compressor maintenance costs
3 Engaging across the product lifecycle has increased significantly throughout the downturn	▪ During the downturn leading OEMs increasingly sold equipment at or lower than break-even prices in order to secure service contracts ▪ Operators value OEMs who provide aftermarket services and increasingly prefer outsourcing maintenance to OEMs as in-house mechanics are increasingly scarce … ▪ … Or often do not have the skills necessary to properly service the entire range of turbomachinery equipment

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