

Global Oil and Gas Industry Outlook and Growth Opportunities, 2024

Transformative Megatrends Drive Oil and Gas Companies to Digitize and Implement Decarbonization Initiatives

Global Energy & Environment Research Team at Frost & Sullivan

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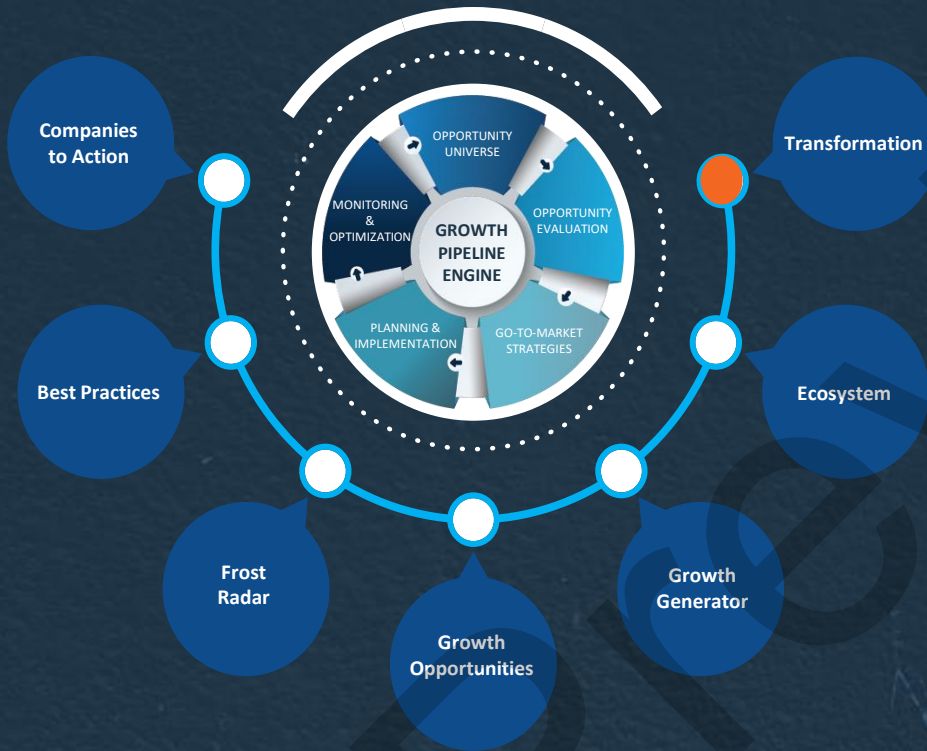
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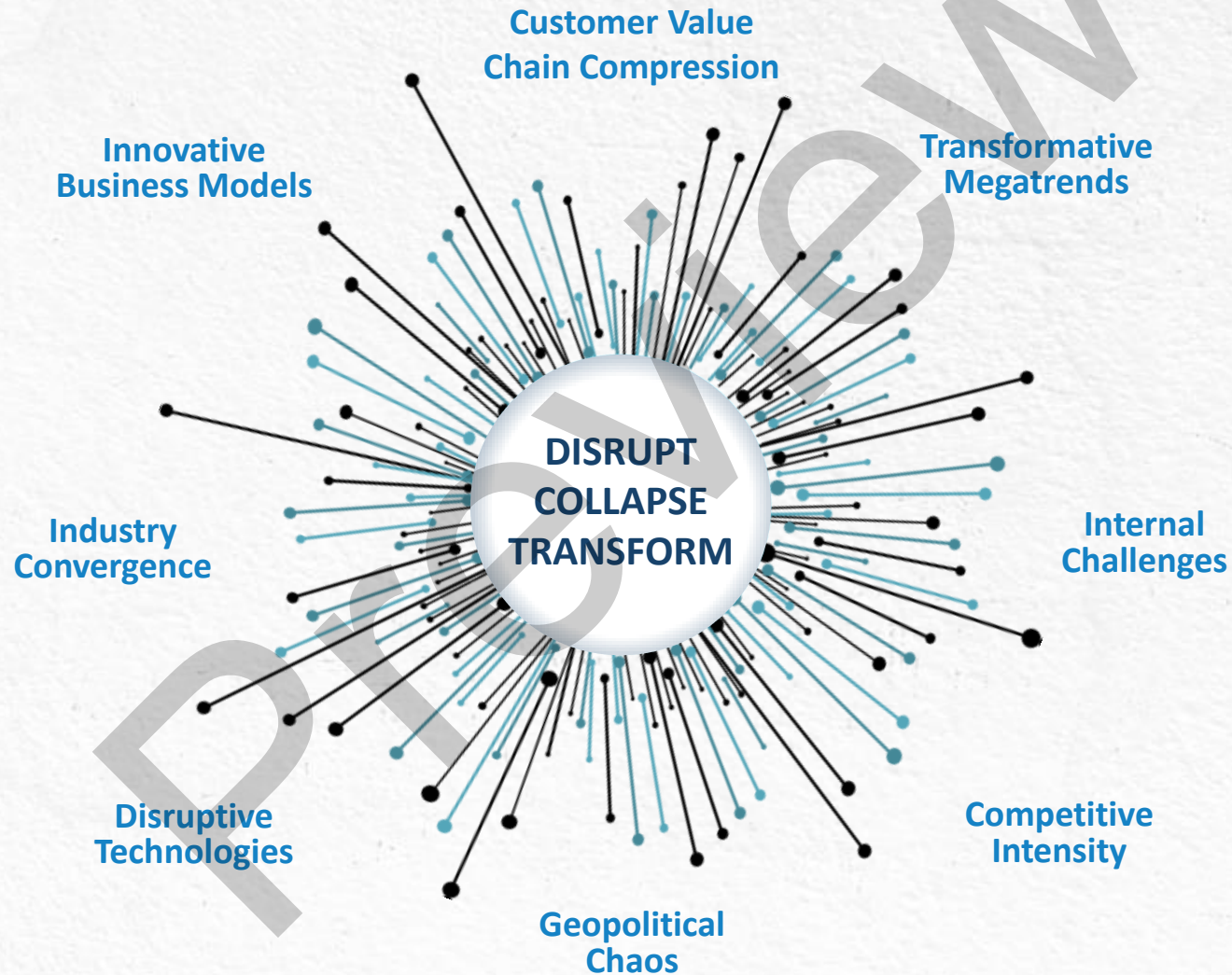
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Strategic Imperatives

Why is it Increasingly Difficult to Grow?

The Strategic Imperative 8™: Factors Creating Pressure on Growth



The Strategic Imperative 8™

Innovative Business Models

A new revenue model that defines how a company creates and capitalizes economic value, typically impacting its value proposition, product offering, operational strategies, and brand positioning

Customer Value Chain Compression

Customer value chain compression as a result of advanced technologies, internet platforms, and other direct-to-consumer models that enables reduction in friction and the number of steps in customer journeys

Transformative Megatrends

Global forces that define the future world with their far-reaching impact on business, societies, economies, cultures, and personal lives

Internal Challenges

The internal organizational behaviors that prevent a company from making required changes

Competitive Intensity

A new wave of competition from start-ups and digital business models that challenge the standing conventions of the past, compelling established industries to re-think their competitive stance

Geopolitical Chaos

Chaos and disorder arising from political discord, natural calamities, pandemics, and social unrest that impact global trade, collaboration, and business security

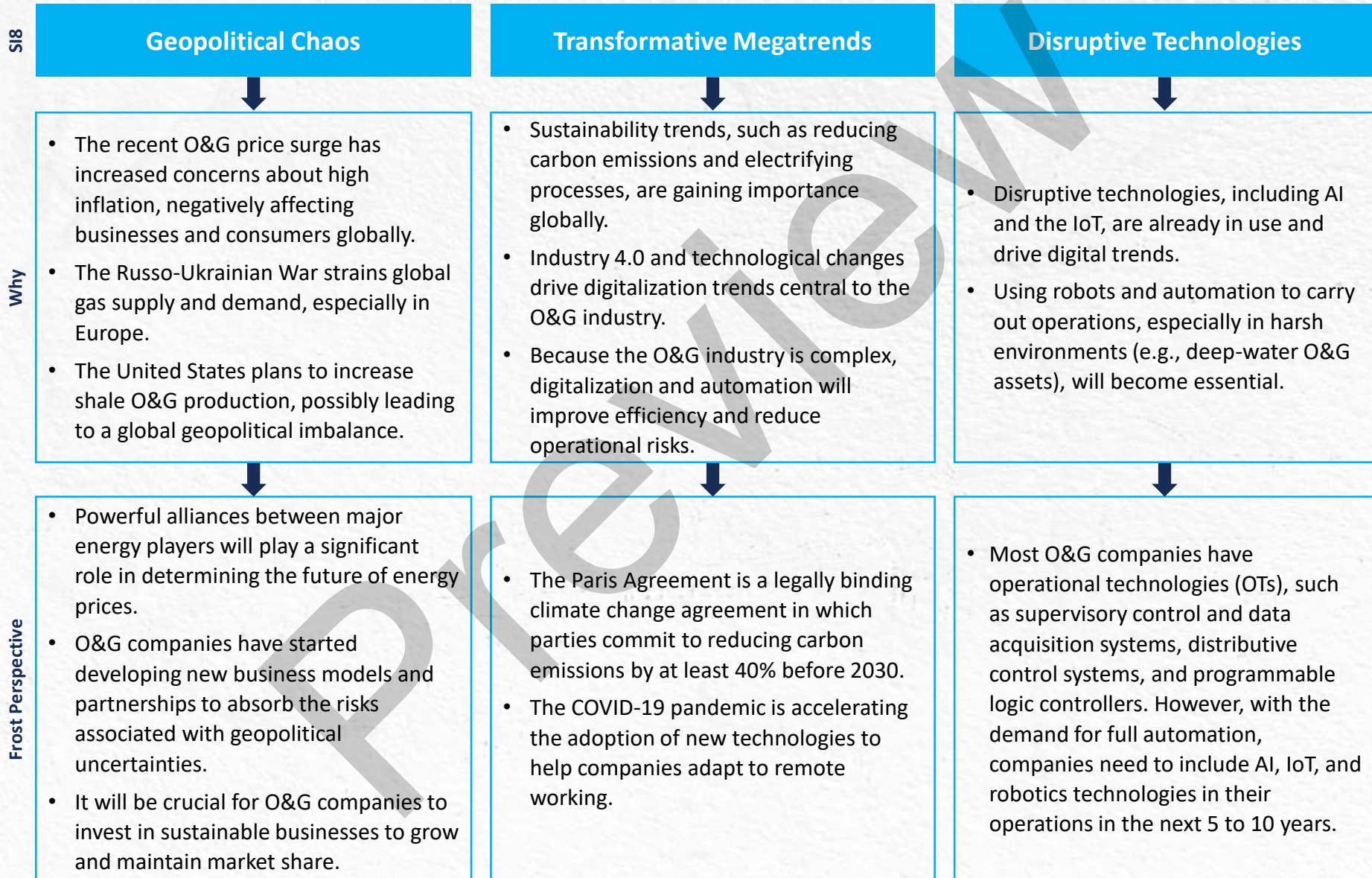
Disruptive Technologies

New, disruptive technologies that are displacing the old, and significantly altering the way consumers, industries, or businesses operate

Industry Convergence

Collaboration between previously disparate industries to deliver on whitespace cross-industry growth opportunities

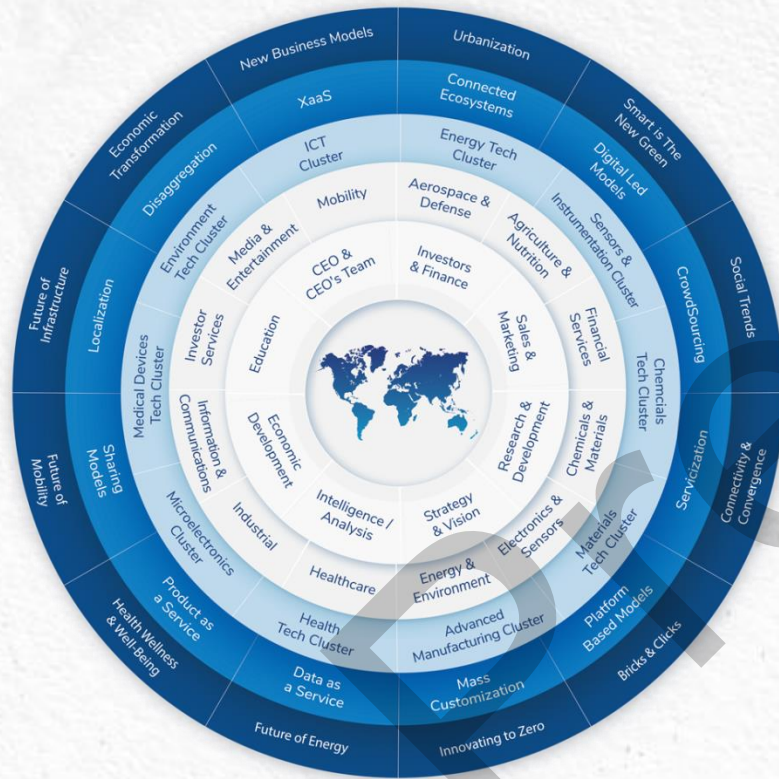
The Impact of the Top 3 Strategic Imperatives on the O&G Industry



Growth Opportunities Fuel the Growth Pipeline Engine™



The Innovation Generator™

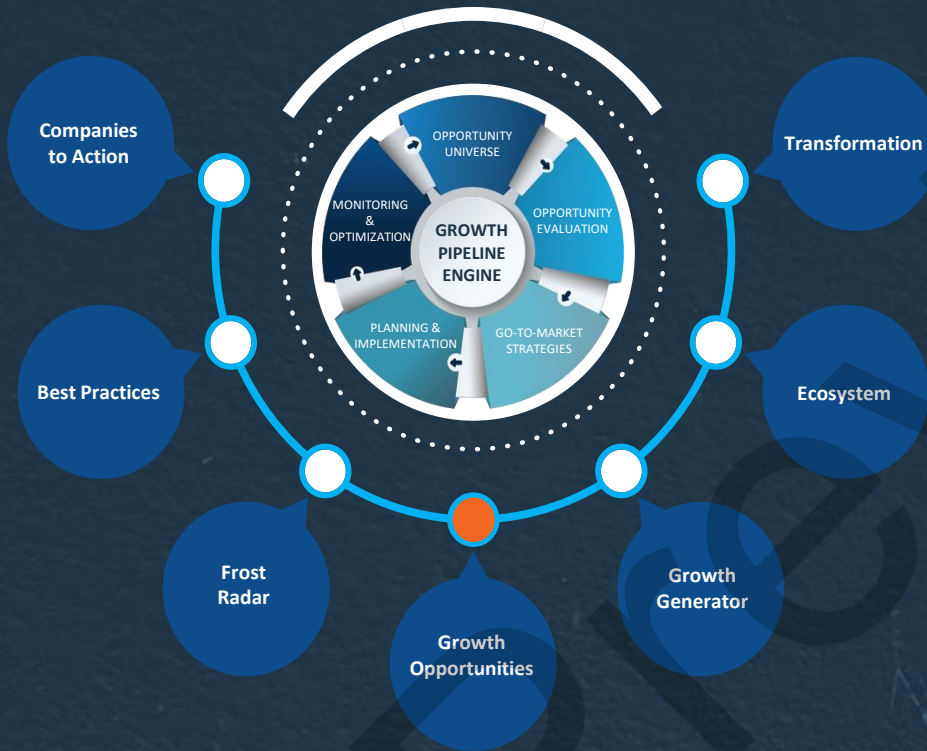


Analytical Perspectives



The Growth Pipeline Engine™





Growth Environment

Research Scope

Base Year	2023		
Study Period	2023–2035		
Forecast Period	2024–2035		
Market Analysis Covered	Upstream	Midstream	Decarbonization
	<ul style="list-style-type: none"> • O&G • Automation • Electrification • Drilling Automation 	<ul style="list-style-type: none"> • Liquefied Natural Gas (LNG) 	<ul style="list-style-type: none"> • Emissions Management • Hydrogen • CCUS • Alternative Fuels
Geographic Scope	<p>North America: United States, Canada, and Mexico</p> <p>LATAM: Brazil, Venezuela, Argentina, and Colombia</p> <p>Europe: United Kingdom, France, Germany, Norway, Netherlands, and Belgium</p> <p>Russia and Commonwealth of Independent States (CIS): Russia and Kazakhstan</p> <p>APAC: India, China, Malaysia, Singapore, Australia, and Japan</p> <p>Middle East and Africa (MEA): Saudi Arabia, United Arab Emirates, Oman, Qatar, Kuwait, Nigeria, Algeria, Egypt, Mozambique, Libya, and Angola</p>		

What Does the Global O&G Outlook Cover?

Upstream Process Electrification

Emissions Management

Automation, Autonomy, and Augmentation

Future Fuels

NG

Global O&G Industry

Drilling Automation

Oil/Other Fossil Fuels

CCUS

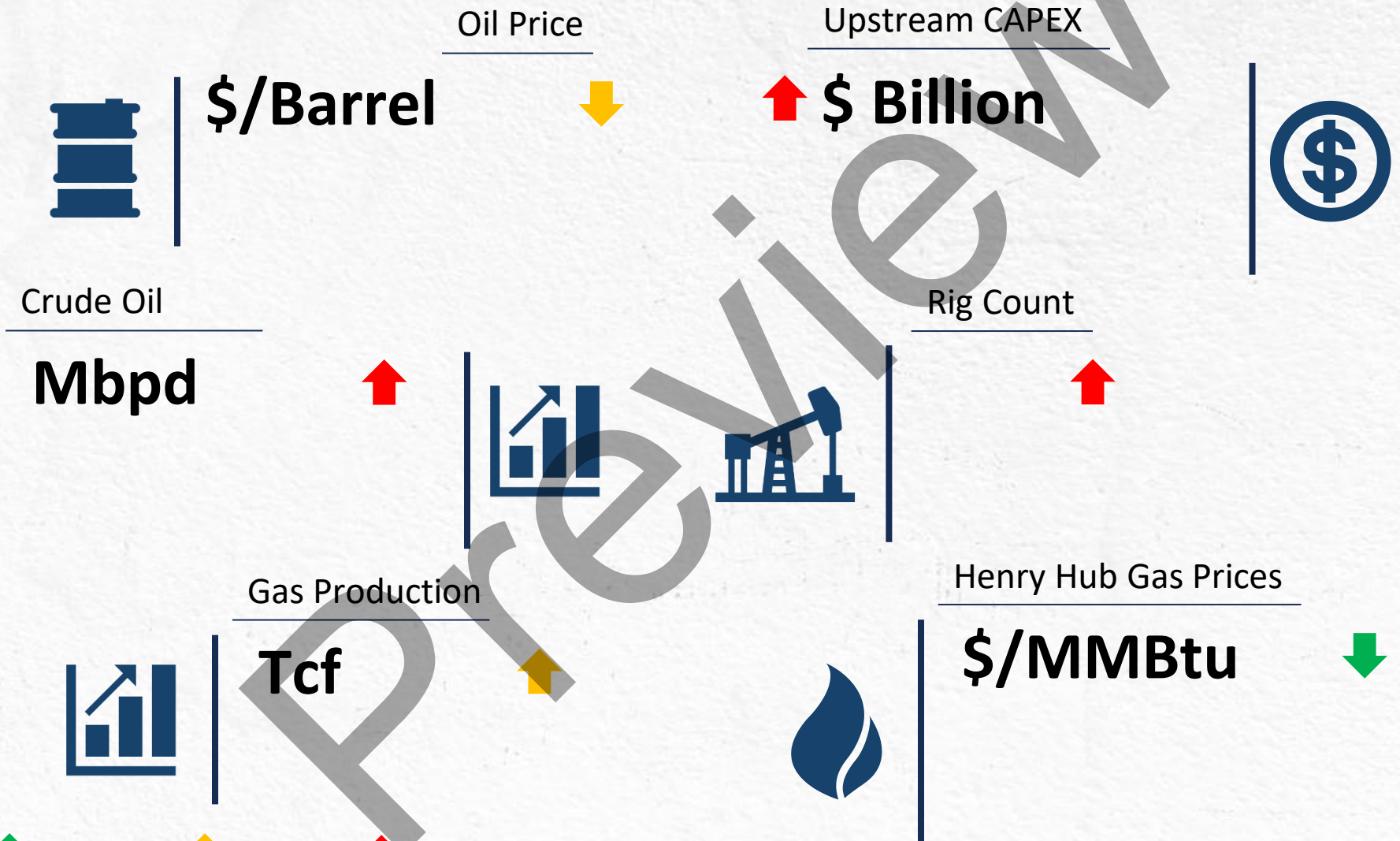


2023 Highlights of the Global O&G Industry

O&G: Global Highlights, 2023

1	Automation	The O&G industry leveraged the evolution of Industry 4.0 to become more productive, safe, and efficient while reducing its carbon footprint. Companies mainly focused on reducing CAPEX, increasing output by optimizing production, improving operational safety, and expanding their bottom line by utilizing and merging sophisticated technologies, such as AI, IoT, and robotics.
2	Decarbonization	O&G companies continued to focus on reducing their greenhouse gas (GHG) emissions and footprints by investing in future energy systems, such as renewables, low-carbon fuels, and negative-emission technologies (e.g., direct air capture [DAC]). The companies invested in technologies to efficiently measure and monitor GHG emissions and decarbonized upstream operations by implementing smart production automation technologies.
3	Digitalization	O&G companies largely focused on adopting digital technologies, such as autonomous solutions for intelligent assets, digital twins, and data analytics, to analyze large complex information, allow cloud-to-edge integration, and create a simpler and smarter IT ecosystem to deliver value and adaptability.
4	Energy Transition	The energy transition continued to be the 1st priority for O&G companies in 2023. They continued to optimize their operational assets by implementing energy-efficient technology, scaling carbon capture projects to achieve decarbonization goals, electrifying important assets to reduce carbon emissions, and investing in renewable energy and carbon offsetting projects.
5	Clean Energy	

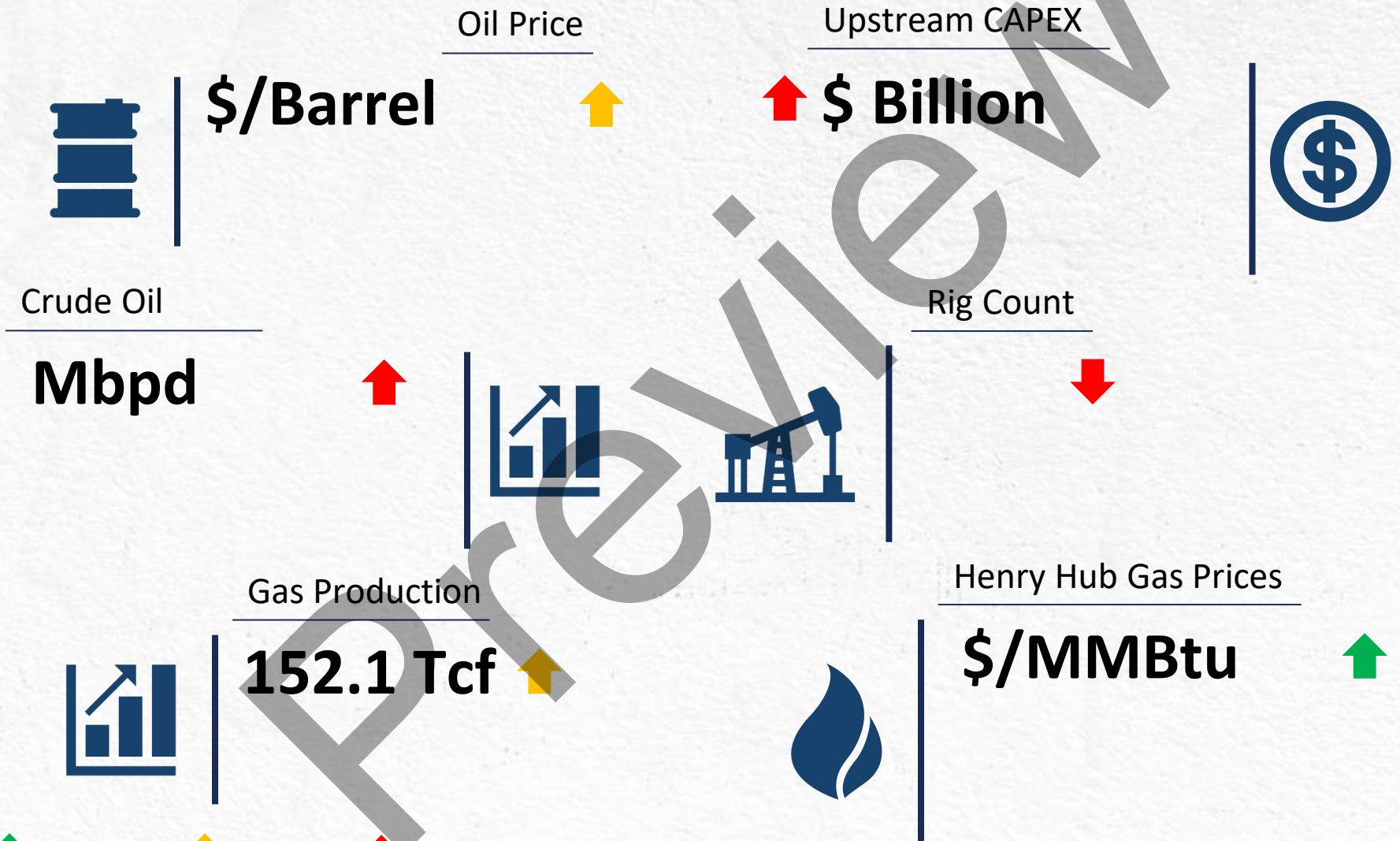
2023 O&G Key Performance Indicators (KPIs): Actual



Exponentially
 Moderately
 Marginally

Note: mbpd = million barrels per day; MMBtu = million metric British thermal units; Tcf = trillion cubic feet

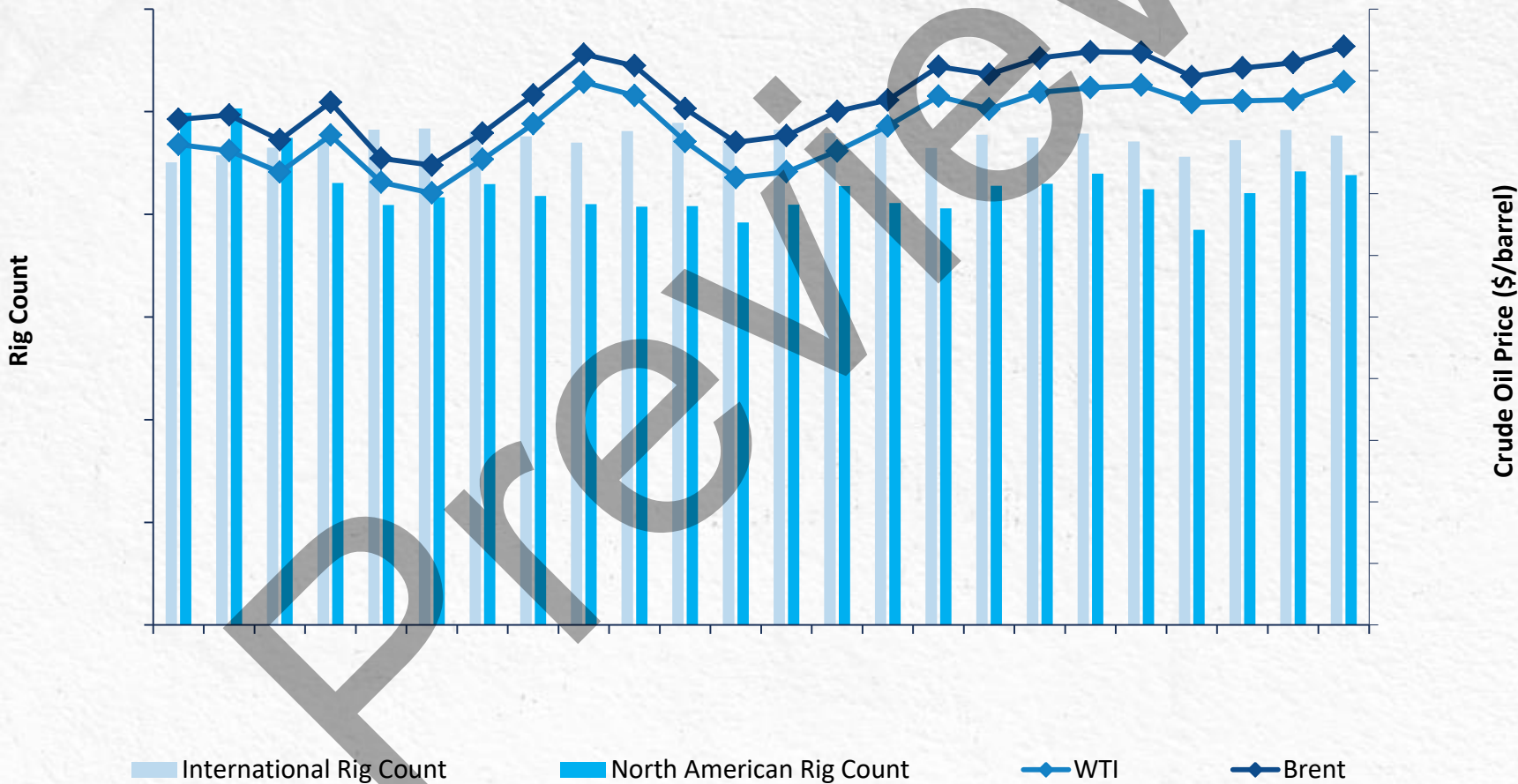
2024 O&G KPIs: Forecast



↑ Exponentially
 ↑ Moderately
 ↑ Marginally

Global Average Rig Count vs Benchmark Crude Oil Prices

O&G: Rig Count vs Benchmark Crude Oil Price Forecast, Global, 2023 and 2024



O&G Industry Trends

CCUS an Important Equation in Decarbonization



Role of LNG in the Energy Spectrum



O&G Electrification as a Decarbonization Pathway



Rise of Hydrogen Economy



O&G Automation (Robotics, AI, IoT)



Emissions Management

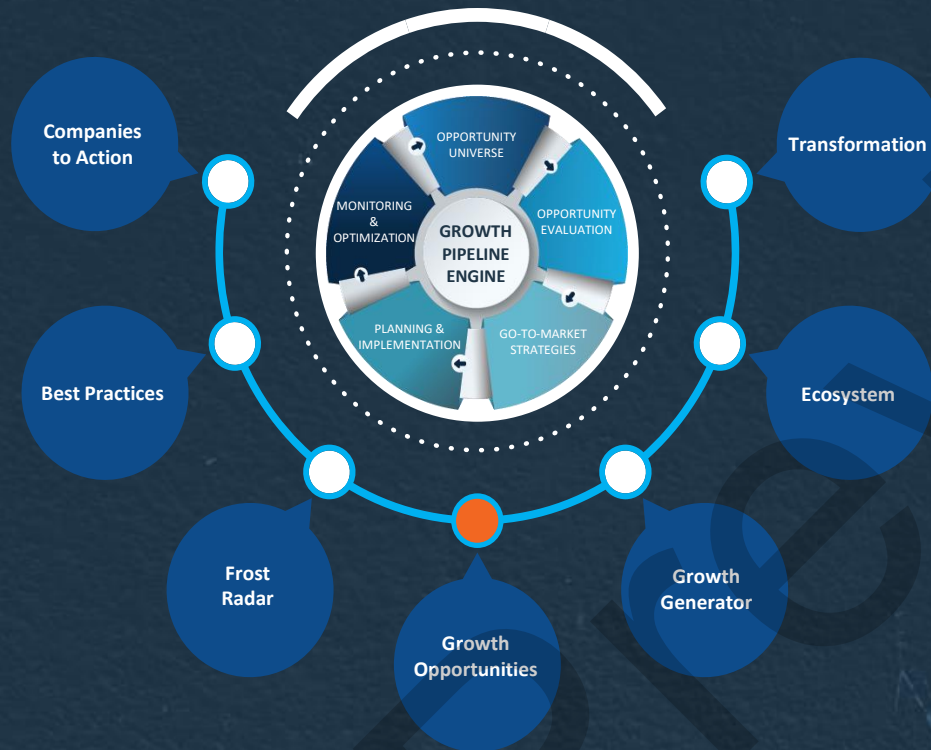


Alternative Fuels



Drilling Automation





Growth Opportunity Universe

What Growth Strategies have you embraced to maximize your Growth Potential?

Growth Opportunity 1: Increased DER and BESS Integration to Drive Electrification Technology Adoption

Opp. Size in 5 Years	Over \$1 B	Relevant End-User Industries for this Growth Opportunity						Applicable Regions		
		Manufacturing	Mobility	Metal & Mining	Energy & Environment	Chemicals & Materials	Information & Communications Technologies	Central & East Europe	South Asia	Western Europe
Timeline for Action	Over 5 Years	Electronics & Semiconductors	Agriculture, Food & Nutrition	Govt and Public Sector	Construction	Education	Healthcare & Lifesciences	CIS	North America	Latin America
		Consumer	Aerospace	Hospitality	Retail	Defense	Banking & Financial Services	Africa	Middle East	Asia-Pacific
GO Base Year	2024									

Frost & Sullivan has identified 10 Growth Processes that serve as levers for determining and evaluating new Growth Opportunities.



Growth Opportunity 2: AI as a Tool to Achieve Sustainability

Opp. Size in 5 Years	Over \$500 M– \$1 B	Relevant End-User Industries for this Growth Opportunity						Applicable Regions		
		Manufacturing	Mobility	Metal & Mining	Energy & Environment	Chemicals & Materials	Information & Communications Technologies	Central & East Europe	South Asia	Western Europe
Timeline for Action	1 to 3 Years	Electronics & Semiconductors	Agriculture, Food & Nutrition	Govt and Public Sector	Construction	Education	Healthcare & Lifesciences	CIS	North America	Latin America
		Consumer	Aerospace	Hospitality	Retail	Defense	Banking & Financial Services	Africa	Middle East	Asia-Pacific
		GO Base Year	2024							

Frost & Sullivan has identified 10 Growth Processes that serve as levers for determining and evaluating new Growth Opportunities.





















Growth Opportunity 3: DACC with CO2 Used for SAF

Opp. Size in 5 Years	Over \$500 M– \$1 B	Relevant End-User Industries for this Growth Opportunity			Applicable Regions
		Manufacturing	Mobility	Metal & Mining	
Timeline for Action	Over 3 to 5 Years	Energy & Environment	Chemicals & Materials	Information & Communications Technologies	South Asia
		Electronics & Semiconductors	Agriculture, Food & Nutrition	Govt and Public Sector	Western Europe
		Construction	Education	Healthcare & Lifesciences	CIS
		Consumer	Aerospace	Hospitality	North America
		Retail	Defense	Banking & Financial Services	Latin America
		GO Base Year	2024		Africa
			Middle East		
			Asia-Pacific		

Frost & Sullivan has identified 10 Growth Processes that serve as levers for determining and evaluating new Growth Opportunities.





















Growth Opportunity 4: Negative-emission Technologies for Achieving the Net-zero Target

Opp. Size in 5 Years	Over \$1 B	Relevant End-User Industries for this Growth Opportunity			Applicable Regions
Timeline for Action	Over 3 to 5 Years	 Manufacturing	 Mobility	 Metal & Mining	Central & East Europe
		 Energy & Environment	 Chemicals & Materials	 Information & Communications Technologies	South Asia
		 Electronics & Semiconductors	 Agriculture, Food & Nutrition	 Govt and Public Sector	Western Europe
GO Base Year	2024	 Construction	 Education	 Healthcare & Lifesciences	CIS
		 Consumer	 Aerospace	 Hospitality	North America
		 Retail	 Defense	 Banking & Financial Services	Latin America
					Africa
					Middle East
					Asia-Pacific

Frost & Sullivan has identified 10 Growth Processes that serve as levers for determining and evaluating new Growth Opportunities.




Growth Opportunity 5: Modularization of CCUS Plants for Small Industries with Fewer CO2 Emissions

Opp. Size in 5 Years	Over \$500 M– \$1 B	Relevant End-User Industries for this Growth Opportunity			Applicable Regions
Timeline for Action	1 to 3 Years	 Manufacturing	 Mobility	 Metal & Mining	Central & East Europe
		 Energy & Environment	 Chemicals & Materials	 Information & Communications Technologies	South Asia
		 Electronics & Semiconductors	 Agriculture, Food & Nutrition	 Govt and Public Sector	Western Europe
GO Base Year	2024	 Construction	 Education	 Healthcare & Lifesciences	CIS
		 Consumer	 Aerospace	 Hospitality	North America
		 Retail	 Defense	 Banking & Financial Services	Latin America
					Africa
					Middle East
					Asia-Pacific

Frost & Sullivan has identified 10 Growth Processes that serve as levers for determining and evaluating new Growth Opportunities.



Growth Opportunity 6: CCUS Clusters and Hubs for Integrating Different Industrial Clusters

Opp. Size in 5 Years	Over \$500 M– \$1 B	Relevant End-User Industries for this Growth Opportunity			Applicable Regions
Timeline for Action	1 to 3 Years	 Manufacturing	 Mobility	 Metal & Mining	Central & East Europe
GO Base Year	2024	 Energy & Environment	 Chemicals & Materials	 Information & Communications Technologies	South Asia
		 Electronics & Semiconductors	 Agriculture, Food & Nutrition	 Govt and Public Sector	Western Europe
		 Construction	 Education	 Healthcare & Lifesciences	CIS
		 Consumer	 Aerospace	 Hospitality	North America
		 Retail	 Defense	 Banking & Financial Services	Latin America
					Africa
					Middle East
					Asia-Pacific

Frost & Sullivan has identified 10 Growth Processes that serve as levers for determining and evaluating new Growth Opportunities.



Growth Opportunity 7: Floating Storage Regasification Units (FSRUs) for Rapid LNG Supply in Europe

Opp. Size in 5 Years	\$100 M–\$500 M	Relevant End-User Industries for this Growth Opportunity						Applicable Regions		
		Manufacturing	Mobility	Metal & Mining	Energy & Environment	Chemicals & Materials	Information & Communications Technologies	Central & East Europe	South Asia	Western Europe
Timeline for Action	1 to 3 Years	Electronics & Semiconductors	Agriculture, Food & Nutrition	Govt and Public Sector	Construction	Education	Healthcare & Lifesciences	CIS	North America	Latin America
		Consumer	Aerospace	Hospitality	Retail	Defense	Banking & Financial Services	Africa	Middle East	Asia-Pacific
		GO Base Year	2024							

Frost & Sullivan has identified 10 Growth Processes that serve as levers for determining and evaluating new Growth Opportunities.



Growth Opportunity 8: Blending Blue Hydrogen in Existing NG Pipelines

Opp. Size in 5 Years	Over \$500 M– \$1 B	Relevant End-User Industries for this Growth Opportunity						Applicable Regions	
		Manufacturing	Mobility	Metal & Mining	Energy & Environment	Chemicals & Materials	Information & Communications Technologies	Central & East Europe	South Asia
Timeline for Action	Over 3 to 5 Years	Electronics & Semiconductors	Agriculture, Food & Nutrition	Govt and Public Sector	Construction	Education	Healthcare & Lifesciences	Western Europe	CIS
		Consumer	Aerospace	Hospitality	Retail	Defense	Banking & Financial Services	North America	Latin America
								Africa	Middle East
GO Base Year	2024							Asia-Pacific	

Frost & Sullivan has identified 10 Growth Processes that serve as levers for determining and evaluating new Growth Opportunities.



Growth Opportunity 9: Robotics for Subsea Automation

Opp. Size in 5 Years Over \$500 M– \$1 B	Relevant End-User Industries for this Growth Opportunity			Applicable Regions
	Manufacturing	Mobility	Metal & Mining	Central & East Europe
Timeline for Action 1 to 3 Years	Energy & Environment	Chemicals & Materials	Information & Communications Technologies	South Asia
	Electronics & Semiconductors	Agriculture, Food & Nutrition	Govt and Public Sector	Western Europe
	Construction	Education	Healthcare & Lifesciences	CIS
	Consumer	Aerospace	Hospitality	North America
	Retail	Defense	Banking & Financial Services	Latin America
	Consumer	Aerospace	Hospitality	Africa
GO Base Year 2024	Consumer	Aerospace	Hospitality	Middle East
Retail	Defense	Banking & Financial Services	Asia-Pacific	

Frost & Sullivan has identified 10 Growth Processes that serve as levers for determining and evaluating new Growth Opportunities.



Growth Opportunity 10: IoT for Boosting Efficiency and Accuracy

Opp. Size in 5 Years	Over \$1 B	Relevant End-User Industries for this Growth Opportunity						Applicable Regions		
		Manufacturing	Mobility	Metal & Mining	Energy & Environment	Chemicals & Materials	Information & Communications Technologies	Central & East Europe	South Asia	Western Europe
Timeline for Action	1 to 3 Years	Electronics & Semiconductors	Agriculture, Food & Nutrition	Govt and Public Sector	Construction	Education	Healthcare & Lifesciences	CIS	North America	Latin America
		Consumer	Aerospace	Hospitality	Retail	Defense	Banking & Financial Services	Africa	Middle East	Asia-Pacific
		GO Base Year	2024							

Frost & Sullivan has identified 10 Growth Processes that serve as levers for determining and evaluating new Growth Opportunities.





Best Practices Recognition

What Best Practices has your organization embraced to maximize your future Growth Potential?

Best Practices Recognition

Company of the Year (COY)

Company that exemplifies visionary innovation, market-leading performance, and unmatched customer care

Customer Value Leadership (CVL)

Company that offers products or services customers find superior for the overall price, performance, and quality

Entrepreneurial Company of the Year (ECOY)

Best up-and-coming, potentially disruptive market participant

New Product Innovation (NPI)

Company that offers a new product or solution that uniquely addresses key customer challenges

Technology Innovation Leadership (TIL)

Company that has introduced the best underlying technology for achieving remarkable product and customer success while driving future business value

Competitive Strategy Leadership (CSL)

Company with a stand-out approach to achieving top-line growth and a superior customer experience

Enabling Technology Leadership (ETL)

Company that applies its technology in new ways to improve existing products and services and elevate the customer experience

Market Leadership (ML)

Company that achieved the greatest market share resulting from outstanding performance, products, and services

Product Leadership (PL)

Company that offers a product or solution with attributes that deliver the best quality, reliability, and performance in the industry



Frost Radar

How is your organization maximizing your future Growth Potential?

Frost Radar

Benchmarking Future Growth Potential



STRATEGIC IMPERATIVE

- A robust analytical tool to benchmark the future growth potential of leading organizations across multiple industries
- Organizations benchmarked across 10 key criteria that relate to innovation and growth, relative to competitors
- An evaluation of every organization's efficacy across these criteria, helps determine how well they are positioned to drive growth in the future
- Our goal is to help them better leverage their strengths and to overcome their weaknesses, and thereby strengthen their growth potential.



SELECTION CRITERIA

Analysts use **6 criteria** in determining markets with Frost Radar coverage:

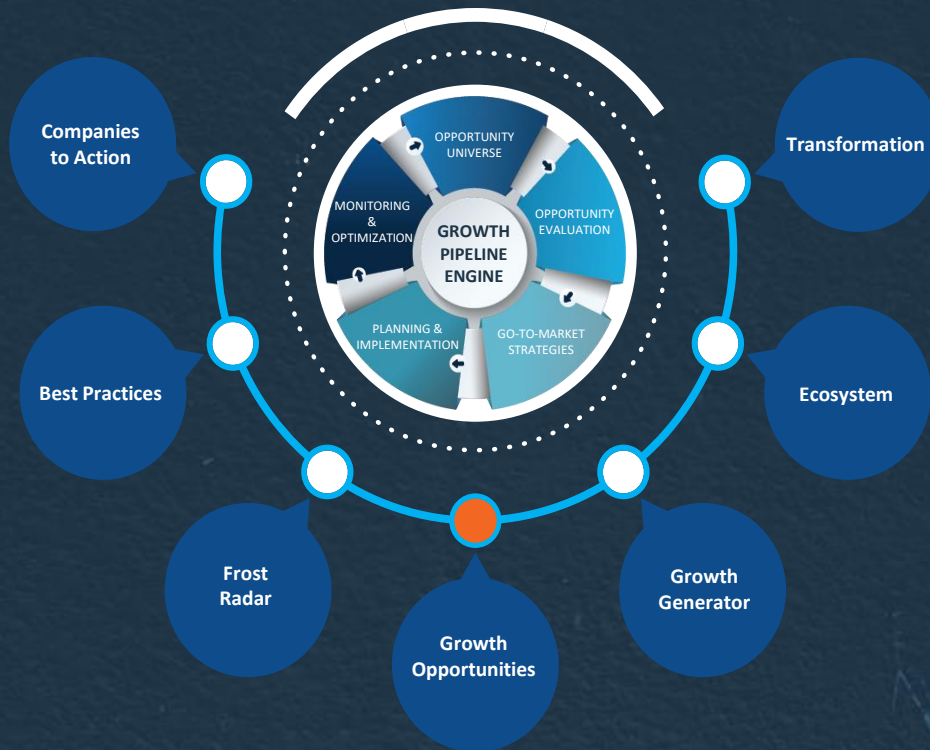
- 1) Markets that are dynamic and fluid
- 2) Markets that are highly fragmented with numerous companies
- 3) Highly competitive market (emerging or mature)
- 4) Highly fragmented customer base
- 5) Frost & Sullivan has a strong brand in the market
- 6) Analyst brand in the market is very strong



WHY Frost Radar?

- Our fundamental value proposition to clients is to help them innovate and accelerate growth
- Market share is important; however, digging into how companies' grow their market share helps us determine future growth potential
- Frost Radar is a tool that helps us identify organizations that can support their customers into the future

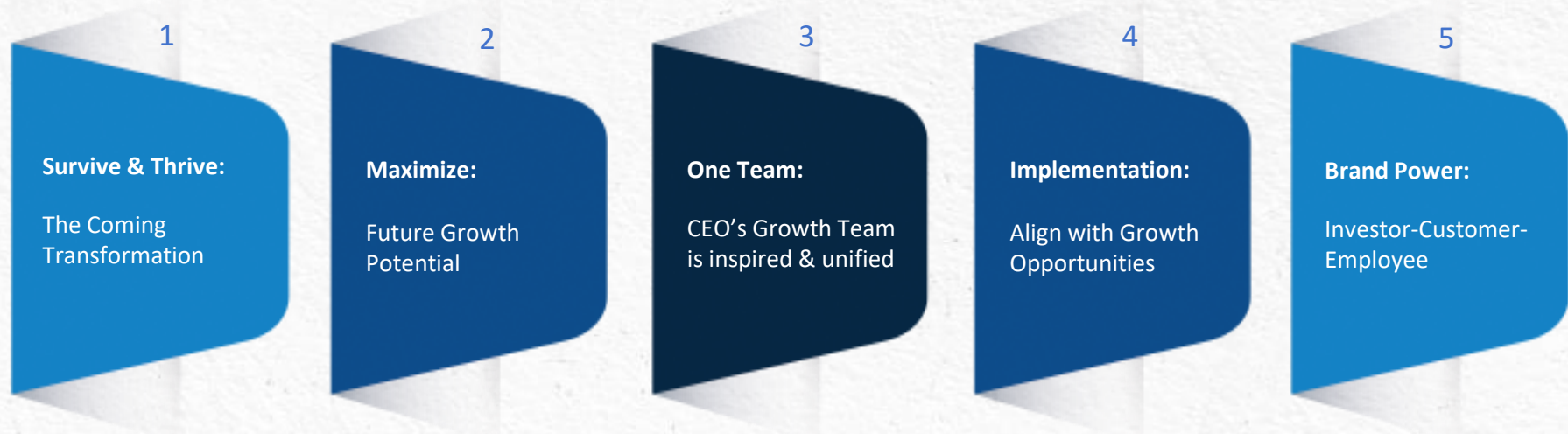
How is your company evaluating its future growth potential?



Next Steps

How does your organization identify & prioritize Growth Opportunities?

Benefits and Impacts of Growth Opportunities



Which of these benefits would be most important to your Investor-Customer-Employee?

Next Steps



JOIN:
Growth Council

APPLY:
Companies to Action

ENGAGE:
Growth Dialog

PARTICIPATE:
Growth Council Think Tank

Does your current system support rapid adaptation to emerging opportunities?

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Frost & Sullivan understands how to prepare companies in the face of an uncertain future. Our global team of consultants work with clients worldwide to help them navigate the many complexities facing their industries and allow them to take advantage of current growth opportunities while positioning them for even more significant growth in the future.



Technology Expertise

Expertise in all enabling technologies for digital transformation, including IoT, cloud computing, big data analytics, security, mobility and value-added services



Industry Convergence

In-depth understanding of digitization Opportunities across the ecosystem, including business models and industry transformation



In-depth Coverage

Expertise and market knowledge to help clients achieve growth objectives by adapting to the new digital economy



Global Perspective

Global expertise across technology applications and verticals, including manufacturing, automotive, healthcare, and many more



Unparalleled Support

Approximately 1,200 analysts and consultants tracking applications, verticals and enabling technologies for digital transformation



Schedule a complimentary dialogue with our team to discuss your strategic growth development

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