

Advancing Energy and Industrial Technology Innovation

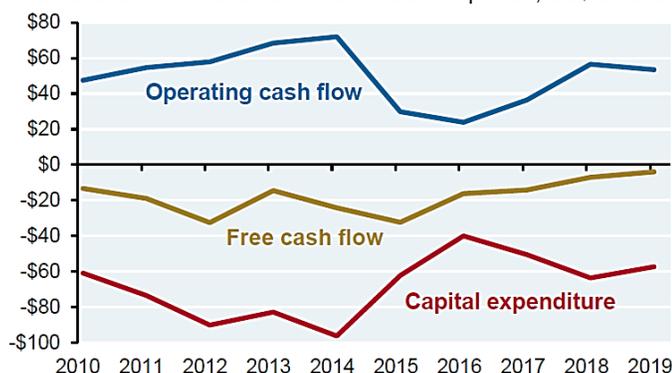
The Energy and Industrial sectors are entering an era where technological innovation has become essential to facilitate cost reduction, efficiency improvement and meet new ESG goals. In this environment, there is a growing need to provide long-term sustainable capital, operational knowledge and guidance to emerging Energy and Industrial technology companies. CSL Ventures was launched in August 2019 with the objective to enable leading entrepreneurs build successful enterprises by providing capital, deep industry connections and technology development and operational expertise.

Why Now?

The Energy Services segment is being asked to do more with less as Energy companies are simultaneously trying to serve the challenging priorities of generating near-term cashflow while meeting the growing energy demand. The industry has reached the bottom of the cost-curve and it now needs more focus on technology to drive further efficiency gains to improve production and expand reserves. As a result, the appetite is at an all-time high to embrace innovation in the Energy sector.

Shale revolution: a revolution in supply, not profit

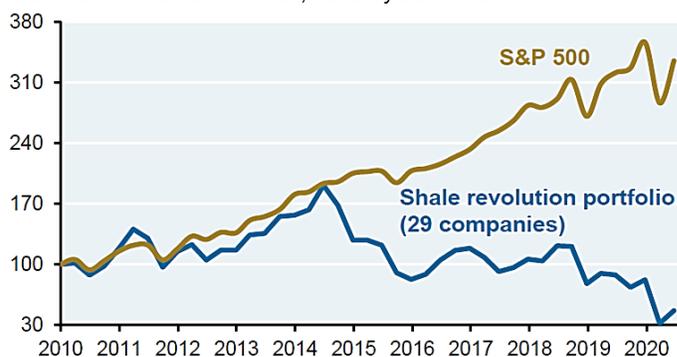
Select cash flow measures for 29 shale companies, US\$ billions



Source: Bloomberg. 2019.

The shale collapse

Cumulative total return index, January 2010=100



Source: Bloomberg. June 26, 2020. Shale revolution portfolio is market cap weighted and rebalances quarterly.

E&P Companies ⁽¹⁾	2014 R&D spend	2019 R&D spend
Exxon	\$971mm	\$1,214mm
Chevron	\$707mm	\$500mm
Shell	\$1,312mm ⁽²⁾	\$962mm
BP	\$663mm	\$364mm
Total	\$1,353mm	\$968mm
ENI	\$217mm	\$227mm
Total Sum	\$5,223mm	\$4,235mm (-19%)
OFS Companies ⁽¹⁾	2014 R&D spend	2019 R&D spend
Schlumberger (R&E) ⁽³⁾	\$1,345mm ⁽⁴⁾	\$717mm
Halliburton	\$601mm	\$404mm
Baker Hughes (R&E) ⁽⁵⁾	\$613mm	\$687mm
Total Sum	\$2,559mm	\$1,808mm (-29%)

(1) All the numbers are extracted from each company's 10-K or Annual Report

(2) Shell's 2014 R&D spend aggregates BG's 2014 R&D spend (\$90mm)

(3) Schlumberger identified R&D as Research and Engineering (R&E) in all its Annual Reports

(4) Schlumberger's 2014 R&E spend aggregates Cameron's 2014 R&D spend (\$128mm)

(5) Baker Hughes identified R&D as R&E in its 2014 annual reports. 2014 R&D spend does not include GE Oil & Gas technology spending. 2019 R&D spend includes Baker Hughes and GE Oil & Gas technology spending

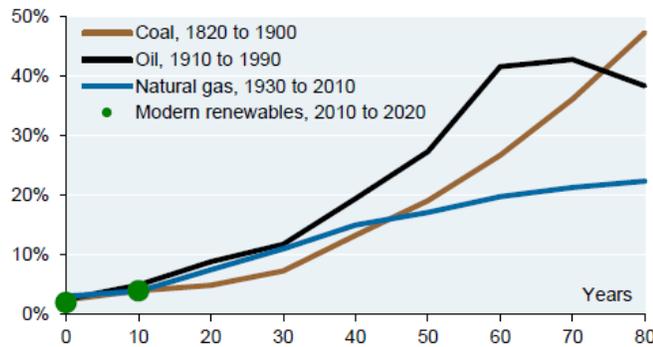
There is also a downward trajectory in terms of the dollars being spent on research and development across the Energy sector. The table below summarizes the R&D spend by leading Energy firms and the % reductions are upper bounds since XTO's and GE Oil & Gas R&D spend in 2014 was not publicly available.

Over the last decade, innovation has started to migrate towards new startups as the growing community of experienced technology and business employees are leaving large companies to become entrepreneurs. The amount of available venture capital allocated towards the Energy and Industrial sectors has been less as compared to other business sectors and this is partially due to the speed of technology adoption in these markets, greater need for domain knowledge and overall complexity. As a result, the uptake of technology and technical disruption in the Energy and Industrial verticals has been relatively slow when compared to the B2C world and some other market verticals.

Energy is an essential ingredient for global economic growth and has been consistently growing at a gradual pace of ~ 2% between 1995 and 2018 (*BP Energy Outlook 2020). Over the next few decades while the sources of primary Energy will continue to evolve as part of the energy transition journey, we can make two inferences:

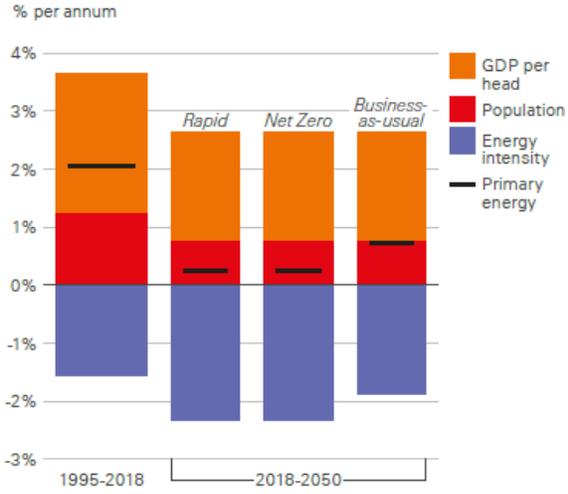
- Demand for Energy is going to continue to increase. Over the next two decades, the likely growth trajectory is going to be between 0.3% and 0.7% based on the different scenario's in the BP Energy Outlook 2020
- The last 3 Energy transitions (coal, oil and natural) each took ~ 40 years to reach a share of ~ 15-20% of the overall Energy mix. The current renewable Energy growth (2010 to 2020) is on a similar trajectory. Currently, fossil fuels represent ~ 85% of the primary Energy source. As per the IEA's projection, fossil fuels are forecasted to represent ~ 75 – 80% of the primary global Energy source by 2040 (coal declining while natural gas showing growth). So, in our view the Oil & Gas industry still has a key role to play as part of the Energy transition journey over the next two decades.

The last three energy transitions took ~40 years to reach 15%-20% shares, % of world primary energy consumption



Source: V. Smil (pre-1965 data), BP (post-1965 data), JPMAM. 2020.

Contribution to primary energy demand growth



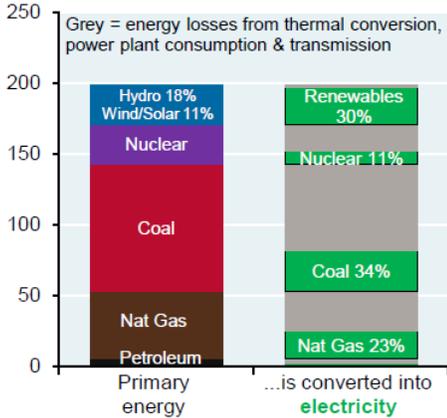
The energy industry is facing challenges around capital access and having a need for increased technology as reservoirs mature, new reserves are more complex in nature, associated production and transport challenges and the need for automation and digital solutions to materially change the cost structure. The above-mentioned macro is creating an environment for where there is a growing and rich ecosystem for startups to address the technology challenges in the Energy and Industrial verticals.

M&A transactions in the digital Energy space are also rising in number as the space grows.

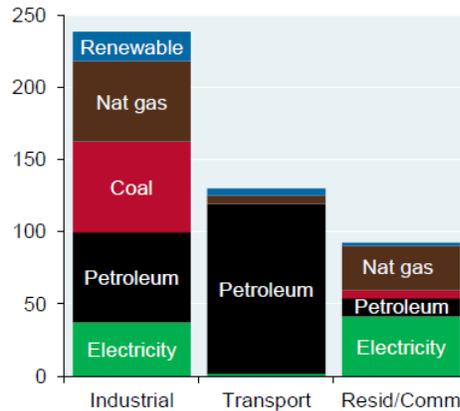
Out of the total energy consumed globally, electricity currently represents approximately 17%. The Industrial sector is by far the greatest consumer of energy at slightly more than 50%. The visual below highlights the key takeaways. Longer term, the electrification of the transport sector and industrial processes will be a pervasive trend. This will allow renewables primarily wind and solar to continue to displace fossil fuels over the next several decades, especially, in electricity generation.

Global electricity generation, and its contribution to total energy consumed by end-users

Electricity generation, quad. BTU



Energy consumed by end-users, quad. BTU



Key Stats

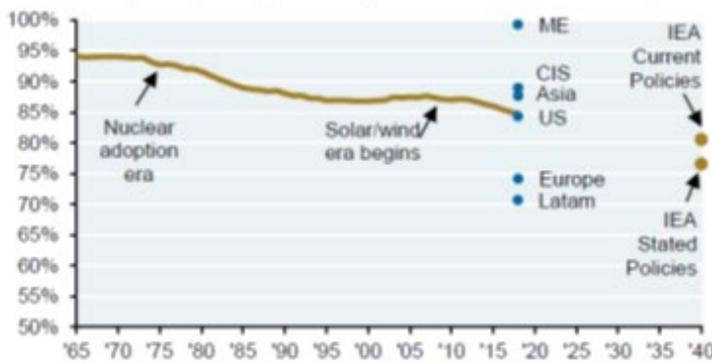
- Electricity is just 17% of global energy consumed by end-users
- Decarbonization via renewables mostly confined to electricity, with some industrial use
- Renewables account for 30% of electricity, and 11% of total energy consumed by end-users
- Fossil fuels used in electricity generation represent 30% of all fossil fuel use
- Industrial sector is by far the greatest consumer of energy

Source: Energy Information Administration, J.P. Morgan Asset Management. 2019. As per BP/EIA convention, primary energy for nuclear power is derived by assuming 38% thermal conversion. For renewables, primary energy conversion only reflects transmission losses.

Even with the increasing speed of decarbonization of electricity, fossil fuels are expected to play a major role in the overall energy mix due to their usage in other applications such as the industrial sector. The visual below shows the projection from the IEA going out to 2040 and the relative fraction of fossil fuels in the overall energy mix. The reason for this is the pervasive use of fossil fuels in industrial processes and this is key challenge in energy transition.

The world uses fossil fuels for ~85% of its energy

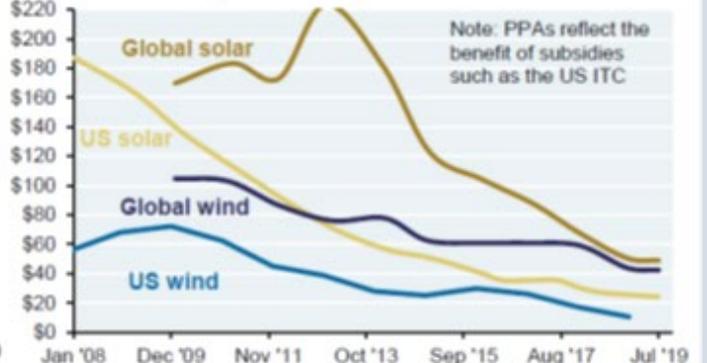
% of global primary energy consumption from coal, oil and nat gas



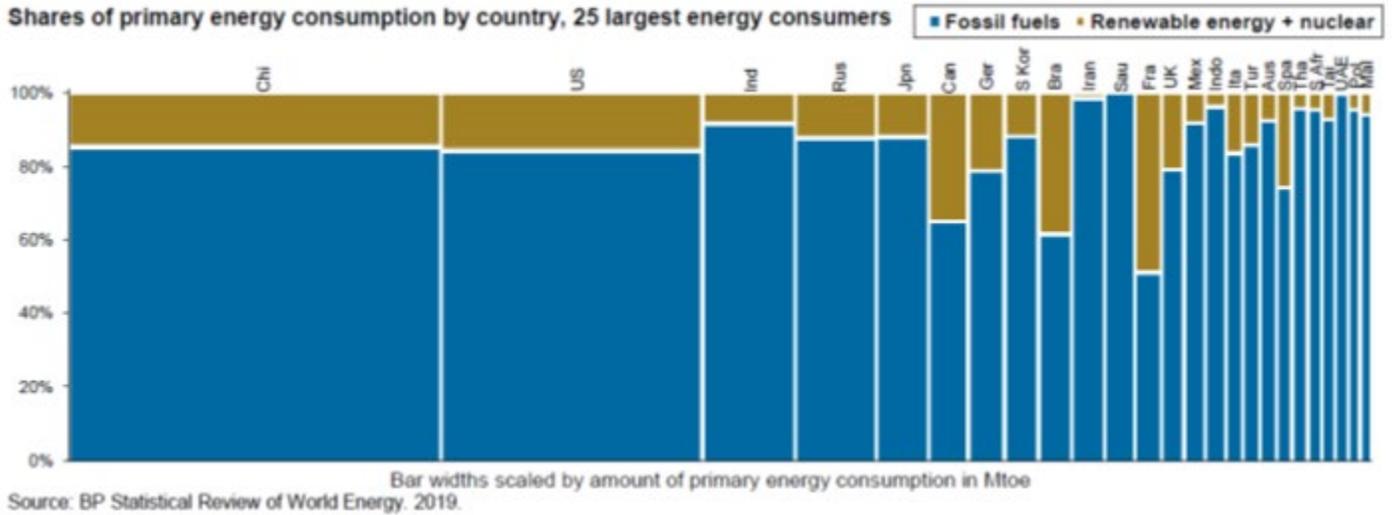
Source: BP Statistical Review of World Energy, IEA. 2019.

Average power purchase agreement prices for wind and solar, Real 2018 \$ per MWh

Average power purchase agreement prices for wind and solar, Real 2018 \$ per MWh



Source: Lawrence Berkeley National Laboratory, IRENA. 2020.



A key consequence of these trends will be the importance of managing the electrical grid and energy storage. In fact, in our view, solving the energy storage challenge at the GWH or TWH scale is critical for wind and solar to displace fossil fuels as a primary energy source. The visual highlights the current situation in the United States where only 1% of the electricity generated is currently stored and most of this storage occur in the form of pumped hydro facilities.

Industrial sectors with "high" potential for electrification

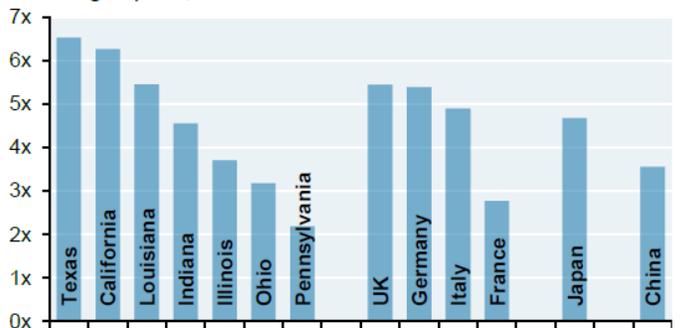
Sector	Heat requirement	Fuel consumption shares:		
		HVAC	Heat	CHP
Primary metals excl. steel	1200°C	6%	75%	7%
Fabricated metal	430°C-680°C	20%	61%	7%
Machinery	730°C	46%	39%	4%
Secondary steel	1425°C-1540°C	4%	87%	0%
Wood products	180°C	10%	50%	14%
Vehicle parts (drying)	150°C	31%	33%	12%
Plastics and rubber	260°C	20%	33%	24%

CHP refers to "combined heat and power", a process by which waste heat from combustion provides additional power. Sectors above have low CHP shares; sectors with higher CHP shares are harder to electrify.

Source: LBNL, "Electrification of buildings and industry", March 2018

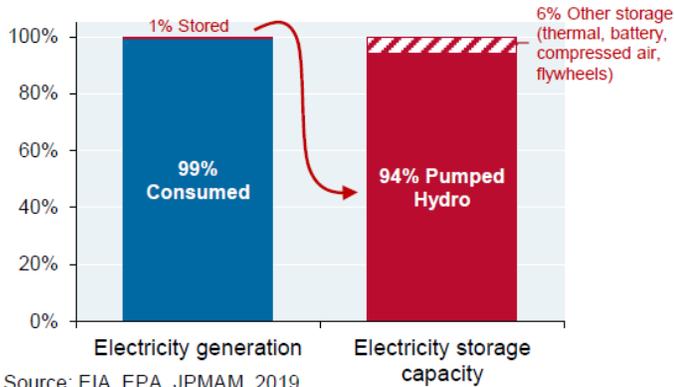
Electricity is 3x-6x more expensive than natural gas

Cost per megajoule of energy, electricity price divided by natural gas price; for industrial users

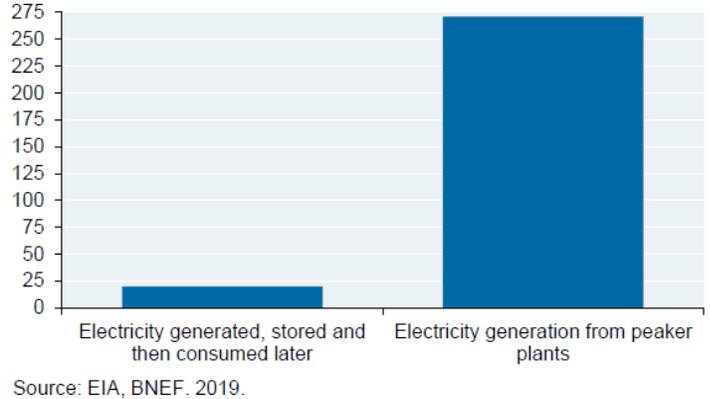


Source: EIA, Eurostat, IAEE, CEIC, IFPEN, JPMAM, World Bank, 2019. States shown are largest industrial users of US primary energy.

Only 1% of US electricity generation is stored, and most storage is via decades-old pumped hydro storage



Much larger storage buildout needed to reduce peaker plant usage, TWh



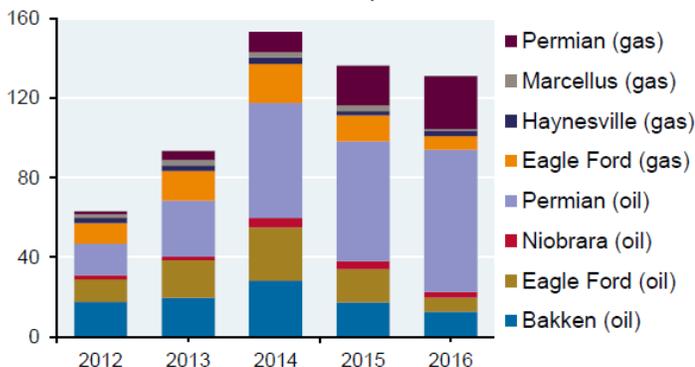
It is for all of these reasons that in addition to the overarching digital theme, CSL Ventures is also focused on startups in the electrical grid and energy storage arenas. We also believe that in the current energy transition phase, all forms of responsible energy production have a significant role to play and due to the level of investment needed, this transition will take place in decades and not a few years.

Internally, we are also working on several key industry themes that we feel are of growing importance to the Energy and Industrial verticals. We refer to these themes as the “rising tides”. Some of these are:

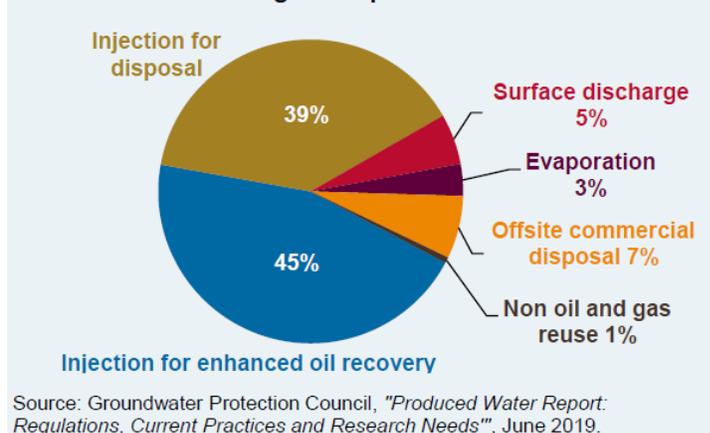
1. Water treatment, handling and disposal
2. Converting flared gas to power
3. Cybersecurity

Let’s look at one example in detail i.e. “Water treatment, handling and disposal”. If we look at “Flowback and Produced” (“FP”) wastewater, this is an increasing global challenge. This is an issue for both Oil & Gas production but is also a growing challenge in the broader industrial space. The chart below shows the trend over 5 years 2012-2016. The “FP” issue has only further accelerated in the last few years to an even bigger energy industry economic and environmental challenge.

Flowback/Produced water in shale oil and gas basins
Millions of cubic meters of FP water produced over first 12 months



Produced water management practices



We at CSL Ventures are strong proponents of these industry trends and are researching these primary themes in technology startups to invest and address these significant technical challenges in the Energy and Industrial verticals.

Our Strategy

CSL Ventures has built its strategy around the key themes of digital, software, big data and IOT and these investments would represent ~ 70% of the overall portfolio. These are key technologies that are of growing importance in the Energy and Industrial verticals and the pace of adoption is faster. However, since we are operating in the physical world we want to selectively invest in the areas of hardware, material science, chemistry, electrical grids and Energy storage. These technology startups would represent ~ 30% of the portfolio.

We focus on companies that can address more than one vertical and we refer to this as “multi-industry”, by bringing technologies from other verticals to the Energy and Industrial sectors and vice versa. We also layer ESG impact as part of our selection and deal evaluation criteria.

Our investment fairway is early-stage companies from SEED to Series B. They need to have a minimum viable product or service, need to have commercial revenue and customers. The product/service needs to be scalable and we pay attention to the go to market strategy and any channel partner relationships. This is particularly important because we try to create asymmetric risk vs reward investment situations.

As much as possible, we want to lead rounds, take board seats and our mandate is to take ownership equity stakes between 5% and 30% with 10-20% being our sweet spot. CSL Ventures' domain knowledge, operational and technical expertise resonates well with entrepreneurs and we engage very actively with our portfolio companies.

Conclusion

Since the inception of CSL Ventures in August 2019, we have started creating deep relationships with entrepreneurs, early-stage SEED funds and incubators, select universities, investors and corporate venture capital organizations as well as a strong brand awareness by participating in industry panels, podcasts and conferences. We have also built a comprehensive venture technology stage gate evaluation and diligence process, and this has allowed us to build an exciting high growth portfolio of companies.

There is an ever-increasing need for capital in Energy and Industrial B2B space to solve the very significant technical challenges. As the vibrant startup ecosystem continues to evolve, it provides investors like CSL Ventures the opportunity to invest and add the force multiplier to the entrepreneurial initiative.

Authors



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Imran joined CSL Capital Management as Managing Director. Prior to joining CSL, he was Vice President of the Schlumberger Corporate Venture Fund based in Houston. As the Head of the Venture Fund, Imran was responsible for investing and managing Schlumberger's venture investment portfolio of ~ \$100mm with approximately 20 investments. In addition, he was also responsible for raising two funds of \$1bn each for Schlumberger's SPM (Schlumberger Production Management) business. Prior to this role, he was Vice President and Treasurer for Schlumberger Limited based in Houston, and has held senior management positions such as Schlumberger Limited Financial Controller, President Reservoir Characterization Group, President of Middle East & Asia and President of Drilling and Measurements. Imran joined Schlumberger as a Wireline and Testing Field Engineer in 1989 and has held numerous operations, management, financial, marketing and human resource positions for the company in the United States, Europe, Middle East and Far East. Imran has a Bachelor of Science in Engineering and Applied Sciences and a Master of Science in Mechanical Engineering, both degrees from the California Institute of Technology.



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Abhinav joined CSL Capital Management as Vice President after spending 10+ years in the oil and gas industry across a variety of functions such as investment banking, strategy consulting, field operations and portfolio company management. Prior to joining CSL, Abhinav had been advising various oilfield services startups (such as Corva, Drill2Frac, SensOLeak, QuantumPro) and portfolio companies of several energy private equity groups (such as EV Private Equity, Total Energy Ventures, Energy Innovation Capital, Altira Group, Apollo Global Management, TPG). Prior to this role, he worked at PwC's oil and gas investment banking group in Houston, providing M&A transaction services to middle-market oilfield services companies. In addition, he also worked with ConocoPhillips and Lazard's oil and gas investment banking group in Houston, evaluating E&P investment opportunities and providing M&A transaction services to E&P and oilfield services clients respectively. Abhinav's oil and gas industry career started in 2009 in Norway with Fugro as an Offshore Seismic Engineer, after which he joined Schlumberger as a Wireline Field Engineer in USA. Abhinav has a Bachelor of Technology in Electronics and Communications Engineering from NIT Durgapur in India and a Masters of Business Administration in energy finance from The University of Texas at Austin and London Business School (U.K.)

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