



*Hifi Engineering Recognized for*

**2021**

**Technology Innovation Leadership**

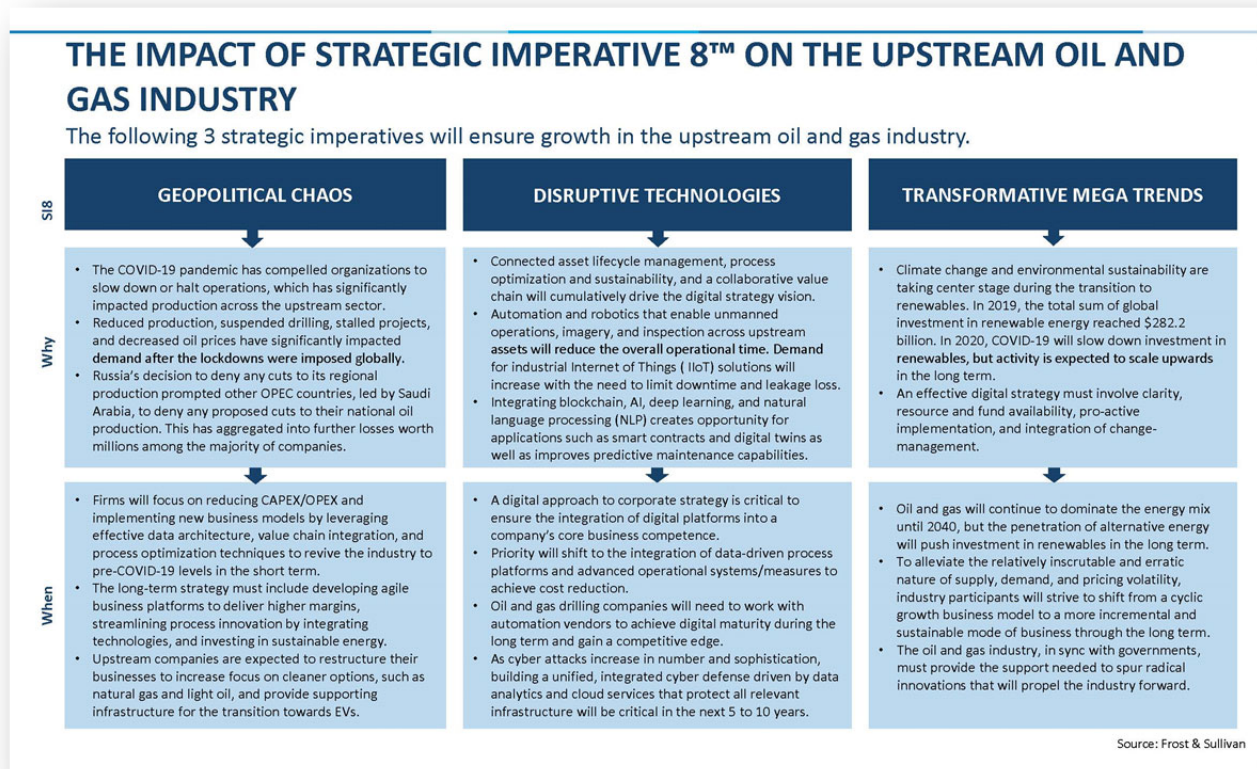
North American

Fiber-optic Sensing Industry

*Excellence in Best Practices*

## Strategic Imperatives

Frost & Sullivan identifies three key strategic imperatives that impact the upstream oil and gas industry: geopolitical chaos, disruptive technologies, and transformative mega trends. Every company that is competing in the upstream oil and gas space is obligated to address these imperatives proactively; failing to do so will almost certainly lead to stagnation or decline. Successful companies overcome the challenges posed by these imperatives and leverage them to drive innovation and growth. Frost & Sullivan’s recognition of Hifi Engineering is a reflection of how well it is performing against the backdrop of these imperatives.



## Best Practices Criteria for World-Class Performance

Frost & Sullivan applies a rigorous analytical process to evaluate multiple nominees for each Award category before determining the final Award recipient. The process involves a detailed evaluation of best practices criteria across two dimensions for each nominated company. Hifi Engineering excels in many of the criteria in the fiber-optic sensing technology market.

# AWARD CRITERIA

<i>Technology Leverage</i>	<i>Business Impact</i>
Commitment to Innovation	Financial Performance
Commitment to Creativity	Customer Acquisition
Technology Incubation	Operational Efficiency
Commercialization Success	Growth Potential
Application Diversity	Human Capital

## ***Innovative Excellence***

Pipeline leakage is a crucial source of material loss in the oil and gas (O&G) industry. Beyond the product loss, the environmental impacts of large leaks can be quite catastrophic. Cleaning up oil spills is a time, workforce, and cost consuming process. Conventional leak detection systems suffer from challenges, such as detecting small leaks, and high implementation costs, or struggle to localize leak points. Such solutions generally require large scale deployments along the pipeline to enable continuous and accurate monitoring.

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***- Samantha Fisher, Best Practices Research Analyst***

Founded in 2007 and headquartered in Calgary, Canada, Hifi Engineering (Hifi) built a fiber-optic sensing technology that monitors long-distance hydrocarbon transportation pipelines. The company leverages machine learning (ML) and big data analytics to perform real-time analysis to detect leaks, measure flow, and find other anomalies that interrupt pipeline operators.

Frost & Sullivan finds that Hifi's technology plays a pivotal role in maintaining pipeline health. Its real-time monitoring platform equips the pipeline

operator with critical data that identifies the exact location of a leak in a pipeline that runs hundreds of kilometers in the distance. Hifi meticulously designed its technology to identify variations in underground sound, vibration/strain, and temperature. The company adopted unique algorithms that process many terabytes of raw data per day produced by the pipeline operators.

Furthermore, the company's novel algorithms capture data in real time and notify pipeline operators when an event such as a leak occurs. Optical fiber's versatile capability allows data transmission faster than the traditional methods of sending data using flow meters. From the operation point, Hifi monitors the pipeline production flow using distributed acoustics that also measure temperature and vibration/strain on an integrated basis. With this information, the operator can detect early pipeline corrosion and paraffin build-ups, indicating when they should perform pigging.

### ***A Keen Approach***

Besides its fiber-optic sensors and cables, Hifi has dedicated significant investment in enhancing its software algorithms both internally through a team of highly skilled system engineers as well as through research partnerships with top universities in North America and Europe. The company's technology analyzes underground vibrations and evaluates the impact of different seasons and the surrounding environment, such as earthquakes and landslides, affecting pipeline operations. Hifi continually works to automate its system fully by improving its artificial intelligence and ML for pipeline operators. This dedication allows the system to generate automatic anomaly alerts as it learns to differentiate between the expected and unusual activities.

Overall, Hifi works with an operator from the deployment stages of a pipeline by managing operations in the control room. Through every milestone of the purchase and post-sales process, the company nicely maintains agility, working with the customer to ensure that they clearly understand the system and attached value. For example, a green-field build is relatively streamlined, as Hifi's technology easily inserts into the customer's plans. Conversely, established legacy fields can result in longer deployment times. The company reported it recently finished a deployment that wrapped up in three to four months - which included sales qualification, answering questions, and proving the technology.

### ***Strong Market Reception***

With a fully commercialized product, Frost & Sullivan analysts find that Hifi disrupts the market with its high-fidelity, fully distributed sensing technology. From a safety perspective, the company's solution senses every centimeter of the asset, informs the operator of leaks, and identifies situations requiring immediate preventative measures. Frost & Sullivan points out that many of the company's other competitors are early-generation companies that use low-fidelity fiber-optic sensing technology, which can fail to detect various leaks, including low level leaks. If left unattended, these leaks increase in size, threatening infrastructure impacts, environmental damages, and increased expenses. Hifi's technology solves major pipeline leaks and accidents with its key fiber-optic technology. Frost & Sullivan recognizes how Hifi possesses higher fidelity, better performance, and a higher signal to noise ratio than its other competitors.

Moreover, the company's business model gives it a distinct advantage, as it ensures that customers receive a cost-effective holistic solution. According to Hifi, anything that goes in the ground with the pipe, such as the physical fiber, is sold to the pipeline operators with full ownership. The company also offers around-the-clock technical support fully wrapped into a platform-as-a-service business model, which includes all the required hardware and software for a monthly fee. Additionally, Hifi offers keen agility in the prototype stage, resulting in rapid software development, with unsupervised and

supervised ML. Thus far, Hifi has experienced critical success in several competitive situations, such as field validation, carving out an exciting space for itself by achieving 100% leak detection performance with zero false positives - which its other competitors simply have not achieved.

### **Strategic Diversity**

While Hifi's primary focus area was O&G, the company realized the importance of maintaining a diverse focus, which influenced its "Pipes Plus Strategy." This strategy advocates expansion into other material pipelines. As a result, Hifi is now building its expertise in other industries, such as mining and utilities. The company keeps an eye out for possible new applications for its high fidelity and high acuity technology for gas, multiphase, wastewater, and potable water. Moreover, Hifi's fiber-optic distributed sensing technology is currently being installed on the Trans Mountain Expansion Pipeline's entire length, one of the world's largest pipelines (at 1,150 kilometers).

In addition, the company has roughly 60 patents in the areas of fiber-optic sensing and flow monitoring. It is a member of the Canadian Energy Pipeline Association (CEPA) Foundation and the Fiber Optic Sensing Association. The company received several industry Awards, including the CEPA Foundation Innovation Award and the Global Petroleum Show Digital Innovator Award, both in 2019. In June 2020, Hifi launched the HDS™ 2.0 system upgrade and HDS™ Monitor control room software. These new products offer improvements in user experience, scalable architecture, streamlined multi-asset monitoring, geospatial context, and brand new features including patented pipeline pig detection, tracking, and analysis.

### **Moving Forward**

Since 2008, Hifi focused mainly on downhole wells; however, the company transitioned to pipelines, which resulted in double growth since 2015. The company leverages its position as a technology

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innovator to provide best-in-class ML event detection algorithms for fiber-optic sensors. In the process, the company adapted and learned how to be pipeliners. Many of its system engineers have become well-versed in pipeline processing and commissioning, enabling the company to provide the best technology and support to customers and the industry. Frost & Sullivan finds that Hifi's visibility and technical

expertise position the company well for high growth in the near future.

The company's growth also rests on a robust platform of speaking engagements and conferences, as well as through word-of-mouth. Customer testimonials go a long way in legacy industries, and have helped Hifi further strengthen its position in the North American market. The company's leadership mostly lets the industry guide its global expansion perspective, enabling it to pursue projects in areas such as Europe, South Africa, India, and South America. As a result, Hifi hit its stride with current installations in over 1,000 kilometers of pipeline, including segments on both the existing Keystone pipeline in Houston and the Trans Mountain pipeline, which runs from Alberta to the British Columbia coast in Canada. Hifi also has various deployments with other midstream operators, including Enbridge,



Husky, ExxonMobil, Orintiv(Encana), Canadian Natural Resources Limited, Suncor, Sask Energy, and Plains Midstream, resulting in a firm footing in North America. The company continues to plan toward scaling on a global basis. Hifi's strategic goal and mantra are to become the next-generation standard while turning to the API Standard 1175, which focuses on a portfolio approach to leak detection program management. Within the industries it operates, there is no such thing as a silver bullet, which means that a real solution must be a complementary technology collection. In this area, Hifi aims to be a significant and valuable partner to pipeline operators around the world.

## **Conclusion**

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*Despite the longevity of fiber-optic in the pipeline industry, significant challenges, such as low fidelity and poor leak detection, render the legacy technology mostly unsafe and inefficient; however, status-quo mentality and fear of high deployment costs hinder the industry from seeking innovations.*

*Since 2007, Hifi Engineering has developed and evolved its portfolio of innovative, cost-efficient solutions for the pipeline industry. While initially focused solely on the oil and gas industry, the company spread its wings into new pipeline operations, such as slurry pipelines, wastewater and potable water as well as other linear asset monitoring applications. In doing so, the company further expanded the fiber-optic sensing technology that differentiates it from its early-generation competitors, as the company achieves 100% leak detection with zero false positives. With a firm strategy of speaking engagements, product testing, and recognition for its technological prowess, Frost & Sullivan concludes that Hifi Engineering is well-positioned to disrupt the market on a foundational and global level.*

*With its differentiated technology, firm strategic focus, widening penetration, and strong overall performance, Hifi Engineering earns the 2021 Frost & Sullivan Technology Innovation Leadership Award.*

## What You Need to Know about the Technology Innovation Leadership Recognition

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Frost & Sullivan's Technology Innovation Award recognizes the company that has introduced the best underlying technology for achieving remarkable product and customer success while driving future business value.

### Best Practices Award Analysis

For the Technology Innovation Leadership Award, Frost & Sullivan analysts independently evaluated the criteria listed below.

#### *Technology Leverage*

**Commitment to Innovation:** Continuous emerging technology adoption and creation enables new product development and enhances product performance

**Commitment to Creativity:** Company leverages technology advancements to push the limits of form and function in the pursuit of white space innovation

**Stage Gate Efficiency:** Technology adoption enhances the stage gate process for launching new products and solutions

**Commercialization Success:** Company displays a proven track record of taking new technologies to market with a high success rate

**Application Diversity:** Company develops and/or integrates technology that serves multiple applications and multiple environments

#### *Business Impact*

**Financial Performance:** Strong overall financial performance is achieved in terms of revenues, revenue growth, operating margin, and other key financial metrics

**Customer Acquisition:** Customer-facing processes support efficient and consistent new customer acquisition while enhancing customer retention

**Operational Efficiency:** Company staff performs assigned tasks productively, quickly, and to a high-quality standard

**Growth Potential:** Growth is fostered by a strong customer focus that strengthens the brand and reinforces customer loyalty

**Human Capital:** Commitment to quality and to customers characterize the company culture, which in turn enhances employee morale and retention

