Let's talk.

Position Paper Series

Understanding and tracking the chemistry of water to increase profits in oil and gas operations

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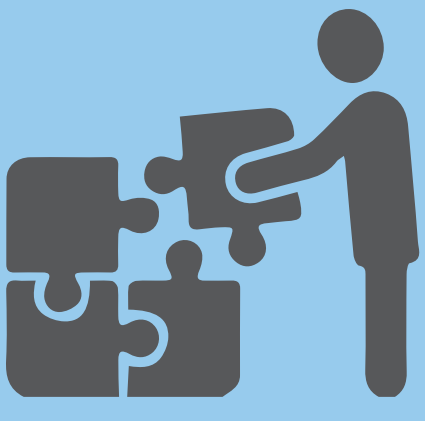
We engage public and energy sector clients with comprehensive advisory services to solve their most challenging water, waste, and energy demands - taking them from early options analysis and front-end thinking right through the full project lifecycle. What's more, our employee-owned team is fueled by our passion for innovative, sustainable solutions.

> **Driving down the costs of unconventional oil and gas operations**

Inside

In a context of low oil and gas prices, increased water stress, and changing regulations, water management platforms that assist in water sourcing, treatment, and reuse are critical to bring costs down in oil and gas operations. This paper:

1. **Unravels** the challenges faced by the oil & gas industry that contribute to higher operational costs.
2. **Presents** proactive solutions to tackling the issues while building resiliency and certainty for your business.
3. **Examines** substantive insight based on real examples, not speculation.



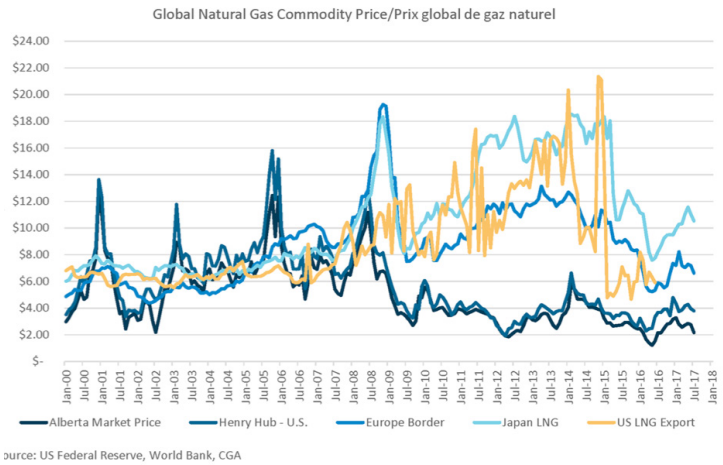
> “Driving down the costs of unconventional oil and gas operations”

THE CHALLENGES:

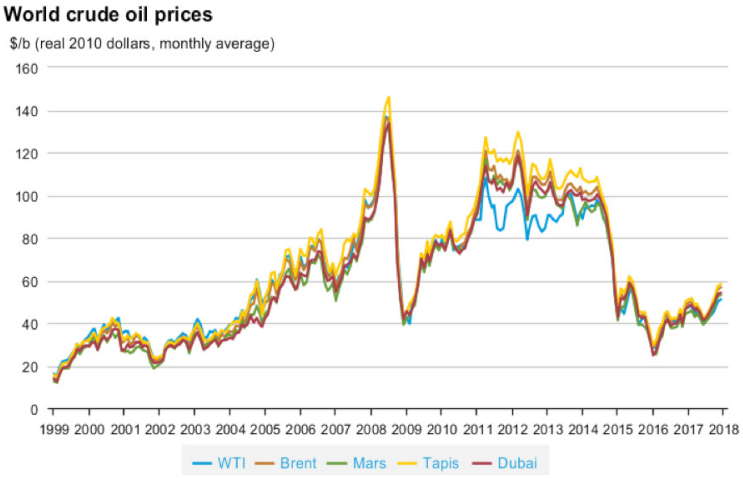
1 Low Commodity Prices

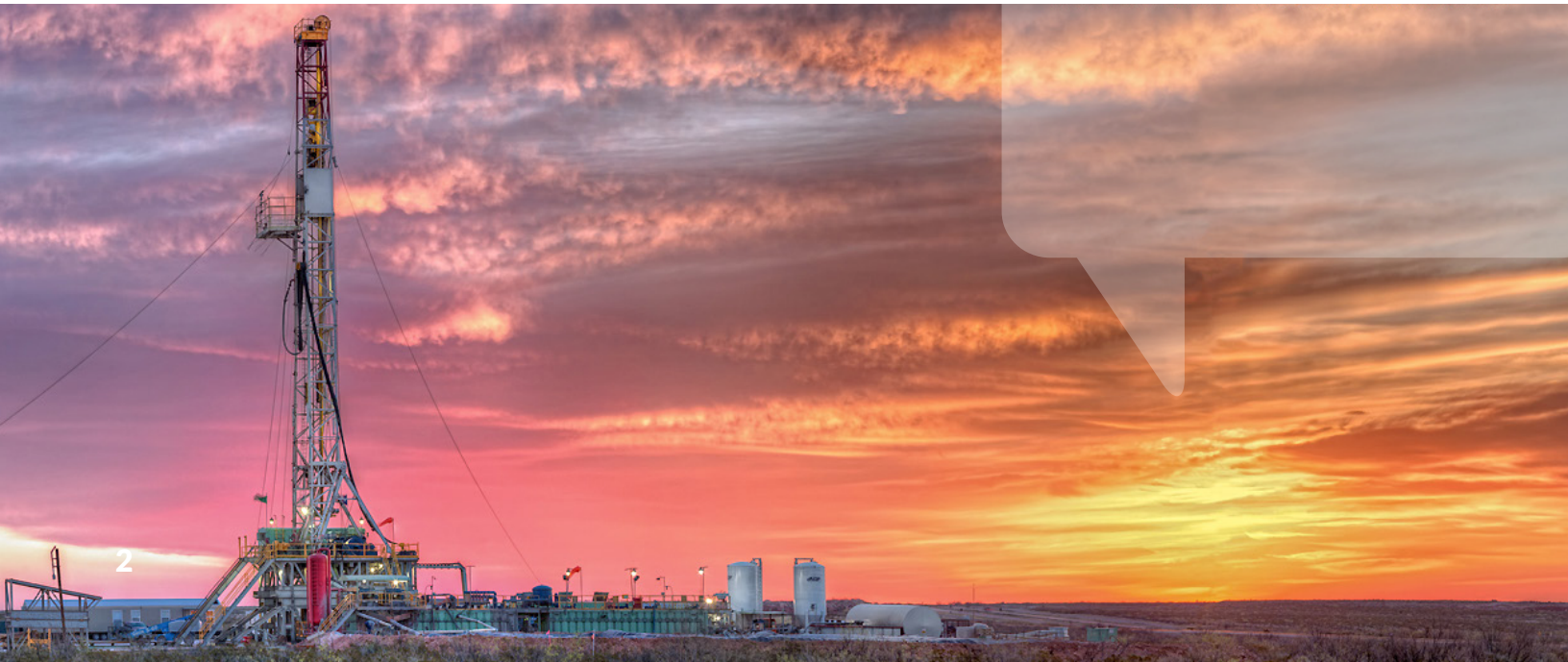
Since 2009, the oil and gas industry has experienced a rapid increase in tight oil and gas production. This has been a direct result of improvements in technology and resource management.

However, this oil and gas peak has been occurring at the same time as decreasing market prices, which has resulted in an erosion of bottom line profits of oil and gas operations.



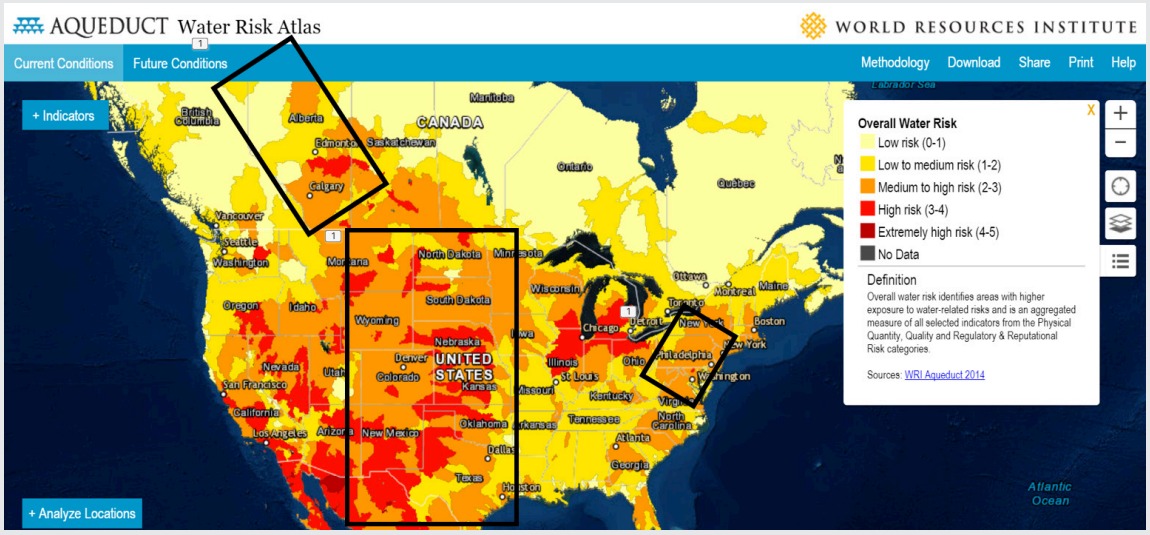
ource: US Federal Reserve, World Bank, CGA





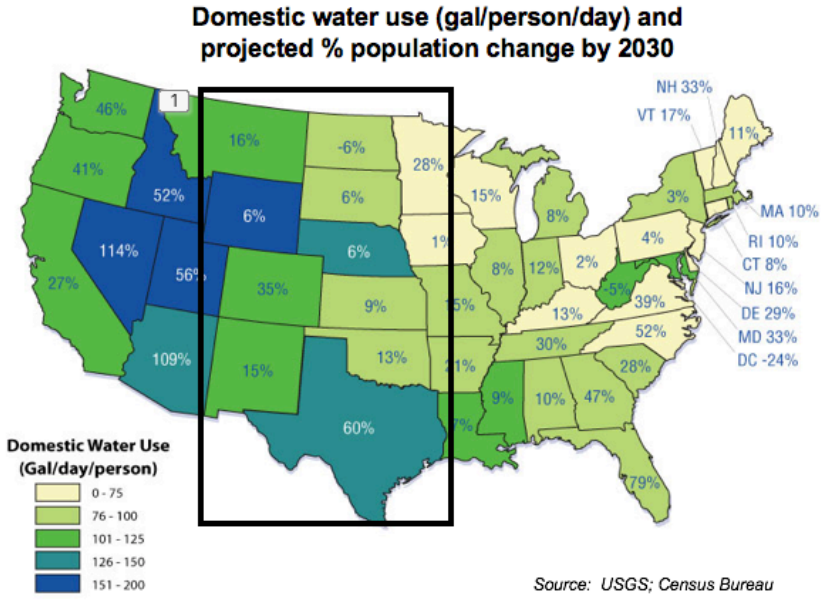
2 Water Stress

In addition to low commodity prices, water stress is also adversely affecting profit margins for many companies in the oil and gas industry.



Water basins in areas such as the Marcellus shale in Pennsylvania, the Permian Basin of West Texas, and the Montney and Duvernay plays of Alberta and British Columbia, Canada are at increased risk due to mounting pressures and regulatory scrutiny.

The rise in water stress is caused in part by the surge in domestic and public water use. Population growth in some areas (e.g. estimated at a 60 per cent increase in Texas by 2030) will further heighten the competition between municipal, industrial, and agricultural sectors for fresh water supplies.



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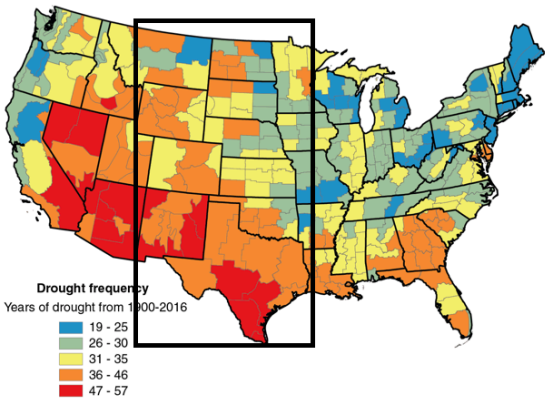
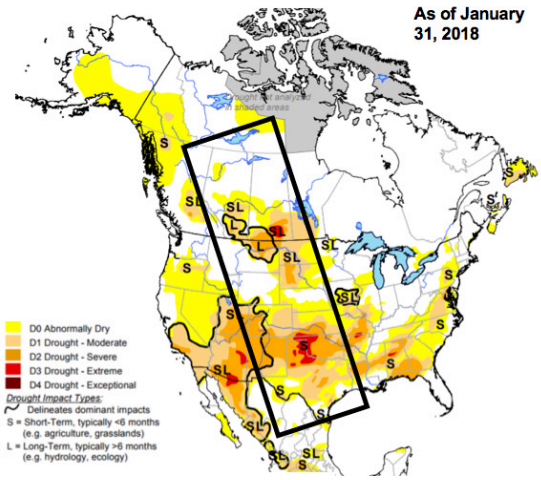
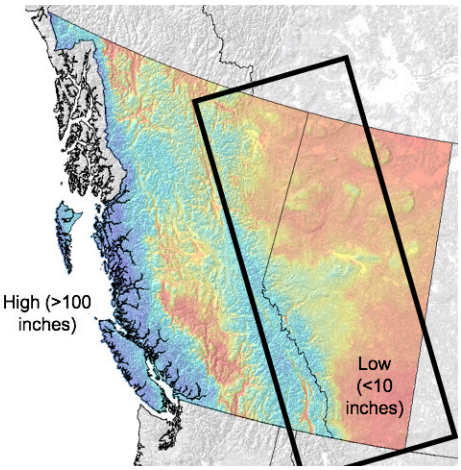




Present and future water shortages in response to our changing climate will only serve to aggravate the situation.

Droughts are becoming more frequent in Texas, the U.S. Midwest and southern regions of Canada as a result. Snowpack, an important source of stored water for many states and provinces, has been continually declining over the last few decades. In Canada, this has been occurring for the last 63 years due to a shortening winter season and more frequent rainfall. This has reduced the amount of snow accumulated during the cold months and, in turn, reduced river flows. Given that 50 to 70 percent of the flow of water in the rivers is directly related to snow melt is placing some water-reliant activities at risk.

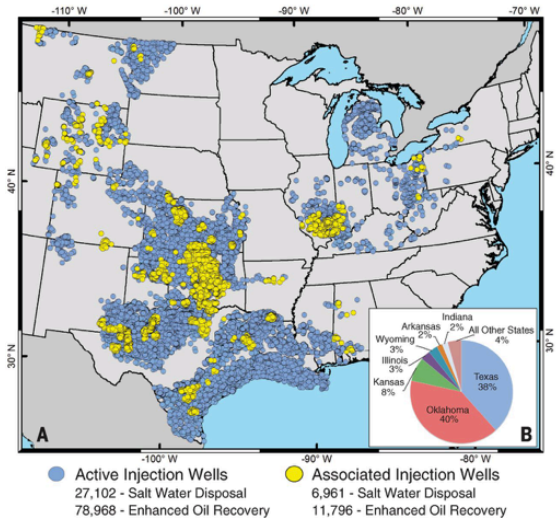
Higher peak flows, shorter flow periods, quicker transitions to flood conditions, and lower ground water contribution to river flows are all potential effects of climate change that will have a direct impact on water availability to the public and oil and gas operations.



Companies relying on timely provision of water are now starting to consider storage strategies so that they can capitalize on higher flow periods and build resiliency into their projects.

3 Water Disposal & Transportation

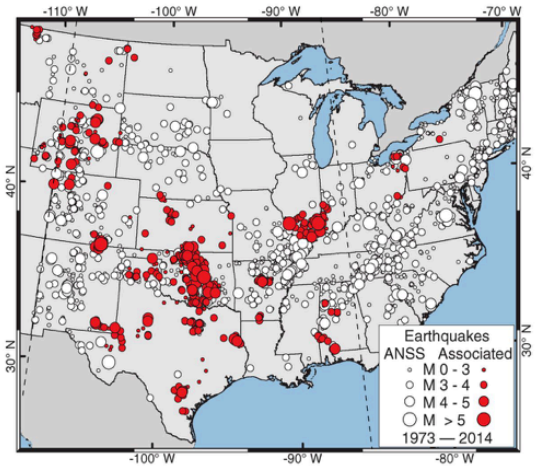
The disposal and transportation of water also add cost and risks to oil and gas operations. In Texas and Oklahoma, one of the side effects of injecting wastewater is an increase in induced seismic events, leading some to feel that this activity should be stopped. Trucking is also becoming onerous due to an insufficient number of trucks and the related health and safety risks associated with on-road activities.



Note: yellow dots indicate injection wells associated with measured earthquake activity.

High-rate injection is associated with the increase in U.S. mid-continent seismicity

M. Weingarten[1,*], S. Ge[1], J. W. Godt[2], B. A. Bekins[3], J. L. Rubinstein[3]



Note: red dots show magnitude of earthquakes associated with injection activity.

As a result, the use of above-ground lay-flat hoses is becoming popular, while the construction of dedicated pipelines is beginning to make more economical sense.

4 Changing Regulation

Changing regulations in both Canada and the U.S. are complicating the sourcing of water for industrial uses.

For example, the Environmental Defense Fund in the U.S. identified higher priority counties in Texas that should reduce fresh water use for oil and gas operations to ensure sufficient volumes for municipal use and rural supplies. In some instances, oil and gas operators are obliged to purchase water from landowners to facilitate their projects, but much of this water tends to be compromised by bacteria, hydrogen sulphide, and dissolved hydrocarbons, requiring treatment prior to use.

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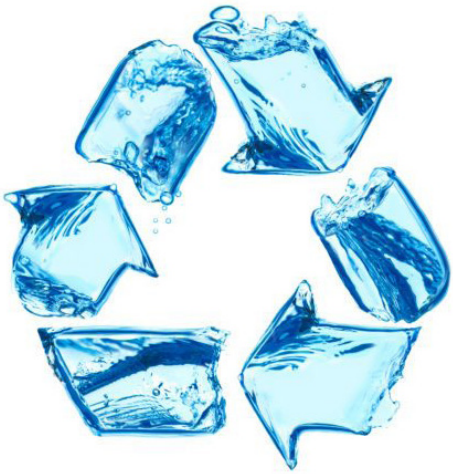
THE SOLUTION:

Water Reuse



Notwithstanding the challenges regarding water availability, disposal, and transportation, and the increasing occurrence of public interventions,

the basic cost of water is significant for oil and gas operators and represents close to 30 percent of drilling and completion costs of a typical well.

Water treatment and reuse are significant cost saving opportunities that help deal with some of the previously mentioned constraints.

Recent introduction of municipal and industrial wastewater use in tight oil and gas development and the use of brackish groundwater are strategies that are being deployed to reduce demands on fresh water resources. The problem, though, is that much of this water requires intense treatment for things such as iron, hardness, bio-fouling and potential corrosiveness caused by hydrogen sulphide. Understanding the chemistry of the water available for use, and how this chemistry may change over time, is crucial to running an efficient oil and gas operation.

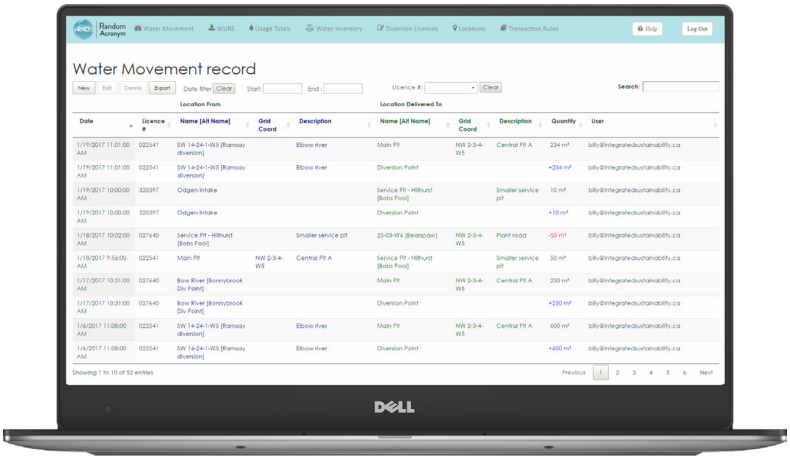
Overall, recycling and reusing water is cheaper than sourcing fresh water or having to dispose of waste fluids by downhole injection. This also reduces the risk exposure to regulatory interventions and possible litigations that could result in the erosion of corporate image and social licence.

REGAINING CONTROL: Data Tracking & Managment Systems

Understanding the chemistry of the water supporting in oil and gas operations requires continuous and systematic control of flow volumes and the quality conditions in collection and delivery systems.

WaterTracker™ provides a centralized, intuitive platform for tracking water from point of diversion, through storage, to the point of use.

- Sensor technology now supports the monitoring of TDS, TSS, pH and temperature, among other things. This information is essential to adjust water treatment strategies in real time and reduce treatment chemical use and related costs.
- Management platforms that optimize water distribution also contribute to optimized water use and ultimately lower costs. Water management platforms such as **WaterTracker™** identify operational opportunities, and track water movement and performance. Tracking this kind of data has been shown to increase operational efficiency and reduce downtime costs up to 10 per cent, based on third party estimates.



In summary, proactive management of water through tailored technology and timely adjustments increases profit in a low-price market with compliance and regulations. In Canada, for example, the use of an area-based and logistical approach to water management is working, and the companies that invest in innovation and management strategies have gained a competitive advantage.

Early planning of data collection and management of water resources are crucial to regain control over water shortages, changing regulations, and challenging market conditions. Water reuse, combined with data tracking and performance monitoring, now exist as the best solutions to ensure water reliability and, ultimately, the profitability of oil and gas operations.