

Constantly investing in new technology.

With more than 65 years' experience, TC Energy is a leader in the responsible development and reliable operation of North American energy infrastructure, including natural gas and liquids pipelines, power generation and gas storage facilities.

Continually improving the integrity and reliability of our pipelines and assets is, and always has been, one of TC Energy's highest priorities.

Ensuring safety

There's no doubt pipelines are the safest method of transporting the natural gas and crude oil that must be moved throughout North America every day to meet society's needs. Improving the integrity and reliability of our assets is one of our top priorities.

Our industry-leading R&D program focuses on improving the safety and efficiency of our operations and minimizing environmental impacts. Partnering with universities, colleges, governments and industry peers, we have a leading industry research and development (R&D) program, investing more than \$142 million in R&D projects across North America in the last five years. We have worked with industry partners on R&D successes such as the development of "smart pigs." Originally used to detect large dents or obstructions in the pipe, pigs have been adapted through R&D to detect flaws, cracks or corrosion from the inside.

Improving efficiency and reducing emissions

TC Energy's commitment to reduced emissions and improved efficiency isn't new. For over half a century we have tested promising new technologies to minimize fugitive emissions and reduce emissions and fuel consumption of our pipeline compressors.

For instance, in 1964 we introduced the pipeline industry's first Rolls-Royce Avon turbine – derived from Rolls-Royce's Avon turbojet – in an Ontario compressor station. Over 50 years later, TC Energy operates the biggest fleet of industrial Rolls-Royce engines in the world.

General Electric (GE) is another long-time partner of TC Energy. In 2014, using key industry insights from TC Energy, GE announced the launch of a new 16.5 megawatt gas turbine, developed to meet the industry's evolving challenges. The NOVALT16 gas turbine raises the standards of efficient and reliable pipeline compressions, power generation and oil and gas plant compression applications.

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TC Energy’s invention of the Two-Stage Supersonic Ejector exemplifies another R&D success in reducing emissions. TC Energy won a number of prestigious awards for developing this innovative ejector that fits into compressors to capture and recycle 100 per cent of the fugitive emissions that would have been normally vented into the atmosphere. The system, which TC Energy patented and has now licensed to a third-party manufacturer, presents a viable way to reduce carbon emissions and increase energy efficiency.

Environmental stewardship

TC Energy has played a key role in advancements related to reducing the environmental footprint not only of our own activities, but across the industry. There are dozens of examples of how TC Energy’s work has set the standard in terms of environmental stewardship. We’ve received international recognition for initiatives such as pioneering the use of innovative winter construction techniques to reduce impacts through short-grass prairie ecosystems, investing in the preservation and

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enhancement of endangered species habitats and adopting and developing new technology to reduce greenhouse gas emissions from our operations.

As well, TC Energy continually works to study and predict the effect of pipelines on soil and groundwater conditions to ensure impacts are mitigated.

TC Energy also invests heavily in research into better



understanding and minimizing the impacts of pipeline rights-of-way (RoWs) on sensitive wildlife species, such as grizzly bears and caribou.

Below is a list of research and development (R&D) organizations TC Energy funds*:

Construction Industry Institute
Electric Power Research Institute
Gas Machinery Research Council - Operating Company - Annual Research Contribution Renewal
Reliability & Maintainability Center
Alberta Sulphur Research Ltd.
Canadian Energy Partnership for Environmental Innovation (CEPEI)
Petroleum Technology Alliance Canada (PTAC)
Pipeline Research Council International (PRCI)
Pipeline Integrity Institute – UBC

*R&D project-specific funding or initiatives funded through other memberships are not included

Smart pig modified with EMAT before its launch into the pipeline. Photo courtesy of ROSEN.

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