Real-time demand for a gas pipeline design: dealing with modern challenges

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There were the days, decades ago, when a gas pipeline designer would punch some cards and go to another room of his company, or even to an outside office, to run a gas pipeline design configuration, and then return at a scheduled time to get the results. Since then, pipeline design has developed signficantly.

Technology development has improved dramatically, and nowadays the gas pipeline designer must respond very quickly to management demands wherever they are is and whenever required. In addition, CEOs are more deeply involved in envisioning new business opportunities and want to check for themselves the feasibility of a prospective project and then lead the process from the start to the end, promoting interaction between all departments involved in the decision making process of a gas pipeline project.

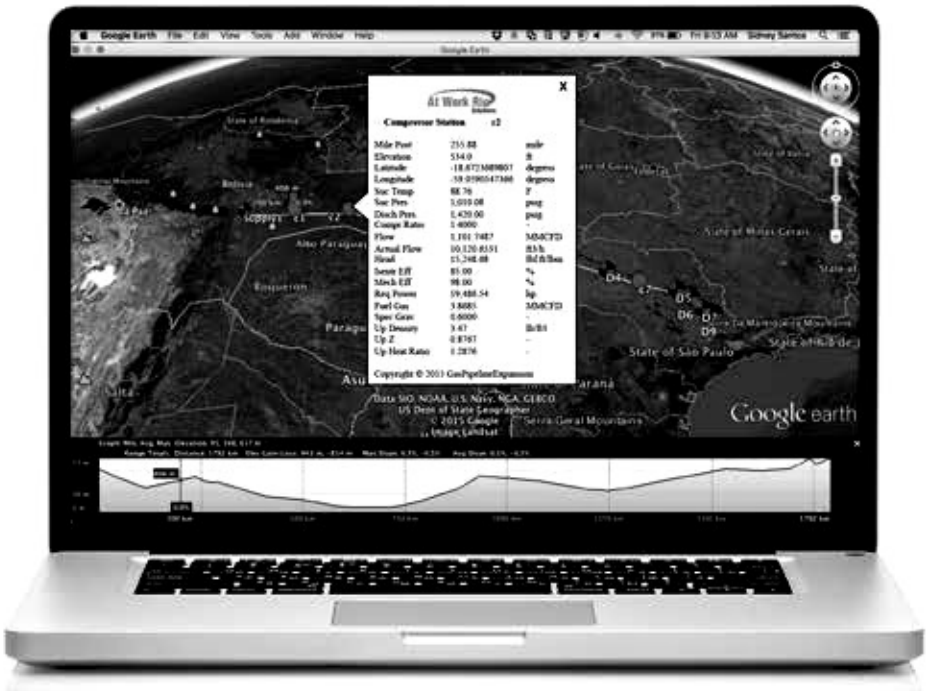
INNOVATIVE TECHNOLOGY

At Work Rio has designed a resourceful and innovative mobile application that provides CEOs, managers, and designers with the means to face the challenges of the ongoing business environment in the context of gas pipeline design. The application is designed to work on iPhones and similar hand-held devices, and comprises:

- **GasPipelineDesign:** performs cost estimates, feasibility studies with J-curves, and thermo-hydraulic simulations, and produces an executive report, a technical report, XML files (thermo-hydraulic model), and a data file for export to GasPipelineExpansion.
- **GasPipelineExpansion:** performs cost estimate for a gas pipeline expansion, adds compressor stations to an existing project, does capacity ramp-up and availability studies, and works with GIS information and elevation profiles.
- **CompressorStationDesign:** performs the calculation for a compressor station design and produces a report with the technical information necessary to specify the compressor station units, drivers, and aftercoolers.
- **CompressorPerformance:** performs the detailed and accurate calculation for an existing compressor unit and supports operation with a technical and economic tool to decide if and/or when a maintenance intervention will be required to re-establish the optimum efficiency of the compressor unit.

These mobile applications have been developed by Sidney Santos, who retired from Petrobras in 2012 after working for more than 25 years as a senior consultant and a gas pipeline design engineer. Using his extensive knowledge of the technology of pipeline design, as well as »

BELOW: Laptop computer applications for gas pipeline design.



programming on spreadsheets, Visual Basic, and C#, Mr Santos has worked with qualified software developers to perfect his applications. His most recent projects at Petrobras prior to retiring were the design of the Bolivia-Brazil Gas Pipeline (GASBOL), and the expansion of the gas pipeline network in Brazil. Mr Santos has also had key participation in many prospective projects such as the Venezuela-Brazil gas pipeline (GASVEN) and the Integration gas pipeline (GASIN). He has also provided consulting assistance to KazTransGas and Intergas Central Asia for the Kazakhstan section of the Trans-Asia Gas Pipeline.

DRIVING PRINCIPLE

At Work Rio's applications rely on these key drivers:

- Must be practical and speedy
- Must be simple
- Does not require any training.

The application has therefore been designed so that managers, planners, and engineers can start using the application immediately and will take advantage of it. It is practical, in that it supports the complete design process for a gas pipeline while substantially reducing the working time normally required for a conceptual design. Pipeline modelling is done for each configuration in the case of GasPipelineDesign and GasPipelineExpansion and does not require any additional work, saving time and resources.

It is rapid and has been designed and optimised to run hundreds to thousands of simulations in a very efficient way to get the results, including the reports, within seconds, depending only on the quality of the internet connection.

CHALLENGING SCENARIO

Imagine yourself at a meeting, a restaurant, or even playing golf, and a fellow CEO asks you about a new gas pipeline or a branch expansion – but they only know basic information such as capacity and length. Then what? Do you quickly call your commercial, planning or engineering department, or do you take your smart phone or tablet and run the case? By using GasPipelineDesign you can get results by yourself right away, and can then provide your fellow CEO with reliable information that may start a promising business case.

INNOVATIVE MOBILE PRODUCTS

With At Work Rio's GasPipelineDesign mobile application, you only need your smart phone, tablet, or notebook, and a couple of minutes. With a user-friendly interface that allows access to a solid and well-designed application running on a certified environment, a feasibility study in an executive report – containing the five best alternatives for the gas pipeline project with cost breakdowns and a very handy J-curve – can be obtained in just a moment.

GasPipelineDesign also provides a technical report containing detailed thermo-hydraulic information including diameter, flows, temperatures, number of compressor stations required, compressor-station spacing, power requirements, and fuel-gas demand that defines the configuration of each of the best five alternatives. It can also export the thermo-hydraulic models to third-party gas pipeline simulator software if required.

At Work Rio's GasPipelineExpansion mobile application has two functionalities: (i) a supplement to GasPipelineDesign; and (ii) an independent application. It works with the elevation profile and GIS information on the route and supports capacity expansion studies for an existing gas pipeline and capacity ramp-up for new ones. It also precisely locates compressor stations along the pipeline's route. The application undertakes both technical and economic evaluations, and runs detailed thermo-hydraulic simulations for steady-state gas flows. It uses a responsive, user friendly, and flexible interface to run on a variety of mobile devices and platforms. It evaluates CAPEX and OPEX for the gas pipeline configuration, and thereby helps selection of the best economic and strategic alternative for a capacity expansion.

Compressor stations for the project can be allocated with accurate spacing and detailed capacity, power, and fuel requirements. Detailed information from conceptual, basic, and executive design – such as diameter changes, class locations and their impacts on pipeline wall thickness, gas supplies, and deliveries – can be incorporated easily in the gas pipeline model to update the project. Both executive and technical reports are produced, with exportable XML files for the detailed thermo-hydraulic model and a KML file for Google Earth visualisation of the project.

CONCLUSION

This innovative technology is designed to improve the design process of a gas pipeline. It is multiplatform (Mac OSX, Windows, Linux, iOS, Android) based on mobile devices (smart phone, tablets, and notebooks), as well as being able to be run through the web by simply using a web browser. Following the concept summarised by Harvard's Michael Porter that "Companies achieve competitive advantage through acts of innovation" [1], At Work Rio's focus is to provide its clients with state-of-the-art, innovative, and mobile applications that will improve their productivity in gas pipeline conceptual designs and feasibility studies through the use of simple, practical, accurate, and rapid solutions. P

Reference

1. Michael E. Porter, 1990. The competitive advantage of nations. Harvard Business Review, March, https://hbr.org/1990/03/the-competitive-advantage-of-nations/ar/1

