PROJECT SUMMARY AND OUTCOMES

DEMONSTRATING CALSCAN'S ZERO-EMISSIONS ELECTRIC LINEAR ACTUATORS BY ENGAGING SMALL TO MEDIUM SIZED PRODUCERS

Calscan leveraged the MCP funding to reduce the price of equipment costs to small to medium sized producers to provide a stronger incentive for them to utilize the electric linear actuator technology and reduce GHG emissions.

Prepared by Calscan Solutions as part of the Methane Consortia Program

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Project Summary

PTAC has received support from Alberta Environment and Parks to collaborate on the formation of consortia with industry to reduce emissions of methane and promote innovation in reduction mechanisms within the Alberta oil and gas sector. As part of PTAC's Methane Consortia Program (MCP), Calscan has engaged smaller producers in demonstrating their new linear electric actuator technology. It has been more challenging to secure trials with junior and intermediate producers due to large capital costs. Calscan has utilized the MCP funding to:

- Create a meaningful discount in prices to early adopters
- Achieve critical runtime under a wide range of configurations
- Gain further technical and operational feedback from producers to refine its product.

Through the MCP program, Calscan has expanded Alberta's innovation ecosystem by connecting junior/intermediate oil and gas companies with itself and with the broader PTAC ecosystem.

The project described in this report was completed in partnership with Advantage Oil and Gas, Jupiter Resources, and Entrada Resources on several sites to date, with plans to complete a few additional installations on a first come, first serve basis. Calscan continues to look for eligible partners/sites and is offering the rebate program to incentivise installation and adoption of their zero emission well control solutions.

Technology Summary

Calscan' s Bear BA series of actuators for level and pressure control are a zero-emission electric solution for control, replacing fuel gas powered pneumatic actuators.

Calscan has developed a wide range of actuation and control solutions that can be adapted to new and existing well sites, by being installed on valves previously actuated pneumatically using fuel gas. The electric actuator technology has been optimized by Calscan to minimize operational downtime and equipment changeover for producers on retrofit installations. This adaptation to industry can reduce up front installation costs for the producers as they use valves already on site for retrofit installations. It allows producers to have a wide choice in valve selection for new installations helping them utilize current inventories for maintenance without complicating the operations inventory and supply chain management systems.

This technology has environmental benefits that include eliminating emissions from the sites and reducing industry waste by utilizing equipment already installed on site. This is achieved by only changing the actuation method from pneumatic to electric and retiring pneumatic actuators but re-using the valves and piping configurations.

Aside from reducing methane emissions from well sites across Alberta, Calscan' s actuation and fail-safe control technology offers other advantages. These advantages include better control/well optimization for operations, overall safer well sites with reliable fail-safe functions, and electrified H2S prevalent wells for reduced sour gas concerns. An economic advantage includes for more fuel gas to be produced and sold, instead of being vented and lost to the atmosphere.

By leveraging funding for end-users to reduce costs of the equipment, combined with the many benefits of the technology, producers are open to electric actuation. As the entire industry looks for emission reducing solutions, Calscan has helped new intermediate and junior producers as they adapt and try different solutions moving forward.

Purchase and Installation Process

The process for purchase is the same as the purchase process within Calscan' s regular sales channel. The main difference with the MCP program is discounts are offered in the form of rebate as an additional incentive for producers. Being in an economic situation where spending is limited, particularly on new technologies, this has allowed new technology to be tested by producers. When engaging potential customers, it is made clear that Calscan can provide the procurement agents a meaningful discount off the retail purchase price of the equipment on a site-by-site basis. This helps the producers understand that there are additional benefits and cost reductions currently in place to take advantage of when adopting this new technology.

After the producer identifies sites that are eligible and would most benefit from trial of the new technology, emission baseline testing is conducted, and the required equipment is agreed upon and procured.

Installation responsibility is generally taken on by the producer's operations team, or their chosen E/I installation/maintenance subcontractor. By leaving installation in the hands of the producers, Calscan can train operations or subcontractors on the equipment before or during install, thus cutting costs and familiarizing their teams with the new equipment. This streamlines the maintenance process and serves as training for any future installations that may take place.

After the installation is verified to have taken place and both parties are satisfied, the next step is to issue a rebate. Once the end-user has paid the invoice at full retail price issued by Calscan for the emission reducing equipment, the agreed upon discount (rebate) is then sent to the procurement department in the form of a cheque.

Project Schedule

Below is the project schedule.

2020

- March 1st - Project kick-off (Calscan & PTAC teams).
- Month of March -Meetings with ~5 or more different junior/intermediate producers, execute purchase orders (POs) for first 2 units.
- Months of April-May- Engineering reviews, site selection process, first 2-3 field visits including vent gas measurements, execute POs for 2 more units.
- Months of June-July - Complete 1st and 2nd installations with Jupiter and Entrada, execute POs for next ~4 deployments with other producers and complete 2-3 field visits.
- Months of August-November – Find partners / sites and complete installations #3 and #4, execute final 2 POs, and complete remaining 4-6 field visits.
- Month of December– Initiating installations #5 to #7, visit/contact operating sites as required to gather data and feedback from operators.

2021

- Month of January – Continued installations #5 to #7
- Month of February-March – Complete installations #8 to #10.

It is important to note that installations may be committed to but do not have operational availability from producers to adhere to schedules. It is also important to note that commitments to sites/equipment come and go as the business environment changes which can lead to schedule deviations.

Emission Profile

Summary of GHG mitigated due to the project

Calscan used its hawk low pressure vent gas meter to determine site specific baseline methane vent rates for each of the project installations. This is the same process that Calscan has used for its beta tests in its grant project with ERA/SDTC (these reports were submitted to ERA for proof of GHG reductions) and has produced accurate data inputs for GHG reduction calculations.

Below is data from the measurements that Calscan has completed for its initial trials of the electric linear actuator and related electric actuators, controllers, and pumps. These vent rates are conservative as Calscan selected simple, "low risk" or low production well sites for the initial trials. Newer, high pressure wells typically vent more because of increased valve actuations and higher chemical injection rates. Subsequent deployments will target higher venting sites to maximize GHG reductions. Reference well sites for GHG Emissions calculations for 7 sites are as follows:

Site #	Vent gas per year	Equipment of focus
1	7,948 m3 vent gas/year (122 tCO2e/y)	2 level controllers, 1 transducer and 1 chemical pump
2	5,122 m3 vent gas/year (78 tCO2e/y)	2 level controllers, 1 transducer and 1 chemical pump
3	9,915 m3 vent gas/year (152 tCO2e/y)	2 level controllers, 1 pressure controller, 1 Kimray valve and 1 chemical pump
4	13,168 m3 vent gas/year (201 tCO2e/y)	2 level controllers, 1 pressure controller, and 1 chemical pump
5	18,194 m3 vent gas/year (278 tCO2e/y)	2 level controllers, 1 pressure controller, 1 valve positioner, and 1 chemical pump
6	43,146 m3 vent gas/year (660 tCO2e/y)	2 level controllers, 2 pressure controllers, and 2 chemical pumps
7	16,761 m3 vent gas/year (256 tCO2e/y)	2 level controllers, 1 pressure controller, 1 valve positioner, and 2 chemical pumps
Average emissions of all sites	**16,322 m3 vent gas/year (250 tCO2e/y).**	

The above data is consistent with pneumatics venting data from a 2016 Alberta Energy Regulator report titled *"Greenpath 2016 Alberta Fugitive and Vented Emissions Inventory Study"* by GreenPath Energy that found average emissions of 413 tCO2e/well/year in the Grande Prairie region, 231 tCO2e/well/year in the Drayton Valley area and 250 tCO2e/well/year in the Red Deer area, all of which are key areas in the province that Calscan will be deploying equipment.

The operation of the Calscan electric equipment does not generate any GHG emissions since the equipment is powered by solar photovoltaic panels and batteries. Therefore, the project emissions are equal to zero and the net GHG reductions are equal to the baseline emissions. GHG emission reductions are calculated based on the following formula:

$$\frac{\frac{tCO2e}{year}}{site} = \frac{m^3 vent \frac{gas}{year}}{site} \times 90\% \times \left(\frac{0.68kg}{m^3}\right) \times \left(\frac{0.001tonnes}{kg}\right) \times \frac{25tCO2e}{tCH_4}$$

The % methane in the vent gas is assumed to be 90% for this estimate, but an actual gas analysis can be collected for the actual field deployments to refine these estimates. Ninety percent is an average value. The global warming potential of methane is 25, consistent with the Alberta Emission Offset System default value. The density of methane is 0.68 kg/m3 at 15°C and 1 atmosphere, a standard value. Based on the above values, an average GHG reduction of 250 tCO2e/year/site is estimated. This is representative of typical Alberta well sites with three phase separator packages. Each site configuration will vary, but by taking an average of 7 well sites, it was possible to obtain a reasonable estimate, especially since the project will target higher emitting sites to maximize GHG emission reductions (which was not the objective in the beta trials for the 7 data sets as simpler lower production and lower emitting sites were chosen for risk reduction).

Post project numbers vary slightly as all sites across the province are venting differently depending on number of instruments, process type, the field they are in, and the production of the site, but the average number of tCO2e/year are comparable to the initial proposal. GHG reductions per sites achieved to date can be found next to their respective sites in the project summary listed above. Some are lower than anticipated due to fewer instruments being procured through Calscan than the initial numbers were based on resulting in a lower GHG reduction overall.

Abatement Cost

The GHG abatement costs of the project are estimated to be $4.93/tCO2e. This is calculated based on the $185,000 funding request divided by estimated lifetime GHG reductions of 37,500 tCO2e from the project based on an estimated GHG reduction per site of 250 tCO2e/year/site and a conservative assumption of a 15-year life of the equipment. The baseline vent rate of 16,322 m3/year (vent gas is assumed to be 90% methane) was derived from the average of 7 data points collected by direct measurements at Alberta well sites by Calscan as part of its beta trials with ERA/SDTC.

Post abatement costs are similar albeit somewhat higher in that a total of $105,321.00 in rebates have been issued or are to be issued for a reduction of 1216 tCO2e/year. If a conservative lifetime of 15 years is assumed, a total reduction of GHG emissions of 18,240 tCO2e for installs completed to date is estimated. Based on the installations performed so far, the most current GHG abatement costs are $5.77/tCO2e.

Conclusion

Project learnings

Learnings from deploying technology and being able to offer discounted equipment to smaller producers has included a few key lessons.

Producers are still weary to try new solutions as pneumatic instrumentation has been involved in oil & gas operations for a very long time. There is an infrastructure of replacement parts, maintenance strategies and procurement that is difficult to get operations to stray from, despite the technological and current economic benefits. Although finding partners has been challenging, the incentives have helped Calscan deploy more equipment to end-users.

Technology learnings

Technology learnings from deploying the Bear FSC (Fail-Safe Controller) & Bear UPS (Uninterruptible Power Supply) modules alongside the rotary and linear actuator solutions has improved the product development. By providing this technology to different industry partners, Calscan has been a part of many different wellsite control configurations and valve orientations at existing sites across Alberta. This has led to design improvements in the control system modules, actuation solutions, and overall safety/operational benefits of control system components.

One example of technology learnings achieved involves the FSC module. Advantage alongside CDN controls in Grande Prairie assisted Calscan in realizing issues with their watchdog timer functionality when used with certain relays.

Another learning has been the ability to have access to more industry used valves, which has laid the groundwork for testing and bracketing solutions, allowing for a wider array of equipment to actuate.

Appendix

N/A