

# Industrial Construction

O P E N S H O P P R O F I L E S

Western Canada's energy sector is in the midst of an unprecedented era of expansion. Total capital expenditures in oil, gas and petrochemical projects slated for the next five years are in excess of \$50 billion. That expenditure will fund a massive construction effort on a wide range of projects. Not surprisingly, a few multi-billion dollar mega-projects have attracted the most media coverage and public interest. Those include expansions by Suncor and Syncrude at Fort McMurray, a polyethylene plant by Nova Chemicals at Joffre, and Shell's entry into the oilsands mining business.

Often overlooked in the shadow of the mega-projects however, are the dozens of small- and medium-sized projects triggered by the turnaround in oil and gas prices. Together, these projects account for a sizeable portion of the industry's capital investment program. And while they may not be of mega-project proportions, their impact is substantial nonetheless. In fact, a few years ago when the market was experiencing a downturn, these jobs would have been heralded with much fanfare and attention.

These projects are a core market for open shop industrial contractors. Industrial owners like the advantages they get from open shop — factors like a flexible and multi-skilled workforce that helps deliver projects on time and on budget. That open shop advantage has recently attracted a great deal of interest from the owner community, particularly in light of recent experiences on some large union-only projects which reported significant cost and schedule overruns and problems with productivity, absenteeism and vandalism.

This article will take a look at two projects typical of the many small- and mid-size ventures that are a major part of energy industry activity. ►

# Steam Assisted Gravity Drainage (SAGD) Projects

One area of industrial construction where open shop contractors are heavily involved is in-situ oil sands projects. These developments differ from the big oil sands mining operations like those at Suncor and Syncrude because they focus on oil sands deposits buried too deeply to be economically mined. A large portion of Alberta's oil sands reserves fall into this category and the oil they contain must be extracted directly from underground or *in situ*. These deposits may be the world's largest single petroleum reserve and much research has gone into developing technology to extract oil from these deep oil sands deposits.

That research has begun to bear fruit and many energy industry observers believe we will soon see a dramatic expansion in in-situ developments.

The technology that has shown the most commercial potential is SAGD or "Steam Assisted Gravity Drainage". This process involves injecting steam into oilsands deposits to allow oil to flow to wells where it can then be extracted using standard oilfield techniques.

Advancements in directional and horizontal drilling technology have been very important in making SAGD viable. The ability to precisely place horizontal well bores through the oil sands deposit allows steam to be injected most effectively, and the released bitumen collected in adjacent production bores.

Although the steam production requirements make SAGD somewhat energy intensive, it offers some attractive advantages over oilsands mining. Economies of scale are very important for mining operations and this is reflected in the current and proposed mine projects. Those are gigantic operations requiring equally huge capital investments. Bringing an oilsands mining operation on stream requires multi-billion dollar projects employing thousands of construction personnel. Those huge jobs are

fraught with risk in a booming economic environment with a tight labour market. The mining operations are also faced with environmental issues – huge settling ponds and the need to reclaim mined areas – that in-situ projects do not have to deal with.

In situ developments can be viable on a smaller scale and lend themselves to phasing and incremental expansion of facilities and production. In addition, the drilling and production aspects of SAGD employ fairly standard oil production techniques and equipment. In Alberta (particularly the northeastern region), there is already a considerable infrastructure of contractors, manpower and equipment in place for which the SAGD facilities and operations are just an incremental step up from those currently being used to produce the conventional crude or the heavy oil common in the region.

Flint Energy Services Ltd., one of the largest open shop industrial contractors in the country, has been very active with SAGD work. They are currently working on a project in Foster Creek for the Alberta Energy Company. Situated north of Bonnyville in northeastern Alberta, the \$200 million Foster Creek project will produce 25,000 barrels a day. Currently in its first phase, the facility is already scheduled for expansion.

The plant facilities being put in place make extensive use of modularization. Assembling piping and processing equipment off-site in transportable modules is rapidly becoming the construction method of choice for many energy industry applications. Lorne Wotton of Flint says a big part of their contract was building 76 module units at their fabrication facility in Edmonton. The only shop in the province specializing in modules, Flint's 80,000 square foot shop is a major asset in doing this kind of work. The AEC work employed a crew of 75 at the fab shop.

With his project well underway, Wotton is very enthusiastic about their



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progress. He explains that AEC experienced some delays in the permitting process but once approvals were in place it has been full steam ahead. "We drove the first pile on August 8, 2000 and by the first of November we were 32% complete – that's one third built in three months". He attributes some of that success to the use of modules. "You just drive the piles, set the modules on and you're done." Good weather was also a contributing factor.

With the amount of construction and general oilpatch work underway across the province, Flint initially had some concerns about assembling a good crew. As it turns out though, those concerns were unwarranted. "I was anticipating problems," Wotton says. "I had all sorts of plans to deal with manpower shortages but they

just didn't happen." Flint has had a long-standing presence in Alberta's oil industry and company-wide employment often peaks at more than 4,000 workers. Their history and employment base gives them a built in network that is an important advantage in manning up for a project. The Foster Creek project required about 130 personnel on site who came from all over the province.

Bob Erickson, Flint's Construction Manager and lead man on the site echoes Wotton's comments. "This has been a good job. It's gone quicker than anybody could have imagined." He credits much of their success to carefully coordinated module delivery. Having each module delivered on the assigned day is vital. "We had a good schedule for trucking," he says. "We haven't missed one item." Erickson also expresses satisfaction at how well they were able to put together a crew in a busy construction market. He admits the booming construction market gave them some initial concern. "The first cloud we thought we might be under was not being able to man the project." He credits his superintendents' and foremens' network of personal contacts for attracting a good crew along with accessing manpower through the Merit Contractors Referral Service. He also has appreciative words for their client, "AEC is a good owner. It doesn't matter where you work for them, they are good to work for. The camp is great."

With current crude oil prices, there is enormous future potential for this kind of work. Wotton says that AEC has announced phases two and three for Foster Creek that will add another 80,000 barrels a day of production. Flint is currently involved in an alliance with Petro Canada to construct a \$200 million dollar, 30,000 barrel a day SAGD facility at their property at Mackay River, north of Fort McMurray. He says, "Modules should start in March or April 2001 and we should be on site by May or June." Flint is also involved in an expansion of Esso facilities at Cold Lake — another \$200 million dollar investment.

Other in-situ projects pending in

the Fort McMurray region include Suncor's Firebag Project north of Fort McMurray, Pan Canadian at Christina Lake, Gulf's Surmount project, an OPTI/Suncor project at Long Lake, Japan Oil's project south of McMurray and a project by Canadian Natural Resources.

All of these projects are attractive propositions for the owner community. They offer an opportunity for substantial crude production and resulting cash flow, without the risks associated with running a three to five-thousand man project in a booming construction market.

Ultimately, in-situ production may equal that of the mining operations. Reaching that level of production can be done incrementally, in small, easily managed steps with less risk. That scenario is ideally suited to the capabilities of open shop industrial contractors and they are looking to the future with a great deal of optimism. ◻

*Joel Thompson*

# CO<sub>2</sub> Injection Oil Production Enhancement

A subsidiary of the Triton Group, Milestone Construction Inc. are industrial contractors who are part of the corporate entity known as the Churchill Group. Triton recently completed an interesting contract for PanCanadian Petroleum at their Weyburn field in southeast Saskatchewan—the site of a large-scale production enhancement project using CO<sub>2</sub> injection.

The Weyburn field was discovered in 1954 and contained estimated total oil reserves of 1.4 billion barrels. “About 25% of the reserve had already been produced, first with conventional production methods, then waterflood, infill drilling and extensive horizontal drilling. It was deemed that the next step was to apply CO<sub>2</sub>,” says PanCanadian Petroleum spokesperson Susan Hancock, explaining the history leading up to the project. Hancock says that while CO<sub>2</sub> injection is not new technology (there have been CO<sub>2</sub> floods in Texas since the ‘70s), this was by far the largest application in Canada.

Making the project feasible was a nearby source of CO<sub>2</sub> just across the border at the Great Plains Synfuel Plant in Beulah, North Dakota. This coal gasification facility was producing CO<sub>2</sub> as a by-product and venting it to the atmosphere. The Weyburn CO<sub>2</sub> flood project will use about half of the plant’s 240 million cubic foot daily production. A big part of the overall project was the 330 kilometre pipeline to transport the CO<sub>2</sub> from North Dakota.

What makes CO<sub>2</sub> injection different from waterflood is that gas is injected to act as a solvent rather than a displacement agent. The addition of CO<sub>2</sub> to the crude oil creates a solution which flows more readily through the formation to the production wells. “CO<sub>2</sub> breaks the bond between oil and rock,” Hancock explains. “Imagine using a paint brush with oil base paint—you wash the brush out with water and get some of the paint out, then you wash the brush in a solvent

and it releases the rest of the paint from the brush.”

Triton’s contract was to construct an addition to existing production facilities which would handle the re-injection of the CO<sub>2</sub> that is now a component of the oil being produced. Eventually, the amount of CO<sub>2</sub> recovered and reinjected from the production stream will meet all requirements and an external source of CO<sub>2</sub> will no longer be necessary. The project included three new compressors, nine coolers, new free water knockout equipment and all the attendant tie-ins.

According to Ed MacLean, Triton’s project manager, the company acted as general contractors for work that included electrical, instrumentation, painting, insulation, structural steel, pipe rack modules, piping installation, equipment installation and grouting. MacLean describes the project as a “very intense, schedule-driven job.” Some of the challenges included meeting tight deadlines despite a number of changes, and completing tie-ins on a sequential basis while keeping the existing facility in operation as they added on new components.

By itself, CO<sub>2</sub> isn’t a particularly difficult gas to handle, but when combined with water it produces highly corrosive carbonic acid. That, coupled with some H<sub>2</sub>S content, dictated the need for a substantial quantity of specialty pipe (both stainless steel and internally coated) which brought additional complexity to the job. “It wasn’t something that we could just slam together.”

“It was a good job, but not an easy one,” says Darryl Zinnick, Milestone’s superintendent on the job. “We put a lot of hours in.” Manpower has become a major concern for most contractors and Zinnick reports that hiring locally was difficult. He says with the level of activity in the local oil patch, “everyone was busy.” Milestone manned the project with a mixture of sub-contractors and their own direct hire forces, with the crew peaking at



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close to 100 men. Trades included welders, millwrights, electricians, ironworkers, painters and insulators. Zinnick says many of the subs and a large part of the crew came from Alberta, although they were able to use all locally-hired welders on the stainless steel piping.

The project was underway from February to September 2000. Despite tight time lines, numerous changes and some specialty materials, the contract was completed on schedule. The facility was fully operational by December 2000.

CO<sub>2</sub> injection is projected to add another 16% to Weyburn’s recoverable reserves, or 120 million barrels over the project’s 25-year span. At current oil prices, you don’t have to be an accountant to understand why this project moved ahead.

“For PanCanadian this was a tremendous project,” Hancock says. “Every company wants to add reserves. In this case, we already knew where the oil was but just had to recover more of it. A 45-year-old oil field will gain 25 years of life with existing technology. Who knows what future developments can add to that?” OM

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## MODULES: Schedule and Cost Beaters for Industrial Construction

The use of shop-fabricated modules is quickly becoming the construction method of choice for oil, gas and other industrial installations.

Off-site prefabrication has some obvious benefits. It's inherent advantages drove the establishment of a pre-fab housing industry that has captured substantial market share in the home building industry. The same reasons that make it attractive to build a house and ship it to a site in one or two pieces, also apply to building a gas plant or oil refinery. While the complexity and size of an industrial plant doesn't allow the finished product to be totally prefabricated, there are compelling benefits to designing a facility in modular units, building the modules in a permanent shop facility, and then trucking them to the site for assembly.

Why have modules caught on and why does prefabrication make sense? There is a long list of advantages, and a number of problems that can be circumvented by employing the maximum amount of shop prefabrication.

Perhaps the biggest payoff is in labour cost savings. Industrial sites are often remote and require a camp to house the work force. Current daily costs for camp accommodation are about \$100 per person. For that reason alone, every hour of construction work that can be done at a facility where the workforce can go home and sleep in their own beds represents about a 30% savings in labour expense. Elimination of travel time and transportation expenses further increase the savings.

More labour efficiencies come from fabrication shop operations where their ability to offer steady year-round employment makes it easier to assemble a skilled and productive workforce. In contrast, on-site construction operations require rapid mobilization and manning up, only to have the crew face layoff, often just when they have reached good productivity levels.

Beating the weather is another obvious plus. Rain and snow, heat and

cold, aren't issues for shop operations. Equipment doesn't get bogged down in mud and there are no extra costs for heating and hoarding.

The list goes on: savings on craneage, more flexibility with scheduling, improved access to vendors and suppliers and better control over the procurement, delivery and storage of materials are other key benefits.

The ability to compress schedules is obvious. Regardless of problems or delays that may be occurring on-site, such as rain, mud, cold, road bans or permitting delays, the construction of the modules can be moving full speed ahead. Given the advantages, it's not surprising that as much modularization as possible is being designed into recent projects.

One of the challenges in the engineering phase is designing modules that meet the process requirements of the facility, while keeping within the size limitations that allow finished components to be transported by road to the job site. Fortunately, most of Western Canada's resource industry installations are located where there are lots of wide open spaces but also a good infrastructure of highways.

The practicalities of trucking the finished units dictate the design of modules. Modules are normally kept under seven meters in width and six meters in height. In Alberta, high load corridors have been established to facilitate this type of transport. The use of multi axle carriers allows the movement of loads far in excess of normal truck transport, but weights are ultimately limited by bridge capacities. This puts an upper limit on total weight at about 175 tonnes. It is possible to transport pieces in excess of those dimensions, but the extra expense involved for traffic management and temporary relocation of utilities can quickly erode the cost advantage of off-site fabrication.

Modules vary, but the label "over-size load" applies to virtually all of them. There are many places in the world where this construction strategy

would not be viable, simply because congestion and the physical limitations of the highway network would make it impossible to transport loads of this size.

For most plants, particularly the larger installations, it is not feasible to completely modularize and prefabricate. There are vessels, towers, compressors and other equipment that are simply too large to build off-site. Nevertheless, every inch of welding, every foot of piping and wiring and every ton of steel that can be handled in a fab shop means money saved. The economics make sense. Industrial construction, like any business enterprise, is driven by dollars and cents. That means that modularization and off-site fabrication will be an increasingly important strategy for industrial projects. ◻

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