IDEAS
Simulation solutions for oil sand operations

The challenge: To reduce the risk to your people, your equipment—and your investment

The solution: Measure. Simulate. And profit.

In every industry, in every business, there is risk—to your people, your equipment, and your investment. Setting your operation free of these risks is what IDEAS is all about. IDEAS is the leading dynamic simulator for oil sands operations in **northern Canada and for mining operations around the world, helping customers to save time, money, and resources.**

IDEAS is more than just a cutting-edge simulation tool. It is supported by a team of development engineers and process experts who have years of hands-on experience at oil sand and mining operations around the world. We bring the power of IDEAS right to your site, no matter where it is in the world. Our global, industry-specific experience means we understand your issues and can provide you with solutions efficiently.

IDEAS provides solutions for three key areas of project development.

Process design

IDEAS enables you to test and verify design concepts and process control logic—quickly, and at low cost and low risk.

Control logic (DCS) verification

IDEAS is an excellent tool for staging, testing, and validating control logic—identifying and correcting errors to help you achieve a faster and smoother start-up.

Operator training

IDEAS works much the same way as a flight simulator, providing your operators with realistic, hands-on training modules—reducing the risk to both themselves and your equipment.

We are dedicated to working with you to help you harness the power of IDEAS. With your vision and our technology, the possibilities are limitless.

How IDEAS is implemented to help your project:

- We build process models of the facility based on P&IDs, pump curves, and other key components of the process.
- We connect these models to an offline version of the actual control logic.
- We then run a simulated start-up and verify and correct control logic against this "virtual plant," months before start-up.
- The models are then used for operator training.

Find out more:
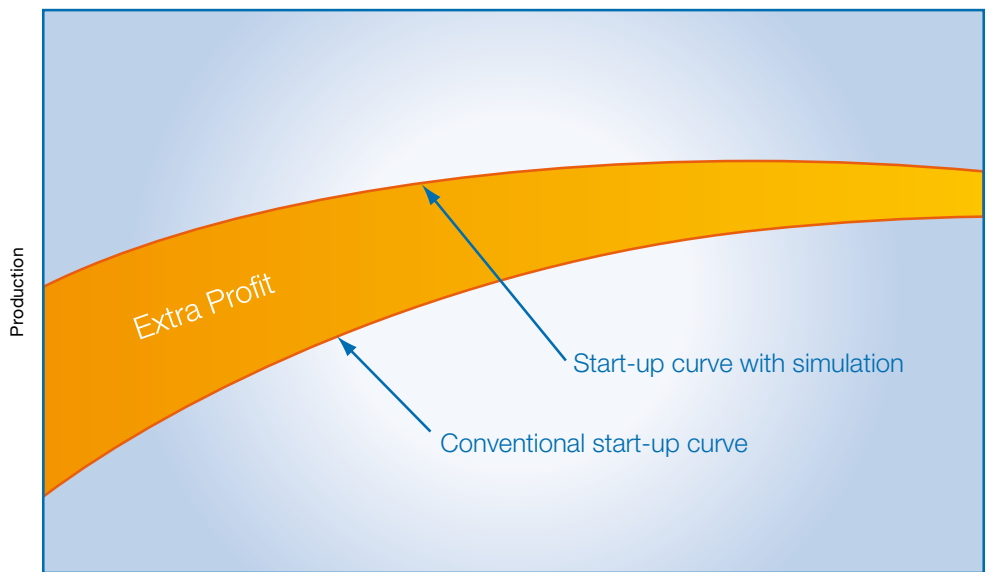
Benefits

- Test and verify design concepts, quickly and at low cost and low risk
- Stage, test, and validate control logic to achieve faster start-up and increase return on investment
- Train operators without risking their safety or plant equipment

The challenge: To design a process that you know will work before you commit capital

The solution: IDEAS steady-state simulation

During the process design phase of a project, IDEAS is a quick and powerful tool that enables users to dynamically model a complete mining project.

IDEAS helps you create a "virtual plant" environment in which process designs, modifications and retrofits can be fine-tuned and verified, faster than in real time, before you commit to any capital costs.

Use the IDEAS simulator to solve complex engineering problems such as:

- Sizing or verifying new process equipment
- Predicting control or process response
- Predicting interaction with other equipment
- Designing control logic
- Increasing product quality

IDEAS is not just an "off-the-shelf" software package. The modular structure of IDEAS means that you do not have to buy a full-performance, plant-wide package when you only need to simulate a small area. IDEAS

can be customized by our process experts specifically for your industry, process, and site.

Working with our customers, ANDRITZ AUTOMATION has developed oil sand libraries that enable users to simulate a conventional centrifuge-based oil sand process and also the paraffinic process. These libraries feature a flexible and easily customized database that contains the material properties for components commonly used in the oil sands industry.

We can model key areas of your process, including truck and shovels, hydrotransport, primary separation, flotation, and tailings.

And, if you have a new process, our development engineers have years of experience in the industry to build a customized working model for you.

IDEAS has the ability to perform mass and energy balances; track components, compounds, and element flow and concentration; handle particle size distributions; and calculate specific gravity and excess enthalpy.

IDEAS also has the flexibility to define chemical reactions. Depending on user needs, process reactions can either be user-defined (for most process analyses) or performed separately by a first principle model (for example, VMG or OLI vapor liquid equilibrium engine).

Benefits

- Create live process flow sheets
- Quickly determine flows and temperatures
- Help verify the selection of process equipment
- Make economical design decisions

IDEAS acts as a superior tool for "what-if?" analysis of oil sand production and optimization. Steady-state models can link to operating costs, complex production logic, discrete simulation of discontinuous events (such as truck and shovel operation), and to spreadsheets for dynamic exchange of data. In addition, as the complexity of the project advances, steady-state models created in IDEAS can be easily converted to a dynamic environment to include detailed dynamic specifications and process control logic.

What does it take to model the oil sands?

To be able to design an oil sands plant in the IDEAS software, ANDRITZ AUTOMATION began by building on the work of pioneers in the oil sands field.

Our first project was Syncrude's Aurora project in 1999, in which the IDEAS team worked with Syncrude Research to develop models of the primary separation vessel and other key areas of the extraction process. We then formed a technology transfer agreement with the Saskatchewan Research Council (SRC) and worked with them to modify an existing model of the hydrotransport process.

We also have included the Krebs hydro cyclone model in IDEAS, as well as inclined plate settlers and, in cooperation with Shell, have developed models of the froth treatment of the oil sands.

On Syncrude's SWQR project, we modified the fundamental code in the IDEAS incompressible solver to include momentum, and the ability to correctly model slurries through pipes, tanks, and pumps. Modeling the pumping oil sand takes a lot more detail than modeling pumping water. At the same time, we included the ability to fundamentally model particle size distribution to correctly characterize how different ore types behaved traveling in various process circuits.

To be able to make the correct design decisions for the Syncrude SWQR project, IDEAS was modified, and then used to help engineers choose the right equipment to achieve the design.

On the Shell Albian Sands project, we modeled both extraction and froth treatment,
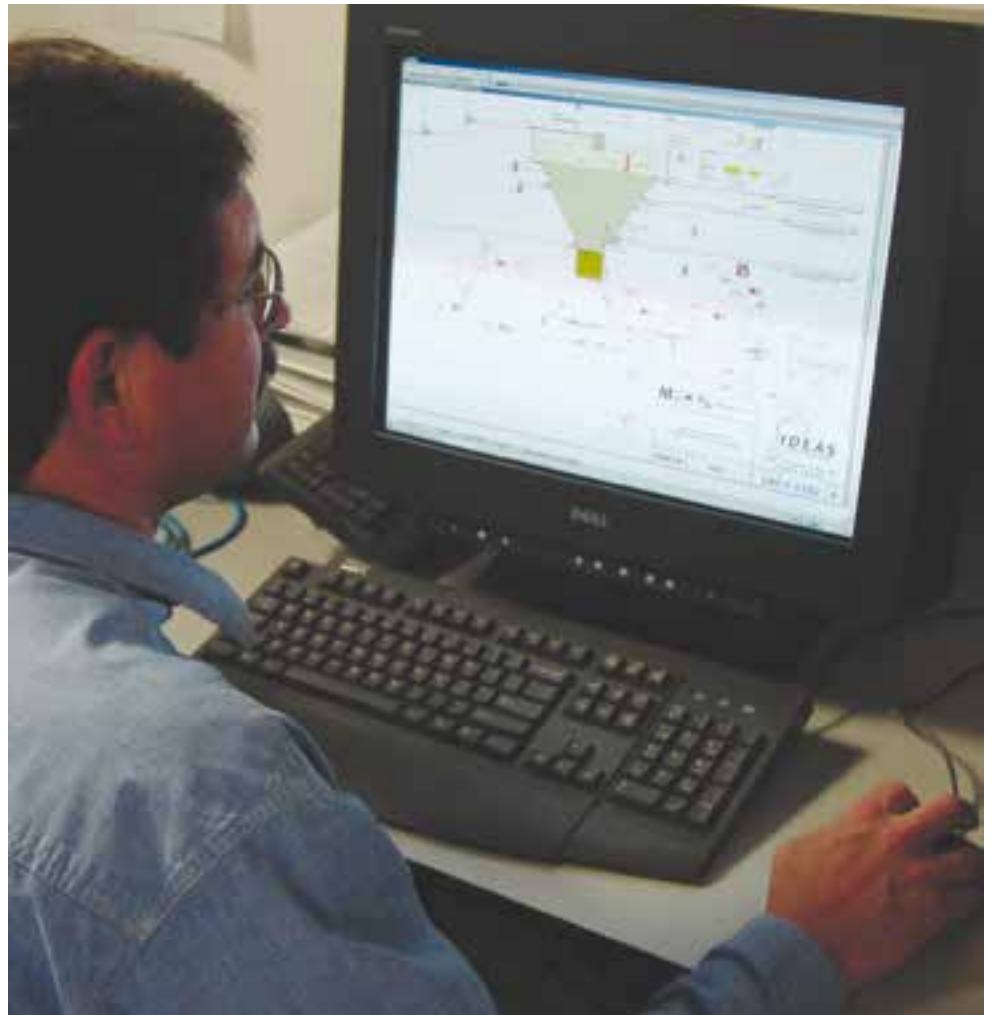
and Bob Tipman noted, "I believe the IDEAS models are the highest fidelity that have ever been achieved in the oil sand industry. They (IDEAS) have created a simulator that without any question is the best there is in the industry."

So what does it take to model the oil sands? It takes cooperation with our customers, and an experienced team with the ability to develop fundamental models using IDEAS.

As the leading dynamic simulator for oil sands operations in northern Canada, IDEAS has been successfully used to model complex plants, including Syncrude, Suncor, Shell Albian Sands, CNRL, and Petro-Canada.

The challenge: To verify that your complicated control scheme will correctly run your plant

The solution: IDEAS dynamic simulation

IDEAS is an effective tool for control logic verification, helping to stage and test control systems quickly and accurately, reducing the steep curve to start-up.

Implementation of control logic is a difficult task, since the performance of the plant is not only dependent upon the electrical and mechanical components, but also on the control logic and the design concept used to control those components.

That's where IDEAS enters the picture. If the control logic cannot start a simulation, it will not be able to start the actual equipment. By using IDEAS for control logic verification, you will reduce costly design errors that could otherwise delay start-up.

Studies have shown that using simulation to help with start-up can correct up to 82% of control logic problems before field implementation. The cost savings are enormous. Control logic verification translates into immediate savings through a smoother start-up and can easily realize a 200% or more return on investment.

IDEAS communicates with all major PLC or DCS equipment. Using our OPC server, OPC client, or one of our custom communication drivers, IDEAS makes the task of control system logic verification more manageable and consistent. In addition, new control logic can be tested and verified on the IDEAS simulator while the actual plant continues to run without interruption.

The biggest benefit of using IDEAS for your control logic verification is that our team works with you every step of the way. Our experts travel directly to your plant site, anywhere in the world, and work directly with the equipment vendors, control company, and plant personnel during commissioning.

Benefits

- Detect and correct up to 82% of control logic errors before field implementation
- Achieve quicker and smoother start-up, resulting in 200% return on investment

	DCS loop back	IDEAS model
I/O and loop test	✓	✓
Process-wide logic test	✗	✓
Tuning constants known before start-up	✗	✓
Realistic process models	✗	✓✓
Remove control logic errors	✗	✓✓
Remove process intent errors	✗	✓✓
Verify advanced control logic	✗	✓

Success story

Customer: CNRL

Simulation objective:

- Oil sands steady-state and dynamic simulation
- Pretest control logic and debug errors
- Train plant operators

ANDRITZ AUTOMATION provided CNRL with a complete simulation solution for the Horizon project in northern Alberta, Canada.

Working closely with CNRL's engineers, we created models of the Horizon bitumen production process that accurately characterized ore preparation, hydrotransport, extraction, tailings, froth treatment, naphtha recovery, and the vapor recovery unit.

The CNRL Horizon project has been the most complete application of the IDEAS simulator in the oil sands sector to date. Starting with steady-state verification of the process design, IDEAS then evolved into a fully dynamic model of the Horizon process to help deter-

mine control characteristics, equipment sizing, and process interaction.

The dynamic models were then connected in real time to the Emerson control system to be used as a virtual plant to debug the actual control logic of the plant.

The IDEAS models were then connected to the offline version of the Emerson control system to provide training for the process

operators, allowing them to practice crucial procedures in the operation of the Horizon plant.

"In addition to the past accolades, re: process design and control system confirmation, the IDEAS simulator is now being used as a valuable training tool," said Joy Romero, Director Bitumen Production, CNRL Horizon Project.

The challenge: To train your operators on a process—and meet your start-up schedule

The solution: IDEAS instructor

IDEAS is an essential tool for operator training; it works like a flight simulator, allowing trainees to gain realistic, hands-on experience without inflicting harm to themselves, the environment, or the plant.

The IDEAS instructor module can help train operators months before the actual plant is up and running. It helps produce better trained operators—operators who will start up new processes faster, react more wisely to plant upsets, and be more productive.

IDEAS instructor contains preconfigured scenarios that teach, train, and challenge trainees on process upsets, including two of the most intensive and complex procedures—start-up and shutdown. We can all imagine this scenario: a relatively new operator is on shift when suddenly a tailings line starts to sand-out. In most cases, such a scenario would have significant safety, environmental, or production consequences—but your new operator, who has practiced start-up and shutdown on the IDEAS simulator, immediately makes the cor-
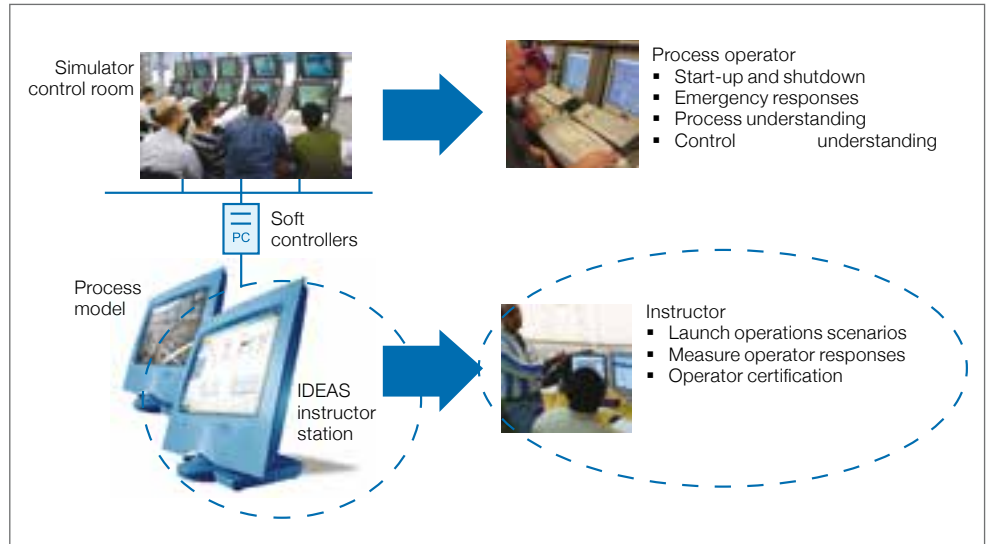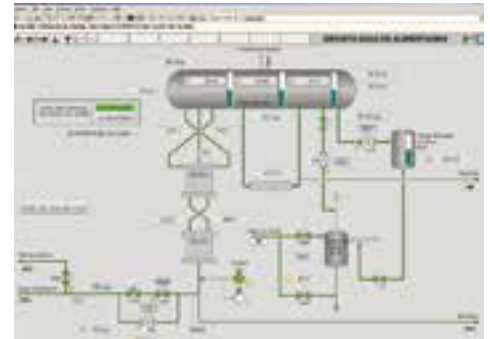

▲ Where IDEAS instructor fits into an operator training system

rect decisions and your operation continues without incident.

Operator interface

The simulator allows the actual plant configuration to be loaded into the training system, so that operators will be trained using the same interface (including the same logic, keyboard, and graphics) as the actual plant. The simulator enhances the learning process by actively involving the operators and providing immediate feedback without risk to production.

Instructor interface

IDEAS instructor software enables you to track individual employee performance, including login and fault scenario management. The operators' performance in executing start-up, shutdown, and normal operating procedures is assessed by tracking selected process variables (for example, temperature, pressure, and flow).

The view from the simulator is identical to the actual DCS screen. ▼

A screen shot from IDEAS instructor demonstrates the easy-to-use interface. ▼
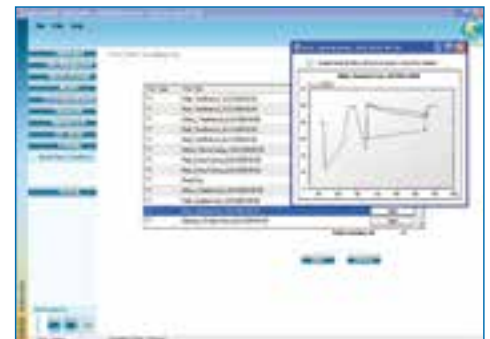
Benefits

- Teach plant operators safely and reliably
- Have personnel practice intensive and complex procedures
- Monitor trainee progress and assess performance
- Standardize and create consistent training

Success story

Customer: Shell Albian Sands
Simulation objective:

- Process verification
- Control logic verification
- Train plant operators

IDEAS played a significant role in the Shell Albian Sands facility in northern Alberta, Canada. The project implemented new technology to produce superior quality bitumen product and IDEAS was used to verify process concepts before the plant went into operation.

IDEAS was then used to check not only the I/O of the DCS, but also the DCS logic and complicated control loops—saving money and valuable time during start-up. For example, IDEAS was able to detect an error in a viscosity control loop equation that would only have become apparent during start-up.

The other key project goal for IDEAS was to train operators prior to start-up of the facility—something accomplished with great success.

"The feedback from the operators has been extremely good," said Gary Foulds of Shell Albian Sands. "We've been able to take them through the operating procedures, the more typical ones like start-up and shutdown, but also taking them into process operating regimes that are undesirable so that they can also see the consequences prior to start-up rather than on the real plant."

The training simulator has since been updated to allow operators to train on different process units to help increase their skills and expertise in each area. The system uses the same configuration and displays as the ac-

tual operator workstations in the control room, DCS and PLCs, and represents a dynamic model of the different process units found in the Shell Albian Sands plant. In addition, it has trainer functions such as the "snapshot" feature, which allows the trainer to start the process plant from pre-saved operating conditions.

When this project was proposed, the oil sands industry was at a crossroads and Shell Albian Sands was looked on as a key "test case" for future expansions of the industry. Because of the technical and commercial

success of this project, many new projects have come online since.

The IDEAS models were useful in minimizing the process risk associated associated with the development of new process concepts. A project of this magnitude called for the best practices that the customer could bring to bear, and IDEAS was considered a small price to pay compared to the process risk and the magnitude of the capital investment being made.

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The challenge: To realize the best net present value on your capital project

The solution:
IDEAS simulation

IDEAS is the leading simulator for the oil sands industry in northern Canada and is quickly becoming the simulator of choice for the mining industry.

IDEAS has been used to help the world's largest pulp mills achieve start-ups that are faster, smoother, safer—and more economical. By using IDEAS, mills have realized significant savings.

$$\underset{\text{Start-up}}{\underset{\text{tonnes/month}}{60{,}000} \quad \times \quad \underset{\text{Incremental}}{\underset{\text{\$/tonne}}{\$400}} \quad \times \quad \underset{}{\underset{\text{Months}}{5}} \quad \times \quad \underset{\text{Additional}}{\underset{\text{production (\%)}}{17\%}} \quad = \quad \underset{\text{Additional}}{\underset{\text{Revenue}}{\$20{,}400{,}000}}}$$

▲ **Increase your revenue**
Sample calculation, showing return on investment of simulation on start-up

Simulation experts

We can model any vendor equipment and are able to communicate with every DCS supplier, so your operators train on the same graphics and logic that they will use in the actual mill.

Realistic process models

IDEAS has realistic models to accurately represent your process, based on first principles of chemistry and physics. IDEAS allows you to model your plant or process at a micro or macro level of fidelity, depending on your need.

Smooth start-up

IDEAS catches hundreds of errors in control logic before start-up, which means your plant achieves products on—or ahead of—schedule.

On-site implementation

Our personnel include experienced project managers who understand your industry. We travel directly to your site to work with vendors and control suppliers during commissioning.

Risk-free training

The IDEAS instructor module allows staging and operator training to take place in complete safety, without risk to your employees or the environment.

The data agrees. At one South American plant, operators used the IDEAS simulator to practice start-up, shutdown, and emergency sequences in the months prior to start-up. This allowed the operators to be better prepared when it came to the operation of the actual plant.

A standardized test with approximately 300 random questions was developed to test operator competency. The test questions were

given in three intervals, once before any training, once after class training, then once again after IDEAS training. The results clearly showed that the IDEAS training made a remarkable improvement in operator competency.

Student competency	
Before any training	20.3%
After classroom training	26.7%
After IDEAS training	85.0%

Ongoing benefits

Since IDEAS is modular and scaleable in design, many plants continue to use the simulator past start-up for a variety of applications, including process design and training of new operators.

Return on investment

The IDEAS simulator acts as a virtual plant that will help pinpoint plant production improvements and shorten projected start-up dates. In many cases, the IDEAS return on investment has been over 200%.

What our customers say

"IDEAS allowed us to implement our existing models and process understanding in a dynamic simulation. We see IDEAS as a flexible simulation environment that allows us to communicate ideas and knowledge through the organization, thus bringing together research, projects and operations. Such a transfer of knowledge allowed Syncrude to leverage its commitment to research in a practical and measurable way."
Jim Kresta, PhD, Senior Engineer
Syncrude Research

"This ability to fully test complicated DCS and control loop logic is why we placed such a high value on using an IDEAS simulation on the project. Prior to operation, complicated process control loops can only be tested against a dynamic process model. IDEAS is proving to be very effective in performing this task on the Albian project. New operators will be able to train on hazardous operating situations in a risk-free environment using the IDEAS simulator."
Gary Foulds, PhD
Shell Albian Sands Project

"I believe the IDEAS models are the highest fidelity that have ever been achieved in the oil sands industry. They were very complex...they [ANDRITZ AUTOMATION] have created a simulator that without any question is the best there is in the industry."
Bob Tipman, PhD, Process Specialist
Shell Albian Sands

Automation solutions
Release your full potential

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