



CADSIM Plus used in Redesign of Newstech PA Paper Recycling Plant

By Georges-Edouard Alexis

Newstech PA is a de-inking pulp mill with a design capacity of 420 air-dry metric tons/day. Our engineering group was asked to assess and improve water management and reduce energy consumption in order to recommission the plant.

At an early stage of our study, we determined that some form of process simulation software should be used because it was important for us not to overlook any aspect of the process.

A full dynamic process simulation was undertaken, which included tank levels, valves and control conditions in our process model. We chose Aurel Systems' CADSIM Plus (CP) dynamic process simulator because it offered the best fit for our needs.

The software was used extensively during the study but it ultimately became the tool that we used to redesign the entire plant. CP allowed us to build up the process flows, input all the specifications and use them to determine the projected quality, yield and energy consumption of the process on a mill-wide basis.



We worked with a consultant who used steady-state process simulation software. When it came time to compare numbers, the consultant argued that certain loops were short on water when our CP balance indicated otherwise. We realized this was because the consultant's simulation had no valves, pumps, or tanks, so it could not accurately represent the mill's range of operating conditions.

In a comprehensive CP simulation, when a loop requires more water, valves open to satisfy that need similar to what happens in the mill. Tank levels rise or fall as needed during the simulation, making it easy to observe if the tanks are sized correctly. If the simulator lacks this capability it may produce more work for the process engineer, and can lead to errors.

Looking at a CP flow-sheet balance is much like looking at a process flow diagram because the software utilizes a CAD drawing front end that allows units and streams to be drawn in any form.

After running the balance to convergence with

tuned controllers, a snapshot of the process is captured. Then the final drawing with simulation results can be exported to AutoCAD with one button click.

The old steady-state software would have required us to do an additional process control study, chest tanks size agreement and then spend hours redrawing the flowsheet in AutoCAD.

Our process begins with two Valmet batch pulpers that discharge into a dump chest. As part of the redesign, we needed to know whether the existing dilution chest for the pulpers was too small for the given tonnage that we wanted to push through the mill.

We used CP to simulate the batch sequence by inputting all of the parameters, such as batch times, batch consistency, discharge consistency, and discharge flow rate. After determining the parameters, we were able to see how quickly the pulper dilution chest would be depleted of water.

The model allowed us to trend the surge caused by the pulper on the white water system. It showed that a constant flow with the overflow routed back to the dilution chest was the optimum

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- Got an interesting CADSIM Plus success story? Send it to us!

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solution to eliminate the surge in the first loop white water chest that occurred when the pulpers were being diluted for discharge.

We were able to test various sizes for the dilution chest until the group felt comfortable with the level during discharge. Since the pulper dilution chest already existed, we concluded that a second unit should be installed.

Most of the water in the front loop comes from pulper dilution. We realized that the most efficient way to cool down the first loop would be to lower the pulper dilution chest temperature enough to account for the heat added from motors and from the previous loop. The CP mass and energy balance made those calculations easy because the software calculates total BTUs.

Pulp dewater extremely well at higher temperatures. However, this can have an adverse effect on temperature-sensitive chemicals. The mill's de-inking cells use a soap, which includes a foaming agent and ink/dirt collector. Too much or too little foam can create quality and other issues. Temperature influences the soap's ability to foam. The simulation helped us to control the temperature within a specified range.

During the redesign we wanted to reuse the existing pumps, motors and equipment as much as possible to keep the capital budget low. Dynamic process simulation allowed us to model the feed consistencies while keeping a close eye on the hydraulic capacities of the existing plant equipment.

In order to produce a top-quality pulp and efficiently use the mill's lim-

ited fresh water supply, we had to design a totally countercurrent system. The CP simulation helped us to separate the mill's water loops, manage the temperatures in those loops and keep the fresh water system separate.

With temperature being an important variable for the removal of stickies and other temperature-sensitive contaminants, it was important not to have the bleach loop warm up the screening loop, which would significantly lower our screening efficiency. The simulation allowed us to input the entire equipment energy load and accurately size a heat exchanger to remove the surplus heat.

We were also able to simulate disaster situations to make sure that the

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Australian Dairy Company Cuts Energy Bill

The Murray Goulburn Cooperative Company (MGC) is Victoria, Australia's largest dairy company. They have manufacturing plants at seven sites around the state. MGC were seeking to better utilize steam production utilities at their Leongatha plant and anticipated installing a small turbine co-generation plant in place of existing pressure reduction stations. Using steady-state spreadsheet calculations, they already had a rough picture of possible savings.

However, Corporate Energy and Utilities Manager, Leon Ryan felt that the varying nature of the steam demand required a dynamic simulation approach, to provide the necessary accuracy in predicting the financial savings that would justify the project. Add in the fact that the Sustainable Energy Authority in Victoria (SEAV) was partnering in the project and needed an accurate greenhouse gas accounting and CADSIM Plus (CP) became a "natural" choice for the job.

Leon commissioned local consultants, Clean Technology Solutions (CTS) to build a CP simulation of the energy system and the proposed additional turbine. MGC engineers then ran the simulation over a range of extended annual operation scenarios. It con-

firmed the expected financial savings in a way that hadn't previously been available. MGC was pleased to have this certainty for their investment.

But that's not the end of the story. Collaboration really started when engineers from MGC and CTS sat down with the equipment supplier's engineers, SEAV officers and Sydney energy consultants MPI, to look more widely at the full utilities requirements for the factory. They looked at alternative designs for meeting these needs, while assessing energy, financial and greenhouse impacts for each.

Additional and multistage turbines, turbo air compressors, turbo chillers and absorption chillers were incorporated into a range of scenarios. Several iterations of this design process ensured that a full range of options was evaluated. Following this holistic approach, a final design was selected to match the plant's anticipated utility needs and fulfil the company's greenhouse gas responsibilities.

MGC's Group Maintenance Manager, Mark Gurney is the project manager. He comments: "The simulation allowed us to evaluate the proposed savings while coping with the changing

loads we experience in our dairy processing operations. That's important to us. You can't get accurate figures if you just guess at average conditions."

"Using the software, we were able to visualize a much wider range of options. Using the simulation toolkit certainly encouraged lateral thinking and allowed cost savings to be explored. And that's when the savings really started to escalate. The improved energy efficiencies have increased the original projected financial savings by a factor of eight times! As you'd imagine, the Board has been enthusiastic about supporting the final project proposal. We're proceeding with a stage-wise implementation and we're now looking at spreading the technology further over our other plants, where similar savings might be available for us."

CTS and MGC used the CADSIM Plus optional Power Library to build the Leongatha co-generation model.



Tech Corner: Markup & Export Your Drawing to Adobe Acrobat PDF

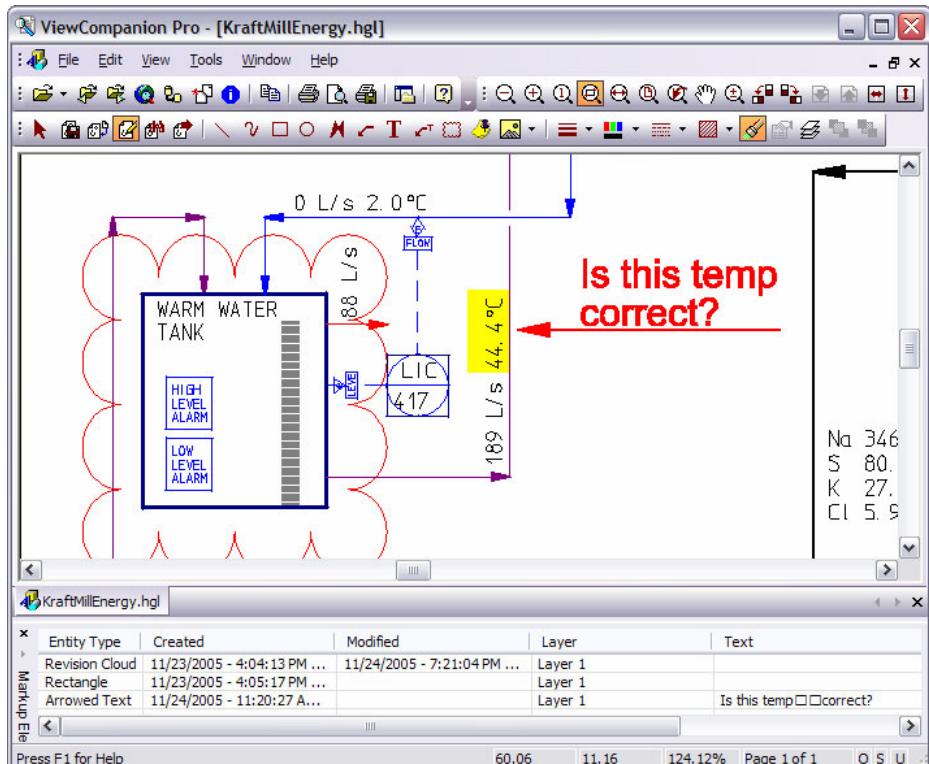
It is now easier to circulate your CADSIM Plus drawings to colleagues or clients, and you can even mark them up for review. One of the new features of CADSIM Plus v2.4 is an expanded drawing export facility. Aurel has licensed Software Companion's ViewCompanion Pro for distribution with CADSIM Plus, which will allow you more choices for exporting your CP drawings to print, plot, share and distribute electronically via Internet and e-mail.

This utility adds the following graphic export formats:

- Adobe® Acrobat (PDF)
- Adobe® PostScript®
- Autodesk® DWF™
- Autodesk® DXF™
- JPEG Raster
- Portable Network Graphics (PNG)

This is in addition to the existing graphic export formats supported directly by CADSIM Plus:

- Hewlett Packard Graphics Language (HPGL/2)
- AutoCAD® Script File
- MicroStation®/Intergraph®



ViewCompanion Pro also includes a Markup feature. When you select File > Export > Preview for Markup... CP launches a Windows-based application that allows you to

view and convert CP generated HPGL/2 graphics files into the other graphic formats listed above.

When you select Preview for Markup, you will be asked to choose scaling, rotation and monochrome options. Then the VC Pro interface will open, which allows you to view and annotate or mark up your drawing prior to exporting it in the format of your choice. VC Pro includes many options for tuning the output format.

To mark up your drawing, make selections from the Markup Toolbar. You can draw lines or geometric shapes filled with transparent or opaque color. You can add pointers and text notes. Insert a revision cloud, or add notes or picture files. You can even import your saved markups from a file.

When you have completed your markups in VC Pro you can save an external markup file, which is automatically given the name of your drawing with a .vcm file extension. The next time that you export a drawing with the same name for markup, your saved markups will automatically be included, and you can edit and update them. The markup function logs changes and markup status.

The most popular export formats include:

Adobe Acrobat Portable Document Format (PDF).

PDF is a widely-used PostScript derivative that can be used to create high quality printable documents that are also small in size. PDF files can be viewed using the free Adobe Acrobat Reader. They are suitable for distribution on the Internet or via e-mail. They can be printed on standard and PostScript printers and plotters. You can also send your PDF file to most commercial printers.

Adobe PostScript can be used to generate a PDF file, or spooled directly to a PostScript printer.

Autodesk DWF is an extremely efficient drawing format that creates small files for distribution via e-mail or the web. It was developed by the makers of AutoCAD, who also provide a free DWF viewer.

The **Autodesk DXF** is an AutoCAD exchange format that can be imported into AutoCAD and other CAD programs.

Portable Network Graphics (PNG) format is ideal for adding drawings to a web page. Microsoft Internet Explorer and other popular web browsers support this format without any additional software.



Aurel Systems Inc.

7197 Ridgeview Drive
Burnaby BC Canada V5A 4S1

Phone: +1 604.299.7707
Fax: +1 604.299.8178
Email: mail@aurelsystems.com
Web: www.aurelsystems.com



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CADSIM PLUS

Did you know...

Want to keep your simulation running fast, but having trouble with a controller that is not keeping up with large process changes?

Try controlling a flow ratio rather than the flow itself. A ratio between two flows will not change as much as the changes needed for a flow to track large swings. Control the ratio (either defined as a user variable or signal) to give the desired setpoint. Manipulate the flow or valve position by taking the product of the ratio with some changing reference flow. The results of this trick can be amazing.

You can also try one of our CADSIM Plus controller modules, which are set up for this specific purpose.

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system was not under-designed. We modeled pulp drier sheet breaks and monitored their effect on the fresh water system. Since dryer sheet breaks generate a large fresh water demand, we were able to see how quickly this might deplete our fresh water reserves. Seeing the high-density storage chest filling with pulp and water during a break demonstrated that if the process is not stopped quickly enough, we would end up with more water than we could handle, and also run out of fresh water. The CP results showed us how long we could continue pulping with a sheet break.

Purchasing CADSIM Plus and developing in-house simulation expertise has turned out to be one of the best investments we could have made. We realized significant savings by doing most of this work in-house.

Georges-Edouard Alexis can be reached via e-mail at gealexis@newstechpa.com.

**Announcing CADSIM Plus v2.4**

New products & features in CADSIM Plus v2.4:

- New (optional) hydrocarbon processing library of process modules and associated physical properties calculation
- New (optional) physical properties database of more than 3200 components
- New (optional) dynamic Data Reconciliation
- New streams and units that support VLE calculations for both hydrocarbon and water-based industries
- New Recovery, Clarifier, Optimizer and Function generator modules
- Added multiple reactions and kinetics to Tower and Hi Density modules
- Improved multi-component Flash module for water-based or hydrocarbon processing applications
- Improved density of aqueous solutions including non-ideal behavior
- Improved pressure flow network calculations with new reversible flows
- Improved speed of simulation performance
- New and improved Help files and tutorials with "Show Me How" movies
- Added new mathematical exp, ln, log, pow functions for creating derived stream variables
- New pH calculation
- Integrated graphic format converter for drawing export, including PDF output, plus the ability to add mark ups
- Revamped AutoCAD conversions to CADSIM Plus
- New ability to assign physical properties from one compound to a user-defined compound