

eXperience **No 01**

Plant Industry



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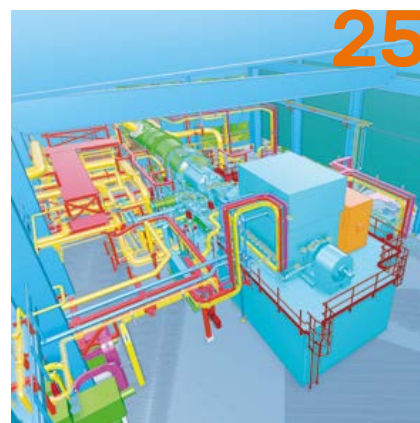
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Taking advantage of Digital Twins

I have the pleasure of welcoming you to the first plant edition of our revamped CADMATIC customer magazine under the new title eXperience. We are continuing our efforts to bring our readers informative and useful content. I hope that you will enjoy the new look and contents of the magazine.



In 2018, CADMATIC has seen growth of up to 40 percent in key markets in the plant industry. This includes design and information management applications.

CADMATIC is strongly involved in the digitalization of the industry. We offer unique solutions to utilize digital information in different stages of plant investment projects from design to construction, maintenance and operation. CADMATIC eShare allows EPCs and O/O's to build Digital Twins of plants and to use their asset information in a single window. They thereby transform numbers and values into a visual experience that is easy to understand. This also eases and expedites decision-making. ENI is an excellent example. The globally operating owner/operators in the oil&gas industry from Italy is currently implementing our eShare solution.

We are continuing our strong efforts in developing the most

user-friendly plant design software for both greenfield and retrofit projects. Ease of use, work efficiency and compatibility with customers' other systems are all key success factors. We have invested greatly in compatibility with Trimble's Tekla products and together we can offer a powerful package for both structural and plant design and related information management.

I am happy to see how CADMATIC software is being used to improve the environment and nature we live in. The Finnish Consulting Group is the main contractor for a vast 10-hectare underground wastewater treatment plant being constructed just outside the Finnish capital of Helsinki.

The cover feature article of this edition highlights this immense design and construction project. It provides me with great pleasure to hear FCG report that they have been able to design the massive facility with a streamlined team

thanks to CADMATIC's efficiency. One of our top goals is making a difference in the bottom line of our customers' projects.

Over our 35-year journey, we have held the international CADMATIC Users' Meeting every second year in different locations all over the world. In September this year, we will be holding the event in our home town of Turku, Finland. We look forward to meeting many of our software users to see both the latest developments and new development trends.

I wish you all happy and interesting reading.


Jukka Rantala
CEO
CADMATIC

Underground wastewater treatment plant design

A big challenge



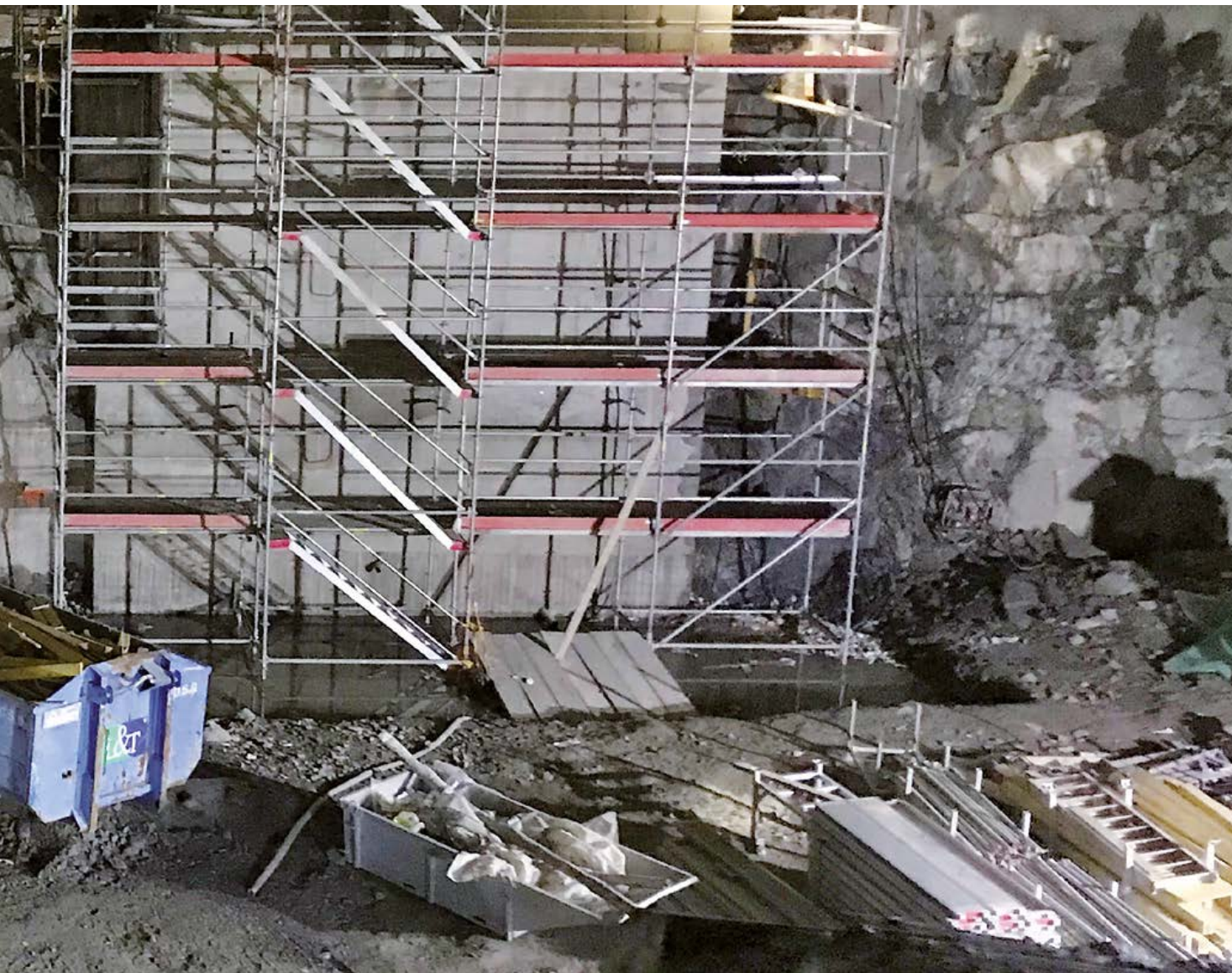
An ecological wastewater treatment plant is currently being constructed close to the Finnish capital of Helsinki in Blominmäki, Espoo. From 2021, it will treat the wastewater of around 400 000 of the city's inhabitants. FCG Finnish Consulting Group Oy is the main contractor for the project. The multidisciplinary consulting company has diverse water know-how and makes use of state-of-the-art project management and design software.

"FCG is the main contractor in the Blominmäki wastewater treatment plant project. We started the design work already eight years ago and preliminary design ten years ago.

At the moment, we are conducting detail design and the space has been excavated into the bedrock. The construction contractors have been selected and the concrete

work should be complete in two years.

Finally, partly overlapping with other phases, the devices and piping will be installed. The treatment



*The underground space for the Blominmäki wastewater treatment plant has been fully excavated.
Copyright © HSY / Jukka Viitanen*

plant will be taken into use in 2021 and for the time being we are on schedule,” says Petri Poikonen, FCG Planning Manager.

The wastewater treatment plant is being constructed in the bedrock of a 10-hectare area. An underground treatment plant is less intrusive to the surrounding living areas and more ecological. Similar plants have been constructed, among others, in Viikinmäki in Helsinki as well as in Oslo and Stockholm. Buildings

have even been constructed on top of the treatment plants.

“The bedrock in Nordic countries is of good quality, which allows us to build such treatment plants. An underground plant is out of sight and does not take up unnecessary space. Potential odour problems are also decreased. In Finland, we have top excavation and mine drainage know-how.

By building underground we reduce construction costs as the

walls and ceilings are ready after excavation. The most challenging aspect of working underground is device installation, as the spaces are compact. All devices, such as HVAC and electrical devices have to fit in the excavated cave. Everything has to be compactly installed and each phase has to be carefully planned.”

During excavation, 300 loads of blasted rock were transported from the underground tunnel to the

crushers on a daily basis. In addition, 800 000 m³ was excavated from the supply and discharge tunnels. Wastewater will be brought to Blominmäki from Espoo, Kaunianen, Kirkkonummi, Siuntio and western Vantaa. The inhabitants' wastewater will flow to Blominmäki in supply tunnels and will be pumped via discharge tunnels into the sea after treatment.

"All the largest wastewater treatment plants in Finland have been designed with CADMATIC."

Finland's second biggest wastewater treatment plant was constructed in Suomenoja, Espoo in 1963. It is outdated now and lacks capacity to treat Espoo's wastewater. The number of inhabitants in Espoo has grown approximately tenfold since 1950. The new treatment plant in Blominmäki will completely replace the old plant in Suomenoja.

"The Blominmäki treatment plant can be expanded to treat up to one million inhabitants' wastewater. The new treatment plant is very efficient and the discharged water is almost as clean as drinking water. With the new technology, we can almost completely remove the nitrogen and phosphorus that cause eutrophication," Poikonen adds.

FCG: diversified consulting company

FCG Finnish Consulting Group's mother company is owned by Kuntaliitto Holding Oy. The company's customers include both the public and private sector.

"Most of our commissions come from municipalities, but private sector companies are an important part of our customer base. FCG Group is divided into four main sectors: design and engineering, consulting, training, and international projects. We do many different kinds of plant design, HVAC, electrical and civil engineering, harbour and waterway design, as well as municipal building design, such as hospitals and

schools. We naturally also do a lot of water supply and water treatment related design", Poikonen says.

Wastewater treatment plants around Finland

FCG does all design work related to water treatment. For the public sector, this includes water intake plants, wastewater treatment plants, potable water plants, water towers, booster stations, water networks and environmental evaluations.

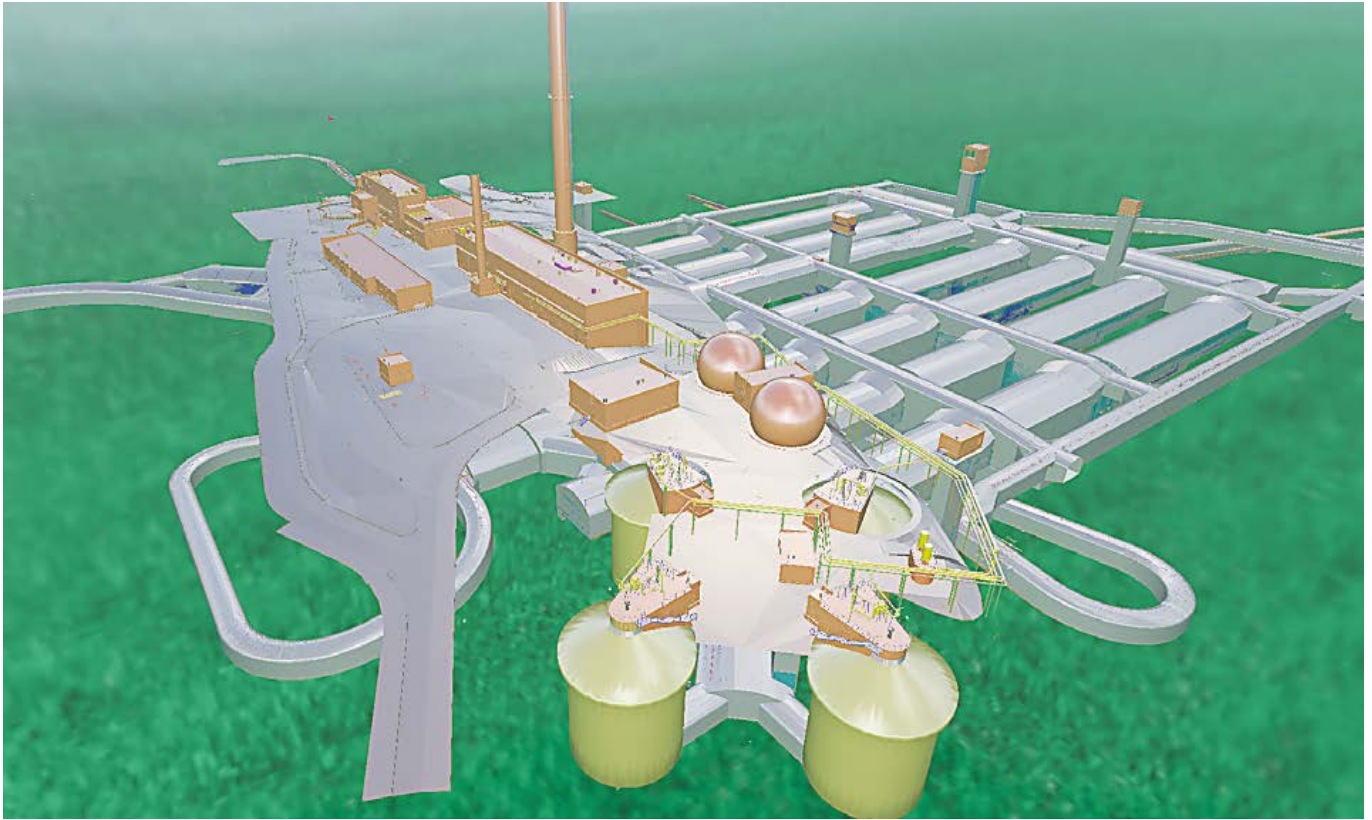
"We have designed underground treatment plants before in Viikinmäki, Helsinki and in Kakola, Turku. The inhabitants don't even necessarily know that there is a treatment plant there, as they are not visible above ground. Only the tall exhaust tower rises above ground level. There are apartment blocks next to the treatment plant and no complaints regarding air quality have been received," explains Poikonen.

Bedrock treatment plants also allow exhaust fumes like nitrous oxide to be recovered and cleaned.

In addition to Viikinmäki and



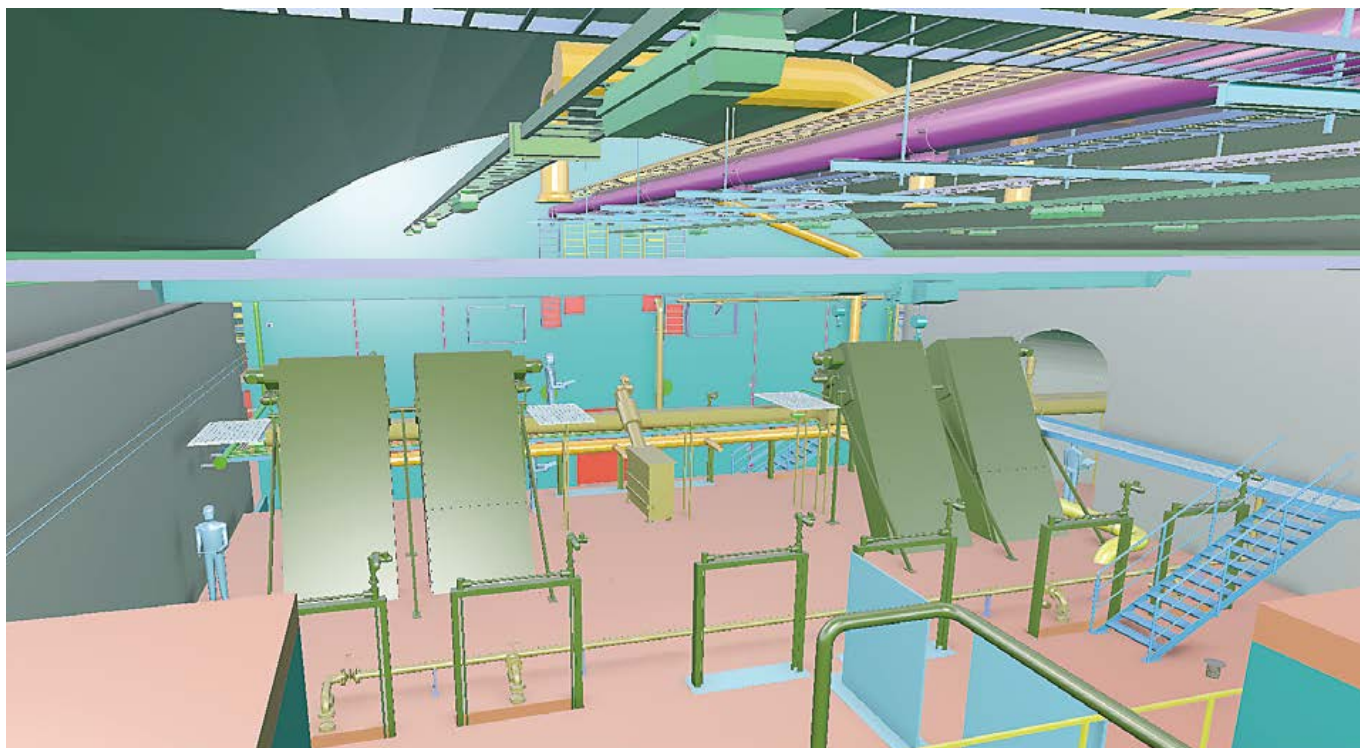
Petri Poikonen, FCG Planning Manager, has been very impressed with CADMATIC's support services and ability to handle large projects with small teams.



A 3D model of whole Blominmäki wastewater treatment plant.



A 3D model of the supply pump house.



A 3D model of the screening area.

Kakola, FCG has designed Finnish wastewater treatment plants in Klaukkala (Nurmijärvi), Luotsimäki (Pori), Taskila (Oulu) and Metsä-Sairila (Mikkeli). According to Poikonen, all the biggest wastewater treatment plants in Finland have been designed with CADMATIC.

CADMATIC is the basis of design

Like in many other projects, the starting point for FCG in this project was CADMATIC design tools. It has used CADMATIC on the project for process and detail design, including 3D modelling and P&IDs.

"Our company has a long history with CADMATIC. I think we were their first external customer about 30 years ago in 1987/88 when it was still called Plant Modelling System (PMS). It is our most important tool in plant design. CADMATIC were

forerunners in 3D design, and so were we.

A very important feature of the software is that it has sufficient capacity to deal with large projects. The Blominmäki treatment plant is a 10-hectare area filled with pipes and devices, which demands a lot from the software. CADMATIC does not run out of steam. Their piping design features are truly world class."

According to Poikonen, other key software features are reliable support and the distribution of project information.

"CADMATIC is one of only a few software houses that have truly functional support. Problems are often solved on the same day. Projects can also be distributed across our regional offices and shared with the customer. The regional offices and the customer communicate

through the Internet and by checking the eBrowser 3D model, which is on the CADMATIC server. The end customer, the Helsinki Region Environmental Services Authority, always sees at most a one-week-old version of the model and can comment on it."

The CADMATIC tools enable FCG to work with a small team.

"Even a project as big as this can be done with 6 permanent designers and 6 CADMATIC licenses. We have been trained well in software use and have the skills to take on the most demanding design projects," Poikonen concludes.



Users' Meeting 2018

Turku, Finland, 12–13 September

The biennial CADMATIC Users' Meeting will be held this year at the Joki Visitor and Innovation Center in Turku, Finland, on the 12th and 13th of September.

We warmly welcome all of our customers to take the opportunity to learn more about our newest software features, join customer presentations and to hear more about our future development plans.

Some of the topics covered include workshops about tools tailored to improve the user's workflow, design optimizations in the basic stages of design, consistency checks to ensure error-free pipe manufacturing and utilization of digital assets in all stages of project life cycles.

There will also be a panel discussion with Product Owners to talk about customers' perspectives of CADMATIC design tools. The Users' Meeting is also an excellent opportunity to network with other CADMATIC software users in workshops

and to enjoy the informal evening program.

3D visualization contest

A 3D visualization contest will be arranged at the meeting where customers can present their flagship project models. All the materials received will be presented during the Users' Meeting and prizes will be awarded for the best models.

More about Turku

The CADMATIC headquarters are located in Turku on the banks of the Aura river. It is the oldest city in Finland, founded in the 13th century, and is the former capital of the country. Currently, Turku has around 190 000 inhabitants, which makes it one of the biggest cities in Finland. Due to its ideal location near the

Aura river, it is a very notable commercial and passenger seaport.

Turku has a great variety of bars, cafes, restaurants, and nightclubs. There are also several interesting theatres, cinemas, art galleries and museums. It is worthwhile visiting the Turku Art Museum, the Turku Cathedral, one of the most notable historical buildings in Finland, and the Turku Castle, which is the largest surviving medieval building in Finland.

Use the QR code below to register for Users' Meeting 2018:



www.cadmatic.com/en/events/users-meeting-2018/signup-form.html



Shroff & Associates

– one plant every 60 days!

Shroff & Associates (Engineers) Pvt. Ltd. (Shroff) celebrated 25 years of service in 2015. The company has been engaged in providing engineering services on an EPCM basis and has built more than 175 plants to date. CADMATIC software became part of the Shroff success story in January 2017, when Shroff implemented CADMATIC 3D Plant Design software for detailed engineering.

Shroff is headquartered in Mumbai, India. Since 1989 they have been offering a wide variety of engineering and related technical services to chemical, pharmaceutical, petrochemical and allied product plants.

The company employs more than 150 experienced engineers who have extensive knowledge in the process, piping, mechanical, electrical, instrumentation, civil and HVAC disciplines.

With increasing competition and demanding clients, Shroff felt the need to invest in an engineering software tool that could provide it with a technological edge and improve their bottom line.

CADMATIC implementation

In 2016, Shroff embarked on a process of evaluating potential new design software packages. After the thorough evaluation process, Shroff decided on CADMATIC due

to the user-friendliness of the software. Shroff management believes CADMATIC works well for engineers because the software was developed by engineers.

“CADMATIC’s support engineers are always available to help and the hands-on training was excellent.”

According to Mr. Pankaj Shroff, the company’s engineers have been impressed with CADMATIC’s strong and compact database, as well as the ease with which it can be managed. Overall, the software package and services have made a good impression.

The purchase decision was made in December 2016 and was followed by training and

implementation. CADMATIC is used mainly for preparing structural, equipment, piping, electrical and instrumentation 3D models.

According to Shroff management, CADMATIC has a very short learning curve and they were quickly able to start using CADMATIC software in live projects. The company has already successfully completed several demanding plant design projects with CADMATIC software.

“We think the graphics of the software look really good and the online clash detection is a highly welcome addition. We are very satisfied with the support we get. CADMATIC’s support engineers are always available to help and the hands-on training was excellent”.

Challenging Agro Intermediate Plant Project

Shroff has recently completed a very critical project which had a

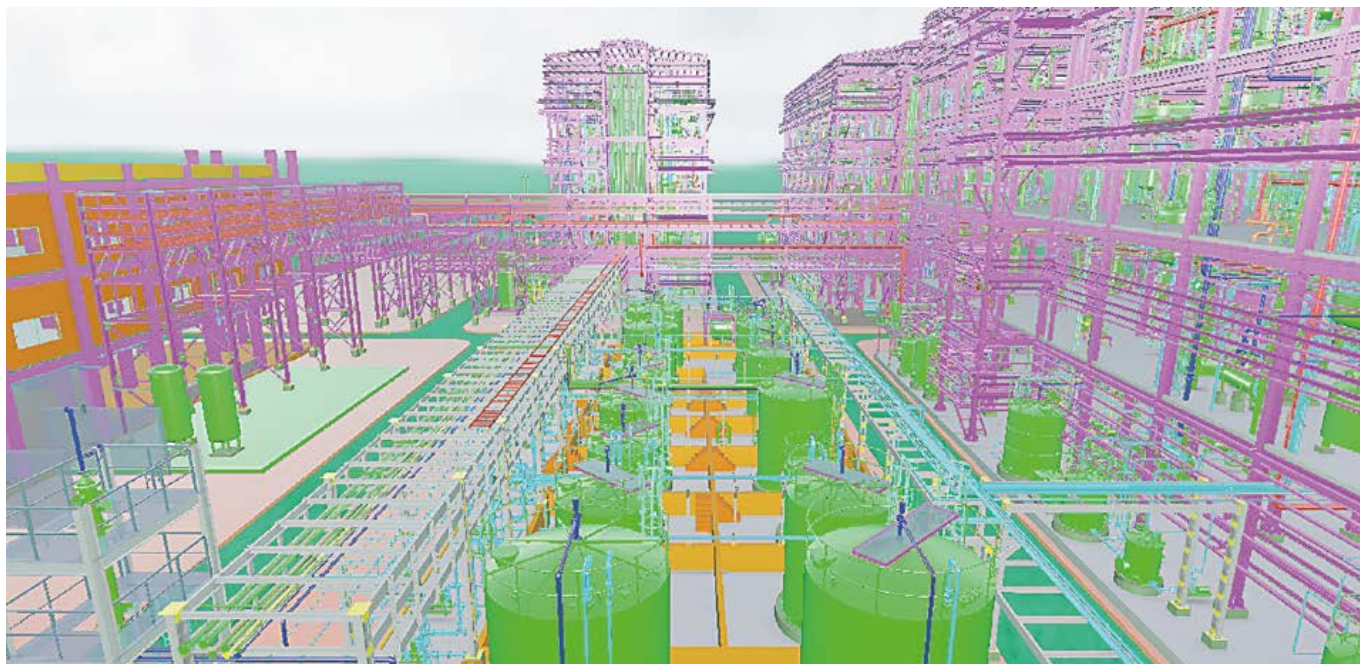
tough schedule with the use of CADMATIC Software. The large model includes about 600 pieces of equipment, 3500 pipelines and 3000 tons of structural elements.

The challenges on the project included managing the pipeline and increasing automation

within the footprints of the plant and working in parallel with all disciplines.

"CADMATIC's online clash detection feature helped us to identify and resolve issues as we worked. Considering the advantages CADMATIC software provides,

our management has decided to use CADMATIC for all our future projects."



A 3D CADMATIC plant model created by Shroff & Associates.



Some of the Shroff team members that work with CADMATIC software.

Profitability and safety risks

Execution challenges in circular and bioeconomy investment projects



Climate change and population growth have been hot topics in the media recently. The overwhelming consensus is that the time has come for resource wisdom and carbon neutrality. Finally, the so-called cowboy economy, where natural resources are consumed as if they were infinite, is coming to an end.

The sustainable use of natural resources and responsible corporate operations are making inroads across the globe. Despite the improving picture and increasing environmental awareness, good examples and forerunners are still needed to secure natural resources and a clean environment for future generations. Several challenges exist in executing circular and bioeconomy investment projects profitably. This article explores these challenges.

A question that is often raised about bioeconomy and circular economy business operations, is how they can be conducted profitably? Without financial

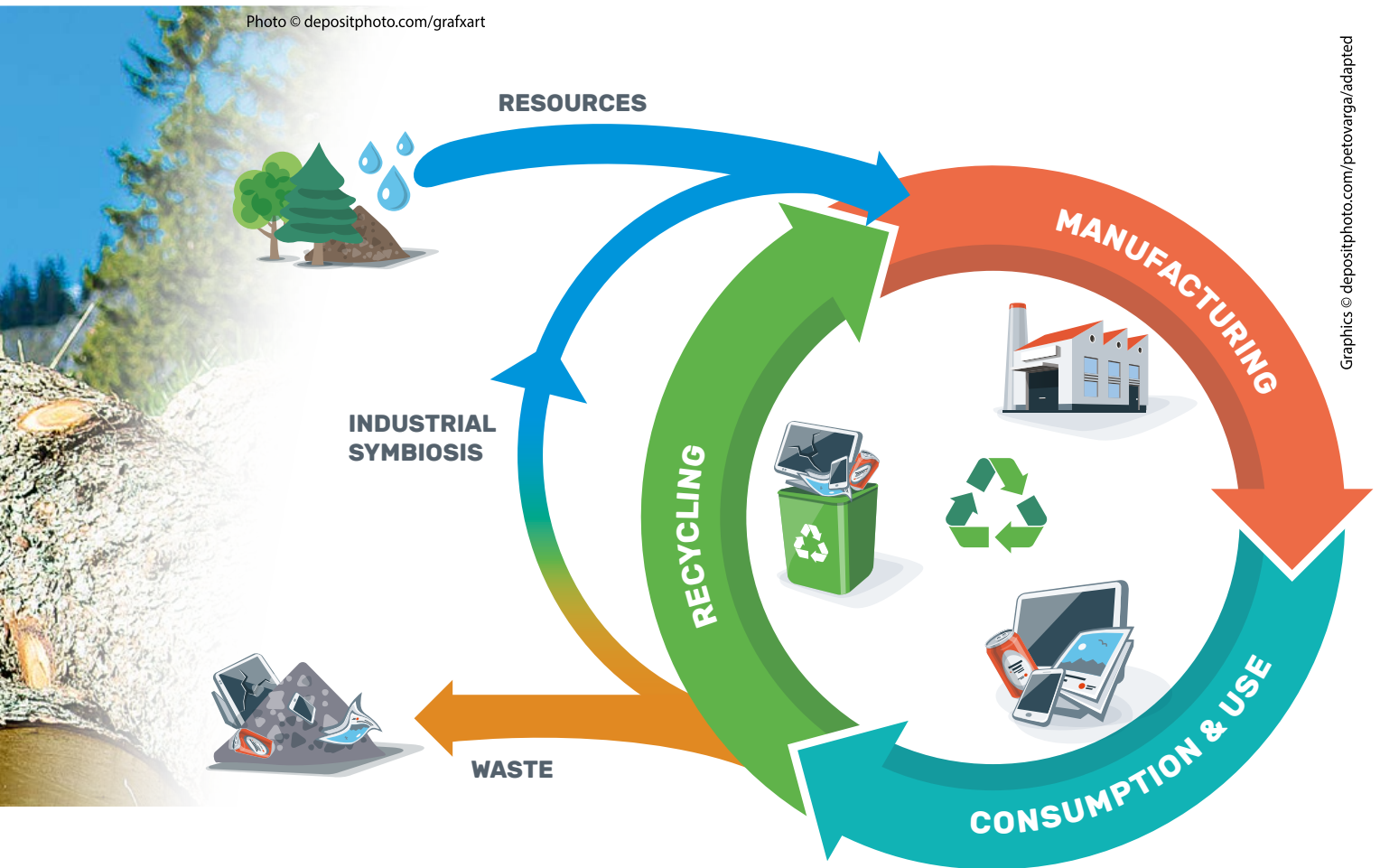
sustainability, one cannot benefit from technologies that produce lower emissions and consume resources more wisely, or support social and cultural sustainability locally, and more broadly, in the corporate supply chain. Put another way, the three pillars of sustainable development, as presented by Gro Harlem Brundtland at the UN in 1987, have to be in balance.

According to the Finnish government program, Finland aims to be a forerunner in the bioeconomy, circular economy and cleantech by 2025. The circular economy refers to operational models and business operations where raw materials,

products and materials are used as productively and sustainably as possible.

So what is slowing Finland's progress in becoming a forerunner in the aforementioned areas? From the perspective of an engineering company, the most significant challenges are ensuring that the new processes are technically sound and reliable. This is the key to making sure companies remain profitable after making the necessary changes.

Engineers are used to solving problems and developing new technologies, but solving new environmental and profitability questions, let alone social questions,



require different types of analyses and know-how. Engineering companies have a good opportunity to take on and meet this challenge. We can use our techno-economic skills and ethics to affect the environment in the way we design processes and products.

Factors affecting the profitability of bioeconomy and circular economy projects

Industrial investment projects generally progress from the preliminary study and concept phases to a rough total cost estimate, which is $\pm 25\text{--}40\%$ accurate, depending on the complexity of the process and the use of new technologies. Based on this, preliminary CAPEX costs can be ascertained for financing requirements and used to get permission to go ahead with the investment.

By clarifying the process demands, location and construction requirements, the costs can be evaluated more precisely, leading to estimates that are $\pm 15\text{--}25\%$ accurate. This cost estimate takes more extensive design, device installations, civil and structural engineering, construction, and project management into consideration. Depending on the contractors and processes, this is further refined in detail design if necessary, at the same time when calls for offers for the most significant procurements are made. At this stage, the investment cost can be estimated with $\pm 5\text{--}10\%$ accuracy.

Many consulting companies favor the EPCM project implementation model in large plant investment projects. It is very suitable for the current fast-paced industrial

environment, where customers' own engineering and project management resources are limited.

The idea behind the EPCM implementation method is to act as the customer representative in implementing projects in the agreed timeframes and budgets, with consideration for the customer's goals and cost pressures.

With several customers, the current goal is nowadays no longer only sticking to schedules and cost discipline, but rather to boldly look into more sustainable concept alternatives to increase capacity and productivity already in the design phase. The investment decision is, thus, affected by the project's ability meet future corporate responsibilities. In other words, we affect environmental loads and energy efficiency and also identify industrial symbiosis alternatives.

These factors all affect the profitability of the project throughout its life cycle and can not only be seen as factors that increase costs. Financiers have also recently highlighted the ability to substantiate the sustainable development effect of investments. A “sustainable investment” grade and category has come to the fore in this regard.

Instead of trying to reduce engineering costs, we should invest in more thorough engineering.

The world of investing is obviously a highly profit-driven affair – everything usually costs too much. In practice, investors often lean towards cutting costs, for example, in engineering. This could be seen as saving in “the wrong place”. In such cases, there is a desire to jump straight into implementation from the rough preliminary study phase. This is naturally possible, but then one has to accept higher cost uncertainty and increased project and procurement risks.

It would be better to invest in more thorough engineering so that the total cost of the investment can be estimated with 10–20% accuracy, depending on the type of project

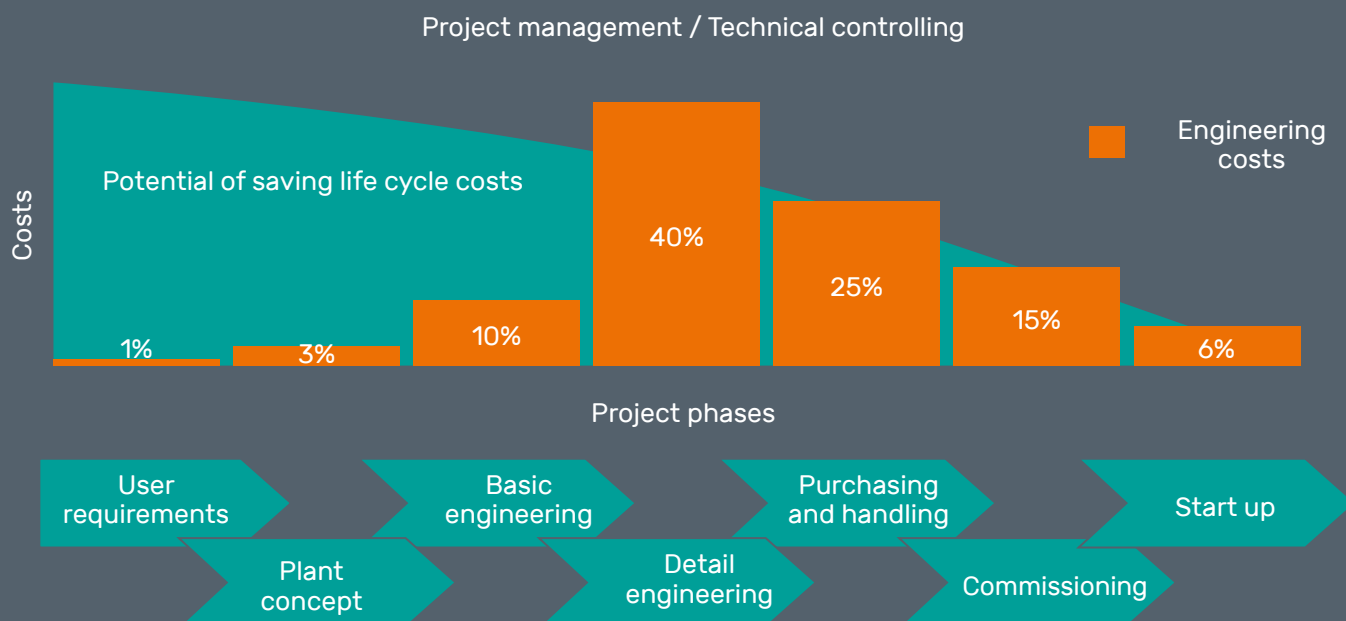
and technological solutions. Investing in engineering is the most likely way to simultaneously end up with the right, most cost-efficient and most sustainable solution.

Bioeconomy and circular economy projects also commonly have to deal with challenges related to developing technologies and changes to existing process parts. To meet these challenges, sufficient pilot-level testing and test runs are required. In such cases, the scale-up should be approached with care to maintain low costs, but also to utilize economies of scale in device and piping solutions.

From a macroeconomic perspective, taxation has a great

Diagram 1. The success of an investment project is supported by EPCM-services and step-by-step project management.

Project Success for Your Plant Engineering



effect on the life cycle profitability of an investment, because of its effect on raw material and energy prices. The game is no easier with regards to end products. The markets and delivery chains of some novel bio-products are only forming now. It is, as a result, difficult to make profitability calculations based on the prices of such products.

Furthermore, in order to succeed, industrial symbioses require a large degree of synergy and trust between different stakeholders. It is also challenging to acquire financing if the payback period is not deemed attractive and there is an inability to communicate the corporate responsibility benefits and savings potential over the investment lifespan to sustainable development investors.

Managing new types safety risks

In Finland, the Finnish government's and the Finnish Innovation Fund's (SITRA) plans of action to boost the bioeconomy and circular economy, do not generally highlight the recognition and handling of safety risks; this burden will be carried by companies and the safety authorities.

The Finnish Safety and Chemicals Agency (TUKES) estimates that bioeconomy and circular economy plant projects are exposed to new types of safety risks. It indicates that these risks should be systematically noted as part of companies' risk management activities. The circular economy may make use of new chemicals, new types of processes and production plants, and require storage and use of recovered and recycled materials. These elements bring with them new safety risks that companies need to take into consideration already in the design phase of plant and/or revamp investments.

A key skill for engineering companies is the ability to work with their customers and the authorities to manage these risks. They also need to keep up to date with changing process and plant safety regulations and highlight safety perspectives in the different design phases. The focus is on the identification of chemical, physical, and biological risks and their timely evaluation in different design phases with regards to new raw materials and processes.

Bioeconomy and circular economy projects can be profitable, if we invest in feasibility studies and engineering.

Biological risks arise due to possible impurities and microbes contained in recovered materials. They may pose health risks to operators (in the form of process risks: e.g. fermentation of stored materials and gas production). End users may even be exposed to the risk of catching diseases.

Chemicals present in recovered materials carry inherent risks. The acidity, alkalinity, and reactivity of these chemicals can, in worst case scenarios, change daily.

Physical risks typically include different types of dirt and dust that need to be managed, even just from an explosion risk perspective. Electrochemical and fire risks, on the other hand, are normally related to battery recycling.

Consultants or engineering companies should define the risk management measures with the customer, while also taking statutory requirements (so-called minimum performance requirements) into consideration. In addition to

the knowledge of safety specialists, HAZOP and FMEA analyses can be employed. Simulation tools (e.g. CFD dispersion models) can be used to evaluate the potential risks that production processes pose to the environment under both normal operation and malfunction.

Safety risk evaluations should be updated again in the detail design phase and during construction. In addition, technical modelling for different safety dimensioning could be done, classification of areas related to explosive atmospheres verified, and device/line CE marking compliance studies conducted. Care should also be taken that the results and actions to minimize the risks are taken into consideration and implemented.

Conclusion

The profitability of bioeconomy and circular economy projects are affected by several factors. These include the project life cycle and size, new technologies and processes applied, the project implementation method and engineering phasing, stakeholder and investor goals, industrial symbiosis options, taxation, legislation, and energy prices.

Profitable investments can be achieved by recognizing these techno-economic factors and investing in feasibility studies and engineering. Projects that are marked by sustainability and corporate responsibility will then be of interest to future responsible investors. Safety risk management is not a negative aspect in such projects, but rather forms part of project management that engineering companies are ready to undertake.

This article was first published in the Top Engineer magazine 2/2017. Author: Riina Brade.

Introducing Rajesh Burase:

Senior Sales Manager

In this interview, CADMATIC Senior Sales Manager in India, Rajesh Burase, talks about Indian market developments and the outlook for the region, his duties as Sales Manager and his history with the company. We also gain insights into the personality behind a growing list of satisfied customer cases.

Who is Rajesh Burase?

I am from Mumbai, in the Maharashtra state in the western region in India.

I studied Mechanical Engineering at the Walchand College of Engineering where I graduated in 2001. I have also done post-grad studies in Business Management at the Xavier Institute of Management in Bhubaneswar as well as Marketing at the SVKM Narsee Monjee Institute of Management Studies in Mumbai. I have been in the CAD/CAM/CAE industry for 17 years, the last five of which with CADMATIC. In my free time, I like reading whenever I'm travelling, watching television and spending time with my children. My youngest son loves chasing and rough-and-tumble games.

How did you end up at CADMATIC?

In 2013, a job consultant contacted me and asked whether I would be interested in working in software sales in the CAD/CAM industry. After familiarizing myself with the company and its presence and product positioning in India,

I felt that I was ready to step out of my comfort zone and take on new challenges. I was ready to leave behind the familiar world of the automotive, aerospace, and industrial machinery industries. So, I decided to take the plunge and apply for the position of Senior Sales Manager. After the interview process, I got the job.

What are your current responsibility areas?

My foremost responsibilities are increasing sales in the Indian plant industry and getting new customers on board. I also do brand positioning with a focus on



understanding and communicating what makes CADMATIC's solutions unique and where we create value for potential customers. To do this, I participate in roadshows, seminars and run webinars.

What does CADMATIC's "succeeding together" value mean to you?

It means that in order to achieve success, working together as a team produces the best results. This can mean teaming up internally with colleagues and also working with our customers and collaborating with them to help them to be successful in achieving their goals and ours.

How do you think you are faring in taking on your bigger competitors in India?

One of the main reasons I joined CADMATIC was to create a footprint for the software in the Indian Plant Industry. This is not a simple task as there are many established players in the market with a very strong foothold. However, I took on the challenge and promised myself that I would create a differentiated position for CADMATIC solutions.

The first two years included much groundwork with a focus on increasing product and brand recognition in the market. I did a lot of cold calling and visited different organizations in all regions. I was convinced of the added value that CADMATIC solutions bring, which helped a lot in convincing potential clients. The results have been promising; we have gained about 29 active customers in the last few years and many more potential clients are in the pipeline.

I think one of the areas we are ahead of our competitors in India is the service we provide. We really pride ourselves on providing the best and closest service on the market. This starts from our very first contact, through the sales and

possible testing period, purchasing, training, implementation all the way through to user support and maintenance.

What do you think are the key success factors in building good customer relationships in India?

For starters, I think it is important that we treat all customers alike, big or small. They all receive the same level of support and customer service from us. It is also important to work very closely with customers, knowing them well and maintaining transparent communication. I always try to identify and anticipate customers' needs and do my utmost to meet those needs. If you get these things right, you can be successful.

Where do you see the biggest potential for CADMATIC growth in India in the next 5-10 years?

The Indian power sector is undergoing significant changes that are redefining the industry outlook. There is currently a lot of investment in generating solar, wind, mini hydel and biomass-based power in India, with investments of US\$ 310-350 billion over the next 5-10 years. The Indian government is also committed to increasing the use of clean energy sources and is already undertaking various large-scale sustainable power projects and promoting green energy extensively, including nuclear power.

Due to rapidly increasing urbanization, the wastewater treatment industry is also set to expand markedly. This in turn will drive growth in the specialty chemical industry as water treatment chemicals are widely used in the purification of water and in large power plants, refineries and fertilizer factories. India's growing per capita consumption and demand for agriculture-related chemicals offers significant scope for future growth in the sector.

With these growth areas in mind, I would say there is a lot of potential for CADMATIC in the power, chemicals, speciality chemicals, agrochemicals and biopharmaceutical industries.

How important is it to attend local exhibitions and industry events?

Local exhibitions and industry events are very powerful marketing and networking mediums in our field. They bring together potential buyers and sellers in one place over a few days. It is a great way to advertise our products to our target market and create brand awareness.

It also provides us with a platform for us to promote and demonstrate our products to people that have little or no knowledge of CADMATIC's products and offering. By attending exhibitions, we also gain insights into industry trends. Events that stand out for me this year are India Chem 2018, the Water India Expo and PETROTECH 2018. We will definitely be flying the CADMATIC flag at these events.

Cadmatic will be holding its biennial users meeting later this year. Why do you think this event is important?

The Users' Meeting helps the CADMATIC user community to share knowledge and network with our peers. It provides us with an opportunity to deliver ideas about upcoming features and functionalities that can assist our users to increase their performance. It also allows us to gather direct feedback about these enhancements from plant and marine industry players. I really hope to be participating this year. I think the best part would be networking and discussing issues with our global members and customers as well as exchanging ideas and sharing our experiences gained from the local and global market.



Concept and preliminary design of energy efficiency measures

Turning optimization suggestions into reality

Energy efficiency audits often generate good efficiency optimization recommendations, but these are rarely developed into a form that allows practical implementation. The actual investment is clouded in many uncertainties that require clarification, even if the optimization potential is known. In many cases the next step in optimization projects is developing a concept, or in the best case scenario, a preliminary design.

In Finland there is a long tradition of energy efficiency operations and most companies have conducted at least some kind of energy analysis of their operations. This is a good starting point, but in order to achieve real savings the efficiency measures need to be put in place.

In optimal cases, the measures are related to operational

technicalities. In such cases savings can be accrued immediately, for example, by changing a process run method or altering building management system settings. In several cases, optimization requires investment, which can become a bottleneck in energy efficiency work.

Results from the 2015 annual report of energy efficiency

contracts in Finland indicate that a large part of optimization measures are classified as “under consideration”. In energy intensive industries, for example, 72% of the optimization measures are classified as such. From a savings perspective this amounts to 63% of savings, which is the equivalent of € 271 million a year (see Table 1). It

Figure 1. Field measurements support audit observations



is noteworthy that the heating and fuel savings measures “under consideration”, are significantly larger than electricity savings measures. Similar trends can be seen in other business area reports.

Energy efficiency measures easily find their way to the bottom of in-tray paper stacks

Why is it that even good optimization measures gather dust at the bottom of in-trays? One reason is obviously related to the profitability of the optimization ideas. In many industrial companies, energy efficiency investments compete directly with other investments where the payback demands can even be as tight as one or two years. The price of energy naturally also affects profitability; at current electricity prices it may be difficult to achieve profitable optimization measures.

The foremost goal is to produce reliable information about the technical implementation of an investment, the costs associated, and its profitability.

Another factor that probably slows the implementation of optimization measures is the fact that investments cannot be directly implemented based on optimization recommendations. In many cases, more detailed analysis, planning and the evaluation of effects on other operations are required before a final investment decision can be made. This phase is often a bottleneck, but this does not have to be the case.

Concept and preliminary design to unclog bottlenecks

Typically, preliminary design is started after an audit. This approach is good if the optimization investment is a clear entity and the different implementation models were thoroughly investigated during the audit. In preliminary design, matters related to the dimensioning of measures are clarified, which leads to more precise investment requirements and cost levels. The changes required to existing systems and new connections are also defined more accurately in flow diagrams, device layouts and lists. This enables the company to get a more comprehensive view of the extent of the measures and their effects on other systems or processes. Possible changes to automation and other control systems are also specified.

Table 1. Energy intensive industry measures per classification in 2015 (Motiva)

	Amount		Electricity		Heat + Fuel		Savings	
	No.	%	GWh/a	%	GWh/a	%	M €	%
Implemented	140	19	193	24	1,124	28	86	20
Decision made	64	9	281	35	450	11	73	17
Under consideration	531	72	334	41	2,467	61	271	63
Total	735	100	808	100	4,041	100	430	100

Usually, the ideas behind the suggested measures are refined and their profitability calculated with more precision. The operational costs of devices, maintenance, and operability throughout the entire life cycle should be analyzed in sufficient detail to ensure that the energy savings delivered by investment provide ROI for as long as possible.

During preliminary design, offers can be sought from device suppliers for comparison purposes. After preliminary design, the measures are ready for decision-making and possible detail design. If there are many implementation models for the optimization measures, however, concept design may be the right choice to make headway.

In energy efficiency concept design, different implementation alternatives are analyzed, including their profitability in view of the offers received, as well as their effect on other operations. When the measures introduced affect larger systems or processes, their operation needs to be checked to ensure that they deliver energy efficiency benefits as required. Typically, a concept design delivers the following:

- More precise analysis and measurements
- Possible adjustment to energy balance taking the effect of different alternatives on the whole operation into consideration
- Cost and profitability comparisons of different alternatives
- System operation description
- Dimensioning of energy technology for main devices
- Cost estimate based on budgeted offers
- Flow diagrams
- Preliminary layout and device positioning
- Review of safety and environmental considerations

- Final report and preliminary project plan, time schedule
- Clarification of energy subsidy matters and presentation of procedure

The concept design content is naturally defined on a case-by-case basis according to the particular features and scope of the target. A concept design works best, for example, in cases where different alternatives for heating, heat recovery processes or industrial air-conditioning development are being considered. A concept design can also focus on a process device (e.g. a furnace or drier) environment, where different suppliers' solutions are compared and their functionality checked as part of overall operations.

How are energy efficiency concepts and preliminary designs implemented?

Concept design implementation can be divided into three main parts:

1. Field work
2. Dimensioning and design
3. Cooperation between different stakeholders

Design work always requires sufficiently detailed initial data and field observations. In some cases, audit measurements need to be supplemented and/or expanded on. In order to evaluate device positioning, the feasibility of piping and labor costs, it is important to check distances and device positioning to a sufficient extent. Even though it may seem that this increases the workload, it will result in further savings in the workload of the next phase and possible implementation.

Different experts are consulted in the design and dimensioning phase. The extent to which such

experts are required depends on the comprehensiveness and quality of existing documentation and observations.

Successful cooperation between different stakeholders is a very important part of concept design and preliminary design. Good communication is needed when the project goals are defined to ensure that the customer's goals are communicated well to the engineering organization. It is also important that information about audit observations is transferred effectively to support design. It is especially important for designers to communicate effectively with device and solution suppliers so that offers received are based on the correct initial data and can be used for comparison. Fluent communication with authorities and regulatory institutions also goes a long way to smoothing the subsidy application process.

The foremost goal of concept and preliminary designs is to produce reliable information for decision making about the technical implementation of an investment, the costs associated, and its profitability.

Efficient use of energy subsidies

In energy efficiency optimization investments, it should be remembered that subsidies are available only when certain conditions are met. When applying for subsidies in Finland, the following factors and conditions should be taken into consideration. These factors differ naturally from country to country:

- The subsidy is dependent on a direct payback period of three to seven years
- The subsidy can be a deciding factor in project implementation
- Subsidies are not granted for revamps or repairs, unless the

energy efficiency improvement part can be separated from the rest of the investment

- The energy efficiency optimization solution needs to be described in sufficient detail
- It is important to note the labor costs of design and implementation in overall costs
- Control automation often plays an important role in energy efficiency investments
- The subsidy application must be made before the investment decision is taken

The subsidy is a maximum of 20% for traditional projects and a maximum of 40% for new technology projects. It is easy to forget certain aspects of subsidies, even though companies may have extensive experience in this regard. Firstly,

subsidies can also be granted for the procurement of production processes and devices, if they have an energy efficiency effect. This opens the door to new possibilities, as subsidy applications have traditionally focused, for example, on heat recovery optimization and process modifications in auxiliary systems.

Secondly, subsidies are allocated for the entire investment, starting from design work all the way through to start-up and personnel training. Investment verification measurements can also be included in the investment and, as such, are covered by the subsidy. Energy subsidies should be applied for in good time, to ensure that all project elements are included.

Applying for subsidies is an essential part of the design process,

albeit a concept design or a preliminary design.

Summary

By developing concept or preliminary designs based on energy efficiency measures identified in audits, we can aid companies to better evaluate the operational benefits and costs. Armed with this information they are able to make informed decisions regarding investment implementation. This enables companies to improve their energy efficiency with profitable measures, which have life cycles that are as long as possible.

This article was first published in the Top Engineer magazine 2/2017. Authors: Teemu Turunen & Jussi Jääskeläinen.

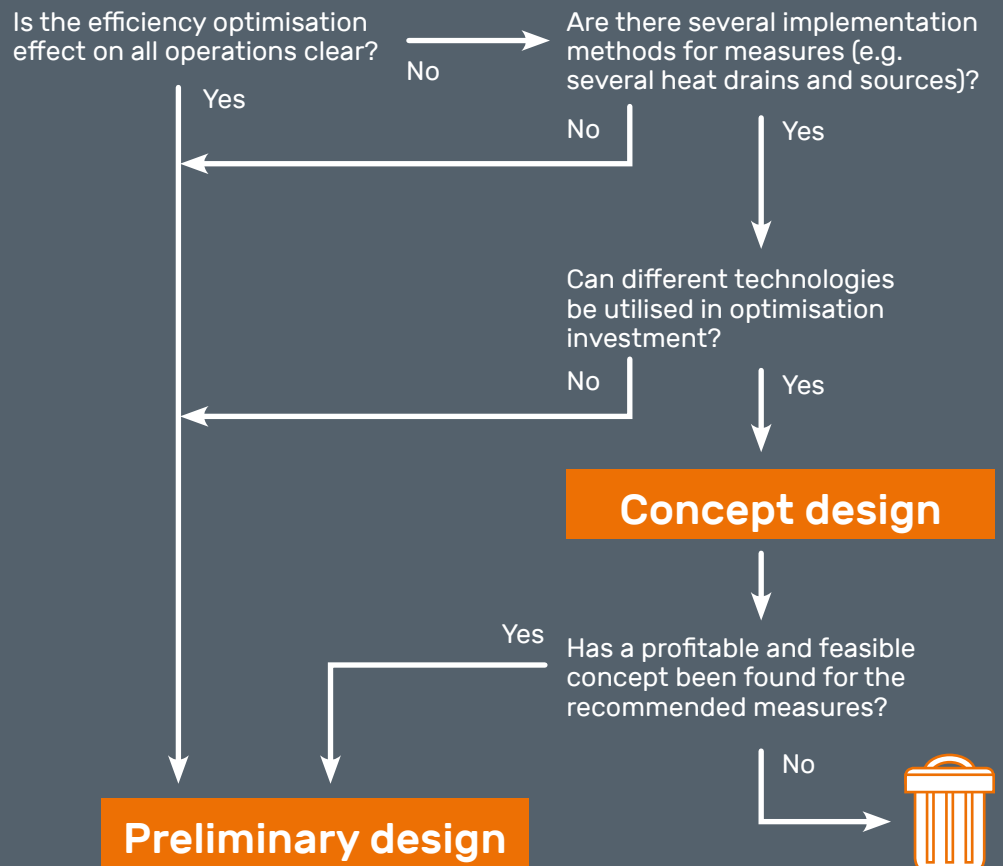


Figure 2. Flow chart for concept design/preliminary plan selection

Indian Nuclear Industry going strong



In the wake of the Fukushima nuclear disaster sparked by a massive Tsunami off the coast of Japan in 2011, nations around the globe have reevaluated their energy mixes and reliance on nuclear energy. In some cases, a move away from nuclear is evident, while many remain undecided. Others, such as India and Finland have continued expanding their nuclear build programs.

In India, the course could not be clearer; the Indian government is going ahead with nuclear to light up the future of millions of its citizens. The entire industry is benefitting from the boom that the clear policy decision has set in motion.

According to the International Atomic Energy Agency's (IAEA) "International Status and Prospects for Nuclear Power 2017" report, new nuclear power stations are under construction in Argentina, Brazil, China, Finland, France, India, Japan, Republic of Korea, Pakistan, the Russian Federation, Slovakia, Ukraine, and USA.

As part of its own clean energy program, the Indian government has already approved the construction of ten pressurized heavy

water reactor (PHWR) units. The nuclear investment program has been enthusiastically received by the local nuclear industry, which has suffered from policy uncertainty and projects that have been delayed for decades.

The ten new reactors will be built in Chutka in Madhya Pradesh (Units 1 and 2), Gorakhpur in Haryana (Units 3 and 4), Kaiga in Karnataka (Units 5 and 6), and Mahi Banswara in Rajasthan (Units 1, 2, 3 and 4). In addition to these 10 (indigenous) reactors, two Russian light water reactors (LWRs) will be built in Kudankulam in Tamil Nadu.

Nuclear boom market

The announcement of the investments has been a tremendous

boost for nuclear equipment suppliers and service providers in the industry. The industry is set for a boom over the next ten years as the ambitious nuclear investment program is implemented.

It is estimated that the nuclear build program will add approximately USD 10.5 billion in supply side opportunities during the period. The Canadian "Candu" technology has been selected for implementation at the ten sites.

Competitive and clean energy

Due to its large population, India has vast energy needs, which have been further fueled by strong economic growth over that last decades. In spite of the increasing uptake in renewable energy



Locations of ten new nuclear reactors to be built in India.

sources across the globe and the decrease in associated production costs, nuclear energy still remains an attractive base option for energy-hungry countries like India.

"We have a strong desire to contribute and be a part of various nuclear programs in the region."

The energy produced from renewable sources is simply not sufficient and constant enough. It needs to be supplemented by a base energy

source such as nuclear. Other alternatives include gas, thermal and coal-powered energy.

Despite its reputation in some circles, nuclear energy is widely held to be a very clean power source and sustainable over the long-term. The design and construction quality of nuclear power plants, however, need to be of the highest standards to safeguard both the plant, its personnel and surrounding human populations.

Strong market position

CADMATIC's position in the Indian nuclear industry is strengthening with every passing year. The strong

position has been achieved by maintaining a decade-long business association with key players in the Indian nuclear industry, such as the Department of Atomic Energy (DAE), the Nuclear Power Corporation of India Limited (NPCIL) and the Bhabha Atomic Research Centre (BARC). NPCIL currently operates 22 nuclear power reactors with a total capacity of 6780 MWe.

"Our association with owners and operators has created opportunities for CADMATIC at prominent engineering and consulting companies in the nuclear segment. Tata Consulting and Engineering (Tata), for example, uses our software

extensively for their nuclear projects,” says Roshansingh Navlur, Director for sales and operations in India and Southeast Asia.

Tata has already successfully completed the design of the Karpur Atomic Power Plant (KAPP, Surat) with CADMATIC and is currently using the software for the design of the Gorakhpur Haryana Vidyut Pariyojana (GHVAP) plant.

Roshansingh Navlur is very optimistic about the outlook for CADMATIC in the Indian nuclear sector.

“Our long relationship with NPCIL and the new contracts we have signed with BARC bode well for the future. We recently concluded a 5-year maintenance contract with NPCIL that will see CADMATIC used as the design tool for the upcoming PHWR nuclear

power plant projects. For the last three years we have also been participating as an associate partner at the annual India Nuclear Energy exhibition. We have a strong desire to contribute and be a part of various nuclear programs in the region. To meet the needs of the regional nuclear industry we are investing in the regional offices by adding more staff,” says Navlur.



More about the team behind the successes in the Indian nuclear industry

CADMATIC's local Indian operations took shape in 2010 when Cadmatic Software Solutions Private Ltd was established. Located in Thane, Maharashtra state, its goal is to promote CADMATIC in India and Southeast Asia in both the plant and marine segments.

The office is strategically located on the Cadbury Junction, Eastern Express Highway, Thane West with excellent connections within the state, country and Southeast Asia, as well as to local public transport networks.

The CADMATIC team in India currently consists of 28 staff members and is led by Mr. Roshansingh Navlur, Director (India & Southeast Asia). They have achieved a strong presence in plant segments such as the nuclear, chemical, oil & gas, thermal, pharmaceutical, food and dairy industries. Significant growth has also been achieved in the marine sector.

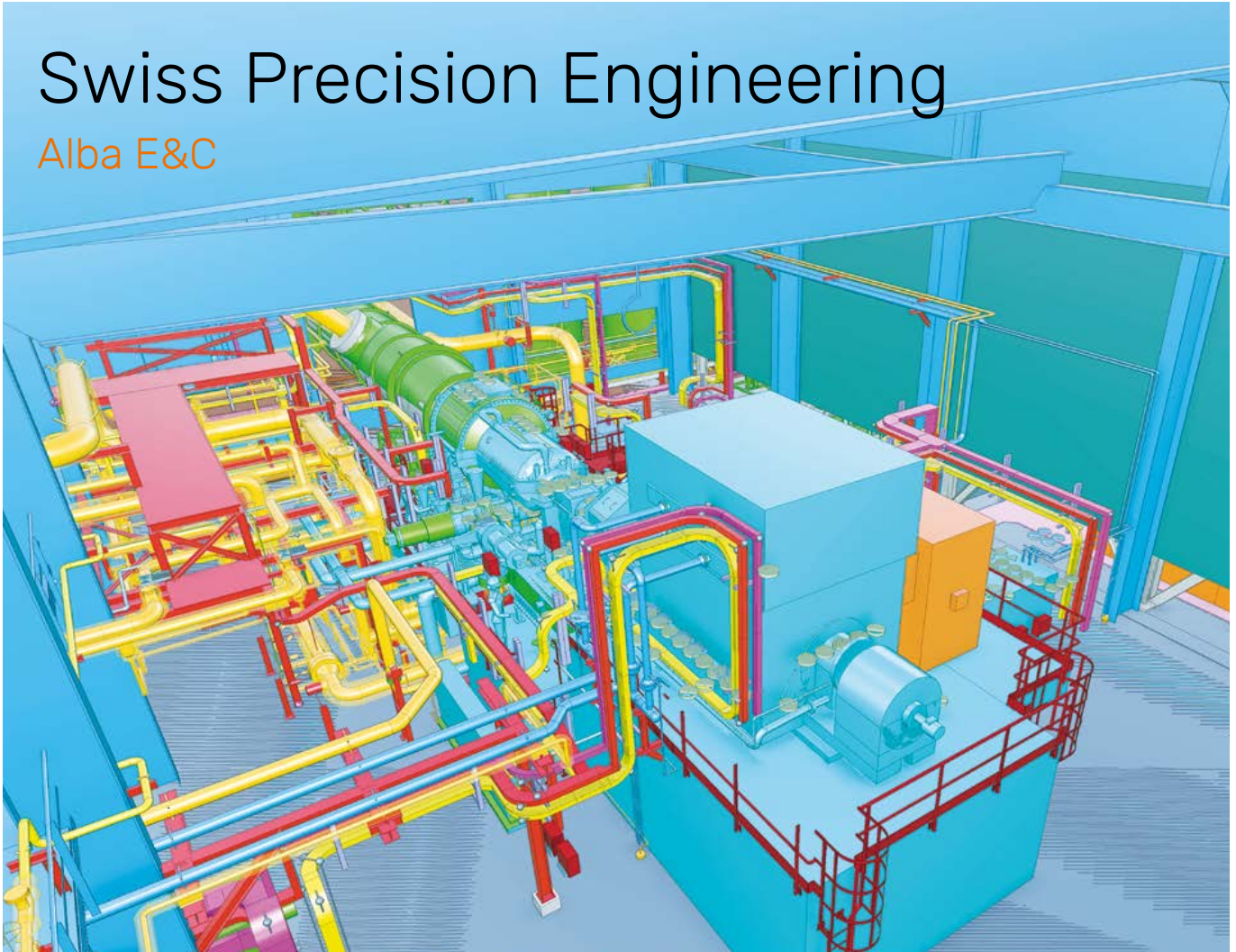
Some of the milestones achieved by the Mumbai team since 2010 include

- More than doubled turnover between 2010 and 2017

- Has significantly grown market share within a highly competitive market
- Numerous new implementations at the biggest shipyards across the region
- Expansion to countries such as Sri Lanka, Indonesia, Vietnam and Singapore
- Grown customer base from a handful to over 60

Swiss Precision Engineering

Alba E&C



Headquartered in the southernmost part of Switzerland in Mendrisio near the Italian border, Alba E&C (Alba) is ideally located to serve a wide range of European industries. Part of the company's philosophy is integrating its engineering services with the most innovative data processing technologies available.

In 2016, Alba implemented CAD-MATIC, which it now uses for design and information management purposes. Not shy of challenges, Alba has already used CADMATIC for the design of a wide range of demanding industrial plants.

Alba was founded in 2008 as a trading company in the steel industry, after which it evolved into an engineering company specialized in the design of industrial and civil plants. Since its remarkable

transformation, the company has been supporting its customers in all design phases. Alba's multidisciplinary skillset covers a wide range of engineering disciplines, as well as software development.

In search of a practical and cost-efficient solution

General Manager Camillo Martiradonna has been with Alba since 2011. He was instrumental in overseeing the evolution at Alba from

a steel trading company into one that specializes in piping and civil engineering.

"CADMATIC helps us to reduce data loss and achieve better quality end products."

"We set up the electrical, instrumentation and control departments first in 2014, which was followed by

the process and automation departments in 2016. From our new head office in Mendrisio, we are able to support clients in basic and detailed engineering, job management and material procurement,” explains Martiradonna.

In 2016, after many years of using various 3D modeling software packages, Alba were keen to implement a practical and cost-efficient solution. According to Martiradonna, a key requirement was real and

fast assistance to reduce the time required to solve possible software management problems.

“After testing the software in 2016, we decided that CADMAT-IC would be the ideal solution for us. Today we have trained all the staff to manage and complete multidisciplinary design tasks. Our IT team was impressed with how user friendly the software administration is. It also takes less time to train new users in CADMATIC

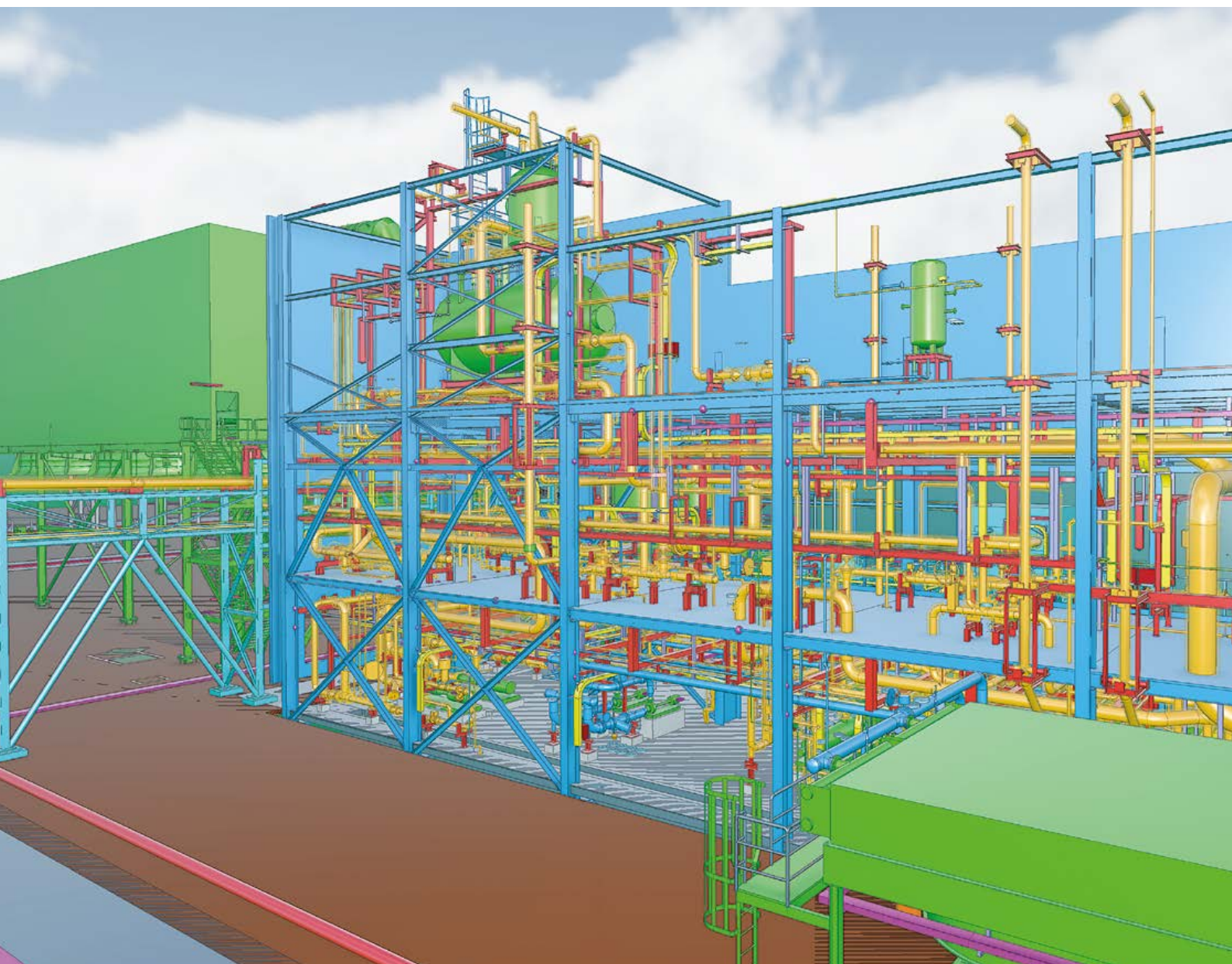
than with other software,” says Martiradonna.

Thermoelectric power plant

A recent challenging project by ALBA with CADMATIC was the design of a thermoelectric power plant for Termokimik Corporation Impianti E Procedimenti Industriali Spa in Russi near Ravenna, Italy.

The plant covers an area of 230 square meters and produces 40 MW of electrical power with a steam

3D model images of a thermoelectric power plant ALBA has designed for a customer in Russi, Italy.



turbine. The steam necessary for the turbine is produced in a combustion thermal cycle with wood chips. The turbine has five spindles in the Rankine cycle.

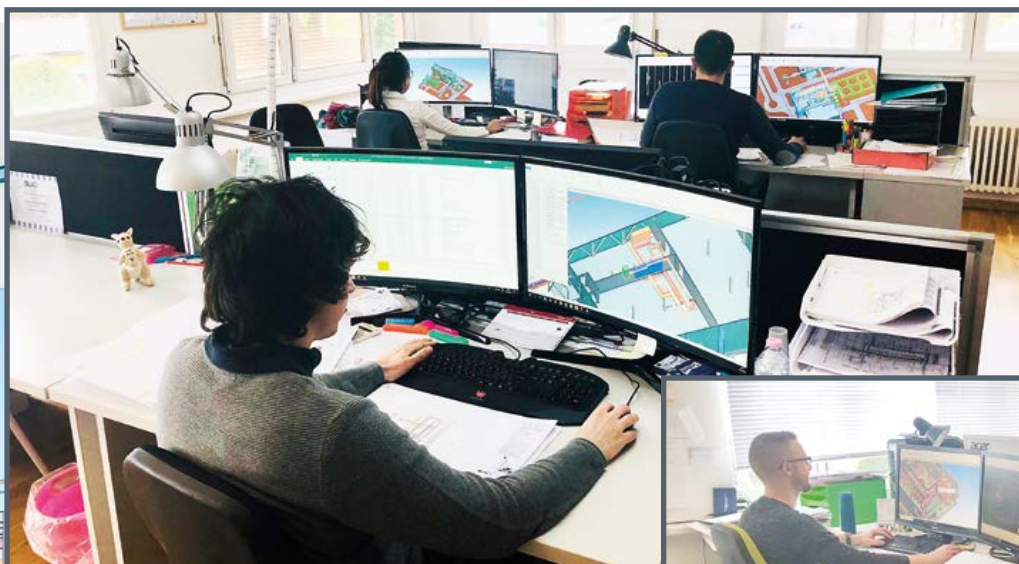
Improving the quality of end products

When asked about which software features he particularly appreciates, Martiradonna mentions the relative ease with which 2D documentation necessary for the procurement of

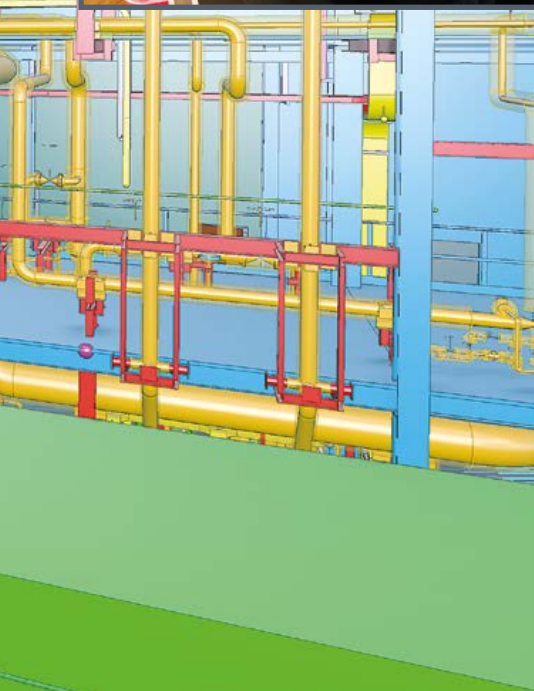
materials, prefabrication and construction can be extracted. CAD-MATIC's automatic cable routing feature and information management tools have also impressed him.

"With the latest release, the automatic cable routing module can save a lot of time in engineering. Our management team uses eBrowser and eShare to ease communication between designers and managers. This ensures that we

have less data loss and achieve better quality end products."



ALBA designers at the ALBA headquarters in Mendrisio, Switzerland.



Alba E&C disciplines

- Process Engineering
- Piping Engineering
- Civil and Structural Engineering
- Mechanical and Piping Engineering
- Electrical/Instrumentation Engineering
- Automation and Control Engineering
- Software Development

New Software Features

Plant Design & Information Management

CADMATIC's T3/2017 and T1/2018 software releases are packed with exciting new features in both plant design and information management. This article highlights some of the new features.

Visually set filter box limits

The new View Cube graphical tool offers faster work with views. The user can set the view direction on the fly and edit the filter box by selecting which face, edge, or vertex of the filter box to move to the current cursor location. In views that are parallel to the main axis, the selection tool is two-dimensional, and in axonometric views it is a cube. In shaded views that are parallel to the main axis, the user can also see a preview of the resultant filter box.

Scan the QR to see a video of this new feature:

https://www.cadmatic.com/assets/videos/2018T1/2018T1_Navigation_in_3D.mp4



IPR protection – predefined expiration date for eBrowser files

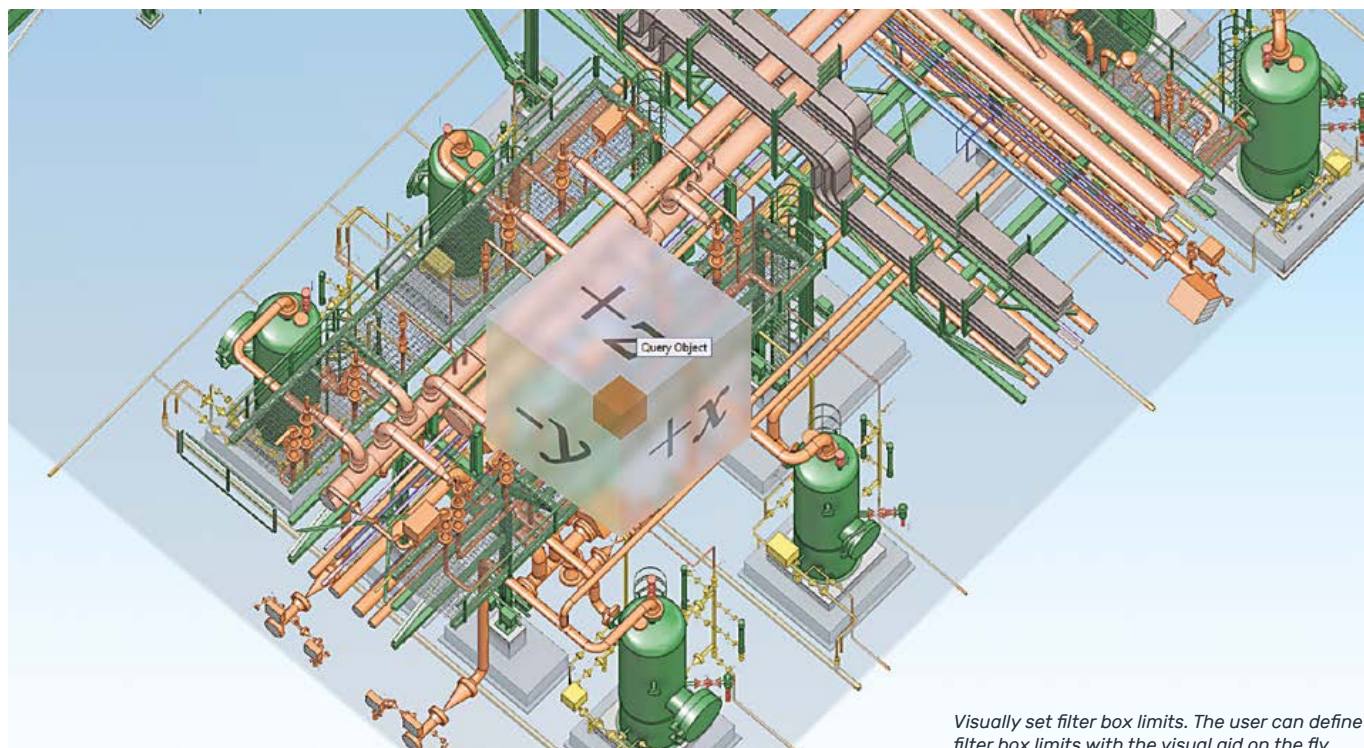
As an additional layer of security, a set validity date for eBrowser files has been introduced. Providing access to view and walk around the 3D model during the design and building phases may be essential. However, leaving the indefinite 3D model, which can potentially be

used as a sketch for next projects, is often seen as a necessary limitation by the owners of the design.

Expiration dates for eBrowser files provide the possibility to control access to the design solutions after the completion of the project and ensures that outdated files are not used.

Up to 75% faster collision control tests

In version 2018T1, collision control tests are significantly less time-consuming. For smaller tests, such as inside a block or area or for an isolated system, the tests will



Visually set filter box limits. The user can define filter box limits with the visual aid on the fly.

be almost twice as fast as previous versions. For extensive collision tests, such as all-against-all in a large 3D model, the user will obtain results up to 75% or almost three times faster.

Visualize open ends of cable routes

For the visual inspection of cable routes, version 2018T1 offers the option to visualize the open ends of cable trays. This allows designers to spot the open ends of cable routes at an earlier stage and to

make the needed adjustments in the nodal network by adding air jumps or additional segments for trays.

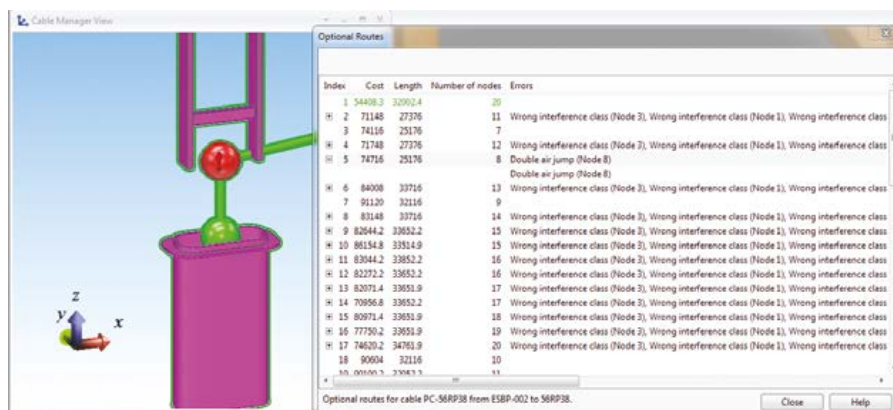
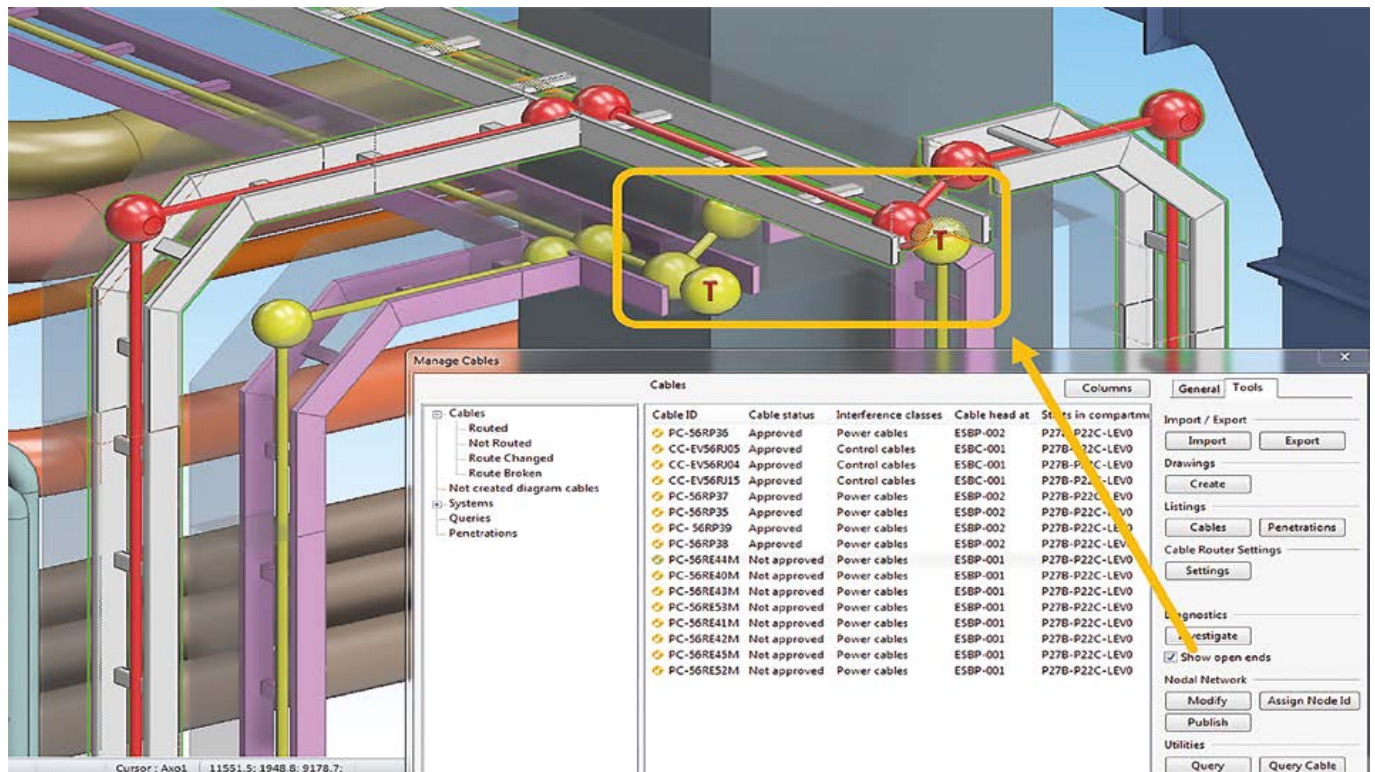
Investigate cable routes

Cables can be investigated to display all possible routes for the cable with option information. It is easy to see the options for routing cables and possible errors, the estimated length, cost and number of node points. Possible errors include double air jumps, if there is a significant distance between the last

node point and the connection to the cable, or differences in interference classes.

Collision detection directly in eBrowser – one step further in project management

In addition to efficient browsing of 3D models, comparison tools and storing discussions, it is now possible to check for collisions directly in eBrowser – with a few clicks. The collision detector in eBrowser enables users to get a deeper insight into the 3D model and combine 3D



Visualize open ends of cable routes.

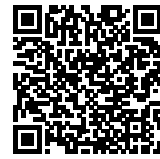
The Investigate Route feature displays all cable route options and related information.

models from different sources and checks for consistency between disciplines.

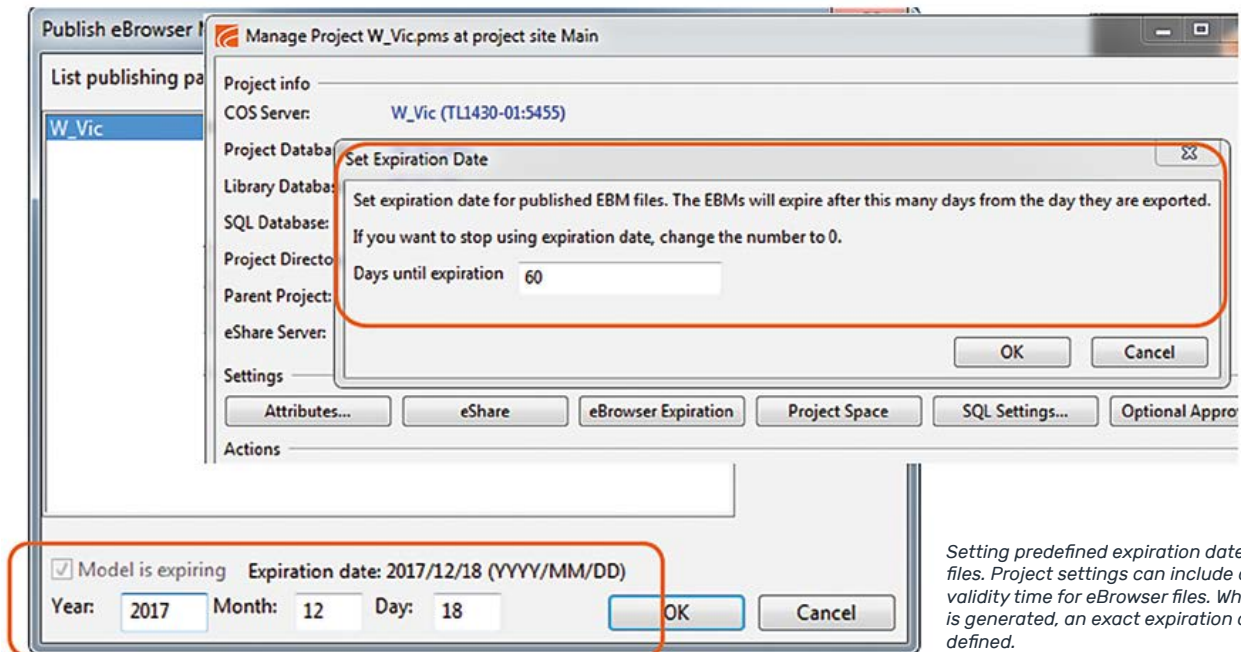
The user can pick objects or tree nodes straight from the model tree and quickly check if the selected objects collide with something else in the model. Additionally, a

fully controlled collision test can be done from the main toolbar. Besides the precise selection of objects for the test, it allows the definition of clearance distances and the exclusion of soft collisions.

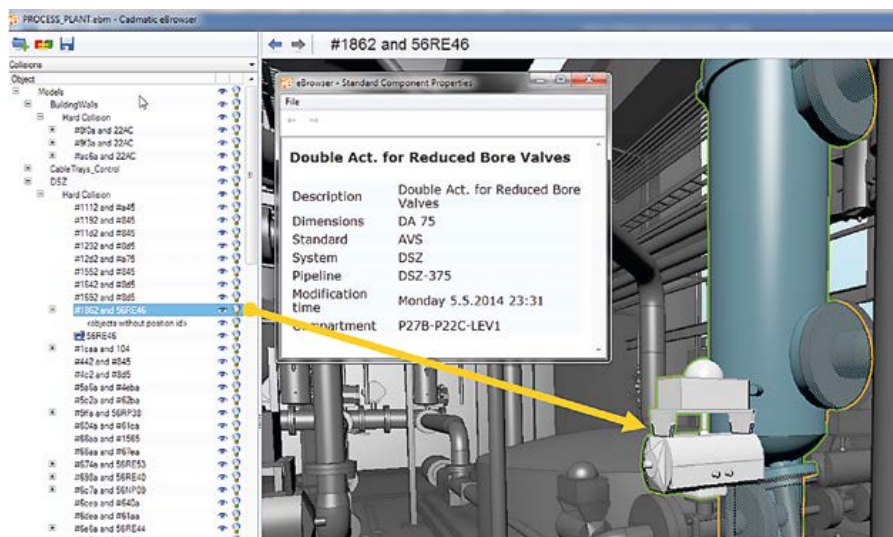
Scan the QR code to view the video about this new feature:



https://www.cadmatic.com/assets/videos/2018T1/2018T1_eBrowser_clash_check.mp4

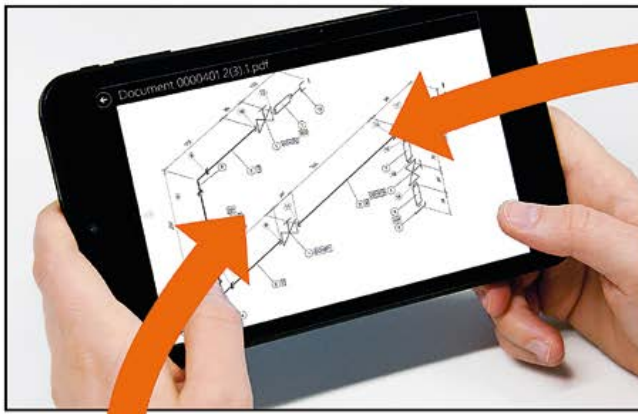


Setting predefined expiration date for eBrowser files. Project settings can include a maximum validity time for eBrowser files. When the file is generated, an exact expiration date can be defined.

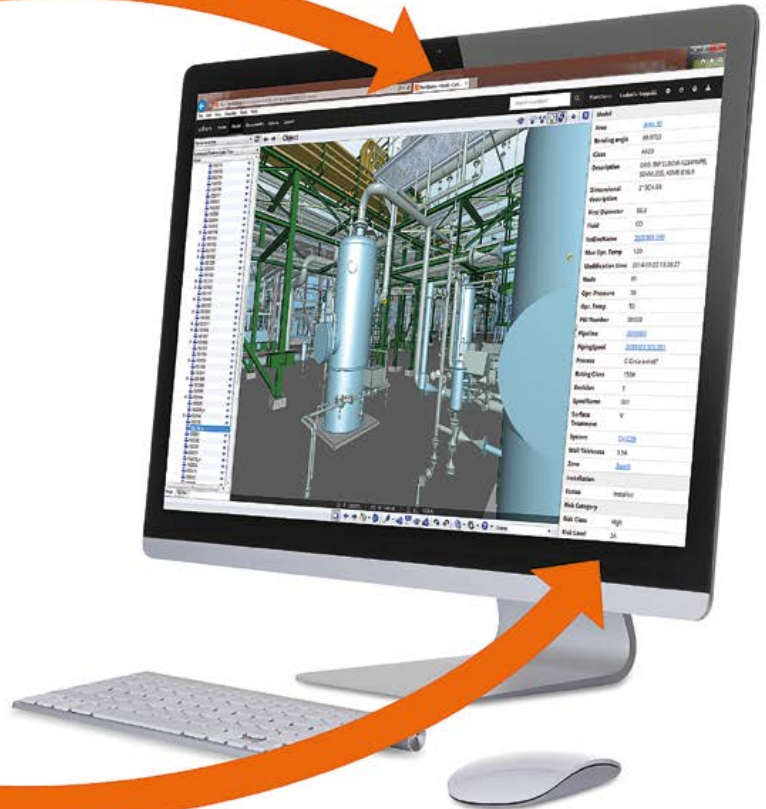


Collision detection directly in eBrowser.

Sync documents between eShare and eGo and use them offline.



Switch from documents to 3D model with one click.



Sync attributes between eShare and eGo.

Import IFC files to eBrowser models

To support projects shared among participants using different software packages, eBrowser allows the user to import IFC files. Collecting all 3D models in one place from various sources using the IFC format opens up extensive possibilities for collaboration. Combining imported IFC files of project parts with clash check boosts eBrowser users in their quest for error-free design.

Download documents for mobile use on eGo

To go completely mobile, users can now not only sync models to

eGo from the eShare server, but also download documents and use them offline. Documents can be used online, with the requirement of eGo being connected to eShare in real time, or selected documents or sets of documents can be downloaded to eGo and used on site. This applies to both PDF and DWG documents. Intelligent links from 2D to 3D are maintained, and the user can go from the document to the 3D model with one touch, including when the user is offline. The same can be done, with eGo connecting to eShare.

Besides documents, eGo shows attributes from eShare when online. This means that not only

published attributes are visible, but also additional data defined in eShare. If eGo is connected to an eShare project, synchronizing the model downloads offline copies of visual styles defined in eShare to the tablet. This allows users to color the model based on the visual styles.

This is especially helpful if the user needs to go to the construction site to verify or update information that can efficiently be visualized with colors, such as construction or verification status.

Cadmatic is a leading 3D design and information management software developer and supplier for the marine, process and energy industries.

- Cadmatic's main offices are located in Turku, Finland and Groningen, the Netherlands.
- We have certified resellers and support partners in 15 countries in Europe, Asia and America. Our growing customer base includes over 1000 customer organizations in 57 countries.
- We have staff in Australia, China, Hungary, India, Italy, Russia, Singapore, Spain and the UAE.



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