Land-Based Aquaculture with Digital Sustainable Engineering

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Learning Objectives

- Understand different methods of combining classic and next-generation tools
- Use Revit as a main tool for process
- Understand the benefits of BIM 360 on BIM projects

Description

This class will focus on BIM for Aquaculture Project delivered in Nordic by Kruger Kaldnes part of Veolia Water Technologies, comprising world class technical know-how and technologies for water purification.

Sustainable development is at the heart of Veolia activities; and land-based Aquaculture provides a sustainable way to feed a growing world population.

The BIM Manager will speak about the process based on Autodesk Technologies starting by the reality capture with Recap, the process definition with Autocad Plant3D Software, Design engineering with Revit, Clash Detection with Navisworks Manage and all the project data managed by BIM360 Platform for collaboration with external subcontractor who permit to reduce Engineering Time and improve quality on the deliverables.
Speakers

Angel Jover, Vice President Operations, Engineering and Procurement, Veolia Water Technologies

Angel Jover is a naval officer by education and engineer by trade, with global working experience. He is currently VP of Operations, Engineering and Procurement with Veolia Water Technologies.

Stig Komma, CAD/BIM Manager / CAD - Mechanical Designer, Veolia / Krüger Kaldnes as

Stig graduated in Mechanical Engineering in 2011. He has worked on introducing and developing Autodesk Revit since 2012. Currently he's working on standardizing work processes around BIM 360, Autodesk Plant 3D P&ID, and Revit. As a BIM coordinator, he’s concerned with how to make an efficient collaboration from the office to the field, and back. He is a member of Veolia Engineering Tools CAD Advisory Board for E&A - Norway, Sweden and Denmark. Stig is always looking for a way to improve collaboration between disciplines and doing things more efficiently, with easy access to information. His work experience includes: Va Tech Hydro - Industrial mechanic 2003-2005; Findus Norway - Industrial mechanic 2005-2006; Jotun - Industrial mechanic 2006-2012; Veolia Krüger Kaldnes - Technical Draftsman / Engineer 2012 - 2018; Veolia Krüger Kaldnes - CAD / BIM Manager 2018 to present.
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Sustainability and environmental impact

Main purpose of presentation

- Introduce you to Veolia Water Technologies
- Present how Krüger Kaldnes worked in 2009
- Present a timeline for the software integrations
- Present how Krüger Kaldnes are working today
- Sustainable engineering - What is the benefit for the earth by working this way
- Population growth and raising demand for food, need better quality and more production in a small footprint
- What is Land Based fish farming

The story starts in 2009

In 2009 Krüger Kaldnes AS(KK) had an own workshop, service and engineering department. KK delivered process equipment, service and solutions in market areas municipal, industry and aquaculture, the latter being a small part of the business.

Aquaculture projects were often controlled by customers or an external advisor. They were responsible for coordination between the different disciplines, in design and execution. KK was then a pure process supplier, who delivered equipment to the treatment plant. Arrangement and assembly drawings in drawn in Autocad 2D. Drawings often consisted of one or more layouts with several sections. In the process of creating the sections errors often occurred; cutouts were misplaced or were left out. Coordination between drawings was performed to the extent possible, using xref and placing drawing files over each other. Collisions were discovered on site where they had to be resolved. This was not an efficient way to run projects for the customer.
Since 2009 Krüger Kaldnes has implemented several programs to make work easier, more efficient and provide a better quality.

First, we needed a program that could help us create a smart PID with PID Blocks / symbols that contain information about the object. **Autocad P&ID (Autocad Plant 3D P&ID)** was chosen as the best program for this purpose. What was important at that time is still important to us today, using this information from PID to lists and implementing these in the electrical, process and mechanical department. This ensures that all departments in Krüger Kaldnes work with the same information.

Furthermore, we needed a program to draw our design and built projects. Previously, this was done in **Autocad**, but the market was changing and customers wanted more 3D.

In the municipal sector, **Revit MEP** was a more common tool to use, and since we had most projects for municipalities in 2012, it was more natural to choose **Revit MEP** as main design tool.

BIM did not have that much focus at that time.

In 2013, **Inventor** was chosen as a tool for mechanical design.

In 2015, we had a project where the customer had taken a 3D scan of his plant. This was too heavy to load into **Revit**, and then we started using **Naviswork Simulate**. Here it was easy to link the files together and ensure that our process matched with the one who was already at the facility.
In 2017, we started using this for compiling aquaculture projects and further in collision control.

**BIM 360** was first used on the aquaculture project Osland 2 in 2018. We wanted a platform that could make the cooperation between the different internal disciplines better and easier. This was later expanded to our suppliers as well. The collaboration on **BIM 360** now gives us better control over the documents / drawings in the projects.

But we missed the connection with the 3d model and the construction site for verification.

In the Osland 2 project a 3D scan was performed. This was taken into the **ReCap Pro** which gave us a point cloud. This was included in the compilation model for the project. Our civil works partner showed us one day that they had used drone to create an image that could be placed over drawings. The images were also uploaded loaded into **ReCap Photo** which processed and made a 3d model. This gives us the opportunity today to compare the projected 3D model with the work done on the construction site.

**Sustainable engineering**

We use sustainable engineering to develop a sustainable industry as fish farming.

The use of BIM360 and its collaborative philosophy helps reduce negative impact on the planet by reducing travel (meetings are done virtually), less paper (work is done directly on models) thus minimizing carbon footprint and pollution.

By using drone scanning we bring the construction space to our engineers, this in turn results in fewer journeys, more time for engineers to project and gives better traceability of what is happening at the construction site.

Using a cloud-based collaboration platform we ensure that information between the executing disciplines is shared. And that this information is compiled in order to be used further in project meetings and planning meetings.
And now in 2019

In aquaculture projects Krüger Kaldnes AS is an “external” advisor and responsible for the process delivery and design. And together with our building partner we deliver turnkey solutions to our customers following the standards and regulations that the Norwegian authorities have set for the industry. So that the customer can focus more on optimization of design and functions in his plant.

From Design to Execution Phase

BIM360 is central to our projects, bringing information from design and execution together. By using the “issue management” feature, the design and execution team can provide information directly to the responsible person by the due date. Every week we send out a report on new and replied issues. Each discipline then has full control and if an issue is over due date, necessary measures can be initiated.

Design

As previously described, each project starts with Plant 3d PID. When a PID is created, it is checked and shared with others for comment. When this is done, work begins on making a 3d model in Revit. Still using codes from PID on the equipment, pipes and valves in the 3d model. When layout is ready, a compilation model is made of the project in Naviswork. By inserting drone scans one can place and customize the facility according to local conditions. And the necessary information is shared via BIM360. This process is repeated several times.

Execution

Our installation crew have access to the latest models and drawings via BIM360. Using drone scans, the Naviswork model is updated with...
the latest information from the construction site. By checking these two models against each other, deviations from design and execution can be detected.

The Project - Osland 2

Project information:
- Startup: May 2018
- End: December 2019
- Capacity Biomass: 360 000 kg (61kg/m^2x2)
- Capacity Feeding: 2 300 kg/d/department
- Project location: Søreide is located approximately three hours North of Bergen.

BIM Manual

During the start-up of the project we created a BIM Manual that laid guidelines for the 3d models in the project. We had to do this so that all parties received the information they needed.

The BIM Manual contains information such as coordinates, discipline contact persons, which file format to be delivered and which information the files should contain.

ReCap

- Scanning of construction site is used to give design team feedback on progress.
- By using Naviswork, scanning and design model are connected. Easy to detect mismatch between design and execution. Corrective actions can be taken earlier.
- Overall better planning

Autocad

- Well known tool that most of the engineers know how to use
- Used for basic equipment and process design by Mechanical engineer
- Hydraulic profile
- Linked together within Revit as an underlayer for creation of 3D layout

Revit

- Multipurpose tool, from architecture….to structure…to mechanical…to plumbing
Basic model/drawing civil contractor
Process arrangement/assembly drawings for piping and equipment
PID tags used to identify components
Quantities of piping by system code from PID
Pipe Class connected to procurement system
Flow calculation, automated pipe sizing.

Naviswork
- Project collaboration model brings together information from all disciplines so it can be used in online meetings
- Easy access of information from Revit on 3d components for engineers and field manager
- Clash detection and report

Clash detection is done in Naviswork Manage. To remove duplicate classes and non clashes we use add inn from iConstruct. When this process is done we use BIMCollab to check the information

Inventor Pro
- Makes production drawings from offer stage (where no details are needed, only placeholder) to workshop production drawings (where every little detail can be included)
- Creating mechanical components with correct BOM
- Less error in production / procurement
- Stress calculation, to document our equipment when demanded
- Easy to implement 3d model in Revit

Plant 3d PID
By creating a smart PID, where every object has a unique tag (code) we extract information as follows:
- Pipeline List, Valve list, Component list and Pump list.
- Pipeline List, this is used by our subcontractor and our engineering team to identify pipelines in model and use the same information for calculation and other documentation.
- Valve, component and pump lists are used further by electrical and process disciplines.

**BIM360**

- Collaboration with Customer & Contractors
- Common platform for drawings, models and issue administration
- Traceable review workflow and transaction
- Used for reviewing drawings on the move
- Using Issue system as an workinglist, sending report on open issues every monday

**Next step**

Our next goal is

- Use VR in tender and project
- Full digital working process (no use of paper)
- Field management
- Cost management
- More use of Dynamo in Revit design
- Streamline project execution
- Wider use for calculations (CFD, pressure drop, structural analyses)
- Better documentation from software (datasheets, lists, BOM)