

Aarbakke Smart Factory – Digital LEAN

The learning factory

PRIDE
in every
MOVE



Monza:engine

Monza Gateway
Customer service desk

Monza APS
Aarbakke Planning System

Monza SAFE
Production Safe, Fast and Effective

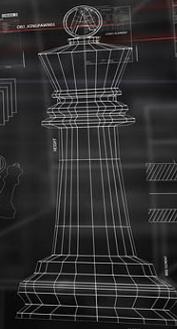
Monza Q
Quality barriers

Monza Evidens
Manufacturing and product documentation

Monza Cargo
Goods receipt, shipment and warehouse

Monza Sales
Bid and proposals

Monza Pit Stop
Non-conformance and exceptions



Aarbakke AS

Proud History



1918



First CNC plant

1981



New plant - later expanded

2003

2008



Brøyt – Storage / material cutting / Assembly & Test

2019

1994

ISO & API certified



2006

Acquired Bryne Mekanikk



* Today certified according to ISO 9001 (incl. NS-EN ISO 3834-2), ISO 14001, ISO 45001 (OHSAS 18001), API-7-1, Achilles, ATEX

Capabilities

- 40 years of CNC machining experience
- Over 50 CNC machines
 - Mazak street
- Mastering a broad range of material specifications and dimensions
 - $\text{Ø}0,19''$ [5mm] to $\text{Ø}52''$ [1300mm] 238" [6000mm] in length
 - 2500mm x 3000mm x 1800mm, 20 tons load capacity
- Flexibility / back-up machines
- Manufacturer of tooling
- Special tooling
- Pallet system and CNC automation & robotization

Capacity

- Yearly machining capacity: 250 000 hours
- Yearly welding capacity: 55 000 hours
- Yearly production capacity: 360 000 hours

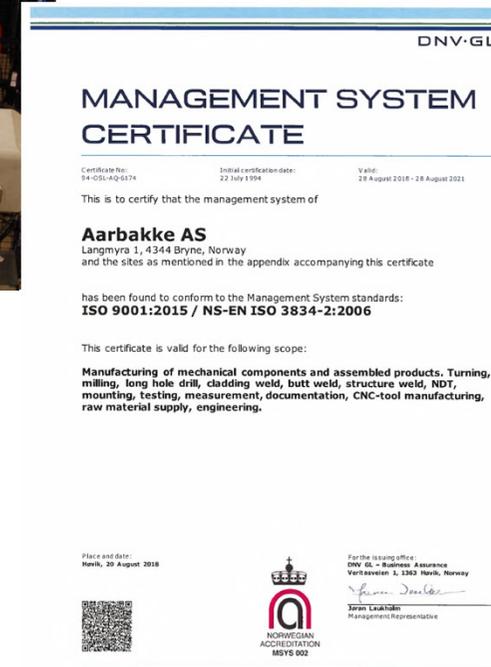


Capabilities - Welding

- High welding competence within
 - Cladding
 - Buttering
 - Pipe welding
- Certified according to most demanding procedural standard, ISO 3834-2
- 10 Automatic welding machines
 - incl. 4 Fronius 9000 ETR, Speedclad
- 2 robot machine
- 5 manual devices
- More than 260 welding procedures
- NDE level 2 & 3 personnel in-house
- 20 tons of Inc 625 welding consumables annually



* Today certified according to ISO 9001 (incl. NS-EN ISO 3834-2), ISO 14001, ISO 45001 (OHSAS 18001), API-7-1, Achilles, ATEX

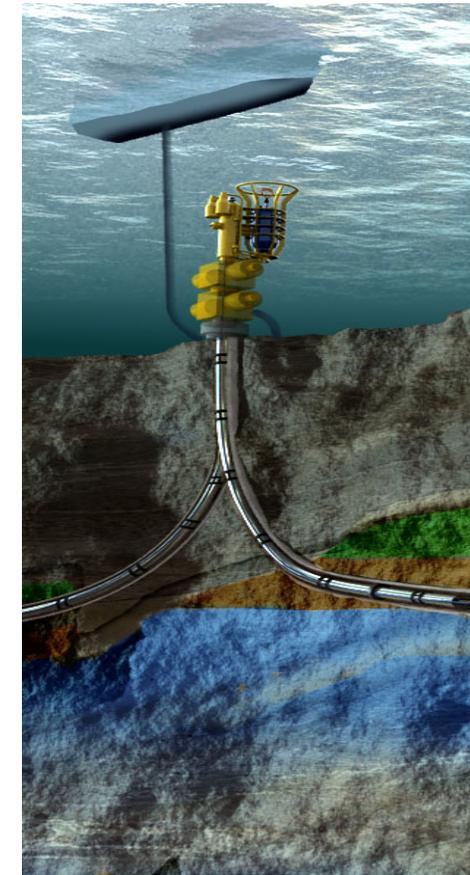
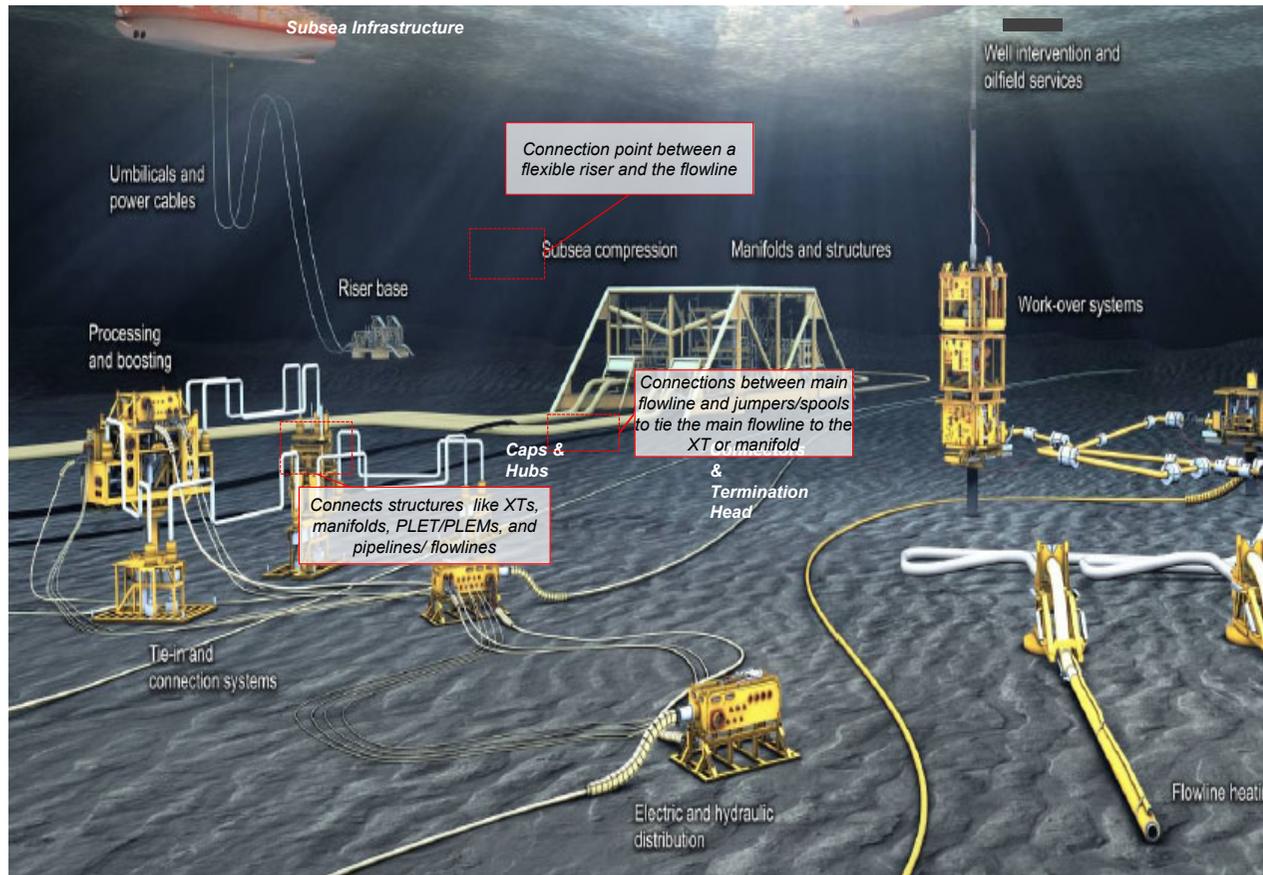




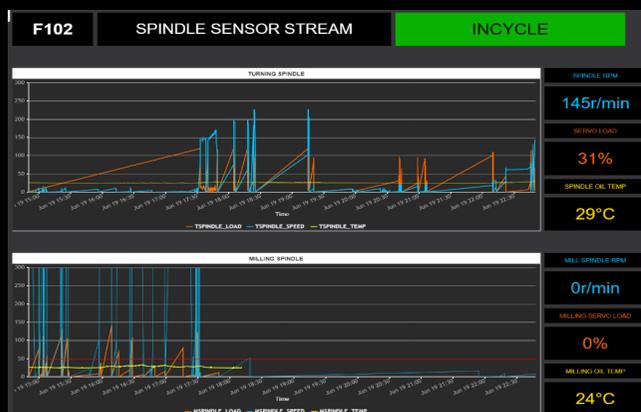
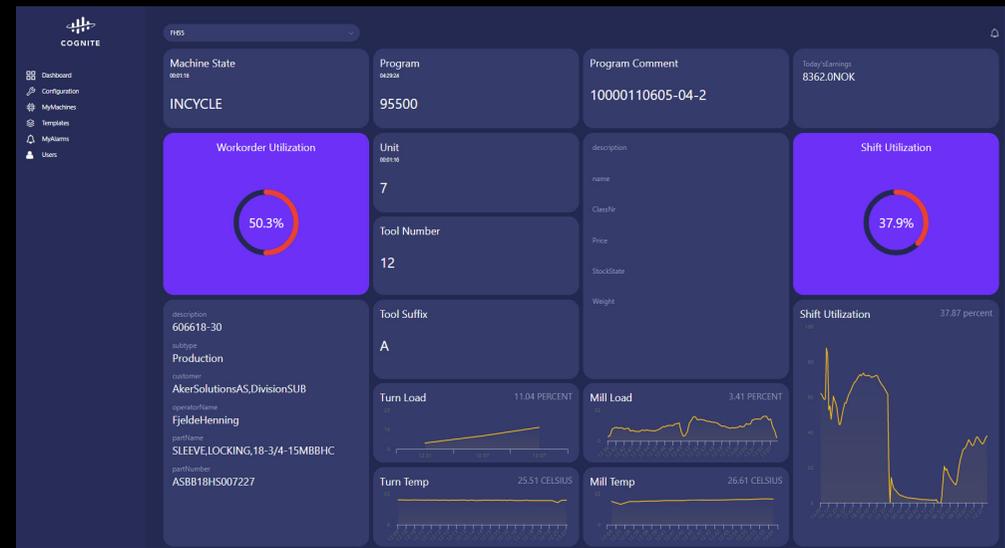
Turn key solutions

Subsea Intervention & Connection Products

Connection equipment is used to connect subsea pipelines and structures of a subsea infrastructure

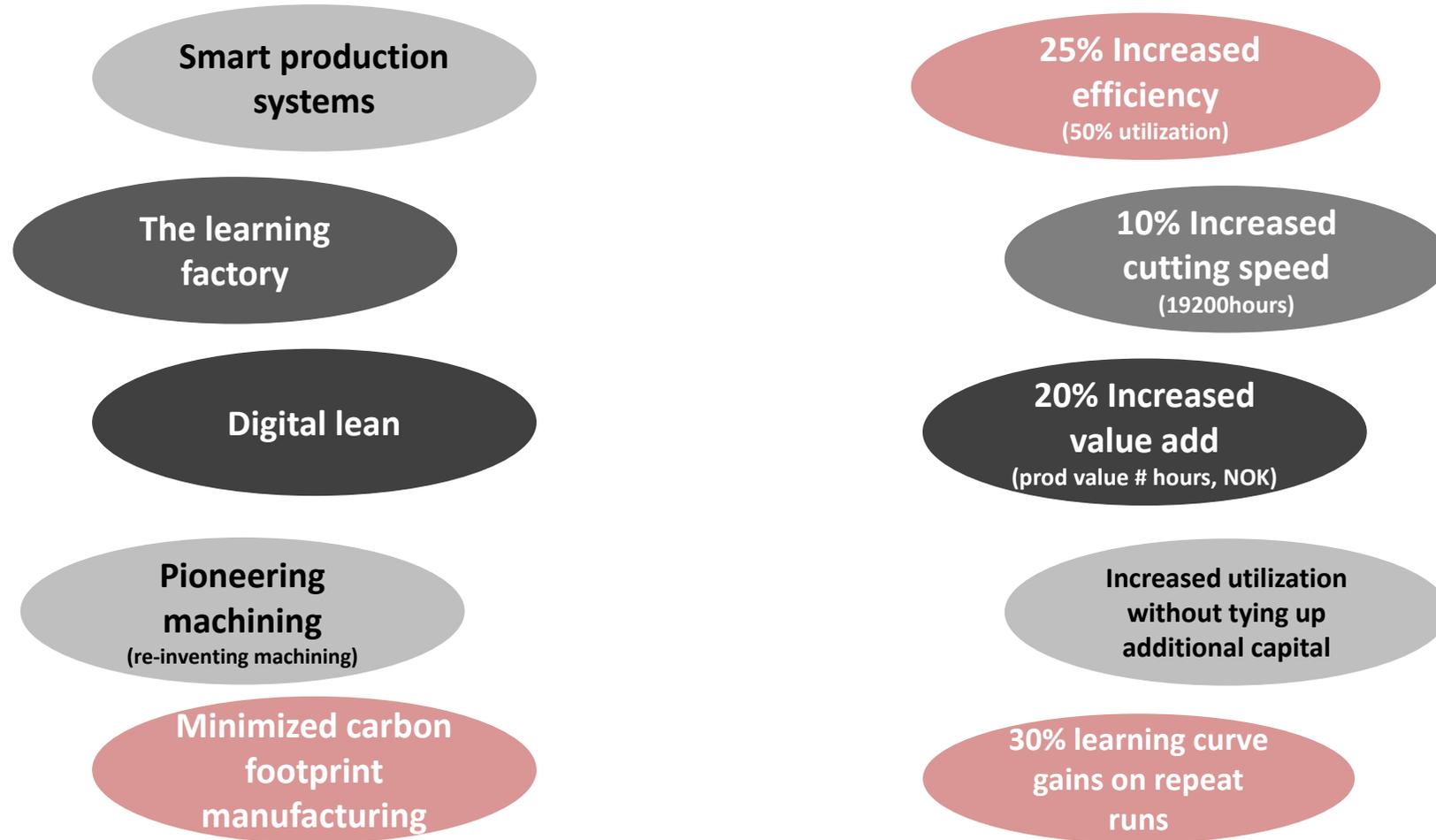


Smartfactory – The Learning factory



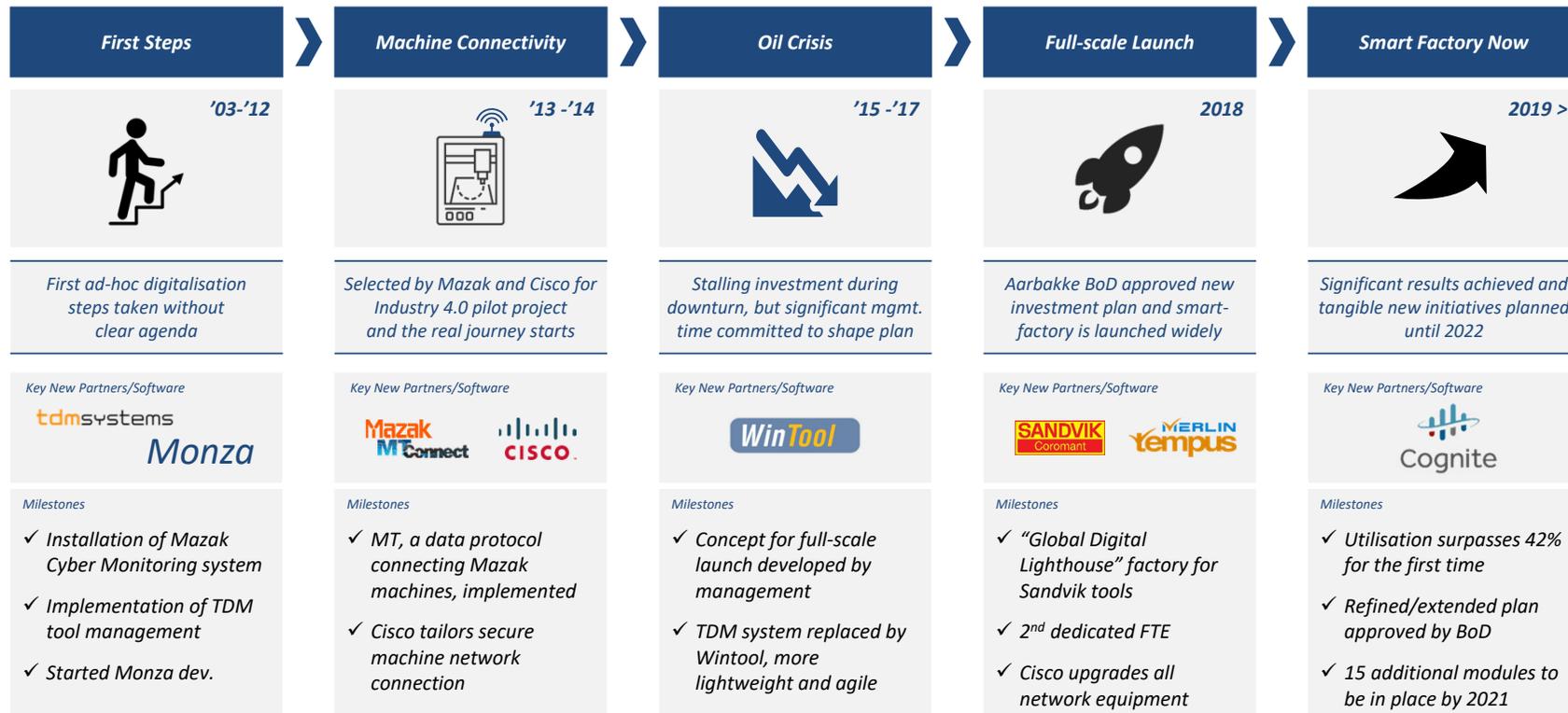
PRIDE in every MOVE

Vision



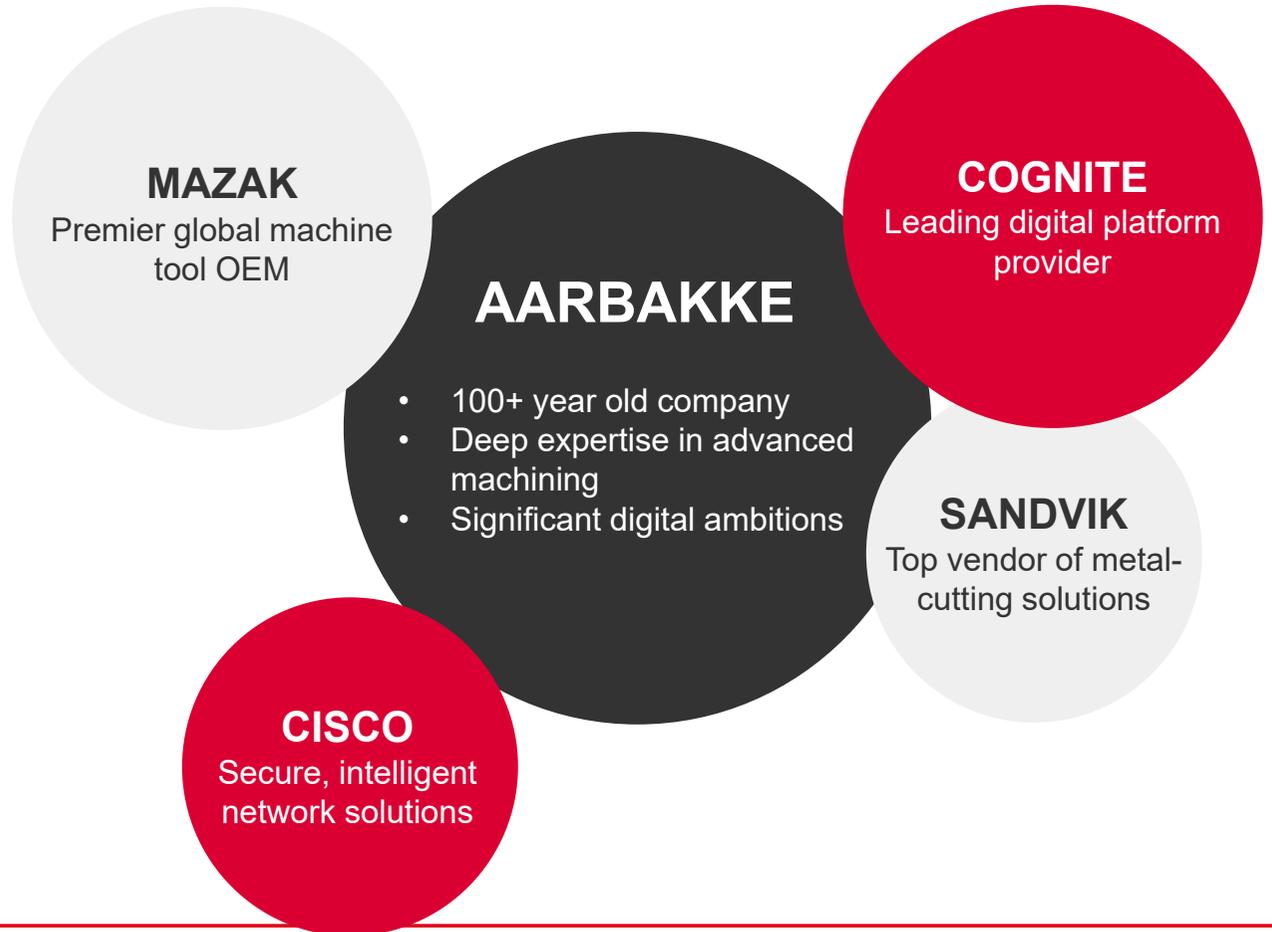
Development of the “Smart Factory” initiative

With roots back to 2003, implementation has accelerated in the last 24 months



We partner to win

- Key strategic partnerships to compliment Aarbakke's deep expertise in machining and operations
- Focuses competence and efforts on core business
- Generates an ecosystem that creates organic benefits through connections between partners and technologies
- Too many digitalization programs end up "Lost in translation" With our model we avoid this



INDUSTRY RECOGNITION OF AARBAKKE SMART FACTORY

Recognized by industry and partners for digital initiatives

NFEA Award 2018



Finalist for "Norges Smarteste Industribedrift" 2019 and 2020

Norwegian Society of Electrical- and Automatic Control awards Aarbakke its 2018 prize



"Aarbakke is in its own class in digitalisation and automation in our industry, proving that new digital tools and a holistic digital approach can allow Norwegian businesses to compete globally"

Partner Recognition

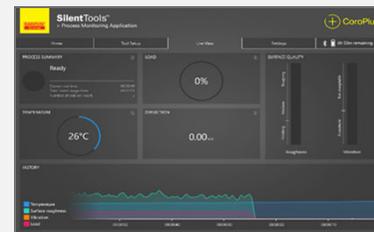
Sole co-development partner to Mazak for Smart Factory solutions



- ✓ Aarbakke is a "showcase" factory for Mazak
- ✓ Contributed to key software



Aarbakke is one of three partners in Sandvik's "Global Digital Lighthouse" project



- ✓ Aarbakke has direct access to Sandvik's R&D department
- ✓ Field testing of Sandvik tools and software

Other Coverage

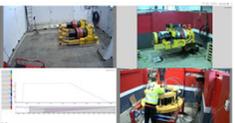


Significant interest in the initiative from press.

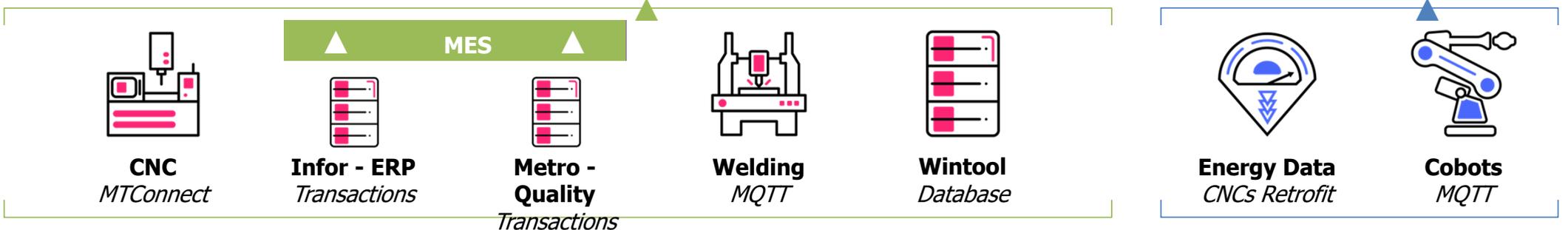


DIGITAL SOLUTIONS

Several Digital Solutions developed that have improved quality and productivity

<p>Machine utilization</p> <p>10-15% increase Machine utilization</p> 	<p>Machine servicing</p> <p>20-30% reduction Service cost</p> 	<p>Tooling optimization</p> <p>60% reduction tool inventory</p> 	<p>Operator application</p> <p>2-5% increase Machine utilization</p> 	<p>Auto welding qualifications</p> <p>80% reduction in 3rd party qualifications</p> 	<p>Quality hotspots</p> <p>10% reduction in quality incidents</p> 	<p>Sustainability</p> <p>Energy monitoring and reporting</p> 	<p>Remote witnessing</p> <p>Remote witness of welding and FAT, Live and on demand</p> 
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COGNITE DATA FUSION



Use case: Digital twin

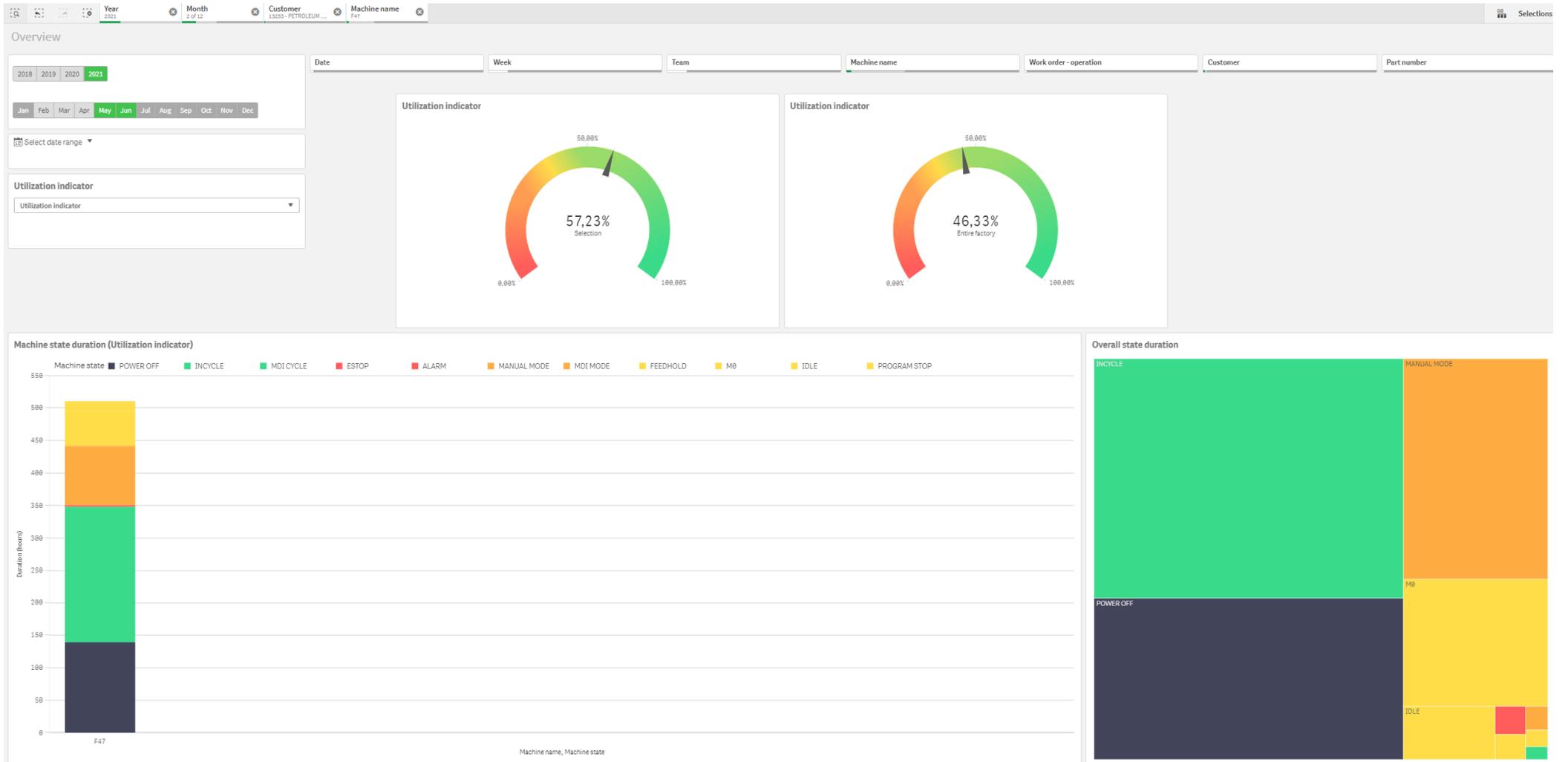
SMART FACTORY LIVE | FIND OBJECTS | LAYERS | TIMELINE

SMART FACTORY | FIND OBJECTS | LAYERS | TIMELINE | PAST | FROM May 3, 2021 | TO May 4, 2021 | 10:55 | 14:35 | 18:15 | 21:55 | 01:35 | 06:15 | 08:55 | May 3, 2021 10:55

F46 : IG500e - Dreistor m/rot. + long bore

ASSET DETAILS	TIMESERIES	EVENTS
AssetUrl		
http://172.30.200.69:5012		
Current Customer		
PETROLEUM TECHNOLOGY COMPANY		
Current Part		
4.5" SPM GUARD SECTION		
Current State		
INCYCLE		
DefaultSchedule		
3SK		
Department		
100		
ResponsibilityArea		
TEAM2		
Shift		
SHIFT 1 (04:00 - 12:00)		
Today's Earnings		
28034.0 NOK		
Today's Utilization		
85.7%		

Use case: Machine monitoring



Use case: Tooling intelligence

Tooling intelligence



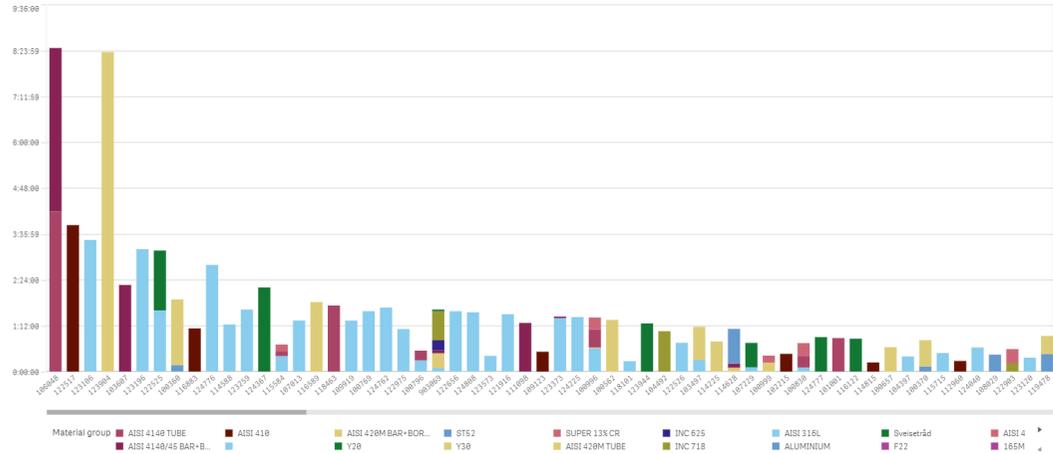
Work order: Machine name: Tool ID: Tool name:

Time filter
Select date range:

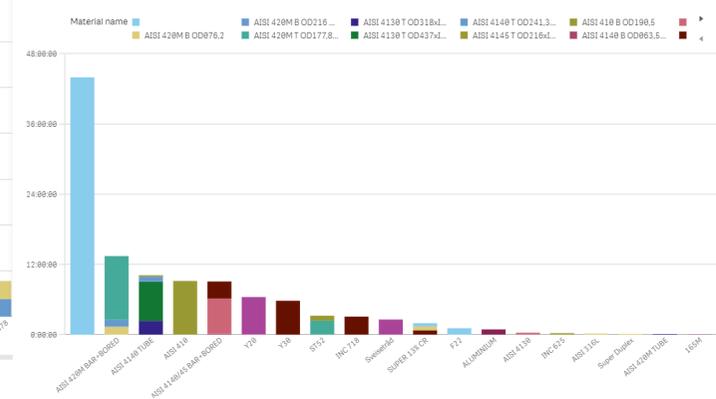
2019 2020 2021 | jan feb mar apr **may** jun jul aug sep okt nov des

Week: Date:

Duration by WinTool Id



Duration by material group



WinTool ID	Q	Tool Description	Q	Part number	Q	Material Description	Q	Material number	Q	Tool Class	Q	Machine	Q	Workorder	Q	Work order - operation	Q	Duration (hh:mm:ss)
122617		Milt Tangslunge 58mm Z5 ISCAR		-		-		-		482		F46		-		-		5:33:18
122617		Milt Tangslunge 58mm Z5 ISCAR		PTCPN28162		AISI 418 B OD198.5		601329		482		F46		632190		632190-30		3:50:32
116812		Insert Mill 316 16mm HiFeed Cool Sandvik		-		-		-		339		FH111		-		-		0:16:35
116589		Chamfermill 6x45° Sandvik		HD997-6000-51		AISI 428M T OD177.8xD76.2		604176		324		D67		638452		638452-30		1:49:39
115584		Insert Mill 316 12mm Chamfer 45° Z2 Sandvik		-		-		-		324		F48		-		-		1:13:25
115584		Insert Mill 316 12mm Chamfer 45° Z2 Sandvik		AS10238985		-		-		324		F69		623910		623910-45		0:19:54
120649		Insert Mill 316 12mm Chamfer 45° Z2 Sandvik		AS10245584		INC 718 B OD139.7 API 6ACRA		602417		324		F121		623924		623924-25		0:12:36
122678		Insert Mill 316 12mm Chamfer 45° Z2 Sandvik		AS10238985		-		-		324		F69		623908		623908-45		0:11:17
120649		Insert Mill 316 12mm Chamfer 45° Z2 Sandvik		WB2866268		SUPER 13XCR B OD228 Y9SKSI		603646		324		F124		629698		629698-30		0:18:16
107100		Insert Mill 316 12mm Chamfer 45° Z2 Sandvik		KOP6009178635		Filter Zeron 100X 2mm T		64798		324		FH111		616574		616574-120		0:00:33
115584		Insert Mill 316 12mm Chamfer 45° Z2 Sandvik		-		-		-		324		F49		-		-		0:07:43
105606		Insert Mill 316 12mm Chamfer 45° Z2 Sandvik		-		-		-		324		FH55		-		-		0:07:25
115584		Insert Mill 316 12mm Chamfer 45° Z2 Sandvik		WB2389141		AISI 4130 T OD318xD200 Y125K		602180		324		F65		629887		629887-30		0:07:18
11846K		Insert Mill 316 12mm Chamfer 45° Z2 Sandvik		WB29851066		AISI 4130 T OD437xD1387		5134		324		F102		678488		678488-70		0:06:45

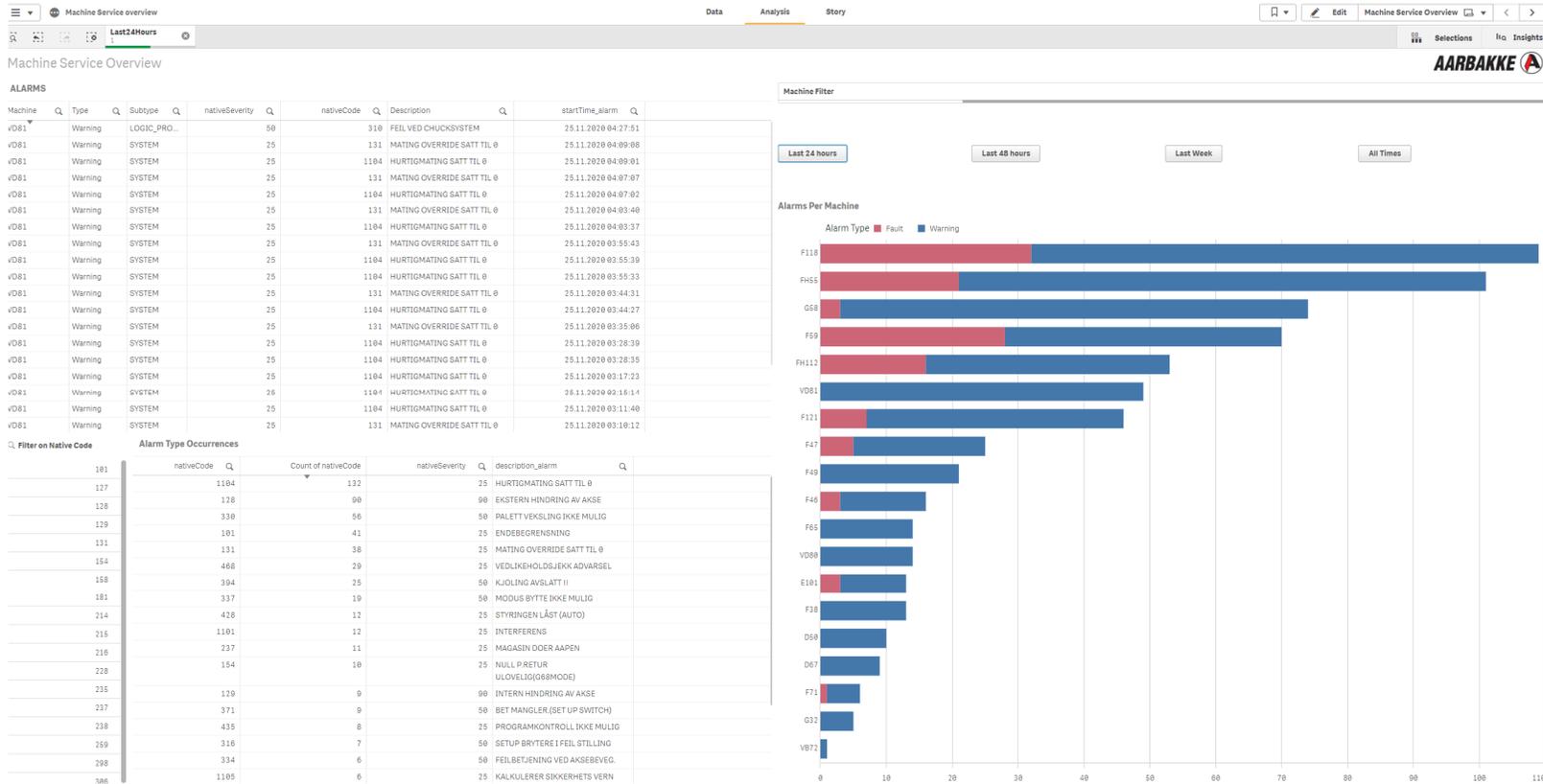


PRIDE in every MOVE

Use case: Operator dash



Use case: Service overview



Use case: Quality zone



Use case: Weld logging and document generator

The dashboard displays several data series: AMPERAGE AND TORCH VOLTAGE (red bar chart), AVERAGE (blue line), GROUND (black line), PULSE (green line), WELD SPEED (green line), and Step (orange line).

Welding Documentation Form:

- Machine: W120
- Select Date: 20/04/2021
- Retrieve Data

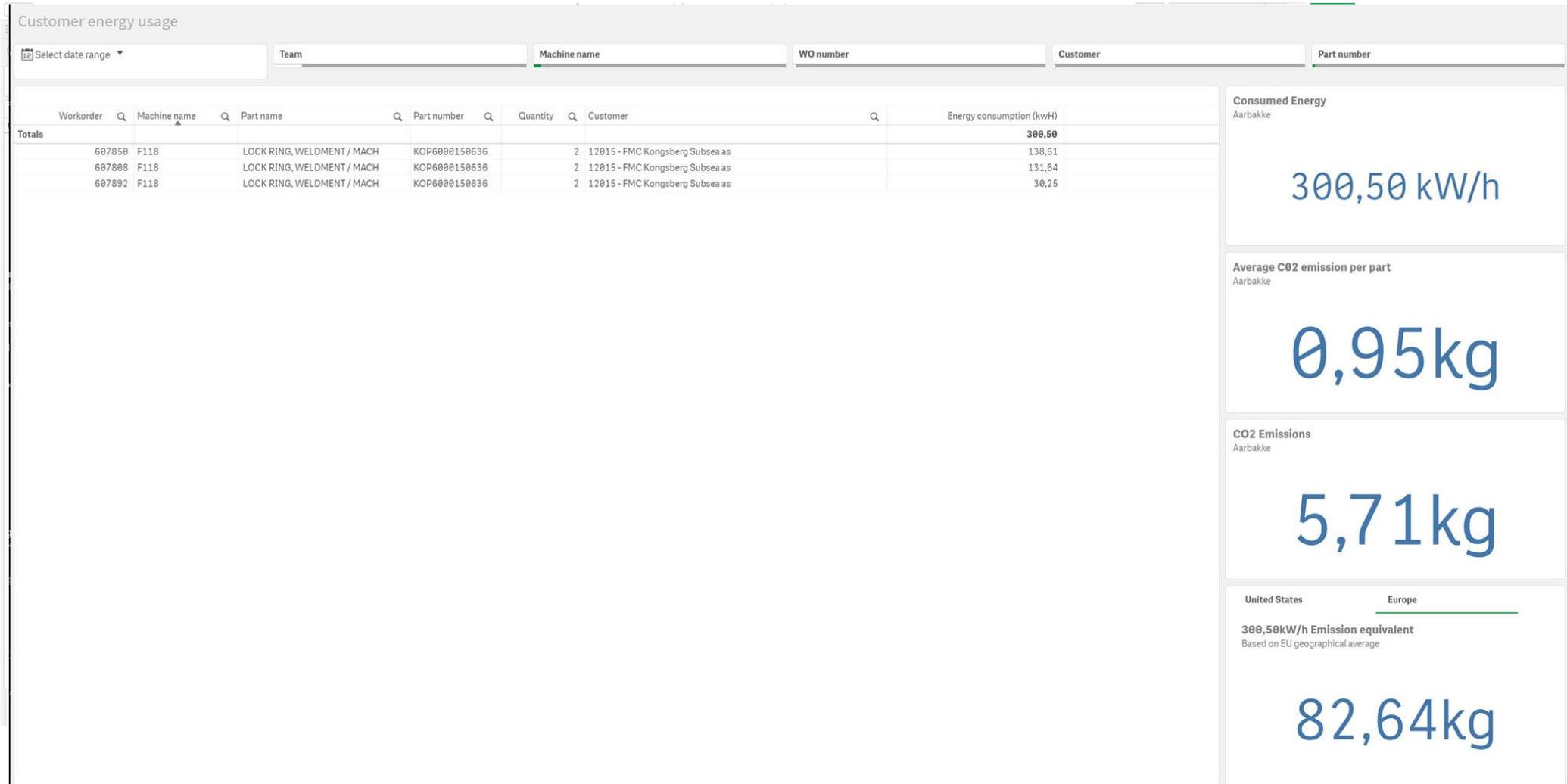
Preview report:

Report can be downloaded at the bottom of the page.

Pass	Index	Welding Method	k	Diam. [mm]	Gas shieldin g	Gas [L/min]	Polarity	Current [A]	Voltage [V]	Weld Time [sec]	Run length [mm]	Travel Speed [mm/min]	Wire Feed [m/min]	Heat input [kJ/mm]	Step [mm]
1	A	141 mech	1	1.14	Argon 4.0	19	DC-	200	12	12	48	249	1.9	0.58	0
2	A	141 mech	1	1.14	Argon 4.0	19	DC-	200	12	11	45	249	2	0.58	0
3	A	141 mech	1	1.14	Argon 4.0	19	DC-	200	12.1	12	48	249	2	0.58	3.1
4	A	141 mech	1	1.14	Argon 4.0	19	DC-	200	10.9	1	4	246	1.9	0.52	3.1

DOWNLOAD

Use case: Emission control and energy monitoring



LEAN example, inspection sheet

Part Number: 630388
Operation: 50
Status: Not Completed

Balloon	Nominal	Machining Dim	Tolerance	Frequency	Coating	Progress
1	344 mm	344.05 mm	+0,805/+0,043	All	50 µm	0/2
2	1,6 µm		0/-1,6	First Article		0/2
3	1"-8 UNC-2B		/	First Article		0/2
4	288 mm		+0,2/-0,2	First Article		0/2
5	274,1 mm	274.15 mm	+0,1/0	First Article	50 µm	0/2
6	273,1 mm	273.15 mm	+0,1/0	First Article	50 µm	0/2

Rows per page: 50 | 1-37 of 37

Sequences: All

Schemas: DU600431096 - A

Links: Existing Links (None), Link Candidates (None)

Tools: COPY TOOLS

Comment: Schema comment

Remote witness: FAT, pressure testing and welding



Summary

- LEAN and GREEN is our goal
- Always improve
- Keep cost under control
- Reduce waste and emission

- How:
- Establish culture for change
- Embed LEAN into processes
- Involve and listen

AARBAKKE
SMART FACTORY
AS A SERVICE

IGNOS

Powered by Cognite

End