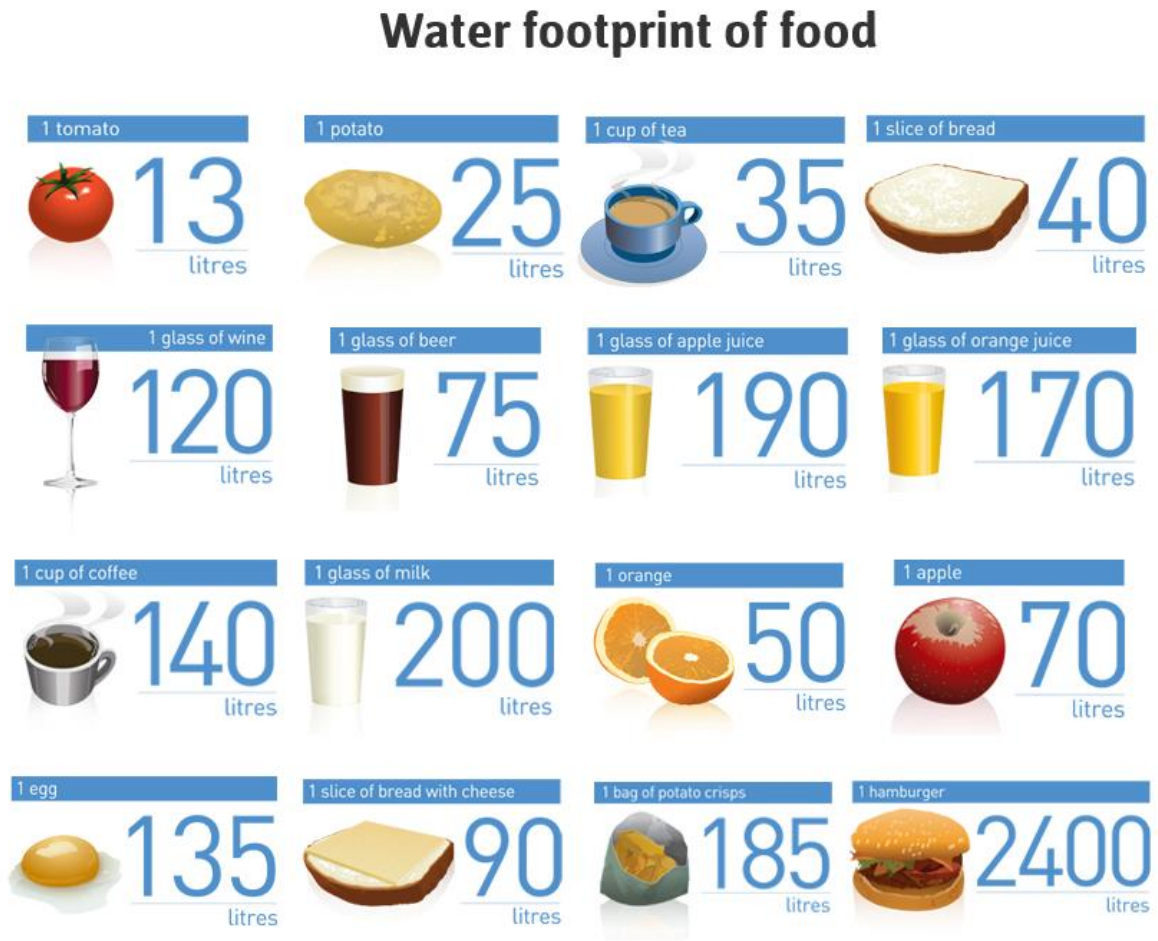
Prosessien optimointi

19.09.2019

Heli Karaila

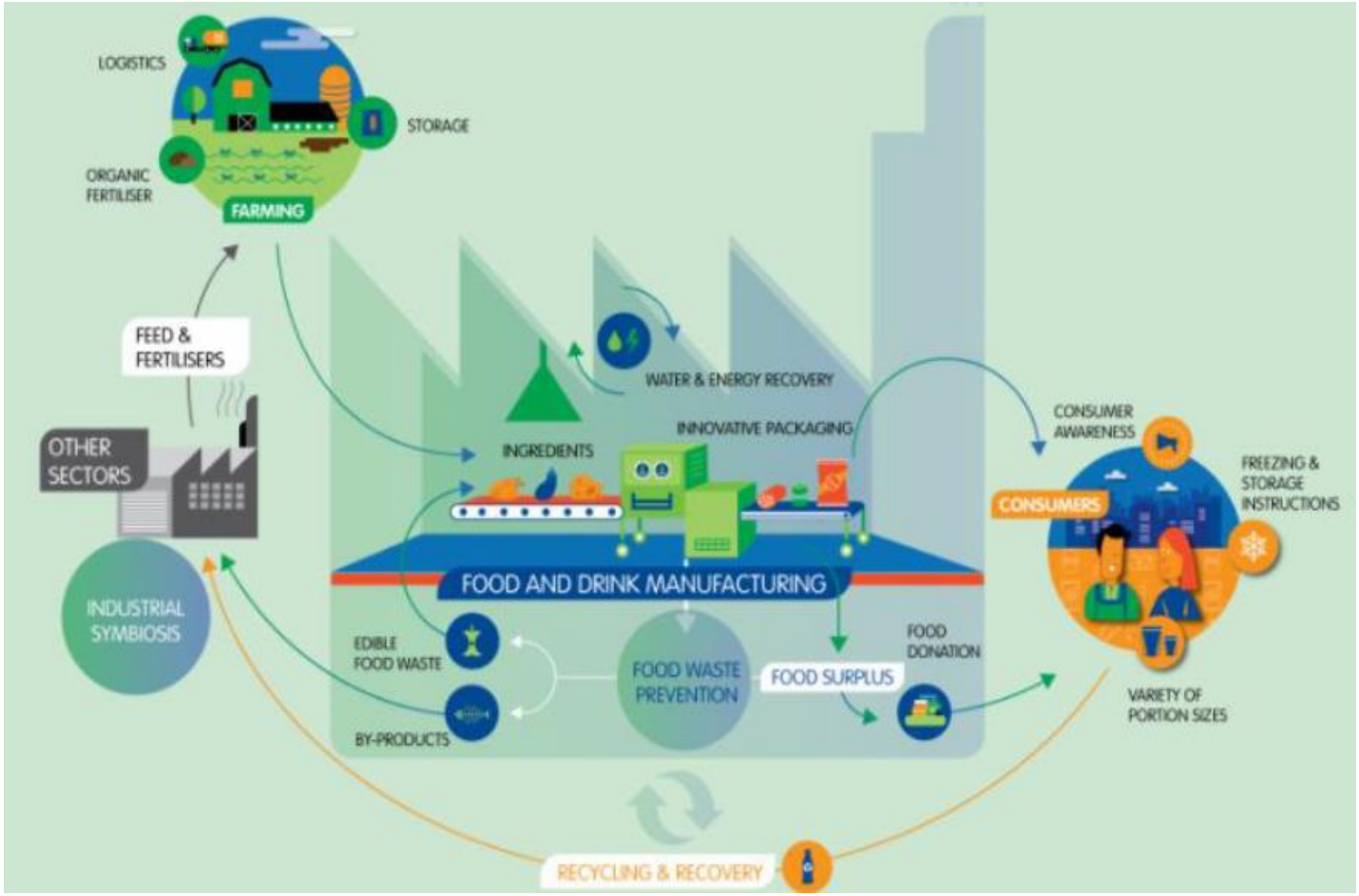
Business manager

Water Footprint



Average water footprint for a number of common food items. Credits: FAO 2012, elaborazione FAO WATER

Recycling / food and drink manufacturing



https://www.etl.fi/media/aineistot/ymparistovastuun-katsaukset/elintarviketeollisuusliiton-ymparistovastuun-katsaus-2016.pdf

Elintarviketeollisuuden tuotantoon suhteutetut ympäristövastuun tunnusluvut.

Tuotantoon suhteutetut tunnusluvut **2012 - 2016**

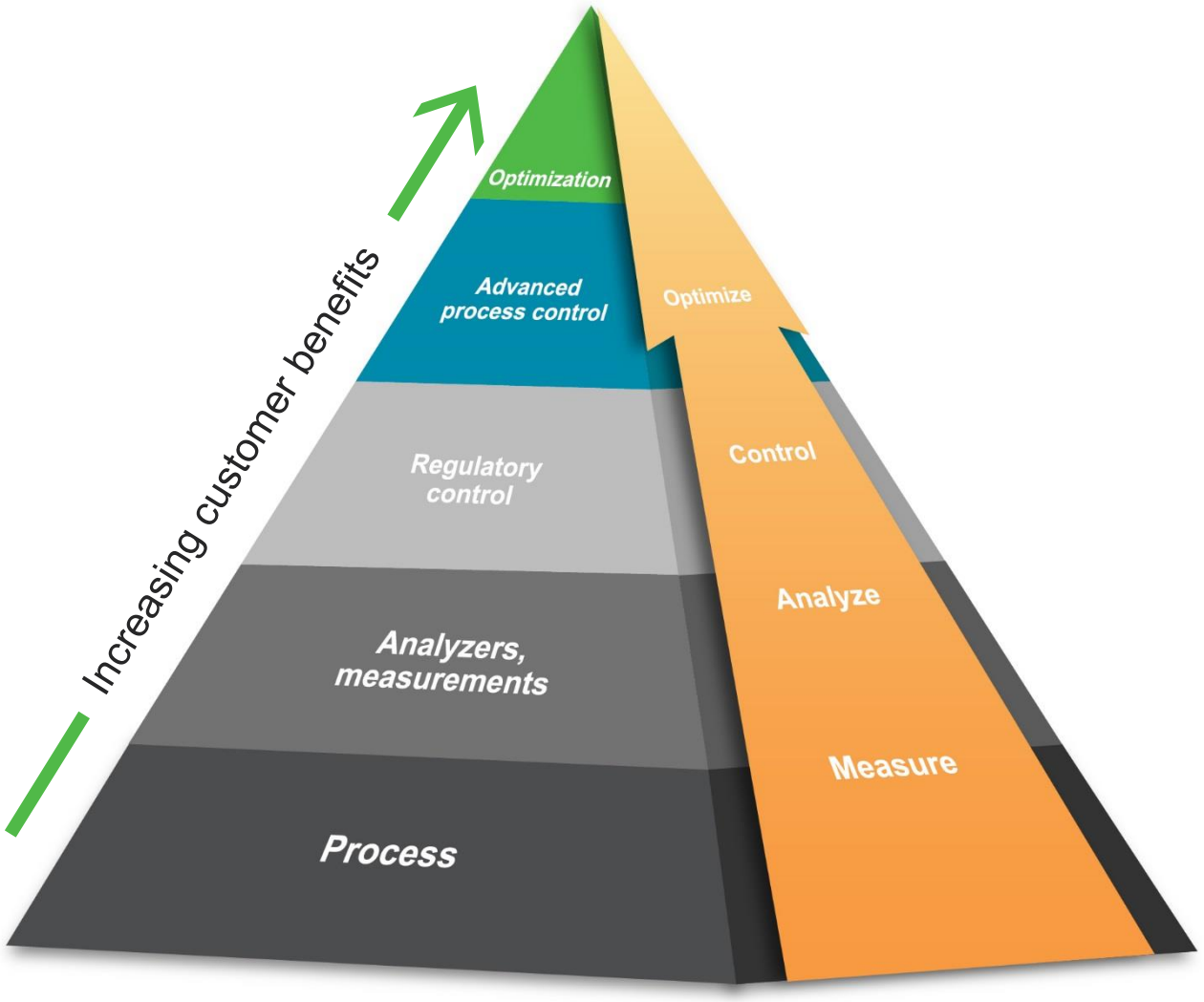
ℹ Kuutiometreinä raportoidut tuotannon määrät on tulkittu tonneina

SELITE	VUOSI 2012	VUOSI 2013	VUOSI 2014	VUOSI 2015	VUOSI 2016
Sähkönkulutus (MWh/tuotetonni)	0,19	0,21	0,21	0,42	0,19
Lämmönkulutus (MWh/tuotetonni)	0,28	0,36	0,30	0,32	0,29
Kokonaisvedenkulutus (m³/tuotetonni)	3,16	3,41	3,26	3,30	3,16
Jäteveden määrä (m³/tuotetonni)	2,42	2,78	2,82	2,93	2,35
Kaatopaikkajätteen määrä (kg/tuotetonni)	2,48	2,31	1,67	1,13	0,66
Biojäte (kg/tuotetonni)	10,67	6,22	14,00	14,14	1,31
Vastauksia	23	22	21	23	19

https://www.etl.fi/media/aineistot/ymparistovastuun-katsaukset/elintarviketeollisuusliiton-ymparistovastuun-katsaus-2016.pdf

Valmet

Reliable measurements -> Control, Optimization –> performance increase and savings

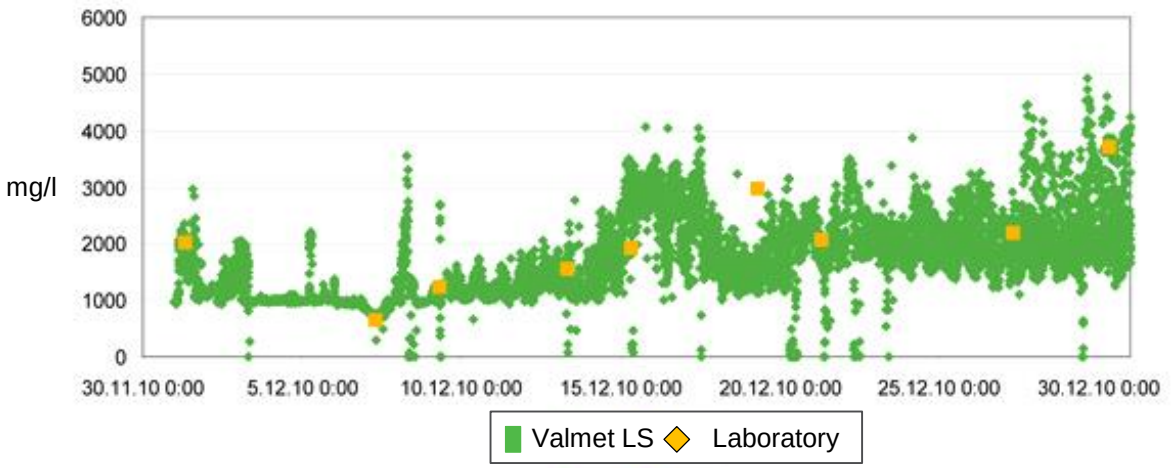


Prosessi tietämys - Vedenkäyttökohteet

Valio case

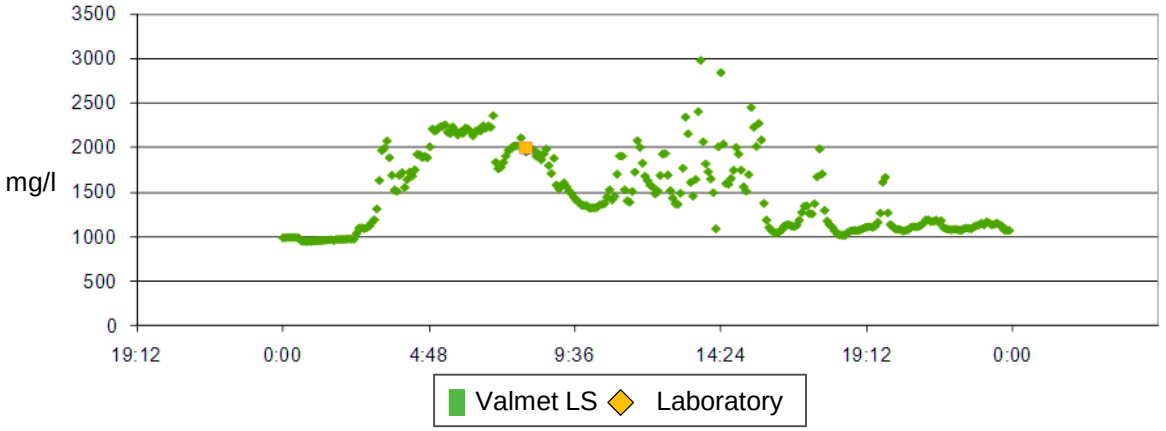
- Meijereillä on kaksi runsaasti vettä kuluttavaa käyttökohdetta: **jäähdytys ja pesut**. Jäähdytykseen käytetään tietyillä laitoksilla pintavettä, joka palautetaan lämmönsiirtimen jälkeen takaisin vesistöön. Maito on herkästi pilaantuva raaka-aine, ja siksi tuotteiden laadun kannalta olennaista tuotantohygieniaa ylläpidetään pesuilla. **Veden kulutusta pyritään vähentämään suosimalla panospesujen sijaan vettä ja kemikaaleja säästäviä kiertopesuja, optimoimalla prosessilaitteistojen kiertopesuja ja kierrättämällä käyttökelpoista vettä**.

Laboratory measurement is not enough



Quality control of centrate water based on infrequently taken lab samples is not adequate

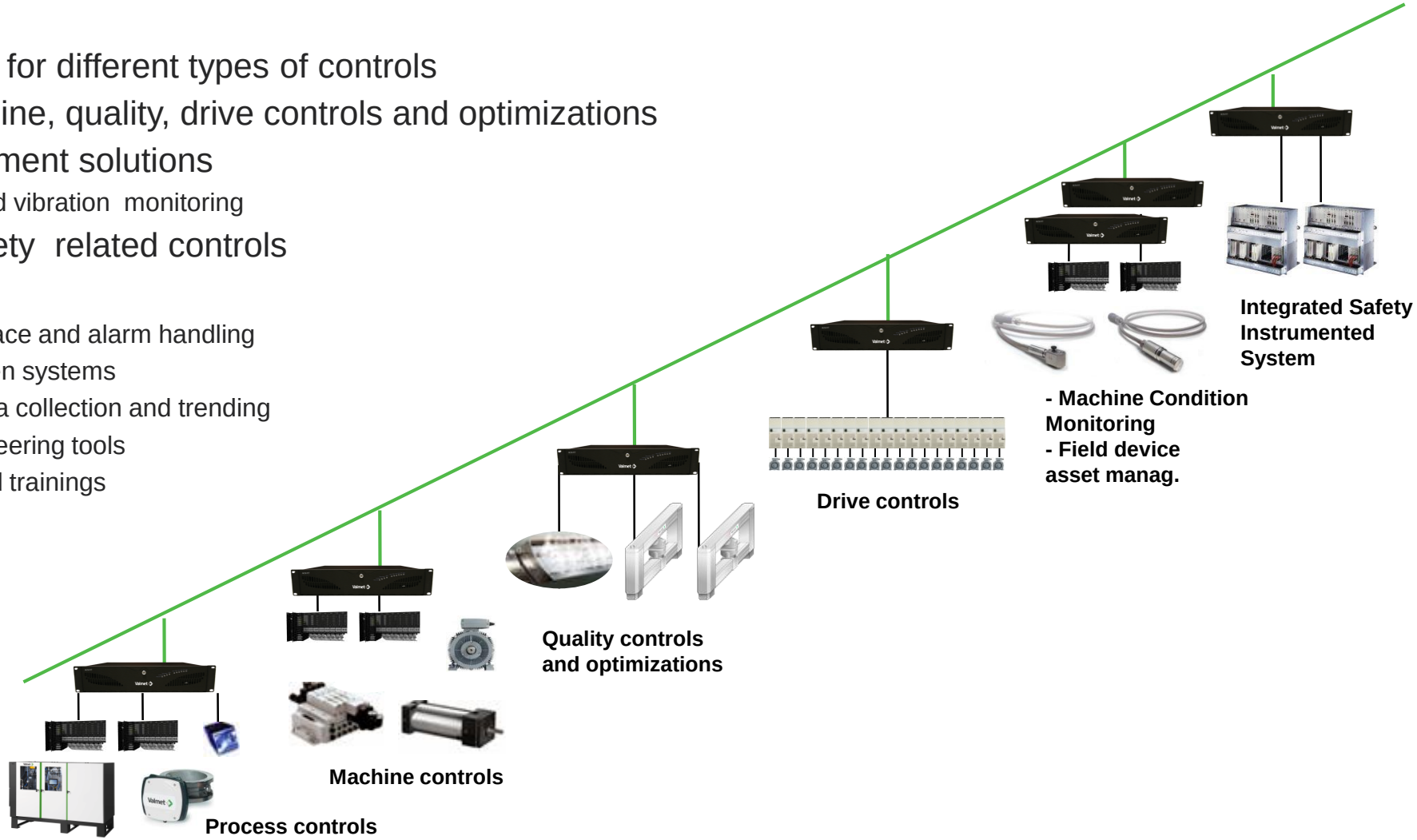
Lab sample represents centrate quality at that specific moment:
- After a half an hour the situation can be completely different!



Level of automation

Valmet DNA - One Platform for All Needs

- Same platform for different types of controls
- Process, machine, quality, drive controls and optimizations
- Asset management solutions
  - Field device and vibration monitoring
- Integrated Safety related controls
- Benefits
  - One user interface and alarm handling
  - No links between systems
  - One history data collection and trending
  - Common engineering tools
  - Spare parts and trainings



Valmet Industrial Internet

Dialogue with data

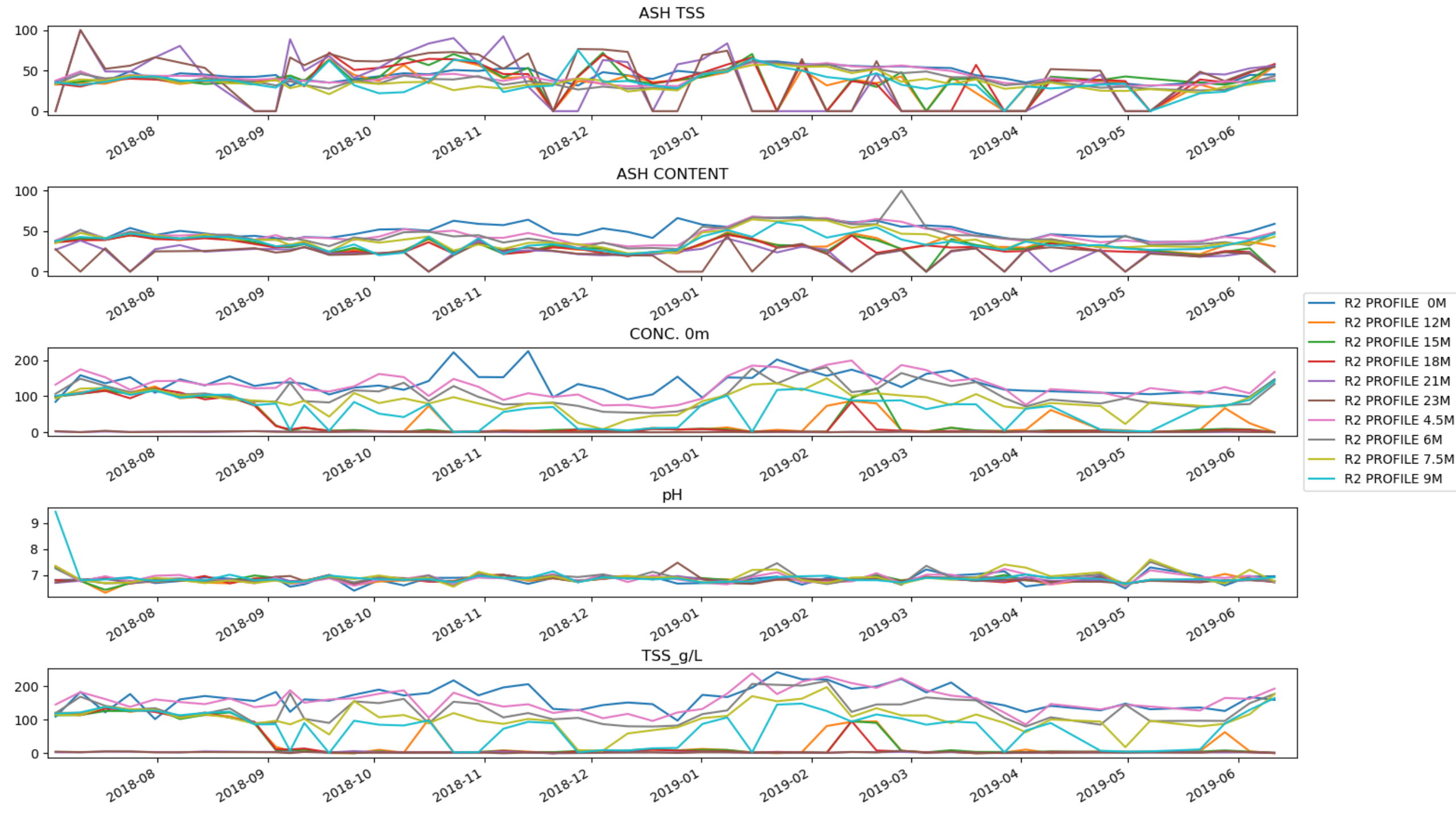
Example Effluent treament plant Data Discovery

Solving the process problems with dataming / analysis

Data analysis

Steps

- collecting the data from different sources available
- verifying the applicability of the data
- going through the process and known correlations
- problem definition in terms of the data


ASH TSS
ASH CONTENT
CONC. 0m
pH
TSS_g/L
2018-08
2018-09
2018-10
2018-11
2018-12
2019-01
2019-02
2019-03
2019-04
2019-05
2019-06
R2 PROFILE 0M
R2 PROFILE 12M
R2 PROFILE 15M
R2 PROFILE 18M
R2 PROFILE 21M
R2 PROFILE 23M
R2 PROFILE 4.5M
R2 PROFILE 6M
R2 PROFILE 7.5M
R2 PROFILE 9M

Models - Proposal

- Utilize the online quality predictor model structure for the ETP data
  - Tag importance discovery (Extremely Randomized Trees classifier)
  - Train a prediction model with selected important tags
  - Analyze the results and find
    - Tags **indicating** the reaction performance
    - Tags **affecting** the reaction performance
  - Create a residual model for
    - performance indication and
    - advisory system

Hand Valve monitoring

Valmet Hand Valve Monitoring

Ensure that hand valves are correctly set in different phases of production

Service description

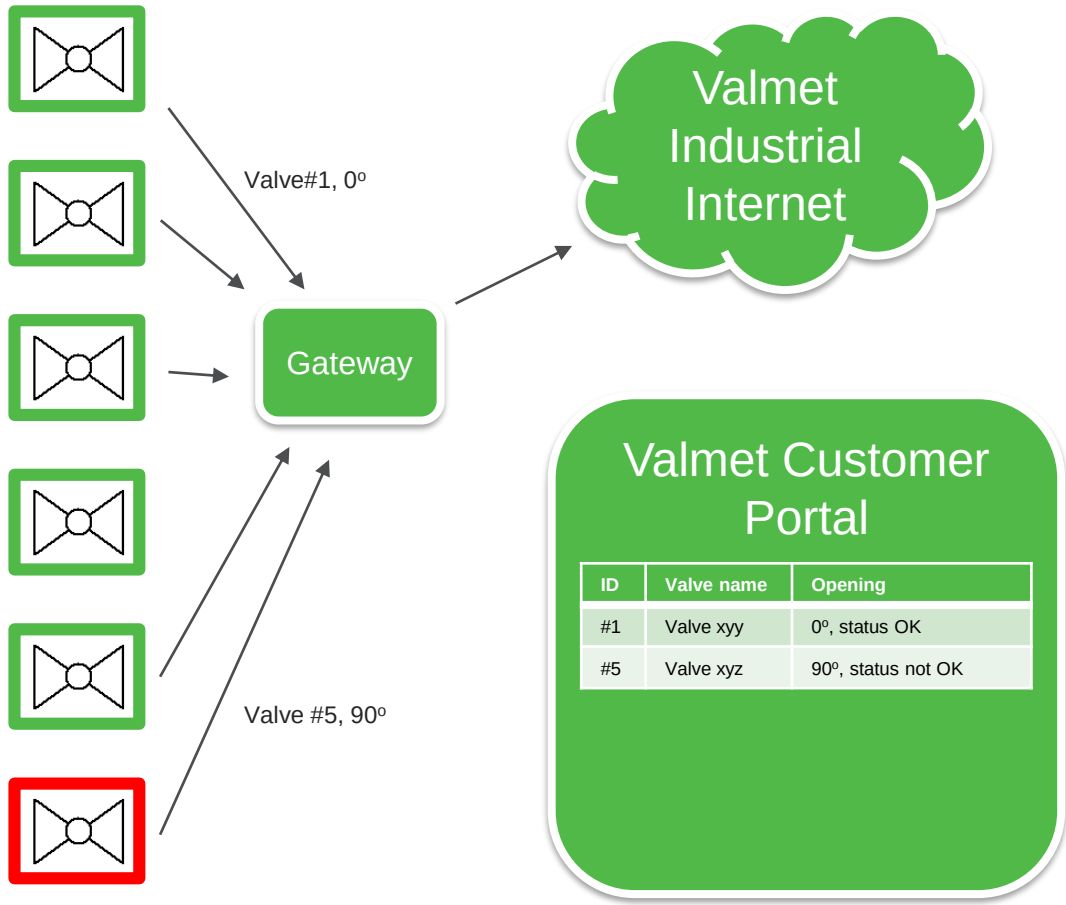
- Hand valves are equipped with smart sensors measuring valve opening angle
- Sensors are connected wirelessly into gateway, which is connected to VII platform via mobile network
- Visualization, connecting the ID’s to valve names and other functionalities (e.g. alarms, etc.) are shown in the operations panel area in Valmet Customer Portal
- Can be accessed also by mobile devices

Benefits

- Quick overview on the status of important hand valves helps in preenting human errors

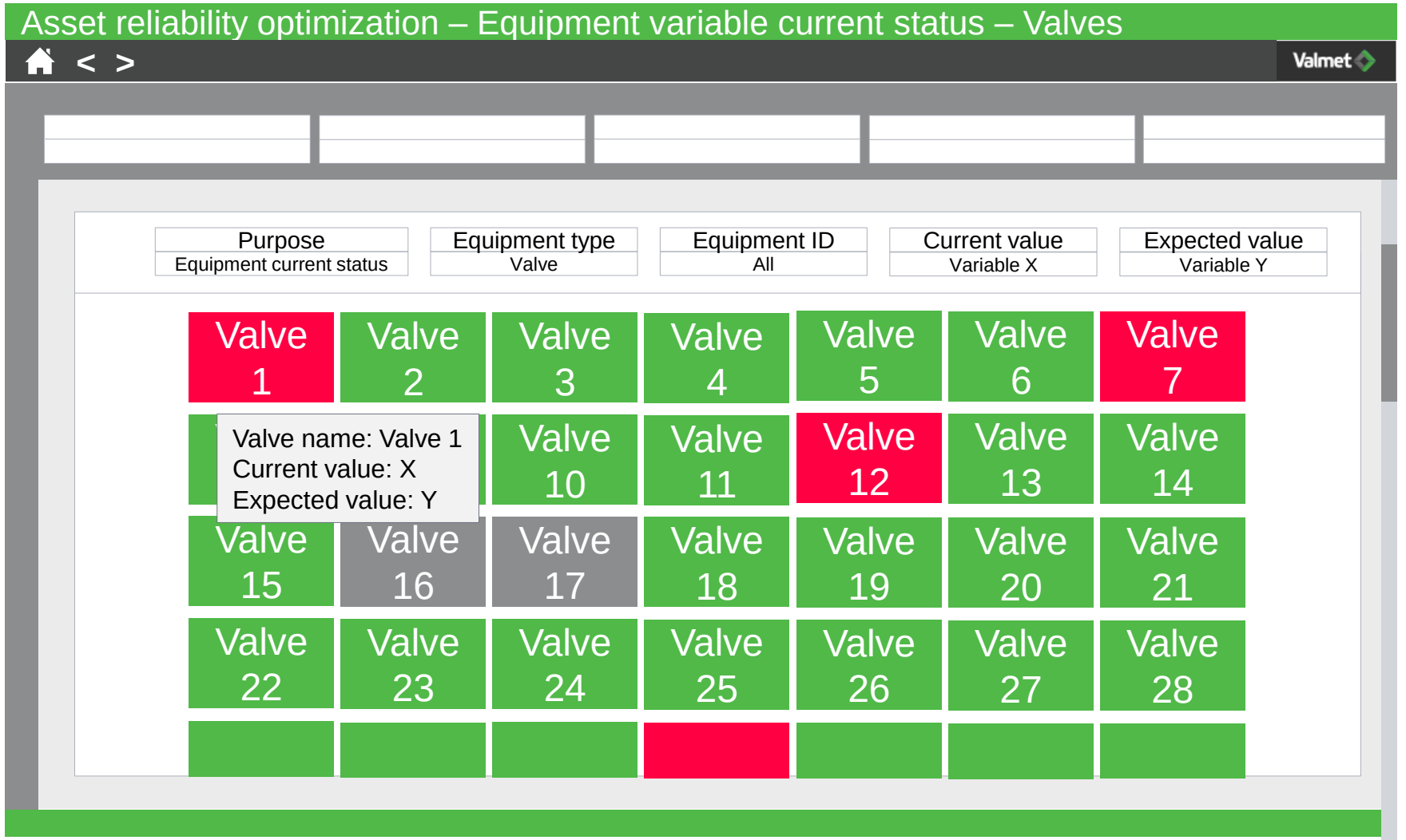
Hand valve monitoring

- Hand valves are equipped with smart sensors measuring valve opening angle
- Sensors are connected wirelessly into gateway, which is connected to VII platform via mobile network
- Data sent over network is anonymous, i.e. only artificial ID, temperature and angle
  - Data is sent when there is a change in angle and every 15 minutes
- Visualization, connecting the ID's to valve names and other functionalities (e.g. alarms, etc.) are shown in the operations panel area in Valmet Customer Portal



KPI general view, small tabs / buttons – All valves

- Larger amount of valves visible simultaneously
- Further information available in a tooltip
- Grey color indicates insufficient data flow or other problems with data



Valmet

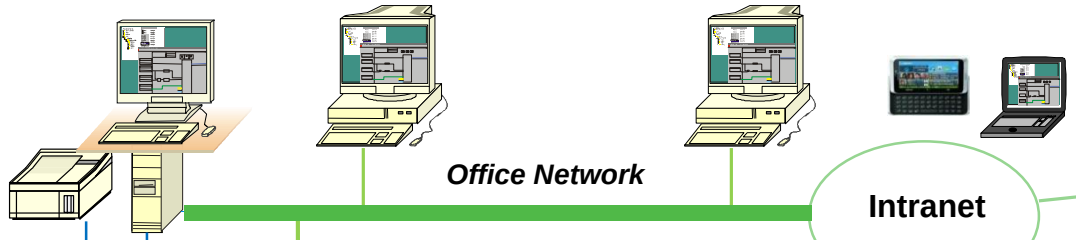
Reporting , follow up

Environmental applications are working on the top of Valmet DNA information system

Control Room Operator
- On-line monitoring of emissions
- Condition monitoring of AMS
- Alarms
- Emission forecasts
- System monitoring (data collection and calculation)

Office
- Web display and reports for analyzing emissions
- Authority reporting and declarations
- Updating and managing of parameters (limits, coefficients)

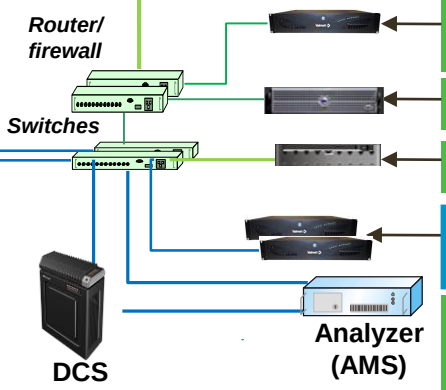
Maintenance
- Maintenance of user interface, reports and calculations



Remote Users
- Access to portal and web reports
- Access to DNA Eco Diary
- (SMS message from emission limit violations)

DNA Info server
- DNA Historian & DNA Calc calculation tool
- DNA Emission Monitoring

Valmet Remote Service
- Support & Maintenance
- Reporting and analyzing service



Portal & DNA Operate Server

DNA Info Server

Back-up disk

CIM-IO server for data buffering (redundant if needed)

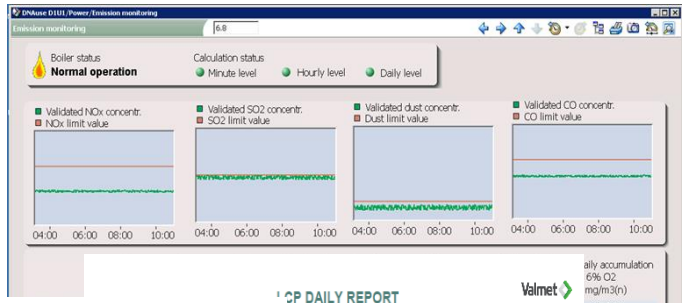
AMS connections to reporting
- **Via DCS**
- **Direct connection to DNA Info**

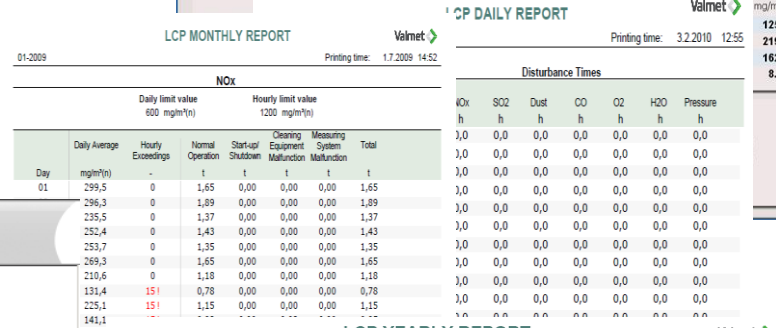
Options:
- **DNA Eco Diary)**

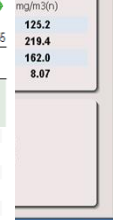
Displays, Reports + Eco Diary

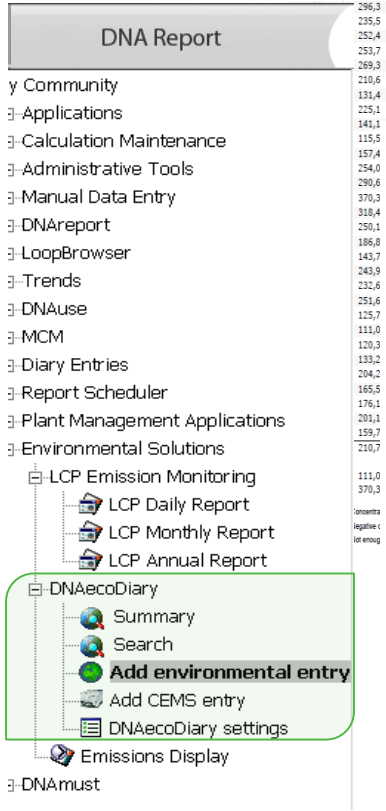
Daily, Monthly, Annual

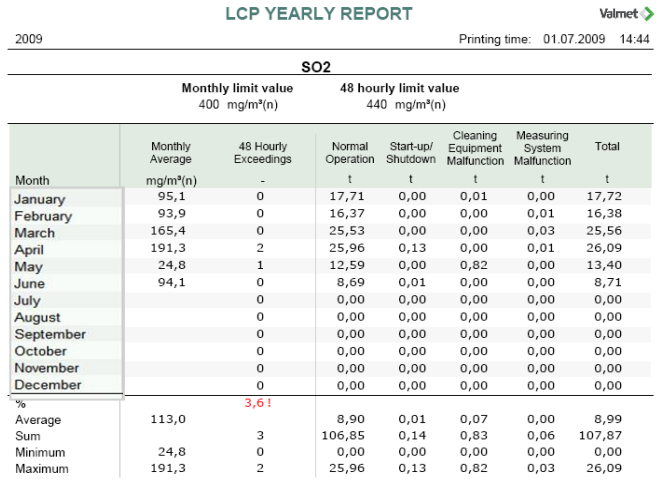
- Diplays, Automatic reports available with trends
  - Daily, monthly , annual reports
- Eco Diary
  - Enhance management of environmental information and knowledge











Remote measurement monitoring and reporting

Wastewater plant measurements fleet management

- Service description
  - Remote around the clock monitoring of measurements fleet
  - Includes predictive maintenance, raporting, diagnostics, remote conditioning and maintenance.
  - Necessary alarm notifications and reports to operator and management
- Benefits
  - Continuous plant process optimization
  - Best process efficiency with timely scheduled conditon-based maintenance
  - Accurate resource allocation
  - Accurate and reliable measurement data at all times

Case:
Tampere Viinikanlahti

Target: Optimization of the whole sludge process

“Optimizaton is possible only with reliable online measurements”

Process optimization

Tampere Viinikanlahti, Finland

Wastewater plant treats municipal and industrial wastewater, about 70 000 m^3/day.

The challenge:

- Get solids rate in centrate water reduced
- Running the process manually in optimal way is difficult
- Laboratory analysis done twice a week to follow up the plant performance
- Pumping from the clarifiers was adjusted on the basis of visual detection
  - Adjustment was carried out by changing pumping sequence length
- Sludge drying process in centrifuges was based on continuous visual inspections
  - Dry cake and centrate water appearance was evaluated and polymer feed was adjusted accordingly

The solution:

- Online measurements
- Also good opportunity to test technology for the new wastewater plant (to be started up 2024)

The solution:

- Online measurements with control applications

Background for project

- For optimizing the whole sludge process we can get remarkable savings and also reduce polymer dosage in the dewatering
- An important issue was also to get solids rate in centrate water reduced
- Running the process manually in optimal way is difficult

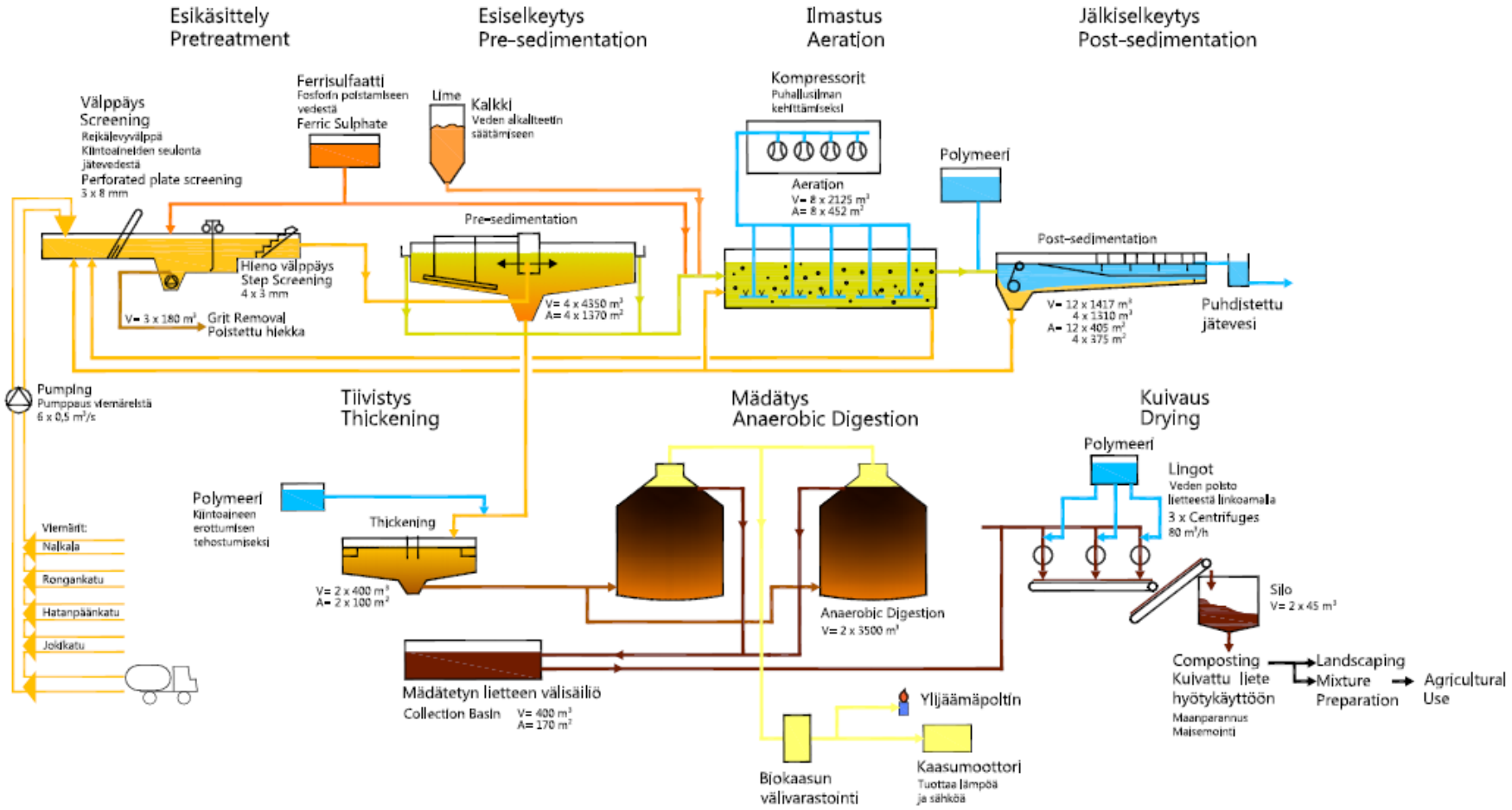
- Originally sludge amount was not measured out of total flow
- Pumping from the clarifiers was adjusted on the basis of visual detection
- Adjustment was carried out by changing pumping sequence length
- Sludge drying process in centrifuges was based on continuous visual inspections
  - → Dry cake and centrate water appearance was evaluated and polymer feed was adjusted accordingly

- Laboratory analysis is done twice a week to follow up the plant performance

- Measurement devices were acquired in order to have exact data from the process
- Incentives were polymer feed optimization, decreasing energy consumption and savings in dry cake transportation costs
- The project is also a perfect opportunity to test new technology for the coming new Sulkavuori underground treatment plant which is estimated to start in 2023
- Our target was to optimize whole sludge treatment process instead of optimizing only centrifuge operation

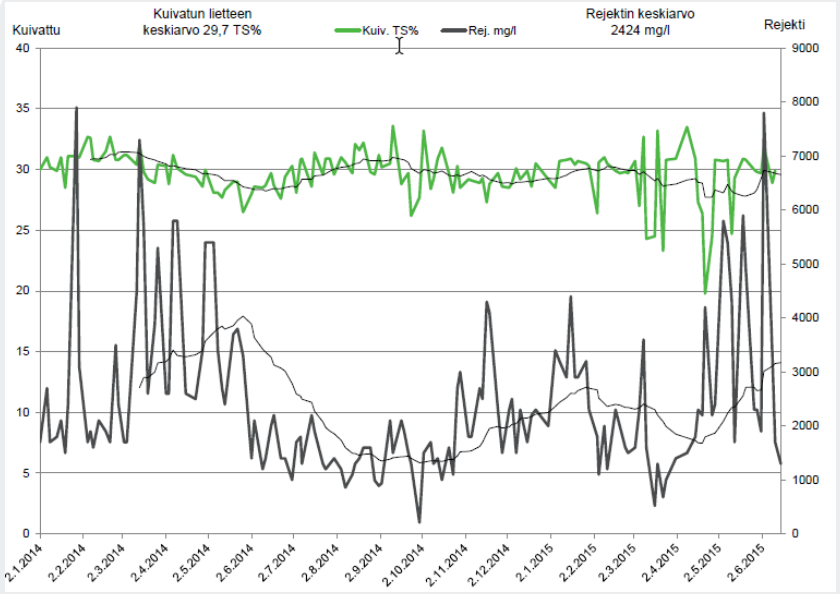
Viinikanlahti wastewater treatment plant

Cleaning process



Savings in sludge dewatering

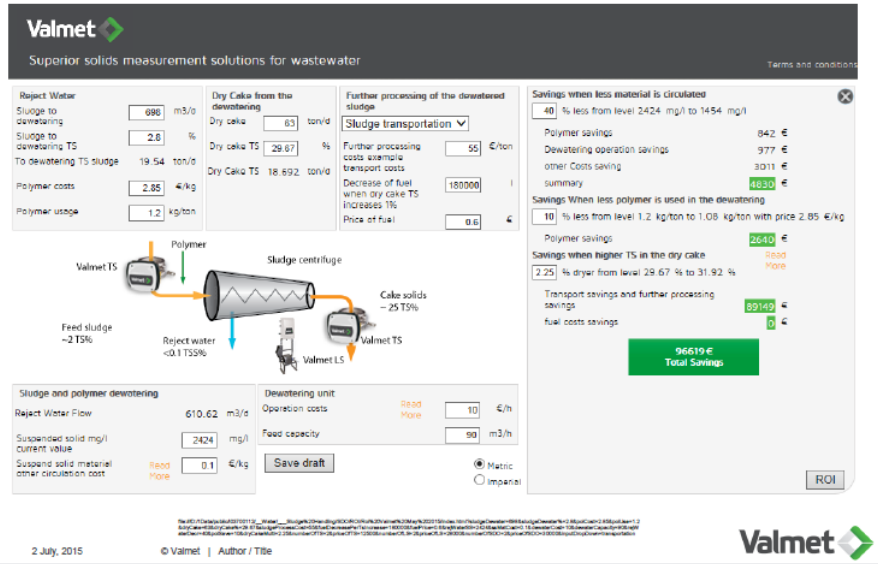
Compared to laboratory measurements



Less water to sludge process,
Digester energy savings, gas production optimization,
Less laboratory samples

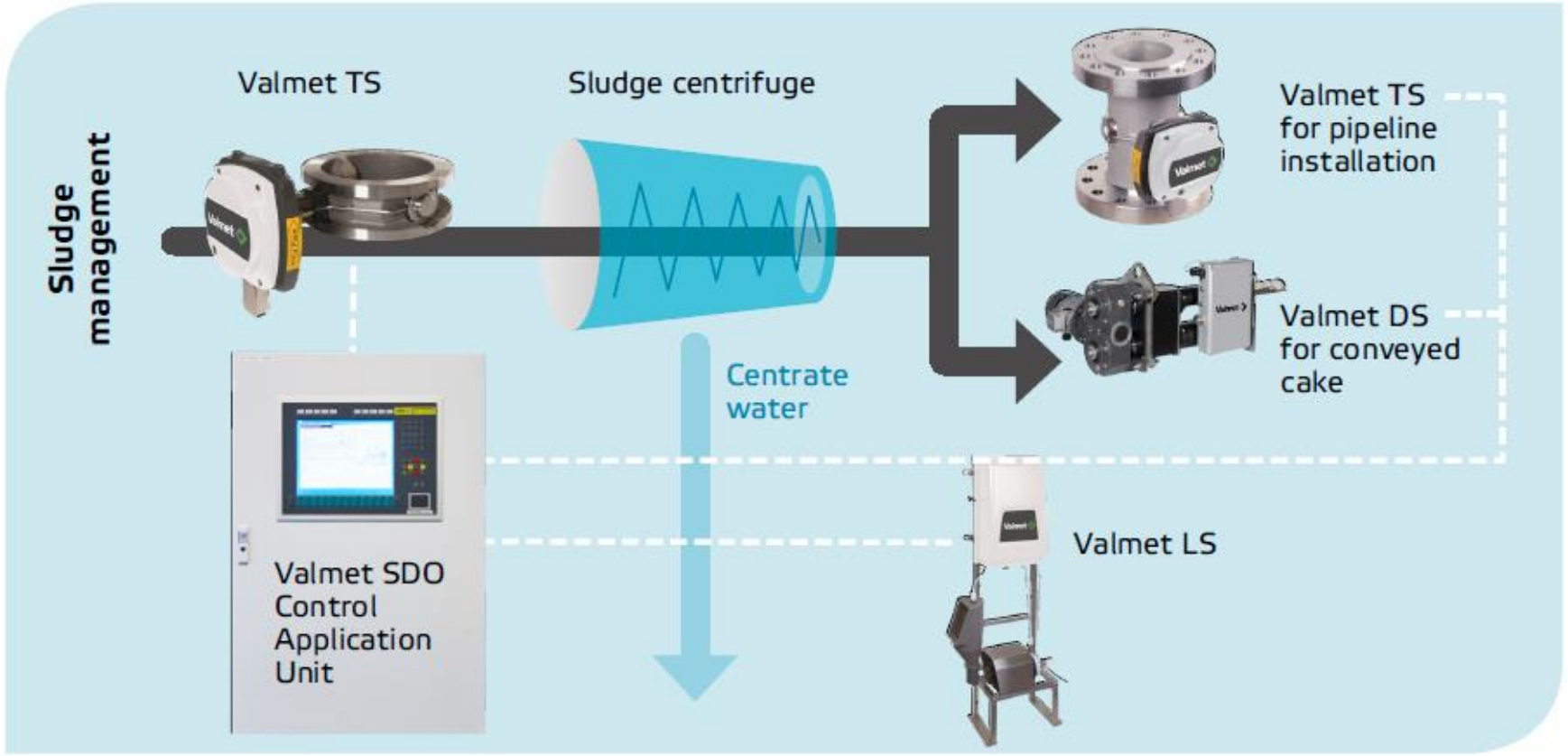
Vuosittainen kustannussäästöpotentiaali

Esimerkki A

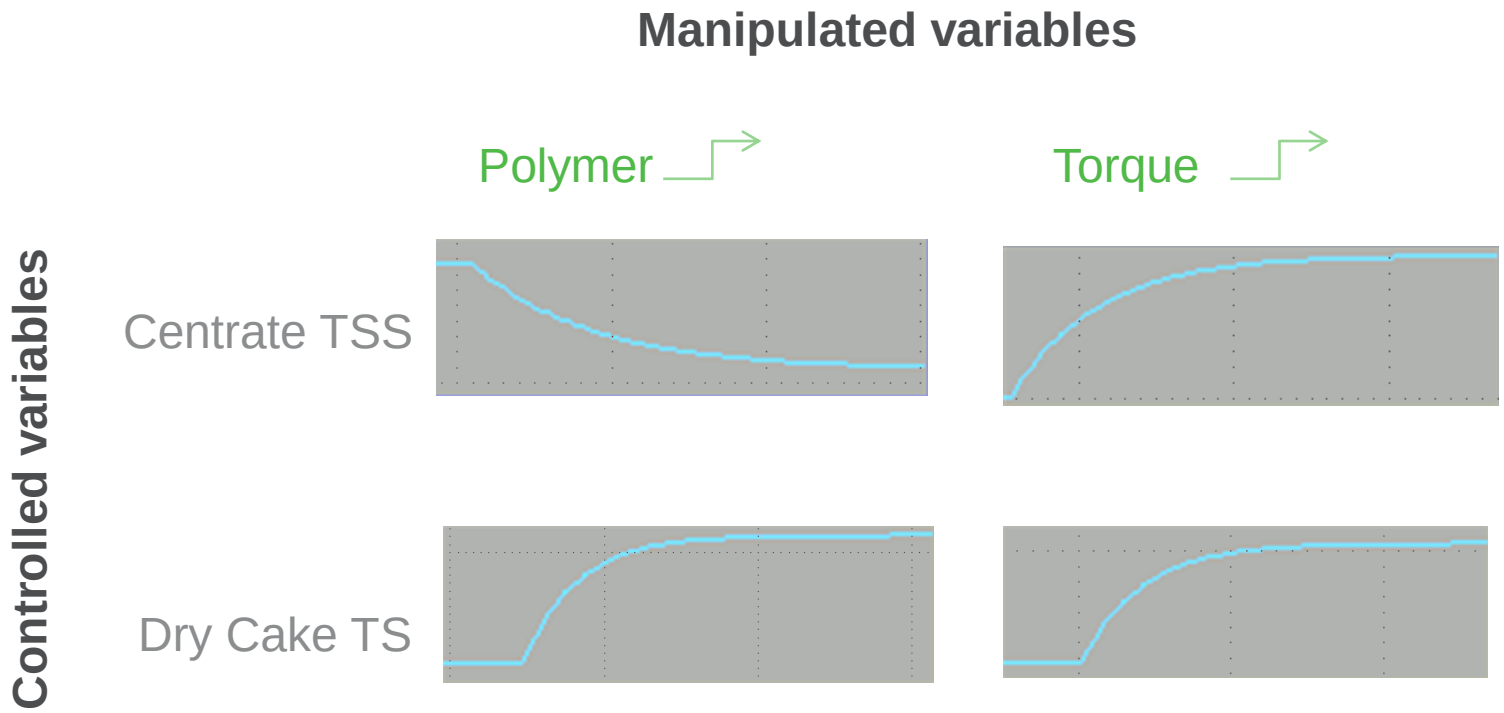


Valmet SDO Control Application unit

Dewatering concept, unique offering



Centrate TSS Dry Cake TS interactions

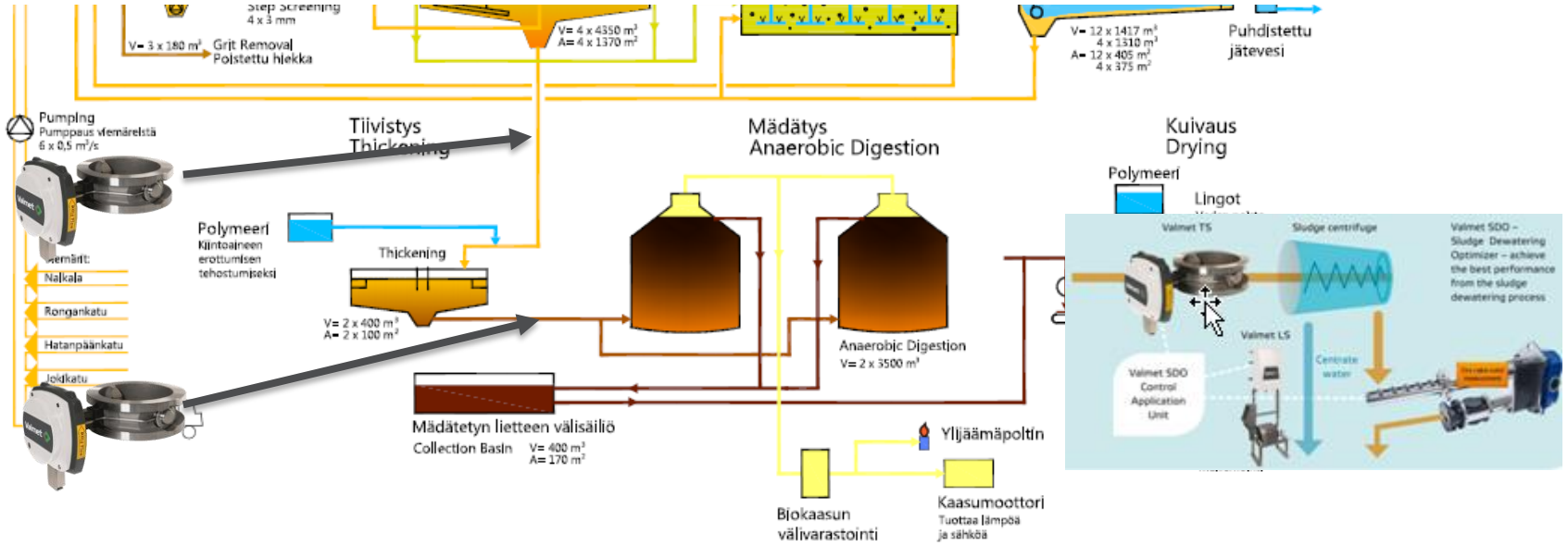


Difficult to control with separate loops , easy with Valmet SDO MPC technology

Tampere wastewater Viinikanlahti case

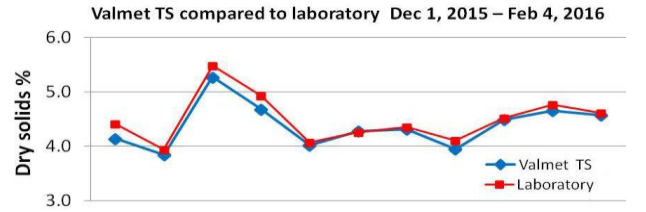
3 pcs Valmet TS glass lined DN 80 sensors (glass lined)
1 pcs Valmet LS
1 pcs Valmet DS
For one centrifuge Valmet stand-alone SDO application

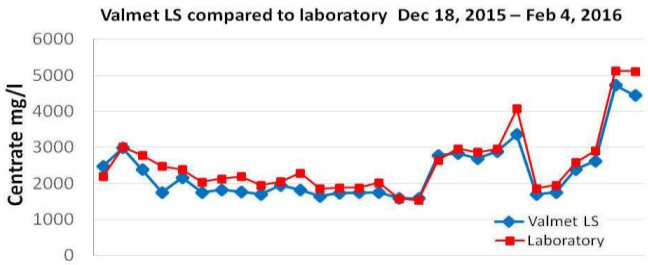
The project was started up September 2015
The acceptance by end customer January 2016

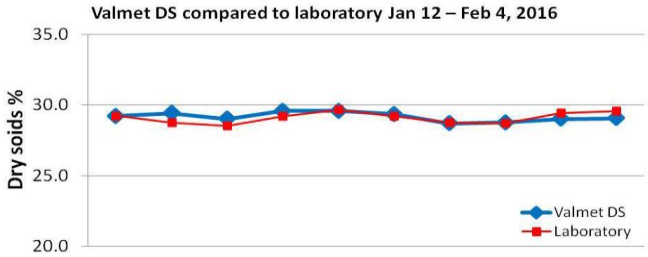


Story of Tampere Water, Finland, with Valmet SDO

Measurements verification







The values are even better now

Results August 2016

- Plant size: 230 000 PE
- Sludge pumping from primary clarifier
  - Energy savings about 37%, 5000 €
  - Thickness after the primary clarifiers has increased: 1,5%→ 3,5% (by using TS-measurement)
  - 32% less sludge to treatment
- Digester
  - Solid content has increased from 3% to up to 5 – 8%. Energy and gas optimization
- Solid content of centrate water is now 50% lower from 2500 mg/l before starting the project

- Dried cake content has increased about 1-2% from 29,7%
  - → Savings in transportation costs due to smaller density of the dry cake
- Polymer consumption has decreased almost 40% from 8 kg/ton
- Easy to test different polymer, quality of the polymer
- Savings:
  - Less material is circulated = 10 000 €/a
  - Less polymer used in the dewatering = 49 000 €/a
  - Higher total solids in the dry cake = 80 000 €/a (transportation costs)

Service contract with Valmet for the measurements was signed in 2017

Valmet


Valmet
FORWARD