Voimalaitoksen polttoaineportfolion ja suorituskyvyn hallinta FuelDiet ratkaisun avulla

VGB-Valiokunnan (Suomi) ja Suomen Automaatioseura ry:n Voimalaitosjaoksen ”*Digitalisaation mahdollisuudet voimalaitoksissa*”-seminaari, 25.4.2017 Tampere

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Valmet Technologies Oy

Valmet

Sisällysluettelo

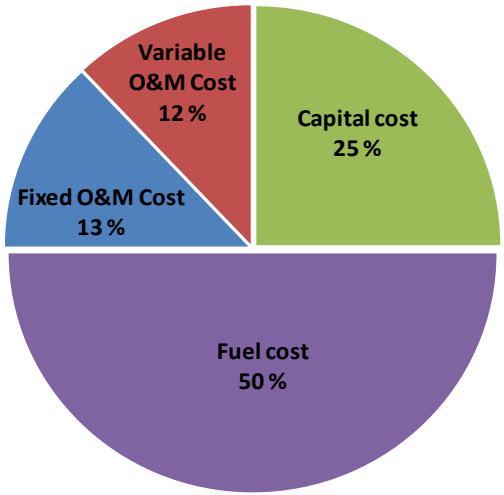
Kummanko polttoaineen valitsisit?

Pb = 31 mg/kg DS
Cl = 3000 mg/kg DS
Ash = 18 wt-% DS

Pb = 110 mg/kg DS
Cl = 400 mg/kg DS
Ash = 1.9 wt-% DS

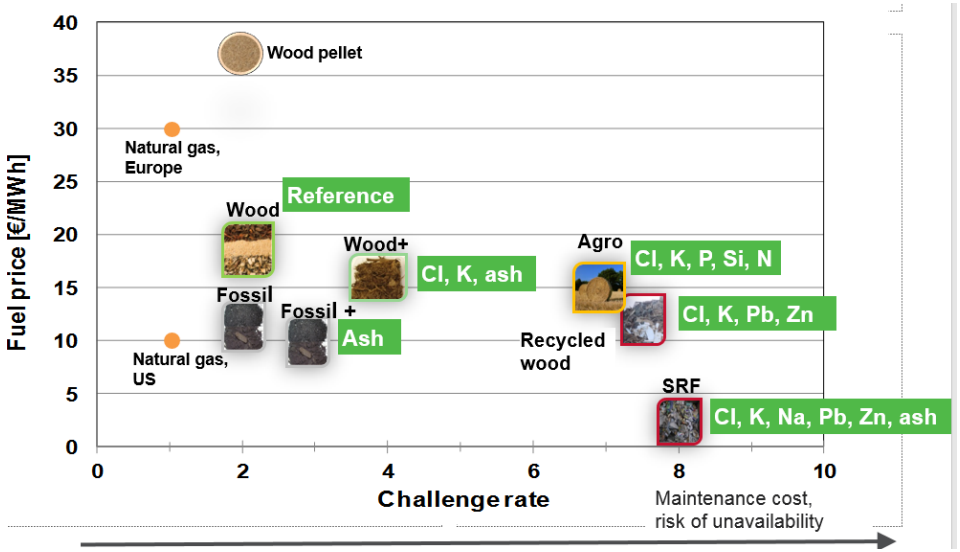
Production cost vs. technical challenge

Production cost



- The energy production cost split of a solid fuel fired thermal power plant.
- For unit size of 80 MW_{fuel} and annual operating time of 8000 hours fuel cost is about 9 MEUR (fuel price 14 €/MWh)

Technical challenge



FuelDiet
Technical description

Data sources

Process data

p, T, flow

Valmet fuel database

Plant fuel database

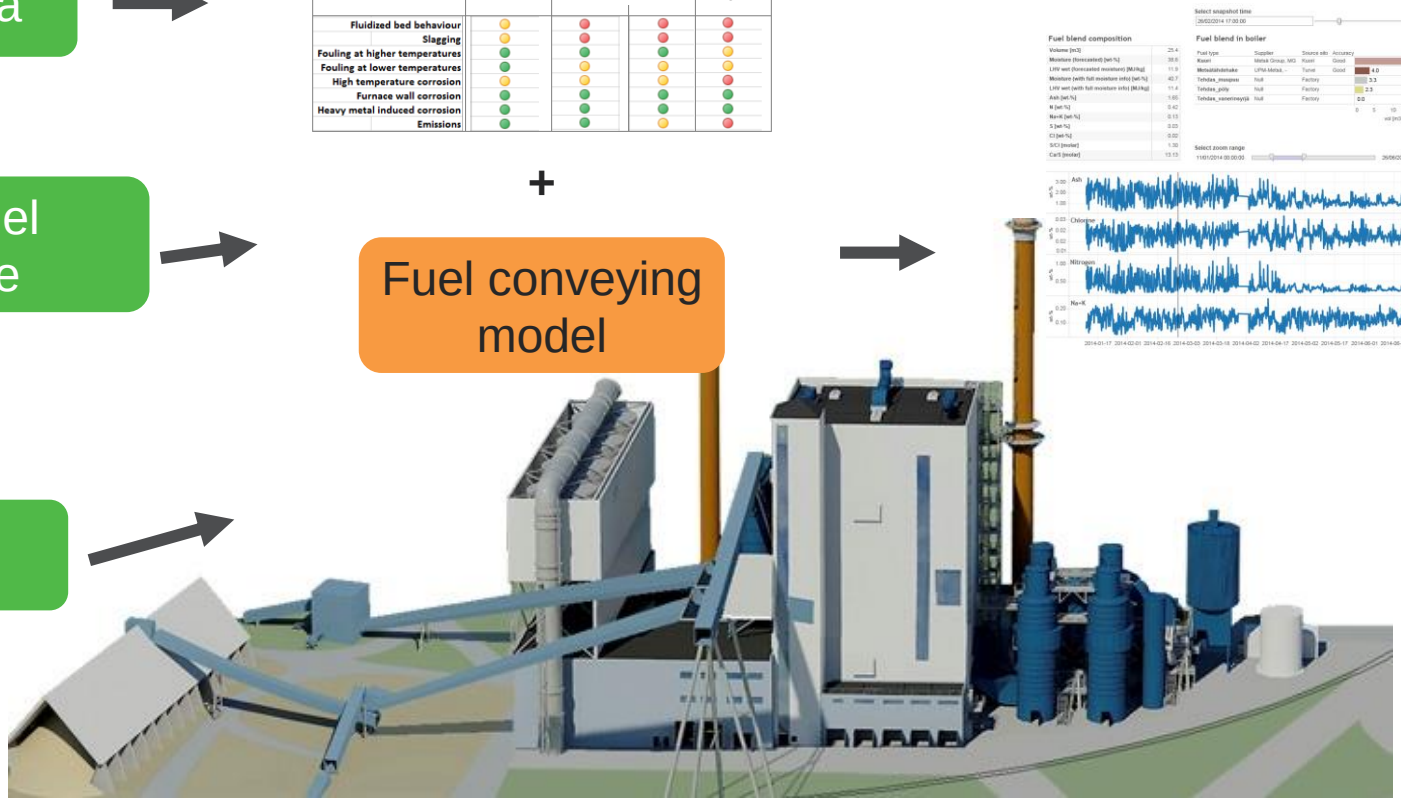
Algorithms

	Reference	FuelDiet 1	FuelDiet 2	FuelDiet 3
Fluidized bed behaviour				
Slagging				
Fouling at higher temperatures				
Fouling at lower temperatures				
High temperature corrosion				
Furnace wall corrosion				
Heavy metal induced corrosion				
Emissions				

+

Fuel conveying model

Realtime ”fuel in the process” visualization



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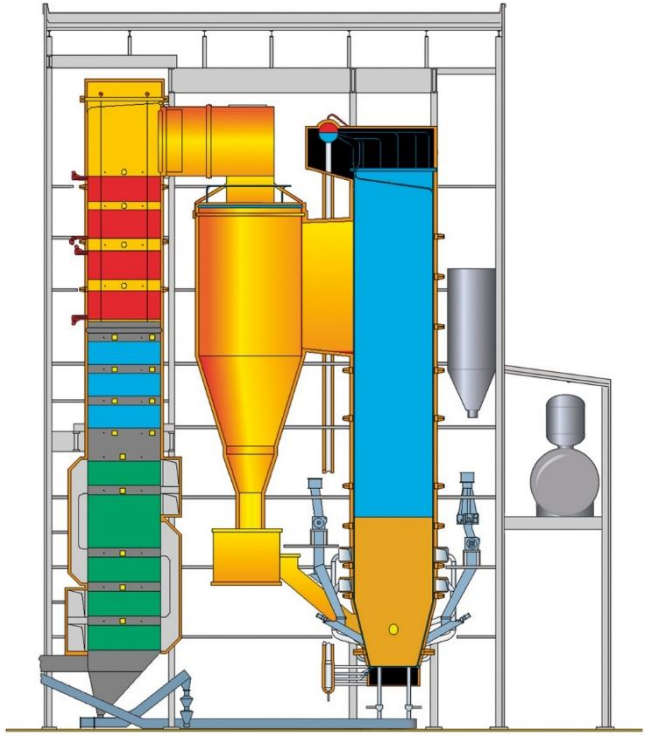
Technical pilots

Utility CHP plant

165 MW_{fuel}
130 bar
535 °C

Woody biomass, peat

CFB

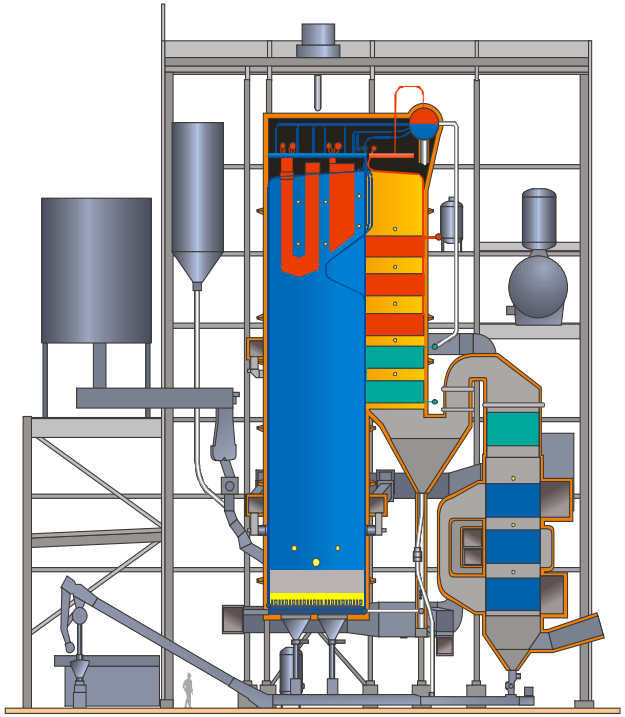


Industrial CHP plant

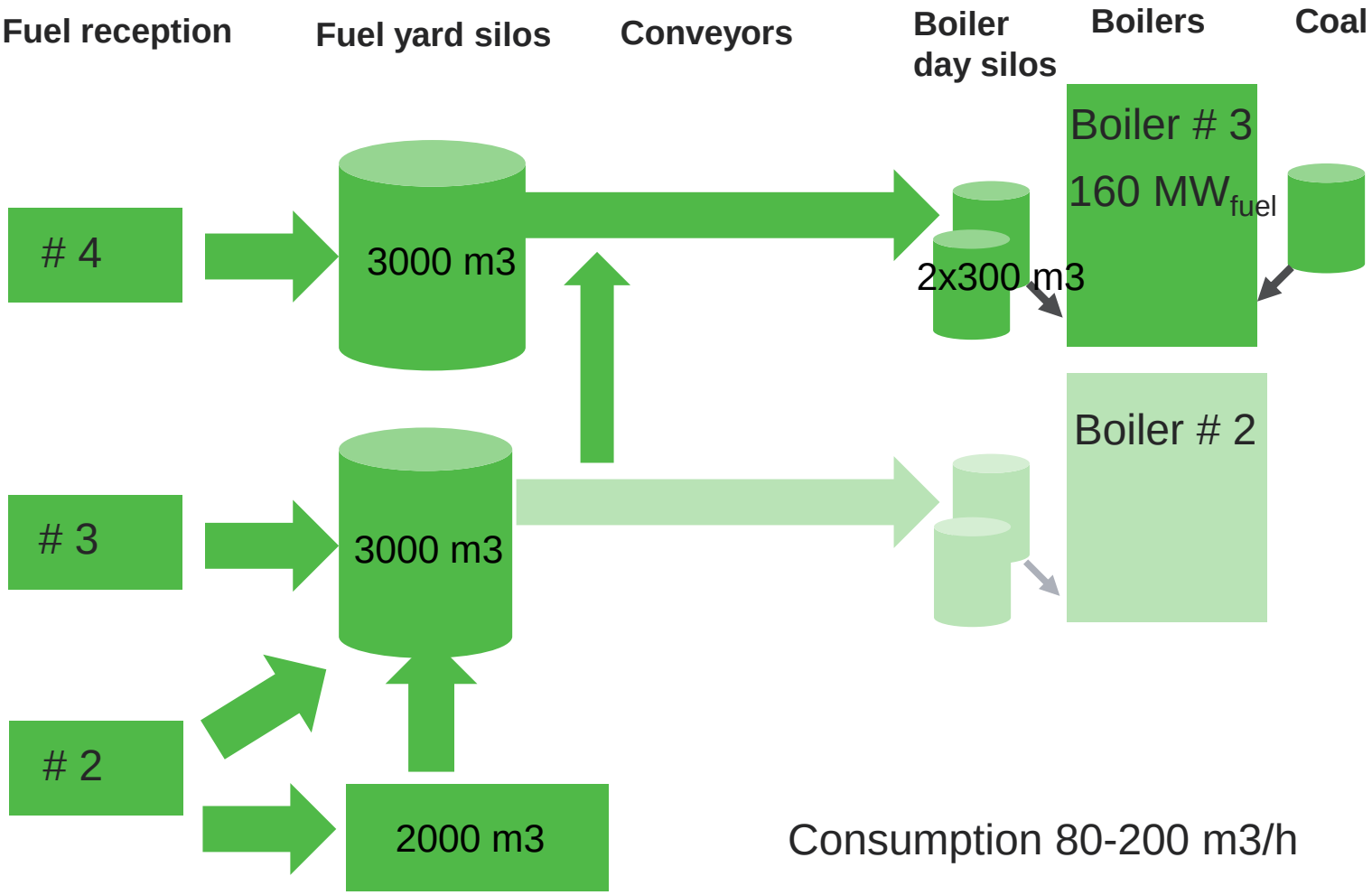
80 MW_{fuel}
92 bar
523 °C

Woody biomass, peat and mill residues

BFB

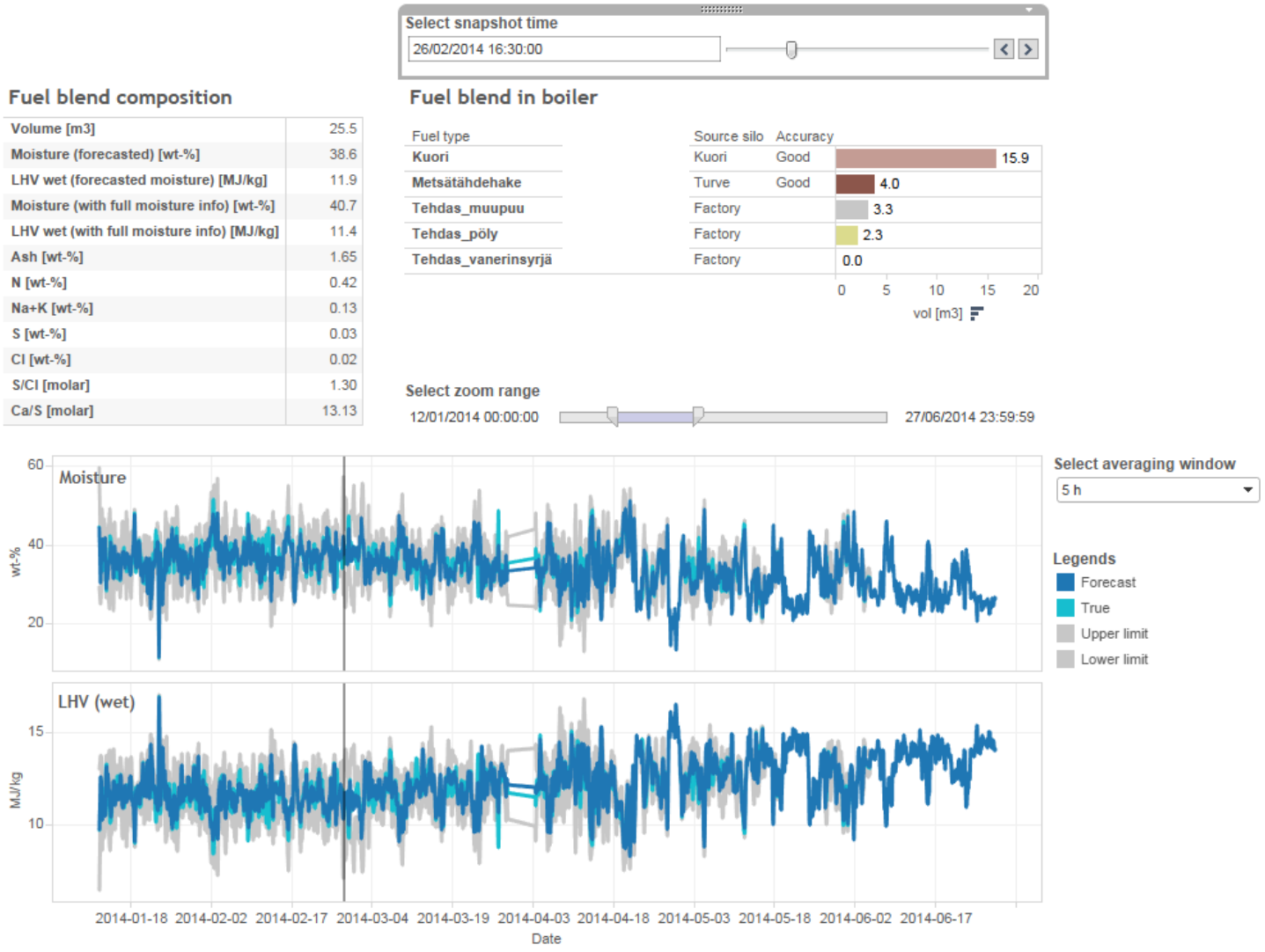


Utility CHP plant-fuel feeding system
Fuel flow tracking model



Consumption 80-200 m3/h

Boiler FuelDiet # 1
Moisture, LHV_{wet}



Boiler FuelDiet # 2
Ash, Cl, N, Na+K

Select snapshot time

26/02/2014 17:00:00

Fuel blend composition

Volume [m3]	25.4
Moisture (forecasted) [wt-%]	38.6
LHV wet (forecasted moisture) [MJ/kg]	11.9
Moisture (with full moisture info) [wt-%]	40.7
LHV wet (with full moisture info) [MJ/kg]	11.4
Ash [wt-%]	1.65
N [wt-%]	0.42
Na+K [wt-%]	0.13
S [wt-%]	0.03
Cl [wt-%]	0.02
S/Cl [molar]	1.30
Ca/S [molar]	13.13

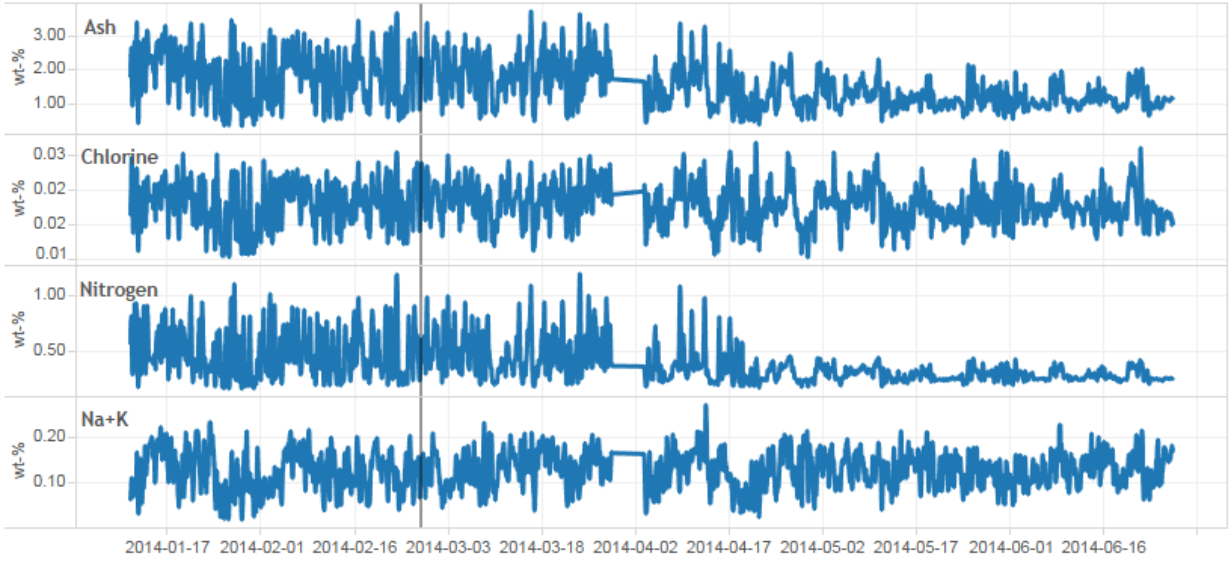
Fuel blend in boiler

Fuel type	Source silo	Accuracy	vol [m3]
Kuori	Kuori	Good	15.8
Metsätähdehake	Turve	Good	4.0
Tehdas_muupuu	Factory		3.3
Tehdas_pöly	Factory		2.3
Tehdas_vanerinsyrjä	Factory		0.0

0 5 10 15 20

Select zoom range

11/01/2014 00:00:00 — 26/06/2014 23:59:59



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Fluidized bed sintering risk tracking

Select snapshot time

10/08/2014 11:30:00

Agglo indicators

Volume [m3]	6.64
Moisture (forecasted) [wt-%]	21.73
LHV wet (forecasted moisture) [MJ/kg]	14.61
Agglo index	39.47
Na+K [wt-%]	0.17
S/Cl [molar]	1.57

Fuel blend in boiler

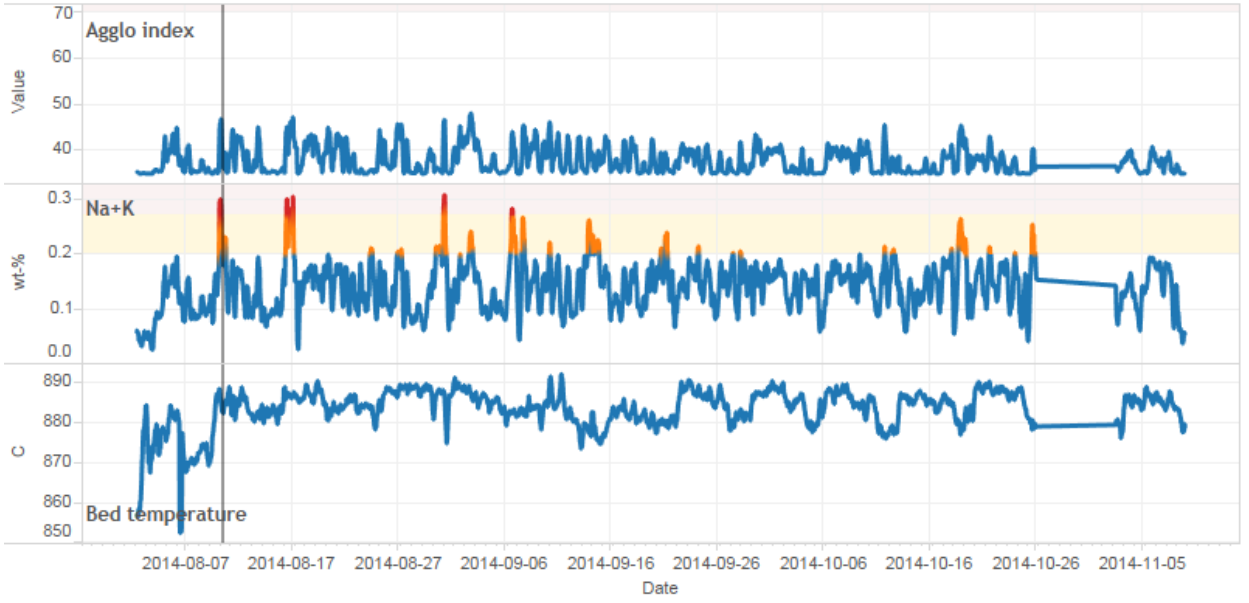
Fuel type	Source silo	Accuracy	vol [m3]
Metsätähdehake	Kuori	Good	1.8
	Turve	Good	0.7
Tehdas_pöly	Factory		2.3
Tehdas_vanerinsyrjä	Factory		1.1
Tehdas_muupuu	Factory		0.7

0 1 2

vol [m3]

Select zoom range

01/08/2014 00:00:00 08/11/2014 23:59:59



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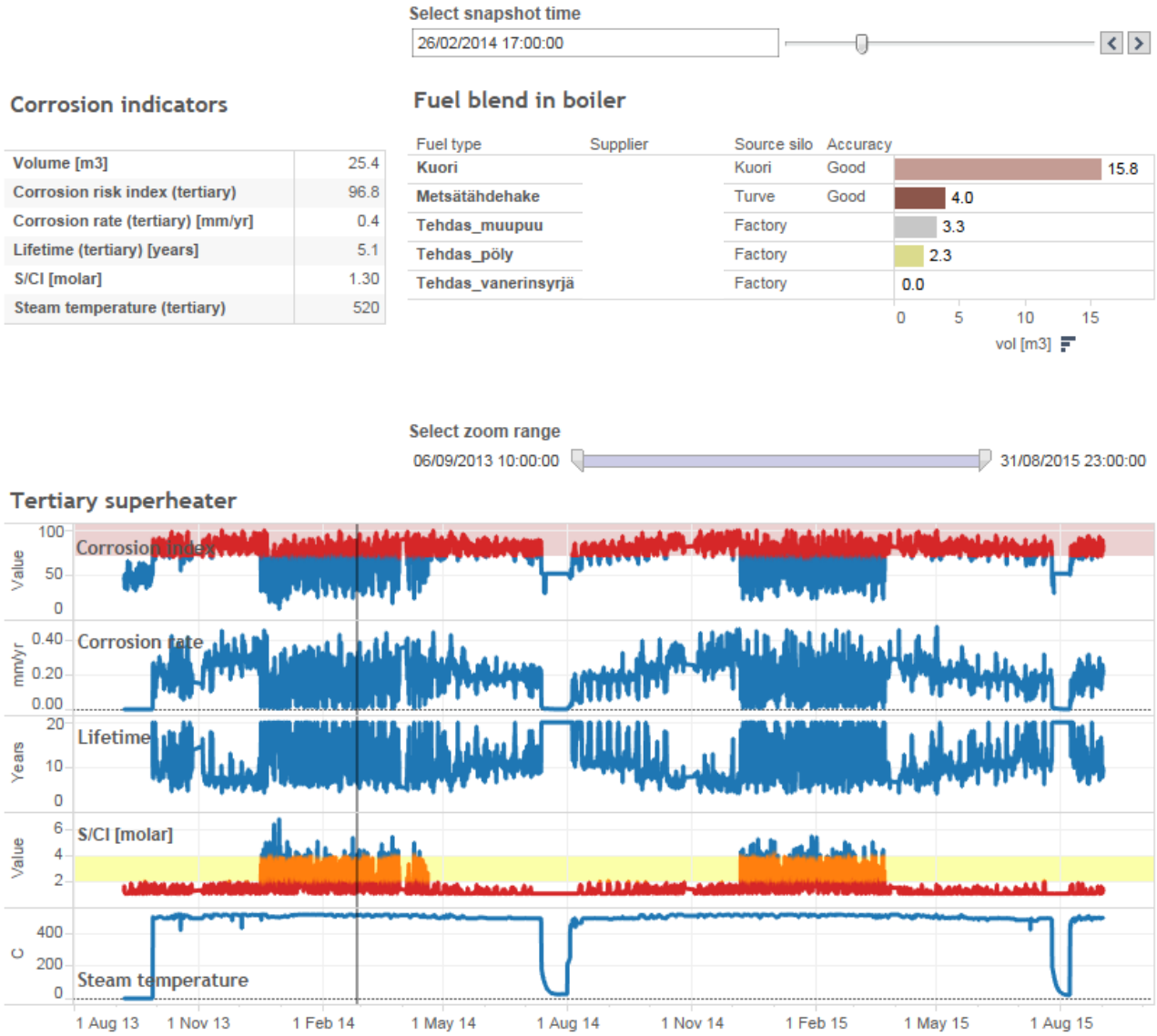
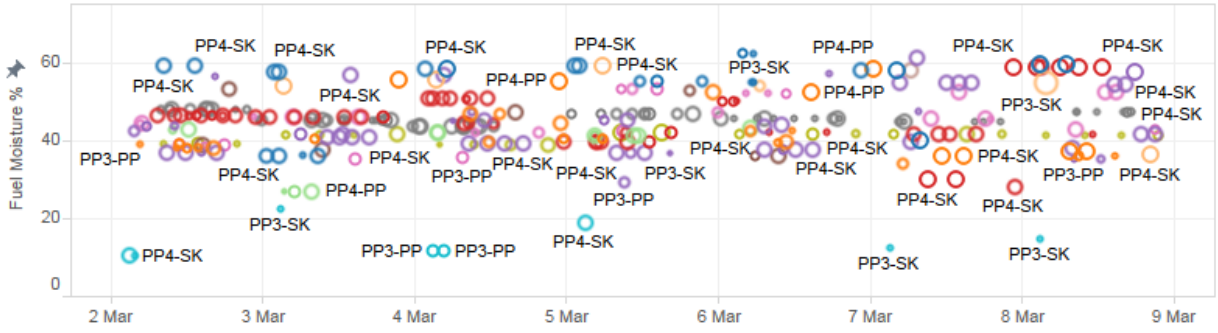
Superheater corrosion risk tracking



Fuel moisture weekly overview

Measured moisture % of fuel loads

Load Name	supplier	Avg. Fuel Moisture	Min. Fuel Moisture	Max. Fuel Moisture	Distinct count..
Metsähake	03	41.4	38	46.6	9
	15	45.1	36.1	62.1	9
	25	38.2	26.8	43.2	12
	31	48.4	39.4	58.6	43
	35	53.2	43.8	54.7	7
	61	52.3	52	52.9	8
	82	43.4	36.1	53	5
Turve	10	38.6	34.1	42.4	11
	21	42.1	29.1	47.3	16
	38	43.3	41.4	44.4	8
	61	44.6	41.9	46.9	14
	_1	45.3	43.3	47.8	66
	_5	41.0	38.8	41.8	23
Kantomurske metsä	03	36.4	35.8	37	4
	15	40.0	40	40	1
	31	29.4	28	29.9	3
	35	38.8	36.6	41.3	23
Puru	15	54.8	54.8	54.8	2
	20	54.8	54.8	54.8	1
	21	57.4	56.3	61.1	6
	36	57.9	57.9	57.9	1
	41	54.9	52.2	58.1	5
Kutterin puru	29	13.9	10.3	22.3	8
Rankahake	61	38.3	35.1	52.9	6
	82	38.1	37.5	38.6	2
Puru / Kuori	15	58.6	57.5	59.6	12
Puru suo	20	51.8	36.4	59.2	5
Turvebriketti	20	Null	Null	Null	1



Select Year

2015

Select week

Week 10

Load Volume

2.0

100.0

200.0

308.0

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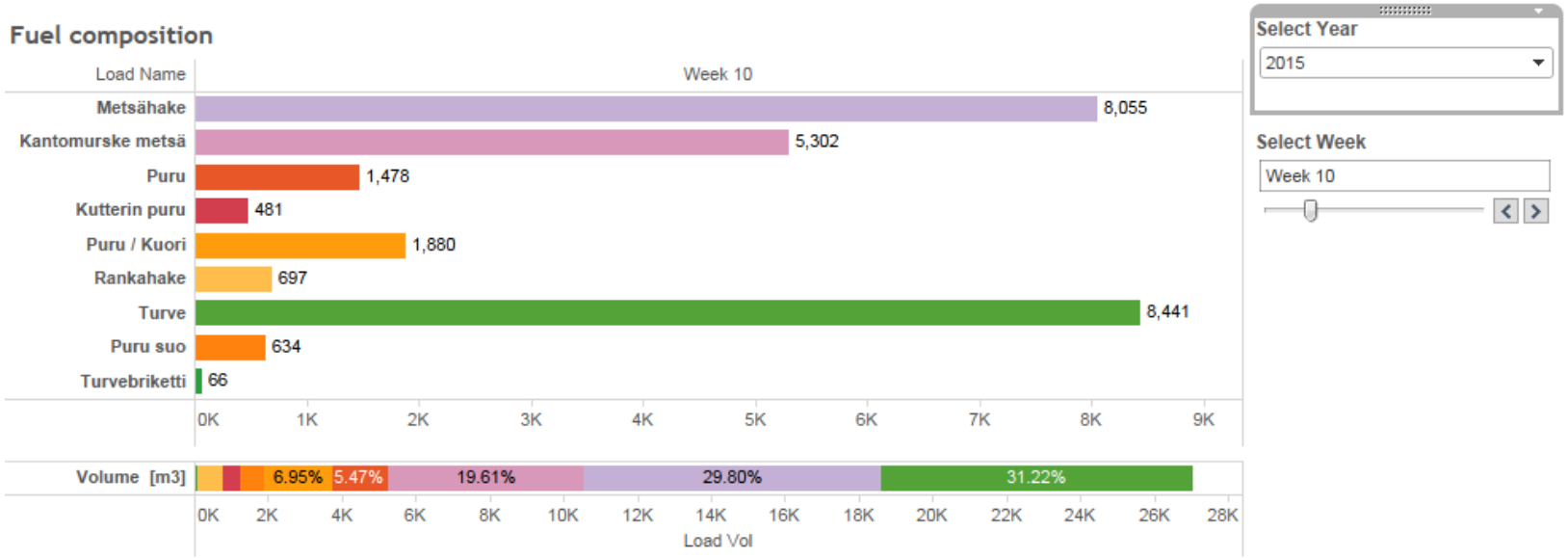
Fuel composition weekly overview



Fuel volume, flow and energy content

	Week 10
Volume [m3]	27,034
Dry weight [t]	4,496
LHV wet [MJ/kg]	9.8
Fuel energy [GWh]	6,135
Average boiler [MW]	122

Measured values

	Week 10
Flue gas Moisture [%]	22.55
Flue gas SO2 [mg/Nm3]	97.97
Cl corrored [mg/m3]	0.008
Flue gas NOx [mg/Nm3]	63.61

Fuel blend

	Week 10
Volume [m3]	27,034
Moisture (forecasted) [wt- %]	44.1
Moisture (with full information) [wt- %]	43.9
LHV wet [MJ/kg]	9.8
S [wt- %]	0.099
Cl [wt- %]	0.022
Ash [wt- %]	3.8
N [wt- %]	0.79
S/Cl [molar]	4.65
Ca/S [molar]	4.06
Na+ K [wt- %]	0.10

Peat, stump wood and recycled wood

	Week 10
Peat [weight %]	36.1%
Peat [energy %]	39.0%
Stump wood [weight %]	15.6%
Stump wood [energy %]	18.1%
Recycled wood [weight %]	0.0%
Recycled wood [energy %]	0.0%

FuelDiet
Business potential

Short and long term fuel supply and cost optimization *€ / MWh*

Plant daily operation, maintenance and consumable utilization optimization *€ / ton*

Flue gas emission management optimization *€ / ton*

Ash quality and cost optimization *€ / ton*

Component lifetime optimization *€ / a*

- Soft sensor based realtime FuelDiet enables to choose the ”suitable” fuel and production cost for the asset

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