AUTOMAATIOSEURAN VOIMALAITOSJAOKSEN KEVÄTSEMINAARI, 31.5.2018

Industry demand side energy management in Pulp&Paper

Case TMP energy optimization

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How to Get Savings in Energy Costs

Reduce	Price you pay $ / MWh	**Average Unit Price / Energy consumption** ***Price Optimization***
Decrease	Energy Consumption MWh / Units	**Total Energy Consumed / Production output** ***Usage Optimization***
Increase	Energy Cost Effectiveness (eE) Units / e$	**Production Units / Unit Energy Cost $** ***Energy Efficiency / Energy Cost***

eE is a KPI = Units per energy dollar

iDSM: industrial Demand Side Management

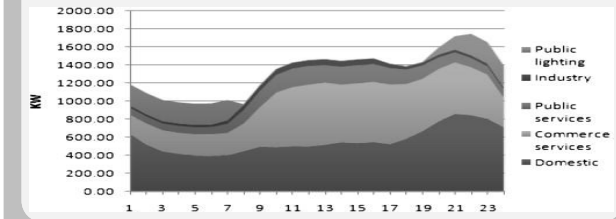
Background and Motivation

Renewables Expansion

GRID STABILITY AND RELIABILITY

Demand & Supply

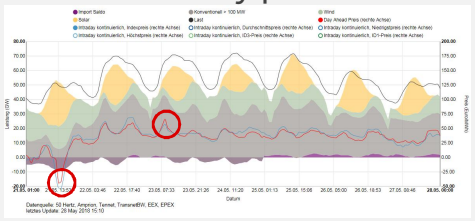
Need for peak load (1)



ENVIRONMENTAL IMPACTS AND INVESTMENT COSTS

Market Liberalization

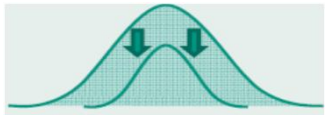
Variable electricity prices (2)



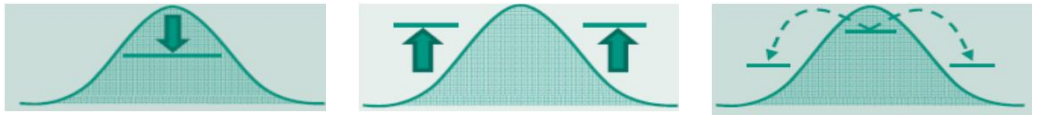
HIGH ENERGY COSTS

Demand Side Management

Energy Efficiency



Load Management



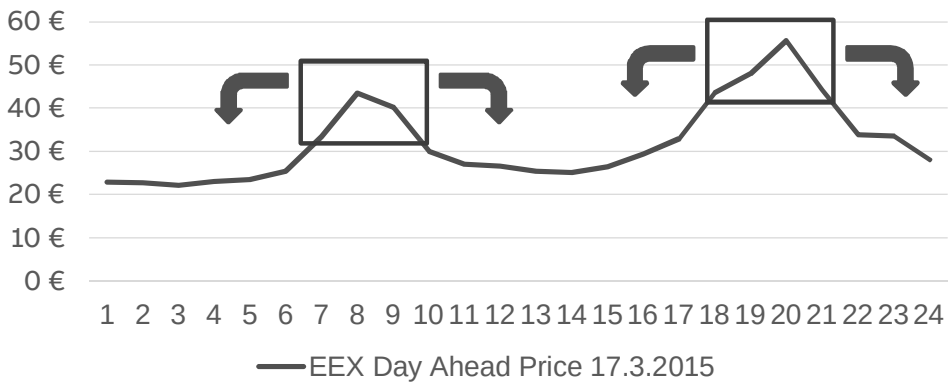
Sources: (1)Pina et. Al, 2012;
(2) EPEX SPOT ,2012

New opportunities of industrial demand side management (iDSM)

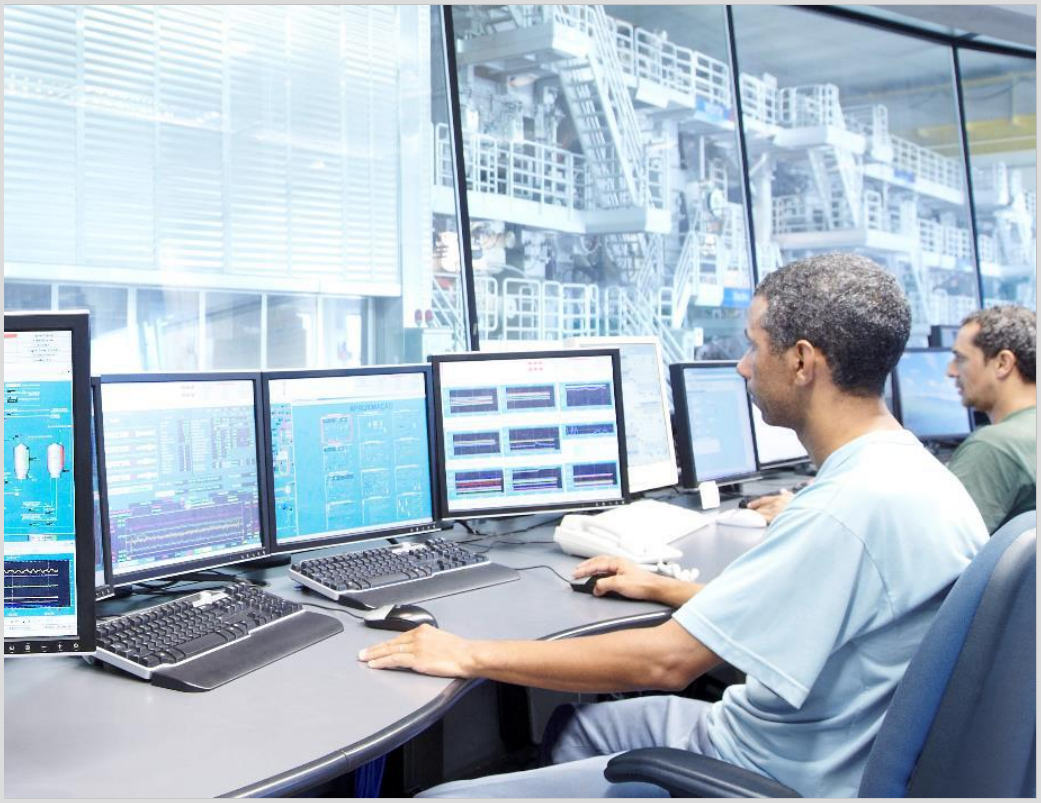
Saving cost with intelligent planning

Using process flexibility for iDSM

Shifting loads of energy intensive process steps to low cost times



iDSM allows important cost savings



Prerequisites for demand side management (DSM) in industry

Flexibility in energy intensive production steps enables demand side management

Process flexibility enables DSM

Elektrolysis

Cement mills, paper mills, …

Electric Arc Furnaces

Refrigeration (cold storage houses, …)

Heating (heaters, furnaces, steam, …)

Compressors, pumps

…

All energy intensive processes not running 24/7.

DSM offers saving potential in many industries

Metalls

Cement

Pulp and paper

Electrolysis

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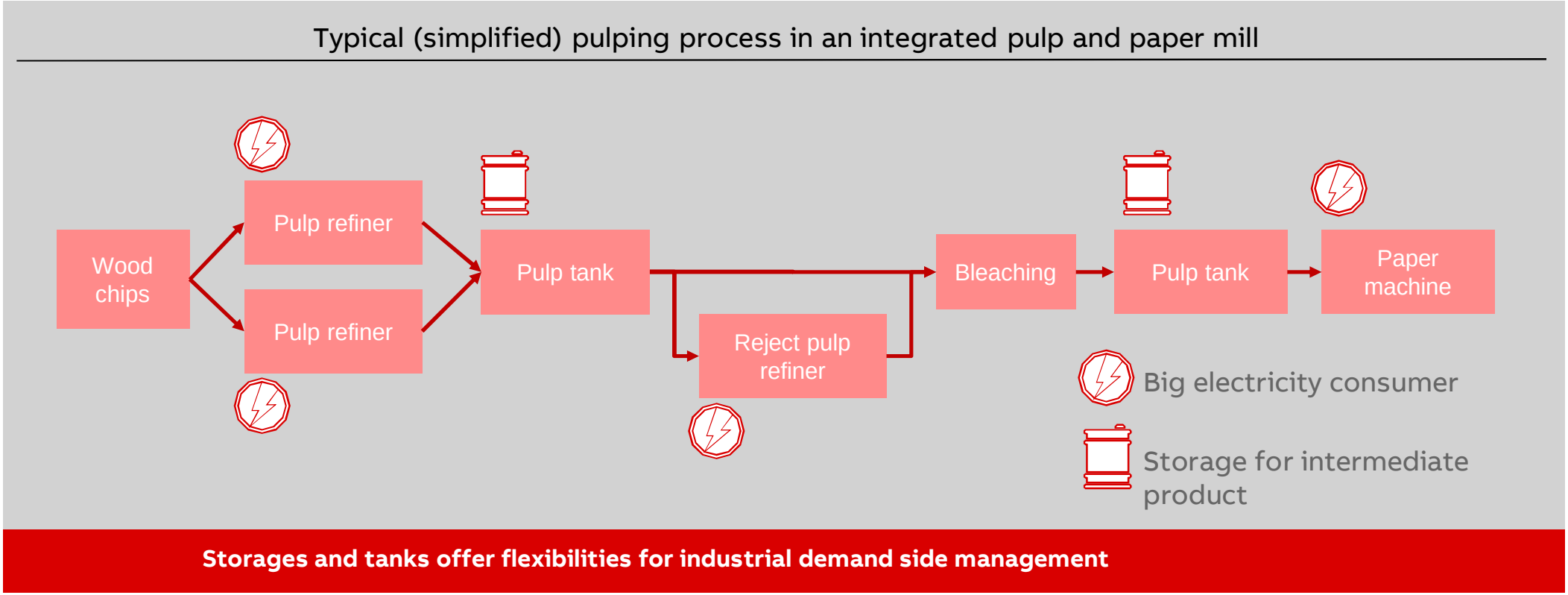
Industrial demand side management in pulp and paper industry

Co-ordination of production planning and energy management



Storages and tanks offer flexibilities for industrial demand side management

Industrial demand side management in pulp and paper industry

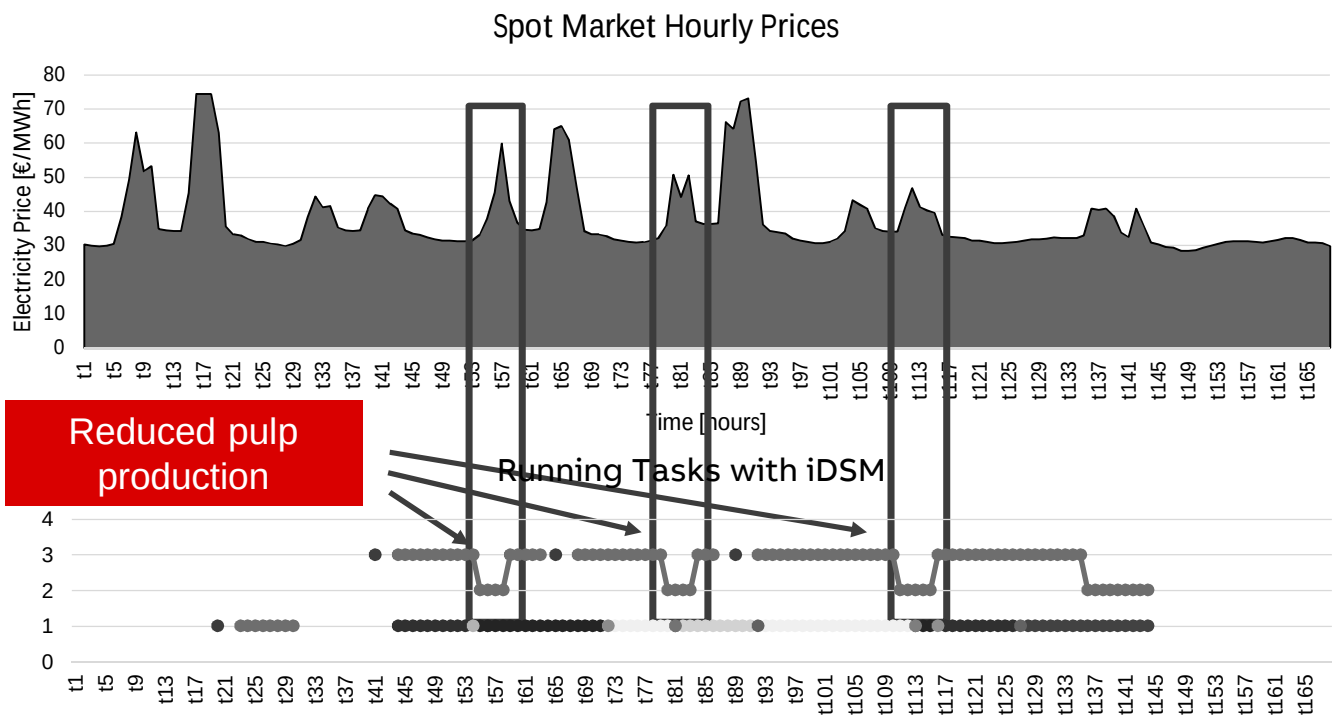
Coordination of production planning and energy management

Pulp production

Continuous production with intermediate storages

Pulp production is highly integrated with other parts of paper plant

Paper output of plant is **not reduced**



Case Mill, RMP Optimization

Production Process and Objectives

Production Process:

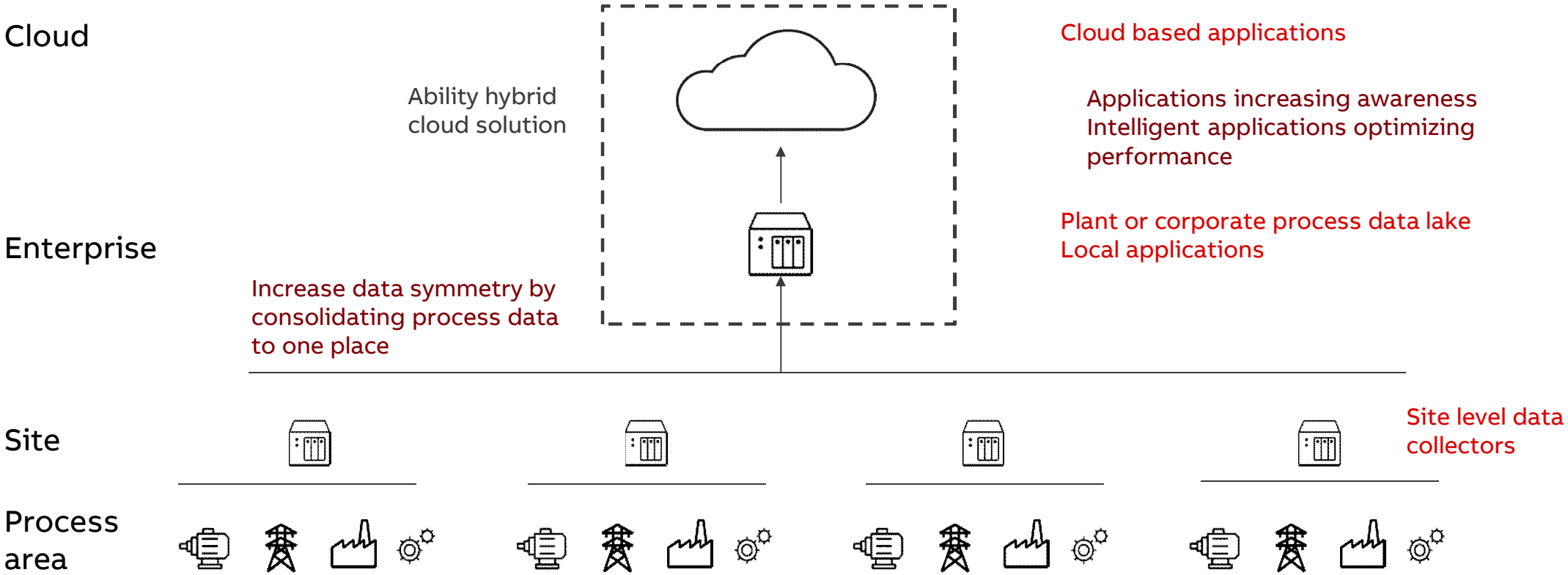
- Two board machines
- RMP plant (Refined Mechanical Pulp), 10 MW_e power, feeds board machines
- Reserve pulper for purchased pulp
- Storage tank between RMP plant and board machines

Objectives:

- Minimize the electricity costs by optimizing the RMP operation according to electricity spot price
- Provide power consumption forecast for electricity purchase

General architecture

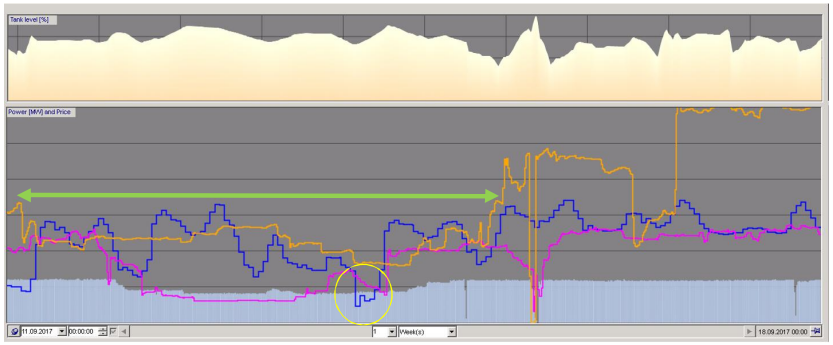
ABB Ability, cpmPlus Energy Manager

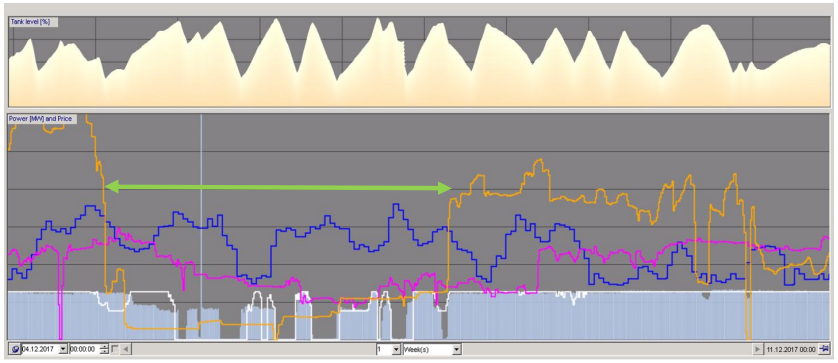


Industrial Demand Side Management (iDSM) in Mechanical Pulping Process

Results – Weeks 37 Before and Week 49 After Start-up

- RMP stock level 0 … 100 %
- RMP to BM1
- RMP to BM2
- RMP power
- Electricity spot price (-20 … +100 EUR/MWh)





- RMP plant must run with full speed when pulp need is high. The time when the process can be optimized is shown with green arrows.

Before (wk 37/2017)

- Spot price is not followed
- Stock level is constantly high

After (wk 49/2017)

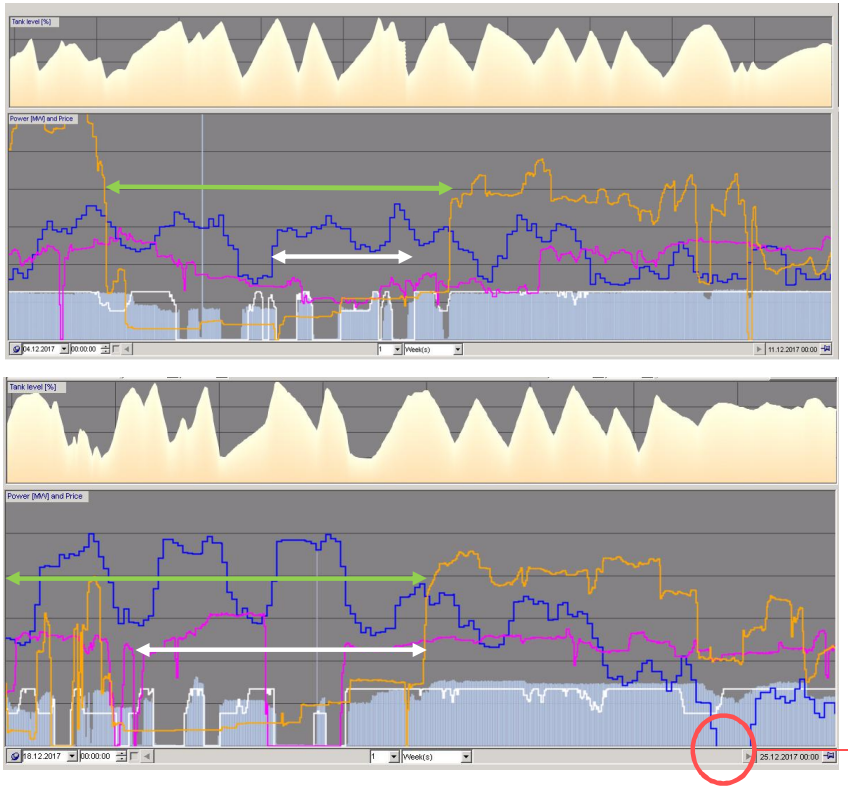
- Spot price is followed quite well
- Stock is utilized and level goes up/down within defined limits

Industrial Demand Side Management (iDSM) in Mechanical Pulping Process

Results – Weeks 49 and 51 After Start-up

- RMP stock level 0 … 100 %
- RMP to BM1
- RMP to BM2
- RMP power
- Electricity spot price (-20 … +100 EUR/MWh)

- Time when optimization is possible (OP)
- Time when optimization is possible and followed (OPF)



Week 49/2017:

- OPF period: 6.12. 07:00 – 7.12. 7:00
- Savings during this period = 7.3 % (*

Week 51/2017

- OPF period: 19.12. 04:00 – 21.12. 12:00
- Savings during this period = 16.0 % (*

Total savings of the two OPF periods = 14.5 % (**

(***

*) Savings calculated comparing the actual cost vs. the cost with average spot price during the OPF period

**) Weighed balance

***) 24.12.2017 00:00 – 07:00 Electricity spot price was -55.47 … -85.73 EUR/MWh