RINA

Advanced solution for Resources Management

INDEX

Focus on:

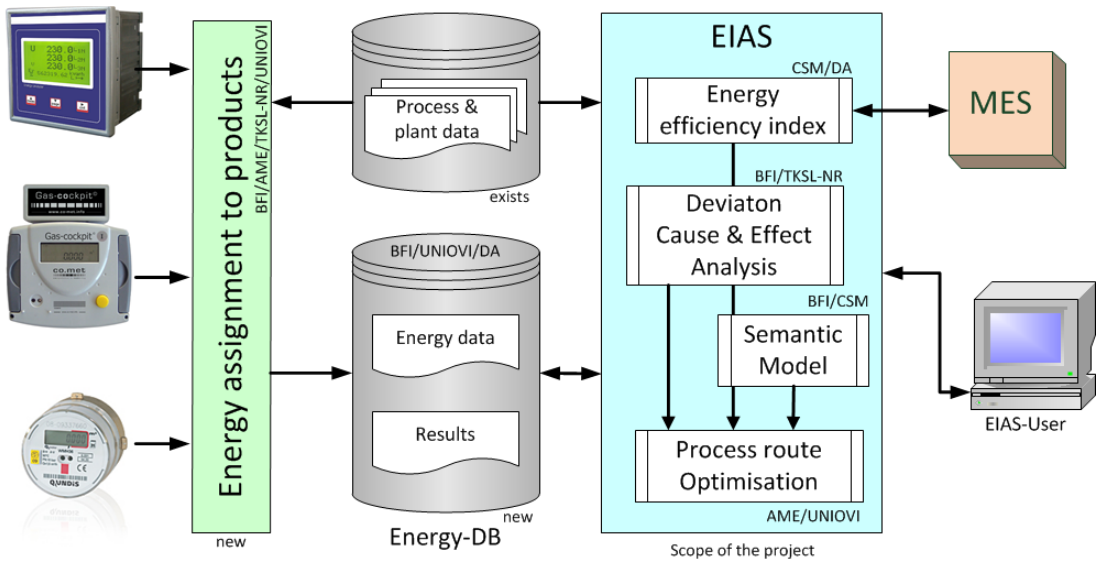
- Energy Management
- Water Management

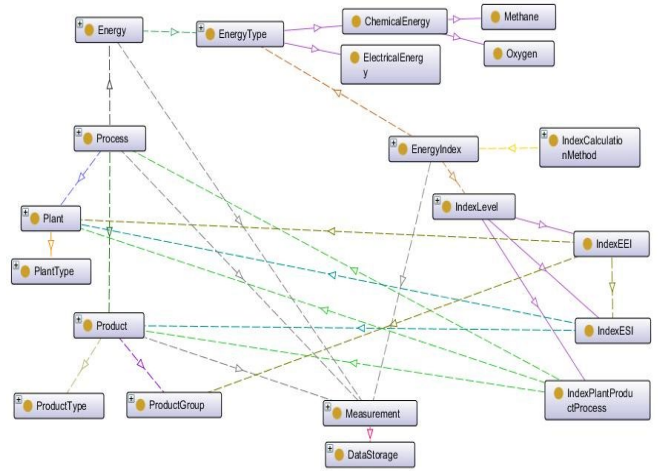
Energy management

"Application of a factory wide and product related energy database for energy reduction"
(EnergyDB)

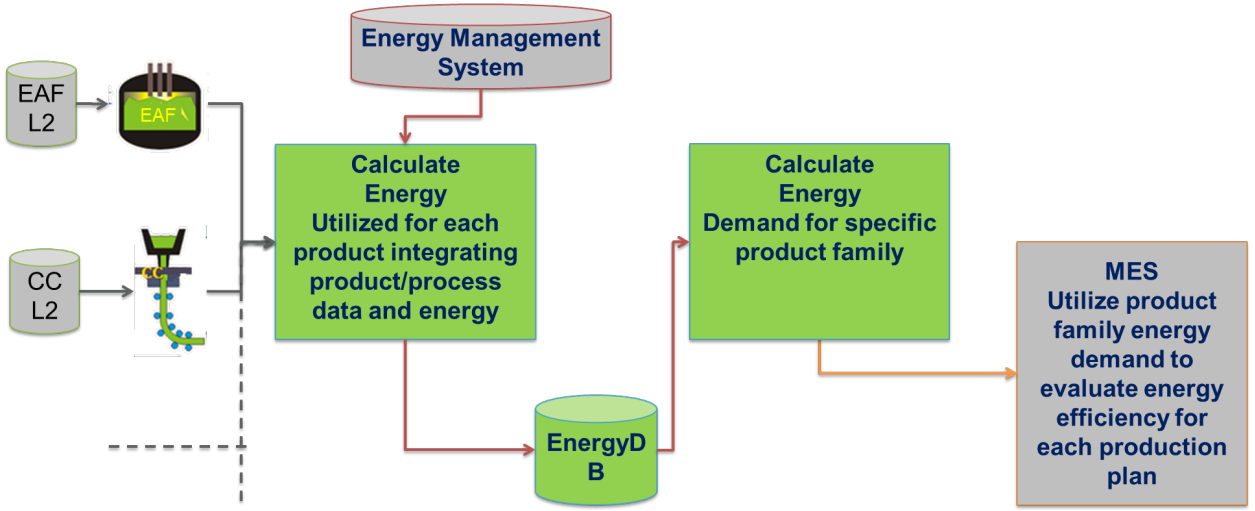
"Integrated dynamic
energy management for steel production"
(DYNERGYSteel)

EnergyDB





Objectives



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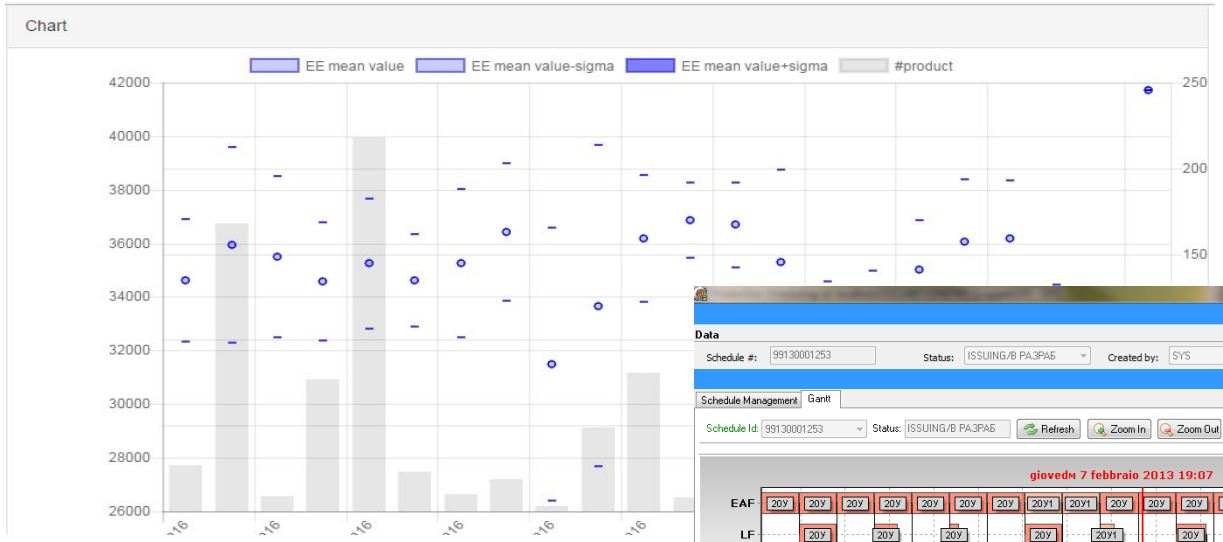
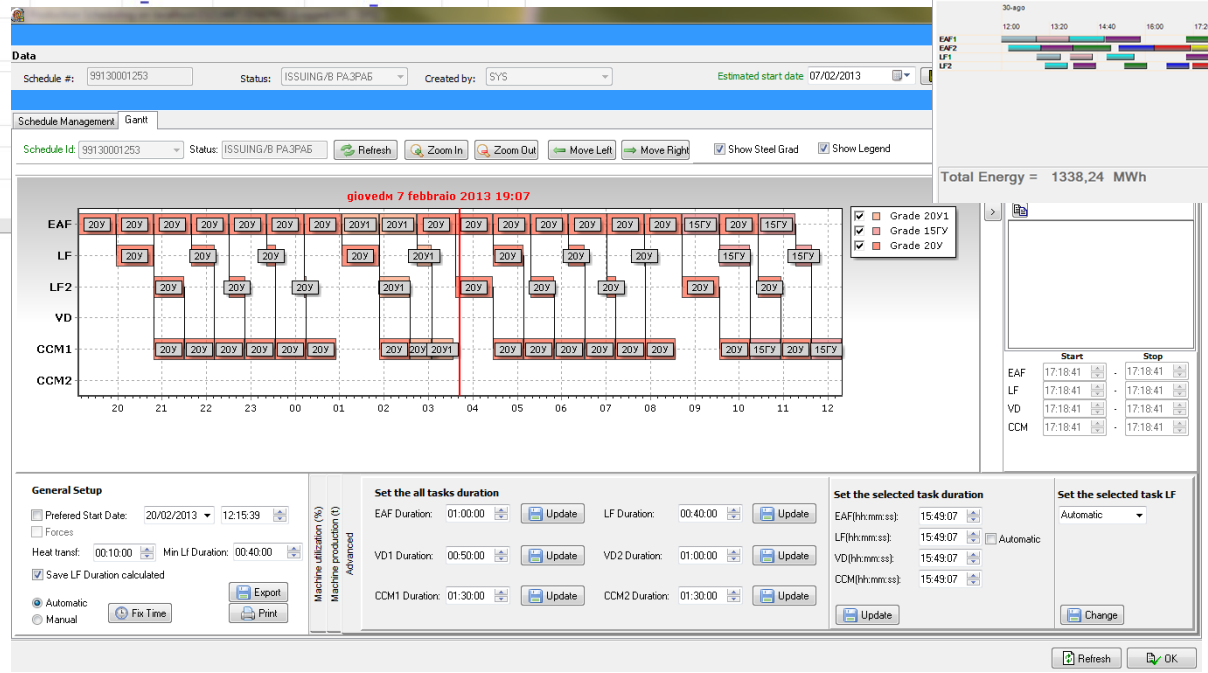
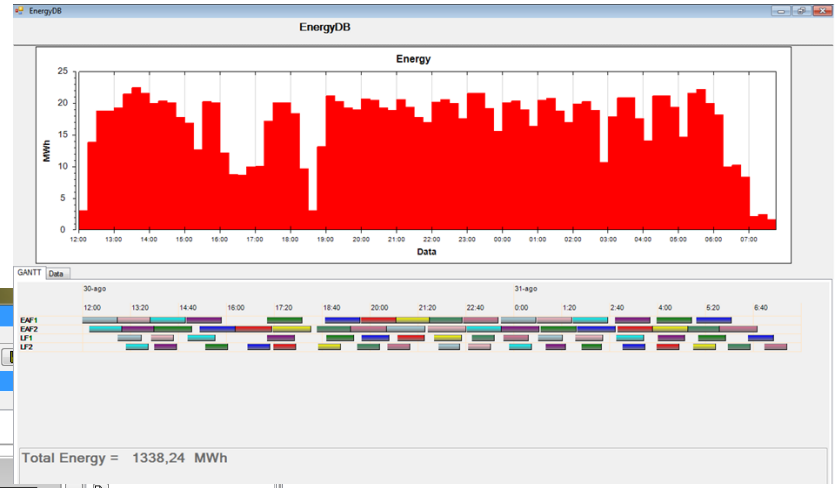
EnergyDB







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DYNERGYSteel Objectives

MARKET

Offers

OPPORTUNITIES

Exploit

DYNAMIC APPROACHES FOR ELECTRICITY DEMAND MONITORING AND TIMELY REACTIONS TO EXTERNAL GRID AND INTERNAL PROCESS SITUATIONS

LONG TERM (Day)

FORECASTING

Day ahead planning according to lower energy cost

ADJUST

Intra Day adjustment according to imbalance

MEDIUM/SHORT TERM

(Minutes/seconds)

PROCESS CONTROL

Manage processes to take advantage from electricity market

ENERGY DEMAND FLEXIBILITY

Online devices to react on electric grid events

Agent System aimed to support the Decision Makers

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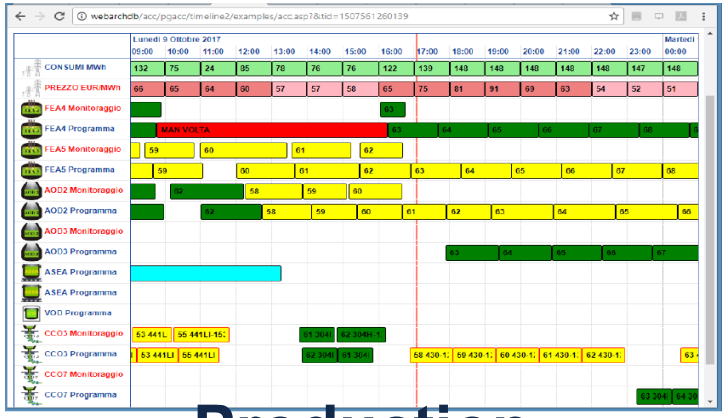
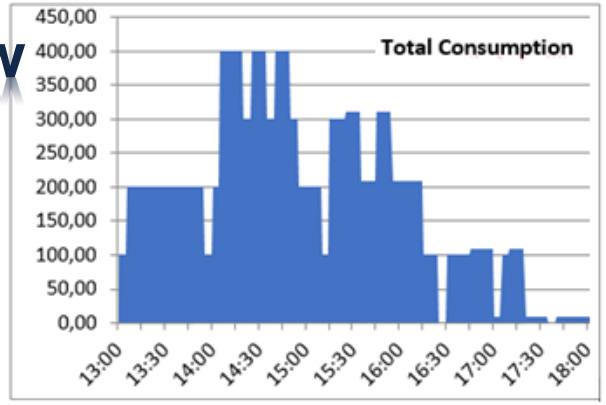
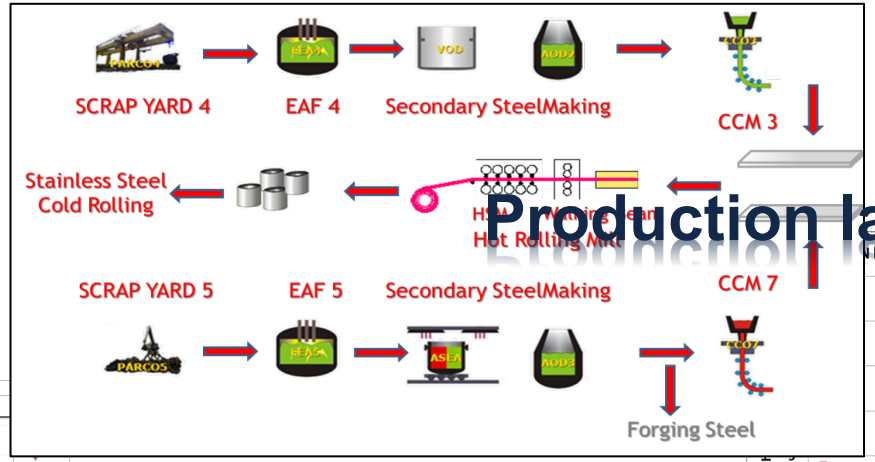
Energy profile forecasting considering energy cost



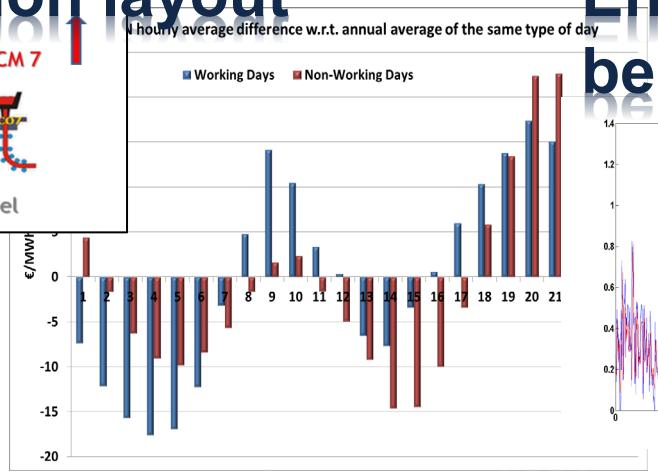
Production Scheduling

Electricity Flow Sheet Model

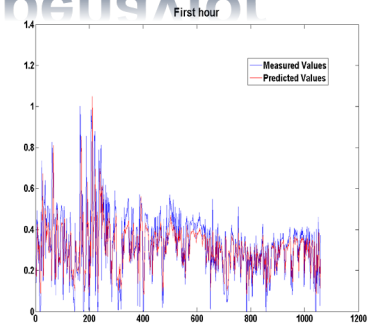


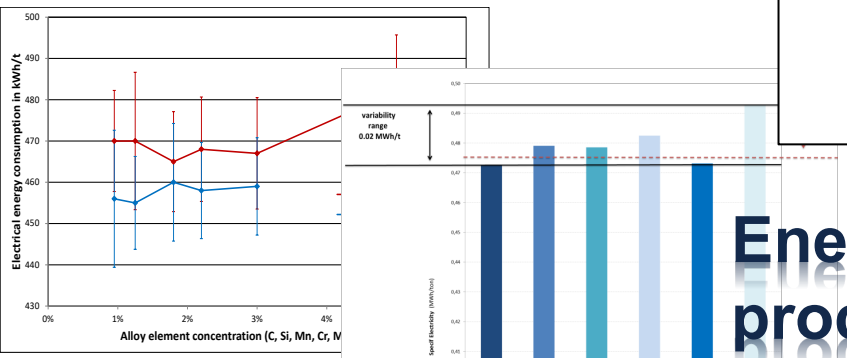


Production layout



Energy grid behavior





Energy demand by process/product

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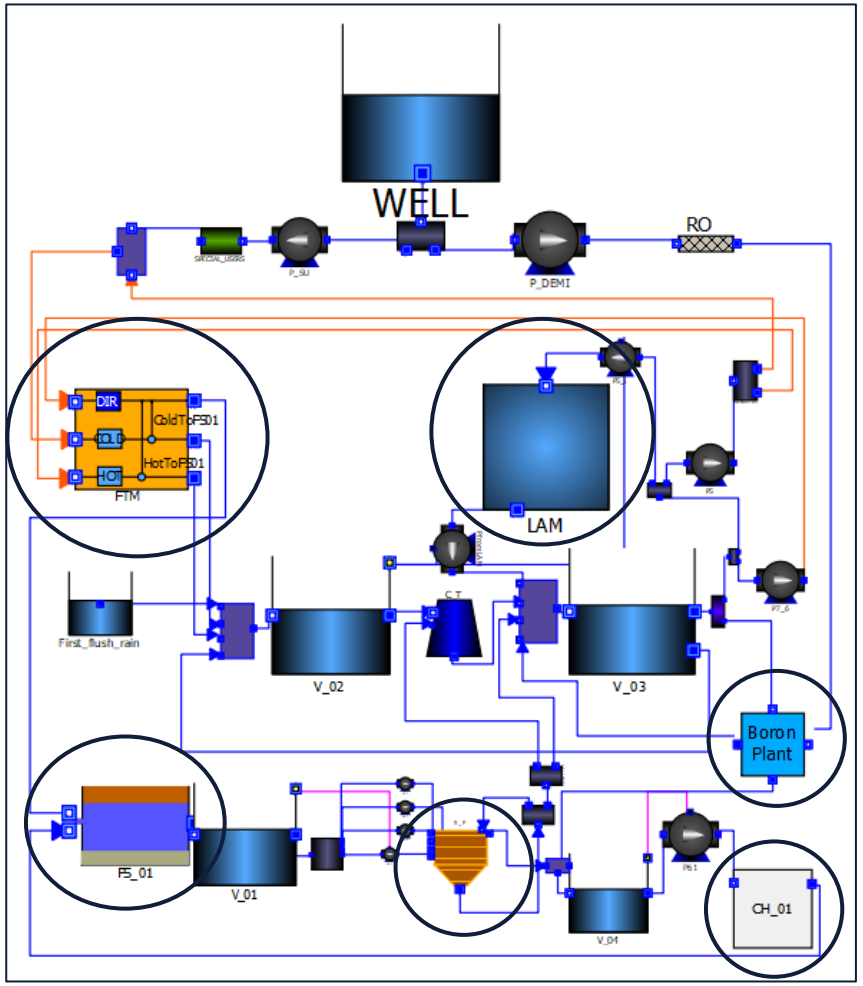
Water management

WHAM –Tenaris case study

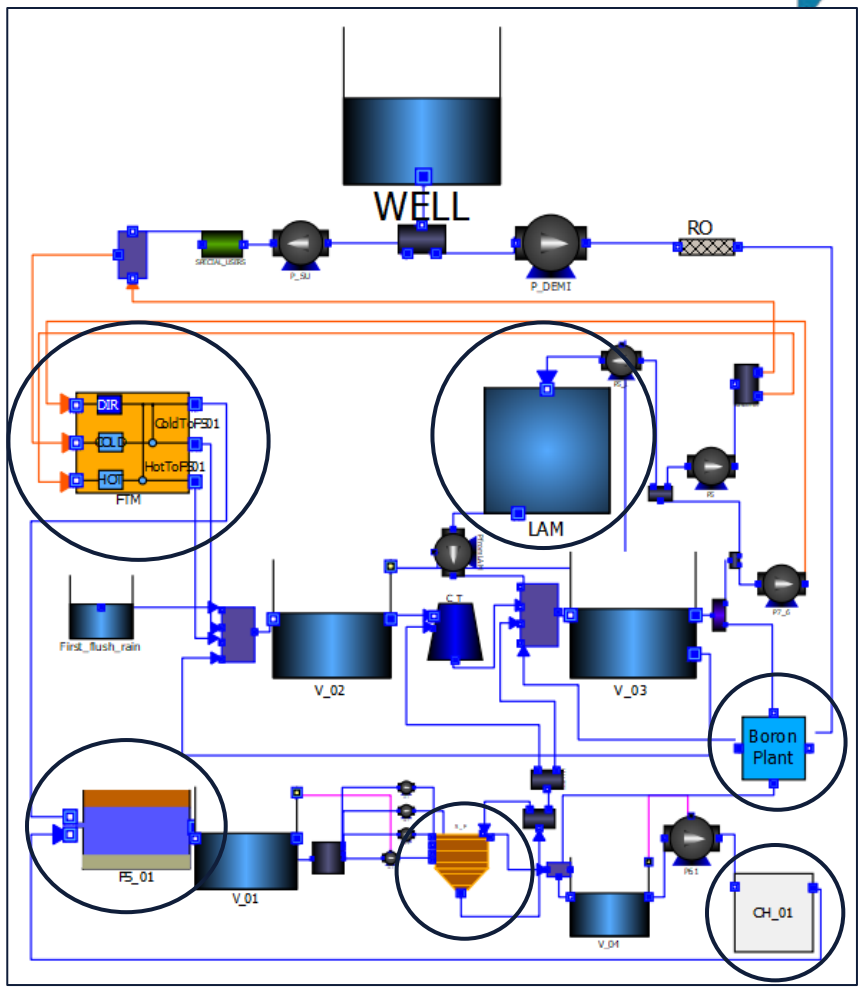
IDRO-FTM Flowsheet

- IDRO-FTM: water treatment plant for water coming from FTM (Fabbrica Tubi Medi, medium size pipes mill).
- Treatment units: tanks, pit scale, cooling tower, sand filters, settlings units, plant for boron removal…
- Aim: the removal of pollutants (total suspended solids, boron and so on) and the lowering of water temperature.



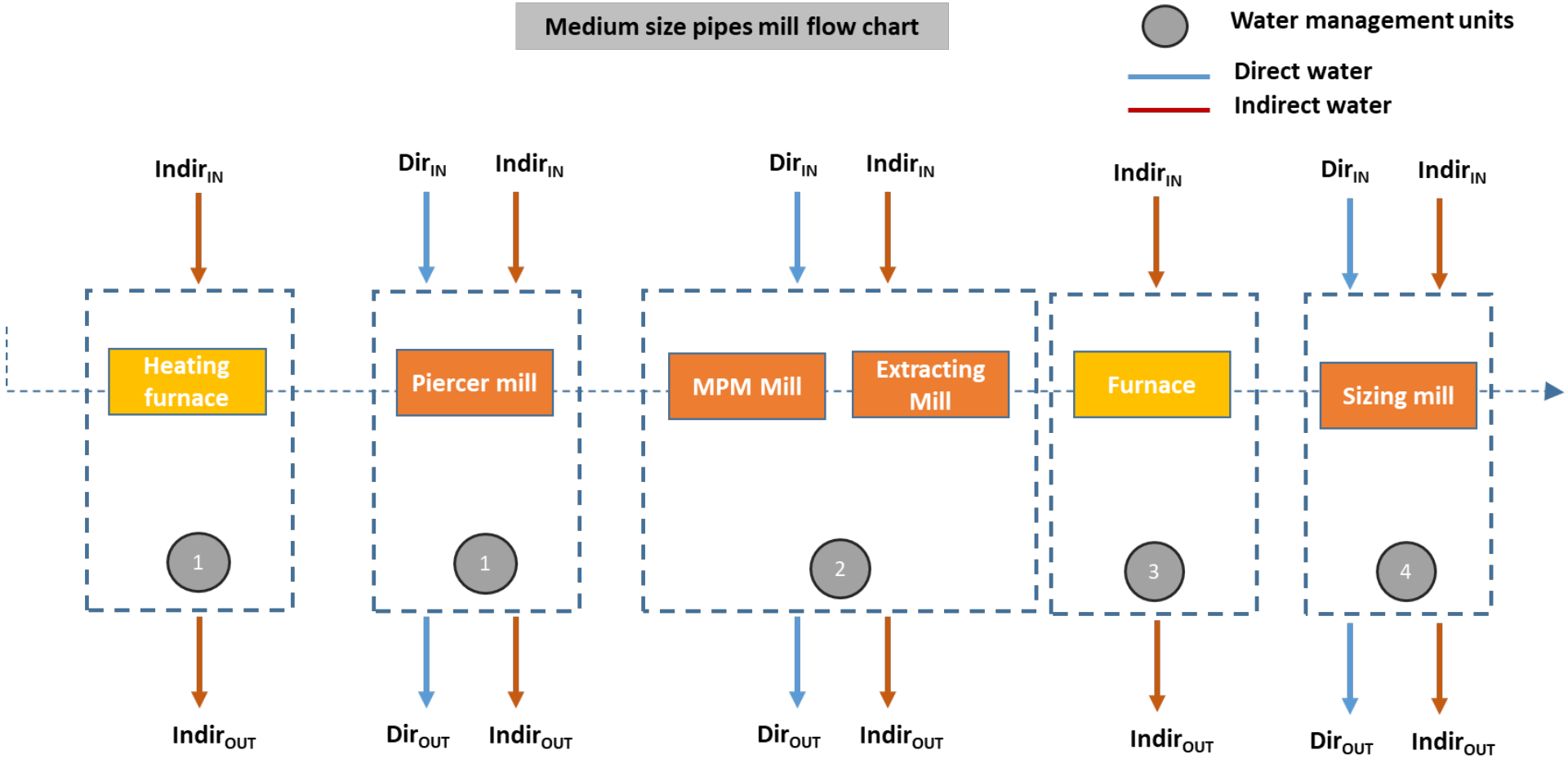
Modelica language

- Modelica is an object-oriented, declarative, multi-domain modeling language for component-oriented modeling of complex systems.
- The free Modelica language is developed by the non-profit Modelica Association.
- Openmodelica is an open-source Modelica-based modeling and simulation environment (no license needed).
- Some commercial Modelica-based simulation environments exist (Amesim, Dymola, Wolfram SystemModeler)



Models for IDRO-FTM

FTM



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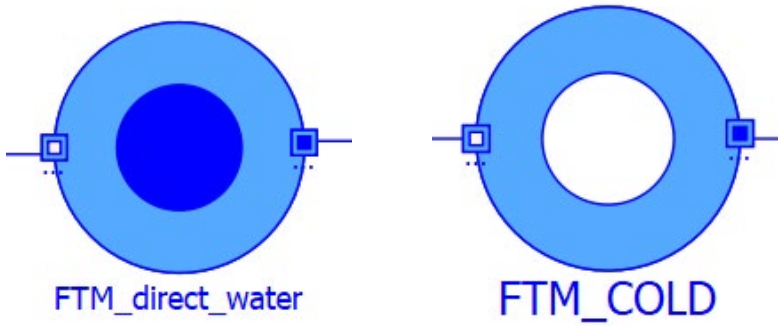
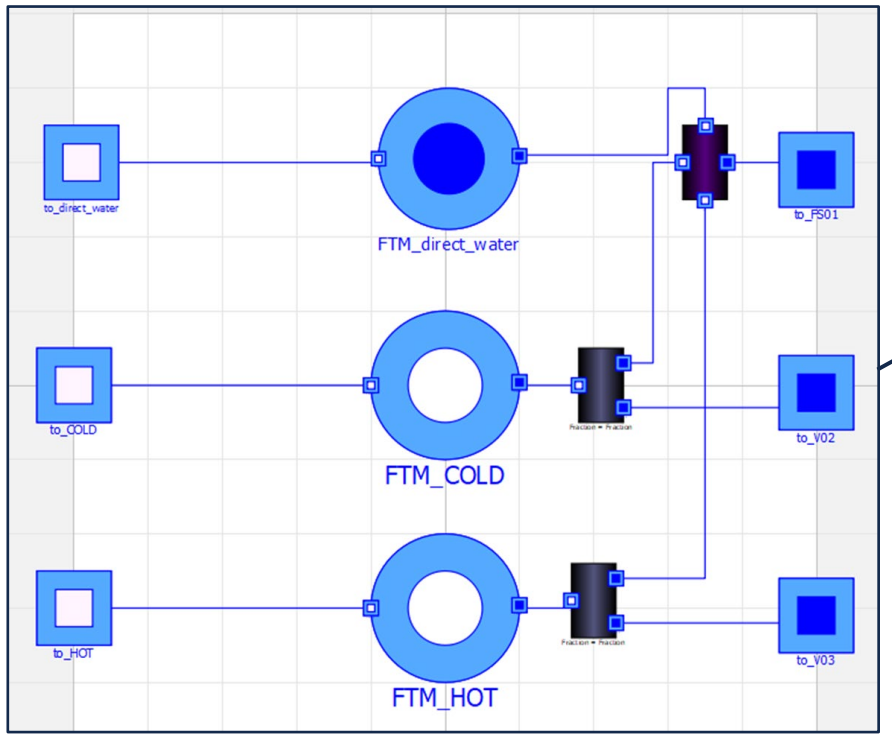
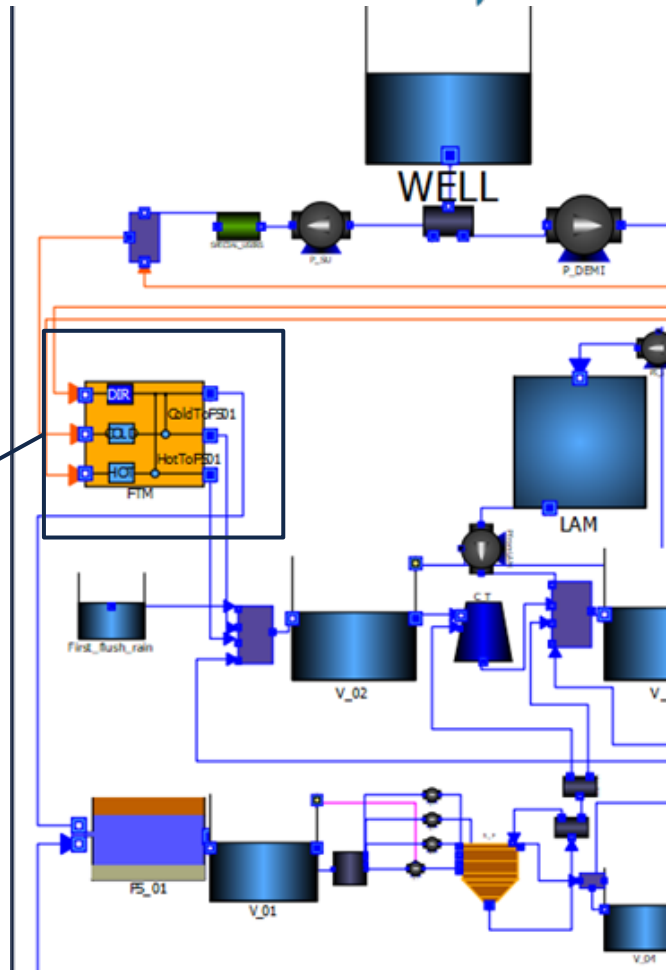
Models for IDRO-FTM

FTM

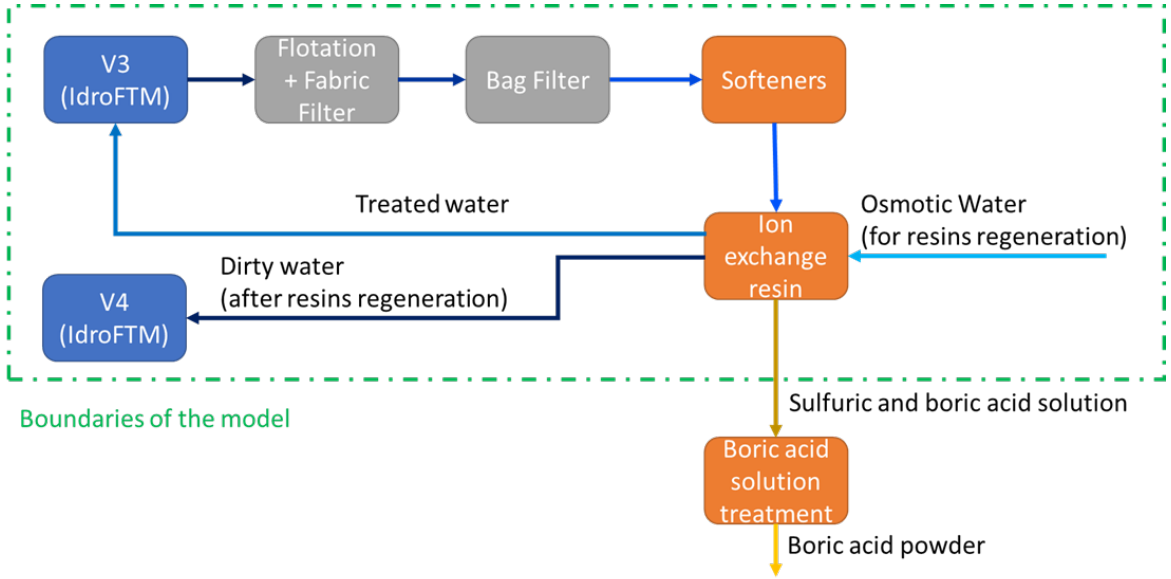


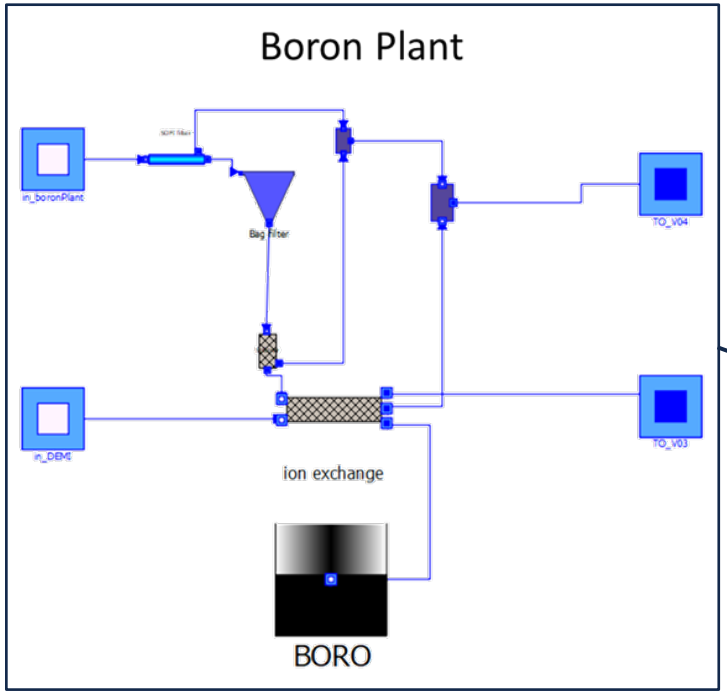
Direct Water	Indirect Water
Temperature is affected	Temperature is affected
Flowrate is affected	Flowrate is constant
Composition is affected	Composition is constant

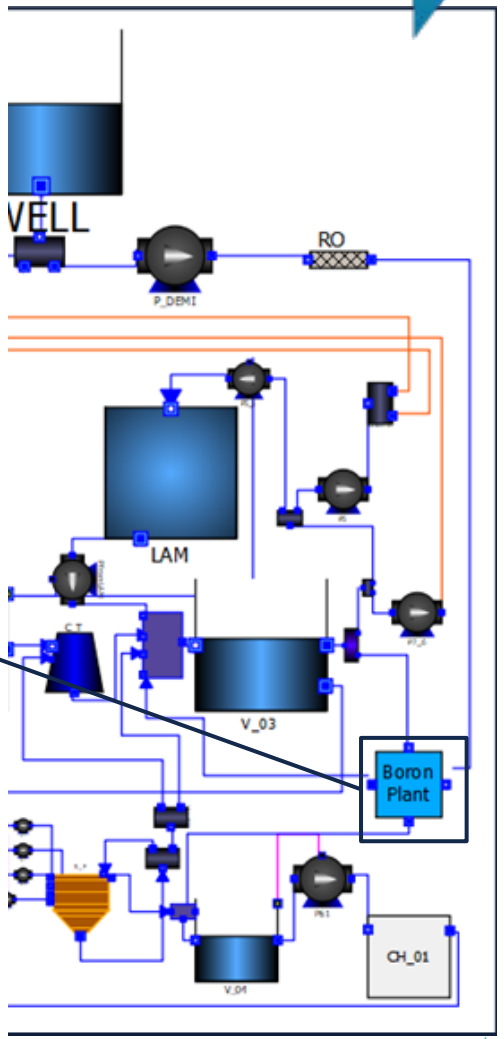




Models for IDRO-FTM
Boron Plant







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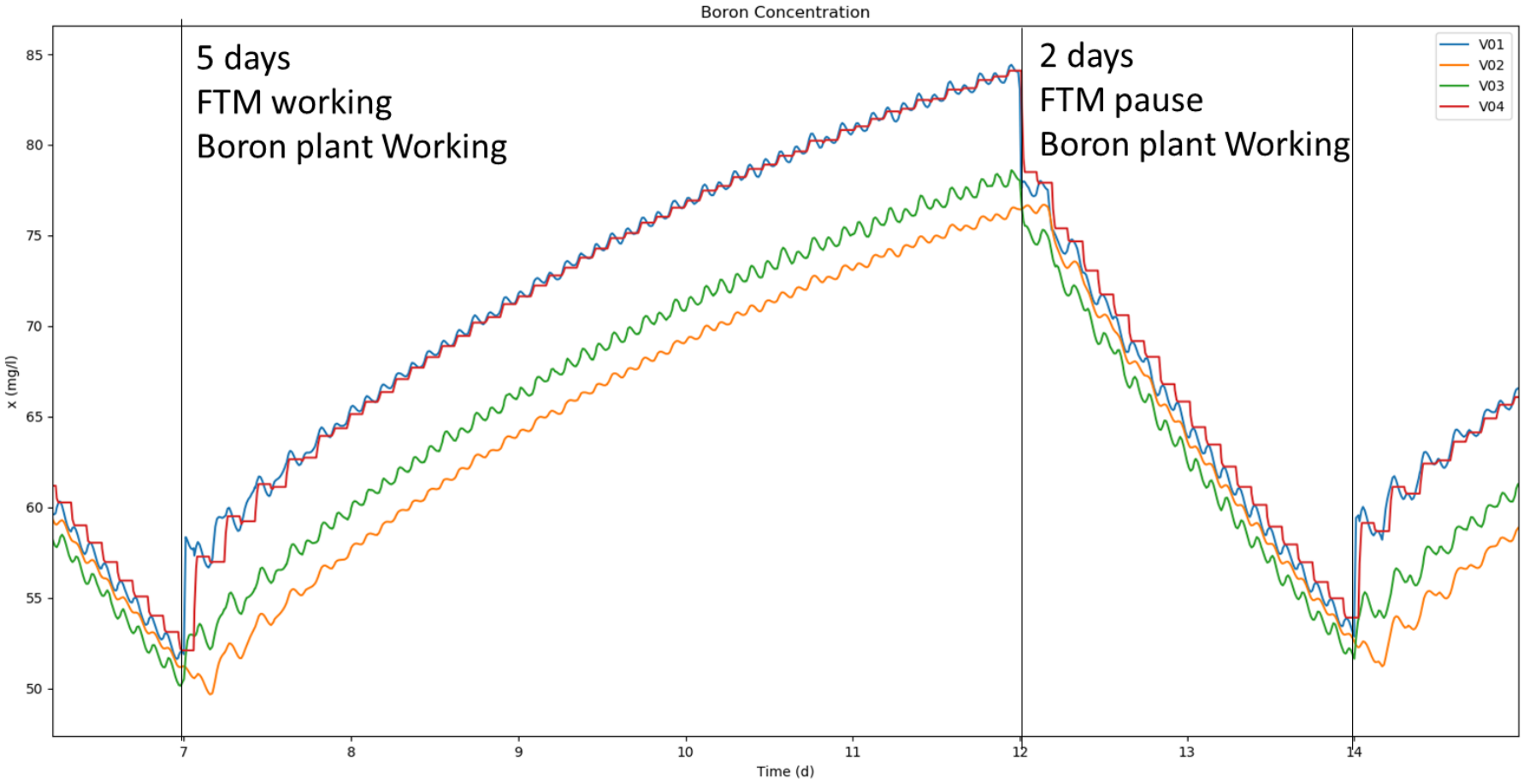
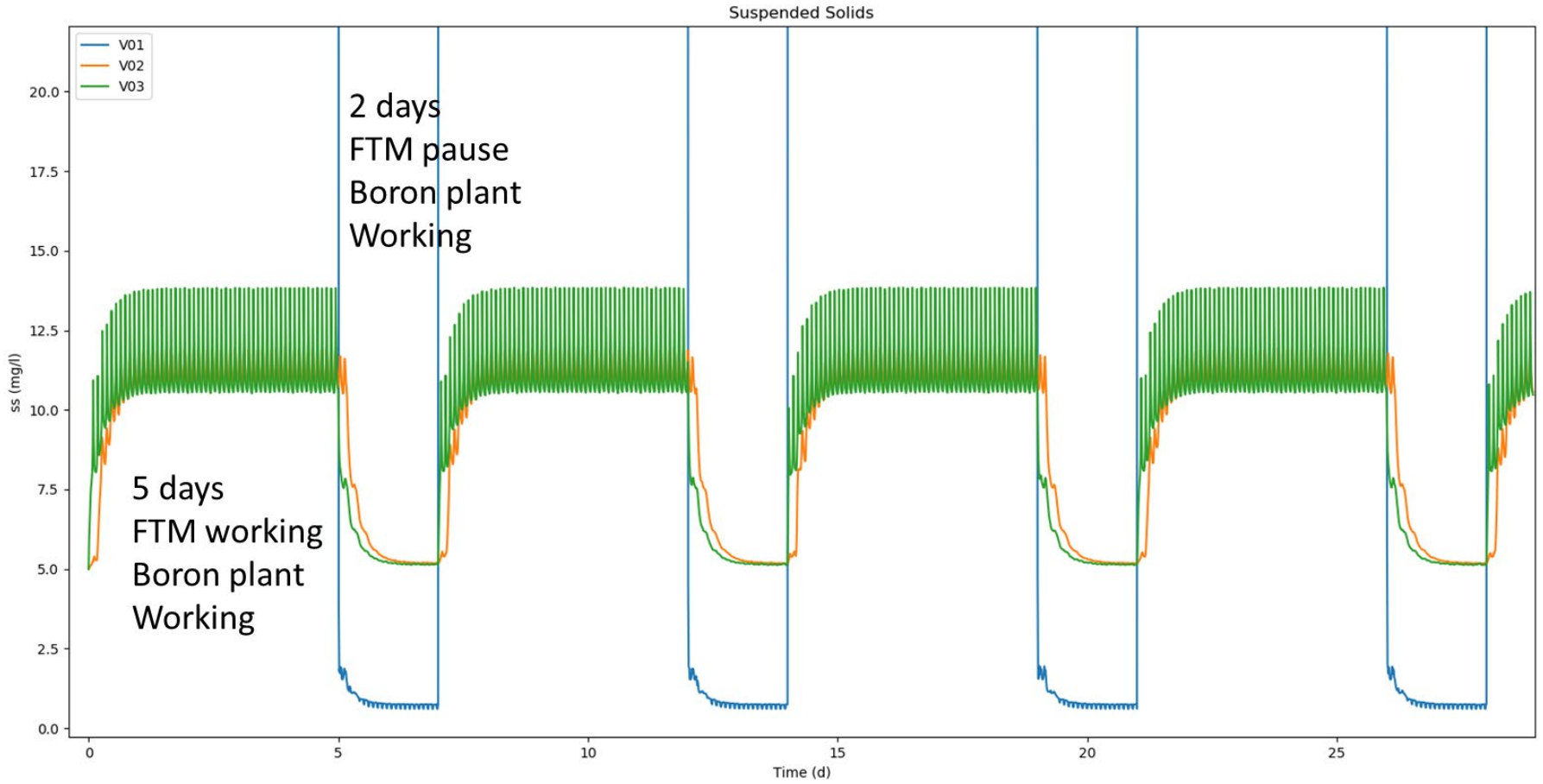
Tenaris – Boron Plant

Week cycle - boron



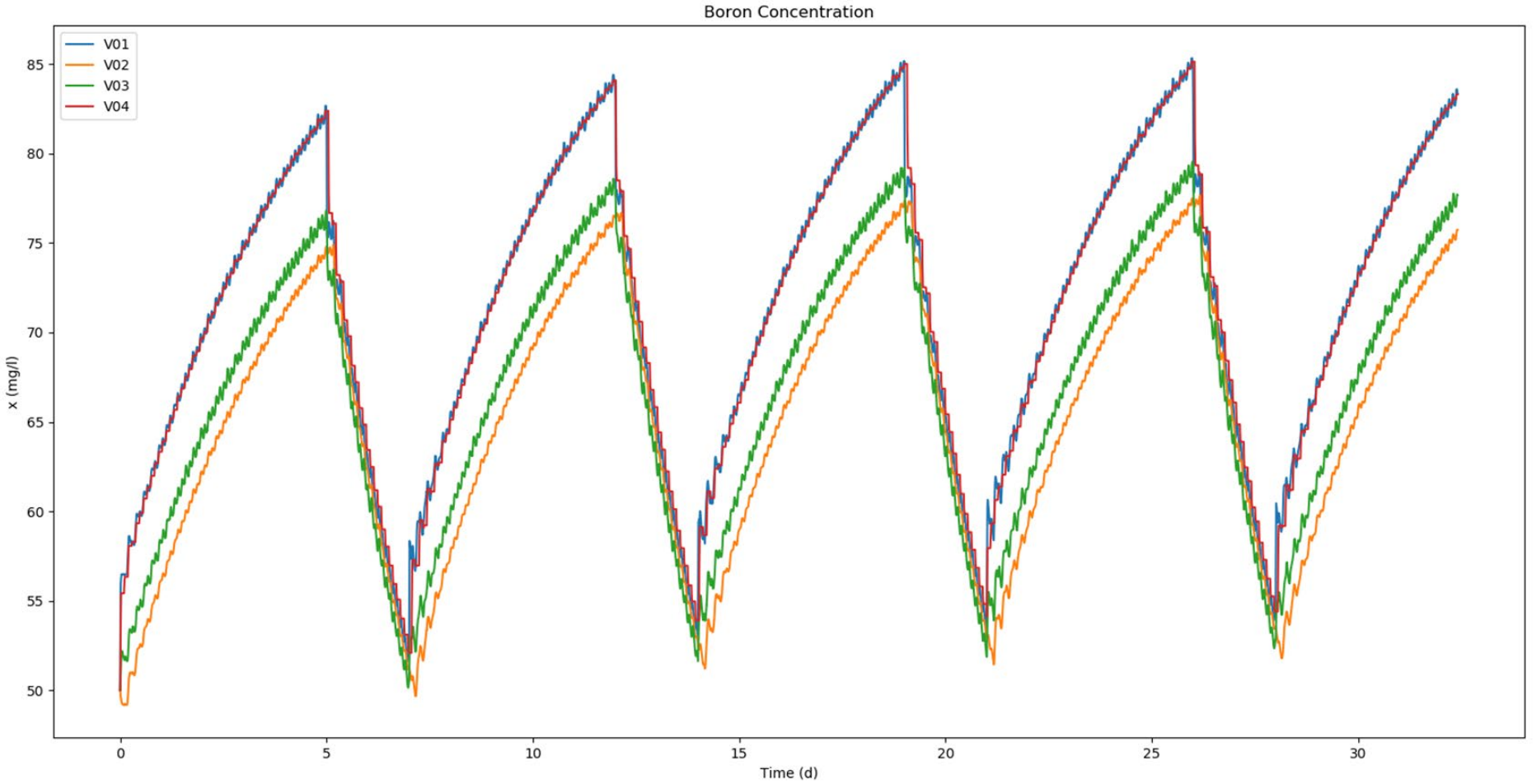
Tenaris – Boron Plant

Week cycle - total suspended solids



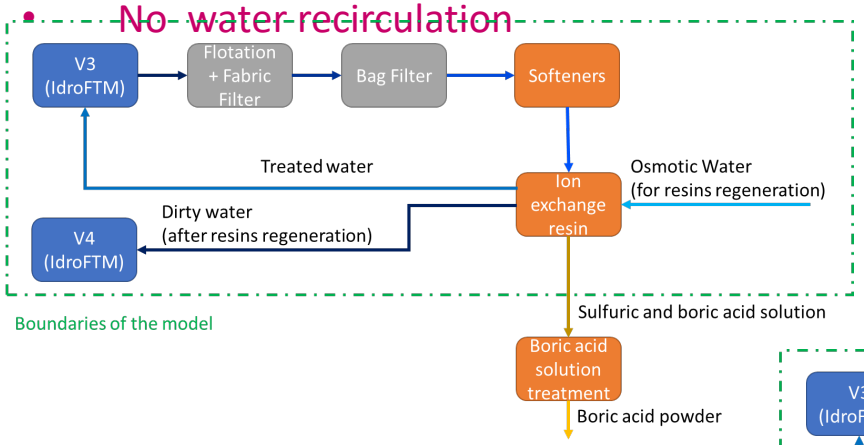
Tenaris – Boron Plant

Month cycle - boron



Tenaris – Boron Plant
Comparison

- **Base**
- Flotation + Fabric Filter
- No water recirculation



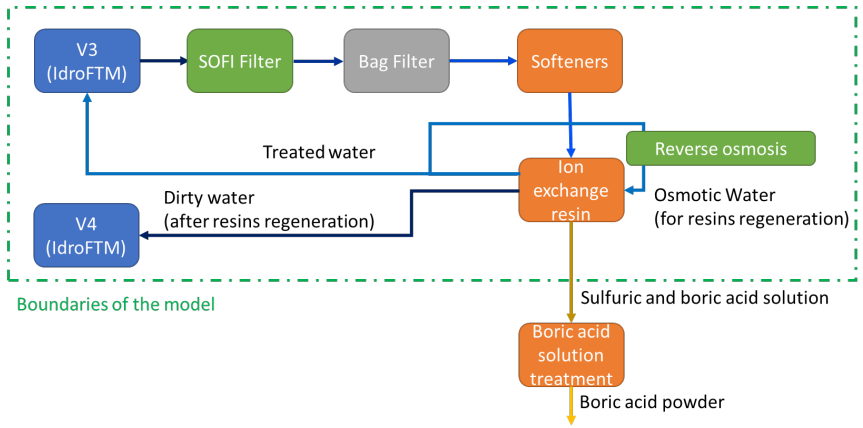
The SOFI filtration

- dynamic cross-flow filter
- self-cleaning technology
- no need for chemicals

SOFI + REC

SOFI

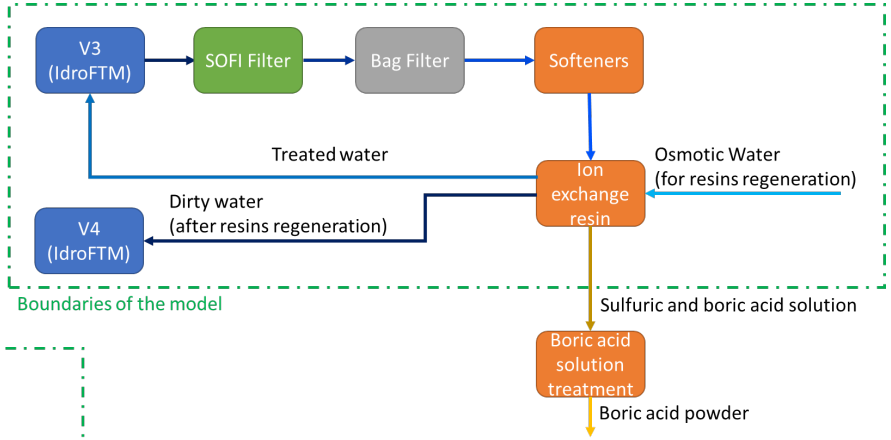
Water recirculation for resins regeneration



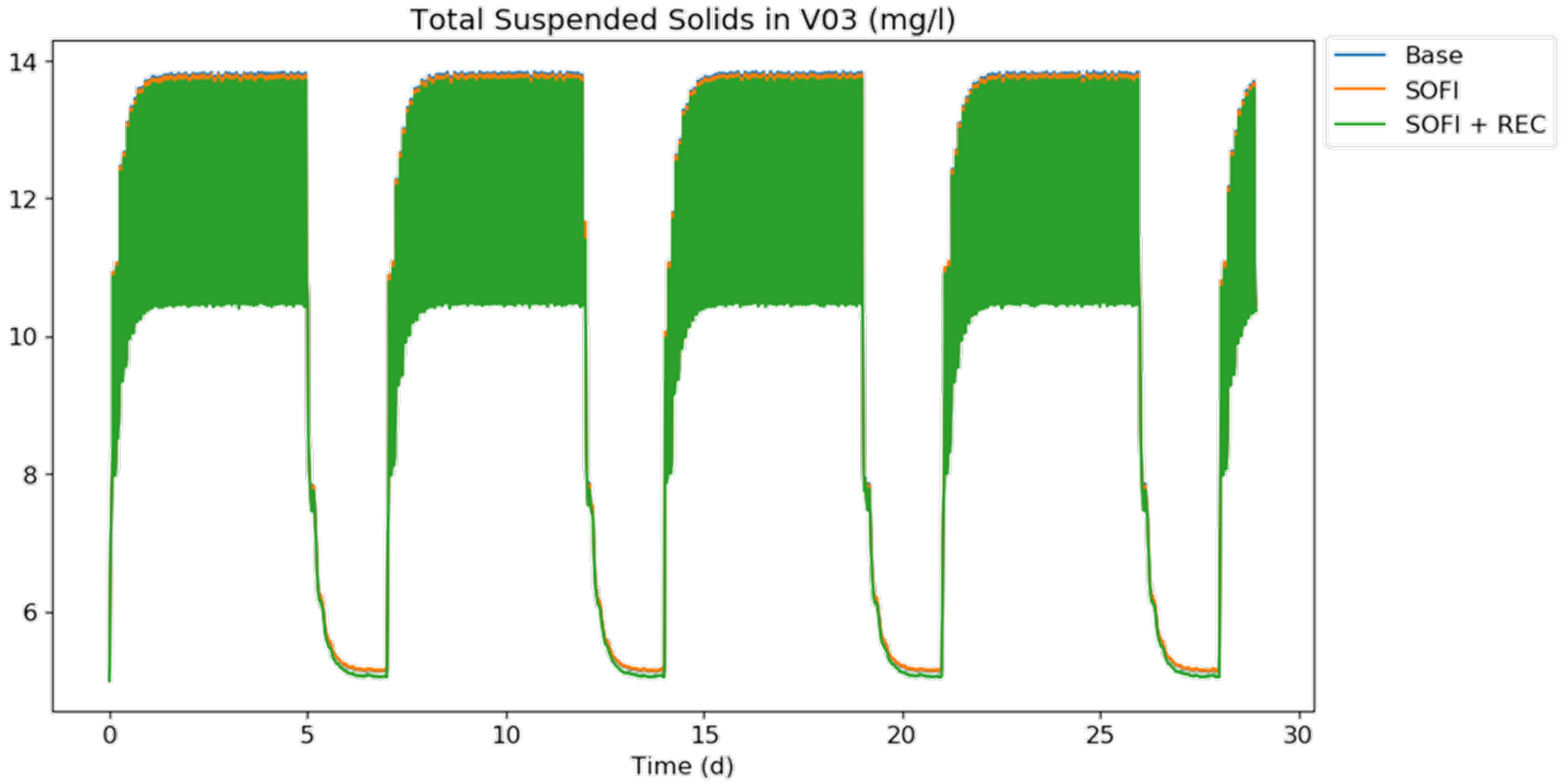
SOFI

SOFI

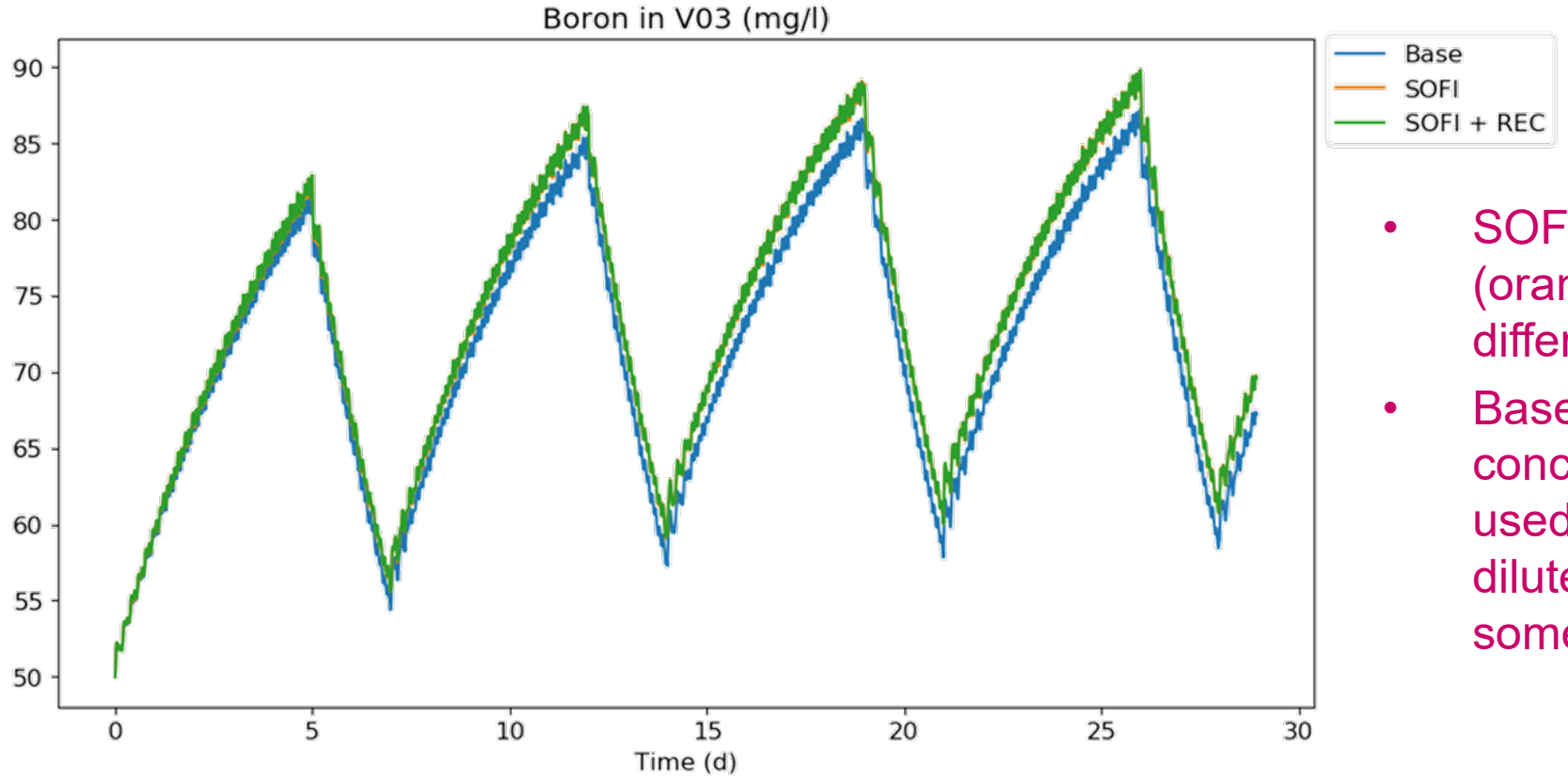
No water recirculation



Tenaris – Boron Plant
Comparison of Total Suspended Solids

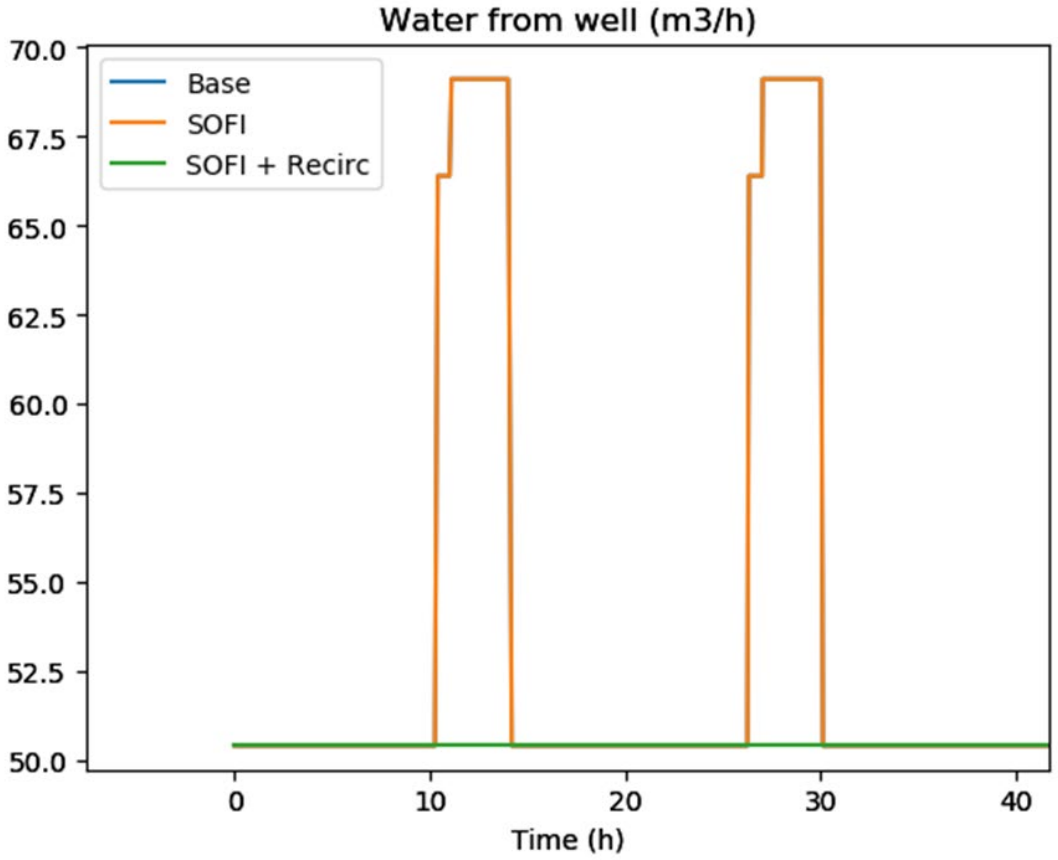


Tenaris – Boron Plant
Comparison Boron Concentrations



- SOFI (green line) and SOFI+REC (orange) does not show any difference.
- Base case has lower boron concentrations because all water is used and the concenctration is diluted, while SOFI case uses some water for backwashing.

Tenaris – Boron Plant
Well water intake



Water from well is requested by two units:

1. Special users: a cluster of units who needs clean water; they requests 50 m3/h, 24/24 h
2. Demi Pump: this pump is devoted to send water to Reverse Osmosis unit in order to supply demineralized water to boron plant; it request almost 20 m3/h for 4 hours, every 10 hours

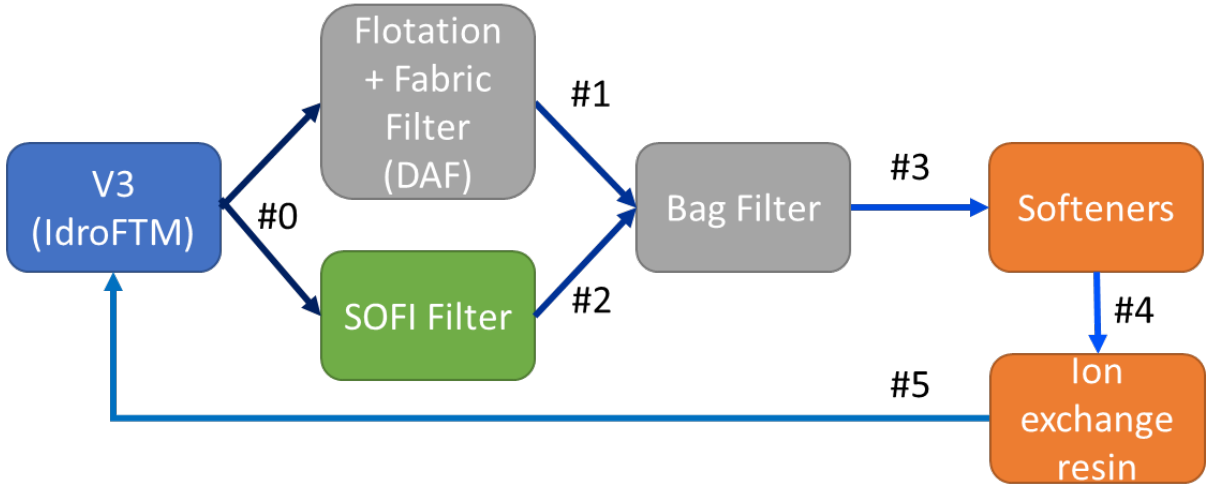
- In case SOFI + Recirc (green line), demineralized water is produced by the boron plant water. The well water request is only 50 m3/h

Tenaris – Boron Plant
Conclusions

Implementations of SOFI filtration plant and internal recirculation would allow for reduction of well water intake

Tenaris – Replacing well water
Pollutants in boron plants streams

Variable	Maximum Limits
Total Suspended Solids	< 10 mg/l
Boron Concentration	100 mg/l



#	Position	Base B (mg/l)	SOFI B (mg/l)	SOFI+REC B (mg/l)
0	From V03	87.25	89.9	89.8
1	After DAF	87.25		
2	After SOFI		89.9	89.8
3	After BAG	87.25	89.9	89.8
4	After Softener	87.25	89.9	89.8
5	After Resins	2.21	2.25	2.25

< 100 mg/l

#	Position	Base ss (mg/l)	SOFI ss (mg/l)	SOFI+REC ss (mg/l)
0	From V03	13.8	13.8	13.8
1	After DAF	6.93		
2	After SOFI		8.0	7.95
3	After BAG	6.37	7.36	7.31
4	After Softener	6.37	7.36	7.31
5	After Resins	6.37	7.36	7.31

< 10 mg/l

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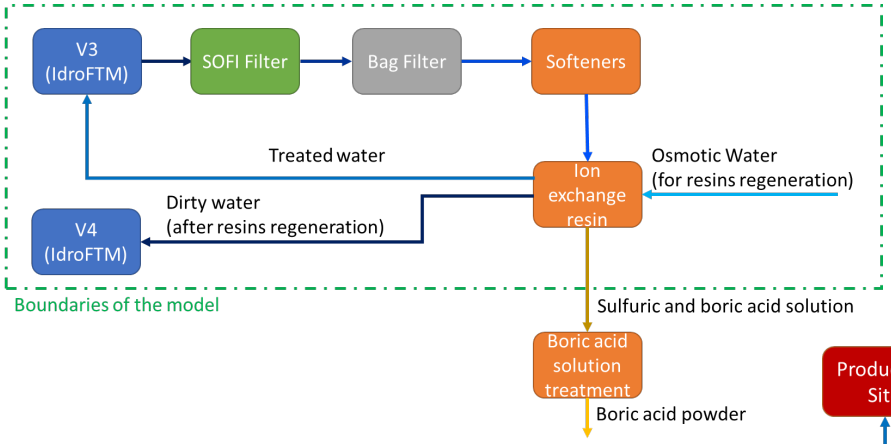
Tenaris – Replacing well water
Comparison

SOFI

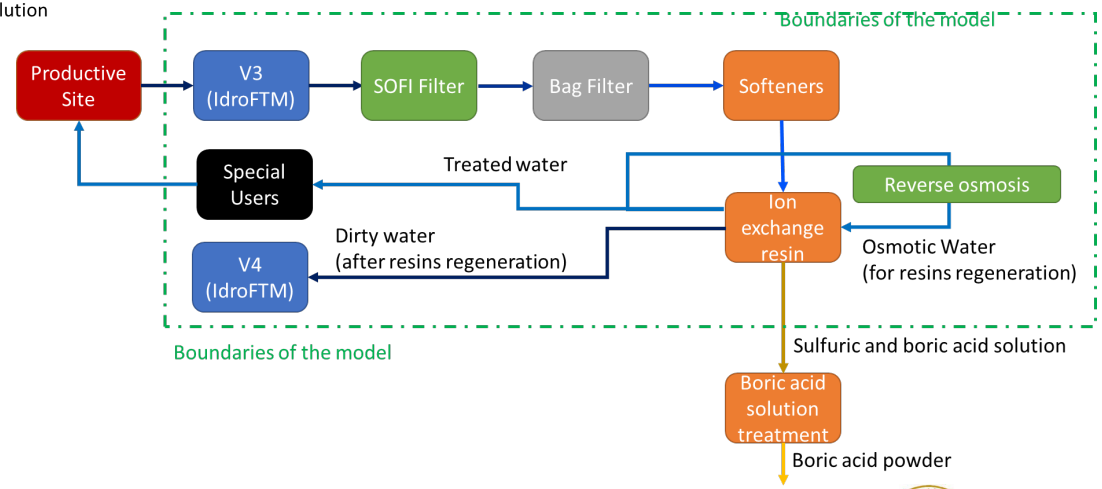
SOFI

No water recirculation



SOFI + REC + to SU

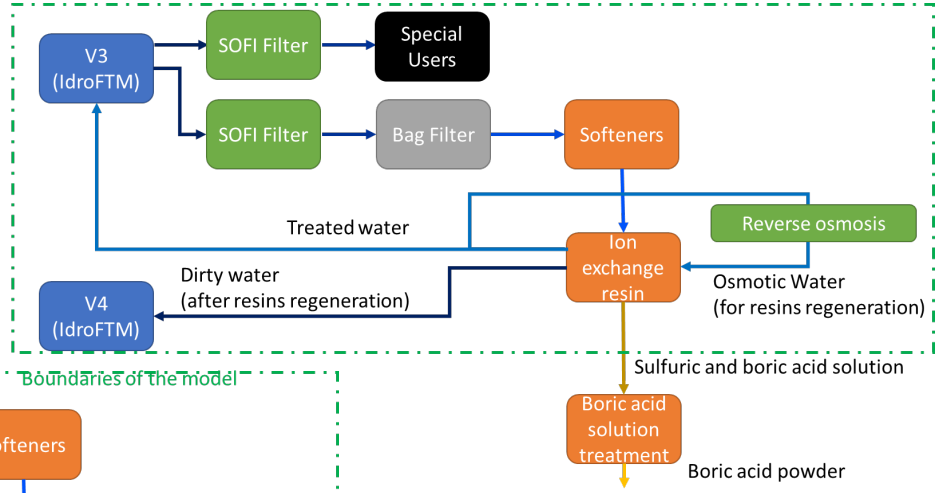
Water from Boron Plant to Special Users



SOFI + REC + SOFI to SU

Water from Boron Plant to V03

Water from second SOFI to Special users



Water from Boron Plant to Special Users:

Water is pumped from well to compensate low water production of boron plant (resins regeneration)

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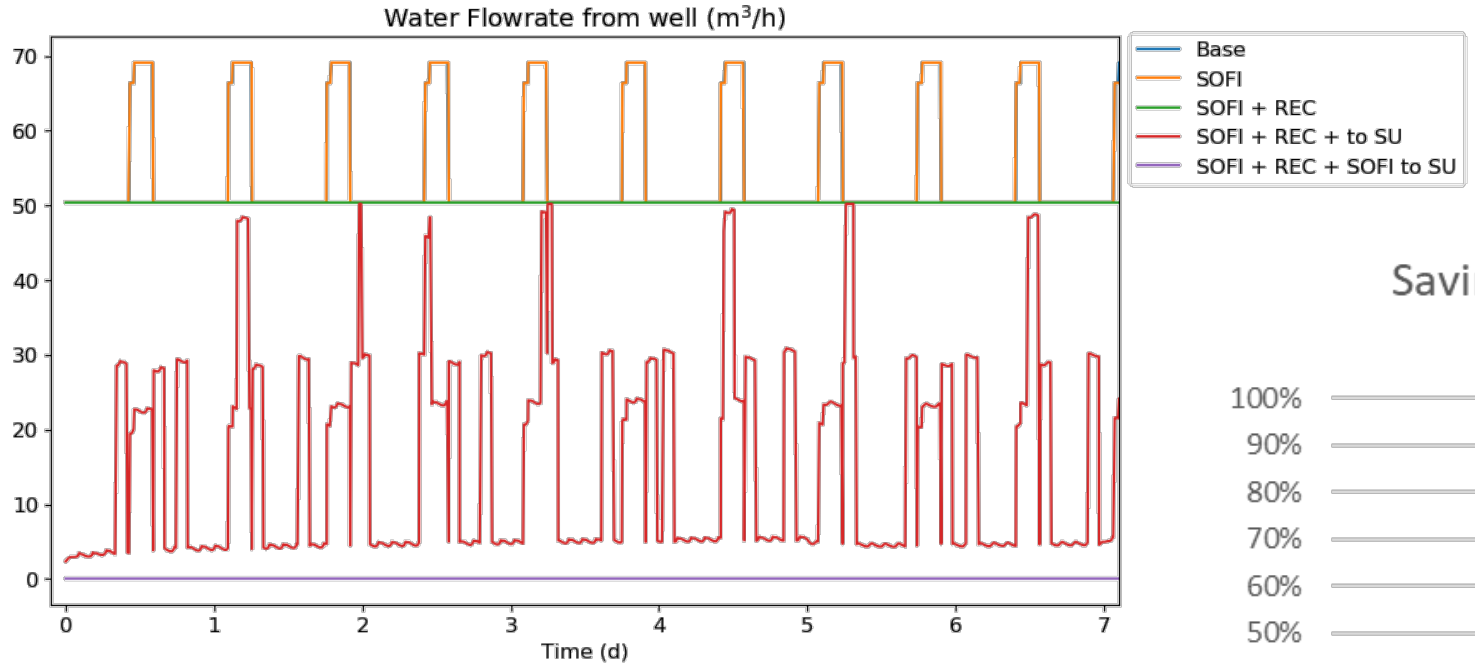
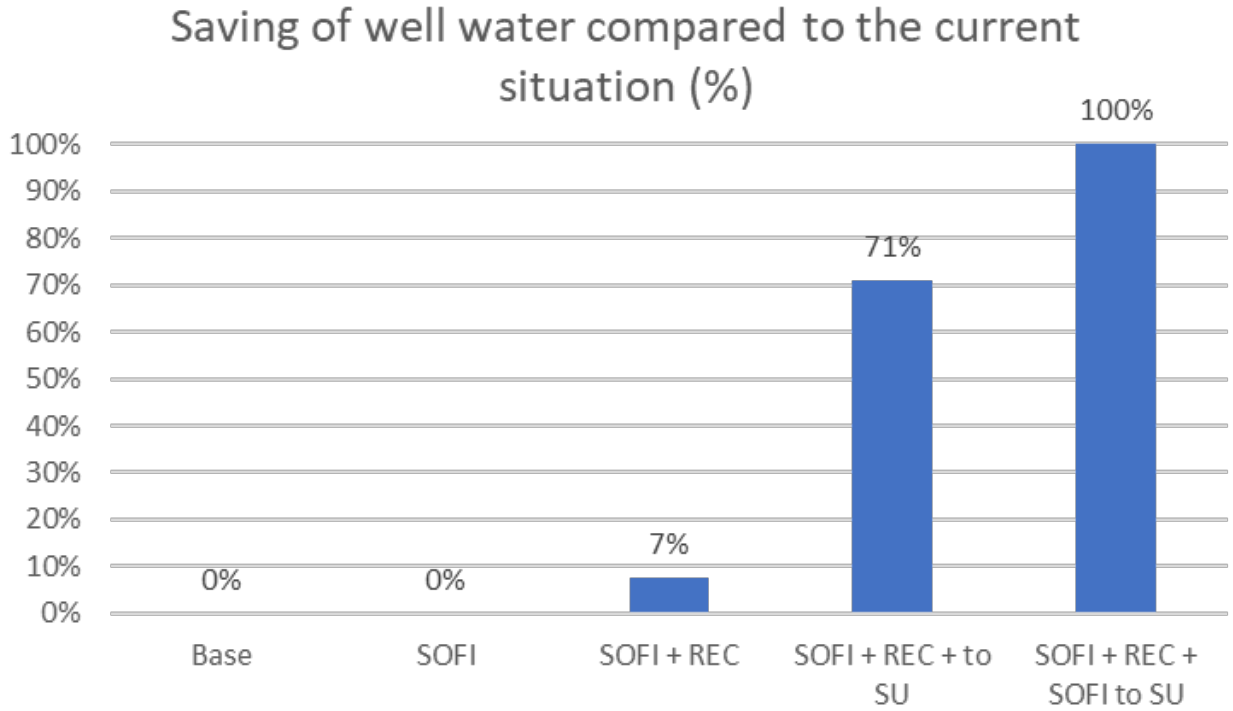
Tenaris – Replacing well water

Well water intake





- Most of well water saving is due to new recirculation from boron plant to special users (but water management is more complex)
- With 2 SOFI filtration plant, no well water is needed (theoretically)

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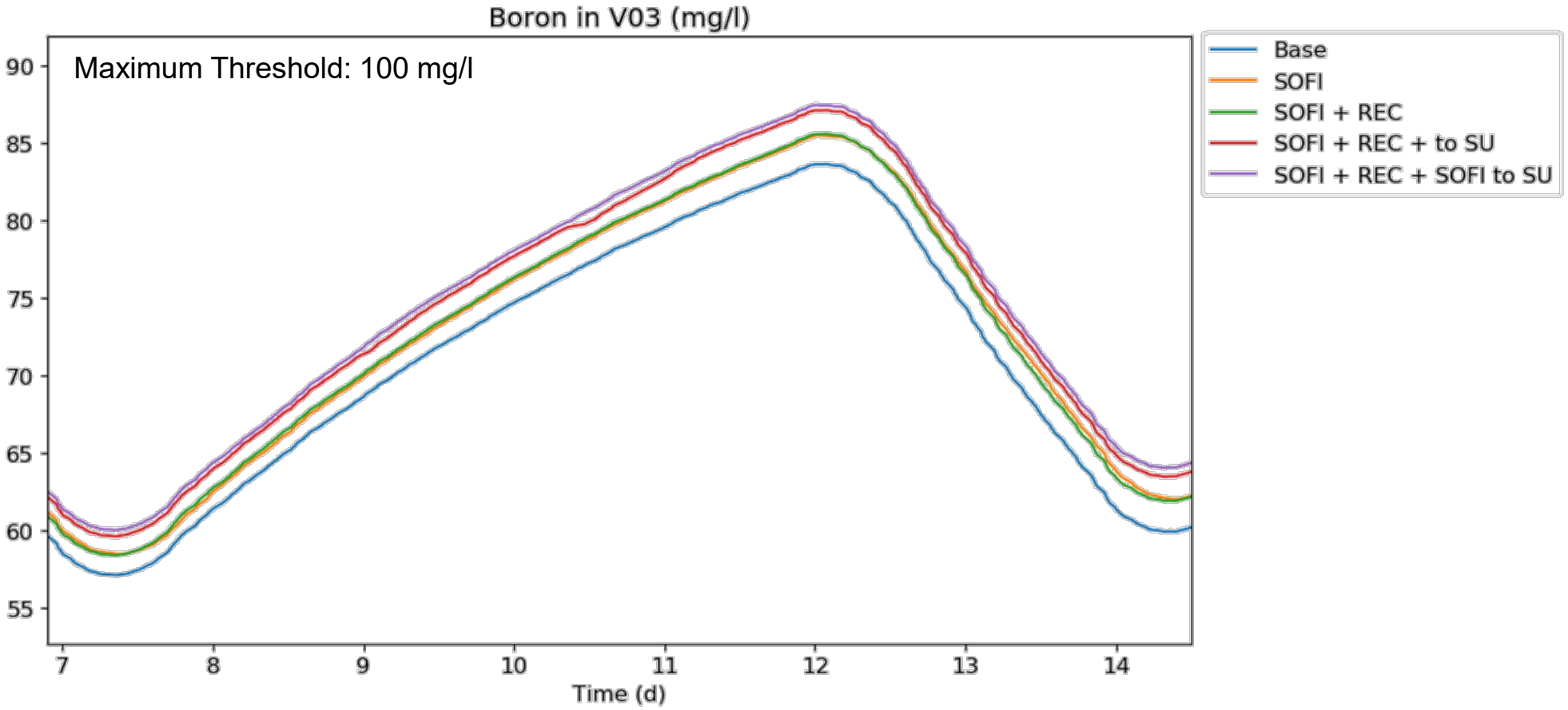
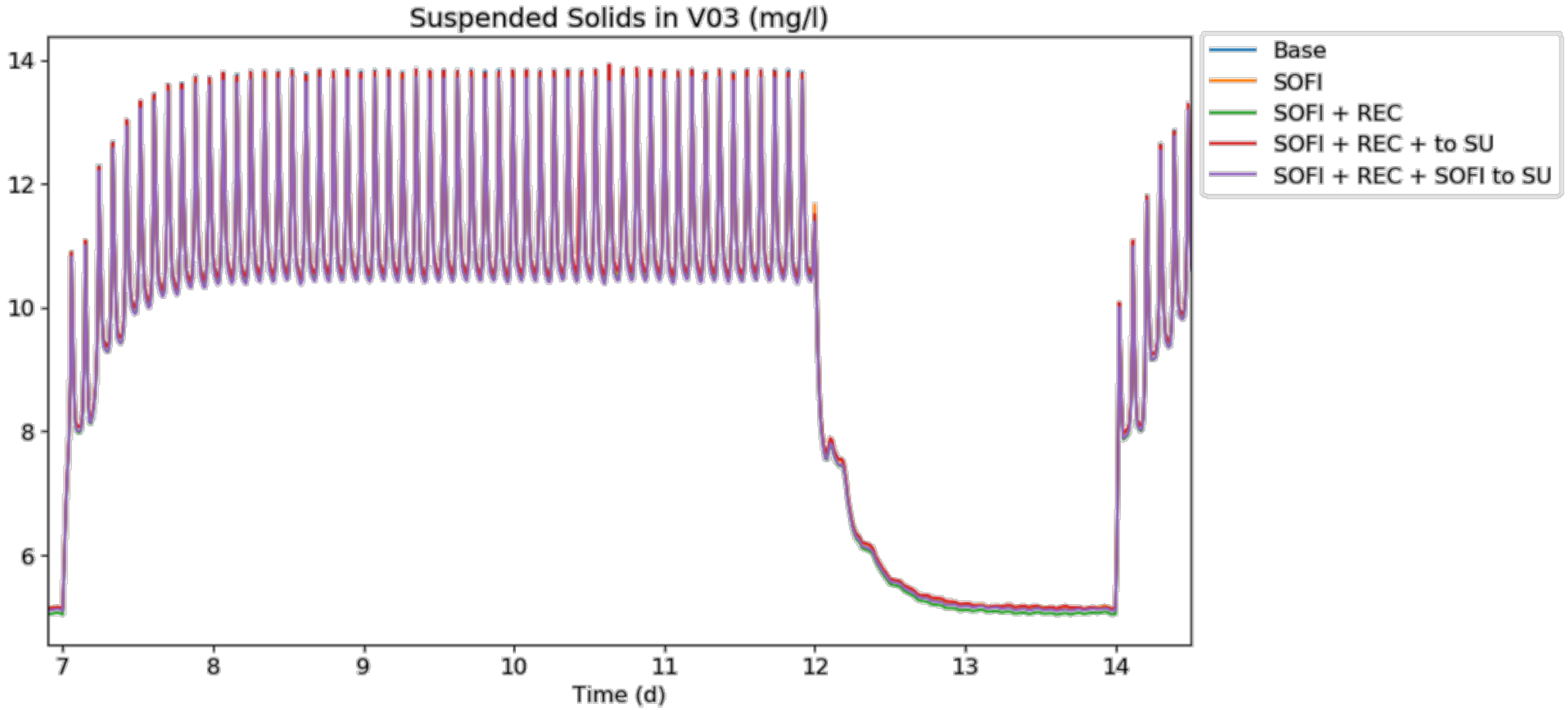
Tenaris – Replacing well water
Boron Concentration



Tenaris – Replacing well water
Total Suspended Solids



Tenaris – Replacing well water
Conclusions

- SOFI filtration application will lower the total suspended solids below the thresholds for Special Users.
- Boron concentration is always lower than thresholds for Special Users.
- Internal water recirculations strongly lower the well water intake.

Tenaris Case Study
Conclusions

- The water treatment plant was modeled using Modelica language
- The model can be used as a soft sensor, to test operative practices and to assess the impact of innovative technologies on the plant
- The tests can be carried out on different portions of the plant (boron plant and internal recirculation, recirculation within the entire water treatment plant)
- The tests allowed showing the possible water saving compared to the original configuration, in compliance with the operative constraints of the plant.