

Cooperation



# gPROMS Modelling Platform

Models, Libraries and Applications as Digital Twin in Water

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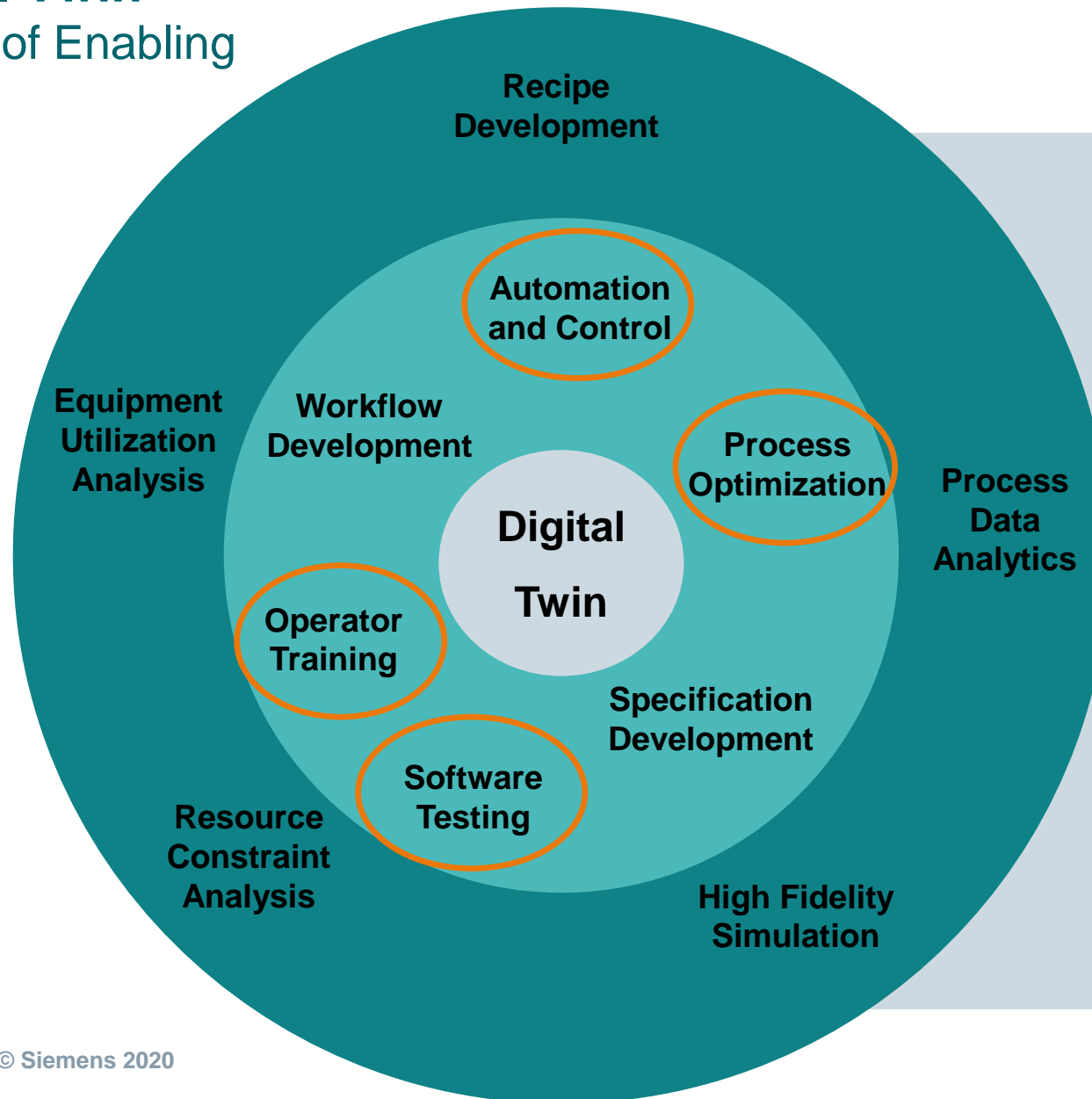
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A Siemens Business

# Digital Twin

## Levels of Enabling



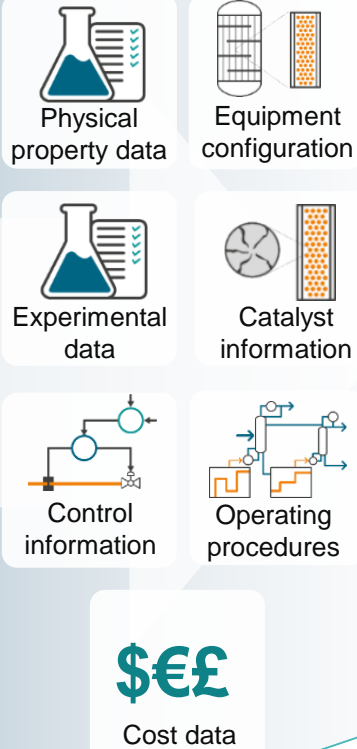
### Objectives

- Experience the plant in a virtual environment
- Test new logic off-line
- Reduce startup cost  
→ Commissioning without tying up plant resources by using simulation
- Access to the (simulated) process for multiple disciplines
- Validate new / modified SOPs (Batch, MES, manual)
- Emulate plant occupation and timing
- Replay of process data

# gPROMS – Advanced Process Modelling Capabilities

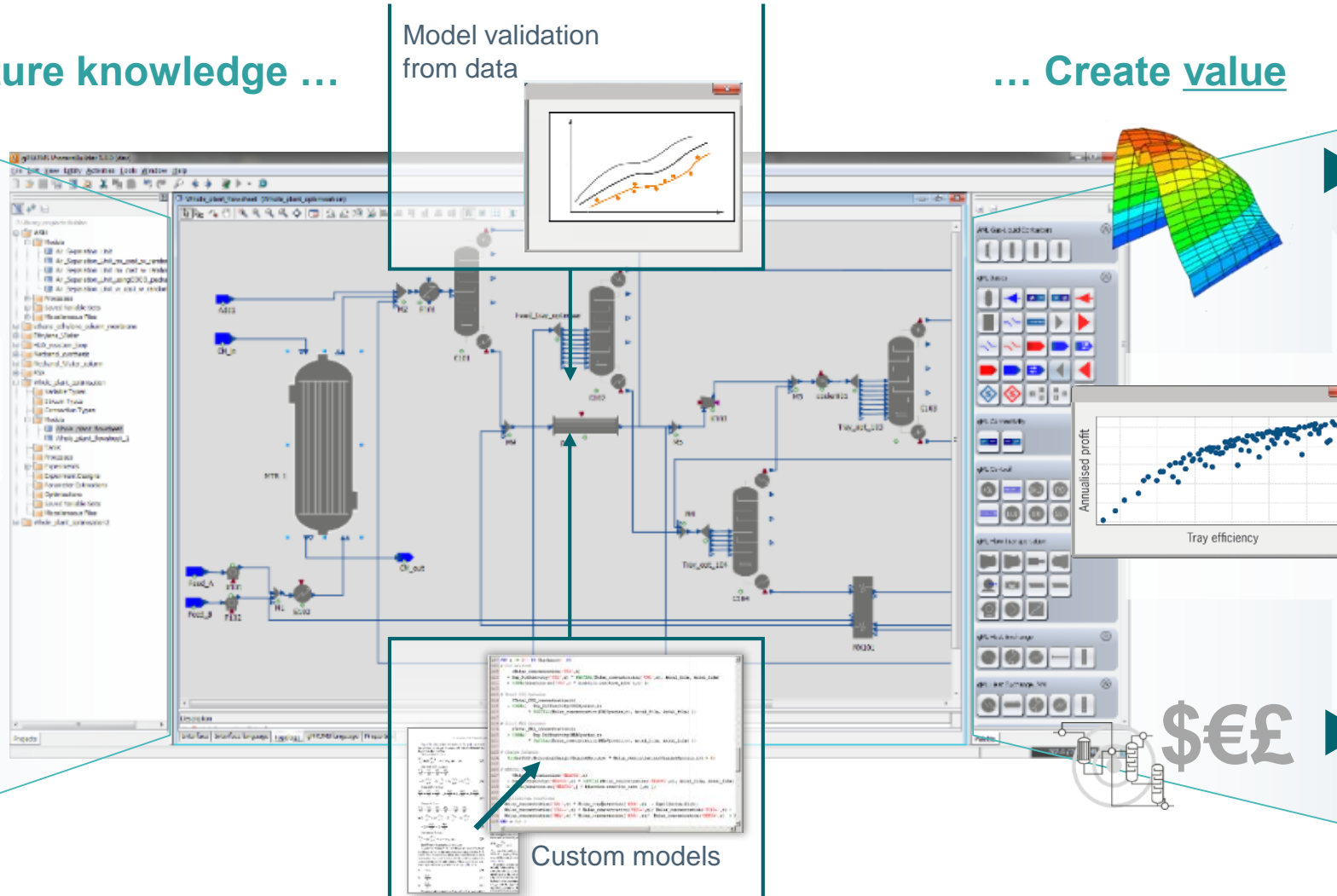
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Capture knowledge ...



Model validation  
from data

... Create value



► **Simulation**  
Enhance understanding of complex processes

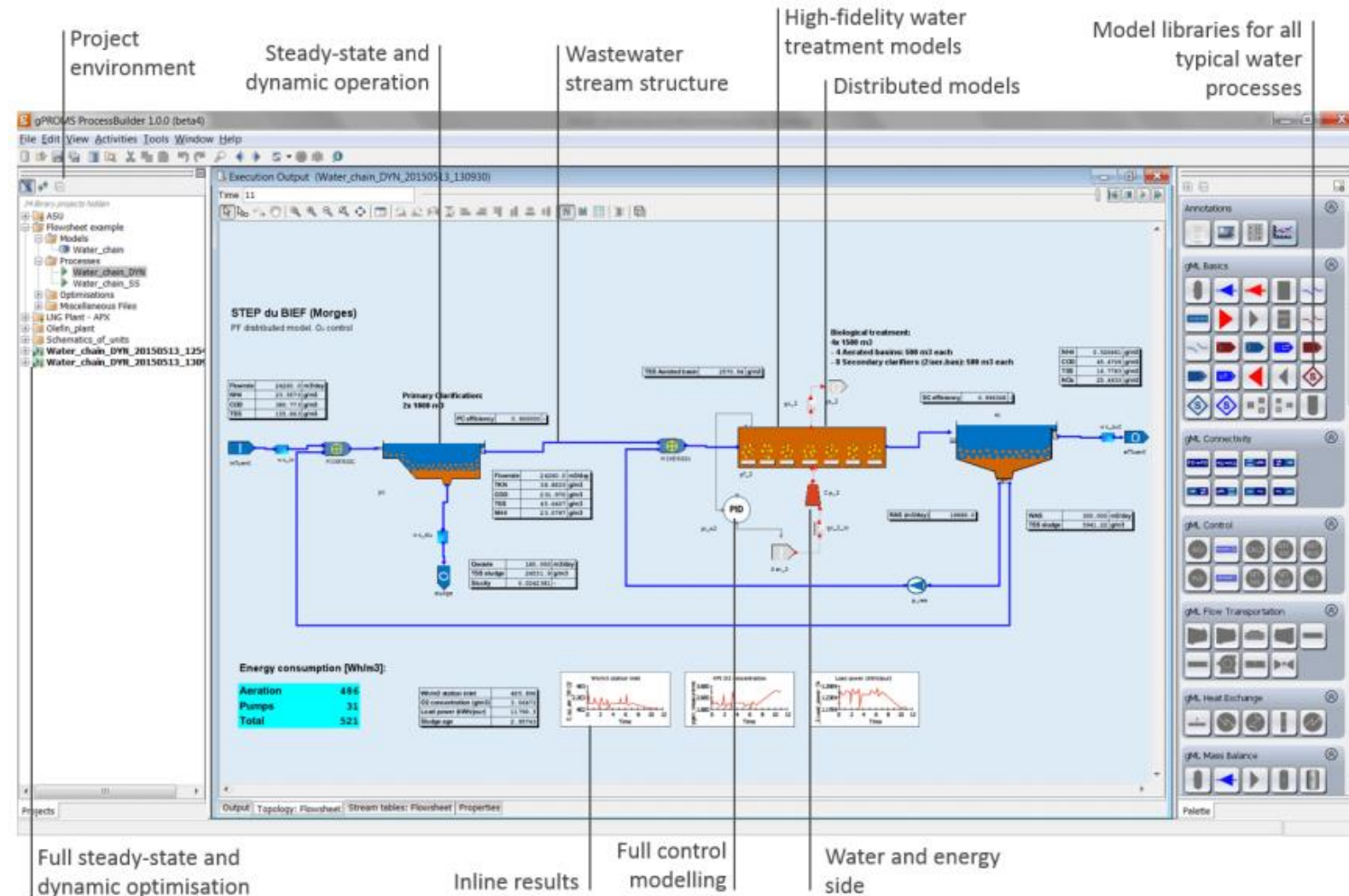
► **Global System Analysis**  
Rapidly explore decision space, uncertainty, risk

**\$€£** ► **Optimization**  
Maximize economic performance



# Digital Model-Based Optimization of Water Treatment Plants

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## High-Fidelity Predictive Models for Water treatment Plants

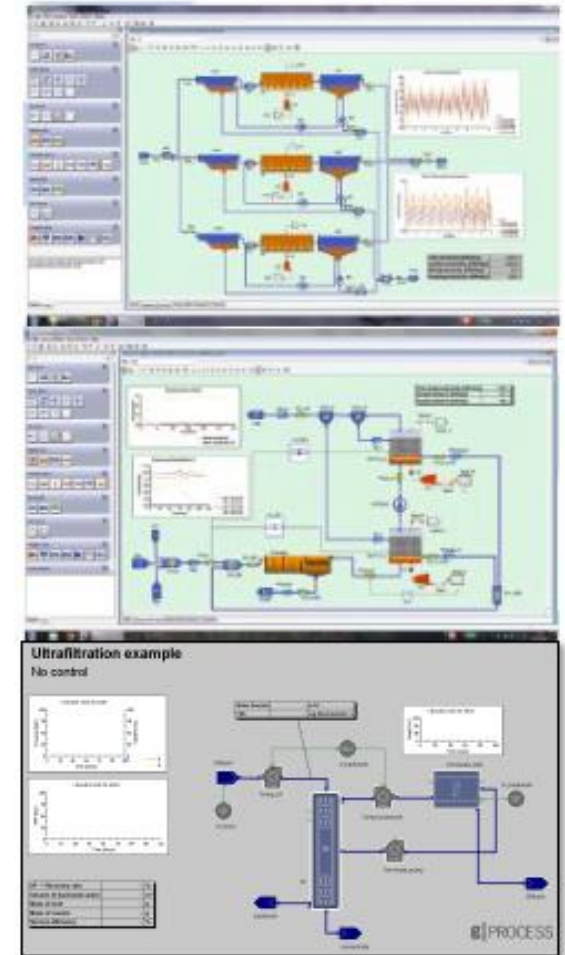
- Enable rapid exploration of the process decision space for optimizing of water treatment process design and operation
- Provide accurate information for reducing energy and chemical consumption
- Support informed decision making about current and future plant capacity and minimizing capital and operational costs

# Water Process Applications

**Flowsheets and libraries** also for complex water treatment plants involving processes like

- Aerobic process, especially aeration basin or activated sludge process
- Anoxic / aerobic selector
- Clarifier / Thickener, sludge decanter, anaerobic solid / sludge digester
- Biogas treatment, e.g. scrubber and utilization e.g. boiler, CHP
- Membrane filtration, membrane bio reactor (MBR)
- Sludge thermal hydrolysis
- Flotation / coagulation / flocculation
- Ion exchange
- Granulated sludge
- Anaerobic reactor (UASB or similar high rate anaerobic WWT processes)
- SBR

**Optimizer** includes integer / discrete decisions on how to operate different treatment / many lines towards maximum efficiency



# gPROMS Software Suite

## User Interfaces for Process Developers and Planners / Engineers

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The screenshot displays the gPROMS ProcessBuilder 14.8 software interface, which is divided into two main sections: 'For Developers' and 'For Engineers'.

**For Developers (Top Section):** This section shows the gPROMS language code for a process model named 'gWATER\_MST\_optimised'. The code includes various assignments and calculations, such as:

```
79 influent_mix.Water_outlet(1) = Anox_1.Water_inlet;  
80 influent.Water_outlet = influent_data.Water_inlet;  
81 WWR_recycle_pump.Water_outlet = influent_mix.Water_inlet(1);  
82 P2.Adjust = InAir_2.setPoint(1);  
83 InAir_2.outlet = P2.outlet;  
84 InAir_1.outlet = Cpl.inlet;  
85 P1.Adjust = InAir_1.setPoint(1);  
86 Cpl.outlet = Aerobic_1.Soa_inlet;  
87 P2.outlet = Aerobic_2.Soa_inlet;  
88 P1.target = Aerobic_1.Measurements(1);  
89 P2.target = Aerobic_2.Measurements(1);  
90 influent_data.Water_outlet = influent_mix.Water_inlet(2);  
91 PWS_pump.Water_outlet = influent_mix.Water_inlet(3);  
92 Equation  
93 # ----- Electricity EPI  
94 Power_total = | Cpl.REP(1).Energy_rate + P2.REP(1).Energy_rate * 1000 * 1/41.866 + PWS_pump.Pumping_Energy + WWR_recycle_pump.Pumping_Energy;  
95  
96 Power_total_specific = 1000 * Power_total / influent_data.Qliq;  
97  
98 # ----- Pollutant EPI  
99 COD_removal = 1 - effluent_data.Res("COD") / influent_data.Res("COD");  
100 BOD_removal = 1 - effluent_data.Res("BOD") / influent_data.Res("BOD");  
101
```

**For Engineers (Bottom Section):** This section shows a graphical process flow diagram (PFD) for the same process model. The diagram illustrates the flow of water and air through various units, including pumps, tanks, and aerators. The units are labeled with their respective names, such as 'InAir\_1', 'InAir\_2', 'Cpl', 'P1', 'P2', 'PWS\_pump', 'WWR\_recycle\_pump', 'Anox\_1', 'Aerobic\_1', and 'Aerobic\_2'. The diagram also shows the flow of water and air between these units, with arrows indicating the direction of flow.

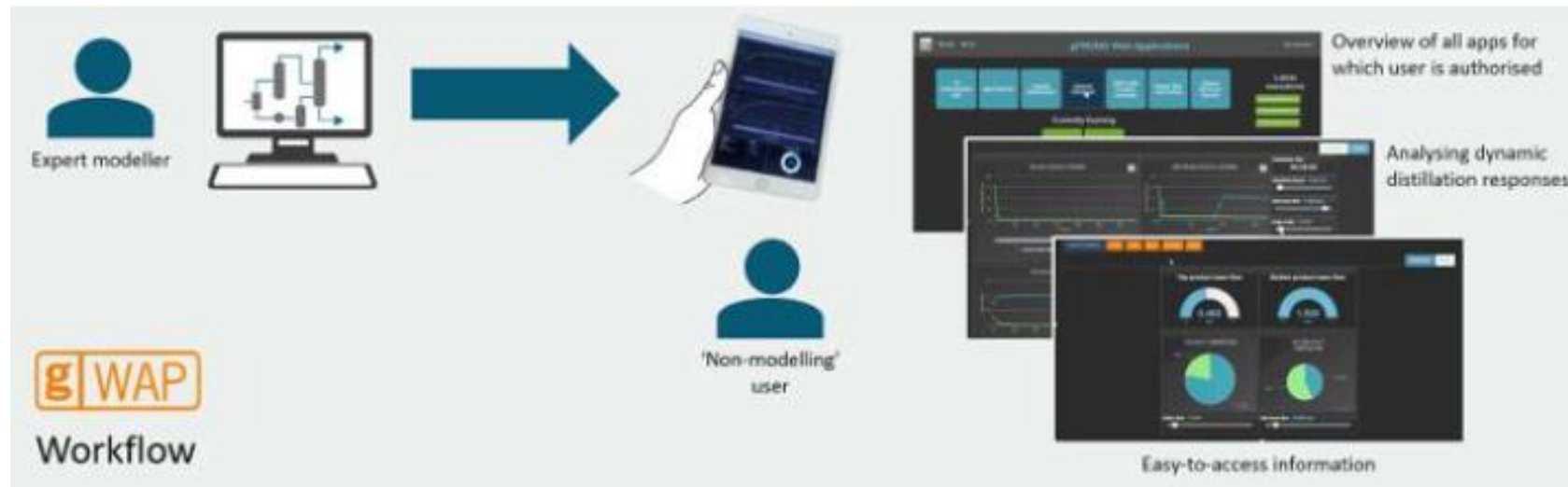
The interface includes a sidebar on the left with a search bar and a list of models, and a sidebar on the right with a search bar and a list of annotations. The bottom of the interface features a 'Projects' panel and a 'Palette' panel.

# gPROMS Software Suite

## Digital Twin: Application for Operator Support

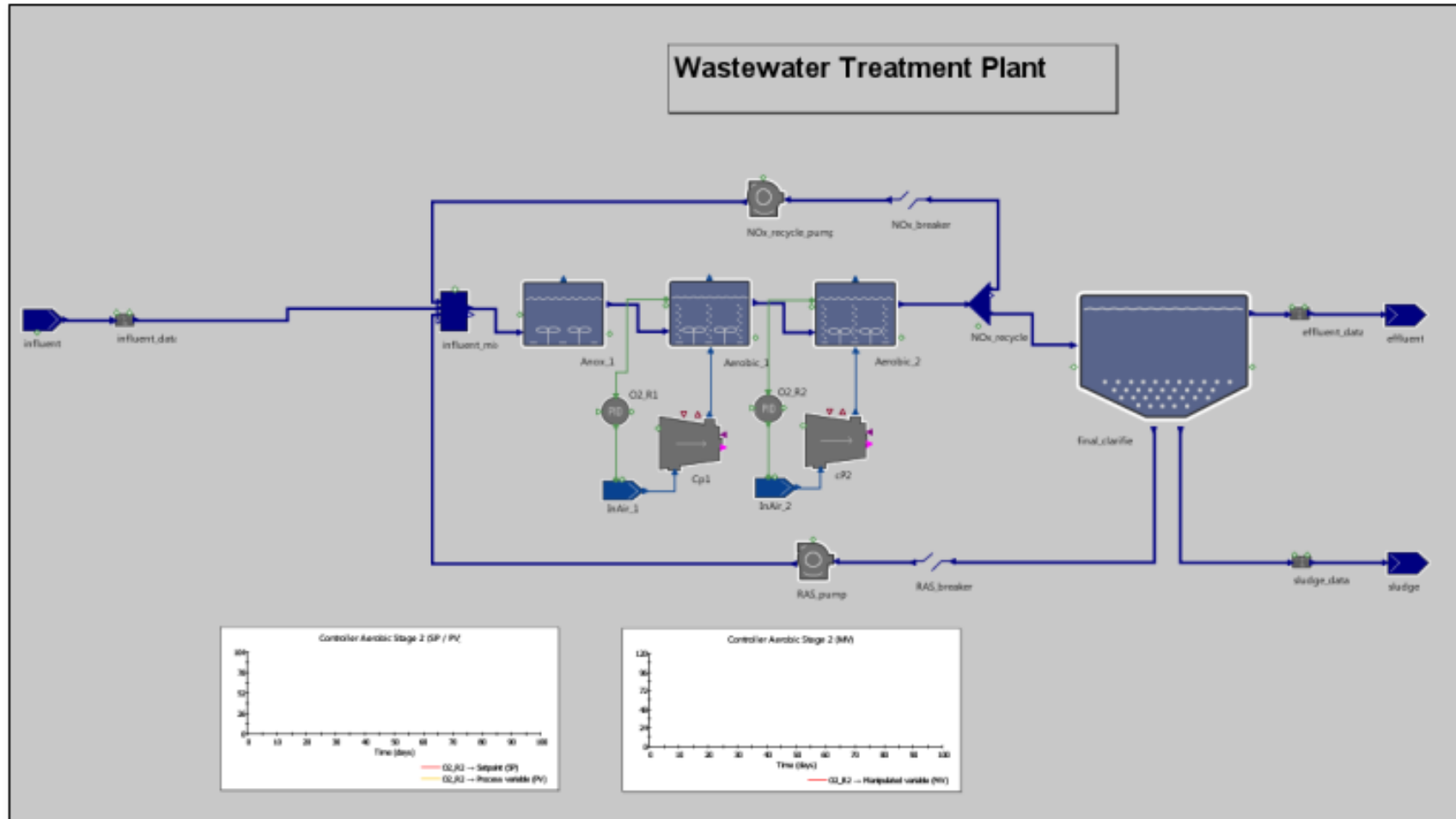
- gPROMS Web Applications Platform (gWAP) allows to publish a model behind an easy-to-use web interface
- Enables 'non-modelling users' across the organization (e.g. operating personnel) to use the information in high-fidelity models for decision support and continuous optimization
- Easy-to-use interface

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# gWATER Application I

## Basic Wastewater Treatment Plant (ASM, gPROMS Example)

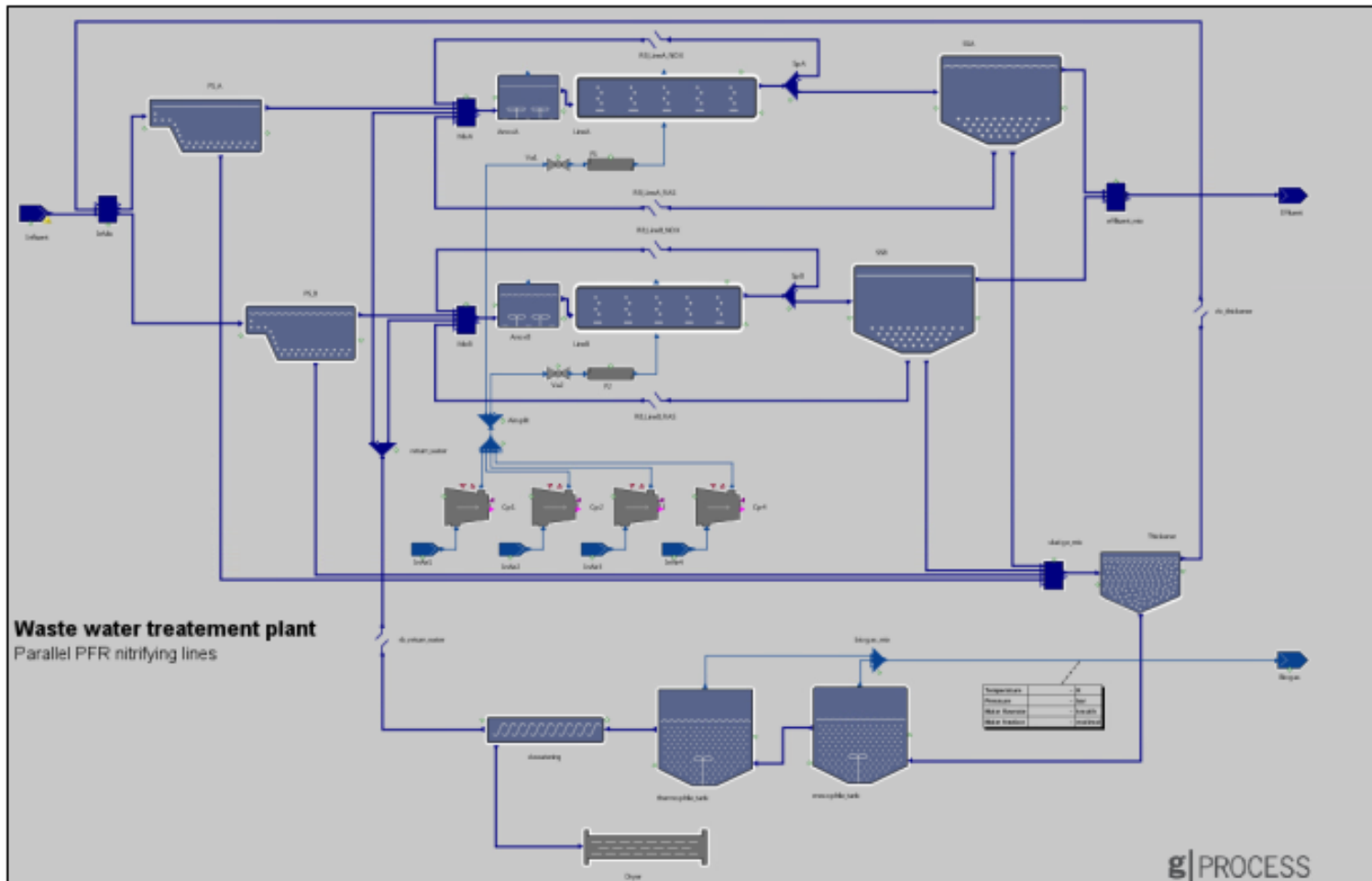




# gWATER Application II

## Plug Flow Reactor Treatment Lines with Sludge Treatment

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# gWATER Application III

## Ultrafiltration (gPROMS Example)

