

# Development and application of Digital Twin Technology in Water Resource Management

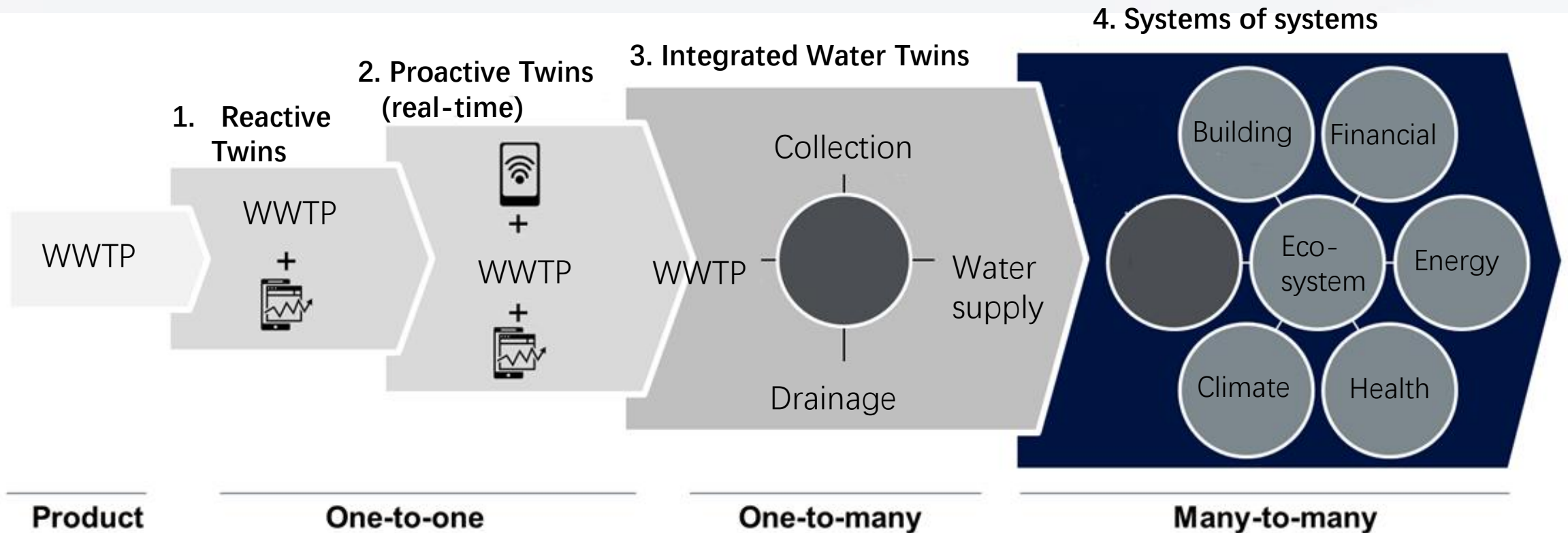
Anders Liechti, CTO

DHI A/S

# Content

- Opening speech
- Example of Digital Twins for Waste Water treatment

## Digital Twin evolution



*A Digital Twin is a real-time digital counterpart of a physical object or process. Digital Twin uses analytical and predictive modeling to speed up and validate decision-making to automate time-consuming and manual engineering or operator processes.*

Schedule	Speakers	Title
11:00-11:05	Anders Pettersson Liechti, Chief Technology Officer of Danish Hydraulic Institute	Opening speech
11:05-11:20		Application and Practice of Smart Water
11:20-11:35	TianTian Shen, Director of Baidu Smart Water Solution, Beijing Baidu Netcom Science Technology Co., Ltd.	Discussion on the Application of Large Models in the Construction of Water Conservancy Digital Twins
11:35-11:50	Hangang Shi, General Manager of the Strategic Customer Department of China Telecom Hubei Branch	The Adventures of New Infrastructure and Digital Twin Watershed
11:50-12:05	Bin Sui, Chief Solution Engineer of Inspur Smart Water Department, Inspur Smart Technology Co., Ltd.	Digital Twin Songtao Reservoir Based on the "Forecast, Early warning, Disaster rehearsal, Contingency plan" Technical System
12:05-12:20	Tjitte Albert Nauta, Regional Manager Asia and the Pacific, Deltares	Digital Twins to Support Water Management
12:20-12:30	Yan Huang, Vice-chief Engineer of Changjiang Water Resources Commission of the Ministry of Water Resources and Vice Chairman of the Hubei Provincial Committee of China Democratic League	Digital Twin River & Smart Water - Changjiang Practices



# Digital Twins for Waste Water Treatment

## Application of digital twins for waste water treatment

- Waste water treatment has a high energy consumption and GHG emissions worldwide, and growing
- Digital twins are a key technology to optimize process efficiency, energy efficiency, plant volume optimization and reduction of chemical dosing
- DHI will show case the application of digital twin applications for the waste water industry

## Process Efficiency

Effluent quality/compliance, removal efficiency

## Energy Efficiency

Energy consumption (aeration, pumping) and recovery

## Carbon Footprint

GHG emission from process, electricity, chemicals

## Cost Efficiency

OPEX calculation for WWTP operation

## Plant Capacity

Flux control, Plant volume optimization

## Resource Efficiency

Chemical dosing, resource recovery, (e.g. biogas, biofuels)

## Hazardous Substances

Pharmaceuticals, PFAS etc.

## Health

Clean water, CSO's

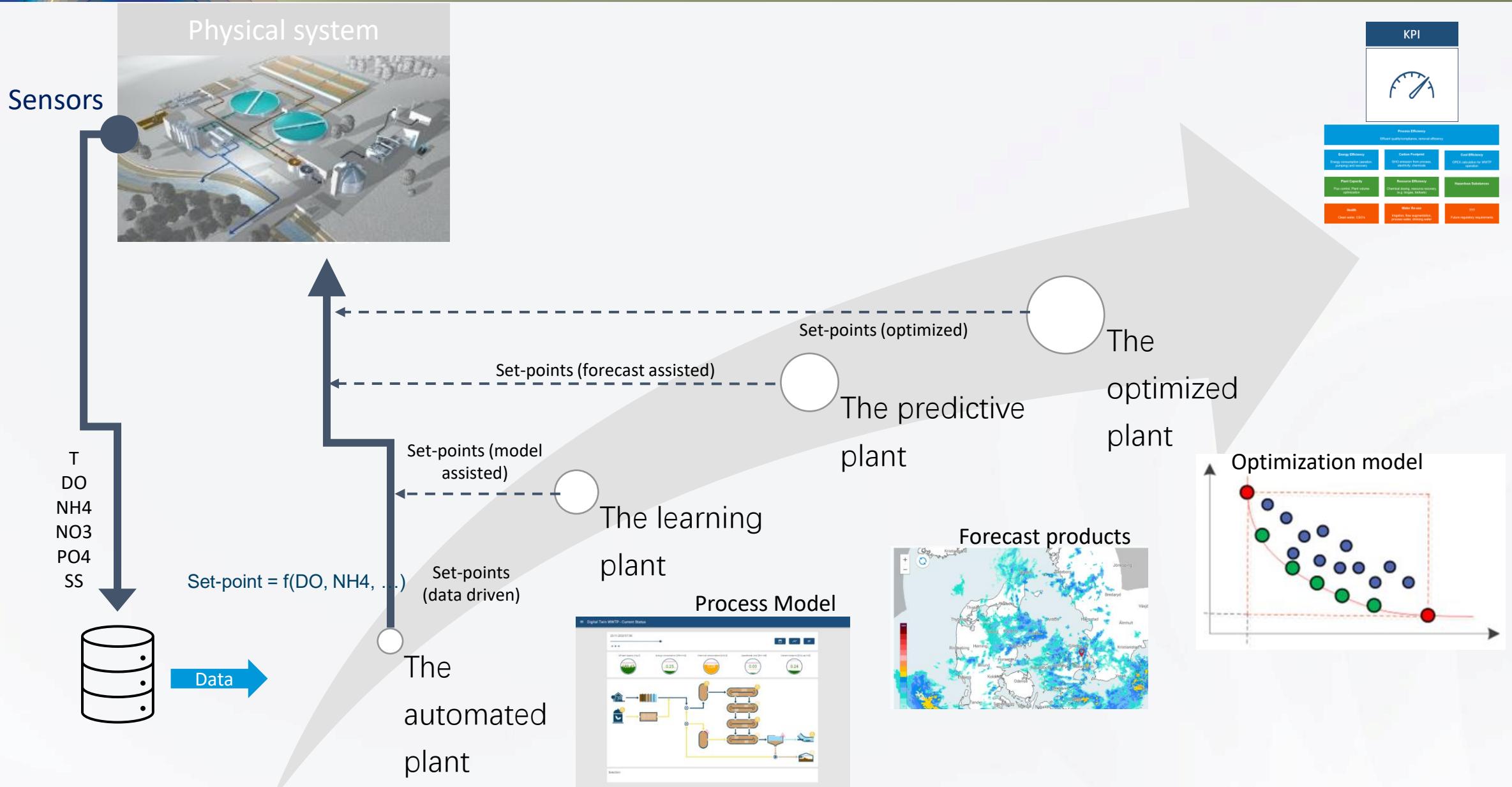
## Water Re-use

Irrigation, flow augmentation, process water, drinking water

## Regulatory compliance

Future regulatory requirements

# Journey of applying TwinPlant to WWTPs





# Digital Twin platform architecture

数值仿真平台 (数学模型、优化算法、模型开发套件)  
Numerical Simulation Platform (mathematical model, optimization algorithm, model development kit)

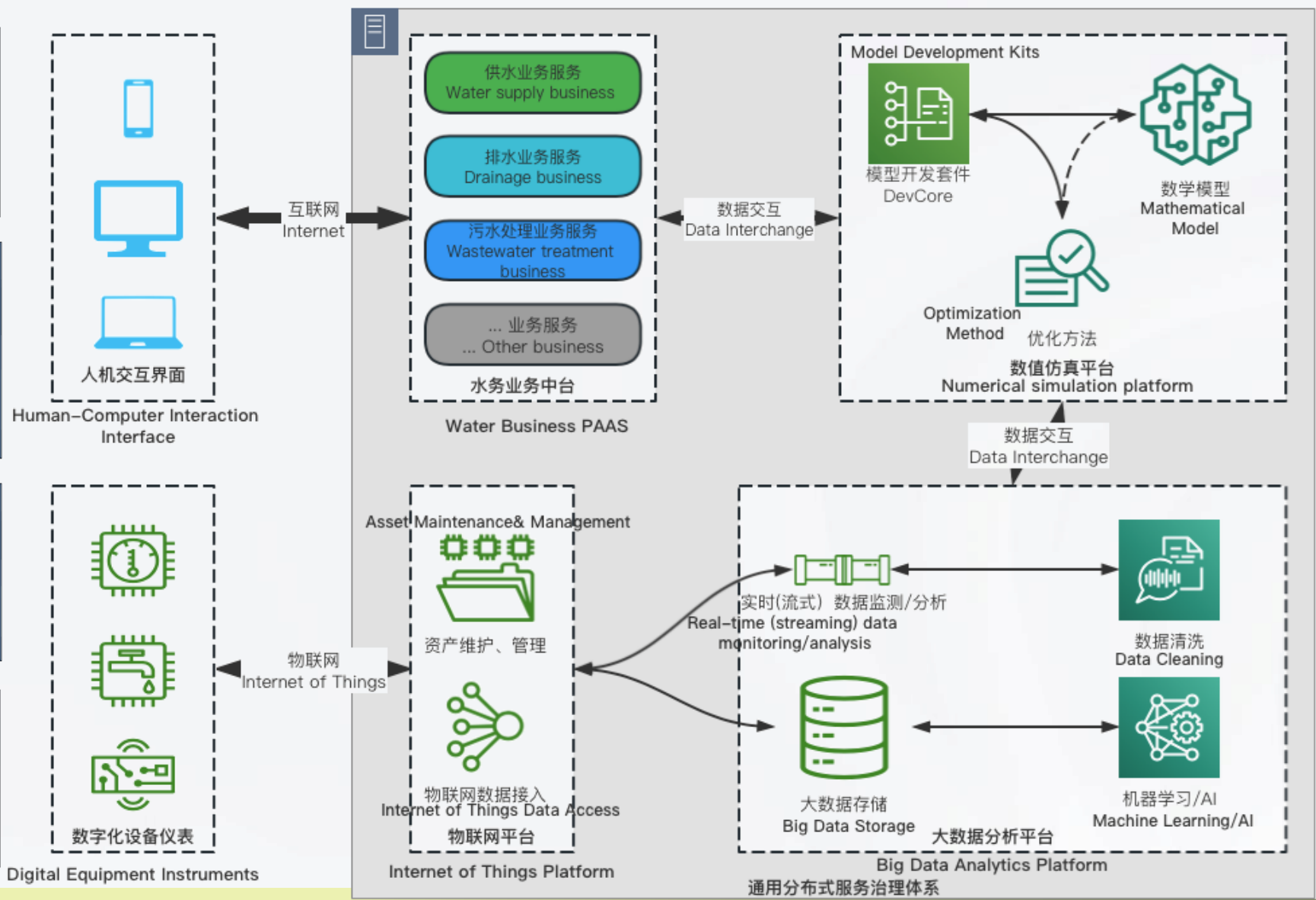
大数据分析平台 (实时数据监测分析、数据清洗、大数据存储、机器学习)  
Data Analysis Platform (real-time data monitoring and analysis, data cleaning, data storage, machine learning)

通用化分布式服务治理体系  
General Distributed Service Governance System

物联网平台  
Internet of Things (IoT) Platform

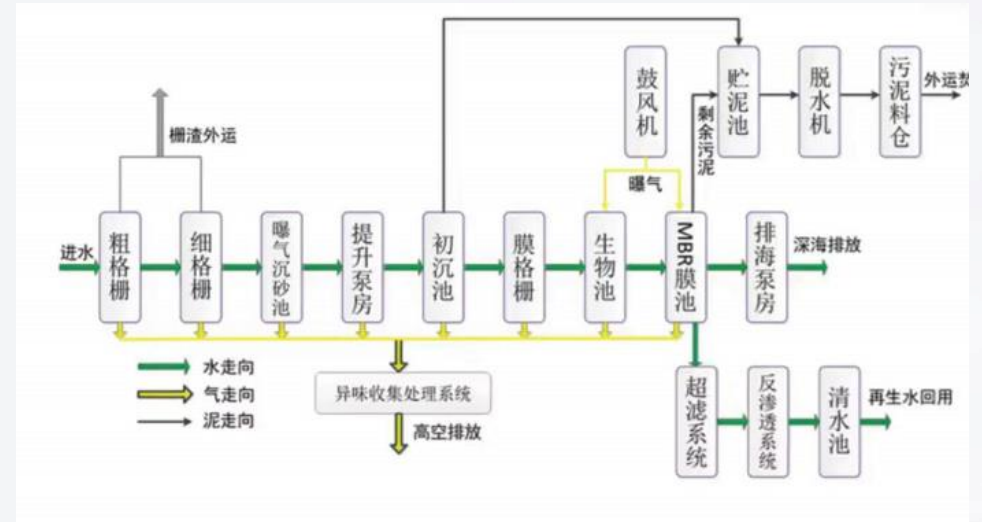
人机交互界面  
Human-Computer Interaction Interface

数字化设备仪表  
Digital Equipment



烟台市套子湾污水处理厂智能化系统项目  
YANTAI TAOZIWAN WASTEWATER TREATMENT PLANT INTELLIGENT SYSTEM

- The treatment capacity of Taoziwan Wastewater Treatment Plant is 350,000 tons/day. The first-phase project adopts AAO + high-efficiency sedimentation tank + filter process, and the second-phase project adopts AAO+MBR process;
- Effluent Quality should meet the standard of first level A, Ref. “ Discharge standard of pollutants for municipal wastewater treatment plant in China”;
- Treatment processes are complicated, and the current production load is very high;
- There are online sensors, central control system, controllers and other equipment in this wastewater treatment plant;



# Main functions of digital twin for Taoziwan

## Online Warning and Forecast

## Scenario Management

## Intelligent Chemical Dosage

## Intelligent Aeration

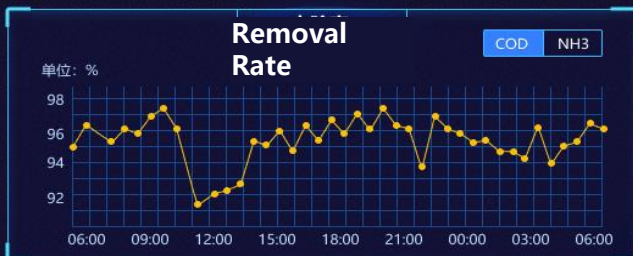
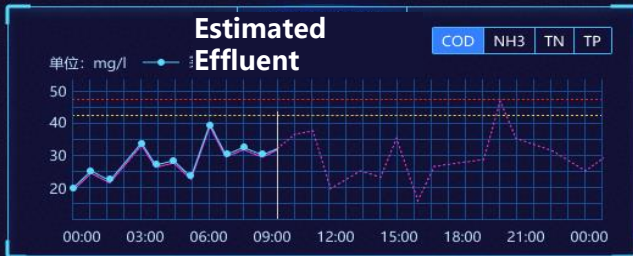
## Taoziwan Digital Twin

## Sludge Management

## Equipment Management

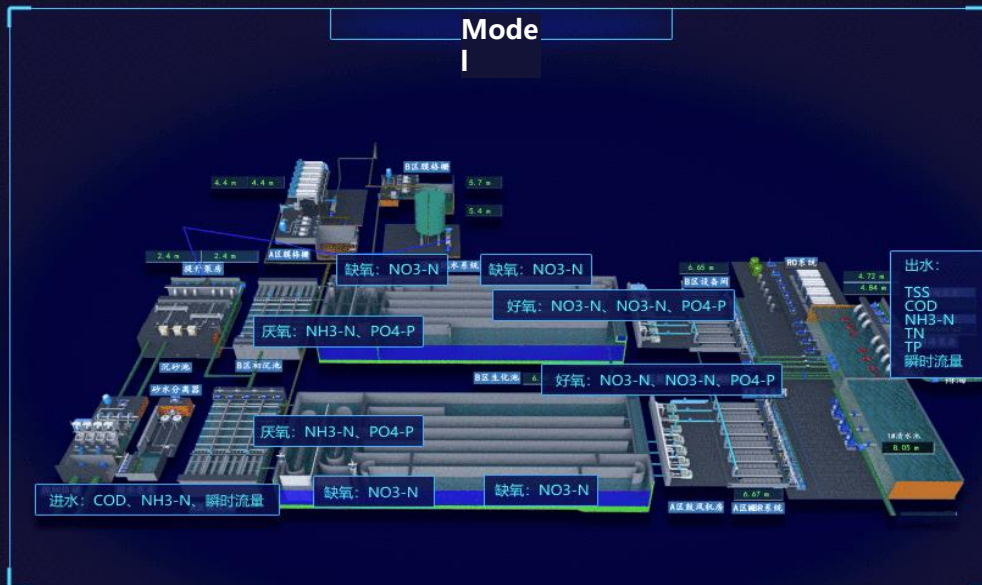
## Loggings

## System Management



### Online Data

- 本月吨水电耗 (生化区): **0,134** kWh/m³
- 本月吨水药耗-碳源: **0,356** kg/m³
- 本月吨水药耗-除磷剂: **0,248** kg/m³
- 今日进水瞬时流量: **1562,453** m³/h
- 今日进水累计流量: **32654,323** m³
- 今日出水累计流量: **32604,165** m³
- 今日耗电 (生化区): **9653** kWh
- 今日药耗-碳源: **32654,323** kg
- 今日药耗-除磷剂: **32604,165** kg/m³



### Performance Analysis

今日截止到当前

- 水质预警信息新增: **3**条
- 仪表异常: **3**条
- 出水水质达标率: **100%**

96% 综合评分

### Warnings

指标	时刻	检测值	警告信息
COD	12:29	42	超出阈值
TP	12:29	0.42	超出阈值
NH-N	12:29	4.5	超出阈值

### Sensors Maintenance

仪表	位置	状态	维护预警
在线COD	进水分析间	数据丢失	维护
溶解氧仪	B区生化池	准确度下降	维护警告
浊度仪	A区生化池	准确度下降	维护警告

AI智能推荐

- From April 2021 to the end of 2021, the application of the digital twin effectively reduced the dosage of external carbon source, carbon emission and energy by 10%, 231 t (CO<sub>2</sub> equivalent) and 1million kwh, and indirectly reduced 1000t carbon emission (CO<sub>2</sub> equivalent) .
- Nominated for Smart Water Project of the Year of the Global Water Awards 2022.



**Cut operation  
cost**



**Improve  
Management**

