
AVEVAWORLD

April 8, 2025

AVEVA: SUPPORTING ADVANCED INTEGRATED E&C AND SUSTAINABILITY PROJECTS IN MAIRE GROUP

MAIRE

Massimo Rosi

Head of Engineering Processes Digitalization Department

Alessandro Borgna

Process Engineer

Edoardo Disaro’

Technology Process Engineer

AGENDA

1 INTRODUCTION TO MAIRE GROUP

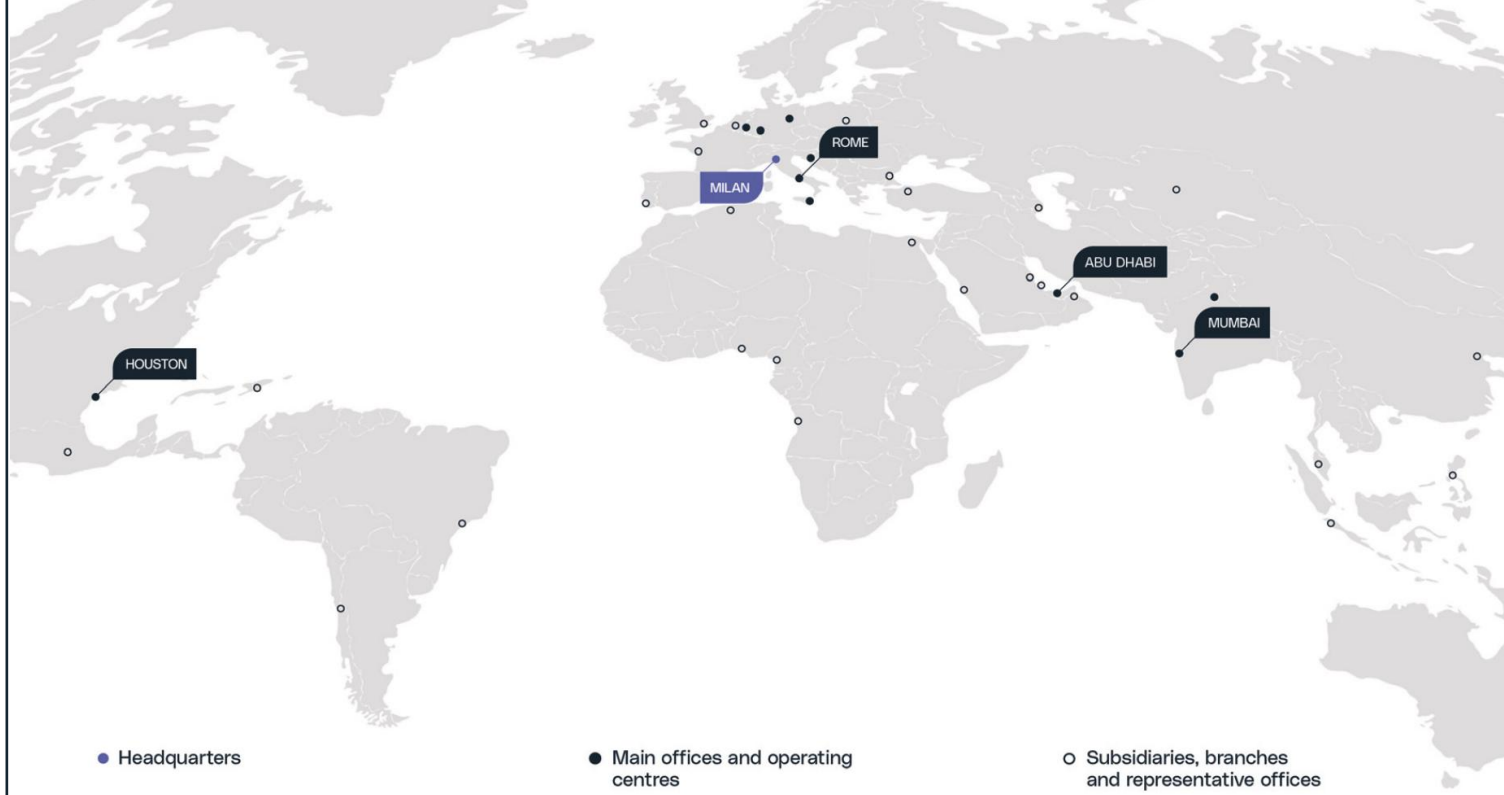
2 MAIRE'S JOURNEY WITH AVEVA

3 LET'S GO TO THE FUTURE!

MAIRE AT A GLANCE

We are a technology and engineering Group that develops and implements innovative solutions to enable the Energy Transition.

We offer Sustainable Technology Solutions and Integrated E&C Solutions in nitrogen fertilizers, hydrogen, circular carbon, fuels, chemicals, and polymers.



5.9
Revenues (€ billion)

13.8
Backlog (€ billion)

212.4
Net Income (€ million)

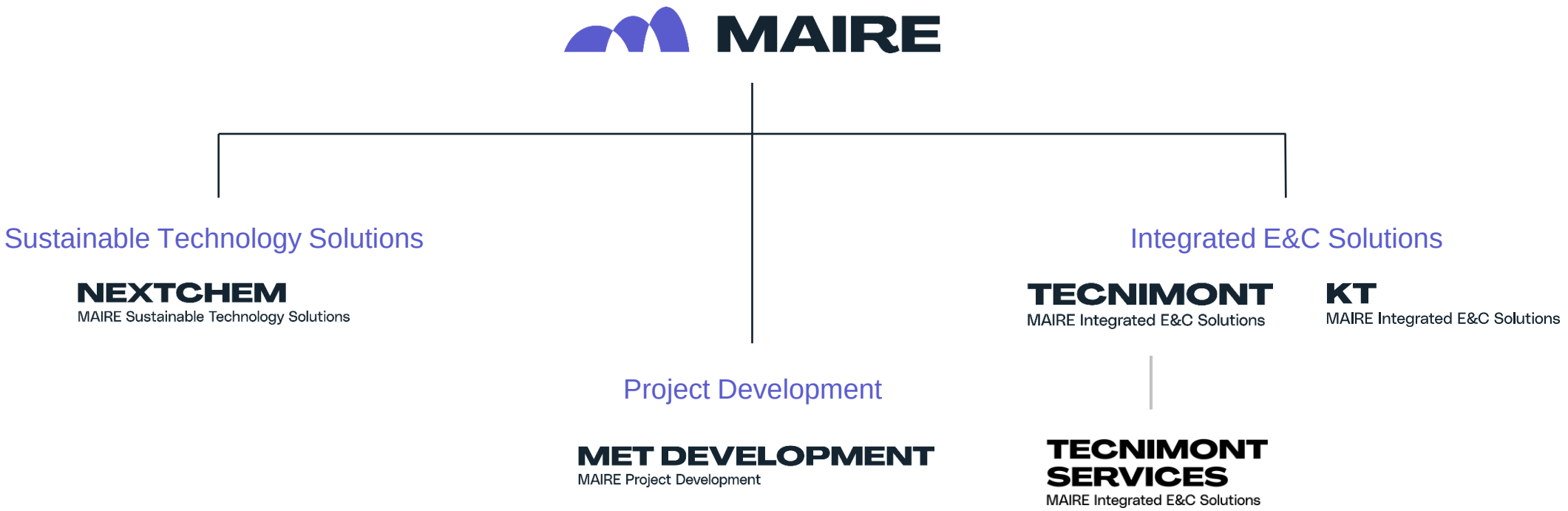
50
Countries

9,800+
Employees

~50,000
People engaged worldwide*

Data as of 31st December, 2024
*The data includes employees, collaborators and sub-contractors

MAIRE INTEGRATED ORGANIZATION

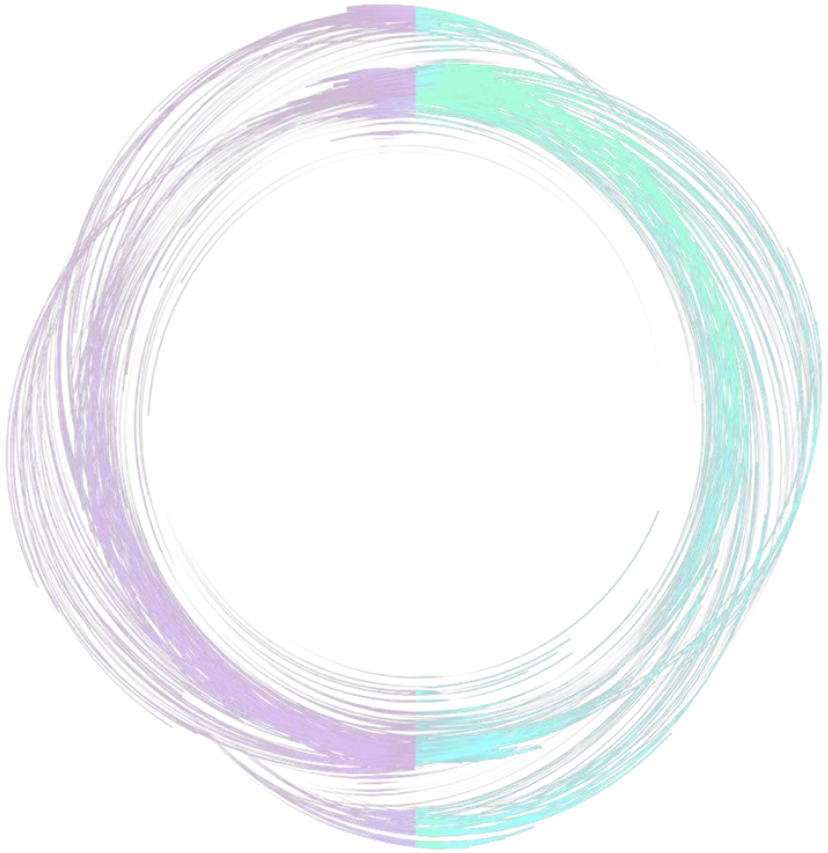


HOME TO THOSE WHO MAKE TO INSPIRE

SUSTAINABLE TECHNOLOGY SOLUTIONS

We offer Sustainable Technology Solutions to fully ENABLE energy transition.

Innovative and sustainable processes, optimizing conventional ones and creating new processes from non-fossil feedstock.



INTEGRATED E&C SOLUTIONS

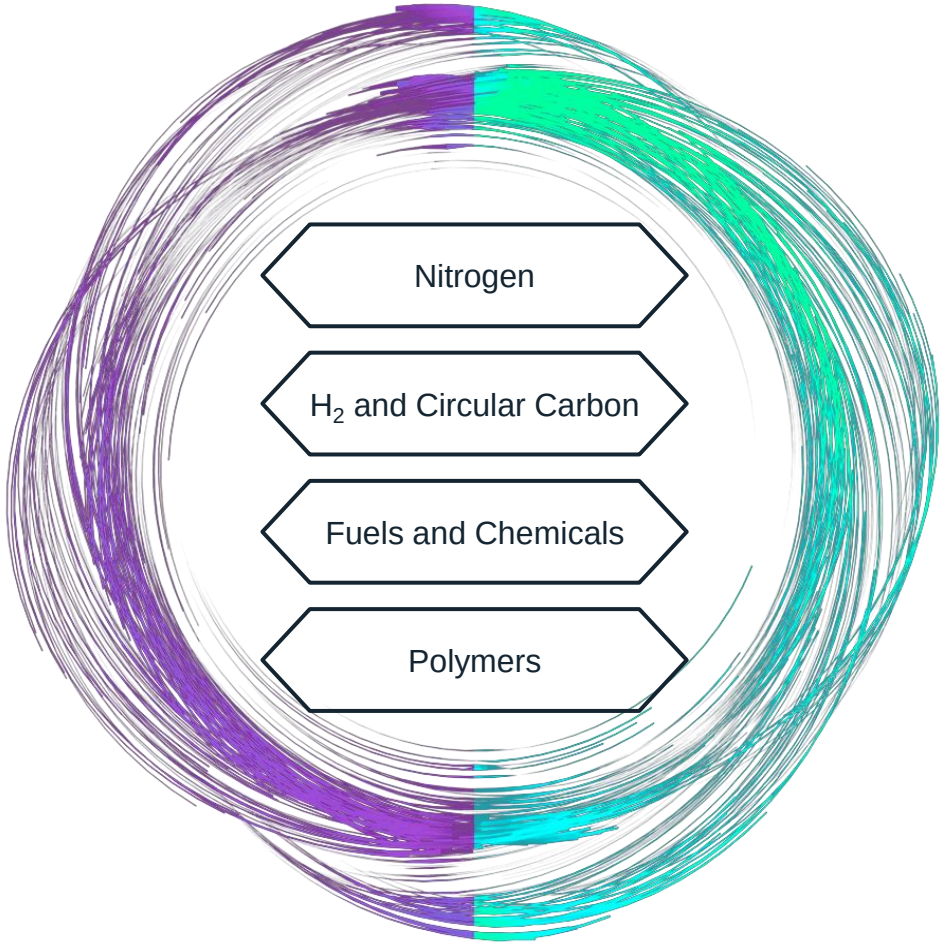
We MAKE energy transition happen through our Integrated E&C Solutions.

We bring into reality complex plants and frontier projects designed to provide access to the latest technologies.

PROJECT DEVELOPMENT

MAIRE CORE BUSINESS

We are enablers of innovation and energy transition, working alongside businesses to co-develop sustainable technologies and design integrated solutions in fertilizers, hydrogen, carbon capture & storage, fuels & chemicals, and polymers.

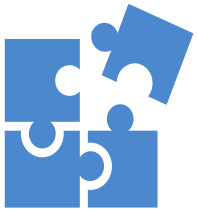


MAIRE’S JOURNEY WITH AVEVA

IE&C

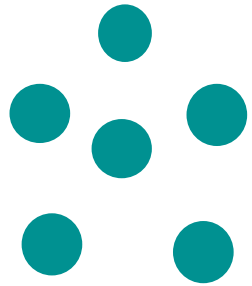
FULL INTEGRATED APPROACH

FROM STAND ALONE TO A FLEXIBLE PLUG & PLAY APPROACH



STS

NEXTCHEM APPROACH: MAKING ENERGY TRANSITION A REALITY



MAIRE’S JOURNEY WITH AVEVA

BENEFITS ARISING FROM THE ADOPTION OF DATA INTEGRATION IN ENGINEERING PROJECTS

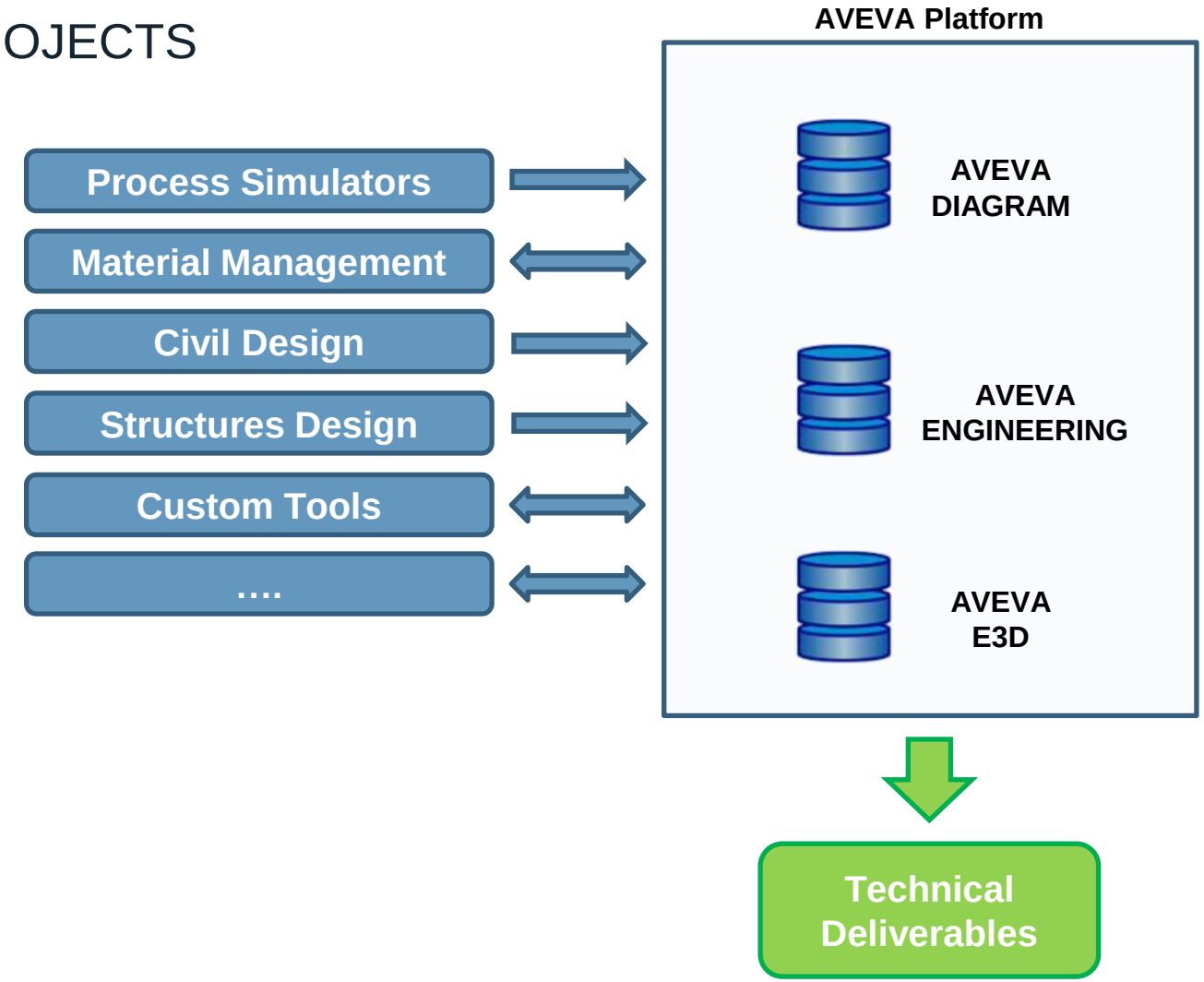
- Aggregation of data from different sources
- Reduction of errors and inconsistencies in data
- Improved collaboration and communication among project team
- Unified view and management of project data
- Increase in efficiency and productivity

MAIRE'S JOURNEY WITH AVEVA

BENEFITS ARISING FROM THE ADOPTION OF DATA INTEGRATION IN ENGINEERING PROJECTS

Aggregation of data from different sources

INFORMATION PRODUCED THROUGH EXTERNAL TOOLS CAN BE COLLECTED, ORGANIZED AND DISPLAYED IN AVEVA MODULES, MAKING THEM EASILY AVAILABLE FOR THE PROJECT TEAM



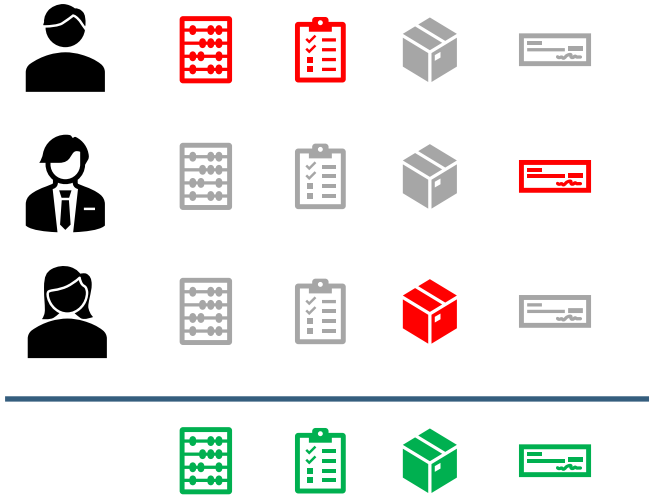
MAIRE'S JOURNEY WITH AVEVA

BENEFITS ARISING FROM THE ADOPTION OF DATA INTEGRATION IN ENGINEERING PROJECTS

Reduction of errors and inconsistencies in data

DATA ARE NOT COPIED OR DUPLICATED, INFORMATION ARE CLASSIFIED DEPENDING ON THE OWNER AND MADE AVAILABLE TO EACH USER THROUGH REFERENCES OR COMPARE/UPDATE OPERATIONS.

MODIFICATIONS DONE BY THE OWNER ARE HIGHLIGTHED BY THE SYSTEM IN THE GRIDS AVAILABLE TO EACH USER



Improves collaboration and communication among project team

THE PROPAGATION OF DATA INSIDE AND BETWEEN THE MODULES REDUCES THE RISK OF LOSS OF INFORMATION OR COMMUNICATION MISTAKES. CHANGES ARE HIGHLIGHTED IN THE GRIDS, GIVING A VISUAL INDICATION OF THE UPDATED INFORMATION.

COMMUNICATION IN THE TEAM IS FOCUSED ON DESIGN STRATEGY, NOT ON DATA SHARING.

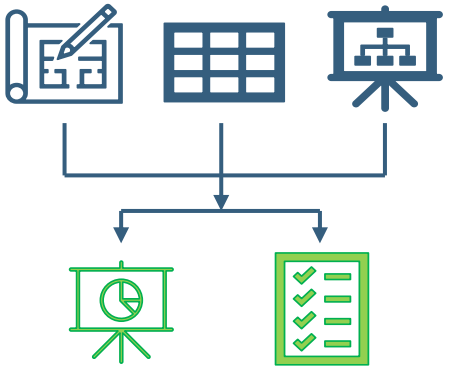
MAIRE’S JOURNEY WITH AVEVA

BENEFITS ARISING FROM THE ADOPTION OF DATA INTEGRATION IN ENGINEERING PROJECTS

Allows for a unified view and management of project data

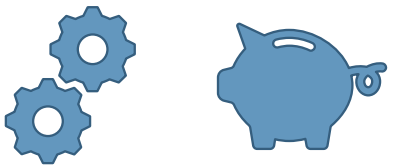
ESTABLISHING A SHARED REPOSITORY FOR INFORMATION VISUALIZATION AND TRACKING OF PROJECT OBJECTIVES IS SIMPLE TO ACCOMPLISH.

REPORTS AND GRIDS CAN BE UTILIZED TO CONDUCT EXTENSIVE AND RECURRING QUALITY ASSESSMENTS.



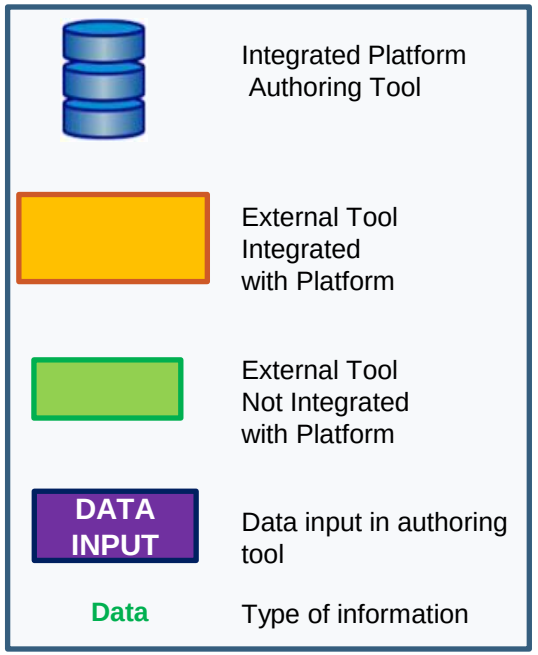
Increase in efficiency and productivity

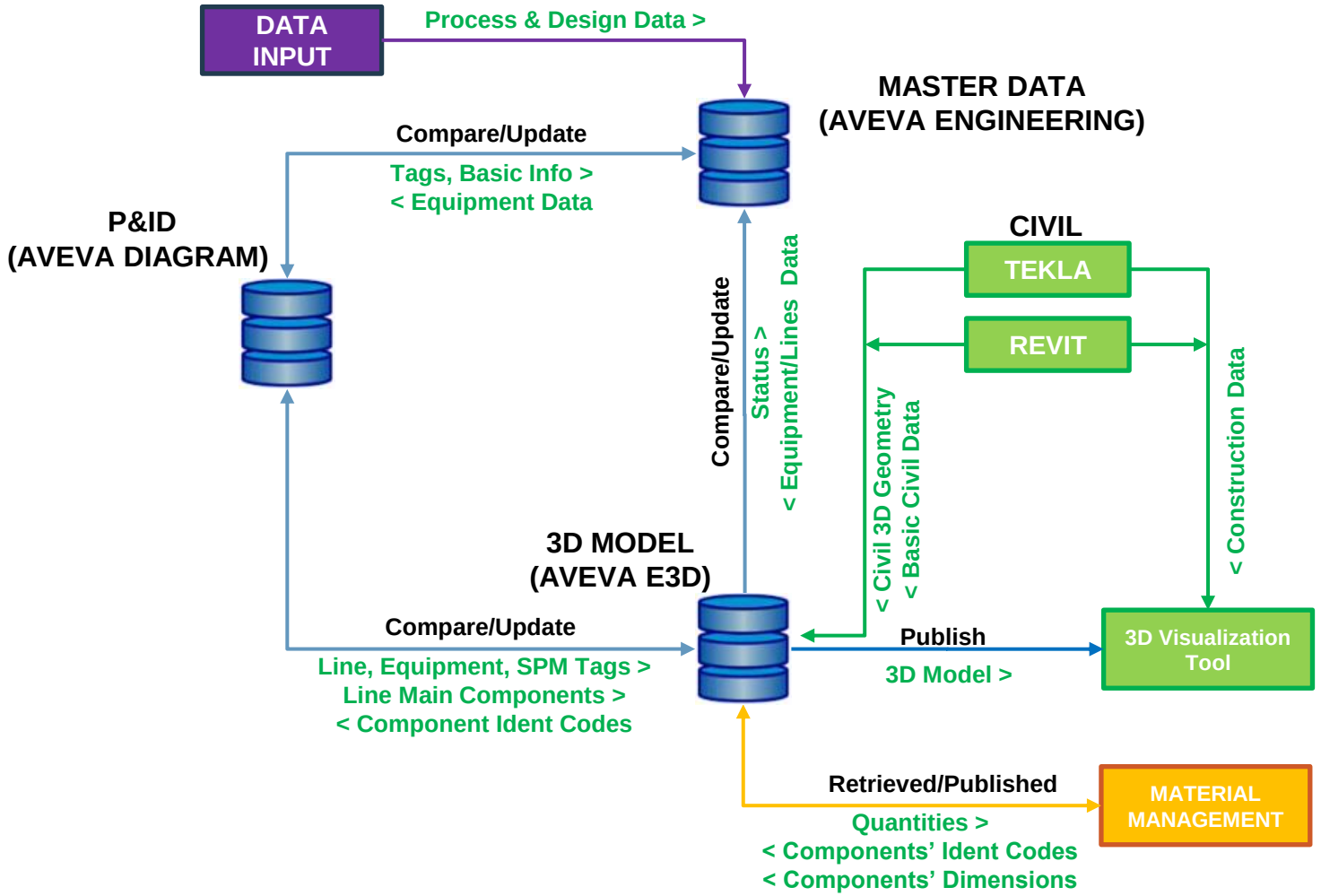
THE UNIFICATION OF DATA IN A CENTRAL ENVIRONMENT, THE REDUCTION OF ERRORS, THE EASE OF INFORMATION COMMUNICATION, AND THE ABILITY TO EASILY MONITOR THE MAIN PARAMETERS INFLUENCING PROJECT PROGRESS LEAD TO AN OVERALL INCREASE IN EFFICIENCY AND PRODUCTIVITY.



MAIRE'S JOURNEY WITH AVEVA

OVERALL FLOW SCHEME



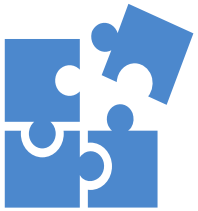


MAIRE’S JOURNEY WITH AVEVA

IE&C

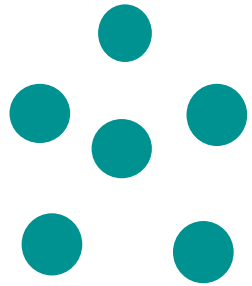
FULL INTEGRATED APPROACH

FROM STAND ALONE TO A FLEXIBLE PLUG & PLAY APPROACH



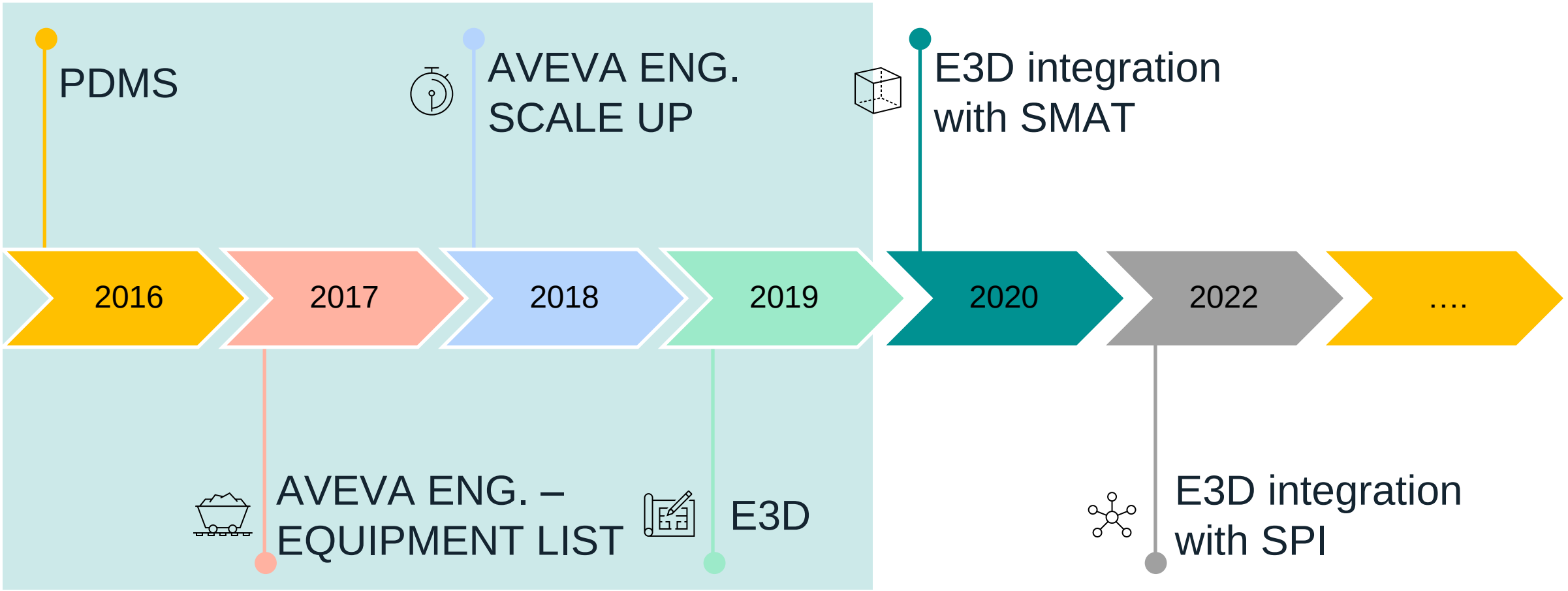
STS

NEXTCHEM: MAKING ENERGY TRANSITION A REALITY



MAIRE’S JOURNEY WITH AVEVA

TECNIMONT APPROACH: FROM STANDALONE TO A FLEXIBLE PLUG&PLAY



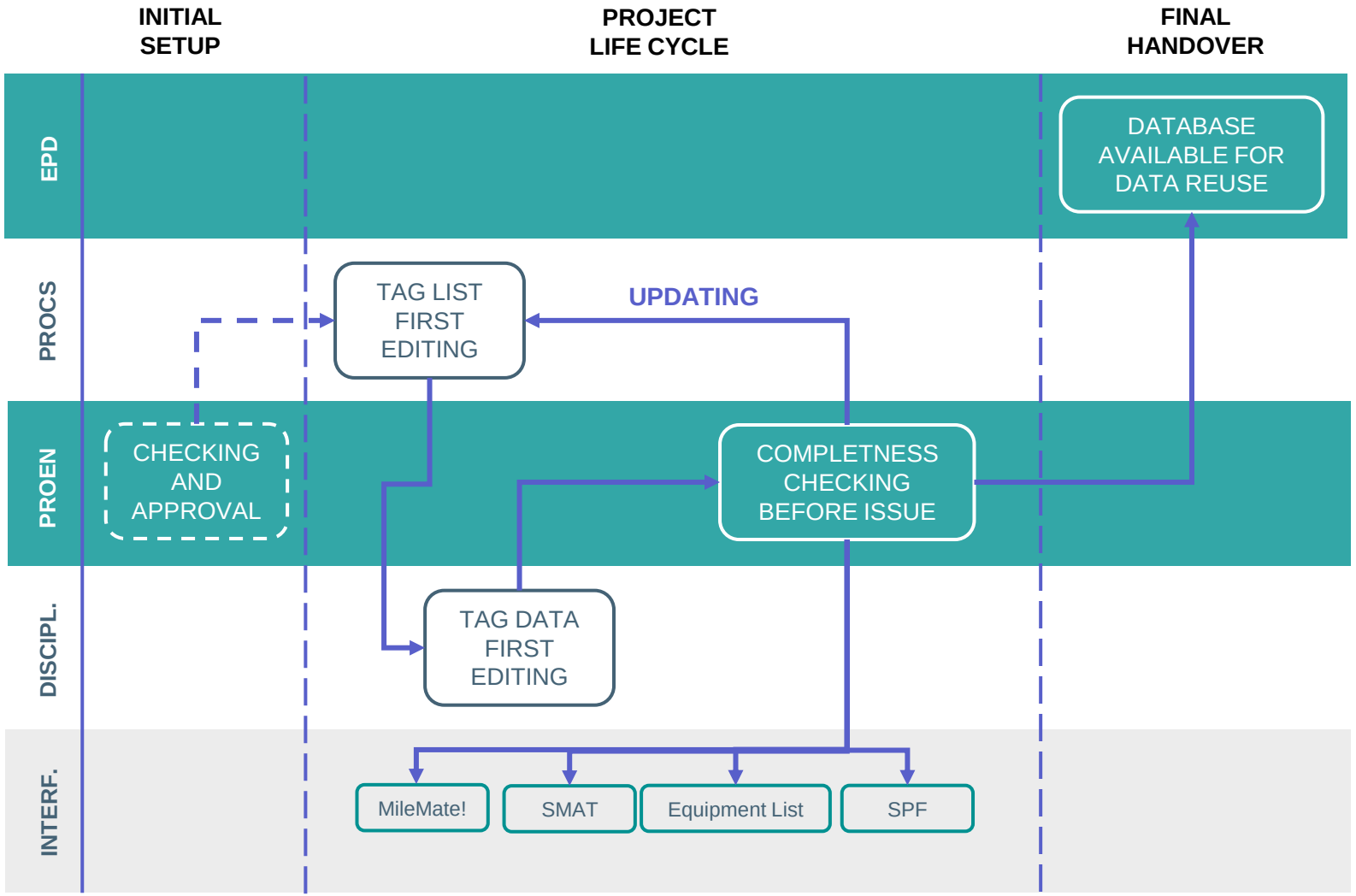
MAIRE'S JOURNEY WITH AVEVA

TECNIMONT APPROACH: FROM STAND ALONE TO A FLEXIBLE PLUG&PLAY

Data management in AVEVA ENGINEERING is supported by Company's procedures that clearly defines how data are created, managed, validated and published by each Discipline

In the perspective of a lean approach, these procedures are manly focused on:

- Tag **quality** in terms of correctness and consistency
- A minimum required set of data extracted from the **CFIHOS** standard



MAIRE’S JOURNEY WITH AVEVA

STAND-ALONE APPROACH: PROS & CONS

AT DISCIPLINE LEVEL

Standardization of the working methodology

Process automation

Flexibility: quick and autonomous customizations

DATA MANAGEMENT CROSS-DISCIPLINE

Poor **data quality**

No single source of truth: **data duplication & errors**

Information misalignment across disciplines

Difficulty in **data handover** to the customer

MAIRE’S JOURNEY WITH AVEVA

FULL INTEGRATED APPROACH

Final Data Handover to Clients

Data publication & correlation in correspondence with specific project **events/milestones (e.g., 3D model review)**

Need to **adopt digital technologies** from **different vendors** following our **Client requirements**

“Rigor alone is death by asphyxiation, creativity alone is pure madness”.

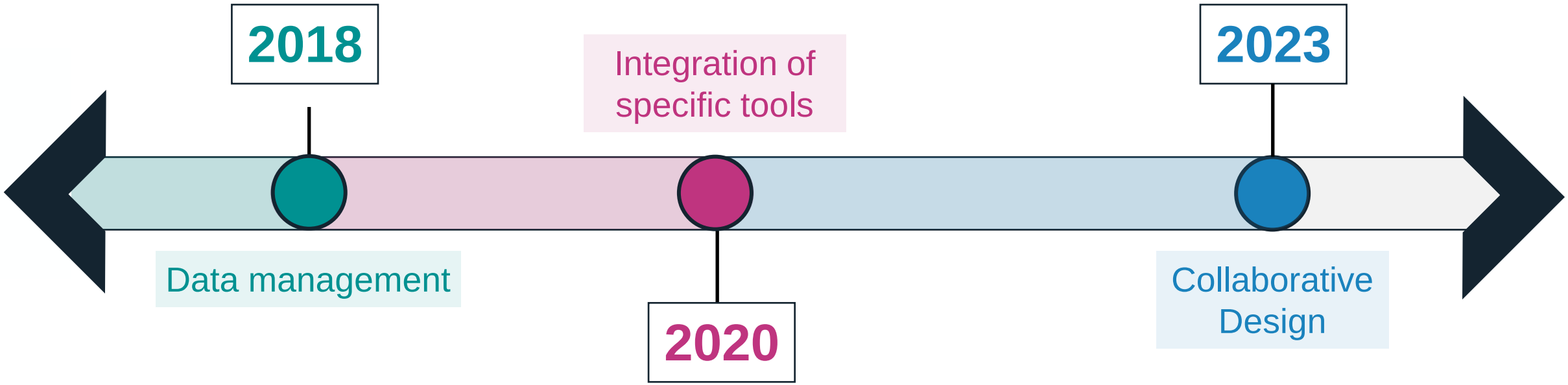
-Gregory Bateson

MAIRE’S JOURNEY WITH AVEVA

TECNIMONT APPROACH: FROM STAND ALONE TO A FLEXIBLE PLUG&PLAY

Plant Information Manager (PIM) **Role** introduction

Change management: transition from a deliverable-centric to a data-centric approach



Procedures and Work Instructions to clearly define the data quality process. **RACI** definition **between PIM** and **disciplines.**

MAIRE'S JOURNEY WITH AVEVA

TECNIMONT APPROACH: FROM STAND ALONE TO A FLEXIBLE PLUG&PLAY

Data quality:

2022	PIM Dashboard	PIMD ⇄	ENG. TOOLS
2023	Engineering Data Hub	EDH ⇄	ENG. TOOLS

Integration between E3D & third-party applications:

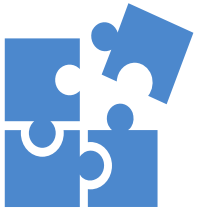
2020	METNET for Component extraction to 3D	SMAT ⇄	E3D
2021	Dimensional Data for Piping (DDP)	SPI ⇄	E3D

MAIRE’S JOURNEY WITH AVEVA

IE&C

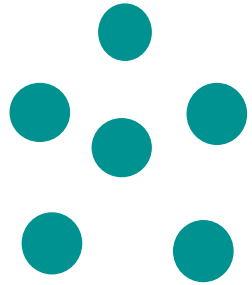
FULL INTEGRATED APPROACH

FROM STAND ALONE TO A FLEXIBLE PLUG & PLAY APPROACH



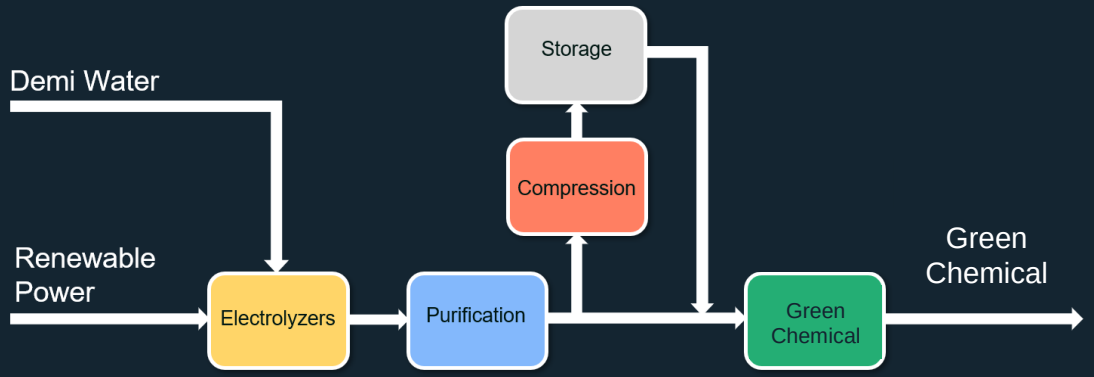
STS

NEXTCHEM: MAKING ENERGY TRANSITION A REALITY



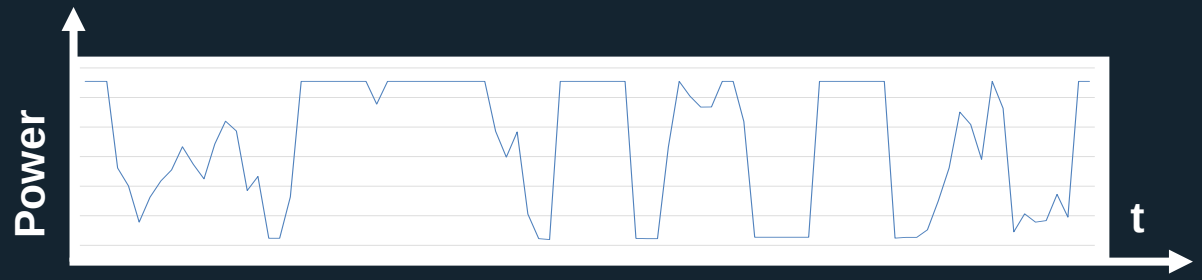
NEW CHALLENGES OF THE ENERGY TRANSITION

Green Chemicals plants are powered by **renewable energy sources**, which are often employed for Hydrogen production by Water Electrolysis. Hydrogen product can be either used as an energy carrier, or as feedstock for the downstream plants.



Hydrogen Storage is employed to buffer these fluctuations.

Renewable energy sources are often discontinuous and require a Complex Plant Design Able to Face Frequent Load Variations



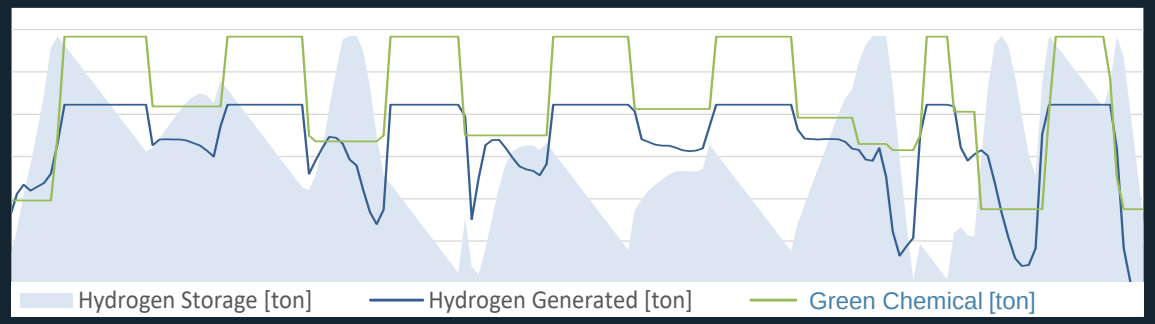
New challenges arise on the technical front

- The design must account for a **wide range** of different **operating conditions** and be optimized for load changes
- The **operation of the plant must be optimized** to minimize costs and material wastes, **managing a time series of events**, based on the system's dynamic behavior and its response to the fluctuations in power availability

OUR SOLUTION

ArcHy: Power-to-X Plants optimizer based on Linear Programming, that minimizes the levelized cost of the desired product

- Technology Selection
- Consumption and Production Profiles
- Sizing of main units
- Financial model



As **process team**, we **translate** the outcomes of the mathematical optimization into **real industrial processes**, designing a plant that is capable to manage power fluctuations. In particular, we recognize the importance of **dynamically simulating** the operation of the plant to validate the sizing and prove the integration of the units.

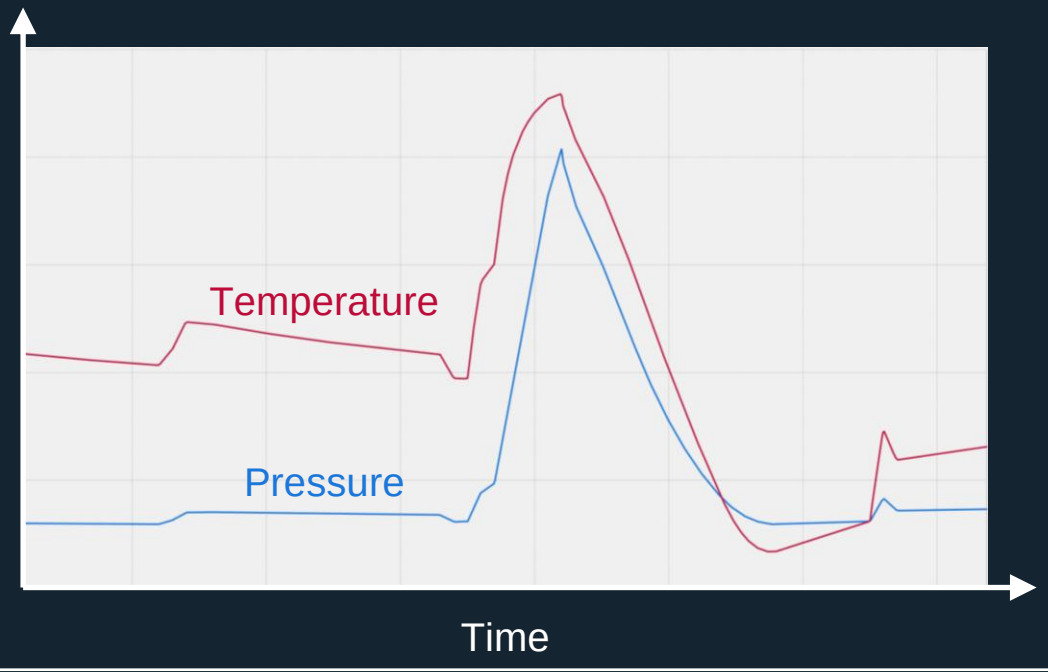
One of the tools that we use for this purpose is **AVEVA™ Process Simulation**

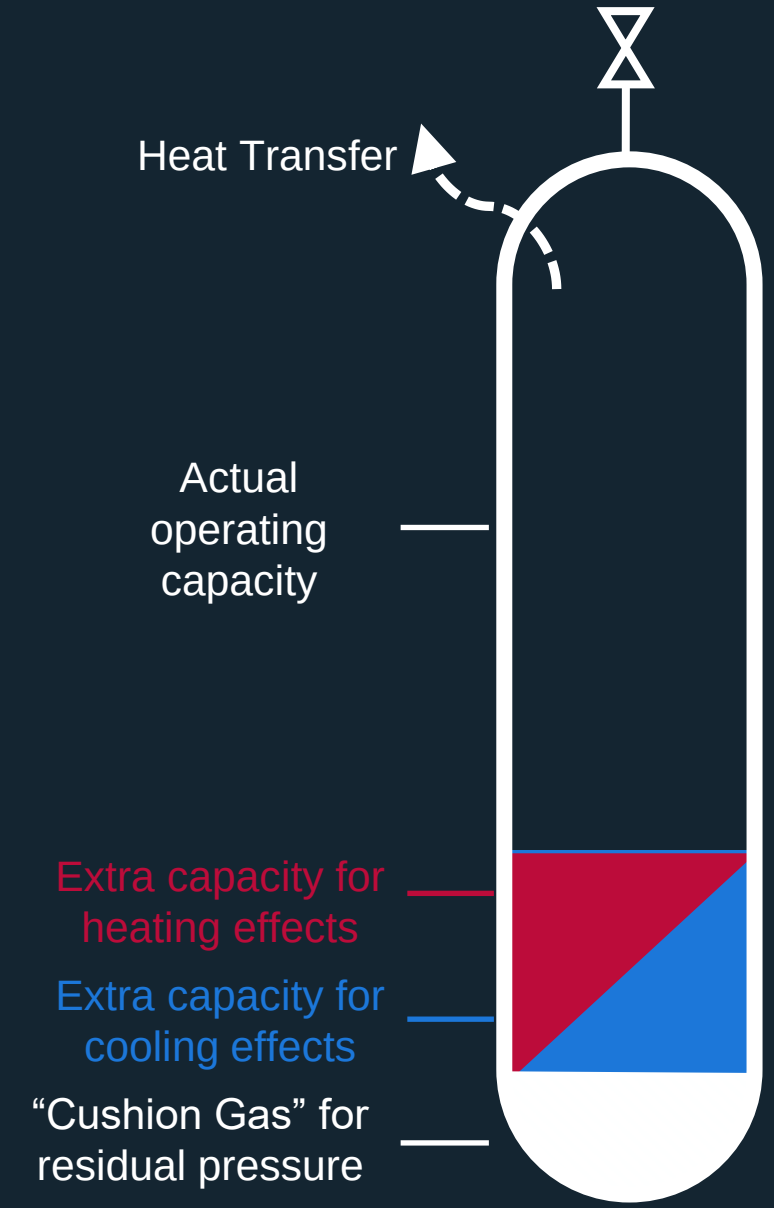
- Seamless transition to dynamics
- Easily customizable
- User friendliness
- Multidisciplinary

OPTIMIZING THE SIZING

- During cyclic filling and emptying of the Hydrogen Storage vessels there are strong **temperature variations** due to Thermodynamic effects and Heat Transfer phenomena

- As a result, during filling, the full capacity of the storage cannot be utilized, because the heating effects cause the stored gas to expand and decrease its density, therefore taking up more volume. Similarly, during emptying, cooling effects prevent the complete release of the gas. A Dynamic simulation allows to keep track of these effects and validate the H_2 storage design capacity.

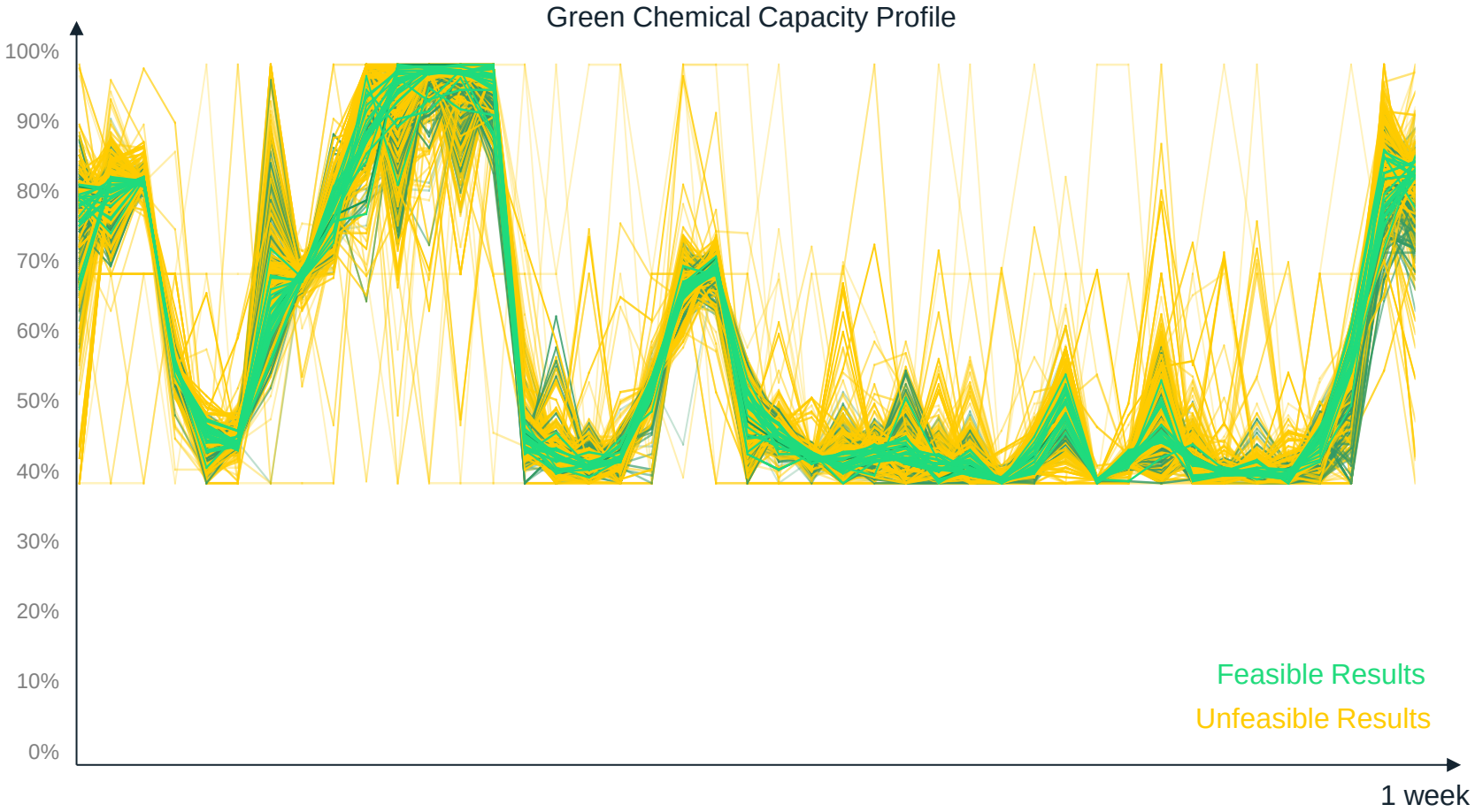




OPTIMIZING THE OPERATION

Optimizing the operation with a fully dynamic simulation would be computationally prohibitive. Therefore, modeFRONTIER, a third-party Multi-Purpose Multi-Objective optimization tool is used to combine dynamic simulation for the storage with steady-state simulation for the rest of the system.

The operation was optimized to minimize H_2 losses, while targeting the lowest specific cost of Green Chemical production, which has been **reduced by 10%**, while ensuring **continuous H_2 availability** throughout the entire analyzed timeframe.

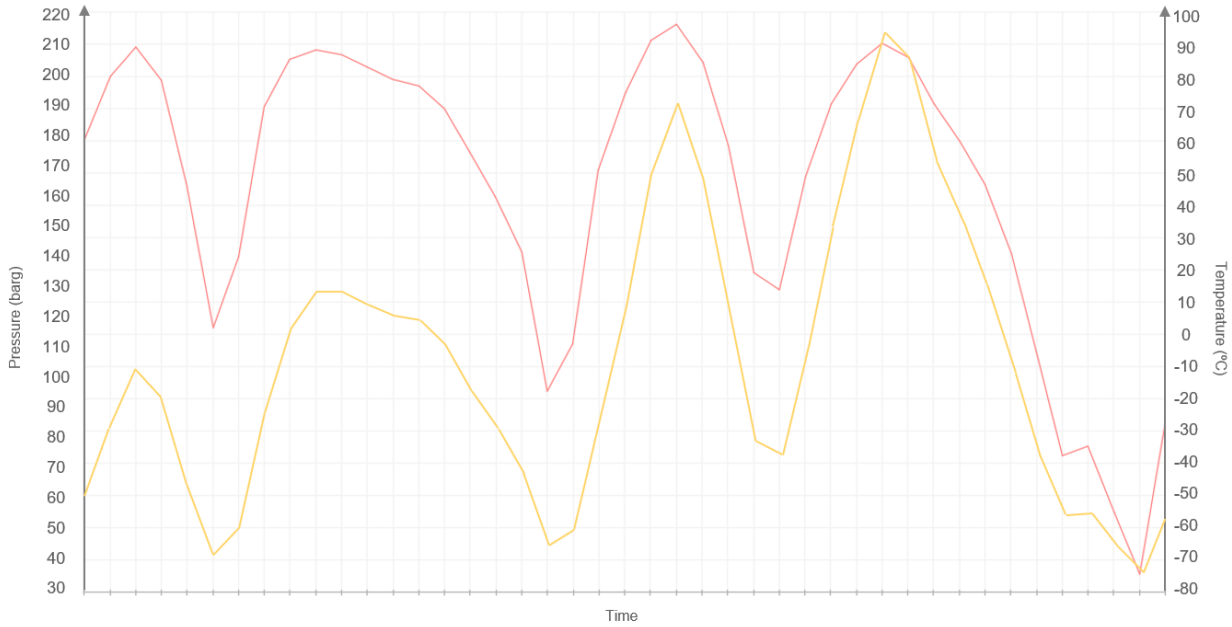


86	127	1566	202 014	6
Optimized Variables	Constraints	Cases Investigated	Simulations	Hours

RESULTS

The and the Green Chemical Capacity Profile (Optimized Variable) for the optimal Case

Temperature and Pressure Profile for the Storage Unit



The first graph shows a comparison between the Power Availability and the Green Chemical capacity profile, highlighting how the optimization leads to storing more hydrogen in advance to maintain the operation consistently above turndown during periods of low power availability.

The second graph displays the temperature and pressure profiles of the hydrogen storage unit over time. Heating and cooling effects play a significant role in influencing these profiles. The pressure increases as the storage unit is filled, when hydrogen is being stored. The temperature within the storage unit also rises affecting the actual capacity of the storage. And, vice versa, for emptying. The heating and cooling effects are accounted in the dynamic simulation and a minimum temperature of -74 ºC is achieved. Neglecting these effects would have led to a shortage of hydrogen of about 15-20% on the last day of operation.

MAIRE'S JOURNEY WITH AVEVA

STS

NEXTCHEM: MAKING ENERGY TRANSITION A REALITY

- **Operation optimization** (**minimize** H2O **losses** and **cost**)

IE&C

INTEGRATED ENGINEERING & CONSTRUCTION APPROACH

- Improved **data quality:** reducing errors and discrepancies by **15%**
- Efficient **data handover:** manhours cost savings of **20%**
- Enhanced **scalability** and **usability**
- Customer satisfaction

LET’S GO TO THE FUTURE!

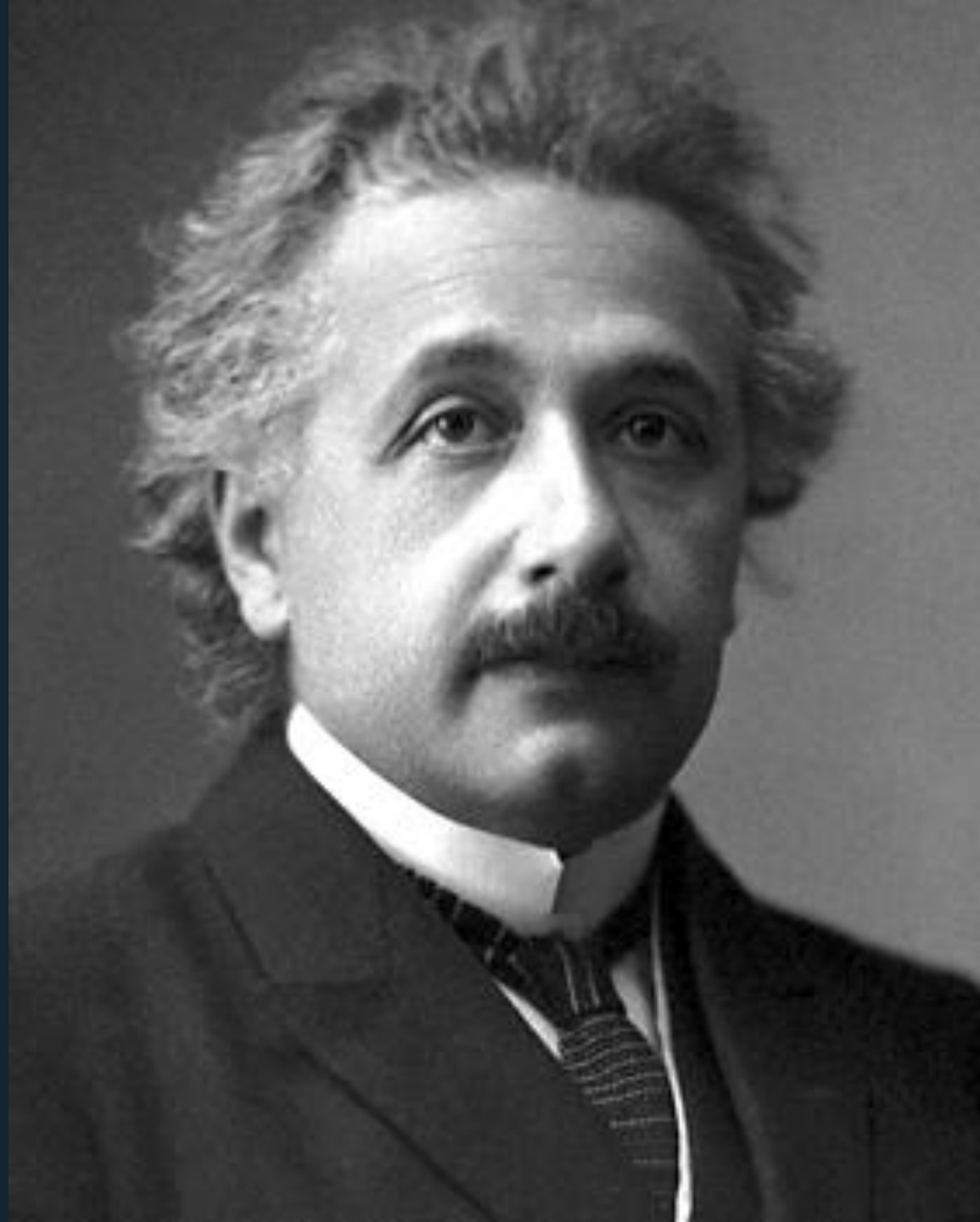
THE CHALLENGE

Achieve an **integrated Digital Twin** with process simulators with **flexibility and data quality during project execution**, not just at the time of data delivery.

Bridging the gap between **business processes** and **technology**

"The world we have created is the product of our thinking and therefore cannot change unless we first change our way of thinking.“

-Albert Einstein



Thank you!

MAIRE

Q&A

MAIRE