Digital PHA
The beginning of a new era?

Contents

About DEKRA

Established in 1925 to ensure road safety in connection with rapidly developing mobility, today DEKRA stands for safety on the road, at work, and at home and offers a broad service portfolio, including qualified and independent expert services in more than 60 countries.

Our **History**

1925	1960	2005	2007	2009	2012	2015	2016	2017	2018	2019	2020	2021
Founded in Berlin as a registered association	Approved as a vehicle testing organization	Establishment of the industrial inspection business	Entry into energy and process industry markets	Entry into product certification market	Expansion of consulting for organizational and process safety	Entry into EMC/ wireless testing market	Combining testing expertise, automated driving, and connected mobility	Investment in the largest cross-manufacturer testing center for autonomous and connected driving in Europe	Founding of DEKRA Digital GmbH to develop new, digital business models	Cooperating with Argus to extend the Cyber Security Service	Establishment of the EMC/ wireless testing in South Korea	Strategic goal: CO_2-neutral by 2025







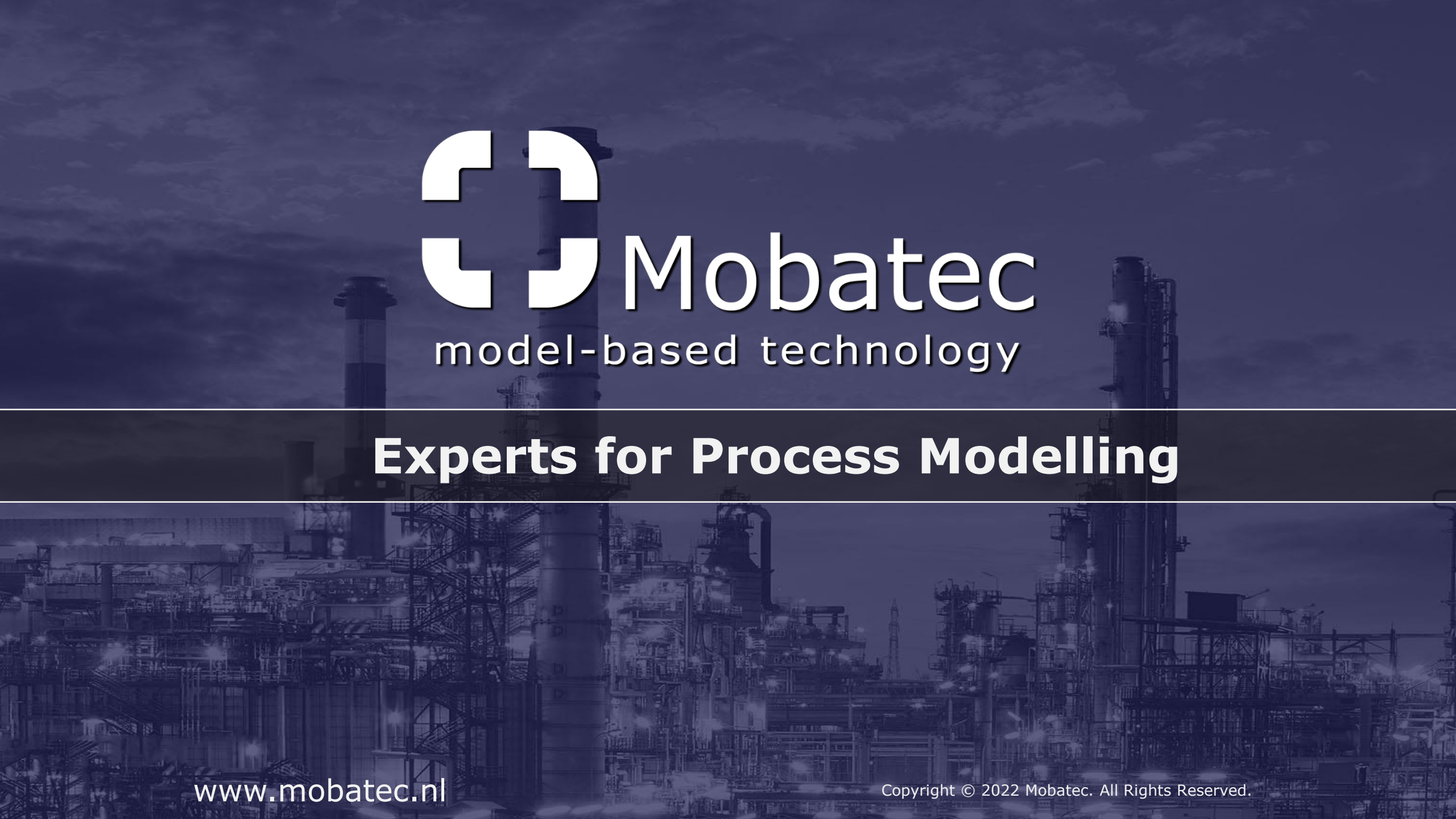






Our Vision

We will be the
global partner
for a
safe, secure
and
sustainable
world



Simulation Tools & services

Mobatec provides:

Mobatec Modeller

State of the art
Dynamic Modelling
Environment

Modelling consultancy and assistance

Model building
Model debugging
Engineering

Operator Training Systems

Real time operator training
Control systems testing
MobaTAGnology

Some of our Customers within Process Industry

info@mobatec.nl

Mobatec
model-based technology

www.mobatec.nl

DEKRA

The presenters

Mathieu Westerweele

PhD Chemical Engineering (Systems & Control Group)

25+ years experience with (dynamic) process modelling

MOBATEC (brief history)

2005: Mobatec founded. Initiative of:

- Jan Laurens
  - Chemical Engineer, specialist in modelling, polymers
  - Equation Solver
- Mathieu Westerweele
  - PhD in dynamic modeling
  - Equation Generator

2005 - 2012:

- Just 2 people
- Focus: models, consulting, software development
- Mathieu ➔ coordinator Post-Master Program: PPD

2012 - present:

- Larger projects => Growth
- (10+ Modelling Experts & Software Developers)

The presenters

Arturo Trujillo

PhD Engineering.

More than 35 years of experience in engineering and process safety.

Expertise in project management, PHA. QRA, PSM.

Main sectors: oil&gas, energy, chemistry, pharma.

DEKRA

Joined in 2012.

Currently Vice President, Global Service Group Manager —Process Safety at Service Division Consulting.

Præludium

Our must-win battles

01 The process safety business has existed for around 60 years, without any conceptual changes. At DEKRA, we believe that we need to push forward the discipline by digitally transforming core and new solutions.

02 Digitalization of processes is a mega-trend that we observe in every aspect of our daily lives. At DEKRA we believe that Process Safety should not be an exception.

03 We believe that a cultural change is required, from an expert organization to a digitally powered expert consulting organization.

Transform a 60 year old business model

Empower experts with digital tools

Achieve cultural change

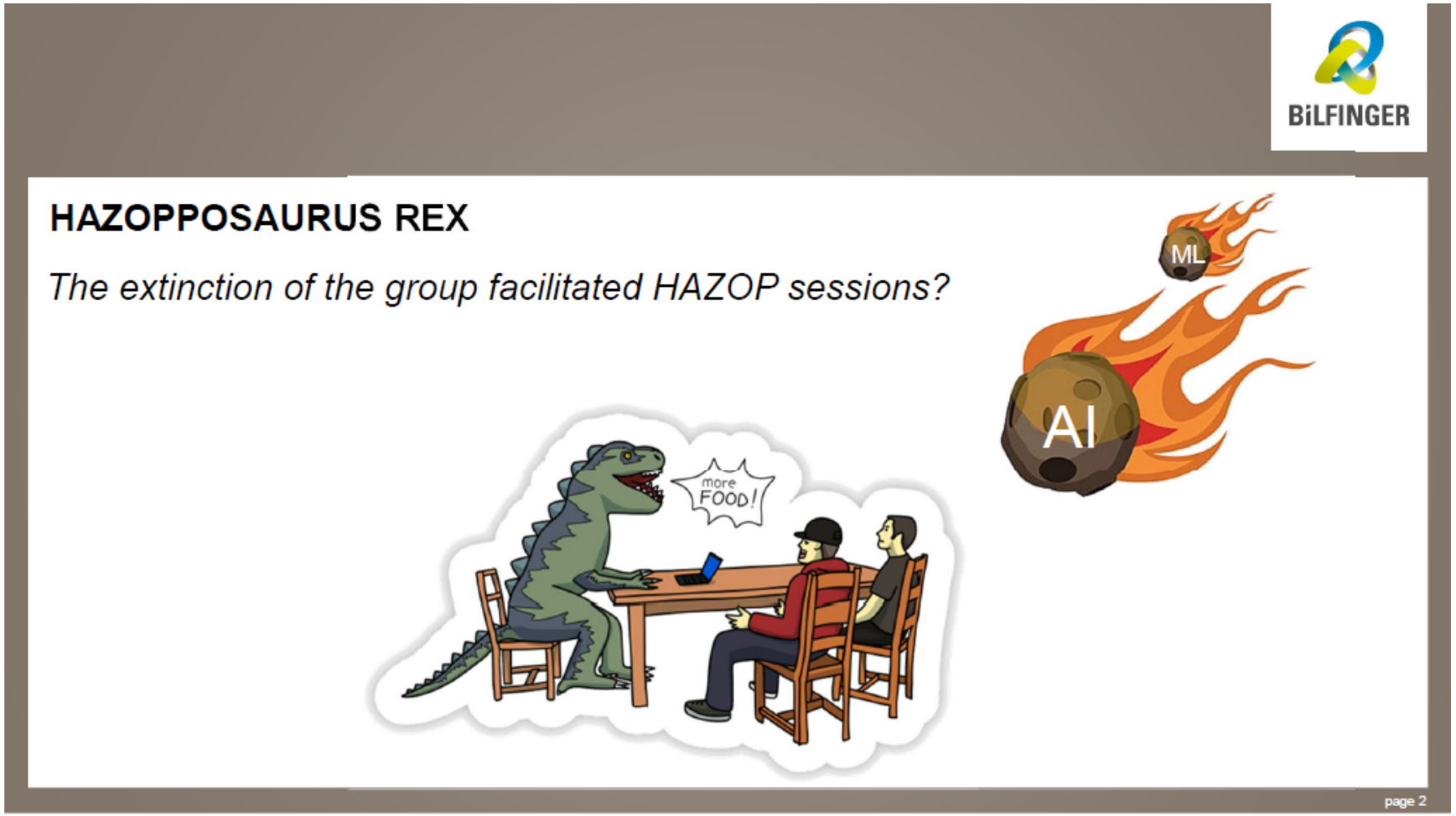
Why Digital PHA?

Process Hazard Analysis, in their many flavors (HAZID, HAZOP, What-If, LOPA, FMEA…) are a significant part of the process safety services of DEKRA. They account for roughly a 25% of total consulting sales.

PHAs have been delivered with only very minor changes since the 1970s.

Why Digital PHA?

What is the market doing?

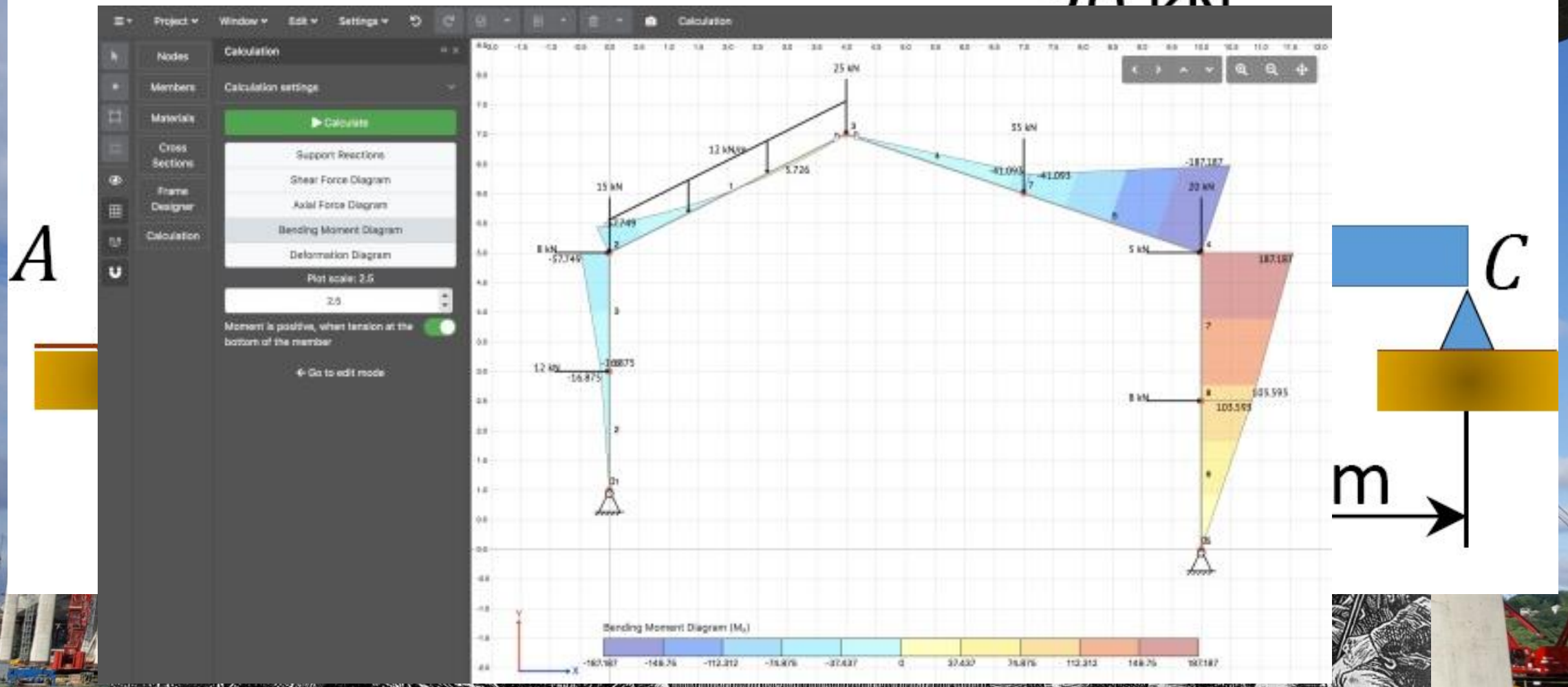


Source: presentation by Maarten Vriezen December 2021

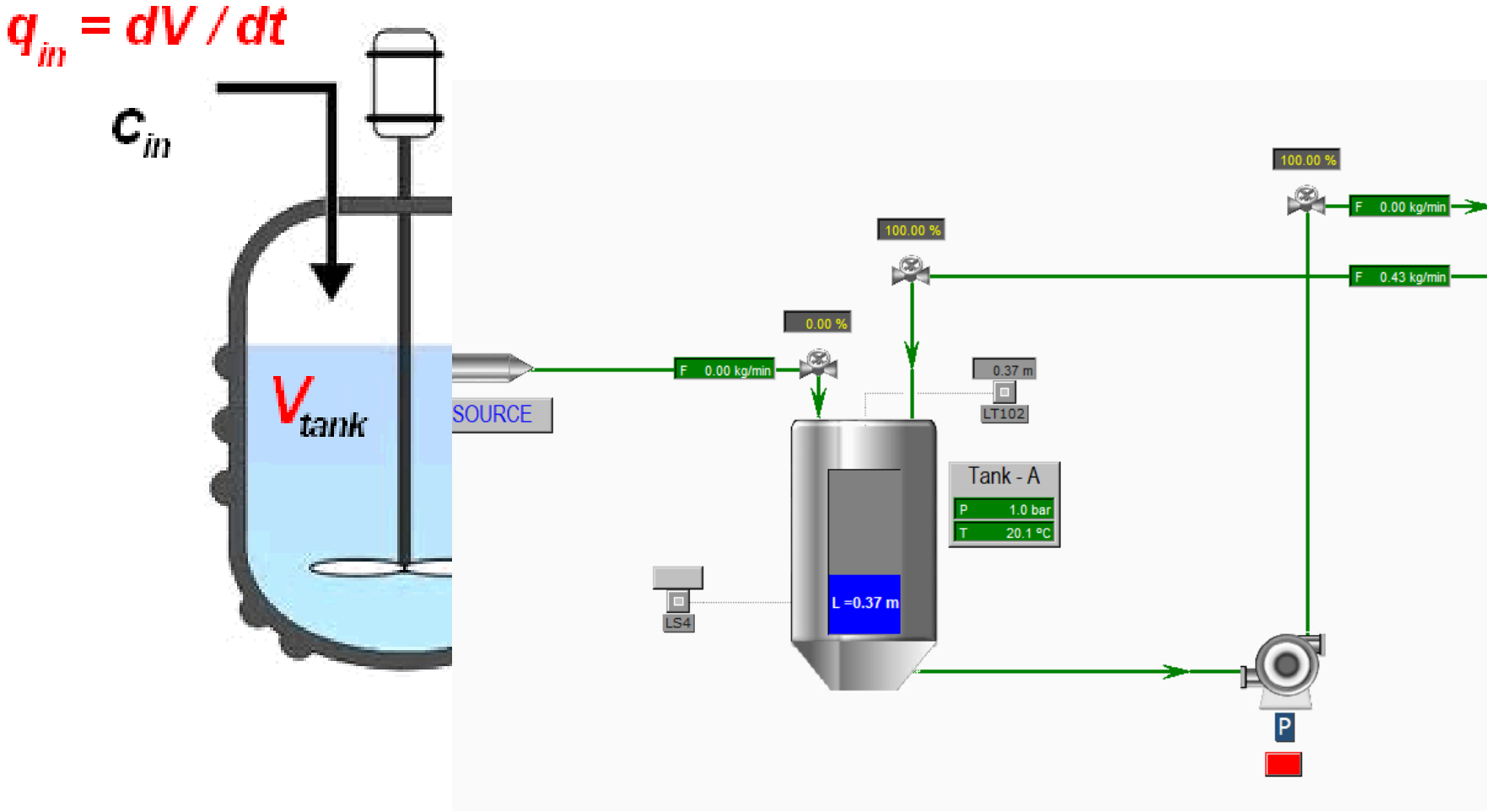
How is it done? – Conventional PHA

Collect required information from client	Client + DEKRA experts
Prepare the HAZOP/SIL sessions	DEKRA experts
Perform brainstorming sessions with the client's personnel	Client + DEKRA experts
Write a report and submit to client	DEKRA experts

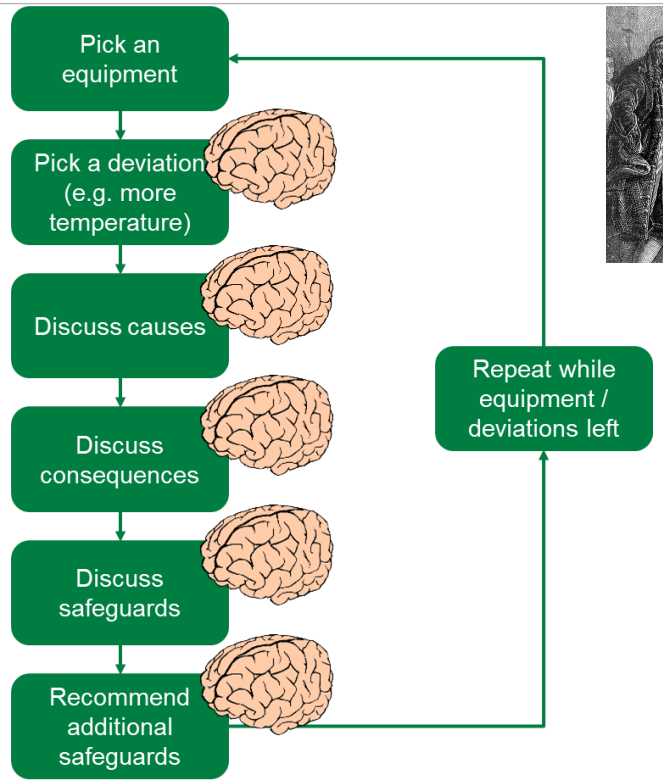
How do they do it in other disciplines?

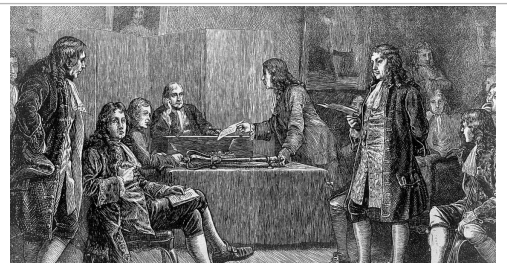


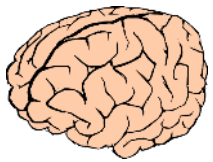
Do we have similar tools available in PS?



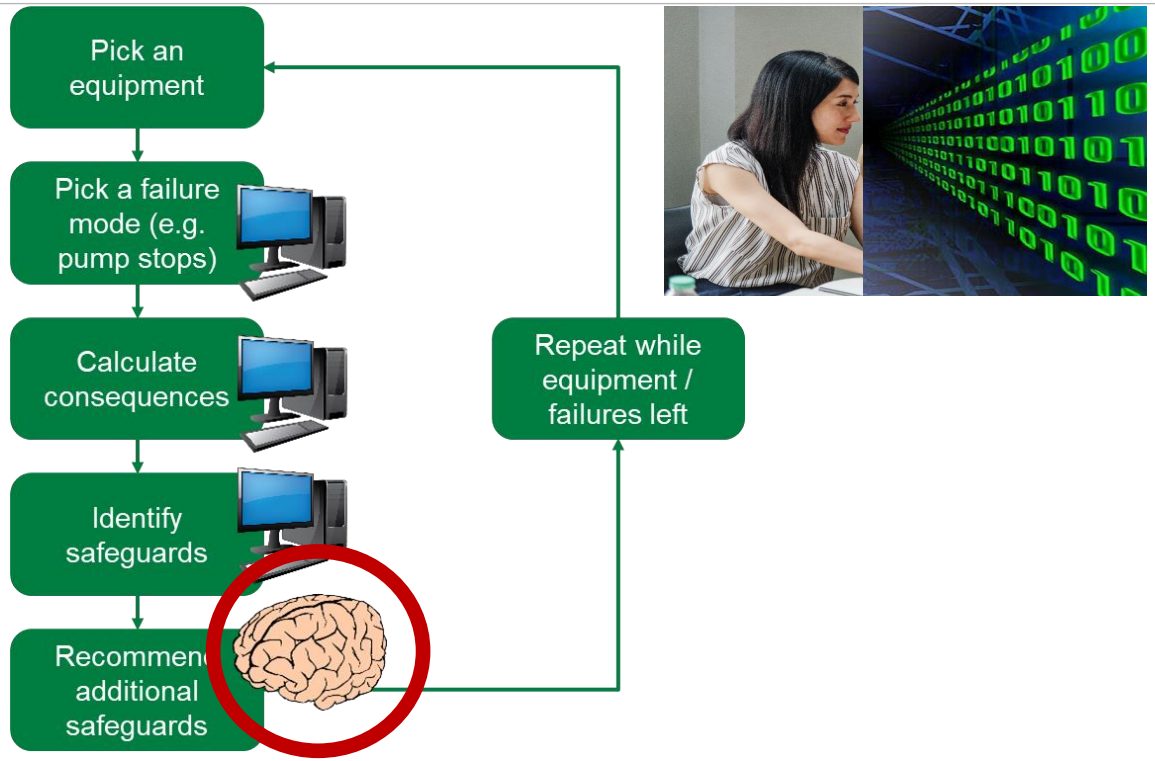
Simulation as a support for brainstorming

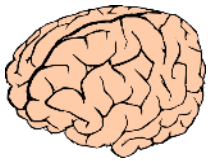






Human brainpower required in many steps of the process.





Human brainpower optimized to focus on solving problems.

Computer simulation used where it can easily outperform human capacities: boring, systematic, repetitive calculations.

How is it done? – Digital PHA

Collect required information from client

Client + DEKRA experts

A computer does most of the "mandays"

DEKRA experts + computer

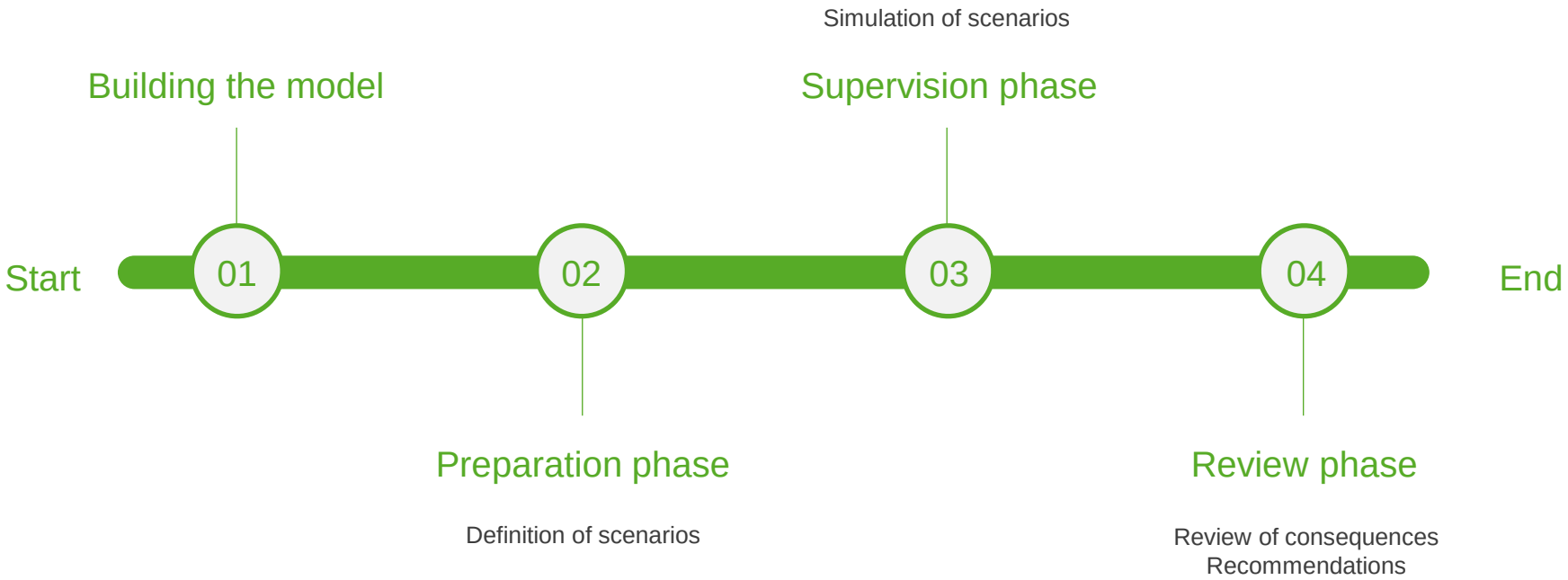
A computer does most of the "mandays"

Reduced duration sessions!

Review the rep… submit to client

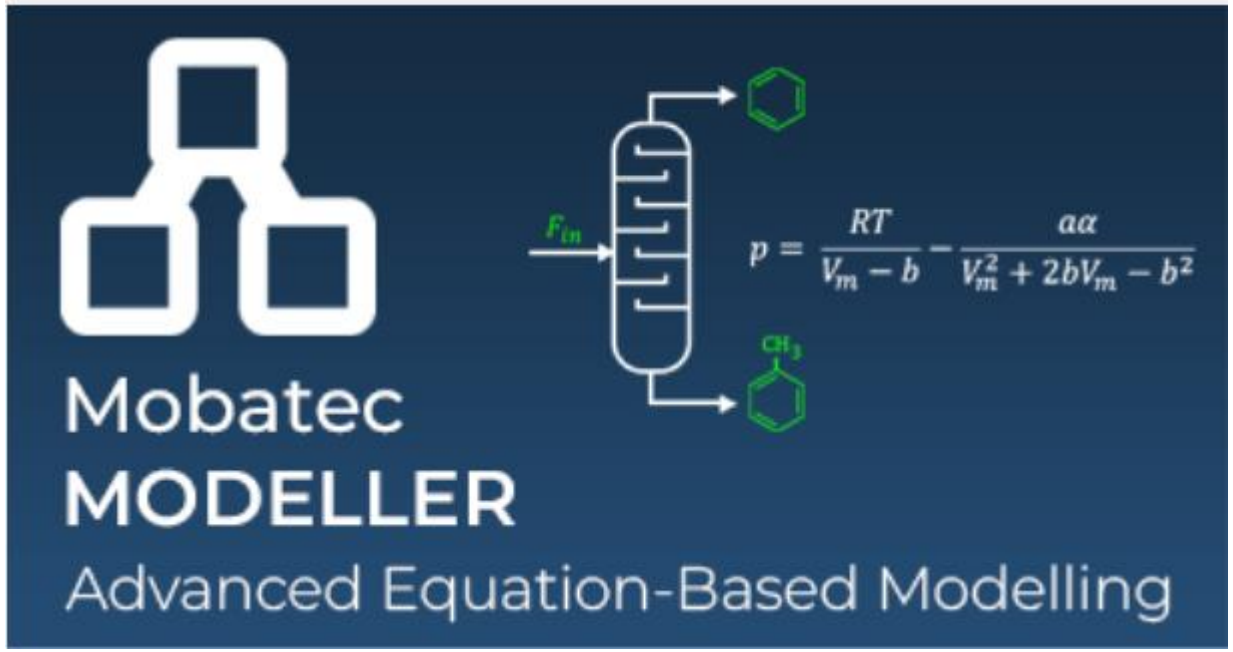
Computer generates a detailed report

The **Digital PHA** process



A few words on model building

Software

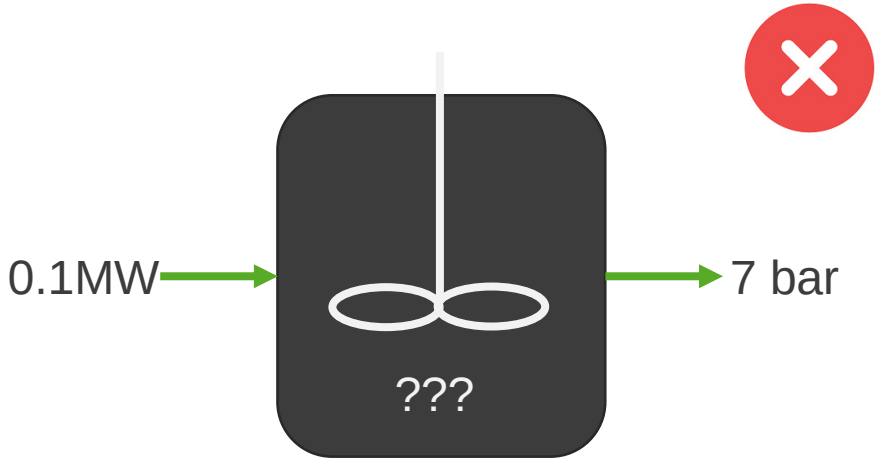


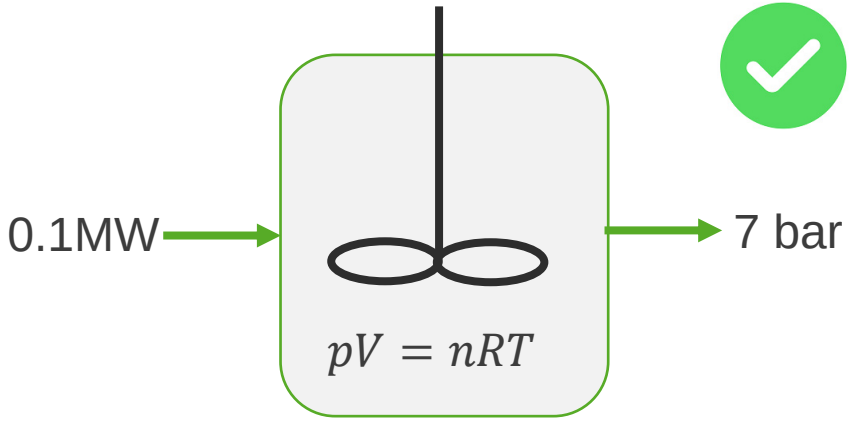
Mobatec Modeler is a software for dynamic process modeling. We chose it because it has some convenient features, like:

- White box.
- Flexible (high transparency).
- No programming skills required.
- System-based.

White Box Modelling

Mobatec Modeller





- See exactly how the model is built up and how it calculates results.
- Core equations exposed.
- Change and manipulate any model anyway you want.

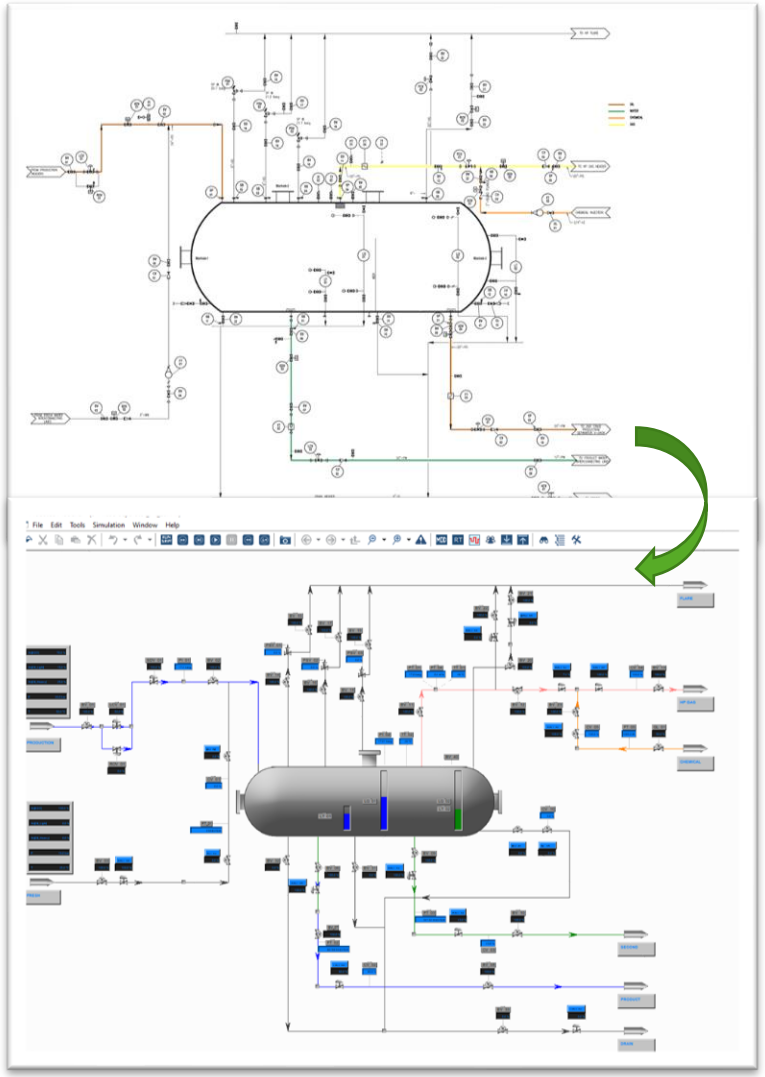
Modelling Flexibility

Mobatec Modeller

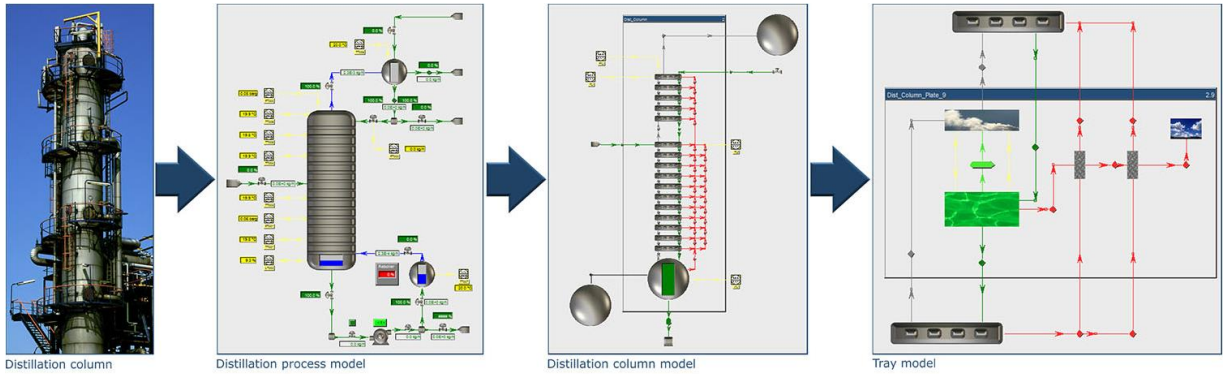
- Any user can use, build or adapt models.
- Connectivity with other software
- Library capabilities

Knowledge needed to build models

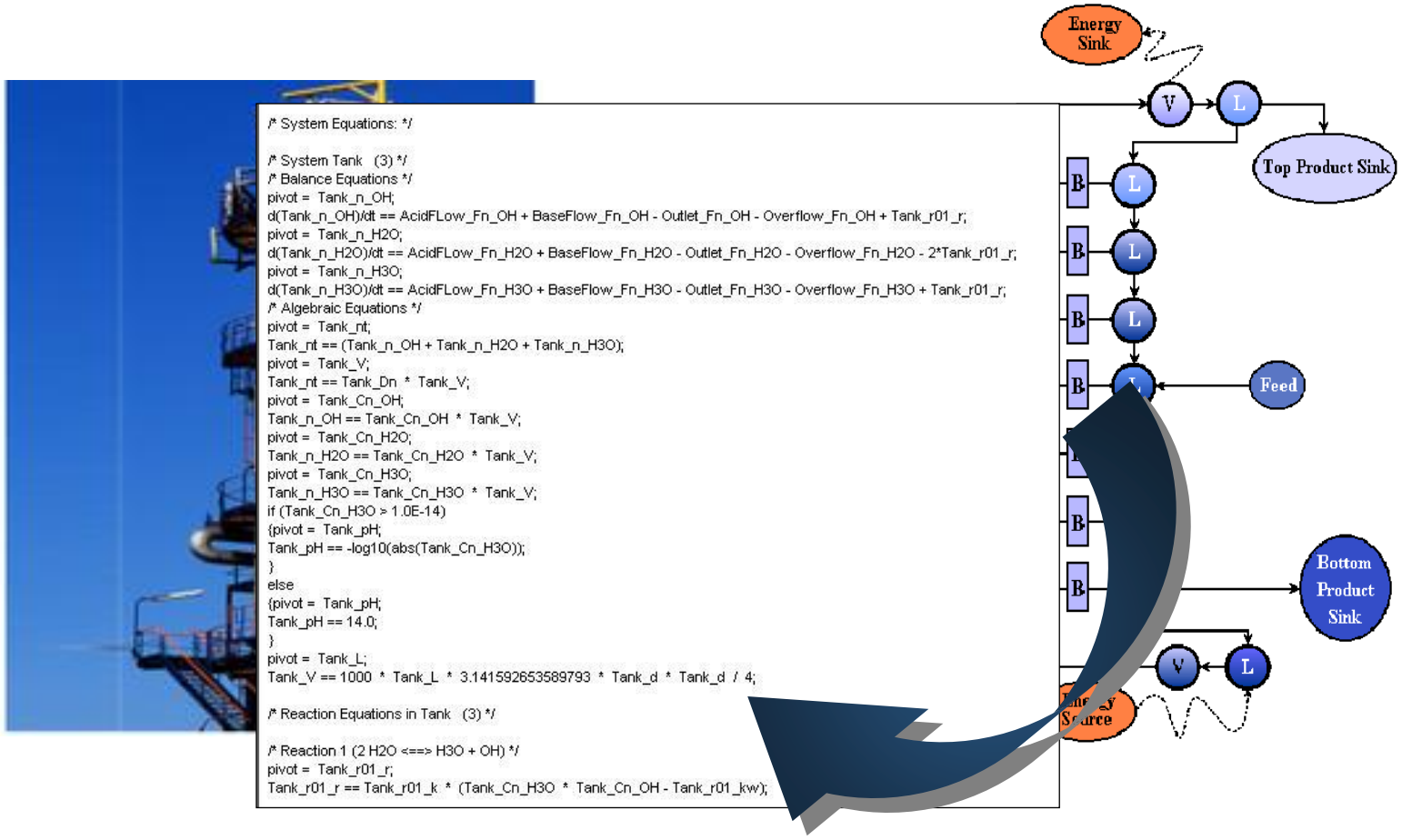
System based approach



- Easy to understand modelling approach
- Split the process into basic building elements
- No Programming skills required



Modelling Methodology



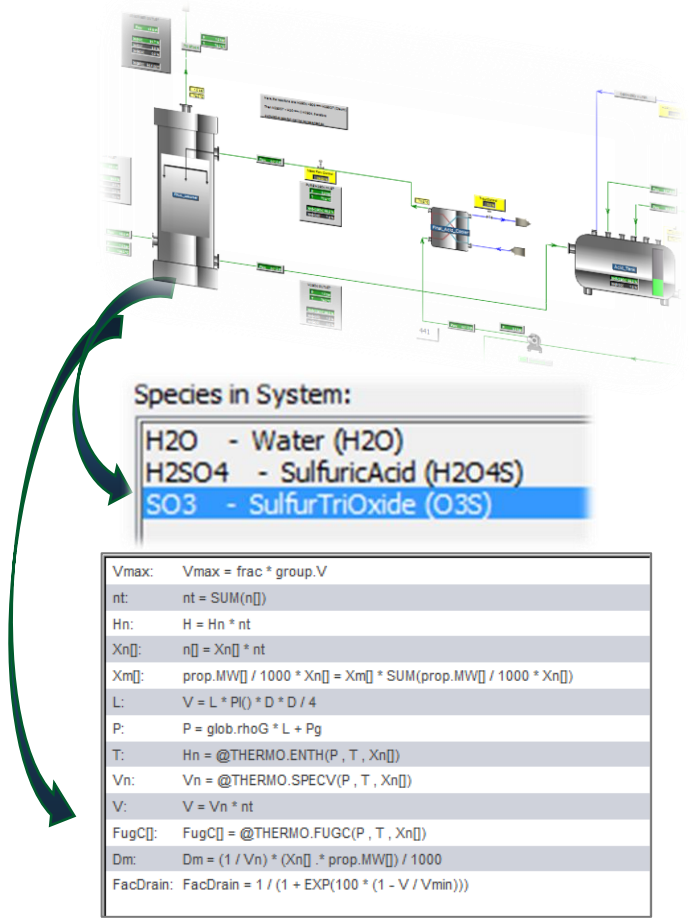
Modelling Methodology - Topologies

Every model created in Mobatec Modeller has:

1 Physical Topology

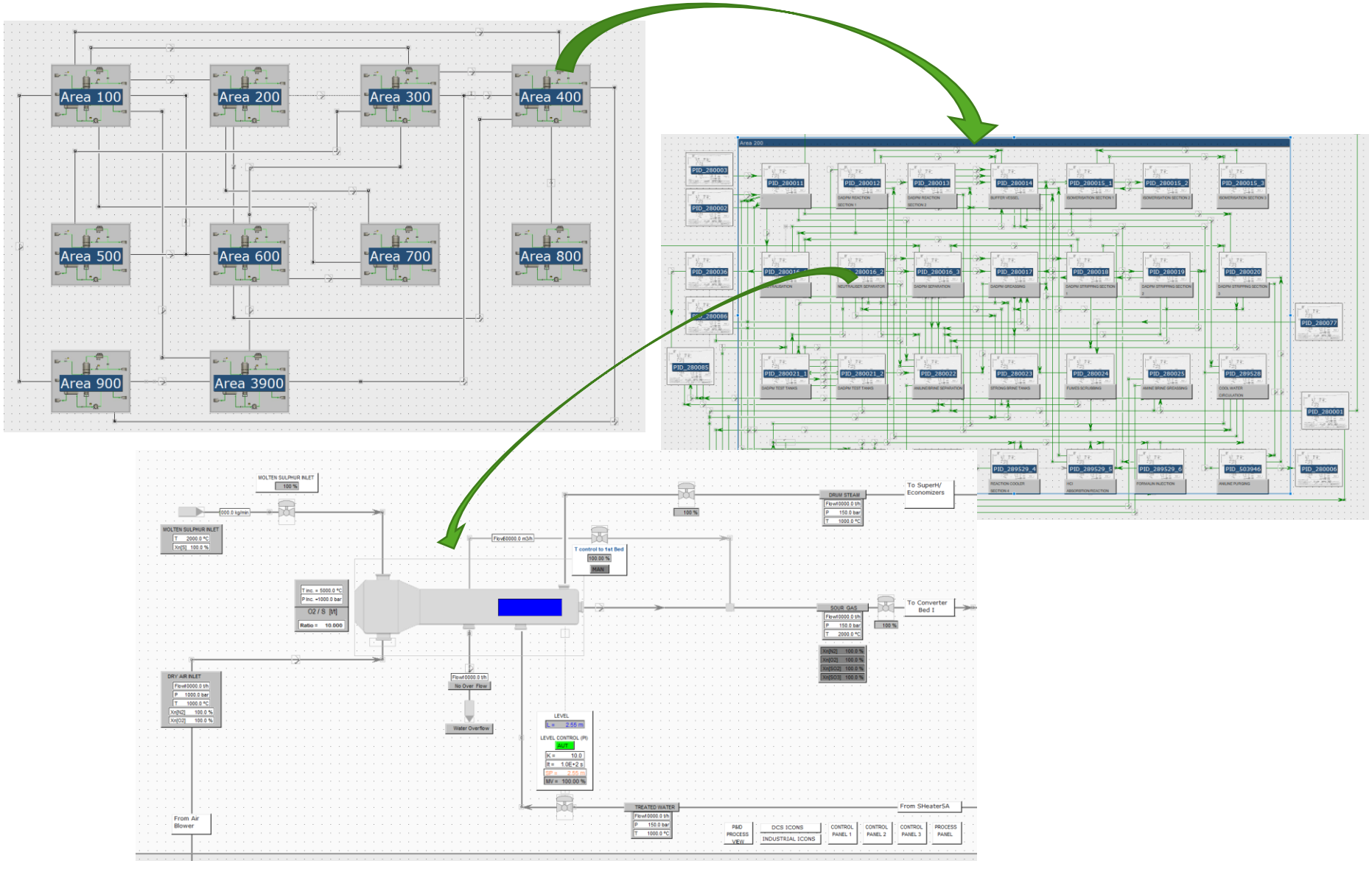
2 Species Topology

3 Equation Topology



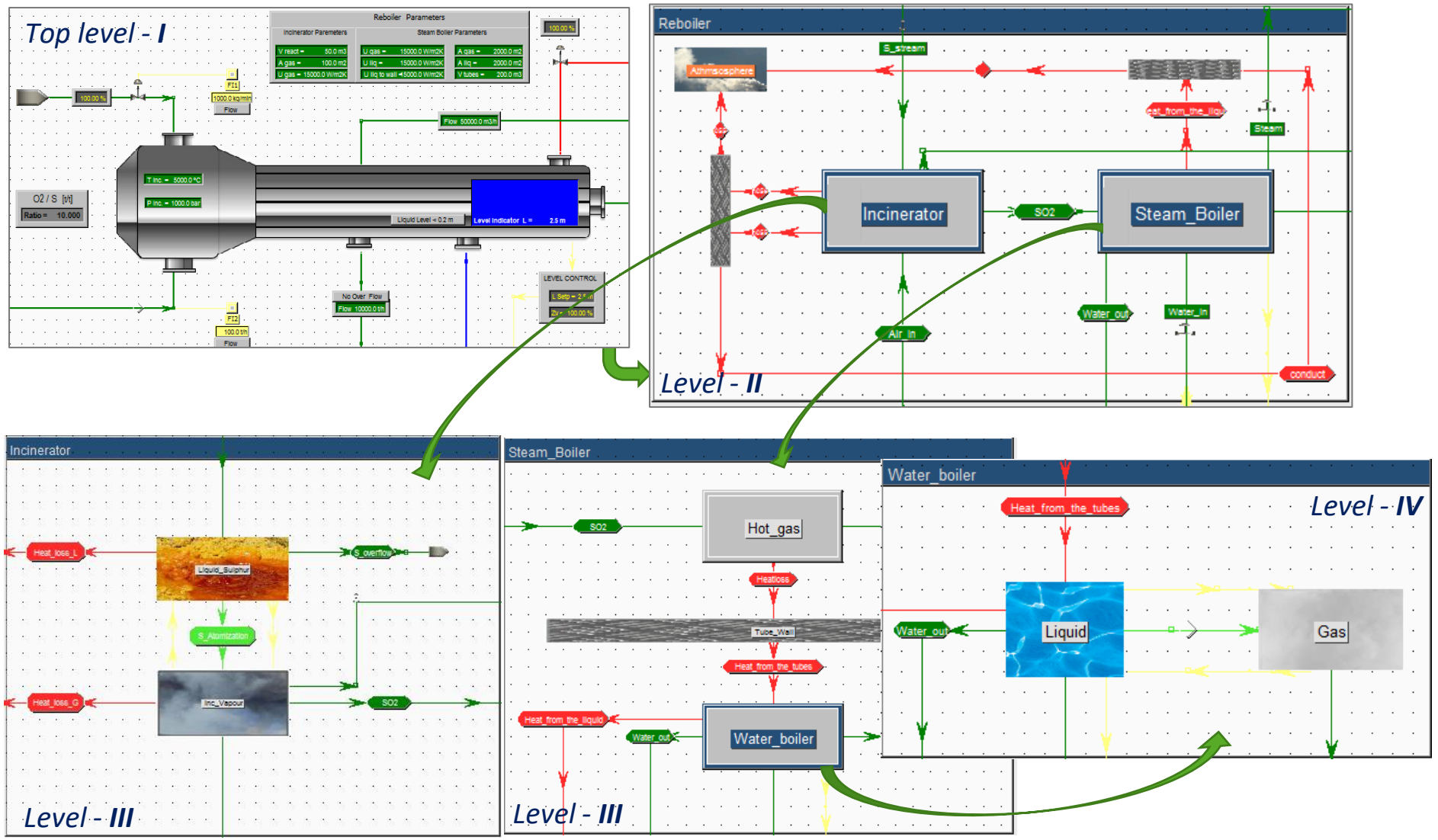
Multi-level model example

Sulphur Incinerator integrated with Steam boiler



Multi-level model example

Sulphur Incinerator integrated with Steam boiler



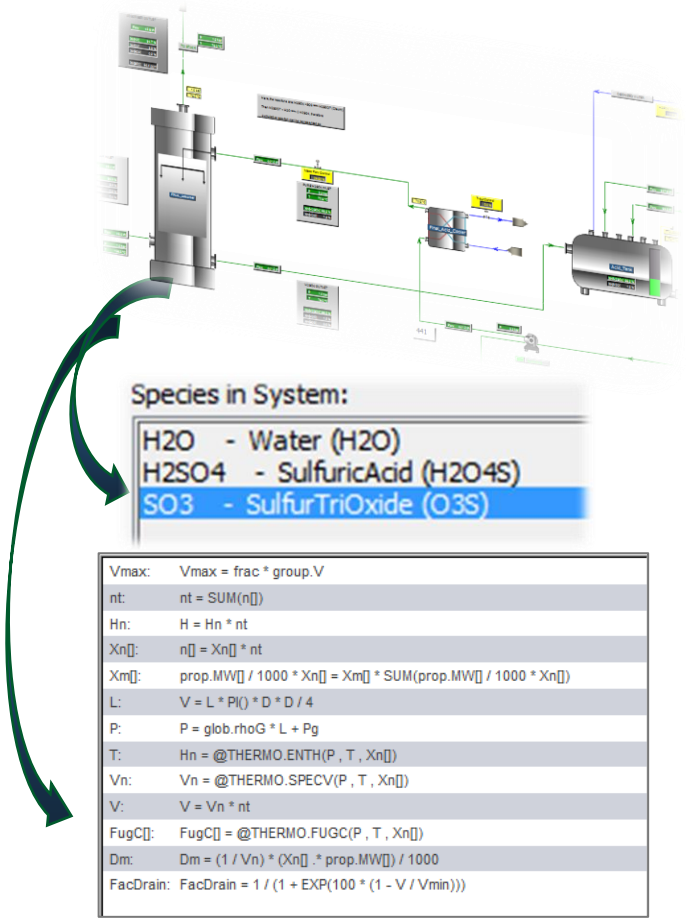
Modelling Methodology - Topologies

Every model created in Mobatec Modeller has:

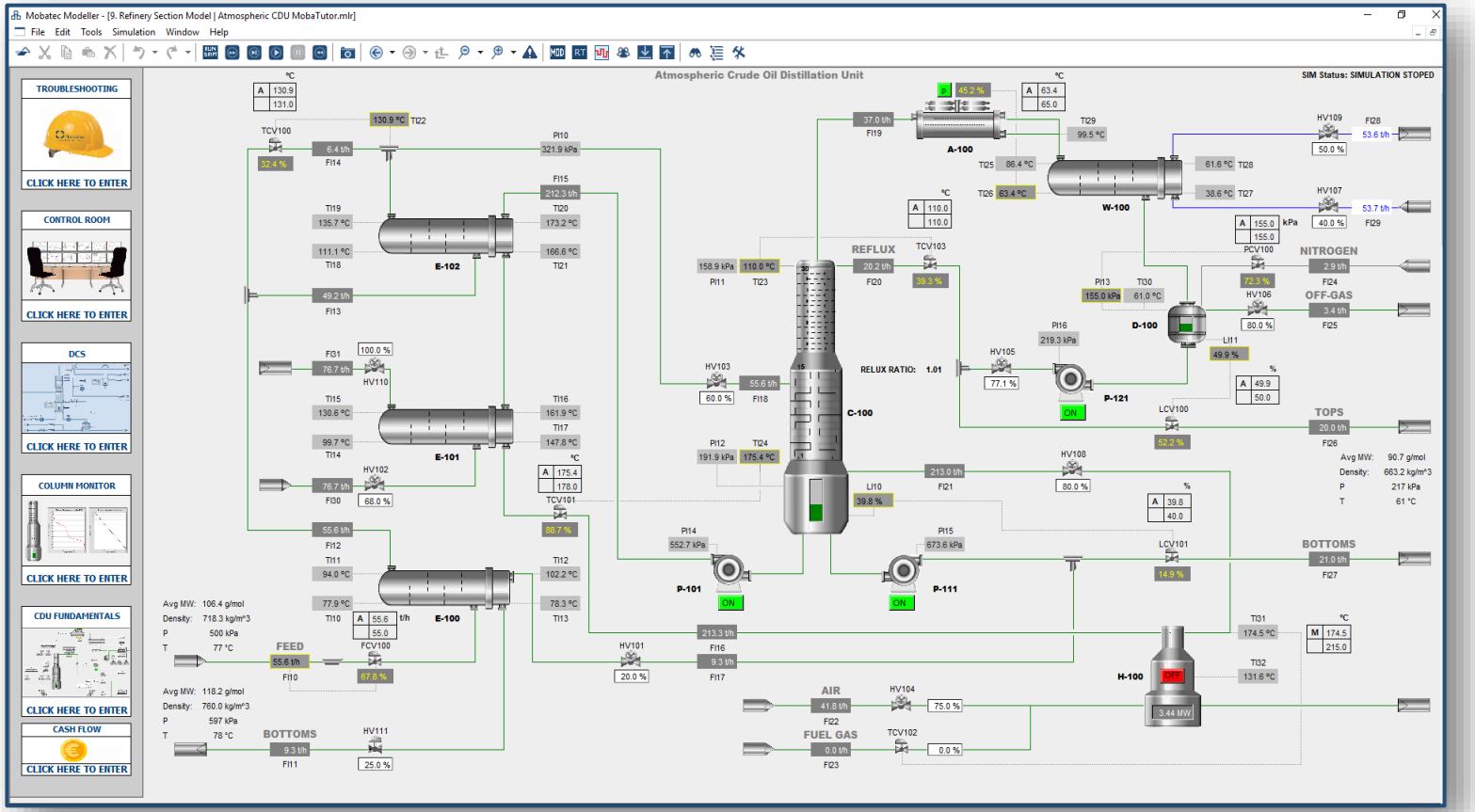
1 Physical Topology

2 Species Topology

3 Equation Topology

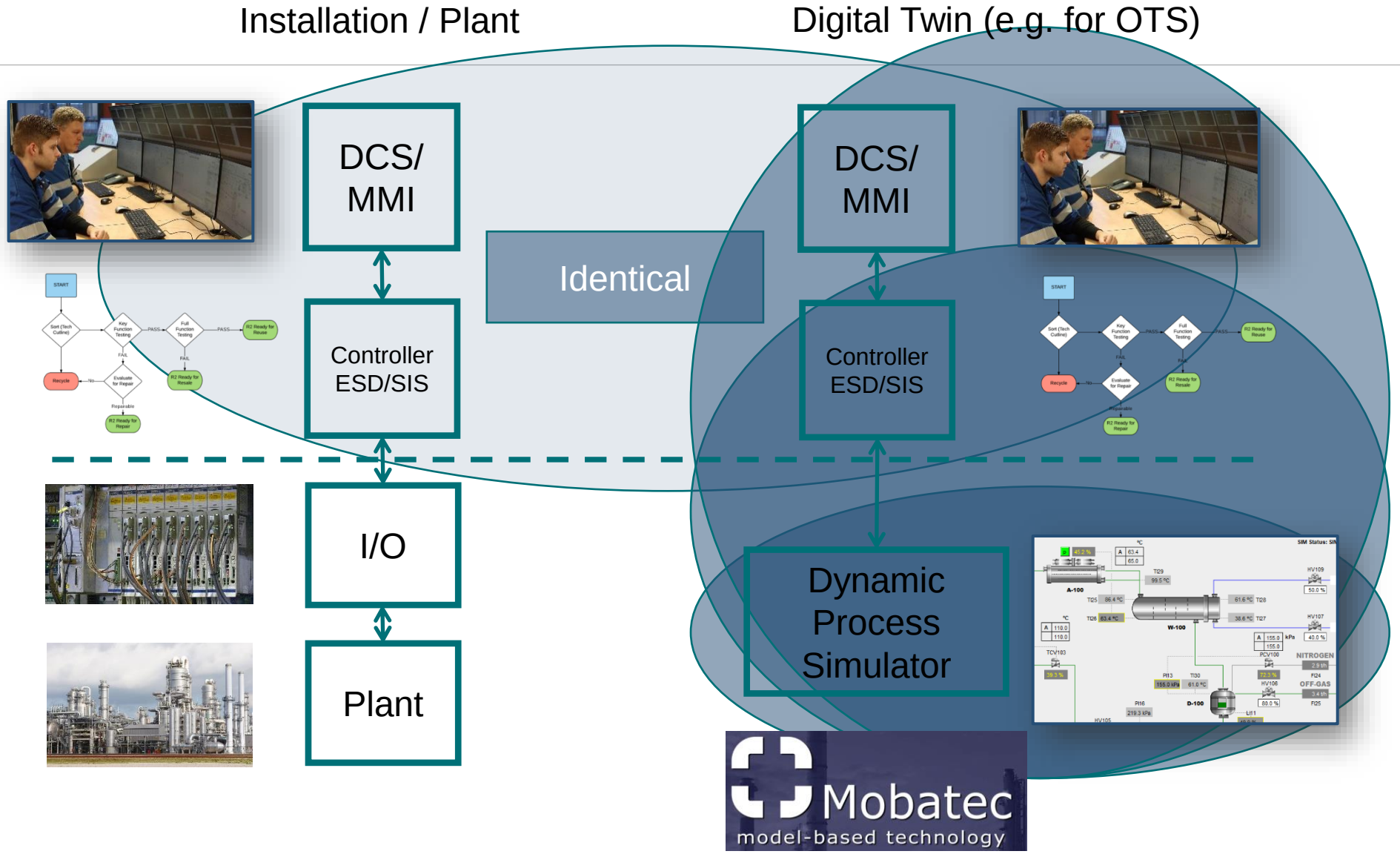


Visual End Result



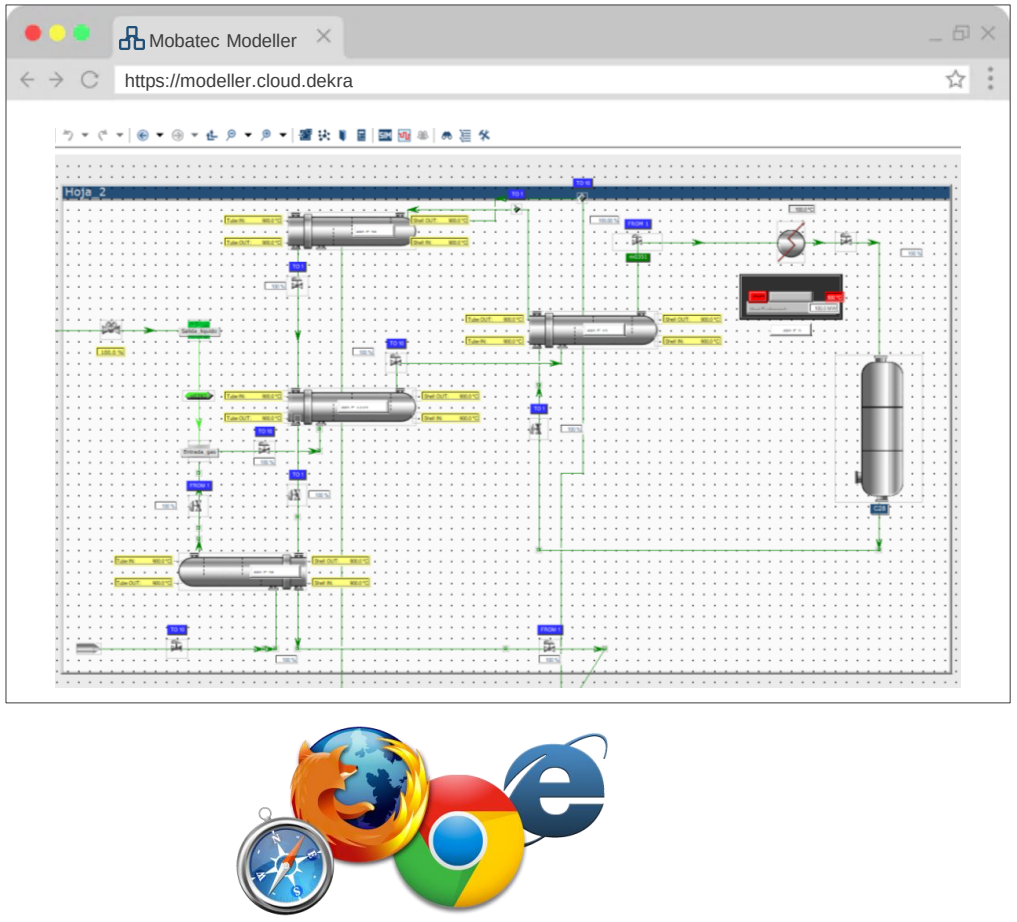
Dynamic Process Model

Digital Twinning



Cloud Ready

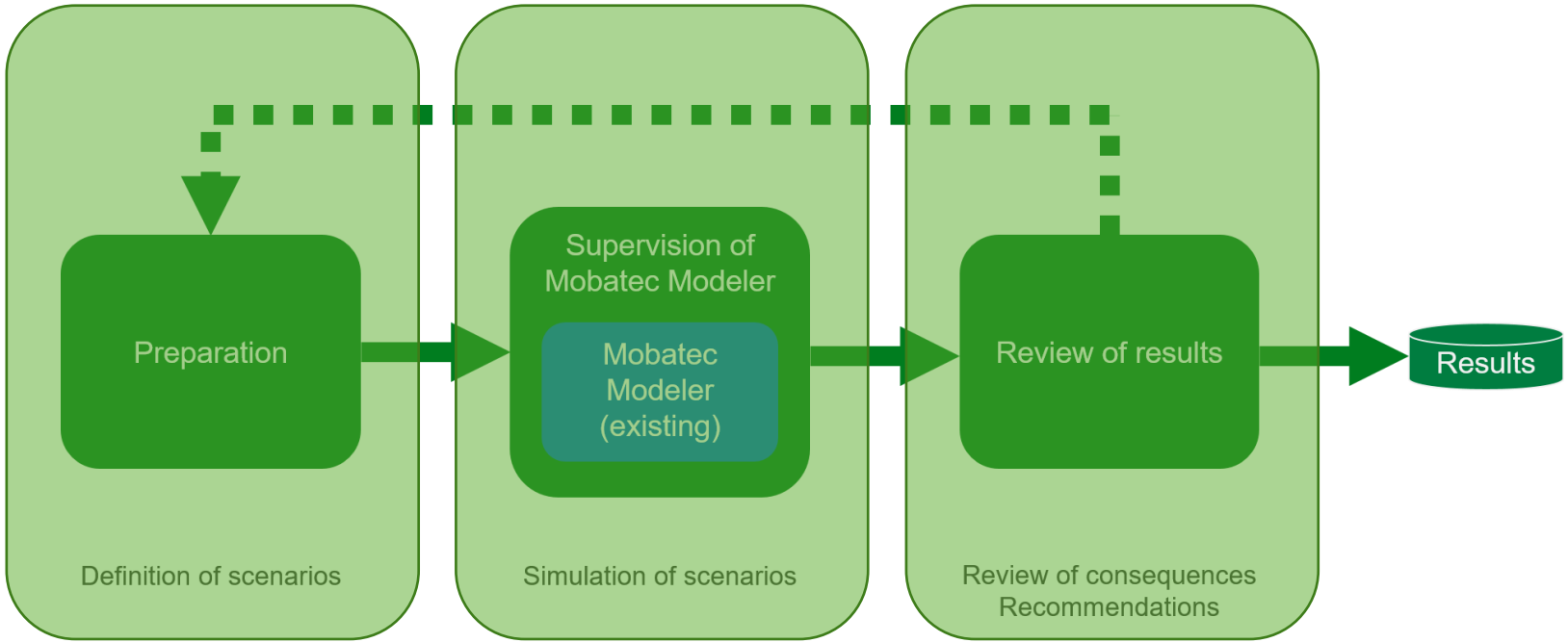
Web Based Software



Mobatec Modeller is a cloud ready software, which makes it easy to **share your** modelling efforts and results accross your company just by making a **login username and password**.

How do we do it?

The Digital PHA process



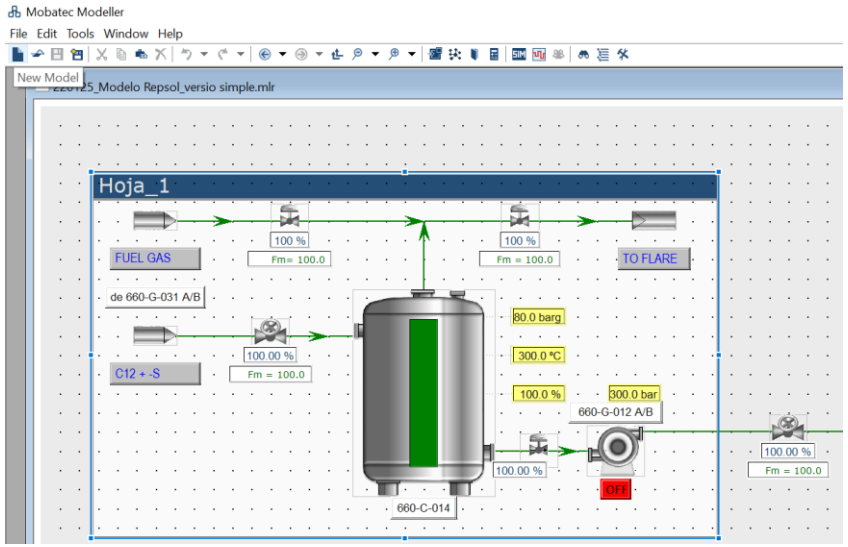
Preparation: the digital tool systematically generates deviations.

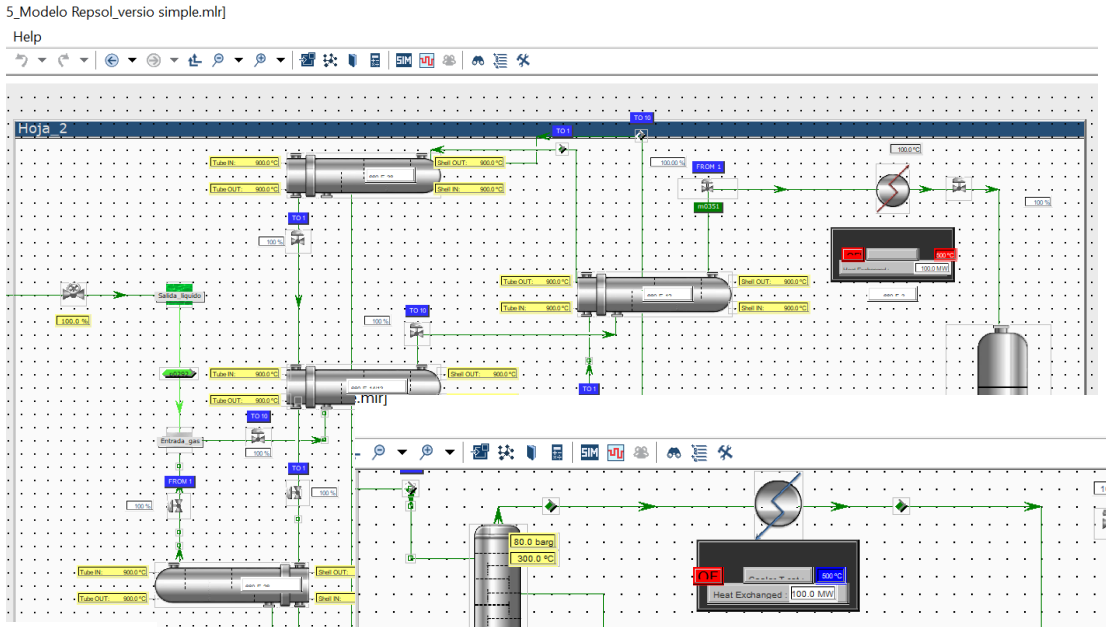
Supervision: the deviations are fed to the model of the process and its evolution is calculated.

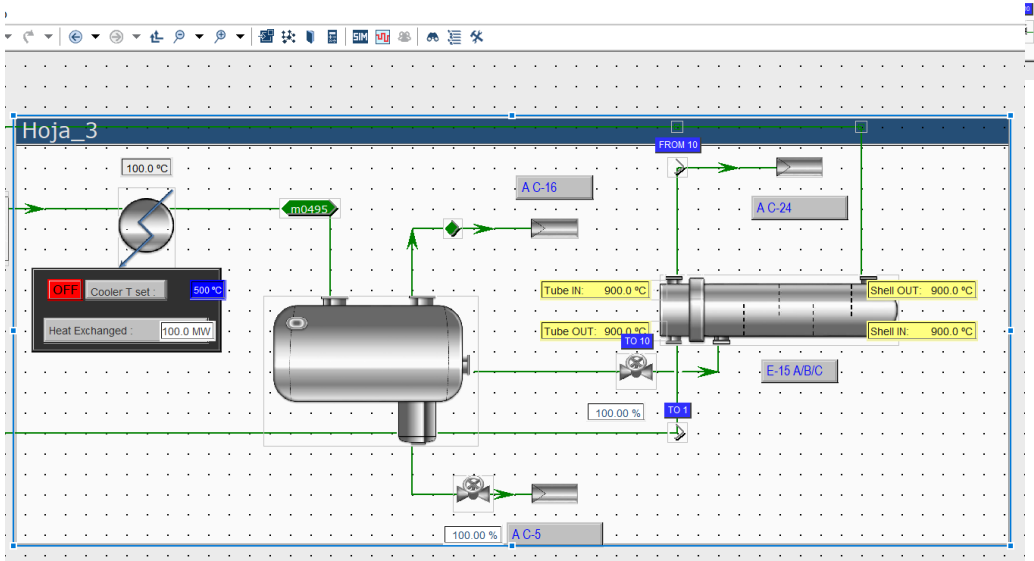
Review: the results of the model (physical and chemical quantities) are mapped into operational upsets or safety issues, safeguards are identified and recommendations are suggested.

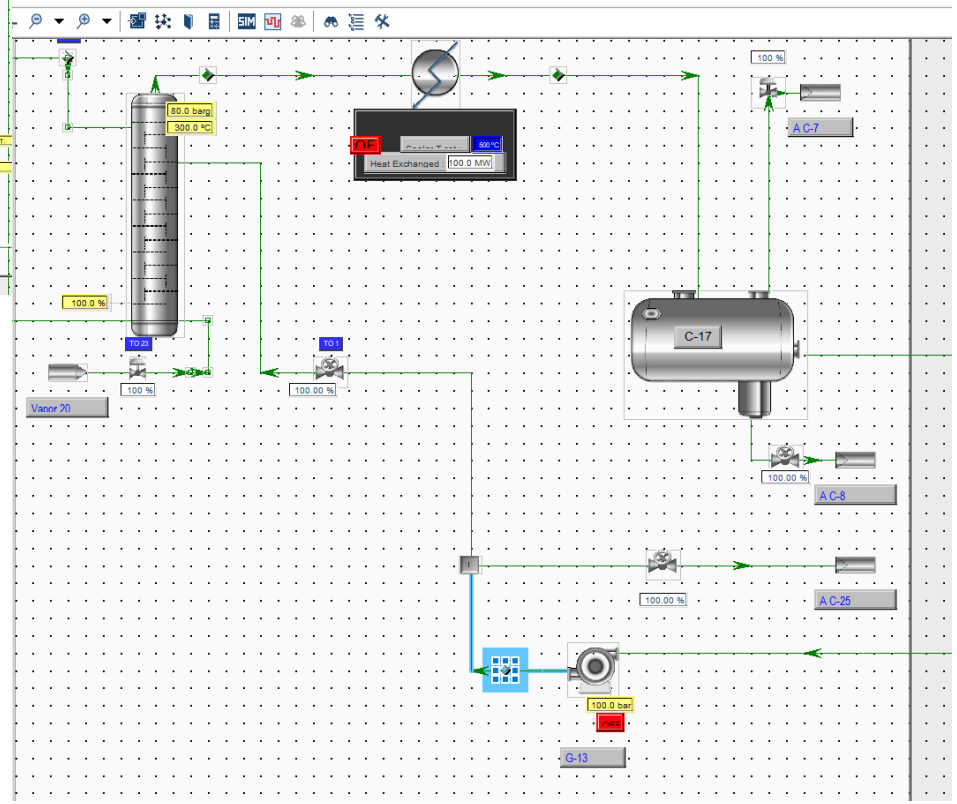
How does it look like?

The model









How does it look like?

The scenarios

DEKRA **Digital PHA**

admin

PROJECTS

Projects

MASTER LIST

Equipment

Species

Variables

Consequences

Final outcomes

General recommendations

USERS

Simulate

New scenario

State

-

Step	Equipment type	Item	Deviation	Value	State	Master	Simulate		
0 - Pump_stopped	Centrifugal Pump Single Curve Model	G12	Stops working	RUN_CP_SC_G12_Pump = 0					
0 - Pump_stopped	Centrifugal Pump Single Curve Model	G12	Undesired start	RUN_CP_SC_G12_Pump = 1					
0 - Pump_stopped	Gas line valve SQRT	01	Valve fails open	Zvset_GL_V_01 = 100					
0 - Pump_stopped	Gas line valve SQRT	01	Valve fails closed	Zvset_GL_V_01 = 0					
0 - Pump_stopped	Gas line valve SQRT	02	Valve fails open	Zvset_GL_V_02 = 100					
0 - Pump_stopped	Gas line valve SQRT	02	Valve fails closed	Zvset_GL_V_02 = 0					
0 - Pump_stopped	Gas source Battery Limit	1	Supply too hot	T_BL_G_IN_1 > 10%					
0 - Pump_stopped	Gas source Battery Limit	1	Supply too cold	T_BL_G_IN_1 < 10%					
0 - Pump_stopped	Gas source Battery Limit	1	Pressure too high	P_BL_G_IN_1 > 10%					
0 - Pump_stopped	Gas source Battery Limit	1	Pressure too low	P_BL_G_IN_1 < 10%					

Showing results from 1 to 10 of 54

«« 1 2 3 ... 6 »»

DEKRA

How does it look like?

The results

DEKRA

admin

PROJECTS

Projects

MASTER LIST

Equipment

Species

Variables

Consequences

Final outcomes

USERS

Users

Clients

					RBS						
Item	Failure	Scenario (OU/SI)	Consequences	PE	F	S	R	Safeguards	RRF	F	
BL_G_IN_1	Supply too hot	The value of Xn_Dodecane_VV_GL_C_014_Liquid on the Vertical Vessel Gas-Liquid System, exceeds the maximum value. Possible equipment breakage and explosion.	Explosion affecting offices close to the plant	1.60e-1	1.60e-2 (OCCASIONAL)	12 (SEVERE)	8.00e-1 (Unacceptable)	Analyzer with alarm (liquid phase)	0.1	2.30e-4 (RARE)	12 (SEV
CP_SC_G12	Stops working	The value of Xn_Dodecane_VV_GL_C_014_Liquid on the Vertical Vessel Gas-Liquid System, exceeds the maximum value. Possible equipment breakage and explosion.	Explosion affecting offices close to the plant	1.60e-1	1.60e-2 (OCCASIONAL)	12 (SEVERE)	8.00e-1 (Unacceptable)	Analyzer with alarm (liquid phase)	0.1	2.30e-4 (RARE)	12 (SEV
CP_SC_G12	Undesired start	The value of Xn_Dodecane_VV_GL_C_014_Liquid on the Vertical Vessel Gas-Liquid System, exceeds the maximum value. Possible equipment breakage and explosion	Explosion affecting offices close to the plant	1.60e-1	1.60e-2 (OCCASIONAL)	12 (SEVERE)	8.00e-1 (Unacceptable)	Analyzer with alarm (liquid phase)	0.1	2.30e-4 (RARE)	12 (SEV

DEKRA

Some conclusions

Our pilot project has confirmed some of the advantages that we forecasted at the beginning of the project. It has pointed out some additional desirable features.

Consistency

Results from the DPHA are consistent across sites.

Data analytics-friendly

Data are collected in the DEKRA Safety Platform.

Precision

Process simulation brings quantitative results into PHAs.

Transients

Often poorly analyzed, can be studied in detail now.

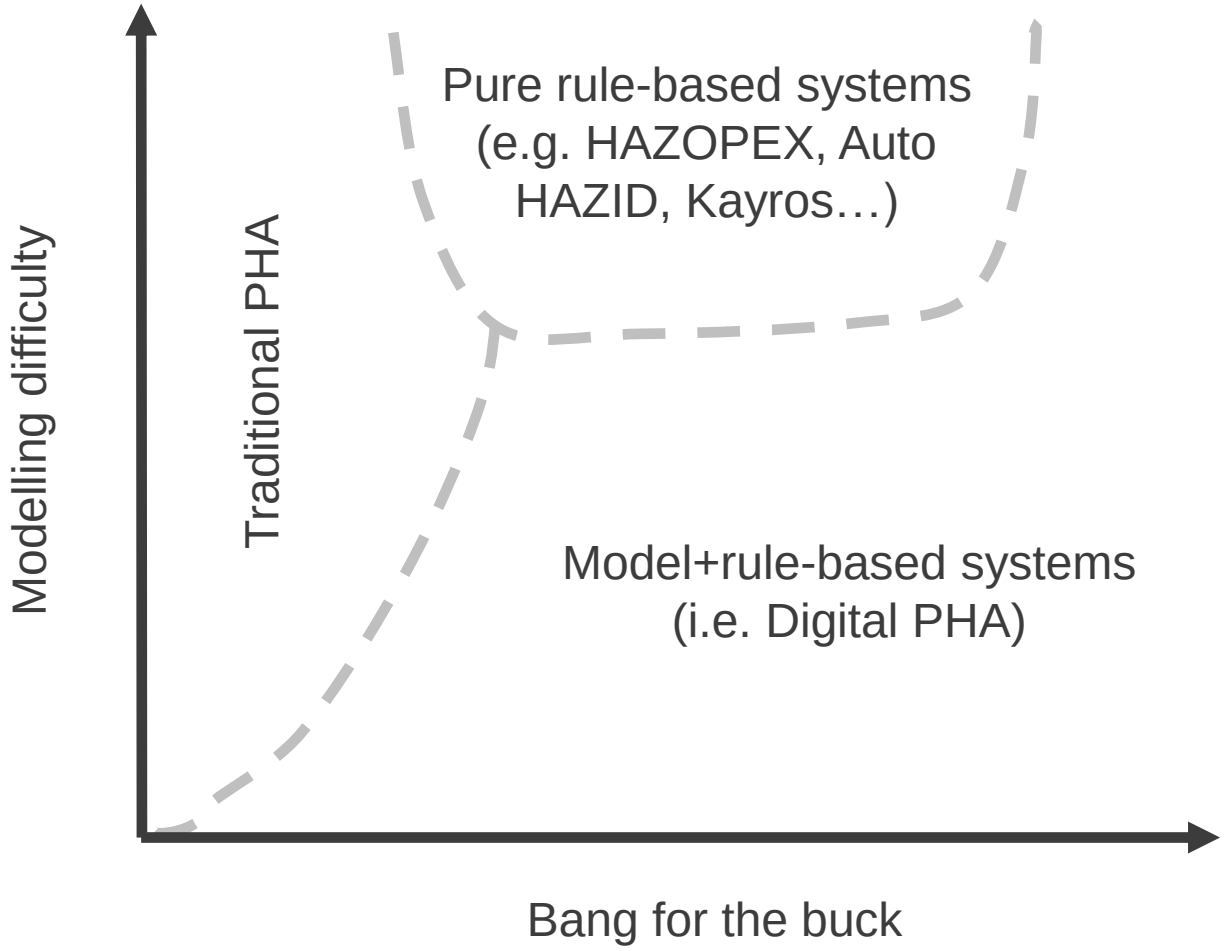
Time saving

Time savings for the site team estimated at 70% in a pilot project.

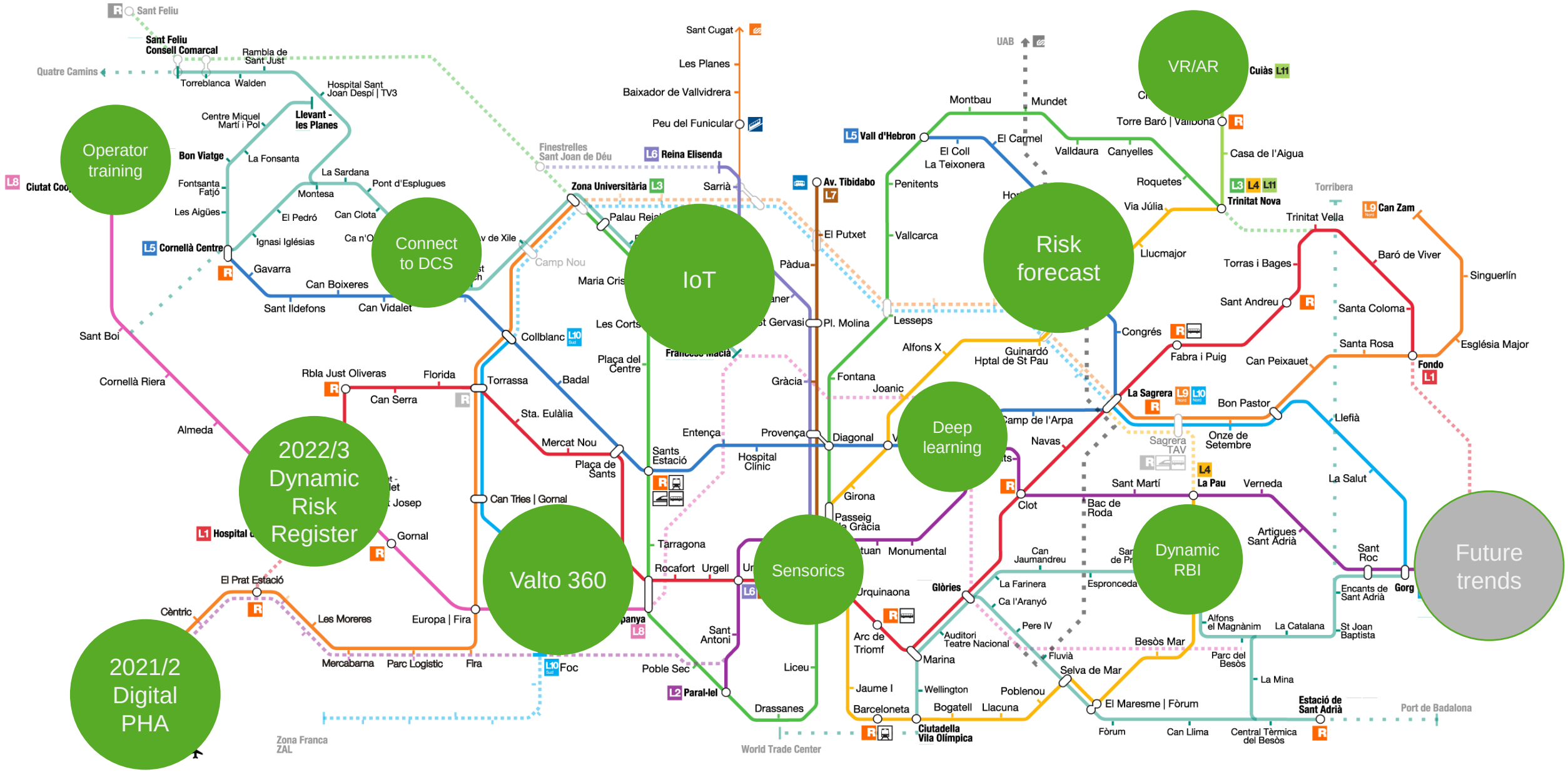
Reusability

Once built, the model can be used for MOC, operator training...

When can we recommend Digital PHA?



To be continued…



THANK YOU

FOR TAKING CARE OF SAFETY!