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ECOFACT (ECO-innovative Energy FACTory Management System)

One Team

Andrea Perego – Consulting & Marketing Director
Riccardo Merizzi – Innovation Consultant

SUSTAINABLE PLACES 2023

AGENDA

1

INTRODUCTION

Company profile

2

PROJECT OVERVIEW

Consortium, targets, demo sites, platform overview

3

THE SOLUTION

Digital Twin Platform with energy and resource tools

4

WHAT'S NEXT?

Future challenges and call to actions

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One Team – mission & business units

For over 25 years we have been transforming skills and technologies into VALUE by offering **consulting services** and the complete supply of **IT solutions** for the construction, civil, infrastructural and manufacturing industries.

We are one of the **top 10 Autodesk Platinum partners** in EMEA.

Smart Buildings & Infrastructures

Smart Manufacturing

Smart Territories

One Team key numbers

EU-FUNDED PROJECTS

BIM4EEB

BIM based fast toolkit for Efficient rEnovation of residential Buildings

One Team main task: BIM Management System development

BUDGET: 7M€

DURATION: 42M

PARTNERS: PoliMI, VTT, Suite 5, Regione Lombardia etc.

LINK: https://www.bim4eeb-project.eu/

INFINITE

INdustrialised durable building envelope retroFitting by all-IN-one Interconnected TEchnology solutions

One Team main task: BIM-based design platform (CDE) development

BUDGET: 10M€

DURATION: 54M

PARTNERS: EURAC, Greendelta, Huygen, Nobatek, Rubner etc.

LINK: https://infinitebuildingrenovation.eu/

ECOFACT

AUTODESK Platform Services

ECO-innovative Energy FACTory Management System based on enhanced LCA and LCCA towards resource efficient manufacturing

One Team main task: Forge-based Digital Twin Platform (Energy&Resource Management System)

BUDGET: 12M€

DURATION: 48M

PARTNERS: CARTIF, RINA, LINKS, WINGS, Schneider Electric etc.

LINK: https://ecofact-project.eu/ecofact-press-release/

BuildON

Affordable and digital solutions to Build the next generatiON of smart EU buildings

One Team main task: Digital Building Logbook and digital twin development

BUDGET: 7M€

DURATION: 42M

Level 4
Digital Twin

PARTNERS: CARTIF, RINA, EURAC, NTUA etc.

LINK: coming soon…

Horizon 2020
European Union Funding
for Research & Innovation

HORIZON EUROPE

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Project overview

M33

The project in a nutshell

ECO-innovative Energy FACTory Management System based on enhanced LCA and LCCA towards resource-efficient manufacturing.

- **12 M €** budget
- Started in **2020**
- **48M** duration
- Consortium of **20 organizations**
- Part of the **Horizon 2020** program
- **Digital Twin Platform (DTP)** based on **Autodesk Platform Services (APS)**
- DTP as ECOFACT **Energy & Resource Management System**

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Scientific and Technological Objectives (STOs)

STO1

- Plug-and-play solution consisting of a hardware Smart Box for **interoperable connection** of different energy sensors (IIoT).
  - Target: reduction of network resources and costs by **20%**

STO2

- Helping O&M staff to forecast problems, do better planning and improve performance in the use of (energy and material) resources thanks to a prognosis-based **ERMS**.
  - Target: cut on the factory energy bill by average of **25 %**.

STO3

- Better control of the **environmental signature** of manufacturing processes and supply chains, enabling green production and product design as a cost-saver and marketing tool for businesses.
  - Target: reducing environmental footprint of manufacturing processes by average of **4-8 %**.

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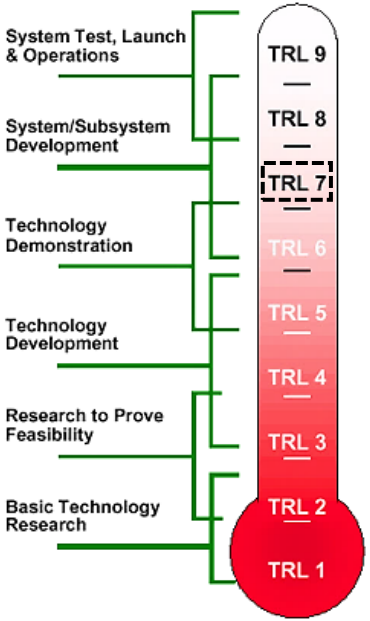
Other Objectives

Other Scientific Technological Objectives

- *STO 4: ECOFACT methodology and platform for holistic manufacturing.*
- *STO 5: demonstration of ECOFACT at TRL7 in four different demo sites.*

Non-technological Objectives (NTOs)

- *NTO 1: inputs to new standardization, certification and regulation schemes.*
- *NTO 2: exploitation for attractive business cases and fostering replication.*
- *NTO 3: dissemination, communication and capacity building.*



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Discrete Manufacturing Demo Sites

Arçelik

Tofaş

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Continuous Manufacturing Demo Sites

Athenian Brewery

Gullón

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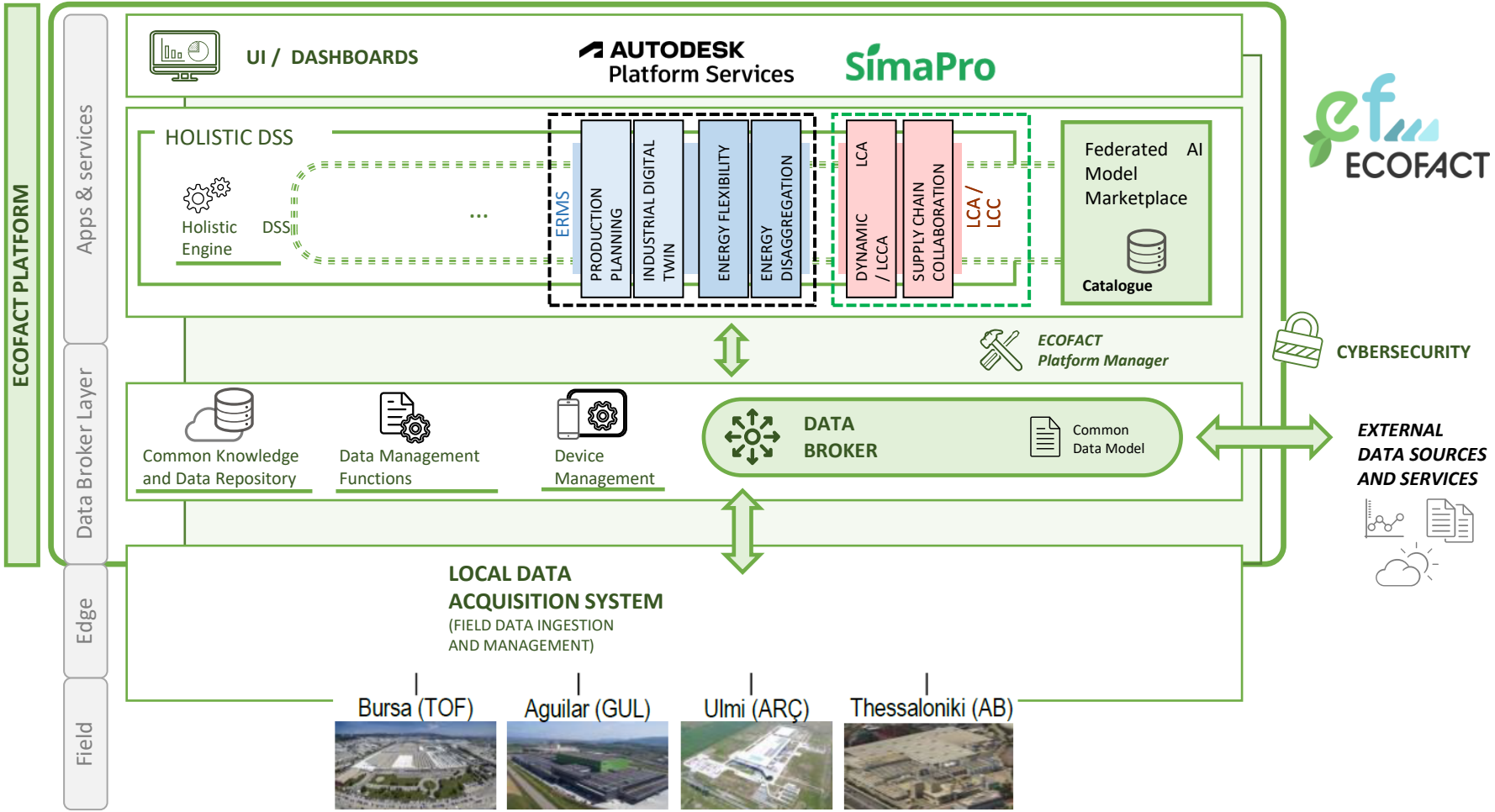

ECOFACT

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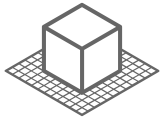
Digital Twin Platform (DTP)

Energy & Resource Management System (ERMS)

Digital Twin Platform sections

Web platform based on Autodesk Platform Services (APS)

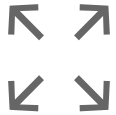


Digital twin models:

- 3D models – IAM – done with **Autodesk Inventor** including sensor positions and types;
- accessible through **APS Viewer** with real-time monitoring data and historical datasets;
- sim and optimization outputs;
- related documents available.

Energy and resource tools:

- GUIs for data input, running simulations and optimisations and viewing outputs;
- **OptimiST** for energy flexibility;
- material-flow sim and prod planning and scheduling;
- energy models & PdM;
- IEDbyP.



Data-exchange layer:

- Platform Services API;
- authorization API;
- resource API;
- user API;
- model and document API;
- external tool API.

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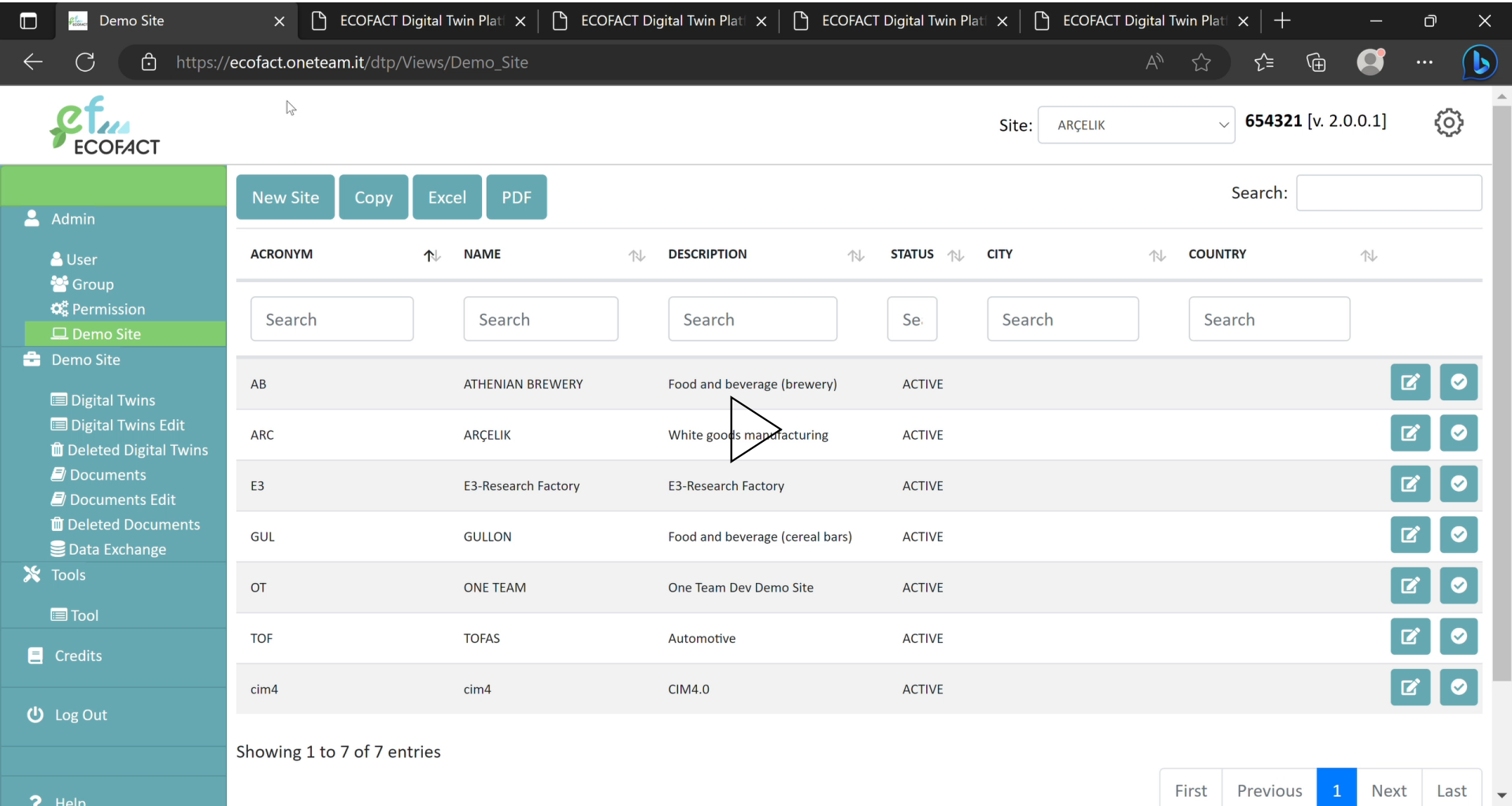
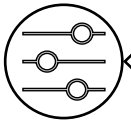
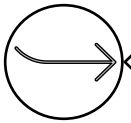
Digital twins – sensor data



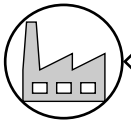
Energy and resource tools



Industrial energy flexibility and optimized management of generation assets – **OptimiST** (based on **Cbc**).

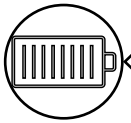


Material-flow simulation for predictive management of manufacturing process data (based on **Siemens plant simulation tool**).



Production planning and scheduling (based on **Gurobi solver**).

Energy simulation for dynamic operations management and cost optimization (energy modeling based on **TRNSYS** and predictive maintenance).



Industrial energy disaggregation – by product.

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Energy and resource tools – OptimiST

How it works

Minimization of:

- change over times defining the production scheduling (AB & GUL)
- electrical energy bill (using PV and depending on energy tariffs) adapting production (ARC)
- energy bill optimizing the management of energy assets (TOF)

Outputs

- Production scheduling for packaging and formation lines (AB & GUL)
- Production scheduling for different liens, buffers and machines (ARC)
- Energy production scheduling of assets and economic parameters (TOF)

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Energy and resource tools – OptimiST

Results (average)

Minimization of change over times

-13 %

CO time, kWh, l, CO_2 ton

Minimization of energy bill

-20 %

GWh/y

-4 to -6 %

CO_2 ton

Consequently

-9k to -0.9M

€/y

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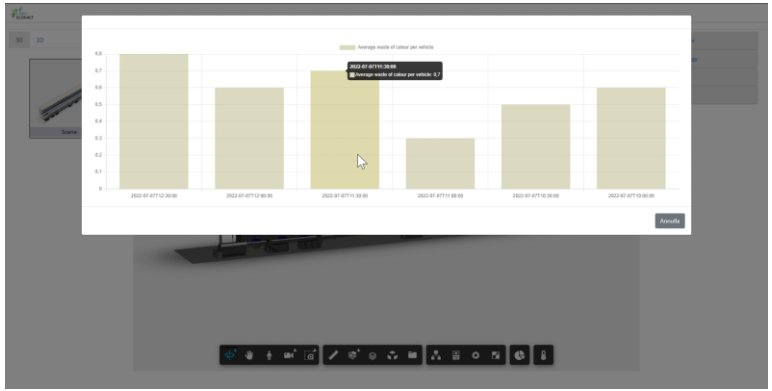
Energy and resource tools – material-flow sim & prod plan and sched

Material-flow simulation for predictive management of manufacturing process data & production planning and scheduling

The two developments are linked and focused on the two discrete manufacturing sites.

Material-flow simulations are conducted through the Siemens plant simulation tool. **Production optimisations** are based on Gurobi solver.



Outputs

- Paint saved for vehicles (TOF)
- Scheduling of two lines with start-up time (TOF)
- Washing machine production and energy spent (ARC)

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Energy and resource tools – energy models & PdM

Energy simulation for dynamic operations management and cost optimization

The energy modeling is based on the TRNSYS software.

The Predictive Maintenance (PdM) leads to cost-effective and energy-efficient operations in terms of machinery management (better than CM and PvM), increasing the manufacturing system robustness.

PdM Results (average)

-2.9 to -11 %

Costs

11 to +600

Forecast of days before maintenance

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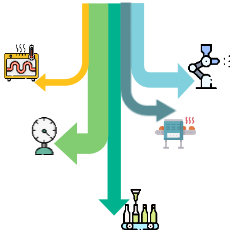
Energy and resource tools – IEDbyP

Industrial energy disaggregation



Industrial Energy Disaggregation (IED) separates different components from energy signal(s).

- IED by Product (IEDbyP) for forecast and wise long-term planning in terms of energy.
- Non-intrusive load monitoring (NILM) study for research purposes.

Outputs

Resources disaggregated by product

- electricity (kWh)
- compressed air (m^3)
- natural gas (m^3)
- hot water (m^3)
- distilled water (m^3)
- water (m^3)

Interaction component in yellow: energy saved producing different item types together, not individually

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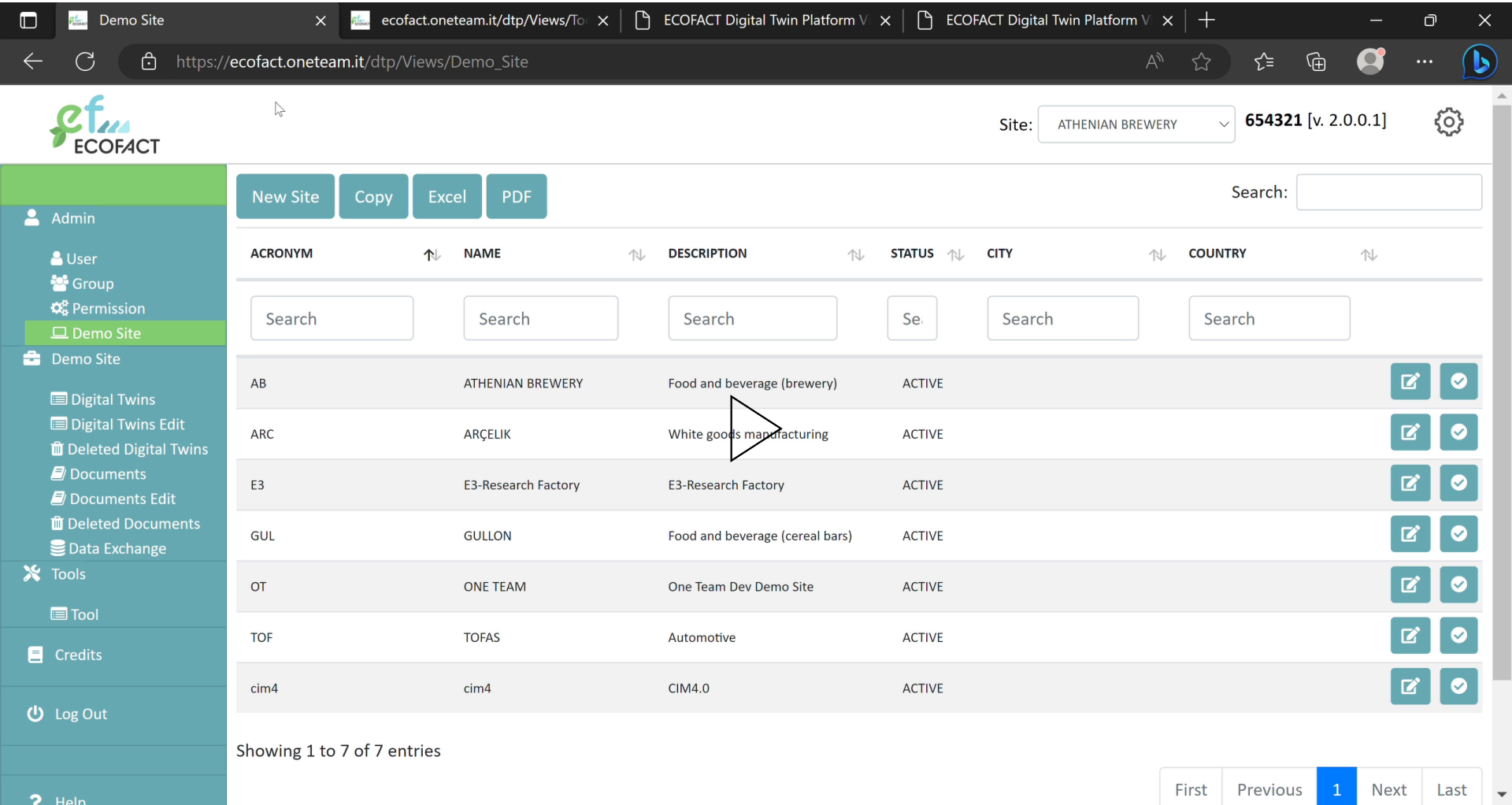
Energy and resource tools – OptimiST & PdM into the DTP



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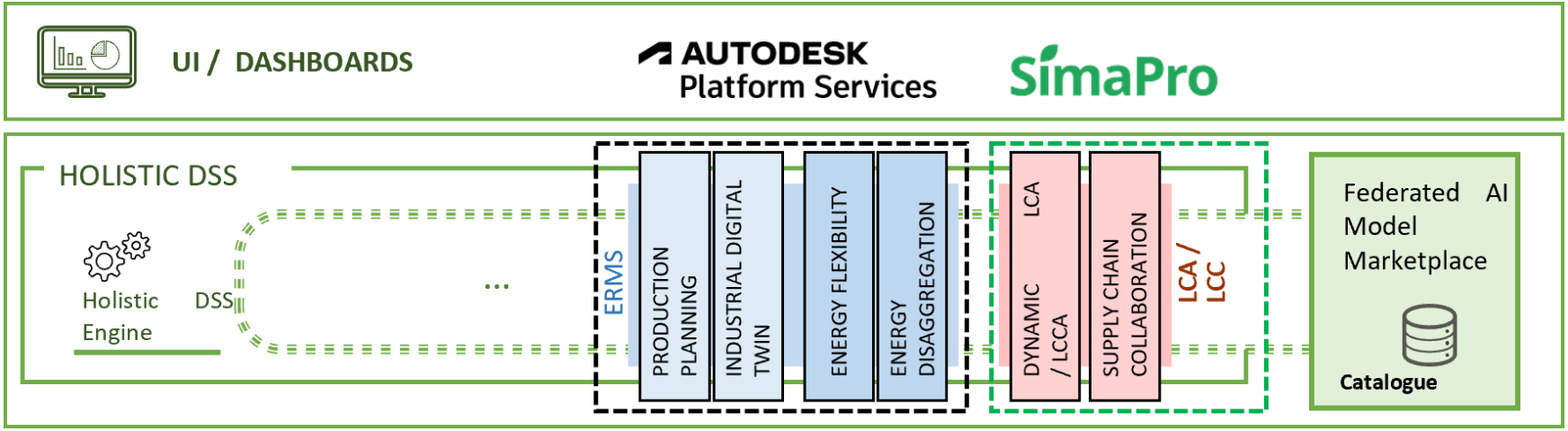
What's next?

Future challenges & call to actions

Future challenges – LCA/LCC together with ERMS/DTP within ECOFACT UI



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Future challenges – be part of the ECOFACT project

For exploitation ECOFACT is looking for up to five other demo sites

Further investments needed for full marketability of the solution by 2028-2030 (from TRL7 to TRL9)

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