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ECOFACT (ECO-innovative Energy FACTory Management System)

One Team

Andrea Perego

Consulting & Marketing Director

AGENDA

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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.

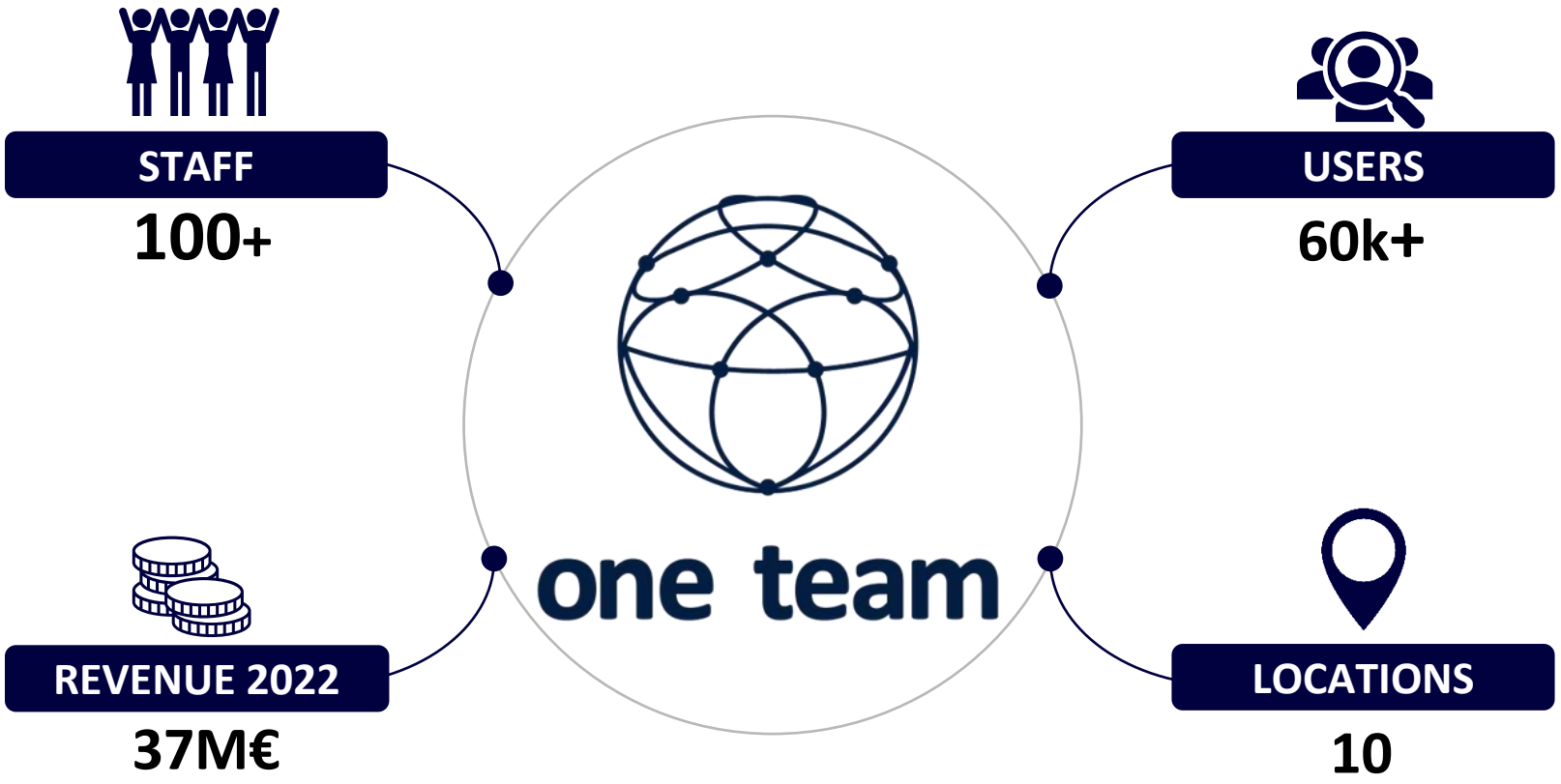
We are one of the **top 10 Autodesk Platinum partners** in EMEA.

Smart Buildings & Infrastructures

Smart Manufacturing

Smart Territories

One Team key numbers



One Team 4 sustainability

One Team logo is a clear reference to the Earth, we always keep an eye on the protection of our Planet indeed. And our commitment is very concrete: we are currently working on very important **eco-innovative projects**, such as BIM4EEB, ECOFACT-project and INFINITE project, and we have chosen to use **only renewable sources** thanks to a special contract signed w/ A2A.

We strongly believe that preserving the **Earth** and its resources is very important, especially in this historical period.

One Team's 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…

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

BIMReL

BIM Regione Lombardia

One Team main task: BIMReL Platform development

BUDGET: 2M€

DURATION: 24M

PARTNERS: PoliMi, Traceparts, Regione Lombardia

LINK: https://www.bimrel.it/

ECOFACT

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

One Team main task: Digital Twin modelling and Platform development on Forge

BUDGET: 12M€

DURATION: 48M

PARTNERS: Cartif, Rina, Links, Wings, Schneider, Veolia…

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

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, Bouygues…

LINK: https://infinitebuildingrenovation.eu/

Horizon 2020
European Union Funding
for Research & Innovation

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Project overview

M24 – halfway

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** based on Autodesk Forge (Energy & Resource Management System)

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Consortium

- 20 partners
- seven different countries (six of the EU)
- five research institutions
- eight large industries
- five SMEs
- two associations across the manufacturing environment

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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 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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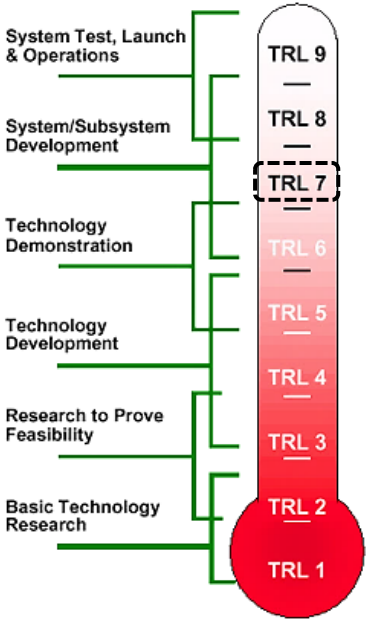
Other Objectives

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

Gullon

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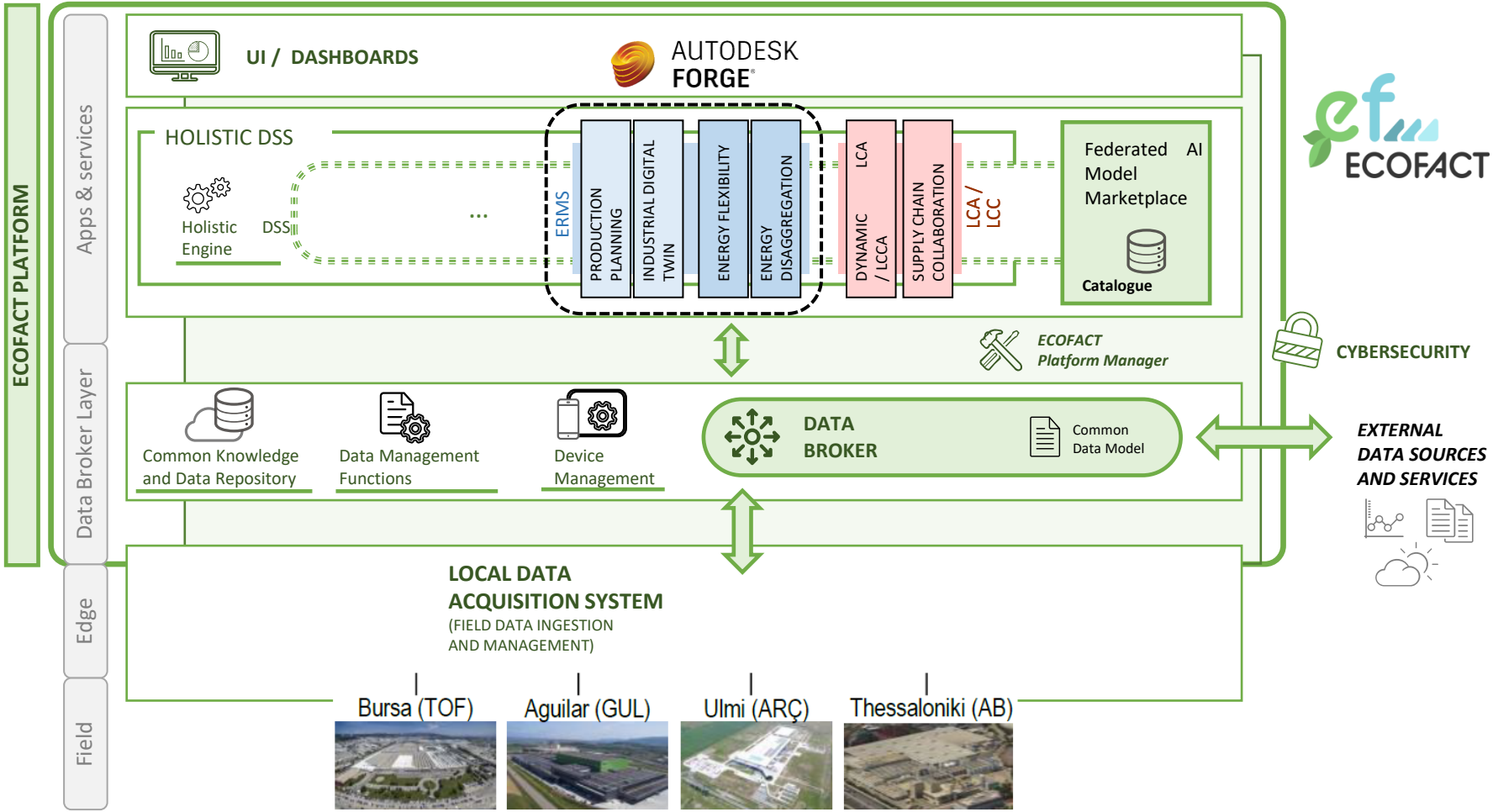

ECOFACT

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4-step ECOFACT concept




Local Data

Holistic monitoring and data-acquisition solutions:

- network for interoperable integration of smart sensors under **IIoT premises**;
- interaction with several levels (sensors, actuators, PLCs, SCADA etc.) within the **industrial processes pyramid**.

Data Broker

- Developed to manage information streams that can be accessed through a series of APIs by data producers, consumers or stream processors.
- Based on an open-source stream-processing software **platform (Kafka)** enhanced with other functionalities.

Holistic DSS

Including:

- the Forge-based **Digital Twin Platform** (DTP) as an Energy and Resource Management System (ERMS);
- a **supply chain** collaboration service and a dynamic **LCA/LCCA approach** leveraging SimaPro.

UI

In which production managers:

- **interact with the DSS**, receiving operational and scheduling suggestions and alerts/alarms and running production scenarios;
- **access different data** (both historical and in real-time) at different granularity.

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ECOFACT

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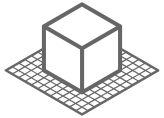
Digital Twin Platform (DTP)

Energy & Resource Management System

DTP sections

Web platform based on Autodesk Forge

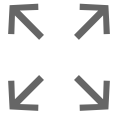


Digital twins:

- accessible through **Forge Viewer**, with the related 3D models realized using **Inventor**;
- relevant documents.

Energy and resource tools:

- **OptimiST** for the industrial energy flexibility and optimized management of generation assets;
- three other applications for four more purposes.



Data-exchange layer:

- authorization API;
- resource APIs;
- user APIs.

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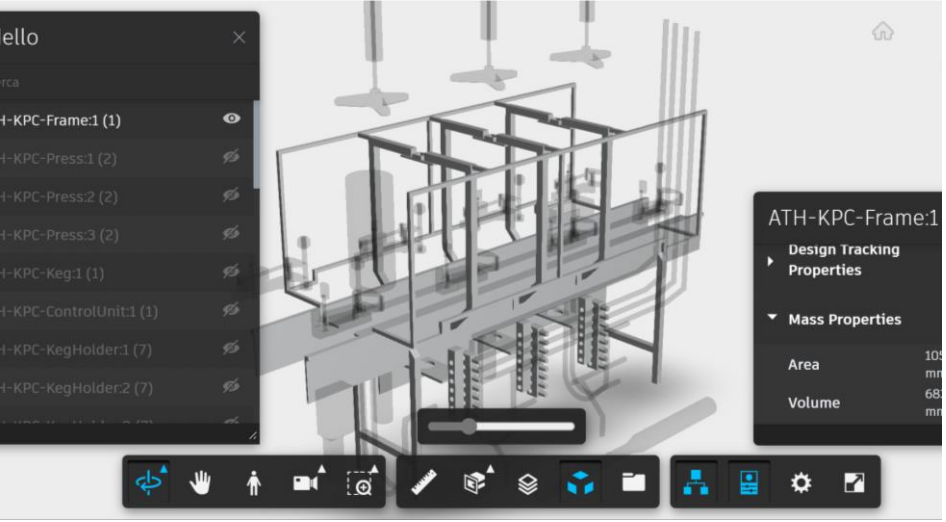
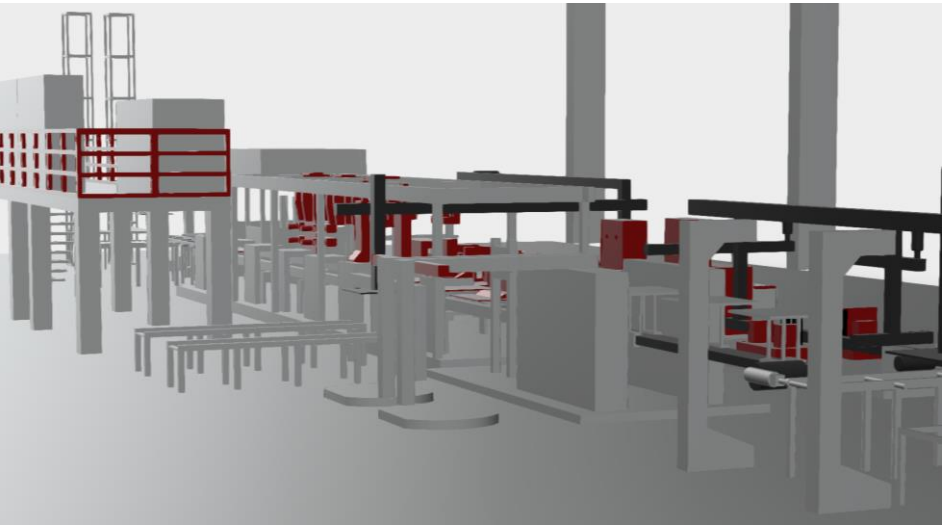
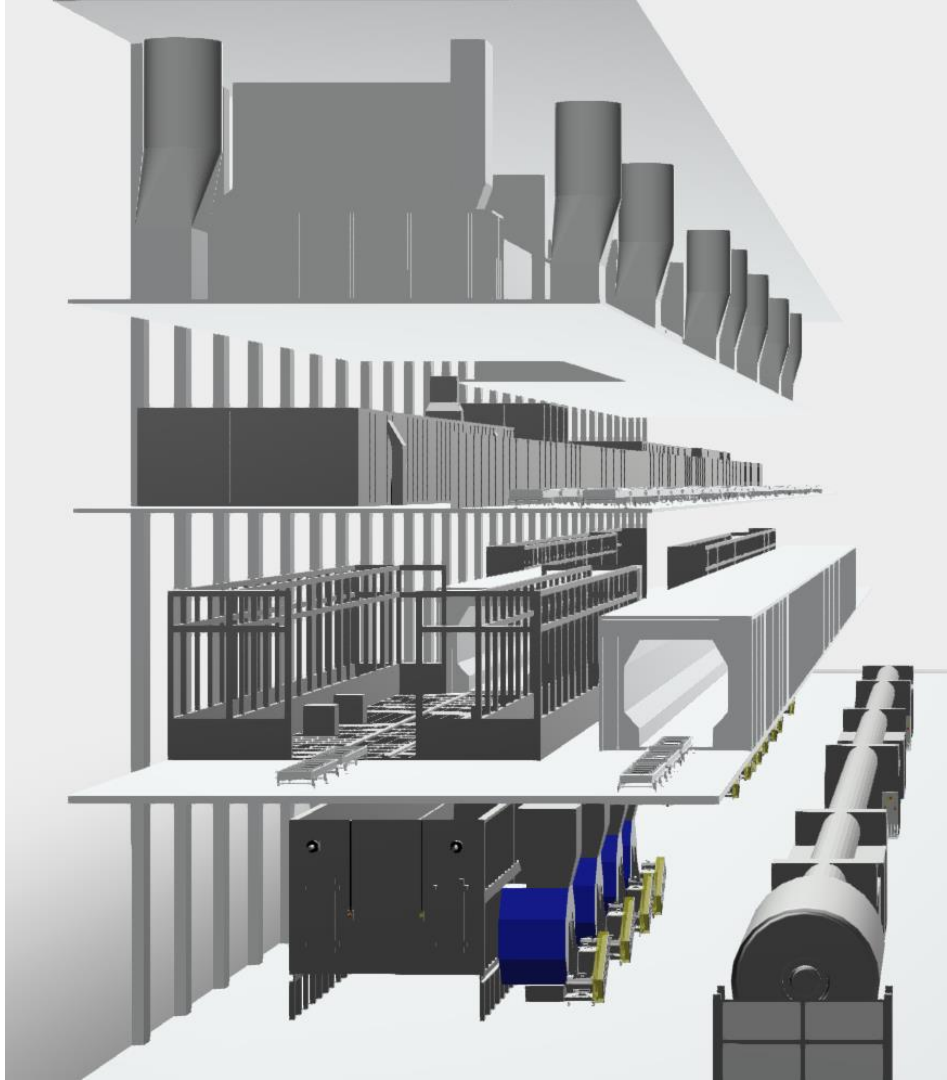
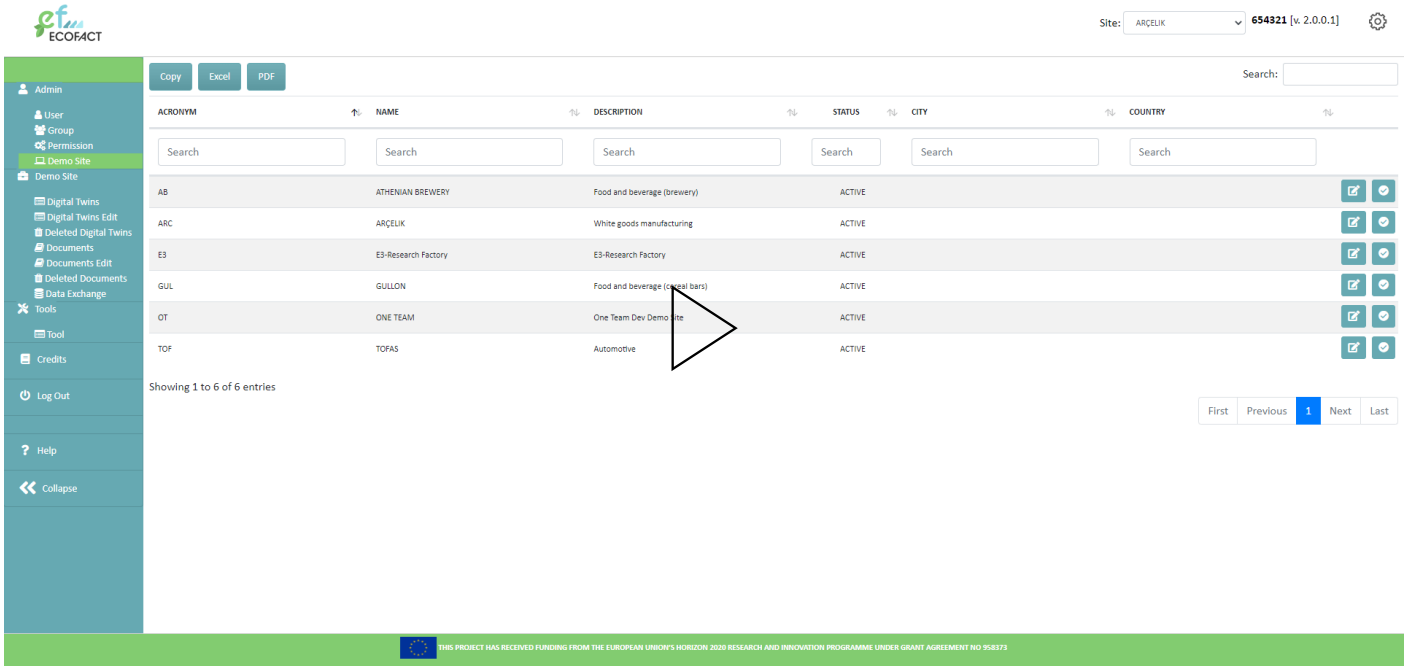

ello
H-KPC-Frame:1 (1)
H-KPC-Press:1 (2)
H-KPC-Press:2 (2)
H-KPC-Press:3 (2)
H-KPC-Keg:1 (1)
H-KPC-ControlUnit:1 (1)
H-KPC-KegHolder:1 (7)
H-KPC-KegHolder:2 (7)
ATH-KPC-Frame:1
Design Tracking Properties
Mass Properties
Area
Volume





Digital twins – sensors' data for TOF demo site



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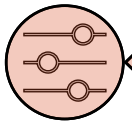
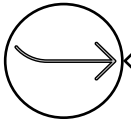
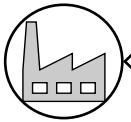
Energy and resource tools – OptimiST and others



Industrial energy flexibility and optimized management of generation assets – **OptimiST**.

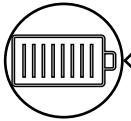


Material-flow simulation for predictive management of manufacturing process data (based on **Siemens plant simulation tool**).



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

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



Industrial energy disaggregation – by product.

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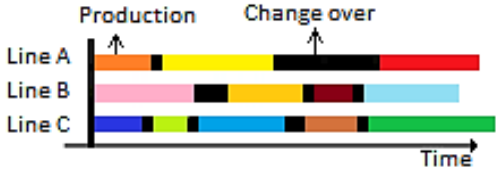
Energy and resource tools – OptimiST for the AB demo site

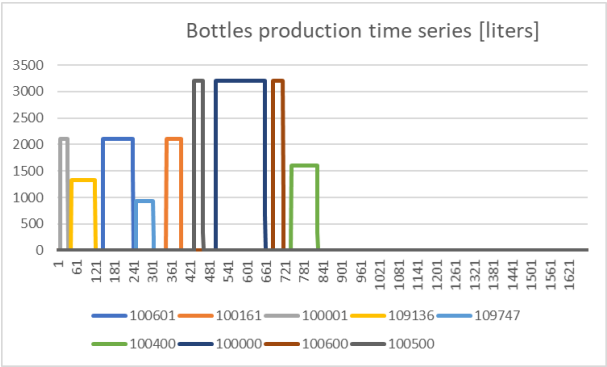
How it works

- Minimization of change overs time (black interval) defining the production scheduling.



Output

- Production scheduling for three packaging lines (for bottles, cans and kegs).



Result

- The bottles makespan has been reduced by **20 %** (from 102 to 82 hours), the change over time, thermal energy consumption and CO2 emissions by **16 %**.

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Energy and resource tools – OptimiST for the AB demo site

Results

- 20 %	- 16 %	- 16 %	- 16 %
Bottles makespan	Change over time	Thermal energy consumption	CO2 emissions

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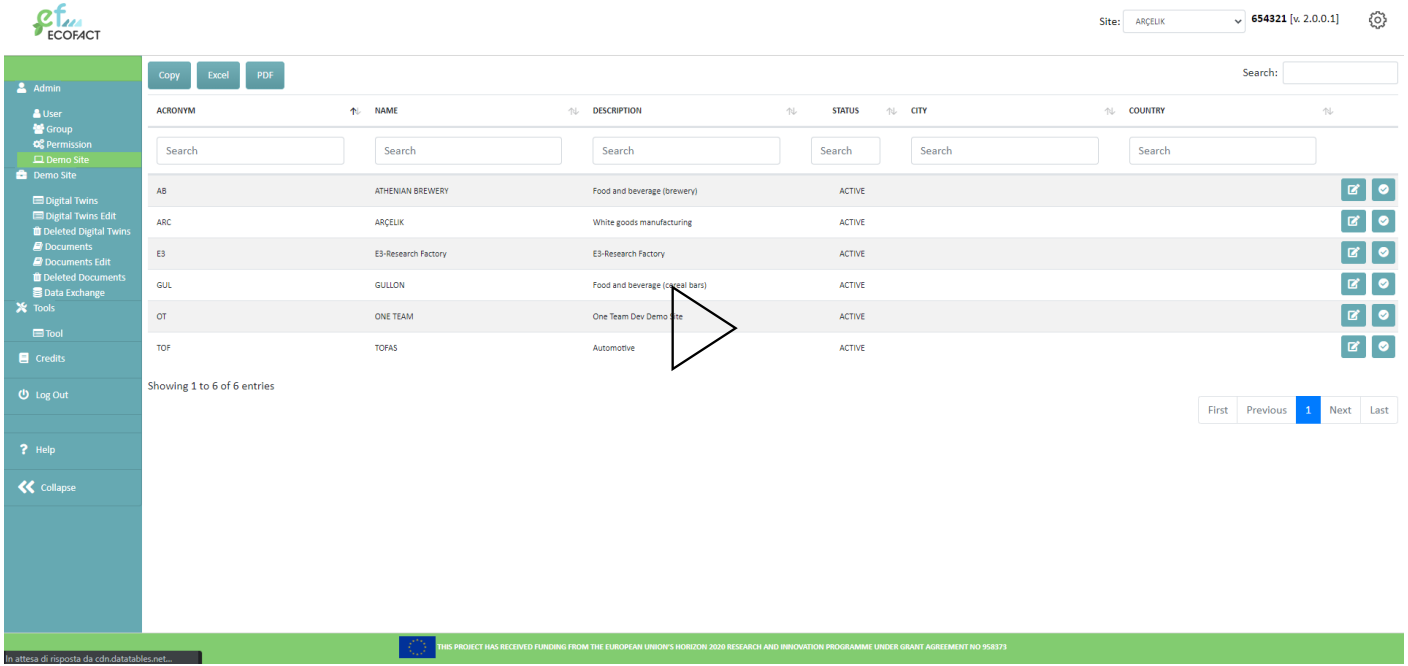
Energy and resource tools – OptimiST for the AB demo site



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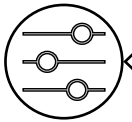
What's next?

Future challenges & call to actions

Future challenges – other tools within the DTP



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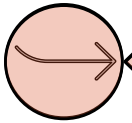
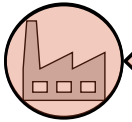
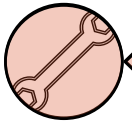


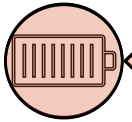
Material-flow simulation for predictive management of manufacturing process data (based on **Siemens plant simulation tool**).



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



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



Industrial energy disaggregation – by product.

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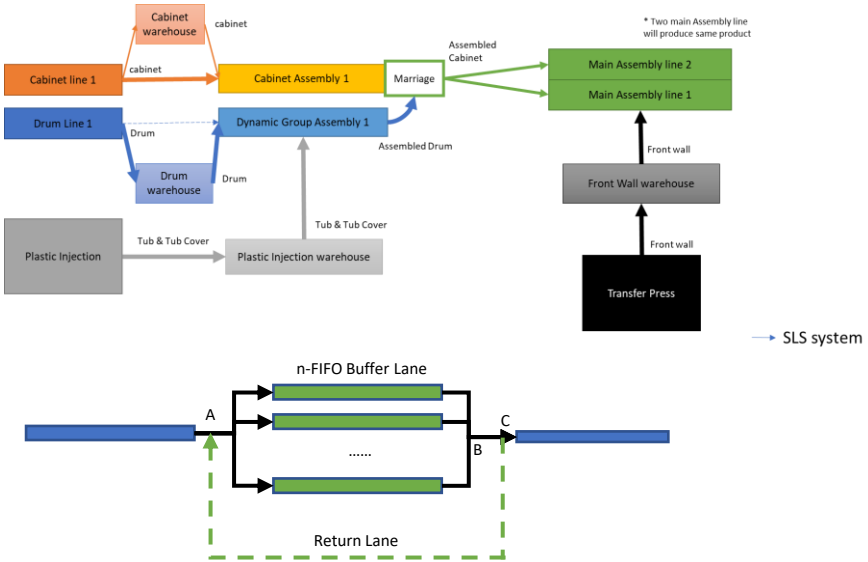
Future challenges – other tools within the DTP

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



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

Material-flow simulations are conducted through the Siemens plant simulation tool: focus on the interaction between energy consumption, power, production, storage and transport. Considering more material flows (two lines at ARC) in a whole simulation model guarantees a better output.

Production optimizations are instead based on the Gurobi solver. Two different solution concepts evaluated at TOF: one with basic batching without return and the other with a two-stage batching with buffer lane for looping.

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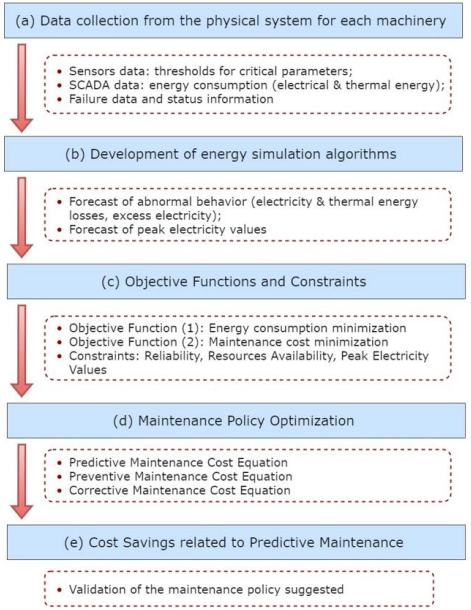
Future challenges – other tools within the DTP

Energy simulation for dynamic operations management and cost optimization



It is dedicated to the predictive management of production operations with the dual aim of reducing manufacturing energy costs (related to maintenance programs) and increasing system robustness.

Implementation methodology:

- data collection from sensors and SCADA systems (of each machinery operation);
- development of energy simulation algorithms to forecast abnormal behaviors (e.g. electricity and thermal energy losses or electricity excess/peak);
- development of **predictive maintenance model** (which will lead to the most cost-effective and energy efficient operations).

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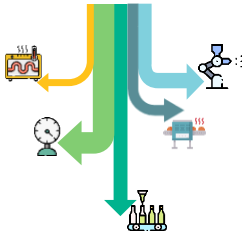
Future challenges – other tools within the DTP

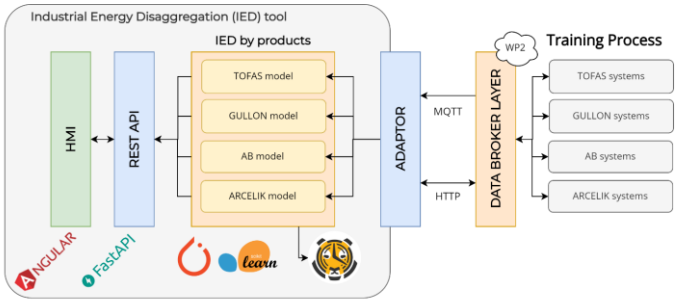
Industrial energy disaggregation



Industrial Energy Disaggregation (IED) is essentially referred to the task of separating different components from the energy signal(s).

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

Sample data gathered from the demos to start training and testing the models.



Draft of the tool's general architecture:

- web platform linked to the DTP;
- tool made available thanks to REST APIs with HMI interface.

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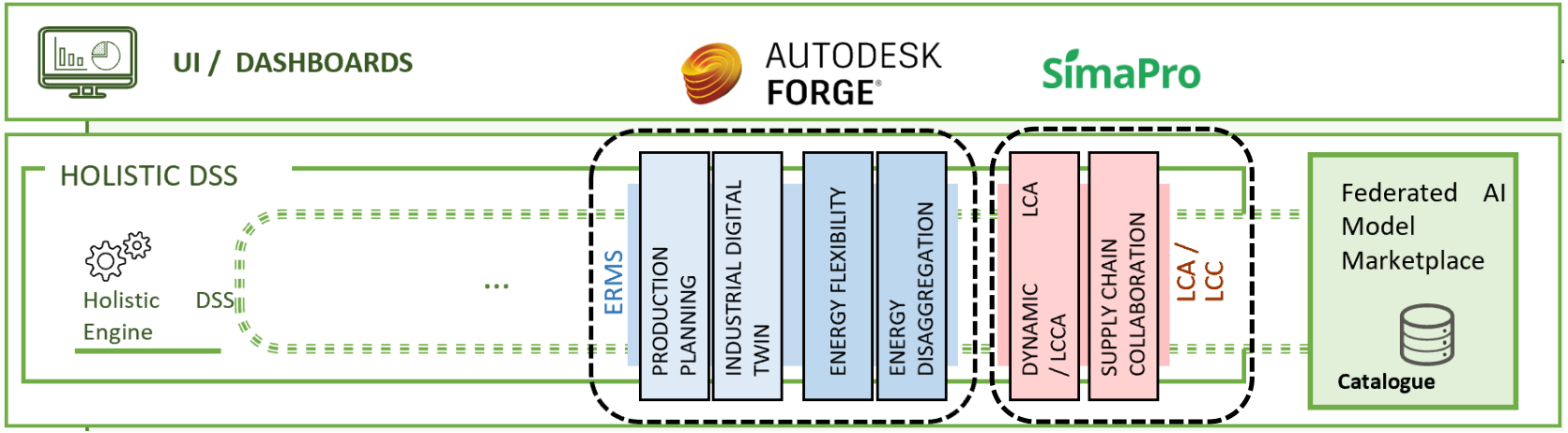
Future challenges – LCA/LCC together with DTP within the holistic DSS



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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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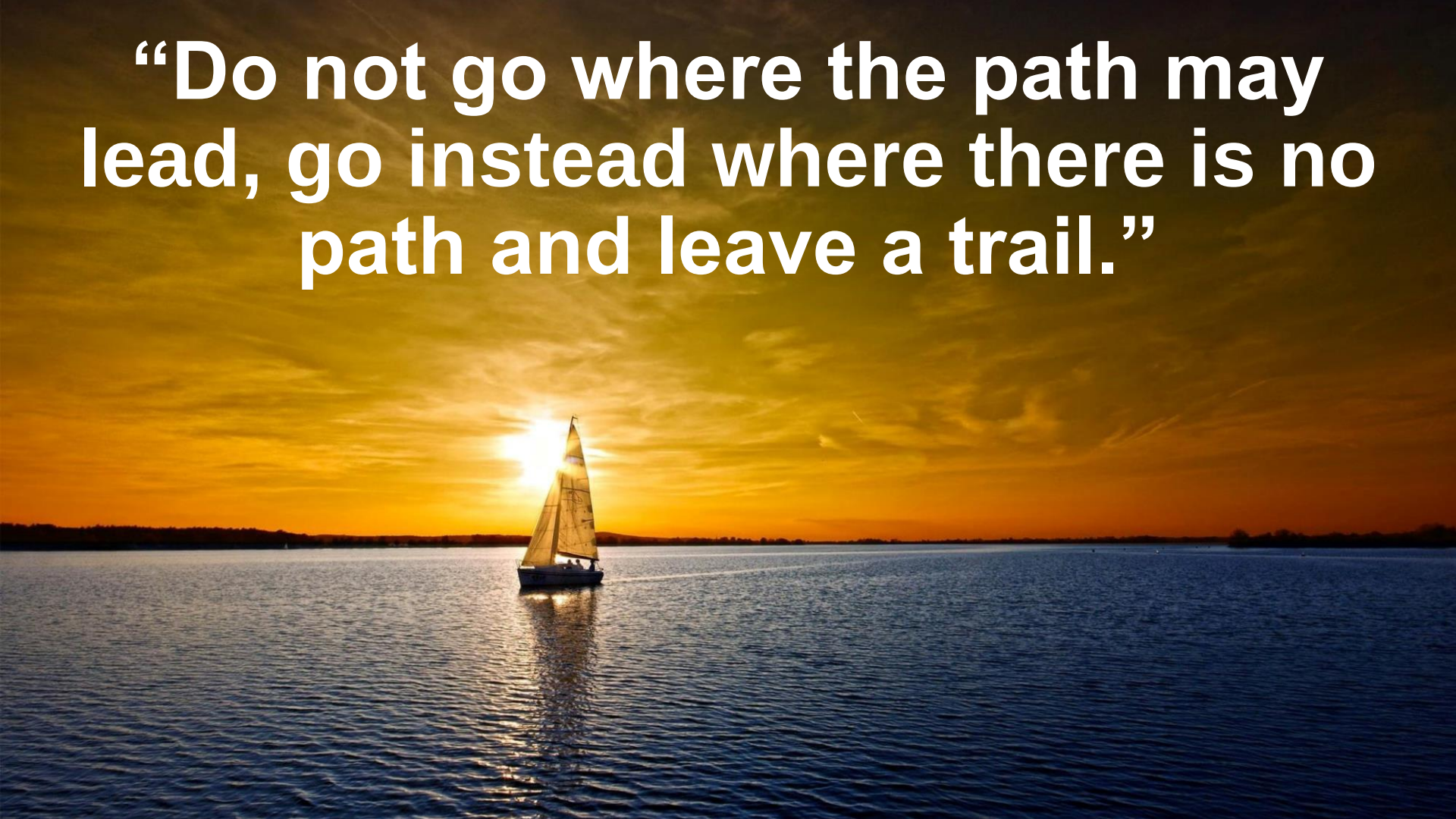
“Do not go where the path may lead, go instead where there is no path and leave a trail.”