

THE FACTORY OF THE FUTURE

FOR THE PROCESS INDUSTRY



- A network of **academic and industrial experts**
 - more than 500 representatives of **French Universities** in Chemical Engineering and **Industry** from diverse economy sectors: chemicals, pharmaceuticals, food, materials, energy, environmental services...
- Committed to addressing **major societal challenges**
 - access to resources, energy transition, employment, development of a responsible economy
- Promoting **scientific animation**
 - Working Parties, Scientific events, **SFGP National Congress**
- Attracting **Talents**
 - annual award of the **SFGP PhD Prize**,
 - innovative training tools, communication towards the younger to promote Chemical Engineering

The Factory of the Future

The challenges of the Process Industry

- **Digital transformation:** Big data, Artificial Intelligence, 3D-printing ...
- **Environmental Responsibility:** limit **Global Warming** and give an answer to **resources scarcity**
 - towards **Carbon Neutrality:** energy mix, process electrification, CO2 capture and utilization
 - towards **Circular Economy:** biobased chemicals, water efficient processes, waste recycling, energy integration of factories...
- **Plant Performance:** energy efficiency, modular design, **process intensification**...
- **Societal Acceptance:** risks management, plant security, process safety, sustainable economy, relocalisation of vital productions ?

***Our actual challenge:** prove there is a Future for Process Industries in the Western World !*

The Commission « Usine du Futur »

The SFGP Team

«END USERS»



ENGINEERING COMPANIES
EQUIPMENT SUPPLIERS



BUSINESS ASSOCIATIONS



UNIVERSITIES



2019 SFGP Congress: publication of the White Book

“L’usine du Futur pour les industries de procédés”



SFGP
2019

Nantes

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Solvay - SFGP Industrial VP



available on SFGP website
www.sfgp.asso.fr

The Factory of the FUTURE

White Book Contents

- 1. The Factory of the Future: What is at stake for Process Industries?**
 - What context for the “Factory of the Future”?
 - The “Factory of the Future” is currently under construction!
 - What issues for the Process Industries?
- 2. From Design to Operation: an outlook of initiatives in the Industry**
 - Digital in Process design
 - Digital in Process operations
 - Eco-efficient Processes
 - Process Intensification
- 3. The Skills of the Engineer of the Future**
 - The key role of the Chemical Engineer for the future industry
 - What training for the Chemical Engineer of the Future?
- 4. Challenges & Opportunities**
- 5. SFGP vision**



Outlook of initiatives in the Industry

Digital in Process Design

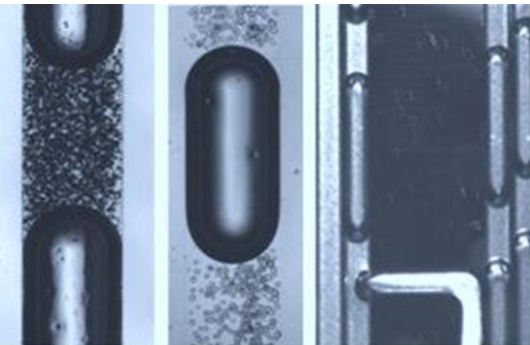
New methodologies for chemical / physical basic data acquisition

In Process Industries, design, scale-up, economic assessment and timing for process implementation are highly dependent on quality and robustness of data available on the process when making decision.



Multiphase flow in microreactors

*High throughput data acquisition
IFPEN Pilot plant*



Basic data acquisition for process scale-up is a relevant area for collaboration between industry, university and public R&D.

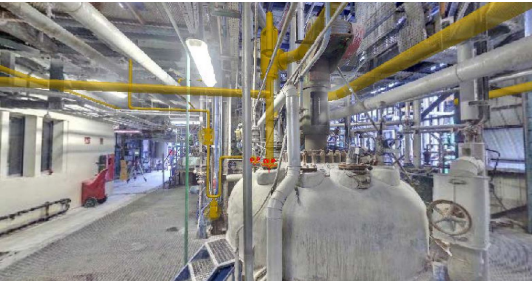
DATAFAB, Laboratory for Intensification of process data acquisition, funded in 2018 in Lyon(F), as an example



New technologies for process engineering

Engineering, as many other areas in the industry, is open to the new technologies the digital transformation brings, and tries to make its own these new applications.

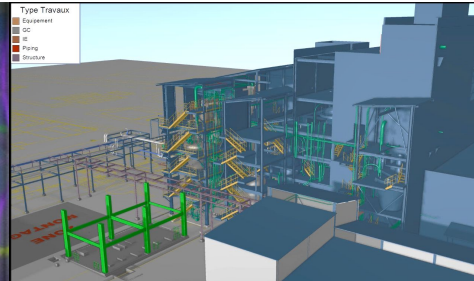
Importation of CAD models in 3D-scan



Use of Virtual Reality goggles in project review



3D scenarios for a plant construction project



Operators training in immersive reality



Chemical Engineering & 3D-Printing : a mutual input

In recent years, 3D printing, or additive manufacturing, has been part of the techniques used to manufacture objects and even products. If process engineering can use it to produce “on demand” optimized equipments or components (agitators, catalysts, etc.), its methods are also needed to optimize the printing process itself.

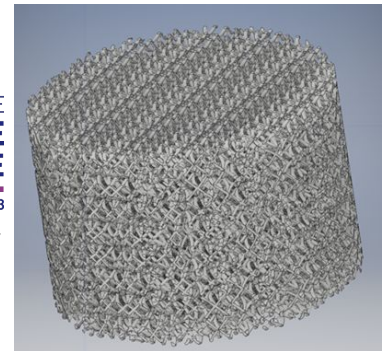


*Prototype pressure reactor for hydrogen production
=> a first in additive manufacturing!*

*“FAIR” project awarded by EFCE in 2017
«Process Intensification Award for Industrial Innovation»*

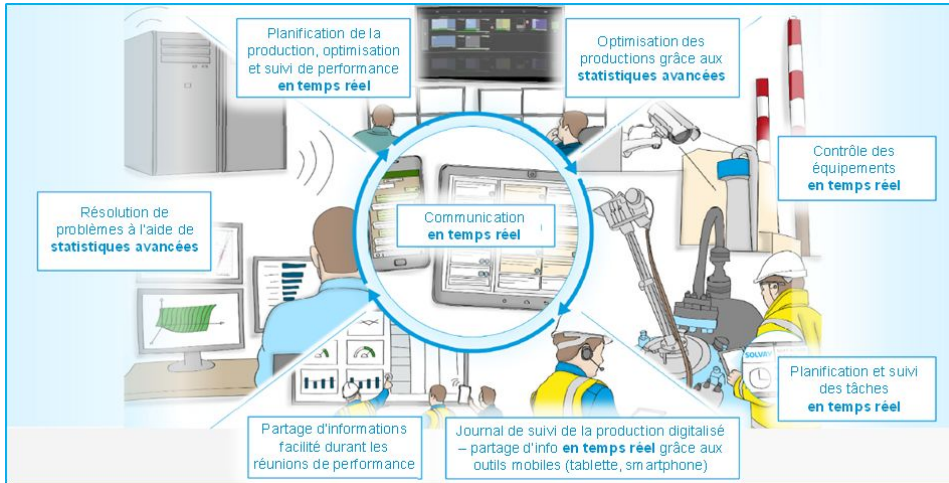


*Innovative packed column internals designed by
Laboratoire de Génie Chimique-Toulouse
and manufactured by 3D-printing*



Digital transformation of a production plant *Z generation is now in our factories!*

Development of digital solutions offers new perspectives for improving the performance and competitiveness of factories.



Use of applications specially designed for smartphones and tablets

Solvay-Tavaux (F)



A monitoring platform designed for the operators

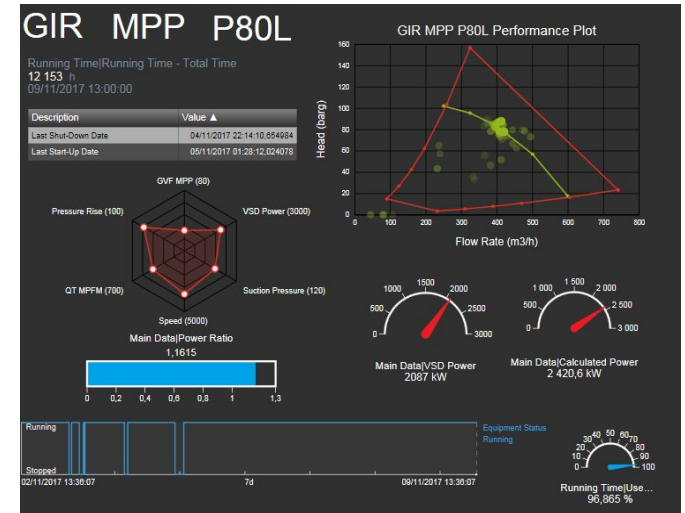


The **monitoring platform** developed by **TOTAL Exploration & Production**, with its integrated application, provides users with **a real-time data processing system**, which enables the most sensitive equipment in the installations to be monitored continuously and effortlessly.

This platform also makes it possible **to share the same level of information** between different teams, whether they are located on site or in administrative headquarters.

It is based on a library of «templates», calculation and visualization modules, which transform the monitoring platform into **a real toolbox**.

Polyphasic pump performance monitoring template



Outlook of initiatives in the Industry

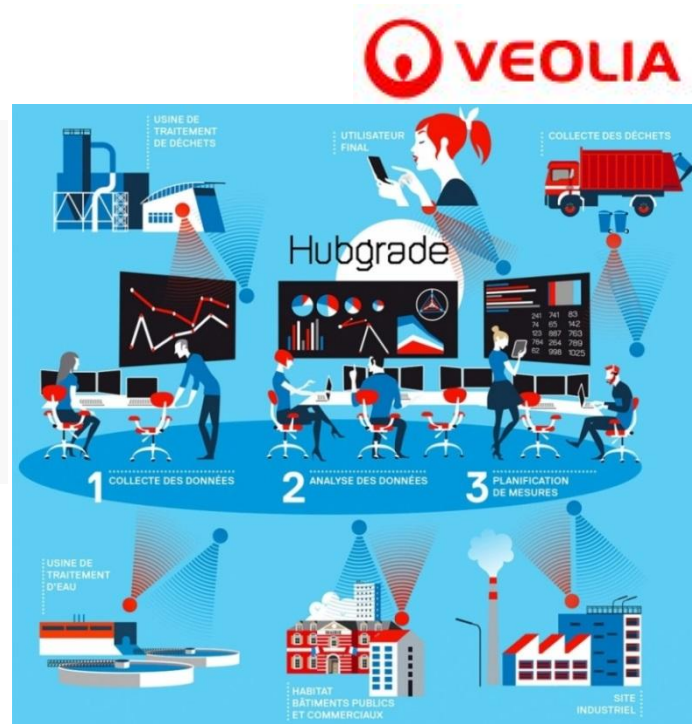
Digital in process operation

Optimisation and remote control of production

First Remote Operation and Optimization Center (COOD), commissioned in 2017 in Lyon, able to manage and optimize the production of twenty industrial gas production sites throughout the territory.



Hubgrade,
a concept of performance monitoring and optimisation of more than 8500 sites or contracts connected to these centres



Outlook of initiatives in the Industry

Eco-efficient Processes

Energy transition: biomethane and renewable energies

Méthélec

The plant of the future will have to respond to the major challenges of the energy and ecological transition, and integrate more fully into its local ecosystem, combining industrial performance and human commitment.

Méthélec (F), a family company in Auvergne, has developed, in a local circular economy, a **2 MW on-farm methanisation unit**, which processes not only the by-products of the farm but also local agro-industrial co-products and waste. The gas produced feeds **an electric turbine**. The CO₂ footprint of the site is minimized thanks to extensive **energy integration** and the complementary installation, in partnership with the LANA group, of **8 photovoltaic plants** with a total power of more than 2 MW



Outlook of initiatives in the Industry

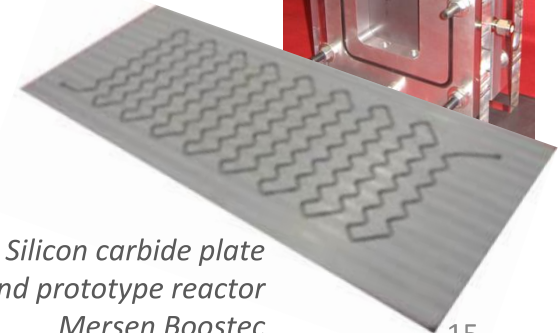
Process Intensification

Intensification for the production of a pharmaceutical active ingredient

Coordinated by **Pierre Fabre** group, the **INPAC** project (**IN**Intensification d'un **Procédé** de production d'**Anti-Cancéreux**) brought together 2 Toulouse University laboratories, the **LGC** (Laboratoire de Génie Chimique) and the **LAAS** (Laboratoire d'Analyse et d'Architecture des Systèmes) as well as the equipment manufacturer **MERSEN BOOSTEC**.

The team has developed **a new route of access** to a pharmaceutical active ingredient, objective achieved thanks to the development by Mersen Boostec of **a new type of reactor** made of silicon carbide, a material highly resistant to corrosion, even under severe conditions.

Feasibility was demonstrated on a 10 kg/h scale at a Pierre Fabre site. The silicon carbide plate reactor-heat exchanger technology, developed as part of this project, is now commercialized by **CORNING** (AFR, Advanced-Flow Reactors™).



Silicon carbide plate
and prototype reactor
Mersen Boostec

The Factory of the Future

What Skills for the Engineer of the Future?

- What role of the **Process Engineer** in meeting the expectations of the Factory of the Future?
- What **training** for the Process Engineer?



⇒ developed by **Eric SCHAER** - SFGP Education WP

The Skills of the Engineer of the Future

Actions in progress within SFGP

- **Develop innovative and interactive *education programs***
 - *Increasing the attractiveness of the discipline to future students*
 - *Anticipating the evolution of the profession*
- **Prepare undergraduates for**
 - *the management of interdisciplinary and complex problems*
 - *the evolution of expectations of industry and the required skills*
 - *the analysis of big data and artificial intelligence*
- **Making the discipline better known and *more attractive* to younger students**
 - *Training secondary school teachers in engineering sciences and chemical engineering*
 - *Introducing base concepts of chemical engineering in secondary school programmes*
 - *Offering a secondary school teaching degree in chemical engineering*



1. The process plant of the future will result from a **renewed process engineering approach** towards **agility** and **efficiency** in a constrained and versatile environment.
2. **Process engineering** is to be enhanced, further developed and implemented:
 - As a major **solution provider**
 - Needed in a demanding and quickly changing world
 - for the **benefit of the customers, the employees and the society** at large.
3. **Solutions are international**
 - new paradigm to develop / to apply : *skills and tools are available !*
 - new organisation of the production : *multi-scale integration to get the performance !*
 - **sanitary crisis as an opportunity ?**

