# Redesigning Beverage Lines : EHEDG Principles for Safety, Sustainability and Efficiency

FFT Roadmap 2025: Bev Trend & Tech Edition

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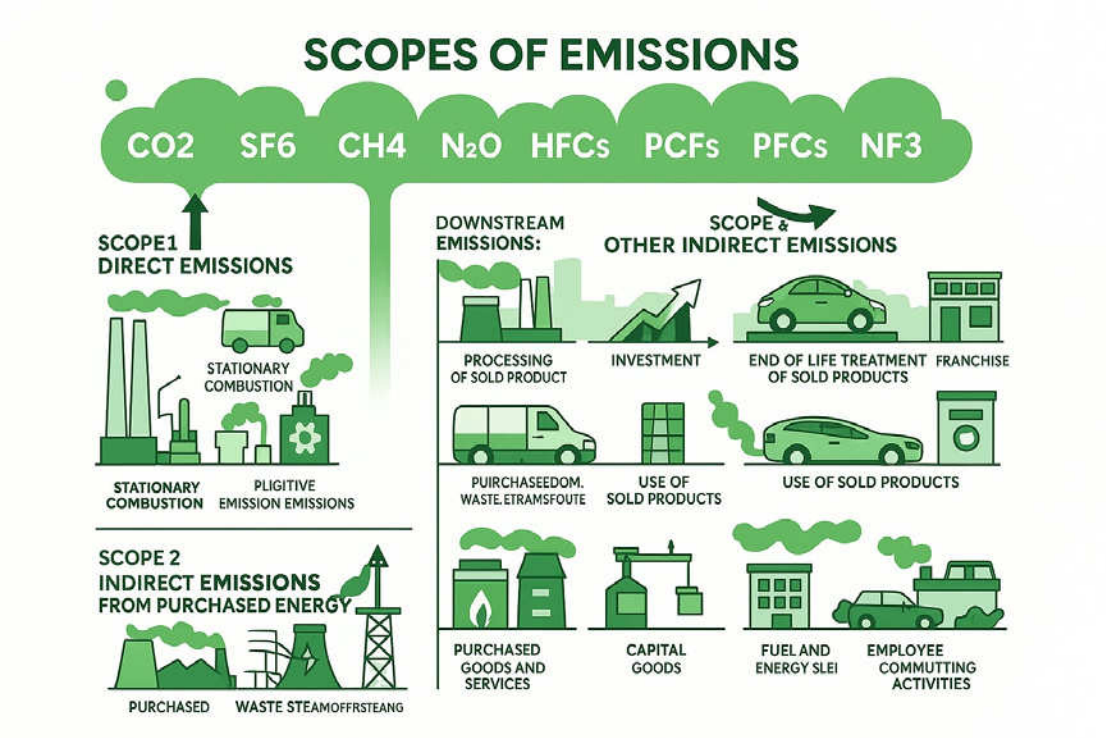
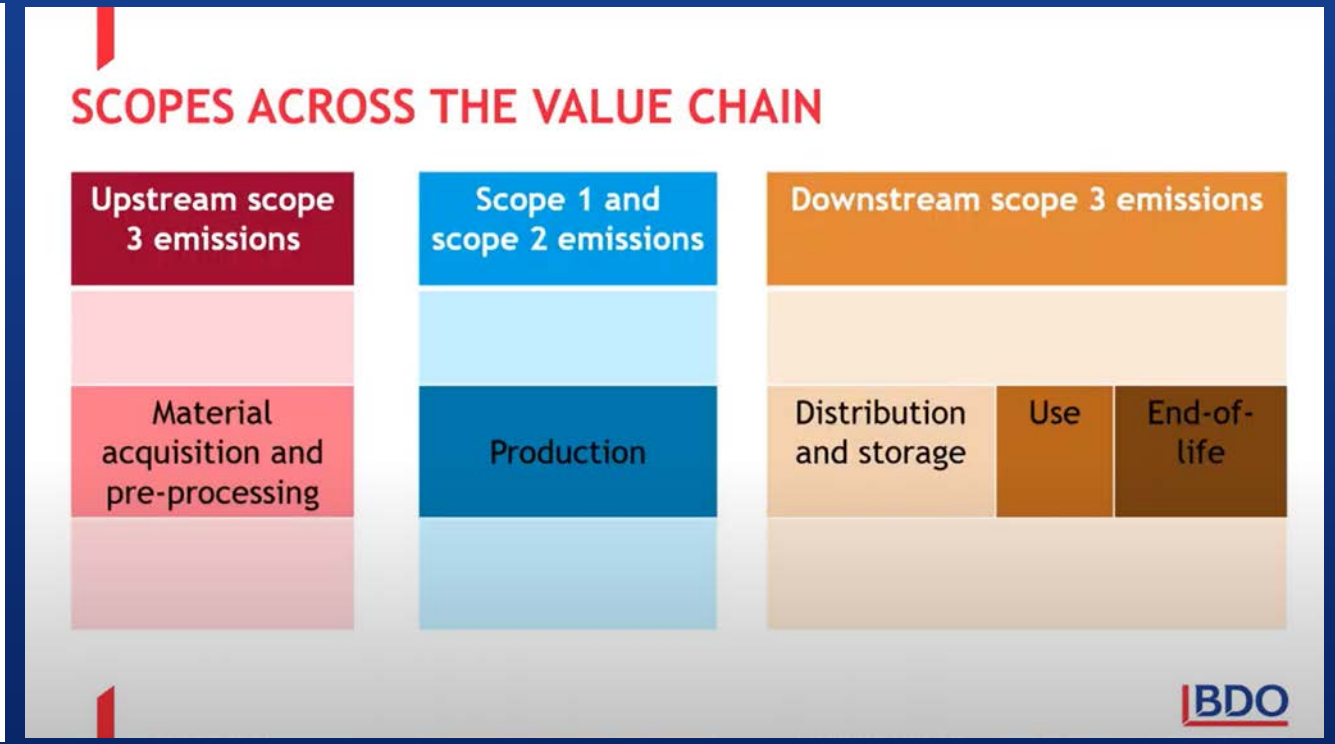
# Introduction




Webinar | GHG Protocol – Measuring scope 1 emissions
https://www.youtube.com/watch?v=4ElTDgqCptA

# Introduction

## Impact of Food Industry on Carbon Emissions:

- The food sector is a major contributor to global greenhouse gas emissions, primarily through agricultural practices, processing, and transportation, resulting in significant carbon footprints that necessitate targeted reduction efforts.


Photo by CA Creative on Unsplash

# Introduction

## Need for Sustainable Practices

Reducing carbon emissions include

- ❑ transitioning to eco-friendly agricultural methods
- ❑ optimizing supply chains, energy efficient technologies
- ❑ and minimizing waste

throughout the production process.


# Introduction

## Food Industry....

Ensuring Safety and Sustainability

Reducing Emissions
&
Earning carbon credits

## Hygienic Deign....

Reduce contamination risks
Reduce cleaning cost and relevant utilities
Increase production time

# Concepts of Hygienic Design

*Simplicity, Accessibility, and Maintainability to facilitate thorough cleaning and reducing contamination risks*

## Design for Cleanability

- allow for easy access to all surfaces that require cleaning, thereby reducing the time and resources needed to maintain high hygiene standards.

## Material Selection

- Non-porous, corrosion-resistant, and easy-to-clean materials can significantly contribute to maintaining hygiene and reducing contamination levels.

## Minimizing Contaminants

- Strategies to minimize contaminants involve designing to reduce crevices and dead spaces where residues throughout the process.

Photo by Crystal Kwok on Unsplash

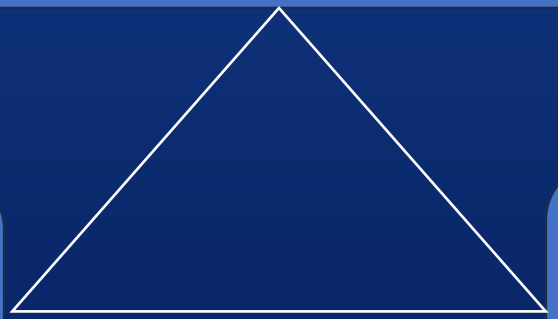
# Impact of Hygienic Design

*Effective cleaning integrated approach*

**Equipment & Facilities Design**

- Construction material, surface finish
- Hygienic Design Criteria
- Line layout
- …

***Hygienic design is a prerequisite*** for efficient and sustainable cleaning



**Influence of Process Design on Soil**

- Soil characteristic & amount
- Run Length

**Cleaning Process**

- Time
- Temperature
- Mechanical action
- Detergent type and concentration

# Impact of Hygienic Design on Emissions

## Reduction of Waste

Effective hygienic design minimizes waste through optimized processes and improved resource management, subsequently decreasing environmental footprints.

## Energy Efficiency

By integrating energy-efficient designs, processes not only conserve energy but also reduce emissions, contributing to more sustainable operations overall.

# Hygienic Design

Hygienic design is essential for *preventing* contamination, *reducing* waste, and *improving* efficiency throughout food production.

**… HOW to get a through understanding of HD…**

# EHEDG

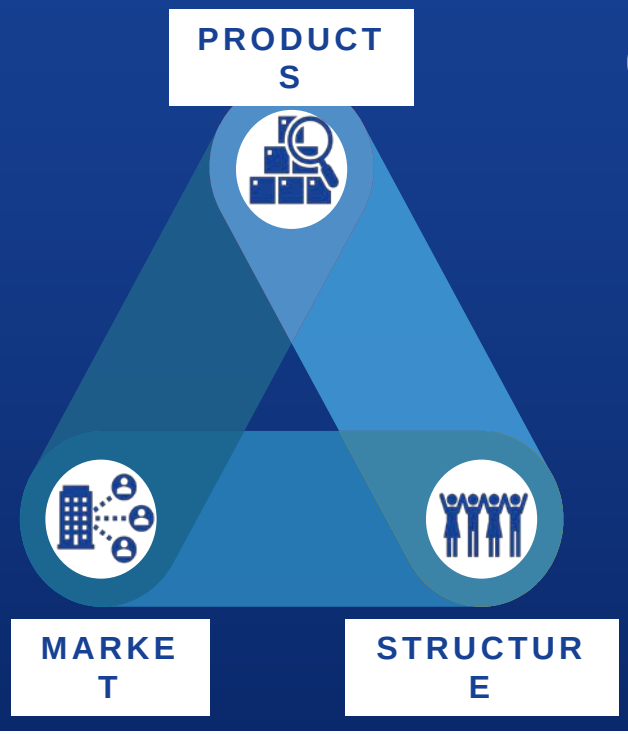
## European Hygienic Engineering & Design Group

EHEDG was founded in 1989 as a non-profit consortium of


**Objective:**

**Develop hygienic engineering and design knowledge to manage food safety and quality**

# The EHEDG Vision




## MARKET

All stakeholders in the production of safe and quality food

- Producers & retailers
- Equipment & system suppliers
- Service providers
- Academia
- Legislators and enforcement agencies

## PRODUCTS

Consensus-based comprehensive product portfolio

- Guidelines on hygienic design requirements and associated practices to manage food safety and quality
- Equipment testing and certification
- Training & Education

## STRUCTURE

A well-balanced membership with global coverage

- Funded by strongly committed members
- Relying upon voluntary contribution and active involvement
- Attractive for large and small companies

# Incorporating HD into Food Safety Management Systems

HD Requirements

GFSI Benchmarking Requirements

JI / JII

started


EHEDG White Paper on GFSI HD scope JI/JII

CPO Standards

Auditing/certification

Certification of FSMS of Food Producers | Include HD Requirements in FSMS: Scope JII

Certification of HDMS of Food Building & Equipment Suppliers: Scope JI

# Challenges in Implementing Hygienic Design

## Cost Considerations

The initial investment in hygienic design practices may be high, but the long-term savings due to reduced waste and improved efficiency can justify this expenditure.

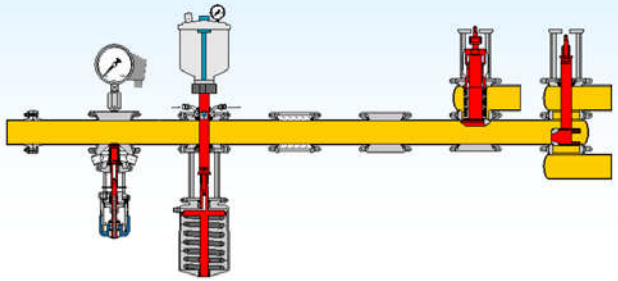

Cultural and institutional resistance within industries can impede the adoption of hygienic design practices. Overcoming this requires demonstrating clear benefits and providing


Technical challenges can arise, particularly in existing facilities where retrofitting design principles involves complex renovations and adjustments.

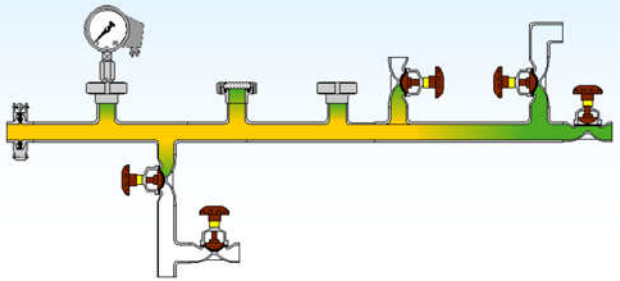
# Challenges in Implementing Hygienic Design

European Hygienic Engineering & Design Group

**Analysis of potential savings for the food industry**
by comparing the latest state of art of hygienic design versus
T-piece designs, that use hygienically risky components



STATE OF THE ART



THE COMMON WAY

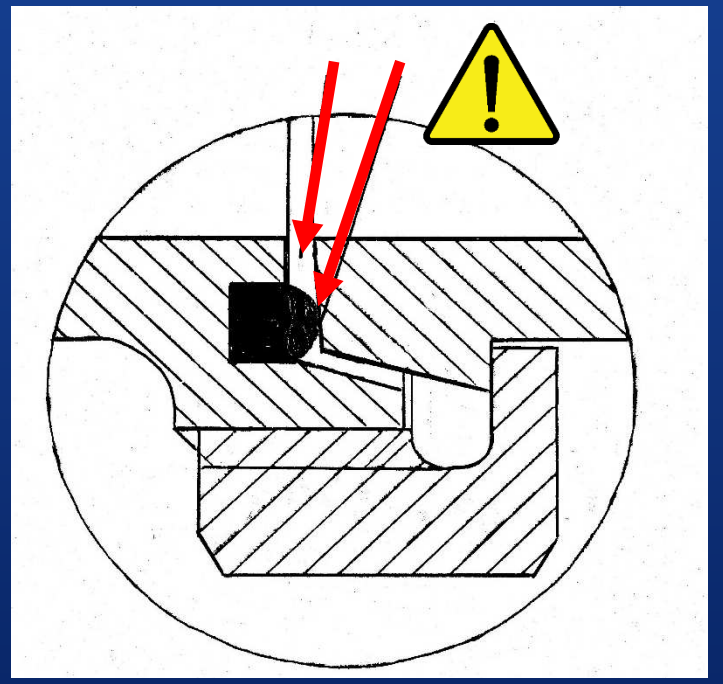
To reduce the risk of undesired microbial growth, effective CIP is vital. This can be achieved only by hygienically designed components which are germ-free after CIP.
Non-hygienic legacy designs are responsible for up to 20% of GMP claims.
The cleaning process is essential for the food safety and is often a CCP of the production process.
It can consume up to 70% of the total water consumption and water treatment costs.
This represents a massive opportunity for savings.


Cost Savings in Hygienic Design
EHEDG Plenary Meeting, 10 - 11 October 2013 in Prague

# Challenges in Implementing Hygienic Design

## Profile Seal Type Systems

DIN 11851



Does not comply with EHEDG Design Criteria in Standard form.
Aftermarket sealing systems available for CIP-ability.

Image provided by Andy Timperley, Timperley Consulting

# Challenges in Implementing Hygienic Design

European Hygienic Engineering & Design Group

**All pipe-connections compromise the inner surface of the pipe**

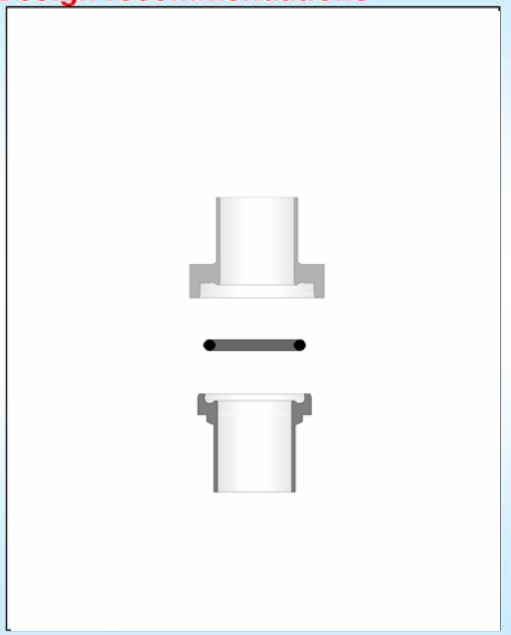
- more difficult to clean
- corrosion-resistance is degraded
- minimize use, preferably by using pipe-bending rather than pipe-bends
- design recommendations: pipe-couplings
- pipe-alignment, centering
- defined sealing-pressure via metal-to-metal contact
- room for thermal expansion of seals
- no crevice/gap, sealed by **elastic** material (not plastic)





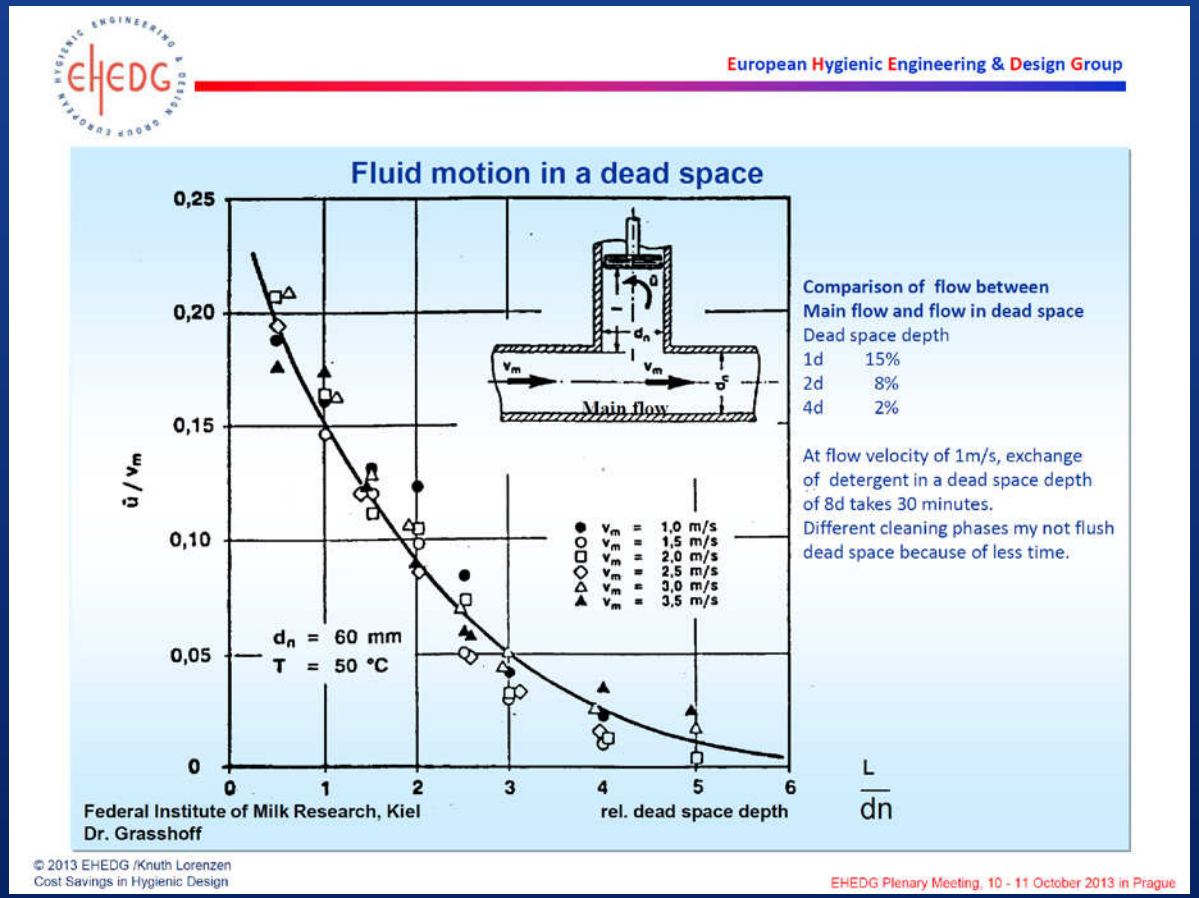
European Hygienic Engineering & Design Group

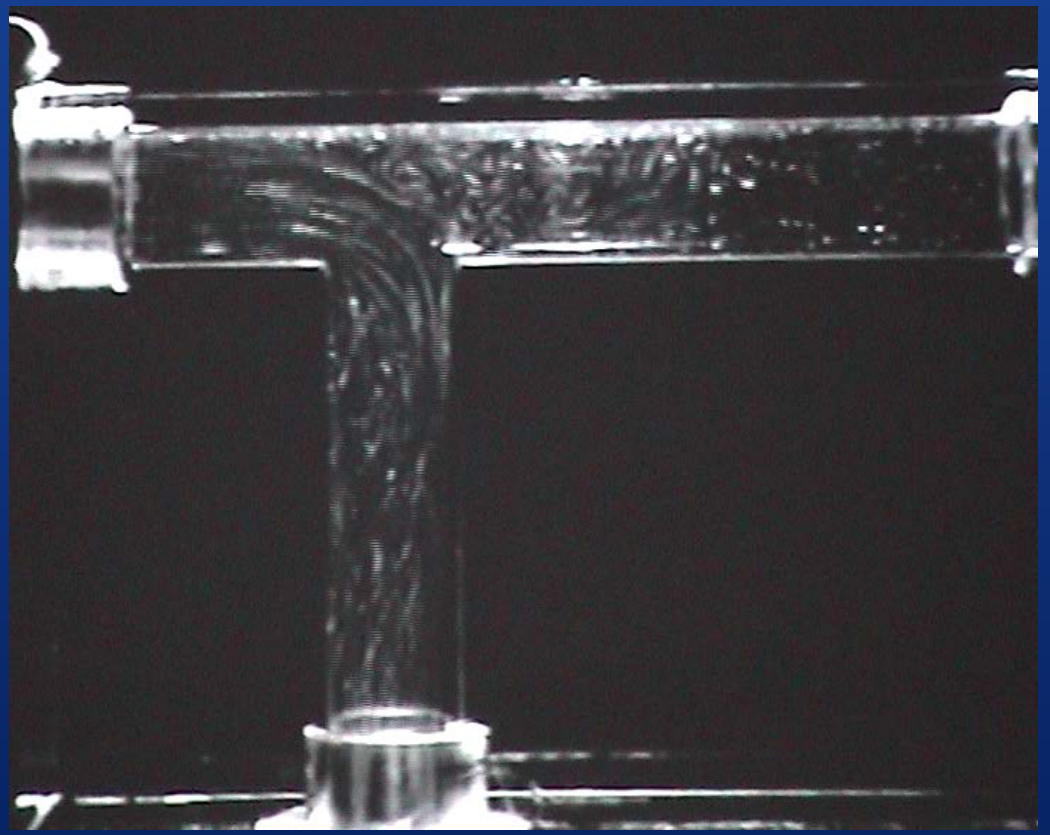
**Pipe-Couplings DIN 11864-2 Form A, DIN 11853-2**
**Design recommendations**



Centered sealing with
defined compression

# Challenges in Implementing Hygienic Design



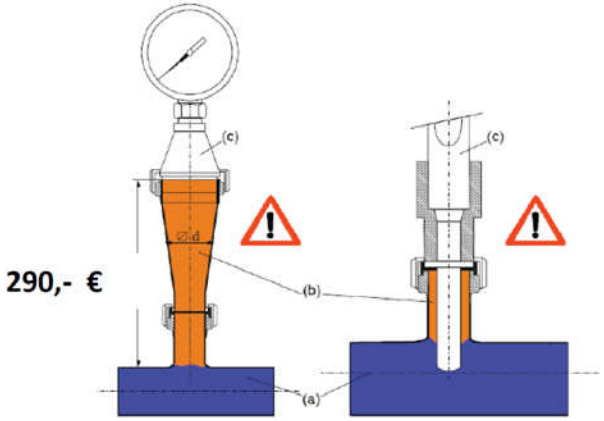



# Challenges in Implementing Hygienic Design

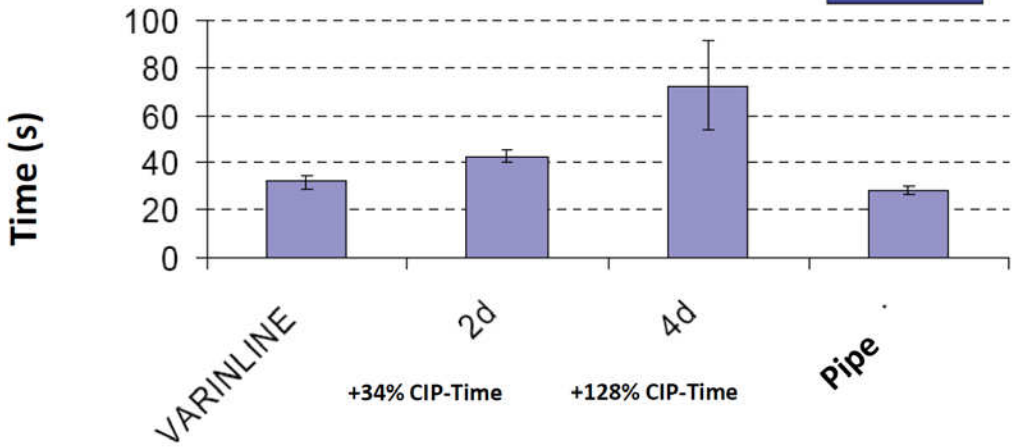
European Hygienic Engineering & Design Group

## CIP Duration per Sensor-Connection

490,- €




290,- €




CIP total costs

Sensor with T-piece = 290,- €

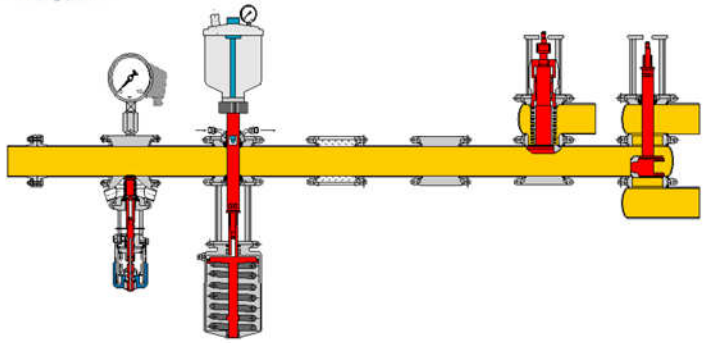
Sensor with Varinline = 200,- €



EHEDG Plenary Meeting, 10 - 11 October 2013 in Prague

# Challenges in Implementing Hygienic Design

European Hygienic Engineering & Design Group



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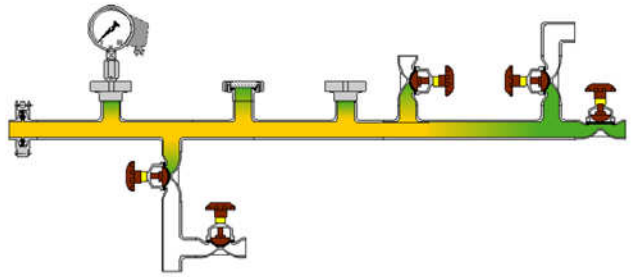
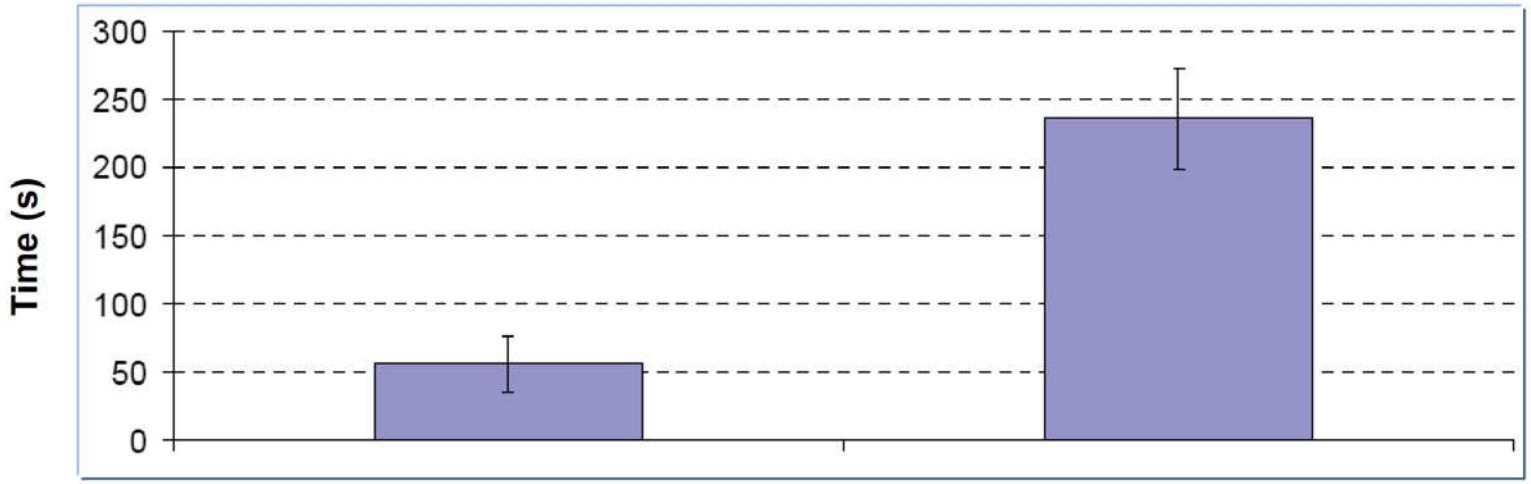


LEGACY DESIGN




Hygienic Design module results in 76% less CIP time


Cost Savings in Hygienic Design

EHEDG Plenary Meeting, 10 - 11 October 2013 in Prague

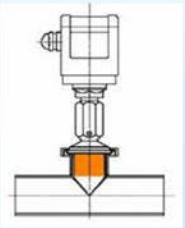
# Challenges in Implementing Hygienic Design

European Hygienic Engineering & Design Group

## Possible Savings in operating Costs through Hygienic Design

- shorter cleaning time, increasing productive time.
- reduced chemicals and additives
- reduced power, steam and fuel consumption
- reduced water and water treatment costs

Correct hygienic design improves cleaning and sterilization via improvements in the mass flow and heat transfer from the CIP-liquids: A temperature-sensor installed in a T-piece that was 2.6 times the diameters long and with a CIP-fluid temperature of 85°C, **reached only 65° C, even after a full 16 minutes**.

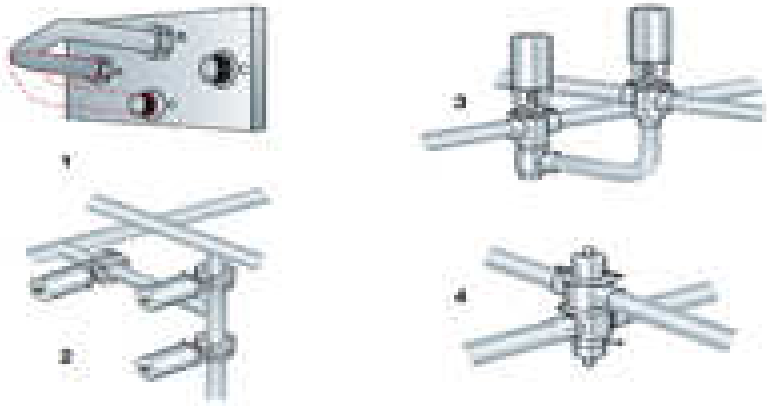


# CIP Key requirements

**Isolation**

**The CIP liquids have to be separated from the food product to avoid cross contamination with chemicals at any time. This can be realised with several engineering solutions, such as:**

- Unique pipe bends
- Flow plates or swing bend panels
- Block and bleed valve configurations
- Mix proof valve solutions





Guideline 30 – published June 2019

# Challenges in Implementing Hygienic Design

## Pipe welding quality

- Excessive colouration, visible defects in the weld surface, lack of fusion, excessive penetration, root convexity, meandering weld beads as well as varying widths of the cap layers are indications that further examination is advisable
- The limited operation distance of endoscopic equipment can be compensated by providing suitable inspection access points around a pipework system


# Challenges in Implementing Hygienic Design

## CIP Key requirements

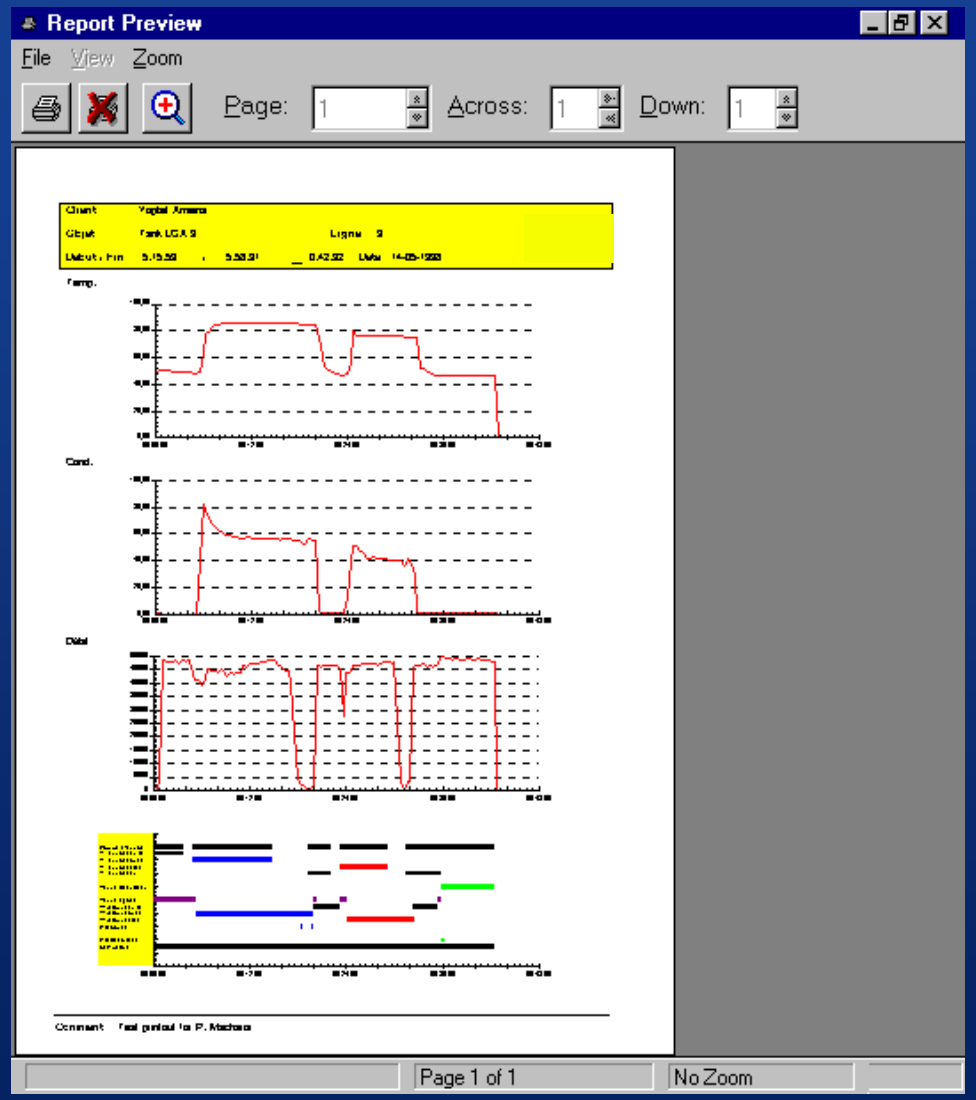
Operation: Traceability

Deliver and document proof of clean for each object:

- Record TACT: temperature , flow, conductivity, time
- Record when the object was cleaned
- Record if cycle was free of alarms

# Challenges in Implementing Hygienic Design

## CIP Key requirements



# Plant quality = Product quality

## Plant quality factor

Plant design

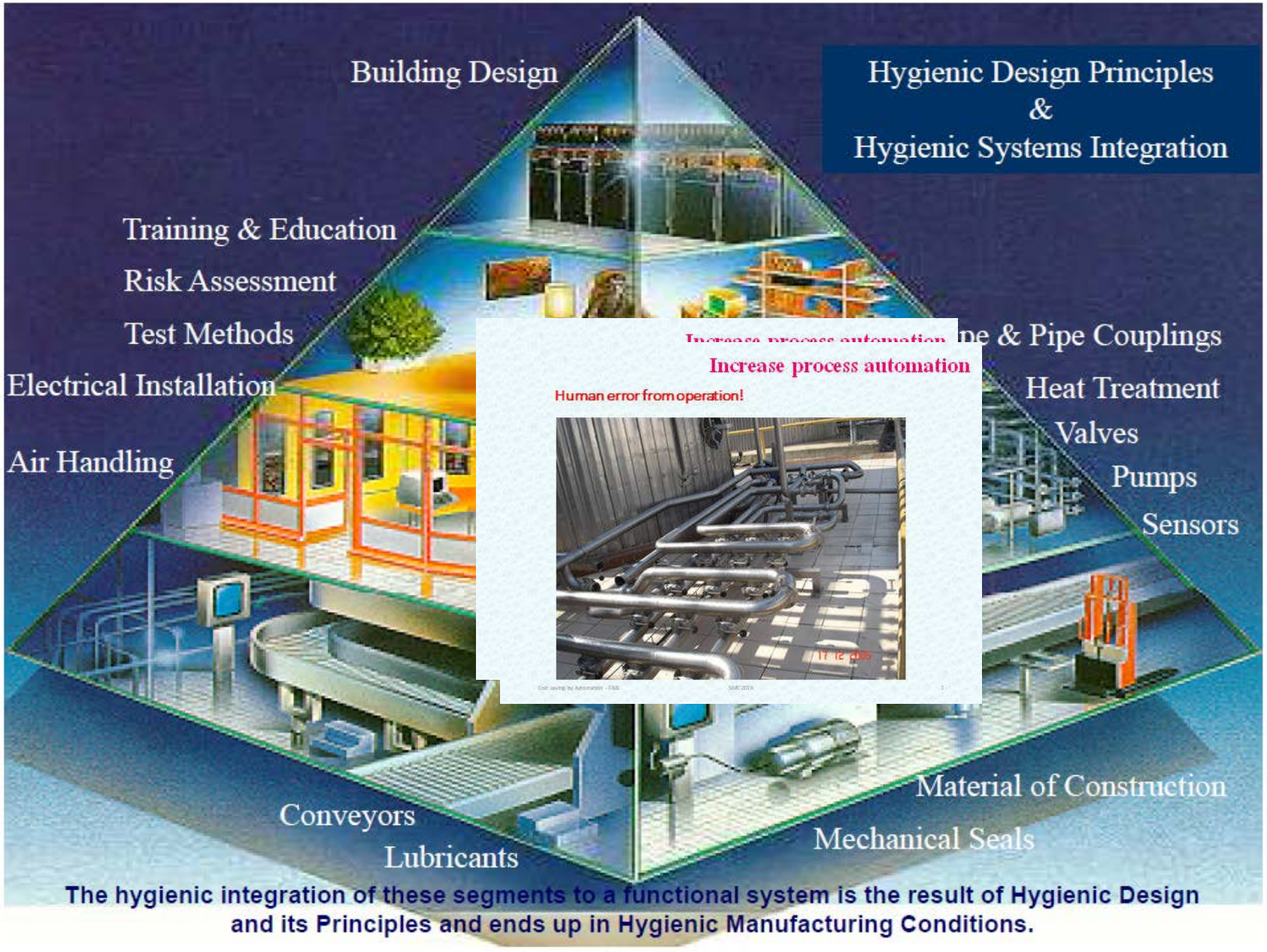
- ❑ Processing & Capacity of plant + future extension
- ❑ Plant layout in hygienic design + process flow
- ❑ Building & Utilities

Installation & Construction

- ❑ Good engineering practice
- ❑ Good skill technician & Supervision

Operation & Maintenance

- ❑ GMP, HACCP

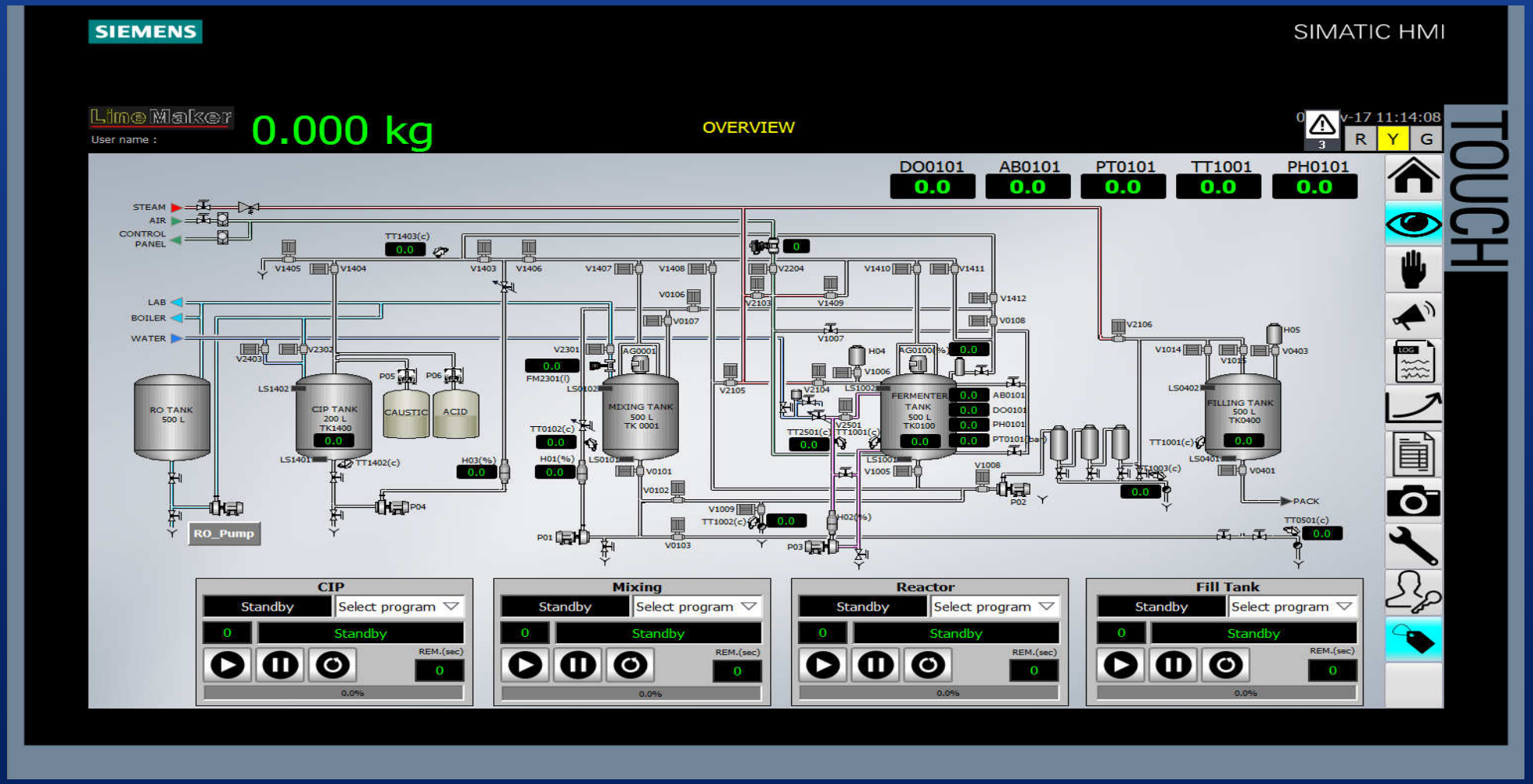

Hygienic Design Principles
&
Hygienic Systems Integration
Building Design
Training & Education
Risk Assessment
Test Methods
Electrical Installation
Air Handling
Increase process automation
Human error from operation!
Heat Treatment
Valves
Pumps
Sensors
Material of Construction
Mechanical Seals
Conveyors
Lubricants
The hygienic integration of these segments to a functional system is the result of Hygienic Design
and its Principles and ends up in Hygienic Manufacturing Conditions.

# Plant Automation

**Human error from operation!**

# Plant Automation

## High accuracy operation.



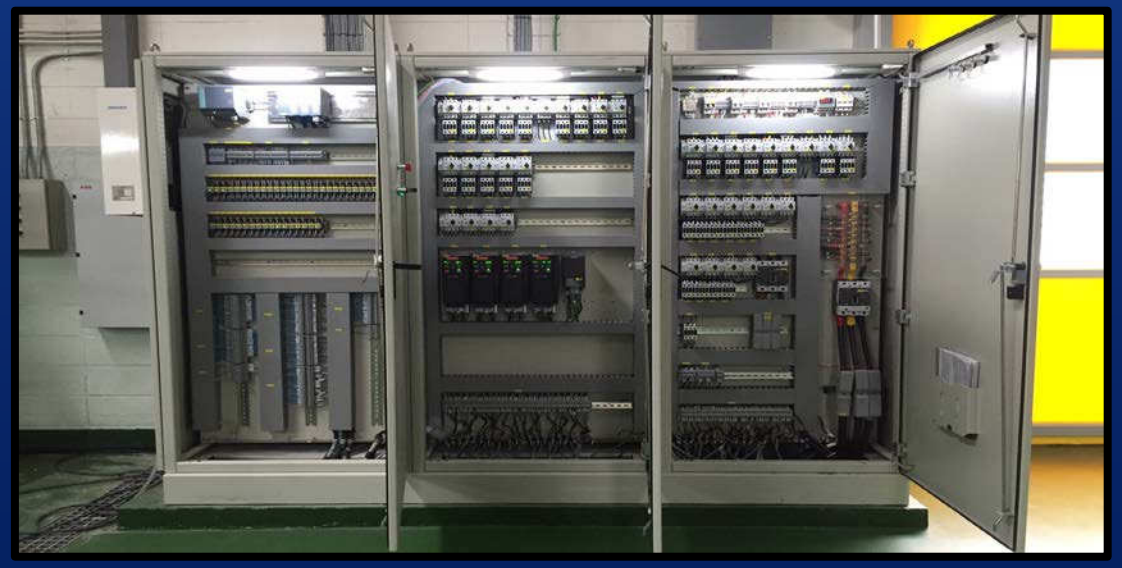
# Plant Automation

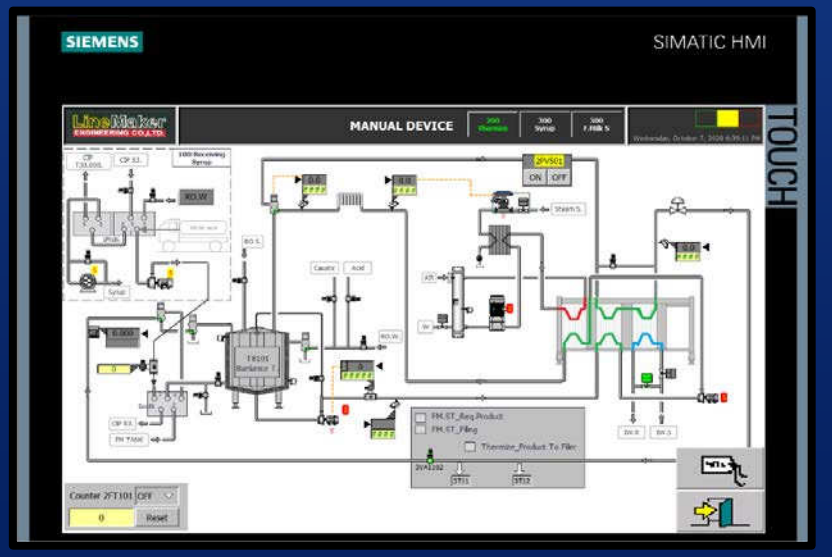
**Reduce waste & human error.**

# Plant Automation

## Level of Automation.

- ❑ On-off, PID controller
- ❑ PLC local unit controller
- ❑ SCADA
- ❑ SCADA + ERP .....



# THANK YOU – Questions?