Digital Factory of the Future
Ecosystem way of Designing, Building and Operating
ABB: pioneering technology leader in digital industries

2nd industrial revolution
(19th century)
+ Electrification
+ Motion

3rd industrial revolution
(20th century)
+ Industrial Automation
+ Robotics

4th industrial revolution
(21st century)
+ Digitalization
+ ABB Ability™
Digital technologies key to address complete asset lifecycle

Increasing customer value along the entire lifecycle with ABB Ability™
Electrification and Digitalization keys to address sustainability challenges

Need to manage and optimize increasingly dynamic, connected world

**Energy systems**

- Renewable electrification
- Smart distribution

**Industry**

- Industry 4.0
- Collaborative, Flexible Manufacturing
- Real-time energy optimization

**Transport & infrastructure**

- Smart Cities
- E-Mobility
- Mobility-as-a-Service
- Data centers
- Healthcare & Hospitals

Electric energy and digitalization are the common denominators
**Why traditional way of working is not good enough?**

Total system design rigid and inefficient due to system silos and stacking of the safety margins

**Process design / System design**

- **Sub system Design / component selection / dimensioning**

  - **Sub system 1**
  - **Component selection**
    - Supplier a
    - Supplier b
    - Supplier c

  - **Manufacturing components / Building the system**

  - **Sub system 2**
  - **Sub system n#**

  - **Running the systems**

**System design:**
Selection of main concepts, process equipment, overall control principles etc.

**Detailed design**
Design of subsystems
Selection of components

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New way: Collaborative design-build-operate ecosystem

Digital twins enable simulation for optimal system and component design

Simultaneous optimization of process, electrical and automation systems

Set-based modular design

1. Process modelling

2. Scenarios and analysis

3. Simulations

4. Equipment selection

Optimization against criteria
New way: Collaborative Design-Build-Operate ecosystem

Optimization throughout the lifecycle

- Process and yield optimization
- Asset Management
- Energy Management
- Troubleshooting
- Performance and knowledge support

- Overall optimization
- Functional integration
- Project management
- Supply management
- Change management

- Site management
- Supply logistics
- Equipment installation
- Commissioning and Start-up
- Accelerated ramp-up

Collaborative Design

Collaborative Build

Collaborative Operations

Learning

Time to profit

Optimized design
Example of simplified Process => 2 scenarios – cases simulated => Optimal Es

Scenario 1: Equipment selection based on peak power need – Typical overdimensioning case because lack of accurate data

Scenario 2: Equipment selection based on iterative, simulated optimal flow and power need – combining Process - Automation, Drives motors and Process electrical power simulations -> control strategy for energy efficiency and LCC optimization -> smaller field devices and power network
Electrical process power simulation

Electrical equipment and load profile

Scenario 1

**Pin**

ACS880-01-363A-3
M3BP 315LKB 4
200kW / 1490rpm

Scenario 2

**Pin**

ACS880-01-293A-3
M3BP 315LKC 6
160kW / 994 rpm
ACS880-01-363A-3
M3BP 315LKB 4
200kW / 1490 rpm
ACS880-01-293A-3
M3BP 315LKC 6
160kW / 994 rpm

Both scenarios outcome is 1058m³ in 4 hours
Production cycle scenario

Variable outflow

Production flow rate cycle for the tank outlet
4-hour cycle with two 0.5-hour spikes
Collaborative design demonstration video
Optimal Collaborative Design saves both CAPEX and OPEX

\[ Es = \frac{P_{\text{in}}}{Q} = \sum \frac{P_{\text{in}} \, dt}{V_{\text{total}}} \]

**Scenario 1**: Equipment selection based on peak power need – Typical overdimensioning case because lack of accurate data

- Mechanical power 708 kWh
- Electrical power 771 kWh
⇒ Specific Energy 0.67 kWh/m³

**Scenario 2**: Equipment selection based on iterative, simulated optimal flow and power need – combining Process Automation, Drives motors and Process electrical power simulations -> control strategy for energy efficiency and LCC optimization -> smaller field devices and power network

- Mechanical power 635 kWh
- Electrical power 692 kWh
⇒ Specific Energy 0.60 kWh/m³

Capex reduction: ~20...25%
Opex reduction: ~10%
Digital Factory of the Future - today

World’s first industrial AI 5G application

Real-time quality control with 5G enabled hybrid cloud AI application
This is how 5G enabled AI application supports work at ABB Drives

1. Worker is assembling drives module
2. Machine vision application is supervising the work
3. Application connects to the cloud backend at the datacenter using 5G wireless network connection
4. Analytics application gives immediate feedback to the worker in case of possible deviations