

Green factory nell'Automotive: ottimizzazione del processo manufatturiero

La Fabbrica Smart&Green

8 September 2014



Our Mission

Comau is a leading **global** provider of advanced manufacturing systems, **innovative** sustainable automation and service solutions

With a strong history in the **automotive industry**, we have continued to grow, and today we offer our skills and know-how to a wide range of **industries** and **applications**

Products & Services



Carrozzerie

- Assembly
- Joining
- Welding
- Riveting



Powertrain & motori:

- Machining
- Assembly
- Test



Robotics

- . Robots



Servizi

- Maintenance
- Facility management



Consulting

- Process engineering
- Project management
- Contract management
- Risk management



eComau

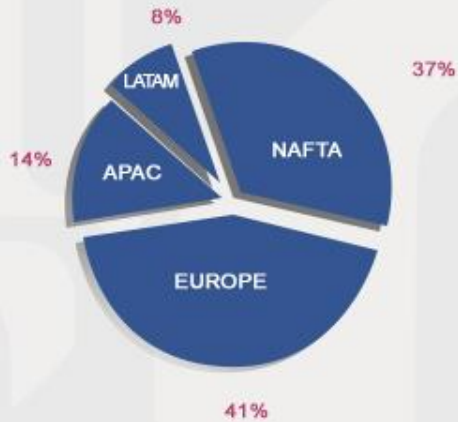
- Energy Efficiency
- Energy management
- Green automation
- Sustainability



Turnover



COMAU GROUP 2011-13 Revenues (MIO €)



COMAU SYSTEMS 2013 Turnover per area (%)

One team

40 years of experience

4 innovation centers

15 manufacturing plants

24 locations

14 countries

Over **110 PMI®** certified project managers

13,480 employees worldwide

- **EMC2-Factory R&D Project**
- Optimization of industrial process and equipment



EMC2-Factory Eco Manufactured transportation means from
Clean and Competitive Factory



EMC²-Factory will improve and develop new technologies and processes, combining existing tools and methods in an overall integrated framework, to achieve economic and ecologic factories.

It will focus on main energy intensive processes within the most relevant industrial sectors in Europe (automotive, rail and aerospace), developing tangible and industry relevant results to be easily implemented in cross-sectorial manufacturing environments.

To assure the impact on European economy, EMC²-Factory partnership includes main Industrial players (as well as SMEs) in manufacturing, highly-recognized Research Centers and Universities and one of the main European industrial associations.

The project results will therefore lead to a sustainable, as well as economically profitable, green factory framework. The new established paradigm will become a permanent reference point in European Manufacturing.



Green



Economic



EMC2-Factory



Productive

Comau goals



Technological advancement

Support of the development of key technologies for the future customers manufacturing plant, focused on the “green” technology and economy.

In body welding system the project will concentrate on the new joining technologies, energy-efficiency oriented system engineering process, energy efficiency monitoring and control systems.

Team development

Develop the knowledge in the area of the energy consumption reduction, propagate the policies and methodologies to support the engineering of energy efficient process and solutions.

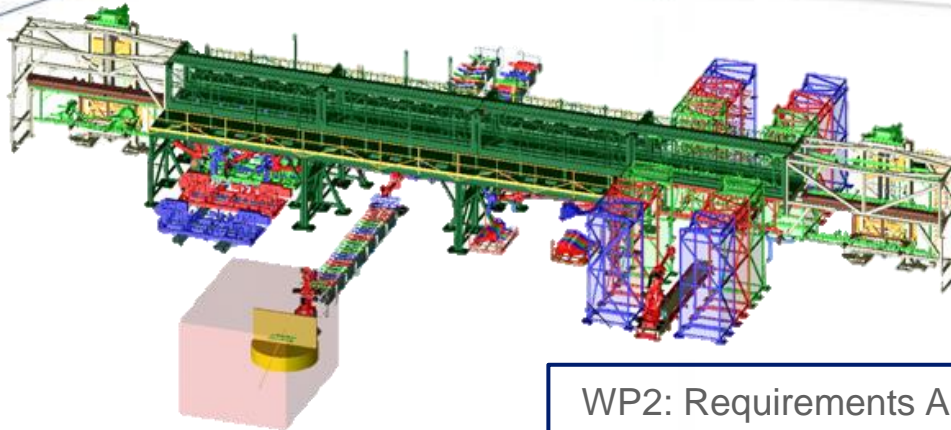
In particular will provide to engineer the needed tool to optimize the energy consumption of the manufacturing systems.

Implementation and marketing

Support eCOMAU in their business and provide customers the needed confidence on energy efficient COMAU solutions.



Comau role in the project ...



Comau mainly focuses on the management and integration of the research and demonstration activities and contributes to the definition of industrial requirements related to new sustainable manufacturing systems

WP2: Requirements Analysis and Review of Enabling Technologies

new sustainable manufacturing systems

WP3: Process Technologies Re-engineering

machining and assembly technologies

WP4: Production Control Systems Re-engineering

control systems for increasing energy efficiency

WP5: Planning, Optimization and Life Cycle Evaluation

management decision making

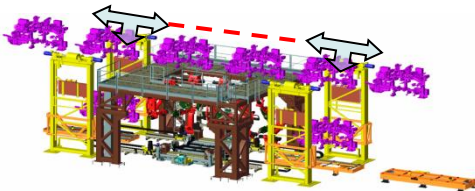
WP8: Automotive Industry Pilot

outcomes evaluation and demonstration

eComau

eComau is the energy efficiency unit of Comau

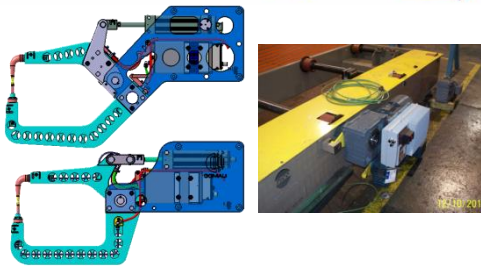
- New Integrated monitoring systems for industrial process and energy usage
- Decision support system based on actual data



Body Welding

Body Welding concentrates on the development of:

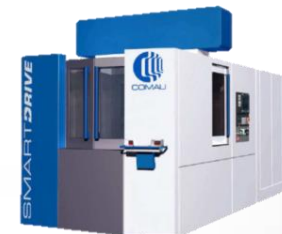
- New architecture to control motors on the manufacturing line by improving the actual frequency inverter (On Board VFD)
- Improving the performance of the joining technologies by exploit new materials and technologies to eliminate the water cooling in tip welding
- Develop new leaner standard product (new framer concepts)



Powertrain

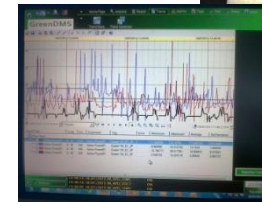
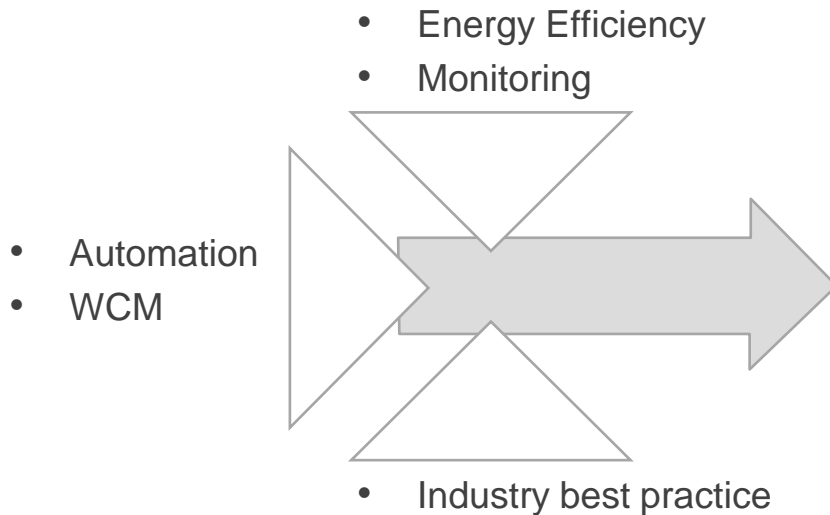
Powertrain concentrates on the development of:

- Machine tool and clamping fixtures lightening
- Machine tool green retooling
- Energy machine modeling and control



Green DMS (Decision Making Support)

eComau has developed the Green DMS: a combined monitoring of industrial process and energy usage based on industry knowledge and best practices



Monitoring device integrated with the industrial process to support fact-based decisions on manufacturing optimization (energy usage, performance improvement, advanced O&M optimization)

- EMC2-Factory R&D Project
- **Optimization of industrial process and equipment**

Real life examples

- Optimization of the energy footprint of industrial robots
- Reduction of energy, lubricant and coolant consumption in PowerTrain and Painting lines in the automotive industry
- Advanced training for O&M personnel on new plant

Robot optimization

Measurement campaign on the energy consumption of industrial robots and automation lines lead to upgrade of the base design.

In order to optimize the Carbon- and Energy-footprint Comau Robots are design taking into consideration

- the re-use of part of the surplus energy
- the recovery of wasted energy

How:

2 different approaches

- ✓ accumulating energy with capacitors
- ✓ using regenerative system to return wasted energy to the energy network through dedicated “electronics”

What else:

- eco-friendly materials for robot structures
- reduced robot weight
- eco-friendly paint, water based

- recycling of pallets for transportation
- innovative spot welding gun





How can energy consumption be reduced?

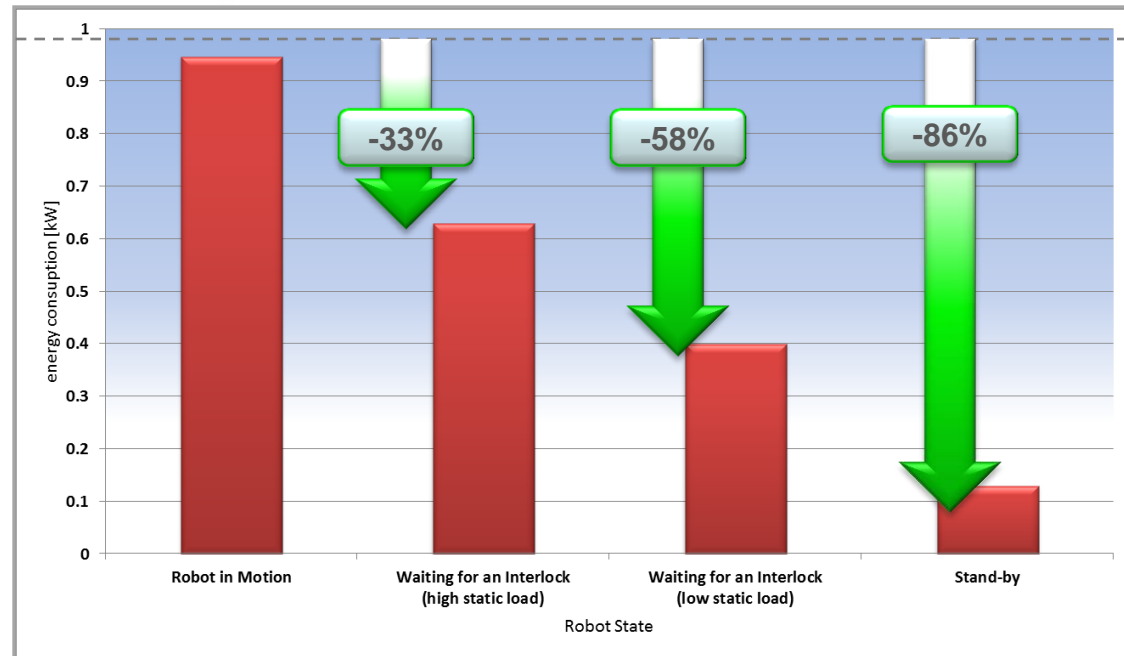
What contributes to energy consumption?

According to the different “robot states” some of the components need power while others do not. This creates different “scenarios” with each requiring different energy consumption.



Test conditions:

- SMART NJ4 175-2,2
- C5G control unit
- Spot-welding cycle from production plant:
 - cycle time: 57 [s]
 - number of spots: 15
- Payload ~175 [kg]



TYPICAL SAVINGS AND PAYBACK IS LESS THAN 2 YEARS

CNC

TRANSFER
LINES

ROBOTICS

PAINTING LINES

250 MACHINING
CENTERS

50 TRANSFER
LINES

400 C4G ROBOT
CONTROLLERS

PAINTING LINES

700L, SD1000
1GXL, 1GZ
Heller
Makino



coat spray booths
bumper line



TIME

< 2 YEARS

< 2 YEARS

<3 YEARS

< 2 YEARS

Cylinder head machining line, 22 COMAU Smart Drive 700L machining centers

Project	Customer	Situation and problems
<ul style="list-style-type: none"> • 2011/12 • 3 Months 	<ul style="list-style-type: none"> • PWT European Automotive 	<ul style="list-style-type: none"> • Line in Production since 2 years • High Customer interest for saving opportunities • Intervention possible only during weekend and no productive periods

Realized actions

- Energy efficiency entire line extension based on previous projects data collected

Results

- Average saving: electricity 29%, compressed air 45%, coolant 36%
- Yearly energy saving equivalent: 400 MWh (3 shifts)
- Reduction of CO2 emissions: 250 ton
- Payback < 2 years



Welding line lightening

Lightweight welding guns allows the usage smaller robots. This increases the density in a single station and the overall performances are improved

Project	Customer	Situation and problems
<ul style="list-style-type: none"> Carried out in: 2013 	<ul style="list-style-type: none"> BW South America Automotive 	<ul style="list-style-type: none"> Mechatronic subsystems require optimization in the materials selection and in the structure design, in order to reduce the energy consumption

Realized actions

1. Analysis of current solutions and energy consumption
2. Components re-design for sustainability and energy consumption reduction
3. Prototype implementation
4. New solution test and validation

Results

- Compact welding gun
- Smart Robot NJ4 90/110
- New 8 robots BRIC architecture

Body welding station



Lightweight subsystems



The learning factory address the fundamental start-up problems of new production plants in developing countries

- The start up of new production plants in developing Countries is complicated both for the technology and people
- Local O&M workforce lacks in:
 - manufacturing experience
 - knowledge of the kind of problems and faults that they will have to face
 - familiarity with industry activities and shift work
- Classical training approach is long and slow and typically starts AFTER the factory is ready
- This results in difficult and long commissioning, high operative faults and low output quality that delays the breakeven of the investment
- Classical back-up solution is the use of non-resident technicians which is expensive and often not effective

The learning factory

Concept and results



- Construction of a factory mock-up well before the start up of the factory



- On-site and on-the-job training on real O&M situations and on most typical faults



- “Progressive” training synchronous with factory start up phases



- Provision on-site of minimal theoretical training



More effective – reduced time to market
Cost saving – no travel agency like



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