GEFOND

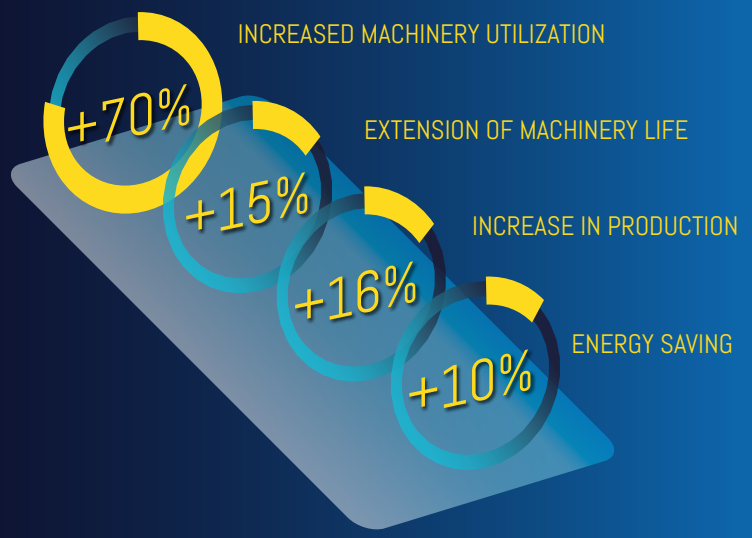
PERPETUO™

ANTICIPATE FAILURES AND REDUCE DOWNTIME
LET YOUR MACHINES TALK WITH PERPETUO

How can industrial Artificial Intelligence help companies reduce scraps, increase productivity and be more environmentally sustainable at the same time?

Do you want to be more competitive in the market? With PERPETUO predictive maintenance software you give value to the data collected from your machinery

THE NUMBERS OF PREDICTIVE MAINTENANCE

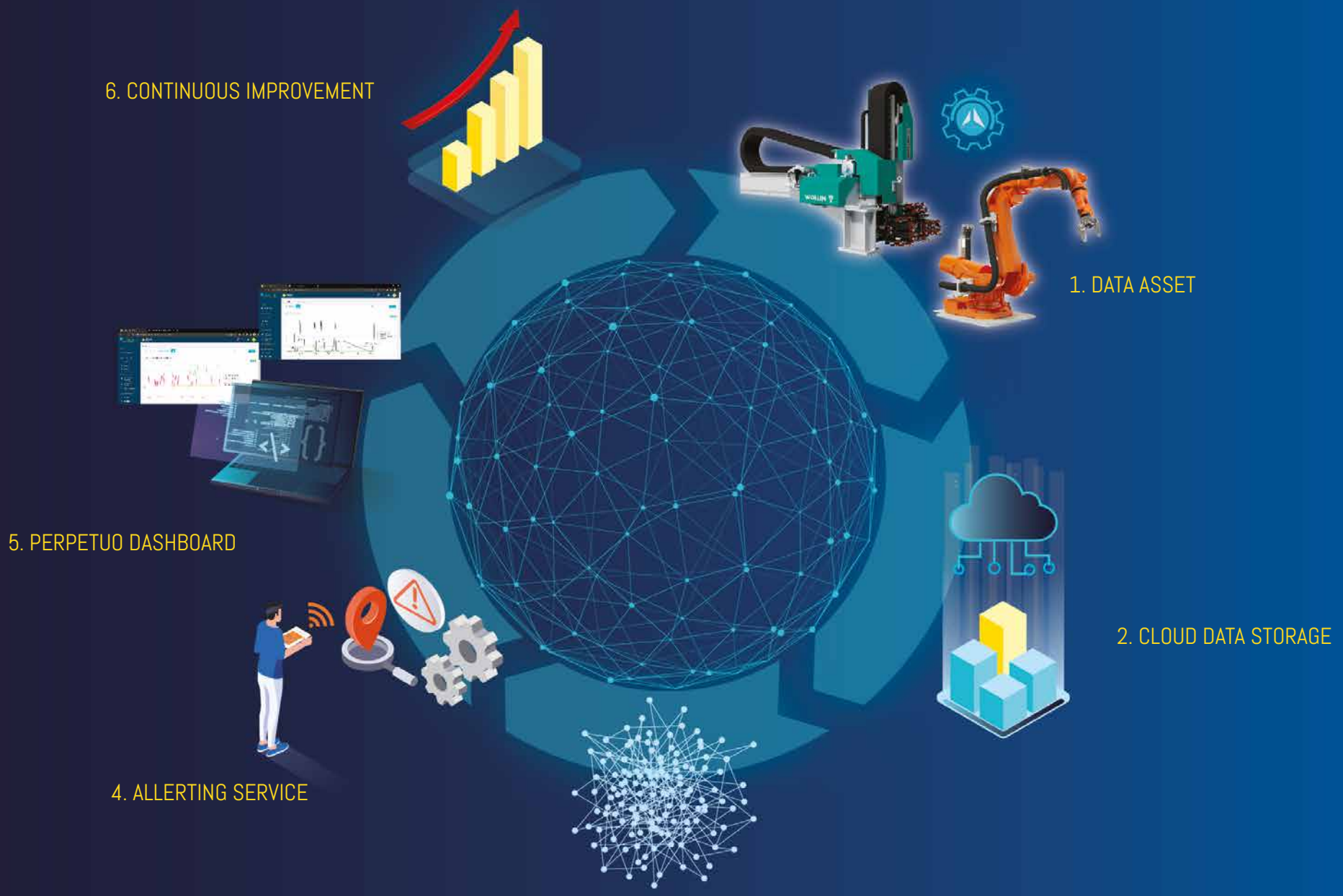


Factory 4.0 can be enhanced thanks to an innovative and technological system that collects and analyses data using Artificial Intelligence algorithms. Predictive maintenance is an intelligent maintenance that can predict what will happen in the future, based on precise parameters from the machines. In the modern manufacturing industry, the maintenance of machinery is no longer limited to the scheduled replacement of worn components but becomes part of the production strategy supported by mathematical models that help maintenance engineers adopting a new data-driven approach.

The company predictive approach saves costs, improves productivity by reducing the frequency of costly unplanned downtime, improves profitability, offers better service levels, improves safety and environmental performance.

With the appropriate IT systems, predictive maintenance also allows to make strategic choices in terms of spare parts selection, more appropriate technologies, and more convenient production plans, effectively extending the life time of the assets and machines themselves.

It is in this context that PERPETUO, the artificial intelligence software for predictive maintenance, was born: intuitive and easy to use, created in the foundry for the foundry, the only one able to dialogue with any machine and peripheral of the casting cell of any brand and type, anywhere in the world.


6. CONTINUOUS IMPROVEMENT
1. DATA ASSET
5. PERPETUO DASHBOARD
2. CLOUD DATA STORAGE
4. ALLERTING SERVICE
3. AI ALGORITHMS

PERPETUO™

TO WHOM PERPETUO IS ADDRESSED

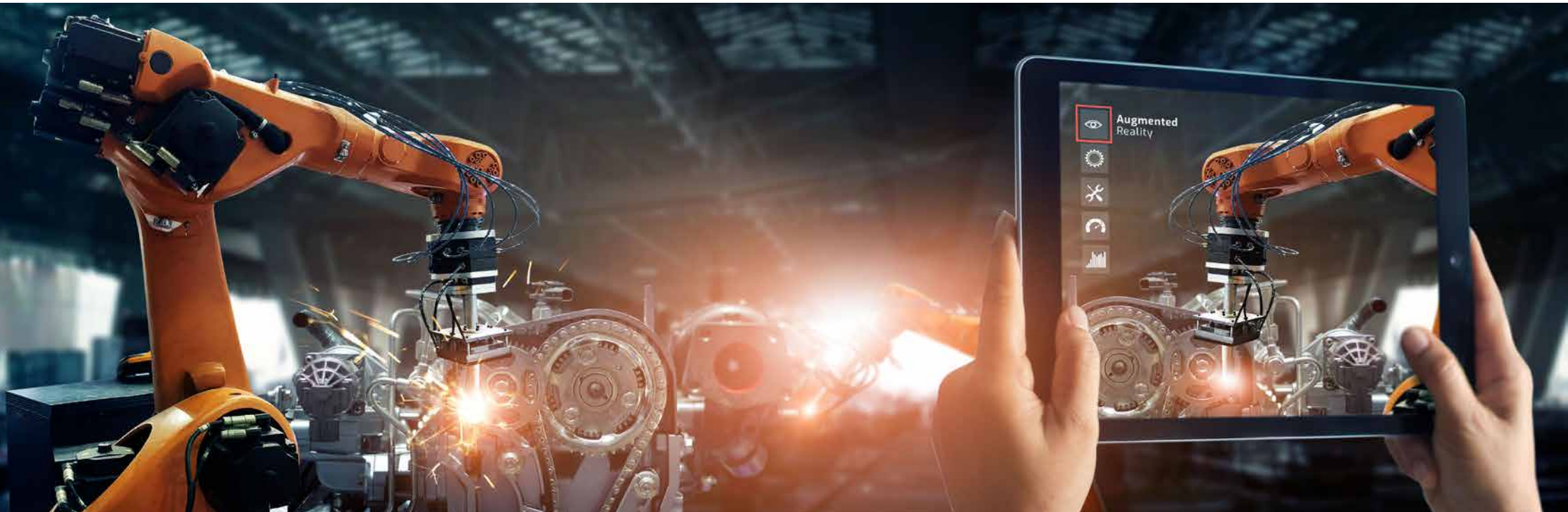
MACHINE OWNERS

Taking care of machinery, not just owning it, that is our mission.

In recent years, the economic crisis and fierce competition have put companies in constant difficulty, forcing them to look even more closely at the relationship between costs and performance of machinery and production equipment. Asset maintenance is a must for a company that wants to stay in the market.

With PERPETUO, it is possible to:

- **Track machinery problems, identify and address the causes of downtime**
- **Avoid unplanned interventions and achieve an optimal operational efficiency and a more stable process at all times**
- **Avoid failures that lead to scrap castings**
- **Reduce maintenance costs**
- **Extend machines life time**
- **Meet IATF certification requirements**
- **Improve safety and environmental performance**



MACHINES MANUFACTURERS (OEMs)

Creating more value for the end customers and a real competitive advantage for the business by enhancing the predictive power of data.

OEMs need to reduce costs and transform their business models from exclusively selling machinery to providing services with the goal of creating more value for the customer. More and more OEMs are showing interest in predictive maintenance because they have realized that by entering the PERPETUO system they can optimize the service to their customers and get a better understanding of how their machines work.

PERPETUO makes it possible to :

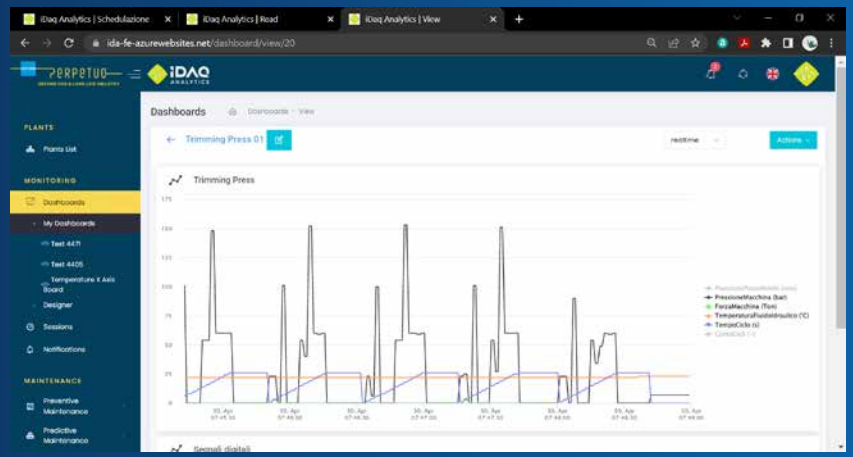
- Predict where and when spare parts will be needed in the company and automatically dispatch new ones
- Understand the life time of consumables and guide research and development
- Reduce warranty costs by quantifying potential problems and responding proactively
- Help customers reduce equipment downtime
- Monitor machines located in different parts of the world

LET YOUR MACHINES TALK WITH PERPETUO: WORK STEPS AND MODULES

PERPETUO is the solution that transforms the historical experience of machinery maintenance into a software platform that uses Machine Learning algorithms to constantly monitor the machines and their trends to determine anomalies in advance.

Leveraging Artificial Intelligence models to identify anomalous behaviours, PERPETUO transforms the data collected from sensors installed on the machinery or from the PLCs of machines into useful information for predictive maintenance of mechanical, electrical, hydraulic and pneumatic parts subject to wear or failure.

PERPETUO is a smart solution that can be accessed from any browser, allowing the customer to view the progress of the parameters monitored on their systems at any time. All the data collected are visible to the maintenance technician, who can use dashboards to check system anomaly reports or analyze the work of the machine in order to improve its performance, thus adding value to the production process without merely chasing faults.



ANALYSIS

Analysis is the first step. Through fault analysis, the causes of downtime with the greatest negative impact on production are identified. The technical experience gained on die-casting cells and close collaboration with leading machine manufacturers have enabled Gefond to build complete packages consisting of IoT sensors and data collection modular architectures.

SOFTWARE

The software uses sophisticated mathematical algorithms, which analyze the data and calculate the risk of failure of a given component. Working side by side, Gefond's engineers and mathematicians from software house T4SM have in fact designed machine learning algorithms specifical for die casting, trained to immediately identify a possible failure of the machinery. By constantly monitoring factors such as temperature, vibration, ultrasound and electromagnetic emissions from the machines, in-depth information on machinery performance can be obtained in real time. Last, cloud computing ensures the secure storage of the collected big data that form the basis of predictive analysis.

HARDWARE

Sensor networks transmit thousands of data from autonomous sensors, each monitoring a physical or environmental parameter. The work of searching and selecting sensors, providing the best solutions available on the market, and implementing them, completes PERPETUO's predictive maintenance. The best solutions available on the market were identified, with the aim of using ready-made hardware suitable for the harsh environment, and scalable to meet any future needs.

PREVENTIVE MAINTENANCE

A module dedicated to preventive maintenance is included in the PERPETUO system and allows the management of a scheduled maintenance program organized by machine and personnel assignments. This module supports the maintenance technician for routine operations, allowing him to schedule activities and create a history of interventions.

YOU CAN ALSO BE SUSTAINABLE THANKS TO PREDICTIVE MAINTENANCE

Predictive maintenance allows energy consumption to be monitored and reduced.
If components are worn out or have a malfunction, they force the machine to work with greater effort, wasting energy unnecessarily.

With predictive maintenance, it is possible to check if the machine is consuming more energy than expected due to the malfunction of one of its components. PERPETUO's energy efficiency kit correlates the analysis of data collected from energy consumption with machine data, allowing to understand in advance if machines are consuming more energy than necessary and correct anomalies.

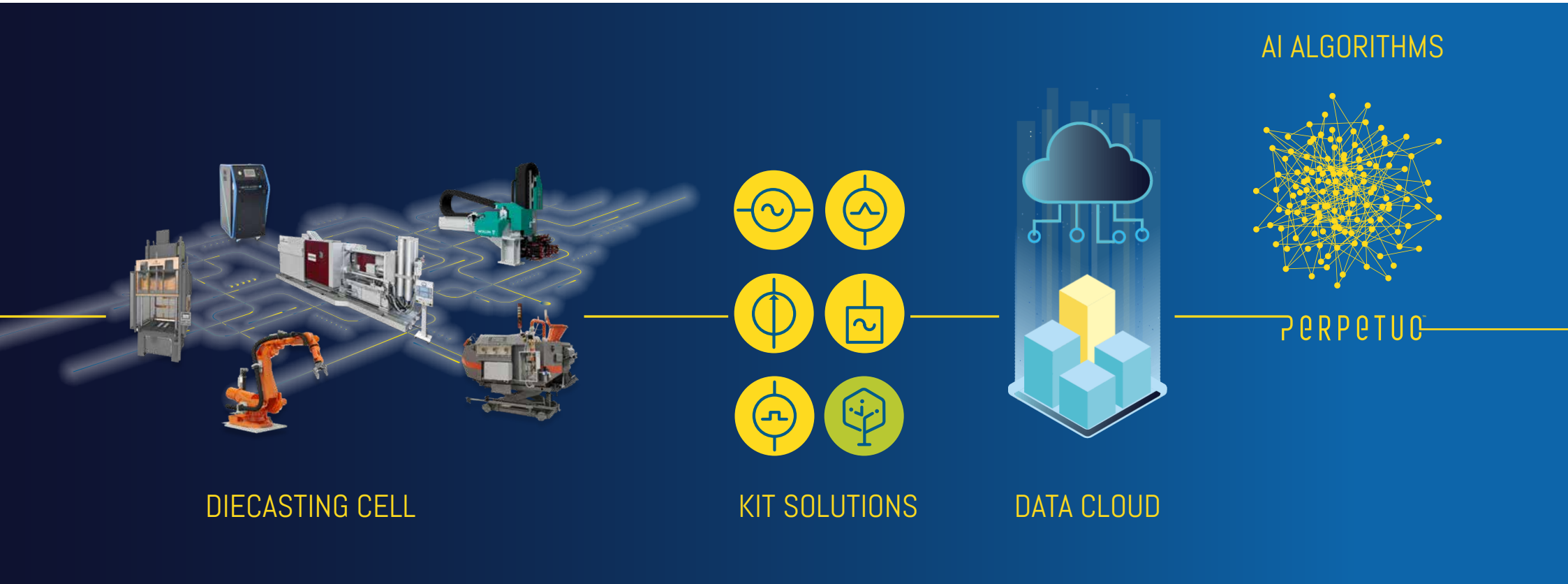
The predictive process safely minimizes operating costs, making plants more efficient and optimized in terms of maintenance. This approach also **reduces the carbon footprint of industrial plants**, thus proactively and intentionally adhering to the decarbonization measures needed to combat ongoing climate change.

MANAGE YOUR FUTURE WITH OUR KITS

The most relevant advantages for those who decide to apply a predictive maintenance plan on their assets are twofold:

- **being able to identify the real problems to be solved**
- **investing resources to achieve concrete results**

To achieve these two targets, Gefond proposes a series of technical kits, conceived and designed on the real problems that can be encountered in die-casting cells.



PERPETUO KIT for DIE CASTING MACHINES

PUMP UNIT

- Motor and/or pump status
- Filter wear status

INJECTION UNIT

- Oil pressure control 2nd and 3rd phase
- Nitrogen pressure control 2nd and 3rd phase

MECHANICAL ASSEMBLY

- Lubrication cycle control
- Wear of the knee pad assembly

HYDRAULIC UNIT

- Cooling system efficiency
- Hydraulic leak detection
- Oil quality
- Check for water in oil

ENERGETIC EFFICIENCY UTILITY GROUP

- Water consumption
- Air consumption
- Electric energy consumption

PERPETUO KIT for ROBOTS

ENERGETIC EFFICIENCY UTILITY GROUP

- Air Consumption
- Energy consumption

PNEUMATIC GROUP

- Leakage monitoring

PERPETUO KIT for TRIMMING PRESSES

PUMP UNIT

- Motor and/or pump status
- Filter wear status

LUBRICATION UNIT

- Lubrication cycle control

HYDRAULIC UNIT

- Cooling system efficiency
- Hydraulic leak detection
- Oil quality
- Check for water in oil

ENERGETIC EFFICIENCY UTILITY GROUP

- Water consumption
- Air consumption
- Electric energy consumption

PERPETUO KIT for FURNACES

MECHANICAL UNIT

- Motor fan status
- Status of heating resistors

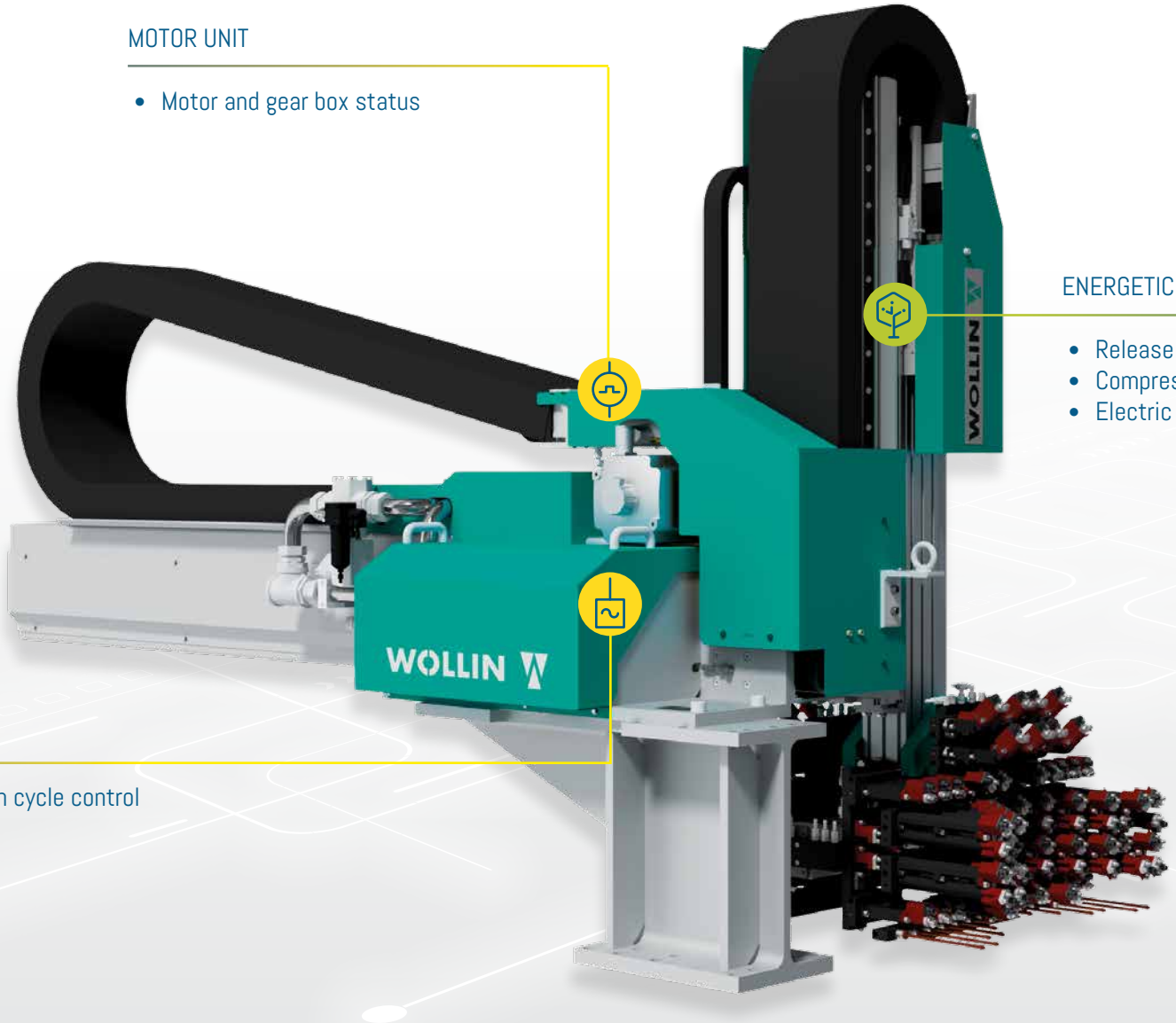
ENERGETIC EFFICIENCY UTILITY GROUP

- Air/gas consumption
- Energy consumption

TEMPERATURE GROUP

- Metal temperature control

PERPETUO KIT for SPRAYING MACHINES



MOTOR UNIT

- Motor and gear box status

ENERGETIC EFFICIENCY UTILITY GROUP

- Release agent consumption
- Compressed air consumption
- Electric energy consumption

MECHANICAL UNIT

- Central Lubrication cycle control
- Guide rails control

PERPETUO KIT for THERMOREGULATORS

PUMP UNIT

- Motor and/or pump status
- Pump efficiency

HEATERS GROUP

- Efficiency of the heating system

MOULD GROUP

- Leaks on the thermoregulation circuits

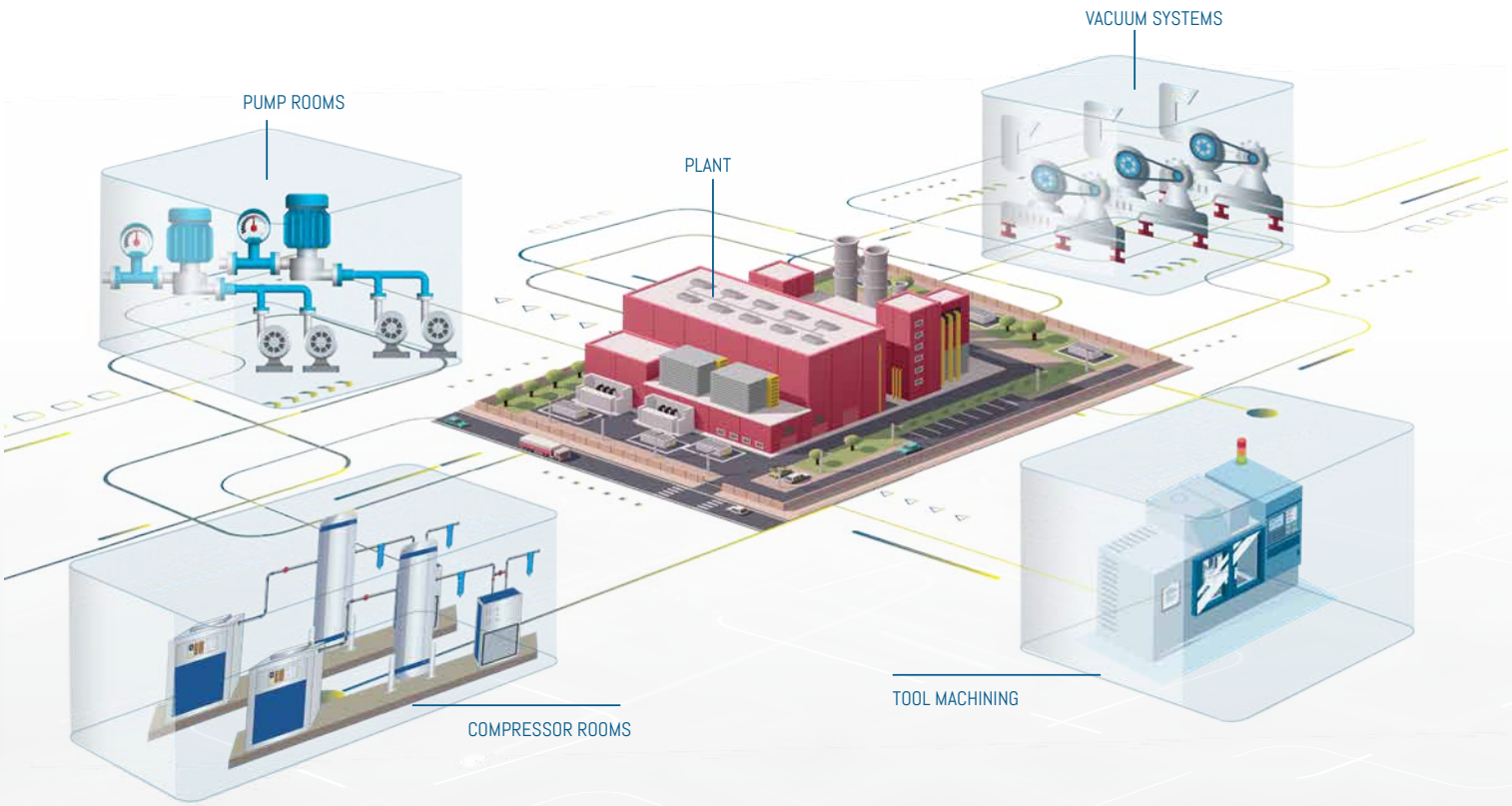
ENERGETIC EFFICIENCY UTILITY GROUP

- Power consumption efficiency
- Gas consumption efficiency

THE IDEAL SOLUTION FOR DIECASTING CELLS

PERPETUO is the platform that allows you to monitor data from the entire diecasting cell and apply predictive maintenance to the complete cell on all brands and models of machines worldwide. Excellent results so far for both diecasting machines and peripherals.

THE IDEAL SOLUTION FOR YOUR PLANT



With PERPETUO, you can also monitor the auxiliary systems in your plant, thus avoiding not only production cell shutdowns but also entire department downtime. For example, we have designed dedicated systems for compressor rooms, pump rooms, vacuum systems, tool machining and melting furnaces.
Compressors as well as suction systems or pump motors are easy to control with appropriate sensors. Vibration, temperature and electrical signature analyses allow us to continuously monitor parameters that are essential indicators of failure.
Tool machining equipment also allow us to make important predictive analyses, and to prevent failures of guides and hydraulic components.

TESTIMONIALS FROM MACHINE OWNERS WHO HAVE CHOSEN PERPETUO

"We are satisfied with the results so far and the solutions that Gefond has been able to propose and implement to turn a problem into an opportunity. We are monitoring diecasting machines and trimming presses from different manufacturers. In particular, we have focused on hydraulic closure failures, with the aim of connecting all the machinery in the factory in the coming months.
The choice of PERPETUO allows us to make the now necessary transition to Industry 4.0, to anticipate failures and to run our company as a capable and digitized reality. We are confident that our customers will appreciate our propensity for continuous improvement."

Gianluca Farina, CEO Alpress.

alpress made in Italy

"I am happy that a system like PERPETUO was born for the foundries. The new generations who are approaching factory work enter the company after their studies. While they acquire managerial skills and theoretical competences, they do not have the time to get to know the folds and twists of operational work. I was already hanging around the factory at the age of six, I breathed the air. My son is now starting to experience in the field at the age of 18 what it means to work in a foundry. Today, thanks to new technological frontiers, we can make sure that this gap is bridged. It is the machines that talk to us and help us make the right decisions. I chose PERPETUO for my foundry because it helps me to pass on more quickly to new generations experience accumulated over years of work."

Marco Scotti, CEO Press 2000

PRESS 2000 s.r.l.

"We have chosen to entrust PERPETUO with predictive maintenance on the tool machining equipment in all our plants. Thanks to predictive maintenance we want to better manage machinery maintenance and anticipate problems in order to reduce downtime and optimize spare parts management."

Carlo Corti, Systems Maintenance & Innovation Manager Costamp Group

COSTAMP GROUP

TESTIMONIAL OF OEMs WHO HAVE CHOSEN PERPETUO

"After 2 years of evaluation and beta-testing on the trimming presses of three major Italian foundries, the innovative project to integrate the PERPETUO Predictive Maintenance software developed by Gefond is finally a reality. The results, as verified during testing, are remarkable and exceed expectations. Failures in the cooling system of the hydraulic circuit have been reduced by 75% and valve and pump failures due to overheating by 50%. In addition to the sensors already installed on our trimming presses, we have decided to go even further, with new sensors that will not only help us with predictive maintenance but will also allow us to gain insight into the behavior of our machines over time. PERPETUO will not only serve our customers but will also help us in continuous improvement and component optimization."

Paolo Claus, Direttore Tecnico Tecnopres

tecnopres TRIM PRESSES

"The collaboration between Wollin and Gefond is an historical one. It began in 1998 when Gefond became the exclusive representative for Italy of Wollin spraying machines and over the time became one of the leading distributors for number of systems sold. The next step forward in this collaboration is the integration of the PERPETUO software on the new line of ESM spraying machine. We support the development of PERPETUO also in-house at Wollin because it offers our customers predictive maintenance and even more reliability and efficiency."

Bjorn Wollin, CEO Wollin

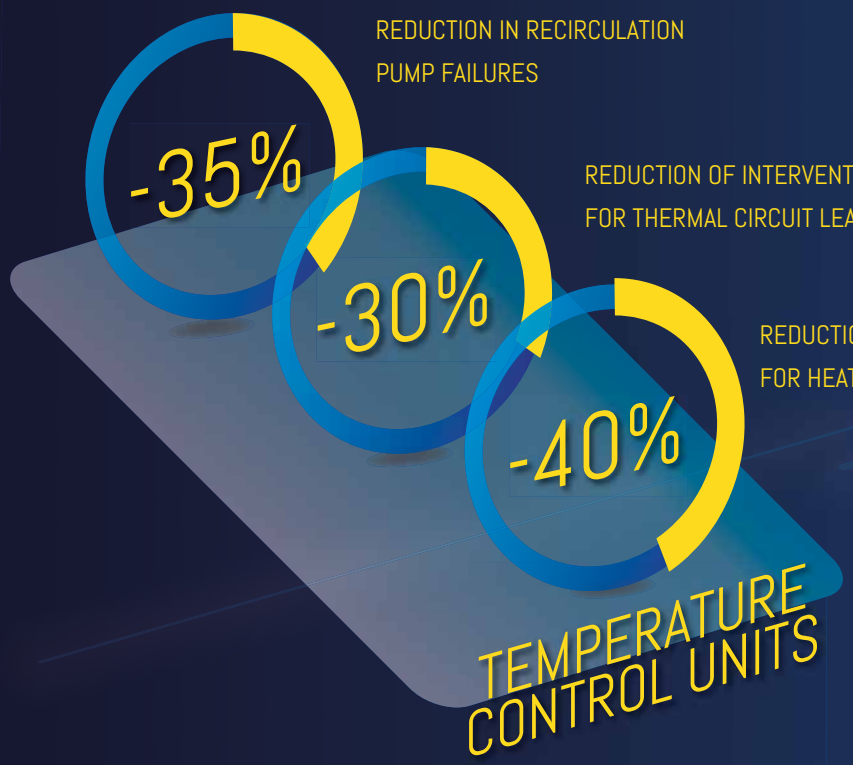
WOLLIN SYSTEMATIC SPRAYING TECHNOLOGY

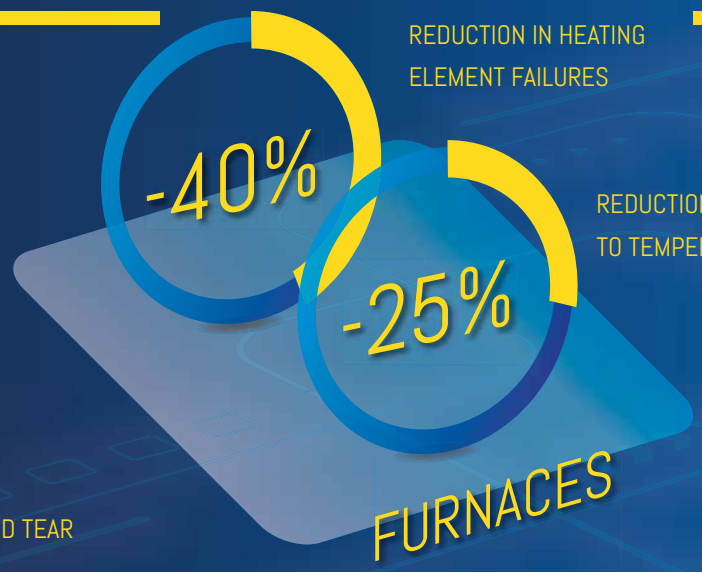
"Agrati AEE's technical choices have always been oriented towards process control that guarantees stable and quality-assured production. We have therefore found ourselves with increasingly complex machines that generate a lot of useful data for the customer, hence the logical thought was, why not use this large amount of data to give added value to our customers? Working with Gefond to install PERPETUO on our products is the right answer for us. Giving value to data and making them vectors for improvement."

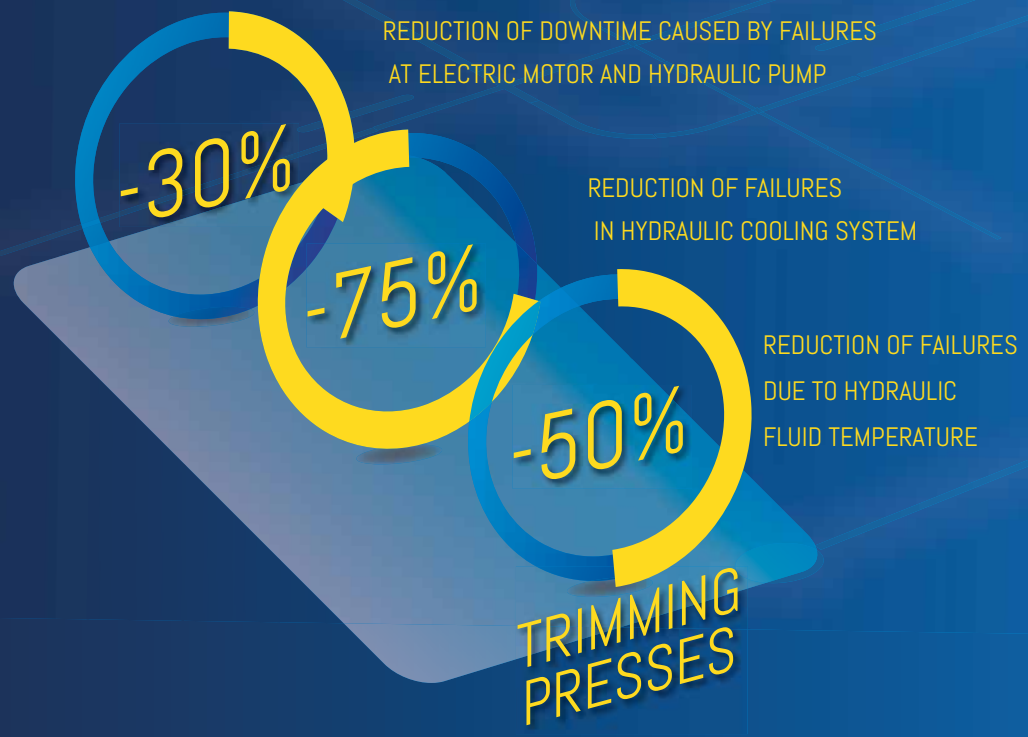
Giorgio Colombo, CEO Agrati

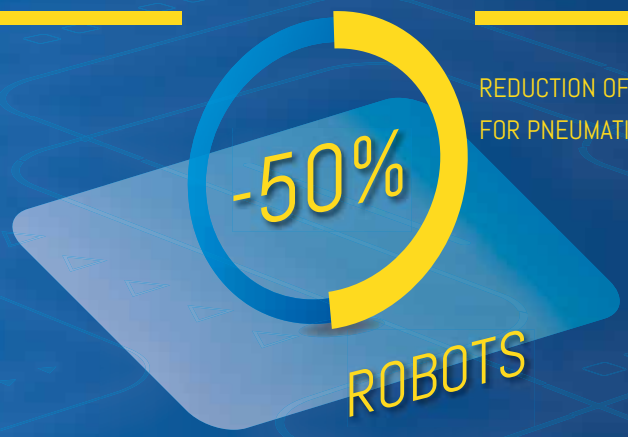
AGRATI·AEE HIGH TECHNOLOGY DIE-CASTING MACHINES

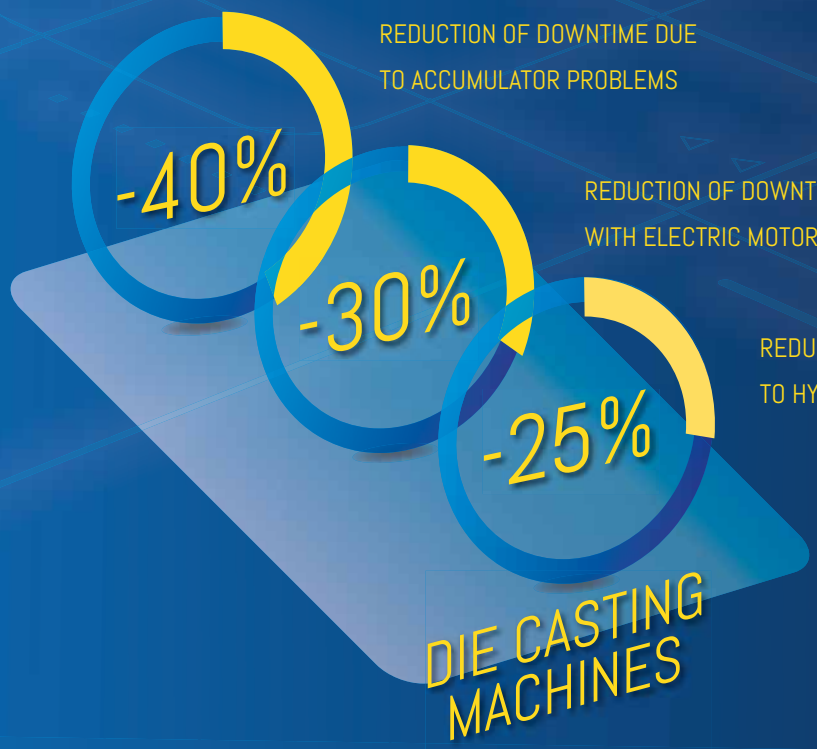
PERPETUO'S RESULTS

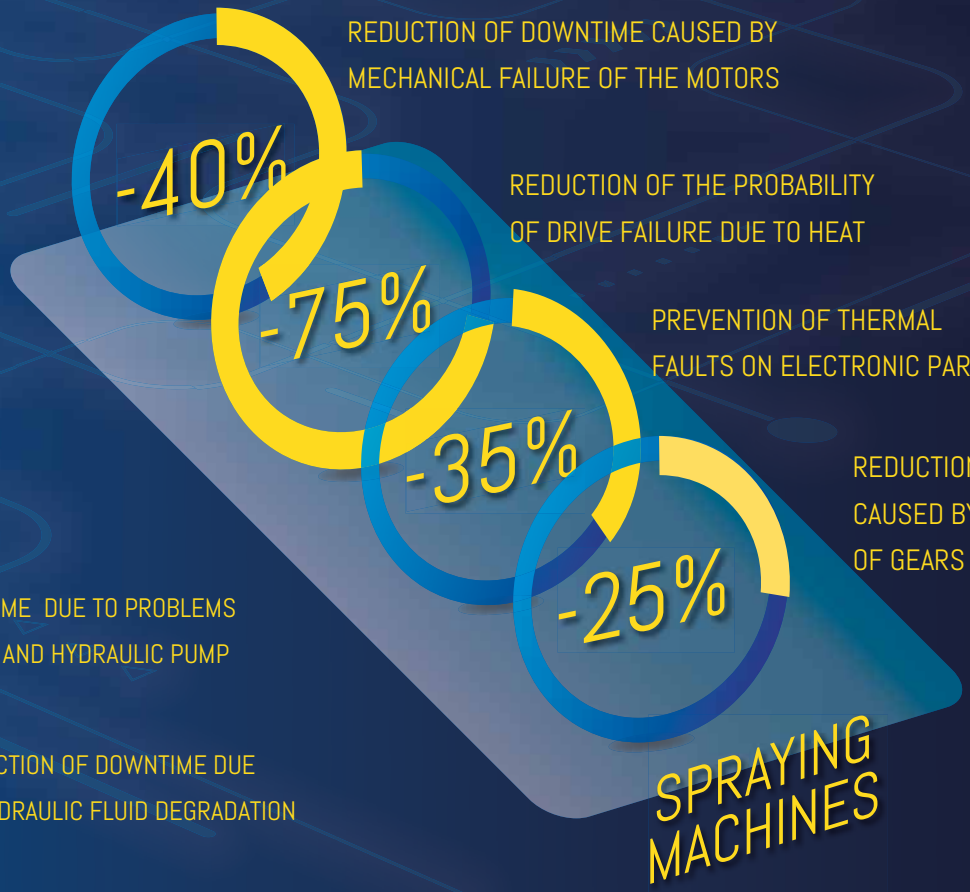







-50%
REDUCTION OF INTERVENTION TIMES
FOR PNEUMATIC CIRCUIT FAULTS
ROBOTS


-40%
REDUCTION OF DOWNTIME DUE
TO ACCUMULATOR PROBLEMS
-30%
REDUCTION OF DOWNTIME DUE TO PROBLEMS
WITH ELECTRIC MOTOR AND HYDRAULIC PUMP
-25%
REDUCTION OF DOWNTIME DUE
TO HYDRAULIC FLUID DEGRADATION
DIE CASTING
MACHINES


-40%
REDUCTION OF DOWNTIME CAUSED BY
MECHANICAL FAILURE OF THE MOTORS
-75%
REDUCTION OF THE PROBABILITY
OF DRIVE FAILURE DUE TO HEAT
-35%
PREVENTION OF THERMAL
FAULTS ON ELECTRONIC PARTS
-25%
REDUCTION OF DOWNTIME
CAUSED BY MECHANICAL FAILURE
OF GEARS AND GUIDE RAILS
SPRAYING
MACHINES

A CASE STUDY

ANALYSIS

A correct and methodical collection of the causes of failure allowed us to study and propose the correct solutions. The analysis of the data, and close collaboration with the company's experienced maintenance engineers, allowed us to identify the installations on which to focus our activity. For this customer, spraying machines and trimming presses were the subject of the feasibility study.

GOALS

The targets we set ourselves were to:

- **identify faults on motors, gearboxes and guide rails in spraying machines**
- **identify faults due to overheating on spraying machines drivers**
- **detect faults in the operation of the hydraulic circuit cooling system on trimming presses**
- **monitor the integrity of the seal on the hydraulic cylinder of trimming presses**

Failures in motors, gearboxes, guide rails and spraying machines drivers have a low impact in terms of frequency, but a very high impact in terms of cost and downtime.

Faults in the cooling system of the hydraulic circuit of trimming presses have low costs and resolution times, but have a heavy impact on the operation and life time of valves and pumps.

METHOD

In order to correctly apply a predictive maintenance strategy, we identified the physical and electrical values that undergo significant variations as the function of the monitored components deteriorate.

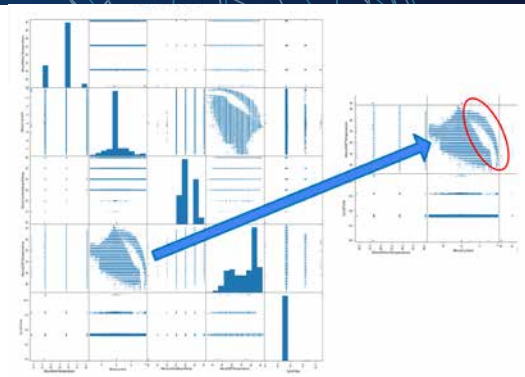
In the spraying machines, these parameters were already available through the axis drivers, that suitably interfaced to the acquisition software provided all the necessary data for the predictive analysis.

For the trimming presses, which were already sensorized, the necessary data were available through a pressure transducer, a temperature sensor and a magnetic stroke sensor.

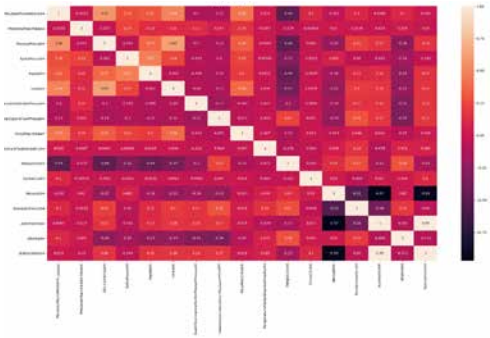
Once the network infrastructure for data collection had been set up and sampling started, the analysis work necessary for the construction of the machine learning algorithms began. A true machine learning system is never plug-and-play, it requires at least 6 months of training before it gives meaningful feedback.

The analysis of the motors' electrical signature supplied important indications; the system detected and reported abnormal temperature variations on motors with stable currents and torques.
It was evident how the analysis of correlations between data allows a more complex analysis.

It allowed us to identify two motors that were working under thermal stress conditions.
On the trimming presses, the most immediate warnings came from checking the temperature of the hydraulic fluid; anomalies such as defective cooling valves, the progressive clogging of a heat exchanger and even the abnormal operation of a pump causing an increase in the temperature of the hydraulic fluid were easily detected.

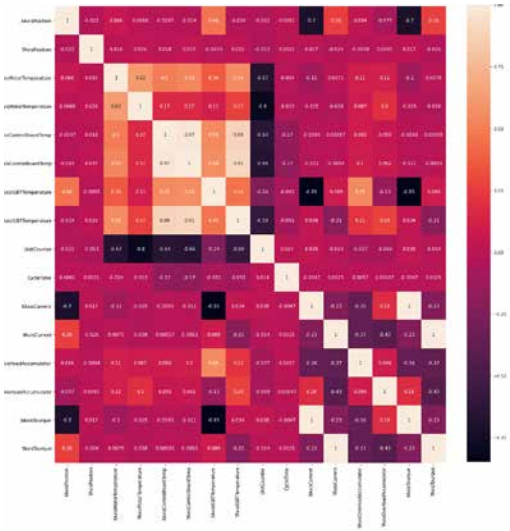


RESULTS



In 2 years, we have reduced by 40% the interventions on mechanical moving parts and by 75% the failures due to over-temperature in drivers and electronics on spraying machines. On trimming presses, the application of PERPETUO has enabled us to reduce by 50% the failures of the hydraulic fluid cooling system and by 75% the failures due to over-temperature.

The goals set together with the customer were largely achieved.



Mathematical analysis for the construction of machine learning algorithms

Gefond for a long life industry

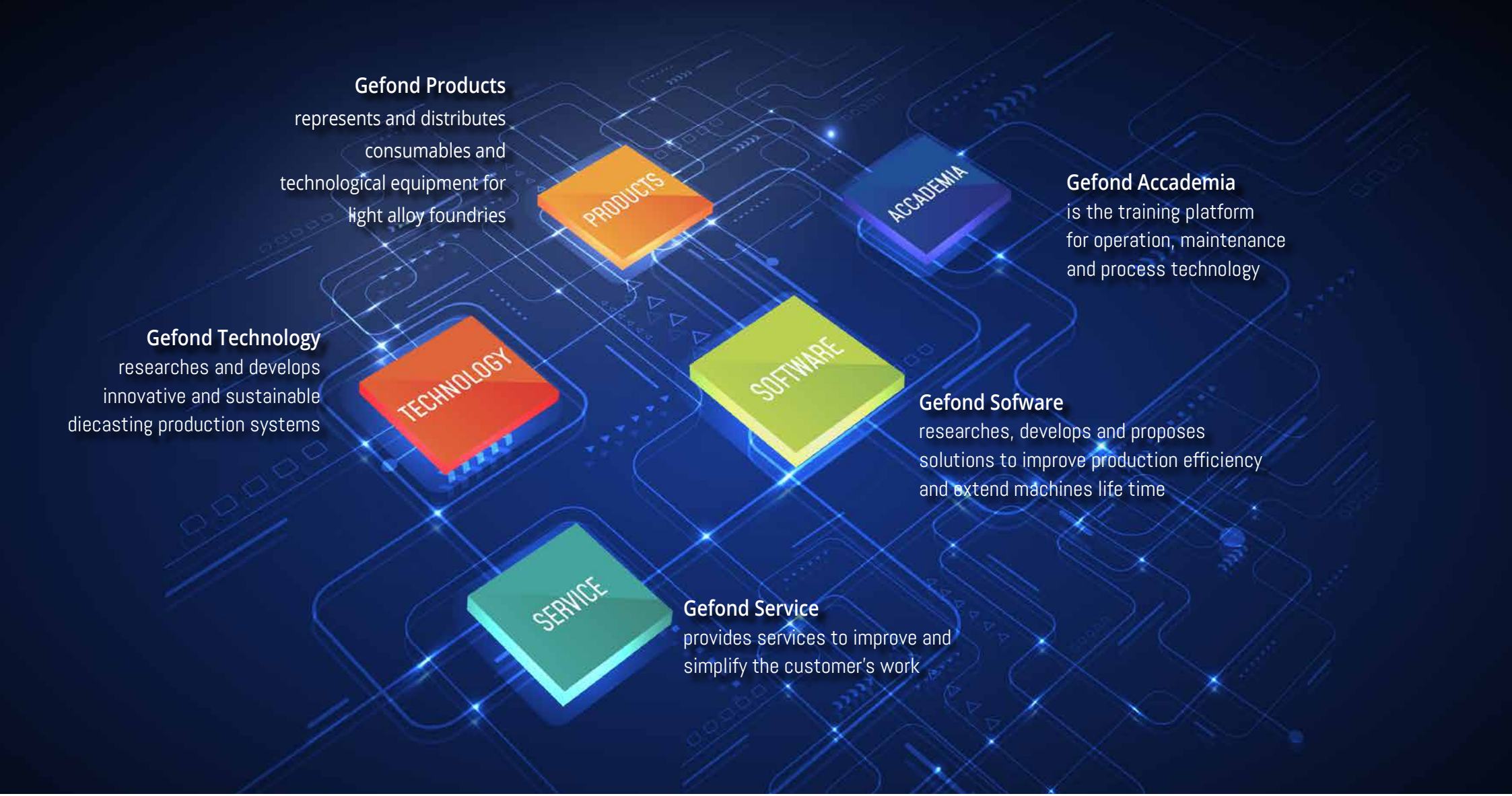
"I can say that my father and I represent a happy and successful case of generational transition and continuity. He is the founder of the company and there is a very useful daily exchange regarding both the company's consolidation and Gefond's new projects, on which my father gives me important support thanks to his long experience. PERPETUO, the result of my passion for my job, is another piece of the 'continuous improvement' that should lead all production activities." Tiziana Tronci

"The entry of my daughter has represented for me, on the one hand innovative ideas and a new vision of the sector and approach to it, and on the other the possibility of giving continuity to the work carried out and transmitting the solid competence acquired and matured in almost thirty years of company activity." Pierluigi Tronci

PERPETUO is developed and proposed by **Gefond for a long Life Industry.**
Founded in 1994, Gefond represents leading suppliers in the diecasting industry and distributes technologically advanced equipment for light alloy foundries.

Gefond's challenge is to stay ahead of the changing time by trying to anticipate it; to support trends in the manufacturing industry with innovative technical solutions, focusing on **digitalization and sustainability**; to expand the range of services; to push on training to increase productivity.

Gefond's strategic vision is embodied in five divisions: **Gefond Products, Gefond Software, Gefond Technology, Gefond Accademia, Gefond Service.**



Gefond represents the following brands in Italy: temperature control units HIGH PERFORMANCE DIE CASTING by Gefond, spraying machines WOLLIN and AED, dosing furnaces FOUNDRY4, crucible furnaces MMP, crucibles Morgan, melting furnaces KROWN, latest-generation laser marking systems LASERAX, adiabatic coolers to replace evaporative towers FRIGEL.

Interview with Tiziana Tronci, board member and new products development GEFOND

How did PERPETUO first come about? It all started by chance. I first heard about Predictive Maintenance at the Aluminium 2018 trade fair. **Curiosity has always played a part in my professional life**, so I decided to find out more. After doing some research and talking at length with Gefond's technicians, I realised that most of our clients request maintenance or emergency intervention once a fault has actually occurred. They get stressed because the machines are at a standstill and production has stopped, and because spare parts are needed: these are not always in stock, and may need to be ordered. And procurement takes time. It dawned on me that it is really hard to optimise work and be more efficient when we work this way. I tried to find out if there were any devices that would allow clients to reduce the number of callouts for support when a fault occurs. **I analysed other industrial fields and realised our own sector also needed to work on preventing faults and consequently cut machine downtime.**

Have the idea and the project itself changed over the course of development work? At first, we only thought about applying PERPETUO to the systems of companies we represent, such as Wollin and Greenbox (of the Frigel group) to name a few. We organised a tour of our suppliers in Italy and abroad, and they were really interested and willing to put their technical knowledge at the disposal of the project. But we also realised that the manufacturers were not interested in being in the frontline; instead it was Gefond that would have to take on the challenge in terms of investing time, energy, human and economic resources. They are sizeable investments for a company like ours to shoulder.
So we were faced with a choice. Either we could abandon the dream, or we could bravely place our bets on the project and invest in it.
I'm not one to give up, and from that moment onwards the idea

acquired a new lease of life: we decided to have an open system that could read any die-casting machine and device.

When did you first realise PERPETUO could actually be achieved? It was a vision, a bit like when you are daydreaming, but you are aware of the obstacles facing you. I never lost the will and desire to try to get as far with it as I could. **My team and I mapped out a path and a strategy in an attempt to achieve an ambitious result. Together, we identified the instruments best suited to the objective, instruments which the new millennium and digital development have placed at our disposal.** And we needed the right partner. We found it in Claudio Vivante and his company, T4SM. We applied instruments developed for other sectors to the needs of the foundry: Machine Learning algorithms. We were able to pull it off by combining our respective know-how.

Why did Gefond embark on this new process? In this new process, Gefond has combined two aspects: a cutting-edge vision of the future of the industry, and experience and skill in foundry work spanning almost thirty years, covering both sales of the equipment and technical assistance, installation and spare parts. Pairing this far-reaching business vision with our experience has brought about change.

It has transformed the business model, which has shifted its attention to the needs of the customer and the market. So the range of services linked to the product is combined with selling the machinery. These days, we get the feeling that customers need solutions over and above just buying the machine. We have transformed this need into training, virtual assistance and the PERPETUO software.

There is lots of talk about Industry 4.0. How are foundries meeting these changes?

Industry 4.0 has prompted companies to buy machines that collect data, but the data are rarely checked, analysed and linked together. **This was one of the realisations that resulted in PERPETUO. A cultural change is needed.**

We need to look after machinery. Not just own it, but actually look after it. **This is Gefond's mission for a long life industry.**

Which client needs have you adopted as your own?

Achieving a modular solution. A software whose key feature and value is predictive maintenance, but which can also guide clients where preventive maintenance is concerned.

Flexibility. Every client has its own Achille's heel, its own weakness and needs. PERPETUO is not a closed system that always works the same way. When we sit around the table, we talk to maintenance technicians, the IT department, the owners and the purchasing office. Each of these players has a different role to perform, and different needs. We collect these needs, process them and manage to create solutions we construct together. It's teamwork. It's also the only way we can provide a customised product, a solution that fits to perfection.

What are the next steps for PERPETUO and Gefond?

Our aim is to link up as many machines as possible. Indeed, with a self-learning process based on artificial intelligence algorithms, the system can become increasingly reliable by connecting machines, recording and interconnecting large amounts of data.

More and more manufactures are showing an interest in predictive maintenance, because they have realised that by entering the PERPETUO system they can optimise service to their customers and understand more about the operation of their equipment. With the PERPETUO software we are demonstrating that today the difference in competitiveness can be made by enhancing the predictive power of data.

Tell me about the name. How did it come about?

The basic concept is that we work to extend the lifetime of the equipment, and maintain the continuity of the production process. Hence PERPETUO.

GEFOND

FOR A LONG LIFE INDUSTRY

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