SUCCESS is an action
Coordinated, Efficient, Customer Oriented
402 Patents
50 Technologies
600 Engineering Solutions

INNOVATION ENLIGHTENS GROWTH

Innovation is a predominant characteristic which has always been part of Cannon’s DNA.
This is why we invest 5% of the annual turnover in R&D every year.
5 laboratories and more than 50 people around the world are dedicated to constant research and development, advanced and endurance test.
Collaboration with other industrial partners and universities led us to run innovative projects supported by the European Commission, in the framework of the environment and climate protection actions.

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EDITORIAL

SUCCESS is an action, not a position

“Staying ahead of the pack” has been a mantra for decades, at Cannon. “Cannon is Ahead!” was a slogan and a sign for exhibitions, back in 1975. Since then, many things have moved ahead.

The only one market served by Cannon equipment at the beginning – Polyurethanes – was growing at a rate of 5-7% per year. At the end of the 1980’s Cannon was the market leader, and diversified towards other plastics and other fields of the industry, namely energy, water treatment, electronics. The mantra is still valid, for all its activities.
Staying ahead is a strenuous exercise. The prey must run faster than the dogs, and this requires stamina, energy, resources. Human and financial. Profits must be constantly reinvested to fuel structure and innovation.

Staying ahead means that we do not have in front of us any other reference point than our vision and our capacity to innovate.

Staying ahead means that we must keep running while defending our competitive advantage. This requires method, organisation, strong defence of our intellectual property.

Staying ahead is possible if our shareholders are not focused on the next quarter’s dividend, but are able to share with us the ups and downs of a market involving capitals on equipment and plants destined to last.

Staying ahead is possible if our efforts are targeted on our client’s success. Only raising their productivity, giving them dedicated industrial solutions, innovative production methods they will succeed. And come back.

The results of the 2018 fiscal year were gratifying for Cannon.

The turnover of 270 Million Euro (+8% on 2017) marks another record year for the Group.

More than 1,200 persons work for the 34 Group Companies present in 20 countries. More than 90 local Agents represent the various interests of Cannon in the rest of the World.

New buildings for manufacturing and R&D have been inaugurated in USA and Italy in the past few months.

The number of new clients has exceeded that of any previous year, adding several new fields of application to the already numerous ones served with the Group’s industrial equipment.

Recently 12 new patents have been granted or applied for, contributing to the protection of those customers that choose a piece of equipment “Made by Cannon”.

We keep moving ahead. We like it.
PRODU
CREA Doubles Productivity

A WELL-KNOW ROOFLIGHTS MANUFACTURER TURNED TO CANNON ERGOS TO THERMOFORM ITS DOMES, INCREASING PRODUCTIVITY BY 100%
Rooflights
Attics can be illuminated and ventilated by different types of rooflights: fixed, aerating, tubular, electric, etc. Among these, domes rooflights have a rounded shape, in order to limit the entry of direct sunlight and thus avoiding overheating.
This type of rooflight consists of a transparent or semi-transparent panel (satin, texturized...), generally made of Polycarbonate or acrylic materials - transparent and very resistant - enclosed in a frame, which can be of wood, aluminium or plastic.

To create the typical bulge, the transparent panel is thermoformed using a mould or even only air pressure, so that the "bubble" which constitutes its shape is created.
The thermoformed panel is then assembled with the frame.

Compared to moulding, pressure allows greater freedom in the variation of the dome curvature even during the rooflights production cycle.

A well-known European manufacturer of dome has thus turned to Cannon Ergos to meet its need of domes flexible production and increase of productivity.

Customer needs
The customer wanted to replace his thermoforming machine, in operation for about 15 years, with one:
• Faster and more efficient
• Able to ensure absolute repeatability
• Fully automated
• Very flexible

The target was to increase the production and make it more constant, releasing it from the dependence on the machine operator. The thermoforming machine already in use, in fact, required the operator to know the "recipe" by heart in order to obtain rooflights of the required quality.

In case of absence of the operator, the production could suffer serious slowdowns.

Furthermore, the thermoforming process is largely dependent on environmental conditions: external temperature and humidity can have a significant impact on the forming action and, consequently, on the final result. The customer, therefore, wanted a machine capable of automatically eliminating the effect of these perturbation on the finished product.

CREA: the Cannon solution
Cannon has responded to the specific requests of the customer by supplying a CREA series single station thermoforming machine with several advanced sensors and high level of automation: the machine is able to produce the finished piece without any operator intervention.

Once the rooflights parameters are set, the machine thermoforms the finished piece, leaving the operator to load the panel to be thermoformed, supervise the processing cycle and unload the piece once it has cooled.

Moreover, thanks to the sensors installed on the thermoforming machine, the system is able to adapt automatically to variations in the environmental working conditions (external temperature and humidity), and to create the correct pressure to obtain the desired crowning. This guarantees maximum repeatability and an always excellent quality of the finished product.

To heat the Polycarbonate panel, Cannon Ergos has opted for infrared high-speed quartz lamps, more suitable to treat materials with very delicate aesthetic performances; the use of this type of lamps eliminates
the risk of opacifying or damaging the material during the heating process.

The experience gained by Cannon Ergos in the field of thermoforming has allowed the company to provide the customer with an exclusive model of CREA, specifically developed to meet the rooflights manufacturer request of greater flexibility: in order to shape domes of different sizes, even during the same production cycle, Cannon Ergos has created a double forming area allowing the simultaneous but independent shaping of two pieces characterized by different final product height and tool dimensions.

The basic configuration of the forming surface involves the use of automatic adjustable plates used to increase or decrease the area to be thermoformed.

In this way it is possible to model pieces with dimensions between 1,200x1,000mm and 3,000x250mm when forming with a single window or even down to 550x1,000 mm when forming in double window configuration.

A dedicated team has developed a specific software for the automation and control of the machine main components: simple and immediate, the touch screen user interface allows the customer to view each parameter of the thermoforming machine in maximum 3 clicks.

Through this software, the machine operator can:
- Regulate the power output of each individual lamp
- Monitor in real time the performance of the thermoforming machine
- Generate a report of each production cycle

In addition, the software allows remote access to the machine in order to make a preventive diagnosis in case of anomaly.

With Cannon Ergos CREA thermoforming machine with divisible plate, the customer can now produce up to 45 pieces per hour, working with a double forming, and 25 pieces per hour in a single forming, compared to the 14 pieces per hour produced with his previous machinery.

With the double configuration provided by Cannon, the production capacity of the rooflights manufacturer is therefore increased by 100%.
No matter what your focus is – circular economy, digitalisation, Industry 4.0, lightweight construction, additive manufacturing, advanced materials or other forward-looking topics in the global plastics and rubber industry – K 2019 is the place to be to scout for new solutions. The fascinating forum for innovation and investment. The industry’s most important business platform. Around 3,200 international exhibitors offer you the latest in research and development. Welcome to the show!

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NUMEROUS CONTRACTS HAVE BEEN SIGNED BY CANNON ARTES IN 2018 AND HAVE BEEN DELIVERED TO VARIOUS OIL&GAS CUSTOMERS

Oil & gas / upstream

China Petroleum Eng. & Const. Co., China, rewarded Cannon Artes with a contract in Iraq worth over € 5m for a complex surface water and injection water treatment system for the Third Oil Train of the Garraf project. This project has a triple value for Cannon Artes. Firstly, it is for Cannon Artes the first plant supply to the CPECC group, one of the most important Chinese contractors operating internationally. Secondly, the supply to Garraf makes it possible to consolidate, on such a prestigious project, its presence in Iraq, one of the most vital markets in the Gulf area. Last but not least, the technological aspect. The injection water treatment system includes the proprietary technology of Cannon Artes ZeroGas® vacuum degassing while the surface water treatment section provides a submerged ultrafiltration system (Submerged Ultrafiltration, SUF), a solution on which few companies can boast experience.

Furthermore Cannon Artes has been selected for two prestigious offshore contracts, respectively in Congo and Australia. Both are concerned with Produced Water treatment systems, i.e. treatment of the water fraction separated from crude oil. The value of these acquisitions is to reconfirm the
presence in the upstream offshore sector (in particular after the economic difficulties of the sector linked to the collapse in oil prices in 2016), on prestigious projects and in strategic areas such as West Africa and Australia.

For Cannon Artes there is also a technological value of these projects: the use of hydrocyclones for de-oiling and sludge removal and of Induced Gas Flotation (IGF) systems that allow a quantitative removal of dissolved and emulsified oils as well as suspended solids.

In 2018, Cannon Artes completed the supply of two water treatment systems for the second liquefied natural gas production train for the Tangguh LNG project being carried out in Indonesia.

The supply of Cannon Artes consists of two parts: a large thermophysical deaerator based on ZeroGas® technology and a treatment system of the aqueous fraction separated from the natural gas for the removal of the organic component. The realization of this latter system is based on Cannon Artes know-how in the field of coalescing resins and adsorption processes on activated carbon.

Cannon Artes completed in 2018 five different supplies in Egypt relating to the Zohr gas exploitation project, which sees the national Italian Oil & gas “Blue-chip” as the main operator and which is allowing Egypt to achieve autonomy from an energy point of view. Cannon Artes supplied two thermophysical deaerators based on the proprietary ZeroGas® technology, two filtration systems on cooling water and a biological wastewater treatment plant that uses biological membrane reactor technology (Membrane Bio Reactor, MBR) that Cannon Artes has in its portfolio of experiences for more than a decade.

Thanks to the qualification obtained with Saudi Aramco in 2016, Cannon Artes was able to participate to two prestigious projects in Saudi Arabia that see the “supermajor” of Saudi oil as the final customer.

For a Sulfur Recovery Facility Cannon Artes has developed a treatment system for waste water recovered by chemical conditioning and remineralization.

Even more significant is the supply for an oil field expansion project, which, in the area of recovery of steam condensate, sees the experience of Cannon Artes recognized in the field of oil and hydrocarbon separation on coalescing resins and the elimination of dissolved solids on mixed bed ion exchangers.

**Oil & gas / Downstream**

The Bahrain Refinery Modernization project in Bahrain is among the largest and most prestigious projects under construction in the Middle East.

Cannon Artes acquired here three large contracts including a remineralization plant using calcite dissolution, a cooling water filtration unit and a massive condensate polishing system using mixed-bed ion exchangers. With a capacity of almost 2,000 m³/h, it is one of the biggest condensate polishing unit ever. Cannon Artes completed in 2018 the supply of a waste water treatment plant for the French Oil&Gas supermajor. Servicing the Ethylene cracking and production plant located in Porth Arthur in Texas, USA, Cannon Artes’ plant is aimed at treating process wastewater by coalescence separation and induced gas flotation.
ECO-SLAB
a Compact Idea

CANNON VIKING UNVEILED AT FOAM EXPO EUROPE THEIR LATEST DEVELOPMENT: THE ECO-SLAB CONTINUOUS FOAM MACHINE.

The new Cannon Viking Eco-Slab unit allows the operator to have a full formulation management, an automatic control of chemical metering, a closed-loop control with a user friendly interface and an historical plant information. Eco-Slab can be used to manufacture all types of Polyurethane foam, using either Trough, Liquid Laydown or a combination of both foaming systems.
Foam Expo Europe, the dedicated trade fair and conference for the technical foam manufacturing supply chain (16 – 18 October 2018; Hannover, Germany), was the occasion for Cannon Viking to introduce Eco-Slab: the new compact continuous foam machine.

Developed to meet the growing demand by the market for a short, compact continuous foam machine, capable of producing a wide range of high quality flexible slabstock foam blocks, the machine has been developed using the latest generation of metering process, computer controls and mixing systems, package together in a modular design giving the customer the ultimate flexibility to design a bespoke machine according to their foam requirements, and allowing for practical future upgrades.

For this reason, Eco-Slab provides unique advantages:

- Thanks to its latest generation of Omega Computer Controls, this system, developed and supported in-house, allows the operator to have a full formulation management, an automatic control of chemical metering, a closed-loop control, with a user-friendly interface and an historical plant information.
- Reduced energy and chemical consumption: thanks to the computer controls, the plant monitoring systems and the precise chemical metering system, Eco-Slab is particularly efficient and allows the costumer to obtain an overall financial saving that can easily exceed 10% if compared to a conventional slabstocks machine.
- Small machine footprint to reduce space and building costs: thanks to its small size, Eco-Slab can easily be integrated with previous plants.
- Flexibility to produce different foam types with different methods: Eco-Slab can be used to manufacture all types of Polyurethane foam, including standard polyether foams, HR foams, visco/memory foams, super soft foams, semi rigid and rigid foams. It can also produce foam blocks using either:
  - Trough: the chemical reaction occurs within the trough before rising from the top onto an adjustable fallplate, which then leads the foam block along a metal slat horizontal conveyor for the completion of the foam rise and initial cure.
  - Liquid Laydown: this process gives an higher quality foam block, reducing the number pinhole because the chemical mix is introduced through direct foam laydown onto the pour plate.
- A combination of both systems.

Eco-Slab represents Cannon Viking’s market philosophy: a flexible approach based on the listening to costumers needs. The company, in fact, does not provide only standard machines but, starting from the specific client requests, can provide tailor made solution.

As Nick Wood, operations director at Vita Group, testifies "... [the Eco-Slab] has a small footprint, and while is capable of producing bigger volumes at high speed, it can manufacture bespoke, novel efficient foam. It has high level of flexibility with the ability to interchange different development additives easily. It has achieved what we needed".

The Eco-Slab shares many of the most popular and successful features seen on other Cannon Viking’s continuous machines whilst maintaining the highest standards of machine construction.

For more information, visit www.cannonviking.com
CarDio™
MAKES IT ALL
MANUFACTURING PU FOAM IN THE US WITH FILLERS, FLAKES AND LIQUID CO₂
The reasons for choosing CO₂ as a blowing agent in flexible Polyurethane foams are well known and the concept has been widely accepted since its introduction over 25 years ago:

- The product is abundantly available and continues to be cheap.
- Carbon Dioxide expands three times more than alternative, more traditional blowing agents, such as Methylene Chloride.
- As a result, much less CO₂ is required and there are no harmful effects on the health of machine operators or on the safety of the factory.
- In addition, CO₂ gives the foam a softer feel, which is a highly sought-after property in certain markets.
- By using CO₂, which is of course a by-product of other industrial processes, no additional gas is released into the atmosphere.

**Cannon Viking CarDio™ System**

CarDio™ is the patented process of the Cannon Group for producing low density polyurethane foams on either Conventional, Maxfoam, Vertifoam or Liquid Laydown continuous slabstock plants, using Liquid Carbon Dioxide (CO₂) as the blowing agent, following many years of research and development. The Cannon group was the first company to develop and install this technology on a full production machine, based on existing Maxfoam technology, over 25 years ago.

To date, well over 75 individual CarDio™ installations have been supplied worldwide, with the equipment in successful daily production throughout the Americas, Europe, the Far East and Australasia.

CarDio™ equipment can be supplied complete as part of a new Cannon Viking Maxfoam Elite or Eco-Slab continuous slabstock plant or installed as a retro-fit to an existing foaming plant, irrespective of the manufacturer. Cannon Viking has extensive experience of retro-fitting the CarDio™ system to competitor’s equipment.

Two standard equipment versions are available. The preferred option is the “Direct” System, where all chemical metering streams, including Carbon Dioxide, are fed at high pressure directly to the CarDio™ high-pressure mixing head. Secondly, there is available an “Indirect” System, where the polyol and additive streams are supplied from the existing low-pressure metering units and the pressure is then raised prior to introduction to the new CarDio™ high-pressure mixing head.

The CarDio™ System has many features and benefits that are simply not available with any other Carbon Dioxide system on the market today. With the unique CarDio™ gatebar, the liquid mix and CO₂ flows effortlessly through an elongated slot, which allows for full foaming width laydown and a much larger flow passage than any other system. CarDio™ remains the preferred Carbon Dioxide system on the market today due to the unique way it handles and processes the liquid foam mix; more specifically the way it can process foam mixtures with larger particle sizes and higher viscosities. Large scale foamers are more reliant on fillers for various applications, such as fire retardancy and the use of Calcium Carbonate to reduce costs.

For the foam makers wishing to manufacture PU foam with a density of less than 1.3 lbs/ft³ in North America – a continent with some of the strictest environmental legislation policies – the use of CO₂ in the process is a must, and Cannon Viking is ready to assist.

**Features and Benefits of CarDio™**

- CarDio™ ensures trouble-free processing of
  - Polymer Polyols from 5 to 20 Micron
  - Fire Retardant Additives from 50 to 120 Micron
  - Fillers (CaCO₃) from 2 to 20 Micron
  - Ground Scrap PU up to 50 Micron
  - High Viscosity MDI Prepolymers
The FPL SR has become more and more the market’s reference head for low-density rigid foams for insulation panels, refrigerators, water boilers. It can be mounted on all new Cannon high pressure dosing units and is progressively replacing the old FPL heads when these have reached the end of their useful life.
Several advantages characterise the Cannon FPL SR series of high pressure mixing heads, that, in addition to the well-known benefits deriving from the L-shaped head’s internal geometry, offer now:
- A much longer useful life (from 3 to 5 times) of the mixing head, thanks to the single-piece design of the bushing.
- A doubled laminar flow rate, thanks to a much longer head’s nose.
- A simpler maintenance, thanks to the availability of a replacement kit that allows Cannon’s International Service Network to easily change bushing and plunger.
- A wider range of head models, to properly size the ratios between the two chambers.

The family of Cannon FPL SR mixing heads is currently available with a diameter of the self-cleaning plunger of 10-12-14-18 and 26mm, with an 8mm model under final characterisation, suitable for low-output applications and new chemical formulations that are currently still under development.

To improve the reliability on the long-term use, the potential head’s sticking problems provoked by modern high-isocyanate-index formulations have been solved using a more efficient design for the self-cleaning plunger.

It is designed as a “scraper”, a double-diameter cylinder whose only last part is in contact with the walls of the cylindrical discharge duct. The reduced surface of this plunger in contact with the duct significantly reduces the heat generated by the friction of parts, thus eliminating the main cause of sticking.

The thermal insulation market segment (the users of rigid foams for panels, refrigerators and similar applications) has greatly appreciated this feature: more than 1,200 FPL SR heads are already on the market, and this model is progressively being welcome also from the processors of flexible integral skin foams for automotive and furniture parts.

**A Patented Design**

The EPO has granted on July 2nd 2018 the European Patent EP 2767376 B1 to Cannon Afros for its family of FPL SR mixing heads. The decision came after two years of technical confrontation deriving from a European opposition procedure filed by a competitor.

The unique design of the FPL SR’s discharge duct had been already granted a patent in Italy in 2014 and one in the USA in 2016.

A peculiar construction of the discharge duct of the head, obtained using a removable self-cleaning cylinder in a single piece bushing, with a cross-hole matching the mixing chamber’s outlet, characterises this mixing head. The cross-hole round surface is provided with a self-regenerating sealing method that is spontaneously formed by mixing and expelling the chemical components: this seal avoids any contamination of foam in the hollow space between the removable cylindrical delivery channel and the rod of the self-cleaning plunger. This feature increases the operational time of the head and reduces dramatically the maintenance tasks.
A ST&P ahead in COGENERATION

TURBODEN AND CANNON BONO SISTEMI DEVELOPED A NEW COGENERATIVE SOLUTION FOR THE PRODUCTION OF MEDIUM-PRESSURE STEAM AND ELECTRICITY
ST&P for innovative cogeneration

In different sectors, many manufacturing processes require large amounts of steam and electricity: food and beverage, chemical, pharmaceutical, paper, textile, plastic and rubber, oil and gas... Typically, these manufacturers utilise steam provided by a standard boiler and electricity coming from the electrical grid, or, alternatively, from a reciprocating engine or from a big gas turbine, as energy for their production processes.

Cannon Bono Sistemi and Turboden, company of the Mitsubishi Heavy Industries Group, jointly and exclusively developed a new cogenerative ORC – Organic Rankine Cycle plant for the production of electricity and steam, called ST&P (Steam & Power).

ST&P is a CHP (Combined Heat and Power) technology with unique characteristics: in fact, it has been developed to cover an area of the CHP market that is unmet by other solutions. It has the big advantage to be capable of producing a much larger quantity of steam, if compared to internal combustion engines, and covering electricity capability lower than gas turbine.

The ST&P plant consists of a Cannon Bono Sistemi thermal plant, in which a diathermic oil heater HTH series (provided by the sister company Cannon Bono Energia) has been specifically redesigned to heat a dedicated thermal fluid up to a temperature of 420°C. This high temperature fluid is used to indirectly evaporate the ORC turbine expanding medium; while the turbine generates electricity, the condensation of the ORC fluid generates medium pressure steam. Steam and electricity are produced in a ratio of 4 to 1, respectively.

ST&P ORC System is the best solution for those industrial processes requiring a medium pressure steam from 4 to 25 ton/h, and electricity between 500 KW and 3 MW.

The advantages of this solution are:
- High steam production with cogeneration
- High efficiency, up to 92%, also at partial loads
- High flexibility and capability to burn waste fuels (the oil heater can be fired with gas, LPG, LFO or any gaseous, liquid waste coming from production processes)
- Low operation and maintenance costs

Being a cogenerative system that reaches very high efficiency (especially with natural gas combustion), Steam & Power benefits from government incentives, thus shortening the time to pay back the initial investment to less than 3 years.

Centrale del Latte di Brescia

The municipal diary "Centrale del Latte" of Brescia - Italy, has chosen the cogenerative solution ST&P to increase the overall efficiency of the long-life milk pasteurisation process: the plant, provided by Turboden and Cannon Bono Sistemi, will cogenerate about 700 KW electric power and 5 ton/h of steam at 15 bar.

Next Steps

Thanks to Cannon Bono Sistemi strong experience in combustion processes and flue gas pollutants abatement, gained during decades of experience in biomass and waste-to-energy fields, the company is working on the possibility of burning process waste in different industrial sectors, both liquid and gaseous, to give the customer a further advantage: reduction or solution to disposal problems and saving of fossil fuels costs.

Moreover, high efficiency and alternative fuels usage generate an important reduction of CO₂ emissions, hence increasing the environmental sustainability of ST&P energy production.
HE Smart
Saves Money

To innovate & protect to defend the client’s investment and the inventor's effort and rights. These have been two driving forces behind the development of the HE Smart concept, today applied successfully to Cannon Bono Energia series of steam boilers. Antonio Landi, R&D Manager, gives more details.
Cannon News: Can we start defining precisely what is the HE Smart concept?
Antonio Landi: The HE Smart package, applicable to the whole range of Cannon Bono Energia steam boilers, is designed to minimise electrical and fuel consumption at every operating load. It is a combination of hardware and software tools that control the boiler's performances, guaranteeing a 97.5% Global Efficiency independently from external factors, such as the temperature of the feed water, the instant load of the boiler, etc.

CN: How does it work, said in the simplest words?
AL: Through the smart and flexible operation of an extensive heat recovery system, as well as of the electrical components, we optimise both the thermal efficiency of the boiler (consequently the CO₂ emissions at the stack) and the content of NOx and CO in the flue gases at the stack.

CN: OK, now again, please, for the specialists.
AL: We split the recovered energy from the flue gases in the feed water and in the air through a clever water feeding system. Our HE system continuously checks the right ratio of power given to air and feed water to maintain the flue gases at the lowest possible temperature, in accordance with anticondensing conditions and to minimize the air temperature (reduce NOx emissions). When one or more factors fluctuates the control system remodulates the ratio of power from water and/or air to reach the best possible condition in terms of efficiency and emissions.
This provides a steady Global Efficiency – at the highest level achievable today on the market – and emissions well below those imposed by the strictest environmental standards.

CN: Why do you insist on the term “Global Efficiency”?
AL: Because it is important to explain that other methods, based on the punctual determination of efficiency measured in one or several moments of the day, can give a false report both in terms of true consumption of gas, leading to possible unpleasant deviations of gas bills at the end of the year.
"Global Efficiency" derives from a continuous, closed-loop monitoring of the performances, with a boiler's efficiency that is independent from the usual fluctuations of feed water temperature and operating load.
"Punctual efficiency" does not take into account operative parameters like how many times the boiler is switched on or off during the week, the operating cycles, the external temperature, the fluctuations in operating load.
We guarantee a higher “Global Efficiency” with any feed water temperature, with fluctuating loads, in a pre-defined
range of working conditions. Our competitors don’t, because they simply can’t make it!

CN: And is this system patented?
AL: Yes, with two international patents; one covers the modulation of the feed water throughput to the economiser and the second extends the efficiency of this control with a dual-zone economiser, where water flows in two different moments and heating situations according to the real need.
To achieve this sophisticated control we need a dedicated hardware and software architecture, based on a network of sensors placed strategically on the circuit and on the availability of “intelligent” electric motors, driven by inverters controlled by the central computer.

CN: This switches the talk from thermodynamics to controls and electronics. What’s new, at this respect?
AL: Software and innovative electronics play a fundamental role in the HE Smart package. Smart thermodynamics are controlled by smart automation. At its core is the OptiSpark automation system, completed with a wide array of metering devices for the optimal setting of the inverters and heat exchangers.
All this package works in an Industry 4.0 environment, with all possible advantages deriving from improving the efficiency and obtaining favourable financial conditions from local and central authorities.

CN: What can you monitor and control, exactly?
AL: All pumps, motors, fans, and the relevant cycles and ramps. We manage complex operating timetables, dictated by the client’s factory habits and shifts, the weekend cycles, the different ambient temperatures according to the season, we distribute the work load across different boilers when more of them are present in a battery or even in different heating plants.
Other advantages include a reduced and controlled level of emissions at the stack, as I said already: specifically, where the norms demand in the fumes max 100 mg/Nm3 of NOx at 3% of Oxygen, we regularly obtain 60 mg or less.

CN: All these electronics, as the rest of the industry tells us, can do much more than a control. Is this the case also for the HE Smart?
AL: It definitely is! As a smartphone is today much more than a portable phone, also these systems are designed to offer many more services and useful tools to their users! I could mention, randomly, the possibility of a Remote Control of the heating plant via internet or on plain phone line, the availability of a sharable Dashboard to show all the working parameters to the heating plant supervisor on a single PC monitor, tablet or smartphone, the Centralised Data Collection for various levels of factory managers, the possibility to host a AR (Augmented Reality) package to interact with a remote Service Technician, through a pair of Google glasses, showing visually the status of various details of the boiler, getting immediate help and technical advice. Moreover, the HE Smart allows the safe unattended operation of the boiler for 72h bringing further advantage in terms of OPEX, besides the fuel and power savings. Then I could add the possibility to upgrade all the software packages online and without stopping the plant,
the possibility to find technical help around the clock from one of the authorised Service Centres, and of course the possibility to perform Predictive Maintenance Interventions, reducing MTBF (Mean Time Between Failures).

CN: We know that there are news in this specific field, can you disclose your latest developments?
AL: We have made, cooperating with Politecnico of Milano, the Predictive Boiler. By collecting parameters from different sources it can forecast precisely the thermal needs of the following hours, getting ready to possible fluctuations in the demand of steam in the most timely and economic way. It works on the basis of both a database of historical data and on the panoramic vision of a number of other incoming indicators collected by the factory CRM and other intelligent networks managing the different functions of the same plant.

CN: Let us talk business, for a while: how is this HE Smart doing, on the market?
AL: We are delivering the #100 HE Smart in May, 2019, while we launched it in 2015. Not bad, I’d say. We sell it well in Europe, where the cost of gas represents an important factor in a factory budget, and in countries where gas is scarce and needs to be used sparingly, Bangladesh and Pakistan, for instance.

CN: Where do you see the most interesting applications?
AL: The HE Smart package is suitable for all Cannon Bono Energia steam boilers, in the range from 3 to 30 ton/hour of steam, as well as up to 200 l/h with the water tube boilers. We can supply, on demand, a further Condensation Module that extracts the last residual heat from fumes, condensing its water portion to liquid phase and increasing the thermal efficiency to 99.5%.

The HE Smart is suitable for industries characterised by complex thermal situations, such as the paper mills, for instance, where feed water can reach 180 °C, or textile and food mills, with very unbalanced workloads and many batch processes.

CN: To close this interview, can you mention one interesting reference?
AL: A major Italian brand in the field of fashion and wool has recently purchased three BONO SG boilers in HE Smart configuration, that provide steam to their large north-Italian textile mill.

All the thermal needs of four different departments (dyeing, finishing, spinning, twisting) are communicated to the heating plant both in terms of real-time demand and of production forecast.

Our HE Smart collects all data and plans the production of steam for the coming hours, ready to go full steam during peak hours of work and to slow down progressively when the workload diminishes. They are saving up to 10% of their huge gas bill only thanks to the HE Smart’s performance and to this intelligent production planning!

HE Smart Package advantages:
- Thermal efficiency guaranteed up to 97.5%
- Smart management of process parameters thanks to OptiSpark automation system
- Low level of NOx and CO₂ emissions
- High efficiency even with feed water temperatures as high as 150°C
- Consistent fuel and power savings
- Reduced OPEX costs
- Internet connection for remote control and monitoring
- Optimised combustion using burners specifically designed for Cannon Bono Energia’s boilers.
- Available for saturated and superheated steam, as well as superheated water production.
NEW SOLUTIONS for New Blowing Agents

Until the late 1950’s Polyurethane foams were chemically blown by adding Water to the formulation. The reaction with Isocyanate leads to the release of CO₂, improving the foam performances in terms of expansion. Later on, most of the PU producers decided to try Chlorofluorocarbons (CFCs), leveraging their stability and low boiling point and expand the foam by physical interaction. This solution provided better results in terms of dimension stability and thermal insulation. The most used CFC was Trichlorofluoromethane, also known as CFC-11.
In 1987, the Montreal Protocol was signed to protect the Ozone layer by phasing out the production of harmful substances, such as CFCs and HCFCs (Hydrochlorofluorocarbons). HCFCs have been an established intermediate alternative to CFCs Phase-out, because their Ozone Depleting Potential (ODP) is ten times less than CFCs.

In 2007, the Parties to the Montreal Protocol agreed to accelerate the phase-out of HCFCs. It was agreed to provide developing countries with financial assistance from the Multilateral Fund (MLF). MLF supports countries in the preparation of investment projects for the conversion of manufacturing processes to environmental friendly alternatives and can provide significant climate benefits.

Taking 2009-2010 usage as a baseline value, the control steps require the 35% reduction by 2020, the 67.5% reduction by 2025, the total elimination by 2030 (considering a 2.5% service tail).

Since its foundation, Cannon has been on the forefront for developing “green” technologies, to safeguard the environment and comply with the international regulations. The continuously improvement policy enables the company to keep up the pace of the stringent and changing protocols, providing the market with modern solutions in line with the best performance and sustainability standards.

As Polyurethane machinery provider, Cannon has always relied on research and development as a way to run for the market leading positions. The Company invests in R&D activities the 5% of his total turnover every year, partnering with a large number of customers and raw material suppliers to develop the optimal combination of components and processing machinery for each kind of application.

This approach enables Cannon to offer very flexible and innovative solutions to fit the changing regulations and process requirements. The NGOs in charge for the replacement of the CFCs and HCFCs (i.e. UNIDO, MLF, World Bank) have demonstrated throughout the years their good attitude for leading conversion projects involving Cannon, which has been recognized as a worldwide leading specialist with more than 600 “lines” supplied, and more than 250 plants retrofitted.

The PU industry is moving towards the usage of a tailor made Blowing Agents (BA) for each kind of different application. A detail-oriented approach is essential to guarantee the effective operability of the plants. The projects present a wide variety of case histories, from the modification of a small part of the production line to the total replacement of the original equipment.

Blowing agents solutions to replace HCFC141b

The reasons behind the choice of the most suitable blowing agent are mainly based on technical, regulatory and economical drivers. The main parameter to be considered when choosing the alternatives for HCFC 141b is the global warming potential (GWP).

HCFC 141b was considered the second generation of blowing agents, and in the latest years has been gradually replaced by water, HFCs and Hydrocarbons (HC). Some other components like Methyl formate and Methylal have been evaluated for this purpose and are available on the market, and a fourth generation of blowing agents called Hydrofluorolefins (HFOs) is already available and are gaining positions in the market.

The main blowing agents present the following features:

- Water is a cheap blowing agent but the final product is subject to a gradual increase of thermal conductivity over time and the PU cells are not dimensionally stable.
- HFC 365mfc and 245fa can easily replace HCFC 141b without major changes in foam processing. HFCs are quite expensive and typically added by the raw material supplier in a non-flammable polyl blend or premix at production site.
- 245fa requires particular process temperature control. These components are a good interim solutions, but will be deprecated in the future because of their high GWP.
- Hydrocarbon technologies, such as Cyclopentane (C5) or HC blends are cheap but flammable blowing agents, representing a good solution in terms of thermal conductivity and product mechanical properties. Upon HC usage, the plant should be equipped with the proper sensors and safety.
- Methyl Formate is the methyl ester of Formic acid. It has zero ODP and zero GWP but is flammable and a part of it goes back to the acid upon PU processing. For this reason, it requires specific anti-corrosion machinery to be processed.
- Methylal (Dimethoxymethane) is a simple molecule with a low boiling point and zero GWP, used in various
industrial applications. It has also been tested for PU processing, but it is still flammable.

- HFOs have a very low GWP, are not flammable, and are highly recommended if an excellent thermal insulation is required. Unfortunately, they are expensive and convenience at an industrial scale is expected to take a few years. Some PU producers have tested (with good results) the co-blowing with Cyclopentane, once the chemicals are properly formulated to be stable, working with a blend of polyol and HFOs does not require any specific equipment solution. The premix units for polyol and HFO need dedicated thermoregulation and special gaskets because of HFO physical and chemical properties.

The following table includes the significant parameters for the main blowing agents on the market, compared to the HCFC141b:

<table>
<thead>
<tr>
<th></th>
<th>HCFC141b</th>
<th>HCFC245fa</th>
<th>HCFC32a</th>
<th>Cyclopentane</th>
<th>Methane</th>
<th>Butane</th>
<th>Heptane</th>
<th>Ethane</th>
<th>HCFC245fa</th>
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<tbody>
<tr>
<td>Weight (mg)</td>
<td>117</td>
<td>154</td>
<td>168</td>
<td>70</td>
<td>60</td>
<td>76</td>
<td>105</td>
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<tr>
<td>Boiling point (°C)</td>
<td>80</td>
<td>159</td>
<td>30</td>
<td>60</td>
<td>76</td>
<td>76</td>
<td>125</td>
<td>125</td>
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</tr>
<tr>
<td>Gas Conductivity at 10°C (m²/m³/s)</td>
<td>9</td>
<td>11</td>
<td>11</td>
<td>13.5</td>
<td>11</td>
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<tr>
<td>Flash point (°C)</td>
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<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
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<tr>
<td>Vapour</td>
<td>0.11</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
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<td>0.9</td>
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<tr>
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<td>790</td>
<td>990</td>
<td>910</td>
<td>11</td>
<td>0.26</td>
<td>0.89</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

A new generation of EasyFroth™

Cannon EasyFroth™ is a well-established technology, represented by a pre-mixing unit composed of two metering devices and one static mixer, specifically designed to keep the polyol and the BA under pressure by using a double effect cylinder, dramatically reducing the solubilisation time of the components. This solution might bring the BA rate in the polyol up to the 25% (also depending on BA and POL formulation).

The first EasyFroth™ was designed in the 70’s and it is continuously improved throughout the years, to keep up with the pace of the emerging technologies and provide the customers with the best of breed equipment for handling PU formulations.

The solution has become completely modular and configurable for the widest range of requirements, providing the capability to process either any BA or a combination of multiple components.

Penta EasyFroth™

Designed to work with flammable BAs (e.g. Cyclopentane or other hydrocarbons). The unit is provided with a transparent Lexan box and equipped with collecting basins, floating levels, Ex-i components and ready for the connection to a ventilation group. This configuration does not include the Booster group for Low Boiling Blowing Agents.

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**The Cannon solutions**

Cannon technological developments and patents have been applied on the market for several years.

The main sectors involved are the following:
- Domestic and commercial refrigeration
- Flexible foam for automotive and furniture
- Low density rigid foam for building and insulation

The Cannon experience lead to the development of dedicated solutions, answering the customer’s specific question and requirements in terms of quality, safety, footprint and product features.

Cannon has the right solution tailored for all the HCFC alternative BAs and still carries the research activities on to strive for the leadership in the PU machinery market. Every single BA requires some specific machine configuration that can make the difference between successful production and frequent stops of the line.
Multi EasyFroth™
Designed to work with LBBAs and flammable BAs, leveraging the Booster group or a heat exchanger on BA inlet to ensure it is fed in liquid phase. This configuration includes the safety to handle flammable Bas.

Cannon DI EasyFroth™
This kind of configuration allows to directly inject the Blowing Agent into the Mixing Head. The BA dosing unit is composed by a membrane pump coupled with a pressure accumulator, including a 16 L tank and/or a plate heat exchanger.

Cannon FlexiFroth
This special premix unit enables customers to perform either the direct injection of the BA to the mixing head or to pre-blend the BA and Polyol upstream the dosing unit. The machine is specifically designed to obtain a variable foam quality during one single production cycle, ensuring the highest performances and flexibility of BA quantity into the final product.

Modular MultiComponent EasyFroth™
Cannon provides the capability to create a MultiComponent EasyFroth™ on customer’s request, by following a modular approach. The Cannon expertise for the usage of any kind of Blowing Agent enables customers to receive production lines prepared for working with multiple BAs, either together or one at the time.

Mixing Heads Solutions
In Europe, the major PU consumers are using the Pentane technology, which seem to be the ideal solution in terms of foam performance and environmental impact. Cannon owns about 1,500 Pentane changeover success histories all over the world, more than the sum of the value reached by the whole competitors together. Cannon provides the retrofitting kit for adapting existing plants to work with Pentane (PentaBasic kit) and also offers some “agile” solutions (NanoPenta) to the small producers manifesting the desire to work with flammable formulations. For DI EasyFroth™ and FlexiFroth premix units installation, Cannon has designed dedicated mixing heads providing the capability to perform a direct injection of the Bas.

FPL SR X/3 Mixing Head
The FPL SR X/3 is a modified FPL SR mixing head with axial injection, including a recycling groove for performing the component recirculation when the head is not pouring. An axial needle prevents the BA to flow into the mixing chamber during the recirculation phase.

FPL DI Mixing Head
Cannon FPL DI is a mixing head which leverages a dedicated injector for external recirculation of the BA stream and provides the capability to perform high pressure injection directly into the mixing chamber.

Pros and Cons of direct injection of flammable Bas
Cannon has worked for several years in order to develop a solution for direct injection of BAs to the mixing head. This solution could help the customers to retrofit their existing machines for working with blowing agents with peculiar properties (flammable, corrosive, acid components) without retrofitting the whole dosing unit.
Another advantage given by the direct injection is the flexibility of the BA stream, providing the capability to adjust in real time the BA ratio in the final product.
A specific competitive advantage can be given by the simultaneous adoption of multiple blowing agents; for example, the insulation properties of a C5/HFO 50/50 blown foam are much closer to pure HFO than pure C5. The presence of 50% HFO in C5 improves of about 10% the insulation properties of the foam.

On the other hand, this technology has two big disadvantages:
- Bringing the third stream to the mixing head also means to bring dangerous chemicals inside the production facility, introducing a risk factor associated to possible breakdown of the equipment due to either improper behaviours or force majeure events.
- The results of the testing activities carried out in the Cannon laboratories showed that the quantity of BA that can be injected directly to the mixing head is lower than the one provided by the products obtained with BA premixed to polyols upstream the dosing machine.

Conclusions
Nowadays the market provides several blowing agents for Polyurethane formulations. The EasyFroth™ premix units offer the technical solutions for all the BAs on the market. The research activities carried out by Cannon enable the Company to remain at the forefront of the industry when dealing with the latest chemical formulations. Direct injection of the chemicals can be performed by the Cannon equipment, where both Cyclopentane and HydroFluoroOlefines can provide the best insulation performances to the foam.
Is Maxfoam Machine Ready for INDUSTRY 4.0?

What is Industry 4.0?
It is the name given to the approach that uses new and advanced technologies to redesign and reinvent products and services incorporating planning, design, engineering, manufacturing, marketing, sales and support. It includes Cyber-physical systems, Cloud computing, the Internet of Things (IoT) and Cognitive computing. Industry 4.0 is often considered to be the fourth industrial revolution.

Why is Industry 4.0 necessary?
Using new developments in digital technology, this new approach enables a rapid acceleration of operational efficiency and enterprise growth. The optimal mix of technologies could result in huge savings in cost and deliver a hyper-personalised experience to the stakeholders.

Flexible Foam Industry and Industry 4.0
The Flexible Foam industry is slowly embracing this new approach, representing a leap forward from more traditional automation to a fully connected and flexible system. The key idea is to develop a smart factory having a flexible system that can self-optimize performance across all departments and suppliers, self-adapting and learning from new changing conditions – both internal and external – in near real time. This would give the foam producers the power to be on top of changing needs in the market by quickly analysing shifting customer demand and taste, expand into new markets, design new products and services, and have more predictive and responsive approach towards operations & maintenance, incorporate new processes and develop new technologies.

Cannon Viking and Industry 4.0
Cannon Viking is well prepared for the future and has willingly embraced Industry 4.0. All Maxfoam machines are controlled by OMEGA software system, which is fully built and serviced since last 25 years. The OMEGA software system is undergoing a massive change – from traditional Closed loop control system to Intuitive Control system offering auto-correction of machine parameters and formulations to ensure reproducibility and repeatability of product quality.

The new OMEGA system
The new developments in the OMEGA system enables Maxfoam plant operators to ensure efficient and reliable production parameters, produce according to pre-determined requirements and helps to collect real time information on chemicals and foam blocks. It offers full integration from the point chemical arrives on site to the foam block being cut on the block cutter. Smart Devices are enabled to start the tanker offloading process and help in setting the right temperature for the chemicals before production. The new OMEGA system is intuitive and can make real time adjustments to machine performance, thus ensuring stable production. The computer system supports the plant operators and ensures no human errors are committed which could prove critical to the production process. The system comes with advisory alarms and critical alarms in order to maintain production. Efficient data logging is transparent and available for all machine parameters thereby helping the operator to fine tune future production plans. Pre-programmed maintenance schedule helps the operator to get advisory messages at the right time. Advisory notices are also given regarding the replacement of key parts. The OMEGA system is modular and therefore addition of more control units is easy and accurate. An optimised OMEGA smart Maxfoam machine allows operations to be executed with minimal manual intervention and high reliability, thus increasing yield, uptime and quality, and reduces costs and waste. Industry 4.0 is an evolving and dynamic solution – it calls for creative thinking and endless configurations. It’s an exciting time for Cannon Viking, continuing the developments with constant inputs from customers and all other stakeholders.
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- Reliability
- Energy Efficiency
- Emission Reduction
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Cannon Bono Energia
www.cannonbonoenergia.com
A RAISED BAR for Domestic Fridges

The EU has set itself years ago a 20% energy savings target by 2020 that is roughly equivalent to turning off 400 power stations.

These compelling energy-saving regulations call for action in the domestic refrigerators and freezers domain. "By switching to more energy efficient refrigerating appliances, you can save up to €600 over the lifetime of an average product." writes the EU Commission in its web page dedicated to this argument, and continues: "More efficient refrigerating appliances will also allow Europe to save up to 4TWh of electricity per year by 2020. This will prevent around 1.5 million tonnes of CO₂ from being emitted every year".

But things are moving further ahead: on 14 June 2018 the Commission, the Parliament and the Council reached a political agreement which includes a binding energy efficiency target for the EU for 2030 of 32.5%, with a clause for an upwards revision by 2023.

This means that all the energy-hungry house holdings must be re-designed to meet these goals. Refrigerator manufacturers are working hard to maintain and gain market shares by offering more efficient appliances. To do so, they co-operate with the suppliers of insulating media – Polyurethane foams, mostly – to obtain the desired thermal efficiency without wasting storage space inside the cabinets and without increasing their external dimensions. To put it simply, they ask for new foams with better insulation performances.

New blowing agents for the challenge

Intense R&D efforts are being made worldwide to define Polyurethane formulations able to meet these requests, and the role played by the blowing agents is fundamental. The switch from CFCs to HCFCs to HFCs to Hydrocarbons – dictated by the recommendations of Montreal and Kyoto Protocols - has characterised the past three decades of production of insulating foams. Now the bar has been raised, and new blowing agents are available to fulfil the task: HFOs (Hydro Fluoro Olefines) provide the lowest Ozone-depleting and Greenhouse-effect potentials – but... at a cost. Chemical suppliers and fridge manufacturers have found an acceptable compromise between cost and performances using blends of HFOs and Cyclopentane: a 50/50 weight ratio of the two blowing agents seems to be the most efficient solution.

An intense revamping activity is undergoing at several leading producers of white appliances, because the current foaming plants must be adapted to the use of these new chemicals. Some of these new blowing agents may chemically interfere with certain catalysts contained in the formulations, shortening their shelf-life and usability.
This chemistry is undergoing continuous evolution, and soon this problem might be solved: up to now it has been noted that these new HFOs are better used if either metered directly into the mixing heads during the injection in the cabinets or if blended in small batches of polyl, to be consumed within a few days.

Cannon is providing equipment and technical solutions for both these methods, through the use of high efficiency three-component mixing heads and of dedicated three-component dosing units and pre-mixing stations. Several supplies have been made in the past 12 months – and more are under delivery – to adapt existing foaming plants, already suitable for using Cyclopentane, to the addition of HFOs. A similar number of new plants has been built for new investments, in various countries.

**New refrigerator plants for China**

Significant orders have been awarded to Cannon from major Chinese suppliers of domestic refrigerators. **Haier** is starting in their Yellow Island’s factory a new 18-lines cabinet foaming plant featuring RotoPlug jigs, the Zero-Time-Plug-Change rotating fixture patented by Cannon in the early 1980’s.

The plant is equipped with metering and mixing equipment able to use the latest chemical formulations, with a great flexibility in the production mix, to supply a wide array of fridge models for both the domestic and the export markets. This flexibility allows Haier to label their fridges with the highest possible level of efficiency.

**Hisense** started in Summer 2018 in Shunde a new 4-jigs refrigerator foaming line featuring the Vacuum-Assisted Injection (VAI) Cannon technology. The “wet side” of this plant includes an A-System 200 dosing unit and one FPL SR mixing head serving the four stations. Also in this case the whole supply has been designed and built to use an array of modern blowing agents.

Hisense and Meiling have awarded Shinnon – the Chinese factory of the Cannon Group – for the supply of two door-foaming carousels of original design, conceived for continuous movement and automated foaming in open moulds. A proven design, carrying the long experience matured in automotive seating equipment, allows these two major Chinese producers to foam refrigerator doors at a fast pace with a modest capital investment in equipment.
CANNON BONO SISTEMI IS SUPPLYING A NEW BOILER HOUSE FOR A SWEDEN BIOREFINERY PLANT, WHICH IS DOUBLING ITS PRODUCTION OF BIODIESEL.

The market of renewable fuels is growing rapidly, due to worldwide regulations for climate changes mitigations. Among the alternatives to petroleum-based fuels, biodiesel is acquiring an increasing role as biofuel coming from renewable sources, and is nowadays largely used in different sectors, such as thermal energy production, plastics processing, vehicle traction.

Doubling a biodiesel plant

The Sweden bio-refinery SunPine is investing about 25 million Euros in a new biodiesel production plant, which will increase its tall diesel capacity by 50%.

The company, strongly committed in the production of environmentally compatible products, is a world leader in the production of second-generation renewable fuels. In its plant located in Piteå (north of Sweden), SunPine produces about 1 billion litres of tall diesel refining a by-product from pulp and paper manufacturing (called Crude Tall Oil – CTO), a residue of chemical pulping process containing natural extractive components of wood.
The role of Poyry

Poyry is an international consulting and engineering company which works across power generation, transmission and distribution, forest industry, biorefinery and chemicals, infrastructure, water and environment.

The company has been entrusted with the engineering, construction and management services related to the SunPine biorefinery expansion project, with a particular focus on new thermal plant, where they have major responsibilities on supplier selection, purchasing and project execution.

Competence and Integration

The extraction process of the refined tall diesel from the tall oil requires energy and high temperature fluids (about 320°C).

For this reason, in the SunPine investment for doubling the Pitê plant, the installation of a new thermal plant to supply hot oil to the bio-refinery industrial process is also needed. Furthermore, the process generates also waste, in form of Crude Tall Oil Resin (CTOR) and exhaust gas. Both of them have to be used as fuels for the boiler house, taking into consideration that, being rich with Sulphur and Nitrogen, the combustion system has to be carefully designed. In addition, the CTOR is characterized by high viscosity and acid number, therefore has to be handled with specific materials and devices. For these reasons, the customer was looking for not only a boiler supplier, but a full system integrator able to develop a complete plant, consisting in a thermal oil heater rated to burn process wastes for a total combustion capacity of 6.9 MW, in order to heat the oil for the process up to 320°C, including the flue gas abatement system to comply with local regulations and all relevant equipment/activities needed for a turn-key supply.

Poyry awarded Cannon Bono Sistemi for the engineering, the supply and the installation of the boiler house, for its proved experience in developing turn-key energy plants fed with no-conventional fuels, coming as waste from agro food, wood, chemical, etc. industries, plants that necessarily need a particular attention to the emissions abatement systems.

Furthermore, the consolidated business relationship between Poyry and Cannon Bono Energia, which has been the link to his sister company, led Poyry to renew its confidence in the high quality of Cannon products.

Cannon Bono Sistemi has properly selected the combustion system, consisting in a rotary cup dual fuels burner, suitable specifically for the CTOR, and then accurately designed the volume of the combustion chamber of the diathermic oil heater (an HTH series boiler, provided by Cannon Bono Energia) for a dedicated combustion of the high Sulphur and Nitrogen content process wastes, by guaranteeing the needed flue gas residence times inside the chamber.

Downstream, in order to reduce the Sulphur, main pollutant into the flue gas, Cannon Bono Sistemi has provided a wet Scrubber, an effective device for Sulphur acids abatement from exhaust streams.

Obviously, the boiler house must be integrated into the rest of the plant: a control software with PCS7 logic (developed in partnership with Cannon Automata, the sister company dedicated to hardware and software solutions) has been provided to control the thermal plant and integrate it into the main control and management system of the existing plant.

In addition, due to the presence of exhaust gas as fuels, all equipment supplied inside the boiler house is ATEX certified for hazardous area operation.

A horizontal design

Compared with the bio-refinery already existing plant in Pitê, which has a boiler house of 10MW, the new one will have a quite smaller heater: 6.9 MW of capacity to heat the process oil up to 320°C.

Moreover, Cannon Bono Sistemi has provided a heater with a horizontal multi-tubular design (the one already installed has a vertical coil design); this configuration brings many advantages, especially in terms of height and footprint: in fact, the building which contains the boiler house is 10mt high, half the size of the existing one. This boiler design guarantees an easy access to all its parts, facilitating all the maintenance operations: through proper inspection doors it is possible to work directly inside the heater.

This result in sensible saving of space, obviously, but above all of costs: local assembly and material handling costs are reduced, huge containment structures are not required.

Is biodiesel the fuel of the future?

The project will end on 2020. But biodiesel market is already growing and expanding, not only in the industrial and the agricultural sectors (where the biodiesel is born): according to the Energy Strategy 2050 guidelines, the innovation and renewal of the vehicle fleet could give further boost to the development of renewables in the transport sector.

In fact, OEM’s are increasingly evaluating this fuel as alternative to the ones nowadays used, developing engines specifically designed for better burn biodiesel.

Biodiesel implementation programs, with applies in different sectors, are underway all over the world, from United States to China: the reuse of process waste as energy necessary for the process itself, like Cannon Bono Sistemi technology applied to SunPine plant prove to be able to do, contributes to increase the companies environmental sustainability.
Two years of work, in Northern Mexico, and counting. A completely new bulk storage farm and premixing station for adding Cyclopentane blowing agent to polyols. The conversion of 18 existing cabinet lines to the use of flammable blowing agent, plus a new door line, a new sophisticated cabinet fixture and fully renewed Polyurethane metering equipment for the whole plant. Kilometres of steel pipes, electrical cables and optic fibres to distribute chemicals, power and signals across a 135,000 sqm factory. And all this without stopping regular production! Monica Grosso, Project Leader appointed by Cannon SPA, unveils the details.

**Cannon News:** This seems to be quite a complex project: can you give us its brief story and the highlights?

**Monica Grosso:** It has been an important job for the Cannon Group, indeed. The story starts in the first months of 2016. Electrolux Mexico required a preliminary study for the complete conversion of their huge refrigerator factory based in Ciudad Juarez, Mexico, at the northern border of the country with El Paso, Texas. The plant featured 18 stationary lines for cabinet foaming, made by two US competitors of Cannon. Existing and obsolete door foaming lines were to be checked if worth for upgrade and conversion or to be replaced with brand new lines.

The required work was to adapt the whole factory to the use of Cyclopentane, a flammable blowing agent. In the meantime a new door foaming plant was required, and a new foaming fixture to increase cabinet foaming output. All had to be compliant with the strict safety rules dictated by NFPA and NEC. The whole Cyclopentane line had to be supplied, starting from an external storage system up to each mixing head. Not exactly a walk in the park, in terms of engineering, logistics, construction, operations, testing and commissioning.

The request was impellent: production stops were not permitted. Everything had to be done “on the fly”.

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**More Efficiency for ELECTROLUX MEXICO**

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**Cannon News**

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CN: Can you give us an idea of the project in size terms?
MG: The factory is 135,000 sqm wide. From the Cyclopentane storage to the last mixing head we measured more than 500 meters. Just to give you an idea, the 240 sqm safe enclosure that we built for the premixing operations covers a minor portion of the chemical storage building. This place is huge!

CN: Can you simply summarise the type of work you have carried in Juarez?
MG: Sure, we could fill this magazine just with the index of the chapters of this project.
We have built from scratch a 50 m³ Cyclopentane storage including all civilian works.
We have connected it with an aerial piping system to the chemical storage building, 100 meters away, crossing a road with an overhead bridge. In that building we have inserted new tanks for raw and formulated polyols, plus some additives, and the premixing station, a wholly panelled structure of 40 by 6 meters, 12 meter high, with three high-pressure premixers for Cyclopentane and polyol. From here we dispense the pre-blended polyol to a 1.5 km ring that brings it to some day tanks.
From these intermediate storages we feed the new Cannon dosing unit supplied to meter the blended polyol to the 18 existing foaming fixtures, plus the Cannon dosing unit feeding the new Cannon door lines and the machine feeding the extra rotating foaming fixture that we have supplied to increase the cabinet’s output.

We delivered the whole package, from the concrete works to the water sprinklers under the roof. At a given point we even realised that the roof of the factory was not able to hold the weight of the added equipment, and we were forced to apply a sturdy structural reinforcement to a large portion of the roof.

CN: Which part of the project was the most challenging?
MG: A major task was the conversion of the 18 existing foaming fixtures, built years ago by two US competitors of Cannon and not at all suitable for working with flammable blowing agents. We had to move out of the sensitive area all the electric components that were removable, and to replace with explosion-proof models those that could not be taken out. Then each fixture was enclosed in a ventilated box with fumes removal ducts and adequate fans. Each fixture needed the repositioning, adaptation or replacement of 80 individual components and took from 2 to 3 weeks of work. The toughest challenge was to carry out the upgrade activities on the running plant without any impact on normal production of the factory: we could manage the retrofitting of the whole line without interrupting the regular operation of the remaining lines and installing in parallel our new foaming plants.
The conversion of existing fixtures and dosing unit was done during nights and weekends.

CN: What was supplied as new equipment?

MG: Several large, medium and small tanks, three premixing units, a huge number of electric motors and valves, two complete, automatic lines for door foaming with the relevant high-pressure dosing units, one new Rotolig station holding two cabinet foaming fixtures rotating at each foam injection, with its high-pressure dosing unit. Plus the whole electronic control, able to synchronise the foaming operation between new and existing dosing units, executed with Allen Bradley PLCs to comply with the clients existing computer network and components.
To connect the whole thing we installed 3.5 km of steel pipes of various diameters for the chemicals and laid roughly 30 km of electric cables and 2 km of optic fibres for data transfer. With a major software project in between, to run everything smoothly!

CN: Can you give an order of idea of the project, in terms of time and man days?
MG: Two years of work, ending during summer 2019, with peak of 65 people involved between internal staff, our people deployed on site and local contractors.
This is one of the major complex jobs taken by Cannon Bono Sistemi on behalf of the Cannon Group, ever, with numerous logistic and bureaucratic obstacles that we could overcome with patience, team work, stubborn approach and lots of flexibility.
Let me thank the whole staff of Electrolux in Juarez for their cooperation!
The utility company TEPCO has chosen Cannon for the recovery of 7500 power line towers at risk of collapse.

The customer and his problem
An area of Japan is running the risk of being without electricity. The part of towers supporting high voltage power lines are built in steel pipes, zinc coated. Some of them exceed 100 m in height. The saline climate of the island, in fact, is corroding the pipes, weakening the structure of the towers in a critical way. At the moment, the replacement of the towers is still a hard work: not only due to the high cost of each tower (about 1 million euros), but also because to replace them it would be necessary to leave without electricity a part of the country, with enormous damage for people and activities.

For this reason, Tepco (Tokyo Electric Power Company Holdings, Incorporated), the largest Japanese electric utility company which serves the Kanto region (Tokyo and its six prefectures), is facing the problem, which interests an estimated number of more than 5,000 high voltage towers.

The external corrosion is treated with a special anti-rust paint. But the inside of the tubes, also affected by this oxidation phenomenon, cannot be easily painted.

As one of the repairs method other than painting, pipes can be filled with PUR foam without gaps, in order to eliminate the corrosion problem. Towers are being filled with mortar in the lower part and Polyurethane foam (closed cells, with a specific density, ten times lighter than mortar) for the top, so as not to make it too heavy.

Due to the particular climatic conditions of the island, the filling of the pipes (which can last even a week for each tower) can only be done from April to July, months during which there are no typhoons and the temperature cannot impact on the process: Polyurethane is best processed at 25 °C and, if the external temperature varies excessively from this value, the foam will not result of the quality required by the customer.

Another problem is the impossibility of controlling the temperature of the metal structure in which the Polyurethane is injected: if it is too low, the chemical reaction would not proceed correctly. That’s why this kind of intervention cannot be done in the coldest months.

The project
To face this problem of corrosion, Tepco, in partnership with Nitto Chemicals, SKYTECH and TLC, relied on Cannon (Nippon Cannon, the Japanese branch of the Cannon group, and Cannon Afros SpA, Cannon’s Polyurethane machinery manufacturer) to develop the most suitable solution to the problem.
The project was organized in four phases:

- **Phase 1 - Preliminary feasibility study:** In this first phase the working conditions were analysed and the possible solutions were examined, starting from the properties of the Polyurethane foam, set up by Nitto Chemicals.
- **Phase 2 - Kits for the development:** Purchase of a high pressure dosing unit for Polyurethane process tests, simulations of foaming in loose pipes and in a mock up of tower, resistance to aging and adhesion to metal surfaces. At the end of 2013 Nitto Chemicals purchased from Cannon one of the most compact and versatile high pressure dosing units on the market, the AP 10. The machine was started in the spring of 2014 to do laboratory tests and field simulations. Tepco, Nitto Chemicals and Cannon have therefore developed the ideal configuration for their own purposes.
- **Phase 3 - Tepco has defined the specifications of the high-pressure machine to be used for the tower recovery, basing on the results obtained and the experience gained during the previous phase.**
- **Phase 4 - Supply of "production" machines to make simultaneous interventions on the towers:** The machines are hoisted to top of the towers, where they remain for the entire duration of the intervention, suspended, while teams of highly specialized acrobatic technicians will drill a hole at the base of each section of pipe to be foamed, and inject Polyurethane.

**Cannon' solution**

To meet the customer’s particular requests, Cannon Afros, with the support of Nippon Cannon, has created a dedicated version of its AP 10 dosing unit.

**Layout:**

The design, already quite simple in the standard configuration, has been lightened and compacted to make the raising operation up to the top of the tower easier: the machine is, in fact, made of an aluminium slid and its dimensions are a tiny 850x850x1500mm, in order to easily pass through even the narrowest section of the tower. The layout has been designed so that it does not present any protrusion that can hinder both the lifting and the work of technicians. This also prevents the operator from interacting inappropriately with the dosing machine.

An auxiliary unit, developed by Nippon Cannon, was added to the dosing unit to supply the machine with cooling water, compressed air and hydraulic oil for operation of the mixing head. To cope with operational needs, this unit is anchored to the machine base, forming a whole unit in two levels.

**Features:**

To achieve the required foam quality, the machine is equipped with a temperature control system for the chemicals and it can work with an ambient temperature between 23 and 35 °C (the average temperature in the Tokyo area between April and July). Cold water is supplied to high pressure heat exchangers by a chiller, installed on board the auxiliary unit.

The machine can heat up water too, thanks to electric heating cartridges installed in the heat exchangers, thus completing the temperature control system. Having to work outdoor, the machine is designed to resist to humidity: the external parts are painted with a special protective paint for outdoor use, while the electrical panel is IP54 certified, so it is protected from dust and splashes of water coming from any direction.

In addition, Cannon provided a waterproof blanket to cover the dosing unit in case of sudden worsening of the weather conditions, as well as during the night.

Finally, the user interface of the control panel has also been designed to have a high contrast, in order to be clearly visible under the sunlight.

In this special configuration, the AP 10 dosing unit can also be airborne by helicopter to inaccessible and mountainous areas.

Thanks to this technology, the proper chemical system and the special foaming machine, utility companies can solve the serious problem of oxidation that affects electric power lines.

Cannon develops completely customized solutions, contributing to the development of innovative ideas and matching all needs and particular requirements of new processes.
New energy-conscious regulations are raising the bar for the insulation performances of any thermal apparatus, and water boilers play an important role in this category of devices, more and more demanded for domestic uses, but in particular for the storage of hot media produced with solar panels and heat pumps. For these applications conventional water-blown low-density rigid foams are not providing a sufficient degree of insulation: alternative blowing agents must be used to raise their lambda value without increasing the thickness of the insulating media. A specific mixing head designed by Cannon provides the right solution, even to the owners of existing foaming plants.
The manufacturers of water boilers and hot water tanks have chosen Cannon foaming equipment to insulate their products for the past 50 years. They have gone through the whole development curve of the foam industry: from low pressure metering to high pressure, from water-blown formulations to more performing CFC- and HCFC-blown ones, to gain foam quality and insulation characteristics.

Now that international regulations call for higher thermal efficiency from their products and for lower environmental impact from their production cycles, they must face a new challenge: increase the thermal efficiency of their boilers without increasing the thickness of the insulating foams.

New Polyurethane formulations are available to raise the insulation factor of the rigid foams, by using a flammable blowing agent like Cyclopentane or a liquid Hydrofluoroolefine.

Both solutions have a specific market:

- **Cyclopentane** can be used by mass-producers of standard models, that can afford the one-time cost of a plant conversion to provide all the required safety against a potential fire, using a flammable blowing agent. The cost of this HydroCarbon is affordable, and the insulation effect meets the desired values.

- **Hydrofluoroolefines** are more expensive than Cyclopentane, but do not demand explosion-proof foaming equipment. This allows the manufacturers of small series of large tanks to avoid important investments in new or refurbished foaming plants. A separate metering line feeding this blowing agent directly into the mixing chamber of the head is desirable when using Hydrofluoroolefines.

Cannon provides high-pressure models, in both explosion-proof or conventional versions, able to efficiently meter the two mentioned blowing agents.

A new mixing head, the FPL SR series, in the QCC and I/3 versions, has proven to be the winning tool for the users of Hydrofluoroolefines: the third stream available on these two models allows for a direct injection of the blowing agent stream into the mixing head, providing optimum foam quality without blending the HFO with the polyoil stored in the tanks.

This solution is obviously available for the supply of new foaming equipment, but can also be provided for existing foaming plants, implementing the necessary adjustments to the machine's circuits and control panel.

A new third component high-pressure dosing module and a new Cannon FPL SR head can retrofit an existing Cannon or competitor's high-pressure dosing unit.

This flexibility in solving new problems through the development of innovative solutions has won for Cannon the confidence of major players in this vast market niche. In the past ten years nearly 200 dosing machines for this specific application, 90% of them high-pressure models, have been supplied to Haier, Electrolux, Ariston, Viessmann, BRD Termea, OSO, and more than 100 other leading manufacturers of hot water tanks and domestic water boilers.
Catch The Right Train!
In several countries trains are increasingly gaining shares of the transportation markets, both as people and freight movers. To be competitive with airplanes on the short range for passengers – with high-speed railway systems – and with ships on the medium-long range for goods – where it is geographically possible – a train demands the same features required for other transport systems: energy efficiency, low environmental impact, comfort and noise reduction.

The use of plastics can greatly contribute to attain these goals, and Cannon provides a number of industry-ready processes and machines.

In spite of a growing percentage of passenger’s traffic preferring airplanes and of goods transported by road on trucks, that characterises some European countries rich of mountains, there is a rising interest for the railway as people and freight mover system in large, flatter countries.

Organising a good network of interconnections, the train has always been preferred to other transportation methods for several reasons: economic, safe, efficient, even socialization was easier on a train than in a bus – at least until the smartphones took over!

But moving a train involves a number of factors that today cannot be underestimated: a lot of electricity must be produced to drive them – with all the involved problems – and they must be more environmentally and people-friendly than in the past.

No one would accept to seat in a wagon more noisy than his car, or to be harassed in bed by the 5:00 a.m. bullet train speeding near her house. Energy efficiency, low environmental impact, comfort and noise reduction – for passengers but also for those who live near the tracks – have become prerequisites for modern trains and railway systems.

Plastics and foams have provided for several years viable alternatives to metals, wood and mineral wool traditionally used for the production of structural and body elements of railway carriages, and for their thermal insulation. Composites, in various forms, can now contribute to improve energy efficiency, aerodynamics, safety and aesthetics.

Cannon supply a number of technologies and equipment to leading players in the field of trains, railways and related gear:

- Acoustic insulation and vibration's reduction – for both the train's passengers and the inhabitants of the areas surrounding a railway – are obtained installing rectangular pads, moulded with a Polyurethane elastomer, between the steel rails and the supporting concrete or wood railway sleepers. These inserts have become an indispensable component of high-speed trains, to guarantee a smooth operation of the trains and an acceptable level of noise around them.

- Interior wall panels, luggage compartments, doors and more complex parts are thermoformed with thermoplastic, thermostetting and Composite plastic sheets, featuring a wide range of mechanical and fire-resistance properties.

For all these products Cannon supplies complete foaming and moulding plants, including high-pressure dosing units and heads for Phenolic and Polyurethane foams, thermoformers, moulds and mould carriers, mould carrying systems (carousels, turning tables, indexing transport systems), Carbon- and glass-fibre preformers, automation system and handling robots.

The international network of Cannon Sales and Service offices, in strict cooperation with the Group's technical specialists, can provide marketing and technical consultancy on these specific subjects.

A unique opportunity for the development of new ideas and projects can be found at Cannon's Development Centres in Italy and USA:

- part's conception and co-design,
- mould prototyping,
- preliminary moulding trials, also for the determination of the correct chemical or plastic materials, in a Cannon laboratory,
- part's prototyping, in a Cannon laboratory,
- industrial mould supply,
- complete moulding plant execution and supply,
- commissioning and industrial start-up can be the objects of a confidential contract with a Cannon company, a unique interface for the whole project.
CANNON USA EXPANDS

THE U.S. BRANCH OF CANNON CELEBRATED THEIR 40TH ANNIVERSARY OF ACTIVITY AND THE EXPANSION OF THE CRANBERRY, PA, FACTORY.
An international Corporate meeting was organized by Cannon on October 22-24 to celebrate both the 40th anniversary of activity in the USA and the extension of the Cranberry, Pa, factory. The three-day event gathered 60 persons arriving from 10 countries, all of them young staff that never had before the opportunity to visit Cannon USA. During this international meeting the Group’s local presence philosophy and the market dynamics have been illustrated and discussed. Cannon USA presented their technological capability and resources, to implement the most effective synergies with the rest of the Cannon Group.

Half day was dedicated to a roundtable session where ten specialists discussed the outlook of the American economy with a specific focus on the plastics industry and the opportunities for the non-plastics activities of the Cannon Group.

Cannon manufactures in the USA since 1978 metering machines, mold carriers and mold carrying systems for Polyurethanes and Composites, supplying the leading producers of domestic refrigerators, foamed parts for automotive and furniture, panels for thermal insulation, technical articles and hundreds of other applications. As a consequence of a growing activity, a new wide space for manufacturing and spare parts operations has been added to the 30-years-old factory of Cranberry Twp, 40 minutes north of Pittsburgh, Pa, doubling the current workshop space.

The new 2,500 msq extension is provided with a very high overhead crane, allowing for the assembly of larger equipment. Designed according to the latest eco-compatible standards, the new building is lit with over 40 skylights and with LED lamps that are automatically dimming when the external light increases, saving energy.

The 4,000 msq existing building, built in 1987 on a 18,600 msq lot in Freedom Road’s industrial area, has been recently modernized refurbishing the offices, extending the overhead crane in the assembly hall and applying other external improvements.

A second workshop is utilized by Cannon USA to assemble the larger plants, a 3,700 msq facility in Zelienople, Pa, located ten miles north of Cranberry. Over 10,000 msq of factories and offices are now available to manufacture dedicated equipment – Proudly Made in USA – for the Cannon Group’s clients in North America and elsewhere.
A Week End at the Museum: 2,000 VISITORS!

A NEW ROOM - THE NUMBER EIGHT - HAS BEEN OPENED IN THE CANNON-SANDRETTO PLASTICS MUSEUM OF PONT CANAVESE, IN PIEDMONT, ITALY.
Dedicated to Composite materials, this new exhibition space constitutes the final step of the guided tour of the Cannon-Sandretto "Civilization of Plastics" Museum. Visited every year since 1985 by thousands of tourists and collectors of plastics, the Museum features since 2015 completely renovated rooms, lighting and display cases, where hundreds of historical plastics parts witness the evolution of "the material that the Nature forgot to invent". Opened every week end from Spring to Fall - and in working days for groups, upon appointment - this is now the most visited of Pont Canavese Museum Pole. This Pole also features here a collection of ancient industrial machines, the original offices of the silk- and cotton-mill that was founded here in the 19th century and, downtown, a small exhibition of ancient costumes and professions.

Owned and completely restored by Cannon, the Plastics Museum's fruition has been entrusted to the Municipality of Pont, that appointed professional guides to lead the tours for the visitors.

**Cannon & FAI - Culture of Plastics**

This year the official opening coincided with the first week end of Spring, when Pont hosted the "Spring Days" of the local delegation of FAI - Fondo Ambiente Italiano, the National Trust for Italy; since 1975 FAI restores and takes care of special places in Italy so that present and future generations from all over the world may enjoy a priceless legacy.

A great honour for Cannon having been part of this event, usually held in prestigious castles, villas and historic gardens. During the two days of special opening (March 23 and 24) 2,000 visitors have been registered at the FAI reception gazebo, at the entrance of the Museum Pole.

Numerous FAI volunteers manned the event, flanked by 50 students of a local high school that had been trained in the previous weeks to act as Guides for the three exhibition sites of the Pole: the Cannon-Sandretto "Civilization of Plastics" Museum, the Modesto Sandretto Collection of ancient industrial equipment and the Pont Manufacture's "Bureaux", the old textile mill offices.

The benefits deriving from the intelligent use of plastics have been illustrated to a wide, non-technological public in a moment when the problems deriving from its improper disposal seem to overwhelm the advantages provided by a family of materials that have revolutionised our way of life.
RUNNING for Charity

ALSO THIS YEAR CANNON PARTICIPATED WITH THREE TEAMS AT THE LATEST EDITION OF EUROP ASSISTANCE RELAY MARATHON, THE ANNUAL 42 KM RACE ACROSS THE CITY OF MILAN.

All the runners donated their admission fee to various NoProfit Organizations, enrolled in the Milano Marathon Charity Program. Again, the Cannon runners have supported the activity of “L’impronta”, an NPO which organizes a series of interventions aimed at disabled people belonging to different age groups, as well as projects to promote volunteering and the culture of solidarity.

The three Cannon team were:

- **Energy&Water Team**, composed by Leonardo Volpato, Davide Bertinat, Andrea Bellazzi, Domenico di Benedetto and Claudio Nava
- **Bono Team**, composed by Massimo Brognoli, Gian Nicola Greco, Andrea Stolcini, Alessandro Lo Piccolo
- **Plastic Runners Team**, composed by Paola Bartilucci, Lorenzo Giudici, Alessandro Bossi e Luca Fantetti.
More than 35,000 Cannon Mixing Heads have been installed on more than 15,000 metering units, on the 5 continents. The output capacity of these heads covers a range up to 10,000 g/s, meeting and exceeding the expectations of a wide number of end users of Polyurethanes, Epoxy, Silicone, Phenolics and DCPD.

Dedicated models have been specifically developed for different applications, chemical components, injection or pouring methods. A continuous commitment for excellence is the driving force that pushes Cannon to search for new solutions, to provide reliable and profit-generating tools to their customers.

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