Cannon is an international group of industrial equipment producers. We like to describe us as suppliers of “Dedicated Industrial Solutions” because it would be difficult to summarise the individual activities of our Units. Some of them were founded in the late 1950s-early 1960s and have grown their own experiences in different fields of the industry. Others were created from within, to specialise in dedicated sectors. In the early 1990’s they were consolidated under a single Cannon SpA, based in Italy, near Milan - which today controls and leads their activities.

Our Plastics Technologies are developed and distributed mainly by three companies:

- Afros SpA - metering and mixing equipment for Polyurethanes, Epoxy and other reactive formulations - based in Caronno Pertusella, north of Milan, Italy.
- Cannon Viking Ltd - foaming plants for sheetstock – based in Stretford, near Manchester, UK.
- Cannon Egores SpA - complete plants for automotive, refrigerators, insulated panels and thermoforming, to process rigid expanded foam - based in Caronno Pertusella.

Some of these companies have grown their own experiences in different fields of the industry. Extensively employed for the manufacture of structural elements demanded by the transportation industry, as well as by sanitary ware manufacturers or in the wind-power industry. Extensively employed for the manufacture of extremely light and stiff, flat parts for automotive interiors, the Reprep process (preforming technology today successfully applied in several countries with a Cannon turn-key line). A thin layer of rigid expanded foam is sprayed over a sandwich structure of folded cardboard, lined on both sides with two sheets of non-woven glass mat.

Epoxy resins

Cannon offers its E-System, high-pressure metering and mixing equipment that guarantees very fast demoulding times and perfect distribution of the resin across the entire mould surface.

Cannon Turns The Key for Composites

"Turn-key plants capacity" will be the leitmotiv of Cannon presence at various Composites shows held in several countries in 2013. The wide range of complete technological solutions available at Cannon for the industrial manufacture of thermosetting and thermoplastic Composites will be presented to the international market by the staff of specialists of Cannon Egores, the new Group Company dedicated to the development of turn-key solutions for the transportation, refrigeration, thermal insulation and other industries.

The Composites shows, a classic meeting occasion for the reinforced plastics specialists of all nations, will see the Cannon Group presenting their latest innovation in several fields of this vast segment of the industry. The problem-solving approach of Cannon has been genrated in the mind of a number of industrial technological solutions for Urethane- and Epoxy-based composites that have found immediate interest and positive response among the most qualified parts makers. Today the complete manufacturing line required for the production of a thermosetting or a thermoplastic composite part - from glass- or carbon-preformer to the finished part trimming, including chemical dispensing unit and mixing head, moulds, mould carriers, handling and heating systems, trimming and controls - is available from a single qualified source.

Polyurethanes

Cannon offers solutions like the InterWet and OuterWet - technologies for the co-injection of rigid Polyurethanes and chopped glass fibre - are widely used for lightweight, wide structural elements demanded by the transportation industry, as well as by sanitary ware manufacturers or in the wind-power industry. Extensively employed for the manufacture of extremely light and stiff, flat parts for automotive interiors, the Reprep process in preforming technology today successfully applied in several countries with a Cannon turn-key line. A thin layer of rigid expanded foam is sprayed over a sandwich structure of folded cardboard, lined on both sides with two sheets of non-woven glass mat.

Epoxy resins

ESTRIM, a complete moulding solution for Epoxy-based fast RTM process has been designed for the production of automotive, leisure and sport parts. On top of dedicated preformers, polyimination clamps and moulds, Cannon offers the E-System, high-pressure metering and mixing equipment that guarantees very fast demoulding times and perfect distribution of the resin across the entire mould surface.

The machine is now available in two versions, one extremely flexible for laboratories and development projects and another, very cost conscious, dedicated to industrial production. Both models come with a 2+1-component mixing head able to handle a regular output of resin and hardener while performing a micro-sloosing injection of an internal release agent or of a second hardener. In addition to a standard high-pressure injection system in closed mould, two new methods for the distribution of the Epoxy resin over a Carbon reinforcement have been developed: ESTRIM LL for a Liquid Laydown and ESTRIM SL for a spray application, that allow to reduce the specific pressure in the polymerisation press reducing the investment in clamping equipment. The wind-power industry is rewarding Cannon with growing volumes of business worldwide, thanks to the availability of dedicated low-pressure resin dispensers for the infusion of Epoxy formulations in the giant blades manufactured for off-shore and conventional wind turbines. The new series of Cannon DX machines now includes a three-components model that allows for the flexible use of two different hardeners in order to obtain different reaction profiles in accordance with the size of the moulded part. The latest design of the blade moulds with a rigid panel system, a stringent request coming from the blade manufacturers that have already appreciated the first two-components model. A new degassing unit for resin and a gluing dispenser for the application of the two-components adhesive on the blade’s edge are now available.

For the aeronautic industry Cannon offers dedicated plants for the assembly of large composite and metal parts, such as the M346 advanced trainer made in Italy by Alenia Aermacchi. An innovative complete compression moulding line for Light Weight Reinforced Thermoplastics (LWRT) is now available for the production of light automotive parts mostly used as engine shields. Cannon is able to supply now top-quality moulds for any type of plastics and Composites pressure vials. Dosing ESTRIM is a dedicated mould making machine with more than 50 years of experience in this field, has recently joined the Cannon Group to complete their range of available packages.

All the above mentioned turn-key solutions are today available for composite parts manufacturers based across the five continents: Cannon extended network of direct offices and agencies guarantees prompt local service, availability of spare parts, technical and marketing assistance. See in this Cannon News several examples of successful application of Cannon Composites technologies and visit the new corporate website (www.cannon.com) to know more.

You Are Welcome, at Cannon!

(Read more at page 5)
The recent introduction of new Cannon technologies for the manufacture of Epoxy-based moulded composites was awarded with numerous positive answers from the market. Cannon have introduced three different impregnation systems based on high-pressure technology. A whole range of solutions is now available to respond to different needs and processes. Cannon supplies today the widest set of tools, including dispensing and mixing devices, preformers, presses, moulds, manipulators, ovens and controls.

**Fast RTM for Epoxy-based moulded composites: more solutions from Cannon!**

Cannon have been active in the field of resin injection and compression moulding for 50 years, and have developed a comprehensive range of equipment for the process. The new press has been designed with a lower platen shuttling completely outside the compression area, allowing for an easy manual or robotised punching period. 

The search for new solutions and the intense cooperation with the major players involved in this business convinced the Cannon management to invest even more resources in this field of activity: in the central R&D laboratory in Canossa Pernussa, near Milano. In less than a year, the moulds and equipment have been dedicated to the development of Epoxy-based composites. In addition to the just announced high-pressure machine with a four-component, dosing method, a new 650 Tons hot press will be installed later this year, allowing for the production of large parts with the customer mould. The new press has been designed with a lower platen shuttling completely outside the compression area, allowing for an easy manual or robotised punching period. 

Cannon have introduced three different impregnation processes: more solutions from Cannon!

**E-STRIM LL** (Liquid Laydown) - the Epoxy formulation is laid over the Carbon mat in “liquid ribbons” of varying width, typically from 40 to 120 mm, perfectly impregnating the reinforcement and finalizing the possibility of air inclusions in the moulded part. This technique allows for the production of very large parts, weighing uniformly the huge, almost flat preforms that characterize parts such as engine hoods, fenders and doors. The reactivity of the systems being controllable on a part-to-part basis, this system allows for a comfortable laydown time even for the largest pieces. As in the SL alternative, the formulation does not need to flow through the mould and guarantees the most homogeneous distribution of liquid resin in the Carbon reinforcement.

**ESTRIM LL** (the new Epoxy Liquid Laydown impregnation system developed by Cannon for a very homogeneous distribution of liquids over Carbon preforms.)

The optimization of the above process not only keeps low part-to-part cycle time, but also requires lower compression force and thus reduced capital investments in which the end leads to lower part cost. We should not forget the development of new alternatives for the traditional high-pressure injection in closed moulds, performed with the original ESTRIM technology. The experiences matured in the past in the field of short-stroke polymerisations press have allowed for at least two more injection methods:

1. The resin can be injected with a variable output, commanding the operation by reading the internal pressure in the moulds. The signal is sent to the unit’s PLC, that defines the new output value to be applied and communicates the dosing pumps in real-time, working in closed loop control. The press does not move during the injection.
2. The injection-compression method can be applied, by leaving the mould partially open during the injection (still guaranteeing the tightness of the cavity) and applying the final compression stroke at the end of it.

Further developments are announced

Cannon announced at JEC Composites Show 2013 in Paris the three-component dosing system for ESTRIM. The three component, a release agent, is metered at a very low output (few grams per minute) by a separate plunger-piston high-pressure dosing unit: the flow of release agent enters in the resin stream immediately before the relevant injector, on the mixing head. Thoroughly blended in with a state mixture, this non-reacting chemical is dosed with extreme precision to the reaction formulation. The hydraulic valve controlling the third component ensures a perfect feeding of the described distribution of this stream into the resin, avoiding any possible contamination of the material. The head performing this operation is an FPE 2.2-1K, which can be supplied in various configurations: for dosed mould injection, for Spray Laydown (SL), or for Liquid Laydown (LL). Two versions of the Cannon E-System machine are now available: one extremely flexible for laboratories and one with a high-pressure, plunger-piston dosing unit for the release agent feeds the non-reactive chemical directly in the resin stream just before the head’s injector.

The new high-pressure, plunger-piston dosing unit for the release agent feeds the non-reactive chemical directly in the resin stream just before the head’s injector.

Worldwide recognition

Up to date, numerous contracts for these Epoxy-dedicated technologies have been signed with major manufacturers of parts (both car manufacturers and Tier 1) and Raw Material Suppliers, in Europe and Japan. Several more are under discussion, and the relevant news will be disclosed if and when this will be allowed by the clients.

**New tools for customers in Cannon R&D facilities**

The cannon press. A unique set of tools is available, to be used, guaranteeing a high degree of flexibility when some operations. The availability of a tilting upper platen and a sliding features a lower platen shuttling completely outside the compression areas, allowing for an easy manual or robotised punching period. With their available, proven industrial solutions for a vast range of needs, Cannon is today the ideal partner for complex – and also for simple – Epoxy processing projects for the composite industry. Once again, the concept of “One-Stop-Shop” for all the chain of equipment and tools can be the winning move for both parties.

Albano Bonansea, Chief of Cannon Central R&D laboratory for reacting formulations, states: “The moulded Epoxy-based composite components, interacted with the ESTRIM LL (Liquid Laydown) technology.”
The range of dedicated presses expands: new models are available for fast RTM and light composites.

More than 45 years of experience in presses for composites, delivering all sorts of models up to 3,500 Tons of clamping force and up to 3,500 x 3,500 mm of platens dimension, characterise the Cannon offer to a sector of the plastics industry that is featuring an impressive growth rate. All the most recent processing technologies can be applied using a Cannon press. A unique set of tools is available, to be used with and around these complex machines: moulds, handling systems, dedicated preformers with patented slip-control methods, pre-heating and post-curing ovens, several methods for the impregnation of the reinforcements with various families of reactive chemicals, all the safeties around the working areas and a specific electronic control designed for these operations.

Designed and built to last, the Cannon presses for composites have been used for more than four decades for compression moulding of SMC, BMC, GMT resins. Characterised by a four-column construction, they allow for optimum distribution of pressure over the whole mould surface and for flexible approach from the four sides for all manual and automated loading and unloading operations. The availability of a sliding upper platens and a sliding lower platen (the shuttle system, that can be supplied in a double version, sliding towards both sides of the press for an increased productivity rate of the working island) allow for ergonomic service operations and for the manipulation of the largest moulded parts. Presses with platens up to 3,500 x 3,500 mm dimensions have been manufactured, featuring specific pressures from 10 to 100 bars: the former is mostly used for materials requiring only a containment in the mould during an impregnation phase, while the latter is specific of true compression processes.

Cannon customers in this field include all the major European manufacturers of composite parts.

A new, flexible 650 Tons model for Product Development

When the highest dimensional precision is demanded, a short-stroke press can be supplied, featuring a very compact design combined with excellent control of active or passive parallelisms during the final clamping stroke and fast operating cycle, due to the limited amount of hydraulic oil used in the circuits. A new 650 Tons model has recently been developed to meet the requests of R&D laboratories. These customers are always looking for a budget-conscious solution to build their development moulds, but also require a free access to the four sides of the mould in order to ease the manual preparation of inserts and the demoulding of parts. For this reason the new press has been designed with a lower platen shuttle in and out from the clamp, allowing for a lot of operations freedom around the mould. The design allows for both closed-mould resin injection or open-mould resin deposition, for maximum freedoms. This new press, engineered with the use of FEA (Finite Elements Analysis), for the structural optimisation of its parts, features platens of 2500 x 1200 mm, a clamping force of 6,500 KN, a clamping stroke of 1,000 mm and a parallel stroke of 1,000 mm. The 200 mm/sec operating speed, during both the clamping phase and the closing operations, ensures high efficiency during the service time. Moulds weighing up to 20 tons can be used, guaranteeing a high degree of flexibility when some industrial pre-production (or production of small lots) is requested for short periods of time to an R&D piece of equipment. The parametric design of this press allows for a prompt availability of models featuring a clamping force up to 10,000 KN, with platen’s length up to 3,000 mm or width up to 2,500 mm.

A new 1500 Tons press for industrial production

Another short-stroke press, featuring a 15,000 KN clamping force, has been recently supplied to a major German supplier of RTM parts for automotive applications. Characterised by platens of 2,500 x 1,500 mm and a max daylight of 2,000 mm, with a parallel stroke of the upper platens of up to 1,600 mm, also this model features a lower platen shuttling completely outside the compression area, allowing for an easy manual or robotised sequence of service tasks. The unit is destined to the industrial production of automotive parts for a major European car manufacturer.

A rich set of peripheral equipment, from a single source

This kind of press is usually the core of a complex moulding island, where several operations must be performed either manually or automatically: a lot of signal’s interfacing is demanded, and a unique supplier can avoid a lot of headaches when trying to put the puzzle together. Cannon developed a unique set of tools to be used with and around these complex machines, taking the responsibility of being for its customers a unique interface to deal with during the plane definition phase and—later on—in case of complications in the set-up phase. Moulds, handling systems and trimming or punching solutions for preforms and finished parts, dedicated preformers with patented slip-control methods, pre-heating and post-curing ovens, several methods for the impregnation of the reinforcements with various families of reactive chemicals, all the safeties around the working areas and a specific electronic control can be supplied as a turn-key package by Cannon Ergos, the Group’s company dedicated to the supply of complete parts to the plastics and Composites industry.
A well-known technology for some years, the Clear Coating attracts more and more end users. The application of a transparent, glossy, hard layer of Polyurethane over natural materials, like wood and veneer, or synthetic ones, like a mat of carbon fibres, appeals mostly the manufacturers of car and boat interior parts, furniture complements and aesthetic parts in general. The transparent layer imparts a “luxury feeling” to the moulded piece, allowing for the production of very nice decorations interior trims.

Cannon became interested in this niche market when they realised that some of the available tools and technology could provide a real “plus” to the manufacturers of aesthetic parts that were looking for some improvements in relation to existing available solutions.

Temperature and pressure controls are fundamental for obtaining repetitive results, required by the car makers for the medium-large solutions.

A smart processing method allowed S Group to reduce the investment cost of their US-based plant that manufactures car components in Baypreg™. Cannon supplied the “wet side” equipment to serve a “dry side” configuration designed and made by the client’s Italian sister company. A good example of efficient international cooperation!

A qualified supplier of automotive interior parts, S Group is specialized in light-weight structural components - such as parcel holders, spare wheel covers, luggage compartment floors, inserts for door panels, etc. - made with reinforced thermoplastics and thermosets. They deliver these large light-weight parts to numerous car and Tier One suppliers, among which Ford, Chrysler and JCI. Operating in this specific field with two factories in Detroit, MI and one in Mexico, the S Group is also present in the USA with other applications made with special polyurethanes and thermoplastics made by their Saco, Nwp and Macromeric companies. When confronted with the need to supply Ford with the space efficient cover, made in Baypreg™, for their 2013 Escape utility vehicle, the company decided to use an existing “dry side” solution developed by their Italian PCM sister company. An external supplier had to be found for the metering and mixing equipment.

The Baypreg™ solution implies the use of a flat insert of a honeycomb material lined with glass mat on both sides, that are then covered with a thin layer of sprayed Polyurethane and compression-shapped in a mould.

An important detail is the fact that the robotic spray application of the formulation should not allow the reacting material to drip from either side of the sandwich prior to its placement in the mould. The availability of Cannon’s “Spray-and-Stay” - a dedicated application technology able to uniformly distribute a frosted layer of Polyurethane evenly over a vertical wall of a mould, without dripping - convinced the S Group’s president, Andrea Savonuzzi, to contract Cannon - a qualified equipment supplier which he knew for several years of cooperation in Italy.

A smart, dedicated unit The order was confirmed to Cannon Aftos for a CannOxide kit, used to meter and feed a small percentage of NLD (Natural Liquid Carbon Dioxide) directly in the appropriate mixture, to guarantee the production of a frosted spray foam. Cannon USA
Smart processing reduces parts cost

Cannon solution for Clear Coating

Specially-designed presses are available for the Clear Coating technology. Accurate trimming and waste several grams of precious material at entering in the mould – must be done in order to avoid a “mark” usually around 2:1 (Iso/Polyol). In addition to this, a very careful mould, without dripping, convinced the S Group’s president, a qualified supplier of automotive interior parts, S Group is designed and made by the client’s Italian sister company. An external supplier had to be found for the metering and mixing equipment.

A qualified supplier of automotive interior parts, S Group is interested in their structural parts made in Baypreg™ and the taxpayer. So, because of the long cure cycle (about 60 seconds), with just one clamp it is possible to get much better production numbers than if they used just one mould with one clamp and much more economically efficient than if they installed one press per mould. The good cooperation between S Group and two manufacturing centers of Cannon allowed for a successful implementation of this project. S Group welcomes inquiries from end users interested in their structural parts made in Baypreg™ and the Cannon Group is ready to provide the requested technology.

As usual, Together We Can Make It!

Processing recovered Carbon fibres: are you interested?

The Cannon Group is executing an EU-sponsored project aimed at the development of suitable fine-tuning, prototyping and launching on the market of an innovative process which recovers the Carbon fiber, a classified waste which would otherwise have an high negative impact on the environment.

Moreover, the process entails dramatic improvements in the production of Carbon fiber composites, in terms of environmental (as well as economic) impact. Cannon Afros, the Group’s unit entitled to run the largest part of the project, welcomes the inquiries from interested parties (Carbon fiber producers and transformers, parts manufacturers, end users of Carbon-reinforced composites, recycling companies) for the possible joint search of new applications and processing methods.

Carbon Fibers (CF) consumption is booming, mainly because of their excellent characteristics which make them an ideal material for high quality structural parts that combine lightweight with high mechanical properties. The global consumption of CF has dramatically increased in the last two decades, reaching approximately 35,000 t in 2008; this number is expected to double by 2014, representing a growth rate of over 12% per year.

Carbon fibre waste: a rising problem

Despite all advantages associated with CFs, the increasing use generates also an increasing amount of CF waste. Common sources of waste include out-of-date pre-pregs, manufacturing scraps and cut-offs, testing materials, production tools and end of life (EOL) components. Several hundreds tonnes of highly valuable material are land-filled every year, with an evident economic and environmental cost, which is finally charged to the consumer and the taxpayer.

Due to the cost and complexity of production of the new Carbon fiber and the difficulties in land-filling the waste, the recycling of the CFRP is a challenging target because of:

- their complex composition (fibres, matrix and fillers),
- the cross-linked nature of thermoset resins (which cannot be remoulded),
- the combination with other materials (metal fixings, honeycomb, hybrid composites, etc.).

At present there is no mature solution on the market for a full recycling and reusing process for CF composites. Many experiences have been developed worldwide in order to demonstrate the feasibility of different recycling processes.

Specialised companies in the UK, Germany, Japan and Italy have been active in this field for several years now, but most of these efforts have reached, in the best scenarios, the pilot stage. Since the idea of recycling composites was first conceived, the greatest challenge has been to develop a profitable recycling process. There’s a urgent need to fill the gap towards a concrete market uptake of the most promising technologies among this lot, in order to provide a concrete solution to transform an emerging problem into a concrete opportunity.

Cannon gets involved

Cannon has started in 2012 a EU-sponsored project, named CRESIM (Carbon Recycling by Epoxy Special Impregnation), finally aimed at the development of proper processing methods for the manufacture of CFRP parts using recycled CF. The CRESIM project addresses fully the waste reuse issue by developing a new innovative manufacturing process which will potentially recycle and reuse up to 100% of the CF waste and scraps from different industries sectors, transforming an environmental problem of today in an opportunity of greening the production processes and getting economic benefit for tomorrow.

An intense R&D program has been planned: it involves several steps for the 2013 and 2014:

- the characterisation of different types of recovered CF,
- the development of a suitable process for the impregnation of different types of reinforcements obtained with recovered CF,
- the characterisation of the obtained test plates,
- the development of economically justified new applications for the obtained process.

An important investment in laboratory surface, new equipment and specialists’ time has been decided by the Cannon Group management for the CRESIM project. The first steps are involving the allocation of a large portion of the renewed R&D Center for Composites in Cammino Pertusella, north of Milano, Italy, where a new high tommage, hot press will be installed, able to host a number of testing moulds as well as the tools supplied for sets of trials by the interested partners. The dedicated area will be equipped with two 6-axes anthropomorphics robots for parts manipulation and mixing head’s handling, as well as with other required hardware. The chemicals required to test various types of impregnation (Polyurethane and Epoxy resin) will be dispensed by two different Cannon dosing units, low-output, high-pressure machine working in full closed-loop control of output and chemical ratio. The staff of specialists that has developed in the past few years a complete line of tools suitable for the production of fast RTM (Resin Transfer Moulding) has been assigned to this project with a high degree of priority.

The details of this project are available on the web at www.life-cresim.com, where the interested parties can find hints for a possible cooperation.

Cannon Afros welcomes the inquiries from Carbon fiber producers and transformers, parts manufacturers, end users of Carbon-reinforced composites, recycling companies, for the possible joint development of new applications and processing methods for these recycled Carbon fibers.
The Global Status of Wind Power in 2011

“The global wind power market recovered somewhat in 2011 thanks to a strong year in a number of national markets. The market grew by about 6% compared to 2010, and the 40.5 GW of new wind power brought on line last year represents investments of more than $550 billion (about $68 billion)” says the Global Wind Energy Council in their 2012 report on the Global Status of Wind Power.

Their interesting and comprehensive annual report — available on www.GWEC.net — states a number of interesting facts. We extracted some of the most relevant and publish them on this Cannon News, giving full acknowledgment to GWEC for their contents and for the relevant comments and forecasts.

Current status
The US market made a respectable recovery, Canada had a record year, and Europe remained on track to meet its 20/20 targets but with essentially a flat market. Offshore installations in Europe decreased slightly last year, but strong growth figures were posted in Romania, Poland and Turkey; and a strong year in Germany reflects a renewal and even stronger commitment to renewables in the wake of the nuclear phase-out decision.

The new global total at the end of 2011 is just shy of 236 GW, representing cumulative market growth of more than 20%, which is certainly a respectable figure for any industry in this economic climate, even though it is lower than the average over the last 10 years, which is about 28%.

Regional Outlook
The main drivers of growth in the global market, as they have been for the past several years, are the Asian powerhouses of China and India. While the era of double and triple digit growth in China’s wind market may be over for the time being, it still represented about 43% of the global market, and India posted yet another year of record installations; the two countries together accounted for just over 50% of the global market in 2011.

Elsewhere, Brazil is beginning to live up to its promise, and along with Mexico will be the major growth markets in the western hemisphere for the coming years; South Africa has finally taken the decision to get into the wind market in earnest. For the second year running, the majority of wind power installations were outside of the OECD/OCSE, and this is a trend which is likely to strengthen even further in the near future.

India moved up to third place in terms of annual market share last year, and confirmed that position in 2011, and is likely to start in 2012 up the cumulative total, surpassing Spain to move into fourth place by the end of 2013.

Looking ahead, the picture is mixed across the different markets, and a bit difficult to read. Major uncertainties about the future of federal support for wind power in the US are the single biggest variable, but not the only one. Grid issues in China, changes in the Indian tax code, questions about the pace of offshore development in Europe, and uncertain politics in the Middle East are just some of the issues we face going forward.

The good news is that wind technology continues to get better and cheaper. The number of markets where wind competes favourably — even in direct competition with heavily subsidised conventional energy — keeps growing; and the benefits from large quantities of indigenous generation whose marginal cost is very low is becoming more and more apparent, especially when it brings local industrial development and much-needed jobs.

Market Forecast for 2012-2016

It doesn’t get any easier to make short term market forecasts for the wind industry. While the market continues to diversify across all continents, it is at the same time plagued by continued slow economic growth and budget crises in the OECD/OCSE, as well as the continuing credit crunch.

While – continues the report – at GWEC we are expecting the industry to continue to grow during the coming five years, it’s not going to be easy. It will be especially tough for manufacturers, with chronic oversupply adding to existing downward price pressure from general economic conditions to cut margins dramatically; and this is only expected to improve very gradually in the short term.

Whatever happens, it seems likely that after a strong 2012, there is going to be a drop in 2013. How big a drop, how long it will last, and what effect it will have on both project and manufacturing investment, is the single largest variable affecting the overall market size in the next few years.

Most of the growth markets in the world now are outside the traditional markets in Europe and North America. While the Chinese market has now stabilised for a while, the Indian market is growing strongly as are Brazil and Mexico. There are also some bright spots in new ‘emerging’ markets in Eastern Europe, as the EU continues its steady if unspectacular march towards its 2020 targets.

Canada and Australia are potentially substantial markets which could add significantly to global growth figures, and South Africa has now entered the market in earnest. Overall, an average annual market growth rates of about 8% for the next five years is expected, but with a strong 2012 and a substantial dip in 2013.

The installations for the 2012-2016 period should total about 235 GW, with the cumulative market growth averaging just under 16%. This is well below the 28% average for the last 15 years, but substantial growth in difficult times. Overall, the total capacity should be ending up at just under 500 GW by the end of 2016, with an annual market in that year of just under 60 GW.

Regional distribution
While there is great interest and excitement in new, fast growing markets with large potential in Latin America and Africa, the majority of the global market remains in Asia, Europe, and North America, and that’s not going to change substantially over the next five years.

While Brazil is well on its way towards becoming a 1,000 MW or more annual market, the other markets in Latin America are just not big enough to put up large numbers, especially now that, in accordance with current practice, Mexico and its burgeoning market has been included in North America. South Africa is expected to become a substantial market over the next five years, and perhaps begin to emerge as a regional hub for the industry towards the end of this period, but along with Morocco and Egypt, the two other substantial markets on the continent, are not going to start to figure prominently in the international picture until after 2016, at least.


The largest blades for offshore wind generators can reach today a length of 80 metres!
More freedom for the largest wind blades

A new three-component version of the Cannon DX series is now available. It allows for more freedom and flexibility in the process of repairing the defective aeroel blades made with resin infusion process, utilised to inject Epoxy formulations in the wind propellers.

The Cannon DX is a compact, transportable, very precise dosing unit for Epoxy resin VARTM (Vacuum Resin Transfer Moulding). Conceived specifically for the infusion of resins in large moulds – aeroel blades and other similar huge parts – this machine is available today in a range of models that includes three output levels (15, 35 and 80 kg/minute) and two configurations.

The smaller unit is now available in a new three-component dosing configuration. Featuring a third feeding line, allowing for the use of a second hardener, this compact machine allows for the fast switch from a slower to a faster reacting formulation when applying small quantities of resin in repaired areas.

The conventional two-component version is offered in a proven configuration, suitable for the infusion of the world’s largest wind blades and characterised by a closed-loop control of total output and ratio.

The assembly line of the Cannon DX 60 and DX 35, industrial dosing units for Epoxy infusion process.

Advantages
The Cannon DX series features:
- Small dimensions, with a single frame equipped with pivoting wheels to easily move the machine close to the mould.
- The unit is designed to be directly attached to chemical storages like IBCs or drums.
- A programmable electronic control for a very flexible planning to the production, with dedicated infusion programs storeable for each mould/product.
- Inverters to control the pumps’ motors speed: the machine can work within a wide range of mixing ratios.
- Closed-loop control of component’s output and ratio to guarantee a continuous control over the flow of liquid resins into the vacuumed moulds and an accurate mixing ratio, which is fundamental to avoid emissions of non-reacted chemicals in the working area.
- Recirculation circuit on both components line to reach the set parameters before starting the pouring, for an even quality of polymised resin across the whole blade.
- A static mixer equipped with dispensible mixing elements attached to a dedicated mixing head block.
- Dedicated flushing program to flush the mixing head with the resin between two subsequent shots.
- Stainless steel circuit for the hardener.
- Wireless remote control, based on radiofrequency, which allows the operator to control the four main operating functions (injection start and stop, output increase and decrease) when he is surveying the mould, very far away from the dosing machine.
- Modern for Remote Service which allows one of the numerous Cannon Service Centres in the world to connect to the machine installed at the customer’s site to know in status when an alarm or a malfunction occurs, to search programming errors in the PLC software, to upload software updates.

An efficient data collection system, Cannon MDLink, to collect, shot by shot, the main working parameters and alarms of the machine. Data are stored in a flash memory card and are usable with any commercial spread sheet.

International positive acceptance
Numerous machines are today in production, installed in Europe, China, United States, Brazil and India at the production sites of the major manufacturers of aeroel blades.

The range of available Cannon equipment and solutions for this industry grows steadily, with the development and launch of new models and accessories. Look for more interesting news in this page!

A New Degasging Unit Saves Time and Money!

A new degassing unit has been designed by Cannon Afros to remove the air from the resin before dosing and mixing it with the hardener. An ancillary piece of equipment much demanded by the manufacturers of aeroel blades, the new degassing unit improves the quality of the blade and dramatically reduces the presence of air bubbles in the cast resin, one of the main sources of post-production repair operations, which bear an unacceptable industrial cost.

The solution designed by Cannon Afros consists of a frame housing a 300 l tank. The resin is moved from an IBC to the tank in batches of about 150 l and it’s recirculated for a few times in it, where a negative pressure removes the air from the liquid, then it is sent to an empty tank when it is ready for being used in the infusion process. The tank is equipped with a specially-shaped diffuser to increase the exchange surface with the vacuumed space. Vacuum is obtained with a specific circuit including vacuum pump, trap-filter, accumulator, valves and vacuum-meter.

The speed of the pump transferring the resin is controlled by a frequency inverter to ensure optimum energy consumption, and is fitted with a magnetic coupling to avoid leakages.

The removal of the gas dissolved in the resin helps in solving a problem that costs a lot to the manufacturers of these giant glass reinforced parts: the presence of large air bubbles and diffused zones of pinholes. In this way the application of the finished parts can provide a concern for the potentially weaker mechanical properties of the interested areas.

A long, intense “search & repair” operation is very common in these factories where dedicated teams identify the defects and fix them with local injection of small quantities of resin or the application of glass reinforced patches in the worst cases.

No air in the resin, no more problems in the blades!

Glued To Last, with the G-System

The equipment package available for the manufacture of aeroel blades grows: the new glue dispenser is now available! Another piece of the puzzle is set at the right place: Cannon target is to become a One-Stop-Shop supplier for the wind blade manufacturers.

Cannon Afros announces the availability of the new G-System dosing machine required to dispense a bi-component Epoxy adhesive on the edges of the half-shells that compose a conventional blade for wind turbines.

Accurate metering precision, uniform dispensing, maintenance friendly design and ease of operation characterize the new dispenser.

The viscosity of the chemical components demanded a special execution of the dosing system, with a dedicated solution to extract the resin from the storage drums, and a double set of pumps.

A static, disposable plastic mixer mounted on the mixing head ensures the perfect blending of resin and hardener and the deposit of a uniform layer of mixed adhesive over the edge of the lower half of the blade.

Mounted on wheels, the machine is designed to be transported around the factory. When the application of the adhesive ends, the upper half of the blade is deposited over the lower edge, and the two parts are perfectly matched and joined. After few hours the aeroel blade is finished, a steady piece of glass-reinforced Epoxy able to withstand for years the power of strong winds.

A perfect application of the adhesive is a fundamental piece of the complex puzzle characterizing this manufacturing process: with this new, dedicated machine Cannon extends the offer of available equipment, confirming their presence on this market as an ideal One-Stop-Shop supplier for the wind blade producers.
Dedicated moulding island for LWRT thermoplastic composites

LWRT (Light Weight Reinforced Thermoplastics) are a category of advanced GMT composites which combine traditional glass mats with one or more layers of textile reinforcements to create sheet-form composites. Several types of continuous filaments (carbon, aramid, thermoplastic polyester) are used for the textile reinforcement, while a Polypropylene (PP) fiber is used as plastic matrix.

Cannon Ergos provides a turn-key solution for the process of LWRT, composed by automated sheet handling, dedicated vertical or horizontal preheating ovens, compression press (with possible automated insertion of decorative foils), moulds, punching and trimming equipment, manipulation systems for the finished products.

The LWRT concept

During the preparation process described above a “fleece” is obtained, that is heated to melt the PP filaments which incorporate the textile filaments in a rather spongy composite that can weigh from 300 up to 2,000 g/m². When, during the parts manufacturing phase, these sheets are heated again, they expand up to three times their original thickness immediately compression moulded under limited pressures, they generate large parts characterised by very high stiffness, strength, and impact resistance. A wide range of densities can be obtained within the same moulded part, allowing for a combination of functions: structural resistance, noise absorption, thermal insulation. Being staked at low pressure, these sheets can be coiled in mould with different aesthetic foils, allowing for a one-step decoration process.

Another unique feature of LWRT vs. conventional GMT or stamped metal is the capacity to vary thickness across the finished part while maintaining the same area weight. The tool design is such that it allows for a different rate of compression over the sheet where a higher thickness is desired, allowing the part to be made thicker on the largest proportion of the moulded product, maintaining an improved local stiffness in thinner, more dense areas where, for instance, the fixation requires higher impact and ductility.

Traditional GMT composites are traditionally used where high stiffness is required for those applications where lightweight stiffness and the possibility to create an aesthetic surface in a one-step process would be beneficial. LWRT composites provide:

• Higher stiffness / weight ratio,
• Part moulding stamping at very low pressures (allowing for one-step decoration with films, fabrics, etc.),
• Possibility to mould very large parts in a single piece or several different parts in a common tool,
• Increased sound absorption and thermal insulation, Capability to vary thickness over the part to provide different stiffness and strength according to local needs.

A dedicated Cannon solution

Cannon Ergos recently supplied to a major producer of automotive plastic parts a turn-key solution for the process of LWRT, for the manufacture of underbody shields.

A typical Cannon working island for LWRT is composed by automated sheet handling, dedicated vertical preheating oven (an horizontal version is also available), compression press with possible automated insertion of decorative foils, multi-cavity mould, punching and trimming equipment and a manipulation system for the finished products.

One six-axes robot is dedicated to transfer the heated material from the oven to the press. This operation must be performed as quickly as possible, in order to maintain the sheet temperature after heating around 200°C. A dedicated hand has been designed, with mechanical grippers that clamp the sheet’s lateral parts.

This gripping system can be also regulated so that the hand can handle 2 different sheet sizes. After picking up the sheet, the robot transfers it in the lower mould half, then in leaves the press area. The press clamps the sheet to shape it. LWRT material can be formed at relative low pressure: a clamping force of 500 Tons is applied for forming and partially cutting the sheet. If the plant includes, downstream, a dedicated trimming solution, the clamping force of the forming press can be reduced.

Post-forming equipment

After the forming press a discharging robot is usually foreseen. Sheet cools down after forming, therefore the hand is fitted with soft vacuum suckers. The discharging robot can put a formed sheet on a discharging table for manual cutting and disposal of the trimmed edge, or serve a cutting unit for an automatic trimming that can be done with a cutting press, water jet cutting unit or other technologies. A cutting press is very effective, therefore the forming press can be designed and built with a reduced clamping force.

Ideal parts for energy-saving requirements

These parts are – today – mostly designed for the transportation industry: several automotive applications are already using LWRT materials for applications like load floors, parcel shelves, sun shades, trim panels, underbody shields, pillars and doors.

By changing the combination of components in the fleece, simply varying the ratio of the various fibers and the way the fleece is subsequently needed, it allows for the fine tuning of numerous mechanical properties to adapt them for a specific application. By increasing the content of glass vs. the PP fibers the resulting part will progressively stiffen.

Higher glass loadings are the most suitable for interior-trim headliners or panels, where lightweight stiffness is a must feature. On the contrary, formulations with less glass are used for applications such as underbody shields, which require higher impact and ductility.

Therefore LWRT parts could be used for several other applications: light structural components, protection casings for machinery and outdoor equipment, large reusable packaging etc.

Cannon Ergos and the Group’s network of local offices welcome enquiries concerning this modern compression moulding technology, assuring maximum cooperation also in the initial stages of the discussion, where the vast experience acquired by Cannon on this subject can be shared with the interested clients.

A major German supplier of plastic car parts has recently installed a dedicated Cannon pre-heating oven for structural-GMT parts near one of their existing presses. An interesting development in the purchase of another pre-heating oven for semi-structural LWRT parts to be compression-moulded with the same presses. These products can be under-motor and under-chassis protections, supports for battery packs, spare wheels housings etc.

A large French Tier 1 supplier to the transportation industry bought in 2012 another Cannon pre-heating oven for their R&D laboratory developing Carbon-based composites. The peculiar physical properties of these reinforcements demanded a special execution, with a layer of glass covering the heating elements to avoid short-circuits caused by Carbon particles floating in that area.

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A wide selection of tools is available. Ask Cannon for the most suitable for your needs!
Bono Sistemi supplied recently a biomass 28 ton/hour superheated steam boiler, main item of a power plant able to generate 6.8 MW electricity burning virgin wood in Fusine, Lombardy - Italy.

The boiler represents for Bono Sistemi a successful example of medium-size biomass thermal plant fully engineered “in house” and manufactured with the key supplies of Bono Energia for boiler parts, Bono Netro for the combustion system and Autorana for the full control system.

A dedicated combustion grid was designed for this application.

The assembly of this 600-ton-weight steam boiler, fired with virgin wood, was carried out at Fusine, in northern Italy.

The plant has been nicknamed “The Ship in the Bottle” due to the difficulties met during the engineering phase first and in the construction on site after, in order to assemble a 600-ton-weight boiler inside an existing 40-years-old concrete factory without modifying any external volume of the plant, as required by the building authorization. A task achieved with a 12-month on-site presence of up to 10 skilled technicians of Bono Sistemi.

Turn-key plants for biomass recycling

The complex assembly line for the M-346 aircraft, manufactured by Cannon for Alenia Aermacchi in Italy in 2011-12, is now in full industrial production.

Alenia Aermacchi’s M-346 in production at full speed - with a Cannon assembly plant

The client
Alenia Aermacchi is the fruit of a merger of the businesses, products, sites and traditions of Alenia Aeronautica and Aermacchi. They manufacture products and systems of superior quality and performance, including proprietary designs like the C-27J airlifter and M-346 advanced trainer, playing key roles in world-class programs like Eurofighter Typhoon, the F-35 Joint Strike Fighter and the Neuron European UCAV demonstrator. Alenia Aermacchi also has a major role in commercial aircraft, designing and building advanced aerostatic structures for state of the art airliners, developing the new generation Superjet regional and building the market-leading ATR turbosjets.

A sophisticated product
Alenia Aermacchi produces in Venegono, northern Italy, the twin-turbofan M-346 aircraft. This is the most advanced lead-in fighter trainer flying today, ordered, so far, by the Air Forces of Italy and Singapore.

A dedicated assembly line
A large number of components must be brought together, with geometric precisions in the order of few hundreds of a millimetre, in an up scaled version of the well-known assembly line commonly used in the automotive industry. In this 100 metre long line they build the three sections of the aircraft – front, central and rear – that are then assembled in a dedicated area nearby. The displacement of the sections is performed by an AGV (Automatically Guided Vehicle) that, commanded by the central computer, picks on request the tools and brings them to the next station or, at the end of a sequence of operations, to the marry-up area.

Why choosing Cannon?
Examining various potential suppliers they noticed at Cannon an interesting concept for the handling of wide, heavy insulated panels throughout a large assembly hall, making use of AGV. After a long definition of the scope of supply, a contract was signed with Cannon. The client knew what they wanted and they designed it, Cannon brought in the know-how related with all the movements and all the logic controls. The erection took several months, mostly spent in ensuring an absolute positioning precision between the various stations. The final result is quite impressive: the Cannon line covers 100x16 meters, reaching 10 meters of height. The parts flow from one working station to the next – there are two for the rear, five for the fuselage and two for the front – with the specified precision and timing. This plant does exactly what was expected, and the electronic control designed and programmed by Cannon Autorana helps greatly in setting all the operative parameters and in saving all the production data, for an accurate and reliable certification of the produced quality.
Cannon is now able to supply top-quality moulds for any type of plastics and Composites processing: DMC, a mould-maker with more than 50 years of experience in various fields of plastics processing, has recently joined the Cannon Group to complete the range of the available technological packages for the plastics and Composites processors. DMC now works in strict cooperation with the new Cannon Ergos company: the synergy between the moulds and the processing plants of the new engineering company of Cannon will promptly reflect into a much easier contact with the final users, a more streamlined flow of information - and a single interface for the customer - when dealing with a complex moulding project.

A long passion for moulds
Based in Carate Brianza, north of Milano, Italy, DMC designs and manufactures moulds since 1962. Started by Angelo Colombro as a mould making shop for foundry in aluminium and cast iron, the company soon approached the Polyurethane technology contributing to the success of a famous supplier of automotive interiors and body parts, Masserini, founded in the nearby Renate Brianza. For almost 30 years DMC supplied increasingly complex moulds for fibreglass, integral skin, semi-rigid, compact and reinforced Polyurethanes to Marchi, at that time a preferred supplier of Alfa Romeo, Fiat, Ferrari, Maserati, Opel, GM and other famous car manufacturer. Their mould-making experience expanded to a wider range of plastics processes, including injection moulding, thermoforming (clastic and twin-shot) blow-moulding, compression moulding of thermosets and thermoplastics, RTM, FRP, fibres preforming (glass, carbon, aramides). If needed, they also supply tools for injection moulding, resin moulds for prototype parts, Blow moulding, Aluminium die-casting and metal foundry. Following the customer step by step, helping him to choose the best procedure for each phase of their process, to reach the final objective timely and with the best quality: this has been the company philosophy since the beginning.

Up-to date with the progress of technology
Today - led by Marco Colombro, the founder’s son - DMC employs 12 skilled mould-making specialists; some of them are still able to manually reproduce any sort of three-dimensional object and render it in wood, resin, resin-reinforced polyester or other material – as it happened when they had to supply a giant wooden Mickey Mouse to the Italian headquarters of Walt Disney Corp.

Equally divided between CAD designing, CAM modelling and workshop, their specialists approach every order with a long-practised team approach, in order to minimise possible inefficiencies deriving from a lack of communication in the engineering phase of each project. Either starting from a 3D CAD drawing of the customer’s part or from a physical sample – digitising it in this case with a reverse engineering CAD system, the designers prepare a CAD project of the new mould, test it with finite elements probing sofware, convert the final result with a CAM module into a sequence of operating machine operations and execute them on six numerically controlled 5-axis machining islands, where finally the mould takes shape out of a block of metal. As Michael Angel said, the masterpiece is already inside, you simply must take it out from the raw stone! When the machine ends its work, the man starts the manual finishing, bringing to shining perfection the surface of the mould and fitting all the hydraulic, pneumatic and electric controls required to move the various parts. Completely designed and assembled in-house, these peripheral equipment are fundamental to ensure the smoothest operation of the mould during its movements and when demoulding a finished part.

Not only moulds...
A long tradition of 360° service to their customers has lead DMC to supply a complete set of ancillary components to the users of their production tools:
• prototyping moulds in various resins or light alloys,
• trimming and punching tools,
• measuring stations that simulate the assembly of the moulded part on the body of a vehicle in the assembly line,
• service trolleys to hold the moulded parts during the cooling phase, or to handle them under a water-jet trimming unit, or
• control templates used for mould testing and fine tuning,
• gripping hands for robots and handling systems for manipulators.

A reliable and structured supplier
DMC is able today to supply moulds and models as large as 4,000 x 1,800 x 800 mm, made in various Aluminium and steel alloys, expanded and compact resins, Epoxy-glass fiber laminated Composites, up to the use of Titanium if needed. Their moulds are mostly used for interior and exterior automotive parts, refrigerator inner liners, large technical parts, furniture, tractors and earth-moving machines, housings for medical applications, exhibition make-ups for bike and automotive sectors, crash helmets for different sports.

A new Cannon Company!
DMC joined Cannon in 2012, allowing the Group to complete their range of plastics processing solutions. Working in strict cooperation with the new Cannon Ergos company - dedicated to the supply of turn-key plants - DMC provides the right tool to guarantee a much easier contact with the final user of Cannon technologies. A simplified flow of information - and a single interface - is now possible when dealing with Cannon a complex moulding project.
News from Cannon World

Cannon Inaugurates A New Factory for Turn-key Plants

A new Cannon factory, designed for the assembly of large manufacturing plants for Polyurethane and Composites technologies, has been completed in December 2012 and is now in full operation in Caronno Pertusella, north of Milan, Italy. The new facility allows for the simultaneous assembly of large moulding lines for automotive parts and long foam laminators for insulated panels, increasing the efficiency of the newly created Cannon Ergos, the Group’s unit dedicated to the construction of turn-key plants.

Cannon implemented last year a reorganisation of their manufacturing centers specialised in Automotive, Refrigeration, Composites, Aluminium Die-casting and Thermofoaming: the new Cannon Ergos incorporates today the activities, assets and personnel of the existing Tecno, Crios, T.C.S. and Forma companies. Cannon problem-solving approach has significantly increased, in the recent years, the acquisition of complex projects for turn-key plants. These Cannon installations are fully manufactured and mounted in-house for final testing, before being shipped to the final site of installation: this philosophy requires wide manufacturing halls, simultaneous presence of different technical specialists and proper logistics and IT resources.

The structural change deriving from the creation of Cannon Ergos included the decision of building a new manufacturing hall able to host under the same roof the assembly of different types of large, complete manufacturing equipment.

Exploiting a large plot of land available in the existing premises of Caronno Pertusella, north of Milan, Italy – hosting the headquarters of the new company – Cannon commissioned a 3,000 sqm, 12 meter high factory able to host the simultaneous construction of several different types of equipment for different final markets and final applications.

The existing office building has been fully restructured and extended, to accommodate a unified engineering department, manufacturing, marketing and sales, finance, logistics and management staff.

More than 5,600 sqm of workshop and 1,000 sqm of offices are now dedicated to the manufacture of automotive plants for seats and sound-insulation elements, compression moulding and RTM presses for Composites, rigid foam laminators for sandwich panels, large industrial thermoformers.

The new factory was officially inaugurated during a Christmas Party held on December 21, 2012. Carlo Fiororentini, Cannon Group President (right), and Marco Volpato, Managing Director (left), cut the traditional ribbon and presented the new investment to the Cannon Ergos staff, gathered there with their families to exchange good wishes for the coming year.

The new factory of Cannon Ergos can host the simultaneous construction of several types of equipment for different markets and applications.

Cannon Inaugurates A New Factory for Turn-key Plants

Landing In Russia With Thermal Plants and Water Treatment

The special equipment divisions of Bono Energia and Bono Artes are ready to serve the Russian Market on the field. Cannon strongly believes in the potential of the Russian market, both as an outlet for its products and as a reference point for starting new commercial actions in other members of the CIS (Commonwealth of Independent States). In particular, Russian abundance of oil and natural gas and the expansion of attractive sectors such as power generation and ecology, make this market characterized by a fast growing rate in replacement and new installations and by an increasing awareness of environmental issues, energy efficiency and request of services - desirable for our companies with more than 50 years’ experience.

After several years of activity in that market with good results, which have allowed Bono to have several plants installed and operating in this area, the Cannon Group decided to increase the structure of Cannon Eurasia in Moscow by adding a qualified team dedicated to Bono solutions, specialized in the promotion of technologies of ‘avant-garde’ and mainly working in order to make available to the stakeholders all the information concerning new opportunities and technical solutions that Bono is able to offer. The highly qualified technical personnel is also prepared to perform all pre-sales and post sales procedures, including installation, start-up service and maintenance.

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Another V.A.I. plant for Chinese Refrigerators

Cannon is proud to announce that another major leader in refrigerator manufacture has installed a Cannon foaming plant for refrigerators based on the Vacuum Assisted Injection (V.A.I.).

A foaming technology co-developed with Dow Europe, which developed the PASCAL™ formulations for it, the V.A.I. solution provides numerous advantages in terms of cycle time, savings in chemicals, optimum insulation properties.

Cannon’s Piero Corradi (below) presenting the Cannon V.A.I. technology during the official launch of Meiling’s Athena new models, in Hefei on November 29, 2012 (right).

Haiier pioneered this vacuum-assisted foaming method when they installed the first plant in Chongqing, China, in 2011.

In 2012 Meiling, another major Chinese manufacturer of domestic appliances, purchased from Cannon a complete foaming line which was announced to the market with a major presentation held in Hefei on November 20, 2012.

The advantages deriving from the new available V.A.I./PASCAL technology have been quickly exploited by the two major Chinese manufacturers and converted in immediate money-savings for thousands of customers of their top-of-the-range refrigerator models!

Meet Us @...

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- Italy
- Russia
- Austria
- Spain
- Canada
- USA