



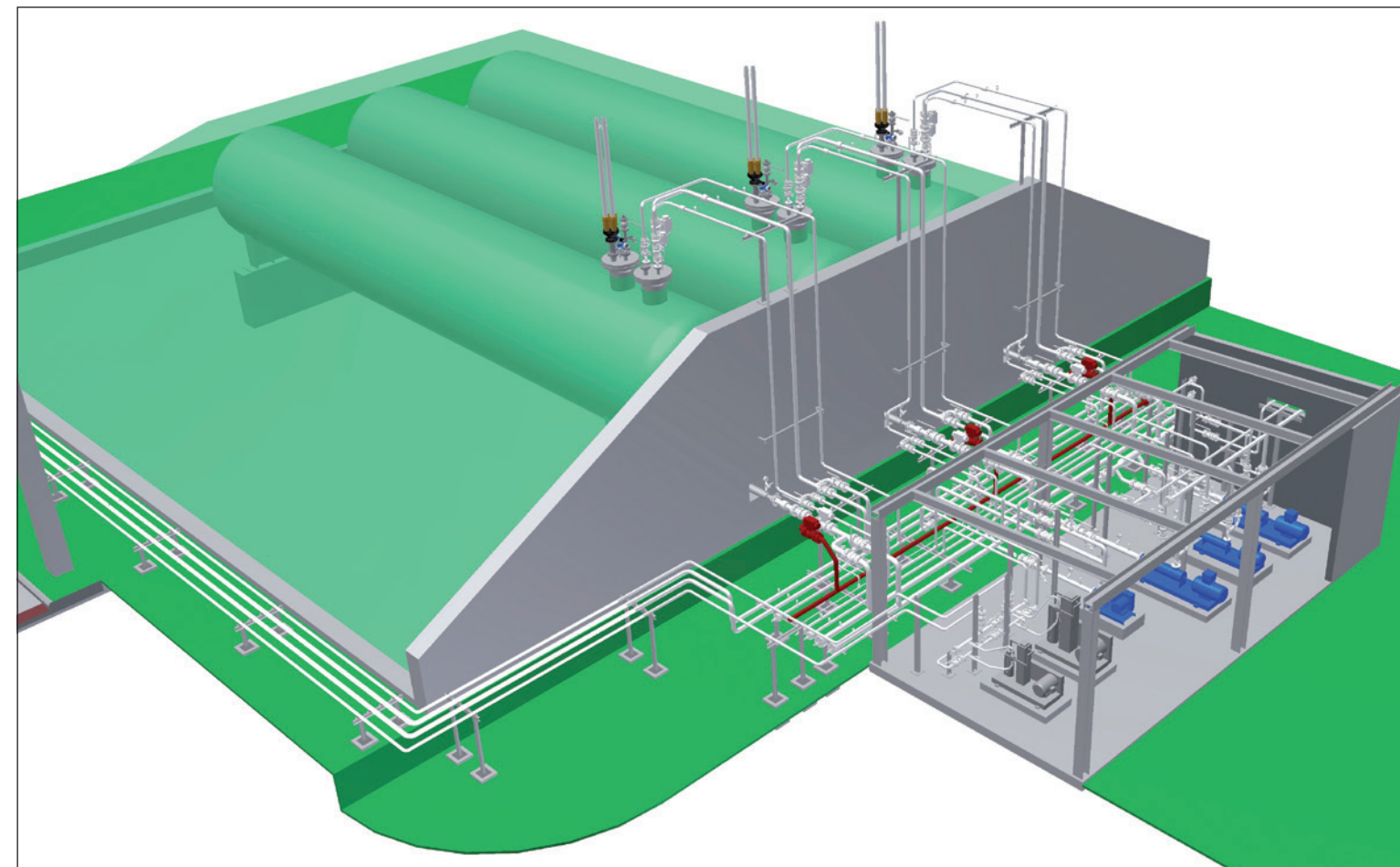
There is not much that can match up to years of experience – theories, studies, FEED (Front End Engineering & Design), etc. often fall short in all three EPC phases (Engineering, Procurement & Construction) so it becomes necessary to call on niche specialists.

Project Director and Group General Sales Manager give an example where a globally recognised engineering company could not get a filling plant to function and consequently contacted MAKEEN Energy (today known as MAKEEN Energy (ME)). A specialist was sent to the site, the problem was quickly identified and the plant was in operation within two days. “It’s not at all strange that the large, well-reputed engineering companies do not have the needed specialist knowledge ... if they did, they would then have to know everything about everything”, says Project Director.

Specialist knowledge

Over the past 60 years, ME has specialised in the gas industry. In addition to being a supplier of equipment and systems, we are also involved in the operation of plants via facility management contracts. For example, in Portugal we are responsible for the operation of a plant filling 7.5 million cylinders per year. Thus, we are indirectly one of the biggest gas fillers in Europe.

Consequently, ME is able to assist the large engineering and EPC companies with delivery of the best and most competitive solution. “Our experience is both broad and deep and stretches across engineering, production and procurement to construc-



tion, initialisation, onsite services and operation. With this broad spectrum, we can stand as a guarantor that things will be done right the first time”, explains General Sales Manager.

MAKEEN Energy’s DNA is generated based on the needs of the gas industry. ME supplies what the customer needs. More specifically, this means that ME clarifies, through dialogue and a relationship to the customer, the needs of the customer, and offer a customised turnkey project where quality and price are in balance.

Everything ‘within the fence’

Experience from daily work and from the operation of every-

thing ‘within the fence’ is the secret behind the special competencies. General Sales Manager explains: “It sounds easy but when you work within a potentially explosive environment, there are many disciplines that need to be mastered and many parameters that need to be considered”.

“We have the expertise within this special field and with working in the dangerous environment”. For the very large projects, ME’s own production of equipment is often a minor part of the overall project. But since our expertise stretches much further than our own production, some of the world’s biggest and best engineering companies, such as Atkins, make use

of ME to design the ‘gas section’ of their project.

Right the first time

“We analyse the situation and propose to the customer the design we know fulfils his needs to the letter”, states Project Director and emphasises an example from a customer who wanted two large tanks. After thorough dialogue it proved, however, that he only needed two smaller tanks but more trucks due to the distance to the refinery. “This is an example of the kind of ‘hands on’ advice we can provide because we are used to taking a look at the operation and quite simply, we get closer to the goal with the first shot”.

If you imagine that a turnkey project is built up of many different LEGO blocks, then ME is the company that uses the correct LEGO blocks; meaning that we draw on the best sub-contractors and partners around the world and ensure that the blocks are placed on the right places and connect them so they function the first time.

“We have done this many times before. We know what it should look like and have references of repute to refer to”, adds General Sales Manager.

Appropriate engineering

In general, all engineering companies need to show that they know and understand how to use the latest technology. Their primary focus is not on the connection between price and technology – they have a tendency to favour advanced technical solutions. Then there’s the fact that they have a tradition of using many resources on FEED and final detailed engineering – those are their ‘products’, of course. “When it’s a matter of an LPG filling plant, this can sometimes result in you ‘shooting sparrows with cannons’”, explain the two experienced colleagues.

“If we put these engineering companies’ projects at index 100, then in many instances ME would be able to deliver the project all the way down to index 60-70”, explains Project Director – mind you, without compromising on quality and safety.

ME’s working method is more direct and often includes FEED and a minimum of preliminary studies. At ME this is called ‘appropriate engineering’. “We can do this because we focus on and

are specialists within the LPG industry. Plus we have many years of experience behind us. We have the necessary ‘tools’ in our toolbox and the components on the shelves. This means that we have a standard programme that we are familiar with, how it should all be combined to hit the right level, in what relates to price, functionality, quality, safety, the first time round”.

Reduce the costs of your project

Our advice is: Skip the large engineering companies, go direct and avoid significant, unnecessary project costs. In comparison to these global companies, ME is a relatively small fellow player, but with close relations to the best people in the industry, and with 17 hubs worldwide, we are used to working under local conditions and to comply with local standards.

“We would like more direct dialogue with the customer”, says General Sales Manager and he points out that dialogue is important because ME is not just about consulting: “It is just as much our obligation that the customers feel secure all the way up to and including initialisation”.

KOTC in Kuwait The plant of the century

KOTC (Kuwait Oil Tanker Company) in Kuwait is building the world's most modern, fully automatic filling plant in the middle of the desert, at Umm Al Aish, north of Kuwait City. The opening is planned for 1 March 2013.

It all began in 2007, when KOTC decided to build 'The Plant of the Future', to relieve the pressure on the facility at Mina Abdullah. KOTC's requirement was simply that the future LPG facility should be the world's most advanced.

Mouchel, the international consultant engineers were responsible for developing the tender material and they left the design of the gas filling facility to a French company which was to prepare the technical specifications for a classical facility. However, they ran into space and lo-

gistics problems, because the requirements for the site demanded many different facilities such as administration buildings, social buildings, a covered parking area, tank storage, workshops and two filling halls with constant gas deliveries by road tanker from the refinery.

FLEXSPEED solves space and logistics challenges

This was in 2008, and ME's *FLEXSPEED*, the world's most advanced high capacity filling system had just been introduced onto the market. ME France was invited to come and inspect the new product. Using a *FLEXSPEED* solution, they designed a facility with greater capacity on a smaller site than would have

been possible with a traditional solution.

This brought about an alternative option in the tender and *FLEXSPEED* was included in the tender. In 2010, Project Director for ME Denmark and General Manager for ME France and Business Unit Manager for Europe, Middle East & Africa, were involved in making an offer to five main contractors, of whom the South Korean company Hanwha ultimately won the contract. In the spring of 2011, ME signed a contract with Hanwha for the delivery of two complete filling halls which included the *FLEXSPEED* technology.

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|---|--|---|
| 01 SECURITY GATE HOUSE | 08 MAIN CONTROL ROOM | 18 SUBSTATION/GENERATOR ROOM |
| 02 MANAGEMENT/ADMINISTRATION AND TECHNICAL BUILDING | 09 12/25 KG FULL PALLET SHED | 19 SECURITY GATE HOUSE |
| 03 MOSQUE | 11 LPG FILLING AREA | 20 ADMINISTRATION/SOCIAL BUILDING |
| 04 SOCIAL BUILDING | 12 LPG MOUNDED STORAGE TANKS FARM | 21 AIR COMPRESSOR ROOM |
| 05 WAREHOUSE | 13 LOADING/UNLOADING STATION WITH WEIGHT BRIDGES | 22 CAR PARKING AREA |
| 06 MECHANICAL/ELECTRICAL MAINTENANCE WORKSHOP / SHOTBLASTING/PAINTING AREA / TRUCK MAINTENANCE WORKSHOP / PALLET REPAIR/PAINTING WORKSHOP | 14 TRAILER PARKING SHED | 23 MANAGEMENT CAR PARKING |
| 07 UNDERGROUND WATER TANK/ PUMP ROOM | 15 TRUCK WASHING STATION | 24 WATCH TOWER |
| | 16 GASOLINE STATION | 25 MAIN LPG PLANT FENCE |
| | 17 PRIVATE LPG FILLING AND MAINTENANCE PLANT | 26 MAIN LPG PLANT EMERGENCY ESCAPE GATES |
| | | 27 PRIVATE LPG PLANT EMERGENCY ESCAPE GATES |
| | | 28 OVERHEAD WATER TANK |
| | | 29 LPG PUMP ROOM |
| | | 30 PRIVATE LPG FILLING CENTER 12/25 KG FULL PALLET SHED |
| | | 31 SLABS ON GRADE UNDER VEHICULAR TRAFFIC |



RFID technology controls filling plant and complete distribution centre

Every aspect has been covered: Complete video monitoring of the entire site, night vision cameras, anti-intruder fences – the entire plant is the first in the world that is completely automated and only manned in certain places. However, the great difference, no larger than a fingertip, is the RFID tag. The technology is well-known in, for example, the post and courier service, where it is used for tracing letters and packages and also for automatic payment on toll bridges. This technology will also control the KOTC facility, from consumer to filling facility.

"It's really operator-friendly and has a high degree of safety", says Project Director. ME has already helped develop software interfaces to work with the advanced data base system.

"Obviously, KOTC will want to trace their cylinders. This has also got to do with safety, as they

will no longer read off the cylinders manually", General Manager for ME France and Business Unit Manager for Europe, Middle East & Africa continues. He also notes that it will moreover benefit the manufacturer, for example when it's necessary to find out when individual cylinders are due for requalification/pressure testing.

High safety level

In accordance with safety regulations, all LPG cylinders must be pressure checked, usually every ten years. This is obligatory. There is a stamp inside the cylinder that can easily get painted over a number of times so it becomes difficult to find and read. This is time consuming and requires a lot of employees. With RFID, all cylinders are registered in a large data base using a microchip.

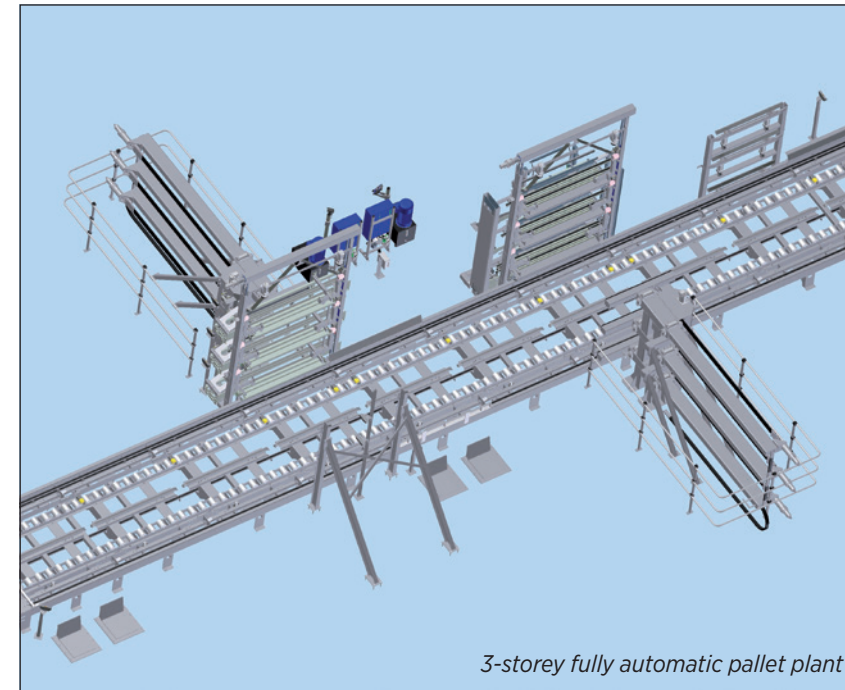
The cylinder's 'identity' is registered in the data base by production year, tare, supplier and last inspection date. "As already mentioned, the RFID system is well-known and now we're de-

veloping it to control a filling facility, as well as an entire distribution centre. Trucks are tagged, pallets are tagged, even the end user is tagged", says General Manager for ME France and Business Unit Manager for Europe, Middle East & Africa.

3D studies show timing

3D studies in real time of an output of 7,200 household cylinders and 1,400 industrial cylinders helped logistics reach new heights. Project Director explains: "We made a 3D simulation – a film of a forklift truck driver's work rhythm and timing. The study showed quite clearly that the timing was realistic. This gave KOTC confidence in the project and convinced them that their forklifts and trucks could both feed the facility and load from it again".

The KOTC plant is a high capacity facility, designed to function optimally in one of the hottest countries in the world, in the middle of the desert, where sandstorms are common. This



3-storey fully automatic pallet plant

requires training of personnel, professional service and maintenance, of which ME has strong competencies and great experience in all areas.

As well as specialists and technical competencies, this ambitious project also requires a solid base of practical experience. According to the MAKEEN Energy Group is guarantor for this: "The construction of the KOTC filling facility has been teamwork. All of ME France and ME Denmark have worked very closely together throughout the project. A large number of technicians within ME France have maintained a good relationship with KOTC, as we have been regular suppliers for the company throughout many years. We obviously benefit from this experience, and it has really strengthened our teamwork".

The size and extent of the KOTC project has also activated ME's extensive network of subcontractors worldwide.

Two complete filling and maintenance halls

ME's share of the total project comprises two complete filling and maintenance halls – including electrical installation and pipe laying – for 12 and 25 kg LPG cylinders.

The large hall has two fully automatic *FLEXSPEED* filling lines for 12 kg cylinders. On each filling line, there is a 3-storey pallet plant, a *FLEXSPEED* carousel with 72 filling posts and equipment for capping, cap shrinking, leak detection, weight adjustment, and check weighing. In addition, there is a filling line for 25 kg cylinders with a pallet system, a filling carousel with 45 filling machines, and equipment for sleeve shrinking, leak detection, weight adjustment, and check weighing. On all three filling lines there is equipment for detection of defective shrouds and valve seals.

Each *FLEXSPEED* filling line has a capacity of 3,600 domestic cylinders per hour. The filling line for 25 kg industrial cylinders has a capacity of 1,400 cylinders per hour.

The large maintenance area for both 12 and 25 kg cylinders includes equipment for pad printing, tare weight marking, painting, washing, valve changing, shroud straightening, foot ring straightening, valve screwing, valve greasing, testing date marking, thread cleaning, pressure testing, tagging, check weighing, valve seal detection, and palletisation.

Private Centre

In the other hall, called the 'Private Centre', there is traditional filling equipment for 1-2-3-5-12-20-25 kg cylinders.

In Kuwait, there are a number of companies such as market gardens and supermarkets that own their own cylinders, so KOTC needs to be able to handle customised cylinders in relatively small quantities, quickly and effectively.

Customers usually arrive at the Private Centre with around 20 LPG cylinders, of which perhaps 10 have centre valves and 10 have screw valves. What is special about the Private Centre is that each customer almost always has to have the same mix of cylinders with them again. This is possible because the cylinders are automatically delivered to a collection bay where they are sorted into the various categories. When the truck is empty, the driver (or an operator) orders matching cylinders. The service time from delivery of 20 empty cylinders to loading 20 filled cylinders is estimated to be around half an hour.



Protection of LPG tanks A rock solid solution

If you google 'LPG explosion', you get already with the first hit a strong impression of how bad things can go by looking at authentic and dramatic films of metre-high shooting flames and metal objects that fly though the air. A BLEVE (Boiling Liquid Expanding Vapour Explosion) can have major, serious consequences because parts of the tank become sharp missiles when they are blasted out in an explosion.

This kind of accident – and perhaps especially the tragic accident in Mexico in 1986 – has lead to a revision and tightening up of the EU safety standards, which has been supported by the French authorities' increased focus on safety around filling plants and gas tanks. In 2001, the tightening of these standards took Butagaz in France into the development of a rock solid alternative: protection of the storage tanks with a concrete wall.

The solution has proved to be ingenious in every way: it is financially sound, it eases the inspection and maintenance work on the tanks and most of all, it is safe. Instead of tearing down old tank installations and, for example, burying them underground, which at one time was the most natural solution, it is now possible to let the tanks stand where they are and build a protective concrete wall around them.

This type of tank protection can withstand all types of attacks and impacts, be they mechanical, seismic, thermal or internal and external excess pressure.

“Protection with a concrete wall may sound like an ordinary and very simple solution, but when it's about LPG“, explains General

The tank protection solution with a concrete wall will result in savings of up to 20-25% on the investment compared to the project engineering of, e.g. mounded tanks.

Manager for ME France and Business Unit Manager for Europe, Middle East & Africa, who has had a good cooperation with Butagaz for many years. He continues: “Beyond the concept of the concrete wall itself, and in order to prevent residual risk around the tank, additional associated facilities are needed like,

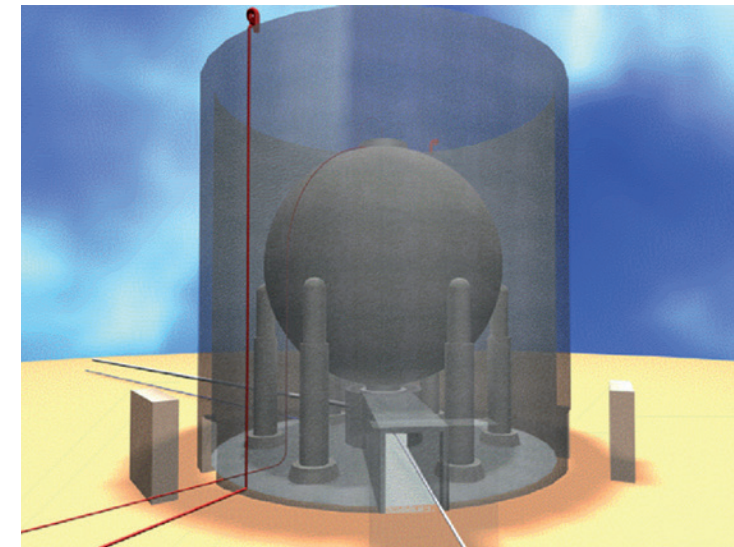
- Cancellation of the risk from jet fire impacting the tank (no flange on the LPG piping around the tank and installation of deflectors on the first set of upper flanges)
- Protection of the tank against thermal attack at the bottom of the sphere (building of a tunnel filled with inert material inte-

- grating the whole fittings)
- Optimal cooling of the tank (fire fighting by zenithal deluge system automatically rescued by 'Akron' guns pre-orientated on site and azimuth)“

Butagaz's goal was ambitious from the outset: they wanted to find an innovative and financial solution that matched the demands from modern LPG businesses and a solution that was better and safer than traditional solutions in the form of mounded tanks, for example.

Safety requirements are becoming greater and greater

For the past 20 to 25 years there has been significant focus on minimising the risk of, among other things, BLEVE accidents. Recently, all tank owners in the EU have been instructed to protect tanks above the ground against thermal or mechanical aggression in order to secure ex-



posed and vulnerable tanks against possible impacts.

The concrete wall is designed to be able to withstand a 700 kg wrecking ball that impacts at a speed of 80 meters per second and to withstand an external pressure of 500 mbar.

At worldwide level, companies within the industry have worked on solution models, which at the end of the 1980s put mounded tanks in the game.

Mounded tanks function primarily as protection of new tanks because the majority of the existing tanks are not dimensioned to be covered by soil. Then, in spite of passive protection (special paint and application) and active protection (cathodic protection, completed eventually by continuous acoustic monitoring), there is the risk of corrosion damages because visual inspection is expensive and hard to gain access to. Today, this makes the solution a cost-heavy choice since there is a requirement that all tanks must be inspected and maintained every tenth year.

Other solutions have been in play, for instance, with protection by using nitrogen and installations similar to swimming pools. But they have all been risky or difficult to implement in practice.

The concrete wall meets authorities' requirements

In 2005, Butagaz was able to reveal the optimal protection solution; the first and only of its kind in the world which met the EU standards and the French authorities' requirements.

The solution is already implemented in France, which should help to ease the work in achieving local approval in other places.

“A long-standing cooperation underlies the relationship between URG/Butagaz and PAM/ME France. We have delivered filling equipment to Butagaz through all the years and we have followed each other closely in relation to developments in the industry“. Therefore, according to General Manager for ME France and Business Unit Manager for Europe, Middle East & Africa, it was quite

natural for Butagaz to begin dialogue with ME about spreading the concept at a national level and onto new markets.

Creates a secure and safe local environment

In December 2009, ME France acquired the rights to use the Butagaz's tank protection solution with all necessary support and involvement from Butagaz. Butagaz has already executed several projects in order to secure and protect old LPG tanks in France. But outside of the LPG industry, the solution is also in demand as protection of both old and new tanks at, for example, refineries and chemical plants.

A study on the causes of a large number of LPG accidents has shown that 60% of these accidents could have been entirely avoided with this type of tank protection. In 40% of the cases, the accident would have been considerably smaller.

“The interest in the strong and resistant concrete wall is not just concentrated in France. We have received enquiries from the rest of Europe and West Africa and we are currently working on several tanks projects, including protection, for LPG and other explosive gases“, tells General Manager for ME France and Business Unit Manager for Europe, Middle East & Africa and continues: “Our mission is to become a total partner with solutions for even more areas within the LPG value chain. With the LPG concrete protection wall, we are upstream in the chain but it doesn't stop there. We want to offer protection of all kinds of tanks and, in so doing, create a secure and safe environment around a LPG plant“.

Protecting LPG cylinders against rust in the rainforest



It is a fundamental philosophy in MAKEEN Energy that we stand by our customers whenever they have an LPG-related problem. Having worked in most corners of the world, we have learned to lay aside conventional thinking, draw on previous experience and knowledge and to view things from different angles. This ability came in handy once again, when a customer in Suriname had trouble with rusting cylinders due to the extreme climate conditions in the country.

The heat is overwhelming in Suriname, and the air is very humid. With two rainy seasons a year, there is literally water everywhere – on the ground, in the air and from above. As most domestic LPG cylinders are placed on the ground outside the houses, they are continuously exposed to the abrasion of the relentless climate. Humidity is very corrosive, and it is quite a task to protect the cylinders against rust.

About 80% of Suriname is covered by pristine rainforest, so the population of about half a million people primarily lives in the

coastal area. Aside from a simple filling station located in a small coastal town, Suriname has but one LPG plant to cover the entire country. This main filling plant is located on the coast as well, near the capital Paramaribo. The state-owned plant was built in the end of the seventies with filling and maintenance equipment from MAKEEN Energy.

The maintenance procedure performed at the plant in Paramaribo includes stripping off the paint (shot-blasting process) and pressure testing the cylinders, after which they are painted again.

And here was the problem. 'We were quite aware that we had a paint problem, as the rust kept creeping in underneath the paint. We'd tried to fight it – changed the procedure, used a different paint. But none of the solutions we'd come up with was good enough', explains Edward Gessel, LPG Operations Manager at N.V. Energiebedrijven Suriname.

Teamwork across the Atlantic

After having the filling system upgraded from mechanical to electronic, the maintenance line was due for an upgrade, and in this connection Edward Gessel wanted to find a solution to the problem with the rusting cylinders as well. When faced with this complex task, the local MAKEEN Energy sales force from ME Americas, Business Unit Manager and Deputy Business Unit Manager, called for assistance from ME Denmark. A team

of experienced and innovative trouble-shooters from both sides of the Atlantic was put together for the project, and they came up with a truly creative solution.

Wet paint or powder?

The wet paint previously used contained zinc as the anti-corrosion agent, which worked fine. However, this paint was rather thick and had been applied by hand, the coating coming out looking lumpy and uneven. On top of this, the process required an excessive amount of paint which was quite expensive.

An alternative to the wet paint would be powder paint, which always does a nice job, as it comes out good-looking and even. But as it is, powder paint contains less anti-corrosion agents than wet paint. Consequently, the dilemma was this: Wet paint was required for its ability to prevent rust and powder paint was required for its ability to make the cylinders look good.

Taking the best from two worlds

It seemed that there was only one thing to do: take the best from two worlds by mixing the two. However, the very idea was

unnatural as it required the mixing of two very different processes in one and the same operation, but MAKEEN Energy's ability to think out of the box made it happen after all.

The new painting procedure first takes the cylinders through a wet paint system. Then they are allowed to vaporise a little before continuing through the powder paint system and from there to a heat zone of 190°C, which makes the powdered layer melt and become all plastic-like. The joint effect of the 'plastic coating' and the rust-preventing primer seals the surface of the cylinders and protects them effectively.

Innovative and tailor-made

Of course quite a few tests of the paint was required before the goal was achieved – of the kind of paint most suitable, the quantity per cylinder, the viscosity, the ratio between wet and powder, etc. As this solution had never been tried before, there was no previous experience to draw on. The final adjustments were made in June 2010; the paint was thinned a little and mixed in smaller portions to reduce the time it had to stay in the pot. In climates as hot as in Suriname,



Edward Gessel
LPG Operations
Manager
N.V. Energiebedrijven
Suriname

there is a high degree of evaporation, which reduces the pot-life of the paint.

Edward Gessel was thrilled: 'It has been a great process with a truly fantastic result. This is a completely new way of doing things that has never been tried before, so we couldn't really be sure that it would work. But it did, and I never really doubted it. MAKEEN Energy are very committed to their customers, and they don't budge until they've found a solution. As they work all over the world, they see a lot of things and deal with many different kinds of problems. And they're very good at using all their knowledge and experience to find new ways. It's like they're picking up things from here and there and putting them together in the light of the new problem, when they're in virgin territory. It has definitely worked for us, and I'm extremely pleased with what they've come up with'.

The next project between N.V. Energiebedrijven Suriname and MAKEEN Energy may well be the installation of a new shot-blasting system. The plant's old shot-blaster from the seventies was not replaced this time and in a couple of years from now, when it is time for the new double-layered paint to come off, a somewhat tougher machine will be required. But that is then. This is now, and everything is working perfectly.



Mounded storage of nearly 500 m³ LPG



Vincent Baudrillard
Managing Director
STOGAZ

Stogaz has two filling plants in France. One in Macon and one in Marignane near Marseille, plus several depots – one of which is in La Motte, a small city located between Draguignan and Le Muy in the south east of France. The first step in what was later to be referred to as the La Motte project, came as a request from the state of France that the risk in connection with storage of LPG be reduced. This was in 2004. After years of careful exploration and debate of the possible solutions, a final contract for the project was signed by Stogaz and MAKEEN Energy in 2009, and the work of getting a new giant tank in place could begin.

Already back in 2004, Stogaz had assessed that the best solution would be to replace the LPG storage tank above ground with one embedded in a concrete 'sarcophagus'. As it turned out, this initial assessment didn't change over the next five years.

From machinery supplier to main contractor

The first actual meeting between Stogaz and MAKEEN Energy

MAKEEN Energy were only machinery suppliers, although we had actually worked with them before. First when they replaced a filling carousel at our plant in Macon, then when they supplied a lot of different equipment to our plant in Marignane. This was between 2005 and 2008. What we didn't know was that they did all the other things as well – i.e. civil works, instrumentation, piping, electricity, etc. When we re-

alized our mistake, everything around the La Motte project became a lot easier, because it meant that we could leave it all with one contractor. With MAKEEN Energy at the helm, we didn't have to worry about the subcontractors'.

took place in the end of 2008, where the opening talk was only concerned with part of the project – all due to a misunderstanding, remembers Managing Director Vincent Baudrillard from Stogaz: 'We wrongly thought that

An experienced team

The project was redefined as a turnkey project with ME France as the sole contractor and MAKEEN Energy's project manager on the La Motte project, knew exactly how to put together the perfect team for the job: 'We had supplied another project very much like this one a couple of years before, for Camping Gaz at Saint Genis Laval, and the team of engineers and technicians, we used at that time, was both highly skilled and very knowledgeable about the newest technology. They would know exactly what to do, when and how, so there was no question about their qualifications. This was the team we were going to put together for the La Motte project too'.

age of water, etc. The tank would be sailed from Italy (port of Venice) to the port of Saint Raphaël in France. It was also MAKEEN Energy's responsibility to get it the rest of the way to La Motte. This, however, turned out to be quite a challenge. Just getting the 417 m³ tank, which weighed a whopping 80 tons, off the freighter and onto the road to La Motte was difficult, and MAKEEN Energy ended up having to bring in a gigantic 700 tons crane to do the job.

2010: Project accomplished

By April 2010, the tank was finally in place in its concrete embedding, and the piping, the instruments, the alarm and electricity and everything else were pre-

Smooth cooperation

Evaluating the cooperation with MAKEEN Energy, Vincent Baudrillard is very pleased. 'We never had any problems at all – not even when the weather conditions seemed to conspire against us. The MAKEEN Energy team was very professional and competent all the way through. There was a ME man stationed on site all day every day to manage and survey all operations and to supervise the subcontractors. Eleven companies were involved in the project some way or other, so in terms of logistics it was quite a task to keep people and work procedures from getting in each others' way. And we

The transportation of a giant

In the beginning of 2009, ME France and Stogaz signed a contract worth EUR 2.4 million. MAKEEN Energy was to supply all hardware – including the tank itself – plus all the connecting services such as piping, electricity, alarm, all instrumentation, drain-

pared. In spite of a couple of weeks' total chaos due to incessant rain, muddy roads and lack of electricity and water and all other necessities, everything was ready on time. As much as 900 tons of concrete was needed to embed the huge tank, and it took 40 days to erect it on site. By the end of June it was fully covered.

had the standards to see to as well. Stogaz being a branch of Totalgaz, we must comply with their standards too. At Stogaz we are very pleased with the result. We think that the project has been very well managed from beginning to end. Very professionally', states Vincent Baudrillard from Stogaz.



The largest LPG filling plant on earth with a capacity of 10,000 cylinders per hour



In 1996, MAKEEN Energy built CLC in Portugal, which at that time was the largest filling plant on earth. Now, we have done it again. MAKEEN Energy has regained momentum in the Moroccan market, where it is involved in the construction and site management of the world's largest LPG cylinder filling plant for GAZAFRIC.

A complete turnkey project, which covers an area of 25 hectares, corresponding to a 500 m long and 500 m wide area, has been constructed from scratch on a bare field, or rather on bare desert land in Agadir, Morocco, right on the Atlantic Ocean. The entire project was negotiated and managed by ME France. Area Sales Manager of ME France, says: "Agadir must definitely be one of the most beautiful places on earth ..."

Family-owned company

GAZAFRIC is owned by two rep-

utable family-owned companies in Morocco: the Akwa Group and the Bicha family group of companies.

The Akwa Group is a major Moroccan conglomerate company headquartered in Casablanca. The company is primarily an oil and gas company, and owns the Afriquia Gaz brand.

The Bicha family owns several companies within many different business areas, including a nationwide chain of petrol stations. Najem Id Hali Bicha, Managing Director of GAZAFRIC, is the son of the owner of the Bicha family group of companies and in charge of the huge LPG project.

Brilliant and simple concept

"Najem Id Hali has done something brilliant," say Project Director, explaining the business concept: "He enters contracts with the other gas companies in Morocco that own cylinders and fills them for them. All the facilities are made available by GAZAF-



Najem Id Hali, Managing Director of GAZAFRIC (right) and ME's Managing Director Anders C. Anderson

RIC. This makes GAZAFRIC a strategically important company in Morocco."

The concept means that GAZAFRIC does not have to invest in cylinders or a distribution network. Filling cylinders is the focus of the business; this way, Najem Id Hali can concentrate on investing in efficient equipment and filling centres, and a large storage capacity.

According to Project Director, this has the following advantages: "Specialising in the branch of the LPG business that focuses on

filling cylinders and nothing else allows GAZAFRIC to concentrate all of its efforts on optimising the cylinder filling business."

"By making the plant so huge, they increase their efficiency and competitiveness. They do what they do best, and based on our expertise, our most important task is constantly to make GAZAFRIC even better at doing it."

The keyword is trust

"Area Sales Manager of ME France of ME France sold the plant based on trust," Project Director explains. "Najem Id Hali and Area Sales Manager of ME France have a close relationship based on mutual trust. Trust is a personal thing and of vital importance to the final result; when price and practical aspects have been settled, it is the personal relationship that ensures the successful completion of a project."

It was therefore a natural thing for MAKEEN Energy to take up the position of site manager. As Najem Id Hali wanted to manage the project himself, he decided not to use a traditional turnkey solution. But, of course, he wanted a professional project management expert to head such a huge and specialised project as this one.

Area Sales Manager of ME France explains: "Building the world's largest LPG filling plant requires expert knowledge in managing projects of this type. Therefore, we offered GAZAFRIC a site manager, one of the best in the industry, to work solely for Najem Id Hali, assisting him in managing the huge project."

Valuable site manager

MAKEEN Energy's appointed site manager, Doru Bosilca, is an ex-



tremely competent person with many years' experience within the gas industry. He is a trained engineer and a former technical manager of a cylinder factory in Romania. For the last ten years, he has been a site manager/operations manager of a gas company in Morocco.

There is no doubt in Project Director's mind: "The project must of course contain the best solution at the right price; however, being certain that nothing is forgotten and everything is remembered is added value that really counts and a sure way to reach your goal."

"The construction process is the most critical phase," Project Director points out. Large, comprehensive projects are often known to be delayed and the consequences can be disastrous if production start has to be postponed, not least if the entire investment depends on earnings being made from a specific time.

"My decision to have MAKEEN Energy's experienced site manager, Doru Bosilca, run the project proved to be one of the decisive factors for the completion of the project at the agreed time and with the agreed means," says Najem Id Hali.

We work to keep our customers satisfied

"It is a known fact that if problems occur in a project, for example, if it isn't up and running in time, the customer will become seriously dissatisfied. And even if MAKEEN Energy is only responsible for sub-supplies, we do not want to run the risk of dissatisfied customers. It is always our job to help make the customer satisfied and turn the entire project into a success. And that is

what we are doing in Agadir thanks to our site manager."

According to Project Director, such a combination gives the customer peace of mind – every single day. The site manager manages all interfaces. And there are tens of thousands of them in projects of this size!

GAZAFRIC started the construction process in 2008 and expects to complete it and start production in the autumn of 2009. No more than a year was required from the time when Najem Id Hali decided to build the largest plant on earth until production is up and running. "They are extremely efficient in Morocco," conclude Project Director and Area Sales Manager of ME France, giving the positive and progressive approach of Najem Id Hali much credit when it comes to completing the project.

MAKEEN Energy supplies to GAZAFRIC

- Site management
- Supervision of the installation by ME Portugal staff
- Electrical engineering and piping engineering
- Complete filling hall with a total of eight carousel filling lines capable of filling all types of cylinders in the Moroccan market
- Four complete carousel filling lines for 3 kg cylinders
- Three complete carousel filling lines for 12 kg cylinders
- One complete carousel filling line for 6 kg cylinders
- A line of stationary filling machines for 35 kg cylinders
- A cold repair plant with two repair lines: one for 12 and 35 kg cylinders and one for 3 and 6 kg cylinders
- LPG pumps
- 10 cylindrical storage tanks, each with a capacity of 250 m³, delivered and installed by MAKEEN Energy's partner Technoimpianti apm from Italy

Kuwait Oil Tanker Co. S.A.K. (KOTC) has a long experience with bottling and distribution of LP gas cylinders. Already in 1962 a modern filling plant was commissioned to supply the country with the necessary portable energy – mainly for cooking – in the form of LP gas cylinders. Today, some 45 years later, they also have one of the most modern LP gas cylinder refurbishing facilities in the world.

Due to the increase of the population in Kuwait in the 1980s, KOTC decided to build a completely new filling plant that was able to produce up to 15 million 12 kg cylinders a year. This plant, located at Mina Abdullah, was put into operation in 1985. Besides the three fully automatic filling lines, they also established several workshops in order to be able to perform all required operations in connection with filling and refurbishing of LP gas cylinders: a dedicated line for refurbishing and periodical test of cylinders, dedicated workshops for maintenance of

cylinders and pallets, and also a large garage for maintenance of the fleet of forklifts, trucks, and trailers. KOTC has always been one step ahead when it comes to safety through advanced technology. During the last five years – in order to achieve higher filling accuracy and equipment that requires less maintenance – all filling lines at the Mina Abdullah plant have been modernized and equipped with filling carousel systems using the latest mass flow technology.

KOTC's latest project, apart from an extension of the storage facilities, has been to build one of the world's most modern refurbishing and requalification plants for LP gas cylinders. The contract was awarded to the MAKEEN Energy Group at the end of 2005, and the plant is presently (October 2007) being commissioned.

Manual handling of the cylinders has been minimized as the cylinders for refurbishing are transferred on a chain conveyor system directly from the filling halls to the refurbishing hall. After refurbishing, the cylinders



Pressure testing unit on PTC-20 pressure testing carousel

are automatically conveyed back to the filling halls.

KOTC has always regarded safety and service as its top priorities. In its efforts to always be abreast of the development in the LP gas business, its objective is to provide all its cylinders with a smart label (an electronic tag) in order to make the filling and refurbishing processes even more efficient and to obtain full traceability of each and every cylinder.

Refurbishing processes at the Mina Abdullah plant (see layout)

Cylinders for refurbishing are automatically sorted out from the filling lines (pos. A-C) and conveyed on the chain conveyor system to the refurbishing hall.



Fully automatic in-line evacuation system

An operator (pos. 3) selects the processes that each cylinder has to undergo. The operator has the possibility of sorting out cylinders to three main lines,

- Line for replacement of cylinder valves on cylinders containing gas (pos. 24 on yellow line)
- Line for straightening of shrouds and foot rings (pos. 19-21 on blue line) and/or replacement and check of valve seals (pos. 22-23 on blue line)
- Line for pressure testing (pos. 4-9 and 12-18 on green line)

Prior to pressure testing, the cylinder is check-weighed (pos. 4) in order to ascertain if it is empty or if it contains residual gas. If the cylinder is found to be completely empty, it is sent directly to the valve unscrewing unit (pos. 8). If, on the other hand, the cylinder contains residual gas, it is sent to the evacuation unit (pos. 5), after which the cylinder is again check-weighed (pos. 7) to see if it still contains residual gas. After check-weighing – and if the cylinder is completely empty – it is returned to the main line for pressure testing.

After valve unscrewing (pos. 8), cylinders for hot repair are sorted out automatically. Before being subjected to hot repair, which takes place externally, cylinders are purged with nitrogen (pos. 10) in order to make sure that they are 100% empty of gas before they are palletized (pos. 11) and transported in pallets to the hot repair facility.

The cylinders that pass the sorting-out point for hot repair are automatically introduced on a

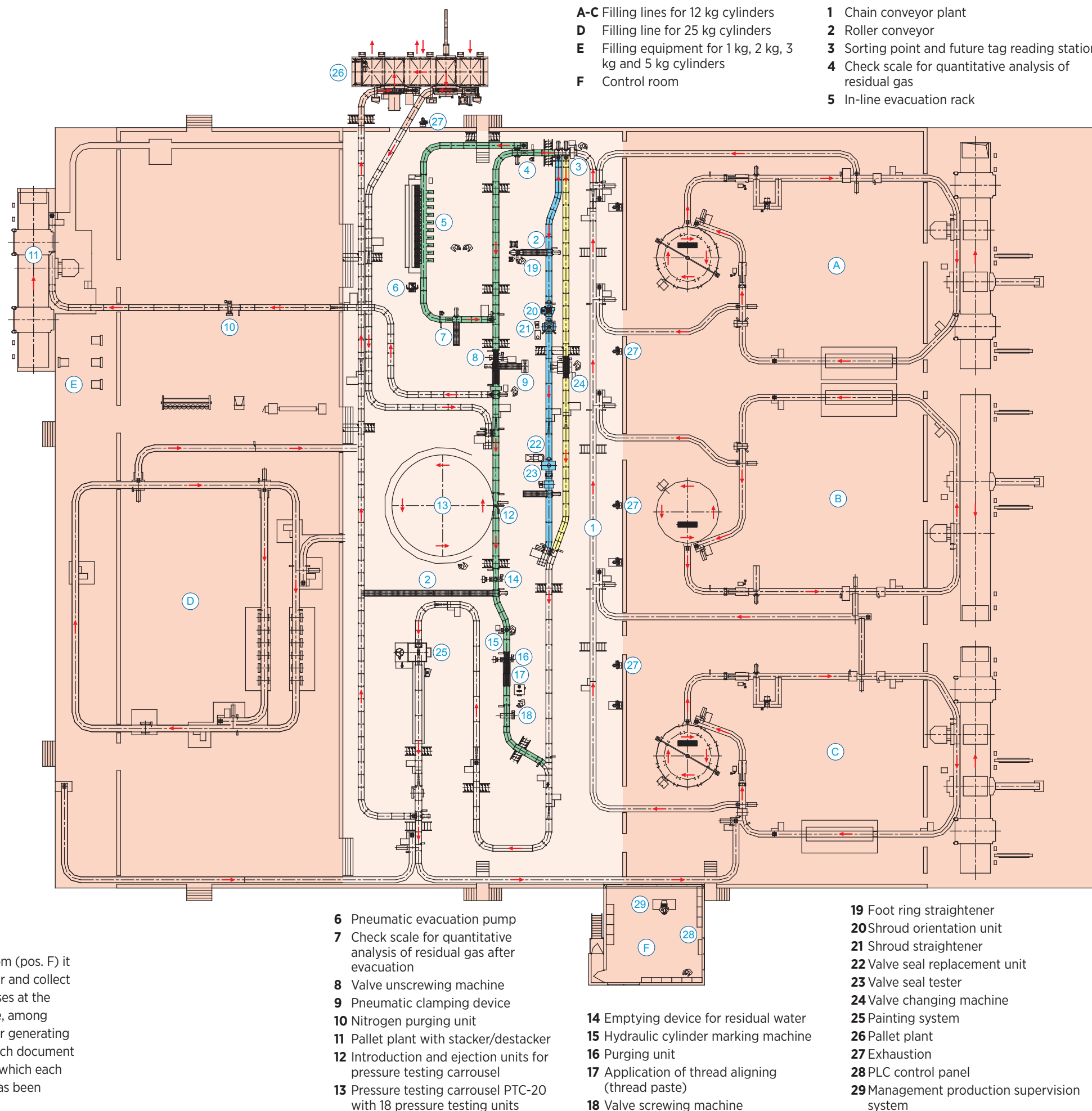
pressure testing unit (pos. 12) on the pressure testing carousel (pos. 13). All cylinders are pressure tested automatically with a pressure of 40 bars while being visually inspected. The cylinders are automatically ejected (pos. 12) from the pressure testing carousel (pos. 13) and are carried on by the chain conveyor to the residual emptying unit (pos. 14), where the cylinders are emptied of the last residuals of water after the pressure testing process. Leaky cylinders are sorted out automatically to a roller conveyor (pos. 2) and are palletized (pos. 26). These leaky cylinders are then sent in pallets either for repair or for scrapping.

Approved cylinders proceed on the chain conveyor to the hydraulic cylinder marking machine (pos. 15), where the date of pressure testing is stamped in the cylinder shroud. Then the cylinder (pos. 16) is purged with a suitable quantity of gas, after which a new valve is automatically screwed on the cylinder (pos. 18).

All refurbished cylinders are finally led through the automatic painting system (pos. 25).

The refurbished cylinders can now either be carried on the chain conveyor back to the filling line (pos. C) or sorted out to a chain conveyor leading them to the pallet plant (pos. 26), where they are palletized in order to be filled at a later time. Moreover, the pallet plant (pos. 26) has the function that it receives cylinders that have been subjected to hot repair. Cylinders that have been hot repaired are sent directly on the chain conveyor to the pressure testing carousel (pos. 13).

From the control room (pos. F) it is possible to monitor and collect data from all processes at the plant. These data are, among other things, used for generating detailed reports, which document all the processes, to which each individual cylinder has been subjected.



A cocktail of vision and 'no compromise' spiced up with hard work is the recipe for a tenfold increase of a cylinder park in just eight years.

In 2001, when Custodio Coelho founded SAIGAS and was granted a licence, he entered into an agreement with the publicly owned gas company SONANGOL and became the largest private LPG player in Angola overnight. And when he chose MAKEEN Energy as his business partner, it was the start of fairytale growth and a professional friendship.

At the time, the project was the first of its kind in Africa – a complete turnkey filling plant, including buildings.

The number of cylinders increases as the business grows

The entrepreneur launched a modest business with extension possibilities. He did not have any prior knowledge of the industry, but gradually built up his business. His few initial cylinders were supplemented by more and more cylinders and so were his distribution points. The progress and the growth of his business occurred at an equal pace.

Today, SAIGAS produces almost day and night, i.e. in two shifts from 7 am until 10 pm. Compared to his starting point, he has increased his capacity tenfold in eight years.

Professional friendship

"He has worked so hard building up his business," says Business Unit Manager, proudly. He has been involved from the start and has a strong feeling of ownership when it comes to SAIGAS projects.



"We have built a successful LPG business in close cooperation – from scratch to huge success. Custodio Coelho is a unique customer to us because of our close professional and personal relationship. The relationship has developed into friendship and we trust each other fully and support each other when it comes to doing successful business."

Constant focus on quality

From the start, SAIGAS has focused a lot on supplying high-quality products down to the last detail. Custodio Coelho is a pioneer and thanks to MAKEEN Energy's products and systems, he is able to supply an extremely safe and solid product.

To illustrate his constant focus on quality, he is currently adding



Customer comment

"The successful results achieved as a consequence of the partnership between SAIGAS and MAKEEN Energy exceeded by far our expectations. We highly recognise the professionalism and high sense of responsibility characterising the behaviour of MAKEEN Energy in the market with regard to installation and equipment assembly, as well as in respect to the highly qualified technical assistance, always delivered on time. All of these factors obviously give us a comparative advantage in the market." "We look upon MAKEEN Energy as our trusted partner, whose availability and quick responses ever since the beginning of this ambitious project have led to the successful implementation of SAIGAS on the Angolan market, where SAIGAS today is recognised as a reference company in this sector." "Due to the professionalism and high quality of service shown by the MAKEEN Energy team, we happily reaffirm our confidence in this company as a future strategic partner of SAIGAS." Custodio Coelho, Managing Director, SAIGAS

a washing system to the existing system. "Yet another proof that he does not want to compromise quality," Business Unit Manager states.

New sound basis for additional growth

SAIGAS is currently upgrading its existing plant in the Luanda area to increase the capacity of

the plant to 1200 cylinders/hour. At the same time, SAIGAS is building a completely new turnkey plant in another city, Huambo, where the company has established a good customer base.

"With this new front line, SAIGAS can develop and expand its market activities even more," Business Unit Manager concludes.

MAKEEN Energy supplies to SAIGAS

- 2001** Complete turnkey filling plant in the Luanda area for 6 and 12 kg cylinders (600 cylinders/hour) with extension possibilities, including buildings and two 100 m³ cylindrical storage tanks
- 2004** Installation of two additional 100 m³ cylindrical storage tanks
- 2006** Installation of an additional filling line for 6 kg cylinders
- 2007** Delivery of two semi-trailers
- 2008** Upgrading of filling facility increasing the capacity of the plant to 1200 cylinders/hour, installation of four additional 100 m³ cylindrical storage tanks, and installation of a cylinder washing plant
- 2009** Complete turnkey filling plant in Huambo for 6 and 12 kg cylinders (600 cylinders/hour) with extension possibilities, including two 100 m³ cylindrical storage tanks





One of MAKEEN Energy's clear objectives is to be represented locally by committed people. Vulcano Gas Italy is an excellent example of how this works in real life.

Vulcano Gas Italy is a new player on the Italian LPG cylinder filling market. The company decided to enter this market with a completely new filling plant and storage tanks.

Vulcano Gas saw exciting business potentials in the legislation that came into force on 1 April 2009, requiring that any company filling gas cylinders must have its own gas storage facility.

"This decision was of course made to increase the level of safety in the filling business, forcing many small gas fillers without gas storage facilities of their own to close down or to build new plants. Vulcano Gas saw this as an opportunity to establish itself on the market," says Branch Manager of ME Italy.

MAKEEN Energy made a bid for the project in 2007, and the contract was signed in 2008. The plant will be put into operation in the autumn of 2009.

A strong local industry network

MAKEEN Energy uses its industry network in Italy to create a positive dialogue and ensure a good working relationship with relevant Italian authorities.

"Part of our strategy is to build strong, local roots through the use of local, committed people as this allows us to meet the local and regional requirements that must be observed," Branch Manager of ME Italy explains and continues: "It is important to know consultants who are capable of communicating with the local municipality that is to approve project descriptions of safety, fire, etc."

The project was kick-started by assigning experienced experts and consultants to the customer,

who knew how to prepare and present projects to make the handling of the project as smooth as possible.

"This way, we assisted Vulcano Gas in preparing the correct project description/local plan in order for them to get an early start



with their project," says Branch Manager of ME Italy.

The Vulcano Gas project was completed using local manpower only; this provided a side benefit in the form of an extremely flexible work team. "The electrician, for example, lived near the project in Naples. This ensured a flexible work process and in case of project delays, he could service other customers in the meantime. Thus, all parties saved efforts and resources," Branch Manager of ME Italy states.

The customer always comes first

MAKEEN Energy supplied local LPG expertise together with a complete gas filling plant. The turnkey supply was made possible, partly thanks to our Italian business partner, Technoimpianti, who specialises in storage tanks and tank trucks. "It is a strong partnership of high priority, which means that we always come first, exactly as our customers always come first with us."



MAKEEN Energy expects to become involved in more gas depot and filling plant projects similar to the ones delivered to Vulcano Gas. "It is a business area where we hold a strong position as the network, expertise and experience required to complete such projects are at our disposal."



MAKEEN Energy supplies for the project

- Complete cylinder filling plant with chain conveyor system, a 12 scale filling carousel, pallet plant, and check weighing and leak testing equipment
- Three mounded cylindrical storage tanks with a capacity of 120 m³ each
- LPG loading point to and from trucks
- Complete electrical installation, including transformers, generators and lighting
- Turnkey solution for controlling and monitoring storage tanks
- Fire water network and fire water pumps

MAKEEN Energy is adding the finishing touches to the largest upgrade project in the company's 60-year history. The project covers 16 complete plants in 15 cities throughout Algeria for the national oil company NAFTAL.

The distance from the Mediterranean coast in the north to the Sahara in the south is about 2,000 km, and the climatic differences are great. The 15 cities vary immensely in terms of geography and culture, and this places great demands on the project management of NAFTAL's 16 plants.

MAKEEN Energy is a global company. The organisation is able to operate in widely differing conditions throughout the world. Project Manager at MAKEEN Energy, provides a vivid illustration of this: "In setting up an international project team, we drew on our global organisation and involved the employees of six different departments: apart from employees from ME Algeria and ME Denmark, there are six from ME Romania, two from ME France and one supervisor from ME Cameroon."

"This is a huge project that requires the strongest competences. At the same time, the project is very valuable to our employees, who are able to gain experience due to the scope of the project. Their experience arises from the upgrade itself and the geographical and cultural aspects, but also from working across our global organisation."

Julius and Carlos are members of the ME family

Project Manager's words touch upon one of MAKEEN Energy's key values: Share your knowledge, make others good. "We chose a supervisor from Cameroon because we would like to make him even better and prepare him for other international tasks." Project Manager explains the spillover effect of the NAFTAL project by pointing out that MAKEEN Energy is a company which is able to draw on the best resources in the world.

"After this project, Julius Ambe Che, our supervisor from Cameroon, will be able to use the experience he has gained to strengthen our supervisor team

for projects in Indonesia or other places where his competences may be needed. That is a great benefit for both MAKEEN Energy and our customers."

Carlos Banca is from Portugal. He is working on an upgrade of the plant in Bechar in southern Algeria. It borders on the Sahara, where day temperatures often reach 50° C. Therefore he has to work at night, when temperatures drop to a level that makes working bearable.

Working at night

"These are tough and demanding working conditions, but we are prepared for that." However, high temperatures are not the only reason for working at night. For instance, Project Manager gives an account of upgrading a plant with two filling lines.

The filling plant manager obviously prefers to have one line upgraded at a time so that he is still able to fill cylinders on the other line. If this is possible, he will be able to carry on with half of his production while one filling line is being upgraded. "And for security reasons the upgrade obviously



has to be carried out at night so that the customer is able to produce in the daytime."

Cultural understanding and know-how

According to Project Manager, cooperation, compromises and appreciation of the customer's needs are prerequisites for maintaining trust between all parties. His personal background gives him great insight into Arabic culture. He was born and raised in Tunisia and has subsequently lived in both France and Denmark. "Know-how is important, but cultural understanding carries at least as much weight," he states.

"Personally, I am in Algeria once a month, for about a week each time." He makes numerous plant visits to check how things are developing and attend meetings to ensure that everything goes as planned. "We have a strong organisation in Algeria, and developing the organisation is a continuous process and a learning experience. It was initiated by shifting competences from Denmark to Algeria."

Make others good

"Know-how has gradually been transferred to local staff, and we are always in close collaboration. We constantly follow up on things to make sure that our people are up to date, so we can enable them to make other colleagues even better and ensure that our customers are satisfied and feel secure."

Communication is the key to success. Part of MAKEEN Energy's corporate culture is that cooperation is based on dialogue. "We assume responsibility for the dialogue. That is the way we are." Project Manager elaborates by giving an example: "We enter into a partnership with the customer. We communicate professionally with people, because that is what our corporate culture is like. And we know our customers consider it very important that the dialogue does not end when the contract has been signed or when the plant has been completed and handed over."

LPG is vital

The entire NAFTAL project is based on a thorough analysis car-

ried out by MAKEEN Energy in cooperation with NAFTAL. Execution of the upgrade project requires meticulous planning to ensure that NAFTAL is still able to ensure the vital gas supply to the population while the project is running.

MAKEEN Energy is the total supplier of all the 16 plants which are part of the upgrade project even though only 7 of the plants were originally supplied by MAKEEN Energy 25 years ago. The project is divided into two phases. The first phase was concluded when 7 plants were delivered as scheduled at the beginning of November 2007, before winter set in. The second phase is taking place this year. 4 plants have already been delivered, and the remaining 5 will be finished over the course of the year.

The overall project is proceeding according to plan, and the first seven plants are currently filling LPG cylinders and supplying the local population with the essential gas. Project Manager concludes: "In Algeria – as in so many other places – LPG is used for cooking, heating, everything really; it is vital. That is why it is important that we meet the deadlines of the overall plan."





In 2005, the French firm Camping Gaz was told by the authorities to close an aboveground LPG storage facility, because it was too dangerous. The order was issued against the background of the fact that many other European countries had banned aboveground LPG tanks. Camping Gaz asked MAKEEN Energy to build new, safe LPG storage tanks.

Project Director at MAKEEN Energy, points at the picture of one of the project's most exciting parts: "This is one of the biggest cranes in France. We use it to lift these tanks. It is a mobile crane and it can lift 400 tons."

We are on a platform above Camping Gaz' factory area. Still higher up stands the old spherical tank. The plant is still filling LPG at full capacity, completely unaffected by MAKEEN Energy's work on establishing new storage tanks.

Full production during construction

The order from the authorities is being obeyed, but production can still continue until the new tanks are approved and ready for production. "We are able to build while the plant is operating because of our wide knowledge of potentially explosive areas. We even work in our filling halls during production." But that is not Project Director's biggest challenge. The actual project management is more demanding, since MAKEEN Energy functions as adviser and employs various specialists on the project.

"You can have the best suppliers, but if you are not able to manage a project and get all the parties involved to work together, it is almost impossible to get the product delivered. That is where the big challenge lies."

Network-based project

Project Director describes the way MAKEEN Energy's network

is put into action. MAKEEN Energy has access to all the necessary expertise in the form of project management experience from large projects, and at the right price.

MAKEEN Energy's contracting and engineering activities are based on the company's own core competences in collaboration with the industry's best specialists, in a fine-meshed network that includes, among many others, one of Europe's leading tank specialists.

"The market's best people are always available to us, because we are able to keep the network active by constantly giving them good and challenging tasks that make us all better. When MAKEEN Energy has a large project, they are 100% there for us."

MAKEEN Energy can guarantee the quality of its network's products by virtue of its local presence. "We hire people and companies that are well-known in the market, for instance via ME France, which has a local market

knowledge that makes the network very effective."

Three fine 'cigars'

The large aboveground spherical tank will be replaced with three new 'cigars': three subterranean, cylindrical tanks.

When the giant crane has manoeuvred the three tanks into their places in carefully constructed sand beds – down to the precise millimetre – they will be filled with water. In his own words, Project Director holds his breath for a moment: the tanks must not sink. But they are just within the tolerance level.

Now they are safely buried under a meter of soil. No maintenance will be necessary except for a check once every 10 years, when the tanks must be emptied, aired and inspected.

"But there will not be any problems," says Project Director with confidence.

500-year lifetime

Everything is traceable. One example of the company's comprehensive security work is that it hired a painting specialist to inspect the tanks before coating, before transport, and again in connection with the installation.

Everything the company does is traceable the whole way through the process. There is 100% X-raying of all welding during production. In fact, there is so much control of the products that Project Director estimates the tanks' lifetime to be 500 years.

7.5 on the Richter scale

The tanks were constructed to withstand an earthquake measuring 7.5 on the Richter scale. "Of course it is totally theoretical. If the area were hit by an earthquake of that magnitude, there probably would not be much left in the region." As Project Director explains, despite the high degree of improbability of such an occurrence, the tanks are earthquake-proofed to main-

tain the highest possible safety standards, and because MAKEEN Energy always respects local rules and seismic conditions.

In France, the three tanks are now completely covered, fenced in and ready for the production of gas cartridges for Europe's many campers.

Camping Gaz

Many people know Camping Gaz' products from camping trips. They are small gas cartridges used for cooking on holidays and the like. Camping Gaz' products are manufactured in France for the European market and owned by The Coleman Company, Inc.

Subterranean LPG tanks planned, delivered and installed by MAKEEN Energy

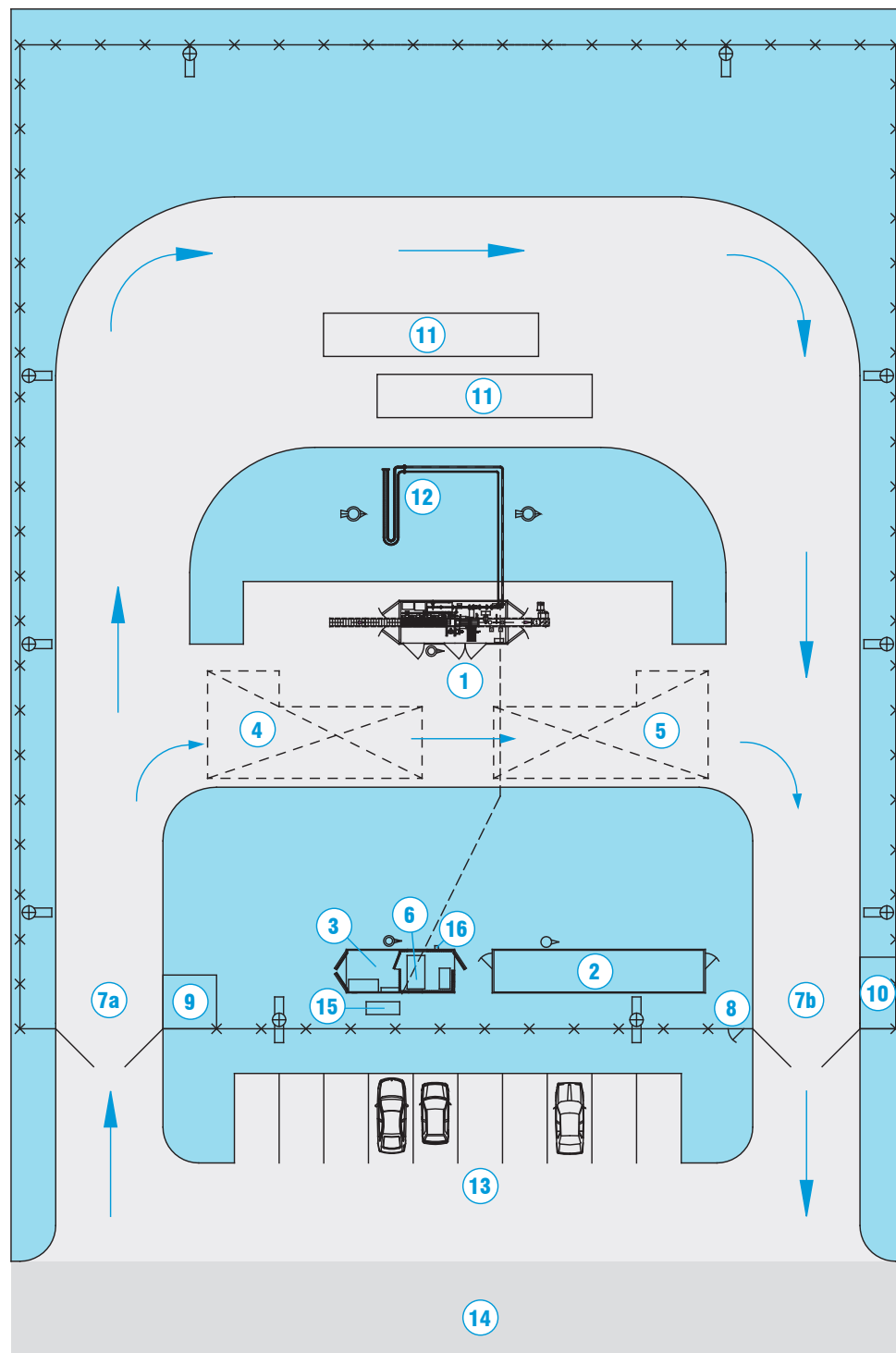
Two 200 m³ and one 100 m³ cylindrical mounted tanks on sand beds built in accordance with CODAP 2000, which is the French norm. They have been coated with a strong material that is covered with a layer of glass fibre and given cathodic protection to prevent corrosion. They are designed to withstand a powerful earthquake measuring 7.5 on the Richter scale.

It has been 17 years since MAKEEN Energy started working on container solutions for filling and/or maintenance of LP gas cylinders. Since we were working on the first container project in Sweden back in 1990, we have learnt that basically only imagination puts limits to the variety of applications when it comes to container solutions.

In connection with the CARICOM (Caribbean Community) cooperation, in which Venezuela is participating, the national Venezuelan oil company PDVSA has extended its activities in the Caribbean region. On that occasion PDVSA established a sister company, PDV Caribe, which, among other things, undertakes the distribution of oil products, including LP gas, in the Caribbean.

As its first project within LP gas distribution, PDV Caribe chose to establish filling facilities on Saint Vincent and the Grenadines. In this connection we were contacted, and PDV Caribe's and MAKEEN Energy's project teams soon agreed that the most expedient solution was to establish a container filling plant on Saint Vincent. The advantages of a container plant were obvious: prefabricated 'plug and play' filling and service containers, a minimum of civil works, and a short construction and installation period.

One of the main reasons why we were chosen for the job was that we were in a position to act as main contractor and offer a turnkey solution. Thus, the project was implemented by our Contracting & Engineering



- | | | |
|------------------------------|--|---|
| 1 20' filling container | 7a Entrance gate | 12 Hoses for 40' ISO containers and loading point |
| 2 40' office container | 7b Exit gate | 13 Car parking |
| 3 20' service container | 8 Entrance for staff | 14 Public road |
| 4 Stock for empty cylinders | 9 Guard house | 15 Power generator tank |
| 5 Stock for filled cylinders | 10 Transformer | 16 Main light switch |
| 6 Power generator | 11 40' ISO container with 24 tons storage tank | |



View of the filling container and the 40' ISO storage tanks

Department in close cooperation with PDV Caribe's project team, our Venezuelan representative SUMIPECA, and our sub-suppliers (among others KELECTRIC Co., who undertakes civil works in the entire Caribbean region).

The whole plant, which was built on an area of just 70 x 50 m, comprises everything from civil works (internal roads, fences, lighting, drainage, gate house, etc.) to complete filling facilities including mobile ISO storage

tanks constructed in accordance with current safety standards.

The filling container itself was delivered complete with chain conveyor system for transport of cylinders, 4 UFM in-line filling machines, check scale, leak detector, steam sealing equipment, evacuation system, and a gas alarm system.

In the service container there is a power generator for backup in case of power cuts, a com-

pressed air generator, and PC supervision system including a PC for data collection, a workshop and a spare parts stock.



View of the entrance to the plant including guard house, 20' service container with backup power generator and 40' office container (white container)



MAKEEN Energy was much honoured to participate in the official opening of PDV Caribe's filling plant on Saint Vincent, headed by President Hugo Chávez and Saint Vincent's Prime Minister Ralph Gonsalves in February 2007

Contracting & Engineering Turnkey project in Algeria

In late 2004, MAKEEN Energy signed a contract with the Algerian gas company NAFTAL for the extension of the LP gas cylinder filling centre in Beni Tamou close to the capital Algiers. MAKEEN Energy was awarded the role as main contractor for the entire project.

20 years before, MAKEEN Energy had installed a mobile mini filling plant at this centre. At that time, the plant formed part of a large project that included delivery of a total of 13 mini filling plants for different filling centres spread across Algeria.

NAFTAL's objective for the extension of the Beni Tamou filling centre was crystal clear: they required a higher capacity for the plant and also wanted to build a more permanent plant suited for further extension as needed.

The entire installation was to be carried out within 12 months practically without stopping production at the existing plant. A relatively tight time schedule in which even minor delays might have consequences for the compliance with the delivery time.

The following tasks and equipment were comprised by the main contract:



MAKEEN Energy's supervisor makes the last equipment adjustments before the final test

Construction works

- New filling hall building as well as panel and compressor room
- Concrete platform for storage of pallets
- New drainage system for rainwater
- New pump platform for LP gas pumps
- Casting of subterranean channels with load-bearing lids for pipe and cable underpass

Systems and equipment

- Filling line with 24-post filling carousel and auxiliary checking equipment, chain conveyor system and pallet plant
- Maintenance line with equipment for pressure testing of cylinders and wet painting plant
- Installation of new LP gas pipe system from existing tanks to new filling hall
- Supply of two LP gas pumps with dry-running protection
- New fire water ring main at the plant as well as installation of fire water hydrants, hose cabinets and fire monitors
- Power panels and electrical installations for all new equipment
- New safety system consisting of a fire/gas detection system. The safety system covers the new filling hall as well as the pump station and the un-loading point for tank trucks. The safety system is connected to automatic fire valves, which in the event of a fire auto-matically open up for fire water for the relevant zone.

In connection with the completion of the assignment, MAKEEN Energy signed agreements with a local contractor who was awarded the construction and civil works contract and with another local company that was award-

ed the welding contract. MAKEEN Energy's highly experienced Site Manager was appointed overall project manager.

In order to limit production loss as much as possible, the installation of the new equipment took place for the most part in parallel with the filling of cylinders on the existing plant. The fact that the entire construction area was thus under gas, very severe safety requirements were in force, which implied considerable coordination and detail planning in cooperation with the filling plant safety organisation.

Approvals

Throughout the building and construction work, concrete samples were continually submitted both to the authorities and to NAFTAL for approval. Furthermore, all welding work on pipes was checked by an independent inspection company by means of x-ray tests and subsequently approved by the authorities.

The entire plant has been constructed in compliance with Algerian regulations and has been approved by the local authorities without reservations. The safety system – consisting of the fire/gas detection system – has similarly been approved by the local fire authorities without reservations. The weighing system on MAKEEN

Energy's filling and checking equipment is ONML approved (Office National de Métrologie Légale) and as such it complies with local authority regulations.

The plant was commissioned on 10 May 2006 following an extensive test and a thorough check of the entire installation. The plant was then handed over to NAFTAL.

Training

As an integral part of the project, NAFTAL's technicians completed an intensive technical training course in Algeria. The course was led and executed by employees from MAKEEN Energy Algérie. The three best course participants were then selected for a 4-week course at MAKEEN Energy's headquarters in Denmark, during which the focus was on the topics of troubleshooting, maintenance and safety.



A view of the finished filling hall at the Beni Tamou filling centre



Inside the filling hall, the new electronic EFC/24 filling carousel with 24 UFM's



The new pump platform with two LP gas pumps with dry-running protection



The new fire water installation including hydrants, hose cabinets and fire monitors



MAKEEN Energy's project team in Algeria (from left to right): Project Manager, Site Manager, Managing Director & CEO, Supervisor, owner of Entreprise de Réalisation Bâtiment et Travaux de Canalisation, E.Re.Ba.T.C., and Supervisor

Reconditioning plants for gas cylinders

Over the past years MAKEEN Energy has supplied 12 cylinder reconditioning plants around the world. We see an increasing interest in reconditioning plants and equipment and we receive many inquiries for various types of reconditioning plants and equipment for gas cylinders at the moment.

This is a clear indication that many customers see it as good business to invest in cylinder reconditioning equipment and/or complete plants. Here are some of the reasons we hear,

- Money saved on cylinder procurement by recirculating inactive cylinders
- Manpower saving solutions compared to older existing equipment
- Higher marketing value gained from visible image improvement of the cylinder park

- Possibility for change of image and information to the consumer
- Improved logistics from finishing the cylinder internally as soon as it returns from the consumer instead of handling, shipment, return shipment, approval, testing etc.
- Possible environmentally safe plants compared to older existing equipment
- Approved cylinder testing equipment according to directives by local authorities and so higher safety and guarantee for the end-users

It is essential to make a thorough needs analysis at the first stage of a reconditioning project to ensure the right combination of equipment. The cylinder park must be analysed to estimate the distribution ratio of cylinders to the processes.

Obviously the purpose of the analysis is to establish whether it pays to invest in a reconditioning plant compared to procuring new cylinders. In our experience an open dialogue and a very close collaboration with our customers show that such investment makes sense, whether we are looking at small manually operated installations or large scale fully automatic facilities.

Plant types

Reconditioning equipment and plants come in four different categories. These categories are based on inquiries from our customers and how they wish to combine the equipment. The categories, however, are also based on basic conditions such as cylinder types to be handled, required capacity etc. The combination of equipment can be varied indefinitely and be adapted to any specific requirement.

- Reconditioning equipment for hazardous zone integrated in existing filling or reconditioning lines at filling plants



- Complete manual or simple reconditioning plants with a capacity of approx. 50-100 cylinders per hour
- Complete automated reconditioning plants with a capacity of up to 175 cylinders per hour
- Complete automated reconditioning plants, including equipment for cylinder repairs and for hot treatment of cylinders, with a capacity of more than 250 cylinders per hour

Reconditioning equipment for hazardous zone integrated in existing filling or reconditioning lines at filling plants

Most characteristically for this type of equipment is the fact that it is approved for use in hazardous areas, which makes it easy and quick to install the equipment at the plant and put it into operation.

Particularly we have supplied many shroud and foot ring straighteners. A cylinder with a straightened foot ring or shroud has a higher market value and is easier to stable, move and process (e.g. in a filling line). Straightening a cylinder obviously you avoid having to change the shroud and/or foot ring, which is a far more extensive process that requires quite different tools.



Foot ring straightener



Internal inspection

It is possible to include equipment for so-called make-up painting of the cylinders. However, this often requires a quick-drying solvent in the paint, which means that the coating thickness on the cylinder surface is limited to maximum 5-10 µ.

Furthermore, we have equipment to prepare the cylinders for reconditioning or filling, such as valve openers and closers, evacuation equipment and pressure testing equipment.

This type of equipment can be supplied in a container, ready for operation. This is a flexible solution that enables you to move the equipment to different plants where cylinders have been taken out of production for inspection and/or reconditioning.

Complete manual or simple reconditioning plants with a capacity of approx. 50-100 cylinders per hour

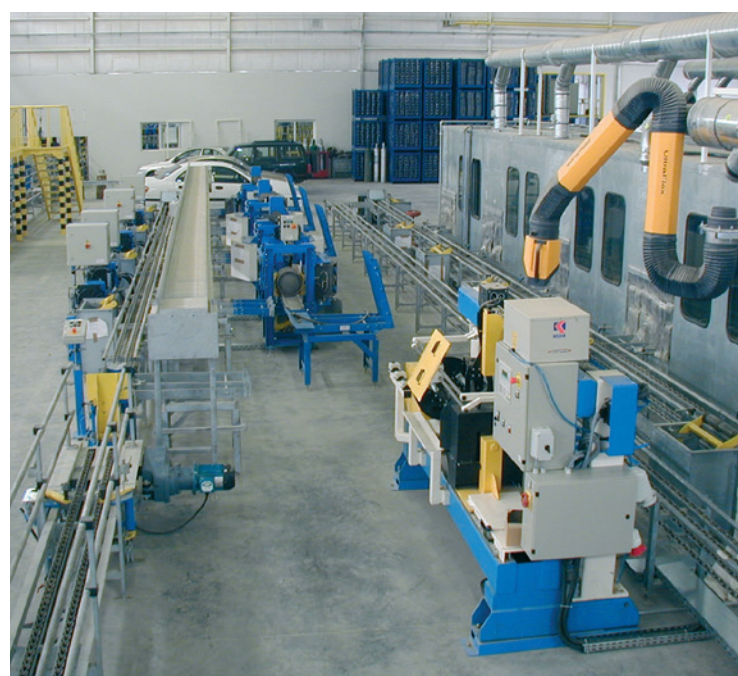
Most processes in this type of plant are performed manually.



Fully automatic powder painting equipment

The equipment is located in a non-hazardous area such as a separate building outside of the filling area. It is foreseen that the cylinders arrive at the plant without gas and with no valve. This type of plant typically comprises the following equipment,

- Shroud and foot ring straighteners
- Pressure testing equipment
- Manual shot blaster
- Semi-automatic painting equipment built into a paint booth, including overhead conveyor with or without drying oven
- Valve opener and closer
- Pressure testing equipment (checking the cylinder and valve connection)
- Equipment for marking the cylinders with corporate logo etc.



View of a reconditioning plant for LPG cylinders in Saudi Arabia



Pressure testing carousel

Complete automated reconditioning plants with a capacity of up to 175 cylinders per hour

This category of reconditioning plants consists of automated solutions in which the manual processes are reduced to a minimum. All heavy work functions are fully automated, and so the manning of this type of plants can be cut with 50% compared to manning existing manual or semi-automatic plants. Surface treatment of cylinders (painting) is usually performed with powder paint.

It is foreseen that the cylinders arrive at the plant without gas and with no valve. This type of plant typically comprises the following processes,

- Equipment for internal cleaning of cylinders
- Equipment for filling water into cylinders before pressure testing
- Carousel solutions for pressure testing with integrated immersion pipes and vertical rotation

of the cylinders for visual inspection of the cylinder body

- Equipment for attachment of hangers for moving the cylinders in an overhead conveyor
- Equipment for loading and unloading cylinders to and from overhead conveyor, shot blaster and painting plant
- Shot blaster
- Complete painting plant with powder application section, curing oven and cooling section
- Equipment for removal of hangers
- Equipment for internal visual inspection of cylinders
- Thread cleaning equipment
- Ink-jet printing equipment for marking data on cylinders (e.g. tare value, last inspection date, etc.)
- Valve opener and closer

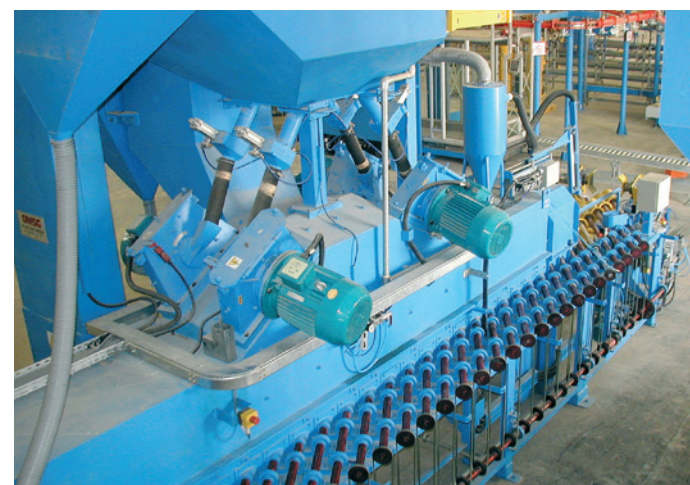
All machinery and functions are tailor-made for our customers, but always on the basis of MAKEEN Energy's thoroughly tested standard solutions for automatic cylinder processing.

Complete automated reconditioning plants, including equipment for cylinder repairs and for hot treatment of cylinders, with a capacity of more than 250 cylinders per hour

The plants in this category are typically designed for reconditioning 250 domestic cylinders per hour or more.

The motivation for investing in these plants is to exploit the high number of cylinders that for various reasons have been taken out of circulation over many years. Cylinders with dents, defective shrouds or foot rings, peeling paint etc. which tend to be stowed away in a remote storage area as they no longer match the requirements to safety and quality for supplies to the end-users.

Over the years the number of discarded cylinders has grown steadily at many filling plants, so that you find several hundreds of thousands of cylinders in remote



Shot blaster



Annealing / normalizing oven

storage areas today. Cylinders that take up valuable storage space without contributing actively to the business as they are out of circulation.

With increasing demands for more cylinders in the market place, you have in principle two solutions, either procure new cylinders or invest in a plant for reconditioning of discarded cylinders. After thorough analysis many customers choose the last option. Today a new cylinder costs 20-25 US dollars. The price of a perfectly reconditioned defective cylinder is as low as about a quarter of the price of a new cylinder depending of the local costs level and the necessary processes.

With a large storage area with hundreds of thousands of defective cylinders just waiting to be recirculated, it is possible to obtain quite a reasonable economy in such a project instead of procuring new cylinders. And indeed the quality of the reconditioned cylinders is fully comparable with the quality of a brand new cylinder!

A complete plant of this type comprises the following equipment and processes,

- Pallet plant for depalletizing defective cylinders and palletizing reconditioned cylinders
- Evacuation equipment and equipment for removing residual gas from the cylinders (in hazardous area)
- Valve opener and closer (in hazardous area)
- Equipment for sorting cylinders to different processes
- Shroud and foot ring straightener
- Equipment for external and internal inspection and washing
- Equipment for checking the cylinder weight
- Equipment for replacing shrouds and foot rings (cutting, grinding and welding equipment)



Equipment for silk screen printing (serigraphy)

- Equipment for straightening of dents
- Annealing / normalizing oven
- Carousel solutions for pressure testing
- Equipment for surface treatment including equipment for loading and unloading of cylinders to and from overhead conveyor to shot blaster and complete painting plant with powder application section, curing oven and cooling section
- Equipment for preparing cylinders for filling including thread cleaning, insertion of valve and tightness testing of the valve connection
- Equipment for marking the cylinders with corporate logo etc.
- Equipment for weighing and marking cylinders, ink-jet print of tare value, inspection data, warnings and information

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