

After a devastating blast

POWERFUL RECOVERY



It was three years ago that 98 containers of explosives being stored at a Naval base, self-detonated – triggering the worst peacetime military accident ever recorded on the island of Cyprus. The human toll was devastating – 13 people lost their lives and 65 others were injured. The nearby Vasilikos power station was destroyed. The recovery and rebuild of the plant since then has been nothing short of remarkable.

"We can't save this."

This was the first thought of Antonis Patsalis, Executive Manager of the Generation Business Unit for the Electricity Authority of Cyprus (EAC), when he saw what the explosion had done to Vasilikos. Despite the shock and disbelief, the reaction of Patsalis' team was to get the still-burning fires put out. "Our overnight crew managed to put out a very dangerous fire in the fuel tank farm," Patsalis says. "If that tank farm had gone up, that would have been the end of it."

The next day, "It was scary – total silence."

When Patsalis' colleague Alexis Michael, Assistant Manager at the Vasilikos power station, first saw the damage, his reaction

was, "Where do you start to clean up this mess? What do we do to make this a power station again? Because it isn't a station anymore."

And yet today, the plant is back in normal production with the same capacity it had before the explosion. It has been a tough journey back, though.

A dark day

Exactly one second before 05:48 on the morning of July 11, 2011, the clock at Vasilikos stopped. At that moment, Patsalis and Michael were in their homes, getting ready for work.

The blast was so powerful (3.5 on the Richter scale) that Patsalis remembers his

wife saying, "It's an earthquake!" Patsalis lives 29 km away from the naval base.

"My house is 40 km away, and I heard it too," says Michael.

Houses and buildings within a 4 km radius from the base had their windows shattered by the blast. The resulting cloud of dust and smoke blocked out the sun. Unfortunately, the Vasilikos power station was not kilometers away from the base. It was right next door – only a couple of hundred meters from the explosion. The damage was monumental.

Most of the building roofs in the power plant collapsed. Cladding on the buildings was either blown away or damaged beyond

repair. There were multiple fires, and the boilers, generators, and other production equipment were severely damaged.

A difficult (re)birth

At first, the police wouldn't allow power station employees into the plant; they had to wait until it was declared safe to enter. There were damaged fuel tanks on a site where fires were burning. There was a big danger of falling objects and even entire buildings (or what was left of them) collapsing. Also, the station had to be checked for radioactivity and explosive ordinance. Examination was done by robots and drones.

When the team was eventually allowed to enter, there were no longer any offices to work from. The initial assessment and planning work was carried out in the shade of a shed. And, ironically for a power station, there was no electricity.

As Michael points out, "At the peak of restoration, there were almost 1,000 people on site. And there were no flush toilets and no drinking water." (Some Cypriot politicians who originally questioned the speed of

response to the accident visited the plant under these conditions – there was no more criticism after that!)

It was under these same conditions that plans had to be made to repair or replace virtually everything that was needed for the power station to return to service. And, it had to be done as rapidly as possible, because with Vasilikos not producing, Cyprus was suddenly and immediately short of power. Despite EAC putting its two other power stations, Dhekelia and Moni, into full production mode, Vasilikos was the largest of the three. As a result, the electricity shortfall was estimated to reach 430 MW during the summer of 2011.

Desperate times call for desperate measures

Even after a "remarkable" response from the people and businesses of Cyprus, who voluntarily reduced their energy use, EAC still had to implement rolling blackouts across the different sectors of society. The authority also was forced to take a number of expensive emergency measures to replace some of the missing power, includ-

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Electricity Authority of Cyprus





ing importing electricity from the northern part of Cyprus, bringing in 85 MW of mobile generator capacity from Greece and Israel, performing a black start of the gas turbine at the heavily-damaged Vasilikos plant, and purchasing another 95 MW of temporary plant and installing it at Dhekelia and Moni Power Stations. The shortfall also required EAC to purchase an additional 120 MW of mobile generators to operate at Dhekelia and Moni the following summer.

All of the above – especially the mobile generators – were expensive, so the time-sensitive urgency of the situation was obvious to everyone.

First things first

Before work could begin on repairing and rebuilding the plant, it was necessary to accurately assess what the problems were and the severity.

Since the predecessor company to ANDRITZ Energy & Environment (AE&E) delivered the boilers to the original power plant, AE&E was an obvious candidate to

carry out a detailed inspection and assess the damage to Boilers #1 and #2.

"We had the detailed engineering drawings," notes Nicholas Sideras, Head of Field Services and Spares for ANDRITZ. Sideras was also one of the people involved in building the original plant.

The damage inspection actually turned out to be one of the major challenges for ANDRITZ, according to Sideras. "This was a rare accident in an industrial context," he says. "Normally, problems are expected to happen with the boiler internals, so we look inside-out. Boilers are not designed to withstand outside-in explosions. This made it difficult to find or estimate damage caused by the blast waves from the explosion."

AE&E's analysis indicated that repairs were possible in some cases, but in other cases the components would have to be replaced – especially the pressure parts. "There was big damage to the pressure parts," says Sideras.

Still, this approach was far preferable to the alternative of completely replacing the plant, as far as EAC was concerned. "If we'd had to build it new, we would still be waiting," says Patsalis.

Big job made even harder

A detailed understanding of what needed to be done was likely a factor in AE&E winning the contract to rebuild Boilers #1 and #2. But it was not the only factor or the only contract that was awarded to AE&E (details below).

Even with the tasks being itemized and estimated, the urgency to complete the rebuild had to be balanced against the need for much more caution than on a "normal" project. For example, the blast from the explosion had moved some walls/buckstays up to one meter. Several buildings had to be stabilized with struts and chains before people could be in or around them, simply to ensure they would not fall down.

This unusual and non-ideal situation, combined with the urgency, was one of the ma-

jor challenges for ANDRITZ, according to Sideras. The schedule was tight: despite the need to make the site infrastructure safe, and despite most supplies needing to be shipped to Cyprus from mainland Europe (taking 3-4 weeks each time), the installation work had to be completed in under six months. This required fast decision-making on-site to prevent delays and to give ANDRITZ engineering and manufacturing personnel the time they needed to complete their portion of the work.

And there was plenty of work to be done. ANDRITZ's focus was on two of the station's five boilers: replacing pressure parts (furnace walls, superheater bundles, headers, the boiler hopper, and manhole refractories), steel structure (main and secondary buckstays and the boiler house structure), ducting (flue gas and combustion air ducts with their supporting elements, expansion joints), piping and supports, the electrostatic precipitator (including insulation and cladding), the burners (burner valve stations, windboxes, expansion joints, burner

internals, burner throat refractories), and EC&I equipment (instruments, cables, cable trays, lighting, etc.).

Above and beyond

AE&E also was awarded other contracts at Vasilikos. EAC commissioned ANDRITZ to convert the boilers to fire on natural gas as well as the heavy fuel oil they had previously operated on. This conversion was already planned before the accident (natural gas is expected to be available on Cyprus in 2017). It was logical for EAC to commis-



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sion the conversion at the same time, since major work was already being carried out on the boilers.

The rehabilitated and converted boilers were re-started in the summer of 2013. The work carried out by AE&E was without fail.

Besides the rehabilitation and conversion of the boilers, ANDRITZ was also asked to do additional work on both boilers: rehabilitate the electrostatic precipitator and burners; rehabilitate the EC&I; rehabilitate the turbine piping; and repair the sampling and dosing piping.

More than just technology

Several factors helped ANDRITZ win these multiple contracts. In addition to AE&E's proprietary knowledge of the two boilers, Patsalis highlights some non-technical reasons. "Some companies tried to exploit our emergency situation," he says. "They thought they could carry out work at any cost. This was not the case with ANDRITZ. ANDRITZ was humane."

Sideras mentions an event that illustrates this attitude. Unexpected damage was discovered when the plant was stripped down, and it was not initially clear whether this work was included in the contract or whether it would count as additional work. "The equipment needed replacing in any case, so we made a suggestion to the client that we discuss the commercial terms at a later date so we could start the work fast. It is very important to treat the other side fairly. That is the basis for you being treated fairly as well."

Michael of EAC agrees, "We executed this project under a very honest and open environment."

Quick reaction

This rehabilitation reflects what Sideras considers one of the key aspects of his company's capabilities: the ability to operate in new or unfamiliar situations and react quickly to unexpected developments.



▲ (Left to right): Nicholas Sideras, ANDRITZ; Antonis Patsalis, EAC; and Alexis Michael, EAC.

Another interesting example of the ANDRITZ attitude was the rehabilitation of the electrostatic precipitators (ESP) that are connected to Boilers #1 and #2. According to Patsalis, the ESPs had never been officially accepted from the original supplier before the accident, because the guaranteed emissions targets had not been met. After the accident, the supplier's loss adjusters declared that the ESPs were damaged beyond repair. After its analysis, AE&E presented a quotation to rebuild the units with the help of a partner, and even guaranteed to meet the original emissions targets. The rebuilt units are today up and running and meeting the emissions targets. "ANDRITZ took a risk," says Patsalis, who clearly appreciated the gesture.

A further demonstration of the relationship between AE&E and EAC came in the form of another challenge while the whole project was underway. Not a technological challenge, but a financial one. One of the consequences of the banking crisis that struck Cyprus in 2013 was that payments outside of Cyprus were temporarily banned. The rehabilitation of Vasilikos, as is common with such projects, involved

EAC agreeing to make payments at certain stages of the project, which it was blocked from doing. With an eye toward keeping the work progressing, AE&E and EAC managed to reach an agreement on when payments would be made, and the project continued as planned. Sideras comments, "We had developed a significant level of trust, so we found a way to solve the problem on the spot."

Knocked down, but not knocked out

As we said at the start of this article, the once devastated Vasilikos power station is operational today, with full capacity restored. ANDRITZ had a part to play in this remarkable comeback story. As Patsalis sums it up: "ANDRITZ was very professional. Things were falling apart and had been exposed to the weather for several months. But, still they got everything done."

CONTACT

Nicholas Sideras
nicholas.sideras@andrutz.com