Operation and control for the new generation cycle

Revitalisation of the first Djerdap hydroelectric power plant is a complex and highly demanding job. All of this looks like a single conveyor belt with clear repair stations and stages whose final result is thoroughly tested and fully prepared for the new operating cycle. When one part of the unit is dismantled, its next station is precisely determined. Runner blades are treated as scrap metal, because a new runner with an enhanced geometry has been developed as part of the study to increase unit capacity. The main generator stator is also treated as scrap metal, together with the upper and lower wicket gates rings. Other parts are undergoing extensive testing, after which they are repaired and re-installed in the same or next unit. After the defect identification, rotor poles of the main generator were dispatched to the Russian factory *Elektrosila* for repair.

Experts involved in revitalisation planning made a number of good decisions to have as much works as possible done by the power plant staff, colleagues from the *Kolubara Metal* branch, local industry and scientific institutions. Not far from the plant, a repair/overhaul shop was set up where the majority of equipment continuing its operation in the new operating cycle of units will be revitalised. Accompanied by Mr. Bojan Mladenovac, the mechanical equipment foreman, who has been here since the very start of erection, we got to know the entire revitalisation process, starting from the entry of dismantled mostly fatigued and corroded metal parts belonging to the generating units until the exit of completely new parts ready for installation to the same place from which they were dismantled. All this looks like a medium-scale mechanical workshop with the usual sounds of grinding, metal welding, sandblasting, together with the odour of a fresh protective paint coating… A lot needs to be done to meet the goal – the repaired part has to meet strict inspection criteria. Only then can it leave the repair shop. In other words, this is like a huge doctor’s surgery from which a patient comes out completely healthy for the next 30 to 40 years, with firm guarantees. One cannot even begin to think what would happen if one of these parts were to accidentally malfunction. Here, we precisely know when each of the parts arrives for repair, what is its repair time and when it leaves the repair shop for its final destination – the turbine hall. The first phase includes sandblasting to remove corrosion from metal parts. This part of the work is done by the staff of the Belgrade-based company *Jadran*. There are several wicket gate blades on the belt. Dragan Jovanovic, a sandblaster, with a 7-bar pressure hose is removing a temporary corrosion protection coating. Despite the fact that heavy-duty fans vacuum the dust, a dust cloud is formed around the sandblaster. After this, the part is sent to the hands of painters, and we peaked into the main hall.

Hundreds of sparks from the grinder, smoke and glowing shavings from the welding equipment break up the grey space. A large turning machine used to machine the wicket gate blades is at the far end of the hall. It has so far machined 160 blades, with another 32

still waiting for their turn when the last unit enters revitalisation. The turning machine has already paid off many times. When the last blade has been machined, it will have fulfilled its role in this power plant. However, it will be useful again when the second Djerdap hydroelectric power plant is revitalised, which is planned in two years. The less equipment in the repair show, the more in the turbine hall ready for installation. When the installation starts, there is less work here and part of the workers will be transferred to the turbine hall.
– We are with the representatives of the Russian factory *Silovije masini* and experts of the IMS Institute. Solutions to all problems are found by mutual agreement. The working time of the repair shop is the first shift extended. In practice, this means that we work every day from seven in the morning to seven in the evening. Every Saturday is a workday. All workers are aware of their roles in this important job and everyone gives their maximum – Mladenovic adds. Not far from the front door, the grinder sparks fizzle and fly in all directions. Djordje Balojevic, a colleague from *Djerdap Usluge* whose face is barely visible from the plastic shield, is machining the front surface of the lower wicket gate blade 240 mm packing gland. He has a long track record of 25 years, and has been here since the beginning of revitalisation. His tools are either a grinder or a welding machine.
Further down the hall is the guide bearing support with a recognizable opening. This turbine part is painted in grey, and it can be seen from the entrance to the turbine area, while this opening reveals the turbine shaft in motion. There are signs of welding and grinding. For a moment our guide approached his colleague Zoran Ristic from the IMS Institute for a consultation about the grinding of welded parts. Every move of the grinder is monitored.
“We apply methods guaranteeing that every part arriving leaves the hall with the firm conviction that it is up to code and ready for the next operating cycle. A little farther away from the hall is the painting shop, or the last repair stop. Everything is clean here, but when can smell the paint. The workers of the *Jadran* company have already come to terms with this scent and meticulously apply fresh paint to the metal structure. We see a few wicket gate blades. Some are grey, coated with a basic zinc-based coat, and a few black-painted ones. Here we also have the quality control of corrosion protection.
– We protect parts with five coats. Two are basic: zinc-based and at least three balanstins, and sometimes four, tar-based. After each coating, we control the coverage, thickness and adhesion of the layer. A huge amount of water passes through the blades, and the coat has to endure all this. The guarantee is five years, however, practice has shown that the protective layer lasts much longer – Ivana Misic, technologist, explains.
By looking down the construction pit, we see the lower wicket gate ring suspended on cables. We can smell the scent of fresh paint. It has also been in the repair shop. Around the pit there are still parts waiting for their turn and installation, getting ready for the start of the new operating cycle.

The question is what happens with the parts that cannot be disassembled? They also pass like the other parts through the hands of the repair crew, but on the spot. Their corrosion protection depends on whether they are in contact with water or not, experts say.