REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL

on the implementation of the work under the nuclear decommissioning assistance programme to Bulgaria, Slovakia and Lithuania in 2020 and previous years
When they joined the EU, Bulgaria, Slovakia and Lithuania undertook to shut down, before the end of their scheduled lifetime, eight reactors based on older Soviet designs. The EU committed itself to providing financial assistance for the safe decommissioning of the reactors. Two Council Regulations governing the EU support in 2014-2020 set out the objectives against which this report reviews progress in 2020.

Bulgaria, Slovakia and Lithuania continued to make effective progress in decommissioning their nuclear power plants in 2020. Dismantling activities are ongoing and the recovered materials are being recycled or treated as radioactive waste. The cost of the work carried out since 2014 is within budget and delays in individual projects have been compensated by re-planning future activities. However, in all three programmes, the risk of postponing the end-date increased and a reassessment of the schedule will be required. These possible adjustments will not impact the EU financial support to the Kozloduy, Bohunice and Ignalina programmes during the MFF 2021-2027. In Ignalina, the selection of the technical solution for the dismantling of the reactors will be decisive for the confirmation of the programme end-date and overall funding needs after 2027.

Progress at the three sites was affected by the COVID-19 crisis, which meant temporary furlough for some staff and limited access by foreign experts and contractors. Measures to ensure that activities could continue safely included physical distancing, use of additional protective equipment and testing. These measures significantly reduced the short-term impact on project milestones. The EU continued to support the salaries of the workers in these difficult times.

The decommissioning programme in Kozloduy (Bulgaria) has a completion date of end 2030. The similar designs of the Kozloduy and Bohunice reactors provided an excellent opportunity to share experience, methods and tools, thus reducing risks and cost. Decontamination of the primary circuits in Kozloduy is being prepared on the basis of experience from Bohunice, from where the decontamination equipment has been transported. In parallel, good progress was made on dismantling other circuits.

In Bohunice (Slovakia), work continued on dismantling the reactor coolant system and auxiliary systems. The decommissioning operator transported the reactor pressure vessel to cutting workshops for size reduction and packaging. Sectioning and packaging of the first steam generator was also completed. The approved schedule, targeting completion in 2025, is being reassessed in function of the latest developments.

In Ignalina (Lithuania), the reactor design includes a large graphite core, the decommissioning of which is a first-of-a-kind challenge. The overall decommissioning programme is scheduled to last until 2038. The dismantling process is therefore at an earlier stage. By the end of 2020, 98% of the spent fuel had been removed from the reactor buildings and transferred to dry safe storage. Transfer operations are expected to last until October 2022. Meanwhile, preparations are under way for dismantling the reactor cores. Possible options for mitigating the risks involved are being identified and assessed, and the work is scheduled to proceed in 2022.

The completion of the decommissioning programmes up to their planned end-state requires additional funding under two new Council Regulations providing for the continuation of the programme in 2021-2027. Among other things, these lay down national contribution levels, thus removing remaining uncertainties as to the availability of the required funding.
1. **INTRODUCTION**

When they joined the EU, Bulgaria, Slovakia and Lithuania undertook to shut down eight nuclear reactors before the end of their scheduled lifetime:

- **Bulgaria** — Kozloduy nuclear power plant (4 units);
- **Slovakia** — Bohunice V1 nuclear power plant (2 units); and
- **Lithuania** — Ignalina nuclear power plant (2 units).

The EU committed itself to providing financial assistance for the safe decommissioning of the reactors.

Two Council Regulations\(^1\) governed EU support for the decommissioning programmes in the 2014-2020 multiannual financial framework (MFF). In line with the reporting requirements in Article 6 of the Regulations, this report reviews results achieved under the EU's nuclear decommissioning assistance programme (NDAP) in 2020.

The general objective of the NDAP is to move to the decommissioning end-state while maintaining the highest safety standards. The programmes do not include mitigation measures in the energy sector that were launched before 2014 and supported under previous MFFs. Implementation of these measures was evaluated in 2019 and was 89% complete at the end of 2020.

The decommissioning plans contain clear provisions on scope, budget and planning, with scheduled end-dates after the financing period for the Regulations. They do not cover the disposal of spent fuel and radioactive waste in a deep geological repository — Council Directive 2011/70/Euratom\(^2\) requires each Member State to handle that itself, under its national programme for the management of spent fuel and radioactive waste.

For the MFF 2021-2027, the Council has adopted two new Regulations\(^3\) that maintain support for decommissioning activities in Bulgaria, Slovakia and Lithuania. In particular, the EU financial support will enable Bulgaria and Slovakia to complete the decommissioning of the concerned reactors, and help Lithuania to proceed safely and steadily with the decommissioning of the Ignalina nuclear power plant, a first-of-a-kind process on an unprecedented scale that involves retrieving a large amount of radioactive graphite.

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\(^3\) Council Regulation (Euratom) 2021/100 of 25 January 2021 establishing a dedicated financial programme for the decommissioning of nuclear facilities and the management of radioactive waste, and repealing Regulation (Euratom) No 1368/2013;
2. **PROGRAMME ADMINISTRATION**

2.1. **Method of implementation**

The Commission has entrusted implementation of the programme budgets to:

- the European Bank for Reconstruction and Development (EBRD) — for all the programmes (since 2001);
- the Central Project Management Agency (CPMA) — for the Ignalina programme (since 2003); and
- the Slovak Innovation and Energy Agency (SIEA) — for the Bohunice programme (since 2016).

Supervision of these ‘entrusted entities’ relies on prior checks (‘pillar assessment’) that they fulfil the requirements for indirect management and is complemented by risk-informed verifications, either as part of the regular monitoring process or assigned to an independent body.

2.2. **Annual programming and monitoring**

Each of the Member States in question has appointed a programme coordinator who is responsible for national programming and the coordination and monitoring of the decommissioning programme at national level. The programme coordinators submitted work programmes for 2020, with activities financed from the EU budget and from national or other sources. The Commission (DG ENER) published on its website the financing decision and the work programmes adopted by the Commission.

A monitoring committee in each Member State is co-chaired by a Commission representative and the programme coordinator. The committees’ role was strengthened in 2019.

The entrusted entities monitor project implementation on a day-to-day basis. In addition, the Commission services follow it closely through desk and biannual on-the-spot reviews. Due to COVID-related site access restrictions, most of these reviews had to be carried out remotely in 2020.

To support the monitoring process, the Commission uses performance indicators, including those set out in the earned value management (EVM) system. By tracking progress against the performance measurement baseline, EVM is used to monitor progress against the schedule, and associated costs.

2.3. **Controls, audits and evaluations**

Due to COVID-related restrictions, the Commission services were able to carry out only one of the six planned monitoring missions on-site. To make up for this, extensive review meetings were held by videoconference.

The entrusted entities regularly assessed the impact of COVID-related restrictions on the implementation of the decommissioning projects. However, as the situation continues to

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4 ISO 21508:2018 Earned value management in project and programme management.
evolve, no final conclusions can be drawn as yet. At present, the impact on the projects is limited; specific situations are described in Section 4 (Progress and performance).

3. **Budgetary Implementation and Co-financing**

Bulgaria and Slovakia have established dedicated funds providing financing for decommissioning and radioactive waste management. These are complemented by other national resources, mostly from their national budgets. In Lithuania, funds accumulated previously for decommissioning and waste management were depleted and the organisation managing them was wound up in 2019. The Lithuanian government undertook to provide funding until the end of the programme. This commitment is taken into account in Table 1.

The EU contributions to the funds managed by the EBRD are augmented by 2-4% with past contributions from other international donors and financial interest on pre-financing. The tables below include these additional amounts.

**Table 1: Funds (disbursements + allocations + proposals), € million**

<table>
<thead>
<tr>
<th>Member State</th>
<th>EU 2001-2020</th>
<th>EU 2021-2027</th>
<th>Total funds</th>
<th>Budget at completion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kozloduy</strong></td>
<td>458</td>
<td>800</td>
<td>63</td>
<td>1 321</td>
</tr>
<tr>
<td><strong>Bohunice</strong></td>
<td>476</td>
<td>671</td>
<td>55</td>
<td>1 202</td>
</tr>
<tr>
<td><strong>Ignalina</strong></td>
<td>478</td>
<td>1 568</td>
<td>552</td>
<td>2 598</td>
</tr>
</tbody>
</table>

Source: Monitoring reports, annual work programmes, EBRD, CPMA, SIEA.

The ‘budget at completion’ in Table 1 includes contingencies and risks. If implementation of the activities goes according to plan, the contingencies will not be needed. In that case, the available funds for Kozloduy and Bohunice will be sufficient. For the Ignalina programme EU funding is defined until 2027: as the programme is scheduled to last until 2038, there is still a difference between the budget at completion and total funds. In the last version of the Ignalina decommissioning plan, the scope was extended to include security expenses of the Interior Ministry (€200 million); the ‘budget at completion’ does not include this amount which remains fully financed by Lithuania.

The legal basis for EU financial support until 2020 does not specify explicitly the co-financing rate. However, the Council Regulations for continued support for decommissioning under the 2021-2027 MFF lay down the multiannual EU contribution and introduce maximum rates of 86% for Lithuania, and 50% for Bulgaria and Slovakia to be applied as of 2021. Table 2 summarises payments to the end-beneficiaries to the end of 2020.

**Table 2: Payments to end beneficiaries — end of 2020 (€ million)**

<table>
<thead>
<tr>
<th></th>
<th>National resources</th>
<th>EU</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kozloduy</strong></td>
<td>312 (40%)</td>
<td>460 (60%)</td>
<td>772</td>
</tr>
<tr>
<td><strong>Bohunice</strong></td>
<td>243 (32%)</td>
<td>507 (68%)</td>
<td>750</td>
</tr>
<tr>
<td><strong>Ignalina</strong></td>
<td>205 (18%)</td>
<td>1 120 (82%)</td>
<td>1 325</td>
</tr>
</tbody>
</table>

Source: Annual work programmes 2021-2022, Monitoring reports, EBRD, CPMA.
4. PROGRESS AND PERFORMANCE

The Commission measures progress and performance against the objectives set out in the Council Regulations establishing the programmes. Detailed targets and schedules in the implementation procedures and the EVM system complement the monitoring.

To date, progress against the objectives has been generally satisfactory and the cost of the work has been as planned. The programmes’ critical path is monitored with the utmost attention and, where risks are identified, mitigating actions are proposed. As a result, the end-dates are still valid at this point in time. However, in 2020 risks threatening compliance with the end-dates were identified for all three programmes (see below).

4.1. Bulgaria — Kozloduy programme

Units 1-4 at the Kozloduy plant are VVER 440/230 reactors. Units 1 and 2 were shut down in 2002 and Units 3 and 4 in 2006.

Under the administrative supervision of the Ministry of Energy, the State Enterprise for Radioactive Waste (SERAW) is the licensed operator in charge of the decommissioning of Units 1-4 and the construction and operation of the national disposal facility for low- and intermediate-level radioactive waste. SERAW’s main mission is the safe management of radioactive waste on the territory of the Republic of Bulgaria.

The Kozloduy programme made significant progress on dismantling in the controlled areas in Unit 1, excluding the primary circuit. Radioactive waste management activities (i.e. the retrieval, treatment and conditioning of decommissioning/historical radioactive waste) are progressing in accordance with the plan. The impact of COVID-19 was limited and mainly involved access restrictions for external contractors.

The plasma melting facility is a first-of-its-kind high-temperature incineration facility for volume reduction of radioactive waste. The resulting waste form is particularly stable and safe. The project was launched in 2009 and reached the operational stage in 2019, for a total investment cost of €8.2 million (Figure 1). In 2019-2020, SERAW carried out the first three operational campaigns at the facility, demonstrating that it could reduce the volume of waste by a factor of 50. The next campaigns will show whether or not the reduced expenditure for disposal of the residual waste volume will deliver the expected economic benefit.

5 In project planning, the critical path is the longest sequence of tasks that must be done to successfully complete the project. Tasks that are in the critical path, if delayed, will delay the whole project.

6 Вводо-водяной энергетический реактор / vodo-vodyanoi energetichesky reaktor (VVER — water-water power reactor) is a series of pressurised water reactors.
The similar designs of the Bohunice and Kozloduy reactors provide an excellent opportunity to share experience, methods and equipment, thus reducing risks and cost. For example, the feasibility of decontaminating the primary circuits at Kozloduy was confirmed on the basis of experience from Bohunice. The transportation of used decontamination equipment from Bohunice was agreed and preparatory work for the full chemical decontamination of the primary circuits advanced in 2020. Decontamination activities will start in 2021. SERAW estimates that a cost saving of about €8 million could be achieved by reusing the equipment developed for the Bohunice programme based on the knowledge and experience gained.

Construction of the near-surface repository for low- and intermediate-level waste (National Disposal Facility) started in 2017 (Figure 2). The construction works do not imply any radiation or nuclear safety risk, however activities were suspended from December 2019 to June 2020 following a fatal accident on the building site. Work restarted after the causes of the accident had been fully analysed and appropriate project management organisation was established to ensure compliance with the highest safety standards for the duration of the project. Improvements are now visible as regards health & safety and supervision. As part of the ex post evaluation of the NDAP implementation in 2014–2020, the Commission services launched an assessment of the safety culture at all three sites, which will show whether or not further improvements are required to ensure the highest level of safety.

In accordance with the performance baseline, the programme completion date remains the end of 2030. Figure 3 shows the amount of work carried out (earned value) against the plan (baseline). The baseline includes contingencies and this explains part of the gap with the actual progress. The lower-than-planned rate of implementation and the complex
interdependency of the activities on the critical path lead to conclude that the risk of delay is increasing significantly and may affect the end-date.

**Figure 3: Kozloduy — progress and performance**

![Graph showing progress and performance](image)

### 4.2. Slovakia — Bohunice programme

The Bohunice V1 plant consists of two VVER 440/230 reactors. Unit 1 was shut down in 2006 and Unit 2 in 2008.

Under the administrative supervision of the Ministry of Economy, *Jadrová a vyráďovacia spoločnosť* (JAVYS) is the operator in charge of decommissioning Bohunice V1. Its mission is the safe decommissioning of the nuclear facilities, spent nuclear fuel and radioactive waste management on Slovak territory.

The Bohunice programme is the most advanced of the three decommissioning programmes assisted by the EU. Worldwide, it will be the first completed decommissioning programme for a VVER-type reactor. The programme made substantial progress in 2020. Dismantling of the large components of the reactor coolant system started, including the transportation of the reactor pressure vessel and other activated components to pools reconfigured as underwater cutting workshops. Remotely operated cutting of the first reactor vessel then started (Figure 4). Cutting is planned to take 17 months for each of the two reactor vessels. Fragmentation of both vessels will take 24 months, thanks to parallel works.
The 12 steam generators, each made of 145 tonnes of steel, are another major part of the reactor coolant system. They were transferred to the former turbine hall in 2019 and the cutting of the first steam generator was completed in June 2020 in a purpose-built dry-cutting workshop (Figure 5). With the lessons learnt from this process and various improvements, it is now expected that the other steam generators can each be dismantled in less than 2.5 months.

The COVID-19 crisis has mainly affected the deployment of contractors on site, for example delaying the completion of the metallic waste melting facility.

In 2020 decommissioning activities at Bohunice V1 produced a total of 2388 tonnes of conventional recyclable material. In addition, dismantling activities in the controlled area produced 2189 tonnes of material: of these, 732 tonnes were decontaminated and recycled as non-radioactive material.

Figure 6 shows the amount of work carried out (earned value) against the plan (baseline). In accordance with the current performance baseline, the approved completion date for the programme is set at the end of 2025 and the budget at completion (including contingencies) remains €1237 million. The successive optimisations of the schedule have
consumed all the time margins, therefore the recent slowdown of the physical progress will impact the end-date of the programme. JAVYS has initiated a complete review of the remaining tasks in preparation of the next work programme.

**Figure 6: Bohunice — progress and performance**

4.3. Lithuania — Ignalina programme

The Ignalina plant consists of two RBMK\(^7\) 1500 reactors. Unit 1 was shut down in 2004 and Unit 2 in 2009.

Under the administrative supervision of the Ministry of Energy, the state enterprise Ignalina Nuclear Power Plant (INPP) is the operator in charge of the facilities under decommissioning and, since 2019, the waste disposal facilities.

The removal of spent-fuel assemblies from the reactor buildings (Units 1 and 2) resumed in September 2016 and both reactors have been completely defueled. All 191 new storage casks were delivered in February 2020, a year ahead of schedule. All undamaged fuel assemblies from Unit 1 and part of Unit 2, which were stored in spent-fuel pools, were transferred to storage casks and then to the interim spent-fuel storage facility (Figure 7). By the end of 2020, 98% of spent-fuel assemblies (against a target of 90%) were safely stored in this new dedicated facility. The remaining assemblies were damaged when the reactor was operational and need to be handled more carefully. This work is scheduled to be completed by October 2022. Meanwhile, work has started under a contract concluded by INPP for cleaning up, emptying and decontaminating the spent-fuel pools.

\(^7\) Реактор Большой Мощности Канальный / reaktor bolshoy moshchnosti kanalnyy (RBMK — high-power channel-type reactor) is a class of graphite-moderated nuclear power reactor (also installed in Chernobyl).
With 43 730 tonnes of material dismantled from the turbine hall and other auxiliary buildings (out of an estimated total of 47 277 tonnes), the removal and decontamination of equipment is close to completion (>90%). The building is being used as temporary storage for material undergoing clearance before regulatory control can be lifted and for low-level radioactive waste before it can be transferred to a final disposal facility.

The programme maintained its support to Lithuania during the 3 weeks of furlough for the on-site workers caused by the COVID-19 crisis in line with the Commission policy to support peripheral regions and the European economy during the pandemic. It was very important to ensure that skilled staff working at the decommissioning programme would not be laid off, as this could generate additional costs and future delays. Correlated access restrictions for the nuclear safeguards inspectors caused some delay in the defueling activities.

The dismantling of the Ignalina reactors is a first-of-a-kind challenge: never before has a large reactor graphite core been dismantled. In a first phase (2020-2027), INPP will remove all components from top and bottom of the reactor shafts. The design of the subsequent removal of the content of the shafts – the graphite, metal structures and filling material – is being preceded by an optioneering study. This has been delayed by about a year due to complex procurement preparation between Lithuanian stakeholders. In 2020, the Commission has established a closer supervision and control of this project, in particular by establishing an ad-hoc independent expert panel. This panel provided specific recommendations for the tendering and contracting strategy. The optioneering study will be followed by the detailed design of the preferred solution and of the facility for the temporary storage of the irradiated waste. The delay in starting the design and the first-of-a-kind nature of the project will require a reassessment of the programme end-date at a later stage.

The procurement procedure for the construction of the near-surface repository for low- and intermediate-level short-lived waste was delayed due to an unsuccessful tender process; it has now been re-launched following minor technical revisions and a budget increase. Construction of the landfill facility for very low-level short-lived waste was completed; formal acceptance of the facility is planned in early 2021 with the first loading campaign to follow soon after. Upon the successful completion of these facilities, INPP will have all the tools it needs for disposal of the short-lived radioactive waste under the decommissioning plan. A blueprint is under development for the conversion of

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8 Optioneering is an iterative process between options identification, assessment and definition.
the bituminised-waste storage vaults into a repository, under the surveillance of the relevant regulatory bodies.

**Figure 8: New low-level waste landfill facility and bituminised waste vault**
photos INPP

In accordance with the updated performance baseline, the programme completion date remains 2038. Figure 9 shows the amount of work carried out (earned value) against the plan (baseline). The Lithuanian government approved the version 8 of the final decommissioning plan in August 2020. The total budget at completion (including contingencies) was increased by €200 million to include fire and physical protection costs that are fully funded from national resources.

**Figure 9: Ignalina — progress and performance**

### 4.4. Energy sector projects

Until 2013, the assistance programmes allocated funds to projects along the energy value chain to mitigate the impact of the closure of the eight nuclear power plants. By December 2020, 51 projects were completed for a value of €841.9 million. Seven other projects are under completion for a value of €105.8 million (83% in Bulgaria, 16% in Slovakia and <1% in Lithuania).

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5. **Knowledge-Sharing**

In 2020, the annual trilateral knowledge-sharing seminar did not take place due to the COVID-19 crisis, but (as explained above) taking advantage of synergies is resulting in time and cost savings. The major areas in which knowledge was shared between the Bohunice and Kozloduy sites were: the decontamination of primary circuits; and the incineration of radioactive waste, via conventional combustion or the state-of-the-art plasma melting facility (see Section 4.1). Contacts were established between Ignalina and the Chernobyl nuclear power plant (Ukraine) to share knowledge on the dismantling of reactor cores.

As of 2021, knowledge sharing has become an explicit objective under the new Council Regulations, with a requirement that experience and lessons learnt from the programmes be shared across the EU and, possibly, cooperating with external countries supported by the Commission’s support programmes. In this framework, the Commission’s Joint Research Centre (JRC) will play a key role for dissemination.

6. **Conclusions**

Bulgaria, Lithuania and Slovakia continued to make effective progress in decommissioning their nuclear power plants in 2020. However, as shown by the EVM analysis, in all three programmes, the risk of delaying the end-date increased and a reassessment of the schedule will be required. Possible delays will not impact the EU financial support to the Kozloduy, Bohunice and Ignalina programmes during the 2021-2027 MFF. In Ignalina, the selection of the technical solution for the dismantling of the reactors will be decisive for the confirmation of the programme end-date and overall funding needs after 2027.

The decommissioning operators took the necessary measures to limit the impact of the COVID-19 crisis on the physical progress of the works. However, the travel restrictions imposed an additional constraint on the very tight schedules for the preparation of future projects.

Knowledge-sharing among the beneficiaries had a positive impact on the programmes and contributed to the latest successes. The Commission built on that to develop concrete synergies, e.g. the decontamination of the primary circuits at Kozloduy was supported by know-how developed by JAVYS and use of equipment acquired under the Bohunice programme.

Indications are that a significant decrease of radiological hazards has been achieved at the sites as a result of EU funding under the 2014-2020 MFF and no additional funding was needed to achieve the objectives set out in the Council Regulations for 2014-2020. Completion of the decommissioning programmes to their planned end-state will be supported by additional funding in 2021-2027, for which the Council has adopted new Regulations. These Regulations also establish national contribution levels, thus removing remaining uncertainties as to the availability of the required funding.

The outlook for 2021 promises further major developments.

**Bulgaria**

- the construction of the National Disposal Facility will proceed steadily;
the plasma melting facility will be in full industrial operation and create relevant know-how; and
work will start on decontaminating and dismantling major components in the reactor building;

**Slovakia**
steady progress is expected on the dismantling of large components from the reactor building, including the reactor vessels and the steam generators, leading to the last stage of decommissioning;

**Lithuania**
the transfer of damaged spent-fuel assemblies to the storage facility will continue;
the very low-level waste disposal facility will be completed and used for the first time;
construction of the low-level waste disposal facility will start; and
kick-off the optioneering study for the dismantling of the graphite cores.

For the three programmes, a study on EVM systems will be completed with some delay due to the COVID-19 pandemic, which has prevented visits to the sites to exchange hands-on experience.

The Commission will carry out an *ex post* evaluation of the programme for 2014-2020.