



EUROPEAN COMMISSION

DG ENER

Support to the mid-term evaluation of the Nuclear  
Decommissioning Assistance Programmes

FINAL REPORT



Building a better  
working world

Report submission date: 22 June 2018  
Version: final  
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## Abstract

In the framework of their accession negotiations, Bulgaria, Lithuania and Slovakia committed to closing eight nuclear reactors located on their territories. Recognising the exceptional circumstances of their closure, the EU committed to provide assistance to these countries to support decommissioning through the Nuclear Decommissioning Assistance Programme (NDAP). The aim of the present study was to provide the European Commission with the necessary information to prepare its mid-term evaluation of the NDAP for the period 2014-2020. The study found that programmes are generally on track towards reasonably achieving the principal objectives set for this programming period. Beyond progress on decommissioning, the NDAP has also contributed to some indirect socio-economic impacts. The programme's Monitoring & Control framework has continued to be refined to respond to past weaknesses and enhance programme management. Programme governance & management structures are fit-for-purpose, but further efforts can be directed to improving their functioning. The cost performance of programmes has been satisfactory, but continuous efforts can be made to secure and improve cost-effectiveness at all levels. Finally, the EU Added Value of the NDAP as it has traditionally been defined is naturally declining, but the programme can redefine how it adds value through an increased focus on knowledge-sharing.

Luxembourg: Publications Office of the European Union, 2019

ISBN: 978-92-76-08717-5

doi: 10.2833/465198

MJ-02-19-489-EN-N

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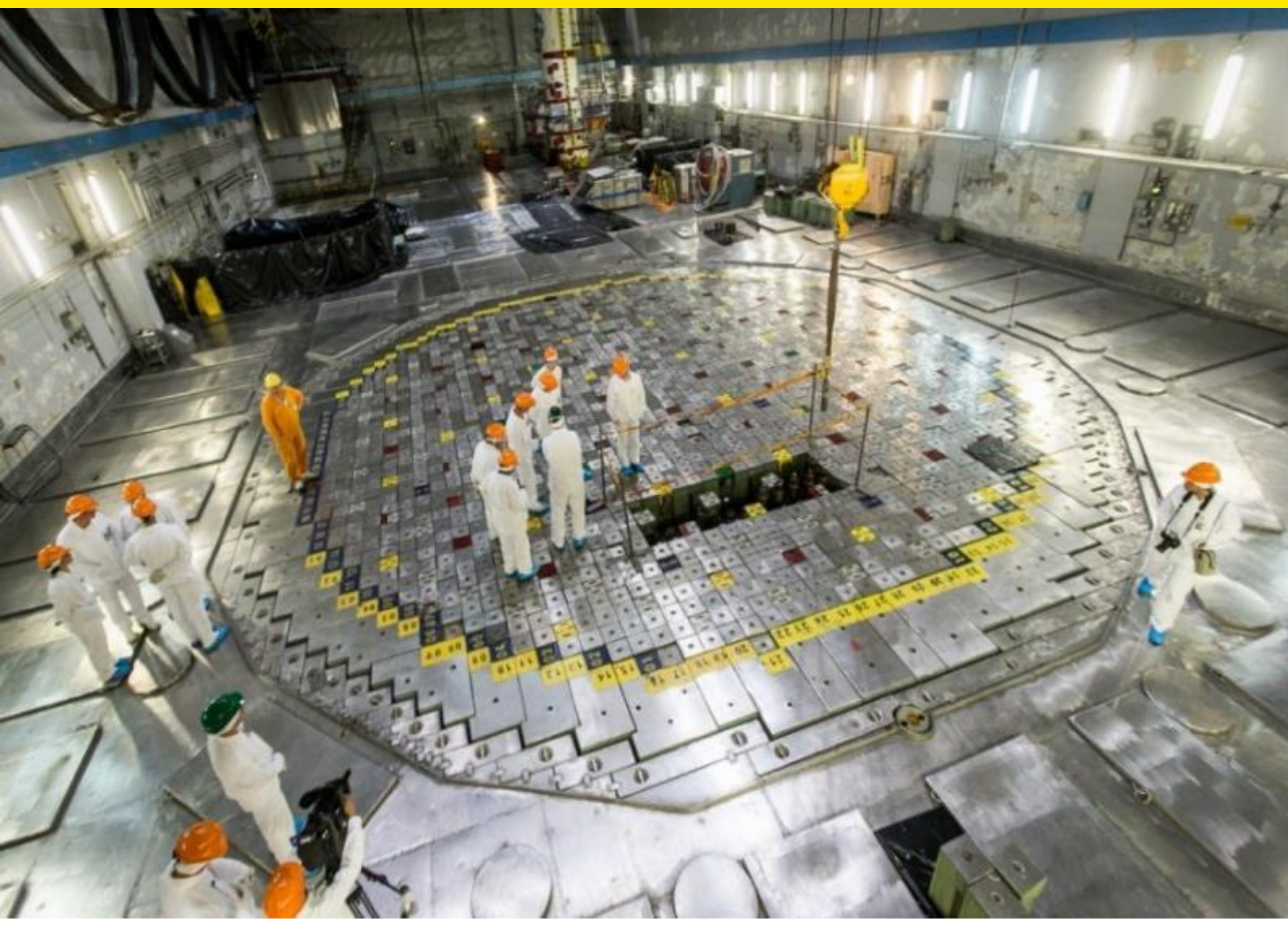
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# Acronyms

BG	Bulgaria
CPMA	Central Project Management Agency, Lithuania
DG	Directorate General
D&D	Dismantling & Decontamination
DfD	Decontamination for decommissioning
EBRD	European Bank for Reconstruction and Development
ECA	European Court of Auditors
ECT	Evaporator Concentrate Tanks
ELENA	European Local Energy Assistance
EQ	Evaluation Question
ESF	European Social Fund
EU	European Union
EVM	Earned Value Monitoring
FTE	Full time equivalent
IER	Ion Exchange Resins
IDSF	International Decommissioning Support Fund (I-Ignalina, K-Kozloduy, B-Bohunice)
ISFSF	Interim Storage Facility for Spent Fuel
LLW, VLLW	Low Level Waste, Very Low Level Waste
LT	Lithuania
MFF	Multi-Annual Financial Framework
MS	Member State
NDF	National Disposal Facility
NGO	Non-Governmental Organisation
NDAP	Nuclear Decommissioning Assistance Programme
NPP	Nuclear power plant

NRA	Nuclear Regulatory Authority, Slovakia
OECD	Organisation for Economic Cooperation and Development
PMU	Project management unit
PQ	Prospective Question
RAW	Radioactive waste
R&D	Research & Development
SAR	Safety Analysis Report
SME	Small and Medium Sized Enterprise
SK	Slovak Republic
SPI	Schedule Performance Index
TBC	To Be Confirmed
TD	Technical design
TOR	Terms of Reference
UK	United Kingdom
VVER	Water-Water Energetic Reactor





# Executive Summary

## Objectives and approach of the study (sections 1.1 & 1.2)

The aim of the present study was to provide the European Commission with the necessary information to prepare its mid-term evaluation of the Nuclear Decommissioning Assistance Programme (NDAP) for the period 2014-2020 as per Article 9 of the NDAP Regulations. In particular, the report aimed to provide the Commission with robust evidence, analysis and conclusions with regards to i) the results of the programmes against the NDAP objectives, as well as the irreversibility of plants' shut-down, enhancement of nuclear safety, changes in organisational structures of Decommissioning Operators and management systems, ii) the efficiency of the use of resources, and iii) the EU Added Value of the programmes. Other evaluation criteria (e.g. relevance & coherence) and the indirect impacts of the NDAP were also examined.

The consulting firm EY (Ernst & Young) was awarded the contract by the European Commission following an open call for proposals. The engagement team was composed of evaluators based in Paris, France with the support of nuclear experts. The study was launched in April 2017 and finalised in March 2018. The methodological approach followed for this study was divided into three sequential phases.

- ▶ The objective of the **Inception Phase** was to lay down the foundations for the evaluation, ensuring that the context and expectations were clearly understood by the Study Team and in line with the Commission's expectations. The final Inception Report was submitted 30 May 2017.
- ▶ The **Data Collection Phase** aimed to collect the evidence necessary from relevant documents and primary research (e.g. three country visits in order to collect data from the stakeholders, around 100 interviews with decommissioning operators and relevant stakeholders, EU officials, EBRD, industry professionals, international organisations, a benchmark with other large projects management, open public consultation, etc.) to respond to the evaluation questions. This main deliverable for this phase was the Intermediate Report submitted 21 August 2017.
- ▶ The **Analysis & Reporting Phase** consisted of the integration and analysis of the data collected in view of the development of recommendations and conclusions. The main deliverables of this phase were the Draft Final Report submitted 20 October 2017 and the present Final Report. The final phase included a wide consultation and revision process to collect feedback from relevant stakeholders, fact-check the document and submit the report to the review of independent experts.

## Background of the study (section 1.3)

Following the Chernobyl disaster in 1986, the EU decided that so-called High Power Channel Type Reactors (RBMK) and first-generation Soviet-designed nuclear reactors would need to be shut down. In the framework of their EU accession negotiations, Bulgaria, Lithuania and Slovakia made a formal commitment to close eight reactors at three Nuclear Power Plants (NPP) located on their territories. These were: Kozloduy NPP Units 1 to 4 in Bulgaria, Ignalina NPP Units 1 and 2 in Lithuania and Bohunice V1 NPP Units 1 and 2 in Slovakia. Recognising the exceptional circumstances of their closure, the EU committed to provide assistance to these three Member States to support decommissioning. The assistance provided can be divided into four distinct periods beginning during the pre-accession period and stretching to the current Multi-Annual Financial Framework (MFF). In December 2013, two new Council Regulations were adopted providing financial assistance for the MFF 2014-2020.<sup>1</sup>

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<sup>1</sup> Council Regulations (Euratom) No 1368/2013 for Bulgaria and Slovakia and (EU) No 1369/2013 for Lithuania.

During the current MFF, the general objective of the NDAP is to *assist Member States in implementing the steady process towards the decommissioning end state of the reactors in question in accordance with their respective decommissioning plans, whilst maintaining the highest level of safety*. Additionally, detailed objectives, targets, milestones and performance indicators have been defined for each programme.<sup>2</sup> The programme is implemented during the current MFF through indirect management. The Financial Regulations, NDAP Regulations and Delegation Agreements with Implementing Bodies set out a framework for programme governance and management.

Having begun the process of decommissioning at different points in time and with each national decommissioning programme subject to unique factors and challenges (e.g. type and size of units, existence of necessary waste management infrastructure, major delays etc.), the programmes have attained different levels of advancement to date. The expected decommissioning end dates range from 2025 for Bohunice to 2030 for Kozloduy and 2038 for Ignalina. By 2020, some EUR 2 995 million in EU financial assistance is expected to have been committed within the framework of the NDAP since 1999 for nuclear decommissioning, of which EUR 671 million for Bohunice (SK), EUR 731 million for Kozloduy (BG) and EUR 1553 million for Ignalina (LT). This amount is in addition to national contributions mobilised through dedicated funds and/or programmed budgets. The total allocated amount of national contributions currently amounts to EUR 1 086 million. EU already disbursed EUR 1366 million to date.

## Main findings & conclusions of the study

The NDAP remains a relevant & coherent instrument (sections 2.1 & 2.2)

**The NDAP remains a relevant instrument for supporting the three decommissioning programmes and is well embedded in the wider policy and regulatory context.** On the general level, the objective set out for the programmes in the Regulations remains relevant: the NDAP continues to support a stepwise reduction in the level of risk and radiological hazard at the three sites concerned. Current decommissioning strategies for the three programmes and on-going activities also remain at present fully aligned with the specific and detailed objectives set out for each programme. Coherence with the Euratom Treaty's acquis in the area of nuclear safety and management of spent nuclear fuel and radioactive waste has been ensured through the legal base of the NDAP, even if the programme constitutes an exception to some underlying principles enshrined in the Euratom acquis.

Notwithstanding the need to recover some delays and effectively mitigate current and future risks, programmes are generally on track to achieve objectives for the current MFF (section 2.3.1 – 2.3.3)

**Programmes can generally be considered to be on track towards reasonably achieving the principal objectives set for this programming period. However, satisfactory achievement of the objectives will in some cases require proactive management or projects and programmes to recover delays and mitigate present and future risks.**

Actual physical dismantling of equipment is progressing relatively quickly compared to previous programming periods. Dismantling & Decontamination work in the turbine halls and auxiliary buildings is winding down at Bohunice and progressing well at Ignalina and Kozloduy. The Bohunice programme has embarked on important physical works in the Controlled Area, whereas the Ignalina and Kozloduy programmes remain at different stages of the preparatory phase. Delays and challenges during this phase will need to be managed closely to avoid longer-term delays with the beginning of major physical works.

This progress reflects the nature of nuclear decommissioning programmes, which require significant upfront investment in planning and supporting infrastructure. Investments under previous programmes

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<sup>2</sup> It should be noted that unlike previous programming periods, the NDAP during the current MFF does not propose further EU support to mitigate the consequences of the early closure of the nuclear power plants.

have thus laid the foundation for the progress being achieved today. In particular, the completion of key waste management infrastructure projects has laid the groundwork for accelerating work at Ignalina and Kozloduy. At Ignalina, for example, the commissioning of the Interim Spent Fuel Storage Facility puts the programme on track to complete the critical task of defueling.

Finally, progress against waste management targets has been slow to date, although programmes should be able to recover delays. This underperformance has mainly been the result of uncertainties concerning radiological inventory and / or lack of anticipation of regulatory procedures leading to under or overestimations of target values, slower than planned progress with D&D activities, technical challenges related to specific legacy waste streams and some delays in the commissioning of waste management facilities.

**Since reactors' final shutdown, the level of risk at each site has been reduced in a stepwise manner, notably with the defueling of reactors and the decontamination, dismantling and disposal of contaminated and irradiated equipment and materials.** At Kozloduy and Bohunice, the remaining radiological hazard concerns primarily workers inside the nuclear facility. The most significant risk reduction was achieved in the previous programming period and the level of risk to the surrounding environment and general population has been highly diminished. In comparison, a relatively significant level of risk remains at Ignalina prior to the completion of defueling activities. During the period covered by this mid-term evaluation, the NDAP has contributed to a risk reduction associated with the Ignalina site with the beginning of defueling activities. This contribution will continue to increase significantly in the coming five years as the process follows its course.

**Overall, a number of different underlying factors have contributed to or detracted from programmes' effectiveness.** Whereas delayed waste management infrastructure projects were a main culprit of delay under the previous MFF, the successful completion of key projects in recent years has contributed and will further contribute to accelerating progress in coming years. Technical challenges remain inherent to the decommissioning process, which cannot yet be considered a mature industry. These technical challenges are further compounded in the case of decommissioning early-generation reactors. Finally, the effectiveness of programme implementation has also been impacted by risks in the administrative realm that could have been completely or at least partially avoided. These challenges reflect in part the limited experience with decommissioning at the national level (and overall).

The NDAP's Monitoring & Control framework has continued to be refined to respond to past weaknesses and ensure stronger strategic management of programme implementation (section 2.3.4)

**With the current programming period, significant progress has been achieved compared with previous generations of the programme in terms of articulating clear objectives and translating those objectives into a robust monitoring framework.** The introduction of Earned Value Management has also enhanced the quality of programme monitoring. New templates were developed for key monitoring and programming documents that are reviewed at new programme-level Monitoring Committees. The Commission also continues to conduct regular monitoring missions. While these developments represent an important step forward, some continued progress is desirable in terms of improving the quality of certain indicators, adjusting and streamlining the contents of Monitoring Reports and Annual Work Programmes and continuing to perfect the implementation and use of the Earned Value Management system.

Communication activities have generally been adequate (section 2.3.5)

Decommissioning Operators in all three countries have implemented relevant communication activities, which contributed to programme effectiveness. However, difficulties faced in Bulgaria with the Kozloduy Programme during the previous and current MFF point, amongst other lessons learnt, to the need to engage early and intensively with stakeholders. On the contrary, almost no communication or public engagement activities specific to the NDAP are undertaken at EU level. While not representing a breach of any legal requirement, the study found that this represents a missed opportunity to communicate on

achievements and add additional EU Added Value.

Beyond supporting decommissioning programmes, the NDAP has also contributed to some indirect socio-economic impacts (section 2.4)

**The economic impact achieved by the NDAP is mainly related to the direct impact of the contracts benefiting the rising European decommissioning market.** Overall, approximately 350 procurement contracts have been signed, representing approximately EUR 1,1 billion injected into the decommissioning market. While large western European companies were important beneficiaries, local industries in Bulgaria, Lithuania and Slovakia have benefited significantly from contracts funded through the NDAP. No new technologies were developed in the framework of NDAP-supported contracts; however, they allowed companies to showcase new technologies and methods. Finally, the experience gained by Decommissioning Operators may have a return on investment in the future through commercial implication in other decommissioning projects.

**The NDAP has also contributed to offsetting the social impact of decommissioning through supporting employment of former NPP staff during the decommissioning process.** Overall, an estimated 2 228 fewer jobs would exist in the Ignalina and Kozloduy programmes had a SAFSTOR approach been adopted rather than the immediate dismantling approach to which the NDAP contributed.

Programme governance & management structures are fit-for-purpose, but further efforts can be directed towards improving their functioning (section 2.5)

**The programme governance and management system is generally considered to be fit-for-purpose.** It provides for a clear and logical division of roles and responsibilities and is adapted to the specific constraints of the programme. In practice, however, some divergences can be observed between the intended and actual functioning, which may impact its effectiveness and efficiency.

The **Commission** plays a high level supervisory role, responsible for ensuring overall programme effectiveness and efficiency. Since 2014, it has worked to develop new tools to monitor effective and efficient implementation of the decommissioning programmes. These have allowed the Commission to improve its ability to strategically manage the programme with an eye on results and cost-effectiveness, rather than simply financial execution. However, the Commission has had some difficulties ensuring timely implementation of the annual programming cycle due to impractical processes and timelines set out in the legal base of the NDAP.

The potential of the **NDAP Committee** is limited by the timeliness and relevance of information provided. In particular, the annual programming documents are regularly provided to the committee for approval six or more months after the beginning of the year. Information is also inadequately filtered and adapted to the audience needs. Where the right conditions are in place, powers of the NDAP Committee may be further focus on high-level programme rather than project level oversight.

Overall, **Implementing Bodies** are effectively fulfilling their delegated responsibilities. In practice, they are also playing a technical oversight role somewhat beyond their formal responsibilities due in part to the historical absence of strong, high-level technical oversight on the part of some national ministries.

**Programme Coordinators** have assumed an increasing ownership of the implementation of decommissioning programmes thanks to political and procedural efforts to strengthen their role as well as a now high level of buy-in; however, there remains further margin for continuing to strengthen their role to varying extents, in particular through stronger technical capacity. Moreover, the current detailed implementation procedures afford only limited latitude to Programme Coordinators to assume a more active role in programme governance.

The cost performance of programmes has been satisfactory, but continuous efforts can be made to secure & improve cost-effectiveness at all levels (section 2.6)

**The cost performance of all three programmes has generally been satisfactory to date. This**



**stands in contrasts to difficulties with some programmes faced in the previous MFFs. At the time of the study, the 2014 programme cost estimates are expected to be maintained or decrease slightly for Ignalina and Bohunice respectively.** The cost of the Kozloduy programme remains unchanged, but was under revision and may evolve. The analysis of implementation would suggest that there is no imminent risk at present of further cost increases due to the extension of programmes.

**Some of the largest increases in project budgets over the years are in fact a result of revised planning and cost estimation or simple uncertainty rather than cost increases per se.** Following poorly made initial estimates, project cost estimates naturally increased as the technical design, planning and regulatory uncertainties became clearer. However, Decommissioning Operators have strengthened their planning and cost estimation methodologies, notably at Kozloduy and Ignalina.

**A number of other specific issues have also influenced the cost-effectiveness of programmes during the current and previous MFFs.** Project delays can be cited as amongst the most often found reasons for cost increases in all three programmes. Issues effectively and efficiently managing the procurement process were frequently identified during project implementation. Technical difficulties remain an inherent part of the decommissioning process and can detract from cost-effectiveness. Largely avoidable administrative issues continue to impact cost-effectiveness, in particular in the Kozloduy programme. Regulatory issues have also contributed to delays and cost increases, in particular for the Kozloduy programme. Finally, the slow process of organisational change within Decommissioning Operator organisations has had some impacts on cost-effectiveness.

**From a more macro perspective, the study found that increasing levels of national contribution is supporting stronger accountability** and inducing economy-seeking behaviour on the part of beneficiaries. However, national contributions could be further increased and expectations clarified on the basis of a clearer framework for co-financing decommissioning programmes. Moreover, the historically open-ended nature of the programme should also be addressed. It does not contribute to reinforcing incentives for economy-seeking behaviour and creates significant future uncertainty concerning the source of financing for decommissioning programmes, in particular in Lithuania.

**The management system established for the NDAP, as amended in 2014, is generally supporting programme efficiency.** The implementation of Earned Value Management has, for the first time, created a tool for systematically monitoring cost-effectiveness. Implementing Bodies have played an important role in ensuring sound financial management of funds. The administrative costs of programme management are also generally reasonable compared to programme size and the transition to 'National Agencies' as Implementing Bodies could potentially reduce administrative costs further in coming years. More generally, stakeholders also raised other minor concerns with regard to the need to further streamline programming and reporting documents and optimise the number of meetings.

**Without prejudice to the margin for increased cost-efficiency identified by the study, exogenous variables can explain in large part the cost variations between the three programmes more so than variations in cost effectiveness.** These variables include factors such as the size of the plants, the reactor technology, the level of pre-existing infrastructure or the local cost of labour and strength of local supply chains.

The EU Added Value of the NDAP as it has traditionally been defined is naturally declining, but the programme can redefine how it adds value through increased focus on knowledge sharing (section 2.8)

**The NDAP has been important to supporting the decommissioning processes in the current MFF. Continued progress of decommissioning would likely have been negatively impacted to varying degrees in absence of the NDAP during the current programming period. Nonetheless, the added value of the programme is naturally declining as implementation progresses.**

The EU added value of the NDAP from its beginning has been cast in terms of financial mitigation and nuclear safety. With a finite level of radioactivity on site, however, each additional euro of investment provides decreasing rates of return. The EU added value of the programme is thus naturally decreasing

over time. Moreover, the funding gap for two of the three programmes (Kozloduy and Bohunice) has been closed to small amounts that do not pose risks for State finances.

The question of the continued added value of the programme can thus be raised on the basis of the diminishing rate of return observed at present; however, other types of EU added value could be further leveraged to justify an adequate 'return on investment' for Europe for future EU assistance. Of the 90 nuclear reactors currently permanently shut down in Europe, only three have been completely dismantled. The level of experience in the dismantling of nuclear reactors in Europe (as well as internationally) is thus limited. The NDAP's contribution to securing the shutdown and immediate dismantling of these reactors has led to the generation of a highly significant amount of experience that can be of benefit to other decommissioning projects. However, the large part of this added value remains confined to the companies benefiting from NDAP contracts and the Decommissioning Operators. While these actors are well placed to disseminate and apply this knowledge in the future, there are no mechanisms in place to ensure this knowledge is diffused into the public domain for use by relevant actors, other NPPs, Decommissioning Operators, national authorities, research actors, etc.

## **Way forward** (section 3.2)

The following table provides a presentation of the key suggestions identified by the study team on the basis of the findings & conclusions. These have been grouped into nine strategic areas.

- 1** Reflecting the advancement of the programmes and the wider context of decommissioning in the EU, the underlying rationales of the NDAP should be adapted to provide stronger added value in terms of knowledge generation and sharing in view of the enormous financial and technical challenge represented by decommissioning in the EU.
- 2** Build on the positive steps taken since 2014 and introduce some targeted amendments to the performance measurement framework to ensure and enhance its continued relevance post-2017.
- 3** Encourage and support the development of further national ownership of decommissioning programmes by national authorities by improving their capacity to ensure the supervision of programmes.
- 4** Strengthen the role of Monitoring Committees in order to establish them as the 'centre of gravity' of decision making within the programme and a forum for Programme Coordinators to assume increased leadership over programme implementation.
- 5** An increased role for Programme Coordinators should be complemented and supported by a clarification of financial responsibilities for the remainder of programmes and stronger national 'buy-in' to strengthen accountability for programme cost-effectiveness.
- 6** Improve the timeliness of the programming process and streamline the contents of programming and monitoring documents to enhance their relevance.
- 7** Adopt a stronger "waste-led approach" to programme implementation through tighter monitoring of critical projects and stronger prospective analysis.
- 8** Consider developing communication and engagement activities at EU level to address political risks and contribute to supporting dialogue with civil society on nuclear decommissioning.
- 9** While remaining the full responsibility of the Member States, the Commission should consider more the social aspects of decommissioning.



1

## Context & introduction

# 1. Introduction

## 1.1 Objectives and scope of the study

The aim of the present study was to provide the European Commission (or ‘Commission’) with the necessary information to prepare its mid-term evaluation of the Nuclear Decommissioning Assistance Programme (NDAP) for the period 2014-2020.<sup>3</sup> In particular, Articles 9 of the 2013 Regulations provide that a mid-term evaluation report should be presented by the Commission in close cooperation with the Member States by 31 December 2017.

The mid-term evaluation will report on the achievement of the objectives of all the NDAP-related measures in relation to:

- ▶ Results and impacts with reference to:
  - The NDAP general objective.
  - The specific and detailed objectives of the NDAP, as well as key performance indicators.
  - The irreversibility of the plants’ shut-down and their decommissioning, the enhancement of nuclear safety, the changes of organizational structure, the lasting changes (e.g. knowledge build up) and the management systems (e.g. waste management systems).
- ▶ Efficiency of the use of resources with focus on costs and target on continuous improvement
- ▶ The EU Added Value, with a focus on the reduction of the nuclear risk for the EU general population and on the Commission’s leverage in order to maximize impacts.

In particular, the evaluation focuses on programme output, safety, governance and knowledge. The indirect impacts of the NDAP will also be examined such as the effects on the national framework for nuclear safety, impacts on SMEs and the local market, employment and social inclusion. The evaluation also considers the future and the scope for simplification and modification of the detailed implementation procedures laid down for the programmes.

With regard to the timeframe, the focus of the evaluation is on the period between 2014 and 2016 and, where relevant, it will be extended to consider the relevant developments from previous programming periods, notably the transition from the previous 2007-2013 programming period to the present.

The geographical scope of the evaluation work focuses on the implementation of the NDAPs in the Slovak Republic, Bulgaria and Lithuania.

## 1.2 Methodological approach, data collection and limitations

### 1.2.1 Methodological approach

The methodological approach followed for this study was divided into three sequential phases:

- ▶ The objective of the **Inception Phase** was to lay down the foundations for the evaluation, ensuring that the context and expectations were clearly understood by the Study Team and in line with the Commission’s expectations. The first version of the Inception Report was submitted 16 May 2017.
- ▶ The objective of the **Data Collection Phase** was to collect the evidence necessary from relevant documents and primary research to respond to the evaluation questions. This main deliverable for this phase was the Intermediate Report. Some data collection activities were subsequently finalised in parallel with analysis during the final stage.

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<sup>3</sup> The full Terms of Reference are available on the EU’s tenders electronic daily (TED) system [here](#).



- ▶ The **Analysis & Reporting Phase** consisted of the integration and analysis of the data collected in view of the development of recommendations and conclusions.

### 1.2.2 Work undertaken

The following table presents in detail the data collection work undertaken during the data collection phase. Some data collection work was also finalised during the Analysis & Reporting Phase.

**Table 1: Overview of data collection**

Task	Work undertaken
<b>Documentary review</b>	<ul style="list-style-type: none"> <li>▶ In-depth desk research was undertaken by the Study Team prior to the field visits with the objective of ensuring a thorough understanding of the respective decommissioning programmes and better adapting the general topic guides to the context of each programme.</li> <li>▶ Documents reviewed included the Detailed Decommissioning Plans, Monitoring Reports, Annual Work Programmes and selected project documentation. Additional documents were gathered during the field visits and reviewed by the Study Team over the course of the data collection phase.</li> </ul>
<b>Interview programme</b>	<ul style="list-style-type: none"> <li>▶ Interviews with the European Commission, including DG ENER and other relevant Services.</li> <li>▶ Interviews with other EU Institutions and International Organisations</li> <li>▶ Interviews with a sample of NDAP Committee members</li> <li>▶ Interviews with a sample of industry actors</li> </ul>
<b>Field visits</b>	<p>Four field visits were organized during the month of June 2014:</p> <ul style="list-style-type: none"> <li>▶ London – United Kingdom, 12 – 14 June 2017 (Observation of the Assembly meetings and a workshop hosted by the EBRD, interviews with key stakeholders of the EBRD)</li> <li>▶ Vilnius and Visaginas – Lithuania, 18 – 23 June 2017 (24 interviews with INPP, CPMA, national authorities and regulatory authorities)</li> <li>▶ Bratislava and Bohunice – Slovak Republic, 26 - 30 June 2017 (14 interviews with SIEA, JAVYS, the Nuclear Regulatory Authority of the Slovak Republic (NRA) and the Ministry of Economy of Slovakia)</li> <li>▶ Sofia and Kozloduy – Bulgaria, 27 - 30 June 2017 (12 interviews with the Ministry of Energy, SE RAW and the Bulgarian Nuclear Regulatory Authority)</li> </ul>
<b>Public consultation</b>	<ul style="list-style-type: none"> <li>▶ An Open Public Consultation launched by the Commission on 23 June 2017 gathered 17 responses.</li> <li>▶ Targeted e-survey consultations launched by the Study Team in July 2017 gathered 10 responses from 202 stakeholders contacted in total (26 in Bulgaria, 40 in Lithuania and 136 in Slovakia)</li> </ul>

Task	Work undertaken
<b>Benchmark exercise</b>	<ul style="list-style-type: none"> <li>▶ In-depth online desk research concerning three comparator programmes (ESIF Major Projects<sup>4 5</sup>, Budget Support Operations and the Connecting Europe Facility).</li> <li>▶ Complementary telephone interviews undertaken with six programmes stakeholders.</li> </ul>
<b>Expert panel</b>	<ul style="list-style-type: none"> <li>▶ An internal Expert Panel was organised on the 22th September 2017 based on the intermediate version of the draft final report in order to validate conclusions and discuss recommendations.</li> </ul>

A more detailed presentation of data collected is included in Annex 1.

### 1.2.3 Challenges and limitations of the study

The results of the study should be considered in the light of some limitations encountered. These limitations are also summarised below and indicated throughout the report where necessary. Overall, these limitations did not pose any major challenges to the evaluation and were able to be mitigated as described below:

- ▶ **Stakeholders with a deep knowledge of the programme are limited in number and generally directly involved in the programme in some way – e.g. Commission, Implementing Bodies, Decommissioning Operators and Programme Coordinators.** This is due primarily to the technical nature of the programme and the limited circulation of detailed information outside direct stakeholders. Even 'internal' and external stakeholders with some level of access to the details of programme implementation considered that it was difficult for them to share an informed opinion on the programme. Members of the NDAP Committee, while having relevant input on issues of governance and monitoring, often felt that they could not offer an informed view on programme effectiveness and efficiency. This was also the case for experts in International Organisations, such as the International Atomic Energy Agency (IAEA) or Organisation for Economic Cooperation & Development-Nuclear Energy Agency (NEA), as well as expert and civil society actors on the national level.

Perceptive information obtained by stakeholders directly involved in the programme had to be considered in light of any potential bias or motive stemming from their direct involvement in the programme. Wherever possible, perceptive data obtained through interviews has been triangulated with other data, in particular monitoring documents and statistics. Where this has not been possible, and the Study Team has had to rely primarily on the first-hand accounts of direct stakeholders, this is clearly indicated in the report. Overall, the limitation is minor and does not significantly impact the main findings of the study due to the availability of other sources for triangulation.

This closed circle of informed stakeholders also likely contributed to the limited response received to the Open Public Consultation launched by the Commission or the targeted e-survey consultations launched by the evaluation team to external actors on the national level. Indeed, a number of stakeholders contacted for the targeted consultation responded that they did not feel adequately informed to respond to the survey.

<sup>4</sup> Article 100 of the Regulation (EU) No 1303/2013 of the European Parliament and of the Council of 17 December 2013

<sup>5</sup> While ESIF Major Projects represent an interesting case study compare with NDAP, it should be noted that it is expressly forbid for these funds to be used for the purpose of supporting decommissioning (Article 3 (3) of the ERDF Regulation & Article 2(2) of the Cohesion Fund Regulation)

- **Some challenges were faced in the analysis of efficiency internally within each programme and through comparison between programmes due to varying approaches for project / financial management.** Each Decommissioning Operator has developed different work breakdown structures, cost structures and modalities for monitoring expenditure and results that are not entirely comparable between programmes, nor do they always align neatly internally within programmes. The use of indirect management mode and existence of multiple implementation channels also adds a layer of administration and entails the coexistence of multiple internal management processes, practices and working cultures. This presented challenges in analysis, in particular of efficiency, and limits comparison between programmes or with other decommissioning programmes. While it did not significantly impact the validity of findings, it limited the extent to which quantitative data from different sources could be fully integrated within and compared across programmes.
- **This Study has been conducted recently following a performance audit undertaken by the European Court of Auditors and an external review conducted by a consortium led by Deloitte (mandated by the Commission).** In one respect, this is a facilitating factor, providing valuable inputs to the study. The analysis and results of the recent studies have been integrated where relevant and certain specific analyses were excluded from the scope of this Study to avoid duplication. Where findings have been integrated from these studies, this has been clearly underlined in the report. However, the findings should be taken in light of the limitations as explained in the source reports – in particular the Deloitte report, which included a number of in depth analyses on issues not covered in the current review.

## 1.3 Background to the study

### 1.3.1 Historical development of the NDAP

**The 1986 Chernobyl disaster and its cross-border impact generated broad concern in Europe and beyond with regard to the operation of some first generation nuclear reactor types.** At the watershed 1992 Munich summit, the G-7 Heads of State and Government collectively committed to supporting the countries of Central and Eastern Europe with Soviet-designed nuclear power plants requiring safety upgrades. As part of these efforts and alongside other G-7 donors and the European Bank for Reconstruction & Development (EBRD), tasked with managing the Nuclear Safety Account, the EU began providing financial and technical assistance during this period to partner countries in Central and Eastern Europe, as well as Central Asia, through the TACIS and PHARE programmes. A number of countries benefited from this assistance, including Bulgaria, Czech Republic, Hungary, Lithuania, Romania, Slovakia, Slovenia, Armenia, Kazakhstan, Russia and Ukraine.

**In the framework of their EU accession negotiations, Bulgaria, Lithuania and Slovakia made a formal commitment to close eight reactors** at three Nuclear Power Plants (NPP) located on their territories. These were: Kozloduy NPP Units 1 to 4 in Bulgaria, Ignalina NPP Units 1 and 2 in Lithuania and Bohunice V1 NPP Units 1 and 2 in Slovakia. The reactors were shutdown, as per the timescales set out in the Accession Treaties, the last one in 2009.

**Table 2: Nuclear reactors subject to early closure and support through the NDAP**

Member State	Reactor unit / type	Envisaged operational lifetime	Closure date	Decommissioning timescale*
<b>Bulgaria</b> Kozloduy NPP Units 1 – 4	Unit 1: VVER- 440/230	1974 - 2004	2002	2030 (24 years)
	Unit 2: VVER- 440/230	1975 - 2005	2002	
	Unit 3: VVER- 440/230	1980 - 2011	2006	

	Unit 4: VVER- 440/230	1982 - 2011	2006	
<b>Lithuania</b> Ignalina NPP Units 1 & 2	Unit 1: RBMK 1500	1984 - 2013	2004	2038 (29 years)
	Unit 2: RBMK 1500	1987 - 2017	2009	
<b>Slovak Rep.</b> Bohunice V1 Units 1 & 2	Unit 1: VVER- 440/230	1980 - 2008	2006	2025 (17 years)
	Unit 2: VVER- 440/230	1981 - 2010	2008	

*\*Pre-decommissioning activities began for all programmes before final shutdown of reactors. The timescales indicated above provide the end date and the duration following the shutdown of the final unit.*

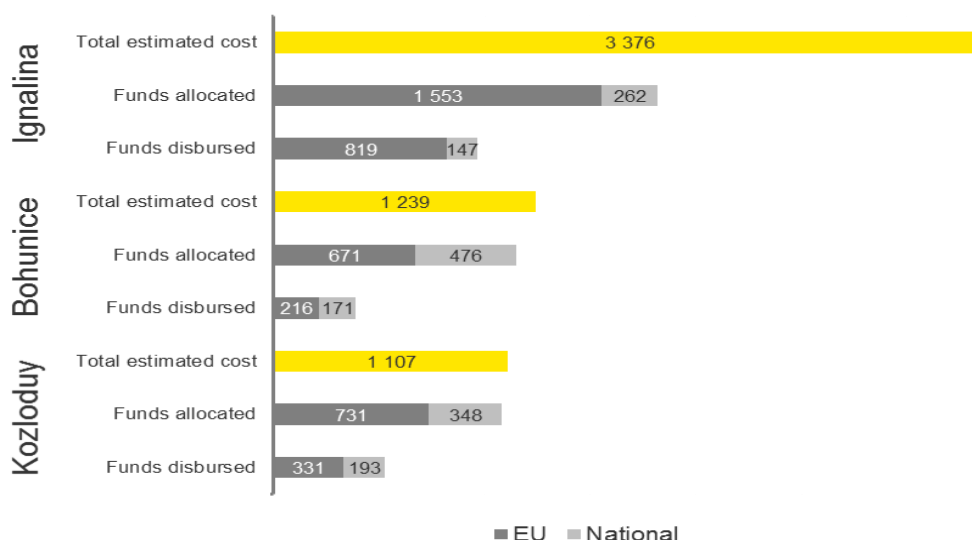
**Recognising the exceptional circumstances of their closure, the EU committed to provide assistance to these three Member States to support decommissioning, as well as mitigation measures to address the consequences of early closure.** Historically, this assistance, provided through the NDAP, can be divided into four distinct periods beginning during the pre-accession period and stretching to the current Multi-Annual Financial Framework (MFF):

- ▶ During the **pre-accession period** (up to 2004 for Slovakia and Lithuania and 2007 for Bulgaria), the three countries received funding through the instruments targeted at candidate and partner countries (PHARE and later the Instrument for Pre-accession Assistance).
- ▶ Financial assistance over the second period (2004 - 2006 for Slovakia and Lithuania and 2007 – 2009 for Bulgaria) was provided under the **protocols to the countries' accession acts**.
- ▶ Since 2007 for Slovakia and Lithuania and 2009 for Bulgaria, **Council Regulations** have ensured the continuation of assistance for decommissioning assistance programmes.
- ▶ The **fourth and current period began in 2014 with the new MFF** and will run until 2020. In December 2013, two new Council Regulations were adopted providing financial assistance for the MFF 2014-2020: Council Regulations (Euratom) No 1368/2013 for Bulgaria and Slovakia and (EU) No 1369/2013 for Lithuania.

**By 2020, some EUR 2 995 million in EU financial assistance is expected to have been committed within the framework of the NDAPs since 1999 for nuclear decommissioning** (excluding energy window projects under previous MFFs). The overall resources available to the three programmes for the current MFF amounts to EUR 969 million. These amounts are in addition to **national contributions** mobilised through dedicated funds and/or programmed budgets. The total allocated amount of national contributions currently amounts to EUR 1 086 million. By the end of 2016, EUR 4 041 million in funds has been allocated for decommissioning projects (including EUR 401,9 million during the current MFF) and EUR 1 876 million has been disbursed (including EUR 3,8 million allocated during the current MFF). The total amount of funds disbursed represents approximately 33% of the overall estimated cost of the three programmes.



**Figure 1: Estimated cost, funds allocated and funds disbursed by programme as of 31 December 2016 (Commission, European Court of Auditors) (M of EUR)**



Further details on the context of this programme are provided in Annex 6.1

### 1.3.2 Objectives of the NDAP

**The NDAP Regulations covering the current MFF define the general objective (article 2.1) and the specific objectives (article 2.2) for each programme.** The general objective is to *assist Member States in implementing the steady process towards the decommissioning end state of the reactors in question in accordance with their respective decommissioning plans, whilst maintaining the highest level of safety.* It should be noted that unlike previous programming periods, the NDAP during the current MFF does not propose further EU support to mitigate the consequences of the early closure of the nuclear power plants. The specific objectives for each programme are summarised in the table below.

**Table 3: Specific objectives of NDAP**

MS	Specific Objectives (as per Article 2.2 of the NDAP Regulations)
Kozloduy (BG)	<ul style="list-style-type: none"> <li>▶ 1. Performing dismantling in the turbine halls of units 1 to 4 and in auxiliary buildings;</li> <li>▶ 2. Dismantling of large components and equipment in the reactor buildings of units 1 to 4; and</li> <li>▶ 3. Safely managing the decommissioning waste in accordance with a detailed waste management plan.</li> </ul>
Ignalina (LT)	<ul style="list-style-type: none"> <li>▶ 1. Defueling of the reactor core of unit 2 and the reactor fuel ponds of units 1 and 2 into the dry spent fuel storage facility;</li> <li>▶ 2. Safely maintaining the reactor units; and</li> <li>▶ 3. Performing dismantling in the turbine hall and other auxiliary buildings and safely managing the decommissioning waste in accordance with a detailed waste management plan.</li> </ul>

Bohunice (SK)	<ul style="list-style-type: none"> <li>▶ 1. Performing dismantling in the turbine hall and auxiliary buildings of reactor V1, to be measured by the number and type of systems dismantled;</li> <li>▶ 2. Dismantling of large components and equipment in the V1 reactor buildings, to be measured by the number and type of systems and equipment dismantled; and</li> <li>▶ 3. Safely managing the decommissioning waste in accordance with a detailed waste management plan, to be measured by the quantity and type of safely conditioned waste.</li> </ul>
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**Additionally, detailed objectives, targets, milestones and performance indicators have been defined for each programme and each specific objective** in Annex 1 of the Commission Implementing Decision C(2014) 5449 final. The Implementing Decision and its Annexes are collectively referred to in this report as the detailed implementation procedures. The detailed objectives, along with the targets, milestones and indicators are presented throughout the section 2.3.1 on programme effectiveness.

### 1.3.3 Management of the NDAP

The Nuclear energy, Nuclear Waste and Decommissioning Unit (D2) under the Nuclear Energy, Safety and ITER Directorate of the Directorate-General for Energy of the European Commission (DG ENER) is the *chef de file* of the NDAP supervision on behalf of the Commission. During the 2014-2020 MFF, the management mode is indirect management, whereby the Commission entrusts budget implementation tasks to Implementing Bodies, but retains overall responsibility and accountability for EU budget implementation.

The EBRD has been selected by the Commission to act as an Implementing Body for all three of these programmes. In Lithuania, the Central Project Management Agency (CPMA), a national public-sector body, has also been designated by the Commission in agreement with Lithuania, and assessed and approved by the Commission to act as a second Implementing Body (since 2001), and performs the same functions as the EBRD for the projects placed under its management. During the current MFF, all new projects have been attributed to the CPMA, meaning the role of the EBRD is being gradually phased out. Slovakia also requested to establish, in addition to the EBRD, a national implementation channel, the Slovak Innovation and Energy Agency (SIEA), which shall implement all new projects. After the legally required assessment for Implementing Bodies (the 'pillar assessment'), the Commission signed a delegation agreement with SIEA in 2016. The first project to be implemented by the SIEA (project D4.4C) was approved in May 2017.

Each Member State has also appointed a Programme Coordinator (Deputy Minister or State Secretary) responsible for overseeing the programming, coordination and monitoring of the respective decommissioning programme. Decommissioning Operators are responsible for implementing the decommissioning programmes under the supervision and with the support of the Programme Coordinators and Implementing Bodies. The Decommissioning Operators are the State Enterprise for Radioactive Waste (SERAW) in Bulgaria (this role was previously held by the Kozloduy Nuclear Power Plant (KNPP)), the Ignalina Nuclear Power Plant (INPP) in Lithuania and Nuclear and Decommissioning Company (*Jadrová a vyrad'ovacia spoločnosť* or JAVYS) in Slovakia.

The governance and management of the NDAP is determined and specified in the legal basis, i.e. the 'NDAP Regulations' and the detailed implementation procedures. The latter set out the roles and responsibilities of different actors and the dispositions for programming, monitoring and reporting. The roles and responsibilities of Implementing Bodies are further developed in specific Delegation Agreements. Finally, the Union Financial Regulations provide the overall regulatory framework for the financial management of the programme. A detailed description of the governance and management of the NDAP is provided in Annex 6.2.

### 1.3.4 Current state-of-play of the decommissioning programmes

Nuclear decommissioning involves a range of specific processes beginning before the final shutdown

of the reactor and ending once the site has been cleaned up to the point where the land can be reused or redeveloped. A more detailed description of the decommissioning process is provided in Annex 6.1. This section provides a summary overview of the current state-of-play of the three programmes in order to acquaint the reader with the current state of advancement prior to the more detailed discussion in this report.

**At Kozloduy and Bohunice, defueling of the reactors and adjacent reactor pools was completed** during the 2007 – 2013 period and requisite Decommissioning Licenses subsequently obtained. Defueling is currently underway in Lithuania at Ignalina and is expected to be completed by July 2022 (as per the 2017 Annual Work Programme).

**Important waste management infrastructure projects have recently been commissioned or are being commissioned at Kozloduy & Ignalina.** Most of the other final key waste management infrastructure projects are approved and under procurement or implementation. This infrastructure is critical to the functioning of the ‘waste management systems’ set up for each programme and has been the object of much of the investment in the early years of the programmes. Slovakia already possessed much of the requisite infrastructure prior to decommissioning and the development of its waste management system is highly mature.

**Actual physical dismantling of equipment is progressing quickly at all three sites compared to the first decade of programme implementation.** This reflects the nature of nuclear decommissioning programmes, which requires significant upfront investment in planning and waste management infrastructure development as explained above. Dismantling & Decontamination (D&D) work in the Turbine Halls and Auxiliary buildings outside the Controlled Area has advanced substantially and is expected to be largely completed by 2020 at Kozloduy and Ignalina and significantly sooner at Bohunice.

**Except for Bohunice, limited D&D work has been undertaken in the reactor buildings to date, reflecting the varying timelines of programmes.** The Kozloduy & Ignalina programmes are currently preparing the technical design for the dismantling of the reactor cores / primary circuit, which will begin in the coming years. The Bohunice programme is advancing well in D&D of the primary circuit, with key projects ongoing or in the planning and procurement phase.

The table below summarises the current state-of-play for each programme. A more detailed evaluation of the progress achieved for the 2014 – 2016 period against the objectives set out for each programme is provided in section 2.3.

**Table 4: State-of-play of decommissioning programmes in Bulgaria, Lithuania and Slovakia**

Prog.	Reactors defueled and fuel in interim storage	Decom. License obtained	Waste Mgmt. Infrastructure in place	D&D work in the Turbine Halls / aux. buildings outside CA	D&D work in the Reactor Buildings
Kozloduy (BG)	<i>Finalised</i> Reactors and fuel ponds are defueled.	<i>Finalised</i> Licenses issued for Units 1 & 2 and Units 3 & 4.	<i>On-going</i> Important treatment, conditioning & storage infrastructure recently commissioned or being commissioned.  Final key projects under implementation.	<i>On-going</i> Significant D&D work has been undertaken and work is expected to be finalized during the current MFF	<i>Under preparation</i> Project for the D&D concept for the reactor core / primary circuit is underway. <sup>6</sup>  Physical works in Controlled Area are ramping.

<sup>6</sup> Project also covers D&D of all other systems and components within the Controlled Area of the Reactor Building and the Auxiliary Buildings

Ignalina (LT)	<i>On-going</i> Defueling is underway and is expected to be completed by 2022.	<i>On-going</i> License pending defueling, but incremental D&D work possible with modifications of current licenses.	<i>On-going &amp; under preparation</i> Important treatment, conditioning & storage infrastructure recently commissioned or being commissioned.  Additional key projects ongoing	<i>On-going</i> Significant D&D work has been undertaken and work is expected to be finalized during the current MFF.	<i>Under preparation</i> Design work for reactor building and reactor core ongoing.  Some limited D&D work to date in the Reactor Building A1, with main physical works to begin in 2019.
Bohunice (SK)	<i>Finalised</i> Reactors defueled and fuel in interim storage	<i>Finalised</i> Licenses obtained for stage 1 / 2.	<i>Almost finalised</i> Final key projects are under implementation.	<i>Almost finalised</i> D&D work is nearing completion.	<i>On-going</i> Significant D&D work underway





# 2

## **Findings of the evaluation**

## 2. Findings of the evaluation

*During the inception phase, an evaluation framework was developed to provide an overarching analytical structure for the evaluation. This framework includes the reconstruction of the intervention logic for the NDAP, as well as the definition of evaluation questions and sub-questions and the development of evaluation grids setting out transparent criteria for drawing judgments and conclusions. In total, eight evaluation questions and 13 sub-questions were defined. The following sections 2.1 – 2.8 provide the answers to the evaluation questions developed on the basis of the evidence collected.*

*The details of the evaluation framework are provided in Annex 2.*

### 2.1 EQ1. To what extent are the general and specific objectives of the NDAP still appropriate in relation to the existing needs?

*The aim of this question was to measure the extent to which the NDAP is still in line with the needs existing in relation to decommissioning for each Member State. To this end, evaluators have examined the extent to which the needs, at a general, specific and detailed level, have evolved since 2014. Where necessary, the study has proposed specific amendments at the level of the detailed objectives (e.g. to the detailed implementation procedures) in order to take into account the evolution of needs observed.*

The objectives of the NDAP in each of the three concerned Member States are set out in the NDAP Regulations (general & specific objectives), and detailed in the detailed implementation procedures<sup>7</sup>. The latter specify the detailed objectives, targets, milestones and performance indicators and the overall decommissioning baselines for the three programmes.

#### **The general and specific objectives of the programme remain relevant**

**On the general and specific level, the objectives set out for the programmes in the Regulations remain relevant to the current situation.** In the current MFF (2014-2020), the underlying need for continued Union assistance to remove radiological hazards through decommissioning remains intact (see sections 2.3.3 & 2.8). Continued progress in the decommissioning at the three sites would likely have been impacted in the present MFF in absence of EU support (see section 2.8). The NDAP thus continues to support a stepwise reduction in the level of risk and radiological hazard at the three sites concerned, in particular at Ignalina where defueling operations are ongoing (see section 2.3.3). Current detailed decommissioning strategies for the three programmes remain at present aligned with the specific objectives set out for each programme. Finally, the detailed objectives also continue to reflect the principal on-going activities as defined in the detailed decommissioning plans.

#### **Some lower level adjustments are required to ensure effective monitoring after 2017**

**While no evolution in the context or decommissioning strategies would merit changes to the objectives, some of the detailed targets, milestones and performance indicators developed to operationalise and monitor attainment of the objectives should be adapted or updated** to ensure effective monitoring after 2017. In particular, fine-tuning to Annexes 1 (detailed objectives) & 3 (baseline decommissioning schedule) of the detailed implementation procedures is necessary to reflect the current programme situation for Bohunice. These changes are supported by Bohunice programme stakeholders to ensure the continued relevance of the monitoring framework. For the Kozloduy

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<sup>7</sup> See the following section for an in depth discussion of objectives and their level of achievement

programme, elements of the monitoring framework should be fine-tuned to clarify the expected milestones and targets for the present programming period and provide fuller coverage of the corresponding detailed objectives.

**Some targets and milestones for all three programmes should also be adapted in order to account for the fact that funds committed up to 2020 will in reality continue to be disbursed over a period of several years following 2020.** The existing 'monitoring framework', consisting of the baseline programme schedule (Annexes 2 – 4 of the detailed implementation procedures), the targets, milestones and indicators (Annex 1 of the detailed implementation procedures) and the more detailed indicators defined on an annual basis, does provide a basis for continuing to monitor programme implementation post-2020. However, the quality and relevance of this framework would be better ensured through some small adjustments. In particular, it is necessary to adapt the targets and milestones, most of which run up to 2020 and thus do not reflect progress to be achieved following that date as disbursement of funds committed up to 2020 continues.

Necessary adjustments to the monitoring framework are discussed in greater detail in section 2.3.4.

## **2.2 EQ2. Is the NDAP coherent with the Euratom Treaty's acquis in the area of nuclear safety and responsible management of spent fuel and radioactive waste? EU acquis in other relevant areas?**

*The aim of this question was to assess the extent to which the NDAP intervention is coherent with relevant EU policies. It is important to note that this question did not aim to assess the extent to which these have been transposed into national regulatory frameworks. Rather, it focused primarily on assessing the extent to which the NDAP Regulations are themselves coherent with EURATOM / EU acquis and the extent to which these have been implemented in practice.*

### **The NDAP is coherent with the Euratom Treaty's acquis in the area of nuclear safety and management of spent nuclear fuel and radioactive waste**

#### **Coherence with the Euratom Treaty's acquis in the area of nuclear safety and management of spent nuclear fuel and radioactive waste has been ensured through the legal base of the NDAP.**

The preambles of the Regulations state that *the decommissioning of the nuclear power plant covered by this Regulation should be carried out in accordance with the legislation on nuclear safety, namely Council Directive 2009/71/Euratom, and waste management, namely Council Directive 2011/70/Euratom.* In addition, the 'ex ante conditionalities' provided a tool for the Commission to ensure coherence with these directives by requiring Member State compliance with the aforementioned Directives before the first commitment of funding under the present MFF.

**While the legal base ensures coherence, the NDAP itself constitutes an exception to some underlying principles enshrined in the Euratom acquis.** On the one hand, the support provided by the NDAP has played an important role in accelerating decommissioning efforts in a safe manner, thus avoiding the passing on of an undue burden to future generations, a fundamental principle in international and EU law. However, the NDAP derogates to the principle, sanctioned by the Council Directive 2011/70, that the costs for the management of spent fuel and radioactive waste is borne by those who generated those materials. The exceptional nature of this programme is due to the specific historical context recognised by the Accession Treaties.

**Beyond the NDAP, the Council adopted Directive 2011/70 on the safe and responsible management of spent fuel and radioactive waste management.** Within this framework, complementary efforts are undertaken by the Commission to encourage and support all Member States in the development of solutions for long term management of spent fuel and high level radioactive waste in line with legal obligations. These actions are highly complementary to the NDAP in that they provide support to the three Member States for aspects of decommissioning not covered by the NDAP (e.g. the final disposal of spent nuclear fuel).

**While not explicitly mentioned by the NDAP Regulations, the NDAP has also been implemented in coherence with radiation protection law, covering basic safety and emergency preparedness and response.** Reporting issued by Regulators between 2014 and 2016 has not signalled any exceeding of dose limits for staff and contractors working on site. Radiological activity surrounding sites is monitored in all countries and has shown no abnormal levels of radiological release to the surrounding environment. More generally, Regulators' reports and company policies of Decommissioning Operators indicate that minimum requirements on the health and safety of workers are fully respected.

**The NDAP has also ensured coherence with other relevant EU acquis, in areas such as environmental and social protections**

In addition to citing the nuclear safety and waste management Directives, the preambles to the NDAP Regulations recall the need to comply with applicable Union law in the area of the environment, in particular Directive 2011/92/EU of the European Parliament and of the Council on the assessment of the effects of certain public and private projects on the environment. In addition, a number of other EU acquis (discussed below) were considered in the assessment of coherence. In all areas, the NDAP was found to be coherent with relevant acquis. However, stronger linkages with certain EU instruments could have been assured by the legal base and Member State authorities.

**Concerning the Environmental Impact Assessment Directive, the implementation of the NDAP has been coherent with the principles and obligations of this legislation.** Environmental Impact Assessments have been conducted across all programmes for both decommissioning programmes and/or individual projects in compliance with national law, including that transposing Directive 2011/92/EU. The Decommissioning Operators in Slovakia and Bulgaria produce an organisational environmental impact report on a yearly basis. In addition, EBRD-implemented projects are systematically required to develop Environmental and Social Plans (ESAP). The ESAP contains mitigation and performance improvement measures and actions that address the identified environmental issues/gaps in compliance with relevant local laws and regulations, as well as EBRD's Environmental and Social Policy Performance Requirements in all relevant stages of the project.

**The NDAP has also been implemented in compliance with relevant social protections in EU law.** The decommissioning process has entailed a process of organisational transformation, creating in some cases redundancies. These cases have been managed in compliance with relevant EU legislation, such as the Collective Redundancies Directive concerning the situation of workers affected by decisions of employers to lay off a group of employees or the Transfer of Undertakings Directive protecting employees' rights in the event that an undertaking is transferred from one employer to another. As discussed in section 2.6.1, redundancies in the Bohunice and Kozloduy programmes have been largely limited by the possibility to transfer redundant staff to other reactors remaining in operation or utilise them in the decommissioning process. At Ignalina, roughly 60% of the staffing level at the time of closure continues to be engaged in decommissioning efforts. However, fewer opportunities are available for staff made redundant due to the lack of other operating (Soviet design) reactors in the country or region.

While the NDAP was coherent with the relevant social acquis, stronger linkages could have been assured with some EU instruments, namely the European Structural & Investment Funds (ESIF). National authorities remained solely responsible for designing strategies to mitigate the socio-economic impact of plant closure. However, in none of the three Member States did the relevant authorities adopt formal strategies as is recognised as best practice. The competent national authorities have followed a more piecemeal approach in practice. While remaining the sole competency of Member State authorities, the Commission could have leveraged the EU's financial support to incite authorities to develop more structured strategies, notably for the use of ESIF resources to mitigate socio-economic impacts.

## 2.3 EQ3. To what extent have the objectives of the NDAP been achieved for each of the three programmes?

*The aim of this question was to measure the extent to which the NDAP's objectives, general, specific and detailed, have been achieved to date and are on track to be achieved. In the evaluation framework, this question is addressed through five sub-questions assessing overall progress achieved and risks of non-achievement (EQ3.1), the factors influencing positively and negatively progress (EQ3.2), the extent to which the level of risk at each site has been improved (EQ3.3), the adequacy of the monitoring & control systems (EQ3.4) and the effectiveness of communications actions (EQ3.5).*

*As stated in section 1.1, the scope of this review covers the first part of the current MFF (2014 – 2016). It is nevertheless useful to reference issues from previous MFFs where they can explain performance during the current period. Likewise, the study also underlines some longer-term challenges beyond the current MFF. However, the evaluative judgements are based solely on the attainment of the prescribed objectives during the period under evaluation and the likelihood of continued progress towards achieving the objectives for the current MFF. Wherever reference is made to issues in previous MFFs or beyond the current MFF, this is clearly identified.*

### 2.3.1 EQ3.1 Overall, what level of progress has been made towards the objectives of each national programme? Is the progress in line with the decommissioning baseline adopted by the Commission<sup>8</sup>? If not, what is the risk that objectives will not be achieved?

*This sub-question assesses the overall progress achieved to date for each programme and identifies risks that objectives set out for the current MFF will not be achieved. The programmes are assessed individually, although a brief overall summary is provided in the first sub-section.*

#### 2.3.1.1 Overall summary

**Programmes are making reasonable progress towards objectives, but continued proactive efforts will be necessary to recover some delays accrued**

**Programmes can generally be considered to be on track towards reasonably achieving the principal objectives set for this programming period – with some delays to recover.** In particular, the Bohunice programme is working proactively to optimise programme implementation in the final years in light of some technical challenges faced and delays accrued. The Kozloduy programme will also need to define a path for recovering delays accumulated, partly due to issues faced in the previous MFF, which have impacted the pace of advancement in the Controlled Area. The generally satisfactory progress, as well as the room for improvement, is reflected in the key performance indicators, including the physical progress indicators (presented in the following subsections) and the Schedule Performance Indicators.<sup>9</sup>

The table below provides a summary of the achievements and issues identified for each programme.

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<sup>8</sup> These are based on the detailed decommissioning plans

<sup>9</sup> However, the Earned Value Management indicators measuring the project performance based on earned vs planned value could be further improved in terms of robustness as discussed in Section 2.3.4.



**Table 5: Effectiveness overview table**

KOZLODUY (BG)	IGNALINA (LT)	BOHUNICE (SK)
<b>Main achievements since 2014</b>		
<ul style="list-style-type: none"> <li>▶ First decommissioning licenses received in 2014 &amp; 2016 (SO2)<sup>10</sup></li> <li>▶ Good progress achieved on D&amp;D in the Turbine Hall (SO1)</li> <li>▶ Key waste management infrastructure projects being commissioned or on positive trajectory (SO3)</li> </ul>	<ul style="list-style-type: none"> <li>▶ Commissioning of key waste management infrastructure (SO4)</li> <li>▶ Acceleration of the defueling process (SO1)</li> <li>▶ Good progress to date on D&amp;D activities in the Turbine Halls and auxiliary buildings (SO4)</li> <li>▶ Safe maintenance of reactors (SO2)</li> </ul>	<ul style="list-style-type: none"> <li>▶ Stage 2 (final) decommissioning license received (SO2)</li> <li>▶ Main part of the buildings in non-Controlled Area is dismantled (SO1)</li> <li>▶ Key D&amp;D activities started in Controlled Area (SO2)</li> <li>▶ Implementation of last waste infrastructure (SO3)</li> </ul>
<b>Risks for the current MFF</b>		
<ul style="list-style-type: none"> <li>▶ Delays to recover on D&amp;D work in the Controlled Area to be recovered<sup>11</sup> (SO2)</li> <li>▶ Technical difficulties managing legacy (operational) waste in Auxiliary Buildings (SO3)</li> <li>▶ Other waste management infrastructure projects to monitor closely during implementation (SO3)</li> </ul>	<ul style="list-style-type: none"> <li>▶ Defueling is critical for allowing programme to move forward, leaving the programme dependent on defueling risks (SO1)</li> <li>▶ Some early delays accumulating in preparation for D&amp;D in the Reactor Building (SO4)</li> <li>▶ Other waste management infrastructure projects to monitor closely during implementation (SO4)</li> </ul>	<ul style="list-style-type: none"> <li>▶ Natural challenges of dismantling of large reactor components (SO2)</li> <li>▶ Review of interlinks between the remaining projects (final steps of decommissioning) (SO2)</li> </ul>
<b>Longer-term risks identified</b>		
<ul style="list-style-type: none"> <li>▶ Natural challenges of dismantling of large reactor components (SO2)</li> </ul>	<ul style="list-style-type: none"> <li>▶ Technical difficulties expected for D&amp;D of Reactor Core due to first-in-kind nature (N/A)</li> <li>▶ Specific challenges associated with the treatment and disposal of</li> </ul>	N/A

<sup>10</sup> Provided in parentheses is reference to the relevant specific objective

<sup>11</sup> The precise shortfall is difficult to qualify due to the necessity to reinforce the monitoring indicators (including targets and milestones) with regard to D&D works in the Controlled Area

KOZLODUY (BG)	IGNALINA (LT)	BOHUNICE (SK)
	irradiated graphite waste (n/a) ► Definition of a solution for the bitumised waste storage facility	

**The completion of key waste management infrastructure projects has laid the groundwork for accelerating work at Ignalina and Kozloduy**

Important achievements have been reached in the Ignalina and Kozloduy programmes with regard to key waste management infrastructure projects. These projects had, in the past MFF, become synonymous with setbacks. At Ignalina, the commissioning of the Interim Spent Fuel Storage Facility (ISFSF) puts the programme on track to complete the critical task of defueling, contingent upon strong management of this challenging process. At Kozloduy, the on-going commissioning of the Plasma Melting Facility (PMF) and the Size Reduction & Decontamination Workshop (SRDW) open the way to ramping up D&D activities and clearing out waste backlog.

At present, there is not an *immediate* risk that the status of on-going waste management infrastructure projects – e.g. the Near Surface Repository and Landfill Facility at Ignalina and the Near Surface Repository at Kozloduy – will impact wider decommissioning efforts. However, these should continue to be monitored carefully to prevent these critical projects from again becoming a risk to programme implementation. In addition, no current imminent risks can be identified with regard to capacity in treating the waste streams. Performance in this respect will be more dependent on progress against D&D objectives.

**Progress against waste management targets has been slow to date, although programmes should be able to recover delays**

The physical performance indicators demonstrate lower than expected progress since 2014 across all three programmes. This underperformance has mainly been the result of uncertainties concerning radiological inventory and / or lack of anticipation of regulatory procedures leading to under or overestimations of target values, slower than planned progress with D&D activities, technical challenges related to specific legacy waste streams and some delays in the commissioning of waste management facilities. These delays remain largely recoverable at present (during the current MFF), dependent on future satisfactory progress with regard to on-going waste management infrastructure projects and D&D work.

**D&D work in the turbine halls and auxiliary buildings is winding down at Bohunice and progressing well at Ignalina and Kozloduy**

At Bohunice, this stage of decommissioning is currently winding down with the final projects approaching completion. At Kozloduy and Ignalina, D&D work is advancing well or even ahead of schedule in the turbine halls and other auxiliary buildings. Decommissioning Operators have successfully managed to identify and address inefficiencies and remove bottlenecks as they have been identified. This progress represents the culmination of significant efforts. This is particularly the case at Ignalina by virtue of the relatively large volume of equipment to be dismantled and the fact that the equipment is technologically subject to a higher degree of contamination and thus requires relatively greater effort.

**The Bohunice programme has embarked on important physical works in the Controlled Area, whereas the Ignalina and Kozloduy programmes remain at different stages of the preparatory phase**

Since the beginning of the current MFF, significant D&D work has begun in the Controlled Area

**in Bohunice.** Some early technical challenges have been met, but the Decommissioning Operator is optimising the implementation strategy to minimise impacts on schedule and cost. This activity will form the largest part of works during the current MFF and drives the critical path of the overall programme in its final stages.

**Minor works have been conducted to date in the Reactor Building at Ignalina and the Controlled Area at Kozloduy.** Both programmes remain at different stages of the preparatory phase for D&D work in this area. At Kozloduy, an important study is underway to develop the technical approach for D&D of large components in the Controlled Area. During the current MFF, early physical works have not advanced entirely as foreseen in the baseline schedule due to delays in the delivery of the Decommissioning Licenses. The licensing delays stem from difficulties in the previous MFF with regards to the approval of the Environmental Impact Assessment. At Ignalina, the technical design work is at a relatively earlier stage. While this work has made significant progress, some difficulties and delays have been encountered. If not recovered, these could create the risk of delay in the start of large-scale physical works beyond the current MFF. In this area, the Ignalina programme faces unique challenges by virtue of its first-in-kind nature, whereas the Kozloduy programme can draw on lessons learnt from Bohunice and Greifswald NPP in Germany.

The following sub-sections provide a more detailed assessment of progress achieved for each programme, as well as the main risks identified.

### 2.3.1.2 Kozloduy programme (Bulgaria)

#### KEY FINDINGS

- ▶ Key milestones were achieved in 2014 and 2016 with the receipt of the Decommissioning Licenses for Units 1 & 2 and 3 & 4 respectively.
- ▶ D&D activities are progressing well in the Turbine Hall and auxiliary buildings outside of the Controlled Area. This work is expected to be largely finalized on schedule by 2019.
- ▶ The first physical D&D works in the Controlled Area have begun in 2015, a year behind the baseline schedule. This is due to delays in receiving the Decommissioning Licenses stemming from the previous MFF. In the current MFF, dismantling activities in the Controlled Area have also been slowed due to the finalisation of the SRDW and the limited amount of buffer storage for waste in the Controlled Area. Concerning the dismantling of large components and equipment in the Reactor Buildings, the timeline for this work will remain unclear until finalisation of the technical design (currently ongoing). Removal of legacy waste from Auxiliary Buildings in the Controlled Area also represents another potential roadblock to progress in this area.
- ▶ Key waste management infrastructures, such as the NDF, the PMF and the SRDW, are on positive trajectories, with construction of the former beginning in 2016 and commissioning of the latter two expected in 2017 at the time of the evaluation. Other projects are being monitored closely to prevent slippage.

According to Council Regulation (Euratom) 1368/2013, the general objective of the 2014 – 2020 Kozloduy Programme is to assist the Member State in implementing the steady process towards the decommissioning end state of Kozloduy units 1 to 4 in accordance with the detailed decommissioning plan, whilst maintaining the highest level of safety. The planned end state of the Kozloduy programme is stated in the detailed decommissioning plan as "brownfield" status - some of the site buildings will be retained for industrial reuse. The end date is set at 2030, beyond the end of the current MFF.

Article 2 of the Council Regulation further specifies three specific objectives:

- ▶ 1. Performing dismantling in the turbine halls of units 1 to 4 and in auxiliary buildings;
- ▶ 2. Dismantling of large components and equipment in the reactor buildings of units 1 to 4; and

- ▶ 3. Safely managing the decommissioning waste in accordance with a detailed waste management plan.

### **D&D activities are progressing well outside of the Controlled Area, in particular in the Turbine Hall (Specific Objective 1)**

The first dismantling work of non-nuclear equipment was initiated in 2010, but dismantling only commenced at full pace at the beginning of the current MFF due to late transfer of Units 3 & 4 to SERAW management during the previous MFF. One of the key objectives of the current programming period is to finalise dismantling of the Turbine Hall for Units 1 – 4 (and other auxiliary buildings). This includes the dismantling of approximately 40 400 tonnes of metal from 160 main and auxiliary systems. SERAW is currently on track to accomplish this objective by August 2019, despite facing some early issues, such as the need for additional equipment and waste backlog building up in the Turbine Hall due to unavailability of waste management infrastructure.

By the end of 2016, 21 628 tonnes of metal had been dismantled from the equipment of the Turbine Hall. This represents 96% of the planned target to date as per the Annual Work Programmes. In addition, 7 744 tonnes of civil structure have been demolished in the turbine hall by the end of 2016 – 122% of planned progress to date. In other buildings outside the Controlled Area, dismantling progress has been somewhat slower than expected. However, this is mainly due to the fact that work in building DGS-1 was put on hold following interest expressed by a potential buyer for equipment in the building, which could generate revenue to finance the decommissioning process. These delays should not have an impact on the overall schedule.

Some shortfalls in the Turbine Hall were experienced in 2014 and the first semester of 2015; however, these have been compensated by generally strong progress since this date. The achievement gap has been closed due to reallocation of resources, procurement of new equipment and clearing of the backlog of dismantling waste from the Turbine Hall. The initial performance gap largely reflects the natural learning curve for this large-scale undertaking and the early challenges to keep pace with the linear plotting of performance targets.

**Table 6: Detailed objectives and performance indicators for Specific Objective 1 as of 31 December 2016**

Detailed objective	Target (2020)	Indicator (2020)	Progress to date (2016)
Dismantling in units 1 to 4 Turbine Hall	Fully dismantled	100% dismantled in 2020	~ 54%
Dismantling in units 1 to 4 Turbine Hall	All metal dismantled	40 400 tonnes in 2020	21 628 tonnes

*\*Green = satisfactory progress; yellow = some gaps with expected performance; red = critical issues identified*

### **Progress has been slower than expected thus far in the Controlled Area (Specific Objective 2)**

Initial physical dismantling work in the Controlled Area has been undertaken in serviced and semi-serviced areas since 2014. By the end of 2016, 299 tonnes of material in the Controlled Area had been dismantled – 75% of planned target to date as per the Annual Work Programmes. In order to avoid a build-up of dismantled material in the Controlled Area awaiting subsequent decontamination, the pace of dismantling was decreased in 2016 until commissioning of the SRDW planned for 2017 in the 2017 Annual Work Programme. The delay in the commissioning of the SRDW was due to mainly to procurement delays stemming largely from the previous MFF. Recovery measures are planned to be

taken to increase capacity through work in shifts once the SRDW is operational.

**More significant D&D works in the Controlled Area started in 2016, approximately two years later than planned.** This is largely due to delays in the delivery of the Decommissioning Licences that stem from the previous MFF. Originally planned for 2010 for Units 1 & 2 and 2012 for Units 3 & 4, the licences were only received from the Regulator in 2014 and 2016 respectively, due notably although not entirely to delays and challenges to the Environmental Impact Assessment (EIA) for the Decommissioning Strategy. Now underway, these works – e.g. removal of fluids from systems, cutting of connections between technological systems, decontaminating spent fuel ponds, etc. – are generally progressing well and achieving milestones defined in the Annual Work Programmes.

**Looking forward, the Kozloduy programme is currently in the process of defining the detailed technical design for the dismantling of large-scale equipment in the Controlled Area** (Project 44). This notably includes the reactor core and internals and the components of the primary circuit (e.g. steam generator, pressuriser, reactor coolant pump, etc.). The contract was signed in July 2016 and the project is currently planned to be finalized in 2019. This project is driving the critical path of key dismantling works in the Controlled Area and any delay in execution will directly affect the overall decommissioning schedule. At the time of the evaluation, the first deliverables had been submitted with only minor delays and were judged to be of good quality.

**Considering the delayed start of D&D in the Controlled Area, the extent to which the Kozloduy programme will progress in this area by the end of the current MFF remains unclear at the time of the evaluation**, in particular with regard to the dismantling of large-size equipment. This activity will only begin once Project 44 has been completed and the results of this project may require the launching of additional preparatory activities or investments depending on the proposed concept. Moreover, a potential obstacle remains with the issue of legacy waste in Auxiliary Buildings in the Controlled Area (see following section).

Despite this delay and uncertainty, it is not possible to draw a clear judgement on the effectiveness of the programme in this area on the basis of the high-level monitoring framework included in the detailed implementation procedures (presented below). The nature of the detailed objectives and targets is such that it is not possible to discern what the programme *ought to have achieved* by the end of the current MFF. The target for 2020 is marked only as 'on-going' (see bold / underlined targets & milestones below). The necessity to clarify the relevant detailed objectives and corresponding indicators is discussed in greater detail in section 2.3.4.

**Table 7: Detailed objectives and performance indicators for Specific Objective 2 as of 31 December 2016**

Detailed objective	Target (2020)	Indicator (2020)	Progress to date (2016)
Preparation of the Controlled Areas (CA) for dismantling (decontamination of systems and equipment, if necessary)	Start 2016 / <b><u>Ongoing 2020</u></b>	Receipt of decommissioning licences	YES
Preparation of Auxiliary Buildings for decommissioning (treatment and conditioning of historical RAW)	Start 2016 / <b><u>Ongoing 2020</u></b>	Receipt of decommissioning licences	YES
Start the dismantling of potentially contaminated equipment in CA	Start 2016 / <b><u>Ongoing 2020</u></b>	Receipt of decommissioning licences	YES



Dismantling of large size equipment in CA	Start 2016 / <b><u>Ongoing 2020 / Milestone 2030</u></b>	Approx. 14 600 tonnes	0 tonnes
Metal to be dismantled in Units 1 to 4 Reactor Buildings	<b><u>Partial dismantlement</u></b>	1 775 tonnes in 2020	298,3 tonnes

*\*Green = satisfactory progress; yellow = some gaps with expected performance; red = critical issues identified*

### **Waste management infrastructure projects are on a positive trajectory, with key infrastructure expected to be commissioned in 2017-2018 (Specific Objective 3)**

Unlike the Ignalina Programme, the Kozloduy Programme did not define any specific detailed objectives for the commissioning of key waste management infrastructure projects.<sup>12</sup> It is nonetheless useful to examine these key projects, all the more so since most of these projects have been hampered by a mix of self-inflicted delays and/or legal challenges under previous MFFs. **Nonetheless, all projects are currently judged to be on a positive trajectory at the time of the evaluation.**

Construction of the **NDF** is envisaged for disposal of low and intermediate level short lived radioactive waste and is obligatory for the implementation of the decommissioning activities. In an important milestone, the Regulator approved the NDF technical design in March 2017 and the construction permit was issued shortly thereafter. This facility was originally expected to be commissioned in 2015 when the accelerated decommissioning schedule was adopted in 2011. Significant delays accrued in the EIA process in a transboundary context, which affected the approval of the technical design and issuance construction permits. As already noted above, most of these stemmed from the previous MFF. At the same time, SERAW took mitigation measures to minimise the impact of delays by including interrelated NDF infrastructural projects in the scope of the NDF construction project, which allowed to start construction on these projects sooner.

The **PMF** is a critical piece of waste management infrastructure permitting to significantly reduce the volume of waste. This innovative technology allows to significantly reduce overall disposal costs. In the past MFF, this project suffered from a number of difficulties and delays, which have been eventually resolved during this MFF. In particular, the long outstanding Nuclear Indemnity Agreement was ratified in 2017. The 72-hour cold trials were then completed at the beginning of June 2017 following the Contractor completing the installation of the facility to an acceptable standard.

Other key projects reaching milestones included the construction of **dismantling waste storage sites** and hot tests of the aforementioned **SRDW**, which was initially delayed during the tendering process in the previous MFF. The commissioning of these facilities was critical for removing bottlenecks, in particular for processing contaminated materials arising from the decommissioning operations. Commissioning of the waste storage sites, for example, has already allowed for a backlog of dismantled equipment to be moved from the turbine halls in order to increase the pace of work. Finally, the tendering process for the **modernisation of the existing SERAW waste management facility** was successfully launched during the first semester of 2017. The key project will allow to significantly expand the capacity of SERAW to match future expected waste flows from decommissioning.

### **Waste management activities have met some difficulties to date, but are proceeding in a satisfactory manner overall (Specific Objective 3)**

**Performance of radioactive waste management activities has been impacted by wider delays in**

<sup>12</sup> Even if corresponding indicators, targets and milestones are not included in the high-level monitoring framework in the detailed implementation procedures, the performance is tracked and targets are set through other elements of the monitoring framework, including the baseline schedule and the performance targets fixed in the Annual Work Programmes

**the decommissioning process.** Technical issues faced with the removal of legacy waste from Auxiliary Buildings, for example, has impacted waste management activities. Similarly, delays in work in the Controlled Area can explain the low level of progress achieved to date. Performance gaps can also be noted with free release of materials. While the level of progress achieved against the detailed objectives in the detailed implementation procedures has been low to date, the programme has consistently performed in a satisfactory manner against annual targets set in the Annual Work Programme, suggesting that the waste management system is capable of performing when progress with dismantling allows.

**As mentioned, legacy waste in Auxiliary Buildings remains an important obstacle to D&D work in the Controlled Area.** Significant amounts of legacy operational waste are stored in the Auxiliary Buildings 1 and 2. This waste must be retrieved, treated, conditioned and stored before dismantling activities can begin. Some important work to this effect has been undertaken, including the transport of 100m<sup>3</sup> of liquid radioactive waste from the Evaporator Concentrate Tanks (ECT) in 2016. However, retrieval, treatment and conditioning of the solidified phase of the ECT and Ion Exchange Resins (IER) have met numerous difficulties in the previous MFF. The second phase of a critical project was cancelled after two years of stalling<sup>13</sup> and SERAW chose to issue a new tender to complete retrieval and conditioning of the contents of the ECT, combining it with the retrieval and treatment of other liquid historical wastes such as sludge and IER.

Successful tendering, award and execution of this significant contract now sets the critical path for dismantling in Auxiliary Buildings 1 & 2. Measures have been taken by SERAW to mitigate these difficulties through the application of a two-stage tendering process for the new 'Project 9b-2' mentioned above, which requires a proven technology of qualified potential contractors. An additional measure is the shared Slovak experience in that area during the knowledge sharing workshops conducted between the three beneficiary countries and bilateral exchanges.

**Free release of materials has been slower than target to date, but does not present a critical risk to the programme.** By the end of 2016, SERAW has achieved overall approximately 80% of the planned target to date – i.e. 17 054 tonnes of material free released. Since 2014, performance has been below planned levels in almost every semester. It was observed that authorisation of free release constituted a new regulatory activity for Bulgaria, making it more difficult for the Decommissioning Operator to properly anticipate time and resources required for free release; which explains the free-release rate slower than planned.

**Table 8: Detailed objectives and performance indicators for Specific Objective 3 as of 31 December 2016**

Detailed objective	Target (2020)	Indicator (2020)	Progress to date (2016)
Free release of materials	Ongoing 2020	39 285 tonnes	17 504 tonnes
Treatment of historical RAW: - Evaporator Concentrate	Ongoing 2020	Up to 866 RCC <sup>14</sup>	137 RCC

<sup>13</sup> The first phase of the project (characterisation of ECT) was successfully completed. The first phase confirmed that the waste characteristics were significantly different from those anticipated in the Technical Specifications. The contractor was unable to offer a credible technology to deal with the waste.

<sup>14</sup> Reinforced Concrete Container (for final disposal). This is not a standard unit of measurement as the quantity of radioactive waste in each RCC can vary due to several factors.

Detailed objective	Target (2020)	Indicator (2020)	Progress to date (2016)
- Solid RAW	Ongoing 2020	Up to 109 RCC	
- Sorbents	Ongoing 2020	Up to 359 RCC	0 RCC
Treatment of RAW from decommissioning	Ongoing 2020	851 RCC with metal solid RAW	94 RCC

*\*Green = satisfactory progress; yellow = some gaps with expected performance; red = critical issues identified*

### 2.3.1.3 Ignalina programme (Lithuania)

#### KEY OBSERVATIONS

- ▶ An important milestone has been met allowing for the critical process of defueling to commence. Defueling of Unit 2 reactor core is now expected to be accomplished 15 months ahead of schedule. The overall process, which also includes the defueling of the spent fuel pools, is expected to be completed by July 2022 at the time of the evaluation (as per AWP 17).
- ▶ Safe maintenance of the reactor units has been ensured by INPP operators without incident during the period 2014 – 2016.
- ▶ Dismantling work began in 2010 and is generally advancing ahead of schedule. Work in the Turbine Hall (G1 & G2) is on track to be completed in line with pre-defined milestones.
- ▶ Although not impacting heavily the current MFF objectives, the start of physical D&D activities in the Reactor Buildings may be delayed due to challenges faced in the preparation of design work in Reactor Building A1 and reactor zones R1/R2/R3. In particular, the design of dismantling the irradiated graphite from the core is a challenge as this is a first-in-kind project.
- ▶ Waste management activities continue to progress. Key infrastructure have come on-line, however, other waste management infrastructure projects need to be delivered on time to prevent any significant bottlenecks in waste management streams beyond the current MFF.

According to Council Regulation (EU) 1369/2013, the general objective of the 2014 - 2020 Ignalina Programme is to support the steady process towards the decommissioning end state of units 1 and 2 of the Ignalina nuclear power plant in accordance with its decommissioning plan, whilst maintaining the highest level of safety. The latest version of the detailed decommissioning plan was approved in 2014 and defines the planned end state as brownfield status in 2038 (beyond the current MFF). Article 2 of the Council Regulation further specifies three specific objectives:

- ▶ 1. Defueling of the reactor core of unit 2 and the reactor fuel ponds of units 1 and 2 into the dry spent fuel storage facility;
- ▶ 2. Safely maintaining the reactor units; and
- ▶ 3. Performing dismantling in the turbine hall and other auxiliary buildings and safely managing the decommissioning waste in accordance with a detailed waste management plan.

#### **Defueling operations are proceeding well following the commissioning of key waste management infrastructure (Specific Objective 1)**

**Defueling of INPP has a direct and critical impact on the overall timeline and cost of the decommissioning process.** The ISFSF formed part of the initial decommissioning support investment package supported by the NDAP. This key infrastructure project was initiated due to the fact that INPP

did not have sufficient existing capacity<sup>15</sup> to interim store its spent fuel.

**The ISFSF project had accumulated significant delays in previous programming periods** due to a variety of factors that eventually led to a suspension of disbursements in January 2013. These delays had a direct impact and contributed significantly to the extension of the overall duration of the decommissioning programme (ISFSF delays contributed 5 years to the overall delay of 9 years) in the latest version of the detailed decommissioning plan. Since late 2014, INPP under new management has worked quickly to resolve outstanding issues with the contractor. Significantly, pending commercial issues were resolved in November 2015 with no increase in the contract price. This progress culminated in the start of ISFSF hot trial operations in September 2016, which were completed in May 2017 five months earlier than planned. Subsequently, INPP received VATESI's authorisation for continued industrial operation.

**The completion of the ISFSF has enabled for the critical process of defueling to begin in 2016.** By the end of 2016, a total of 267 spent fuel assemblies had been transferred from the Unit 1 and Unit 2 spent fuel ponds to the ISFSF. At the end of August 2017 a total of 2 154 spent fuel assemblies, including 246 removed from the Unit 2 reactor core, had been transferred from the Units 1 and Unit 2 spent fuel ponds to the ISFSF. The defueling of the Unit 2 reactor core was expected to be completed at the time of the evaluation by March 2018 – approximately 15 months earlier than initially foreseen. While reactor core defueling may be achieved ahead of schedule, the final end-date for defueling remains behind the baseline schedule - July 2022 according to the 2017 Annual Work Programme or eight months behind initial schedule.

**The programme is nonetheless on track to deliver against the two relevant detailed objectives in the timeframe foreseen.** Even if some risks materialize, current progress should allow INPP staff some buffer time to accommodate future delays. The most important challenges for the continued progress of the defueling process relate to the management of damaged fuel. This issue has been well identified and work is currently progressing on schedule. While the risk can be considered as manageable, delays in the defueling process have a high *negative float*, meaning they would unavoidably entail direct delays to overall decommissioning.

**Table 9: Detailed objectives and performance indicators for Specific Objective 1 as of August 2017\***

Detailed objective	Target (2020)	Indicator (2020) <sup>15</sup>	Progress to date (Aug 17)*
Removal of spent fuel assemblies (SFA) from Units 1 and 2 spent fuel ponds	Fully unloaded by Nov. 2021 and Jun. 2022	12 345 SFAs	2 154 SFAs
Removal of spent fuel assemblies from Unit 2 reactor core	Fully defueled by Jun 2019	1 134 SFAs	246 SFAs

*\*Due to the importance of this activity, the most up-to-date figures are provided (August 2017) rather than 31 December 2016 – the temporal scope of this review*

*\*Green = satisfactory progress; yellow = some gaps with expected performance; red = critical issues identified*

<sup>15</sup> During operation, spent fuel assemblies were loaded from the spent fuel ponds into storage casks and transferred to an existing interim storage facility at an adjacent site. However, that interim storage facility could not contain all of the spent fuel that accumulated in the reactor cores and spent fuel ponds prior to and at shutdown of Ignalina.

<sup>16</sup> The figure for unloading the pools includes spent fuel assemblies in the core, as these must also pass through the pools.

## **INPP has ensured continued safe maintenance of Units 1 & 2, as well as the safety of decommissioning activities (Specific Objective 2)**

**The presence of nuclear fuel in the reactor and spent fuel ponds requires the maintenance of a high level of safety.** Both INPP units are finally shut down and decommissioning works are being carried out. At the same time, they will be used for storing spent nuclear fuel until the previous objective is accomplished. Thus, for both units, the following must be assured: i) sub-criticality of spent nuclear fuel; ii) heat removal from the reactor's core (the active zone) and spent nuclear fuel pools; and iii) confinement of radionuclides, installation of barriers suppressing ionising radiation and control over release of radionuclides. These key safety functions at INPP are performed by various important systems.

**Since 2014, INPP staff has ensured safe maintenance of Units 1 & 2 without any incident as classified by the INES scale.**<sup>17</sup> The Regulatory authority, VATESI, carries out regular inspections and technical checks at INPP predominantly focused on safety requirements during maintenance, fire safety and ageing management of structures, systems and components important to safety of finally shut-down units. VATESI monitors INPP's safety culture through its safety culture index<sup>18</sup>. The purpose is to evaluate the less obvious factors that could have a negative impact on safety and bring them to the attention of Ignalina NPP management. The indicator has been maintained at an acceptable level during the period under evaluation.

**Table 10: Detailed objectives and performance indicators for Specific Objective 2 as of 31 December 2016**

Detailed objective	Target (2020)	Indicator (2020)	Progress to date (2016)
Safe maintenance of units 1 and 2	Safe maintenance without any major incident	0 (registered) incidents	0 (registered) incidents

*\*Green = satisfactory progress; yellow = some gaps with expected performance; red = critical issues identified*

## **D&D activities are progressing well in the Turbine Hall and auxiliary buildings (Specific Objective 3)**

**Dismantling activities are currently ahead of schedule in terms of overall number of tonnes of equipment dismantled** in the Turbine Hall. By the end of the first semester of 2017, 26 862 tonnes of equipment had been dismantled in INPP – 107% of the planned total to date as per the Annual Work Programmes and 66% of the 2020 target. Equipment dismantled from the Turbine Hall made up the large majority of this tonnage – approximately 85%. Work in the Turbine Hall is currently expected to be completed by June 2019 in line with the baseline schedule.

**Decontamination activities are progressing well, with 2 901 tonnes dismantled and**

<sup>17</sup> The International Nuclear and Radiological Event Scale (INES) is a tool for communicating the safety significance of nuclear and radiological events to the public. It goes from 1 ('anomaly') to 7 ('major accident').

<sup>18</sup> For the quantitative assessment of the safety culture at INPP, a system of safety culture indicators has been established. The overall 'Safety Culture Index' is measured and reported on annually by the regulator VATESI. The index takes into account indicators such as implemented measures of safety culture development (e.g. training), unusual events caused by human factor or the implementation of agreed measures to improve operational procedures applicable to ensure maintenance of systems and their components important to safety at Ignalina NPP. The regulator approves on an annual basis the Plan of Measures for Developing Safety Culture.



**decontaminated from 2014 to the end of 2016.** Fragmentation and decontamination facilities in the Turbine Hall entered routine operation in 2014. Due to the higher-than-expected progress in dismantling, some challenges were initially faced with the quantity of wastes generated. In 2015, INPP formulated a plan for the more efficient use of space within the Turbine Hall as buffer storage in order to more effectively decouple dismantling/fragmentation activities from the decontamination line. In addition, the decontamination capacity is being expanded to ensure higher decontamination throughput in coming years.

**Challenges faced during the preparatory design activities for D&D in the Reactor Building will not significantly impact programme performance during the current MFF, but create the risk of delays after 2020 (Specific Objective 3)**

**INPP has made the decision to conduct much of the preparatory technical design work for D&D in house.** The Ignalina programme called on external expertise for the development of the technical design and safety documentation for a number of pilot D&D projects. Since, the programme has largely used internal resources to leverage expertise of former plant staff and reduce the cost of this activity. A procurement for project B9/4 for the reactor dismantling and decontamination feasibility study was notably cancelled and brought in house.

**Delays in preparatory design activities for D&D in the Reactor Building of Unit 1 have resulted from technical challenges and inadequate internal expertise.** Submission of the technical design and safety documentation for Reactor Building A1 (all systems except for works within the reactor shaft – project UP01) is now scheduled for the fourth quarter of 2017. As a result, the programme is currently behind the projected schedule for D&D activities in A1. However, these delays should be largely recovered during the current MFF once works begin given current project timelines. Concerning preparatory work for D&D in the reactor shaft of Unit 1, preparation of the technical and safety documentation for reactor zones R1&2 has lagged behind due to a lack of qualified personnel and overall rethinking of the general approach. INPP has also come to the conclusion that preparatory work for the D&D of reactor zone R3 cannot be completed relying only on in-house resources. Technical Specifications for the procurement of technical support to complete this work is currently underway over seven years after the procurement for the original project (B9/4) was cancelled. The development of Technical Specifications has fallen behind schedule. According to CPMA, insufficient allocation of qualified human resources are responsible for delays, whereas INPP credits the decision to split the scope of the tender.

**These challenges should have limited impact on the achievement of objectives for the current MFF, but may lead to a delayed start of large-scale physical works in the post-2020 period.** As noted, the delays in preparatory activities for D&D activities in Reactor Building A1 (outside the reactor shaft) are recoverable unless significant further delay is accumulated. INPP should thus be in measure to achieve the objectives set out for the current MFF. Indeed, the large part of physical works in A1 and the reactor shaft of Unit 1 is not scheduled to begin until the post-2020 period. The challenging task of developing the technical design for the D&D of reactor zone R3 has accumulated significant delays (over five years). The delays accumulated with the preparatory design and safety analysis work do create the possibility that the beginning of physical works (beyond the current MFF) could be delayed.

**Table 11: Detailed objectives and performance indicators for Specific Objective 3 – D&D as of 31 December 2016**

Detailed objective	Target	Indicator	Progress to
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	(2020)	(2020)	date (2016)
Shutdown and isolation of process systems	Systems being dismantled	35 systems	11 partially isolated
Dismantling of process equipment and components	Dismantling ongoing	40 454 tonnes	26 862 tonnes
Dismantling of Unit 1 reactor installation components	Dismantling ongoing	1 095 tonnes	0 tonnes

*\*Green = satisfactory progress; yellow = some gaps with expected performance; red = critical issues identified*

### **Important achievements in key waste management infrastructure, but other key infrastructure projects underway should be monitored closely (Specific Objective 3)**

The Ignalina programme achieved important milestones with the commissioning of ISFSF and on-going commissioning of the Solid Waste Management and Storage Facility (SWMSF). As previously noted, successful commissioning of the ISFSF opened up the path for defueling activities to begin in 2017. The SWMSF projects have also made good progress towards commissioning since 2014. Cold trials were successfully completed in April 2017 and hot trial activities are under way at the time of the evaluation. This progress represents an important achievement for the Ignalina programme having in mind the criticality of this infrastructure for the decommissioning process and the level of difficulties that had been faced in previous programming periods with these large projects.

**A number of other key infrastructure projects remain in early stages of implementation and have faced difficulties resulting in delays in their preparation.** The award of the contract for the landfill facility for short-lived very low level waste was delayed in the tendering process for several months. The schedule for the Near Surface Repository (NSR) for low & intermediate level short-lived waste has slipped due to delays incurred during the design phase during previous programming periods and a protracted approval process under the current MFF. Finally, progress on the bituminised waste storage facility remains dependent on a number of unknown variables due to close proximity with other facilities and upgrade works.

**While slippage in project schedules can be noted, delays do not risk creating significant bottlenecks in waste streams in the medium-term at the time of the evaluation.** INPP considers the critical start date for the NSR to be in 2024, although the exact date will vary depending on the operational capacity of the SWMSF. The delay in construction of the landfill facility will result in a shortage of buffer storage capacity; however, dismantled areas of the turbine hall have been adapted for temporary buffer storage to avoid bottlenecks. The issue of the bituminised waste storage facility does not create any risks for the current MFF, but the identification of an appropriate solution remains an important liability for the decommissioning programme overall.

**Table 12: Detailed objectives and performance indicators for Specific Objective 3 – waste management (1/2) as of 31 December 2016**

Detailed objective	Target (2020)	Indicator (2020)	Progress to date (2016)
New Interim Spent Fuel Storage Facility	B1	Operational Q4 2017	Operational Q2 2017

New Solid Waste Treatment & Storage Facilities	B2 / 3 / 4	Operational Q4 2018	Expected operational Q4 2018
Landfill Facility for Short-Lived Very Low Level Waste	B19/2	Operational Q3 2018	Expected 2019
Near Surface Repository for Low & Intermediate Level Short-Lived Waste	B25/2	Group 1 operational - 2020 (Q4)	Expected 2021 – 2022
Transformation of Bituminized Waste Storage Facility into a Repository	B20	SAR for selected option 2018 Q4	2018 Q4

*\*Green = satisfactory progress; yellow = some gaps with expected performance; red = critical issues identified*

### **Management of radioactive waste is progressing well, even if waste flows have been less than expected to date (Specific Objective 3)**

**Processing and transport of radioactive waste to storage facilities is progressing well to date, although flows have been less than expected.** Some gaps compared with expected progress can be noted due to delays in the availability of infrastructure and progress with D&D work in some areas, but work has been rescheduled to adapt. To present, the very large majority of waste generated by decommissioning has been (very) low level waste<sup>19</sup>. Generation of this low-level waste will decrease in coming years until the late 2020s, while the generation of higher level wastes will peak during the years 2019 - 2023. Higher level waste requires additional efforts to move, treat and dispose. A learning curve may be expected as the characteristics of waste management activities evolve in coming years.

**Free release of waste generated by decommissioning has progressed without issue to date.** In 2016, 4 051 m<sup>3</sup> of waste were transferred to verifications and 3 640 m<sup>3</sup> were free released after measurement. No potential bottlenecks are currently seen in the free release process, which has a maximum capacity of 5 000 m<sup>3</sup> per year.

**Table 13: Detailed objectives and performance indicators for Specific Objective 3 – waste management (2/2) as of 31 December 2016**

Detailed objective	Target (2020)	Indicator (2020)	Progress to date (2016)
Treatment (processing) of radioactive waste	Processing ongoing	45 000 m <sup>3</sup>	15 828 m <sup>3</sup>
Radioactive waste transportation to storage facilities	Transport ongoing	13 000 m <sup>3</sup>	3 230 m <sup>3</sup>

<sup>19</sup> Class 0 and Class A waste in the Lithuanian classification.

#### 2.3.1.4 Bohunice programme (Slovak Republic)

##### KEY OBSERVATIONS

- ▶ Dismantling outside the Controlled Area is winding down. Works in the Turbine Hall were completed in 2016, with the building now used as buffer storage. The last items to remove are four cooling towers, which are currently being demolished.
- ▶ A key milestone was achieved in December 2014 with the reception of license for the final stage of decommissioning (Controlled Area). Large-scale D&D works have since begun in the Controlled Area. The removal of thermal insulation was the first completed project in a series of technically complex projects to be implemented in the coming years.
- ▶ The decontamination of the reactor primary cooling circuit was delayed due to difficulties with the methods chosen by a contractor; a new contractor was selected and the project is now back on track to be completed by the end of 2017.
- ▶ As a consequence of this delay, some adjustments of the decommissioning plan have been taken or are currently in discussion to optimize the articulation of final projects and ensure the completion of the programme in 2025 as planned.
- ▶ The large part of waste management infrastructure necessary for decommissioning is in place. Two additional waste management projects are currently being implemented, with the Interim RAW Storage facility on the verge of beginning trial storage and commissioning activities at the time of the evaluation.

According to Council Regulation (Euratom) 1368/2013, the general objective of the Bohunice Programme is to support the steady process towards the decommissioning end state of Bohunice V1 units 1 and 2 in accordance with its decommissioning plan, whilst maintaining the highest level of safety. The “immediate decommissioning option” was selected and the final status of the site will be brownfield in 2025 (beyond the current MFF) according to the current detailed decommissioning plan. Article 2 of the Council Regulation further specifies three specific objectives:

- ▶ 1. Performing dismantling in the turbine hall and auxiliary buildings of reactor V1, to be measured by the number and type of systems dismantled;
- ▶ 2. Dismantling of large components and equipment in the V1 reactor buildings, to be measured by the number and type of systems and equipment dismantled; and
- ▶ 3. Safely managing the decommissioning waste in accordance with a detailed waste management plan, to be measured by the quantity and type of safely conditioned waste.

##### **The dismantling of the Turbine Hall is completed and the last auxiliary structures (cooling towers) are under demolition (Specific Objective 1)**

**The dismantling of non-active systems has been almost achieved during the stage 1 of the decommissioning programme.** The main work undertaken consisted of the dismantling of outdoor non-contaminated facilities and objects, the Diesel Group and Electric Power Supply Systems, the Technical Equipment in the Turbine Hall and the dismantling and demolition of V1 NPP external buildings.

**The last project remaining under implementation is the dismantling and demolition of the V1 NPP cooling towers.** The project has been postponed by the operator JAVYS (partly because of the larger quantity of asbestos than initially estimated), but it is not on the programme critical path and it was eventually contracted for a substantially lower price than budgeted. Currently site works are ongoing and the first cooling tower has been fully demolished. The project is planned to be completed

in 2018.

**Table 14: Detailed objectives and performance indicators for Specific Objective 1 as of 31 December 2016**

Detailed objective	Target (2020)	Indicator (2020)	Progress to date (2016)
Electricity production system	100% of the system dismantled in 2015	D 1.2	100%
Auxiliary Circuit System for Secondary Circuit – Phase 1	100% of the system dismantled in 2015	D3.1A	100%
Secondary Circuit Cooling System	100% of the system dismantled in 2016	D3.1B	(25%)*
Auxiliary Circuit System for Secondary Circuit – Phase 2	100% of the system dismantled in 2014	D3.2	100%
Electric Power Supply System	100% of the system dismantled in 2015	D3.3	100%
Emergency Electric Power Supply System	100% of the system dismantled in 2015	D3.4	100%

\*September 2017

\*Green = satisfactory progress; yellow = some gaps with expected performance; red = critical issues identified

**Work in the Reactor Buildings has started, initially with some technical difficulties, and preparatory work on the dismantling of large components is expected to start by the end of 2017 (Specific Objective 2)**

**JAVYS received the license for the stage 2 of decommissioning (Controlled Area) in December 2014** which gives the green light to begin the dismantling process in the Reactor Building. One project has already been completed: the dismantling of insulation in Controlled Area with the dismantling of the technological equipment and piping systems. The removed insulation material was sorted, processed, disposed of and metal cladding decontaminated.

**The global achievement of the projects in the Controlled Area has been delayed due to difficulties with the implementation of the decontamination of the primary circuit.** The decontamination of the primary circuits is a pre-condition for the dismantling of the primary circuits of Bohunice V1 NPP. After several months of implementation, including the establishment of the decontamination circuit technology on the reactor vessel, the original contractor faced several technical difficulties and was unable to finalise the project. The contract was terminated in 2016. This can be qualified as an important set-back.

**JAVYS developed a full revision of the project and the technology implemented by the original contractor to learn from this experience and gain know-how.** The decision was taken to continue with the decontamination of the primary circuit and a new project (Decontamination of the Primary Circuit – II) was built on the use of the Decontamination for Decommissioning (DfD) facilities installed during the first project. After selection of a new contractor through direct tendering, the decontamination process restarted in 2017. The project was planned to be completed by the end of 2017 at the time of the evaluation (subsequently completed); however, some uncertainties remain as to the possibility to



reuse the DfD line for the second reactor, which could cause delays or additional costs if it cannot be reused.

**Most of the subsequent dismantling projects are on the programme critical path according to the detailed decommissioning plan of the V1 reactor and depend on successful completion of the decontamination.** The dismantling of the reactor coolant system large components has been rescheduled for completion in 2022 (compared with 2020 in the baseline schedule) due to issues described above with primary circuit decontamination. Following the dismantling, fragmentation, decontamination and transport of components, 99,99% of the radioactive waste will be removed from the site, which is related with a very low remaining risk in the NPP.

**In order to optimise the final steps of the programme and ensure the completion of the activities in 2025 despite the delays incurred, JAVYS has modified the scope of some projects.** For example, the project for the disposal of remote handled waste from Mogilnik<sup>20</sup> has been included within the project for the dismantling of reactor coolant system large components to ensure higher effectiveness (only one fragmentation facility and the same type of containers for ILW will be needed). Moreover inter-linkages between the decontamination of the primary circuit and the project for dismantling systems in the Controlled Area were cut to ensure the independence from former and allow the simultaneous implementation. JAVYS has also developed a new strategy for the implementation of the three final projects concerning the Reactor and Auxiliary Building decontamination, building decommissioning, backfilling and site restoration so that they are implemented under one contract, with the objective being to facilitate coordination and ensure a smoother and continuous process (time savings).

**Table 15: Detailed objectives and performance indicators for Specific Objective 2 as of 31 December 2016**

Detailed objective	Target (2020)	Indicator (2020)	Progress to date (2016)
Remote Handled RAW Storage System	100% of the system dismantled in 2018	C14	0%
Nuclear Steam Supply System (NSSS)	100% of the system dismantled in 2020	D4.2	0% (Tender completed)
Primary Circuit Equipment Insulation	100% of the system dismantled in 2016	D4.3A	100%
Auxiliary Circuit System for Primary Circuit – Phase 1	100% of the system dismantled in 2020	D4.4B	0% (Tender completed)
Auxiliary Circuit System for Primary Circuit – Phase 2	100% of the system dismantled in 2020	D4.4C	0%

<sup>20</sup> Mogilnik is a historical storage structure with a large number of contaminated pipes

*\*Green = satisfactory progress; yellow = some gaps with expected performance; red = critical issues identified*

### **Most legacy waste<sup>21</sup> and waste produced by the decommissioning of non-Controlled Areas have been safely stored and the last storage facilities are under construction (Specific Objective 3)**

**The Bohunice programme has benefited from the availability of existing waste management infrastructure** for several contextual reasons (operation of several other reactors on site, shutdown and decommissioning of the A1 reactor prior to the V1 reactors). Two final projects are currently under implementation to increase the capacity of the waste management infrastructure and adapt facilities to the quantity of radioactive waste produced by Bohunice decommissioning:

- ▶ Implementation of projects to erect the VLLW storage and to extend the LLW storage capacity at the Mochovce site – by the end of June 2017 the physical progress of was 75% and 15% respectively.
- ▶ Construction of the Interim Storage of radioactive waste from decommissioning of V1 NPP in Bohunice - the Interim storage was commissioned in August 2017.

**Currently, all radioactive waste produced during the dismantling of the non-Controlled Area and historical waste (except from Mogilnik) have been safely disposed of at the national repository in Mohovce.** Some difficulties have been encountered related to the quantity of radioactive waste produced, which was higher than initially estimated. For example, the insulation of steam generators did not pass the free release verifications and had to be treated as radioactive waste. The quantity of hazardous waste was also higher than initially estimated due to higher quantity of asbestos in the cooling towers.

Data presented in the Monitoring Reports appears significantly lower than the overall targets. This is not a signal of underperformance in waste processing, because it is mainly due to the time shift of projects concerning the dismantling and demolition of V1 NPP cooling towers and the reactor coolant system large components dismantling, accounting respectively for 25,6% and 39% of waste produced up to 2020.

**Table 16: Detailed objectives and performance indicators for Specific Objective 3 as of 31 December 2016**

Decommissioning waste treatment	Target (2020)	Indicator (2020)	Progress to date (2016)
Conventional waste	Cumulative amount achieved by 2016	169 148 tonnes (2016)	74 752 tonnes
Hazardous waste	Cumulative amount achieved by 2016	888 tonnes (2016)	182,5 tonnes
RAW	Cumulative amount achieved by 2016	4 255 tonnes (2016)	1 440 tonnes

<sup>21</sup> Except historical waste of Mogilnik planned to be treated during the D4.2 project

*\*Green = satisfactory progress; yellow = some gaps with expected performance; red = critical issues identified*

### 2.3.2 EQ3.2 What external and internal factors influenced (positively and negatively) the progress of the decommissioning programmes?

*This sub-question assesses the primary factors influencing positively and negatively the progress of the decommissioning programmes. As schedule performance has often an impact on cost performance, this analysis can be considered in complement to the more detailed analysis developed in section 2.6 on efficiency.*

#### **The (on-going) commissioning of key waste management infrastructure projects is supporting a ramping up in decommissioning activities**

**The construction of waste management infrastructure is often not thought of as being part of the decommissioning process itself. However, this infrastructure is a necessary pre-condition for decommissioning to begin. As such, it is included in the detailed decommissioning plan where existing infrastructure is not adequate / available.** The three Member States had varying levels of pre-existing infrastructure in place. Slovakia, where decommissioning of Bohunice A1 had begun before Bohunice V1 decommissioning started, had well-developed infrastructure already in place, whereas Bulgaria had some existing waste treatment and disposal facilities, and, for historical reasons, Lithuania had almost none of the required infrastructure on its territory.

For this reason, **the three programmes started in drastically different conditions, with this infrastructure requiring years for design, construction and commissioning.** Adding to this, key infrastructure projects at Kozloduy and, in particular, Ignalina were delayed by years in past programming periods due to various technical and administrative issues. Notably, the lack of adequate interim spent fuel storage capacity contributed to slowing down the overall decommissioning process at Ignalina significantly.

**Consequently, the start of licensed operations (or imminent start pending commissioning) of key infrastructure in these two countries since 2014 has had and will have a significant positive impact on the pace of decommissioning work.** At Ignalina, the successful commissioning and start of operations at the ISFSF has allowed for the critical process of defueling to commence. At Kozloduy, a number of infrastructures coming on line will allow for a ramping up of D&D efforts in the short and medium term.

**In line with international experience, it is apparent that the proper management of the dismantling waste is the key to control and contain the time needed for dismantling.** Bottlenecks caused by a lack of capacity when and where it is needed in the waste management system lead to uncertainties, increased space requirements and negatively impact the overall project schedule and cost. This ever-present risk calls for special attention and careful monitoring to avoid or mitigate delays in further infrastructure projects being launched or currently under implementation. At present the risk of these projects significantly impacting wider decommissioning efforts is deemed low due to the positive trajectory of these projects as described in the previous sections.

#### **Recent years have seen an acceleration of organisational transformation, providing a strong support framework for decommissioning programmes**

The transition from operation to shut-down and finally decommissioning requires that the necessary organizational support systems be put in place to manage these complex processes. This may entail transitioning ownership to a specialized entity or restructuring and retraining existing organisations. This transition, as with all organizational transitions requires time, clear objectives and the deployment of effective change management efforts. Previous audits and assessments have underlined the importance of organizational issues in effectively supporting the decommissioning programmes and found that organizational changes in some cases had been too slow.

**The transition process at Kozloduy has been successfully completed with the handover of**

**ownership of Units 1 – 4 to SERAW from KNPP in 2013.** The hand-over of responsibility, including the transfer of project ownership and some plant personnel, was a complex and time-consuming process that diverted energies within the beneficiary organisations and the EBRD away from core responsibilities. While the process was ultimately successfully completed, there is evidence that some difficulties persist with regard to efficient communication and coordination between KNPP and SERAW. The Programme Coordinator is ultimately responsible for ensuring adequate coordination.

**At Ignalina, a new leadership team was put in place at INPP in 2013 bringing positive changes.** In addition to quickly addressing commercial disputes that affected the construction of the ISFSF, the new management team has embarked upon a number of important organisational reforms. A Project Management Service was re-established in 2014 in order to concentrate decommissioning project management functions and improve planning, execution and control of activities. This was followed in subsequent years by efforts to optimise a number of business processes and significantly strengthen the corporate risk management framework. In previous years, the organisation had struggled to adequately prioritise decommissioning activities and build up adequate planning and monitoring expertise within the organisation.

**At Bohunice, the share of internalised expertise has strongly increased over years.** Indeed, the PMU consultant support was progressively reduced from the beginning of the programme to date (from with 7 external consultants to 2). The main know how transfer concerned technical capacity (e.g. development of project documentation, decommissioning strategy...) the project management. This development of knowledge and know how regarding technologies and project management support by experience sharing with the decommissioning of the Bohunice A1 reactor also operated by JAVYS (outside of NDAP).

### **International experience in the decommissioning process remains low, in particular for the final stages of decommissioning**

As underlined by the European Commission in its Nuclear Illustrative Programme (PINC), only three of the 90 reactors in shut down mode in the European Union have been declared completely decommissioned. Hence the decommissioning process is not considered to be fully mature. If it has been proven to be entirely feasible, even in sub-optimal conditions, R&D efforts are continually leading to improvements in methods and technologies and hold significant potential to reduce the price and hazard of the decommissioning process. Yet, many of these technologies remain largely untested on the industrial scale.

**In this context, the possibility for technical challenges and failures remains an inherent part of the decommissioning process.** At Bohunice and Kozloduy, recent examples with the management of legacy waste and the decontamination of the primary circuit have demonstrated that even an internationally-recognised contractor can struggle or fail to implement their proposed solutions. Moreover, the risk of underestimation (or overestimation) of time and costs necessary for projects is also naturally higher. This issue is cited (see section 2.6.1) as a contributor to cost increases observed across programmes in previous programming periods.

**As programmes progress towards or arrive at the critical step of dismantling in and around the reactors, the technical challenges become more complex.** The experiences in the Bohunice programme, as well as experiences at similar facilities such as Greifswald, have illustrated that Decommissioning Operators must be prepared to rethink or reorganize their approach when confronted with unexpected challenges. In the Kozloduy and the Ignalina programmes, the design for this stage of decommissioning is being formulated, thus important open questions remain. While the Kozloduy programme can rely on existing experience (in particular Bohunice), in the case of Ignalina these challenges are further compounded by the first-in-kind nature of this undertaking (RMBK reactor) and the open questions remaining amongst international experts concerning treatment and disposal solutions for irradiated graphite (although the ultimate disposal is strictly speaking beyond the scope of

the decommissioning programme).<sup>22</sup>

**These technical challenges are further compounded in the case of decommissioning early-generation reactors.** While best practice today is to incorporate decommissioning considerations into the design and construction of nuclear reactors, this was not taken into account with the design and construction of previous generations of reactors, such as the ones concerned by the NDAP. All three Decommissioning Operators also have to manage the consequences of incomplete historical data on operational waste, spent fuel and RAW and poor information on how the plants were actually built. This is particularly the case of Ignalina. This issue creates uncertainty in the planning stages that in some cases subsequently led to delays as the actual situation required a reconfiguration of the approach. However, the Decommissioning Operators can rely on the strong knowledge of former plant staff to help address these information gaps.

### **Administrative issues have also impacted programme effectiveness**

**The effectiveness of programme implementation has also been impacted by risks in the administrative realm that could have been completely or at least partially avoided.** For example in Bulgaria, the delay in ratification of the Nuclear Indemnity Agreement for the PMF created a significant risk for the project. More generally the Decommissioning Operators have also had difficulties correctly anticipating some regulatory issues.

**These challenges reflect in part the limited experience with decommissioning at the national level.** Slovakia is the only one of the three Member States concerned by the NDAP with prior experience in nuclear decommissioning. This has entailed a strong learning curve for Decommissioning Operators and national authorities when it comes to issues such as managing large and complex contracts, accomplishing administrative formalities or anticipating regulatory constraints. Indeed, the development of regulations on the national level has been an on-going process. Stakeholders have developed lessons learnt and built experience as the decommissioning programmes have progressed, which are being applied at present. In the case of Slovakia and Bulgaria, which will be faced in the future with other decommissioning projects, this capacity building aspect may also provide future return on investment.

### **Effective stakeholder engagement is necessary to prevent legal challenges and lack of political support**

**Decommissioning is a large-scale undertaking that has the potential to impact many stakeholders in various ways.** Without prejudice to legal requirements, international experience to date has underlined the importance of developing a clear stakeholder engagement strategy to structure the process, early and proactively to achieve wide participation in stakeholder discussions.

**Progress at Kozloduy was negatively impacted by legal challenges to Environmental Impact Assessments.** The Kozloduy programme illustrates well the legal and political risks that can arise during the decommissioning process. Multiple legal challenges slowed the approval of the Environmental Impact Assessment for the decommissioning of units 1 – 4, as well as the project-specific Environmental Impact Assessments for PMF and the NDF. The experience at Kozloduy can be connected to a complex set of factors, including the need for early and wide public engagement. Bulgarian legislation guarantees public access to information at the earliest possible stage of any project relating to nuclear energy. This is carried out through a process of mandatory public consultations, part

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<sup>22</sup> While numerous other graphite moderated reactors exist and are currently being decommissioned, the lack of international experience at present reflects that most countries have adopted deferred dismantling or SAFSTOR strategies for these plants. Significant international research is underway to develop appropriate treatment and disposal options. The Euratom research programme notably financed the CARBOWASTE project under the last MFF to help 'address Europe's looming irradiated-graphite waste challenge'. The main Lithuanian TSO (Lithuanian Energy Institute) and another research centre notably participated in the EUR 12 million project bringing together almost a dozen countries.

of the EIA procedure itself. While the process was implemented as stipulated by law, Bulgarian authorities underlined that a lesson learnt from the experience is to engage the public early and intensively to ensure wide support. At the same time, they also showed that early engagement cannot prevent all risks (e.g. anti-nuclear activists). These difficulties also point to some issues with administrative capacity as discussed in the previous section, including the need for training judges on this issue and requirements, for speeding up the process, as well as for ensuring adequate (and independent) quality checks of Impact Assessments before their submission to competent national authorities.

### 2.3.3 EQ3.3 To what extent has the level of risk at each nuclear site been improved thanks to the NDAP support?

*This sub-question assesses the extent to which the NDAP has contributed to risk reduction. It primarily focuses on the level of risk associated with the three sites for the general public.*

Since reactors' final shutdown, the level of risk at each site has been reduced in a stepwise manner, notably with the defueling of reactors and the decontamination, dismantling and disposal of contaminated and irradiated equipment and materials.

#### **At Kozloduy and Bohunice, the level of radiological hazard has been significantly reduced with the removal and safe storage of spent fuel in the previous MFF**

More than 99% of the overall level of radioactivity in nuclear reactors is associated with the spent nuclear fuel. Once the fuel has been removed from the reactor core and adjacent spent fuel pools and safely stored in interim storage, most of the reactor's radioactive inventory is consequently removed, thereby drastically reducing the potential impact of radiological hazards. Moreover, the NDAP supported the construction of interim spent fuel storage facilities at Ignalina and Kozloduy utilising the best available technology on the market to ensure long-term safe storage until final disposal. As a result of this work, the level of risk to the surrounding environment and general population has been highly diminished.

**At Kozloduy and Bohunice, the remaining radiological hazard concerns primarily workers inside the nuclear facility.** Apart from surface contamination of equipment, the remaining radioactivity in nuclear reactors largely comes from 'activation products'<sup>23</sup> such as steel components inside the reactor core. In Pressurised Water Reactors (Kozloduy & Bohunice V1), the largest part of the induced activity (close to 100%) is concentrated in the heart of the reactor internals, while the remainder of the induced activity is mainly concentrated in the surrounding Reactor Pressure Vessel cladding (a stainless steel layer inside the vessel) and the vessel itself. The activation of the components and civil structures outside the vessel is extremely low.

**In comparison with Bohunice and Kozloduy, a relatively significant level of risk remains at Ignalina prior to the completion of defueling activities.** While the reactor remains in shutdown mode, a large fissile material inventory requires active control. The occurrence of accidental criticality<sup>24</sup> remains a possibility in shutdown nuclear reactors from which the fuel elements have not been completely removed, including their removal from associated transit stores. The level of the overall radiological inventory remains similar to operational levels.

**In the current MFF, a significant level of additional risk reduction will be achieved, in**

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<sup>23</sup> Activation occurs when neutrons react with a substance, and generally change its isotope number. Activation can thus only occur in very specific parts of the reactor where materials are subject to neutrons flux.

<sup>24</sup> When the atom-splitting reactor of a nuclear power plant is operating normally, it is said to be in a state of "criticality." Accidental criticality occurs if the same reaction is achieved unintentionally, for example in an unsafe environment or during reactor maintenance or final shut down.



## particular at Ignalina

**During the period covered by this mid-term evaluation (2014 – 2016), the NDAP has contributed to a risk reduction associated with the Ignalina site with the beginning of defueling activities.**

This contribution will continue to increase significantly in the coming five years as the process follows its course. As described above, current defueling work will bring the overall risk levels for Ignalina in line with those that can be observed presently at Bohunice and Kozloduy. In other words, the level of risk to the surrounding environment and general public will be highly diminished. However, the risk profile of the Ignalina will continue to be impacted following defueling by the special case of presence of activated graphite in the reactor core<sup>25</sup>.

**At the other two sites, the most significant risk reduction was achieved in the previous programming period, but challenging work lies ahead to remove remaining radiological hazard.**

The choice of an immediate dismantling strategy implies that the remaining radiological hazard will be quickly reduced, along with the risks related to aging facilities after shut-down. At Bohunice, decontamination of the primary circuit is currently undergoing to significantly reduce the level of hazard, which will also decrease dose rates for personnel during dismantling operations. At Kozloduy, preparatory design work is currently underway to define the approach for dismantling of large equipment beginning in the latter part of the current MFF.

**Monitoring of safety-related issues at EU level can be strengthened to better reflect the overall purpose of the programme**

The driving factor behind the NDAP from its beginning has been the reduction of the ultimate risk to the general population posed by these facilities. It has also sought to ensure that decommissioning is conducted in a safe manner. However, it can be noted that these aspects have not been well captured in the high level monitoring framework that is the basis for communication of the results to external parties (e.g. reporting to the Council and the Parliament). Only the Ignalina programme included a specific indicator on safe reactor maintenance (no incidents on the INES scale). These issues are nonetheless very closely monitored by the Regulators and their monitoring as such does not reveal any deficiencies. Including some high level indicators could be valuable to communicate on the contribution of the programme on these key safety aspects (see section 2.3.5). This could include, for example, the evolution of the inventory of radiological hazard on site.

### 2.3.4 EQ3.4 To what extent are Monitoring & Control systems in place to measure the progress of the decommissioning programmes?

*This sub-question assesses the adequacy of the Monitoring & Control System. This 'system' includes the high level monitoring framework developed around the detailed objectives for each programme, the baseline schedules, other performance targets and indicators defined on a regular basis and the suite of Earned Value Management indicators. Performance data is disseminated through different channels and discussed in dedicated fora at national and EU level.*

**With the current programming period, significant progress has been achieved compared with previous generations of the programme** in terms of articulating clear objectives (e.g. submission of updated detailed decommissioning plans, detailed objectives to operationalise general & specific objectives, etc.) and translating those objectives into a robust monitoring framework (set out in Annex 1 the detailed Implementing procedures and Annual Work Programmes). The introduction of Earned Value Management has also enhanced the quality of programme monitoring. New templates were developed for key monitoring and programming documents that are reviewed at programme-level Monitoring Committees. The Commission also continues to conduct regular monitoring missions. While

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<sup>25</sup> Graphite has particular characteristics that make it a special waste form. The phenomenon of stored "Wigner energy", which contributed to the Windscale reactor fire in 1957, the perceived possibilities of conventional fire and dust explosion, and the problems associated with isotope inventories of carbon-14 and chlorine-36, are some of the issues.

this represents an important step forward, some continued progress is desirable in terms of improving the quality of indicators, adjusting and streamlining the contents of monitoring reports and Annual Work Programmes and continuing to perfect the implementation and use of the Earned Value Management system.

**The NDAP follows clearly defined objectives, with detailed work breakdown structures, schedules and costs**

**Significant progress has been made with efforts put in place since 2014 to strengthen the clarity of programme objectives and corresponding monitoring framework.** These enhancements were intended to address weaknesses identified in previous generations of the programme. In paragraphs 31 – 32 of the ECA's 2011 Special Report, the Court observed that, *'the Commission did not ensure that the broad priorities...were translated into a coherent set of detailed targets and indicators....None of the [programme stakeholders] has established a system to monitor and assess the progress towards the achievement of the overall objectives...Monitoring and reporting on programme achievements at all levels were therefore difficult'*.

The EC responded to these findings by strengthening the clarity of the objectives of the programme in the legal base. This was done through the definition of general and specific objectives for each programme in the NDAP Regulations, as well as the elaboration of detailed objectives in the detailed implementation procedures. On the operational level, all Member States have developed robust detailed decommissioning plans – which also form part of the legal base of the programme, as required by the *ex ante conditionalities*. These plans are broken down to detail the level of decommissioning activities (e.g. a multi-tiered work breakdown structure), including a schedule and corresponding costs structure based on internationally recognised standards for the estimation of decommissioning costs.

The decommissioning plans were reviewed by the Commission at the outset of the programme and more recently by an independent consortium of consultants.<sup>26</sup> The critical review, which was not re-performed in the scope of this mid-term review, found that the detailed decommissioning plans were broadly complete, relevant and comprehensive - i.e. include all necessary activities to reach the defined brownfield end-state.

**An adequate monitoring framework has been developed to review implementation progress...**

**The clarified programme objectives and decommissioning plans provide a clear baseline and framework for the monitoring and control of programme implementation.** A mandatory set of high-level indicators has been adopted as part of the legal base of the programme. This includes performance indicators, targets and milestones for each of the detailed objectives defined in the detailed implementation procedures. In total, 37 indicators are set out for the Kozloduy (10), Ignalina (13) and Bohunice (14) programmes. In addition, 18 other common indicators are defined. Moreover, the detailed decommissioning plans serve as a baseline for measuring the schedule performance of the individual programmes. All beneficiaries maintain detailed, activity and project-level schedule performance milestones and regularly report against these milestones.

**This framework has been further enhanced since 2014 through the roll out of Earned Value Management**, an initiative strongly pushed by the Commission. Schedule Performance Indicators (SPI) are now reported systematically by programmes at the project level and, in most cases, at the global programme level. This provides for a simplified analysis of schedule performance, in particular for external stakeholders, and provides useful aggregate-level indicators for strategic decision-making.

**In addition to this mandatory framework, some programmes have developed additional monitoring activities at the project and activity level.** The Ignalina programme has defined

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<sup>26</sup> Report is not publicly available at present

additional performance indicators beyond those mandated by the legal base: for 2016, it includes 35 project-level indicators, milestones and targets. The Kozloduy programme also defines a set of activity-level performance indicators in its Annual Work Programmes; for 2016, the activities have been grouped into 17 measurable targets. For the Bohunice programme additional waste management and safety indicators have been developed.

### **...but the use of performance indicators can be further improved**

**The monitoring framework put in place for the current NDAP is overall judged to be adequate.** Indicators are generally relevant to the detailed and specific objectives for each programme and focused on results achieved rather than inputs or processes. They are also limited in number and in most cases focused on the most relevant results sought by the programme.

#### **BENCHMARK – Results based management in budget support**

The monitoring framework for the NDAP is generally in line with best practice observed in other EU programmes. In particular, the budget support mechanism has pioneered the use of results-based monitoring. The establishment of the monitoring system and related disbursement criteria is at the heart of a budget support operation, providing the framework for conditionality and for policy dialogue. During the formulation stage, EU Delegations work with recipient countries to a number of indicators aligned with the objectives of the budget support. In the selection of indicators, the Commission gives particular attention to outcome indicators, because these promote ultimate accountability for results, stimulate use of evidence-based policy making and allow recipients a large latitude of flexibility for deciding how to achieve the desired results best. The Commission Guidelines (*Programming, Design and Management - A modern approach to Budget Support* - 2012) further recommend that the number of indicators should not exceed eight per tranche. With the exception of a number of specific cases, the indicators developed to monitor NDAP implementation are relevant, focused on outcomes and selective.

**However, the quality and relevance of some indicators set out in Annex 1 of the detailed implementing procedures, including the use of targets and milestones, should be improved. Additionally, the monitoring framework can also be updated to ensure continued effective monitoring post 2020. Finally, further improvement in the comparability of the indicators throughout the three programmes would be desirable.**

**Performance indicators for the Kozloduy programme – specific objective 2 – should be improved and updated** in order to improve the level of accountability and provide a granular view of the physical progress of D&D works in the Controlled Area. For example, there is currently no basis for determining how many tonnes of equipment and structures ought to have been dismantled by the end of the current programming period. **Concerning the Bohunice programme, some less critical issues were noted with regard to the approach for defining indicators and milestones.** The indicators for specific objectives 1 & 2 follow a project output-based approach that, while comprehensive with regard to the specific objectives, does not provide granular physical progress metrics towards dismantling. Finally, the Bohunice programme opted for annual milestones for measuring the performance of decommissioning waste treatment, which are easily made redundant in changes to the programme schedule – e.g. pace or timing of work may change while work is still on track to reach overall target.

**It should be noted that for both the Kozloduy and Bohunice programmes, some of the issues raised have been addressed in practice in programming and monitoring documents.** In the Monitoring Reports for the Kozloduy programme, more detailed activity-level performance indicators provide for a much more detailed assessment of the progress made towards specific objective 2, assessed against annual targets set out in the Annual Work Programme. The Monitoring Reports prepared by the national stakeholders for the Bohunice Programme include a ‘waste conditioning performance indicator’ to provide for an overall assessment of performance rather than using the annual targets. While this has helped to address the issue in practice, it would remain advantageous to further

formalise these changes in the detailed implementing procedures.

**Some targets and milestones for all three programmes should also be adapted in order to account for the fact that funds committed up to 2020 will in reality continue to be disbursed over a period of several years following 2020.** The existing 'monitoring framework' does provide a basis for continuing to monitor programme implementation post-2020. However, the quality and relevance of this framework would be better ensured through some small adjustments. In particular, it is necessary to adapt the targets and milestones for the indicators set out in Annex 1 of the detailed implementing procedures, most of which run up to 2020 and thus do not reflect progress to be achieved following that date as programme implementation continues.

**As a final issue, the comparability of indicators across programmes is difficult, even though all programmes pursue similar goals, with some specifics.** This makes inter-comparison across the three Member States difficult. For example, none of the three programmes uses the same units of measure for tracking waste management performance. To some extent, the introduction of Earned Value Management has contributed to addressing this issue as it provides a set of indicators that are fully comparable across all programmes. It should also be recognised that the different programme management cultures and approaches should be respected and taken into account; in this respect it is worth noting that the use of ISDC does not imply automatically the definition of the same Work Breakdown Structure. The cost of significantly restructuring the programme management to achieve greater comparability would likely far outweigh the benefit of fully comparable indicators. Moreover, benchmarking of decommissioning programmes is notoriously difficult. Nonetheless, further room for harmonisation while respecting national approaches does appear possible. As an example, a possible approach to harmonising and enhancing waste management indicators could be to provide target output levels based on the existing capacity of the waste treatment facilities, complemented with an indication whether the capacity of these facilities is adequate to cope with the needs to be re-estimated on a yearly basis.

**The rollout of Earned Value Management has contributed to strengthening programme monitoring, but continued efforts can be made to perfect its use in practice**

**The use of Earned Value Management represents a significant progress towards strengthening the monitoring framework and creating a common progress measurement framework.** With regard to the previous weaknesses identified, it provides for a greater degree of objective comparison of the performance of the three programmes and supports strategic oversight at EU level by the Commission, Member States and other stakeholders such as the European Parliament and the Council of the EU.

**The implementation has been gradual from 2014.** Whilst all programmes are now systematically reporting using Earned Value Management, the implementation process has been and continues to be a learning experience and fine-tuning has been on-going. At the time of evaluation (H2 2016 Monitoring Report) Earned Value Management schedule and cost performance indicators are provided by all programmes for most projects and activities. Indicators are computed both against the Annual Work Programmes and the detailed decommissioning plan baseline. It is thus possible in most cases to identify assess progress against annual targets, but more importantly identify longer-term slippages against the decommissioning baseline.

**Some minor difficulties nonetheless remain for the full implementation of Earned Value Management,** in particular with regard to contracts implemented by third parties. Best practice use of this methodology is dependent on a number of boundary conditions that make it difficult to apply to projects implemented through contractors if it is not embedded as a condition of the contract. These projects thus can only be partially monitored with the same approach as project reporting depends on the contractor. For existing contractors, depending on their cooperation, transitory measures might be needed.

**More generally, Earned Value Management should be fully imbedded in beneficiary management**

**systems to produce full benefit.** The Earned Value Management system is not designed to function as an additional layer of reporting. Rather, best practice is to fully embed Earned Value Management in the management system – e.g. the processes, tools, practices and culture – of an organisation. This is necessary to ensure the robustness of performance indicators, but also the impact of Earned Value Management as a management tool. While no detailed audit was conducted, INPP was found to generally have the most mature level of implementation of the three Decommissioning Operators. This is due largely to the fact that the organisation had made the decision to implement the tool independently of and previous to the Commission's decision to adopt it. Decommissioning Operators would derive long-lasting benefit from efforts to fully embed the cutting-edge tool and use it, the case being, beyond the scope of their NDAP activities. Further significant effort to improve implementation would thus have return on investment beyond the scope of the NDAP alone.

### **Adequate mechanisms have been put in place to produce monitoring data, with only isolated issues identified with data quality**

**Decommissioning Operators for all three programmes have continued efforts to develop monitoring and control systems to help ensure that the right data are being collected at the right time during and after project implementation.** Beneficiaries have put in place mechanisms to produce internal monitoring reports for the use of managers covering schedule and cost performance. They have also ensured adequate capacity to produce mandated EU-level monitoring reports and provide necessary monitoring information to the Implementing Bodies, even if reporting procedures could be further streamlined to improve efficiency according to some stakeholders.

**One exception to this overall finding concerns the difficulty experienced by the Kozloduy programme** in reporting on overall waste management activities using the framework proposed in the detailed implementation procedures. Upon specific request of the Commission, the necessary data was provided, but it had not been regularly reported in Monitoring Reports through the end of the first semester of 2016.

All Implementing Bodies have been pillar assessed<sup>27</sup>, which provides a guarantee that they are able to exercise the adequate level of control on the monitoring systems of the Decommissioning Operators and the consistency of monitoring data reported. The EBRD's approach is to ensure that the quality of reporting by beneficiaries is assured through the embedded PMUs and the substance of progress reported is regularly scrutinised through progress review meetings. In Lithuania, the CPMA has embedded a staff member on site at INPP also carries out annually a programme of specific spot checks to provide assurance of the robustness of internal monitoring processes – both for monitoring physical progress and financial management. The SIEA has also set up similar procedures to ensure an adequate level of control over the monitoring system. However, little evidence is available on effectiveness at present due to the fact that it has just begun operation as an Implementing Body.

### **Reporting and programming documents can be further streamlined and simplified to augment strategic decision-making effectiveness**

**While programmes have generally defined adequate monitoring frameworks and are capable of producing the requisite monitoring data, the challenge remains to better structure and filter information provided in monitoring reports.** In particular, the study assessed the quality of the bi-annual Monitoring Reports and the Annual Work Programmes. Overall, these documents are satisfactory and present a very comprehensive set of information allowing to assess implementation. Nonetheless, a number of areas for improvement were identified, including the heterogeneity of the reports and their length.

**Beneficiaries comply with guidelines for reporting and programming documents, but the actual**

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<sup>27</sup> An assessment required of an entity entrusted with implementation of the EU budget under indirect management mode

**content can vary widely.** A template for Monitoring Reports and Annual Work Programmes was included in the detailed implementation procedures and updated by Guidelines on Preparation of Monitoring Reports issued by the Commission in 2015 to address issues with the original template and take into account feedback from beneficiaries. Beneficiaries submit documents in line with the guidelines, but their actual contents vary widely in practice reflecting local management systems and cultures. Moreover when two Implementing Bodies are involved, this adds further complexities to the structure of the report. This does not detract from the quality of monitoring of individual programmes, but can make it more complex and time-intensive to manage the programme at EU level.

**The monitoring and programming documents, which can count up to hundreds of pages with annexes, could better filter and prioritise information** in order to provide greater clarity and focus with regard to key issues. Member State representatives of the NDAP Committee underlined that the level of accessibility of the monitoring and programming information in the reports was not adapted to strategic-level oversight of the programmes. Nevertheless, it can be noted that each of the three programmes' Monitoring Reports feature best practice that could be generalized.

### 2.3.5 EQ3.5 Are the communication actions addressed to the stakeholders and the public effective, adequate and accurate?

*This sub-questions considers the adequacy of communication activities. This was assessed primarily in so far as they contributed to the effectiveness of the decommissioning process. The extent communication activities may have fulfilled other objectives was secondary.*

#### **Decommissioning Operators in all three countries have implemented relevant communication activities**

**Communication activities are primarily undertaken by Decommissioning Operators as the primary stakeholders involved in decommissioning activities.** These activities are focused on both local and national audiences. They include communication on safety and environmental aspects of interest to local populations, as well as general awareness-raising about decommissioning activities.

- ▶ **Kozloduy:** The Public Relations team of SERAW is responsible for communication activities. An Information Centre is notably being built at Kozloduy. SERAW's communication efforts have also included local projects undertaken within the local community, such as clean-up days. SERAW maintains a public website with information on the Kozloduy decommissioning programme and had developed various other communication material.
- ▶ **Ignalina:** The Communications Division of INPP is responsible for public relations and communications. An 'exhibition hall' with a model of the Unit, model fuel assembly, model spent fuel cask, various information posters and videos and monitors providing a direct video feed of different areas of the plant can be viewed by the public since 1995. According to INPP statistics, 92 000 people from thirty countries have visited the facility since it was established.

Radiation monitoring activities undertaken by the Lithuanian Radiation Protection Centre are also extensively communicated to the surrounding population. Dose measurements are continually recorded at 13 sites in the region.

- ▶ **Bohunice:** The communication activities are mainly undertaken by JAVYS through the construction of the new information centre. The information centre is open to all public who can discover a 3D movie about V1 NPP decommissioning and look at the models of V1 NPP, reactor WWER 440. It is mainly used by schools and universities. JAVYS provides in parallel a monthly journal to population living close to the NPP to provide news on the activities of decommissioning. The JAVYS website also provides a large amount of information related to the achievement of the V1 NPP decommissioning programme.

**All sites had close ties with local communities and other relevant stakeholders.** Local communities had very close ties to the plants by virtue of many (generations of) residents being employed by the plants. They are thus generally aware of safety aspects of nuclear power and used to



living in the vicinity of a nuclear facility. These efforts generally contributed to securing critical buy-in from local populations, with the exception of some difficulties in Bulgaria (see below).

**Communication activities respected EU visibility rules.** Local populations are highly knowledgeable of the EU assistance provided to decommissioning. The power plants have traditionally been the main employer in the surrounding areas and the population is thus well aware of developments with regards to decommissioning. This was also supported by the politically sensitive nature of the closure of the reactors and the attention received in the national press.

### **Difficulties with stakeholder engagement contributed to slowing progress at Kozloduy**

**As discussed in section 2.3.2, the experience with Kozloduy can be connected to a complex set of factors, including the need for early and wide public engagement.** Bulgarian legislation guarantees public access to information at the earliest possible stage of any project relating to nuclear energy. While the process was implemented as stipulated by law, Bulgarian authorities underlined that a lesson learnt from the experience is to be engaged with the public early to ensure wide public support. However, it also showed the difficulties posed by anti-nuclear activists.

### **Almost no communication or public engagement activities specific to the NDAP are undertaken at EU level, representing a missed opportunity**

Communication activities within the framework of the NDAP at EU level were limited to the statutory reporting required by the legal base (e.g. reporting to the Council and the Parliament and to the Member States through the NDAP Committee). The Commission's website provides the statutory reporting documents and a brief description of the programme with little information beyond this. Compared to other EU programmes, this 'digital footprint' is very minimal. The Commission could highlight the tangible benefits of the programme for the European public, as well as the secondary positive effects (e.g. business opportunities for the EU decommissioning market, knowledge generation, etc.).

Moreover, there appears to be added value in engaging early with relevant public, industry and civil society actors on the EU level in order to contribute to shaping public discourse on decommissioning, an issue that will take on increasing importance for the EU in coming years. Potential synergies also appear with other areas of European Commission action. For example, societal acceptance of deep geological disposal is recognised as a key risk for the development of a sustainable solution for the final disposal of spent nuclear fuel – in addition to the technical challenges. Recognising this, the Euratom research programme has been used to invest in the sharing of experiences and the development of best practices (e.g. the EAGLE project financed under Euratom FP7). This engagement activity is beyond the objectives of the programme; however, it appeared during analysis as a potential opportunity for enhancing added value (see also section 2.8 on EU added value).

## **2.4 EQ4. Aside from the financial assistance provided, what other types of results and impacts can be attributed to the NDAP?**

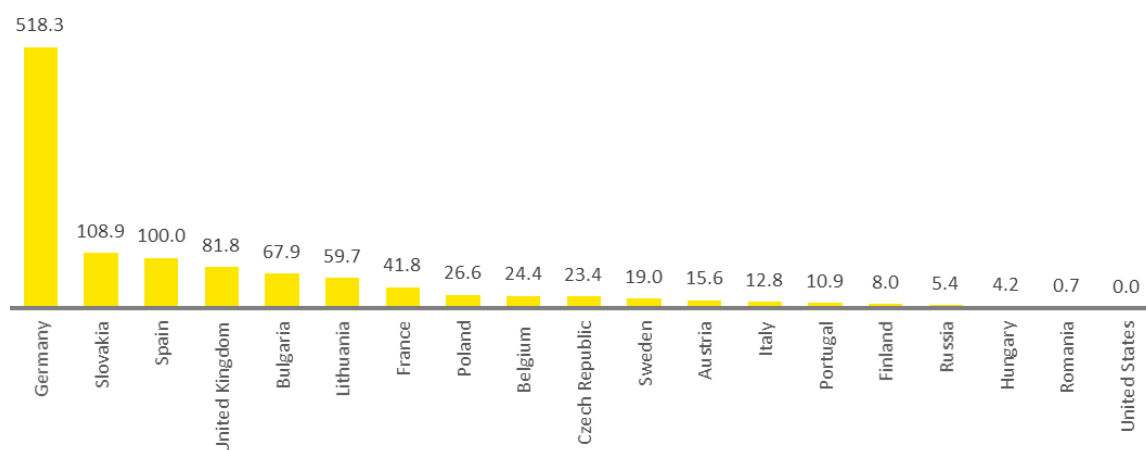
*Going beyond the effectiveness of the NDAP in terms of making progress against the decommissioning plans, this evaluation question seeks to measure other types of positive and negative effects and impacts that have been generated by the NDAP in each country.*

*According to the evaluation grids elaborated for this question, evaluators assessed three principal types of additional impacts that may be generated by the NDAP, beyond the explicit impacts set out in the Regulation. This includes economic, social and environmental impacts. These impacts are purely additional and their presence or absence does not and should not be considered to have any bearing on the effectiveness of the programme – e.g. with regard to its explicit objectives.*

## The economic impact of the NDAP is mainly related to the economic effects of contracts - totalling over EUR 1,1 billion since its inception

The economic impact achieved by the NDAP is mainly related to the direct impact of the contracts benefiting the rising European decommissioning market. Overall, approximately 350 procurement contracts have been signed, representing approximately EUR 1,1 billion injected into the decommissioning market.<sup>28</sup> Making some (simplistic) assumptions<sup>29</sup>, an indicative repartition of contract value can be made. Germany stands out as a major recipient of contracts, but this observation can be nuanced as discussed further below. Other important beneficiaries include nuclear ‘heavy weights’ in Western Europe, notably Spain and the United Kingdom. Looking on the level of companies, the largest beneficiaries were large nuclear consultancy / engineering firms, such as NUKEM Technologies (Germany), GNS (Germany), Iberdrola (Spain), Empresarios Agrupados (Spain) or Nuvia (UK) amongst others. These firms provided extensive project management and engineering support to programmes, in particular through PMU contracts for EBRD-implemented projects.

**Figure 2: Indicative repartition of contract value by MS from programme beginning to present (EBRD, CPMA contract data) (M of EUR)**



It is also clear that local industry in Bulgaria, Lithuania and Slovakia has benefited significantly from contracts funded through NDAP. These are generally smaller companies providing works and services, as well as engineering and consultancy services to a smaller extent. Slovakia boasts the largest portion of contract value flowing to national industry (47%) according to the indicative repartition presented above. This is partly due to commercial contracts signed with JAVYS (26% of contracts with national industry) for waste management services – whereas this activity is funded through salaries of Decommissioning Operator staff in the other two programmes. However, other Slovak companies, such as the Technical Safety Organisation *VUJE* or the engineering and design firm *ROBO Piešťany*, also won significant NDAP-funded business. If one adds the salaries paid to INPP and KNPP / SERAW staff, this contributes significantly to closing the gap with Slovakia. Moreover, the figure for Lithuania can be further revised upwards as small procurements benefiting largely local companies are directly managed by INPP and not included in the above analysis. For both Lithuania and Bulgaria, over two thirds of investments can be estimated to benefit the local economy through contracts or salaries.

<sup>28</sup> This excludes contracts under the annual support projects for INPP in Lithuania, mainly for maintenance and general running costs. This amount has been included in the overall amount reported to the European Commission in the context of the programme reporting, representing approximately EUR 27 million since 2010.

<sup>29</sup> Contract value is equally divided amongst consortia partners, the nationality of the contracting entity is counted rather than that of the ultimate parent company

**For all three programmes, another source of economic benefit for the local economy not captured in the figures above is subcontracting to local companies for projects implemented by foreign-led consortia.** In other words, significant amounts of contracts awarded to foreign companies can actually remain in the country. Data provided by Decommissioning Operators provides a picture of the significant amount of benefit sub-contracting represents. For the Bohunice programme, a total for EUR 54 million from recent contracts awarded to foreign companies remained in the country – benefiting 62 Slovak consortia partners. This represents approximately 28% of the total value of these contracts. Adding this results in an almost 50% increase in the figures found in the analysis above. A similar trend can be noted with some examples in Bulgaria. A third of the contract value for the construction of the PMF and half of the contract value for the construction of the SRDW benefited Bulgarian firms. EUR 7,1 million in spending on PMU has also benefited local Bulgarian companies. In Lithuania, the Decommissioning Operator conducted analysis for EUR 404 million in projects (including the ISFSF and the SWTST) and found that approximately 35% (EUR 136,8 million) likely benefited local contracts.

However, it can also be noted that very few or no local companies in Bulgaria, Lithuania or Slovakia took part in business opportunities in other programmes (e.g. beyond national borders). If Slovakia had the highest level of national participation in its programme, only one Slovak company has won work in Bulgaria or Lithuania so far (DECOM a.s.). The Lithuanian firm *Specialus montażas-NTP* was one of the only local companies in an NDAP country to implement work in the other two NDAP countries to date.

#### **Limitations of data**

It should be noted that these figures do not reflect the strict reality as fully tracing the flows of funding is not possible due to the limited amount of data available on project consortia and the use of sub-contractors, as well as issues of corporate ownership. For example, the Russian firm *Atomstroyexport* purchased Nukem Technologies in 2009, even if the firm is still headquartered in Germany. The actual level of benefit accrued to Russia is thus certainly higher than portrayed in the figure above. At the same time, a large contract (such as the ISFSF at Ignalina) benefiting a European company with a Russian parent company is nonetheless in large part implemented through sub-contractors, many of which are based locally or elsewhere in the EU. This example provides an indication of the complexities that exist behind these figures. While the figures can provide some indication of relative distribution, they should not be taken to represent the actual repartition of funding by Member State.

**Beyond the direct economic effect, the economy-wide economic impact achieved by the NDAP could be significantly higher depending on the indirect and induced effect.** As described above, the direct effect achieved is the increase in demand for goods and services resulting from the programme (e.g. EUR 1,1 billion in contracts), which results in an increase in output by economic actors to meet demand. The indirect effect concerns the increase in demand down the supply chain (e.g. primary contractors buy goods and services from their suppliers) and the induced effect is the impact on the general economy as a result of increased household income, part of which is re-spent on goods and services.<sup>30</sup>

**Finally, it can be noted that significant business opportunities were captured by leading EU nuclear consultancy and engineering firms, which have the potential to serve as repositories and transfer mechanisms for knowledge and experience developed during these projects as they assist other decommissioning projects in the future.** EWN, a commercial spin-off of the Greifswald decommissioning, for example, served as a contractor at Kozloduy, Bohunice and Ignalina. While it is important that knowledge be retained and transferred in the public sphere (as an EU-financed

<sup>30</sup> The calculation of the economy-wide effects, which relies on advanced input-output modelling to calculate ‘multipliers’, was beyond the scope of the current study.

project), private companies can also play a role in this process.

### **While no new technologies were developed, NDAP-funded contracts allowed companies to showcase new technologies and methods**

**The programmes have also allowed to showcase advanced or new technologies, providing EU companies with valuable references to further monetize their experience and involvement in the NDAP.** At Kozloduy, for example, the PMF represents only the second application of plasma melting in the domain of nuclear waste management in the world. Demand for such cost-effective technologies can be expected to grow in coming years with the expected growth of the wider decommissioning market.

The process of decommissioning is also an opportunity to collect knowledge and experience. There is a significant need for reliable data about decommissioning process to improve the accuracy of plans and properly assess the cost of it. The following information is particularly valuable:

- ▶ evaluation and optimization of decommissioning options and especially the time schedule for the purpose of selection of the optimal decommissioning option;
- ▶ modelling of dismantling techniques with special attention to application of remote dismantling techniques;
- ▶ evaluation of safety in decommissioning; and
- ▶ waste management scenarios including the analytical approach for evaluation of conditional release of metallic materials<sup>31</sup>.

It allows for further development of specific codes for decision making process and planning in decommissioning, which can be considered as an additional important impact of the NDAP with economic dimension.

Apart from the above, no other examples were found of truly innovative technology developed by companies or Decommissioning Operators as part of NDAP.<sup>32</sup> The Ignalina programme holds the highest potential for the development of innovative technologies as the conditioning and storage of irradiated graphite is subject to extensive R&D in the world and no clear solutions are yet available.

### **The experience gained by Decommissioning Operators may have a return on investment in the future through commercial implication in other decommissioning projects**

**JAVYS and INPP have included as an objective in their organizational strategies the desire to leverage experience gained into future commercial opportunities.** The current position of SERAW management is to focus at present on the Kozloduy programme before developing future activities, although future commercial spin-off activities are not excluded. The experience and credentials gained through the NDAP may thus contribute to an additional return on investment for the European economy through the emergence of new decommissioning companies active on the European and international market, in the same way that it has contributed to developing the expertise and experience of large engineering firms as previously described.

JAVYS is currently the only operator that has made concrete steps in this direction at present. The company is presently bidding for decommissioning work in the international decommissioning market. According to JAVYS management, it has met some initial success, such as contracts to process waste

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<sup>31</sup> Innovative and Adaptive Technologies in Decommissioning of Nuclear Facilities; Final report of a coordinated research project 2004-2008; IAEA, 2008

<sup>32</sup> Nor do Decommissioning Operators conduct extensive R&D. According to desk review, there are no EU-level instruments that support research in the area of decommissioning. Euratom supports research in relevant areas, such as waste management (deep geological disposal, partitioning & transmutation...), but the relative timelines do not provide for any potential synergies.

for the Czech company ČEZ (NPPs Dukovany and Temelín) and for the Italian company SOGIN (NPP Caorso).

### **The NDAP has contributed to offsetting the social impact of decommissioning through supporting employment of former NPP staff**

**The process of decommissioning is linked with a decreasing level of economic activity and number of employees, which may have a negative impact on the economic health and development of surrounding regions<sup>33</sup>.** Indeed, the shutdown of the eight units concerned by the NDAP has inevitably had some negative socio-economic impact on the areas where these NPPs are located. The NPPs were important sources of employment in these regions, even the most important local employer. However, significant differences from one Member State to another can be noted, depending on the existence of other local economic activities and, in particular, working reactors on site (the case of Slovakia and Bulgaria).

**In this context, the NDAP has contributed to mitigating these negative impacts, notably by influencing the decommissioning strategy of Member States.** As discussed in section 2.8 in further detail, the NDAP exercised a strong influence on the choice to pursue an immediate dismantling strategy in Bulgaria and Lithuania. This created a logical opportunity for former NPP staff, who have strong knowledge of the facilities, to participate in the decommissioning process. Under the alternative scenario of deferred decommissioning (SAFSTOR), which had been initially envisaged, staffing requirements would have dropped much more precipitously. In these Member States, the decommissioning process has leveraged the skills and expertise of a significant number of former NPP staff. The NDAP has thus supported employment of these staff for decommissioning work, whereas this employment may have otherwise been lost in absence of EU support.

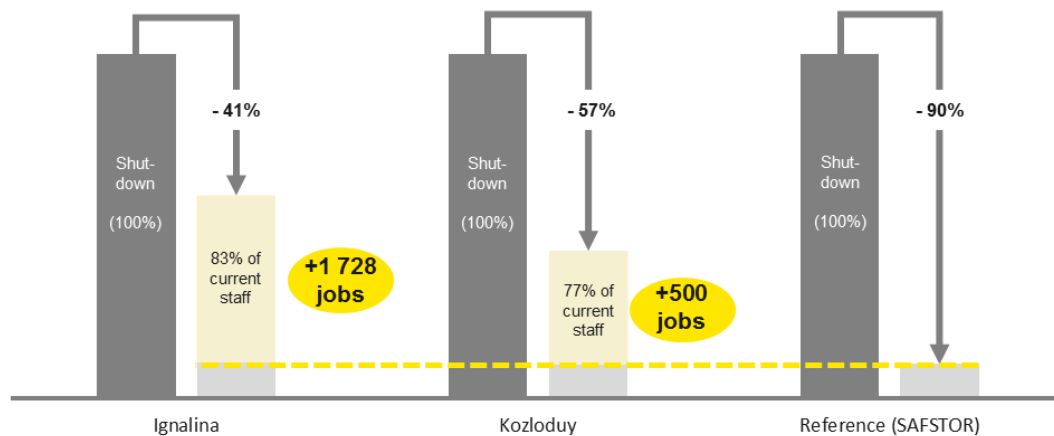
**Overall, an estimated 2 228 fewer jobs would exist in the Ignalina and Kozloduy programmes had a SAFSTOR approach been adopted.** While the reference scenarios vary and data are not systematically available, it is reasonable based on international experience to estimate that 10% of staff levels at shut down are necessary to safely maintain a typical NPP once in SAFSTOR – higher staff levels are required during the transition period while the facility is being prepared for SAFSTOR.<sup>34</sup> Comparing the current staff levels at the Ignalina and Kozloduy programmes to this reference scenario, one can estimate that 83% of current staff positions at the former and 77% at the latter currently exist due to the choice of immediate dismantling – or 2 228 jobs.

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<sup>33</sup> Managing the Socioeconomic Impact of the Decommissioning of Nuclear Facilities, IAEA

<sup>34</sup> The 10% figure is drawn from the publicly available data on experience of NPPs in the United States (Crystal River NPP) and Canada (Gentilly). As noted, the actual staffing levels would be subject to a number of specific factors and could vary.

**Figure 3: Comparison of staffing level evolutions at Ignalina and Kozloduy with SAFSTOR reference scenario**



This is a simplistic analysis in some ways. The staffing levels in SAFSTOR at both plants would depend on a complex set of factors that it is not possible to fully assess here. This does also not take into account the employment prospects for former plant staff, some of whom could have found employment elsewhere. Nonetheless, it very reasonably demonstrates that a significant level of employment has been maintained due to the choice of immediate dismantling in Lithuania and Bulgaria, which can be clearly attributed to the NDAP. Moreover, many of these opportunities have benefited former plant staff, some of whom had few other prospects. This is particularly the case in Ignalina, where few other opportunities in the nuclear sector exist, and the higher age of many staff would have likely locked them out of the job market. Many are thus able to apply their skills and expertise of the NPP towards a socially and environmentally useful undertaking.

**However, it should also be noted that the preservation of employment to the extent that it is not indispensable to decommissioning and maintaining safety is at odds with the objective of supporting cost-effective programme delivery.** Indeed, desires to minimize social impact on the national level contradict the effort for the cost-effectiveness of the decommissioning process.

## 2.5 EQ5. How effective is the governance and project management framework at EU and national levels?

*This evaluation question went beyond the expected outputs and results of the programmes themselves to assess the governance and project management framework that has been put in place at the EU and national levels. This question is addressed through three evaluation sub-questions looking individually at the clarity and effectiveness of roles at the EU and national levels and then at the overall effectiveness and fit-for-purpose of the governance and management system.*

*The role and responsibilities of individual actors are presented only briefly in the following sections. A more detailed description of the governance and management system of the NDAP is provided in Annex 6.2.*

The Directorate-General for Energy of the European Commission (DG ENER) is the *chef de file* of the NDAP supervision on behalf of the Commission. The management mode is indirect management, whereby the Commission entrusts budget implementation tasks to Implementing Bodies, but retains overall responsibility and accountability for EU budget implementation. Three such Implementing Bodies have been established to date. Programme Coordinators are designated in each Member State, responsible for the programming, coordination and monitoring of the respective decommissioning programme. Decommissioning Operators implement the programme under the supervision of the



Programme Coordinator and closely monitored and supported by the Implementing Bodies. A more detailed presentation of the governance and management system is presented in Annex 6.2.

### **BENCHMARK – Considering alternatives to the indirect management model**

The study of comparator instruments and programmes allowed to take stock of some of the advantages and disadvantages of the different approaches that could be used to implement the NDAP<sup>35</sup>. It concluded that indirect management was an appropriate tool and that changing management mode for delivery of the NDAP at present would induce costs not compensated by the expected benefits. Nevertheless, should the programme be continued in the future, its evolving scope and volume could change the balance of costs and benefits and another approach might be considered more appropriate.

Due to the high level of capacity and expertise necessary to implement the NDAP and the historical context, indirect management was chosen and implementation tasks were delegated to the EBRD. The EBRD has a recognised expertise and experience delivering similar programmes. Since their accession and with the encouragement of the Commission, two Member States have subsequently decided to establish national implementing channels. These 'national agencies' thus coexist alongside the EBRD in Lithuania and Slovakia during a transition period. Indirect management has the advantage of ensuring the requisite level of expertise and capacity while avoiding the necessity to increase headcount in the Commission. The flexibility offered by this management mode has also contributed to gradually developing national ownership of the programmes through the subsequent creation of the national agencies.

Alternatively, the Commission could have managed the programme directly, in particular with the growing recourse to Executive Agencies to manage the implementation tasks of large EU programmes. While legally distinct entities, Executive Agencies are very close to the Commission in terms of their regulatory framework, business processes and working practices (and geographical location). In-sourcing management, either to the Commission or an Executive Agency, could lead to reducing some of the natural transaction costs of the indirect management model. However, such a decision would also require the development of an adequate level of internal expertise, in addition to the necessary capacity. Potential future use for such a high level of in-house expertise would need to be weighed against the costs of developing it.

The other alternative, shared management, would offer the advantage of shifting greater responsibility to the Member States and possibly increasing the level of 'ownership'. The Programme Coordinator or existing national agencies in Lithuania and Slovakia could assume the responsibility as 'Managing Authority' and a management & control system has already been put in place. Implementation of the programme in practice, however, has pointed to some weaknesses at national level in some Member States, in particular Bulgaria and Lithuania. These risks would need to be weighed on a case by case basis.

While changing management mode in a future programme could potentially lead to some benefits as discussed above, it should also be recognised that it would imply a period of overlap during which new projects would be implemented under the new management mode, while on-going projects would continue to be implemented under the previous regulatory framework. Past experience has shown that the co-existence of regulatory frameworks creates significant administrative complexities and engenders inefficiencies in programme management. This would thus need to be included in

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<sup>35</sup> The EU Financial Regulation and its Rules of Application define three types of 'management mode': i) direct management whereby the Commission is in charge of all EU budget implementation tasks, which are performed directly by its departments, ii) indirect management whereby the Commission entrusts budget implementation tasks to a third party after strict due diligence, or iii) shared management whereby the Commission delegates implementation tasks to the EU Member States.

any cost-benefit assessment.
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## 2.5.1 EQ5.1 How well are roles defined and effective at EU level in terms of planning, monitoring and reporting?

*This sub-question looks specifically at the roles & responsibilities and effectiveness of actors at the EU level in terms of planning, monitoring and reporting. Specifically, this section looks at the Commission, the NDAP Committee and the Implementing Bodies.*

### **The roles and responsibilities of the Commission are clearly defined and appropriate**

The basic obligations of the Commission are detailed in the EU Financial Regulations. Under indirect management mode, the Commission delegates budget execution tasks to a third party while retaining overall final responsibility for the general budget execution. The specific roles and responsibilities of the Commission as they relate to the management of the NDAP are defined in the detailed implementation procedures – specifically Article 3 of the Commission Implementing Decision.

**The roles and responsibilities of the Commission are clearly set out and provide for a logical division of responsibilities when considered alongside the roles and responsibilities of other actors.** These are considered to be appropriate for supporting effective programme implementation while safeguarding Union interests. The Commission has retained largely strategic oversight responsibilities in line with its available internal resources, with administrative implementation tasks delegated to specialised bodies with strong technical and administrative competencies.

### **Since 2014, the Commission has worked to develop new tools to monitor the decommissioning programmes**

**A necessary precondition of providing strategic oversight to a programme and ensuring its efficient and effective implementation is the availability of relevant, quality data in a timely manner.** Since 2014, the Commission has placed emphasis on improving the availability and quality of schedule and cost performance data. This has notably been accomplished through the definition of clearer objectives and a more robust monitoring framework. The progressive implementation of Earned Value Management has also provided the Commission with a new tool to monitor programme implementation, in particular at EU level by allowing for greater comparability between the decommissioning programmes.

**Beyond these specific initiatives, the Commission has continued to fulfil its responsibilities with regard to participation in the monitoring of programme implementation,** notably through chairing Monitoring Committees / Assembly of Contributors and periodic on-the-spot monitoring missions. The assigned Programme Officers play an important role in following developments and maintaining contacts with the Implementing Bodies and beneficiaries on a day-to-day basis. Stakeholders reported good and improving relations with Commission teams, maintained through regular contacts. Commission officials are generally seen as playing an open, pragmatic and proactive role and focused on working with stakeholders to achieve results.

The Commission has limited human resources to exercise its responsibilities compared to those available at other levels of programme implementation (Implementing Bodies, beneficiaries), reflecting its strategic oversight role. The development of the tools described above is an important step in allowing the Commission to further focus its limited resources on high added-value tasks. These tools should allow the Commission to progressively provide greater leeway to beneficiaries to manage programmes while ensuring adequate control over the overall cost and schedule performance of the programmes.

**Finally, specific mention can be made of the Commission's role with regards to ensuring the safeguarding of Union financial interests.** In the strict sense of the protection of financial interests as defined in the Financial Regulations, the Commission takes a number of steps to ensure that all EU funds are used as intended and in full compliance with the law. This includes various preventative,

investigative and corrective mechanisms deployed during the full lifecycle of programme implementation, from pillar assessments of Implementing Bodies, to regular financial audits and specific risk-based controls, such as the recent procurement audit. However, these efforts also rely on effective Member State cooperation. This has been lacking in some instances, such as the on-going case of the recovery of funds from Bulgaria following an audit.<sup>36</sup> In the broader sense, the Commission must also ensure that the Union derives the maximum benefit from the funds invested. In this respect, the development of new and enhanced monitoring tools is contributing to its ability to ensure cost-effective and efficient implementation. The Commission's push to increase the *leverage* of EU resources through higher levels of national contribution and risk sharing can also be mentioned as a positive development.

### **The Commission fulfils obligations with regard to the annual programming cycle, but the time-lines have not proven realistic**

**The Commission plays an important role in the annual programming cycle.** It approved the decommissioning plans (baselines) and reviews and adopts, after seeking the opinion of the NDAP Committee, the Annual Work Programmes (and any revision thereof). On this basis, it adopts annual Financing Decisions and provides funding to the respective Implementing Bodies. At the end of the year, a Progress Report is transmitted to the European Parliament and the Council, which should serve as the basis for the adoption of the next Annual Work Programme.

**In practice, timely delivery in this process has proven difficult.** While the Annual Work Programmes should be adopted at the beginning of each year, thus far these have not been approved before the summer due to delays in the publishing of Progress Reports. The adoption of the Commission Financing Decision is consequently delayed as the Annual Work Programme, although not exercising an influence on the amount of financing approved annually, serves as justification for the Decision. Reporting to the Parliament and the Council has also been subject to delays due to the time necessary to formally adopt Monitoring Reports. The Progress Report for 2015 and 2016 were both adopted in June of the following year. This is then problematic as the Progress Reports are intended in theory to inform the following year's Annual Work Programmes, which are subsequently delayed.

**The importance of addressing the issue is recognised by all actors and the Commission has initiated reflection on possible solutions, notably small modifications to the detailed implementation procedures.** Specifically, the timeline should be re-thought, as well as the sequencing of and linkages in processes and streamlining or otherwise adapting the content of programming documents (see section 2.3).

**The Commission also has the authority to decide on the eligibility of individual projects** (and any amendment thereof) and to grant conditional approvals as it deems necessary for safeguarding Union interests (see paragraph in the previous section). Prior to approval, the projects documentation is transmitted to the NDAP Committee for information. Most projects are approved within a short period of time, nonetheless stakeholders underlined the need for clearer timelines for project approval as the time necessary for approval can be prolonged in some rare cases<sup>37</sup> when the Commission deems necessary to obtain specific guarantees before approving a project (e.g. co-financing of near surface repositories at Kozloduy and Ignalina). More generally, the process for approval of projects at EU level may also be rethought if the necessary conditions are secured (see following section).

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<sup>36</sup> Through the EBRD, the Commission continues to seek the reimbursement to the KIDSF of expenditure identified as ineligible by the financial audit in 2013. Bulgarian authorities have not facilitated this process.

<sup>37</sup> It was noted that the very large majority of projects were approved by the Commission without delay and, in cases where approval required more time than average, the incurred delays have been minor when compared to delays incurred at other phases of project development.

## **The NDAP Committee is acting as defined by its mandate, but the timeliness and relevance of information provided to Committee members could be improved**

The NDAP Committee is a "comitology committee" set up in accordance with Article 291 of the TFEU and Regulation 182/2011, to control the Commission's exercise of implementing powers.

**Overall, the NDAP Committee is considered to be fulfilling its mandate as described in EU legislation.** However, NDAP Committee members interviewed reported the issue of timeliness in managing the programming cycle, due to the reasons discussed above, and that Monitoring Reports should be streamlined for high level oversight purposes (see section 2.3.4). These issues make effectively fulfilling the strategic oversight role of the Committee more difficult and lead to limited participation by members during Committee meetings. At the same time, members interviewed also reported that they often have limited time to devote to NDAP-related tasks with their normal workloads.

## **The NDAP Committee has also played a knowledge sharing role**

**Beyond its statutory purposes, the NDAP Committee meetings have also provided the opportunity for Member states to share their knowledge on the decommissioning process.** In the first years of the programmes, this flow of knowledge came from 'experienced' Member States (e.g. France, Germany or Italy) to programme beneficiaries, whereas now the flow has been reversed and Decommissioning Operators are sharing their experiences with other Member States. This is perceived as a positive aspect by the Committee members interviewed and an incentive for the attendance of some.

**However, the extent to which these aspects could or should be incorporated formally into the role of the NDAP is questionable.** The Committee has a clearly defined role in the legal and treaty base and only very limited time to fulfil its existing formal tasks. As an alternative, other avenues outside the framework of the NDAP Committee for engaging Member States further in the programme and facilitating the exchange of knowledge, such as (ad hoc) expert groups or thematic workshops, could potentially be explored by the Commission. This issue is covered in greater detail in section 2.8.

## **Implementing Bodies are fulfilling their responsibilities and playing a technical oversight role somewhat beyond their formal responsibilities**

The role of the Implementing Bodies is laid out in EU Financial Regulations, Articles 6 & 7 of the detailed implementation procedures and the Delegation Agreements signed with the organisations. As summarised by the detailed implementation procedures, the Implementing Bodies are responsible for the proper performance of activities as fund manager and the sound financial management of projects. This includes establishing sound monitoring & control systems, requesting funds from the Commission, supporting the development of programming and project documentation, monitoring of implementation, control of procurement, assessment of cost eligibility, payments and financial management and recovery of irregularities.

**Overall, Implementing Bodies (i.e. EBRD and CPMA, with SIEA having recently commenced their activities at the time of the evaluation) were found to be effectively fulfilling their responsibilities as per the framework described above.** These organisations have been subject to required pillar assessments and various external verification/audits in recent years that confirm their aptitude and performance. Feedback from relevant stakeholders also generally pointed to satisfactory fulfilment of their roles and responsibilities.

**Some isolated issues were raised by beneficiaries,** such as the time to provide approval or non-objection, but these could not be extensively substantiated and do not appear to have resulted in significant delays. More significantly, the working relationship between INPP and CPMA could be improved. The relationship has become strained as the CPMA has taken an increasingly important role in programme delivery. This has been notably driven by the increasing application of national procurement rules, which INPP stakeholders find less preferable to EBRD rules. The necessary adaptation to differences in working culture in the CPMA compared with the EBRD also appears to

contribute. While this issue has not entailed any impact on the effective and efficient implementation of the programme, it can be flagged as a risk in the context of the increasingly important role of the national implementing channel in Lithuania.

**In practice, Implementing Bodies were also found to be playing an important role in providing strategic technical oversight to programme implementation beyond what can be deduced from a surface reading of their roles and responsibilities;** they can rely on internal nuclear expertise and extensive experience with implementation of complex projects. The EBRD's Nuclear Safety Department has 14 full-time employees working wholly or partly on the NDAP, with fund managers all having a technical background and having worked in the nuclear industry or nuclear regulatory agencies. Concerning the number of staff effectively engaged in working on programme management, this was 2,1 for Ignalina, 3,8 for Kozloduy and 3 for Bohunice according to figures provided by the EBRD. The Ignalina Programme Division of the CPMA is composed of 17 full and part-time employees, including 4 nuclear specialists and other relevant technical expertise, such as construction. The EBRD has also historically supported the definition of the detailed decommissioning plans (and been instrumental in the decisions on immediate dismantling strategies) and key strategic projects of the three beneficiaries through PMUs embedded in beneficiary organisations.

**The transition between implementation channels has entailed some risks under previous programming periods, which have been largely addressed**

**The transition between implementing bodies – in this case from an international organisation to national agencies – implies a transition period with multiple active Implementing Bodies.** This situation appears to have raised more issues in the past than at present in Lithuania. Programming activities have been adequately integrated to avoid the coordination challenges that have been observed in previous programming periods. However, the existence of two Implementing Bodies in Lithuania appears to entail some minor transactional costs, in terms of coordination, complying with differing administrative requirements for various documentation, etc. The transition of EU support from the IIDSF to the national channel also appears to have created frictions with INPP management due to the varying nature of their management styles and procurement rules. Some stakeholders in Slovakia have expressed concerns that difficulties may similarly arise with the arrival of SIEA to replace the EBRD for future projects. The installation of a national agency was promoted by the respective Member State. Lessons learned from experiences in Lithuania are being taken into consideration to limit the potential negative impact of this change on the implementation of the programme.

## 2.5.2 EQ5.2 At national level, how well are the roles of the Programme Coordinator defined and effective in terms of: planning; monitoring; and reporting?

*This sub-question looks specifically at the roles & responsibilities and effectiveness of actors at the national level in terms of planning, monitoring and reporting. Specifically, this section looks at the Programme Coordinators and beneficiaries.*

**Programme Coordinators have assumed a more active role in the implementation of decommissioning programmes...**

**Early political resistance in Member States in past MFFs has given way to acceptance and greater ownership at present.** The political commitment obtained by the EU for the early closure of the reactors in the three Member States was met with some domestic resistance in early years, with negative impacts on both the political and technical levels. Already before the end of the previous programming period, this resistance had progressively given way to widespread acceptance of the irreversible shutdown of reactors, which has also become a technical reality in the present MFF. Increasingly, this has also translated into an assumption of greater ownership over the decommissioning process itself on the part of national governments. This process is recognised by the Commission as a necessary condition of continuing to consolidate the governance of the NDAP.

**This evolution can be attributed in part to important efforts on the part of the Commission on a**

**political and procedural level.** On a political level, important diplomatic efforts have been engaged to stem political resistance and, in more recent years, encourage national governments to assume a more active role in and ownership over the decommissioning programmes. On a procedural level, the Commission modified the governance of the programmes for the current MFF to put in place clearer roles and responsibilities on the national level.

**Evidence can be noted of increased ownership and participation in NDAP implementation.** In line with the revised detailed implementation procedures, each of the three Member States has appointed a Programme Coordinator (Minister or State Secretary) to be responsible for the programming, coordination and monitoring of the decommissioning programme at national level. Tangible signs of increased ownership could be noted in Lithuania and Slovakia in particular<sup>38</sup>. In Lithuania, the Ministry of Energy took some steps to strengthen its technical oversight capacity through the National Agency for Radioactive Waste Management (RATA) – although the future implication of the agency is in question – and stronger corporate oversight of INPP. In Slovakia, the Ministry of Economy works in close cooperation with JAVYS and pre-validates all the projects before submission to EBRD and SIEA. In all three Member States, the national ministries played a strong role in the most recent updates (circa 2014) to the detailed decommissioning plans as ultimate owners of these strategies.

#### **BENCHMARK – National ownership of other EU funded programmes**

As sought by the NDAP, all EU funding instruments seek to ensure strong national ownership of project implementation through early buy in and strong Member State involvement. Member States are implicated early on in the development of the projects or programmes and have input at key phases. This is best exemplified by Budget support, which encourages strong national ownership through the fact that the beneficiary is entirely responsible for developing the strategy to be implemented with the aid of the donor and implements the strategy using national management systems.

The NDAP has taken steps similar to those used in other programmes to encourage national ownership. However, the specific context of the NDAP should be borne in mind. There was political resistance early on to the closure of the reactors in all three Member States. While this has since dissipated, initially it had impacts that have lingering effect today. Secondly, decommissioning inevitably does not have the same political appeal as building new infrastructure, making it more difficult to maintain the same level of political interest.

**...but there remains further margin for strengthening the Member States' ownership of the programmes**

**While clear progress has been made in raising the profile and role of national governments in the NDAP, the findings of the evaluation also point to the need for further progress.** National ministries in Lithuania and, in particular, Bulgaria, could continue to strengthen their levels of technical capacity in order to exercise stronger technical oversight of programmes – e.g. acting as *informed clients*. The risk of inadequate technical capacity of Programme Coordinators has been identified by the Commission and it is taking steps to better qualify this risk (including the present mid-term evaluation) before formulating the appropriate actions to mitigate it. Moreover, the current detailed implementation procedures afford only limited latitude to Programme Coordinators to assume a more active role in programme governance.

**If the detailed implementation procedures note that the Programme Coordinator should assume overall responsibility drawing up the Annual Work Programme, their role in practice mostly focuses on the administrative aspects** of the programming process – e.g. coordination and formal

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<sup>38</sup> According to the Commission, increased participation was obtained in meetings both of high-level Member State authorities and of Commission staff with the appropriate level of seniority.



submission of the documents. The beneficiaries retain a large degree of influence on the programming in practice – and subsequent development of projects - even if it is developed in the strategic framework of the detailed decommissioning plans sanctioned by the national ministries.

**Similarly for the monitoring and management of programme implementation, ministries generally defer to Decommissioning Operators**, who are largely responsible for monitoring *and* drawing conclusions on the basis of monitoring. Although the ministries may have internal capacity to follow and analyse technical progress, their technical contribution to challenge important decisions or provide counter-expertise is more limited. This reflects the largely administrative nature of their tutelage over Decommissioning Operators, which concentrate the majority of national decommissioning expertise. The latter have also benefited from over EUR 150 million in financing for consultancy support developing and implementing decommissioning programmes since the outset of the programme. National ministries, on the other hand, have benefited from relatively marginal amounts of capacity building support.

**Ministries may rely on other external stakeholders to provide technical expertise, such as RATA in Lithuania or National Nuclear Fund and nuclear authorities in Slovakia.** Lithuania and Slovakia had the strongest technical capacity available at ministerial level. In the case of Lithuania, however, recent example has shown that the Ministry continues to act cautiously when questioning decisions of INPP, even with a reinforced technical capacity. In 2016, an in depth review of the detailed decommissioning plan was conducted with the support of internationally recognized nuclear consultants. This review identified a number of risks and recommendations concerning efficiency. RATA developed an Action Plan based on the findings and provided it to the Ministry of Energy. According to stakeholders interviewed, the follow up of this Action Plan was weak, with implementation of the different measures being largely *optional* for INPP management and the latter rejecting a number of the major findings. The Ministry of Energy, on the other hand, attributed the low level of follow up to the poor quality of the report and recommendations. The Ministry is currently examining the possibility of merging RATA into INPP, ostensibly transferring the supervision function to another actor.

**The case of Bulgaria merits a separate discussion. The same underlying issues developed above have been further aggravated in recent years by political instability.** At the time of the evaluation, a new government was formed following several months of a caretaker government. The Bulgarian administration has also had difficulties addressing administrative issues in a timely manner, which has impacted the advancement of the programme. Such is the case of the ratification of the Nuclear Indemnity Agreement for the PMF, which was outstanding for nearly two years and became a critical risk for project completion.

**Regardless of the technical capacity of national ministries and other obstacles faced, the detailed implementation procedures also limit the extent of the involvement of Programme Coordinators.** The introduction of Monitoring Committees presided over by the Programming Coordinators is an important first step in designating a more strategic role of national ministries in the NDAP governance framework. However, the role of this committee is confined to formally validating Monitoring Reports. While stakeholders participating in these committees have reported quality dialogue on progress and good coordination between stakeholders, the scope of this committee's role is ultimately limited. Greater scope to make decisions, with regard to project approval, for instance, may provide greater impetus for Programme Coordinators to make further investments in strengthening their role in the programme. However, such procedural changes would be dependent on also strengthening the technical capacity of Programme Coordinators. They would also be supported through continuing to develop the financial buy-in of Member States in the programmes (see section 2.6.3).

#### **BENCHMARK – Dialogue with beneficiaries in budget support operations**

'Budget support dialogue' is a core element of the financial assistance package and a centre piece for mutual accountability. At the outset, these high-level meetings provide a framework to take stock of the implementation of the recipient country's policies and reforms and discuss future strategy.

During implementation, policy dialogue provides a forum to track performance and to identify policy slippages and reach a common understanding on corrective measures to meet policy objectives. The NDAP has put in place Monitoring Committees that are similar in some ways to the budget support policy dialogue. They place emphasis on bringing together all relevant stakeholders for programme implementation. Similar to budget support, the Monitoring Committees are seen as an important instrument for building national ownership. However, it can be noted that the role of Monitoring Committees is largely limited to ex post monitoring. It may thus be useful to consider developing more of a prospective decision-making role for the Monitoring Committees.

### **Decommissioning Operators work within a perfectible accountability framework**

**Decommissioning Operators play a more important role in programme governance and management than would be deduced from a simple reading of the detailed implementation procedures** – in which they do not feature prominently. Being the license holders, they are the primary liable party for the safe implementation of the decommissioning programmes; thus they have generally maintained an important level of influence over programme implementation, with primary responsibility in practice for drawing up programming, project and monitoring documentation. These organisations concentrate a significant part of national nuclear expertise and can thus often expect deference on technical issues in their relationships with the Programme Coordinator. Strategic decommissioning planning has also historically been largely developed under their responsibility with the support of external consultants. In some cases, these organisations have also benefited from a historically independent role with little outside influence – e.g. INPP.

**These factors combine to create a perfectible accountability framework for Decommissioning Operators** with regard to the effective and efficient implementation of decommissioning programmes. However, they are not evidence of a lack of good will on the part of beneficiaries during the period under evaluation, nor is there reason to suspect this. In this context, Implementing Bodies have played an important role in supporting efficient and effective programme implementation, playing the role of *informed customer*. For example, intense pressure applied by the EBRD, under the direction of the EC and with the cooperation of new INPP management, contributed to resolving long-standing issues with the construction of the ISFSF. The EBRD and CPMA have not hesitated in other instances to constructively challenge or question decisions by the beneficiary when further justification was needed to ensure the most efficient and effective course of action was chosen.

### **2.5.3 EQ5.3 How effective is the governance system of the decommissioning programmes?**

*The clarity and effectiveness of the roles of the actors participating in the governance and management of the NDAP was examined in the previous section. This sub-question serves to synthesise findings to draw overall conclusions on the effectiveness and fit-for-purpose of the governance system, with regard in particular to its ability to: i) develop robust and coherent work programmes, ii) ensure adequate monitoring, iii) ensure adequate coordination and communication, and iv) ensure adequate project management.*

**Overall, the governance system of the NDAP is considered to be fit-for-purpose and contributing to effective programme implementation.** However, a number of practical enhancements appear viable to address identified issues. These relate primarily to procedural modifications to improve the timeliness of the programming process, but also the recalibration of the roles of certain actors.

**Programming documents provide a coherent basis for programme implementation, but their utility would be improved through more timely adoption**

**The NDAP programming documents are generally robust, coherent and developed in line with the detailed implementation procedures.** The strengthening of the clarity of objectives and the incorporation of the detailed decommissioning plan baseline schedule has also contributed to improving the quality of programming documents under the current programming period. The Annual Work Programmes are thus by definition closely aligned with the detailed decommissioning plans developed

by the Member States, helping to ensure the relevance of EU assistance. According to stakeholders interviewed, one of the weaknesses of the previous *Combined Programming Document*, the main programming document under the previous MFF, was that it did not establish strong links between the programming documents and the decommissioning strategies.

**However, the timeline and process set out in the detailed implementation procedures has not been tenable in practice despite the best efforts of all stakeholders.** The usefulness of Annual Work Programmes is thus diminished by their late adoption. A number of issues in the detailed implementation procedures, while logical, are contributing to their overall impracticability. This notably includes: i) the necessity to develop the Annual Work Programmes on the basis of the Progress Reports to the Parliament and the Council, ii) the necessity to adopt all Work Programmes collectively and iii) the obligation to use the Annual Work programmes as the underlying supporting document for the Commission Financing Decision. Annual Work Programmes and the relevant financing decisions should be consistently met at the beginning of each year (quarter one), in order to ensure the highest relevance of the implementation framework. Beyond 'tweaking' the detailed implementation procedures to make the process more practical (see section 2.5.1) a more radical move could also be envisaged to move to multi-annual programming as is common in other EU programmes.

**The strengthened monitoring framework has enhanced the ability of the Commission to oversee programme implementation and had positive effects at individual programme level**

**As previously discussed, the monitoring of programme implementation has been significantly enhanced under the current MFF** addressing weaknesses identified in previous programming periods. The complementary use of Earned Value Management has also contributed to strengthening monitoring and the overall accountability framework. These efforts have contributed to strengthening the Commission's strategic oversight role, whereas in the past the European Court of Auditors has criticised it for focusing too much on financial implementation at the expense of programme effectiveness and efficiency.

**Observation and analysis of the minutes of meetings of the Monitoring Committees and Assembly of Contributors point to the effectiveness of the improved monitoring framework in feeding the quality of discussion and focusing attention on problematic areas.** Rather than managing a collection of projects, the Commission has been able to shift more of its attention to programme level management, focusing on controlling overall progress and costs. Beneficiaries accord due importance to the indicators and are proactively and independently taking steps to maintain indicators within a satisfactory range. As already noted, there nonetheless remains margin for further enhancing the quality of performance indicators and the implementation of Earned Value Management.

**This is also creating a trickle-down effect on the national level.** According to beneficiaries, these data are also being used in the context of regular management meetings to control progress and make informed management decisions. Stakeholders consulted in all three Member States confirmed that significant progress has been made in terms of putting in place a stronger results-focused management culture within the beneficiary organisations. It should be noted that INPP actually began implementation of Earned Value Management before it was implemented at EU level.

**The role of Implementing Bodies has been critical in supervising day-to-day implementation, but Programme Coordinators are also assuming an increasingly important role**

**Implementing Bodies have played a key role in supervising day-to-day implementation of the national programmes.** As noted, they can notably rely on extensive internal experience, relevant expertise and capacity. In this way, they also play an important technical oversight role in the context of relatively weaker supervision and oversight by national governments in some Member States, notably Lithuania and Bulgaria. Nonetheless, this role is somewhat beyond their legal responsibilities.

**However, Programme Coordinators have increasingly taken a stronger role in programme oversight and ownership.** This process has been gradual since the pre-accession period and remains very much ongoing. Recognising the importance and positive impact of greater national ownership on supporting effective and efficient programme delivery, the Commission has encouraged this process on both the political and procedural level. Today, Programme Coordinators are active in the programme governance, but some still require additional technical capacity to provide adequate oversight of programmes and their role in the governance framework could be further enhanced to promote stronger ownership and leadership.

**Further evolutions in the procedural framework may contribute to facilitating this process if the right boundary conditions are in place,** most notably adequate capacity and political will on the ministerial level. This could include, for example, a partial devolution of decision-making to the national level, for example, through broadening the scope of the Monitoring Committees to include approving Annual Work Programmes or project documentation, while also ensuring that Member States retain adequate oversight of programme implementation through the NDAP Committee.

**The question of the level of national contribution is also inextricably linked with the notion of ownership.** Economic self-interest is a powerful motivator and the Commission, in line with the recommendations of the European Court of Auditors, has continually pushed for national governments to increase their level of financial contribution – in absolute terms and relative to the EU contribution. This issue is further discussed in section 2.6.3, but additional measures to clarify the definition of and future expectations for the level of national contribution, as well as the future perspective for EU assistance, would undoubtedly provide further impetus to national governments to take stronger ownership of programmes.

**Stronger national ownership and the development of Monitoring Committees have also contributed to improving coordination and communication**

**The Programme Coordinator role has also evolved to increasingly emphasise the responsibility for coordination and communication with relevant national stakeholders,** as well as complementary sources of national financing contributing directly and indirectly to the decommissioning programmes. As national governments have become more engaged in the NDAP governance, this aspect has been naturally strengthened. As a positive sign of this evolution, the participation in Monitoring Committees has widened to regularly include relevant national stakeholders, such as regulatory bodies and relevant sectoral ministries. As discussed in section 2.6.3, however, there remains margin for Programme Coordinators to strengthen this role, in particular in Bulgaria.

**Project management systems and culture have progressively been strengthened**

Previous evaluations and audits have underlined the need to strengthen project management practices at the level of beneficiaries. Closely connected with this are the wider questions of the organisational transformations necessary to support the decommissioning process. As discussed previously (see section 2.3.2), **Decommissioning Operators have progressively put in place more robust project management systems and taken steps necessary to adapt their organisations to the needs of the decommissioning process. This has been reflected in the quality of project management structures and, increasingly, stronger project management cultures.**

It is useful to make a distinction between the implementation of the basic tenets of project management and project management culture more generally. Concerning the former, beneficiaries display a good level of maturity. Practices are based on basic principles of project management, such as clearly defined scope and goals, clear timelines with milestones and targets, resource estimation methodologies, risk management, project control, etc., even if some aspects, such as budgeting and risk management may be improved (see section 2.6.3). It is concerning the latter that progress has been made in recent years, and future gains may continue to be realised. This concerns not just the knowledge of concepts and availability of tools, but the development of strong management culture that promotes their full and correct use in practice as means to an end rather than an end in themselves.

Since 2014, positive evolutions on this front have been identified as a contributing factor to programme effectiveness and efficiency. At Ignalina in particular, a new management team has accelerated the process of organisational transformation and made investments in developing necessary corporate expertise in areas such as risk management. More generally, as already mentioned, the evaluation also found that the strengthened monitoring framework and introduction of Earned Value Management had trickled down and support stronger management practices at EU level, but also at national programme level.

## 2.6 EQ6. To what extent is the management of the decommissioning programmes cost effective and efficient?

*The objective of this question is to measure the extent to which the desired effects of the NDAP are achieved at a reasonable cost. Efficiency will therefore measure how the resources/inputs are converted to results and how the systems in place, including the monitoring and reporting systems and governance, assist in efficiency. This evaluation question is addressed through three sub-questions. EQ6.1 provides an overall cost-effectiveness of the NDAP during the period under evaluation and looks at the quality of indicators for measuring efficiency. EQ6.2 looks at the major factors impacting the efficiency of the programmes, whereas EQ6.3 analyses the differences in costs arising between Member States.*

### 2.6.1 EQ6.1 To what extent has the NDAP been cost-effective when considering each activity and cost category compared against performance indicators?

*This sub-question provides an overall assessment of the cost-effectiveness of the NDAP during the period under evaluation, and the quality of indicators for measuring efficiency (addressed in EQ6.1bis in the following section 2.6.2).*

**The last revision of cost estimates at the outset of the current MFF resulted in a small decrease for one programme and an increase for the two others**

**At the outset of the current MFF, the three Member States formally submitted updated nuclear decommissioning cost estimates as part of their updated detailed decommissioning plans.** Slovakia also made further minor downward changes in 2016. The new cost estimates resulted in a relative stability for the Kozloduy programme with an overall cost variation of EUR -11,1 million (-1%), and an estimated overall cost increase for the Bohunice and Ignalina programmes of EUR 289 million (+24%) and EUR 1 643 (+40%) respectively.

**The increase in cost estimate for the Ignalina programme came in the context of a nine year extension of its overall duration** (see section 2.3.1); not surprisingly, a large part of the cost increase can be attributed to time-dependent costs associated with project duration, such as energy resources and personnel costs. The cost increase also reflected increased project costs and the inclusion of additional costs not previously foreseen.

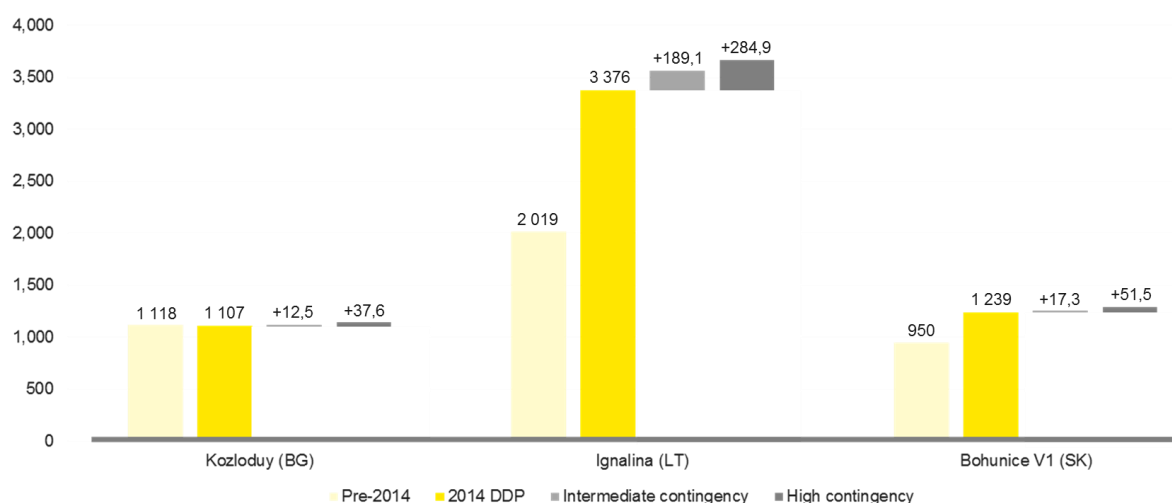
**An independent review was undertaken of the detailed decommissioning plans and cost estimations for all programmes in 2016.**<sup>39</sup> The study confirmed the conclusions of the Commission and notably that the overall base cost estimations for the three programmes, as stated in the detailed decommissioning plans, are generally appropriate. However, the report also underlined that cost estimation may benefit from further adopting cost estimation methodologies in line with evolving international experience. In particular, it was found that the allowances made for contingencies in the cost estimations for all three programmes did not entirely follow best practice methodologies and were consequently on the lower end of international practice that can be observed in this field. The revised

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<sup>39</sup> This document is not available publicly

contingency scenarios calculated by the consultants may thus provide a more robust estimation of the potential total cost of the decommissioning programmes taking into account risks in line with best practice (see figure below).

**Figure 4: Evolution of cost estimates for decommissioning programmes and revised contingency scenarios (Decommissioning plans, Deloitte Report) (M of EUR)**



*The total decommissioning cost numbers include inflation and contingency or risk*

**All three programmes currently remain on track to implement decommissioning programmes according to current cost estimates**

**Notwithstanding the independent assessment of the adequacy of contingencies, the updated (2014) programme cost estimates were expected to be maintained at the time of the evaluation.** The analysis of programme implementation (section 2.3) would also suggest that programmes remain broadly on track when compared against the baseline schedule and that there is no major risk at present of further cost increases due to time delays, as was witnessed with the Ignalina programme. This is considering that slippages against the schedule may reasonably be recovered through proactive and close management.

**It should be noted, however, that Bulgarian authorities were in the process of revising the cost estimate associated with a review of their decommissioning programme.** This is part of the regular three-year review cycle of the decommissioning plan, which was originally expected to be finalised in the fourth quarter of 2016. This study cannot provide any reliable information on expected evolution of the estimated cost as the review by the Bulgarian authorities is on-going. If no cost increases due to an extension of the duration of the programme or significant increases in the cost of existing projects appear likely, the study cannot exclude that additional costs may be identified by Bulgarian authorities that were not taken into account in current estimates.

**The cost estimate for the Bohunice V1 programme was updated in 2016 and has been slightly reduced to EUR 1 239 million** (inflation taken into account). The readjustment thus lowered the overall estimated price by EUR 5,89 million. Reductions in labour (-EUR 9,3 million) and contingency (-EUR 12,5 million) largely offset increases in investment and current expenses costs. The financial reassessment, along with the Slovak government's commitment to increase its national contribution in 2016, have contributed to reducing the overall funding gap to EUR 92 million. According to Slovak stakeholders interviewed, the Decommissioning Operator is committed to further closing this gap in the 2021 – 2025 period through savings to be achieved on future procurements. An optimisation strategy is notably under development by JAVYS to merge the final projects of the decommissioning programme into the so-called project D4.7, which will be allocated to one contractor. It is hoped that this strategy will decrease the overall cost of these projects and reduce the level of project management risk.



At Ignalina, slippages of some project budgets can be identified (variation exceeding 15 % or EUR 500 000 in comparison to the detailed decommissioning plan), but the overall decommissioning budget has not been increased since 2014 nor is it currently expected to increase according to stakeholders interviewed. The increases have been offset by cost savings achieved on other projects and activities. Most of the cost increases in the current budget projections concern the waste treatment programme and, to a lesser extent, post operation costs.

### **Earned Value Management indicators point to satisfactory cost effectiveness to date**

The implementation of Earned Value Management in the three programmes has provided for the first time a means for easily monitoring cost performance at project and programme level and for making cost performance comparisons between the programmes. Since 2014, the earned value of the programmes has been largely aligned with or in excess of actual costs (i.e. resulting in a cost performance indicator of approximately 1 or higher<sup>40</sup>). This demonstrates that programmes have been achieving the outputs at the expected costs or less. At the same time, these indicators should be considered in light of some present limitations discussed in the following section 2.6.2.

**Table 17: Cost performance indicators for the three national programmes (1 January 2014 – 31 December 2016) (Mil. of EUR)**

Kozloduy (BG)	Ignalina (LT)	Bohunice (SK)
EV = 118	EV = 296	EV = 385
AC = 111	AC = 280	AC = 372
CPI = 1,06	CPI = 1,06	CPI = 1,03

### **The possibilities for a more granular assessment of cost-effectiveness and comparison between the programmes is rendered difficult by varying budgeting, programming and reporting modalities**

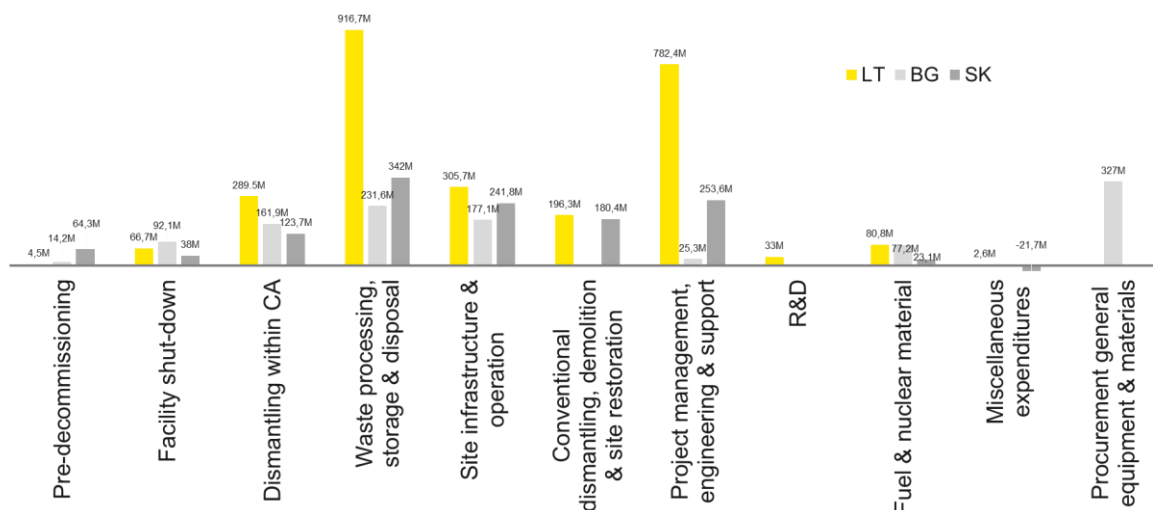
The mid-term review sought to assess the cost-effectiveness of programmes on a more granular level considering individual activities and expense categories against relevant performance indicators. However, this task is rendered difficult by the differences in the approach to budgeting, programming, tracking expenditure and monitoring results within each programme. Indeed, the budget structure for cost estimates does not always align with the work breakdown structure used for planning and programming, which itself is not always possible to align with the headings used for tracking budget implementation or results monitoring. It is thus not possible to fully integrate the quantitative data from the budgeting, programming, expenditure or monitoring documents in any sort of robust and systematic manner. A more ad hoc and qualitative approach must thus be adopted for considering cost effectiveness beyond the information provided through Earned Value Management (presented above).

**One can also note the inherent difficulties in comparing decommissioning programmes.** Even if all three programmes have relied on the International Structure for Decommissioning Costing (ISDC) standardised cost structure for developing their budgets, the methodology allows for enough flexibility for the programmes to be difficult to compare. As illustrated in the graph below, not all programmes used the same activity and cost categories, and the affectation of different costs between categories was very different in some cases. Moreover, the most recent Ignalina programme cost estimate only

<sup>40</sup> The Cost Performance Index is a measure of the efficiency of expenses spent on a project. It is calculated by dividing the 'earned value' of progress achieved to date by the actual costs incurred. Earned value is the approved budget for the work actually completed by the specified date, also known as the budgeted cost of work performed.

presents costs from 2014 onwards under the new budget structure (making it impossible to present a consolidated breakdown of the entire cost) and presents risk & inflation separately contrary to the other two programmes. Likewise, the approach to structuring the overall project work breakdown structure varies for each programme and is in no cases based on the ISDC activity breakdown. Finally the specificities and unique aspects of individual programmes make benchmarking a complicated endeavour even when fully comparable data is available. A very small difference in the parameter of an otherwise identical project can lead (justifiably) to important cost differences.

**Figure 5: Overview of cost estimates by activity area (in M of EUR)**



*\*For Ignalina, the costs for risk and inflation have been proportionally distributed across activity areas, costs are for 2014 onwards only*

### More detailed analysis based on available data points to some variations in the cost effectiveness of different activities and cost categories

**This analysis supported the overall conclusion that programmes have generally been implemented in a cost-effective manner.** However, looking at the principal areas of decommissioning activities, some variation in cost-effectiveness can be noted in function of the different challenges faced. More generally, the findings also pointed to the need to continue to rebalance resources towards core decommissioning tasks to improve cost effectiveness.

**Significant resources continue to be allocated to facility shut down and post-operation activities during the current MFF at the Ignalina programme** in order to maintain safety systems and support the defueling process. Delayed defueling has significantly impacted the cost of these activities by extending their duration. According to INPP reporting, post-operation activities continued to consume 32% of man-hours during the second half of 2016. The broader category of 'pre-decommissioning' activities continues to represent approximately 37% of expenditure between 2014 and 2017. Given the importance of this activity in the budget, INPP has recently undertaken efforts to improve cost-effectiveness in this area, for example through the reorganisation and reduction of maintenance teams. This area of the organisation was considered by many stakeholders to have long avoided necessary reorganisation.

**The limited externalisation of site maintenance activities points to some margin for enhancing cost effectiveness in this area.** In particular, the now extended duration of the Ignalina programme significantly increases the potential scope of cost-savings that can be achieved in this way. With strong support from the Commission (through a conditionality attached to the 2017 Annual Decommissioning Activities (ADA) grant), INPP is implementing a make-or-buy strategy in order to identify activities (many falling in this area) that it would be advantageous to externalise. If all 39 activities in the first round of review were externalised at the maximum 'buy' cost, a minimum economy of approximately 750K per

annum, or 2% of the 2017 ADA grant, could be realised. Such measures could also be considered for the Kozloduy programme in the future.

**Expenditure on project management and technical support activities represents a significant portion of overall costs and number of staff.** Internally administrative and technical support staff accounted for 33%<sup>41</sup> for the Ignalina programme, 28%<sup>42</sup> for the Kozloduy programme and 51%<sup>43</sup> for the Bohunice programme. For Bohunice, it should be noted that a relatively larger portion of core decommissioning tasks are externalised, contributing to the artificially high overhead. In addition to internal resources, programmes have spent significant resources on external consultancy & engineering support through the PMU contracts notably. In total, this support amounts to EUR 175,7 million for all three programmes since their outset. This total does not include other consultancy contracts outside of the Grant Agreements for PMU services. Decommissioning operators have made extensive use of consultancies and engineering firms for similar services through separate contracts or as part of large project contracts. The amount allocated to the PMU is lower in Slovakia, for example, although it can be noted that an additional EUR 6,8 million was allocated to consultancy contracts for the development of decommissioning documentation and support to the licensing process, a task supported directly by the PMUs in other programmes.

Considering issues identified with regard to inadequate planning and project management capacity in some programmes, the cost-effectiveness of these investments, in particular the large amount funnelled to external consultancies and engineering firms, can be questioned. This would point to a continued need to ensure the assessment of the cost and benefit of contracting technical support (versus use of internal resources) and enhanced management of contract implementation to ensure consultants are delivering added value. The EBRD has conducted capacity assessments to assist with decisions on the sizing of the PMUs. Finally, continued high spending on external support contracts would point to a need to better ensure knowledge transfer and internal capacity building through these investments.

**If Dismantling & Decontamination activities outside the Controlled Area have been implemented in a largely cost-effective manner, the cost effectiveness of work in the Controlled Area / Reactor Buildings has been negatively impacted by technical difficulties** faced across the three programmes. Due to the inherently challenging nature of work in this area and the low level of maturity of the decommissioning processes and technologies, these challenges to some degree can be expected. The Bohunice programme saw significant cost increases for work in the Controlled Area (dismantling of large reactor components) also due to inadequate cost estimations. This example again underlines the lack of experience with decommissioning internationally, which can contribute to difficulties estimating costs.

**In the area of radioactive waste management, the cost effectiveness of large infrastructure projects at Kozloduy has been impacted by difficulties during implementation.** These follow on significant cost increases and delays incurred during the previous MFF at Ignalina and Kozloduy. Concerning the treatment, storage and disposal of radioactive waste from the decommissioning process and legacy waste, activities have generally been cost-effective to date. However, the Kozloduy programme has run up against significant technical difficulties in addressing legacy waste – which is

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<sup>41</sup> In the activity typology used by INPP, this includes: P.0 Enterprise Activity Organizing; and P.1 Preparation for decommissioning

<sup>42</sup> In the activity typology used by Kozloduy, this includes: 03. Procurement of equipment; 06. Site management and support; and 07. Project management and engineering. Parts of activity category 06 were excluded as pertaining to site upkeep and maintenance. This estimation was made through cross-referencing the more detailed activity breakdown in the EBRD Grant Agreement 48B

<sup>43</sup> In the activity typology used by Bohunice in the Grant Agreement 21D, this includes: BIDSF Management Department; BIDSF Procurement Department; General Director Unit; Management and Human Resources Section; Business and Services Division; Tech support; V1 Decommissioning Planning Section; Planning, Costs Budgeting and Technical Engineering Department; V1 Decommissioning Support Section; V1 Decommissioning Support Department; Investments and Sectional Projects Management Department; Planning, Controlling and Calculations Department; and the V1 NPP Decommissioning and PMU Division

recognised as a challenge in early generation NPPs. Programmes have also faced issues of idle capacity as waste flows have been less than expected due to overestimation or slower progress on D&D work.

**Overall, the analysis found that a significant level of resources continue to be devoted to ancillary decommissioning tasks – or support tasks.** What constitutes a ‘core decommissioning activity’ can become something of a philosophical debate. Although many seemingly dissociated activities that can be identified in programme budgets, such as ‘railroad maintenance’ for example, upon further examination they can logically be traced back to critical decommissioning activities. To stay with this same example, a short railroad network at Ignalina is used to transport spent fuel during defueling operations. As another example, radiation protection staff, personal dosimetry devices and even specialised laundry services are necessary to ensuring personnel can work in Controlled Areas safely while respecting radioprotection regulations. Nonetheless, core decommissioning activities can be defined broadly as D&D and waste management tasks (including defueling) that directly result in physical progress towards performance objectives.

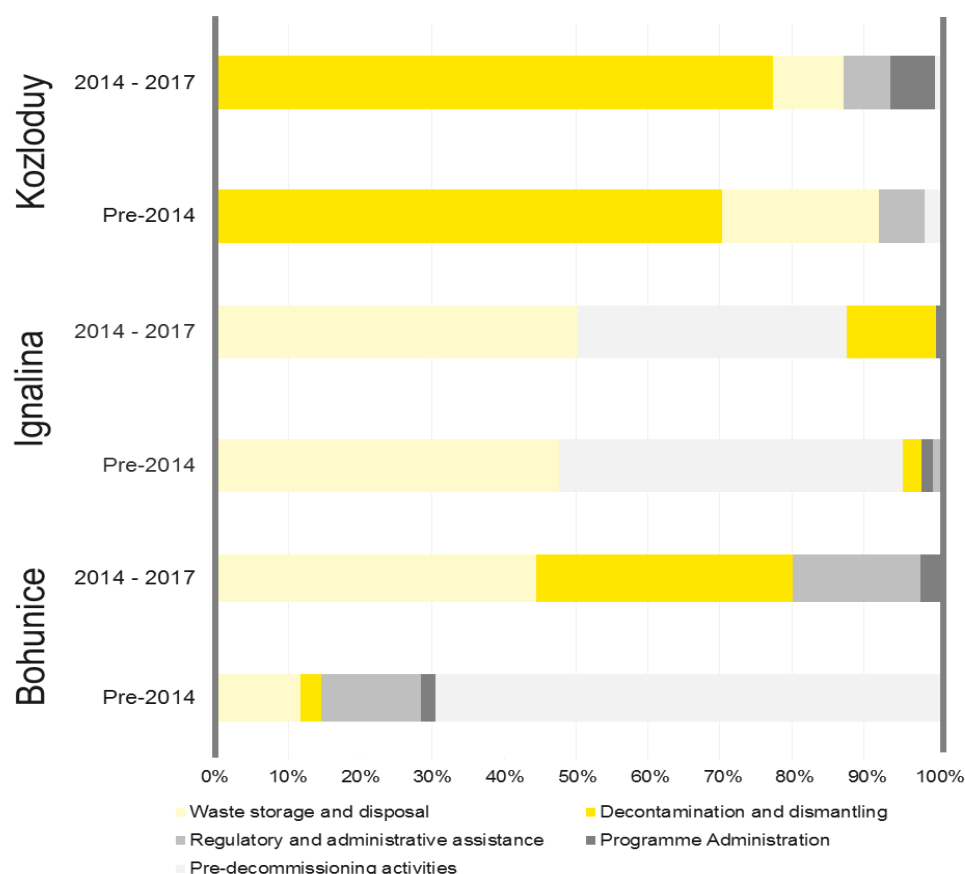
As described previously, the heterogeneous management systems put in place by decommissioning programmes severely limit the extent to which analytical concepts such as ‘core’ and ‘support’ tasks can be operationalised and presented reliably and consistently. The only (somewhat) consistent reporting data across all three programmes comes from the Annual Work Programmes, which include a mandatory typology of activities (presented in the figure below).<sup>44</sup> Aside from the Kozloduy programme, which appears as something of an anomaly<sup>45</sup>, the data provides a useful overview of the relative amounts invested in different activities – 2017 are ‘planned’ figures while other years are based on actual expenditure.

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<sup>44</sup> While the template for reporting is mandatory, there is no detailed guidance on filling in this data which very likely gives rise to inconsistencies between programmes in terms of which activities are included under which headings.

<sup>45</sup> The data provided by the Kozloduy programme has used a different approach for affecting the actual / planned costs between categories, with a wide array of expenses being included under decontamination & dismantling.

**Figure 6: Distribution of cumulative programme spending by macro-category over programme lifetime**



Expenditure on D&D work was almost negligible in the Ignalina and Bohunice programmes prior to 2014 and it has only grown minimally for the Ignalina programme for the period 2014 – 2017. Likewise, expenditure on waste storage and disposal has only significantly ramped up in the Bohunice programme since 2014. If it has been the largest expenditure category for the Ignalina programme since the pre-2014 period, this can largely be attributed to the relatively high level of up front expenditure necessary in waste management infrastructure rather than physical waste management work. In Lithuania, pre-decommissioning activities also remain the second largest expenditure category post-2014.

Looking at the distribution of staff FTE or man/hours by activity also provides indication of the distribution of investment. In Lithuania, only 35% of the Decommissioning Operator's personnel are focused on core decommissioning activities<sup>46</sup>. In Bulgaria, the number stands at 43%<sup>47</sup>, whereas in Slovakia it stands at 28%<sup>48</sup>. For Slovakia, it should be noted that a relatively larger portion of these tasks are externalised, contributing to the artificially low number. As already noted, more significant staff time is invested in

<sup>46</sup> In activity typology used by INPP, this includes: P.2 Objects dismantling / demolition; P.3 Spent nuclear fuel handling; and P.4 Waste handling

<sup>47</sup> In the activity typology used by Kozloduy, this includes: 04. Dismantling activities; and 05. Treatment of RAM and RAW and delivery for disposal

<sup>48</sup> In the activity typology used by Bohunice in the Grant Agreement 21D, this includes: V1 Decommissioning Realization Section; Production Block Facilities Dismantling Department; Management of Material from Decommissioning Department; Alterations Management Department; Adaptation, Dismantling and Demolition of Construction Objects Department; and A1 NPP decommissioning and RAW and SNF Management Division

administrative and technical support activities.

These trends reflect to a certain degree the natural course of the decommissioning process, which requires a large amount of upfront investment in careful planning and infrastructure. Due to the nature of nuclear decommissioning work, with the presence of significant radiological and conventional hazards, it is also unsurprising that a significant portion of costs during later phases continue to arise from the various support activities (notably safety and regulatory compliance). However, this ratio of resource expenditure in core and support activities lies at the heart of the cost-effectiveness of decommissioning activities as a whole. Creating the correct incentives to contain costs in the latter and direct all necessary resources to the former thus appear critical.

The Commission has continuously pushed Decommissioning Operators to improve the cost-efficiency of support activities in order to direct EU support towards high value added (in terms of physical progress) core decommissioning activities. With the Ignalina programme, for example, the recent make-or-buy strategy aims to realise economies on many support activities. The Commission has also signalled that it will no longer finance certain costs, such as energy costs, in the future. However, this input-focused approach can be time consuming and resource intensive itself. Another interesting approach can be observed in the Bohunice programme. Due to factors specific to the programme, output-based contracts have been used to finance waste management activities implemented by the Decommissioning Operator (e.g. X euros for X tonnes of waste processing), rather than financing based on inputs (e.g. salaries of Decommissioning Operator personnel). This inherently creates greater incentives for the operator to seek maximum efficiency to avoid potential economic losses due to cost increases. It also puts the financial risk of time delay on the operator. Such an approach could potentially be piloted in other programmes in order to create greater incentives for cost-effectiveness, while also focusing management activities more on outputs and inputs.

## 2.6.2 EQ6.1bis Are there adequate indicators for measuring efficiency?

**Earned Value Management provides a valuable tool, but its current use for tracking cost performance in particular is subject to some limitations**

**As already discussed in section 2.3.4, the roll out of Earned Value Management since 2014 has strengthened the ability to monitor implementation of the programmes, in particular at EU level. However, its current use for tracking cost performance is subject to some limitations**, in particular for the Kozloduy and Bohunice programmes. Specifically, these limitations relate to the application of the Earned Value Management system to projects implemented by third parties and the use of contract price for planned value, rather than the 'baseline price' in the decommissioning cost estimates.

**As already discussed in section 2.3.4, difficulties are due in part to limitations in the application of Earned Value Management in contracts implemented by external contractors.** For these projects, Planned Value is defined as the contract value and split into payment milestones. As milestones are achieved, payments are made to the contractor and thus the Cost Performance Index is consistently equal to one. It is impractical to implement Earned Value Management if it is not embedded in the contract itself in order to impose a standard approach and secure close cooperation of the contractor. In particular, Earned Value Management requires a greater deal of transparency on the part of the contractor than is habitual and the methodology must be integrated into the project management approach from the beginning; many contractors may not use Earned Value Management in their internal project management practices and, if they do, approaches may vary significantly.

**A more fundamental issue that can be underlined is that the Planned Value for projects implemented by third party contractors is based on the contract value rather than the estimated cost in the baseline.** If the project cost increases as a result of the market response (tenders quote higher prices than what was expected) or during contract execution (the price of the contract must be increased through amendment), the planned value is re-baselined and the cost increase is not reflected in the Cost Performance Index. For example, if a project is estimated to cost 100 in the baseline cost estimate, and the contract is signed for 105 and subsequently increases to 110 during implementation,

the Cost Performance Indicator will remain 1. Planned Value should thus always be based on the detailed decommissioning plan and baseline cost estimate to accurately reflect cost performance.

**This is not the case with the Ignalina programme, which has adopted another approach to reporting the cost performance indicators.** It can also be noted that Ignalina relative to the other two programmes uses significantly more internal resources, with over 2 000 personnel currently active. Doing more work ‘in house’, it is thus easier to skirt some of the issues faced with the application of Earned Value Management to third party contracts and report more meaningful figures. However, it can be noted that for its ‘decommissioning programme’, the Kozloduy programme does report a cost performance indicator not subject to these limitations. This covers all tasks under the programme not related to projects implemented by third parties, notably tasks implemented by SERAW personnel.

### **Beyond Earned Value Management, few other tools are available for effectively tracking cost effectiveness and efficiency**

**Beyond the use of Earned Value Management, no other efficiency indicators were identified at the level of national programmes.** In particular, there would appear to be greater scope for the use of efficiency indicators for activities performed by the personnel of the Decommissioning Operators, such as D&D work or preparatory work – for example, the average cost of dismantling one tonne of equipment or the ratio of operational to support staff. This would provide a clearer picture of process efficiency issues and, additionally, may provide useful information to ongoing research on decommissioning costing and benchmarking – a subject attracting attention in Europe and not well developed.

**The use of process efficiency indicators at the EU level to monitor and address bottlenecks in the governance and management system would also be useful.** As discussed further in section 6.2, the evaluation faced difficulties objectifying claims made by stakeholders concerning the efficiency of different aspects of governance and programme management. While the available evidence allows to conclude that the efficiency is generally satisfactory, more systematic tracking (and reporting) of issues such as the time to approve project documentation or the time to receive non-objection for a procurement, would allow for more effective monitoring of the efficiency of governance and programme management processes and create stronger accountability. For example, the CPMA has begun reporting in Monitoring Reports on the average time to approve small procurements managed directly by INPP (this data has been tracked internally since 2012). The EBRD tracks time for issuance of non-objection (under 5 days for 87% of procurement in 2017), but these are not formally reported or monitored.

## **2.6.3 EQ6.2 What are the major factors impacting the efficiency of the assistance programmes? What are the root causes of these factors?**

*Building on the overall findings presented in section 2.6.1, this sub-question presents a more detailed assessment of specific factors identified as impacting the efficiency of programmes and their root causes.*

**As described in the previous section, the cost performance of all three programmes has generally been satisfactory to date.** This stands in contrast to difficulties with some programmes faced in the previous MFFs. As noted in previous evaluations by the European Court of Auditors, many of the key decommissioning infrastructure projects have experienced delays and / or cost increases. The successful completion or current positive trajectory of certain projects facing chronic problems in the past, such as the ISFSF at Ignalina or the PMF at Kozloduy, suggests that Decommissioning Operators have successfully integrated lessons learnt and built up internal capacity. Some good practices have also been identified that are helping to ensure the general cost-effectiveness of the programme implementation

**Despite these positive signs, delays and budget slippages in some projects can still be noted since 2014.** A number of different issues impacting efficiency can thus be identified. On a more structural level, continued concerns can also be raised with regard to the strength of the incentive



framework put in place and its potential impact on the overall cost-effectiveness of the programme. The overall programme governance framework on the other hand, can generally be considered to be supporting programme cost effectiveness, even if some scope for simplification exists.

### **Increasing levels of national contribution is supporting stronger accountability, but the historically open-ended nature of the programme should also be addressed**

**Creating an adequate level of economic self-interest is an important factor in encouraging economy-seeking behaviour in beneficiaries in the context of EU assistance programmes.** In its response to the European Court of Auditors, the Commission noted that the national financial contribution *contributes to the efficient and effective implementation of the programmes and increases ownership by the Member State*. Recognising this, the legal base notes that full financing of projects should be limited to *well-founded exceptional cases* and that *every effort should be made to continue the co-financing practice established under the pre-accession assistance and the assistance provided over the period 2007-2013*.

**In practice, however, the EU budget finances the majority of decommissioning costs in all three Member States – even the large majority in Bulgaria and Lithuania (67% & 75% respectively).** This does not reflect a lack of will of the Commission to enforce the legal base, but rather its lack of clarity. Limited to only a brief mention in the preamble to the NDAP Regulations, the paragraph makes allusion to *a practice of co-financing* that was in reality never clearly established under previous programming periods. The co-financing practice thus relies on a weak legal basis and has consequently not been extensively defined. Notably, the NDAP has not formally set an expected level of national contribution (relative to the EU contribution) or formalised a framework defining how national resources can or should contribute (e.g. at project or programme level, to certain types of projects or activities, etc.). Rather, specific ‘co-financing’ agreements have been struck only for a limited number of infrastructure projects for which part of the capacity would be used for non-NDAP activities.

#### **BENCHMARK – Definition of co-financing in other EU-funded programmes**

Two of the comparator programmes had a clearly defined framework for co-financing, with EU co-financing rates clearly set out in the legal base. For the CEF, grants for works included (EU) co-financing rates varying between 20% - 75%. For ESIF Major Projects<sup>49</sup>, the co-financing rates reflect those defined for ESIF - vary between 50% - 85% (95% in exceptional cases).

Interestingly, the practice of ‘co-financing’ of budget support operations was similar in ways to the NDAP. Budget support operations support partner countries’ development strategies, often in a specific sector, for which national resources are also mobilised. However, the idea of co-financing strictly speaking does not exist. For budget support operations, the level of Union funding allocated is based on a number of needs and performance criteria following a more qualitative than mechanistic assessment. The criteria mentioned in the Commission guidelines (Programming, Design and Management: A modern approach to Budget Support - 2012) include: i) financing needs of the partner country, ii) the partner country’s commitment to allocating national resources, iii) effectiveness, value for money and impact of the budget support operation, iv) track record and absorption capacity of the partner country and v) the strength of the monitoring system. While the NDAP does not have clearly established criteria, the level of national contribution is largely informally set through dialogue between Member States and the Commission, taking into account implicitly different factors, such as

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<sup>49</sup> While ESIF Major Projects represent an interesting case study compare with NDAP, it should be noted that it is expressly forbid for these funds to be used for the purpose of supporting decommissioning (Article 3 (3) of the ERDF Regulation & Article 2(2) of the Cohesion Fund Regulation)

capacity to finance or historical context.

The CEF and ESIF Major projects thus ensure that an adequate incentive structure is in place through a clear framework for co-financing<sup>50 51</sup> (which also ensures a clear mechanism for risk-sharing in the case of cost increase). If a cost increase is accepted (not always the case), the beneficiary contribution for a project automatically increases. In addition, there is strong incentive for beneficiaries to avoid significant delays due to the possibility of decommitment of funds<sup>52</sup>. Under the automatic decommitment principle for ESIF, if a sum committed to a programme has not been claimed by the end of the third year following the programme's adoption, any unpaid money ceases to be available to that programme. On the other hand, budget support creates incentives to perform through the use of variable tranches based on actual performance against pre-agreed performance indicators.

**Nonetheless, the three Member States have contributed (and will continue to contribute) a significant share to the decommissioning programmes.** The European Court of Auditors estimated that this contribution amounted to over EUR 1 billion between the beginning of EU support and 2016. The rate of national contribution on programme level varies from 15% in Lithuania<sup>53</sup> to 33% in Bulgaria<sup>54</sup> and 44% in Slovakia<sup>55</sup>. While co-financing remains the exception on the project level (see infobox below), Member States finance a wide range of complementary activities within the decommissioning programmes. All three Member States have established one or more dedicated Funds, which provide part of the financing. Other national resources come from the national budgets.

**The 2016 report of the European Court of Auditors called for further increasing the amount of national contribution relative to EU support. In line with its political objectives set out since the beginning of the MFF, the Commission has continued to increase efforts to raise the level of national contribution, both at the project and programme levels.** It has also introduced stronger conditionalities requiring risk-sharing in the event of increase in project cost and requirements to offset any cost increases through reductions in other areas of the programme. These efforts have been met with varying levels of cooperation on the part of the three Member States. Slovakia has notably committed to increase programme funding from national resources by 28% from EUR 372 million to EUR 476 million. More modest commitments have been secured from Bulgaria and Lithuania. Until now, the Commission has thus focused on political dialogue and ad hoc measures, but it also declared in its response to the Court of Auditors' report that it would seek to settle the issue in 2018 by means of an update of the detailed implementation procedures.

**Increased levels of national contribution would very likely continue to encourage greater national ownership and economy-seeking on the part of beneficiaries.** However, the performance of the few co-financed projects to date does not suggest that these are consistently more efficient or effective than those financed entirely through EU support. Moreover, systematic project-level co-financing would likely create additional administrative burden and increase the risk that national resources may not be made available in a timely manner, in particular if requested urgently to respond

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<sup>50</sup> Regulation (EU) No 1303/2013 of 17 December 2013

<sup>51</sup> Regulation (EU) No 1316/2013 of 11 December 2013

<sup>52</sup> Regulation (EU) No 1303/2013 of 17 December 2013

<sup>53</sup> From inception of the programme to end 2016

<sup>54</sup> From 2003 - 2016

<sup>55</sup> From inception of programme to end 2015

to unforeseen cost increases. National funds are typically budgeted on a multi-annual basis with little-to-no contingent resources available for immediate use, even if Member States have shown themselves to be flexible in the past. In this context, increased programme-level co-financing within a clarified implementing framework might thus provide the advantages of increased national contribution without the risks associated with project level co-financing. This would also provide greater long-term clarity to national governments to allow them to secure and ensure the availability of national resources.

### Performance of co-financed projects

A review of Grant Agreements has identified ten projects for which an explicit 'co-financing' has been agreed. This includes eight projects at Bohunice and two at Kozloduy<sup>56</sup>. The majority of projects concern waste management infrastructure. It can be noted that the rationale for co-financing projects has not generally speaking been to share responsibility and risks, but to exclude infrastructure capacity that will serve other national needs from the scope of the NDAP.

The list of co-financed projects is small in absolute terms, providing only limited evidence upon which to draw conclusions. Looking at the general performance of these projects, they do not demonstrate a significantly higher performance (to the extent to that would allow to infer causation) than the general project portfolio. Most have faced difficulties or delays at some point, and for some cost increases. For example, project D4.2 at Bohunice and project 5b at Kozloduy notably saw their cost increase significantly from the first estimates (largely due to inadequate market analysis).

In addition to the co-financed projects examined, the Grant Agreements for the quasi-totality of other projects specify explicitly what (and in some cases the estimated amount of) national resources to also be mobilised in support of the project even if there was no co-financing per se. This includes overheads, provision of support to contractors, payment of certain types of expenses, etc. Poor performance of these projects would also in many cases, although not to the same extent, have some financial repercussions for beneficiaries.

**A more fundamental issue that appears to weaken the overall accountability framework is the open-ended nature of EU assistance.** The Commission never negotiated a clear upfront financial commitment to the three Member States as a counterpart to the closure of the units during accession negotiations (e.g. a specific amount of assistance or assistance up to a specific point in the decommissioning process). Since the first generation of the NDAP, the legislator has subsequently never defined a clear end-point for support, despite the fact that the Commission proposed in 2013 to clarify this in the programme's general objective for the current MFF (see below). Rather, the programme has long remained a de facto open-ended commitment for the decommissioning programmes, renewed from one MFF to the next. This does not contribute to reinforcing incentives for economy-seeking behaviour and creates significant future uncertainty concerning the source of financing for decommissioning programmes, in particular in Lithuania.

### 2013 Commission proposal for general objective

*The general objective of the Programme is to assist the Member States concerned to reach an irreversible state within the decommissioning process of Kozloduy units 1 to 4, Ignalina units 1 and 2 and Bohunice V1 units 1 and 2 nuclear power plants, in accordance with their respective*

<sup>56</sup> Given the unavailability of a list of co-financed projects, a list has been established based on a review of grant agreements. The projects include: A3-A "Reconstruction of Area Protection System AKOBOJE" (SK); C8 "Interim storage of RAW at Bohunice site" (SK); C7-A4 "Metallic RAW Melting Facility" (SK); C7-C "Treatment and conditioning of historical waste" (SK); A6 "PMU Offices Relocation" (SK); B8 "NPP V1 Decommissioning Information Centre" (SK); D4.2 Dismantling of Reactor Coolant system Large Components (SK); D4.4B "Dismantling of Systems in V1 NPP Controlled Area - Part 1 - Cost for RAW disposal in NRR Mochove site (SK); 5b "Design, Supply, Installation and associated Services of Equipment (including EIA) for conditioning of solid radioactive waste with High Volume Reduction Factor" (BG); 5a "Design, Supply, Installation and associated Services of Equipment for conditioning of Ion Exchange Resins" (BG)

*decommissioning plans, while keeping the highest level of safety.*

#### **General objective adopted by the legislator**

*The general objective of the [programmes] is to assist the Member States concerned in implementing the steady process towards the decommissioning end state of [the units concerned] in accordance with their respective decommissioning plans, whilst maintaining the highest level of safety.*

### **The programme management system is generally supporting programme efficiency**

**The management system established for the NDAP, as amended in 2014, is generally supporting programme efficiency.** In particular, the introduction of Earned Value Management has better equipped the Commission to play a strategic oversight role with respect to programme costs. On an operational level, the Implementing Bodies have also played an important role in supporting the cost-effectiveness of programmes.

**The implementation of Earned Value Management has, for the first time, created a tool for systematically monitoring cost-effectiveness.** It should allow the decision-makers at each level of programme governance and management to more effectively monitor programme costs and contribute to enriching discussion on issues of cost-efficacy. The Commission, for example, has increasingly tried to emphasise the need to manage the costs of the programme as a whole rather than unnecessarily *micro-managing* cost increases in individual projects from the EU level. Notwithstanding this progress, there appears to be greater room for the use of indicators of monitoring cost-effectiveness and process efficiency.

As discussed in section 2.5.1, **Implementing Bodies have played an important role in ensuring sound financial management of funds.** They are responsible for implementing the necessary due diligence and controls to ensure proper use of funds, but evidence suggests that they also contribute more generally to ensuring programme cost-effectiveness at the level of strategic and operational decision-making. For example, Implementing Bodies may require justification of the economy of decisions before approving funding, leverage the use of conditionalities or otherwise constructively challenge beneficiary decisions on issues of economy.

**On the other hand, some stakeholders raised the issue of the time needed for approval of decisions at the level of Implementing Bodies or the Commission.** This could concern both initial approval of project documentation or subsequent amendments to scope or budget. According to the stakeholders interviewed, these procedures may in some cases limit the flexibility of Decommissioning Operators to quickly respond on the ground and avoid delay. While a lack of adequate monitoring data exists to fully corroborate these statements, complaints appear to be mainly based on exceptional cases. According to the Implementing Bodies and the Commission, the overwhelming majority of required approvals are obtained within reasonable delay. Where more time is needed for approval, the anecdotal cases examined have been justified by the need to safeguard the financial interests of the EU and conduct necessary due diligence.

Nonetheless, this issue points more generally to the **lack of indicators to monitor process efficiency** within the management system. Some steps in this direction have been made. For example the CPMA has begun to report in its Monitoring Report statistics with regard to its performance processing INPP procurement submittals (previously these were tracked internally). The EBRD also conducts internal monitoring of such statistics, but they are not formally reported on a regular basis.

### **The administrative costs of programme management are generally reasonable, but some streamlining may be possible**

While it is not possible to reliably calculate the overall costs of NDAP programme administration, these are judged to generally be reasonable and proportionate to the size of the programme. This is supported by quantitative data, where available, and the perception collected from key stakeholders during interviews. Looking forward, the transition to 'National Agencies' as Implementing Bodies could

potentially reduce administrative costs in coming years. Interviews with programme stakeholders also pointed to some further potential for reducing the administrative burden of programme administration.

**It is difficult to piece together the full administrative cost of the programme as they are spread across multiple actors and are not systematically tracked at all levels.** At the EU level, the administrative costs consist for the most part of the salaries of Commission officials responsible for programme oversight – approximately 4,5 FTE –, mission costs and general overheads. Implementing Bodies are responsible for overseeing the implementation of many project and financial management tasks and ensuring the eligibility of expenditure. Their operating costs, which are carefully tracked, amount to EUR 25,2 million since the outset of the programme.<sup>57</sup> In addition to this, one must add at least part of the cost associated with the embedded PMUs for EBRD-implemented projects (EUR 175,7 million since the beginning of the programme). At national level, costs incurred relate to the production of requisite programming, monitoring and project documents and participation in meetings (Assembly of Contributors, Monitoring Committees and NDAP Committee). According to reporting in the Annual Work Programmes, ‘programme administration’ costs amount to approximately EUR 25,6 million since the beginning of the programme.<sup>58</sup> However, the exact costs included in these figures are not clear and it is not possible to isolate what part of these costs can be directly attributed to the NDAP administrative burden (e.g. which part would have been incurred as part of decommissioning in absence of the NDAP).

**The administrative cost of the programme could potentially be reduced in the future with the growing recourse to ‘National Agencies’ as Implementing Bodies in Lithuania and Slovakia.** This is based on the demonstrated cost performance of the CPMA relative to the EBRD. While the latter may appear less expensive considering only the operating costs of the central team in London (1,23% of project approvals managed compared with 1,33% for the CPMA), the use of embedded PMUs for project preparation and management under the EBRD operating model adds additional costs to the headline figure. Even if only a very small portion of those costs are affected to programme management tasks, this alters the cost-effectiveness.<sup>59</sup> Under the CPMA model, to be replicated by the SIEA in Slovakia, all these administrative support tasks are handled ‘in house’ and accounted for in the overall operating costs. A complex set of additional factors may also be taken into account in this analysis<sup>60</sup>; based on these considerations, according to figures provided by the CPMA, operating costs as a percentage of project approvals could be considered as low as 0,89%.

In Slovakia, the creation of a National Agency to serve as Implementing Body alongside the EBRD is seen by Slovak stakeholders as a means to potentially decrease the cost of the management of the programme through lower staff costs. This is in addition to other possible benefits it is hoped will materialise, such as the proximity and acceleration of decision-making. However, some ‘transaction costs’ could be expected with two Implementing Bodies operating side-by-side (see section 2.5.2).

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<sup>57</sup> Overall, the cost of programme administration for Implementing Bodies since 2001 amounts to EUR 36,1 million, including the EBRD and the CPMA. Excluding the costs of management of energy sector projects in previous MFFs on a pro rata basis, the total cost of administrative management of the decommissioning programmes comes to EUR 25,2 million.

<sup>58</sup> These figures were extracted from reporting in the Annual Work Programmes (reporting on ‘EU funding by sector’). No consistent reporting of programme administration costs is available elsewhere.

<sup>59</sup> It is difficult to discern which portion of PMU costs corresponds with what can be classified as programme administration connected with the NDAP, such as developing project documentation, supporting procurement, contract management, etc. Indeed, the PMUs provided much more general support including technical and planning support that would have been incurred by programmes as ‘normal operating costs’ in absence of an EU programme. Nonetheless, even affecting a small percentage of PMU costs to ‘programme management tasks’, the ‘real costs’ under the EBRD model can be considered to be higher.

<sup>60</sup> The cost-effectiveness of the CPMA is likely understated in the aforementioned figure due to i) the varying nature of projects handled by the CPMA & EBRD (the former handles smaller, more labour-intensive projects), ii) it does not take into account the pipeline of projects in pre-approval phase (on which significant resources have already been expended) iii) it does not take into account additional tasks that have been carried out by CPMA (e.g. active participation in make-or-buy), iv) the CPMA, contrary to the EBRD, is not tax exempt, and v) the CPMA is subject to a fixed-rate remuneration scheme since 2015.

**More generally, stakeholders also raised concerns with regard to the need to further streamline programming and reporting documents and optimise the number of meetings**, notably those necessitating international travel. Concerning programming and reporting documents, there would appear to be some margin for streamlining the contents of documents through more detailed templates and a more selective attitude. This would also contribute to improving the clarity and accessibility of these documents for users. As already noted, the option of moving to multi-annual programming could also be considered as a means to further reduce the programme administration costs. Redundancies were also noted between the Monitoring Committees and the EBRD's Assembly of Contributors. Moreover, beneficiaries and Programme Coordinators are also expected to send a delegation to the meetings of the NDAP Committee. While the Bank does not have flexibility insofar as such meetings are required in the fund rules, alternative arrangements may exist such as the back-to-back organisation of NDAP Committee and Assembly of Contributor meetings.

**Some of the largest 'cost increases' are in fact due to poor initial cost estimations or simple uncertainty rather than actual increases in costs due to difficulties or inefficiencies**

**Cost increases of key projects have been well documented by successive audits and evaluations.** A number of significant projects, launched under previous MFFs, have been delivered with cost increases up to as much as 300% (e.g. construction of the PMF for the Kozloduy programme). Such a spectacular cost increase over the course of the project lifecycle is exceptional, but more modest cost increases of 10% - 50% can be more regularly observed for projects. Over the course of previous MFFs, the SWTSF at Ignalina, for example, saw the project cost increase by 53% from the first version of the Project Information Sheet. At Bohunice, the project for dismantling of large components of the Reactor Coolant System rose from an original estimate of EUR 60 million to EUR 120 million at the time of signature of the contract in 2017.

**Closer inspection of many such cases suggests that one of the primary culprits has in fact been poor planning, inadequate costing methodologies or simple uncertainty.** Following poorly made initial estimates (in previous MFFs), project cost estimates naturally increased as the technical design, planning and regulatory uncertainties became clearer. To a certain extent, uncertainty in the development of projects is unavoidable; however, more detailed planning and rigorous cost estimates can significantly reduce this uncertainty. The 2016 Deloitte study, which looked more closely at the robustness of cost estimates, identified multiple examples of poor quality project documentation at early stages of the project lifecycle, in particular at Ignalina and Kozloduy.

#### **BENCHMARK – Approval of ESIF Major Projects before implementation<sup>61</sup>**

'ESIF Major Projects' are large-scale infrastructure projects in transport, environment and other sectors such as research, energy or ICT implemented under ERDF / CF programmes. The threshold for qualification as an ESIF Major Project is EUR 50 million, except in the transport sector where the threshold is EUR 75 million<sup>62</sup>. Due to their large size and strategic importance, ESIF Major Projects are submitted to a specific quality appraisal by the Commission beyond what is required of all ERDF / CF projects. Before an ESIF Major Project is approved, Managing Authorities must undertake very exhaustive preparatory activities in view of the submission of a formal application to the Commission.

<sup>61</sup> While ESIF Major Projects represent an interesting case study compared with NDAP, it should be noted that it is expressly forbid for these funds to be used for the purpose of supporting decommissioning (Article 3 (3) of the ERDF Regulation & Article 2(2) of the Cohesion Fund Regulation)

<sup>62</sup> Please refer to article 100 of the Common Provision Regulation on ESIF (Regulation (EU) 1303/2013), Article 3(3) of the ERDF Regulation (Regulation (EU) 1301/2013) and Article 2(2) of the Cohesion Fund Regulation (Regulation (EU) 1300/2013).

They may receive technical assistance from JASPERS, a technical assistance partnership between the Commission and EIB. In comparison, it can be noted that, regarding the NDAP, there is no explicit quality checklist for the approval of project documentation for large, strategic projects in the decommissioning programmes<sup>63</sup>. However, NDAP developed other type of quality review and technical support:

- ▶ Stakeholders do benefit from extensive technical assistance in the development of project documentation and the Commission (consulting the NDAP Committee) has final approval over projects.
- ▶ Beneficiaries for EBRD-implemented projects are assisted by the embedded PMU units for this preparatory work.
- ▶ The CPMA also has a team of in-house nuclear specialists and procurement experts to assist with this work.
- ▶ In some cases, consultancy contracts have been used, for example to help estimate project budgets.

While the NDAP assures ample technical support for the development of large projects, the establishment of a checklist may ensure more uniform quality standards and assist Implementing Bodies and the Commission in their quality review and approval responsibilities.

**Notwithstanding these issues, the Deloitte study found, and the current mid-term review confirmed, that Decommissioning Operators have strengthened their planning and cost estimation methodologies in recent years**, notably at Kozloduy and Ignalina. At Ignalina, for example, cost estimates are now prepared on a bottom up basis with reference to a standardised database of Lithuanian costs for applicable purchased goods. Cost estimates are also continuously updated (i.e. not just during period revisions of the decommissioning plan) as the projects' progress and time schedules and dependent costs evolve, with the support of advanced project management software.

**Similarly, a number of cost increases can also be ascribed to 'scope creep', with new sub-projects appearing as unforeseen needs are subsequently identified.** Examples identified include the project for the procurement of a free release measurement facility and associated equipment for the Kozloduy programme (past and current MFF), or the project for the modification of the plant and installation of new equipment at Bohunice (current MFF). This is to a certain extent inevitable, as unforeseen complications and additional needs arise, but also point to deficiencies in project scoping and planning. Failure to properly scoping projects from the beginning can generate additional delays and costs beyond just the supplemental cost of the scope adjustment, such as those incurred in the process of negotiations, contract amendments, additional permissions, etc.

**Due to the time-dependent nature of many costs, project delays are often synonymous with cost increases**

**Project delays can be cited as amongst the most often found reasons for cost increases in all three programmes.** By their nature, many of the costs associated with the decommissioning programmes are time dependent, meaning they will automatically increase in the occurrence of delays. These cost increases can be materialized through a need to extend contracts, for example a EUR 1 million increase in pre-disposal monitoring due to delays with the NDF at Kozloduy (current MFF), and additional costs to settle contractor claims. Delays were caused by a complex set of issues such as administrative delays, delays in the regulatory approval process, legal challenges to projects, technical difficulties etc.

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<sup>63</sup> Articles 101-103 of the Common Provision Regulation on ESIF (Regulation (EU)1303/2013)



**Due to the decision to rely extensively on internal staff of the Decommissioning Operators, in particular at Ignalina and Kozloduy, delays in the decommissioning programme can easily lead to a sub-optimal use of human resources within the organisation.** This includes under-utilisation of resources where delays have caused a stop in works, or over-utilisation of resources (with the additional overtime costs entailed) in order to make up lost time. As described in the previous section 2.6.1, the Bohunice programme has made relatively more extensive use of external contractors for decommissioning work, allowing for somewhat greater flexibility in the use of human resources. However, delays incurred on projects implemented by contractors can equally lead to significant cost increases if they are not foreseen before the contract is signed. As discussed in further detail later in this section, more rigorous anticipation of potential delays (notably in the regulatory review process and the potential risks and factors that could delay this process) could help to avoid the incurring of additional costs through contractor claims.

### **Difficulties with procurement have contributed in some cases to slowing down the procurement process or sub-optimal procurement outcomes**

**Difficulties with the procurement process were frequently identified as an issue during project implementation, leading to delays or sub-optimal outcomes.** This does not concern irregularities in procurement procedures, but rather the efficient and effective management of the process. Indeed, an audit recently conducted by the Commission found that procurement procedures across all three programmes were respected and the procurement processes of Implementing Bodies are thoroughly examined as part of the 'pillar assessments'. Stakeholders in all three programmes voiced concerns with public procurement rules, which were often seen as lacking adequate flexibility. While some scope for optimisation and accommodation may exist (this was not within the scope of this study), many of the issues raised seem to point equally to difficulties anticipating potential issues, inadequate expertise and capacity. At the same time, these difficulties may be considered to be reflective of the complex nature of the procurements themselves and sub-optimal market conditions (e.g. narrow markets for some goods & services).

At **Kozloduy**, a number of tendering processes have been met with non-satisfactory market response, prompting the Decommissioning Operator to adjust tender specifications and re-launch the tendering process. While the identified examples have not adversely impacted the overall decommissioning programme, they have resulted in additional administrative effort. For the restoration of the water insulation of the machine hall and the reactor compartment of Units 1–4 (current MFF), SERAW found the three lowest price tender proposals to be technically non-compliant and the other three were significantly higher than the project cost estimate. The PMU had to adjust the technical specifications to ensure that tenderers were able to fully understand the scope of this assignment and calculate prices more accurately. The original tendering process for the supply of lifting and transport equipment for RAW management sites (current MFF) was also cancelled due to inadequate market response. SERAW concluded that restrictive technical requirements and a tight delivery schedule were responsible for the unsatisfactory response. For the design and construction of the SRDW (previous MFF), only two tenders were submitted with prices three times higher than the estimated and allocated budget and the tender was subsequently cancelled and re-launched. While one can never fully anticipate market outcomes (and some procurements inevitably face difficult market conditions), all of these examples point to quality issues in the preparation of technical specifications and other upstream procurement tasks (e.g. market analysis).

A recent example from the current MFF at **Bohunice** also points to questions on the quality and adequacy of the procurement process. After an initial delay of almost two years (the process was initiated in the previous MFF), the tender related to the decontamination of the primary circuit only elicited one response from a company that was not amongst two organisations internationally recognised to be dominant in this technology. The contract was nonetheless signed, but cancelled following technical difficulties experienced by the contractor. A subsequent contract was signed with one of the market leaders in this technology using a negotiated procedure. This raises the question of what aspect of the protracted initial tendering process led to such an unsatisfactory market response –

e.g. market research, adequacy of technical specifications or allocated budget, engagement with potential contractors, etc.

At **Ignalina**, issues with procurement have arisen more from difficulties complying with national procurement rules.<sup>64</sup> As noted by the CPMA, *the planning and conduct of public procurement by INPP has long been problematic*, in particular in INPP's Vilnius office. Around 20% of procurement-related submittals by INPP through the *Annual Decommissioning Activities* grant<sup>65</sup> are rejected due to lack of justification of scope, a lack of clarity and/or justification in the decisions of evaluation committees or other quality issues.<sup>66</sup> Overall, 5% of INPP procurements were definitively rejected in 2015 – 2016. Vigilant control by the CPMA has allowed to avoid irregularities. Stakeholders also agree that the situation has improved in recent years with the arrival of new management.

The issue of procurement has led to some frictions between INPP and the CPMA, as noted in section 2.5.1. In the worst-case example, for a contract for the procurement of bitumen, INPP contested the findings of the CPMA on grounds that the public procurement rules were not applied appropriately. This contention led to a legal conflict opposing the INPP and the Lithuanian Public Procurement Office (that had the same interpretation of the Law as CPMA) financed partly by EU funds.<sup>67</sup> CPMA's position was recently supported by the Lithuania Administrative Court, which found that INPP had developed technical specifications improperly aimed at a single producer and wrongly conducted the evaluation procedure. The recent audit conducted by the Commission also found no evidence that CPMA has applied procurement rules in a way that is inconsistent with the law.

**Stakeholders in all three programmes raised concerns with regard to specific limitations with regards to public procurement and EBRD procurement rules.** Public procurement rests on principles, such as transparency, openness and fairness that are different than those required for private sector procurement and may thus result in constraints for users in specific cases. Within unique contexts, such as decommissioning, public procurement rules may moreover not be fully adapted to specific needs or constraints of users as they have a more universal vocation. Nonetheless, such rules are regularly applied within the context of large and complex projects funded by the EU and the EBRD.

Some cases identified do point to a certain extent to challenges specific to the decommissioning context, notably the **lack of optimal technical information at the tendering stage**. Issues related to uncertain waste characterisation at the start of projects, for example, are typical of nuclear decommissioning programmes and have potential to cause contractual and technical difficulties during project delivery. However, **the cases also point to a need to further strengthen expertise and capacity on the part of beneficiaries in particular, allowing them to anticipate and proactively identify and address potential challenges**. If public procurement may be naturally subject to some constraints not faced in the private sector, it also offers a wide range of different procedures and tools that can be used to achieve optimal outcomes in a wide range of contexts. In particular, this situation may point to the need to balance private sector experience and expertise (notably vested within the PMUs and other consultancy support) with stronger capacity and expertise in public procurement for large, complex projects.

**Technical difficulties remain an inherent part of the decommissioning process, both**

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<sup>64</sup> It can be noted that, to present, Ignalina is the only programme where procurements have been undertaken using national procurement rules in addition to EBRD procurement rules. The former apply to projects implemented by the CPMA.

<sup>65</sup> These are smaller (<500K) procurements managed by INPP rather than CPMA, but under the oversight of the latter.

<sup>66</sup> While the statistics for the procurement handled by the Vilnius office is pointed out in particular, it can be noted that this office generally handles more complex issues, which may partly account for the higher rate of rejection.

<sup>67</sup> External legal services of INPP are not funded from the Ignalina Programme. However, INPP's internal legal services and technical staff, plus the relevant staff of CPMA and its legal services are funded from the Ignalina Programme.

## **supporting and detracting from cost-effectiveness**

**As previously noted (see section 2.3.2), the decommissioning market remains in a developmental stage due to the level of world-wide experience.** These technical challenges are further compounded in the case of decommissioning early-generation reactors. These characteristics have proven both a facilitator and obstacle to cost effectiveness. New technologies and approaches can contribute to significantly reducing costs. On the other hand, contractors can sometimes fail to deliver on contract deliverables due to technical difficulties. This also underlines the importance of knowledge sharing and exchange of best practices amongst the three programmes, which collectively represent Europe's most ambitious nuclear decommissioning undertaking to date.

**Several instances of contractor non-performance due to technical challenges can be noted. In addition, Decommissioning Operators have also struggled with technical issues internally.** In the most high profile case to date, the initial contractor selected to implement the decontamination of the primary circuit did not have the full knowledge to achieve the task. In this case, JAVYS was able nonetheless to minimise cost increase through reuse of part of the deliverables of the first contractor and retooling of the wider decommissioning programme. At Kozloduy, a number of projects in the past have also suffered from contractors' inability to perform adequately, such as: projects for the procurement of solutions for cleaning & conditioning liquid RAW, decontaminating pools and tanks and extracting and processing spent IER, the procurement of a platform scale for the measurement of vehicles (previous MFFs), and the retrieval and processing of the solidified phase from the ECTs (current MFF). The contract for the latter project was cancelled in 2016 and a new mega-contract launched for the management of legacy (wet) radioactive waste. At Ignalina, efforts to develop the technical concept for dismantling of the reactor in house have been partially unsuccessful and new tender documents are currently under development to solicit external support to finalise the technical design for the dismantling of Reactor zone R3.

**On the other hand, the dynamic nature of the decommissioning market holds potentially for improving cost effectiveness through the leveraging of new or novel technologies and approaches.** For example, the market response to tendering for PMF at Kozloduy resulted in a significant increase in the estimated upfront cost of the project; however, the volume reduction factor offered by the application of plasma melting technology is estimated to save tens of millions in the long-term – e.g. storage costs.

These factors point to the importance of a careful balancing of risks when going to market and making strategic decisions on internalisation vs. externalisation. It also underlines the necessity to develop strong contract management capacity. Lessons learnt, in particular at Kozloduy, point to the importance of establishing extremely close working relationships with contractors, to navigate technically demanding projects and address challenges as they arise. In the Kozloduy programme, this has been achieved through establishing open and continuous communication with contractors and even mobilising internal resources to support contractors when necessary. Finally, these lessons also underscore the usefulness of sharing knowledge and exchanging best practices between programmes. A recent example concerns Slovak and Bulgarian exchanges of experience with regard to management of legacy (wet) radioactive waste.

## **The process of organisational change within Decommissioning Operator organisations has had some impacts on cost-effectiveness**

**As previously discussed in section 2.3.1, the transition from operation to shut-down and finally decommissioning requires that the necessary organizational support systems be put in place** to manage these complex processes. A lack of or the slow pace of organizational evolutions can have important impacts on cost effectiveness. In particular, slow or difficult organisational adaptation has resulted in organisations carrying excess human resources capacity, increasing the level of administrative transaction costs or impeding at moments the development of strong project management expertise and capacity.

**Ignalina is the only programme in which the historic operating organisation directly became the Decommissioning Operator.** This relative continuity, combined with the historical insularity and independence of the organisation, has no doubt contributed to making the implementation of necessary organisational changes more challenging in previous MFFs. While the organisation has recently accelerated efforts to put in place a modern and fit-for-purpose organisational structure, this was inadequately anticipated and internal resistance slowed the process. If recent organizational enhancements have led to significant savings (e.g. creation of a combined Maintenance Department), they also indicate that the organisation may have been carrying excess human resource capacity. On the one hand, the natural evolution of activities allows for a streamlining of human resources, especially with regards to post-operation activities. On the other hand, internal documents provide evidence of gains realised through rationalisation of the organisation more so than evolving workload. It can be noted that the new leadership team put in place since 2013 at INPP has come in large part from outside the organisation, while also including career INPP staff particularly in key technical positions.

**Poorly adapted organizational structures, aside from retaining excessive human resources, can also more generally impact organisational cost-effectiveness.** Decisions relative to the organisational structure of INPP have in previous MFFs contributed to inadequate prioritisation of resources for decommissioning, fuelled organisational political tensions and impeded the continuous development of strong project management culture. Since 2013, new leadership at INPP has sought to restore the centrality of strong project management within the organisation and strengthen the internal accountability framework (the *customer-client relationship*) to favour cost-effectiveness.

**The transfer of ownership and responsibility of the NPP from one organisation to another likely had beneficial effects in terms of shaking up mentalities and breaking up entrenched interests that may be contrary to cost-effective implementation of the decommissioning programme. However, this transition can also generate delay and costly transaction costs if not managed well.** At Kozloduy, the transfer of ownership and responsibility – in two steps – for Kozloduy units 1 – 4 led to delays and complications in numerous cases. Even after transfer, interfacing between SERAW and KNPP has continued in some cases to create delays. To cite some examples from the current MFF, the transfer of construction rights for the decay storage sites created delays and cost increases in this important project and protracted discussions between KNPP and SERAW on the interfaces of common infrastructure on site and the licensing process required for modifications to the existing infrastructure have led to delays in separating infrastructure.

**Largely avoidable administrative issues continue to impact cost-effectiveness, in particular in the Kozloduy programme**

**The cost-effectiveness of programme implementation has also been impacted by issues in the administrative realm that could have been completely or at least partially avoided.** Previous sections have already evoked the key issues of procurement and contractor management, as well as administrative obstacles arising from the process of organisational change in Decommissioning Operators. Beyond the latter, national administrations, in particular in Bulgaria, have not always made all reasonable attempts to remove administrative obstacles to cost-effective programme implementation.

The design and construction of the PMF has in particular been slowed and faced with unnecessary risks due to administrative capacity and efficacy issues (e.g. complying with regulations, managing contracts, administrative approvals, etc.) during the previous and current MFF. In addition to difficulties faced with contract management and the management of the regulatory approval process, the ratification of the Nuclear Indemnity Agreement remained outstanding for nearly two years and became a critical risk for project completion. During the previous MFF, repeated challenges to Environmental Impact Assessments also led to the accumulation of important delays in projects and the programme as a whole that must now be made up. According to SERAW, these difficulties were mostly due to the fact that these are new regulatory activities for Bulgaria, leading to an inadequate understanding of regulatory requirements and adequate quality control measures.

## **Regulatory issues have contributed to delays and cost increases, in particular for the Kozloduy programme**

**Delays and cost increases have been noted due to inadequate anticipation of modifications to regulations and underestimation of the time necessary for regulatory approval or fulfilling regulatory requirements.** Safety decisions in the nuclear domain should always be made independently of specific economic factors; however, questions can be raised as to the extent that Decommissioning Operators are adequately working with regulators to anticipate such evolutions in the regulatory domain and adequately accounting for regulatory processes (and the risks that can be encountered during the process) in project planning. At the same time, it can be acknowledged that some difficulties have been faced due to inadequate capacity on the part of regulators and other administrative entities involved in the regulatory approval process.

**While some isolated examples were identified at Ignalina and Bohunice, this issue has impacted most strongly the Kozloduy programme.** In the previous MFF, the activity control monitoring devices within the Moveable Personnel Redressing and Decontamination Monitoring Facility had to be replaced at a cost of approximately EUR 150 000 due to regulatory changes. The contract for the design of the NDF also had to be amended after signing and the cost increased due to changes in the national legislation and due to increase in the scope of the project related to development of Article 41 and Article 37 EURATOM Reports. Preparation of the Environmental Impact Assessment for the decommissioning of Units 1 – 4 was also delayed due to a protracted approval process, with the Ministry of Environment and Waters requiring extensive changes to be made. During the current MFF, the contract for the construction of the PMF was amended and the cost increased in part due to delays accrued during the regulatory approval process. The free release of materials since 2014 has also persistently failed to meet performance targets. According to stakeholders and documents, the gap with expected performance is due to an underestimation of the time necessary to comply with national regulations in this domain.

In some cases, delays have been encountered due to inadequate capacity on the part of regulators and other administrative bodies. The NDAP has attempted to mitigate this issue through the provision of technical assistance to regulators. Poor performance on the part of contractors has also in some cases contributed to delays. However, the root issue behind this pattern of difficulties appears to be inadequate anticipation and planning for possible regulatory evolutions and the expectations of the regulator for obtaining the requisite approval, as well as more generally the failure to make adequate allowance within the project time schedules for regulatory compliance, especially when this can be expected to be extensive for projects with high levels of safety significance. Project planning and contract schedules systematically include regulatory reviews and take into account the approval process. However, the estimations may suffer from being overly ambitious or failing to appreciate certain risks (e.g. likelihood of delays on the side of the regulator due to capacity issues).

To not overstate the problem, it can be acknowledged that the situation has shown continuous improvement since the beginning of the programme. Decommissioning Operators are becoming more experienced with navigating these processes, planning accordingly and taking mitigation measures. Contact and cooperation between Decommissioning Operators and regulators was generally reported to be good (and improving). Moreover, as underlined in section 2.8, the regulators as much as the Decommissioning Operators have benefited from experience, as well as the technical assistance provided through the NDAP.

### **2.6.4 EQ6.3 What factors can explain differences in costs (and possibly benefits) arising between Member States?**

The table below provides an overview of the current total estimated costs for the decommissioning programmes, as well as the number of units, total nameplate capacity and duration of the decommissioning programmes. A cursory glance at the cost estimates will find the notable difference in the overall cost between the Ignalina programme and the Kozloduy and Bohunice programmes.

However, a number of other variables must also be taken into account before drawing conclusions, such as the size of the NPPs, the reactor technology or duration of the decommissioning process.

**Table 18: Comparison of decommissioning programmes / plant characteristics**

Programme	Current total estimated cost (M) <sup>68</sup>	Units	Nameplate capacity (MW)	Reactor technology	Years	End state
Kozloduy (BG)	EUR 1 107	4	1 760	VVER (PWR)	27 years	Brownfield
Ignalina (LT)	EUR 3 377	2	3 000	RBMK	38 years	Brownfield
Bohunice (SK)	EUR 1 239	2	880	VVER (PWR)	22 years	Brownfield

**Overall, exogenous variables can explain in large part the cost variations between the three countries more so than variations in cost effectiveness.** Nonetheless, an important nuance to this overall conclusion can be made for the Ignalina programme. The extension of the duration of the programme as a result of issues faced with critical waste management infrastructure projects in the last MFF significantly contributed to the increased overall decommissioning cost. Combined with cost differences arising from historical factors and the innate characteristics of the facility itself, these increases have largely driven the rise in overall costs.

**The primary factor explaining the differences in costs between the three programmes is the size of facilities and complexities for dismantling**

**From a cursory look at Table 18 above, one can immediately note that the Ignalina programme is significantly more costly than that of Kozloduy or Bohunice. However, looking at the cost per Megawatt of installed capacity it becomes clear that part of the price disparity can be attributed to the larger size of the plant** – using installed capacity as a rough proxy of the overall volume of equipment and civil structures. Looking at this very rough indicator of cost performance, Ignalina can actually be considered cheaper than the Bohunice V1 decommissioning programme - EUR 1,13 million per Megawatt of installed capacity for the former compared with EUR 1,42 million for the latter.

Looking at some specific comparisons, one can appreciate the difference in size and its impact on cost. The amount of steel from equipment to be dismantled at Ignalina (157 000 tonnes), for example, is more comparable to that of the six unit 2 640 MW Greifswald NPP (116 000)<sup>69</sup>, which is itself triple the size of the Bohunice V1 NPP and 50% larger than the Kozloduy NPP. Interestingly, the cost of decommissioning at Ignalina is significantly lower than the current cost estimates for the decommissioning of Greifswald (EUR 5 750 million).<sup>70</sup> Concerning the reactor core structures, Ignalina dwarfs the mass of VVER reactors, with 17 100 tonnes of steep graphite and shielding (serpentine / sand) to be dismantled and disposed of. Finally, it can also be noted that the RBMK produces higher quantities of operational waste than its VVER counterpart.

**Moreover, the technical challenges for the decommissioning of Ignalina are significantly more**

<sup>68</sup> Total cost of programmes – e.g. to be financed from national funding & approved EU contribution

<sup>69</sup> The similar reactor technology at Greifswald makes it useful for comparison with the decommissioning programmes of Kozloduy and Bohunice

<sup>70</sup> According to approximate figures provided by EWN, the total cost of Greifswald decommissioning is EUR 6 600. To make a rough comparison with the cost estimate for Ignalina, it is necessary to subtract EUR 650 for the final disposal of spent nuclear fuel and 200 for the demolition of the RAW repository at Rheinsberg NPP (the equivalent costs are not included in the Ignalina cost estimate).

**complex than the other two programmes due to its first-in-kind nature and the fact that a larger percentage of the equipment is contaminated.** Ignalina is the first RBMK to be decommissioned in the world. This means there is no precedence or experience that the Decommissioning Operator can rely on. While technically beyond the scope of the decommissioning programme, open questions remain in particular with regard to the management and disposal of irradiated graphite waste. Some useful experience can potentially be provided by other graphite moderated reactors currently being decommissioned; however, none of these has been completely decommissioned. Governments, such as the UK and France, have tended to favour SAFSTOR strategies. Compared to its VVER counterpart, the RBMK-type reactor can also be noted for the much larger contamination zone. An estimated 91% of steel from equipment to be dismantled is contaminated, compared with 59% at the Greifswald plant for example. This inevitably requires greater efforts and planning during the decommissioning process.

### **Economic factors such as the cost of labour can also distort the ‘sticker price’ of decommissioning**

**One can also note that the cost estimate for Kozloduy is relatively low compared to the estimated cost of Bohunice V1 decommissioning,** in particular considering that the installed capacity of Kozloduy is double that of Bohunice V1 – EUR 0,63 million by Megawatt of installed capacity compared with EUR 1,42 million for Bohunice. However, consultants from Deloitte reviewing the cost estimates demonstrated that correcting for the relatively lower labour costs in Bulgaria gives a revised comparable cost of EUR 1,743 million for the Kozloduy programme. This revised figure would put the Kozloduy estimate in a more expected position relative to the Bohunice estimate.

**Other local economic factors may also contribute to lesser extents to generally increasing or decreasing prices.** For example, Decommissioning Operators are able to attract and retain highly qualified and skilled staff with varying degrees of ease and cost, due notably to the geographic situation of the plants and local quality of life. The strength of local, in particular non-nuclear, supply chains can also contribute to increasing or decreasing the prices of consumables and services. Within the context of the INPP’s on-going ‘mark-or-buy review, ten of the activities considered for outsourcing were judged to have a ‘high’ market supply risk (limited supply of 1 – 2 eligible participants). An additional 12 were considered to have a ‘medium’ market supply risk (moderate supply of 3 – 4 eligible participants). This market risk translates into a risk premium of 5% - 10% of the activity price that must be taken into account when deciding whether to conduct an activity (in house), often at a higher price, rather than externalise it.

### **The necessary upfront investment in site infrastructure varied significantly between programmes**

**The construction of waste management infrastructure is often forgotten as an integral part of the decommissioning process. However, this infrastructure is a necessary pre-condition for decommissioning to begin.** The three Member States had varying level of existing infrastructure in place. Slovakia, where decommissioning of Bohunice A1 had already begun before V1 decommissioning started, had a large part of the necessary infrastructure already in place, whereas Bulgaria had only some existing waste treatment and disposal facilities. For historical reasons, Lithuania had almost none of the required infrastructure.

For this reason, **the three programmes exhibited drastically different upfront investment costs before decommissioning activities could begin.** Slovak authorities estimated that national contributions to necessary pre-existing waste management infrastructure (thus outside the decommissioning plan cost estimates), amounted to EUR 300 million. Looking at the Ignalina programme, the cost of key infrastructure projects B1 and B2/3/4 alone amounts to approximately EUR 400 million. At Kozloduy, the ISFSF amounted to approximately EUR 72 million. The case of the Ignalina programme is highly specific due to the fact that the country found itself in possession of the facility, which it has not been responsible for constructing or managing, at the moment of its independence.



**The overall duration of decommissioning programmes ultimately has an important impact on cost**

**While a large part of the cost difference between programmes can be explained by exogenous factors, the difficulties faced in the past at Ignalina have clearly contributed significantly to driving up costs.** Issues with key waste management infrastructure projects, most notably the ISFSF, have significantly slowed the advancement of the programme until 2016. As previously discussed, the defueling process at Ignalina has had an important influence on the programme time schedule since the outset. The difficulties faced with specific projects have also contributed to project-specific cost increases; however, it is the overall extension of the programme that has driven price increases most significantly.

## 2.7 EQ7. How does the governance and management system of the NDAP compare to other programmes managed by the Commission (or other actors)? Do these comparators provide any best practices in terms of governance or management?

*The purpose of this question was to provide an analytical framework for the benchmarking exercise, which has been undertaken during the study. It aimed to develop comparative case studies to compare governance and finance structures and examine advantages and disadvantages presented by each programme chosen compared to the NDAP. The full case studies can be found in Annex 7. This section provides an overview of the main findings.*

**Three ‘comparator’ instruments were selected for analysis as part of the benchmarking exercise:** Connecting Europe Facility (CEF), Budget Support aid delivery mechanism and ESIF Majors Projects. These three comparators were selected because they represent a variety of different approaches for programme implementation and are used to deliver large-scale projects, including notably in the energy sector. Nonetheless, the comparator programmes remain very different from the NDAP in terms of their objectives, types of projects supported and timescale (e.g. lifespan of projects is much shorter than decommissioning). Due to the unique nature of the NDAP, overall comparability is limited.

With comparability limited, rather than focusing on comparing performance metrics, the benchmark was focused on the identification of relevant best practices. The desk research and interviews mainly focused on the comparison of governance, programme and project management and financial instruments/management.

**Table 19: Presentation of comparator programmes / instruments**

Programme	Short description	Rationale under the selection of this programme in the benchmark
Connecting Europe Facility	Facility for the delivery of large infrastructure (energy, transport & ITC) projects across Europe (direct management)	As NDAP projects, CEF also finance large size infrastructure projects with large European budget (including in energy sector). Moreover some of these projects are very specific actions and include the development of innovative technologies. They are also implemented by with large number of contractors with very specific skills and various areas of expertise.
Budget support aid delivery modality	Instrument primarily used for delivering aid and capacity	The budget support instrument has a number of potential benefits that make it

		building support to third countries (direct management)	an interesting comparative case study. While budget support has little precedent for being used in the 'domestic' Union context, it is increasingly being considered for wider, including internal, use.
ESIF - Projects <sup>71</sup>	Major	Mechanism for approving and implementing large projects (>50M) (shared management)	ESIF Major projects are large scale complex projects with some commonalities with NDAP projects such as the part of innovation, the involvement of specific knowledge, the work with contractors,... Some of them are in energy and infrastructure sectors. However ESIF Major Projects do not finance decommissioning activities <sup>72</sup> . The management of project implementation is however very different as the NDAP projects.

The table below provides a summary of the main findings for each of the case studies. These are discussed in further details below.

**Table 20: Overview of the findings of the benchmarking exercise**

Connecting Europe Facility	Budget Support	ESIF Major Projects <sup>73</sup>
<ul style="list-style-type: none"> <li>▶ <b>Promotes strong national ownership</b> through MS approval of European 'corridors' and individual projects</li> <li>▶ <b>Multi-annual framework</b> for project implementation</li> <li>▶ <b>Strong, harmonised project management procedures</b> through centralised management at INEA</li> <li>▶ Use of <b>online system for production of annual monitoring reports</b></li> </ul>	<ul style="list-style-type: none"> <li>▶ <b>Promotes strong national ownership</b> through national development of strategy</li> <li>▶ <b>Multi-annual framework</b> for project implementation</li> <li>▶ Use of <b>results-based performance indicators</b></li> </ul>	<ul style="list-style-type: none"> <li>▶ <b>Promotes strong national ownership</b> through MS programme and implement projects in high autonomy</li> <li>▶ <b>Multi-annual framework</b> for project implementation</li> <li>▶ <b>Strong assessment of projects necessary prior to approval</b>, including cost estimates</li> </ul>

<sup>71</sup> While ESIF Major Projects represent an interesting case study compared with NDAP, it should be noted that it is expressly forbidden for these funds to be used for the purpose of supporting decommissioning (Article 3 (3) of the ERDF Regulation & Article 2(2) of the Cohesion Fund Regulation)

<sup>72</sup> Article 3(3) of the ERDF Regulation (Regulation (EU) 1301/2013) and Article 2(2) of the Cohesion Fund Regulation (Regulation (EU) 1300/2013).

Connecting Europe Facility	Budget Support	ESIF Major Projects <sup>73</sup>
<ul style="list-style-type: none"> <li>▶ Development of programme level results-based monitoring indicators</li> <li>▶ Clear <b>co-financing framework</b></li> </ul>	<ul style="list-style-type: none"> <li>▶ Use of <b>performance incentives</b></li> <li>▶ <b>Less burdensome financial management controls</b> and contribution to strengthening national capacity</li> <li>▶ Strong focus on political &amp; technical dialogue with the beneficiaries</li> </ul>	<ul style="list-style-type: none"> <li>▶ Clear <b>co-financing framework</b></li> <li>▶ <b>Strong incentive to ensure effective implementation</b> through risk of decommitment</li> </ul>

As for the NDAP, the programmes chosen include projects with high complexity and technical innovations but show very different management and governance systems. In comparison to the NDAP, some overall interesting practices can be underlined:

- ▶ Considering the advantages and disadvantages of the different approaches that could be used to implement the NDAP<sup>74</sup> as well as the context and characteristics of the NDAP, **indirect management was an appropriate choice for delivery of the NDAP**. Looking forward, other delivery methods could potentially offer advantages over indirect management in some areas. The cost / benefit analysis will depend on large part on the shape of a successor programme, should one be approved by the legislator.
- ▶ **The monitoring framework for the NDAP is generally in line with best practice, in particular practices in budget support operations**. The budget support mechanism has pioneered the use of results-based monitoring. In the selection of indicators, the Commission gives particular attention to outcome indicators, because these promote ultimate accountability for results, stimulate use of evidence-based policy making and allow recipients a large latitude of flexibility for deciding how to achieve the desired results best.
- ▶ **As sought by the NDAP, all instruments seek to ensure strong national ownership of project implementation through early buy in and strong Member State involvement**. Member States are implicated early on in the development of the projects or programmes and have input at key phases. This is best exemplified by Budget support, which encourages strong national ownership through the fact that the beneficiary is entirely responsible for developing the strategy to be implemented with the aid of the donor and implements the strategy using national management systems. Management decisions are left to the national authorities, who are held to account for the results obtained.
- ▶ **Two of the comparator programmes had a clearly defined framework for co-financing, pre-defined co-financing rates and a risk-sharing rule in case of cost increase**. These factors contributed to a number of advantages over the current use of co-financing within the NDAP. The clearly defined framework and pre-defined rates create certainty with regard to the responsibilities of all parties (particularly useful in the context of long-term financial planning) and avoid the

<sup>74</sup> The EU Financial Regulation and its Rules of Application define three types of 'management mode': i) direct management whereby the Commission is in charge of all EU budget implementation tasks, which are performed directly by its departments, ii) indirect management whereby the Commission entrusts budget implementation tasks to a third party after strict due diligence, or iii) shared management whereby the Commission delegates implementation tasks to the EU Member States.

transaction costs associated with negotiating cost-sharing on a case-by-case basis. Within the NDAP, the relative level of national and EU contributions remains a constant source of contention and negotiations over cost-sharing and have in the past caused some delays in the approval of projects. These two comparator programmes also tended to create stronger incentives for economy-seeking and effective project implementation with a risk-sharing rule in case of cost increase. Any cost increases, if approved, automatically engaged the financial responsibility of the beneficiary, which is not typically the case in the NDAP. Moreover, there is strong incentive for beneficiaries in ESIF Major Projects to avoid significant delays due to the possibility of decommitment of funds if they are not disbursed within three years of the beginning of the programme. The Commission has taken steps in this direction with the NDAP, by increasingly introducing ad-hoc conditions to put the burden of extra costs on the beneficiary or to oblige any cost increases to be recovered elsewhere in the programme budget.

- ▶ **Interestingly, the practice of ‘co-financing’ in budget support operations was similar in ways to the NDAP.** The concept of co-financing strictly speaking does not exist within budget support operations. The scaling of Union funding is based on a case-by-case assessment of a number of needs and performance criteria. While budget support does not have risk-sharing rule for cost increases, operations can be suspended in the case of non-performance and they create additional incentives to perform through the use of variable tranches based on actual performance against pre-agreed performance indicators. The NDAP similarly does not define a clear framework for the relative level of EU and national contribution. However, the NDAP has not developed any clear criteria for assessing the level of Union contribution relative to national contribution, nor does it have any mechanism to create performance incentives in absence of a risk-sharing mechanism.
- ▶ **The management modalities of the three programmes provide for the greater harmonisation of programme implementation data.** This is notably due to the fact that the NDAP is implemented through third party organisations and reporting modalities are not as prescriptive as the comparator programmes. The CEF and budget support are implemented directly by the Commission, with the former implemented by the INEA Executive Agency and the latter by EU Delegations. The Commission thus has direct control over the management systems put in place. On the other hand, ESIF Major Projects are implemented under shared management by Managing Authorities set up by the Member States. Like the NDAP, implementation is thus outside of the EU institutional framework. However, ESIF Common Provisions and reporting templates are much more prescriptive than the NDAP in terms of reporting on financial management and implementation.
- ▶ **All comparator instruments offer a fully multi-annual rather than annual framework for programming.** While comparator programmes all imposed annual monitoring and reporting requirements, none had an annual cycle for programming and commitments such as is the case for the NDAP. Under comparator instruments, the full budget envelope is approved at the outset of the project; funds are disbursed as projects are implemented in line with their work plans, also adopted with project approval. For CEF and ESIF Major Projects, specific approval is nonetheless necessary prior to substantive deviations from the approved work plan or budget implementation plan. For budget support, the beneficiary has full flexibility over the work programme and budget execution, but is required to meet performance targets to fully benefit from tranches periodically released during implementation of the agreed programme of reform.
- ▶ **The defining characteristics of ESIF Major Projects is the specific approval procedure to which they are subject.** This includes a number of analyses meant to ensure the quality of the project proposal, its feasibility and its utility. By contrast, the NDAP does not have a specific quality check list for key / large projects, even if the embedded PMUs / Implementing Bodies provide technical support and guidance during this process and projects are all subject to approval by the Commission. While the NDAP assures ample technical support for the development of large projects, the establishment of a checklist may ensure more uniform quality standards and assist Implementing Bodies and the Commission in their quality review and approval responsibilities.

## 2.8 EQ8. What would be the likely result of ending the NDAP in the three Member States concerned?

*This transversal question sought to measure the EU added value of the NDAP. EU added value is additional to the value created by actions of individual Member States, which may result from different factors, such as coordination gains, legal certainty, greater effectiveness or complementarities, economies of scale, promotion of best practice, benchmarking, etc.*

**Since its inception, the NDAP has contributed very clearly to facilitating the immediate and safe decommissioning of the eight reactors concerned by the programme**

The NDAP represented an important commitment by the EU to the three Member States during negotiations to shut down the reactors. EU support to decommissioning (and to mitigating the impacts of closure) represented a politically and financially significant offer that helped enable the EU to obtain a commitment on the part of the three Member States to permanently shut down the reactors. The shutdown of these reactors, considered unsafe and un-upgradable by the international community, was a politically contentious issue in all (then candidate) Member States, which relied on these reactors for a significant (or in the case of Lithuania the quasi-totality) of their electricity production needs. Moreover, the early shutdown before the end of their envisaged operational lifetime, combined with specific historical factors, meant that inadequate financial resources existed to finance decommissioning.

**Beyond obtaining the commitment to shutdown, EU support likely influenced the timescale for decommissioning.** Both Lithuania and Bulgaria had initially (briefly) envisaged pursuing a strategy of deferred dismantling. The immediate availability of EU assistance factored significantly into the decision to change to an immediate dismantling strategy. In Bulgaria, EU support has also contributed to the government's decision to further shorten the duration of decommissioning, bringing forward the envisaged end-date to 2030 from 2035 as initially foreseen. Compared to deferred dismantling / safe enclosure, EU support has thus allowed for the level of radiological hazard to be reduced more rapidly and to avoid passing on a significant financial burden to future generations, in line with internationally accepted principles of management of nuclear waste and decommissioning. Indeed, deferred dismantling / safe enclosure by its very nature entails leaving part of the radiological hazard on site for a period of 30 years or longer. It also defers the major part of the costs and the total costs may in some cases be higher overall.

**Continued progress of decommissioning would likely have been impacted to varying extents in absence of NDAP during the current programming period**

The EU added value of financial support to the Ignalina programme appears the most significant of the three programmes. While it is difficult to confidently predict the counterfactual, a lack of EU support for the current MFF would in all likelihood have resulted in a disruption of programme implementation and a change in the decommissioning strategy (likely to deferred dismantling). The financing shortfall for Ignalina prior to the EU commitments for the current MFF were significantly higher than the other two programmes at EUR 2 012 million. The assessment by Deloitte<sup>75</sup> found that fully funding the (lower) current shortfall (of EUR 1 561 million)<sup>76</sup> from state finances would *entail a significant increase in Lithuania's budget deficit, and either a decrease in budget spending on non-energy areas, a higher national debt level, or a combination thereof*. At the same time, there remains a staunch public and political resistance in the country to supporting the costs of decommissioning without EU assistance due to the unique historical factors and perceived promises made at the moment of accession.

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<sup>75</sup> This report is not available publicly

<sup>76</sup> 4,2% of the 2015 Nominal GDP of Lithuania

Recognising these concerns, stakeholders interviewed were unanimous in affirming that a disruption of EU funding would have entailed a dramatic and immediate change in the decommissioning strategy for the current period.

In addition to the financial added value, the potential of EU funding to contribute to a reduction in radiological hazard and risk at Ignalina during the current MFF is significantly higher than the other two programmes (as detailed in section 2.3.3). Moreover, national authorities remain concerned as to the impact of a cessation of decommissioning activities on the perception of the EU amongst the Lithuanian population and neighbouring countries' populations, notably with regard to the attitude of the EU towards nuclear safety precautions. These precautions are very closely looked at in a context where the neighbouring Belarus is building its first reactors. The largely Russian-speaking population in the Ignalina region also creates the potential for the cessation of decommissioning to become a diplomatic flashpoint. These factors contribute to increasing the EU added value of the Ignalina programme for the current MFF.

**In Bulgaria, EU support was likely an important factor in supporting the continued progress of decommissioning activities during the current programming period in line with the existing strategy.** The absence of such funding may have resulted in a change of strategy for national authorities or an extension of the timeline. Even if the EUR 321 million funding gap prior to the current MFF can be considered to have been very reasonably within the limits of Bulgarian public finances, a lack of continued EU funding may have put the project at risk of political obstacles in a Member State that has been marked by the instability of government and nuclear policy in particular in recent years. Stakeholders with knowledge of the Kozloduy programme also underlined that EU oversight and the use of EBRD procurement rules (rather than national rules) allows the programme to navigate administrative obstacles in the country. In absence of this, stakeholders believed, the programme would be more susceptible to management difficulties that could significantly hinder progress.

**Due to the relatively advanced nature of the decommissioning process at Bohunice and the size of the financial shortfall, the current EU added value of support in the current MFF is relatively lower than in the other two Member States.** Considering the hypothetical funding gap of EUR 317 million prior to the current MFF, full financing from national coffers can be considered to have been very reasonably within the limits of Slovak public finances. The Decommissioning Operator is experienced and highly capable. Moreover, the operator hopes to leverage this experience into future economic opportunities on the international decommissioning market. The absence of EU funding during the current programming period could potentially have slowed the pace of progress, but would very likely not have significantly impacted progress all other things held constant. Nonetheless, Slovak authorities interviewed maintain that EU support during the current MFF has been important to ensuring that the decommissioning programme continues without disruption.

**The added value of the programmes, as it has historically been perceived, is naturally declining as programme implementation advances**

**The EU added value of the NDAP from its beginning has been cast in terms of financial mitigation and nuclear safety.** The NDAP has contributed over previous MFFs and continues to contribute in the current MFF to a stepwise decrease in the level of radiological hazard and risk to the general public. With a finite level of radioactivity on site, however, each additional euro of investment provides decreasing rates of return in terms of risk reduction. The EU added value of the programme is thus naturally decreasing over time. Moreover, the funding gap has been closed to relatively small amounts for two of the three programmes.

**With the exception of the Ignalina programme, where defueling remains ongoing, the level of radiological hazard on the sites has been reduced to approximately 1% of original levels and the level of risk to the general public highly diminished.** During the remainder of the current MFF, the Bohunice programme will remove much of the final significant sources of radioactivity in the technically challenging process of dismantling the reactor cores and the Kozloduy programme will embark upon this process. The question of the continued added value of the programme can thus be raised on the

basis of the diminishing rate of return observed at present.

**An enhancement of knowledge sharing and capitalisation aspects of the programme appears as an avenue for ensuring continued added value**

**Of the 90 nuclear reactors currently permanently shut down in Europe, only three have been completely dismantled. The level of experience in the dismantling of nuclear reactors in Europe (as well as internationally) is thus highly limited.** The NDAP's contribution to securing the shutdown and immediate dismantling of these reactors has thus led to the generation of a highly significant amount of experience that can be of benefit to other decommissioning projects.

**First and foremost, the knowledge and experience gained can be of use to the three national programmes.** To this end, the Commission has continually encouraged stakeholders to share experience and best practice. Some specific cases can be identified of programmes sharing best practices, in particular between Bohunice and Kozloduy due to the similarity of the plants.

**Beyond the three programmes, the knowledge and experience generated may also prove of use to other decommissioning projects in Europe. However, the knowledge sharing and capitalisation process is not currently structured and is largely organic.** Member State representatives on the NDAP Committee noted that their attendance was in part motivated due to this knowledge-sharing aspect, although it is not fit to this purpose. Decommissioning Operators have also shared some experiences in other international fora, such as the IAEA or NEA. As discussed in section 2.5, European companies benefiting from contracts through the NDAP will also serve an important role in transferring knowledge and experience accrued from the NDAP to other decommissioning programmes. There thus appears to be scope for a more structured organisation of the knowledge sharing process. The Commission can facilitate this process, but Member States should also recognise the value of the information generated and ensure relevant stakeholders are informed and able to take part.

**Member State capacity has also been strengthened by the NDAP, with important future 'return on investment' in Bulgaria in particular**

**In Bulgaria and Lithuania, the NDAP represents the first time these countries have decommissioned nuclear reactors.** This process, as with all other steps in the nuclear lifecycle, must be carefully overseen and regulated by the State. To accompany these Member States, the NDAP has financed some capacity building and technical support projects aimed at supporting the implementation of national regulatory tasks and building regulatory capacity. Specifically, these grants have benefited Regulators in Lithuania and Bulgaria. The Slovak Regulator did not request assistance.

In Lithuania, nine regulatory support projects were implemented by the CPMA, including six projects with the nuclear safety Regulator VATESI, two projects with the Radiation Protection Centre and one project with the Environmental Protection Agency. Support to the latter two agencies has been discontinued due to changes in national regulations. The ongoing VAT.06 project (EUR 1,8 million) provides on-demand Technical Support Organisations (TSO) support to VATESI for review of submittals through the end of the current MFF. The Bulgarian Nuclear Regulatory Agency has benefited from on-going support through a EUR 9,4 million EBRD grant (building on two projects implemented under PHARE). This project provides support from the French-German consortium IRSN/GRS including the review and evaluation of decommissioning documentation subject to regulatory approval, licensing submittals, radiological characterisation and clearance material, as well as developments in the regulatory framework in respect to decommissioning (e.g. regulatory guides or internal procedure documents) and training.

Aside from the Regulators, the experience and support provided through the NDAP is naturally contributing to the development of capacity and experience in Decommissioning Operators. In Slovakia and Bulgaria, the operators will in the future be responsible for decommissioning other facilities in their countries. Finally, the programme has contributed to supporting the development of the local ecosystems of TSO. The expertise of these actors is of great importance to national capacity in the



areas of nuclear safety and waste management through the support they provide to NPPs and regulatory authorities. Prominent local TSOs, such as the Lithuanian Energy Institute or the Slovak VUJE, have benefited from numerous contracts.

**Considering potential future ‘return on investment’ in this area, the added value of the NDAP appears to be the greatest in Bulgaria.** This is due to the existence of other operating nuclear reactors in the country and the future prospects for the development of nuclear energy beyond the current decommissioning programme. Moreover, the support provided to the Bulgarian Regulator has focused on both supporting regulatory tasks (e.g. review of submittals), but also the development of the national regulatory framework and training. The latter can be expected to have more sustainable impacts. Nonetheless, support provided to VATESI will continue to be useful, according to the Regulator, beyond the end of the current programme as decommissioning extends well beyond 2020.



3

**Conclusions &  
way forward**

### 3. Conclusions & way forward

*This section presents the transversal conclusions and recommendations developed on the basis of the responses to the evaluation questions. The development of conclusions was also strongly guided by a number of prospective questions set out in the Terms of Reference. These prospective questions concerned the adequacy of the level of national co-financing in each of the three concerned MS (PQ1), the identification of areas of improvement of the 'Detailed implementation procedures' (PQ2) and the simplification of the NDAP governance structure (PQ3). These specific questions, as well as other issues identified, are addressed through the conclusions and recommendations below.*

*Issues relative to the three prospective questions are specifically identified – e.g. PQ1, PQ2 or PQ3.*

#### **Transversal conclusions & suggestions for improvement**

**The NDAP remains a relevant instrument for supporting the three decommissioning programmes and is well embedded in the wider policy and regulatory context**

**On the general level, the objective set out for the programmes in the Regulations remains relevant.** Continued progress in the decommissioning at the three NPPs would likely have been impacted during the present MFF in absence of EU support. The NDAP thus continues to support a stepwise reduction in the level of risk and radiological hazard at the three sites concerned, in particular at Ignalina where defueling operations are ongoing.

**Current decommissioning strategies for the three programmes also remain at present fully aligned with the specific objectives set out for each programme.** Likewise, the detailed objectives set out in the detailed implementation procedures continue to reflect the principal on-going activities as defined in the detailed decommissioning plans. Nonetheless, some enhancements may be made to indicators, targets & milestones to ensure the future relevance of monitoring and reflect the evolving context.

**Coherence with the Euratom Treaty's acquis in the area of nuclear safety and management of spent nuclear fuel and radioactive waste has been ensured through the legal base of the NDAP.** However, it constitutes an exception to some underlying principles enshrined in the Euratom acquis, in particular that the costs for the management of spent fuel and radioactive waste is borne by those who generated those materials. This reflects the specific historical context at the origin of this programme. Programme implementation has also been undertaken in full coherence with other relevant EU acquis, in areas such as environmental protection or social protections.

**Decommissioning programmes are all on a positive trajectory, but some delays will need to be proactively managed to meet the objectives of the current MFF**

**Since the beginning of the current MFF in 2014, the three programmes have progressed in the implementation of their decommissioning programmes.** Actual physical dismantling of equipment is progressing relatively quickly compared to previous programming periods. This reflects the nature of nuclear decommissioning programmes, which requires significant upfront investment. Investments under previous programmes have thus laid the foundation for the progress being achieved today.

**At Ignalina, the critical process of defueling of Unit 2 reactor core and spent fuel ponds has begun.** This process was significantly delayed under the previous MFF due to delays in the construction of the ISFSF. The project was successfully recovered at no additional cost from a 'near death' situation in 2013. Defueling is now critical for allowing the programme to move forward. Risks during the process will need to be tightly managed moving forward.

#### **Suggestion for improvement**

- ▶ Monitor the defueling process very closely. A very low risk appetite should be maintained, due to the important cost implications of disrupting the defueling process.

**D&D work in the turbine halls and auxiliary buildings outside the Controlled Area has advanced substantially in all three programmes.** The final key project is under way in Bohunice and large-scale works are expected to be largely completed by 2020 in Kozloduy and Ignalina.

**Bohunice has progressed to the stage of large-scale physical D&D works in the Controlled Area. The Kozloduy and Ignalina programmes are at varying stages of the preparatory phase for this work.** The Kozloduy programme has accumulated approximately two years delay in the Controlled Area largely stemming from issues faced under the previous MFF. It is difficult to qualify the delay in the Kozloduy programme and the impact on the achievement of objectives due to inadequacies in certain targets and milestones in the monitoring framework. This will need to be clarified in any revision of the detailed implementation procedures (PQ2).

**Important achievements have been reached in the Ignalina and Kozloduy programmes with regard to key waste management infrastructure projects.** Other important projects have also been recently launched or are under implementation in these two programmes. Waste management activities during the current MFF have progressed with few significant issues, although the expected waste flows have generally been less than expected. Some critical path risks will need to continue to be managed proactively, such as the issue of legacy wet radioactive waste at Kozloduy.

**A number of different underlying factors have contributed to or detracted from effectiveness**

**Whereas delayed waste management infrastructure projects were a main culprit of delay under the previous MFF, the successful completion of key projects in recent years has contributed and will further contribute to accelerating progress in coming years.** Experience has shown that proper management of the dismantling waste is the key to control and contain the time needed for dismantling. The risk of important disruptions due to delayed waste management infrastructure projects appears now to be contained, but calls for special attention to avoid or mitigate delays in further infrastructure projects being launched or currently under implementation.

#### **Suggestions for improvement**

- ▶ Monitor important waste management infrastructure projects still under implementation / to be launched in order to proactively identify and address any issues that could have an impact on the decommissioning process.
- ▶ Carefully examine and report on expected capacity levels and projected flows for waste management streams in order to identify risks of bottlenecks and proactively address them.

**Technical challenges remain inherent to the decommissioning process, which cannot yet be considered a mature industry.** These technical challenges are further compounded in the case of decommissioning early-generation reactors. As programmes progress towards or arrive at the critical step of dismantling in and around the reactors, the technical challenges become more complex. While the Kozloduy programme can rely on existing experience, in the case of Ignalina these challenges are further compounded by the first-in-kind nature of this undertaking.

#### **Suggestions for improvement**

- ▶ Continue to strongly encourage Decommissioning Operators in Bulgaria and Slovakia to exchange experiences and best practice, in particular concerning D&D in the Controlled Area.

- ▶ Encourage the relevant stakeholders to develop a proposal for a EURATOM research project on the issue of irradiated graphite management at Ignalina to support the programme and the capitalisation of this experience.

**The effectiveness of programme implementation has also been impacted by risks in the administrative realm** that could have been completely or at least partially avoided. These challenges reflect in part the relatively limited experience with decommissioning at the national level (and overall). Slovakia is the only one of the three Member States concerned by the NDAP with some prior experience in nuclear decommissioning. Nonetheless, over a decade since programmes have been launched, one can expect these difficulties to be largely overcome.

#### **Suggestion for improvement**

- ▶ Develop risk registries at ministerial level (Programme Coordinators) identifying all programme implementation risks in the administrative realm and mitigation measures to be put in place.

**Although the NDAP does not seek to generate economic or social impact, some positive additional benefits of the programme can be observed**

**Some ‘additional’ positive economic impact of the NDAP can be observed for the EU decommissioning market.** This is mainly related to the direct impact of the contracts benefiting EU companies (notably in Germany, Spain and UK companies alongside the three recipient countries’ companies). From the beginning of the programme, approximately 350 procurement contracts have been signed, representing over EUR 1.1 billion injected into the decommissioning market. Additional economic added value may also be realized in the coming years through the future development of Decommissioning Operators.

**The NDAP’s legal base does not cover any social mitigation objectives – these remaining under the sole responsibility of the Member States.** National, regional and local authorities have undertaken different steps to mitigate impact and develop alternative economic opportunities. Environmental Impact Assessments have also addressed some of these issues, as well as the EBRD’s Environmental and Social Policy. Nonetheless, no dedicated social mitigation strategies were identified.

**The NDAP has indirectly helped to offset to some extent the socio-economic impact of decommissioning for the surrounding regions,** notably by contributing to the decision in Lithuania and Bulgaria to pursue an immediate dismantling strategy. This avoided the more precipitous decline in staffing levels typical of a deferred dismantling strategy and allowed to redeploy former plant staff in the context of decommissioning. Overall, an estimated 2 228 fewer jobs would exist in the Ignalina and Kozloduy programmes had a SAFSTOR approach been adopted. More generally, the choice of immediate dismantling has also contributed to reducing the economic burden of decommissioning on future generations.

#### **Suggestions for improvement**

- ▶ Monitor and report on the positive economic and socio-economic mitigation (and other) impacts of the NDAP at EU level.
- ▶ While remaining the sole responsibility of the Member States, consider ways to encourage proactive interventions to address the social impacts of decommissioning, in line with international best practice.

**The low priority given to communication and engagement at the EU level represents a missed opportunity**

At national level, communication activities generally contributed to supporting programme effectiveness; however, difficulties with stakeholder engagement contributed to slowing progress at



Kozloduy.

Notwithstanding the fact that communication needs at local and EU level are very different, communication activities on the EU level have not been a priority. This is a missed opportunity to positively communicate on the tangible benefits accruing to European citizens. Moreover, the 'historical happenstance' behind the genesis of the NDAP has put the Commission at the forefront of an important societal challenge in Europe – with many nuclear reactors to safely decommission in coming years. While beyond the objectives the legislator has bestowed upon this programme, the Commission could further leverage its position to play an important role in supporting Member States in tackling this challenge.

#### **Suggestion for improvement**

- ▶ Put in place activities to communicate more clearly on the objectives and achievements of the NDAP. Where relevant, the Commission should also engage with EU-level civil society actors on questions of decommissioning.

### **All three programmes currently remain on track to implement decommissioning programmes according to current cost estimates**

New estimated costs submitted by Member States for the current MFF led to costs increases in some cases, but also a decrease for one programme. The main part of the cost increase was linked to the nine-year extension of the decommissioning process for Ignalina. At present, the 2014 programme cost estimates are expected to be maintained or decrease slightly for Ignalina and Bohunice respectively. The cost of the Kozloduy programme remains unchanged at present, but was under revision at the time of the evaluation and may evolve. The analysis of programme implementation would suggest that there is no imminent risk at present of further cost increases due to the extension of programmes. This is notwithstanding delays that will need to be recovered in coming years or additional costs not included in current estimates that may be identified.

### **A number of underlying issues have influenced the cost-effectiveness of programmes...**

**Some of the largest increases in project budgets are in fact a result of poor planning and cost estimation or simple uncertainty rather than cost increases per se.** Following poorly made initial estimates, project cost estimates naturally increased as the technical design, planning and regulatory uncertainties became clearer. However, Decommissioning Operators have strengthened their planning and cost estimation methodologies in recent years, notably at Kozloduy and Ignalina.

**Project delays can be cited as amongst the most often found reasons for cost increases in all three programmes.** By their nature, many of the costs associated with the decommissioning programmes are time dependent, meaning they will automatically increase in the occurrence of delays.

**Issues effectively and efficiently managing the procurement process were frequently identified during project implementation.** Some challenges are specific to the decommissioning context and public procurement rules can sometimes pose constraints compared to private rules. However, the evidence points more towards the potential to develop greater capacity and expertise in order to proactively anticipate and address potential issues and use the full range of possibilities allowed for by law. Programme Coordinators should also assist in facilitating the process where appropriate.

#### **Suggestions for improvement**

- ▶ Continue to assess procurement capacities to ensure that operators have adequate expertise and experience with (international / national) public procurement in the context of large, complex projects.

- ▶ Programme Coordinators should be kept apprised of, where appropriate, key procurement processes and take all steps within their power to remove and address obstacles should they arise.

**Technical difficulties remain an inherent part of the decommissioning process, both supporting and detracting from cost-effectiveness.** The cost effectiveness of work in the Controlled Area / Reactor Buildings in particular has been impacted by technical difficulties faced across the three programmes.

**Largely avoidable administrative issues also continue to impact cost-effectiveness, in particular in the Kozloduy programme.** The cost effectiveness of certain large infrastructure projects has been significantly impacted by administrative difficulties during implementation. For example, the long delay in ratifying the Nuclear Indemnity Agreement in Bulgaria also created an avoidable risk for the project.

**The slow process of organisational change within Decommissioning Operator organisations has had some impacts on cost-effectiveness.** The use of former plant staff in the decommissioning process can be seen as good practice. However, evidence suggests that some programmes have carried excess human resources due to the slow pace of organisational change. The use of former plant staff also creates pressures to limit the number of redundancies (and thus wider change), in particular where few alternative opportunities are available.

#### **Suggestion for improvement**

- ▶ Consider restricting EU financing to core staff dedicated to decommissioning to more strongly incentivise programmes to ensure optimum staffing levels. Other approaches seeking to strengthen incentives could also be considered, such as an output based approach to financing staff work.

**Regulatory issues have contributed to delays and cost increases, in particular for the Kozloduy programme.** Questions can be raised as to the extent that Decommissioning Operators are adequately working with regulators to anticipate evolutions in the regulatory domain and adequately accounting for regulatory processes in project planning.

#### **Suggestions for improvement**

- ▶ Make efforts to improve cooperation with regulatory authorities.
- ▶ Include relevant regulatory authorities as permanent observers of the Monitoring Committees.

**...but cost differences between programmes are largely linked to exogenous variables**

**Exogenous variables can explain in large part the cost variations between the three programmes more so than variations in cost effectiveness.** These variables include factors such as the size of the plants, the reactor technology, the level of pre-existing infrastructure or the local cost of labour and strength of local supply chains.

**Nonetheless, an important exception to this overall conclusion is the Ignalina programme.** In 2014, the extension of the duration of the programme as a result of issues faced with key waste management infrastructure projects in previous MFFs significantly contributed to the increased overall decommissioning cost – in addition to the unique characteristics of the programme.

**The governance and management structure is generally fit for purpose, but some divergence can be noted between the theoretical and actual functioning**

**The programme governance and management system is generally considered to be fit for purpose (PQ3).** It provides for a clear and logical division of roles and responsibilities and is adapted to the specific constraints of the programme. In practice, however, some divergences can be observed



between the intended and actual functioning, which may impact its effectiveness and efficiency.

The **Commission** plays a high level supervisory role, responsible for ensuring overall programme effectiveness and efficiency. Since 2014, it has worked to develop new tools to monitor effective and efficient implementation of the decommissioning programmes. These have allowed the Commission to improve its ability to strategically manage the programme with an eye on results and cost-effectiveness, rather than simply financial execution. Stronger programme level monitoring tools may support some further devolution of decision-making to Member States (PQ3).

The potential of the **NDAP Committee** is limited by the timeliness and relevance of information provided. In particular, the annual programming documents are regularly provided to the committee for approval six or more months after the beginning of the year. Information is also inadequately filtered and adapted to the audience needs. Finally, representatives do not always benefit from adequate resources to follow the file, due to strategic choices in their home administrations.

Overall, **Implementing Bodies** are effectively fulfilling their delegated responsibilities. In practice, they are also playing a technical oversight role somewhat beyond their formal responsibilities due in part to the historical absence of strong, high-level technical oversight on the part of some national ministries.

**Programme Coordinators** have assumed an increasing ownership of the implementation of decommissioning programmes thanks to political and procedural efforts to strengthen their role as well as a now high level of buy-in; however, there remains further margin for continuing to strengthen their role to varying extents, in particular through stronger technical capacity. Moreover, the current detailed implementation procedures afford only limited latitude to Programme Coordinators to assume a more active role in programme governance (PQ3).

#### **Suggestions for improvement**

- ▶ Consider expanding the role of the Monitoring Committees to include the discussion and approval of individual projects.
- ▶ Consider allowing the Programme Coordinators to approve or make adjustments to (EU financed) projects under a certain threshold.
- ▶ Consider ways to strengthen the capacity of Programme Coordinators to ensure adequate programme oversight.

#### **Expanding the ownership and implication of national authorities must go hand-in-hand with a stronger financial ‘buy-in’**

**The open-ended nature of EU assistance does not contribute to strengthening the accountability framework and maintains a continuous uncertainty over the financing of the programme** that does not favour long-term planning. No upfront financial commitment to the three Member States was negotiated as a counterpart to the closure of the units. The Legislator has subsequently never defined a clear end-point in temporal or financial terms despite Commission proposals to clarify this. This situation does not favour long-term financial planning or create strong incentives for cost-effectiveness.

**Creating an adequate level of economic self-interest is an important factor in encouraging economy-seeking behaviour in beneficiaries.** Increasing national relative to EU contributions and defining a clear and formalised framework for ‘co-financing’ (either at programme or project level) would very likely continue to encourage greater national ownership and economy-seeking on the part of beneficiaries. This is a necessary counterpart to greater implication of Programme Coordinators.

**The current study cannot provide any specific indication of the ‘correct’ ratio of national to EU financing, although some objective criteria should be taken into account (PQ1).** An evaluation cannot portend to provide an answer from a normative perspective (e.g. *how much should be contributed*), and the limited amount of empirical evidence available for analysis excludes the drawing of robust conclusions on the necessary rate of national contribution to bring about desired outcomes

(e.g. *economy seeking behaviour*). Nonetheless, a number of objective criteria can be identified by the evaluation, which may be taken into account in negotiations over the future expected level of national contribution:

- ▶ **EU added value:** To what extent is additional EU investment providing a clear return in terms of reducing the level of radiological hazard and risk to the general population? Would the suspension of EU assistance, in the worst case scenario, create any risk for the general population? Alternatively, is EU added value being achieved through other means?
- ▶ **Historical context:** To what extent did the Member State benefit from the electricity generation? How much longer were the reactors expected to produce electricity? Did the specific socio-political context of the construction and operation of the reactors mean that it was reasonable to expect that the Member States should have amassed the necessary resources for dismantling?
- ▶ **Financial burden:** Taking into account the health of public finances and the wider economic context, to what extent is it reasonable to expect that national authorities can address the current financing gap while maintaining current budgetary commitments vis-à-vis the Union and without creating undue burden.
- ▶ **Performance:** To what extent have beneficiaries demonstrated effective and efficient use of Union resources in the implementation of their programmes to present? Are the necessary preconditions in place to ensure sound management of Union resources in the future?

Considering these factors, one could expect the level of national contribution, while already relatively high, to increase sharply or to entirely cover costs for Bohunice and Kozloduy, in particular considering the criteria of EU added value, the historical context and financial burden. With regard to Ignalina, EU added value remains relatively stronger, an entirely unique historical context can be noted and the financial burden is significantly larger (although ultimately manageable). Nonetheless, the Decommissioning Operator bears responsibility for part of the cost increases incurred with the extension of programme duration. A more modest, but significant, increase could be expected taking into consideration these criteria. This assessment is summarised in the table below.

**Table 21: Evaluators' analysis of co-financing criteria**

	EU-Added Value	Historic context	Financial burden	Performance
Kozloduy (BG)	<p><b>+</b></p> <p><i>Extremely low remaining risk to general public</i></p> <p><i>Political instability, national administrative issues could pose risks to programme in absence of EU support</i></p> <p><i>Useful knowledge generation</i></p>	<p><b>+</b></p> <p><i>Decisions made in a different political / economic system</i></p> <p><i>Significant potential operational lifetime at shutdown (with upgrades)</i></p>	<p><b>+</b></p> <p><i>Small financing gap of EUR 28 million on the basis of current cost estimates</i></p> <p><i>Insignificant impact on public finances</i></p>	<p><b>++</b></p> <p><i>Overall satisfactory performance</i></p> <p><i>Largely avoidable administrative challenges have impacted programme performance</i></p>
Ignalina (LT)	<p><b>+++</b></p> <p><i>Significant additional risk reduction to be achieved</i></p> <p><i>Complex challenges ahead due to first-in-kind nature</i></p> <p><i>High probability of programme disruption</i></p>	<p><b>+++</b></p> <p><i>Decisions taken prior to the existence of the Lithuanian State</i></p> <p><i>NPP largely did not benefit population during operation</i></p> <p><i>Potential at shutdown to continue to provide</i></p>	<p><b>+++</b></p> <p><i>Large financing shortfall of EUR 1 561 million</i></p> <p><i>Impact on public finances, but considered manageable</i></p>	<p><b>++</b></p> <p><i>Issues in previous MFF led to an extension of programme duration and a significant increase in cost</i></p> <p><i>Very positive developments during the current MFF, putting the programme back on</i></p>

	<i>Useful knowledge generation</i>	<i>large majority of electricity needs (with upgrades)</i>		<i>track</i>
Bohunice (SK)	<p>+</p> <p><i>Extremely low remaining risk to general public</i></p> <p><i>Most complex work already currently achieved or underway</i></p> <p><i>Useful knowledge generation</i></p>	<p>+</p> <p><i>Decisions made in a different political / economic system</i></p> <p><i>Significant potential operational lifetime at shutdown</i></p>	<p>+</p> <p><i>Small financing gap of EUR 92 million with plans already formulated to further close gap through savings</i></p> <p><i>Insignificant impact on public finances</i></p>	<p>+++</p> <p><i>Overall good performance</i></p> <p><i>Some delays faced during current MFF due largely to technical challenges</i></p>

#### Suggestions for improvement

- ▶ Define a clear end-point for the NDAP for each of the decommissioning programmes, either in financial, temporal or technical terms in order to provide clarity to all parties on responsibilities to the end of the decommissioning process.
- ▶ Take steps to clarify and codify the meaning of co-financing and negotiate targets for national contribution levels relative to EU contributions. The least burdensome solution would be to clearly demarcate the boundaries of EU support (e.g. specific projects), leaving Member States responsible for other costs.
- ▶ Undertake negotiations with Member States to clearly define the expected level of national contribution, taking into account objective criteria.

#### Monitoring can be further enhanced to ensure continued relevance post 2017

**The performance monitoring framework put in place for the current NDAP is overall judged to be adequate.** However, the quality of indicators across the programmes, including the use of targets and milestones is variable and in some cases should be improved. This notably relates to the Kozloduy and Bohunice programmes. Some aspects of the monitoring framework (specifically the indicators, targets & milestones defined in Annex 1 of the detailed implementation procedures) could also be amended to ensure their relevance post 2020, taking into account that funds committed up to 2020 will be disbursed over the course of several years following the end of the MFF. Finally, the comparability of indicators across programmes is difficult even though all programmes pursue similar goals.

#### Suggestions for improvement

- ▶ Indicators, milestones and targets should be adjusted in order to ensure the relevance of the performance monitoring framework post-2017.
- ▶ Programmes should collaborate to identify 'quick wins' for harmonising existing performance indicators to ensure greater comparability.

**The introduction of Earned Value Management has provided stakeholders with a useful new tool to manage programme implementation at the strategic and operational level.** However, there remains room for further efforts towards fully embedding Earned Value Management and improving the quality of indicators. These efforts should have a long lasting positive impact on the managerial capacities of Decommissioning Operators beyond the NDAP.

#### Suggestions for improvement

- ▶ Continue to cooperate in order to address the existing limitations of Earned Value Management.

- ▶ Make efforts to fully embed Earned Value Management in their internal management systems. The experience of INPP can be shared with other programmes as example.

### **The annual programming process can be improved through small adjustments to the detailed implementation procedures**

**The NDAP programming documents are generally robust and coherent, but their relevance is undermined by issues of timeliness.** The timeline and process set out in the detailed implementation procedures has not been tenable in practice and has actually tended to contribute to delays in the process. A number of issues in the detailed implementation procedures, while logical, are contributing to their overall impracticability (PQ2).

#### **Suggestion for improvement**

- ▶ Amend the detailed implementation procedures concerning the production of the Annual Work Programme in order to promote greater timeliness in its preparation and adoption. Transitioning to a multi-annual programming process could also be envisaged.

### **The contents of programming and monitoring documents can also be enhanced**

**Another challenge is harmonising, better structuring and filtering information provided in programming and monitoring documents.** While templates and guidelines exist, the content of programming and monitoring documents vary widely. Documents could also better filter and prioritise information in order to provide greater clarity and focus (PQ2).

More prescriptive guidelines can to some extent address these issues. However, constraints should be recognised when considering remedies. Each Decommissioning Operator has developed different work breakdown structures, cost structures and performance monitoring frameworks that are not entirely comparable, nor do they always align neatly internally within programmes. The use of indirect management mode and existence of multiple implementation channels also adds a layer of administration and entails the coexistence of multiple internal management processes, practices and cultures. These factors make it difficult to aggregate, neatly summarise and analyse planning, budget and performance data in a manner that is possible with most EU programmes. Given the mature state of programmes, reconfiguring these aspects entirely would entail important efforts and costs.

#### **Suggestions for improvement**

- ▶ Adapt the detailed implementation procedures concerning programming and monitoring document in order to further harmonise and streamline their contents to the greatest extent practical given constraints.
- ▶ Significantly shorten primary documents or develop summary documents for dissemination to relevant stakeholders.

### **The NDAP has been important to supporting the decommissioning processes in the current MFF, but the added value of the programme is naturally declining as implementation progresses**

**Continued progress of decommissioning would likely have been negatively impacted to varying degrees in absence of the NDAP during the current programming period.** In particular, the financing gap for the Ignalina programme would have represented a significant burden on the public finances – even if it is a manageable one. Disruption of EU support would have very likely led to a change in decommissioning strategy for the current programming period. For the Kozloduy programme, a lack of EU assistance may have impacted the pace or strategy of decommissioning considering political and administrative capacity factors. The EU added value of the Bohunice programme appears lowest for the current MFF.

**The EU added value of the NDAP from its beginning has been cast in terms of financial mitigation and nuclear safety.** With a finite level of radioactivity on site, however, each additional euro of investment provides decreasing rates of return. The EU added value of the programme is thus naturally decreasing over time. Moreover, the funding gap for two of the three programmes has been closed to small amounts that do not pose risks for State finances. The question of the continued added value of the programme can thus be raised on the basis of the diminishing rate of return observed at present.

**...but other types of EU added value could be further leveraged to justify an adequate ‘return on investment’ for Europe for future EU assistance**

**Of the 90 nuclear reactors currently permanently shut down in Europe, only three have been completely dismantled. The level of experience in the dismantling of nuclear reactors in Europe (as well as internationally) is thus limited.** The NDAP’s contribution to securing the shutdown and immediate dismantling of these reactors has led to the generation of a highly significant amount of experience that can be of benefit to other decommissioning projects. However, the large part of this added value remains confined to the companies benefiting from NDAP contracts and the Decommissioning Operators. While these actors are well placed to disseminate and apply this knowledge in the future, there are no mechanisms in place to ensure this knowledge is diffused into the public domain for use by relevant actors – other NPPs, Decommissioning Operators, national authorities, research actors, etc.

#### **Suggestions for improvement**

- ▶ Establish mechanisms to identify, structure and disseminate relevant knowledge and experience gained in the three programmes.
- ▶ The primary responsibility of Decommissioning Operators should remain programme implementation.

## 3.2 Summary table

The following table summarises and develops the suggestions for improvement presented in the previous section. They are organised under nine strategic areas.

<b>1. Reflecting the advancement of the programmes and the wider context of decommissioning in the EU, the underlying rationales of the NDAP should be adapted to provide stronger added value in terms of knowledge generation and sharing in view of the enormous financial and technical challenge represented by decommissioning in the EU.</b>
<p>1.1 The Commission should explore the possibility to establish mechanisms to identify, structure and disseminate relevant knowledge and experience gained in the three programmes to all other relevant users across the EU to assist them in tackling the enormous future challenge of decommissioning and positioning the EU internationally as the leader in decommissioning.</p> <p>1.2 Future emphasis on developing stronger knowledge diffusion mechanisms should not place undue burden on Decommissioning Operators. Their primary responsibility should remain programme implementation.</p> <p>1.3 Member States with nuclear reactors should invest the necessary time and effort in working with the Commission to capitalise on the knowledge gained, starting with encouraging site visits in the context of NDAP committees.</p> <p>1.4 The Commission should continue to strongly encourage cooperation within and beyond the programme to ensure effective and efficient programme implementation. Specifically:</p> <ul style="list-style-type: none"><li>▶ The Commission should continue to encourage exchange of experiences and best practice, in particular concerning D&amp;D in the Controlled Area, between Bulgaria and Slovakia. A structured process should be put in place identifying the post relevant areas for exchange and laying out the means for this sharing - exchange of documents or, when necessary, meetings of technical experts.</li><li>▶ The Commission should encourage the relevant stakeholders to develop a proposal for a EURATOM research project on the issue of irradiated graphite management at Ignalina to support the programme and the capitalisation of this experience.</li></ul>
<b>2. Build on the positive steps taken since 2014 and introduce some targeted amendments to the performance measurement framework to ensure and enhance its continued relevance post-2017.</b>
<p>2.1 Indicators, milestones and targets should be adjusted in order to ensure the relevance of the performance monitoring framework post-2017. In particular:</p> <ul style="list-style-type: none"><li>▶ Targets and milestones in the performance monitoring framework for the Kozloduy programme should be amended to provide for a clearer accountability</li></ul>

framework for D&D works in the Controlled Area for the remainder of the MFF.

- ▶ The Bohunice programme should consider adopting in lieu of or in addition to existing indicators more results-based indicators (rather than project-based output indicators) in line with those used by the other two programmes.
- ▶ The milestones and targets for all programmes should be amended to extend to at least 2025 in order to take into account progress achieved with funding committed until 2020.

2.2 Programmes stakeholders should collaborate to identify 'quick wins' for harmonising existing performance indicators to ensure greater comparability.

2.3 The Commission should continue to work with Decommissioning Operators to address the existing limitations of Earned Value Management.

2.4 Decommissioning Operators should make efforts to fully embed Earned Value Management in their internal management systems. The experience of INPP can be shared with other programmes as example.

2.5 Should be NDAP be continued in the future, the Commission should work with beneficiaries to ensure more consistent usage of the ISDC methodology in order to facilitate financial benchmarking.

### **3. Encourage and support the development of further national ownership of decommissioning programmes by national authorities by improving their capacity to ensure the supervision of programmes.**

3.1 Programme Coordinators should take steps to ensure they have the necessary technical capacity and expertise to provide stronger technical oversight to programme implementation. These investments should allow them to:

- ▶ Lead the definition of the strategic approach and weigh in on important decisions;
- ▶ Conduct reasonable due diligence of decisions made and justifications provided by Decommissioning Operators; and
- ▶ Play a more proactive role in the monitoring of programme implementation (approval and adjustments to projects under a certain threshold).

3.2 The Commission should consider means to encourage and support Programme Coordinators in developing their capacity and expertise, such as:

- ▶ The Commission could support capacity assessments of Ministries / relevant national actors similar by those done by the EBRD for SERAW and JAVYS in order to identify areas for improvement.
- ▶ In cases where there is a clear need, use EU funds to support human resources in the national ministries and / or other support interventions
- ▶ Create incentives for developing capacity and expertise at ministerial level

### **4. Strengthen the role of Monitoring Committees in order to establish them as the 'centre of gravity' of decision making within the programme and a forum for Programme Coordinators to assume increased leadership over programme**



## implementation.

4.1 The Commission should consider expanding the role of the Monitoring Committees to include the approval of individual projects and project amendments when the latter are tabled by Implementing Bodies.

4.2 The Commission may consider allowing the Programme Coordinators to approve adjustments to (EU financed) projects under a certain threshold.

4.3 Programme Coordinators should work with relevant national stakeholders to develop ministerial-level risk registries identifying all relevant interfaces with administrative risks identified at the level of Decommissioning Operators. These should continually be updated and discussed during Monitoring Committees.

▶ In particular, Programme Coordinators should also be kept apprised of, where appropriate, key procurement processes and take all steps within their power to remove and address obstacles should they arise.

4.4 Programme Coordinators and Decommissioning Operators should take efforts to improve cooperation with regulatory authorities. Relevant regulatory authorities should be included as permanent observers of the Monitoring Committees, as has become informal practice.

## **5. An increased role for Programme Coordinators should be complemented and supported by a clarification of financial responsibilities for the remainder of programmes and stronger national ‘buy-in’ to strengthen accountability for programme cost-effectiveness.**

5.1 If support is continued in future MFFs, the legislator should define a clear end-point for the NDAP for each of the decommissioning programmes, either in financial, temporal or technical terms in order to provide clarity to all parties on responsibilities to the end of the decommissioning process.

▶ Programme Coordinators should work with national governments to develop a framework for securing long-term national contributions to decommissioning programmes.

5.2 For current and, the case being, future MFFs, the Commission should take steps to clarify and codify the meaning of co-financing and negotiate targets for national contribution rates relative to EU contributions.

▶ The least burdensome solution would be to clearly demarcate the boundaries of EU support (e.g. specific projects), leaving Member States responsible for other costs.

5.3 In the context of a clarified framework for co-financing, the EU should consider restricting EU financing to core staff dedicated to decommissioning (planning and project management, D&D and waste / spent fuel management) to more strongly incentivise programmes to ensure optimum staffing levels. Other approaches may also be experimented depending on the specificities of each programme, such as results-based modalities for financing the work of Decommissioning Operator staff.

## **6. Improve the timeliness of the programming process and streamline the contents of programming and monitoring documents to enhance their relevance.**

6.1 The detailed implementation procedures concerning the production of the Annual Work Programme should be amended in order to:

- ▶ De-link the development of the Annual Work Programme from the annual Progress Report to the Parliament and the Council;
- ▶ Create the possibility to approve Annual Work Programmes individually by programme rather than collectively
- ▶ Remove the obligation to use the Member States' Annual Work Programme as the underlying supporting document for the Commission Financing Decision

As another option, the cycle of annual programming could be abandoned in favour of multi-annual work programmes covering two or more years. However, this would also need to be combined with some tweaking of the process taking into account lessons learned from the first years. This would have the advantage of decreasing the administrative burden of the annual cycle.

6.2 The detailed implementation procedures concerning programming and monitoring document should be modified in order to further harmonise and streamline their contents to the greatest extent practical given constraints. The templates should clearly and succinctly present:

- ▶ Performance indicators defined in the legal base;
- ▶ EVM indicators at project and programme level calculated against annual and baseline references;
- ▶ A critical path analysis;
- ▶ Risk registry for critical path projects; and
- ▶ Clear reporting of schedule and cost deviations with the baseline estimates.

6.3 The primary documents should be significantly shortened or summary documents should be developed for dissemination to relevant stakeholders.

## **7. Adopt a stronger “waste-led approach” to programme implementation through tighter monitoring of critical projects and stronger prospective analysis.**

7.1 Stakeholders should ensure close supervision of critical spent fuel / waste management projects with a significant potential to impact the wider decommissioning process through specific focus in programming and reporting documents and regular informal monitoring meetings where necessary:

- ▶ Stakeholders at the Ignalina should monitor the defueling process very closely. A very low risk appetite should be maintained, due to the major cost implications of disrupting the defueling process.

- ▶ Stakeholders at Kozloduy and Ignalina should monitor important waste management infrastructure projects still under implementation / to be launched in order to proactively identify and address any issues that could have an impact on the decommissioning process.
- ▶ Decommissioning Operators should carefully examine and report on expected capacity levels and projected flows for waste management streams in order to identify risks of bottlenecks and proactively address them.

## **8. Consider developing communication and engagement activities at EU level to address political risks and contribute to supporting dialogue with civil society on nuclear decommissioning.**

8.1 The Commission should put in place activities to communicate more clearly on the objectives and achievements of the NDAP. Where relevant, the Commission could consider, beyond the scope of the NDAP, engaging with EU-level civil society, industry and public actors on questions of decommissioning in view of the expected strong increase in the number of decommissioning projects across Europe in coming years. This can be seen as supporting the capitalisation and sharing of knowledge generated by the programmes.

8.2 The Commission should work with Decommissioning Operators and national authorities to publicise the positive 'additional' impacts of the NDAP on the EU decommissioning market and local communities in its communication on the programme.

## **9. While remaining the full responsibility of the Member States, the Commission should consider more the social aspects of decommissioning.**

9.1 While remaining the sole responsibility of the Member States, the Commission should consider ways to encourage proactive interventions to address the socioeconomic impacts of decommissioning, such as:

- ▶ Encouraging or requiring Member States to put in place strategies for socio-economic mitigation, for example using an ex ante conditionality;
- ▶ Incentivising social mitigation investments by counting this towards the national contribution; or
- ▶ Encouraging more coordination with other EU tools, such as the ESF.

