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Alternative Contracting and Ownership Approaches for New Nuclear Power Plants

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ALTERNATIVE CONTRACTING AND OWNERSHIP APPROACHES FOR NEW NUCLEAR POWER PLANTS

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INTERNATIONAL ATOMIC ENERGY AGENCY
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FOREWORD

This publication examines alternative contracting and ownership approaches for the development, construction, commissioning, operation and decommissioning of new nuclear power plants. It identifies issues faced by Member States considering the applicability of such approaches to their national programmes. Two new approaches to nuclear project development are analysed here: build–own–operate (BOO)/build–own–operate–transfer (BOOT) approaches; and regional approaches. This publication includes practical examples, current practices, case studies, and reflections on the presentations made and discussions held during a series of consultants meetings and at the Technical Meeting on Alternative Contracting and Ownership Practices for Nuclear Power Plants, held in Vienna, 14−16 March 2011.

In the BOO structure, a private or non-private entity (the developer) is granted the right by the government to develop, finance, build, own, operate and maintain a facility for a specified period, during which the entity owns the project, retains the revenue and bears the associated risk. The BOOT structure is similar to BOO, except that the ownership of the facility is transferred to the government at the end of a predetermined period.

The second approach discussed in this publication is the regional approach, where two or more States collaborate on the development of a nuclear power project. Both BOOT and regional structures are being either considered or utilized in current nuclear power projects around the world.

There are 19 issues described in the IAEA Milestones Approach, which are relevant to all contracting and ownership approaches described in this publication and are to be carefully considered when developing the infrastructure for a nuclear power programme. Certain responsibilities remain with the host country of the nuclear power plant, and a clear understanding of this balance between national responsibility and external support is required.

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1. INTRODUCTION

1.1. BACKGROUND

Member States have expressed interest in using alternative contracting and ownership approaches for their first nuclear power plants and have asked the International Atomic Energy Agency (IAEA) to prepare a publication on the issues, benefits, and challenges associated with these approaches.

Countries embarking on a nuclear programme (hereinafter, 'Embarking Countries'), as well as countries with small programmes that that are planning expansions, have expressed a number of common challenges that include the availability of the required human resources, securing financing, and managing radioactive waste. Some alternative[1] contracting and ownership schemes, such as Build-Own-Operate (BOO), Build-Own-Operate-Transfer (BOOT) models, and regional ownership approaches might address these common challenges to some extent. These schemes have been used in non-nuclear power projects and in other industries successfully for decades and, although they have been discussed within the nuclear industry community, they have not been used for nuclear power plants until the recent announcement of the Akkuyu project in Turkey.

In a BOOT structure, a private or non-private entity (the developer) is granted the right by the government to develop, finance, build, own, operate, and maintain a facility for a specified period, during which the entity retains the revenue and associated risk. The developer is the entity that takes the responsibility for delivering the project (i.e. commissioning a nuclear power plant). Under a BOOT, at the end of a pre-determined period, ownership of the facility is transferred to the government. BOO is like BOOT, except the original entity owns the project outright and retains the revenue and associated risk in perpetuity [1].

Under the regional ownership approach the development of the NPP involves the participation of two or more countries. The process normally begins with government-to-government planning at the inception of the project. While such coordination might occur among entities that are parts of national governments (e.g. national utilities), the project usually begins at a national level, whereby representatives of the sovereign nations decide to cooperate towards a common goal. These sovereign commitments become the basis upon which the project will then proceed. The main benefit of this approach is the aggregation of resources among the participating countries that allows the sharing of costs, risks, human resources, grid infrastructure, and other capacities.

It is important to note that there can be several ownership and contractual approaches to the development of a nuclear power programme and the commissioning of a nuclear power plant. The selection of the suitable approach will depend on the specifics and goals of the desired nuclear programme and circumstances of the Member State's economic situation, as there is no 'one-size-fits-all' structure. This document provides an explanation of the concepts, with some examples, to assist Member States in understanding the range of options available and the associated benefits and challenges. Regardless of the approach chosen by a Member State, the requirements for the safe, secure, and peaceful operation of the nuclear power plant

[1] 'Alternative' means a contracting and ownership approach that is different from those used historically in the nuclear power industry, as explained in the section of this report titled - Classical contracting and ownership structures.

remain the same. The challenge is to make sure that these requirements are adequately considered and addressed in a Member State's nuclear programme.

1.2. SCOPE AND OBJECTIVES

This publication describes the alternative contracting and ownership approaches limited to BOO and BOOT arrangements (hereinafter collectively referred to as BOO(T)), and regional ownership of nuclear power plants (NPPs). The discussions are in context with the nuclear infrastructure development approach described in NG-G-3.1, 'Milestones in the Development of a National Infrastructure for Nuclear Power.'

The objective of this publication is to facilitate an understanding of the use of alternative contracting and ownership approaches for deployment of nuclear power plants by identifying the general applicability of the approaches, their potential benefits and challenges, and specific considerations for their implementation. This publication is not intended to recommend a preferred approach to contracting and ownership for an NPP. Instead, it should be viewed as a description of multiple options where each case is being considered on its own merits. Therefore, the suitability of any one approach is dependent upon the national situation within a Member State.

1.3. STRUCTURE OF THE REPORT

This report is structured as follows: Section 2 discusses the classical approaches to NPP development; Section 3 discusses the motivation for seeking alternative approaches; Section 4 briefly describes host country responsibilities; Section 5 then discusses BOO(T) structures in detail; Section 6 focuses on the Regional Approaches and the motivation for such approaches; and finally Section 7 presents the conclusion.

The report also discusses some recent examples of alternative contracting and ownership approaches in the Appendices, in the form of case studies.

1.4. USERS

The target audience includes those individuals in governmental organizations, utilities, other industries, and regulatory bodies responsible for planning the development of the infrastructure for a nuclear power programme. This includes the Nuclear Energy Programme Implementing Organization (NEPIO) and the future owners of the NPP [2].

Ideally, this publication should be read only after the user has first reviewed other IAEA publications that establish the guidelines for developing a national nuclear power programme. Only after a sense of the full breadth of a national nuclear power programme is understood can a meaningful assessment of alternative contracting and ownership approaches be carried out.

2. CLASSICAL CONTRACTING AND OWNERSHIP STRUCTURES FOR NUCLEAR POWER PLANTS

In order to understand the alternative contracting and ownership approaches that are described in subsequent sections, it is important to provide a conceptual framework within which to discuss these approaches, as well as a brief overview of the historical approaches that have been used or considered for national nuclear power programmes throughout the world.

2.1. STAKEHOLDERS, RISK ALLOCATION, CONTRACTING AND OWNERSHIP

In order to distinguish between the various contracting and ownership models to be discussed in this document it will be useful to highlight the key aspects in which such models can differ. The purpose of this section is to identify these key aspects, and to provide a terminology which will help in their discussion.

An NPP project will run over many years, and will involve many different activities. Various project stakeholders will carry out a range of different functions, such as designing the NPP, operating it, disposing of used fuel, and so on. The functions to be carried out by these stakeholders will typically be defined by contracts setting out their rights (usually to some kind of payment) and their responsibilities (usually to carry out some service, and/or to deliver equipment, spare parts, fuel etc.).

It is important to recognize that many of these functions will involve financial risk, in that the cost of carrying them out may exceed what was initially expected. Crucially then, a key aspect of all stakeholders' contracts will be the way in which they allocate that risk. For example, a fuel supply contract might allocate the risk of changes in the price of key commodities such as uranium to the fuel supplier by specifying that fuel be delivered at a fixed price. Alternatively, the risk of such changes could be allocated to the owner of the nuclear plant which is buying the fuel, *via* contractual clauses specifying that the price to be paid to the supplier will increase in line with increases in uranium prices.

Risk allocations like this will be embedded in all of the contracts which are signed and implemented during a nuclear project's lifecycle.

Figure 1 illustrates a very simple contractual framework such as might be in force at the outset of an NPP project. It is not intended to be comprehensive. The left-hand side of Figure 1 illustrates the contracts which will govern just three key functions which will need to be performed if the project is to be delivered: the supply of a Nuclear Steam Supply System (NSSS), the Engineering, Procurement and Construction (EPC) of the NPP, and the supply of fuel to the NPP. Each of these functions is governed by an agreement (contract) – and all of these agreements will include language which will effectively allocate the financial risks involved in supplying a NSSS (or carrying out EPC activities, or supplying fuel) between the supplier and the owner.

The top of Figure 1 illustrates two possible ownership relations (represented by dashed lines). The ownership possibilities shown represent 'ultimate' ownership in that if the owner of the plant is a sovereign government then the 'ultimate' owners are taxpayers – whereas if the owner of the plant is a corporate entity then the 'ultimate' owners are the shareholders of that corporate entity.

It is important to recognize that 'ownership' will generally give rise to *rights*, *responsibilities* and *exposure*. Ownership of an asset such as an NPP will give the owner the *right* to the revenues generated by that asset, but also the *responsibility* to make payments agreed with contractors. In general, ownership will also result in *exposure* in the sense that failure to make such payments may result in the effective loss not only of the asset itself, but also, depending on national legislation, of other assets to which the owner holds title.

For corporate ownership, the question of which of the owner's assets creditors will be legally entitled to take possession of in the event of the owner's bankruptcy is the question of

'recourse'[2]. A 'full recourse' legal structure means that all of the owner's assets – including those not connected to a particular project – are at risk in the event of bankruptcy. In contrast, a 'limited recourse' refers to a situation in which only a limited range of assets (typically those associated with the project in question) are at risk. This is a distinction which will be central to the discussion of the 'Project based model' of contracting and ownership discussed below.

In general, in the event that any project (such as an energy project or a road project) enters bankruptcy, under standard commercial law, owners typically only have access to whatever residual value remains in a bankrupt project (if any) after creditors have been paid in full. In this context it is said that creditors (holders of debt) enjoy 'priority' over shareholders (holders of equity).

In this context it is important to note that a common feature of the 'classical' contractual and ownership models discussed below was that much of the risk surrounding a nuclear project was ultimately transferred (indirectly) to taxpayers, or to power consumers, or to both. This was because either the plant was owned and operated by a state-owned company to which taxpayer subsidies could be transferred in the event of (for example) construction cost overruns, or else the plant was built and operated within a regulated market that allowed all 'reasonable' costs associated with the plant to be passed on to power consumers ('ratepayers') via adjustments to the price they paid for electricity.

Another common feature of these models is that it was the taxpayers and/or ratepayers of the *host government* (i.e. the government of the jurisdiction within which the plant was physically sited) who were exposed to the financial risks associated with the project.

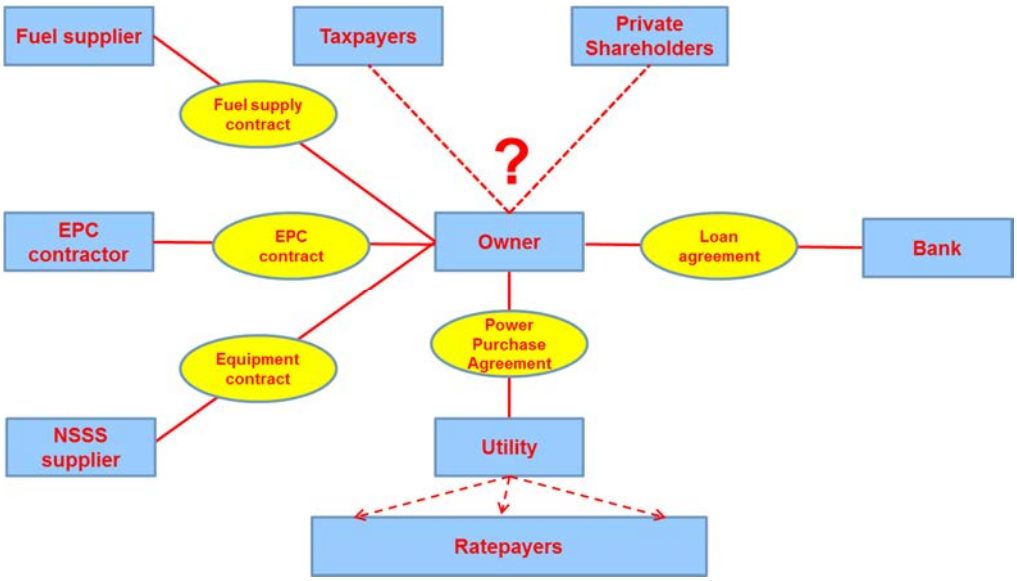

FIG. 1. An example of a contracting structure.

[2] Note that the issue of *recourse* will likely be of more relevance in situations involving non-government owned entities; typically the resolution of financial difficulties involving government entities will involve taxpayer subsidies rather than the bankruptcy which would lead to considerations of the nature of recourse.

In Figure 1, the right hand side of the chart illustrates one possible form of debt financing, in which a bank provides the debt component of the capital required to finance the project, under terms and conditions governed by a loan agreement.

It should be noted that the owner will be the counterparty to all of the contracts discussed here – the contract with the fuel supplier, the contract with the Engineering, Procurement and Construction (EPC) contractor, the contract with the NSSS supplier, and the loan agreement. Additionally, its role as counterparty may extend beyond the *direct* role shown in Figure 1 to an *indirect* role – as would be the case if the EPC contractor were to subcontract with another company to carry out the construction (C) function (or a part of it). However, if the owner were to negotiate a fixed-price contract with the EPC contractor, it would be effectively insulated from potential financial risks which could arise as a result of any problems encountered by the EPC's sub-contracts.

By carefully designing and entering a contract with a stakeholder which carries out ('bundles') several functions (e.g. E + P + C) the owner can custom-make a single bilateral (i.e. two party) risk allocation to suit itself, rather than entering into multiple risk sharing contractual relationships. The contracting company will however usually charge a risk premium for taking on and managing these risks, which will be incurred across a range of different functions, but the owner may find such an arrangement preferable if the contracting company understands and can manage the risks better than the owner does.

At the bottom of Figure 1 a contractual relationship is shown which illustrates a relationship between the 'ultimate' customers (electricity 'ratepayers') and the NPP owner. It also shows an intermediate entity (utility) exists between the NPP owner and the 'ultimate' customer base, necessitating a power purchase agreement (PPA). This is perhaps a more recent model than that which typically characterized, for example, the United States for many years, in which the NPP owner carried out the function of operator as part of the utility itself. The key financial terms of the owner-utility relationship will usually be contained in a PPA. Once again, risk allocation will be reflected in the terms of this contract. For example, the risk that excess system capacity may result in insufficient power demand may be allocated to the utility via a so-called 'take-or-pay' clause whereby the utility must pay the NPP owner for power which it could have generated even if that power was not actually generated due to lack of demand by the utility's customers. A PPA is effectively a guarantee of a secure revenue stream to the owner of an NPP. As such, it provides a degree of financial security which will be attractive to investors – both lenders and shareholders.

The models of contracting and ownership discussed in the remainder of this document can be understood in terms of the concepts and ideas discussed above. Underlying the document is the recognition that views regarding ownership and contracting models are evolving. Since both ownership and contracting are largely about risk, and the shifting of risk, an underlying theme of this document is about the appropriate allocation of risk. Alternative contracting and ownership approaches are about shifting more risks away from the domestic taxpayers and/or ratepayers of the host country and achieving a more efficient allocation of those risks.

The following sub-sections examine some key aspects of the classical and 'alternative' models.

2.2. NPP OWNERSHIP AND FINANCING

Historically, as discussed above, a common feature of the contractual and ownership models employed for nuclear projects was that much of the risk surrounding such projects was ultimately transferred to taxpayers, or to power consumers, or to both. This was because either the plant was owned and operated by a state-owned company to which taxpayer subsidies could be transferred in the event of construction cost overruns, or else the plant was built and operated within a regulated market, which allowed all 'reasonable' costs associated with the plant to be passed on to power consumers. Specifically then, nuclear power development occurred either (i) as part of a national nuclear power programme that has been led by the host government (e.g. France, India, China), or (ii) by national or regional utility companies that have been able to recover project costs through a regulated rate base (e.g. the current U.S. nuclear fleet).

However, governments are increasingly looking for private investors to finance and bear more of the risk associated with new infrastructure investments. The reasons for this are complex, but a major factor in some regions of the world such as Europe and North America, is that there is now less opportunity to cover development costs through the regulated customer base as a result of electricity market liberalization. Instead, potential NPPs in those regions must be assessed on the strength of the underlying economics of the project, within a competitive market structure.

The following describes the two basic historical or 'classic' NPP financing structures (the 'sovereign based' and 'corporate based' models), but goes on to describe a third (the 'project based model') which has not been used in the nuclear context to this point, but which has attracted some recent interest. [3].

Sovereign based model
Under a sovereign based model, investment in the NPP is financed through contributions from the national (sovereign) budget and/or borrowing. Often, borrowing (if any) will take place as part of overall government borrowing, rather than being identified as being for specific NPP purposes, and lenders will implicitly have the same assurance that they will be repaid as they would enjoy if they were to lend to the national government for general purposes (e.g. by buying its bonds) . Traditionally, governments have been regarded as being highly likely to repay lenders, since they have a reliable source of stable revenues under their control - the tax base. Under the sovereign based model, the financial risk that the investment will not produce revenues sufficient to cover its costs and provide a return (profit) is ultimately borne by taxpayers. A contractual framework is needed to structure the project.

Corporate based model
Under a corporate based or balance sheet finance model, investment in the NPP is financed through a combination of debt and equity obtained by a corporation (company) on commercially driven terms. A bank or bond holder which lends to the corporation has a claim against its entire cash flow (unless the loan is secured against a particular asset). The financial risk that the investment will not produce revenues sufficient to cover its costs and provide a return (profit) is borne by all providers of capital to the corporation (but primarily by equity providers/shareholders) since lenders' claims on corporate revenues and assets typically have priority. Similarly to the sovereign based structure, some sort of contractual framework is needed to structure the project.

Project based model

Recently there has been some interest amongst Member States as to the potential viability of a project based structure. Under this structure, which has been widely used in the oil and gas sector, investment in a project is financed through a combination of debt and equity (as in the corporate based model) but, crucially, lenders have recourse only to the revenues and/or assets of the project itself and not to any other revenues and/or assets of the project's owner(s). Legally, the project in question is financially protected since it is structured so that lenders have no right, in any circumstances, including financial distress of the project, to revenues or assets other than those of the project itself. Typically, this is achieved by establishment of a 'special purpose vehicle' or SPV. Thus project owner(s) do not expose their entire balance sheets to the risks arising from a single project. Lenders agree to finance the project purely based on their expectations as to its future viability and profitability, and their assessment of the value of the asset to which they will have access in the event of financial distress (typically, a semi-constructed facility). Comprehensive contractual and financing arrangements are required to support a project based structure.

It is important to note that to date there has never been a project financed NPP. The likely reason for this lies in the perceived value of the asset to which lenders will have access in the event of financial distress. While there may be a large number of civil engineering companies capable of completing a half-built natural gas terminal, it is unlikely that completion of a half-built NPP could proceed smoothly. The value to lenders of assuming ownership of such a facility in the event of financial distress in a project based context is questionable and as a result they will be reluctant to lend to that project.

Variations in the above three models are possible, thus providing flexibility for potential innovative techniques that are crafted to suit the specific case. The economics and legal/regulatory environment can put a range of constraints on these models. Figure 2 below shows the relationship between the different models relative to risk, measured by the following parameters that affect the allocation of risk:

- Degree of market unbundling[3] and market liberalization: the project model scores highest against this parameter, with the sovereign and corporate model scoring lower;
- Amount of risk transferability (from public to private sector): the corporate model (assuming the corporation is not state owned) scores the highest against this parameter, followed by the project model, then the sovereign model;
- Degree of recourse on shareholders: the corporate and sovereign models score the highest against this parameter (with the government being viewed as a shareholder), followed by the project model.

[3] 'Unbundling' refers to the separation of vertically integrated components of a utility: electricity generation, distribution, and retail utilization.

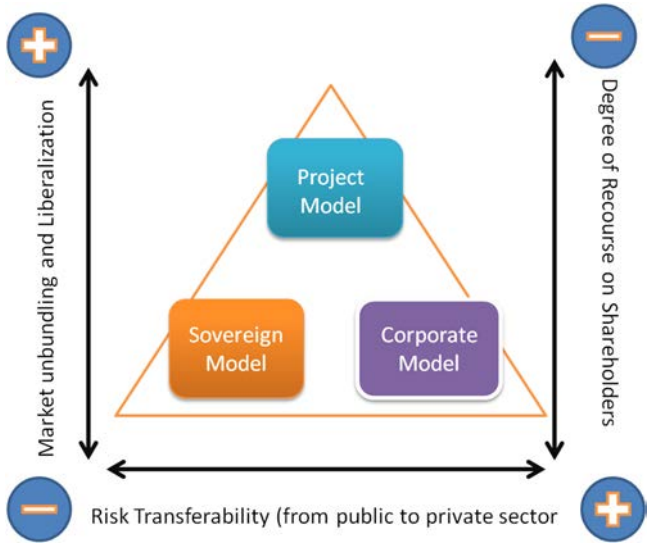

FIG. 2. Different contracting models and financing techniques.

2.3. CONTRACTING STRUCTURES

Distinct from the issue of ownership of the NPP is the mechanism by which the project will be delivered (i.e. the contract to deliver the NPP). Three main contracting structures have been used in the development of an NPP. In each case, the owner arranges financing for the project.

Turnkey Contract (i.e. Engineering, Procurement, and Construction (EPC))
First, the owner can acquire the nuclear unit under a turnkey contract, whereby the owner enters into a contract with a single contractor or a consortium of contractors (the EPC Contractor) that will deliver the NSSS technology and construct the facility [4]. Under this approach, the owner monitors the project but is looking to the EPC Contractor to deliver the project under the terms of the turnkey contract.

Split-package contract
The owner can divide the procurement based on the three main elements of the plant: the nuclear island, the turbine/generator, and the balance of plant. This is termed a split-package approach, where the owner might work with different entities, based on perceived strengths and/or relationships, also possibly mixing foreign delivery (nuclear island) with domestic delivery (balance of plant and, perhaps, turbine/generator). With the three elements occurring simultaneously, the owner will need to take more of a managerial role (as opposed to the more monitoring role under the EPC structure), in order to ensure that the three elements come together successfully.

Multi package contract
Under this contract the owner can serve as architect-engineer, whereby it enters into a myriad of contracts for various services (engineering, design, and construction) and equipment. Under this approach, the owner should have the experience and internal capability to manage multiple contracts. This structure has been used in France and the United States by experienced utilities like EDF (Electricité de France S.A) and TVA (Tennessee Valley Authority), respectively. These owners then became the operators of the plants following

completion of construction. It is not likely that that this approach could be used by an owner looking to develop its first NPP, since it would typically lack the necessary expertise.

2.3.1. Pricing

A key element of the contracting structures is the pricing under which the contract(s) will be delivered. While there can be multiple variations on the theme, the three primary means by which projects can be priced are discussed below:

Lump sum or fixed price contracts
Under a lump sum approach, the EPC contractor agrees to deliver the project for a fixed price, based on a pre-agreed schedule. If the project ultimately costs more than the fixed price, the additional costs are borne by the EPC contractor, unless such cost changes have been mutually agreed during the construction process (e.g. if the owner has requested a change in scope). Whereas a lump sum contract is designed to provide greater project cost certainty for the owner, such certainty usually comes at a higher cost. Given the increasing size and complexity of nuclear power projects, the contractor/vendor community has become increasingly reluctant to offer lump sum contracts.

Cost reimbursable model
Under a pure cost reimbursable model, the project owner reimburses the EPC contractor for all costs incurred during the project. In a variant of this approach the parties set a 'target' price for the work. However, if the project costs exceed the target price, the overrun risk is borne by the owner. Of course, given the size of the project, the owner would expect that the contractor shares some of the risk by losing some of its economic benefit (e.g. reduction or return of fee). An owner may wish to use cost reimbursable models as a means of driving down contract costs (while assuming the risk of cost overruns). A cost reimbursable approach is designed to pass along the true costs of the project to the owner, who may find it difficult to embark upon a massive capital outlay without having a full understanding of the final cost of the project. Without having the ability to pass all costs through a regulated rate base, owners are necessarily reluctant to pursue pure cost reimbursable structures.

A pure cost reimbursable approach does not require a target price element; however, the target price aspect is utilized to impose a performance metric (with consequences) on the EPC Contractor.

Hybrid approach
Under a hybrid approach, a combination of fixed and reimbursable elements is used. This approach can be done within one contract or spread across contracts in a split-package approach. For example, under a split-package approach, cost reimbursable pricing could be used on the nuclear island, while a lump sum approach could be applied to the turbine island and balance of plant, which are viewed as carrying less risk. Alternatively, under one contract, fixed pricing could be used for engineering and design, but cost reimbursable might be more appropriate for labour and certain materials that might involve greater price uncertainty due to market conditions. Another option would be to apply a 'phased' contracting approach, whereby elements of the contract price are initially cost reimbursable or target numbers, but then become fixed as engineering and design progresses and/or certain key subcontracts (especially major equipment purchase orders) are awarded under fixed terms.

As the cost of constructing a nuclear power plant increases, owners continue to put pressure on contractors and vendors to provide price certainty. How the balance is struck between the two sides is one of the most difficult issues in concluding contract negotiations. Owners have to weigh their desire for price certainty against the desire not to overpay for contingency and market uncertainty. Thus, finding ways to share risks between the two sides necessarily leads deal structures to move towards hybrid forms. Taken to the extreme, such hybrid structures result in new delivery models for the nuclear power sector, which will be addressed in the coming sections.

3. MOTIVATIONS FOR ALTERNATIVE APPROACHES

Making the decision to embark upon a national nuclear power programme (or to expand a long-stable national nuclear programme) is a major undertaking for any Member State. Such a decision involves careful planning, as well as a long-term commitment to the national nuclear power programme and requires substantial time and resources (e.g. human, financial, etc.). The process involves the development of a nuclear power project within the overall national nuclear power programme; consequently, the Member State should consider both the NPP project and the supporting infrastructure for the NPP. Such infrastructure should include legal, regulatory, technological, human resources, and industrial support.

When considering the development of a national infrastructure for nuclear power, a Member State might see significant challenges when comparing its current financial, industrial and skills capacities against the desired implementation schedule. The Member State might find that traditional contractual and ownership approaches do not meet its needs. In such a case, there may be a desire to explore alternative contracting and ownership approaches.

3.1. THE DESIRE FOR ALTERNATIVES

For a Member State that is launching a national nuclear power programme, a number of considerations will affect its project development and execution strategy. They include:

Possible lack of technical capability and skilled personnel
A Member State embarking on a nuclear power programme may not have the construction, engineering, manufacturing, and operating knowledge and capacity necessary to develop its first NPP locally. Many of these capabilities may need to be out-sourced, in order for the NPP project to be successful.

The human resource capabilities needed by the Member State will include significant demands for experienced personnel, due to needing to staff the owner, the operator, and the regulatory body. If such talent does not exist locally, it will have to be brought in or trained, all of which will take considerable time and financial commitment. If the owner and operator functions can be transferred to others, the limited resources can be focused on staffing the regulator.

Possible lack of project management expertise
The Milestones Approach envisions a period of ten to fifteen years for a Member State to achieve its first NPP. Historically, even this timeframe has proved to be challenging. Therefore, by seeking external support, such as project management and other expertise, it could enhance the ability of the country to achieve its objectives.

The Milestones Approach identifies 19 issues over three phases of development, and highlights the level of infrastructure needed. This effort involves a significant financial and development commitment with sustained host government support over a prolonged period of time. A Member State might not have the financial and human resources needed to accomplish all of these goals. Consequently, it may wish to 'outsource' or share some of the responsibilities, especially related to managing the project, and thereby enabling it to focus its limited resources on core competencies such as safety, security, and licensing that must reside with the Member State.

Leveraging financial resources
Significant financial obligations are required, both to develop a national nuclear power programme and to finance one or more NPPs. A Member State might therefore look to transfer or to share some of that burden, which includes infrastructure funding (programme) and financing (project). By bringing in a developer, the Member State can limit its own financial investment in the project, especially if multiple units are desired, thereby leveraging the Member State's limited financial resources. However, it is important to note that such leverage will generally come at a price. The developer will only offer financing on terms which give it a return on its investment in excess of what it could earn by deploying its financial resources in similarly risky investments elsewhere. If a Member State enjoys a strong international credit rating it may be able to borrow at more advantageous rates itself.

Regional and strategic partnership and risk sharing
A Member State might not need power in excess of 1000 MW(e), or its grid might not be large enough to accommodate such a large facility. In such an instance, a Member State may wish to seek out a regional partner in neighbouring countries which import electricity, so that it can still enjoy the economies of scale that accompany a larger-scale NPP.

A Member State might feel certain pressures in trying to integrate all aspects of NPP development. These can include: EPC functions, NSSS technology operations and maintenance, ownership, fuel supply, financing, etc. Looking to an external partner that can deliver certain aspects of the project would remove some of the pressure that comes from a Member State attempting to deliver the project on its own. In this instance, the nature of the partnership need not necessarily be regional – partners who bring expertise and/or capacity pertaining to particular functions are often referred to as 'strategic' partners.

Risk sharing and risk allocation are key aspects of financing a project through to completion. Careful contracting and strong project management skills are the key elements in commercial risk allocation and mitigation, even for governments. In principle, risk is most efficiently allocated to the party that can best control the risk, and the cost of risk tends to vary with the efficiency of this allocation. How much risk is acceptable, and with what kind and level of compensation, varies with the sponsors and investors. This also depends not only on risk aversion but also on perception, and on the actual ability to manage, mitigate, secure, or shift risk. By bringing in a developer, the Member State might be able to transfer or share some of the financial risks associated with the project to the developer.

Beneficiary to pay
If a Member State has difficulty in removing existing subsidies, turning to an outside developer may increase acceptance by the public that the beneficiaries of a project (i.e. the customers) should pay for the full cost rather than relegate it to the government/ taxpayers.

Given the aforementioned considerations for NPP development by a Member State, it is natural to consider alternative contracting and ownership structures in the context of nuclear power generation. In choosing a contracting approach, it should be recognized that the motivations will differ among Member States. A Member State should consider what its long term goals are before embarking on a particular procurement path, recognizing that some of the alternative approaches discussed in this document reduce some of the control that the Member State might otherwise have by developing a programme along the more classical lines discussed previously.

4. HOST COUNTRY RESPONSIBILITIES

Regardless of the ownership and contracting structure that is chosen by a Member State, certain responsibilities should remain with the government of the host country. They involve decisions and accountability that reside, and should remain, at the country level. While EPC functions, financing, fuel supply, operations, and maintenance can be provided by the developer, certain activities, which involve regulatory and international functions, or relate to the environment or the general welfare of the population, can only be provided by the host country. These responsibilities may include (in no particular order):

- National commitment to a nuclear power programme;
- Involvement of the necessary stakeholders and public outreach;
- Site selection;
- Legal and regulatory framework including licensing and compliance;
- Adherence to international legal instruments, bilateral agreements;
- Civil liability for nuclear damage;
- Safety, security, safeguards implementation;
- Spent fuel and nuclear waste policy;
- Policy for Decommissioning of NPP;
- Regulation and strategic management of the national electrical grid;
- Developing and maintaining the human resources required to manage the programme.

Since a national nuclear power programme is a long term commitment, on the order of one hundred years, it raises several questions in the context of alternative contracting and ownership approaches that should be considered. Some of these are given below:

- How can a programme based on external expertise be sustainable, or is a transition to the development of local capabilities/staffing an essential feature of any long term plan?
- Does the host country accept having a foreign developer make major decisions on a project that will have an impact over a one hundred year period?
- In case the developer does not respect its contractual obligations in terms of nuclear safety, how can the host country ensure the safety and security of the installation? Is the host country capable of assuming control over the facility?
- In case of a major crisis (e.g. civil war) that may lead to the repatriation of non-nationals, how can the host country ensure the safety and security of the nuclear facilities and nuclear material?

- Nuclear waste has to be managed and secured over several generations. Can a host country rely only on foreign expertise, ensured by a commercial contract, to deal with this major safety issue?

4.1. SAFETY, SECURITY AND SAFEGUARDS CONSIDERATIONS

The need to maintain nuclear safety in operations and the security of nuclear materials and facilities, and preventing the proliferation of nuclear weapons, makes nuclear energy unique among the various energy options. For the programme to be sustainable, it should be recognized that nuclear safety, security, and international safeguards is a national responsibility and that this responsibility cannot be outsourced. Nuclear safety should be evidenced by a strong safety culture and a competent, independent national regulatory authority. Nuclear security should be evidenced by a strong nuclear security culture and appropriate allocation of roles to all of the competent authorities involved, It must be recognized that nuclear safeguards involves international treaty obligations between the Member State and the IAEA.

The IAEA Safety Standards [5] are based on the principle that nuclear safety is a national responsibility that cannot be delegated. The prime responsibility for safety must rest with the person or organization responsible for facilities and activities that give rise to radiation risks – the Licensee.

The IAEA Nuclear Security Series [6] is also based on the principle that nuclear security is a State responsibility. Nuclear security focuses on the prevention of, detection of and response to criminal or intentional unauthorised acts involving or directed at nuclear material, other radioactive material, associated facilities or associated activities.

Nuclear Security and Nuclear Safety have in common the aim of protecting persons, property, society and the environment. Security measures and safety measures have to be designed and developed in an integrated manner[4] and also in a way that the security measures do not compromise safety and safety measures do not compromise security.

- The person or organization responsible for any facility or activity that gives rise to radiation risks or for carrying out a programme of actions to reduce radiation exposure has the prime responsibility for safety.
- Authorization to operate a facility or conduct an activity may be granted to an operating organization, known as the Licensee.
- The Licensee retains the prime responsibility for safety throughout the lifetime of facilities and activities, and this responsibility cannot be delegated. Other groups, such as designers, manufacturers and constructors, employers, contractors, and consignors and carriers, also have legal, professional, or functional responsibilities with regard to safety. For example, while the EPC Contractor has responsibility for delivering an NPP that meets the specifications set forth in the contract, which includes safety criteria, the

[4] "Safety measures, nuclear security measures, and arrangements for the State system of accounting for, and control of, nuclear material for a nuclear power plant shall be designed and implemented in an integrated manner so that they do not compromise one another." IAEA Safety Standard Series No. SSR-2/1, (2012) Safety of Nuclear Power Plants: Design

Licensee (following transfer of care, custody, and control of the NPP) will be the party that is responsible for the operation of the NPP.

These responsibilities are to be fulfilled in accordance with applicable safety objectives and requirements, as established or approved by the regulatory body, and their fulfilment is to be ensured through the implementation of a management system.

An effective legal and governmental framework for safety, security, and safeguards, including an independent regulatory body, must be established and sustained. A properly established legal and governmental framework provides for the regulation of facilities and for the clear assignment of responsibilities. The host country is responsible for the adoption within its national legal system of such legislation, regulations, and other standards and measures as may be necessary to fulfil all its national responsibilities and international obligations effectively, and for the establishment of an independent regulatory body. The regulatory authority must be fully staffed, properly funded, trained, and familiar with the technology it is to regulate. The regulatory body must have clear regulations, processes, and procedures, along with the corresponding authority, to perform its designated tasks. The regulatory body should:

- Have adequate legal authority, technical, and managerial competence, as well as the human and financial resources to fulfil its responsibilities;
- Be effectively independent of the licensee and of any other body, so that it is free from any undue pressure from interested parties;
- Set up appropriate means of informing parties in the vicinity, the public and other interested parties, and the information media about the safety aspects (including health and environmental aspects) of facilities and activities and about regulatory processes;
- Consult parties in the vicinity, the public and other interested parties, as appropriate, in an open and inclusive process.

Host countries and regulatory bodies, therefore, have an important responsibility in establishing standards and the regulatory framework needed for protecting people and the environment against radiation risks, including assurance of adequate emergency planning and response capabilities. Further issues of safety, security and safeguards related to alternative contracting and ownership approaches are discussed in Sections 5 and 6.

5. BOO(T) STRUCTURES

BOO(T) structures have been extensively used in non-nuclear sectors , and the goal of this section is to explore their applicability to the nuclear sector. BOO(T) is a general term that can encompass a number of different concepts and this document discusses general thematic considerations applicable to nuclear power. The analysis of potential BOO(T) structures is intended to highlight some of the important aspects and, as such, is not intended to be comprehensive. This section should therefore be viewed only as a framework for discussions for further analysis, at the level desired.

5.1. DESCRIPTION OF THE BOO(T) CONCEPT

In a BOO (Build-Own-Operate) or a BOOT (Build-Own-Operate-Transfer) structure, an private or non-private entity is granted the right by the host country to develop, finance, build, own, operate, and maintain a facility for a specified period, during which the entity retains the

revenue and associated risk. Under a BOOT, at the end of the designated period, ownership of the facility is transferred to the host country.

A key stakeholder in the BOO(T) arrangement is the developer, which is the entity that takes responsibility for delivering the project, typically in return for being granted some kind of concession (such as the exclusive right to supply a particular customer base often on terms set out in a PPA). Very simply, the BOO(T) structure places the responsibility for delivering the project on the developer.[5] The developer will often be a project company (i.e. SPV), which could be comprised of a single entity or consist of a joint venture (JV) which has been set up by a number of partners in order to limit their individual exposure to financial risk, with the terms and conditions of each partner's shareholding in the developer typically defined *via* a Shareholders' Agreement. Often, the partners who contract to act jointly as the developer (*via* the SPV) have relevant capabilities, such as technology specific expertise, local knowledge, engineering, procurement, and construction experience etc.

In general, the Shareholders' Agreement may make provision for the sale of one or more partners' shares at the point in the evolution of the project lifecycle at which a partner's particular expertise (e.g. construction) ceases to be as relevant to the project's success. In this sense the developer is fluid. For example, a partner with EPC expertise may sell its shareholding to an experienced operator at a later stage in the project lifecycle. Alternatively, such an operator may be part of the developer from project inception.

BOO and BOOT structures have been used successfully in a variety of large engineering projects, but the Akkuyu project in Turkey is the first attempt in the nuclear industry.

Build

The developer is responsible for building the project, which in general includes the selection of the technology since one or more partners may be strongly linked with a particular technology (for example a national technology). The host country may establish certain project parameters that must be met by the developer. How much input the host country has on the overall project parameters will be based on the desires of the host country - whether it is focused merely on the output (i.e. getting power) or on both output and the local participation in the project.

It is important to recognize that economic development and technology choice are linked in the nuclear industry. Consequently, to the extent that the Member State is interested in national development as part of the national nuclear power programme, it may choose to be heavily involved in the technology selection, or in the selection of the developer (which often amounts to the same thing).

Given its preferred technology, the developer may then decide on a contracting strategy for the engineering, procurement, and construction of the project. Alternatively, an EPC contractor may already be a partner within an SPV which constitutes the developer. In such a

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[5] This Section focuses on a BOO(T) structure. However, the reader should be aware that another variation called a BOT (Build-Operate-Transfer) structure has been employed in other sectors, whereby the developer never takes an ownership stake in the project. In such an instance, the host country retains ownership (either directly or indirectly) in the project. Of course, the economics of the project have to be structured to incentivize the developer to take project development risks without the promise of a favorable return on equity. However, the BOT structure does eliminate the foreign ownership question, which could be a sensitive issue for a Member State, especially from a public opinion perspective. While a BOT structure might be of interest for further consideration by certain Member States, this document focuses on the full BOO(T) structure, given that financing is one of the key challenges for NPP development.

case, if the developer has internal capabilities to manage all three elements of execution, then it can perform this role itself. However, if the developer does not have such capabilities in house, a separate EPC Contractor would be used.

A critical component of the build phase of the project cycle is the provision of financing for the project. By choosing a BOO(T) structure, the host country transfers the financing component to the developer. Through a combination of equity and debt financing, the developer should then provide the capital necessary to develop the project and bring the NPP to commercial operation. Of all the challenges relating to a nuclear power project, the financing component will be the most significant one faced by the developer, recognizing that the developer's balance sheet will need to be of sufficient strength to support the needs of the project.

A further component of the structure is having an assured fuel supply. In a BOO(T) structure, the developer should provide for all fuel, over the operating lifecycle of the project (as judged by the developer r's length of involvement, whether through the useful life of the project or up to the point of transfer). When considering the fuel aspects of the project, arrangements should also be made for spent fuel. If spent fuel is to be stored permanently within the host country, then the developer should coordinate such arrangements with the host country.

Own

The developer takes ownership risk. Ownership risk is essentially completion, profitability and cost recovery risk. As noted above, by being the owner of the project, the developer is responsible for providing financing for the project and thus takes responsibility for the economic viability of the project. Such economic viability is judged by the developer's own corporate governance and investment decisions, as well as by financing institutions that are supplying debt financing for the project.

Given the scale of a nuclear power project, in terms of both overall cost and the length of the development period that precedes commercial operation, completion risk is the greatest risk in a nuclear power project. Such completion risk is evaluated on whether or not the project is completed on time and on budget.

By turning to a developer under the BOO(T) structure, the host government is placing the burden of completion risk on the developer. Considering the history of NPP development, where cost overruns and schedule delays have been major challenges for NPPs, a developer will put a risk premium on such an exposure. Higher risks have a direct effect on the overall cost of a project (i.e. higher risks = higher costs). Noting that schedule delays can be caused both by project execution and by regulatory reviews (and, perhaps, changing regulatory requirements during the construction period), the developer will look to share some of this risk with the host government in areas where the host country is involved in the process.

It is important to recognize that, given current market conditions, ownership will likely involve foreign ownership (either directly or indirectly). For the BOO(T) structure the foreign developer will have the controlling equity interest in the NPP. This foreign ownership (and control) component will need to be accounted for in the laws and regulations of the Member State.

Operate
The developer must operate the project over an agreed period of time. Being both the owner and the operator of the nuclear power plant involves a number of considerations for the developer.

Firstly, at the time of commissioning, the developer must have the capabilities to operate a nuclear facility with trained operators. These operators may come from outside the host country or may be from inside the country (either persons with existing expertise or those that are suitably trained by the developer).

Secondly, the developer will have responsibility for all licensing aspects of the project. Such licensing will involve close work with the regulatory organization within the host country so that the project obtains licenses for construction and operation of the facility. Therefore, consideration should be given for regulatory requirements not just for the operation of the project but also for initial coordination of licensing activities for the construction of the project.

Thirdly, during the operations phase, the developer will focus on the profitability of the project. The developer will need to understand the commercial regime under which it must operate the facility, and it will look for assurances from the host country regarding the revenue stream associated with successful operation. Such assurances could come from a pre-agreed PPA.

And finally, in the event that the structure is BOO and not a BOOT, the developer must have a decommissioning strategy for the facility, including funding.

Transfer
If the project structure contemplates that the developer will not remain in an ownership/operations role for the life of the NPP, the project structure will need to incorporate a transfer of the NPP from the developer to the Member State.

The key difference between BOO and BOOT structures is, of course, the transfer. Under the BOO structure, the developer retains ownership throughout the life of the project. In contrast, under the BOOT structure, the developer ultimately transfers ownership of the project to the Member State (the host government, its designee, or a national utility) after a period established in the concession contract. Such transfer is made against payment of a transfer value, depending on the terms of the agreement between the concessionaire and the awarding authority.

Prior to the transfer occurring, the host country and other entities must develop the capability to own and operate the NPP. Thus, a training and knowledge transfer programme should occur, so that the transferee is prepared to take the asset at the end of the concession period.

A BOO(T) mechanism is a complex structure with multiple, inter-dependent agreements and contracts among various participants. A simplified example is given in Figure 3. The project company will be responsible for all aspects of operating the plant and will be the holder of the operating license. The composition of the project company may change over time as the construction is complete and the plant is commissioned and starts operation. Individual partners may sell their stake and new partners may join, depending on their interests.

In addition to the developer, major stakeholders in BOO(T) projects may include the Host country, one or more lenders (banks), suppliers, etc. In Figure 3, it is assumed that the project company has been set up as a JV between an NSSS supplier and an EPC contractor (which were shown as being linked to the 'Owner' via contracts). Their respective roles, shares of profits *etcetera* will be defined in the Shareholder Agreement.

Figure 3 also shows a bank as having provided the debt component of capital to the project (the developer having provided equity). A fuel supplier has been contracted, and the developer has the financial assurance of a Power Purchase Agreement (PPA) with a utility (the 'concession' often referred to in the context of BOO(T) structures). The PPA may be structured in such a way as to place various risks (such as the risk of insufficient demand for electricity) on the utility, and so perhaps ultimately on the ratepayers. The PPA is shown as being backed by a sovereign guarantee from the host country; in other words, if the utility becomes unable to honour the PPA (if it were to go bankrupt) then the host country would pay the developer the money it was entitled to under the terms of that PPA.

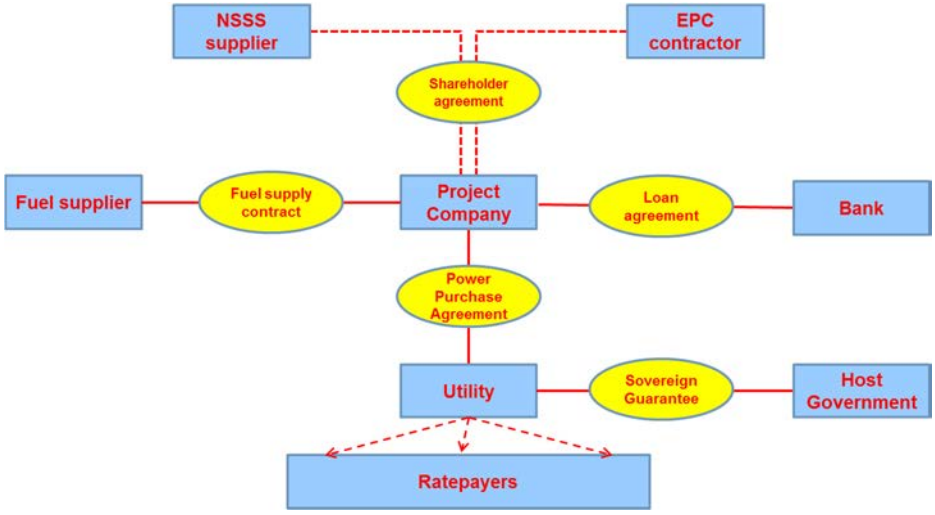

FIG. 3. An example of a BOO(T) structure.

5.2. BENEFITS OF BOO(T) – HOST COUNTRY PERSPECTIVE

Traditionally, there are several reasons for considering BOO(T) structures, some of these are discussed below.

Limited host country financial resources
In the event that a Member State is trying to develop a particular project, but lacks the financial capabilities to support the project, the BOO(T) transfers the financial responsibility for the project to the developer. The developer is responsible for a financing plan for the project including both debt and equity to support the project's implementation.[6]

[6] The aggregate project costs, over the lifecycle of the project may likely be higher for a BOO(T) project than a more traditionally structured project. Thus, the host government should balance the near term cost savings with greater costs over the life of the project. As noted herein, equity will come at a greater price than debt.

Limited host country technical expertise
If the Member State wishes to embark upon a new technology, but lacks the technical expertise (within the national utility and/or local industry), looking outside the national boundaries for international involvement can provide the capabilities that do not exist within the host country. The host country could also view a BOO(T) arrangement as a means of ultimately transferring know how and/or industry best practices to the host country over the period of the arrangement.

Leverage of limited resources
Using an outside developer to provide a public service, such as electricity, can serve as a means for a host country to leverage its limited resources. Instead of committing resources to the project in question, the host country can redirect such resources to other endeavours, limiting its financial commitment to the NPP to the 'off-take[7]' arrangements.

Risk transfer
Opting for a BOO(T) structure serves as a means of risk transfer in terms of the risk of bringing such a project to the market. In the event that the NPP suffers cost overruns or schedule delays, it is the developer that would endure the impact, not the host country. Considering that completion risk is generally viewed as the most significant risk to the NPP in development, such risk transfer from the public sector to the private sector might be considered to be a significant benefit for the Member State.

While the developer will be directly affected in case of any delays, the Member State could also feel a negative impact from the delay, if the guaranteed date for commercial operation is critical to meet national demand for electricity. In such a circumstance, the host country might want to consider including economic measures in the concession agreement, to account for the impact of such delays.

Accelerated timeline for project development
A developer with better capabilities and experience will be in a better position to deliver the project within the budget and scheduled timeframe, than if such project were developed through the host country which lacks such capabilities, means, and technical expertise. This accelerated timeline should be distinguished from those of a host country with limited technical expertise. In the latter case, the host country is truly unable to embark on a new technology, utilization of a BOO(T) approach can be viewed as buying experience, thereby facilitating faster project completion.

5.3. BENEFITS OF BOO(T) – DEVELOPERS'S PERSPECTIVE

Market entry
From the developer's perspective, another potential benefit of the BOO(T) structure is that it can facilitate market entry. If a large utility is looking to expand operations beyond its national borders, a limiting factor is that the electricity market in another country might be dominated by a national utility, making it exceedingly difficult for the foreign entity to gain access to the market. A BOO(T) opportunity, if structured properly by the host country as a concession, would allow the foreign entity to enter the marketplace in a manner that could

[7] Off take arrangement means that an entity, normally the host government or a utility, agrees to purchase the electricity from the nuclear power plant per a defined price structure and period of time.

ensure a proper equity rate of return. This access to the power market in the host country would otherwise be impossible due to the protected/preferred status of the national utility.

Sovereign backing
In the case where a PPA exists that covers a significant period of operations and is supported by a sovereign guarantee, the developer would have greater confidence in the overall project profile when compared to an opportunity without such a sovereign presence. In instances where Export Credit Agency financing is present, resulting in a sovereign presence on both sides of the deal, a developer would have even more confidence in such a project given the government to government relationship. It is important to recognize, however, that by giving the developer a sovereign guarantee the host country would be exposing its taxpayers to potentially large financial losses. Similarly, but depending on the terms of a PPA, giving the developer such a PPA may expose electricity ratepayers. While it might be expected that reduced risk faced by the developer as a result of such arrangements may result in their providing the host country with more advantageous terms elsewhere, it must be recognized that entering into such arrangements is inherently risky in itself – and may eliminate some of the supposed risk sharing advantages of BOO/BOO(T) arrangements.

Decommissioning for BOOT
From a developer's perspective, the BOOT structure has a certain attraction in respect to decommissioning, assuming that the own/operate period is sufficient to allow the developer to recover its investment costs and make a sufficient rate of return. By transferring the facility to the host country prior to the end of the facility's useful life, the developer avoids having responsibility for the actual decommissioning of the operating unit. Decommissioning is particularly challenging, as the operating life of the newer NSSS designs can range in excess of 60 years. Being able to forecast decommissioning costs and responsibilities over such a time horizon is particularly difficult for an equity investor. By transferring such responsibility back to the host country, such project uncertainty would not have to be estimated by the developer.

However, it would be essential for the host country to require the developer to set aside agreed amounts for decommissioning during the developer's operating period, thereby ensuring that (a) the developer bears a sufficient burden for decommissioning, and (b) the project demonstrates to the financial community that it is being environmentally prudent, and is considering the full lifecycle costs of nuclear development. On this latter point, it is to be expected that commercial financial institutions, and, more significantly, export credit agencies, will consider decommissioning in their lending decisions, making sure that the project has a decommissioning plan and is setting aside sufficient funds to support decommissioning (even though decommissioning will occur far beyond the term of the project loans). The host country should also take into account the risk that eventual decommissioning costs exceed the required funds set-aside from the developer, in which case the balance of decommissioning costs would be borne by the host country. Presumably, decommissioning costs could be factored into the transfer price paid at the end of the concession period.

The foregoing decommissioning discussion envisions a situation where the operating asset is transferred before the end of its operating life, as is the case under a BOOT structure. Under a BOO structure, transfer of the site would follow decommissioning and restoration of the site to a pre-agreed condition. In such an instance, the developer's operating plan would need to

account for such decommissioning costs. The pre-agreed condition becomes critical for structuring of the project.

The decommissioning strategy is also dependent on the ownership of the site. If the host country contributes the site to the project, with the project company leasing the actual site from the Member State, the terms of the lease would need to determine the return conditions. Moreover, such a site ownership structure could result in a risk allocation structure whereby the project company has limited obligations to restore the site, with the Member State taking some responsibility for restoration to a condition that makes the site suitable for secondary use. Such a structure would also eliminate a potential problem for a developer, not being able to resell the site post-decommissioning, as it would never have to acquire the site in the first place.

5.4. CONSIDERATIONS FOR BOO(T) STRUCTURES

5.4.1. Economic considerations and project risk

Investment recovery period
When transfer of the nuclear project occurs, it will strongly influence the economics of the project in the BOOT case. For the developer to be incentivized to enter into a BOOT arrangement, the project should be structured to clearly establish a period during which the developer will recover the costs of its investment and have the opportunity to make its desired rate of return on the project (i.e. the investment recovery period). Given the lengthy construction period for a nuclear power project, coupled with the high construction costs of a nuclear power plant, the investment recovery period will need to be much longer (unless offset by the pre-agreed transfer price), when compared to the BOO(T) structures used in other industries or in projects which rely on other technologies (e.g. combined cycle gas turbine).

The investment recovery period is, perhaps, more critical in the BOOT structure, given that the developer will not be able to recover his costs over the full lifecycle of the project, given that a transfer will occur at some point falling short of the expected useful life of the NPP. Consequently, the concession period preceding the transfer, together with any price paid by the host country at the time of transfer, will need to provide the developer with sufficient economic return to drive the investment decision at the start of the project and support full cost recovery with an appropriate rate of return. In other words, because the developer will not have an equity recovery period that matches the life of the asset, the rate of recovery will need to be accelerated, given the abbreviated ownership life. While industry data clearly demonstrates that nuclear power plants are very cost efficient during the operating phase of the units (when compared to other base load generation such as natural gas and coal generation), the BOOT structure denies the developer some of the benefit of cheap operating costs by shortening the recovery period. When considering that the latest nuclear designs offer a minimum 60 year operating lifecycle, the operating dividend is quite significant when balanced against the very high development and construction costs for a nuclear power plant. Therefore, the length of time during which a developer has the opportunity to recover its investment costs, and make the desired rate of return on the investment and the residual value

of the assets will be the greatest challenges for BOOT structuring – hence the need for careful consideration before developing a project under a BOOT scheme.[8]

While the construction period for a nuclear power project could run 60 months, the development period (the period from initial contemplation of a BOO(T) project through the commercial operation date) for a project is, in fact, much longer. A developer would need to invest considerable time and effort in assembling a team to cover all disciplines (as noted above), preparing a proposal, negotiating terms, doing preliminary site work, and obtaining licenses, all prior to beginning construction. This long time horizon can be fairly challenging for the project financial evaluation. One example is the United States Department of Energy seeking advice from rating agencies regarding their Nuclear Power Project Loan Guarantee programme, where the loan period is thirty years[9]. An initial challenge for the rating agencies was the long time horizon, as rating agencies simply had not rated projects, debt, and corporate balance sheets over such a long time horizon.

Power purchase agreements (PPAs) and incentives

In both BOO and BOOT structures, how the developer recovers his investment is critical to the structuring of the project. Traditionally, to create the proper incentives for the developer, the host country offers something of a protected revenue stream for the developer. In the case of a project like a toll road, the revenue is protected, based on projections of usage, through an agreed toll for users and a monopolistic position (i.e. the road). The power industry is different because the host country usually agrees to take the power generated from the facility, based on the availability of the unit and the usage of the power. Such off take arrangements, traditionally through a power purchase agreement, are structured in a manner under which the developer, as owner/operator, is paid under pre-established terms for both availability and for actual usage (often, structured as a 'take or pay arrangement'). The length of time of the power purchase agreement (as well as the credit strength of the entity purchasing the electricity) will be a key factor in the developer's economic analysis of the project.

Given the importance of the off take arrangement, the host country should secure its obligations (or those obligations of the national utility that could, in fact, be the off taker), either through financial instruments or sovereign guarantees. In crafting such requirements, the developer will look to the host country's past practices in meeting commercial obligations. Also, for successful execution of such arrangements the host country can consider tax exemptions, tax credits, interest free loans, equity participation, Government guarantee and revenue guarantee approaches.

Financial model

Based on the economics of such terms, the developer can then produce a financial model for the project to determine whether or not the desired return on investment is achievable (albeit not guaranteed, given that off take risks include meeting the desired commercial operation date and having the projected output and availability throughout the life of the power purchase agreement). To the extent that the off take terms are based on a pre-determined price, and offered from a credit-worthy entity, the developer will have more certainty in project cash flow (i.e. project revenues) over the life of the project. Moreover, recognizing that nuclear power plants are traditionally viewed as base load generation (as compared to

[8] The development costs could be shared by the host country, as part of its procurement strategy for the project. Such an up-front investment by the Member State would be viewed by the market (and by the developer) as a signal of the host government's strong support to the project.

[9] From first drawdown on debt through final repayment of the guaranteed loans.

load following generation), the more certainty that the host country can provide to the developer that it will be able to generate reliable revenue based on both availability and actual off take, the less risky the project will be for the developer during the operation phase following completion of construction. Assessment of the financial model will also be the primary consideration of financial institutions that will be providing debt financing to the project.

Cost of capital
In assessing the development of the project, the host country should take into account the fact that equity comes at a higher price than debt. As an equity position is inherently more risky than a debt position, the developer will seek a greater return on its equity investment in the NPP. Whereas a non-BOO(T) structure might have sovereign equity in the deal structure, a BOO(T) structure will have commercial equity (although not necessarily to the exclusion of sovereign equity from the Member State). Such commercial equity will drive up the off take price required as the necessary incentive to bring the developer (and its equity) to the transaction. In this context a host government – particularly one which enjoys a strong international credit rating and/or strong fiscal position – should always investigate whether it may be able to obtain capital at rates that are more advantageous than those embedded in that off take price.

Project risks
While it might be convenient for a host country to simply view project risks as risks to be owned by the developer, the reality for the host county is that it needs to attract Developers to its project. Given current market conditions, where the global nuclear industry has faced a number of challenges (e.g. construction delays, supply chain limitations and human resources limitations) there is competition to create interest within the nuclear industry for particular projects. Developing potential projects is a lengthy and expensive undertaking, and the resources of the major companies within the nuclear industry are not unlimited. Additionally, a BOO(T) project has an additional challenge in that such projects would focus upon a subset of an already stretched industry.

Consequently, the potential costs and benefits of creating a less risky project for the developer become key factors for Member States to consider. If the considered view of the Member State is that a nuclear power project is desired, considering such factors as energy diversity, security of supply, and carbon-free emissions, the host country should take into account the views and concerns of the developer.

While developer concerns will focus, to a large extent, on the linkage between the aggregate costs to develop the project and the sale price of electricity (and the period over which such price might be guaranteed by the host country), the developer will also look to the following issues in assessing the risks associated with a particular project:

- Country stability (both economic and political);
- Sovereign credit rating;
- Exchange rate fluctuations;
- Currency convertibility;
- Tax policy;
- Legal and regulatory requirements;
- Consistency (vs. unpredictability) in the legal and regulatory regime;

- Geopolitical dynamics, to include specific bilateral linkages between host country and Developer/NSSS country of origin;
- Rule of law[10];
- Ethical behaviour (e.g. country rating on levels of corruption);
- Contractual terms and conditions;
- Local market capacity (to include host country plans to develop / expand such capacity);
- Local content requirements;
- Technology/knowledge transfer requirements;
- Availability of skilled local labour;
- Prior experience with nuclear technology and power generation;
- Commitment to multiple NPPs (as opposed to a single NPP).

It is important to note that, while a BOO(T) structure could envision a situation whereby the licensed operator could be responsible for both spent fuel and decommissioning, the host country will have to establish the framework under which such tasks are performed.

5.4.2. Selection of technology

In approaching the marketplace for bids for the BOO(T) project, the host country will need to establish a list of minimum requirements for the NPP. One key aspect of such minimum requirements will be what type of NSSS technology will qualify for the solicitation. While the technology may already be implicit in the choice of developer, it might be prudent for the host country to specify that as a basic condition proven technology be employed. This will increase the confidence in the viability of the overall project.

The host country will also need to consider the country of origin of potential technologies for selection. In the case where a host country is resource constrained and/or inexperienced, it may need to draw upon the expertise of the regulator of the country of origin of the technology, in terms of both training of personnel and reliance upon certifications made by such regulator (in cases where the host country intends to rely on the country of origin for design certification, etc.).

Further to this exchange of knowledge and cooperation between the host country and the country of origin, an inter-governmental agreement for peaceful use of nuclear energy is a likely step in the process. Such an agreement might be a precondition to the participation of certain technology providers (e.g. the 123 Agreement[11] is a precondition for participation of U.S. NSSS suppliers in any international nuclear project).

5.4.3. Transfer of the NPP under BOOT

A fundamental part of a BOOT structure is that, at some pre-determined point of time in the future, the host country must take the asset back from the developer. In order for this transfer to occur, two considerations must be addressed.

First, the host country must have the capability to take over control of the operating NPP. ‘Transfer’ in the nuclear industry means that the NPP is transferred from one owner/operator

[10] Rule of Law means the ability of parties to redress contractual disputes through a functioning and transparent legal system.
[11] Section 123 of the United States Atomic Energy Act of 1954, titled “Cooperation With Other Nations”, establishes an agreement for cooperation as a prerequisite for nuclear deals between the US and any other nation. Such an agreement is called a ‘123 Agreement.’

to another one, with the transferee having to comply with all the obligations required by the license or to apply for a new license, according to the legal and regulatory framework in the country. Consequently, even though a BOOT approach might not require that a host country develop certain human resources and other capacities necessary to own and operate the NPP to support initial commercial operation of the NPP, the host country should implement a development programme during the developer's own/operate period, so that it is fully capable of executing a transition from developer control to host country/national utility control. In order to facilitate development of national capabilities, a training and development programme could be implemented with the developer, during the developer's own/operate period, so that the host country's/national utility's operating staff has received actual training on the unit before takeover. At some point in the future, the outside experts will return to their countries of origin and/or transition to other projects. Therefore the host country should plan such a transition well in advance of the transfer date.

Second, the conditions precedent to transfer must be clearly established, so that the developer is not faced with a situation where the host country can reject the transfer, except in extreme cases. While at first it may appear that not having the transfer occur might be viewed favourably by the developer, as it can enjoy the benefits of operating the plant for a longer period of time, it should not be assumed that the term associated with any sort of preferred generator status would cover the delayed transfer. If the transfer were to be denied by the host country, the developer could be left holding an asset that it can no longer operate economically. The developer will therefore want to limit discretion and subjectivity in the conditions of transfer.

5.4.4. Separating ownership and operation

The international legal framework governing the safe uses of nuclear energy places the primary responsibility for the safety of the nuclear power plant on the license holder (i.e. operator). This principle is also reflected in the international instruments governing third party liability for nuclear damage which provide that liability is channeled to the operator of a nuclear installation. The separation of ownership and operation is essentially about separating the equity position and debt financing for the project from the technical capability necessary to operate the plant economically, safely, and securely and to get licensed by the regulator. Theoretically, the owner has only equity risk if a nuclear accident were to occur and the plant ceases to operate based on the assumptions that (i) the debt financing would be logged with the special purpose company in charge of developing the project and (ii) there would be no recourse to the shareholder of that SPV (e.g. the Owner) during the operating phase[12]. However, because there are gaps in the current nuclear liability regimes with respect to cross border damage, owners could still be exposed to claims from third parties (to the extent that cross border damage is suffered in a country that is not a fellow treaty member). Figure 4 below is a simplified diagram of the basic functions of an NPP owner and operator.

[12] As of the writing of this report, there has not been any such clear cut financing put into place for a NPP, so it is not known whether the Owner would have the equity risk only.

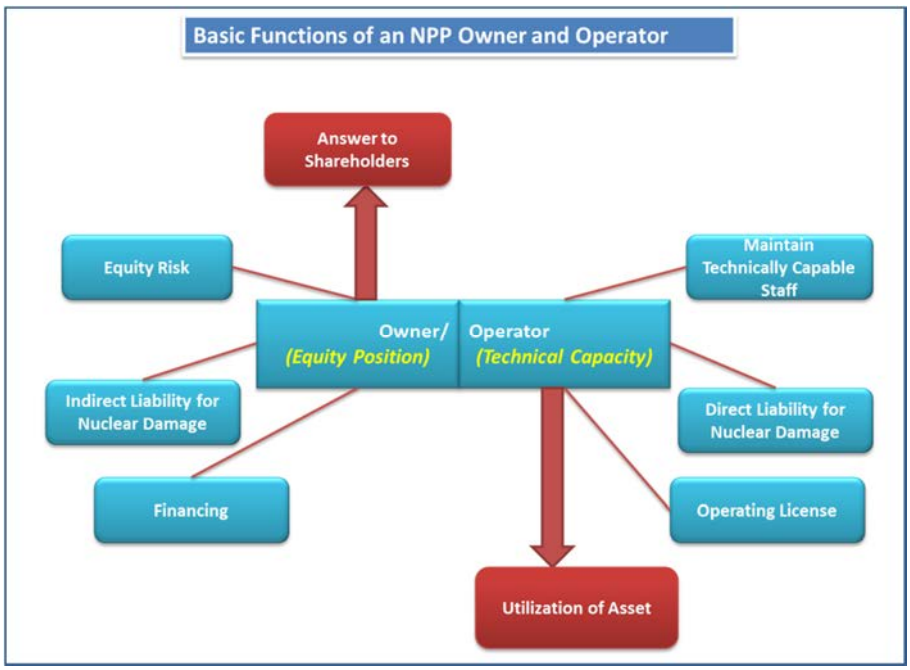

FIG. 4. Simplified diagram of the basic functions of an NPP owner and operator.

As can be seen, several considerations should be addressed regarding whether ownership and operation of a nuclear unit can be separated in a BOO(T) structure. First, it is most likely that the developer will establish SPVs for both the ownership and the operation of the asset. Such SPVs serve to limit the liability of the ultimate owners of the asset and of the operator.

- Theoretically, ownership interests in the NPP owner and the operator could be transferred (subject to regulatory approval). Such transferability will have to be carefully considered by the host country. In the case of the ownership in the project, the host country might want to require that the developer retains a certain controlling interest in the project, especially during the early stages of the project, in an effort to ensure that the developer is committed to the long term development of the project. A similar concern exists with ownership interests in the operator. If the ultimate owner(s) of the operator provide the technical personnel to staff the operator, the host country will again want to ensure that the ultimate sponsor(s) of the project has a long term commitment to the project. Ultimately, the decision to award a BOO(T) project will be based on the composition and capabilities (both technical and financial) of the bidding team. Therefore, the host country will need to put in place mechanisms to ensure that the participants do not change over time in a manner that yields an undesirable result for the Member State.

- Despite the use of SPVs, lending institutions will still expect that parent guarantees from creditworthy entities are available to support the obligations of the project companies.[13]
- Under the major international nuclear liability regimes (e.g. Vienna Convention, Paris Convention, Convention on Supplementary Compensation), the operator[14] is assigned liability for damages, arising out of a nuclear incident at the nuclear facility, that are

[13] As of the publication date of this report, no nuclear power plant has ever been project financed.

[14] Under the 1997 Vienna Convention on Civil Liability for Nuclear Damage: *'Operator', in relation to a nuclear installation, means the person designated or recognized by the Installation State as the operator of the installation.*

suffered by third parties. Such nuclear liability is significant;[15] consequently, the host country will probably require that such obligations are fully insured or collateralized through adequate financial means. In support of such obligations, the insurance or financial companies providing such instruments would also require parent guarantees from credit worthy entities. Furthermore, because of the incomplete coverage provided by current international nuclear liability regimes, the host country might yet need to provide an indemnity for cross border damage, to the extent any exposure exists. Thus, it is important to acknowledge that the complexity of the nuclear liability issue, and the associated risk particularly in the area of cross border damage, could serve as a deterrent for BOO(T) market entrants.[16]

Second, it is assumed that the national law of the host country will require that the licensed operator be an entity formed under the local jurisdiction. Whether or not the ownership interest in the asset would be held by a local entity would also be a function of national legal requirements, as well as tax considerations of the parent entities of the owner.

- The regulator will be particularly concerned with the technical capabilities, experience, and human resources that exist within the licensed operator. To ensure that the operator continues to meet its obligations under the license, the regulator will most likely insist on limitations regarding the transfer of ownership and control of the operator.
- It should also be recognized that there is a fundamental difference between transferring elements of ownership within an SPV and transferring the actual license held by the SPV. While limitations on the transfer of the actual license will be much more overt, the host country will need to protect against a de facto transfer of the license through changes in ownership of the SPV, which might result in changes in control of the SPV.
- The concern regarding transfer of ownership of the asset is focused on control and financial capability. The concern regarding transfer of license is focused on technical capability, as well as financial capability in terms of required insurances and nuclear liability coverage.

Third, when considering having different entities involved in the ownership and operation of the NPP, ownership can be limited to a financial structure, whereas operation involves technical capabilities. With two different roles, different parties could participate based on their desired roles and capabilities. For example, passive investors that lack nuclear experience could participate in the project through an equity stake in the owner entity. However, while separating ownership and operation might seem like a possible structure for the project, the financial burden associated with nuclear liability that is tied to the operator would seem to encourage unity of interest in the operations and ownership of the project, since operating fees alone would not serve as a sufficient economic incentive to offset the burdens associated with nuclear liability. In addition, the license necessary for the operation of the facility is held by the operator. Thus, there seems to be a desirable linkage between ownership and operation within a nuclear context, which is not necessarily the case for BOO(T) arrangements in other industries.

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[15] Under the 1997 amendments to the Vienna Convention on Nuclear Liability, the operator has sole liability for nuclear damage suffered by third parties arising out of the operation of the nuclear facility. The operator's liability is 300 million SDRs (as of the date of this report approximately US$462 million). Special drawing rights (SDRs) are supplementary foreign exchange reserve assets defined and maintained by the International Monetary Fund (IMF). Not a currency, SDRs instead represent a claim to currency held by IMF member countries for which they may be exchanged.

[16] The Member State will need to consider how it intends to cover liability in excess of the operator's limit. The concept of a predetermined, legally mandated liability – under a 'strict liability' construct – is unique to the nuclear industry.

Finally, the host country should have adequate assurances from the developer that the developer will not abandon the project. While abandonment during construction could be detrimental to the overall energy plan of the Member State, abandonment following commercial operation is a concern of a different magnitude, recognizing the safety, security, and safeguards issues involving an operating nuclear facility. However, the host country should always prepare for the possibility that the foreign developer could abandon the project, whether due to poor economics or force majeure. As a result, the host country should be ready to take the project, even if such taking falls short of commercial operation and is limited to securing the asset. Linking ownership and operation, therefore, seems to create proper alignment for both the developer and the host country, by linking equity return and operational success. By tying together operational responsibility with equity motivation, economic practicalities might triumph where mere contractual remedies would otherwise fail. That being said, the Member State should always have the capability to intervene when immediate safety is at issue, so that it does not have only a contractual obligation of the developer as its only source of recourse to deal with an emergency situation.

5.4.5. National responsibilities

As noted previously, there are a number of responsibilities that must remain with the host country. While turning to outside experts and industry to develop, finance, and operate a nuclear facility might be an efficient strategy for an embarking Member State that lacks sufficient resources to develop an entire national nuclear power programme, the Member State should understand that certain responsibilities must be managed by agencies of the host country. Not only does the Member State have to be capable of taking transfer of the operating nuclear power plant in the BOOT structure, but it should also have certain levels of programmatic development, as noted in the Milestones Approach.

National nuclear law[17] *and regulatory framework*
Of particular concern to any developer will be the status of the legal and regulatory framework for the NPP within a Member State. If such frameworks are not clearly established at the development stage of the project, the developer will then look to the host country to take those project risks. In the event that the host country is not willing to assume such risks, the developer will likely insert a higher risk premium into the commercial conditions of the deal, thereby driving up the costs of the project and the market cost of the electricity generated by the unit(s).

Without clear guidance from the Member State as to the legal obligations of the developer, a project will be perceived as more uncertain and as having greater country risk. While having such frameworks develop as the project develops and construction occurs is theoretically possible, such parallel progress does not create a stable environment for the developer and debt financing providers. It also raises a question as to how much influence the developer might have over the progress of the licensing, regulatory, and general legal frameworks. If such regimes are shaped to accommodate the desires of the developer, concerns would certainly arise as to the independence of the regulator and the prudence of the licensing, regulatory, and general legal regimes within the Member State. While working with industry to create a practical set of legal guidelines is not a problem per se, as the guidelines should

[17] An approach used by many countries is to establish a nuclear legal framework within the national legal system that encompasses all major laws (e.g. regulatory authority, nuclear liability, ownership, non-proliferation, licensing, etc.) relating to the nuclear industry (e.g. The United States' *Atomic Energy Act*).

take into consideration market realities, a delicate balance should be maintained between consulting with industry and having industry exert undue influence on the process. Therefore, the earlier such regimes can be implemented, the better result for both the Member State and the developer.

Ultimately, potential developers will expect that mechanisms are developed that promote legal stability in the Member States. Recognizing the long operating life of the asset, with the corresponding concern that legislative and/or regulatory changes can jeopardize the developer's economic return on the asset, the developer will seek confidence-building measures. These measures can be either through law and regulation, or through contractual protections, to include pricing measures and change order provisions to mitigate risks that can arise from an unclear legal structure. Political risk insurance (which can often be expensive) has been a traditional means by which developers insulate themselves from certain types of host country action that deny the developers their intended economic benefit from the asset.

Safety

As stated previously, safety is ultimately the responsibility of the operator. However, there is a close relationship between the licensee and the host country (as represented by the regulator). The licensed operator will have day to day responsibility for the safe operation of the nuclear facility. On the other hand, the regulator must have a robust set of guidelines to ensure that the licensed operator is held to the appropriate operational safety standards. The Member State must also be able to staff the regulator with the recommended level of adequately trained and experienced personnel that have the capability to regulate the licensed operator. For more information regarding issues and responsibilities related to a nuclear power programme, the IAEA Safety Series should be consulted.

Financing entities will look to the host country regulator for project discipline, as the regulator would be expected to have the authority to stop construction or operation if the project is being built or operated in an unsafe manner. Financing entities do not have the ability to monitor the project in the same fashion as the host country regulator; as a result, the financing entities will rely on the regulator being the entity that ensures that the project is complying with the established regulations.

Safeguards, security and export control

The Member State should enter into the customary agreements with the IAEA (e.g. Comprehensive Safeguards Agreements after signing the Nuclear Non-proliferation Treaty, and the Additional Protocol). By doing so, the Member State commits itself to transparency with regard to its nuclear facilities, material, and technologies. These commitments should then be coordinated with the owner/operator of the facility, so that the activities of the owner/operator work in conjunction with the national goals. The developer must apply adequate nuclear material control and accountancy that meets the requirements of the Member State's system of accounting for and control of nuclear material, which are part of their international safeguards commitments. The main relationship for international agreements is between the IAEA and the Member State. In other words, a nuclear BOO(T) structure is unlike other types of approaches for foreign development of national resources, given the international commitments of the Member State. For more information regarding the issues

and responsibilities related to international safeguards, the IAEA Safeguards Legal Framework should be consulted.[18]

While the operator has responsibility for nuclear security at the NPP site (essentially, at the NPP fence line), and such capabilities should be evaluated by the host country, nuclear security outside the site is within the responsibility of the host country. An unfortunate reality is that the introduction of a nuclear power programme introduces a potential threat of a criminal or other intentional unauthorised act being carried out in relation to the nuclear facility or the nuclear material. The threat to the facility or the material and the risk arising must be managed by the State. Mitigation of the risk of sabotage or unauthorised removal of material is the responsibility of both the State and the operator. For more information regarding the issues and responsibilities related to nuclear security, the IAEA Nuclear Security Series should be consulted.

Additionally, the host country, through its export controls regime, must ensure that nuclear technology and materials are not then improperly exported to third parties and as such it will need to have an export control capability to support such goals. This oversight effort by the host country will need to be coordinated with the country of origin of the technology and nuclear fuel, recognizing that in a BOO(T) arrangement these may be controlled by an external developer.

Spent fuel and radioactive waste

The host country, through its regulatory body, must ensure that spent fuel and other radioactive wastes are properly handled by the operator. While the developer might retain ownership and operational responsibility through the useful life of the asset (or for a shorter period in the case of a BOOT structure), the host country must retain certain control over activities on the site, as the site resides within its national borders. Such control must look to the well-being of the population and the environment. To that end, clear regulations must govern the proper handling, transport, interim storage, and final disposal of spent fuel and radioactive waste. Furthermore, while the owner/operator might have custody of the fuel, the host country will need to determine the final disposal of such fuel, whether through the establishment of a permanent repository for spent fuel or through an arrangement with the fuel provider that might take back the fuel after usage and return such fuel to the country of origin. Such regulations must align with the international safeguards obligations of the host country, to include any bilateral arrangements with the country of origin of the fuel.

Decommissioning

Whether or not a transfer of the asset to the host country occurs, the host country must address the decommissioning of the nuclear power plant. While decommissioning obligations can be imposed upon the owner in a BOO structure, the host country must have a plan for managing the final disposition of the asset, in either the BOO or BOOT structures. All project participants, including financing entities, should understand the decommissioning plan. The host country cannot cede such a responsibility to the developer, even though they will actually develop the decommissioning plan for the nuclear power plant. It is to be expected that the host country will impose certain financing responsibilities on the developer, regardless of whether or not the developer is ultimately responsible for decommissioning the asset. Given that such decommissioning costs will be significant (i.e. perhaps several billion U.S. dollars),

[18] Also available: IAEA Services Series 21, Guidance for States Implementing Comprehensive Safeguards Agreements and Additional Protocols, IAEA Services Series 21, (March 2012).

it will be important for the host country to establish such requirements and funding commitments early in the project development cycle, so that the developer can then factor such costs and responsibilities into the project's financial model.

Knowledgeable customer
Separate from the consideration under the heading National Responsibility is the concept of being a knowledgeable customer[19] [7]. While the host country might see the BOO(T) structure as a means of outsourcing significant elements of a nuclear power programme, it should be a knowledgeable customer from a commercial perspective. As such, the host country should have sufficient technical and commercial knowledge in order to shape the overall BOO(T) deal structure and assess the capabilities of each of the bidding teams [7]. This knowledge might come from a specialized government entity that is tasked with overall responsibility for the development of the national nuclear power programme. It could also come from an existing utility that has the lead role in coordinating the development of the nuclear power plant. It may come, in part, from an outside contractor/consultant. In any case, the entity responsible for the host country's interests should be able to understand the concerns of the developer community, balancing such concerns against national goals. Moreover, the host country should appreciate the unique risks and considerations associated with an NPP in order to understand the associated deal terms that will be needed for a commercial transaction to be successfully structured. Being a knowledgeable customer will help the host country to get the best deal commercially achievable.

5.4.6. Foreign ownership and sustainability

The host country will need to recognize that a nuclear power project is a highly visible and politically sensitive issue. In that light, it will need to consider whether or not there will be public acceptance of a nuclear power plant that is ultimately owned and operated by a foreign party. Such a foreign element will also need to be measured in consideration of the strength of bilateral relations between the host country and the developer's country of origin. The stronger the linkages, the less likely it is that force majeure events could frustrate the relationship and possibly jeopardize the ability of the Member State to fully benefit from the project or the ability of the owner to receive the projected economic return on the project, as well as safely operate the project over the intended period of time.

If all expertise comes from abroad, a concern arises as to the sustainability of the project. It should be acknowledged that if all operators come from foreign countries, the operator might have difficulties staffing the project in the event of a force majeure. In such an instance, the greater amount of local capability for the operation of the unit that can be developed and incorporated into the unit, the less likelihood that the operating unit can be faced with a situation where a minimum shift complement is not available at all times. Because a nuclear power plant must always be staffed for operational, safety, and security considerations due to the presence of nuclear fuel, the host country must have contingency plans, to include disaster preparedness, in place in respect to the nuclear facility.

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[19] Knowledgeable Customer means an organization (or individual) that has the competence to specify the scope and standard of a required product or service and subsequently assess whether the supplied product or service meets the specified requirements. (NOTE: the term 'knowledgeable' used here and 'intelligent' customer used in IAEA Nuclear Energy Series NG-T-3.10 are interchangeable)

Additionally, the host country will have to create mechanisms for the sustainability of the project. In an instance where a transfer occurs (BOOT), consideration should be given to the long term viability and sustainability of the project, given the implications of decommissioning, spent fuel, nuclear waste, and radiological releases. Even in cases where a transfer does not occur (BOO), the host country should create mechanisms where the owner/operator is held responsible for the impact that the nuclear facility has on the national well-being.

5.4.7. Limited technology transfer and local content

When a Member State chooses to embark upon a national nuclear power programme, it might wish to factor a number of ulterior considerations into the requirements of the project. For example, the Member State might require that a certain percentage of the project is comprised of local content. Another consideration could be that a certain level of knowledge transfer (i.e. training and development of local human resources capabilities) occurs. On a larger scale, if multiple units are contemplated by the Member State, the procurement specifications might even require that the bidders license or sell their technology to the host country, so that the host country can ultimately assume manufacture of critical nuclear technology (as was required in the 2005 procurement of the AREVA and Westinghouse NSSS designs by the People's Republic of China). These considerations all represent national goals that go beyond the pure economics of a particular NPP. These are secondary effects.

In opting for a BOO(T) structure, the Member State might have to forego some of these secondary considerations. By asking a foreign developer to bring a project to market, the Member State must accept that the developer's concerns are primarily driven by the economics of the project. The more conditions the host country places on the developer, which do not constitute essential regulatory and other legal requirements, the less willing the developer will be to pursue the project. Thus, a Member State will have to accept that, beyond such regulatory and contractual covenants to ensure proper operational, reliability, and safety conditions, the developer may resist additional involvement by the host country to avoid potential project delays and cost increases. Therefore, before embarking upon a BOO(T) structure, the Member State should consider the trade-offs involved, recognizing that it will have less ability to dictate secondary terms and conditions for the NPP.

5.5. CURRENT BOO(T) ARRANGEMENTS

Given the potential time horizon for the development, construction, and investment recovery periods associated with a BOO(T) structure for a NPP (as compared to an equity investor's traditional desire to earn a swift return on investment), there appears to be a limited marketplace within the developer community for such projects. However, two recent developments: the Akkuyu project [see Annex 1] in Turkey by a Russian-owned, Turkish project company,[20] along with the Korean units in the United Arab Emirates (see the following sections), indicate that the nuclear industry is willing to expand its commitment beyond the construction phase and take ownership and operating positions in the projects that they are constructing.

In order for a BOO(T) project to be viable, the developer must be experienced in the operation of nuclear power plants. General experience is important, but technology specific experience

[20] At the time of drafting of this Report, a similar project was also being considered for an additional site to be located at Sinop, Turkey.

is preferred. Acknowledging that the latest technology designs are being developed in the international marketplace during the development of this document, capacity constraints may appear within the operator market.

Potential investors

Given the financial commitment necessary to develop the NPP, the number of serious investors that have the capacity to invest in such a project may be limited. Any investor might wish to spread the development risk of the NPP across other similar projects, or, at a minimum, share the risk with other strategic partners. Recognizing that carrying the development costs (including EPC costs) of the NPP on a balance sheet could have detrimental effects on the credit rating of the developer, the developer would have to be of sufficient market capitalization to support one, not to mention several, such projects. When surveying the current marketplace, it should be recognized that such 'large cap' investors either might not exist or might prefer to invest in other opportunities. Recognizing such market constraints, an advantage might exist for the initial Member States that seek BOO(T) structures.

In addition, when looking at potential investors for NPPs, an embarking Member State should recognize that it is at a competitive disadvantage relative to countries with existing nuclear programmes. Any new programme has greater uncertainties, and therefore greater risks, when compared to a potential development opportunity in a Member State with an existing national nuclear power programme and a mature regulatory framework. Given the choice between an embarking Member State and a Member State with nuclear experience, a large cap investor will presumably choose the latter. Furthermore, there is a strong likelihood that investors that wish, and have the financial wherewithal, to develop a nuclear power plant come from countries with a nuclear history; thus, an embarking Member State will have to address this competitive disadvantage by creating a favourable set of investment conditions and returns to encourage such 'large cap' investors to invest in their projects.

Operation phase and financing

Despite the challenges with identifying potential developers within the marketplace, Member States should also understand that, once commercial operation of the NPP has occurred, the attitudes of the financial community change significantly, as the greatest risk associated with a nuclear power plant (completion risk) has been overcome. Once a nuclear power plant reaches commercial operation, it is relatively inexpensive (when compared with its base load peer group) to run, as fuel costs are very small and, therefore, even significant fluctuations in the market price of uranium have minimal impact on the economics of the asset. The highest level of risk exists during the construction phase, when construction delay and cost overruns can have a serious impact on the overall economics of the project. It is during this time that the investors would require the highest return to compensate for the high risk, demanding higher cost of capital. As the operations phase start and positive cash flow begins, the project risks drop off substantially and it is possible for project sponsors to refinance at much lower cost.

Given this significant reduction in the risk profile of the asset, both debt and equity are much more attractive from a financing perspective, following the commercial operation date for the NPP. As a result, while a Member State might find financing very difficult to obtain during the development phase of the project, financing will most likely be more available during the operations phase of the asset's life, especially following completion of the first reload of fuel. With this consideration in mind, Member States might consider moving the 'T' in a BOOT structure to an earlier date, even if it means a buyout of the developer at a premium, if the

asset's economics are such that it would be more favourable to the Member State to terminate (for convenience) the off take agreement (and thereby avoid paying the off take premium required by the developer), capture the asset revenue stream, and obtain debt financing from commercial lenders and/or equity financing from long term passive investors at more favourable rates. Of course, the developer will demand a premium for this compression of its ownership/operations period, given that it will have projected a certain premium for taking the Construction Period risk.

5.6. VARIATIONS OF THE BOO(T) THEME

5.6.1. United Arab Emirates: the 'JV-BOO'

In December 2009, the United Arab Emirates (UAE) awarded a contract for up to four nuclear units to a consortium of Korean companies that was led by the Korean government owned company KEPCO. The Korean consortium is responsible for NSSS technology, EPC functions, operations, fuel supply, and significant debt and equity financing.

The UAE project cannot be truly classified as a BOO, recognizing that the ownership and operation of the units will be by an entity comprised of both Emirati (Emirates Nuclear Energy Corporation-ENEC) and Korean (KEPCO) shareholders. Thus, the ownership/operation function is not done solely by a developer, which would be the case in a classic BOO structure.

In creating this joint venture (JV) structure, the UAE has combined the desire for foreign development expertise, and integration with an equity/ownership component that aligns the interests of the Member State and the foreign developer and enhances the long term viability and success of the operating assets. With the ENEC integrating with the foreign developer in the JV entity that will serve as owner and operator, the host country has been able to have a more active role in the development and execution of the project and facilitate the indigenization of the nuclear programme over time, instead of simply relying on the foreign consortium to deliver, own, and operate the project. Of course, in order to have such an integrated role through the owner/operator JV, ENEC has had to develop its own talent base and financing resources, such that the foreign consortium does not have to source all capital and ownership functions. Such a structure depends on the level of national preparedness that is present within the host country; in this case the UAE. Therefore, for other Member States to consider such an integrated JV-BOO structure, an understanding of, and capacity for, the capital and human resource requirements is critical in this model.

5.6.2. Horizon Nuclear Power in the UK (United Kingdom)

Horizon Nuclear Power is a UK energy company which was established with the objective of developing a new generation of nuclear power stations in the UK. Horizon Nuclear Power was a joint venture between E.ON UK and RWE npower; however, in March 2012, E.ON UK and RWE npower announced that they were withdrawing from the joint venture to build new nuclear plants in the UK due to, among other factors, pressure from Germany's decision to phase out all nuclear power[21]. The sale of Horizon Nuclear Power to Hitachi Limited of Japan was announced in November 2012. The Hitachi Horizon programme involves building two to three 1,300 MW plants at each of Horizon's sites at Wylfa, Anglesey, and Oldbury,

[21] Nuclear perspectives: the UK outlook, 22 May 2012.

Gloucestershire, with the first unit becoming operational in the first half of the 2020s, and employing its Advanced Boiling Water Reactor (ABWR) technology. The fact that a technology provider like Hitachi, which might otherwise be in the market only to sell NSSS technology, was willing to purchase Horizon and take over the planned projects demonstrates that classic models and roles are being rethought in the current marketplace. Current developers of NPPs are looking for new and innovative ways to finance NPPs and to partner with technology providers to allocate risk in new ways. For an additional example of Hitachi's willingness to take an equity stake in the project, please see the discussion of the Visaginas nuclear project in Lithuania in Section 6.

5.7. MEMBER STATE PREPARATIONS FOR A BOO(T) APPROACH

The following section discusses some main issues to consider when preparing to enter a BOO(T) arrangement. It is not intended to be a comprehensive list and should be used in conjunction with the other sections in this report.

5.7.1. Dialogue with industry

A Member State should understand that a BOO(T) project is a long term partnership with the developer. To that end, the host country should spend considerable time in open dialogue with industry, prior to issuance of a formal request for proposals, in order to gain a complete understanding of technology options, bilateral relationships, financing sources, and commercial terms. Without such a dialogue, a Member State runs the risk either of creating a one sided set of deal terms that yields limited or no responses from potential developers, or finds that the terms bid by potential developers do not meet with the host country's preconceived notions on what would be necessary to get a deal concluded, resulting in a project structure and economic burden that are beyond its capabilities at a very late stage in the process.

5.7.2. Dialogue with countries using the BOO(T) structures

The host country may consider engaging other Member States who are implementing the alternative contracting and ownership structures (e.g. Turkey), participating in the structure (e.g. Russian Federation), or utilizing or participating in variations on the theme (e.g. the United Arab Emirates, the Republic of Korea, Japan, and the United States). Working with such Member States to understand what considerations went into the decision to pursue a particular project structure, and what challenges and lessons learned they have from their experiences, will help a Member State considering alternative contracting and ownership structures to assess whether or not its national situation is appropriate for one of these project implementation models.

5.7.3. Expert advice

As stated previously in this Section, a BOO(T) structure is complicated and its success is highly driven by the economic conditions and risk allocations set forth in the deal structure. Without prior experience with such structures and/or nuclear power, host country's might find themselves with a significant knowledge deficit. In order to fully appreciate the complexities and market conditions that would surround a BOO(T) for the NPP, it is advisable for the host country to seek outside technical, legal, financing, and commercial advice early in the process.

5.8. CONCEPT OF A REGIONAL APPROACH

A regional approach for the development of the NPP involves the participation of two or more Member States. The process normally begins with government to government planning at the inception of the project. While such coordination might occur among entities part of national governments (e.g. national utilities), the project usually begins at a national level, whereby representatives of the sovereign nations decide to cooperate towards a common goal. These sovereign commitments become the basis upon which the project will then proceed. Without such a sovereign commitment, it is unlikely that a regional structure will achieve success. It should be noted that a regional approach is not a contracting structure, it is about development and ownership of a nuclear power project.

Although a regional approach involves two or more countries and could have a complex structure, ultimately one Member State must be the host of the NPP. This imposes special obligations on that Member State. In a base case, the host country could assume most responsibility for the development of the project, with the other national partners simply being off takers of the power. In such a model, the host country is the true developer of the NPP, with its national partners having an interest solely in obtaining power at an economical rate. Presently, operating nuclear power plants sell power across borders in Europe, so simply selling power across a border does not make a development model for the purposes of this report. Instead, the idea is that from the initial conception of the NPP, the project would look to utilize cross border opportunities in a pre-arranged manner that is coordinated at the Member State level.

A more integrated model would involve each of the national partners taking an ownership stake in the project. In this first level of integration, the host country would still assume the bulk of the responsibility associated with the development of the NPP, with the other national partners really being a source of equity financing for the project. By taking such an ownership stake in the NPP, the national partners ensure greater involvement in the decisions associated with the asset, entrench their off take position through an ownership interest in the asset, and obtain an equity return on the asset itself (either directly or through a reduced purchase price for the power generated by the asset).

At the highest level of integration, the non-host national partners both take an ownership interest in the asset and assume a more active role in the development of the NPP. This higher level of involvement is driven by a desire to obtain the secondary benefits of the NPP, beyond an equity return and favourable off take rights from the power generated by the asset. In such instances, the non-host national partners wish to share in the technological and human resources developments associated with a nuclear power programme, as well as ensure that a certain level of national content is incorporated into the NPP, allowing its local industry to share in the economic benefit associated with the construction of the NPP.

5.9. MOTIVATIONS FOR A REGIONAL APPROACH

A number of reasons could justify pursuing a regional structure for the NPP. Some of these are discussed below.

5.9.1. Aggregation

Sharing costs
Given the significant effort and cost of developing a national nuclear power programme, which extend beyond the cost of the actual facility itself, sharing costs among the national partners might enable a group of countries to develop a project collectively.

Risk sharing and diversification
Financial risks can be spread out among multiple participants and result in more efficient allocation of project risks.

Sharing human resources
Given the human resource requirements needed to support a national nuclear power programme, a group of countries might decide to share their human resource pool. This should be considered in terms of both a nation's existing talent pool, and the time and cost to develop further the technical talent required to support a national nuclear power programme, considering operational and regulatory demands.

Sharing infrastructure
A regional approach to infrastructure development is a tangible extension of cost sharing. The end result yields a direct and lasting benefit to all the partners, including those that do not host the NPP [8].

Knowledge development
Another potential rationale for a Member State to engage in a regional effort is to develop nuclear knowledge in cooperation with its teaming Member States, and then to use such knowledge gained through the joint effort to develop a new project alone, later on. Through a regional approach, a Member State would share the burden and experience in the first instance before feeling confident that it is capable of developing the NPP without outside assistance.
Figure 5 below illustrates a very simplified hypothetical case, where three neighbouring Member States form a regional alliance and collaborate to build the NPP, by sharing the financial risks and benefits. They utilise cross border resources to structure the debt and equity to raise finance. The regional partners apply a corporate finance model, employing the balance sheet of the utilities, to inject equity into the subsidiary or project company to construct the nuclear power plant. Country A, which is also the host country with good credit ratings, takes the lead and contributes twice the equity in comparison with the other regional partners. In this case, debt financing is contributed by local and international banks and export credit agencies[22]. The regional partners share project risks, such as costs and liability (waste), as well as benefits like electricity output and revenue. However, the risk sharing is based on the ownership structure of the three countries.

[22] Export Credit Agencies can provide direct lending to a project or insurance coverage to banks which will lend to a project.

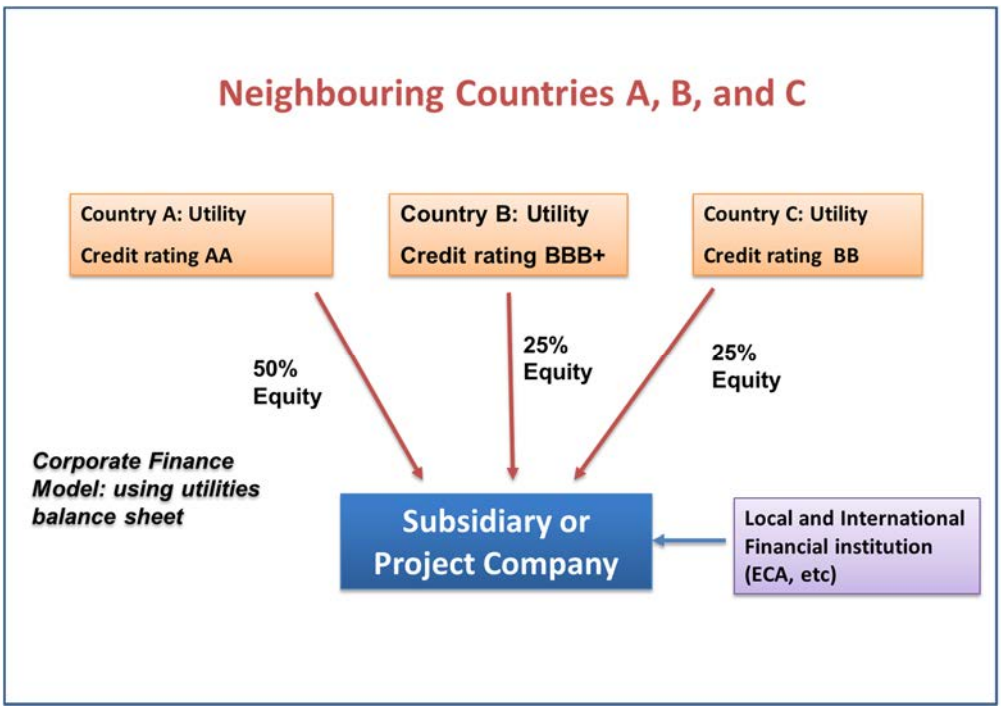

FIG. 5. Example of a regional approach for financing.

5.9.2. Security of supply

As noted earlier in this document, there are various motivations for pursuing nuclear power as an energy option. These include energy security, energy diversity, and carbon neutral generating capacity. In the case of some or all of the national partners, a regional endeavour might simply amount to assuring a source of reliable base load generation.

5.9.3. Grid size constraints vs. economies of scale

Most current NPP designs on the market are in excess of 1000 MW. Given the grid size and power needs of certain countries, such generating capacity might not be technically feasible. This is because no single power plant should comprise more than 10% of the lowest demand on the grid. While new small to medium reactor designs are presently in development, a Member State either (a) might not want to wait for such reactors to become commercially available; (b) might want to wait for such reactors to become 'proven' technology; and/or (c) might prefer to utilize the larger designs to achieve economies of scale, in light of the significant programmatic costs for implementing a national nuclear power programme. Thus, for any of the aforementioned reasons, a regional structure would enable the deployment of a larger scale design, so that the excess capacity can be utilized by the other national partners.

A variation of a regional approach could be where the host country seeks regional partners for a predetermined period of time, during which it does not need the excess power. Then, based on its projections for economic growth and the accompanying increase in demand for base load generation, the host country could then reclaim that excess power for national use after the sharing period expires. Such a strategy would need to be established prior to the participation of other Member States, and the details of the reclaiming provisions would need to be clearly understood (and priced), in order for the other Member States to participate in the regional effort.

5.9.4. Site limitations

Despite a Member State' desire, and even its financial and/or technical means, to develop a national nuclear power programme, it might not have a suitable site. In this case, it might seek out regional partners that do have suitable sites. A further subset of this consideration is that a country simply might not want to build a nuclear power plant on its own soil, whether due to public resistance or a feeling that it cannot fully manage the tasks associated with locating the NPP within its borders. However, it could still recognize the benefit of participating in the development of an NPP in a neighbouring country.

5.9.5. Technological and human resources development

A Member State might seek opportunities to develop local talent, in terms of jobs requiring significant technological training and higher education as is required for a nuclear power programme. Participants in a regional nuclear power programme might hope to have their populations benefit from such opportunities, thereby resulting in technology transfer/development and bringing better paying and professionally focused job opportunities, along with associated knowledge transfer to its citizens and educational institutions.

5.9.6. General economic development

Current estimates for the overnight cost of one nuclear unit range up to several billions of US dollars. Since overnight cost estimates are limited to the cost of the general facility as if it were to be built overnight (i.e. no financing or infrastructure costs included), the additional infrastructure required to support the NPP can be of similar or greater orders of magnitude, depending on the existing level of infrastructure within the host country. To the extent that the host country and its other national partners can have their local industries participate in the development of the programme, such development can benefit local economies with increased business. Consequently, a non-host national partner will see this potential economic opportunity as another reason for taking an active role in the development of the programme.

5.9.7. Sharing carbon credits

One item for consideration is the ‘credit’ obtained through the creation of a carbon neutral form of power generation, under any sort of international standard for emissions. If all participants wish to share the benefit under an international carbon regime, consideration should be given as to how such interests can be accommodated within such a regime and how the participants in the regional NPP will share such benefits. Even if the credit cannot be shared, the participants will benefit by being able to substitute the power received from the NPP for other forms of base load generation that would require carbon allowances under a Kyoto Protocol like system[23].

5.10. CONDITIONS FOR THE APPLICABILITY OF A REGIONAL STRUCTURE

Before getting into the specifics of a regional NPP, a basic consideration is whether or not a regional effort for the development of an NPP will stand a chance of success is the level of commonality among the countries in question. In order to cooperate to the degree necessary for the NPP, it would be beneficial for the countries to have a history of cooperation and openness. Having similar legal and economic systems, along with some level of a shared

[23] NPPs are currently not eligible for Carbon Credits under the Kyoto Protocol.

history will enhance the endeavour's chance for success. Examining both the Baltic (Estonia, Latvia, Lithuania)[24] efforts that have been currently under consideration, many of the countries involved share some combination of common histories and cultural similarities, common legal and political/economic systems, and/or a high level economic integration.

Similarly, political stability will be a key factor in the success or failure of the endeavour. To the extent that commitment to the project cannot be maintained over time and across political cycles (or changes in leadership, as applicable), the project will suffer, and the remaining participants might find themselves in a situation where they must raise their level of commitment to the project, if the support of one of the participants falters. As it has already been mentioned that a nuclear power programme is a one hundred year commitment, from initial planning to commercial operation through decommissioning, choosing partners in such an endeavour is a long term decision.

Furthermore, in the event that more than two countries are involved, and the countries all wish to be off takers of the power generated by the NPP, border proximity will be a consideration, to minimize transmission distance and the associated line loss. In addition, in order for the power to be shared functionally, the grids of such countries should be integrated in order to ensure grid stability.

The key period for regional cooperation is the Development Period that precedes commercial operation. While there must be a certain level of confidence among the participants that each will honour their commercial obligations following NPP operation, the greatest level of coordination, decision making and economic/resource commitment will be during the development of the project. Thus, while the histories of nations might be difficult to predict over a one hundred year cycle, the critical period will necessarily be the ten to fifteen year project development period.

5.11. CHALLENGES TO CREATING A REGIONAL STRUCTURE FOR NPP

5.11.1. Leadership

The dynamics of any group structure dictate that, in order for the group to be successful, a leader must be chosen, the leader should lead effectively, and the other members of the group should support the direction of the leader. Within an environment of sovereign nations, identifying the lead country might prove to be a challenge, especially in cases where multiple participants are vying for the role of the host country. Identifying a preferred site early in the process might then lead to the identification of a natural leader, recognizing that the host country will have a number of additional concerns and considerations.

5.11.2. National responsibility

Despite the desire for the members of the consortium to share in all aspects of the project, certain responsibilities associated with the NPP and the nuclear programme in general can only reside with the host country.

Legal and regulatory framework
The NPP will be governed by the laws of the host country, which will be responsible for developing the legal and regulatory framework. While the non-host national partners might

[24] For a more detailed description of the Baltic NPP, please refer to Appendix 5.

have the opportunity to participate in the development of such structures, as well as have a vested interest in them, such structures will be the responsibility of the host country, even if key institutions such as the regulatory body were to be partially staffed by participants from the non-host national partners.

Safeguards, security and export control
The host country must take responsibility for the legal and regulatory requirements for nuclear security in relation to nuclear facility and nuclear material, including while in transport.

International safeguards regimes involve sovereign obligations. In order for the NPP to fall within IAEA safeguards, it must be the host country that is a signatory to the appropriate international safeguards regimes. However, while a safeguards regime would reside at the national level, involving the host country, broader commitments to non-proliferation would need to involve all members of the regional consortium recognizing that all participants could have access to sensitive nuclear information. Such commitments would not necessarily be limited to the Nuclear Non-Proliferation Treaty. They could in addition involve what would otherwise be bilateral commitments (e.g. the United States' 123 Agreement), which could turn into multilateral commitments to cover all participants in the regional structure. Collaborating Member States would need to consider the manner in which they establish and enforce bilateral agreements with vendor countries, as well as how they manage exports to third countries, taking into account issues such as 'dual use' items and 'deemed exports'.

Nuclear liability
International nuclear liability regimes are treaty level commitments of sovereign nations. While it would make sense for all the consortium members to have similar international obligations in respect to nuclear liability, with harmonization of national laws,[25] the key participant (among the countries involved in the project) in the international nuclear liability structure is the host country because of the legal channelling[26] provisions of the major international nuclear liability regimes (Vienna Convention, Paris Convention, and Convention on Supplementary Compensation). Under legal channelling, the host country must handle all claims, providing a competent court and abiding by the principles embedded within the applicable treaty regime, with the licensed operator having sole liability under the treaty regime. The host country is the treaty member and the operator is the party to whom all liability is channelled, hence both are involved.

A unique question exists as to the definition of owner/operator under the international treaty regimes and national laws. Consideration should be given to how the project is structured relative to such terms within the treaty regimes of the host country and its national nuclear law. If the participating countries each hold an ownership interest in the NPP, all might incur exposure for nuclear liability either directly (due to gaps in the international nuclear liability regimes in the context of cross border damage) or indirectly (via their equity interests in the project). However, the participating countries will also have to establish or designate a company within the host country that will be deemed the licensed operator. Ownership of the licensed operator could be different than ownership of the NPP itself. Thus, careful consideration would need to be given as to how such structures would affect legal exposure in

[25] Such coordination will serve, in part, to address concerns relating to cross border damage and whether or not legal channeling back to the host country will occur.
[26] Legal Channeling involves the channeling of all liability to one party associated with the NPP, which is traditionally the operator.

respect to the asset itself. In the event that certain participants do not share in legal liability as a matter of law, based on the structuring of the ownership in the asset or in the operator, separate arrangements could be made among the participants to share in the initial burden of the licensed operator, for example a contribution/indemnity agreement that could be done on a *pro rata* basis. However, to the extent the limit of liability under the treaty regime is exceeded, the host country might wish to extend coverage once the licensed operator's legal responsibilities are exceeded. In this case, excess coverage could become a shared responsibility of all participating Member States.

5.11.3. Share of investment

Establishing the ownership shares and associated off take rights might be challenging. For example, all countries might not wish to have the same levels of involvement in the overall project development, which could affect their entitlements in both the equity and the energy generated. Another consideration would be how much recognition is given to efforts of the host country in developing the project. Much effort will be required in developing the nuclear power programme, the infrastructure to support the NPP, and the legal and regulatory regimes. The consortium partners might then try to assign certain value within the ownership structure to this effort. Similarly, the host country will bear certain additional risks and burdens by having the NPP sited within its borders.

5.11.4. Lifecycle considerations

Key elements of NPP development involve considerations of nuclear waste, spent fuel, and decommissioning. While partnering countries will naturally focus on the aforementioned benefits of NPP development, these countries will also have to account for waste disposal. While decommissioning will ultimately be an issue at the NPP site, it should be a shared activity including the financial responsibility. Additionally, even though the host country will have a primary and proximate issue in the handling of spent fuel and nuclear wastes, the long term disposal of such materials could be handled by another participant in the project. This assumes that transport of high level waste can be achieved across the national boundaries. These issues will necessarily need to be addressed early on in the development of the project, so that clear lines of responsibility, both for management and funding, are established and understood.

5.11.5. Decision making

The more complicated the ownership structure and levels of participation, the more complicated the decision making structure. Moreover, the consortium members should decide whether or not the host country has certain special voting rights (e.g. veto rights) for certain issues. As noted above, certain responsibilities will ultimately reside with the host country, and this dictates that the host country will have a greater role in the decision making associated with such issues.

The participants will have to delineate the decision making process for the project. Such matters should be identified early in the process, addressing matters such as the following:

- Should all the countries vote on project decisions, or just on certain major decisions?
- More specifically, should all the participants have a vote in selection of the technology, the major contractors that are engineering and constructing the facility, and the operator?

- In terms of decision making, is unanimity required? Could unanimity be limited to certain major decisions? Could unanimity result in deadlocks among the participating Member States? [27]
- Must all participants approve the construction and operating licenses for the NPP? Or do such decisions reside with the host country and its regulator?

5.11.6. The addition of complexity

Historically, governments take longer to make decisions than corporations. Moreover, governments are oftentimes not accustomed to working in commercial space. Structuring the regional development of a nuclear power plant is a very complicated undertaking. If this were simply being done at a corporate level, such an undertaking would be challenging enough. By adding sovereign governments to the equation, the degree of difficulty automatically increases. This conclusion does not mean that the goal is unattainable; however, the parties should acknowledge the difficulty in trying to bring together sovereign entities at both a commercial level and a political/diplomatic level.

5.11.7. Contracting issues and considerations

In order to account for the varied roles and interest of the members of a regional consortium, complex contractual structures will need to be implemented. Given that such a regional structure is at a government to government level, normal contractual protections might not provide adequate protections to the members of the multinational consortium. It is important to recognize that from initial project development through decommissioning, the relationship among the Member States in respect of the NPP could last for one hundred years; as a result, it is important for documentation to address how these relationships may evolve over time. Some issues that should be considered are discussed in the following section.

Host country not meeting its obligations
What meaningful protections can the non-host national participants have, if the host country is not living up to its obligations? These may include:

- In a commercial context, participants could seize the asset. However, a contractual right of this kind might not be practical among the regional participants, because the exercise of such an extreme contractual right becomes not simply an economic/legal decision, but also a decision having diplomatic implications. Therefore, if termination is not a meaningful remedy, what other mechanisms can be used to ensure that each nation fulfils its obligations under the regional arrangement?
- The non-host national participants will need to have protections to ensure that the host country will not legislate locally in a manner that denies the other Member States the full enjoyment and benefit of their proportionate share in the NPP. The non-host national participants may look to protections afforded by bilateral investment treaties, regional arrangements, or topical treaties which provide certain rights and remedies that are not contractually based. The key for the non-host national participants is to identify material rights that can be enforced in a meaningful way, so that the host country is disciplined by the prospect of legal recourse.

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[27] Consequently, any voting structures requiring unanimity should be carefully considered and accordingly limited to the extent possible. The participating Member States will need to balance political processes with commercial considerations, understanding that, while the overall Milestones process might be a policy driven endeavor, bringing an NPP to market is a commercial undertaking.

Non-host country not meeting its obligations
If a participant non-host country does not live up to its financial obligations, either during project development or operation, participants should consider whether or not the programme can continue when one of the participants does not meet its obligation. If financial burden sharing is one of the key motivations for a regional arrangement, the participants might wish to consider how much contingency each participant should have in its financial commitment, such that the remaining members could fund the shortfall created if one member withdraws or fails to live up to its financial obligations. This can raise a number of issues or questions, including:

- Will the other members be forced to fund shortfalls in order to maintain the project? What are the ramifications if one of the participants is terminated? Can a nonconforming partner truly be removed from a regional structure?
- If a participant withdraws and no longer takes its share of the output, can the remaining participants use the additional capacity? If such capacity cannot be used, does the project maintain financial viability, given the decrease in revenue?
- If political instability arises within one of the countries or a dispute unrelated to the NPP arises between or among members of the consortium, how will cooperation be affected?
- How can meaningful contractual protections be crafted among sovereign states that share in the equity and power produced by the asset?
- How can such protections be crafted to ensure their enforceability in a meaningful way?
- What protections are to the benefit of the non-host country participants, in the event that the host country for the NPP takes an adverse action (e.g. passes a law to prohibit the use of nuclear power, fails to export power generated, seizes the asset, etc.)?

The non-host country participants should consider insisting upon affirmative legal protections within the national law of the host country, to ensure that certain special legal rights are afforded to them.

5.11.8. Lack of true energy independence

If one of the goals sought by participants in the regional structure is energy independence, such participants should consider whether or not they are truly achieving energy independence when the generating facility is operating outside of their borders. The non-host participant is always exposed to a force majeure risk that the host country closes its borders, denying the recipient access to the power generated by the NPP. Recent examples in natural gas markets demonstrate that such market manipulation is always a risk. Thus, in trying to create a new source of energy, the participating countries should balance that goal against the contravening dependencies that are created.

5.12. EXAMPLES OF REGIONAL APPROACHES

5.12.1. Lithuania's Visaginas NPP: a Baltic regional initiative

As part of the Accession Treaty to the European Union of 2003, Lithuania closed the Ignalina NPP Units 1 and 2 in 2004 and 2009, respectively. To meet its energy needs and to ensure security of supply (i.e. reduce reliance on imports), Lithuania started regional preparations for the new NPP project (Visaginas) in 2006, with the three Baltic countries (Lithuania, Estonia,

Latvia) and Poland. The EU initiatives to create an integrated single energy market, with planned interconnections with neighbouring markets (like Sweden, Poland and Estonia-Finland) have also been an influencing factor. Lithuania, being the host country of the proposed Visaginas NPP, established a new company called Visagino Atominė Elektrinė (VAE) in 2008, to start preparatory work for the NPP including strategic planning, risk management, investment planning, etc. In 2009, the regional partners were solidified (with Poland ultimately dropped out) and a 'strategic investor' approach for the development of the Visaginas NPP was established. In November 2010, Korea Electric Power Corporation was recognized as a potential strategic partner, but later withdrew. In July 2011, Hitachi was selected as the Strategic Investor for the Visaginas NPP. Hitachi committed to immediately start work required for the preparation of the Concession Agreement. Hitachi's proposal included their 1350 MW(e) AWBR technology. In March 2012, the Prime Ministers of Lithuania, Latvia and Estonia maintained their commitment to participating in the project. Additionally, the project structure allows Poland to reconsider their investment at a later date. Due to the scale and time horizon of project, there are limited sources of financing available in the private markets. Hence, the main providers of capital are expected to be export credit agencies, development finance institutions, and the project shareholders.

5.12.2. Croatia/Slovenia: Krško

The Krško NPP started with an agreement in 1970 between Croatia and Slovenia, both then part of Yugoslavia, to establish the NPP and share the financial responsibility in return for the benefit of at cost electricity to be generated by the NPP. The 1970 agreement set out the legal framework for the mutual operating and investment in the NPP, based on a principle of equality between both investors in all aspects of the joint project. Originally, two NPPs were contemplated, with the first in Slovenia and the second in Croatia. A joint venture company was formed to develop the NPP and it entered into commercial operation in January 1983. Following the dissolution of Yugoslavia, the NPP became a project owned by two independent republics. After a decade of disputes (1993-2002), Croatia and Slovenia reached agreement on the future of Krško, and the NPP is now operated by a management board that is comprised of representatives from both sides. The development of the NPP, the associated disputes, and their ultimate resolution serve as an interesting case study for regional development and ownership of an NPP. For a more detailed description of Krško, please refer to Annex 4.

5.13. MEMBER STATE PREPARATIONS FOR A REGIONAL STRUCTURE

The following section discusses several main issues to consider when preparing to enter a regional structure. It is not intended to be a comprehensive list and should be used in conjunction with the other sections in this report.

5.13.1. NEPIO/ Project company

As discussed in the Milestones Approach, a Nuclear Energy Programme Implementing Organization (NEPIO) [9] should be formed to study and initially guide the development of the programme. In the context of a regional structure, the NEPIO would need to take on the regional character of the programme. This would involve the staffing of the NEPIO by representatives of each of the Member States, thereby affording adequate representation and information sharing among all participants. While the Milestones Approach envisions the NEPIO evolving over time, as the nuclear programme moves beyond Milestone 1, the NEPIO

might take the role of a 'steering committee' in the regional context, even though the owner/operator and regulator assume larger roles in Phase 2.

As the NEPIO evolves in the later stages of project development, and as the project approaches the commercial phases of the lifecycle (procurement and financing, followed by operation), the participants could then form a project company, with participation interests backed by sovereign guarantees. With such sovereign involvement in a commercial entity, the project company will then have the means to obtain financing for the project, as well as contract with the NSSS supplier and EPC Contractor for the construction of the NPP.

5.13.2. Business Plan/ Project development agreement

If the feasibility study establishes that an NPP is viable, then the participating Member States should establish a business plan. Such a plan would need to encompass both the nuclear power programme and the specific project itself. Such a business plan would need to define levels of involvement, scopes of work, financial contributions (to include the timing of contributions), decision making procedures and leadership, and development schedules, in each case for both the programme and the project.

The business plan will need to agree on liabilities and benefits in advance. It should establish legal commitments and remedies, to include an expedited dispute resolution process. The parties should find ways to expedite the resolution of disagreements, otherwise, the progress on the overall programme schedule will suffer.

5.13.3. Harmonization

Harmonization of legal regimes will facilitate regional structures. In the event that laws are being created to address a new situation (i.e. nuclear power in a Member State without a nuclear history), similar laws should be developed across the legal regimes of each of the participants, so that each participant shares the same risk. For example:

- If the participating Member States elect to have a repository for nuclear waste in a country other than the host country for the NPP, laws would need to be in place for the transportation of nuclear waste across national borders.

- Export control laws will need to be harmonized to ensure that during the execution of the project, materials, equipment, and related technologies will be able to move across borders in order to reach the project site, as needed.

- Each of the participants will need to have the same demonstrated commitment to non-proliferation and the peaceful use of nuclear energy. Without such commitments established in the national laws of each participant, certain members of a regional effort could find that the development of nuclear energy has led to unintended applications of the technology by some of its partners in the endeavour, or has been transferred outside of the regional effort for similar unintended applications.

- Although, under international nuclear liability conventions, nuclear liability runs to the operator of the NPP with legal channelling to the courts of the host country, nuclear liability issues (including cross border damage both within the regional structure and external to the regional structure) should receive identical treatment. Without such commonality across legal regimes, commercial entities such as technology suppliers,

contractors, and operators might find that certain gaps exist that make the project untenable.

- Given the highly proprietary technology involved in a NPP, harmonization of intellectual property regimes should also exist. Without equal protection across all participating Member States, vendors, suppliers, contractors, and operators might be unwilling to engage with the Member States, for fear that their intellectual property rights will not be observed.

To the extent that existing laws are already in place that deal with nuclear issues, harmonization could be more of a challenge, as laws are often more difficult to change than to create. A key activity will be to assess the current legal regimes in place for each of the participating Member States, so that there is a clear understanding early in the process as to the level of harmonization and compatibility that exists across the Member States and the efforts that will need to be made legislatively to facilitate a regionalized NPP development effort.

5.13.4. Streamlined participation and expert advice

As noted above, government decision making can be cumbersome. Moreover, government entities might lack commercial experience, especially in the area of complicated deal structures. In order to address these challenges, participants can take two steps:

- Create a limited number of representatives for coordination among the participating countries. While a number of stakeholders will need to participate within a Member State to establish such Member State's national position on the project, such inputs should be synthesized in a coordinated manner and then put forth by a limited number of representatives, each of whom are dedicated full time to the development of the project (to include the overall nuclear programme).
- Hire outside consultants to assist with technical advice and commercial and legal structuring.

6. VARIATIONS ON THE THEME: THE MULTIPLE OWNERSHIP STRUCTURE

The principal reason for regional efforts towards NPP development is the aggregation of resources and efforts needed to achieve the desired result, which might otherwise not be feasible by Member States acting alone. This aggregation principle can be applied without a regional structure, as shown in the following examples.

6.1. USA: TENANT-IN-COMMON STRUCTURES

The United States has the largest civilian nuclear fleet in the world, with 104 units currently in operation. Multiple units within the US fleet are owned under tenant-in-common structures, whereby several utilities hold undivided interests in the NPP asset. Such undivided interest insulates the co-owners from bankruptcy scenarios, which, in the absence of such a structure, could collapse the project in the event of the bankruptcy of one of the co-owners. With the undivided interest, each co-owner is entitled to its corresponding share of the power generated by the asset. Such utilities can be regulated utilities or cooperatives, or they can serve unregulated markets. The basic concept is that several utilities share the economic burden of

developing the NPP, instead of having one utility shoulder the full burden (and balance sheet exposure) of development risk.

6.2. EUROPE (GENERALLY)

A range of contractual arrangements have been developed and used by various European utilities over times, with a view to sharing assets through: (i) the undertaking to pay for the operating costs of dedicated assets for a certain period of time, in exchange for the delivery of pre-defined quantities of electricity generated by said assets during that period; (ii) physically swapping assets for a defined period of time; or (iii) swapping assets by designing 'virtual ownership' of said assets through the granting of drawing rights for a defined period of time.

6.3. FINLAND: OLKILUOTO 3

For Olkiluoto 3, a number of power companies and high end industrial users of electricity have combined under the ownership structure of Teollisuuden Voima Oyj (TVO), a private power company which generates no profit, but produces electricity for its owners at cost. Comprised of about sixty companies, TVO holds the ownership of Olkiluoto 3. Through a diverse ownership base behind TVO, the participants are able to diversify the cost and risk of the development of Olkiluoto 3. In turn, they enjoy their pro rata share of the power ultimately generated by the asset, either using the power themselves or selling it on the open market. Interestingly, the model of high end users of electricity has also been employed recently with the Exeltium transaction in France and the Blue Sky transaction in Belgium, but has been limited to off take arrangements (as opposed to the equity role used in Olkiluoto 3). For a more detailed description of Olkiluoto 3, please refer to Annex 2.

6.4. ROMANIA: CERNAVODA 3 and 4

For the Cernavoda project, the multiple owner structure is again utilized; however, the owners are not all domestic entities, as is the case in the United States, nor are the co-owners all utilities. Instead, in the case of Cernavoda, the multiple ownership structure involves both domestic and foreign utilities in the ownership structure, as well as high end users of electricity (ArcelorMittal). For a more detailed description of Cernavoda 3 & 4, please refer to Annex 3.

7. CONCLUSIONS

With the increasing interest of Member States in developing an NPP and the challenges associated with bringing a nuclear power plant online, a wider set of options have to be considered for NPP development, as all Member States are not similarly situated. Each NPP project is unique and has very specific to national conditions when considering factors such as: technology preferences, the localisation strategy, regulatory environment, economic conditions, public acceptance, political systems, level of development, electricity pricing markets, financial resources, and technical capabilities. As a result, no one approach will work for all. Taking into consideration the challenges foreseen by a country embarking on nuclear power, classical models that have been used for prior and current NPP development might not be suitable for their particular situations. In light of these concerns, this report has attempted to identify other possible options for NPP development. In doing so, the following principles should be considered, as a Member State attempts to assess whether a particular approach is feasible. These include:

- *Host country responsibilities*: While alternative contracting or ownership methodologies might serve to transfer some of the NPP development burden to parties outside of the host country, the host country must retain certain core competencies, which remain a responsibility of the sovereign host. There are certain responsibilities that must remain with the host country of the NPP, such as licensing and regulatory, security, safeguards, etc.
- *Technical expertise*: Prior to embarking on a particular contracting or ownership structure, Member States are encouraged to engage outside experts to assist with their assessments and decision making, as well as consult with Member States that have experience with such structures and potential participants from the nuclear industry.
- *Country specific conditions*: The contractual and ownership structures discussed in this report are highly dependent on the specific circumstances of the Member States overall economic situation, as there is no 'one size fit all' structure. Member States embarking on a nuclear power programme will need to assess the underlying factors that support each of the possible structures, considering both the pros and cons of such structures, before deciding whether or not a structure is appropriate for its national situation.
- *Economic and financial considerations*: These are key factors in selecting a particular contracting or ownership structure, as well as determining the viability of the project.
- *Risk sharing:* As Member States look to possible contracting and ownership structures, they should recognize that all potential stakeholders in the NPP will assess the risk/reward ratio that is embedded within a particular project structure. In order for a Member State to attract the nuclear industry to a particular project, it should consider current and future market conditions, country risk factors, and the overall risk allocation mix between the developer and the host country.
- *Sustainable development issues:* Environmental considerations, as well as other considerations regarding sustainable development, should be factored into the Member State's analysis. In many respects, these considerations are similar for any large infrastructure project; however, the Member State should also consider the nuclear specific issues, such as disposition of spent fuel and nuclear waste, as well as decommissioning.
- *Skilled labour*: Countries embarking on an NPP programme are particularly concerned with the challenges of limited financial resources, a shortage of human resources with specific, specialized skills, the lack of technological and industrial capacity within their countries, and the lengthy development and construction periods associated with nuclear power. Alternative contracting and ownership structures may offer such countries new pathways to achieving the ultimate goal of commercial operation of the NPP, but a Member State will need to balance the risks and rewards associated with such alternative approaches and have an appreciation of how such alternative approaches differ from traditional structures.

In considering potential contracting and ownership paths, the Member State should also consider the end result that it desires. To the extent that considerations beyond the supply of power are key programmatic factors, the Member State will need to consider how particular structures enhance or detract from such factors. Regardless of the strategy selected, the Milestones Approach provides a thorough methodology for a Member State to assess its progress in developing the infrastructure needed to support the first NPP and can be used as basic guidance for programme development.

CASE STUDIES

AKKUYU NPP PROJECT BASED ON THE BOO APPROACH: TURKEY

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1. HISTORY OF THE DEVELOPMENT OF NUCLEAR POWER

The total primary energy supply, in Turkey, amounted to 109 Mtoe in 2010, out of which energy generation using national natural resources amounted to 32.5 Mtoe. This demonstrates that at least 70% of Turkey's energy supply depended on the importation of energy resources.

The growth rate of electric energy consumption in Turkey has been about 7.5% per year between the years 1980 and 2009. As of September 2012, the total installed capacity of Turkey increased to 55,380 MW. In 2010, about 60% of their primary energy was generated from conventional sources. This consisted of 31% electricity generation from coal and 32% from natural gas. In 2011, 45% of Turkey's electricity was generated from gas, 27% from coal and 23% from hydro power. As a result of all these factors, nuclear energy has become an attractive source of energy for Turkey.

Turkey expressed its interest in the development of a nuclear industry decades ago. In 1965, Turkey conducted several studies to investigate the possibility of constructing a Nuclear Power Plant (NPP). Between 1967 and 1970, a series of feasibility studies were undertaken for a NPP with a 300 MW capacity. However, due to difficulties relating to the selection of the project site and other associated problems, the project was not implemented.

In 1976, the Akkuyu site on the Mediterranean coast (Mersin province) was licensed for the construction of an NPP. In 1977, following the site selection, the tender for the construction of a 600 MW plant was announced, with one French and three Swedish companies bidding. The contract was awarded to the Swedish companies: ASEA-Atom and STAL-LAVAL. The tender was, however, cancelled due to the withdrawal of a guarantee that had been issued by the Swedish government. Negotiations were concluded in 1979.

At the beginning of the 1980s, a site selection survey for a new NPP was held. The Inceburun site, located near Sinop on the Black Sea coast, was selected. In 1983, the second tender was announced. Bids were received from seven companies and letters of intent were submitted by three more, for a total of one CANDU unit by Atomic Energy of Canada ("AECL"), one PWR unit by Kraftwerk Union AG ("KWU") at Akkuyu, and one or two BWR units by General Electric at Inceburun.

In Sinop, the preliminary results of the site surveys conducted by a General Electric expert team were provided. The team consulted with experts from the IAEA and from Turkey, who had previously carried out similar studies in the region which concluded that a NPP was not feasible[4].

2. BACKGROUND ON THE AKKUYU NPP PROJECT

The Akkuyu NPP negotiations continued with AECL and KWU throughout 1984. The structure of the project was converted from a turnkey project to a Build-Operate-Transfer ("BOT") project in 1985. This was the first time the Turkish government considered the idea of a "public-private partnership" for the development of the national nuclear program. The Turkish government suggested that AECL should construct the NPPs together with KWU, by forming a joint venture company with the state owned Turkish Electricity Authority (TEK), in a BOT model project. Accordingly, the project ownership would be 60% AECL and KWU, and 40% TEK. The joint venture company would operate the reactors for fifteen years while selling the generated electricity to TEK, and would then subsequently transfer their shares in the nuclear site to TEK. Both AECL and KWU were required to provide for the greater portion of the financing[1].

At this stage, KWU resigned from the bid. Even though AECL accepted the BOT model, it insisted on a financial guarantee from the Turkish government for the implementation of the project. This guarantee was not provided.[1]

In the mid 1990s, the idea of nuclear power development in Turkey resurfaced. In 1993, the High Council of Science and Technology identified nuclear power generation as the 3rd highest priority project for the country. In view of this decision, the state owned Turkish Electricity Generation and Transmission Company (TEAŞ) included an NPP project in its investment program for 1993.

A new bidding process for the construction of an NPP at Akkuyu began in 1996. Bids were submitted by three consortia, led by the engineering companies AECL, Westinghouse-Mitsubishi and Nuclear Power International (Framatome). The project was, however, postponed in July 2000, after a series of delays due to economic circumstances.

In 2007, a new law (Law No. 5710), concerning the construction and operation of NPPs and the sale of the electricity generated by them, was passed by the Turkish parliament and subsequently approved by the Turkish President. The bill provided the Turkish Atomic Energy Authority (TAEK) with the authority to set the criteria for building and operating NPPs. The Turkish Electricity Trade & Contract Corporation (TETAŞ) would purchase all power generated by NPPs built by foreign investors, based on the principles of "private-public partnership", within a timeframe not exceeding 15 years following the commissioning[28] of the NPP.

In March 2008, a new tender for the construction of the first NPP at the Akkuyu site, with a total power capacity of 5000 MW by 2015, was announced on the basis of a Build-Own-Operate (BOO) model. Turkey was ready to guarantee the purchase of electricity generated by this NPP until 2030. Thirteen world leading engineering companies were invited to take part in the tender.

The BOO model for the Akkuyu NPP project implementation was chosen due to a number of factors including:

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[28] Law No. 5710 of the Turkish Republic dated 09 November 2007.

- relatively stable economic circumstances (budget deficit was 2.21% of the GDP according to UNCTAD and the national debt was 46.3% of the GDP according to OECD in 2009)

- steadily high wholesale electricity prices in the open market (higher than average prices in Europe), thus ensuring the economic efficiency of the project and sustainable growth of the demand for electricity

- guaranteed purchase of fixed amount of electricity, with the terms stipulated in the power purchase agreement to be concluded with TETAŞ

A consortium of the Russian Atomstroyexport JSC, along with Inter RAO UES and Turkey's Park Teknik Group, was the sole bidder in a tender to build and operate Turkey's first NPP. The offer specified construction of four NPP units with a capacity of 1200 MW each[29].

On the 20th of November 2009, Turkey cancelled the tender and made a decision to implement the project on the basis of bilateral cooperation with the Russian Federation. On the 13th of January 2010, Deputy Head of the Russian government, Igor Sechin, and the Minister of Energy and Natural Resources of Turkey, Taner Yildiz, signed a joint statement on the cooperative constructing an NPP in Turkey.

3. STRUCTURE OF THE AKKUYU NPP PROJECT

As a result of the bilateral negotiations, an agreement (IGA) between the governments of the Russian Federation and the Republic of Turkey, on the construction and operation of a NPP at the Akkuyu site in the Republic of Turkey, was signed on the 12th of May 2010. The IGA entered into force in Turkey and Russia on the 21st of July 2010 and the 13th of December 2010, respectively.

The IGA set out the construction and operation of an NPP, based on the BOO model, at the Akkuyu site in Turkey. It included four NPP units based on the Russian VVER (water-moderated water-cooled power reactor) design, each with a capacity of 1200 MW. The IGA also included the establishment of an onsite, full scope simulator for the training of the NPP's operations personnel.

Currently, the IGA is the primary document which outlines the key parameters of the BOO model of the NPP at the Akkuyu site. These parameters include:

- general technical characteristics of the units and terms of their commissioning;
- scope of cooperation under the project;
- terms and conditions of the incorporation of the project company, as well as its status as the employer, owner and operator of the NPP;
- major parameters of the power purchase agreement (PPA);
- free of charge training of the Turkish operating personnel for the NPP;
- free of charge land allocation to the project company (including the site);
- project funding issues;

[29] WNA Country Briefings.

- taxation;
- fuel supply;
- intellectual property rights;
- international nuclear framework and nuclear liability.

TABLE 1. MAIN TECHNICAL CHARACTERISTICS OF AKKUYU NPP PROJECT.

Unit technology	**VVER**
Nominal electric power/ heating power	1190 MW / 3200 MW
Number of loops in the primary circuit	4
Installed capacity utilisation factor	92%
NPP lifetime	60 years
Fuel cycle	4-5 years

The Pyramid in Figure 1 reflects the major legal documents and conditions which set out the background for the Akkuyu NPP project implementation, based on the BOO model.

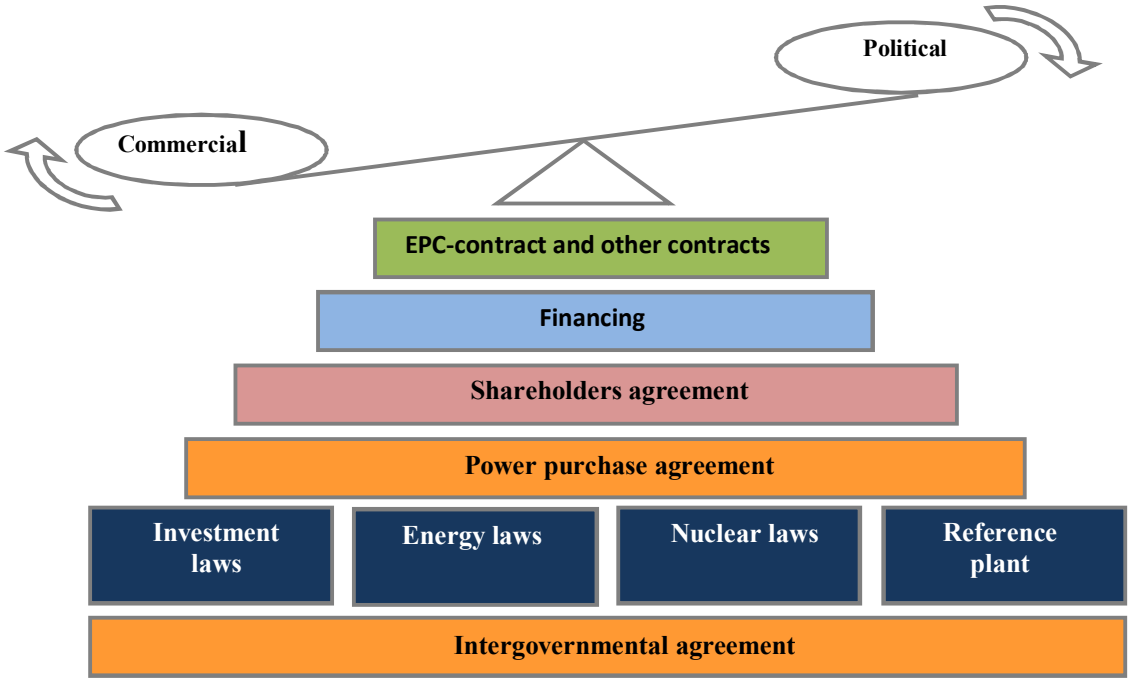

FIG. 1. Legal background for Akkuyu NPP project.

The second layer of the pyramid formed by the Turkish legislation is related to investments, energy (grid code[30], balancing market, etc.) and nuclear energy together with other national laws (i.e. on licensing, permits etc.), based on a number of multilateral and bilateral international agreements. Examples of important international covenants are the Treaty on the Non-Proliferation of Nuclear Weapons (1968), Convention on Early Notification of a Nuclear Accident (1986), Convention on Nuclear Safety (1994), Convention on the Physical Protection of Nuclear Material (1979), Paris Convention on Third Party Liability in the Field of Nuclear Energy (1960) and the Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (1988). Agreements between the governments of the Russian Federation and the Republic of Turkey include the Early Notification of a Nuclear Accident and Exchange of Information on Nuclear Facilities (2009), Cooperation in the Energy Field (1997) and the Cooperation in the Field of Peaceful Use of Nuclear Energy (2009). Protocols between the Ministry of Energy of the Russian Federation and the Ministry of Energy and Natural Resources of the Republic of Turkey include the Cooperation on the Sphere of Nuclear Power (2009).

The Turkish government plays a key role in determining the legal basis necessary to attract investments concerning the engineering, procurement, construction, commissioning, operation, sale of electricity, and decommissioning of the NPP in the Akkuyu project.

Even though Turkey has taken a major step in the direction of creating the national infrastructure needed for its nuclear program, considering that the Akkuyu NPP will be the first NPP in Turkey there are still issues on which the Republic of Turkey and the Russian Federation are required to collaborate, in order to develop the legal basis for the project implementation.

The reference plant concept is at the base of the Pyramid in Fig.1. It uses a model NPP project with similar technical characteristics that is taken into consideration when calculating the preliminary commercial and technical aspects, in addition to assessing the potential legal risks.

4. SHAREHOLDERS

The principal shareholders of the Akkuyu NPP project are the Russian Federation and the Republic of Turkey, which are contractually bound by the IGA. According to the IGA, the Akkuyu NPP project is to be implemented by a special purpose vehicle (the "Project Company"), established in accordance with the laws and regulations of the Republic of Turkey. The Project Company should commission the first NPP unit within seven years from the date of issuance of all permits and licenses necessary for the commencement of construction. Other units should be put into commercial operation in one-year intervals, consecutively, after commencement of the commercial operation of the first unit. The Project Company will own both the NPP and the electricity generated by it. In accordance with the IGA, 100% of the Project Company shareholding is to be held by Russian investors initially.

The first three levels of the Pyramid form the basis of the shareholders agreement. The Turkish legislation does not require such an agreement to be signed in order to incorporate a commercial company. The execution of a shareholders' agreement would be required for the

[30] Such technical features of the NPP as power generation in base load with a limited ability to follow the load fluctuations require specific exemptions from the standard Grid Code.

accession of new equity investors (other than the Project Company's founders) to the NPP project. Therefore, it is difficult to estimate the function of such an agreement at this stage (while none exist) for both debt and equity investors of the Project Company.

In order to implement the project, the Project Company will enter into contracts with its initial Russian shareholders. Such contracts will provide major requirements necessary for the implementation of the project. The shareholders are:

- Atomstroyexport JSC – engineering, procurement and construction of the NPP;
- INTER RAO UES JSC – energy trading;
- Concern Rosenergoatom JSC – operation and maintenance of the NPP;
- Atomenergoremont – maintenance of the NPP;
- Atomtechenergo – commissioning of the NPP.

The nuclear fuel supply contract is to be signed with the Russian nuclear fuel manufacturer TVEL JSC.

5. FINANCIAL STRUCTURE

All the documents and conditions forming the first four levels of the Pyramid outline the basis for attracting debt and equity financing for the project, mainly on a limited recourse basis. In this respect, it is very important to provide bankability of these documents by drafting them in a format that minimizes project implementation risks and financial risks.

As was stated above, the Russian shareholders with the support of the Russian State Atomic Energy Corporation **(**ROSATOM**)** are in the position to provide equity during early stages of the project. According to the IGA, the cumulative share of the Russian investors in the Project Company is not to be less than 51% at any time. Russian investors need to be authorised by the government of the Russian Federation to participate in the project.

On the 13th of December 2010, the Project Company, i.e. Akkuyu Electricity Generation JSC (AKKUYU NPP ELEKTRIK ÜRETIM ANONIM ŞIRKETI), was established in Turkey. The shareholding was initially divided as.

- Concern Rosenergoatom JSC (REA) – 92.85%;
- Atomstroyexport JSC (ASE) – 3.47%;
- INTER RAO UES JSC (IRAO) – 3.47%;
- Atomenergoremont JSC (AER)– 0.1%;
- Atomtechenergo JSC (ATE) – 0.1%.

At a later stage, the Russian party is to attract foreign investors, primarily Turkish investors. However, the distribution of the remaining 49% of the Project Company's shares will, in any circumstance, be subject to the approval of the Republic of Turkey due to national interest, security and economic circumstances.

The total project capital expenditure with taxes amounts to approximately USD 21 billion. According to the current Turkish legislation, the Project Company's share capital must be equal to 15% of the total project costs, in order to obtain a generation licence. The financial structure of the project is envisioned as 20% equity and 80% debt. Return on investment – i.e. all the capital expenditure (including financing costs) incurred by the Project Company in relation to the construction and commercial operation of the Akkuyu NPP is required to be returned within 15 years from the commencement date of commercial operation of the NPP units. The liability in relation to the investment and operation risks of the project remains with the Project Company. Duly incorporated and having raised the corresponding funds, the Project Company is ready to enter into EPC and other contractual arrangements necessary to fulfil its obligations.

Pursuant to the IGA, TETAŞ will enter into the PPA with the Project Company. TETAŞ is required to guarantee the purchase of a fixed amount of electricity generated by the NPP from the project company for a period of 15 years, starting from the date of commencement of the commercial operation of each unit, in consideration for a weighted average price of USD cents 12.35 per kWh: 70% for units 1 and 2, 30% for units 3 and 4.

6. CURRENT STATUS

(i) Corporate

Following consecutive share capital increases, the Project Company has increased its share capital to TL 1,440,000,000 (approximately EUR 632 million). Negotiations with the largest Russian and international banks are underway, in order to provide the debt component of the project's financial structure. The Project Company has applied to the Ministry of Customs and Trade to adopt the registered share capital system which will allow its Board of Directors to decide on share capital increases. The Ministry of Customs and Trade gave its permission to the Project Company for the registered capital system in October 2012.

(ii) Regulatory

Application has been made to the Energy Market Regulatory Authority for the electricity generation licence in accordance with the IGA. The Grid Operator's opinion is expected and will carry the licence application forward to the review and evaluation stage. The Environmental Impact Assessment (EIA) process is moving forward and the format for the EIA report will be determined soon. The Project Company submitted the EIA to the Ministry of Environment and Urbanism on the 24th of November 2011. It was applied to the Energy Market Regulatory Authority for Electricity Generation License on the 2nd of December 2011. The licence and EIA approval is expected to be obtained by the year 2013.

(iii) Project contracts

Land Allocation Agreements: Preliminary land permits are obtained in accordance with the applicable legislation. The allocation of land for the Project Company is currently being carried out. Negotiations continue on limited *in rem* agreements setting out the terms and conditions of the allocation for different types of land owned by the relevant state entities. Land owned by the Treasury will be allocated by the Ministry of Finance, forestry land will be allocated by the Ministry of Forestry and Water Affairs, and the State owned Electricity Generation Company will allocate land under its own ownership.

PPA: The negotiations on the PPA with TETAŞ are expected to begin soon. A draft PPA was prepared with the input from ROSATOM, InterRAO, the Project Company and its technical advisors. The draft was submitted to the Ministry of Energy and Natural Resources for review.

(iv) Technical

Field work in accordance with the applicable legislation and preliminary land permits continue in Akkuyu, Mersin. An updated site report for the purpose of reviewing the site parameters has been submitted to TAEK and is being reviewed at the moment.

Consequently, the Akkuyu site is expected to receive its generation licence by mid-2013, as it is likely to take more than a year to complete all the procedures regarding licensing. The Project Company is likely to start building the Akkuyu nuclear power plant in 2014 and the first reactor is planned to generate electricity in 2019.

7. LESSONS LEARNED AND CONCLUSION

It is the content of the documents, set out in the Pyramid, which predetermines the balance of the scales placed on the top of the Pyramid. The more bankable the documents are and heavier weighing of the commercial side in comparison to the political side result in more attractive conditions to attract limited resource financing.

Recognising the significance of the commercial aspects of NPP projects based on the BOO model, as well as their considerable scale and costs, intensifies the responsibility of the host government to create a predictable and investor friendly environment.

The NPP project at the Akkuyu site in Turkey is the first international NPP construction project to be implemented on the basis of a classical BOO model. Its successful implementation will prove the worthiness of this model and will enable replication of this experience, fostering cooperation among a growing number of countries willing to develop nuclear energy. In order to further implement projects based on BOO models, ROSATOM established, in 2011, CJSC “Rusatom Overseas” to represent ROSATOM’s group of companies and implement its key projects overseas.

OLKILUOTO-3 'MANKALA' APPROACH: FINLAND

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1. HISTORY OF NUCLEAR POWER DEVELOPMENT

Finland's four operating reactors provide currently 30% of its electricity. Two boiling water reactors (Olkiluoto-1 and 2), supplied by Asea-Atom, are operated by Teollisuuden Voima Oy (TVO); and two modified Russian pressurized water reactors (VVER), with Western containment and control systems (Loviisa-1 and 2), are operated by Fortum. A fifth reactor, Olkiluoto-3 is under construction and three more are planned. Out of these, two obtained a positive Decision in Principle from the Finnish parliament in 2010 and are progressing towards construction phase.

The first steps on this road were taken in the late 1950s and early 1960s. At that time, the demand for electricity was growing rapidly (at an annual rate of close to 10%) as the degree of both industrialization and processing of industrial goods was growing. On the supply side, the economically feasible hydropower potential had nearly been exhausted. Increasing domestic condensing power production, as opposed to importing electricity, was seen as the primary way to secure access to cheap electricity and, thus, ensure the competitiveness of the energy intensive paper and pulp industry in particular, which made up around 2/3 of the total value of Finnish exports at the time.

The next steps, prompted by national power companies, private industry, state officials and experts, all with their own aims and agendas more than express political decisions or guidance, were studies of the feasibility of a nuclear build program. Heavily mingled with the foreign politics of the time, the progress took two parallel paths. Following the traditional sovereign based approach, the dominant national power company Imatran Voima (IVO, later to be privatized and evolve into Fortum) initiated an international invitation for bids for a turnkey NPP. After a number of twist and turns, the government finally decided to order a unit from the Soviet Union in 1969. The construction of Loviisa-1 took place in 1971-77 and Loviisa-2 in 1972-80.

The paper and pulp industry was not content to just sit by and watch the story unfold, but was eager to retain control over an essential factor of production and guarantee access to cheap electricity. Therefore, alongside with the government led development, the private industry established TVO in 1969, in order to launch a nuclear project of its own. The project quickly gathered momentum and TVO started negotiations with Asea-Atom in 1972 to order a unit. In 1974, TVO announced that it would order a second unit of the same kind. Olkiluoto-1 was constructed from 1974-78 and Olkiluoto-2 from 1975-80. In hindsight, gaining political acceptance for a private industry led enterprise was, of course, far from obvious due to the societal significance of nuclear power, especially in terms of risks and liabilities.

An additional factor for power generation in Finland is the fact that the Nordic energy markets are deregulated. Nord Pool Spot runs the largest market for electrical energy in the world, measured in volume traded (TWh) and in market share. It operates in Norway, Denmark, Sweden, Finland and Estonia. More than 70% of the total consumption of electrical energy in the Nordic market is traded through the marketplace. Fortum and a large number of other companies sell their generation at market prices through the Nord Pool Spot.

2. OLKILUOTO-3 NPP PROJECT BACKGROUND

After a few unsuccessful initiatives in the 1980s and 90s, the nuclear build program really took off when the parliament voted to approve building a fifth unit in 2002, following an application from TVO two years earlier. The result was a breakthrough, in the sense that this was the first decision to build a new nuclear unit in Western Europe for more than a decade. TVO rationalized the application primarily on economic criteria (lowest kWh cost, lowest sensitivity to fuel price increases), but security of energy supply and emissions savings were also referred to in the paper. Governmental support for the proposal was based mainly on climate policy that was being drafted at the time.

Following the submission of tenders by three vendors, TVO chose, in October 2003, the Areva 1,600 MWe European Pressurized Water Reactor (EPR) as the most cost effective option. Siemens was contracted to provide the turbines and generators. TVO signed the contracts with Areva and Siemens for an EPR unit in December 2003. Construction of the unit started in May 2005, but the project has experienced a number of delays.

In March 2007, TVO and Fortum commenced environmental impact assessments for new nuclear power units at the Olkiluoto and Loviisa sites, respectively. In June 2007, a consortium of industrial and energy companies announced plans to establish a joint venture company – Fennovoima Oy – to construct a new nuclear power plant in Finland. All three companies submitted an application for a Decision in Principle to the government by January 2009. The applications from TVO and Fennovoima received a positive decision, and these two projects are progressing towards construction phase.

3. OLKILUOTO-3 NPP PROJECT STRUCTURE

A typical ownership model for energy production companies in Finland is the 'Mankala' model (PVO, TVO, Fennovoima), named after the rapids of the same name, where the first hydro plant based on this ownership model was built in the 1950s. One of the main reasons this ownership model was established is that it allows for smaller power companies or regional utilities to participate jointly in large, capital intensive projects, to benefit from the economies of scale. Typically, at least one of the owners has extensive experience in the nuclear industry. For TVO, this owner is Fortum and for Fennovoima, this owner is E.ON (Note: As of October 2012, E.ON announced plans to withdraw from the Fennovoima Oy nuclear power project).

In the Mankala arrangement, the shareholders set up a company. The primary purpose of the company is the generation, transfer, and transmission of electricity to the shareholders. The electricity is distributed among shareholders at cost based on ownership shares, i.e. each shareholder is obligated to pay for the expenses arising from the company's operations relative to ownership, and the shareholders are then entitled to the electricity generated by the company (but not to dividends, as there is no profit). Each owner can then choose whether to use the electricity or sell it to the market.

The key document in this model is the articles of association. The payment terms defined in the articles of association are usually very strict, in order to secure cash flow. To secure stability, a large majority (or even unanimous) shareholder support is required to change the document. The shareholders have the right to acquire electricity being generated at the power plant at any given time, or electricity acquired by the company, in proportion to the number of

shares they hold of the total number of shares. Each shareholder is responsible for the company, for the annual expenses of the power plant.

Typically each shareholder is responsible for the variable annual costs, in the in the proportion that they consumed electricity generated at the company's plant or transferred by the company. These costs are those related to acquisition, transport, transportation insurance, storage and handling costs of fuel, taxes depending on the power production, and other costs incurred to the company directly, depending on the power volume used by the respective shareholder. In addition, each shareholder, irrespective of whether or not they have used their share of electricity, is responsible, in proportion to its share, for the fixed annual costs of the company related to normal operation, maintenance and administrative costs, other taxes than those depending on the power production, insurance costs, instalments and interest payments on the loans of the company. They are also responsible for other expenses resulting from financing or the arranging thereof, depreciations, costs incurred by the company's nuclear waste management, and other costs independent of power production related to the company's normal business and included in the company's budget or approved by company board. A shareholder's share of the liability for the annual expenses is limited to the amount corresponding to the proportion of its shareholding, and another shareholder's failure will not increase the shareholder's liability based on shareholding.

A prerequisite to a shareholder's right to receive electricity is that is has paid its share of the fixed costs in advance, and the variable costs as notified by the company. If a shareholder neglects its obligations, the company may have the right to cut off the distribution of electricity to the shareholder and to sell its portion of electricity to a party submitting the best offer (primarily to another shareholder).

It may be worthwhile to mention that in its efforts to increase competition within the European Union, the European Commission has made some unfavourable statements regarding the possible anticompetitive potential on similar arrangements. However, the Finnish Competition Authority (FCA) has recently stated that the purpose of competition legislation is not to inhibit undertakings which would otherwise enhance functioning of the market if realized and which cannot be carried through without cooperation among the (small) market players. Based on this and other considerations, the FCA has not seen any need to investigate the matter further. In Sweden, however, the co-ownership of NPPs has been under much more intense scrutiny. The situation there is different in the sense that the ownership is divided among the three major market players - Vattenfall, E.ON, and Fortum - and is a consequence of mergers, acquisitions, and political decisions, rather than the current owners setting up the Mankala companies to build and operate the units.

4. SHAREHOLDERS

TVO, which is the operator/licensee of the two units in Olkiluoto and is building Olkiluoto-3, is a non-listed public company founded in 1969 to produce electricity for its shareholders at cost. The company is owned by a consortium of power and industrial companies (heavy end users). The biggest shareholders are Pohjolan Voima (57 %) and Fortum (26 %). Pohjolan Voima (PVO), the founder and main shareholder of TVO, is itself a Mankala company, the main shareholders being Finnish pulp and paper manufacturers: UPM Oyj (42 %) and Stora Enso Oyj (16 %). Other shareholders include power and utility companies owned by several municipalities.

Fortum, on the other hand, is a publicly listed company with activities covering the generation, distribution and sales of electricity and operates in the Nordic countries, Russia, and the Baltic Rim area. In Finland, Fortum is the sole owner and operator/licensee of the two reactors in Loviisa. Furthermore, Fortum is a shareholder in eight other operating units.

5. FINANCING STRUCTURE

As mentioned previously, in a Mankala model each shareholder is obligated to pay for the expenses arising from the company's operations relative to ownership, but the shares entitle them to the electricity generated rather than to dividends. In the construction phase, the project is financed like any other investment: through loans from equity holders of the company, and operations in the domestic and international money and capital markets.

In 2003, TVO signed a firm and fixed price (turnkey) contract with Areva and Siemens for a 1,600 MWe EPR to be built at the Olkiluoto site, with the contractor responsible e.g. for the design, engineering, scheduling, project management, quality, licensability, manufacturing, procurement, transport, construction, erection, installation, testing, commissioning and performance values of the unit. TVO was responsible for applying for the necessary licences (based on licensing documentation from the contractor and granted by the Finnish Radiation and Nuclear Safety Authority), infrastructure and excavation work, connections to the national grid, and construction of certain auxiliary buildings.

The Olkiluoto-3 contract is a firm and fixed price (also known as turnkey) contract. In this type of a contract, the stated total contract price consists typically of the un-escalated fixed price, plus a firm (invariable) contingency to take escalation and project risks into account. The total contract price is the price bid, with no incentives or fees added. This total contract price will not be adjusted under any circumstances, even in case of a change in costs to the contractor while executing the project. However, any changes to the scope of the works, the design or the occurrence of risks for which the client may be typically responsible, e.g. late or non-issue of instructions, may nevertheless entitle the contractor to claim more than the fixed stated contract price.

A firm fixed price contract is the preferred type when cost risk is minimal or can be predicted with an acceptable accuracy. These contracts are thus negotiated only in cases where reasonably definite specifications are available. The contractor has more or less completed the design by the time the contract is signed, assessed the feasibility of the project, and organized supply chain and subcontractors. Costs (including possible price escalation and contingencies) can be estimated with satisfactory accuracy, so that the contractor can satisfy himself that the job can be completed at a profit, for the contract price and within schedule. A firm fixed price contract imposes minimum administrative burden on the contracting parties.

In the past, a number of development programs have tried such contracts with the result that the contractor was losing money on them. There are also examples of project failures in which the actual costs greatly exceeded the ability of the contractor to absorb the unforeseen cost overruns. A contractor who takes on too great a risk represents a risk also for the client.

TVO signed a €3.2 billion contract with Areva and Siemens for an EPR unit in December 2003. Construction of the unit started in May 2005, but the project has experienced a number of delays. The cost overrun is considerable, and Areva has made provisions for the write-down of €2.7 billion in its accounts.

6. CURRENT STATUS

The commercial operation was scheduled for May 2009, some 48 months after the first concrete pour for the nuclear island. This was in line with TVO's experience from the construction of Olkiluoto-2. However, circumstances had changed quite dramatically since the 1970s, when the contractor (then Asea-Atom) had an experienced, large organization ready to go, there was no shortage of manufacturing capacity in the market, and the plant design was ready. Areva agreed to the schedule, although it was clearly (at least in hindsight) too ambitious for a unit that was first of a kind and larger than any unit built before.

Owing to close cooperation between the turbine island contractor and an experienced construction company, work on the turbine island has progressed well and resulted in good integration of design and construction work. The nuclear island has been plagued by difficulties of all sorts. Installation works and plant automation system engineering at the unit have not progressed according to schedule. TVO estimates that the plant unit will not be ready for regular electricity production in 2014. The civil construction works of the unit have been mainly completed. The major components of the reactor island, such as reactor pressure vessel, pressurizer and four steam generators have been installed. Welding works of the primary coolant circuit pipeline have been completed. Commissioning preparations of the turbine island are ongoing. Planning, documentation and licensing of the reactor island automation are not yet completed.

7. LESSONS LEARNED AND CONCLUSION

Various reasons can be found for the delays of the Olkiluoto-3 project. The time it took to finalize site specific design was clearly underestimated. When the main contract for the project was signed and the construction license was applied for, the basic design of the plant had been completed and the technical requirements for the systems had been specified. However, the detailed design (e.g. dimensioning calculations, final site drawings) had not been carried out, and the time and amount of work needed for completing the design had been underestimated.

In addition, there were significant licensing and regulatory risks that were not given proper consideration. Not only have nuclear regulations become more stringent as to quality assurance and control, but the contractor also underestimated the impact of the Finnish licensing requirements, which are over and above those of the standard European Utility Requirements (EUR). Moreover, Finnish licensing practices differ in some respects from those in France, in as much as there is much more involvement by the Finnish Radiation and Nuclear Safety Authority (STUK) during the actual work. All this resulted in changes in regulatory and design requirements, which in their turn brought about numerous changes in the scope of work, accompanied by delays and cost increases. The cost overruns are the subject of disputes, in some cases it seems not to be quite clear who may be held responsible for what. This emphasizes the importance of having an extensive and detailed contract.

One factor that probably contributed significantly to the complications experienced during the project is missing, or rather, lost competence. Nuclear construction was long dormant in Europe, and a large number of experts and specialists went into retirement without being replaced, whilst others left the nuclear industry to find jobs elsewhere. The loss of experience has manifested itself in unsatisfactory quality of work followed by costly and time consuming

corrective measures. In addition, the contractor for the nuclear steam supply system had not previously tackled a turnkey power plant contract for a first of a kind unit.

In the years following the start of construction, the situation was aggravated by soaring steel prices. The enormous demand caused by China's booming economy swept the world markets clean of building steel. At the same time, oil prices rose to levels never seen before. Rising materials and labour costs also contributed to cost overruns.

All things considered, if the contractor had realistically appreciated all these aspects, it would have certainly ruled out entering into a firm fixed price contract, even under the aspect of taking on a higher risk in return for getting a foot in the door of a prospective, larger market. Firm fixed price contracts should not be used for projects where the implementation of untested or undeveloped technologies does not permit reliable cost estimates to be made, or if the regulatory environment is not yet fully understood. This type of a contract subjects the contractor to the maximum risk arising from full responsibility for all cost escalations and resulting profit or loss.

In summary, in selecting the contracting model the important criteria related to risks to the client in a project of this type are the design and development status of the plant, status of licensing, the experience and capability of the contractor, possibility of technology transfer, and the existence of a reference plant. It is absolutely essential that at the start of the construction phase, the maturity of the basic design be such that the requirements of EUR (at least in Europe) and the national licensing authority are fulfilled. Secondary selection criteria then come from enhanced safety features, special materials, fuel cycle services, ease of construction, plant availability, maintainability, radioactive waste and spent fuel aspects, decommissioning, cost estimate and schedule, design lifetime, unit size, local participation, the availability of adequate infrastructure, etc. The risk assessment criteria can be rigorously applied for plant designs when the first technological evaluation is available, but, as emphasized, technological and safety assessments are not nearly enough: risks inherently connected to the management of the construction phase and to the conduct of the national licensing authority should be taken into account. To reduce risks, the contracting can be done in steps (e.g. planning contract, works contract).

CERNAVODA NPP UNITS 3 AND 4 EQUITY APPROACH: ROMANIA

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1. HISTORY OF NUCLEAR POWER DEVELOPMENT

The Cernavoda NPP site is located in the Dobrogea, a region in the southeast of Romania as shown in Figure 1. Construction on the Cernavoda NPP site started in 1982, with the intention of building five CANDU 6 units in parallel. Work on Units 2 to 5 stopped in 1990, as the government of Romania focussed its attention on the completion of Unit 1. The core structures of Units 2-4 were left at different stages of completion. Preservation activities were performed on these structures, but were dependent on the available budget.

Unit 1 started commercial operation in December 1996. After Unit 1 started commercial operation, the completion of Unit 2 started in 2001 (commercial contract effective in 2003) and was finalized in 2007. Additionally, Romania developed a matching nuclear power infrastructure, including the CANDU 6 nuclear fuel manufacturing and heavy water fabrication.

FIG. 1. Cernavoda NPP location.

Figure 2 shows the current status of the development of the Cernavoda NPP site, in sequence from right to left, with Unit 1 (in operation), Unit 2 (in operation) and the containments of the third, fourth and fifth units. The figure shows that significant progress has been made in the construction work of Units 3 and 4.

In July 2003, the Romanian government released `The Road Map for the Energy Sector in Romania'. This is the strategy paper outlining the government's plans for the development of Romania's energy sector in the period 2004–2015. This paper concludes that the demand for electricity in Romania will begin to exceed available domestic supply in 2015, if no remedial action is taken. The government has therefore identified a number of strategic objectives in

the energy sector, including the refurbishment of several existing thermal and hydro plants, and the construction of new hydro, thermal and nuclear power plants. In this context, the government has announced that it plans to increase nuclear generating capacity, by 1,404 MW by 2015, through the commissioning of Units 3 and 4 of the Cernavoda NPP. This will significantly alter the mix of electricity generated in Romania, with nuclear power forecast to generate 25% of Romania's electricity production by 2015, compared to 9% in 2003. The government considers this change in the generating mix to be a clear indication of its long term commitment to nuclear energy.

FIG. 2. NPP Cernavoda site.

The Romanian government's commitment to nuclear energy is based on:

- A Levelled Unit Energy Cost analysis indicates that new nuclear plants are competitive in terms of net cost per MWh;
- Romania has proven expertise in nuclear power generation;
- Romania is self-sufficient in heavy water and CANDU 6 nuclear fuel fabrications;
- Nuclear energy does not emit significant levels of greenhouse gases and acid rain pollutants;
- The production of nuclear energy is independent of weather conditions;
- Nuclear power plants have a demonstrable record of cost stability.

The Pre-Feasibility Study of Cernavoda Unit 3 was finalized in 2003 and it identified the main constraints in project development. Among the constraints was the unavailability of direct financial support from the government and sovereign guaranties, due to the government policy of withdrawing from the electric power sector. The liberalization of the electric power market and the specific regulations concerning the subsidies granted by the government already began its implementation in Romania in 2000–2001. Such deregulation of the electricity markets usually drives new partnerships with larger interested entities. Additionally, the study identified insufficient capability of the Cernavoda NPP Owner (SNN

SA) to finance and attract the needed financing resources, taking into account the repayment of the loans for Cernavoda Units 2 (due in the next 10–15 years following starting the commercial operation in 2007).

These issues were the main drivers in adopting the approach for the finalization of Cernavoda Unit 3. Later, this approach was extended to Cernavoda Unit 4, based on the experience that completion of two nuclear units in parallel is more efficient than in series.

2. CERNAVODA UNITS 3 & 4 NPP PROJECT BACKGROUND

The Ministry of Economy and Commerce decided that the completion of Unit 3 of the Cernavoda NPP will be implemented through a Joint Venture (Project Company-PCO) between NuclearElectrica (a 100% state owned company, owner and operator of Cernavoda Units 1 and 2) and one or several local or foreign private investors. The PCO will be established for the purpose of owning and operating Unit 3 and shall be a Romanian registered legal entity. The objectives of the ministry in undertaking the project as a joint venture include:

- Bringing foreign expertise and finance into Romania;
- Creating a new player into the Romanian energy market, in line with the liberalisation programme implemented by the government, during the period 2003–2004;
- Faster implementation of the project than would otherwise be possible, given the other financial commitments of NuclearElectrica and the ministry;
- Demonstrating the feasibility of joint venture structures in investment projects in Romania, especially in the energy field;
- Such a partnership in this nuclear project is expected to bring experienced partners and allow for better risk management tools.

In the adopted model, NuclearElectrica (owner of existing assets of Cernavoda Units 3 and 4) had the following intentions and expectations:

- PCO (project) to be funded on a stand-alone basis in a similar manner to other financed power plant projects. To enable the project to proceed on this basis, it was recognized that the additional risks inherent in the operation of nuclear power plants, including radioactive waste disposal and decommissioning of the nuclear units, need to be addressed and responsibilities clarified.
- PCO (project) will be primarily funded by debt. At the initial stage and in line with other similar projects, it was expected the debt to equity ratio to be in the region of 70:30, subject to financing arrangements that the PCO's investors are able to agree to with lenders. Equity will be assured by the PCO's investors (shareholders), except NuclearElectrica, who will participate in PCO with the existing assets of Cernavoda Units 3 and 4.
- PCO shall have a long term Power Purchase Agreement (PPA) to be able to raise debt finance. Due to the current liberalization of the Romanian electricity sector and the privatization programme for the Romanian distribution companies, such long term

PPA can be concluded with major power consumers or electricity suppliers acting on the national and regional electricity market. However, the government will not be providing a sovereign guarantee to secure the debt of the PCO.

In order to implement the adopted approach and to determine the agreements between NuclearElectrica and potential foreign investors, the following actions were implemented:

- 2004: promotion of the project to potential foreign investors by seminars and workshops in Europe (London) and Romania.
- 2005: Project Feasibility Study (FS) was finalized, using specialized consultants.
- 2005: international announcement of the project finalization intention and request for Letter of Intention (LOI). A specific project Implementation Memorandum (PIM) was prepared for this announcement and also the executive summary of the FS was available. As a result of this action, 16 LOI were received, demonstrating a large interest for the project.
- 2007: request for Binding Offer from the interested sponsors/investors. In this request, the draft of Investment Agreement was included and comments on this draft were required from potential investors to be included in the Binding Offer. In October 2007, Binding Offers were received and six potential investors were selected.
- 2008: negotiations with selected investors for the Investment Agreement.
- 2009 January: conclusion and signature of the agreed upon Investment Agreement.

3. CERNAVODA UNITS 3 AND 4 PROJECT STRUCTURE

The main provisions of the Investment Agreement declare that a PCO, named EnergoNuclear, will be established as a joint stock company incorporated in Romania in accordance with the Romanian Companies Act. EnergoNuclear shall be in charge for the construction, commissioning and operation of the Units for electricity production. The Investor Agreement includes the statute of EnergoNuclear, which shall be used for the company registration.

Additionally, the Investment Agreement specifies that ANDRAD, the national authority in charge of coordination of activities for safe management of radioactive waste, is responsible for disposal of spent fuel and radioactive waste, including those resulting from decommissioning of nuclear and radiological installations, using the financial resources collected for disposal of spent fuel and radioactive waste management. The responsibility in the field of decommissioning can be transferred by the nuclear licence holder (EnergoNuclear) to ANDRAD after the shutdown of the installation (Cernavoda Units 3 and 4).

In case of a nuclear accident, the civil liability for nuclear damage will be determined by the 1963 Vienna Convention, as amended in 1997 and as implemented in the corresponding Romanian legislation. The operator for Cernavoda Units 3 and 4 will obtain insurance cover against any claims arising from damages caused to third parties following nuclear accidents (up to the insurance ceiling established by nuclear liability law).

In accordance with Romanian legislation on nuclear liability, the government will assume liability for nuclear damage that is a direct result of an act of terrorism.

4. SHAREHOLDERS

The Shareholders of EnergoNuclear and their percentage of shares from total are:

- ArcelorMittal Galati Romania – 6.20%;
- ČEZ – 9.15%;
- GDF SUEZ – 9.15%;
- Enel Investment Holding – 9.15%;
- Iberdrola Generación – 6.20%;
- RWE Power –9.15%;
- Nuclearelectrica –51.00%.

All of the 6 potential investors (except NuclearElectrica) had a long term investment grade rating of BBB+ or better under the Standard & Poor's' rating scale, or Baa1 or better under the Moody's rating scale.

NuclearElectrica shall be responsible for the operation and maintenance of Cernavoda Units 3 and 4, based on the specific contract with EnergoNuclear. Terms and conditions of this commercial contract shall be agreed during the pre-project period.

The initial heavy water inventory and fuel loads shall be supplied by Romanian local suppliers. On the other hand, EnergoNuclear shall be responsible for radioactive waste management generated by its activity.

5. FINANCIAL STRUCTURE

Each shareholder will commit to its proportionate share of all the electricity generated by the Units, on a take or pay basis. Shareholders will get the electricity at cost (plus a profit margin, if the EnergoNuclear so decides and determines that it is required under the applicable law).

The project shall be implemented in two steps:

1. Pre-project
2. Project implementation

Pre-project activities have an 18 month duration and a 30M Euro budget. The allocated budget is assured by shareholders proportionally with their shares. In this period, specific preparatory activities shall be performed such as project definition, bid invitation specification for EPC contractor, bid analyses and determination of the project cost.

'Project Definition' corresponds to preparation of final, detailed specifications, performance parameters for the Units, description of Units, configuration and identification of interfaces with the existing facilities at the Cernavoda site and the finalization of the full scope of

supply. Investors have expressed a clear preference for the execution of the project under a fixed price turnkey EPC (Engineering, Procurement, and Construction) contract. The intent is to minimize risk to the PCO and to obtain strong assurances from potential contractors regarding their on time and on budget execution of the works.

At the end of this period, based on the determined cost to implement the project, investors have the right to continue or to stop their participation in the project.

Project implementation is within the duration determined by the EPC contract (estimated to be 64 months). In this period, both nuclear units shall be constructed and commissioned with due consideration of the applicable rules. The investors shall participate in the project by financing proportionally with their shares (equity) and shall assure appropriate guarantees for the required loans.

This corresponds to investors proportionally bearing the cost for collection, handling, transport, treatment, conditioning, and temporary storage of the waste. Accordingly, the investors pay the legal contribution for the radioactive waste management, spent fuel management, their disposal and for decommissioning of nuclear installations. In Romania, as per legal provision, the licence holders have the obligation to pay two types of contributions:

- Annual contributions aiming at the constitution of financial resources for decommissioning of each nuclear power unit (0.6 euro/MWh of the net electricity generated)

- Annual contributions aiming at constitution of financial resources for the final disposal of radioactive waste (including spent fuel) generated during operation and decommissioning of each nuclear power unit (1.4 euro/MWh of the net electricity generated).

6. CURRENT STATUS

After the signature of the Investor Agreement in January 2009, the new entity (EnergoNuclear) was registered in March 2009 and started to work per the rules established in the agreement, in order to implement the activities established for the pre-project period.

EnergoNuclear hired the Owner Engineering Consultant, in order to develop the preparatory activities, including Bid Invitation Specifications, for the completion contract. In parallel, the legal consultant and financial consultant were hired by EnergoNuclear.

Some activities performed on the Cernavoda Units 3 and 4 sites are shown in Figure 3. These activities are mainly verification of the existing assets and cleaning. They are not progress works.

FIG. 3. Cernavoda Units 3 and 4 actual status.

It was considered that the decision for further participation on the project shall be taken based on the best selected bid for the project completion. A decision was adopted on the contractual approach for the completion of the project in September 2010, when a public competition was initiated for the qualification of the main contractor for an EPC contract. The required documentation on the main contractor qualifications were given to EnergoNuclear in January, 2011.

Due to the expiration of the pre-project period, without any conclusion on the final participation of the investors on project finalization (due to the status of the selection of the best bid), the negotiations for extension of the Investor Agreement started in November 2010. During this negotiation, one potential investor, ČEZ, announced that it will not continue with participation in Cernavoda Units 3 and 4, due to its investment in its country in the development of new nuclear power units. In light of this decision, NuclearElectrica took the ČEZ shares (9.15%) at the end of 2010, now having 60.15% of total shares of EnergoNuclear.

In January 2011, three other investors (GDF SUEZ, Iberdrola Generación and RWE Power) announced that they would stop their participation in the project. The remaining two investors, (ArcelorMittal Galati Romania and Enel Investment Holding) have declared that they are still interested in completing the project.

Even in these circumstances, the government decided to continue the project and NuclearElectrica took all the shares from GDF SUEZ, Iberdrola Generación and RWE Power. In February 2011, it signed a revised Investor Agreement with ArcelorMittal Galati Romania and Enel Investment Holding for the project finalization. The future EnergoNuclear activities shall be concentrated on the following:

- Identification and selection of the new potential investors who will be brought into the project by selling half (around 40 % of total shares) of NucleareElectrica's shares

- Selection of the EPC main contractor and Bid Invitation Specification finalization by the end of August 2011. It is expected that by end of 2011, the preliminary bids will be received from the EPC potential main contractors

In 2012, using the input data from the preliminary bids, the Feasibility Study shall be revised in order to determine the predicted cost for one MWh produced by Cernavoda Units 3 and 4.

Based on this indicator, the investor shall have the final decision for their participation in the project finalization.

It is also expected that, in 2012, specific engineering work shall be performed for the Preliminary Safety Analyses Report preparation, in order to be submitted to the Romanian Regulatory Body for analyses and submission of the construction license for Cernavoda Units 3 and 4. In parallel, the selected EnergoNuclear financial advisor shall develop and implement all the required financial arrangement, which will ensure the effectiveness of the commercial contract for the finalization of Cernavoda Units 3 and 4.

7. LESSONS LEARNED AND CONCLUSION

These new approaches for NPP ownership represent a challenge, and the implementation of such alternatives requires significant time. There are neither clear references nor similar experiences. In addition, the specific conditions of each country will impose the particular solution in that country.

A Nuclear power project is fundamentally more complex than other power projects. This complexity adds to the challenge of financing and includes:

- higher capital costs;
- longer planning and construction periods;
- significant risk factors that need to be expertly managed.

Despite these constraints, the particular benefits of nuclear power (competitive cost, green energy, etc.) will help the financing of the project. These represent the most important constraints and benefits in a nuclear power plant project implementation.

SHARING NPP KRŠKO BETWEEN CROATIA AND SLOVENIA: SLOVENIA

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1. HISTORY OF NUCLEAR POWER DEVELOPMENT

In the late 1960s, Slovenia and Croatia were often affected by power shortages. The two republics agreed in 1970 to jointly build two nuclear power plants, one in Slovenia and, following its construction, one in Croatia. These were to be the first NPPs in the Republics, both of which were, at the time, part of Yugoslavia. However, due to a changing political climate following the nuclear accident in Chernobyl, Ukraine, only the nuclear power plant situated in Slovenia was built.

The reasons for the commitment of The Socialist Republic of Slovenia and Croatia to the development of nuclear power were the recognized, crucial link between the growth of electric energy production and the economic growth of the two Republics. It was concluded that the Republics' future energy needs could not be met solely by classic power plants, and that the most optimal solution was the construction of a joint nuclear power plant.

Accordingly, the electric power companies of both Republics have initiated the action for joint construction of the first nuclear power plant in their territory, with the two Republics playing a critical role in attracting the required financial investment, and in coordinating and facilitating the development of nuclear power plants within their respective economic and energy sectors.

Based on these shared understandings, the Socialist Republics of Croatia and Slovenia began the 1970 Agreement with an express mutual commitment to support the action of electric power industries, and other interested organizations from Croatia and Slovenia, with regards to the construction of the joint nuclear power plant, and to provide all assistance and support necessary to achieve the goal of the proposed actions.

2. KRŠKO NPP PROJECT BACKGROUND

Between 1970 and 1974, the representatives of the electric power industries from both Slovenia and Croatia completed the necessary design and preparatory work for commencement of construction of the nuclear power plant at Krško, located as shown in Figure 1. This included the completion of economic and electric power studies, site exploration, preparation of technical specifications and tenders for construction of the plant, bid evaluations, arrangements for construction financing, and the execution of a Letter Of Intent with Westinghouse.

The plant is a 2 loop Westinghouse pressurized water reactor, with a rated thermal capacity of 1,994 thermal megawatts (MWth) and net 696 megawatts electric (MWe). It runs on enriched uranium (up to 5 weight percent Uranium 235). Fuel mass is 48.7t with 121 fuel elements, demineralized water as the moderator, and 36 bundles of 20 control rods each; made of silver, indium and cadmium alloys to regulate power. Its sister power plant is Angra I, in Brazil.

The power plant's net electrical power is 696 MW. It is connected to the 400 kV grid supplying power to consumer centres in Slovenia and Croatia. It generates over five billion kWh of electrical energy per year, which represents approximately 40% of the total electricity produced in Slovenia. The power plant provides 17% of Slovenia's and roughly 14% of Croatia's electricity.

The basic technical data for the Krško NPP is:

- 2 Loop Pressurised Light Water Reactor (PWR)
- Output: 1994 MWth, gross 727 MWe , net 696 MWe
- Construction started in 1975
- Start of operational production: 15 January 1983
- 12 Month cycles until 2003 (335 EFPD), 18 month after 2004 (500 EFPD)
- Planned lifetime: 40 years
- Annual generation: 5.5 TWh

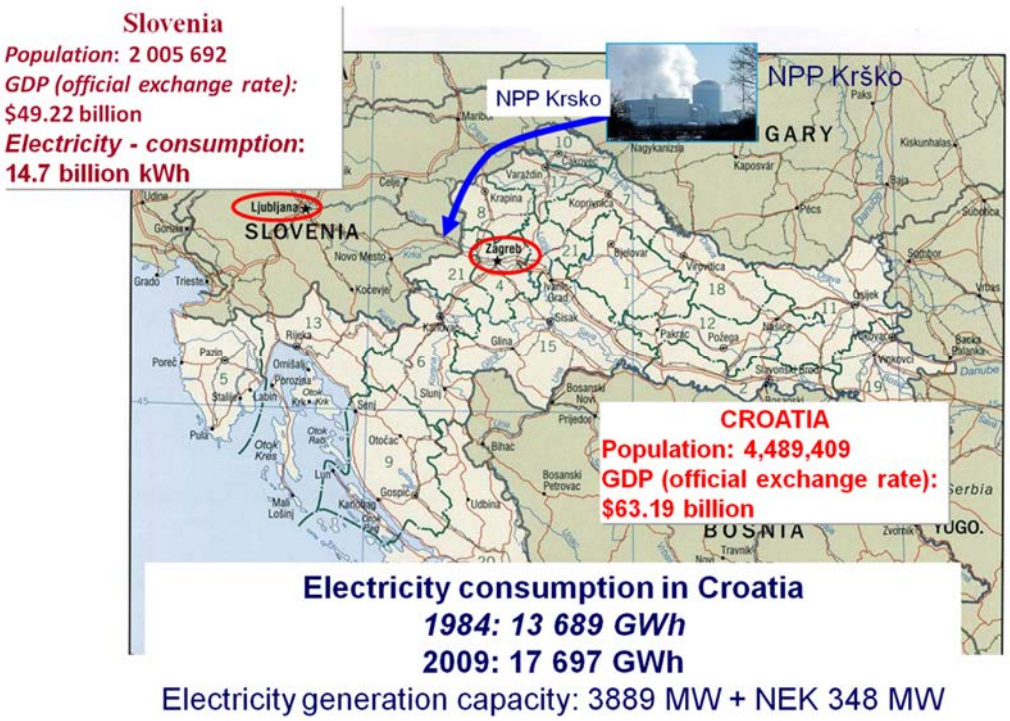

FIG. 1. A map of the Krško NPP location.

3. KRŠKO NPP PROJECT STRUCTURE

The main principle of the 1970 Agreement is the principle of equality between Slovenian and Croatian investors, in all aspects of the joint project. Prior to the commencement of commercial operations at the Krško NPP, the rights and responsibilities of the parties were comprehensively defined in four separate written agreements. These four agreements are collectively referred as the 'Governing Agreements' and are:

- The Agreement, executed on October 27, 1970, between the Socialist Republic of Croatia and the Socialist Republic of Slovenia (the '1970 Agreement')

- The 'Agreement on Pooling of Resources for Joint Construction and Joint Exploitation of Krško Nuclear Power Plant' executed on 22 March 1974, between Elektroprivreda Zagreb, on behalf of electric power companies of Croatia, and Savske Elektrarne Ljubljana, on behalf of electric power companies of Slovenia (the '1974 Pooling Agreement')

- The 'Annex of the Agreement on Pooling of Resources for Joint Construction and Joint Exploitation of Krško Nuclear Power Plant', (the '1982 Annex' to the 1974 Pooling Agreement)

- The 'Self-Management Agreement on Regulation of Mutual Rights and Liabilities between the Incorporators and Krško Nuclear Power Plant', executed on 16 April 1982, amongst

  (i) the Associated Electric Power Industry Companies of Slovenia, Maribor
  (ii) the Association of Electric Power Industry Companies of Croatia, Zagreb
  (iii) Krško Nuclear Power Plant, in the process of incorporation (the '1982 Self-Management Agreement')

The Governing Agreements did not expressly deal with financing of the decommissioning at the end of the Krško NPP's useful life (2032). With regards to spent nuclear fuel and radioactive waste, the Governing Agreements stated that: "The Parties shall take all measures to provide, upon completion of construction of the Krško NPP, the security measures for prevention of possible adverse consequences for the human environment and the cost arising from disposal of nuclear fuel and radioactive waste shall be borne by the parties from each Republic, in a proportion of 50:50." There was no timescale for the performance and financing of such activities.

A bedrock principle of the 1970 Agreement, and a cardinal feature of each of the Governing Agreements, is the principle of equality between the Slovenian and Croatian investors in all aspects of the development, financing, ownership, operations, management and use of the Krško NPP. This 'parity principle' is articulated in unequivocal terms in Clause 4 of the 1970 Agreement, which states that the joint investors from both republics should participate in financing of construction of joint nuclear power plant in equal parts, and that their rights and liabilities should reflect such equal parts. The same principles should apply in establishing the rights and obligations during the operation of the joint nuclear power plant.

The bulk of the 1974 Pooling Agreement is devoted to a detailed delineation of the parties' agreements with respect to:

- the financing of plant construction

- the organization of Nuklearna Elektrana Krško, p.o., the joint venture company formed under Slovenian law to operate the plant

The company organized by the Slovenian and Croatian co-investors to operate the Krško NPP (i.e. the joint venture company) was named 'Nuklearna Elektrana Krško u osnivanju', which roughly translates to 'Krško Nuclear Power Plant - in the process of incorporation'. From the

mid 1970s until July 1998, the parties often referred in their correspondence to their joint venture company as 'NEK, p.o.' or 'NEK'.

4. SHAREHOLDERS

The operating company Nuklearna Elektrarna Krško (NEK) is co-owned by the Slovenian company GEN Energija, a daughter company of the state owned Elektro Slovenija (ELES), and the Croatian state owned company Hrvatska elektroprivreda (HEP).

After the disputes, from 1998 and following the 2001 Agreement, the Management Board has been in charge of business operations, as well as business policy, in order to ensure safe, reliable and competitive operation and public acceptability. The structure of the Management Board is based on the parity principle, considering equal business shares of both partners. The Management Board, which in principle makes decisions by consensus, consists of two members. The President is nominated by the Slovenian partner and the Member by the Croatian partner.

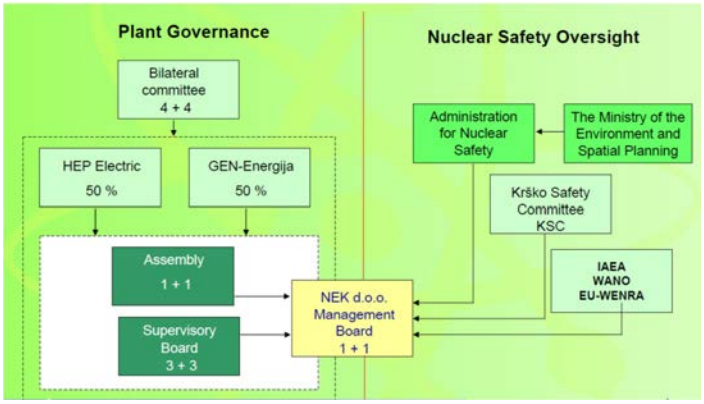

FIG. 2. Organizational structure of the joint venture.

The shareholders have defined obligations in disposal of radioactive waste and nuclear spent fuel from plant operation and decommissioning. It shall be carried out in accordance with the decommissioning programme of radioactive waste and nuclear spent fuel. The decommissioning programme shall be developed in accordance with international standards, and with the cooperation of NEK, by expert organizations which shall be appointed by the contracting parties. The decommissioning programme shall include: proposals for possible sharing and acceptance of both radioactive waste and nuclear spent fuel, acceptance criteria for disposal, assessment of necessary funds, and completion dates.

Regarding decommissioning, radioactive waste and nuclear spent fuel, 'The 2001 Agreement' stated that this is a joint liability for both shareholders (contracting parties). The NEK location can be used for interim storage of radioactive waste and nuclear spent fuel, for the plant lifetime. It also defines the obligations of Croatia, for cooperation in decommissioning and disposal of radioactive waste and nuclear spent fuel to be proportional to electrical energy, accepted by the Croatian Founder, in quantities NEK could have produced in normal circumstances from the beginning of plant operation to the end of plant life time.

5. FINANCIAL STRUCTURE

The Krško NPP project was a turnkey solution from Westinghouse Electric, USA. The costs of design, development and construction totalled US$1.2 billion. It was funded by equal contributions from the national power industries of the Socialist Republics of Slovenia and Croatia, when they were both still part of the former Yugoslavia. HEP is the successor in interest of the original Croatian investors, which contributed US $600 million to design and construct the Plant. The Krško NPP constituted the single largest foreign investment of any Croatian company at the time.

The 1974 Pooling Agreement Clauses contain a detailed breakdown of the plant construction budget, as well as a year by year schedule of anticipated construction expenditures from 1974 to 1979.

The cornerstone of the Governing Agreements was the principle that the co investors were to be 50:50 partners in all aspects of plant construction, management, use and operations. Production costs arise from roughly equal areas of material and service, depreciation, nuclear fuel and labour (salaries, wages, and social security). In turn, each co-owner had the right to receive 50% of the power output of the plant, at prices to be determined in accordance with the Governing Agreements.

The 2001 Agreement states that the price for electricity deliveries comprises operating costs in the amounts necessary for long term investment, and includes the depreciation costs.

Regarding Financing of Decommissioning and Disposal, the 2001 Agreement stipulates that decommissioning and radioactive waste disposal are joint liabilities of Croatia and Slovenia, and shall be financed in equal proportions. The funds for decommissioning shall be collected in a special fund created by each State as:

- Contracting Partners bind themselves to provide equal shares funding for Decommissioning Program development, its implementation as well as RAO and IJG Disposal Program development

- If the Contracting Partners agree on a joint decision on disposal of radioactive waste and nuclear spent fuel, these expenses shall also be covered in equal shares. If such an agreement is not reached, the Contracting Parties shall independently cover the expenses of all activities of the RAO and IJG Disposal Program implementation, not being of a joint nature

Contracting Parties shall, within 12 months from the effective date of the 2001 Agreement, adopt suitable regulations to provide funds for covering the costs from the first and second paragraph of this Article, namely in such a manner that each Contracting Party will provide regular paying in capital from its own special fund in the amount expected in the approved programs. Both the Contracting Parties and the special fund, respectively, will cover half of the costs of all activities in connection with decommissioning and disposal of all radioactive waste and nuclear spent fuel, originating from plant operation and decommissioning of NEK, which shall be approved by the interstate commission. Each Contracting Party shall warrant obligations of its special fund.

6. ISSUES AND SOLUTIONS DURING OPERATION

As the only NPP in the alternative ownership case study that is actually built and being operated, the Krško NPP offers a unique overview of some issues that may arise in such cases and solutions that may be needed.

Slovenia and Croatia both declared their independence in 1991. During the next several years, the Slovenian government adopted a series of measures that were viewed by HEP as inconsistent with the parity principle and with the basic provisions of the Governing Agreements. In 1997, ELES and NEK decided to increase the operational and decommissioning costs billed to both ELES and HEP, but the latter refused to pay. On the 30th of July 1998, the Slovenians' parties disconnected the electricity lines from the Krško NPP to Croatia, terminated all electricity deliveries to HEP, and issued a Governmental 'Decree', which HEP claims affected its rights as a 50 percent owner and manager of the plant. Slovenia nationalized NEK, stopped supplying power from Krško to HEP, and sued HEP for the unpaid bills. In 1999, HEP counter sued for damages because of lack of supply.

Following Slovenia's displacement of HEP from its role as a 50 percent owner of the Krško NPP, the governments of the two countries entered into negotiations aimed at restoring HEP's rights. Those talks eventually stalled over financial issues. In mid 2001, Croatia proposed a settlement approach that ultimately broke the deadlock. On that agreed date, deliveries of electricity to HEP from the Krško NPP were to be restored. At a meeting of the Prime Ministers of Croatia and Slovenia, held in Rijeka, Croatia on the 9th of June 2001, the Prime Ministers formally endorsed the settlement approach. They agreed on the 30th of June 2002 as the date for resumption of deliveries of electricity to HEP, and the date by which all financial claims were to be waived. These agreements were recorded in the 'Agreement between the Government of the Republic of Croatia and the Government of the Republic of Slovenia on Regulation of the Status and Other Legal Relations Regarding the Investment, Use and Dismantling of Nuclear Power Plant Krško' (the '2001 Agreement').

The waiver of the financial claims and the resumption of electricity deliveries were planned to take place by the 30th of June 2002. However, the resumption of electricity deliveries of Krško generated electricity to HEP took place on the 19th of April 2003, after the Agreement was ratified by both Parliaments.

Due to Slovenian delay in the electricity resumption, HEP d.d. commenced arbitration against the Slovenian Government before the International Centre for Settlement of Investment Disputes (ICSID) in Washington D.C., in late 2005, seeking compensation for the period of delay (30th of June 2002 – 19th of April 2003). HEP contends that Slovenia failed to restore HEP's rights as a 50 percent owner of the Krško NPP or to resume electricity deliveries from the plant by the 30th of June 2002, as agreed in the 2001 Agreement. Slovenia did not ratify the 2001 Agreement until late February of 2003, and Slovenia did not resume deliveries of electricity from the Krško NPP to HEP until the 19th of April 2003. HEP sought compensation for the financial losses it alleges that it has suffered as a result of Slovenia's failure to resume deliveries of electricity from the Krško NPP to HEP by the 30th of June 2002, the date established in the 2001 Agreement. First, HEP alleges that Slovenia's termination of electricity deliveries to HEP on the 30th of July 1998, together with the issuance that same day of a Decree removing HEP's rights as a 50 percent owner of the Krško NPP, violated HEP's right as an investor of the Energy Charter Treaty. HEP contends that those violations continued until deliveries of electricity were restored to HEP on the 19th April 2003. Separately, and independently, HEP asserts a claim against Slovenia for breach of

its obligation under the 2001 Agreement to restore electricity deliveries to HEP from the Krško NPP by the 30th of June 2002.

7. CURRENT STATUS

The Krško NPP has been achieving excellent business results in the last few years. Current disputes, which arose previously, are expected to be solved in 2012 or 2013. The Krško NPP is in very good financial health. The Krško NPP is the most highly profitable energy source for both co owners today. Figures 3 and 4 show two of the performance indicators.

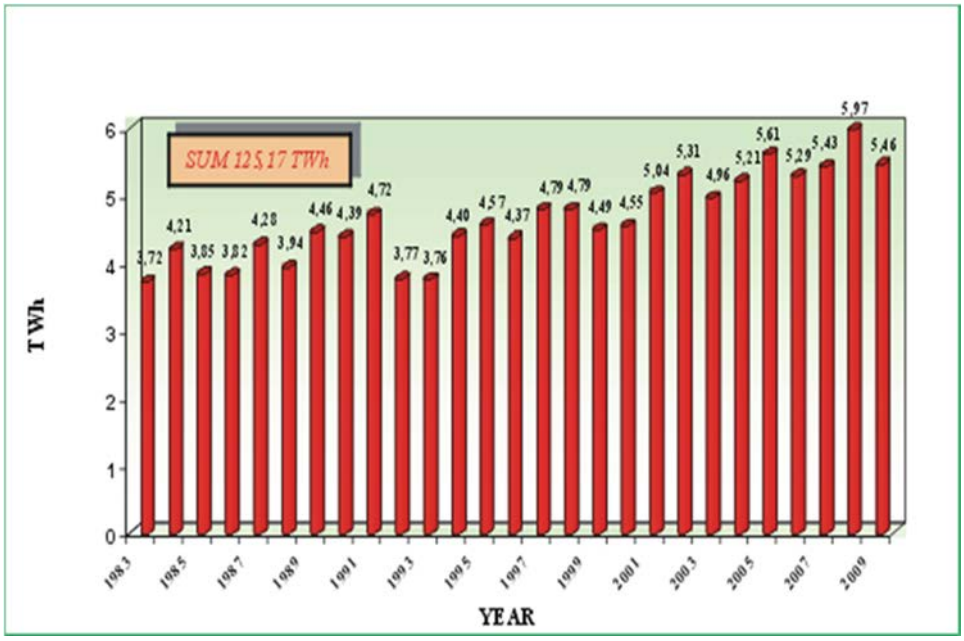

FIG. 3. Annual production of electricity.

Currently, the operation of the NPP is going well. NPP Krško is in the first quartile of NPPs in the world, according to its performance records. Both owners understand the peculiarities of the nuclear facility and keep 35 M€, approved yearly, for upgrades. In addition, their financial discipline is in good condition, with no delays in payments. The business plan for

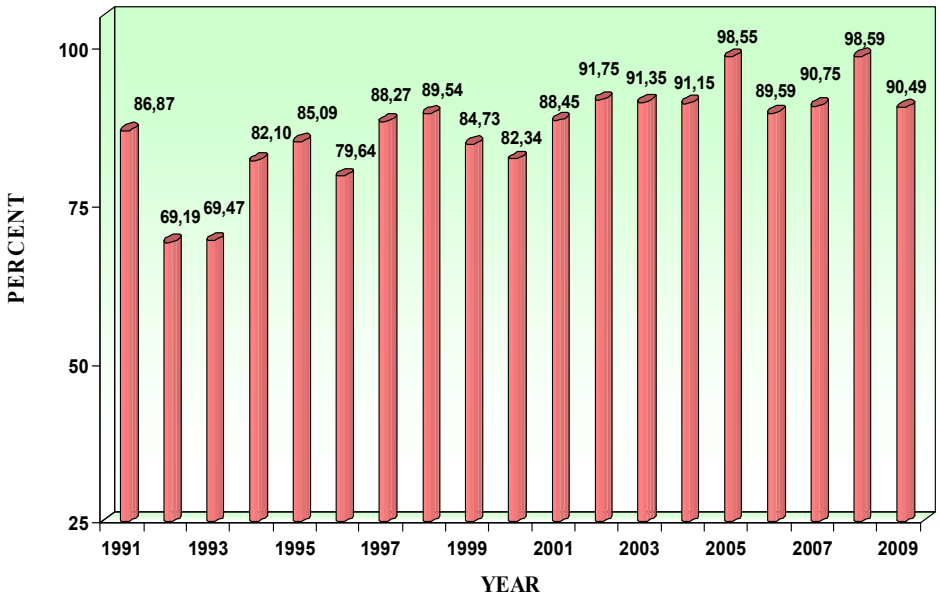

FIG. 4. Unit Capability Factor.

2011 and the long term investments plan for the next 5 years are already agreed upon and approved. Because of that, the operator can continue to steadily operate and both owners can enjoy the benefits of low cost electricity.

The 2009 operations of NPP Krško were within the planned annual outage; nevertheless, its achieved availability was at the noteworthy level of 91.2 percent, without automatic or forced shutdowns, while the capacity factor was at 93.58 percent. The output was 5460 GWh of electric power at a high level of safety systems availability. The effects on the environment were below administrative limits. This annual production was 1.11 percent higher than the planned figure of 5,400 GWh.

8. LESSONS LEARNED AND CONCLUSIONS

a. **1981-1992: first decade of commercial operation**

In the first decade of commercial operation, Krško NPP was operating without serious problems, with full respect for the provisions of the Governing Agreements

The 1986 Chernobyl disaster dropped the overall public acceptance of nuclear energy. The Croatian Parliament postponed the decision on the construction of its first NPP, according to the provision from 1970 Agreement, and on the 20th of November 1987, the Slovenian parliament adopted the 'Moratorium on the Construction of Nuclear Power Plants until the Year 2000'. On the 24th of December 1987, such a moratorium was also adopted by the Federal Parliament of Yugoslavia.

On 25 June 1991, the Republics of Slovenia and Croatia both declared their independence from the former Socialist Federal Republic of Yugoslavia, and differences regarding legal status and application of Governing Agreements began to emerge.

b. **1993-2002: decade of disputes**

On the 25th of June 1991, the Republics of Slovenia and Croatia both declared their independence from the former Socialist Federal Republic of Yugoslavia, and Slovenia suggested that it was not bound by the legal commitments made by Socialist Republic of Slovenia in the Governing Agreements. The government of Slovenia named itself the legal successor to the Slovenian co investors in the Krško NPP. Croatian electric companies were consolidated to form Hrvatska Elektroprivreda (HEP), a State owned electric company, which was the legal successor to the Croatian co investors in the Krško NPP.

Differences in their understanding of the Governing Agreements produced numerous disputes between the parties. The main disputable issues for HEP and Croatia were: reduced rights for employment of Croatian workers, participation of the Croatian managers in the Krško NPP senior level management, HEP's participation in the steam generators replacement project, application of different accounting standards for HEP and Slovenian stakeholders, and Slovenian insistence on HEP's contribution into the Slovenian Decommissioning Fund. The main disputable issues for Slovenia were: HEP's failure to pay for the electricity it received from the Krško NPP, HEP's refusal to contribute to the Slovenian Decommissioning Fund, HEP's refusal to approve all projects from the modernization programme and the amount of pooled depreciation.

Disputes culminated on the 30th of July 1998, when the government of Slovenia, the Slovenian transmission company ELES, and the Krško NPP disconnected transmission lines from the Krško NPP to Croatia, and terminated all deliveries of electricity from the Krško NPP to HEP. The government of Slovenia issued a Decree on the Transformation of the Krško NPP, in line with Slovenia's new company laws. The Decree provided that it shall remain in force until the entry of a new Bilateral Agreement between Slovenia and Croatia.

Recent Slovenian actions motivated the two governments to start with a new set of negotiations on the new Bilateral Agreement. Negotiations were carried out from August 1998 to July 2001. The new 'Agreement Between the Government of the Republic of Croatia and the Government of the Republic of Slovenia on Regulation of the Status and Other Legal Relations Regarding the Investment, Use and Dismantling of Nuclear Power Plant Krško' ('2001 Agreement') was finally signed on 19 December 2001.

c. **2001 Agreement**

The expectations on both sides were that the ratification of the 2001 Agreement would be no later than the 30th of June 2002, but unfortunately both Parliaments delayed the ratification: Croatia ratified the 2001 Agreement on the 3rd of July 2002, and Slovenia more than 7 months later, on the 25th of February 2003. The 2001 Agreement entered into force on the 11th of March 2003. The resumption of electricity deliveries from the Krško NPP occurred on the 19th of April 2003, almost 5 years after 1998's cut off.

'Agreement Between the Government of the Republic of Croatia and the Government of the Republic of Slovenia on Regulation of the Status and Other Legal Relations Regarding the Investment, Use and Dismantling of Nuclear Power Plant Krško' (valid since the 11th of March 2003) determines: ownership and capital, delivery of electricity, company governance, the price and production costs, employment and training, contractors, dismantling, radioactive waste, financing of dismantling and disposal.

Finally, it should be pointed out that even with many political disputes, NPP Krško worked very well at all times, and the most important condition for an NPP to run well is that the management and owners of the nuclear power plant fully understand nuclear safety culture for NPPs.

VISAGINAS NPP PROJECT REGIONAL APPROACH: LITHUANIA

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1. HISTORY OF NUCLEAR POWER DEVELOPMENT

Lithuania has a long standing nuclear energy history. The country is the host of the Ignalina NPP consisting of two RBMK-1500 reactors (a type of boiling water reactor developed by the Soviet Union) located in Visaginas, Lithuania. Ignalina NPP (INPP) Unit 1 came online in December 1983 and Unit 2 was completed in 1987. Lithuania agreed to close the Ignalina NPP as part of its Accession Treaty to the European Union of 2003, as the Ignalina NPP design shares similarities with the Chernobyl NPP. Unit 1 was closed in December 2004 and Unit 2 was closed on 31 December 2009.

Around 80% of electricity production in Lithuania in 2009 came from Unit 2 of the INPP. However, following the closure of the Ignalina NPP, Lithuanian electricity net import was 62%[31] of the entire electricity demand in 2010 and 59%[32] in 2011. To meet its energy needs following the INPP's closure, in the absence of a new nuclear power plant, Lithuania relies on a combination of imported electricity, predominantly from interconnections with the UPS / IPS network, and power from alternative domestic generation facilities, which are predominantly fossil plants reliant on gas or oil imports from other countries.

It is clear that such a mix of energy supply presents two key risks for the security of Lithuania's power supply:

(i) reliance on the availability and price of imported electricity

(ii) reliance on imports of non-indigenous fuel necessary to generate power in domestic power plants (predominantly oil and gas)

A central objective, stipulated in the renewed National Strategy of Energy Independence (adopted in 2012) and other legislation, is to implement an energy policy that delivers reliable electricity provision to end consumers and guarantees energy security in the long term. The strategy sets key objectives for the Lithuanian energy sector for the period leading up to 2020, and outlining the vision of the energy sector up until 2050. The major objective of the strategy is to ensure energy independence for Lithuania by 2020. The strategy also states that the Lithuanian energy sector has to be integrated into the EU Energy system. The three key national documents governing the new NPP project are presented in Figure 5.

[31] Source: Annual Report of the National Control Commission for Prices and Energy (in Lithuanian).
[32] Source: Annual Report of the National Control Commission for Prices and Energy (in Lithuanian).

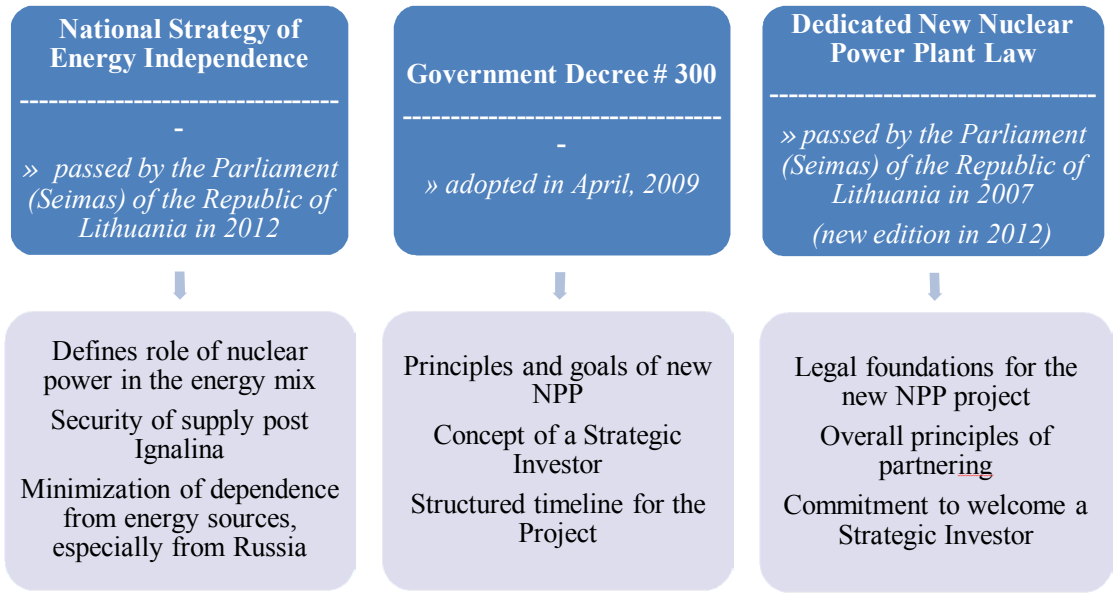

FIG. 5. Principle national documents governing the new NPP project.

The development of the new NPP and the significant part of nuclear power in the national energy mix would increase generation capacity and diversity in Lithuania (increasing the regional supply of electricity), improve security of supply (reduce future Lithuanian reliance on imports and diversify energy supply sources), reinforce the need for the planned interconnections with neighbouring markets, facilitate the Government's and the EU's green agenda, and promote local and regional economic growth by attracting direct foreign investment.

The Lithuanian electricity market's transition from a regulated system to a deregulated market based system has accelerated since its EU accession in 2004. Accession has allowed Lithuania to participate in the formation of a common energy policy within the EU. Currently, the Baltic energy market is in the process of convergence with the rest of Europe, as the Baltic countries seek to achieve the following objectives:

- to liberalize their national and regional electricity markets and ultimately integrate with Nord Pool;
- to increase interconnection with the wider region;
- to strengthen the long term security of energy supply and reduce import and gas supply dependence.

Based on EU initiatives to create an integrated single energy market, the three Baltic States have instigated legislation which seeks to:

- phase out regulated retail tariffs;
- further liberalize wholesale markets;

- ensure independence of regional transmission system operators (TSOs) as prescribed by the EU legislation.

In addition, as part of their long term energy integration strategy, the Baltic States have launched a coordinated and ongoing effort to create an open and transparent common Baltic electricity market and integrate it with, first and foremost, the Nordic electricity market and in particular, adopt the Nord Pool Spot market mechanism for wholesale market trading. A day ahead open market adopted on Nord Pool Spot rules started to function in Lithuania in 2010. Since June, 2012, Lithuania joined the Nord Pool Spot family, with Nord Pool Spot launching bidding area for day ahead market in the country. It is expected that a common Baltic-Nordic energy market based on Nord Pool Spot will be established in 2013, when Nord Pool Spot bidding will be launched in Latvia.

Due to the lack of connections to other non-Baltic EU member states (the only current Baltic grid interconnection is between Estonia's 350 MW 'EstLink' and Finland), the Baltic region countries started to implement the Baltic Energy Market Interconnection Plan ('BEMIP'). On the 17th of June 2009, the Baltic States, the Scandinavian countries, Poland and Germany signed a memorandum of understanding expressing their intent to pursue the implementation of BEMIP, thereby providing for the following developments:

- A Lithuania – Sweden interconnector (NordBalt), coming online in 2016 with a capacity of 700 MW[33]

- A Lithuania – Poland interconnector (LitPolLink) with 500 MW, coming online in 2015 and a further 500 MW online in 2020[34]

- A second Estonia – Finland interconnector (Estlink 2), coming online in 2014 with 650 MW of capacity (the lower end of the currently predicted range)

In order to prepare for market harmonisation and their role in the expanded European energy market, the Baltic States have placed a strong, strategic focus on strengthening the region's energy supply security, reducing dependence on electricity imports and generation from other import driven fuel sources (e.g. gas). This includes the need to develop additional power generation capacity, in part to replace ageing existing installations.

Due to above summarized regional electricity market issues, the new Visaginas NPP was recognized as a natural choice for the region, to solve the new electricity generation source matter.

2. VISAGINAS NPP PROJECT BACKGROUND

Regional preparations for the new NPP project commenced in 2006. The cooperation of three Baltic countries (Lithuania, Estonia and Latvia) and Poland proceeded on the governmental level, as well as on the corporate level. The following is the chronology of the early project development stages:

- On the 27th of February 2006, the Prime Ministers of Lithuania, Latvia and Estonia signed the Declaration on security of supply in the Baltic States and Common

[33] Up to date information on NordBalt project can be found in the Lithuanian TSO webpage..
[34] Up to date information can be found on LitPolLink webpage.

European energy policy, the Communiqué concerning energy strategy of the Baltic States, and initiated plans to build a new nuclear power plant in Lithuania.

- On the 8th of March 2006, and as a reply to this invitation, representatives from the energy companies of the three Baltic States, Lietuvos Energija AB, AS Latvenergo and Eesti Energia AS, concluded a Memorandum of Understanding concerning the preparations for a Feasibility Study on the new NPP project.

- In September 2006, the Feasibility Study for the construction of a new NPP was completed.

- On the 8th of December 2006, the Ministers of the Baltic States and Poland signed a joint Communiqué, by which signatories acknowledged the importance of the interconnection of the Lithuanian and Polish electric systems and encouraged initiation of corporate experts' consultations regarding the new NPP project in Lithuania.

- On the 9th of January 2007, during the new NPP project executive committee meeting, the representatives from Baltic States energy companies met with the Polish energy company Polskie Sieci Elektroenergetyczne S.A., in order to discuss the peculiarities regarding the participation in the project.

As the host country of the new Visaginas NPP sites, with a number of additional concerns (e.g. impact on the Lithuanian energy market from the scheduled closure of the Ignalina NPP) and liabilities (e.g. responsibility for the creation of effective and transparent nuclear regulation environment), Lithuania emerged as the natural leader for project steering and preparatory works implementation. Activities undertaken were:

- In December 2006, Lietuvos Energija AB (a state owned energy company) established a Nuclear Energy Department, to ensure smooth, timely preparation for construction of the Visaginas NPP.

- In August 2008, the Nuclear Energy Department was spun off from the AB Lietuvos Energija. This became a new company called Visagino Atominė Elektrinė (VAE). The main aim of VAE activities was the fulfilment of preparatory work for a new NPP project in Lithuania, including, but not limited to, project design studies, strategic planning and risk management, investment planning, organizing of project development activities and their implementation and control. All the sites studies and assessments, including EIAs, are performed in accordance with international practice and in line with the relevant IAEA safety standards

- On the 21st of April 2009, VAE completed the international Environmental Impact Assessment. The Ministry of Environment of the Republic of Lithuania adopted the decision, whereby the construction of the new Visaginas NPP is permissible in terms of environmental impact, and the NPP may be constructed in the same territory as the present Ignalina Nuclear Power Plant, at Drūkšiai Lake. Eleven state and municipal authorities took part in the coordination of the EIA report. During public meetings, the report was introduced to the society of Lithuania and neighbouring countries. The report was also presented to seven foreign countries. Cross border consultations with institutions in Poland, Belarus, Latvia and Austria were organised. The environmental impact assessment report was positively evaluated by the experts' mission from the IAEA.

- In June 2009, an inter institutional committee for public procurement, set up especially for this purpose, completed the public tender for selection of the consultant to assist in the preparation of the new NPP business model and financing plan.

- In September 2009, the consortium completed the first stage of works by preparing and presenting the business model and financing plan for the new Visaginas NPP. After technical and market analysis, and financial assessment of the project, the business model developed by the international consortium evaluated opportunities for the construction of a new NPP in Lithuania.

According to the completed analysis findings, prepared business models and the world economic situation at that moment, the Lithuanian government made a strategic decision to attract an experienced Strategic Investor into the Visaginas NPP project. Given the significant capital commitment required, and the substantial risks associated with a NPP, the introduction of a Strategic Investor, with nuclear or large generation plant construction management and nuclear operational experience, provides significant project risk mitigation.

The end of 2009 marked the beginning of the new project stage. During this stage, the joint regional partners and strategic investor cooperation approach to the development of the Visaginas NPP was finally crystallized. Moreover, Regional Partners, with leadership from the Lithuanian party, started actively interacting with the European Commission, as the project arose from and helps to deliver EU energy market and environmental policies. The main milestones are:

- On the 8th of December 2009, the strategic investor selection procedure was officially started. The international invitation to investors was announced in the Official Journal of the European Union.

- On the 29th of January 2010, the pre-qualification applications were received and five preferred bidders were qualified for further discussions.

- On the 12th of April 2010, the initial indications of interest responses were received.

- On the 21th of May 2010, the Joint Communiqué regarding the integration of the Baltic electricity market into the EU energy market, and development of a new nuclear plant in Lithuania was signed by four Baltic Ministers of Economy/Energy in the presence of the Commissioner for Energy, Günther Oettinger.

- In September 2010, the Lithuanian Concession Tender Commission, which had been delegated to organise a tender for the selection of a Strategic Investor in the Visaginas nuclear power plant, sent the request for the binding proposals submission to the potential Strategic Investors.

- On the 15th of September 2010 – The High Level Task Force on Nuclear Power Generation within the framework of the Baltic Energy Market Interconnection Plan (BEMIP) was established and the first meeting in Warsaw was held. The HLTF is chaired by the European Commission and has two working groups: WG 1: Risks and Interconnections and WG 2: Regional Partners Forum and Financing.

- Between the 8-12th of November 2010, the IAEA review mission on the process and results of the evaluation of the sites conformance with IAEA safety requirements took place in Vilnius. The Site Evaluation Report was reviewed by the site safety review

mission, with the conclusion statement formulated on the final day of the mission that the sites' evaluation was conducted in line with IAEA requirements and guides, that the volume of investigation was sufficient, and sites were suitable for construction of the Visaginas NPP.

- On the 10th of November 2010, two responses were received by the Concession Tender Commission from the potential Strategic Investors, One of them did not meet official tender requirements. The Korea Electric Power Corporation (KEPCO) submitted a binding proposal to co invest in the project and to construct a nuclear power plant in the period to 2020 for an attractive fixed price. KEPCO dedicated an experienced project team, invested a considerable amount of time and human resources and visited Visaginas nuclear power plant construction site a number of times, in order to prepare the binding proposal for the Visaginas project. Two weeks after the submission of its proposal, KEPCO unexpectedly informed the Concession Tender Commission that it was revoking its proposal, even though just prior to the withdrawal, KEPCO had publicly disclosed and confirmed in the media its participation in the tender.

Following the withdrawal of KEPCO from the project, a decision was made to continue the selection of a Strategic Investor during direct negotiations. In parallel, by the beginning of 2011, the main works of the preparatory stage were completed, including the evaluation of the construction sites according to IAEA safety requirements, i.e., the assessment of seismic factors, geotechnical and geological conditions, and the transportation routes of heavy and bulky goods; the radioactive waste management strategy was prepared; the possibilities to use the Ignalina NPP's infrastructure and the possibilities for local businesses to participate in the Visaginas NPP project were analysed. Setting up the proper legal environment, in June 2011, the Parliament (Seimas) of the Republic of Lithuania adopted the separate body of laws amending the laws regulating nuclear energy, which consists of twelve laws, thus creating a more efficient and transparent model for the licensing and granting authorization for activities in the nuclear energy sector.

June and July 2011 marked as a new phase of the project development, after the proposals from potential Strategic Investors, Hitachi and Hitachi-GE Nuclear Energy and Westinghouse Electric Company, were received. The main milestones underlined were:

- On the 14th of July 2011, Hitachi, Ltd with Hitachi-GE Nuclear Energy, Ltd was selected as the Strategic Investor for Visaginas NPP. Hitachi committed to immediately begin the work required for the preparation of the Concession Agreement. Hitachi's proposal also included the nuclear technology 1350 MWe AWBR.

- Between July–December 2011, Hitachi and VAE specialists conducted the preparatory works necessary for the preparation of the Concession Agreement.

- In October 2011, the European Commission was formally notified of the Visaginas NPP project, under Article 41 of the Euratom Treaty.

- In December 2011, the Polish energy company PGE withdrew from the Visaginas NPP project.

- In December 2011, Exelon, the utility company with the largest number of nuclear (BWR type) plants in the United States, joined the project, with its subsidiary Exelon Nuclear Partners acting as the Owner's Engineer.

- On the 8th of June 2012, the European Commission gave its favourable opinion on the Visaginas NPP project, per Article 41 of the Euratom Treaty.

- On the 21st of June 2012, the Seimas of the Republic of Lithuania, during its spring session, adopted the Law on the Nuclear Power Plant, the Law on granting the concession and assuming the essential property obligations of the Republic of Lithuania in the Visaginas NPP project, thus providing the investment environment created by the Concession Agreement.

The adoption of these laws has created an opportunity for commercial investors, the regional partners and Strategic Investor Hitachi to conclude discussions on the establishment of the project development company (PCO) that will be the future operator of the Visaginas NPP and signing the necessary agreements on the conditions approved by the Parliament.

After PCO is granted the Concession, it will be able to sign the Engineering, Procurement and Construction (EPC) Contract with Hitachi-GE Nuclear Energy, to carry out design work and, after the final investment decision is taken by all the investors (expected in 2015), to start the construction of Visaginas NPP with the expected commercial operation date in 2020–2022.

3. VISAGINAS NPP PROJECT STRUCTURE

It is necessary to point out that Lithuania, being a European Union member, is subject to the EU legal framework and regulations applied in the energy sector. Each structure planned to be used in energy generation projects in EU countries must obtain EU approvals and ensure compliance that arrangements made do not have a negative 'market distortion' from a competition perspective, or provide unreasonable 'State Aid'.

Since each new NPP project is a complex and unique development, requiring a custom tailored structure to produce the best outcome for all participants, the project development process is a dynamic and complex procedure which requires parties to be open and flexible, for constant project structure tailoring to achieve the best outcomes. The relations between the project shareholders and their roles are also subject to further changes.

The Visaginas NPP project structure, from the project developer point of view, can be split up into two stages, each having its own tasks, timeline and financing approach. The principal scheme of the project developer transition and stages is provided in Figure 6.

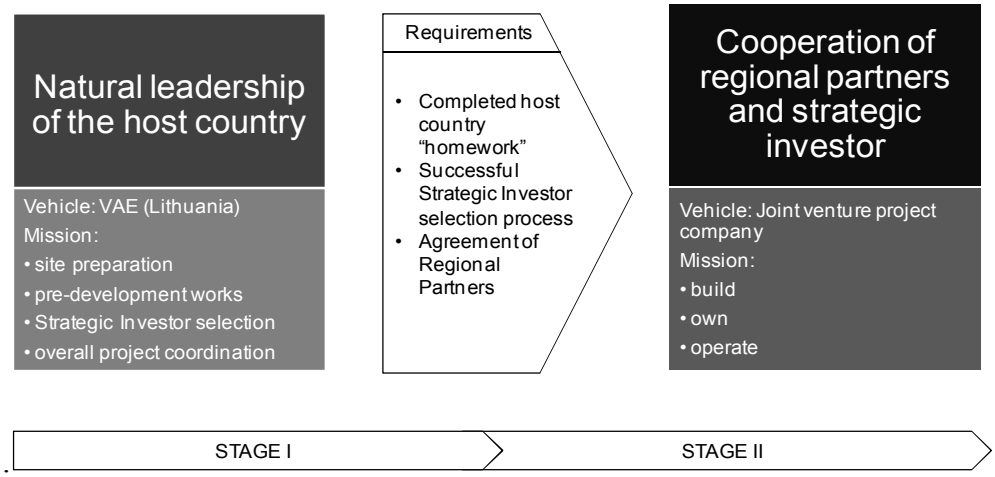

FIG. 6. Illustrative scheme of project developer transition. For illustrative purposes only.

Stage I can be characterized as the host country homework stage, during which the project environment must be prepared to some particular level and certain key tasks must be completed. Depending on the nature and complexity of the tasks, they are carried out by the VAE company, the Ministry of Energy of the Republic of Lithuania (owner of VAE), other governmental institutions of Lithuania or jointly. In the Visaginas NPP case the key tasks include:

- Site preparation and required pre-development works (list of activities are given in table 2 below)
- Strategic Investor selection through official concession tender
- Overall project coordination between Regional Partners, including cooperation with the European Commission
- Enhancement of the regulatory environment of nuclear safety and adoption of essential laws or amendments to the existing ones

TABLE 2. LIST OF ACTIVITIES WITH REGARD TO SITE PREPARATION AND REQUIRED PRE-DEVELOPMENT WORKS FOR VISAGINAS NPP PROJECT (AS OF NOVEMBER, 2012)

International Environmental Impact Assessment	Finished
Preparation of EIA Programme	Finished
Preparation of EIA Report	Finished
IAEA mission	Finished
Site evaluation against IAEA safety requirements	Ongoing
Evaluation of geological conditions	Finished
Evaluation of external human induced and meteorological events	Ongoing
Evaluation of seismic factors	Finished
Evaluation of geotechnical conditions	Finished
Evaluation of distribution of population and dispersion of radionuclides	Finished
IAEA mission	Finished
Transportation study	Finished
Route selection	Finished
Technical and economical evaluation	Finished
Territorial planning	Ongoing
Coordination of preparation of territorial planning document	Finished
Preparation of VAE special communication plan	Ongoing

Route safety survey	Finished
Drūkšiai lake (ultimate heat sink) hydrological and thermal balance measurement	Finished
Description of existing Ignalina Nuclear Power Plant (NPP) infrastructure	Finished
Evaluation of possibilities to connect to the engineering networks	Finished
Preparation of infrastructure for connection of VAE to the distribution network Preliminary study on connection of VAE to the schemes of distribution network Preliminary solutions for connection of VAE construction sites to the electricity networks	Ongoing Finished Ongoing
Environmental due diligence of the sites Eco geological audit Study on removal of construction remains Study on radionuclide contamination of the sites	Finished Finished Finished Finished
Regional supply chain study	Finished
Legal and regulatory environment description	Finished
Description of requirements on physical protection	Finished
Nuclear fuel supply strategy	Finished
Radioactive waste management strategy	Finished

4. SHAREHOLDERS

Taking into account the unique regional approach to the project and the need for strategic partner integration in it, the principal scheme of the Visaginas NPP project is provided in Figure 7. The Figure provides an overview of the targeted project structure, its shareholders and their responsibilities in the Visaginas NPP project. The project shareholders and their responsibilities may be subject to change and this is not the final shareholder structure.

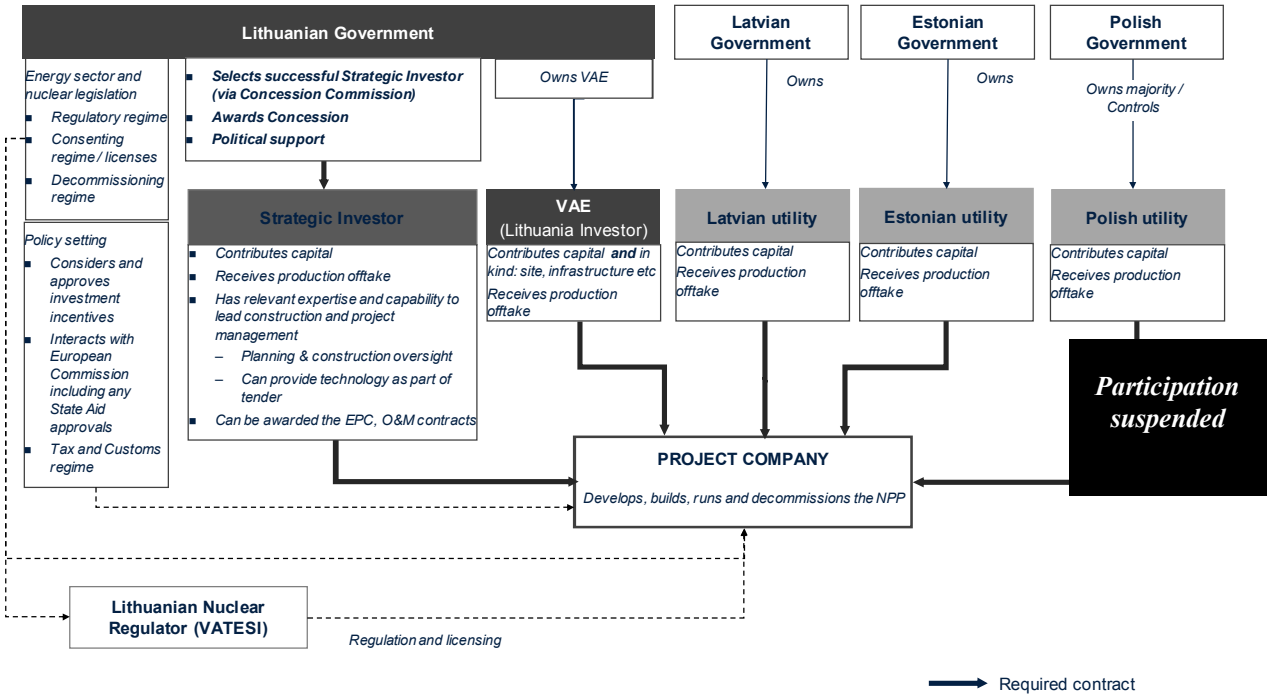

FIG. 7. Illustrative principal scheme of Visaginas NPP project. For illustrative purposes only.

In December 2011, the Polish energy company PGE announced that it was suspending its participation in the Visaginas NPP project. In March 2012, the Prime Ministers of Lithuania, Latvia and Estonia expressed their intention of maintaining an open opportunity to participate in the project. The present project structure enables Polish investment to still come in, even at a later date. In May 2012, the deputy CEO of Polish state-controlled PGE, Pawel Skowronski,

spoke about the possibility of returning to the project, during the European Economy Congress in Katowice, Poland.

5. FINANCIAL STRUCTURE

Due to the scale and time frame of nuclear projects, there are limited sources of financing available in the private markets. Hence, the main providers of capital are expected to be the export credit agencies, development finance institutions and the project shareholders. Under the regional partnership for the Visaginas NPP, all shareholders will take a share of the electricity produced and each will be expected to advance their pro rata share of the project funding requirement, in the agreed ratio of debt and equity.

The levels of debt and equity for the project have not yet been agreed upon and will depend on the optimal capital structure agreed to between the shareholders and third party lenders. The selection of Hitachi and Hitachi-GE Nuclear Energy as strategic investor and EPC contractor provides the project with access to the Export-Import Bank of the United States (US ExIm) and the Japan Bank for International Cooperation (JBIC), with whom discussions have taken place in relation to securing loans under their export windows. The Visaginas NPP is also eligible for financing from European institutions. A favourable opinion under the Euratom Treaty was issued by the European Commission in June 2012, and enables the application process for obtaining funds from the European credit facilities. It is envisaged that debt will be provided in parallel tranches, but on a basis which shares core common terms and where all senior loans rank *pari passu* (i.e. on equal terms). The equity funding will come from VAE, regional partners and Hitachi.

The financing and credit support structure will be driven to a great extent by the Project Company ownership structure. The Project Company is intended be run as zero profit making entity for the benefit of its shareholders, through the 'power at cost model'. Under this model, shareholders will have the obligation to make contributions to cover the costs of the project and will realise their profits at the shareholder level, rather than at the company level, by acquiring the electricity at its production cost and selling it for market price.

6. LESSONS LEARNED AND CONCLUSIONS

The recent renaissance of nuclear new builds has led to governments considering nuclear energy as an option for increasing generation capacity. Such developments have tended to be pursued in partnerships due to the core reasons that:

- nuclear developments are complex, multinational processes requiring essential interactions with various nuclear safety authorities.
- significant funds are required to construct nuclear plants which necessitates a diverse portfolio.

It shall be highlighted that each new nuclear build case is absolutely unique and highly complex. This applies to the regional projects too, where some extra dimensions of project 'building blocks' come in to play, as shown in Figure 8. Each of the work streams must be managed perfectly to in order to achieve one common goal.

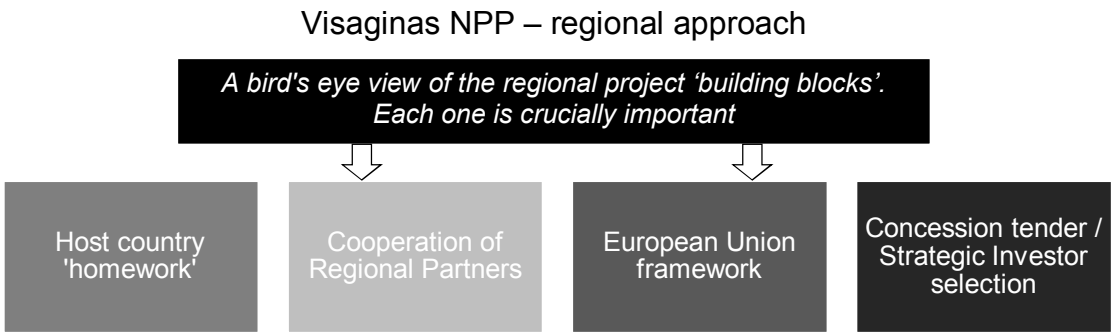

FIG. 8. Building blocks for Visaginas NPP regional approach.

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DEFINITION OF TERMS

Construction period: The period that covers any construction activity that requires approval by the nuclear regulatory body (license) up through commercial operation of the NPP.

Developer: An entity that takes responsibility for delivering the project, typically in return for being granted some kind of concession (such as the exclusive right to supply a particular customer base – often on terms set out in a PPA). The developer will often be a project company with a single 'parent' company (to whose assets recourse is limited by virtue of the project company framework) or else be comprised of a Joint Venture (JV) set up by a number of partners. This framework is designed to limit exposure(s) to financial risk. If more than one shareholder is involved (i.e. JV) then terms and conditions of each partner's shareholding in the developer are typically defined in a Shareholder Agreement. In general, such a Shareholder Agreement may make provision for the sale of one or more partners' shares at the point in the evolution of the project lifecycle at which such partners' particular expertise (e.g. construction) ceases to be as relevant to the project's future success.

Country of origin: The country from which a Member State will receive NPP technology.

Development period: The period from initial decision to proceed with the project through commissioning of the NPP.

ECA or **Export Credit Agency:** A governmental or quasi-governmental agency that, among other things, provides financing or guarantees to financing used to promote exports from its country.

Embarking country: A Member State that has decided to start a national nuclear power programme.

EPC: Engineering, Procurement, and Construction.

EPC contractor: The entity hired to engineer, procure, and construct the NPP.

Financing: The financial support and arrangements needed to pay for the total costs of a project.

Funding: The financial support to institutions that is vital for the preparation, development, implementation, and oversight of a nuclear power programme in the host country.

Host country: The country in which the NPP will be built and operated.

Investment recovery period: The period of time during which the developer recovers the costs of its investment and has the opportunity to make its desired rate of return on the Project.

Licensee: The entity that is licensed by the national regulatory authority to operate the nuclear power project. This is normally the owner/ operator.

NEPIO: Nuclear Energy Programme Implementing Organization.

NPP: Nuclear Power Plant.

NSSS: Nuclear Steam Supply System.

Operator: The entity that operates the nuclear power project. The Operator and the Owner can be separate entities, but they are often the same.

Owner: The entity that holds the equity interest in the nuclear power project. The Owner can also be the developer.

PPA: The Power Purchase Agreement, also known as an 'off take' agreement, for the long term supply and purchase of electricity generated by the NPP.

Programme: A Member State's national nuclear power programme.

Project: A particular nuclear power project within the national nuclear power programme.

SPVs: Special Purpose Vehicles are corporate entities that are created specifically for a particular project and can encompass both the ownership and the operation of the NPP. SPVs serve to limit the liability of the ultimate owners of the asset and of the operator.

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