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Challenges of SMR Licensing Practices

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ABSTRACT – The SMR licensing process has been under discussion in the USA and this trend is to be seen also in Europe. The current licensing practices in European countries vary from one another and some harmonization will be needed in the future for SMR licensing. This study goes through SMR specific features affecting the licensing process. Licensing processes in selected countries are studied in high level, trying to indicate the features that could be suitable for SMR licensing.

1. Introduction

The trend of nuclear industry has been moving towards more simple designs and natural circulation based solutions. Small Modular Reactors (SMR) are designed to benefit simplicity and passivity in such high level that is not possible in large NPPs. Modularity, being one of the SMR design basis, can be defined as several reactors on same site with shared systems. In addition modularity can be seen as a construction method to decrease the actions on site, as it is already used in some large reactors. Modularity is one of the features providing the need of licensing process modification.

Nuclear industry is quite specific industry field in terms of licensing. This being said, there are also other industries, such as aviation industry, that have similar or comparable safety features to deal with. This study investigates features of different countries nuclear licensing processes and also it introduces certain factors of aviation industry licensing that could be applied also for nuclear field. The focus of the study is in suitable licensing process development for light water SMRs in a country like Finland.

2. SMR special licensing features

The competitiveness of SMRs will be based on simplification of the design, including extensive use of passive safety systems, standardization, mass production, short construction time and serial construction (enabling self financing) and sustainability issues. Also an effectiveness of licensing process, if properly achieved, could make one of the competitiveness factors. SMR licensing should be planned keeping in mind the modularity of the design. This discussion has been started in USA, where the different types of license configurations are presented as an option.

3. Comparison of licensing processes

There are many similarities and also differences in licensing practices in different countries. The scope of this study comprises the USA, UK, France and Finland. Licensing processes have been subject to development during recent years.
Public hearings are getting more focus on licensing; in the USA among some other countries they have been playing a big role for a long time.
The current licensing concepts in the studied countries are presented here.

Table 1. Licensing processes

UK	Generic Design Assessment (GDA) - separate from licensing process	Nuclear Site License (Environmental, Safety and Security review processes)	
Finland	Decision in Principle	Construction Licence	Operating Licence
France	Plan Pluriannual d'Investissement (PPI) - multiyear investment plan	The authorization decree for NPP creation	Operating License
USA	Early Site Permit	Combined Construction and Operating License (COL)	Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)
	Standard Design Certification		

The licensing process in aviation industry is based on aircraft Type Certification and registration. In the EU the development has progressed in past years and 2002 European Aviation Safety Agency (EASA) was created. EASA is competent to issue Type Certificates valid in all EU Member States. Extensive work was done to harmonize the European national standards and also to harmonize the European standards with US standards. Aviation industry is a good example of design standardization. Recently the focus has shifted towards more integrated collaboration of regulators and common approach of certification, which has been included in Cyprus arrangements 1990.

4. Findings

In Fig. 1 the estimated duration of licensing processes in the studied countries are presented assuming that the licensing would start in the beginning of year 2013. This figure shows that all the licensing processes are quite long to SMR deployment. For these approximations, lengths of the recently issued licensing processes have been used as a basis, but it has to be noticed that the designs have been first of a kind. This figure shouldn't be used to compare the licensing process durations with each other, because of the differences of the licensing step contents and the uncertainties of the analysis.

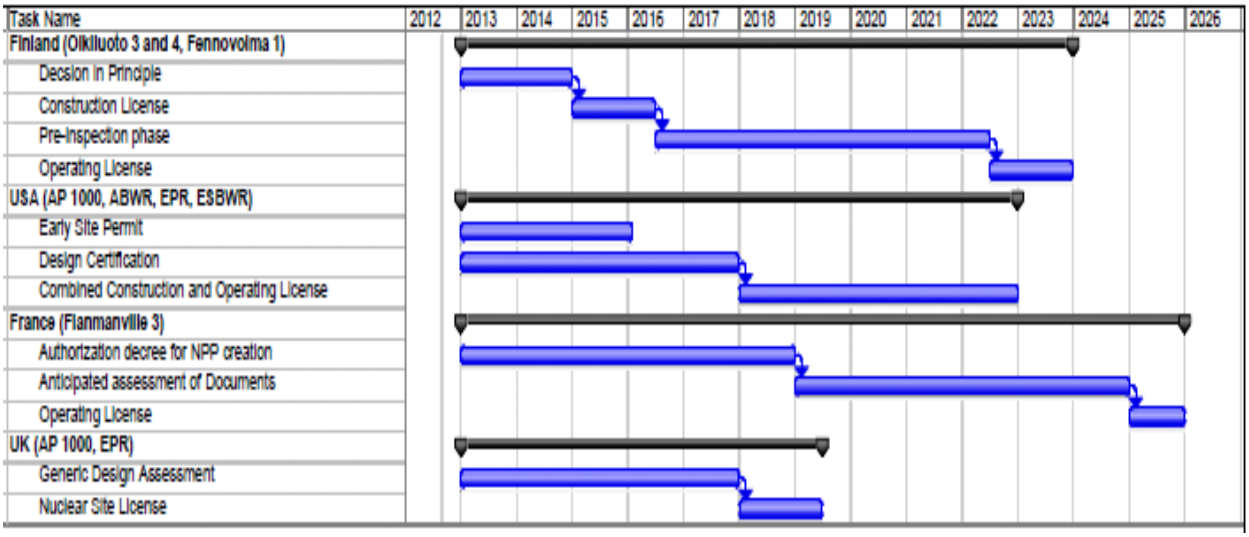

Figure 1. Overview of licensing process durations in different countries

There are differences in the contents of licensing steps in each country and therefore the comparison cannot be straightforward. The licensing process in the USA is quite well known and it has been used as a basis for licensing process development in many countries. The 1954 Atomic Energy Act (AEA) does not contain requirements concerning nuclear safety, but since NRC was founded due the Energy Reorganization Act of 1974, NRC is empowered to establish specific regulatory standards. NRC issue rules defining binding requirements and regulatory guides to provide guidance concerning the application of the rule.

The Finnish licensing process includes a political step: the Decision in Principle is purely political decision that is granted by the Council of State and it has to be ratified by the Parliament. This process is to some extent comparable with French political decision PPI (Plan Pluriannual d'Investissement - multiyear investment plan) included in French new law, implemented in 2006. The big difference is that the Finnish process can be initiated only by the industry, as the French process is initiated and conducted by the State.
In Finnish process the main review of technical issues is handled in Construction license phase and also in Pre-inspection phase (between construction license and operating license). The design certification issues as well as site specific issues are all addressed in this phase.

UK is moving forward to two-stage nuclear licensing process. In UK the licensing is based on the Site License, but the Generic Design Assessment (GDA) has taken a comparable place in nuclear licensing to Design Certification in USA. In UK no specific set of general regulations for the safety of NPP exists. The basis of a safety case lies on a risk assessment and application of the ALARP (As Low As Reasonably Practical) principle. The main idea of UK licensing is to have the licensee highly responsible for safety while regulator issues only large complexes and guiding principles. In other countries the regulator commonly examines detailed design issues; the regulator's responsibility in UK is to review the level of safety due the presented safety case.

In addition to the licensing processes differences, the level of details varies from one country to another. The depth of details has been studied in earlier studies and the estimations can be presented. One of the studies shows that only in France, of the studied countries, the level of

supervision and inspection is in high level. In Finland and in USA the level is medium and the risk-informed supervision is used. In UK the level is low, due the different type of approach of licensing, as the licensee writes his own rules and prepares the safety case for the regulator.

This analysis and study of different licensing features gives a perspective of possible suitability of different licensing steps for SMR licensing taking into account SMR specific features, especially focusing on a country like Finland.

Early political decision is an effective way to reduce the political licensing risk. Finnish licensing process Pre-Application review (Decision in Principle) would suite well for SMR licensing assuring the political acceptance for 5 years. The modification is needed only to the format and extent of the decision, changing the decision to concern for example the amount of the produced power (nowadays it contains the amount of units allowed to be built on site).
The Site Approval process (Early Site Permit in US) is well suitable for SMR licensing because it can be applied separately from other licensing steps and it is quite flexible.
The Design Certification process is also suitable practice for SMRs because of the modular design with large numbers of identical modules, which can all be issued with one license. The scope of Design Certification in SMRs could be modified to contain only the module specific issues.
The Combined Construction and Operating License (COL), or Master Facility License in this study, would be suitable process in principle for SMRs with only some modification of the contents. Master Facility License could contain only the project specific issues, external hazards, common cause failures and other possible affects that are common for all the modules. The repetition of reviewing module specific issues in every project would be minimized.

The inspections, tests, analyses, and acceptance criteria (ITAAC) process is proposed to include in the licensing steps. The inspections, tests, analyses and acceptance criteria can be handled within the licensing steps due Requirements Management process V-curve.

The discussion of European licensing process has been raised due European Reactor Design Acceptance (ERDA) core group. For SMRs this framework is good opening but it is not adequate. The SMR specific issues like modularity and mass production should be taken into account while planning the licensing process. This is the way to make the SMR implementation and licensing feasible in Europe in the future.

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