

# **A STRATEGIC PLAN FOR EUROPE AND THE MENA REGION TO FURTHER COOPERATION, SUSTAINABILITY AND INNOVATION IN THE NUCLEAR FIELD**

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## **Abstract**

Although sustainable development is not possible without sustainable energy, its rising cost puts the sustainability of nuclear energy into question. To find adequate responses to the cost issue, Europe and the region of the Middle East and North Africa (MENA) may look at opportunities arising from furthering regional cooperation in the nuclear field. This paper examines how the two regions can inspire the other in the long term by providing topical examples in the areas of nuclear regulation in the fields of 3SL, standardisation and investment support. The paper asserts that both the European Atomic Energy Community (Euratom) and the Gulf Cooperation Council (GCC) have the potential to create and host the world's first binding regional nuclear regulatory mechanism that could become, if implemented, an inspirational model also for the wider MENA region.

## **Introduction**

In the energy-civilisation hierarchy, nuclear power has been considered the most advanced energy-generation technology [1]. Harnessing the power of the atoms for peaceful purposes was one of the most remarkable scientific and technological accomplishments of the 20<sup>th</sup> century, which enabled – through its controlled use – the development of today's technological society [2]. As nuclear energy is still the only energy source that has all that characterises the industrial dream, nuclear energy remains the equivalent of powerful and technologically competent in one's dictionary and an aspiring goal for those that have plans to modernise their country by upholding the values of scientific rigor, accuracy and cooperation at the broadest level possible [3]. Today, when the world faces a new challenge of preserving a liveable planet for future generations, nuclear energy, viewed objectively, can support by simultaneously achieving ambitious greenhouse-gas emission-reduction targets and expanding access to energy and economic opportunity the many international and national climate change mitigation efforts and sustainable development goals pursue [4]. Despite its potential to contribute to the decarbonisation of the energy sector, the central problem that hinders worldwide expansion of nuclear programmes is their ever-increasing cost at a time when other energy-generation technologies have become relatively inexpensive [2].

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## **Sustainability of nuclear programmes**

Due to the specific risks and the longevity of operations related to the controlled use of nuclear energy, the sustainability (and certainly, the economic viability) of nuclear programmes will always be doubtful in the absence of long-term supportive political leadership, which – when translated into well-designed energy and climate change policies – will promise stability and provide stimulus and financial aid to invest in a country's nuclear programme [5]. While in the past countries favoured creating their nuclear programme by developing an indigenous technology, this trend seems to have changed potentially due to the high barriers the sophistication of the most advanced nuclear reactor designs have created to enter the nuclear club with an affordable, equally safe and economically competitive alternative reactor design developed in isolation [6]. Yet, to receive the green light to import foreign nuclear technology, with a view to becoming a member of the nuclear club, trust is primordial that the international community needs to have with respect to the new entrant. On a diplomatic level, this will require time, effort and long-term alignment of national interests with those transferring nuclear technology. Therefore, a state's own willingness and financial preparedness to initiate a nuclear programme alone may not be sufficient to ensure sustainability [7]. Public acceptance and presence of foreign nuclear industry may also be criteria. Substantial initial investment is required to develop a national nuclear programme infrastructure, which – different from any other industrial activity – makes in reality nuclear technology costly for any new entrant. The cost, which national governments choose to carry for serving wider social, economic and regional development goals, will be sunk by the time first concrete is poured. So as to create the conditions for sustainable development in the nuclear field, nuclear programmes must therefore address first cost concerns that may prevent nuclear megaprojects to become sustainable.

Nevertheless, nuclear technology is not to blame for cost overruns and delays during project delivery as the combination of a novel technology that has only become more sophisticated with time, and the ever-increasing complexity of the network of stakeholders involved in realising a nuclear programme would make any megaproject easily broken [8]. However, proven project management practices promise that if project developers were able to construct based on the same (or very similar) nuclear reactor design several times in a row, relying on the same project delivery infrastructure and supply chain, nuclear programmes could reach breakeven [8]. For example, moving away from the field construction of highly site-specific nuclear power plants to serial fabrication of standardised nuclear power plants would allow considerable learning from the construction of the systems, structures and components of each nuclear power plant unit [2]. Taking advantage of factory fabrication and modular construction could help shorten the innovation cycle for nuclear technology and improve the economic returns of the nuclear industry [2]. However, inconsistency in the design margins required by different standards and codes may result in relative underdesign or overdesign of structures, systems and components that requires independent review and verification by the competent regulatory body each time the design is deployed [2]. In order to harmonise overlapping standards, consensus codes used in the design and construction of nuclear power plants may require re-evaluation, with a promise to reduce the regulatory burden while ensuring the highest safety of nuclear technology. In this respect, the regulatory body can play a key role. If – in the absence of a hiatus in constructing nuclear power plants domestically – a regulatory body is used to reviewing nuclear reactor designs and inspecting nuclear power plants, the probability to deliver a nuclear megaproject on time and budget could still be increased provided that the nuclear supply chain that delivers the project is properly integrated [8]. Conversely, as no single nation can operate a nuclear programme that could employ a complete nuclear supply chain eternally and new entrants generally require localisation of the nuclear industry in the host state, the nuclear supply chain has historically developed internationally. On one hand, a positive side effect of this is the increased opportunity to maximise the availability of export credit financing. On the other hand, this underlines the importance of nuclear liability regimes that not without a reason claim

for an international cover: without unfailingly channelling the nuclear liability to the nuclear operator in the host state, no nuclear supply chain would be ready to participate in the delivery of a nuclear programme abroad. Likewise, the nuclear industry's claim for a sovereign guarantee to act as an ultimate backstop for nuclear liability remains adequate due to the enormous exposure a government-authorised risk-prone activity represents to the investors, lenders, the public and the neighbouring countries. Therefore, sovereign states have recognised early that their regulatory bodies could not work in vacuum. While – as a result of their international cooperation – most of the principles governing the licensing procedure have been internationally recognised, the application of these principles is still deeply rooted in national traditions: philosophical differences in promoting technology-specific or technology-neutral requirements, deterministic or risk-based evaluations, and prescriptive or goal-setting requirements are the outcome of different cultural approaches to nuclear safety [8]. In fact, the absence of international harmonisation remains one of the greatest impediments to the development of standardisation in the nuclear industry worldwide. As regulatory bodies, shielded by national sovereignty, review and independently verify on the state's behalf that a given nuclear reactor system design can perform necessary safety functions with reasonable assurance to protect public health and safety, and the environment at a given site, the risk in licensing delays or refusal by a specific regulatory body of a submitted site-specific design is high when one considers the value of investment already made by the time the regulatory body is in the position to commence the licensing procedure [2]. And so, regulatory cooperation and standardisation with the aim of having a virtually seamless area that constantly improves high level of nuclear safety under the same conditions regionally, and perhaps internationally, are found to be the number one enabler of sustainable nuclear megaprojects worldwide. Without nuclear reactor design standardisation and innovation in construction approaches such a standardisation is determined to generate, the inherent technological features of any of the advanced nuclear reactor designs will not be able to produce the level of cost reduction desired to make nuclear energy competitive with other energy-generation options [8].

### **The European Atomic Energy Community (Euratom)**

Euratom is an international organisation separate from the European Union (EU), which has close ties with it however. No structure similar to Euratom exists in the nuclear field: Euratom is supranational law with teeth; it has a binding and enforceable regional nuclear-energy regime operating within the framework of EU law, praised to be the world's most advanced legal system governing the nuclear field. Euratom has set an ambitious EU-wide objective of reducing the risk of nuclear incidents and avoiding large radioactive releases so that the highest possible standards for the safe and responsible use of nuclear energy and to protect the public from ionising radiation are ensured [9]. To operationalise this objective, Euratom has established a European system of peer reviews and promotes increased transparency and public participation in forming public policy for the front- and back-end of the nuclear fuel cycle, and enhanced forms of regulatory-body cooperation through the European Nuclear Safety Regulators Group (ENSREG) where regulatory bodies share their best practices [9]. Yet, there is still room for action: while encouraging the nuclear industry, with a view to a nuclear reactor design that is considered safe in one EU Member State would not have to be substantially modified to meet licensing requirements in another EU Member State, to standardise nuclear reactor designs, standards and codes, and structures, systems and components to facilitate procurement, greater comparability, and more transparent and higher safety standards, Euratom has urged adoption in its latest Nuclear Illustrative Programme of a public policy that focuses on improving cooperation between European regulatory bodies by setting common criteria for the non-site specific design certification and pre-licensing steps, and the licensing procedure [9]. While – along these lines – the European Commission will propose initiatives towards a new institutional framework for a forward-looking EU energy and climate policy, with the possible reform of the Euratom Treaty (EAECT) [10], appetite of the

Member States for any modification of the *status quo* will have to be seen. As an attempt to accelerate further cooperation, sustainability and innovation in the nuclear field in the EU, national competences and interests need to be equally considered. Yet, no level-playing field may exist for nuclear energy in the EU without an EU-wide authorisation system that includes harmonisation of technical standards. In parallel to the Articles 30-31 EAECT basic standards developed by the European Commission as binding legislative acts, there is also a need to make the non-binding Euratom *acquis* legally binding, such as the safety reference levels developed by the Western European Nuclear Regulators Association and the nuclear safety standards of the International Atomic Energy Agency (IAEA), which are applied at present throughout the EU on a voluntary basis. Consequently, introduction of binding technical standards, supplementing the basic standards, in the Euratom *acquis* toolkit seems appropriate. To this end, it has been argued in [11] that without the need to amend the EAECT a European System of Nuclear Regulation could be set up, by a legislative act adopted in the form of regulation on the legal bases of Articles 31-32 EAECT, as a single system with legal personality, comprising the European Nuclear Regulatory Body (ENRB), to which ENSREG could be transformed, being in the heart of such a system at European level, and the National Regulatory Authorities (NRAs), being the national constituencies of the system in the EU Member States. Both the ENRB (composed of the ENRB Chair, appointed by the European Council based on the joint proposal of the European Commission and the Heads of the NRAs following the approval of the European Parliament, and the heads of the NRAs, representing the Member States) and the NRAs should act, based on their respective competences, in the name of the European System of Nuclear Regulation of which primary objective would be to achieve and improve high level of nuclear safety in the EU. The NRAs would be under the duty to cooperate in good faith with the ENRB, obliged to exchange information and to comply with the instructions of the ENRB when executing tasks in relation to the functions of the ENRB in the European System of Nuclear Regulation, however, they would remain independent with respect to carrying out their tasks within the European System of Nuclear Regulation, and as such they could not be considered only as executive arms of the European System of Nuclear Regulation. The European System of Nuclear Regulation should therefore be based on centralised decision-making with collective responsibility of the ENRB and the NRAs in its harmonisation function (acting by qualified majority voting) and on decentralised implementation through the infrastructure of the NRAs the effectiveness of which could be verified by the ENRB in its peer-review function (acting on a consensus basis).

### ***Towards binding European technical standards and harmonised European regulatory outcomes in the nuclear field***

As to regulating nuclear safety, filling the gap between the high-level EU-wide nuclear safety objective and the industry-led voluntary standardisation efforts appears necessary through a clearly defined adjustable mechanism of compulsory nature. To this end, in its function of preventing occurrence of nuclear incidents by ensuring high level of nuclear safety, the European System of Nuclear Regulation, under the leadership of the ENRB, should be tasked to establish and ensure a level-playing field by developing binding technical standards in the form of draft delegated and implementing acts. In its function of regulating the European nuclear industry, however, the European System of Nuclear Regulation, under the leadership of the NRAs, should be tasked, besides contributing to the development of binding technical standards, to apply, and enforce the application of, such delegated and implementing acts, and with due regard to national sovereignty, to adopt licensing measures when exercising their regulatory functions towards the nuclear operators. As a consequence, licensing decisions and direct regulation of nuclear operators would remain with the NRAs, however, the ENRB, in its peer-review function, could address recommendations or opinions to the respective NRA in specific licensing procedures, or guidelines to the NRAs in general, in a view to establishing consistency of regulatory expectations and outcomes throughout the EU, and thus to

harmonising the licensing procedures, while the NRAs would be under the duty to follow a comply-or-explain procedure accordingly.

Binding technical standards could be adopted as delegated or implementing acts, which could either supplement or amend non-essential elements of legislative acts, or provide uniform conditions for implementation of legislative acts by defining or detailing the technical requirements for measuring, and/or providing technical specifications concerning, compliance with nuclear safety objectives, nuclear safety reference levels, and standards and codes. To this effect, the ENRB could, with the contribution of the NRAs, develop and prepare draft regulatory or implementing technical standards, and could propose them to the European Commission, which in a non-objection procedure could adopt binding technical standards in the form of delegated or implementing regulations or decisions of general application. The European Commission, despite being the addressee of the conferral of regulatory and implementing powers by a legislative act adopted on the legal bases of Articles 31-32 EAECT, could not propose modifications to the initial ENRB proposal, however, in the case of objection by the European Commission a mediation panel could be set up from the same number of representatives of the European Commission and the ENRB to better understand the European Commission's reasons for objection. Then following a mandatory cooling-off period, the ENRB should be obliged to propose revised draft regulatory or implementing acts for adoption by the European Commission. Such a procedure to adopt binding technical standards, as confirmed by the Court of Justice of the EU (CJEU) in Case C-270/12, would be in line with its Meroni and Romano doctrines and would guarantee that in the absence of a proposal of the ENRB, which as an EU body under the continuous duty to practice mutual sincere cooperation should develop and prepare the drafts of such acts, the European Commission could not adopt binding technical standards in the nuclear field by exercising its delegated or implementing powers granted by legislative acts.

In the case of delegated acts, regulatory technical standards could enter into force only if no objection had been made by the Council acting by a qualified majority (or if authorised by a legislative act, by the European Parliament, acting by a majority of its component members) within a period set by the legislative act. If objection was made by the Council (or the European Parliament, if applicable), a mediation panel comprising the representative of the European Commission accompanied by the ENRB Chair and the (same number of) representatives of the Council (and of the competent committees of the European Parliament, if applicable) should be convened in order to better understand the Council's (and/or the European Parliament's) reasons for objection. Then following a mandatory cooling-off period, the European Commission, based on the proposal of the ENRB taking into account the reasons for objection by the Council (and/or the European Parliament, if applicable), should be obliged to adopt in a non-objection procedure a revised delegated act. However, in the case of implementing acts, implementing technical standards could be adopted by the European Commission only if an examination procedure conducted by a committee composed of the representatives of the Member States and chaired by the representative of the European Commission, accompanied by the ENRB Chair, had been applied in accordance with Article 2(a) or (b) (iii) of Regulation (EU) No 182/2011. In the case of health and safety matters, such a committee would need to deliver a positive opinion adopted in qualified majority voting (the representative of the European Commission and the ENRB Chair would not have voting rights in the committee) so that the European Commission could adopt the draft implementing act. Consequently, in the absence of a positive opinion, the European Commission could not adopt the draft implementing act, but would be obliged to resubmit a revised draft implementing act or to submit the initial draft implementing act to an appeal committee established in accordance with Regulation (EU) No 182/2011. Where no opinion would be delivered by the appeal committee adopted in qualified majority voting, the European Commission could adopt the initial draft implementing act. However, if an amendment were proposed to the initial draft implementing act by the members of the committee or the appeal committee during the deliberations of the committee or the appeal committee, the European Commission should be

obliged to consult the ENRB and to take into account its position adopted in qualified majority voting before such an amendment could be accepted in the examination procedure. Notwithstanding Regulation (EU) No 182/2011, the European Commission should be obliged to abstain from proposing amendments to the initial draft implementing act. To this effect, if no positive opinion could be obtained in the ENRB in qualified majority voting, the European Commission should be obliged to withdraw the initial draft implementing act for review and consideration of the amendment proposals by the ENRB. Alternatively, the ENRB, through the ENRB Chair, could request withdrawal of the initial draft implementing act if in its opinion such amendments to the initial draft implementing act were contrary to the objectives of such an act, would disturb its coherence or consistency, or would cause significant inconveniences to the addressees of such an act during its implementation. The European Commission should, without delay, fulfil such a request. However, as in the ENRB qualified majority of the representatives of the Member States would need to vote for the initial draft implementing act, it is likely that the same support would exist also during the examination procedure.

#### *Flexibility provisions and flexibility procedures in cognisance of legitimate national interests*

Where national traditions and diverging national regulatory practices coexist in the nuclear field, *ex-ante* flexibility provisions could be introduced and binding technical standards could accordingly allow, in justified cases, for options and/or national discretions by authorising the Member States or the NRAs to adopt specific national implementing measures or national practices that could best fit to the national needs or circumstances for a certain period of time or until the national needs or circumstances so justify. Therefore, options and national discretions could be authorised in legislative, delegated and implementing acts with a view to harmonising existing national practices to the extent practicable (e.g. in the case of ongoing licensing and construction of a fleet comprising several nuclear power plants, or imposing back-fitting obligations on the nuclear operators), while *ex-ante* exemptions from the harmonisation obligation could only be authorised in legislative acts (e.g. in the case of first-generation nuclear power plants and management of legacy waste). If the Member States were the addressees of such options and/or national discretions, the European Commission could rely on Article 33 EAECT recommendations, while if the NRAs were the addressees of such options and national discretions, the ENRB could have recourse to *ex-ante* opinions and recommendations (general or special application), or to *ex-post* guidelines (general application), to ensure, to the extent possible, convergence of such national implementing measures and practices. Adequacy, necessity and proportionality (justification) of national implementing measures concerning options and national discretions by the Member States could be verified *ex post* by the ENRB in its peer-review function.

*Ex-post* flexibility procedures would be different from *ex-ante* flexibility provisions as flexibility procedures would concern the requirements of existing delegated and implementing acts, while flexibility provisions could be introduced when legislative, delegated and implementing acts would be adopted, and therefore when a flexibility provision would be exercised, no recourse could be made to flexibility procedures. Legislative, delegated and implementing acts should not prevent the NRAs from reacting immediately to a nuclear safety problem they encounter. In such a case, the respective NRA should immediately notify the ENRB, the European Commission and other NRAs (through the ENRB) of the adopted measures, their reason and their duration. The ENRB, in its peer-review function, could verify the adequacy, necessity and proportionality (justification) of such measures, and as a result, if inadequate level of nuclear safety, shortcomings in legislative, delegated and implementing acts or gaps between any such acts were identified, the ENRB could recommend, in qualified majority voting, adoption of new or amended legislative act, or propose adoption of an amended delegated or implementing act to the European Commission. The related NRA measures should be reviewed at the latest upon the entry into force of the respective new or

amended legislative, delegated or implementing act. However, if the ENRB found that the measures taken were not justified, the NRA should be obliged to withdraw them. The ENRB, in its peer-review function, could propose to this effect a draft decision to ban the concerned practice of the respective NRA that could be adopted by the European Commission in a non-objection procedure. While amended delegated and implementing acts would be generally applicable and may amend or withdraw certain options or national discretions (which would need to be followed by amending or withdrawing national implementing measures of the Member States, as appropriate), the decision of the European Commission to ban the concerned practice would be addressed only to the NRA which adopted the corresponding measures and would not affect the national implementing measures adopted by the Member States for existing options and national discretions. In addition, an NRA could grant temporary exemption for a limited period from a substantive requirement of delegated and implementing acts in the event of unforeseen and urgent operational circumstances or needs provided that the level of nuclear safety would not be adversely affected. In such a case, the ENRB, in its peer-review function, could assess if the temporary exemption granted by the respective NRA complied with the general safety objectives of the relevant legislative, delegated and implementing acts. If compliance were confirmed by the ENRB, acting in its peer-review function, based on an opinion of the ENRB, the European Commission could issue a recommendation addressed to all NRAs that the concerned practice is compliant with the relevant legislative, delegated or implementing acts and therefore could be applied by the NRAs if so justified. Nevertheless, if compliance could not be confirmed by the ENRB, acting in its peer-review function, based on a draft decision of the ENRB, the European Commission could, in a non-objection procedure, adopt a decision to ban the concerned practice of the respective NRA. In such a case, the NRA would be obliged to immediately withdraw the temporary exemption granted. Likewise, an NRA could grant a general derogation from certain delegated and implementing acts where an equivalent level of protection to that attained by those acts could be achieved by other means without discrimination on grounds of nationality. If an NRA intended to grant such derogation, it should notify the ENRB and the European Commission in advance by giving reasons and demonstrating the need to derogate from those acts and the conditions to ensure that an equivalent level of protection would be achieved. If equivalence were confirmed by the ENRB in its peer-review function, based on an opinion of the ENRB, the European Commission could issue a recommendation addressed to all NRAs that the concerned practice is equivalent with the protection level of the relevant delegated and implementing acts if the conditions detailed in that recommendation were met, and therefore could be applied by the NRAs. As in fact there would be no deviation from existing safety reference levels, no binding measure would need to be adopted by the European Commission, but the requesting NRA would still need to adopt binding national implementing measures and grant derogation in accordance with the national laws of the Member State concerned. However, if equivalence could not be confirmed by the ENRB, acting in its peer-review function, based on a draft decision of the ENRB, the European Commission could, in a non-objection procedure, adopt a decision to refuse the requested derogation, and accordingly, the requesting NRA would be bound to refrain from adopting national implementing measures to grant that derogation.

### ***Towards a forward-looking, single European nuclear liability regime***

To operate a nuclear power plant, nuclear fuel – fissionable material – is required. In the EU, special fissile materials are the sole property of Euratom, subject to the nuclear operator's unlimited right of use and consumption. As the CJEU noted in its Ruling 1/78, it is Euratom alone who is in a position to ensure that in the management of nuclear materials the general needs of public are safeguarded. As a result, when a new requirement of general interest appears, it is primarily for the owner of the nuclear materials to meet it, which if not met, may be indissociably linked to the ultimate right of the owner to require the nuclear operator to surrender the nuclear material. Therefore, Euratom has a key interest, arising from its ownership right of special fissile materials, to legislate on any new requirement that may affect the conditions under which nuclear material may be used and consumed in the EU. As a consequence, Euratom should be directly involved in any matters concerning adoption of measures in the field of nuclear liability at EU- or Member State-level. Likewise, the second paragraph of Article 86 EAECT extends Euratom's right of ownership of special fissile materials to special fissile materials that are produced or imported by a Member State, a person or an undertaking, thereby implying that Euratom, acting through its institutions, could produce or import (and, as owner, make use of) special fissile materials itself. Articles 194(1) and (3) EAECT even go further by suggesting that Euratom, having the most extensive legal capacity accorded to legal persons in the Member States, may acquire (the direct or indirect property of) nuclear installations. One way of doing so could be to have recourse to the policy tools available under Chapters 5 and 6 EAECT which are expressly authorised ways in the EAECT for Euratom to become user of nuclear materials and to engage in nuclear energy generation. Accordingly, Euratom could decide to finance the construction and/or operation of a nuclear power plant (to be) operated by a Euratom joint undertaking to which the nuclear fuel could be made available from the uranium enrichment plants operated, or the commercial stocks managed, by the Euratom Supply Agency or a Euratom joint undertaking set up for this purpose. Similarly, the EAECT permits that an EU-body operator is established by a single decision of the European Commission and/or the Council, as the case may be, to construct and operate based on the same nuclear reactor design nuclear installations in different Member States. Therefore, the same nuclear reactor design would need to be licensed and built in different Member States under the oversight of different NRAs. Notwithstanding that the same nuclear reactor design would be employed throughout the fleet, the Euratom joint undertaking's liability arising out of a nuclear incident caused by a design fault would still depend on the national laws of the Member States in which the nuclear incident would actually occur, provided that the nuclear liability of the Euratom joint undertaking would fall under the jurisdiction of national courts of the Member States. Thus, in the unfortunate event of a subsequent nuclear incident caused by the same design fault in another nuclear installation operated by the same Euratom joint undertaking but in a neighbouring Member State, the compensation rights of the same victims could be different from the compensation rights they would have acquired as a result of the first incident. Hence, even at present as a result of any of the above decisions of Euratom, an action for damages could be possibly filed against an EU-body operator of a nuclear installation, should a nuclear incident occur. Consequently, if the argument that differing national laws concerning nuclear liability may affect the application of the fundamental freedoms under Chapter 9 EAECT could be accepted, it must follow that the free operation of such a Euratom joint undertaking in the territories of the Member States may be hindered by differing national laws of the Member States concerning nuclear liability. In the case of occurrence of nuclear damage that would not be eligible for compensation under the Paris Convention or the Vienna Convention either due to its material or geographical scope of application, or in the absence of operators of nuclear installations (and any other person that could be otherwise held liable for a nuclear incident under the national laws of the Member States, if applicable), or under Article 188 EAECT as the EU-body operator, having a separate legal personality from Euratom, would have successfully exculpated itself from liability, an action for damages could be possibly directed against Euratom as owner of special fissile materials in the EU (the presence of which is arguably one precondition for a nuclear incident

to occur), which, in the absence of any legal channelling, could ultimately be held liable for any such damage (secondary liability of Euratom) provided that any person that could be otherwise held liable would have successfully exculpated himself from incurring such liability in accordance with the national laws governing non-contractual liability rendered applicable to compensate such damage by the competent national courts of the Member State. This interpretation of the EAECT may be supported by Article 87 EAECT which confirms that any right of use and consumption of special fissile materials are subject to continuous compliance with the health and safety requirements of the EAECT, therefore, Euratom could have reasonably exercised its right to surrender any special fissile materials, should deterioration of the level of nuclear safety be experienced or suspected, considering also due performance by the European Commission of its monitoring obligations under Chapter 3 EAECT, although, the casual link between Euratom's conduct (inaction) and the damage suffered may be held too remote by the CJEU. This argument may nevertheless still remain valid for nuclear installations operated by EU-body operators against which, due to their privileges and immunities, the NRAs may only exercise limited powers or to which the national authorisation system, the establishment of which has been required by Council Directive 2009/71/Euratom and Council Directive 2013/59/Euratom could not have been applied in its entirety, and for which Euratom should have reasonably exercised enhanced scrutiny accordingly.

Euratom enjoys immunity from national jurisdiction of the Member States, limited to cases where the CJEU has exclusive jurisdiction. Euratom joint undertakings may also fall under the exclusive jurisdiction of the CJEU if their statutes so provide (e.g. Article 9 of Council Decision 2007/198/Euratom). Through joint application of Articles 106a and 188 EAECT and Article 268 TFEU it appears however that the CJEU would be the exclusive forum to hear cases for non-contractual liability of Euratom and EU-body operators, including their liability for nuclear damage. Article 13 of the Paris Convention and Article XI of the Vienna Convention, both of which regulate non-contractual liability for nuclear damage, provide for exclusive jurisdiction of national courts of the contracting-party Member State where nuclear incident occurs. This is however contrary to the exclusive jurisdiction of the CJEU in the EU, which is not a national court within the meaning of the Paris Convention and the Vienna Convention, over Euratom's non-contractual liability. While, in the absence of national executing laws to the contrary, neither the Paris Convention nor the Vienna Convention allows, without limitation, for the admissibility of claims from victims who suffered damage in Member States that are not contracting parties to the same Convention unless those states are contracting parties also to the Joint Protocol to the two Conventions, the EAECT and the TFEU allow any persons irrespective of their nationality (seat), domicile or residence to proceed before the CJEU with an action concerning an action or inaction (act) of EU bodies (Article 263 TFEU) or damage they suffer inside or outside the EU as a consequence thereof (Article 340 TFEU and Article 188 EAECT). Euratom's and EU bodies' non-contractual liability has uniform rules developed by the CJEU. Initially based on the general principles common to the Member States' national laws, it operates as an autonomous concept independently therefrom. Although non-contractual obligations arising out of nuclear damage are excluded from the application of Regulation (EC) No 864/2007, its Recital (11), largely inspired by the case-law of the CJEU, confirms that non-contractual obligations as an autonomous concept under EU law cover also non-contractual obligations arising from strict liability. Civil third-party liability for nuclear damage as defined by the Paris Convention and the Vienna Convention is a special form of strict liability; therefore, in the absence of specific conditions defined by EU law or the CJEU, Euratom's and EU bodies' nuclear liability is likely to fall under the general concept of Euratom's non-contractual liability. Supported by the wording of Article 188 EAECT, which does not limit its application to certain type of damages, the CJEU could establish, based on the joint reading of Articles 106a and 188 EAECT and Article 268 TFEU, its jurisdiction over non-contractual liability of Euratom and EU bodies arising out of a nuclear incident. Under Article 188 EAECT, in order for a Euratom joint undertaking to incur non-contractual liability in analogy with the EU institutions, the unlawfulness of their alleged conduct in performance of their duties, the actual damage, and the existence of a causal link between that conduct and

the alleged damage must be proven by the applicant. If one of those conditions is not satisfied, the action must be dismissed in its entirety and it is unnecessary to consider the other conditions. While to establish the conditions of the nuclear operator's liability for nuclear damage the Paris Convention and the Vienna Convention may be considered conclusive: liability is channelled exclusively to the operator of the nuclear installation, whose liability is absolute, and the applicant must only prove that the damage was caused by a nuclear incident; in the case of non-contractual liability under Article 188 EAECT, the CJEU left the possibility for Euratom and EU bodies to exculpate themselves from their liability by proving due diligence. In addition, nuclear liability would not necessarily be channelled to the EU-body operators (or to Euratom) and a right of recourse against the nuclear supply chain would generally be available to EU-body operators (and to Euratom) should their liability be finally established. It is however apparent that nuclear damage may not be linked to the nuclear operator's conduct, and may occur even in cases where the nuclear operator exercised due diligence. Likewise, the limitation period for Euratom's and EU bodies' non-contractual liability is five years from the date on which the event giving rise to the damage occurred, while both the Paris Convention and the Vienna Convention provide for longer periods: compensation rights are extinguished under them if an action is not brought within ten years (or longer) from the date of the nuclear incident.

Even if national courts of the Member States could adjudicate actions that could invoke the liability of Euratom or EU bodies, due to the primacy of EU law over national laws of the Member States in conflict, national laws would need to be disapplied by national courts of the Member States, being courts of the EU. As neither the Paris Convention nor the Vienna Convention, neither of which binds Euratom, are self-executive, the national executing laws would therefore need to be disapplied to give full effect of EU law, in this case the settled case-law of the CJEU, concerning non-contractual liability of Euratom and EU bodies. This obligation would be apparent concerning the limitation period where liability of Euratom or EU bodies would be invoked, which, irrespective of any jurisdiction of the CJEU, would remain directly binding and applicable in all Member States, being laid down in a Protocol to the Treaties. Although these differences not being present in the same legal order do not constitute discrimination *per se*, the compulsory application of EU law in the Member States, even when recourse to the principle of primacy of EU law needs to be made, may create a situation that may effectively frustrate the compensation rights of victims that would be otherwise available according to the national laws of a Member State should a nuclear incident occur in that Member State, being a contracting party to the Paris Convention or the Vienna Convention. To this end, the different legal status of EU-body operators or the public interest an EU-body operator may pursue may not objectively justify the different levels of protection available to potential victims of a nuclear incident resulting in the same kind of exposure to ionising radiation, and hence causing the same kind of nuclear damage, especially that both regimes pursue the aim of full (or – better to say – adequate) compensation of victims. Implementation of the common supply policy or, as to the Euratom joint undertakings, the public interest attached to the development of the nuclear industry in the EU as legitimate aim may only justify difference in treatment of operators concerning licensing (authorisation), inspection and enforcement without prejudice to their continuous obligation to maintain high level of nuclear safety, however, to uphold the difference in treatment to remedy the consequences of nuclear incidents as a result of their privileges and immunities may not be considered appropriate and necessary to achieve that aim. Then again, seeing that EU-body operators, within the scope of application of the EAECT, may engage in the operation of nuclear installations and thus can carry out the same activities as industrial nuclear operators, differing conditions to incur liability for nuclear damage may be perceived as a measure unduly distorting competition in the nuclear common market notwithstanding that EU bodies' non-contractual liability, which would not leave room for the application of the national laws executing the Paris Convention or the Vienna Convention, is an autonomous concept independent from national laws of the Member States. It is likely that the CJEU would continue to apply its settled case-law to nuclear liability of EU-body operators in the absence of general

principles common to the national laws of Member States concerning nuclear liability, which could raise concerns of the nuclear supply chain regarding their non-contractual liability for nuclear damage and the EU-body operator's right of recourse against them. Therefore, should Euratom implement any of the policy tools of Chapters 5 and 6 EAECT discussed previously, the absence of a single EU nuclear liability regime, applicable to both industrial and EU-body operators, may amount in its effects to breach of the equal treatment principle. As Article 21 of the Charter of Fundamental Rights of the EU, which protects any person against conduct of EU bodies that infringe their fundamental rights, confirms that Article 18 TFEU is binding vis-à-vis the EU (and Euratom), Euratom must ensure equal treatment of potential victims of a nuclear incident in a nuclear installation operated by an EU body, being in a comparable situation with potential victims of a nuclear incident in a nuclear installation operated by an industrial nuclear operator in the same Member State. Conversely, financeability and insurability of nuclear installations operated by EU bodies from the single financial market, and therefore, viability of any such Euratom projects could be seriously undermined, which could at last risk the achievement of the objectives pursued by the EAECT.

Yet, in order to avoid that the CJEU would conclude that Euratom by adopting Council Directive 2013/59/Euratom and establishing an authorisation system for nuclear installations under Council Directive 2009/71/Euratom established the framework of authorising and monitoring the operation of nuclear installations and thus delegated, in a reasonable manner, its obligation as owner to verify application of Article 87 EAECT to the competent NRAs designated by the Member States, Euratom should adopt uniform nuclear liability rules in the form of regulation to ensure a level-playing field for industrial nuclear operators and EU-body operators, and potential victims of nuclear incidents residing in the same Member State, which due to the geographical position of the EU could function as a regional regime. Accordingly, Euratom's responsibility (not necessarily legal liability) would need to become explicit in the event that a nuclear incident occurs in the EU as a result of the use of nuclear energy for peaceful purposes: Euratom should make funds available for compensation of victims in the event of a serious nuclear incident in one of its Member States, which would – being the consequence of such a responsibility – not constitute aid to the nuclear industry, and would undeniably demonstrate solidarity of the Euratom community. To this end, at Tier 1 level, the nuclear operator, wholly backed up by compulsory insurance (limited in amount), at Tier 2 level, the Member State authorising the operation of the nuclear installation in which the nuclear incident occurs (limited in amount, to be made available in the event of a nuclear incident), and at Tier 3 level, Euratom as owner of special fissile materials (unlimited in amount, to be made available in the event of a serious nuclear incident) should make funds available for compensation. The sum of funds made available under Tier 1 and Tier 2 levels should be the same in each Member State, while Tier 3 level could in effect replace the cover the Brussels Supplementary Convention intends to provide. Moreover, Euratom could introduce a support scheme for industrial nuclear operators of existing nuclear installations to enable them to increase their respective insurance cover at least to the minimum amount prescribed by a delegated or implementing act. The cost of evacuation and other emergency response measures national authorities would order and implement in the event of a nuclear incident should be advanced and borne by the nuclear installation Member State, therefore, Tier 2 level funds could be disbursed in parallel to, or even before, the disbursement of Tier 1 level funds, which should be primarily reserved to compensate victims. Accordingly, should Euratom funds be activated, Euratom could vindicate for the CJEU to exclusively resolve nuclear liability cases in the EU. A true level-playing field could be created as the CJEU as single court having exclusive jurisdiction could adjudicate nuclear liability of EU-body operators, Euratom, and industrial nuclear operators in the event of a serious nuclear incident in one of the Member States having severe consequences in several EU Member States, according to uniform conditions with no discrimination based on nationality and without geographical limitations concerning the place where nuclear damage, including its indirect consequences, would have been suffered, inside or outside the EU. To this end, an Article 257 TFEU regulation, adopted in an ordinary legislative procedure, could establish a

specialised court attached to the General Court that could hear and determine at first instance nuclear third-party liability claims in the event of a serious nuclear incident in one of the Member States, where it would be in the public interest to do so, having regard to the extent and the estimated cost of the damage triggering application of Euratom funds at Tier 3 level, and the advantages of having the claims dealt with by an administrative court which would be more efficient and equitable, also with due regard to the number of victims and their nationalities, than a single national court. Due to channelling of nuclear liability to the nuclear operator, legal guarantees of court proceedings could be lowered down and could allow for administrative handling of claims, for example by presuming causation for personal injury and by accepting reduced level of burden of proof from applicants. While the Euratom measure on nuclear liability – a regulation must call for unity by providing a single set of rules, applicable to everyone, in the EU – should recognise the relevance and robustness of the basic principles of the Paris Convention and the Vienna Convention, focus should be on reparation of damage by restoring the victims' pre-incident life (to the extent possible) and reintegrating them into the society rather than adjudicating non-contractual liability of nuclear operators. The objective of a Euratom legislative act should therefore be to create an as-simple-as-possible claim handling system providing timely and adequate compensation to victims of nuclear incidents. If therefore the measure's objective were the protection of victims of nuclear incidents, rather than improving access conditions to nuclear materials, nuclear liability measures could not be founded on Article 98 EAECT alone. Liability rules in a highly specialised sector, with a primary objective of protecting victims of nuclear incidents, are therefore likely to fall under Euratom's health and safety policy (Chapter 3). Nuclear safety and liability, in this regard, are the two sides of the same coin: nuclear safety concerns prevention, in which field Euratom has already adopted binding measures, and nuclear liability, which concerns the consequences of unsafe operation of a nuclear installation. Ionising radiation emitted in the event of nuclear incidents, which occur during one of the operational states of a nuclear installation, may be seen as one specific case of radiation exposure which may cause nuclear damage to workers and the general public. This unique state of operation is already covered by Council Directive 2013/59/Euratom and the systems established by Council Directive 2009/71/Euratom and Council Directive 2011/70/Euratom in order to prevent or mitigate the consequences of nuclear incidents. It follows that Euratom must possess competences, in order to protect (the interests of) workers, the general public, as potential victims, and the environment, to adopt measures concerning the consequences of nuclear risks, i.e. radiation exposure in the case of nuclear incidents when ionising radiation exceeds the dose limits defined by Council Directive 2013/59/Euratom. Therefore, where these standards are not complied with, non-compliance may give rise to nuclear liability provided that nuclear damage occurs. *A contrario*, if compliance is ensured, i.e. nuclear safety is maintained, no liability is likely to arise. In this context, one may conclude that through adoption of binding technical standards, as discussed previously, Euratom would in fact minimise the risk of incurring liability for nuclear damage, and the consequences of nuclear incidents in the EU, implying that standardisation efforts alone should no longer be seen as a measure to support the development of the European nuclear industry only. Therefore, a Euratom measure on nuclear liability, with a view to the preamble to the EAECT, which underlines that the drafters of the EAECT were "[a]nxious to establish conditions of safety which will eliminate danger to the life and health of the people," would necessarily supplement the basic standards of Articles 30-31 EAECT (i.e. Council Directive 2013/59/Euratom) and the systems established by Council Directive 2009/71/Euratom and Council Directive 2011/70/Euratom. Such a regime may require amongst others compulsory insurance cover before authorisation to operate is granted. Similarly, having in mind that compensation for nuclear damage should be made to victims as quickly as possible; national claim handling systems and coordination among them may supplement the radiological emergency and emergency preparedness and response systems under Council Directive 2013/59/Euratom and Council Directive 2009/71/Euratom. An Article 31-32 EAECT regulation, as argued in [12], in addition to the Article 257 TFEU regulation laying down the rules of the organisation of the specialised court and the extent of the jurisdiction conferred upon it, could authorise the Council to declare that the conditions of

a serious nuclear incident are met, and thus, to activate the jurisdiction of the specialised court, and could authorise the European Commission to adopt delegated and implementing acts based on the proposal of the ENRB in a non-objection procedure which could establish detailed rules for claim handling, priorities for classes of damage, reducing awards on a pro-rata basis for specified classes of damage and fixing a maximum award within a specified class of damage and establishing classes of damage for which compensation is not to be awarded. Decisions given by the specialised court may be subject to a right of appeal on points of law only or, when provided for in the regulation establishing the specialised court, a right of appeal also on matters of fact, before the General Court. Moreover, the specialised court should establish, in agreement with the CJEU, its Rules of Procedure, to be approved by the Council, which should aim for justice and fairness while providing the necessary flexibility. The Council, acting anonymously, would appoint the judges who should be independent professionals with high standing in the field of nuclear liability. Being a specialised court of the CJEU, its language arrangements would continue to apply, and therefore, the language of the case could be any one of the 24 official languages of the EU. Decisions on disbursement of funds and provisional payments, and judgements of the specialised court would be directly enforceable in accordance with Articles 280 and 299 TFEU. In addition, through the procedure foreseen by Article 281 TFEU, Article 46 of the Statute of the CJEU should be amended and the limitation period laid down for non-contractual liability of Euratom (in the event of a nuclear incident) should be extended to become compliant with the requirements applicable to industrial nuclear operators, currently defined in the Paris Convention and the Vienna Convention. As a consequence, the European Commission should conduct effective consultation with the CJEU and the European Parliament, respectively, which would make a small step towards reducing the democratic deficit on one important aspect of the EAECT.

### ***Euratom investment support***

While the European nuclear industry has developed into a global technology leader in all nuclear industry segments, the question remains how Euratom could assist the European nuclear industry to maintain its leadership and increase its competitiveness worldwide while applying the world's highest standards in its operations [9]. As Euratom embodies the ideology of integration through cooperation of resources by carrying out joint nuclear research and development, stimulating and coordinating its Member States' efforts, or financing nuclear investments through supranational effort, the EAECT does not include competition norms with due consideration to the technological, economic and legal developments arising from nuclear research and development, and nuclear-industry integration Euratom is liable to pursue. Accordingly, Euratom could intervene directly in the further development of the European nuclear industry through participation agreements which would qualify permitted investment support to selected nuclear research and development projects, or establishment of Euratom joint undertakings as special purpose vehicles to realise nuclear projects of fundamental importance. Pursuing nuclear research and development, which has made Euratom a remarkable experience, requires, on one hand, continued investment in the European nuclear research infrastructure, and on the other hand, as Europe is emerging from a long construction hiatus, development and testing of an appropriate project delivery infrastructure. To this end, Euratom (in sync with its Member States) could establish one or several nuclear reactor sites where the nuclear industry could deploy prototype reactors for testing and operation oriented to regulatory licensing. In cooperation with the regulatory bodies of the host Member States, Euratom, assisted by the ENRB, could provide appropriate supervision and support – including nuclear safety protocols, infrastructure, and nuclear fuel services – and be directly involved in all testing. Euratom (in sync with the host Member States) should enable a flexible regulatory environment that could accommodate small, unanticipated changes in the nuclear reactor design and construction in a timely fashion. To operationalise this endeavour, Euratom could establish a joint undertaking for prototype testing and commercial deployment of advanced nuclear reactor designs, and launch appropriate funding programmes in order to share, with

industrial project developers, regulatory licensing costs, and research and development costs, reward performance and successful demonstration. In turn, Euratom could require that greater portions of the detailed design are completed prior to construction, proven nuclear supply chain and skilled workforce are used, manufacturers and builders are incorporated early into the nuclear reactor design teams to assure that nuclear power plant systems, structures and components are designed for efficient construction and fabrication to mutually exclusive standards and codes. Provided that a project delivery infrastructure so tested would be available and a robust nuclear supply chain would be able to commit to deliver one or several nuclear power plants on time and budget based on a standardised European nuclear reactor design, as the EAECT gives the same entitlement for treaty-making power in the nuclear field to Euratom and to its Member States, owing to which Euratom has been able to establish itself as a credible actor in dealing with nuclear matters in international forums and has interacted with international legal personalities on equal footing, Euratom could enter into international agreements with new-entrant third countries offering them, in view of realising the country's nuclear programme primarily relying on European nuclear technology, loans, construction, operation, maintenance, decommissioning, nuclear-fuel services, waste management, and nuclear regulation pursuing the highest standards of nuclear safety, security, waste management and non-proliferation. To this end, Euratom could raise funds through bond issuance, the proceeds of which it could directly loan under the same conditions to the third country for a specific purpose. As Euratom borrowings, which do not carry any interest rate or foreign exchange risk, are direct and unconditional obligations of Euratom, which it is legally bound to service – irrespective of any default of the Euratom loan beneficiary – from the EU's multiannual budget independent from its Member States, low-interest rates and thus low financing cost for the nuclear power plant construction could be warranted. In order to operationalise the international agreement which would need to guarantee customary investor protection standards, Euratom could establish a for-profit Euratom joint undertaking which would build, own and later decommission the nuclear power plant. In this respect the Euratom joint undertaking would be tasked to deliver, as Euratom's executive arm, enjoying its privileges and immunities, turn-key the nuclear power plant in cooperation with the host state, the conditions of which would be set out in a host agreement. As permitted by the EAECT, third countries seeking to develop their own indigenous nuclear industry could also participate in the Euratom joint undertaking, which would on one hand provide legal certainty for the European nuclear industry for its operations in a third country, and on the other hand, assure that any dispute among members of the Euratom joint undertaking and any non-contractual liability arising from the operations of the Euratom joint undertaking could still be adjudicated by the CJEU. Yet, in order to ensure the application of the host state's nuclear liability laws to the fullest extent, the operation of the nuclear power plant would need to be outsourced to a joint venture enacted according to the national laws of the host state. In this context, Euratom-sponsored build-own-operate and transfer arrangements would be highly desirable due to their nuclear proliferation resistance which Euratom's authority and credibility would warrant to the international community. Depending on the nuclear fuel policy chosen by the host state, Euratom could also make arrangements for the supply of nuclear fuel for the operations of the nuclear power plants and manage the nuclear spent fuel and radioactive waste in a safe and responsible manner in the host state according to the highest nuclear non-proliferation standards. One way of doing so would be, due to the fact that Euratom enjoys exclusive jurisdiction over nuclear-fuel supply both in its internal and external relations, to establish a Euratom joint undertaking which would operationalise the nuclear fuel provisions of the international agreement Euratom and the third country enters into. As initially the concept of a Euratom joint undertaking was born with the aim of facilitating the creation of a European multinational nuclear fuel industry, involved in enrichment and reprocessing activities, the choice of a Euratom joint undertaking, in which the European nuclear fuel industry – the owner of sensitive nuclear technology – could exploit its expertise to build, own and operate a for-profit enrichment plant, nuclear fuel fabrication plant and/or reprocessing plant would seem appropriate that could serve the nuclear industry's needs in the host state and its wider region. Production in the plants built, owned and operated by the Euratom joint undertaking could be

exclusively located in the host state, or distributed between plants located in the host state and one or several EU Member States. As the Euratom joint undertaking, Euratom's executive arm, enjoying its privileges and immunities guaranteed by the host state, may exercise its functions limited to peaceful purposes only, entrusting a Euratom joint undertaking to manage the nuclear fuel production in the host state would reduce any nuclear-weapon proliferation risk to the minimum. In addition, as Euratom would be obliged to ensure that it complies with its international obligations concerning the supply and use of nuclear materials, also in its enrichment plants, nuclear fuel fabrication plants and/or reprocessing plants located in the host state, the new entrant would *de facto* be subjected to the world's most rigorous nuclear safeguards system [13]. Therefore, Euratom nuclear inspectors would need to be able to carry out their inspections and perform related nuclear material accountancy in the plants owned and operated by its joint undertaking with no interference of the host state.

### **Nuclear cooperation in the MENA region**

Despite its challenges, the MENA region holds enormous potential both for economic growth and political cooperation, especially if one takes into account that the Arab countries of the MENA region share the same language, culture, religion and history [14]. Nuclear energy, which is seen a cutting-edge technology and also a prestige project by countries in the MENA region, uniquely responds to the MENA region's growing and interconnected challenges surrounding water, energy and food – challenges that climate change and rapid urbanisation multiple [15]. In this context, regional cooperation in the field of nuclear energy may enable the MENA region to more effectively deal with its pressing challenges, allowing interested countries to realise the promises of nuclear energy while ensuring security and safety and avoiding political impasse [15]. However, whether or not nuclear energy offers the MENA region a cost-effective solution, it will soon be a reality in the Members of the GCC. The United Arab Emirates, followed by Saudi Arabia, will become nuclear energy generators in the MENA region, and the first Arab countries with access to nuclear technology. Yet, the growing interest in nuclear energy in the MENA region calls for a sustainable, institutional and regional mechanism for responsible nuclear energy infrastructure development for which the GCC may provide a scalable model. For example, the United Arab Emirates shares its experience in setting up a nuclear programme and the related infrastructure, and developing resources, approaches and regulations, and is committed to provide assistance to countries in the MENA region interested in launching nuclear programmes that warrant safe and secure operation. Indeed, the GCC is predetermined to actively cooperate as the proximity of the GCC Members implies that accidents in one Member's nuclear power plant is likely to affect all other Members in the densely populated Gulf coastline where little space is available for evacuation in the case of a serious nuclear incident. Besides, the United Arab Emirates seeks, while developing a national storage and disposal programme, to explore regional cooperation options within the GCC also in this respect.

## ***Gulf Cooperation Council (GCC)***

By the formation of the GCC an international organisation was established by Saudi Arabia, Kuwait, the United Arab Emirates, Qatar, Bahrain and Oman, resembling a cooperative alliance of states whose agreements have not fundamentally compromised their sovereignty [16]. Every Arab state has been keen to maintain its special characteristics, its independence and legislative authorities and judicial bodies, while at the same time strong desire exists among the GCC Members to promote their regional potential within one framework. Indeed, setting up of a framework in which increasing cooperation through practical integration could gradually lead to higher levels of inter-state ties, without indication of what result that cooperation is intended to achieve, is the GCC's most important objective [17]. If one looks at regional international organisations outside Europe, the longevity of the GCC, which is the most advanced example of sub-regional integration in the MENA region, is noteworthy. Development of the GCC framework has been uninterrupted in the MENA region where instability and acute economic difficulty continue [17]. The success of the GCC rests on its unity which is the consequence of its organisational structure based predominantly on consensus building [17]. The GCC's structure is simple: at the top a Supreme Council composed of the rulers of its Member States, to meet annually; a Council of Ministers, to meet quarterly; and a Secretariat-General, each of which is empowered to establish sub-organisations as necessary. Agreements signed between the Member States are classified as mandatory or non-mandatory [18]. Shared interests bind the GCC Members but are insufficient to lead them to transfer sovereignty to the GCC. One unusual aspect of the GCC is the dichotomy between political development, where institutions remain quite traditional in which key decisions emerge from intergovernmental procedures rather than from empowered supranational institutions, and economic ambitions, which is to be compared with the most sophisticated economies in the world [18]. Therefore, cooperation generally takes the form of joint infrastructure programmes and projects, and establishment of joint undertakings, taking into account the economic consideration that resource commitments are maximised through joint participation. In this respect, pursuing nuclear energy in a cooperative spirit offers clear economic, technological, safety, security and non-proliferation benefits for all countries in the MENA region. As the conditions for the rapid construction of nuclear power plants are more favourable in the GCC than in other parts of the world, the Revised 2010-2025 Long-Term Comprehensive Development Strategy for the GCC States relies on nuclear energy as part of the sustainable development goals of the GCC [19]. With this the GCC clearly contradicts the trend towards a decline in nuclear energy in other parts of the world.

Nuclear-energy generation is required to maintain oil revenues and to avoid opportunity cost, while oil revenues are required to finance nuclear programmes domestically. Therefore, the key to success is to consider nuclear technology as an economic, not a political or security choice [19]. Nuclear power plants can be bought from international nuclear reactor vendors. To this end, the nuclear programme of the United Arab Emirates is an excellent example of sound economic and political decision making [20]. The existence of a nuclear power plant has a political message in the MENA region for best practices in transparency and regional security. The United Arab Emirates attaches great importance to these matters to solidify its image as commercial hub and centre of stability in the MENA region [20]. The United Arab Emirates' approach has been praised as a model for how to introduce a transparent, safe and secure national nuclear programme [21]. Other countries (like the smaller GCC Members) could still venture into the nuclear option by exploiting synergies and economies of scale: Qatar may consider the possibility of a regional project for nuclear energy generation; Oman's investment in a nuclear power plant in a neighbouring GCC State is conceivable. Before the United Arab Emirates implemented its nuclear power programme, it was considered that a new national nuclear programme would be developed sequentially and slowly. The United Arab Emirates, however, proved that it was possible to proceed faster by using experienced expatriates initially and transitioning to local expertise over time, and by committing to an experienced nuclear reactor design and nuclear power plant builder with a track record of

delivering on-time and -budget. As the GCC Members have considerable experience and good track record in managing megaprojects, creating industrial centres that could host nuclear programmes and a political culture that tolerates extensive reliance on foreign expertise, which is essential at the start of a nuclear programme while progressively internalising the nuclear technology and knowledge, continued success of the GCC Member's nuclear programme seems warranted [5].

The GCC Members have a great interest in achieving the highest level of coordination, also in the nuclear field. The objective of economic integration is codified both in the GCC Charter and the Unified Economic Agreement with a view to coordinating, standardising and unifying their economic and industrial policies, and their commercial and industrial legislation [22]. The mechanics of such an enhanced cooperation with the aim of standardisation has successfully created an institutionalised and centralised framework for technical cooperation. In this effort, application of the Unified Industrial Development Strategy to nuclear energy would require adoption of unified laws, which would however be not mandatory laws. Member States would not be obliged to implement them; yet if they intended to pursue a nuclear programme, it would be in their best interest to make the sovereign decision to apply these laws domestically to ensure a level-playing field for their nuclear industries in the GCC and beyond. To this end, building on the existing functions and operating methods of the GCC organs, the GCC could adopt an unprecedented binding, state-of-art nuclear regulatory mechanism at intergovernmental level, which would ensure adherence of its Members' nuclear programme to the highest international standards in the nuclear field. Inspired by the Statutes of the Standardisation Organizations for the States of the Gulf Cooperation Council, as implementation of a resolution of the Supreme Council, a Gulf organisation could be established to further technical cooperation of the GCC Members in the nuclear field. Established by an international agreement of all or several GCC Members, the Gulf Nuclear Regulatory Cooperation Organisation would function as a sub-organisation of the Supreme Council, comprising a Board of Directors, composed of the competent Ministers responsible for nuclear energy in each Member, a Technical Council, composed of the chairs of the regulatory body's board of management responsible for nuclear regulation in each Member, and a Secretariat-General, coordinating technical cooperation between the nuclear regulatory bodies of each Member. The Secretariat-General would prepare draft Gulf technical regulations and draft Gulf standards with a view to harmonising nuclear regulation, and draft Gulf conformity assessment procedures with a view to harmonising licensing procedures among the GCC Members in the nuclear field. Initially, the Federal Authority for Nuclear Regulation in the United Arab Emirates and the Saudi Arabian Atomic Regulatory Authority in Saudi Arabia could host and provide support to the Secretariat-General so that it could discharge its functions. Once adopted by the Board of Directors in a non-objection procedure based on the proposal of the Technical Council, approved by consensus, having heard the opinion of the International Nuclear Regulatory Advisory Committee attached to the Board of Directors, composed of independent professionals with high standing in the fields of 3SL, adherence to the unified Gulf technical regulations – once transposed into the national laws of the GCC Members – would be compulsory while to the Gulf standards would only be recommendatory; Gulf conformity assessment procedures would guide regulatory bodies through recommendations in implementing best practices to verify that the specific requirements of the Gulf technical regulations and technical standards are satisfied during the licencing procedure the implementation of which the Secretariat-General would oversee so that it could provide impetus for further technical cooperation in the standardisation efforts of the GCC Members.

Although the United Arab Emirates has expressed its intention to standardise on one nuclear technology – since Saudi Arabia seems to favour dual-purpose or hybrid nuclear power plants as independent water and energy-generation plants –, a performance-based, generally technology-neutral GCC framework that introduces technology-specific requirements only where such requirements would be actually needed would be a

fundamental element for the sustainable deployment of regional nuclear programmes with worldwide outreach as it would give nuclear reactor vendors maximum flexibility to innovate on nuclear reactor designs and features while ensuring adequate protection of public health and safety, and the environment. While the GCC is not limited by the constraints to opt for small modular reactors (SMRs), in order to receive preferential access to the technology, Saudi Arabia's strategic decision to support a nascent nuclear technology is above all rooted in gaining a footing in the development of future nuclear technologies [6]. As certain technologies promise significant added value to the requirements of the MENA region, early movers will be able to establish a nuclear supply chain that could engage in future nuclear reactor deployment projects worldwide. For similar reasons, the GCC could consider establishing partnership with the International Thermonuclear Experimental Reactor (ITER) project members, and eventually submitting its candidature to host the nuclear fusion demonstration reactor, DEMO that will follow ITER. This aspect is especially important to nuclear programmes that pursue localisation, sustainability and nuclear-industry development objectives. Therefore, contrary to most of the countries involved in an SMR nuclear programme that adopt a prescriptive licensing approach the GCC could develop state-of-art nuclear regulations, and a highly effective and flexible licensing procedure, primarily on a goal-setting basis, which it could later on export to the MENA region and beyond. To this effect, the GCC framework could test alternatives that could prove workable in respect of the notion of a nuclear power plant being certified in the factory, which is still far away from practice in Europe. Even if all the mechanical components may be certified in the factory, according to our current way of thinking, the licensing procedure would still apply to the operating system installed onsite where the nuclear operator and not its component manufacturer would be the ultimate and sole responsible for nuclear safety [8].

Nuclear energy itself does not guarantee supply security, which partly explains why states give such an importance to the inalienable right to pursue peaceful uses of nuclear energy. Yet, such a right does not imply that every state has to develop the full nuclear fuel cycle alone. A multilateral approach, based on some voluntarily self-imposed constraint on certain parts of the nuclear fuel cycle in return for essential economic, security and non-proliferation benefits could represent an attractive compromise. As a cost-effective option, the United Arab Emirates accepted such a non-proliferation clause in its nuclear cooperation agreement with the US and pledged, as a unilateral sovereign act, to forgo uranium enrichment and spent fuel reprocessing in exchange of guaranteed supply of nuclear technology, knowledge and fuel [23]. The way the United Arab Emirates develops its nuclear programme for peaceful purposes in a transparent manner and with proper political oversight is a substantial political success for Western governments and international organisations which the United Arab Emirates may leverage to become the norm for the MENA region [20]. Yet, the nuclear non-proliferation gold standard is not necessarily the ideal model for other GCC Members, as for example, Saudi Arabia may intend to pursue an indigenisation policy and become entirely self-sufficient in nuclear fuel production through exploitation of domestic uranium deposits [24]. In the absence of an international obligation to ban nuclear fuel processing and spent fuel reprocessing the international community puts importance on the transparency and accountability of the uranium enrichment and spent fuel reprocessing procedures [20]. While creation of a regional nuclear weapon-free zone would be desirable, its political reality remains limited. The only true regional verification body, Euratom, is in a region that has no regional treaty banning nuclear weapons [25]. The GCC Members may create a supranational verification body similar to Euratom whose legal sovereignty allowed Euratom and the IAEA to harmonise their systems of controls, rather than subordinate one system of control to the other [26]. Yet, being unprecedented in the GCC architecture, it is highly unlikely that the GCC Members would agree to transfer parts of their sovereignty to a Euratom-like body. As the GCC Members with continued commitment to limit the risk of nuclear proliferation are members of the IAEA and have safeguards agreements in place, creation of a supranational organisation may not be necessary if all the GCC Members entered into an additional protocol with the IAEA [27]. This would allow a Western company, backed up by a nuclear cooperation

agreement entered into between the GCC Members and the country of origin, to provide nuclear fuel services and to operate uranium enrichment plants in Saudi Arabia on the basis of the French Eurodif model where the Western company would be the exclusive technology owner and the Saudi and other GCC partners would only enjoy drawing rights of low-enriched uranium, and/or also in other GCC Members (with the exception of the United Arab Emirates due to its international commitments) on the basis of the British-Dutch-German Urenco model, where a GCC joint undertaking or companies of the various GCC Members would fully participate in the research, development, fabrication, operation and management of the enrichment enterprise and would only receive a certain amount of critical nuclear technology and knowledge that would be strictly necessary to perform a function and would make a break-out decision rather costly, in a way that would meet both the GCC Members' low-enriched uranium demands and international non-proliferation standards at the same time under the oversight of the IAEA [23]. Alternatively, the GCC Members could mandate Saudi Arabia to enter into an international agreement on their behalf with Euratom to provide, as described previously, nuclear fuel services and nuclear safeguards through Saudi Arabia to the nuclear power plants operating in the GCC Members, in which case the most rigorous nuclear safeguards system complementing the oversight of the IAEA would guarantee towards the international community that uranium enrichment would be pursued for peaceful purposes only.

## **Conclusion**

No forward-looking energy and climate policy may be successfully implemented without nuclear energy. Yet, nuclear energy needs investment, both public and private. In order to provide in this context an adequate answer to the nuclear cost issue, regional cooperation is indeed a requirement specific to nuclear energy as regionalisation of efforts with a view to harmonising nuclear regulation and standardising nuclear reactor design and construction codes guarantee that nuclear technology will become safer and cheaper than if it were developed by isolated efforts of individual states having more limited expertise or resources. In Europe, for optimal conditions to boost investment in nuclear energy and the European nuclear industry, Euratom needs to create a level-playing field for nuclear energy and its regulation in the EU and beyond through an EU-wide authorisation system that could be set up without the need to amend the EAECT. In the MENA region, provided that the goal of self-sufficient nuclear fuel production can be realised in a transparent and accountable manner that comfortably addresses the security and proliferation concerns of the international community, the GCC Members have the potential to create and host the world's first binding and scalable nuclear regulatory mechanism at intergovernmental level that could become the model for new entrants without the need to compromise their sovereignty and develop state-of-art regulation and licensing procedure, amongst others, for SMR deployment.

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