# INTERNATIONAL BANK FOR NUCLEAR INFRASTRUCTURE (IBNI)

***A Comprehensive and Multi-Dimensional Solution that will Enable Accelerated Global Scaling of Small Modular Reactors***

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## INTRODUCTION

The International Bank for Nuclear Infrastructure (“IBNI” or the “Bank”) is a proposed new multilateral international financial institution (“IFI”) that will maintain an exclusive focus on financing and other multi-dimensional support for qualifying nuclear projects, industries and programs within all the IBNI shareholder member nations (which is expected to include a subset of IAEA Member States). It is anticipated that IBNI will be established, through treaty, by a coalition of policy-aligned nations by a target date of the end of 2026. The Bank would provide funding, financing and other forms of support and resources to qualified public and private stakeholder applicants within the group of IBNI shareholder member nations on a country-, technology- and supplier-neutral basis. IBNI would support projects, programs and industry within all its shareholder member countries, without limitation to geography, national income levels or developmental status. Through specific mechanisms, as will be further described herein, IBNI will enable accelerated deployment, scaling and de-risking of all types of nuclear technologies, specifically including Small Modular Reactors (“SMRs”).

The foremost aim of the new Bank will be to give all its shareholder member nations access to the financial and other resources necessary in rapidly deploy and expand nuclear energy capacities at the scale and speed necessary to achieve global policy objectives including 2050 net zero greenhouse gas emission, sustainable decarbonisation and development, just and equitable energy transition and global energy security.

IBNI will provide comprehensive and multi-dimensional solutions and its products, services and programs shall extend well beyond funding and financing elements. The paper focuses specifically on those financial and non-financial support dimensions of the Bank that will ‘fill the gaps’ with respect to unfulfilled needs of the embarking IAEA Member States’ (“MSs”) adoption and acceleration of nuclear power programs with SMRs. Inherently, IBNI will finance and sponsor a range of accessible global pooled/aggregated resource programs that all IBNI member nations, including embarking MSs, can access that will aid these countries in accelerating all aspects of their nuclear infrastructure sand deploying SMRs much more quickly. Such IBNI-sponsored programs, which will be grounded in ‘international best practices’, shall include capacity building; regulatory, licensing and technical expertise and cooperation, human resource (specialised skills) development, project/program management; environmental and social assessment and management; and public and industrial engagement and across many other diverse areas of nuclear infrastructure development.

## INBI’S NUCLEAR INFRASTRUCTURE SUPPORT PROGRAMS

IBNI will have two primary operating arms: the IBNI Ordinary Operations Fund (“IBNI OOF”) and the IBNI Special Operations Fund (“IBNI SOF”) [1]. Whereas the IBNI OOF, as the commercial operations arm of the Bank, will be focused on ‘arms-length’ commercial financing products, services and programs, the IBNI SOF will be focused on specific earmarked donor-supported programs. Over time, as nuclear programs and projects reach a ‘finance ready state’, the embarking MSs will be able to access programs out of both the IBNI OOF and the IBNI SOF. However, in respect to the earlier stages of nuclear program development, the support programs within the IBNI SOF will be specifically tailored to facilitating embarking MSs’ achievement of accelerated development of their enabling nuclear infrastructure and the many diverse aspect that this entails. Specifically, IBNI SOF programs shall provide certain funding, concessionary financing, and access to IBNI-sponsored globally pooled and procured resources that will enable such MSs to progress as quickly as possible through the IAEA’s Milestones [2], and thereby enabling a significant compression of the time span between Phase 1 and Phase 3, with the objective of shortening the duration of the process by a measure of years. By providing access to the necessary early-stage technical, regulatory, financial, commercial and legal resources, in additional to funding and financing resources, IBNI SOF will play a key role in empowering those embarking MSs in their aspiration to attain nuclear ‘knowledgeable customer’ status much faster and more efficiently than would otherwise be the case under prevailing fiscal and resource constraints.

It should be further noted that IBNI would aim to play a complimentary and supporting role alongside the IAEA and its many existing programs, such as the Integrated Nuclear Infrastructure Review (“INIR”) service [3], the Integrated Regulatory Review Service (“IRRS”) [4], Technical Cooperation (“TC”) [5] and all other relevant IAEA support programs and services that are currently offered to the embarking MSs. Despite IAEA’s programs and resources available to the MSs, there remain numerous outstanding challenges and impediments (e.g. ‘gaps’) confronting most embarking MSs with respect to becoming nuclear-ready ‘knowledgeable customers’ on an accelerated basis. Three of the foremost challenges facing embarking MSs with intentions to deploy SMRs are addressed here:

(a) access to funding and affordable financing for earlier-stage enabling nuclear infrastructure investments;

(b) access to and development of specialised nuclear resources; and

(c) uncertainties about affordability and market competitiveness of SMRs in local energy markets.

Accordingly, IBNI will aim to ‘fill each of these gaps’ through funding and financing and other integrated non-financial resources and other support programs that are specifically tailored to address these three areas, as further developed below.

### IBNI Funding and Affordable Financing Programs Supporting Embarking MSs

Many embarking MSs that are pursuing nuclear programs, including those seeking to deploy SMRs face critical constraints in respect to accessing funding and affordable external financing for their necessary earlier-stage investments in their enabling nuclear infrastructure and nuclear implementation programs. It is important to note that, with the exception of certain early-stage bilateral export-driven programs, the embarking MS would be typically required to self-finance most of the early-stage investments in its nuclear infrastructure development. Years or even decades before the first kilowatt hour (kWh) of generated energy can be sold, hundreds of millions or perhaps even billions (US $ equivalent) worth of investments in developing and/or procuring nuclear-specialised resources, may be necessary to conduct the meta-activities under governmental agencies, a national nuclear energy programme implementing organisation (“NEPIO”), competent regulatory bodies, an owner-operator entity and the numerous other stakeholder-led activities under the nineteen (19) infrastructure issues under the IAEA Milestones approach[[1]](#footnote-2).

The IBNI initiative recognises that many governments do not and will not have the necessary and sufficient ‘fiscal headroom’ to self-finance all of their earlier-stage costs that will be required to advance their nuclear programs apace. In order to address the need for embarking MSs access to external funding and affordable financing solutions, is envisaged that IBNI offer the following specific products and programs to qualified applicant stakeholders:

1. Competitive grant funding for early-stage nuclear infrastructure developments;
2. Competitive concessionary financing (low-cost and/or partially or fully forgivable loans, guarantees and credits) for early-stage nuclear infrastructure developments;
3. Sovereign risk (partial risk) guarantees;
4. Enclave financing;
5. Early-stage equity co-investments in nuclear energy sector companies; and,
6. Climate and sustainability impact financing through public-private partnership (“PPP”) delivery models.

Each of the preceding IBNI funding and financing tools and their specific applications for embarking MSs pursuing SMRs is further described below.

#### IBNI Competitive Grant Funding Programs.

Through the IBNI SOF, the Bank will offer qualified stakeholder applicants within IBNI shareholder member states supplemental grant funding programs (referencing Section 2.1(a), above) that will be competitively awarded based on uniform evaluation frameworks under IBNI Standards and Criteria (“S&Cs”) and established procedures[[2]](#footnote-3). Such grant funding programs, based on specific needs and limitation of access to other earlier-stage funding and affordable financing alternatives to the embarking MS, will be designed to enable critical early-stage investments in the country’s nuclear infrastructure and nuclear program. Such competitively awarded grants will supplement and extend the embarking MS’s other nuclear program funding and financing resources, *including* other IBNI funding and financing programs that the stakeholder applicants within the embarking MS may also qualify for. IBNI SOF grant funding will often be structured with certain deferred performance/milestone disbursement provisions and/or full or partial reimbursement provisions in the event of a later-stage successful nuclear project or program financing.

#### IBNI Competitive Concessionary Finance Programs.

Similar to and also further complimenting the IBNI Competitive Grant Funding Programs (as described above in Section 2.1.1), IBNI SOF will also offer qualified stakeholder applicants within IBNI shareholder member nations supplemental concessionary financing products and programs that will also be competitively awarded under same procedures as described above in Section 2.1.1. IBNI’s Competitive Concessionary Financing Programs (referencing Section 2.1.(b), above) will offer qualified applicants from IBNI shareholder member states low-interest (subsidised) loans, guarantees and other forms of concessionary credit facilities. Such credit facilities would typically have advantageous flexible repayment features, may be fixed- or variable-rate and may offer a range of different currency denominations. As a lending condition, such concessionary loans and/or other credit facilities may be structured as partially- or fully-forgivable instruments. In some cases, incremental drawing provisions on such concessionary credit facilities may also be subject to performance/milestone conditions as described above within Section 2.1.1.

#### IBNI Sovereign Risk (Partial Risk) Guarantee Programs.

In the case of numerous embarking MSs, the sovereign credit of the country may be insufficient (below ‘investment grade’ or non-rated) in order to attract external third-party international commercial and/or capital markets financing for the national nuclear programs. Recognising this issue and the current scenario, whereby the other major multilateral financing institutions that routinely provide such sovereign guarantee products are not participating in the nuclear ‘capacity-expansion’ space, IBNI SOF would provide access to qualified IBNI shareholder member governments with competitive sovereign risk (partial risk) guarantees (referenced above in Section 2.1(c)) that would facilitate sovereign financing for such earlier-stage investments in the embarking MS’s nuclear infrastructure programs[[3]](#footnote-4). As existing precedent multilateral sovereign guarantee models provide, such guarantee instruments would essentially backstop a limited set of sovereign payment and performance obligations linked to an international investment (such as a sovereign bond, loan or other financing instrument). Whereas, under the existing circumstances, the embarking MS may not have access to the global financial markets due to insufficient creditworthiness and/or financing track record. Such IBNI sovereign risk guarantee (partial risk) would enable such countries to access low-cost external financing available for the national nuclear infrastructure programs based on the substitute credit of IBNI SOF (which targets highest grade ‘AAA’ category credit ratings).

#### IBNI Enclave Financing Programs.

In additional to and complementing the finite IBNI SOF Competitive Grant, IBNI Competitive Concessionary Loans and IBNI Sovereign Guarantee Program resources described above in Sections 2.1.1 – 2.1.3, IBNI SOF is expected to also offer an Enclave Financing Programs (referenced above 2.1(d)). Enclave financing is a product, first developed by the International Bank for Reconstruction and Development (“IBRD” as a member of the World Bank Group) to address certain financing needs within some of its low-income members states beyond what other concessionary financing and other support could provided under relevant limitations (sovereign borrowing limits, credit capacity, etc.)[[4]](#footnote-5) Enclave Financing (loans, guarantees and other credits) can be accessed by qualified stakeholder applicants within IBNI shareholder members nations in certain cases where the additional financial support from IBNI is sought beyond certain constraints and limitations of the three above programs. Unlike a sovereign credit program, IBNI Enclave Financing would be secured by a dedicated enterprise’s revenue streams (state-owned, investor-owned or joint venture, such as a utility, for example) combined with sufficient security features from the state or other institutions that sufficiently insulate IBNI SOF from the risk of borrower default, non-payment or non-performance. The cost of IBNI Enclave Financing would reflect the substitute credit of IBNI SOF (targeting highest grade ‘AAA’ category credit ratings) as opposed to the underlying credit of the sovereign or the enterprise.

#### IBNI Early-Stage Equity Investments in Nuclear Sector Companies

In many embarking MS’s national governments may be seeking private investor involvement in their emerging nuclear sector. In such cases, there may be existing or an aspiration to structure new key companies as either joint ventures (government and private ownership) or purely investor-owned from the beginning. Opportunities for initial ‘from the very beginning’ private shareholder investment in the country’s owner-operator organisation(s) (a utility and/or other companies), offtaker(s), local supply chains, nuclear fuel-cycle industries (where applicable) and other related industrial companies. Through IBNI SOF (and/or potentially IBNI OOF) Early-Stage Equity Investment Program (referenced above in Section 2.1(e)), whereby if requested, there may be opportunities for IBNI to participate in such companies as an early-stage equity investor (minority shareholder) in effort to catalyse additional external equity and debt capital for such key companies, which will play a critical role in funding and financing certain meta-activities in relation to the MS’s nuclear infrastructure investment programs.

#### IBNI Climate and Sustainability Impact Financing Programs Delivered through PPP Mechanisms

The last major category of IBNI’s funding and financing support programs that embarking MSs’ (that are also IBNI shareholder members) could access is the Climate and Sustainability Impact Financing Programs (as reference above under Section 2.1(f)). Given the growth of the multi-trillion dollar (US $ equivalent capitalization)[[5]](#footnote-6) segment of the global financial markets engaged in climate; sustainability; energy transition; clean energy; green and environmental, social and governance (“ESG”) focused investments, IBNI aims to develop new markets for nuclear sector climate and sustainability impact financing (climate and sustainability impact-linked bonds, loans, etc.) A climate or sustainability impact bond, loan or similar instrument is a type of ‘social impact financing’ where all or a portion of the investment and level of returns are based on the achievement of certain measurable outcomes. In the case of the proposed IBNI Climate and Sustainable Impact Financing Programs, such payments would be linked to metrics such as the degree to which certain mitigated greenhouse gas (“GHG”) emissions, access to reliable clean energy, sustainable development targets are achieved within a certain geographic and/or economic development strata and within a defined time period.

It is envisaged that IBNI’s Climate and Sustainability Impact Financing Programs could also be administered through PPP service delivery mechanisms. In general, IBNI SOF would contract with a PPP consortium (which would include one or more impact investor or lender that which could fund all or a portion of the consortium’s costs) that would, under the administration of IBNI SOF, carry out certain mandates to support embarking MSs (IBNI shareholder members who may opt into such programs). Under such PPP constructs the PPP consortium’s payments (from IBNI SOF and the embarking MS and its stakeholders) would also be linked to certain specified performance outcomes and milestone achievements, which could include progression from IAEA Phase 1/Milestone 1 to Phase 3/Milestone 3 in accordance with a certain time frame, amongst various other time-based milestone achievements and outcomes, including both qualitative and quantitative criteria. IBNI would potentially guarantee repayment of invested principle and a minimum rate of return (whereby the necessity for such guarantees would be expected to steadily diminish as such programs mature).

### IBNI Programs Enabling Access to and Development of Nuclear-Specialised Resources

As set forth above, embarking MSs also face significant impediments with respect to developing and/or procuring the full spectrum of necessary nuclear specialised resources (including skilled human resources, institutions and consultants at an affordable cost). In principle, an embarking MS can pursue the development of such resources in-country or procure resources from regional or international sources, or in most cases, a combination of these two. The key constraints are cost, time and availability or qualified resources. In a less fiscally constrained and euphoric situation, a MS could perhaps accelerate development of nuclear infrastructure through procurement of highly experienced ‘best-of-class’ global expatriate resources. However, heavy reliance on expatriate skilled expertise is likely to prove to be extremely costly and could be subject to bottlenecks in the future availability of such resources (particularly, under the scenario of a global scale-up of nuclear resource demand and potential scarcity/unavailability of such resources). On the other hand, developing in-country resources and expertise, from the ‘ground-up’, including education and training of a new generation of domestic nuclear scientists and engineers, regulators, operators, industries, and a large skilled workforce is a very significant national (and perhaps multinational undertaking) that takes many years and also requires significant near-term investment from the embarking MS.

Recognising the above resource constraints, IBNI SOF will support the establishment of global resource pools and aggregator organisations that will be accessible to embarking MSs (that are IBNI shareholder members) that seek readily available access to affordable, high-quality resources across the diverse spectrum necessary to optimally accelerate the national nuclear infrastructure development programs in IBNI shareholder member states.

Specifically, IBNI SOF will provide funding and financing, administration, guidelines, standards and criteria, frameworks and oversight for participating public-private resource pooling/aggregator organisations accessible to qualified stakeholder applicants within IBNI shareholder member states. Such IBNI supported resource pooling/aggregator organisations would include global and multinational nuclear-specialised ‘skills banks/pools’, ‘international technical service organisations’ (“ITSOs”) and other similar types and variations of organisations. IBNI supported resource pools and aggregator organisations are expected to cover a full range of the specialised resources needed by embarking MSs. This range would specifically include resources with specific expertise in ‘best international practices’ within areas including ‘regulatory and licensing’ (in particular, with experience and expertise in globally harmonised regulatory and licensing of SMR designs in precedent countries’ frameworks), ‘operations’, ‘nuclear safety, security and safeguards’, ‘project development and program management’, ‘contracting, financing and legal’, ‘human resource development’, ‘procurement’, ‘risk management’, ‘ESG management’, ‘industrial and public engagement’ and many more specialised resource areas that will be required.

IBNI supported resource pooling /aggregating organisations would generally be comprised of different amalgamations of globally contributed public entities (governmental, regulatory, academic and research and technical institutions and instrumentalities) and private entities (technical, legal, financial, commercial, environmental, etc. nuclear sector service and consultancy companies; non-governmental organisations and individual subject matter experts). Embarking MSs that have an ambition to develop and expand their own nuclear sectors, both in-country and globally will be encouraged to contribute their own resources to these global organisations. For many of the embarking MSs, the opportunity to not only access, but also contribute to the IBNI sponsored global resource organisations also offers profound economic development (international training, human resource and institutional development, well-paid job opportunities for its citizenry and in-country and expanded global growth opportunities for its own emerging nuclear industry sector, if applicable).

IBNI would provide competitive funding and financing for the resource pools through similar variations the IBNI SOF funding and financing mechanisms outlines in Section 2.1.1 – 2.1.6. In particular, the IBNI Climate and Sustainability Impact Financing Program (Section 2.1.6) would be expected to play a role in many of the support organisation that would be structured as PPPs.

### IBNI Programs to Manage Affordability and Costs Competitiveness of SMRs/Nuclear

Lastly, significant concern facing any embarking MS is whether proposed deployment of SMR/nuclear technology will be financially feasible (e.g. bankable and financeable), affordable and cost-competitive in its energy markets. There is a significant risk posed to embarking MSs, that after years and perhaps billions (US $ equivalent) of investments in a nuclear program, that the anticipated SMR technologies may prove to be simply unfeasible (unbankable, uninvestable, etc.) and unaffordable within its markets. This risk could be manifested in the form of eventual nuclear project/program cancellation/abandonment, which could be seen as a worst-case outcome.

The global nuclear sector (by extension, the SMR industry) needs to reliably demonstrate that nuclear can be cost competitive against all other generation alternatives (both low-carbon and otherwise, including unabated fossil fuels). Achieving this objective will necessitate rapid de-risking and scaling of the global SMR/nuclear sector. This, in turn first requires robust global demand signals in the form of a significant and sustained growth in volume in the form of firm customer orders. However, there are few ‘first-mover’ customers who are, rationally unwilling to take the risk of being saddled with the costs of first-of-a-kind (“FOAK”) and current-stage, pre-scaled SMR/nuclear technology deployments. Similarly, the nuclear industry, financial markets and individual governments (taxpayers and institutions) are not capable of shouldering all risks of FOAK and early-stage deployments. In markets around the world, there is currently little customer/market confidence that SMRs can be delivered to achieve a competitive energy price for its customers. The misalignment of costs/risks abnd global benefits will likely continue to keep many potentially interested SMR customers off of the sidelines and not compel them to move into ‘confirmed order’ status. Instead of the ideal ‘race to be first’ for SMRs, we are confounded with a ‘race to be last’, which is the rationale position of a large number of customers (who wish to enter only after de-risking and scaling has been assured). The current situation is problematic, in that at the current trajectory, this unlikely to enable SMR technologies to become reliably affordable within a reasonable time period (e.g. by 2035).

What is IBNI’s solution? An IBNI Demand Aggregation Program will enable a high degree of early-stage confidence to the embarking MS stakeholders around the bankability and financeability of a range of SMR technologies as well as affordability of end-user costs related to those SMR/nuclear technologies which would offer the availability of an array of supplier-led ‘IBNI stapled financing’ products, programs and services. Stakeholder applicants from IBNI shareholder member countries will have the ability participate in global demand aggregation pools related to specific qualified SMR/nuclear technologies, whereby the risks and costs of entering into near-term order will be aligned with the benefits of these technologies after de-risking and scaling (e.g global scaled-up benefits). Through such supplier-led demand aggregation programs, IBNI will rapidly stimulate ‘first mover’ demand by capping and globally allocating FOAK and pre-scaled deployment risks and costs in proportion to the post-scaled, de-risked benefits (e.g. after so-called ‘nth-of-a-kind or ‘NOAK’ deployment and movement along cost/experience/learning curves of the related technologies).

A fully detailed description of each of the potential ‘IBNI stapled financing’ products, programs and services that may be offered under the IBNI Demand Aggregation Program is beyond the scope of the paper. The following is a summarisation of these potential ‘IBNI stapled financing’ solutions:

1. Stapled supplemental ‘emerging technologies’grant and concessionary grant funding;
2. Stapled IBNI committed senior and/or subordinate financing;
3. Stapled IBNI committed equity (minority shareholding or other) financing;
4. Stapled IBNI committed *contingent* debt and/or equity financing (in case of delays and overruns);
5. Stapled IBNI hedging contracts: interest rate, inflation, currency risks;
6. Stapled IBNI completion risk insurance (cost overrun and delay risks); and,
7. Stapled IBNI capital markets and transactional advisory services.

## CONCLUSIONS

Timely establishment of IBNI will impact will extend well beyond providing access to pooled external funding and low-cost financing that the Bank will make available to those MS stakeholders pursuing SMRs. IBNI will also act as the global facilitator and aggregator of pooled global ‘fleets-of’fleets’ demand for SMRs and other nuclear technologies (which is critical for enabling facilitating market confidence and driving global demand signals and firm order flow, de-risking, scaling, bankability/investability and ultimately cost-competitiveness of the sector); pooled nuclear-specific expertise and standards and criteria and achievement of a high degree of global harmonisation, standardisation and replicability across regulatory, policy frameworks, commercial and delivery models, and many more financial and non-financial dimensions.

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The author of this manuscript, Daniel Dean is a citizen of the United States of America. He is currently the Chairman of the International Bank for Nuclear Infrastructure – Implementation Organisation Strategic Advisory Group (“IBNI-IO SAG”).

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IBNI-IO SAG is an organisation private individual experts. For this article publicly available information about the IBNI initiative has been used as referenced below. Not all IBNI-IO SAG members have been listed in this publication.

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1. The IAEA Publication Nr. NG-T-3.21 *“Resource Requirements for Nuclear Power Infrastructure Development”* Dated June 2022 [6] quantifies an estimated 7,730 person years overall resource requirements related to the various required meta-activities of the various key stakeholder entities through up through IAEA Milestone 3. While skills service and labor costs can vary significantly from country-to-country, apply a range of US $ 30,000 to US $ 250,000 as the median average cost per person year provide a rough estimate of these costs that might range from ca. US $ 230 million (potential low-end) to more than $1.9 billion (potential high-end). These estimates are related to costs (typically largely by borne by embarking MS governments) that need to be incurred before the first kWh of energy can be sold. [↑](#footnote-ref-2)
2. IBNI’s proposed Standards and Criteria (“S&Cs”) and related Net Zero Cooperation and Framework Agreements (“NZCAFAs”) are more fully described under IBNI”) *Initial Report and Action Plan (“IRAP”), November 2021 Section 5 Proposed IBNI Standards & Criteria* [7]. In terms of the proposed alternatives for IBNI governance structures and potential policies, procedures and frameworks and considerations related to the approvals of IBNI funding and support is more fully developed under *“IBNI Briefing Note on Board Oversight of IBNI Funding and Financing Decisions”* [8]. [↑](#footnote-ref-3)
3. As an example of an existing multilateral sovereign risk guarantee programs, please refer to *“World Bank Guarantees Program”* [9] [↑](#footnote-ref-4)
4. Please reference *“World Bank Group Product Note: IBRD Enclave Loans of IDA Countries”* [10]. Such as product adapted to the specific requirements of the nuclear sector may serve a model or template for IBNI’s Enclave Financing programs. [↑](#footnote-ref-5)
5. According to a Bloomberg Intelligence report [11], as of the time of that report (8 February 2024), the current global size of the worldwide ESG market segment was estimated to be over US $ 30 billion in 2022 and on track to surpass over US $ 40 billion by 2030 (estimated to be more than 25% of total global assets under management). [↑](#footnote-ref-6)