8. Proposed IBNI 2050 Global Impact Targets and Goals.

Key Points

- IBNI shall be established as a results-oriented organization that will fulfill its mission to expand global nuclear generation capacities in order to achieve sustainable net zero by 2050.
- IBNI will establish specific measurable targets and goals that related to its direct impacts as well as indirect impacts in all the countries and markets that it supports.
- IBNI's success will be measured by its achievement of various specific goals and targets, but the most important objective will be the achievement of 2050 Net Zero.

Each nation of the world will need to make their own independent decisions on energy and climate change policies and strategies, based on their own unique circumstances. However, given those nations that collectively represent both the vast majority of both global GHG emissions and global energy consumption have already submitted their NDC pledges, each nation needs to formulate their own actionable and achievable plans that will allow for the achievement of all net zero commitments under their respective NDC pledges.

IBNI will offer a powerful set of new tools available to any nation that makes the policy decision to develop, expand and scale-up their nuclear energy program as a significant element of their own pathway to providing a future sustainable low-carbon economy and achieving net zero by 2050. Currently, the challenges for many nations to develop and expand their nuclear capacities are numerous. Significant impediments include access to affordable finance, market and regulatory challenges, ESG issues, uncertainties regarding affordability, status of the nuclear industry and supply chains, safety and security concerns, and numerous other issues. IBNI will offer a comprehensive "game changing" set of solutions to the multifaceted nuclear related challenges mentioned above.

There are effectively only two existing low carbon generation technologies that are technically feasible, commercially proven and scalable: nuclear and renewables. As the world has now become aware, the challenge of achieving 2050 net zero requires nothing short of immediate and drastic action. There is simply no time remaining to wait for hopeful future clean energy breakthroughs that might become commercialized, scalable and affordable in the years and decades ahead[85]. It is clear that the world must take action today

[85] Note that IBNI is fully supportive and is a strong advocate for governments and private sector investment in emerging new low carbon energy generation, grid and storage technologies. Clearly, the world should make every reasonable effort to advance all such promising new technologies as quickly as possible. Irrespective, the main concerns remain with respect to the timeframes and the uncertainties over when and whether many of these technologies may become commercially viable, economical and available at global scale quickly enough to make an impact prior to 2050 (if ever). It is envisaged that IBNI itself will be well-positioned emerge as a global leading

and begin investing in a clean energy future of tomorrow using existing technically and commercially proven generating technologies.

A key question that policymakers in every nation should be asking is not "which low carbon generation technologies should we begin investing in?", but rather "what will be the *cost* of our low carbon future be for our future generations, based on the investment decisions (generation mix) that we undertake today?" It may be technically feasible, using today's technologies, for certain nations of the world to achieve net zero by 2050 through implementation of virtually 100% renewables. *But what at what cost?* Most nations of the world do not have sufficient and affordable dispatchable renewable resources (principally, additional proven and economically exploitable hydrological, geothermal and biomass resources). Therefore, for any nation that chooses an '*all renewables pathway*', there will need to be a reliance on a very high percentage of and investment in VRE generation (mainly wind and solar) together with a correspondingly large investment in related grid, energy storage and other systems costs. Even without considering the practical limitations related to land, coastal area and materials consumption related to very high global VRE penetration levels, the question about *cost* persists. As shown in *Section 3.1 - Nuclear Power is Amongst the Most Affordable Low Carbon Generation Technologies in Existence*, as the VRE penetration rates increase, system costs also tend to increase at a disproportionately high rate.

Considering the context described above, it is SAG's opinion that as many nations of the world (in the very immediate future) will begin to consider their own limited options to achieve net zero in their national context, not an insignificant number of nations will reach their own conclusion that *the significant benefits of developing, expanding and scaling-up* nuclear energy programs over the next 30-years outweigh the *risks of nuclear energy and the significant costs associated with reliance on very high VRE in their 2050 generation mixes.*

Without IBNI, due to the many of the above-mentioned challenges and impediments currently facing nuclear energy, most nations will reasonably determine that it is inconceivable for nuclear to play anything but a very minor role in achieving 2050 Net Zero. However, when IBNI is established, it will play a pivotal "game changing" role in breaking down the many existing barriers and impediments that nations are currently facing in developing, expanding and scaling-up their nuclear capacities. After the establishment of IBNI, all nations ranging from developing countries to the world's most advanced industrialized economies, will have uniform access to all the necessary tools that will allow them to access nuclear energy as a significant component of their energy futures that will also provide the most affordable pathways to their sustainable low carbon future economies.

Many recent and highly credible analyses and projections from reputable organizations have significantly discounted the global role and impact of nuclear generation by 2050. Based on recent meta-analyses of many of these recent studies, the projected 2050 nuclear shares of total world electricity generation range

funder, supporter and catalyst of many new and innovative nuclear generation and nuclear fuel cycle related technologies as set forth in Section 7.

from 4.5% to 25%[86]. However, within those studies, many of the assumptions pertaining to nuclear energy industry and markets and broader energy markets are well understood and are reflective of existing conditions and reasonable forecasts under a 'status quo' state. However, in consideration of IBNI becoming the pivotal "game changer" in the global nuclear landscape, many potential scenarios of much higher growth in nuclear capacities over the next 30-years become entirely plausible.

It is neither the intention nor the objective of the SAG to critique the many studies and analyses from many esteemed organizations, including many that are strong proponents of expanding nuclear capacities. Each of these studies were conducted for specific purposes and rely upon many reasonable and defensible assumptions and modeling outputs. It is clear, at the time of this publication, that none of these studies took into consideration the potential near-term establishment of IBNI and the global impacts that the Bank may have. Taking all of the above points into consideration, SAG's analytical objective was to take an independent and fresh look at what level of additional and incremental impact IBNI, as the pivotal "game changer", could reasonably have on the prospective growth of global nuclear generation capacities and outputs over the next 30 years.

In the IRAP scenarios, we envisage a world where IBNI will offer all nations of the world a comprehensive solution, which removes most of the impediments relating to developing, expanding and scaling-up their nuclear programs. A simple and fundamental decision for most nations charting their low carbon future will become whether:

A. to *scale-up* nuclear generation and rely *less* on VRE; or,
B. to *scale up* VRE and rely *less* on nuclear or not at all.

Certainly not all nations will choose or even consider 'A', and for many well-understood and respected non-economic reasons. However, it is the opinion of the SAG that under the above simplified framework, a great number of the world's nations will choose 'A', for numerous reasons, but overwhelmingly, because of one overriding economic reason: *Because they will determine it is far and away their least cost low carbon solution available in their national context.*

Table 7, below summarizes our three scenarios, which consider worldwide access to IBNI's programs.

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[86] Sources: [3], [5], [6], [43] & [46]. Note WNA, in report *World Energy Need and Nuclear Power (updated May 2021)* ([43]) conducted a comprehensive survey of numerous world energy and nuclear energy forecasts. Within this report, WNA sets forth a "harmony goal" for the world nuclear industry to provide 25% of electricity output by 2050. It should be noted that the IPCC pathway scenario P2 (SSP2-19) also shows 25% nuclear share of generation by 2050. It is noted that OECD IEA/NEA and IAEA have recently projected amongst the most conservative nuclear scenarios for 2050 world nuclear generation shares with declines to 8% and 4.5%, respectively (OECD IEA/NEA [6] & [43] have also assumed 2050 world VRE share of 70%). It should be further noted that each of these studied scenarios utilized different forecasts and assumptions for total 2050 world electricity demand.

TABLE 7 - SUMMARY OF ASSUMED WORLD ELECTRICITY GENERATION, NUCLEAR AND VRE SHARES UNDER SAG SCENARIOS

Scenario			2030			2040			2050		
Nr.	Electricity Generation	2050 Nuclear Penetration	Total Gen. (PWh/a)	Nuclear (PWh/a)	% Nuclear (% VRE)	Total Gen. (PWh/a)	Nuclear (PWh/a)	% Nuclear (% VRE)	Total Gen. (PWh/a)	Nuclear (PWh/a)	% Nuclear (% VRE)
1a	Projected	Low VALCOE	37.3	3.78	10.1(43.2)%	56.6	27.13	48.0(28.7)%	71.2	42.70	60.0(22.0)%
1b	High	Low VALCOE	49.8	3.78	7.6(57.4)%	75.5	35.71	47.3(35.2)%	95.0	57.00	60.0(26.5)%
1c	Low	Low VALCOE	28.5	3.78	16.0(10.2)%	35.8	17.71	49.5(13.6)%	45.0	27.00	60.0(11.5)%
2a	Projected	Mid VALCOE	37.3	3.78	10.1(43.2)%	56.6	15.17	26.8(49.9)%	71.2	22.77	32.0(50.0)%
2b	High	Mid VALCOE	49.8	3.78	7.6(57.4)%	75.5	19.75	26.2(56.4)%	95.0	30.39	32.0(54.5)%
2c	Low	Mid VALCOE	28.5	3.78	16.0(10.2)%	35.8	10.15	28.4(34.8)%	45.0	14.40	32.0(39.5)%
3a	Projected	High VALCOE	37.3	3.78	10.1(43.2)%	56.6	6.63	11.7(65.0)%	71.2	8.54	12.0(70.0)%
3b	High	High VALCOE	49.8	3.78	7.6(57.4)%	75.5	8.35	11.1(71.5)%	95.0	11.40	12.0(75.0)%
3c	Low	High VALCOE	28.5	3.78	16.0(10.2)%	35.8	4.75	13.3(60.0)%	45.0	5.40	12.0(59.5)%

Source: IBNI-IO SAG. Notes: The following three world electricity demand cases apply: "Projected" = OECD IEA/NEA Net Zero Emissions by 2050 Scenario, Source [53]- Table A.3d, pg. 312; "High" and "Low" scenarios are adapted by IBNI-IO SAG from a synthesis of projections from various sources detailed in Figure 5. The following three 2050 World Nuclear Penetrations cases apply: "Low VALCOE" = the IBNI-IO SAG optimistic target case which limits the necessity to scale-up global VRE shares to < 30% under high electricity demand cases, and this also limits annualized growth in nuclear capacity during the 2030 – 50 period to similar levels as the nuclear industry has demonstrated in the 1960 – 1990 growth period (as discussed further below); "Mid VALCOE" and "High VALCOE" were calculated based on a targeted 2050 VRE penetration targets of 50% and 70%, respectively (in the case of "Projected" Electricity Generation). Furthermore, it is assumed that while IBNI would be established by 2023, the nuclear projects that it begins financing in the 2020's will most likely not be operational and connected to the grid until after 2030. Therefore, under all scenarios nuclear generation output for 2030 has been assumed to be 3.777 PWh/a, which is consistent with the NZE scenario. Significant IBNI-initiated growth of global nuclear output becomes most plausible beginning in the 2030 – 2040 decade.

Based on such a wide range of scenarios which consider various levels of electricity demand and nuclear penetration over the next 30-years, the above scenarios indicate a correspondingly wide range in 2050 nuclear generation output ranging from 5.4 PWh/a to 57.0 PWh/a. This corresponds to range of 725.2 GW_e to 7,654.9 GW_e of required total nuclear installed capacity connected to the grids by 2050[87] (representing an average annual capacity growth rate of 2.0% to 10.5% (CAGR) over the 30-year period). Historically, the nuclear industry has already demonstrated its capabilities to deliver even faster growth over similar time horizons. As shown in Figure 31, the growth in nuclear capacity from 1960 – 1990 increased at an average annual growth rate of 20.8% (CAGR)[88]. Under the appropriate frameworks, there is no fundamental reason that global nuclear industries and supply chains of today and tomorrow cannot be reactivated in the 2030's and 2040's to deliver similar or higher growth rates.

Table 8, below summarizes the modeled world nuclear capacity increase requirement associated with the various scenarios show above in Table 7.

TABLE 8 - SUMMARY OF ESTIMATED OF TOTAL REQUIRED GLOBAL NUCLEAR INSTALLED CAPACITIES UNDER VARIOUS SCENARIOS

Scenario			2020	2030		2040			2050		
Nr.	Electricity Generation	2050 Nuclear Penetration	Nuclear Installed Capacity GW_e	Nuclear Installed Capacity GW_e	2020-30 CAGR%	Nuclear Installed Capacity GW_e	2020-40 CAGR%	2030-40 CAGR%	Nuclear Installed Capacity GW_e	2020-50 CAGR%	2040-50 CAGR%
1a	Projected	Low VALCOE	392.6	507.2	2.6%	3,643.5	11.8%	21.8%	5,734.4	9.4%	4.6%
1b	High	Low VALCOE	392.6	507.2	2.6%	4,795.8	13.3%	25.2%	7,654.9	10.4%	4.8%

87 These figures assume an average global capacity factor of 85%.

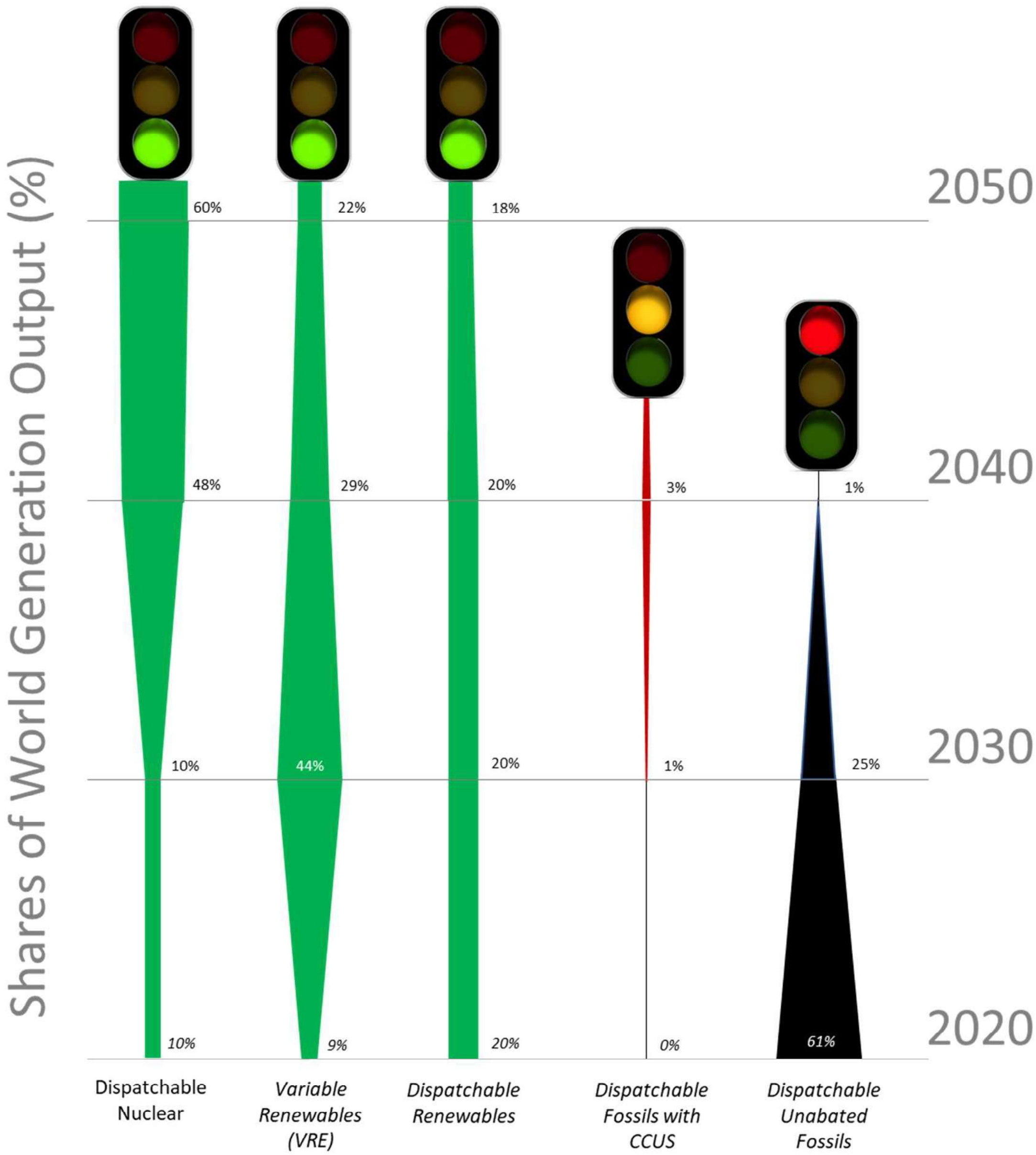
88 Note: Historical world nuclear capacity growth rates averaged 32.1% (CAGR) from 1960 – 70 and 22.4% (CAGR) from 1980 -90 or 27.2% (CAGR) from 1960 – 1980.

Scenario			2020	2030		2040			2050		
Nr.	Electricity Generation	2050 Nuclear Penetration	Nuclear Installed Capacity GW_e	Nuclear Installed Capacity GW_e	2020-30 CAGR%	Nuclear Installed Capacity GW_e	2020-40 CAGR%	2030-40 CAGR%	Nuclear Installed Capacity GW_e	2020-50 CAGR%	2040-50 CAGR%
1c	Low	Low VALCOE	392.6	507.2	2.6%	2,378.6	9.4%	16.7%	3,626.1	7.7%	4.3%
2a	Projected	Mid VALCOE	392.6	507.2	2.6%	2,037.9	8.9%	14.9%	3,058.4	7.1%	4.1%
2b	High	Mid VALCOE	392.6	507.2	2.6%	2,652.4	10.0%	18.0%	4,082.6	8.1%	4.4%
2c	Low	Mid VALCOE	392.6	507.2	2.6%	1,363.3	6.4%	10.4%	1,933.9	5.5%	3.6%
3a	Projected	High VALCOE	392.6	507.2	2.6%	891.0	4.2%	5.8%	1,146.9	3.6%	2.6%
3b	High	High VALCOE	392.6	507.2	2.6%	1,121.5	5.4%	8.3%	1,531.0	4.6%	3.2%
3c	Low	High VALCOE	392.6	507.2	2.6%	638.0	2.5%	2.3%	725.2	1.3%	2.1%

Source: IBNI-IO SAG. Notes: All installed capacities represent net electrical capacities. Data Source for 2020 installed capacities: [16]. 2030 – 50 capacities assume 85% average capacity factors for all world nuclear power plants.

While the above Table 8 addresses only the projected nuclear and VRE shares (which are poised to become the dominant sources of generation by 2050), the diagram below (Figure 46), reflecting Scenario 1a, illustrates potential incremental process, whereby renewable capacities, which are typically quicker to deploy, would be scaled-up more immediately (through the 2030s) and nuclear capacities, which take more time to deploy, would be scaled-up in the 2030s and 2040.

FIGURE 46 – POTENTIAL EVOLUTION OF WORLD LOW-CARBON AND FOSSILS GENERATION SHARES UNDER SCENARIO 1A



Source: IBNI-IO SAG

IBNI will be a strong advocate of global nuclear capacity expansion and will provide all INBI Member States with the tools and resources to develop, expand and scale up nuclear programs in the cheapest, fastest and safest manner possible. Therefore, the Bank is expected to have a very strong influence on the global nuclear growth evolution from 2020 – 50. IBNI will be an active and strong proponent in challenging an expanding universe of nuclear nations to advance their programs and project as quickly as possible. The global nuclear industry and supply chains will rapidly respond to evidence of growing nuclear demand. Ultimately, the decisions that will enable a rapid global expansion of nuclear capacities, reminiscent of the global nuclear growth rates of the 1960s – 1990s, will be entirely dependent on the nations of the world. Nations need to make their own decisions in the near team as whether they will choose to scale-up nuclear generation or rely on renewables in the decades ahead. IBNI will be there to support and remove barriers for those nations that choose nuclear at any scale.

Irrespectively, as a results- and performance-based organization, IBNI should establish and periodically update long-term world targets and goals with respect to emission reductions, energy generation per capita, economic growth and development targets, world nuclear generation capacities and reductions in energy costs. Such targets and goals should be set at levels that are reasonably achievable, but on the aggressive side (the “bar should be set high”). These targets and goals will become one important organizational performance metric that IBNI’s management and the IBNI Member State shareholders will be able to continually assess and measure the effectiveness of IBNI’s programs in meeting the overriding organizational goals.

8.1 Proposed IBNI 2050 Global Emissions & Sustainability Targets and Goals

Assisting IBNI Member States in phasing-out fossil fuels generation and completely transitioning away from fossil fuel based economic systems as rapidly and efficiently as possible is a fundamental objective of the Bank. This global transitioning, while continuing to drive global economic development and prosperity, taken all together will represent a prodigious undertaking under any calculus. We also must remember that reducing GHG and all other emissions to zero by 2050 encompasses much more than just the power generation sector. As illustrated in Figure 1, the global power generation sector accounts for just 26% of total annual GHG emissions. Power generation, in combination with energy consumed in industry, for transport and within the built environment (the “energy sector”) constitute about 65% of total annual GHG emissions (collectively about 34 Gt per annum)[89]. Total annual GHG emissions of about 52 Gt needs to be brought to 0.

It will be necessary for each nation to develop entirely new energy systems that are centered around energy generation supplied by nuclear and renewables. In addition to power generation, the vast majority of the world’s industrial, transportation and built environments currently rely on vast inputs of fossil fuels (coal, oil and gas). Each of these systems and their associated vast infrastructures to supply them with fossil-based energies will need to be completely transformed to rely on energies supplied by nuclear and renewables. Accordingly, all of these systems will need to be either electrified or supplied with another energy carrier, such as hydrogen, electrofuels, heat and cooling provided by nuclear and renewables generation plants. Transitioning fossil fuels-based industries and economic systems to new clean energy ones, will create enormous challenges for policymakers in every nation. These changes will need to be conducted in the most responsible manner in effort to avoid any major unintentional economic repercussions.

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[89] Sources: [7] & [8]

If we expect these very significant transitions to occur in such a relatively short time period, the key consideration will come down to the question *what does it cost?* Addressing this question is where nuclear and IBNI will play a critical role. For nations that choose to make nuclear a significant part of their new low carbon energy and economic systems (as shown above), IBNI will support each nation by helping make this transition in an economically sustainable manner. Undertaking such a massive transition, will require large near-term capital investments in each country's energy and related infrastructure[90]. Where nuclear, under the IBNI framework is part of this capital investment profile, many 'sustainable societal level returns' will result. Some of these sustainable 'societal level returns' will include:

- Access to *least-cost energy*[91] that is also abundant, reliable, secure, safe and clean;
- Mitigation of more severe detrimental human, economic and environmental consequences global climate change;
- Clean air, water and soils which sustain improved human health and environment;
- New economic models that create opportunities for growth of sustainable new industries, good jobs and human development;
- Preservation of land, aquatic and mineral resources available for sustainable agriculture, fishery, forestry, human and conservancy uses;

All of the above outcomes are integral within the IBNI S&C framework (See Section 5) which are inclusive of the SDGs[92] and broader ESG sets of principles.

While there are some factors, such as demographics (global population growth) that may not be directly impacted by the energy sector, nuclear energy and IBNI, other factors such as global economic development (GDP per capita) that will be highly correlated with the energy sector. Therefore, while IBNI cannot directly influence global population growth, its programs which are designed to provide all nations from developing countries to highly developed countries with access to the most affordable, reliable, clean and safe energy has a direct impact on economic development, improvement of living standards for all and poverty reduction. These elements can be measured by increasing energy consumption per capita. Energy efficiency and energy conservation (behavior changes) have and are expected to continue to lead to a "de-coupling" of energy consumption per unit of GDP. Combining the goals of sustainable global economic development, improvement of living standards for all, poverty reduction (increasing energy consumption per capita and

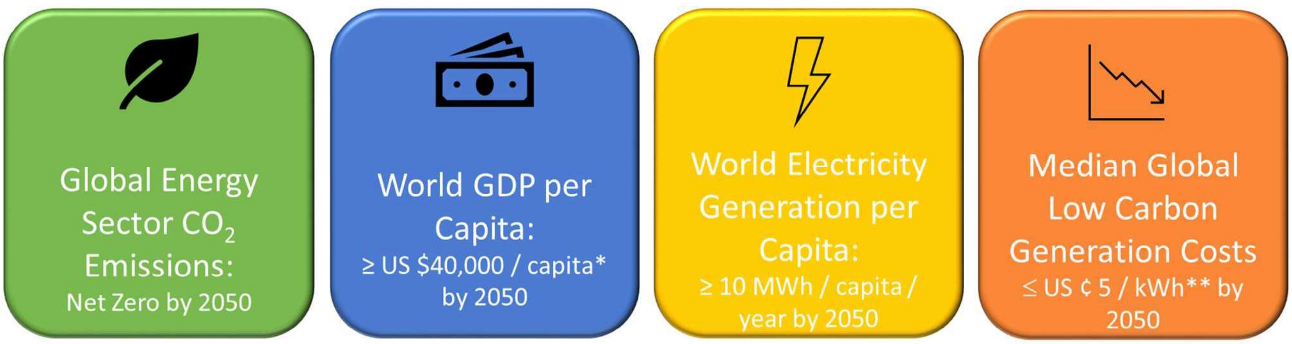
[90] However, as shown in Section 3.1, a proportionately higher nuclear share of the generation mix will serve to minimize the overall quantum of these near-term capital investments, as well as maximizing the societal level returns on such capital investments.
[91] After the low carbon transition, the unit cost (cost per kWh) of all forms of energy carriers consumed, including electricity, hydrogen, electrofuels, heat and cooling should be *cheaper* both in comparison to: a) prior fossils-based market models; and, b) relative to all other low carbon alternative market models (such as ~100% renewables). In the case that energy costs resulting from the low carbon transition model are significantly higher, it will be exceedingly challenging for low carbon (net zero) transitions to occur on time.
[92] Reference: [50]

increasing GDP per capita) and deflating the energy intensity of growth (decreasing energy consumption per unit of GDP) is expected to result in overall growth in energy demand per capita.

We must also remain mindful that approximately 13% of the world's population currently does not have access to electricity[93]. IBNI as an inclusive organization will also set specific goals and targets to ensure that special focus and assistance is provided to its developing country IBNI Member States that have low electrification rates, so that all people in the world who want access to affordable electricity, have access well prior to 2050.

In terms of some of the specific metrics for the sustainable development goals that IBNI should target, it is proposed that these specific measurable global sustainability goals should be the following:

FIGURE 47 - 2050 IBNI GLOBAL EMISSIONS AND SUSTAINABLE ECONOMIC DEVELOPMENT GOALS



*Source: IBNI-IO SAG Modeled Scenarios. * GDP/Capita reflective of 2019 "Purchasing Power Parity" as published by OECD. ** In 2020 values, inclusive of incremental systems costs related to type of energy generation mix. Includes targeted reductions in capital (overnight costs) for all low carbon technologies and cost of capital and other life-cycle generation costs (see Section 8.2).*

8.2 Proposed IBNI 2050 Global Nuclear Energy Targets and Goals

IBNI's above targets and goals related to global emissions reductions and sustainable development are inextricably linked to its goals and targets for expanding global nuclear capacities. From an IBNI perspective, the stimulation of a swift expansion of worldwide nuclear capacities (driven by near-term decisions by IBNI Member States), increasing nuclear shares of generation and the driving down capital costs of nuclear projects will be amongst the primary mechanisms for which the Bank will use to achieve the preceding emissions and sustainable development goals.

While there are some factors, such as demographics (global population growth or decline) that may not be directly impacted by the energy sector, other factors such as global economic development (GDP per capita) are viewed to be highly correlated with the energy sector. IBNI's programs will be designed to provide all its

[93] Source: [51]

Member State nations ranging from developing countries to highly developed countries with uniform access to the most affordable, reliable, clean and safe energy has a direct impact on each Member State's ability to sustain economic development, improvement of living standards for all and poverty reduction.

Expanding electrification, both in the developing world and intensive electrification globally, taken together with global advances in energy efficiency and energy conservation (behavior changes) will likely continue to contribute to a "de-coupling" of total final energy consumption per unit of GDP and per capita. While both world population and world GDP are projected to continue to grow, net energy demand per capita and per unit of GDP will likely continue to decrease. For example, OECD IEA/NEA has projected a total decrease in total world energy final consumption from 412 EJ/a (114.4 PWh/a) in 2020 to 344 EJ/a (95.6 PWh/a) in 2050 (an annualized -0.6% CAGR decrease). At the same time, both world population and GDP are projected to grow from 7.8 billion people and US $ 134.7 trillion in 2020 to 9.7 billion people and US $ 316.4 trillion in 2050 (annualized 0.7% CAGR growth in world population and 3.1% CAGR growth in GDP)[94].

The preceding forecasts indicate that final energy consumption per capita is projected to decrease from 14.8 MWh/capita in 2020 and 9.8 MWh/a in 2050 (an annualized -1.35% CAGR decrease) and final energy consumption per unit of GDP would decrease from 891.8 watts/US $ 1 of GDP in 2020 to 519.5 watts/US $1 of GDP in 2050 (an annualized -1.79% CAGR decrease).

Materialization of the above trends are positive, as the projections are indicative that world is projected to sustain robust and continued economic growth over the next 30 years, while generating that economic output more efficiently (e.g. with less energy and other resources per unit of output).

While overall world energy demand is expected to decrease over this time period, the transition to a global low carbon economy will entail a complete transition away from fossil fuels - not only in the power generation sector, but also for industry and transport sectors and in the built environment. Extensive electrification will serve as a practical replacement for much of the fossil fuels currently being consumed in industry, transport and buildings. Low carbon thermal generators such as nuclear, biomass, geothermal and CSP, which in some cases, can be located close to industrial and population centers may also be used to provide co-generated heat, cooling and desalinated water for industrial and/or residential consumption. In some circumstances, such as certain industrial and transport applications where direct electrification may be technically or commercially unfeasible, hydrogen and other electrofuels generated from low carbon sources may be utilized as well. All other residual GHG emissions from industry and transport, together with net GHG emissions from agriculture, forestry and land use (AFLU) and all other sources of GHG emissions will need to be either sequestered (through CCUS technologies) or offset by carbon sinks.

Figure 48 below illustrates a potential nuclear-oriented low-carbon economic system that IBNI would support.

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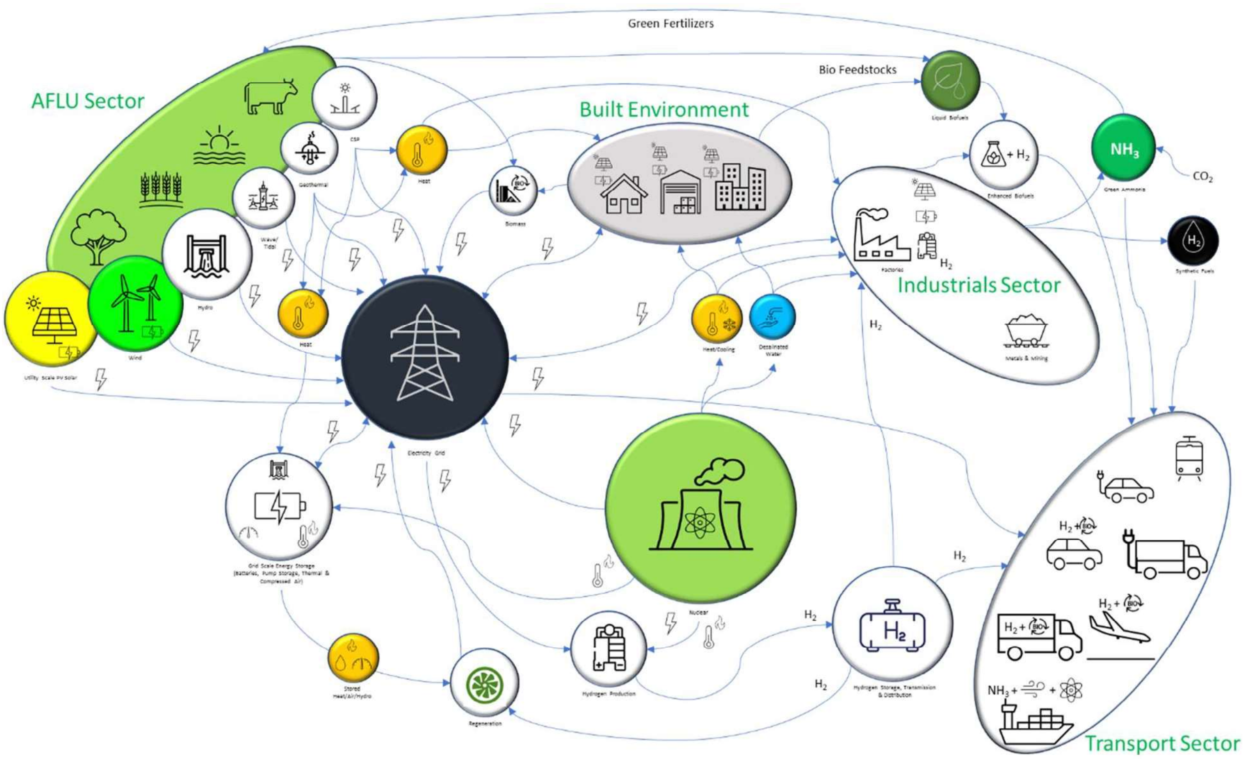
[94] Source: [6] – Table A.2, pg. 196 and Tables A.5, pg. 200. Note GDP is stated in terms of 2019 "Purchase Price Parity".

FIGURE 48 – ILLUSTRATIVE NUCLEAR-BASED FUTURE LOW CARBON ENERGY SYSTEMS ENDORSED BY IBNI



The future low carbon world will require the production of much more electricity, hydrogen, electrofuels, heat and cooling energy. Additionally, markets that choose to significantly scale up VRE generation will generally require increasing amounts of energy storage infrastructure (which may be stored in the form of hydrogen, electrofuels or using long-duration utility scale batteries, or in some cases pumped storage or as heat or compressed air[95]) if residual electricity demand cannot be otherwise provided by system reserves from dispatchable low-carbon generators (such as nuclear, hydros, geothermal and biomass) or from interconnections.

All of the foregoing suggests that despite the projected decreasing trend in total end-user energy demand, there will very likely be a significant increase in demand for low carbon electricity generation (which aldo includes electricity demand used to generate hydrogen and electrofuels) over the next 30 years. OECD IEA/NEA NZE 2050 has projected a more than doubling in global end-user electricity demand from 22.5 PWh/a in 2020 to 46.9 PW/a in 2050 (an annualized 2.5% CAGR growth rate). However, the same referenced NZE scenario shows a near tripling of global electricity generation from 26.8 PWh/a in 2020 to 71.2 PWh/a in 2050 (an annualized increase of 3.3% CAGR)[96]. It should be noted that the same referenced NZE scenario

95 It should be noted that many of these emerging storage technologies are in various states of development and many are not yet commercially proven.
96 Source: [6] – Table A.2, pg. 196 and Table A.3, pg. 198

assumes a 70% VRE and 8% nuclear energy mix by 2050. A critical observation is that by 2050, global electricity generation (at 71.2 PWh/a) is projected to be 1.5x the 2050 projected end-user electricity demand (46.9 PWh/a), whereas in 2020 (where global VRE share was 9.1%) this ratio was 1.2x.

In low carbon future generation scenarios, an increasing amount of electricity generation is expected to be needed for the production of hydrogen and electrofuels such as ammonia, synthetic liquid fuels and enhanced biofuels. Each of these fuels require energy conversion processes that are energy-intensive and result in energy losses through their conversion processes. All of these energy carriers can also be used for energy storage (stored or transported and then combusted or applied to hydrogen fuel cells to produce electricity). However, the "round-trip" process of re-generating electricity from these carriers results in further energy losses[97].

Given the preceding, what is the role of nuclear energy and for IBNI? IBNI will support Member States with nuclear generation tools and related solutions that will make each nation's low carbon future system most affordable, practical and sustainable. Specifically, IBNI-enabled nuclear energy solutions will offer Member States following tangible benefits:

- Scaling up nuclear generation and limited VRE penetration rates will be translated into the following:
    - Minimization of end-user energy costs associated with decarbonization program[98]
    - Substantial reductions in land, coastal areas and materials consumption[99]
    - Substantial reductions in required electricity grid and energy storage investment costs
    - Substantial reductions in required hydrogen and electrofuels production, transportation and storage costs[100]
- Nuclear power plants can also be used to co-generate heat and cooling energy and to produce desalinated water (where applicable)
    - "The UN predicts that 68% of the world's population will live in cities in 2050. Nuclear power occupies a very small footprint of land and can supply large urban areas and megacities with electricity and heating and cooling [and desalinated water and hydrogen]."[101]

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[97] Source: [20] – Pg. 56: *"The electricity-to-hydrogen conversion efficiencies are typically less than 70%, implying a round-trip efficiency of less than 50%."* From the perspective of round-trip efficiency, other commercially proven and emerging energy storage technologies may offer much greater "round-trip" efficiencies, including pumped storage, emerging advance battery storage (long-term, grid scale), heat storage, compressed air storage. These storage technologies may offer "round-trip" efficiencies ranging from 40% - 95%. Sources: [20] & [52].

[98] See Section 3.1.

[99] Source: [31] – Figure 22, Slide 18. On average, nuclear energy consumes almost 6 times less land than wind energy and almost 4 times less than solar.

[100] Nuclear energy is extremely energy dense in comparison to most renewables technologies, and in general can be located near major demand centers. This implies that large-scale hydrogen and electrofuels production facilities can be located near or adjacent to nuclear generation facilities and industrial consumers, improving cost efficiencies. Nuclear energy is also dispatchable technology, which results in less production of hydrogen used to fuel electricity production.

[101] Source: [44] – Pg. 53.

- Development of nuclear energy programs, nuclear industries and localized supply chains offer nations' with both a near-term and a long-term economic development benefit.
  - Construction and operation of nuclear power plants provides many direct near-term and long-term direct employment opportunities.
  - Indirectly, many other sectors of the economy will benefit over the long-term: employment, tax revenue, innovation, etc.

Taking into consideration the fundamental arguments for many of the nations of the world to take the near-term decisions to include a significant nuclear energy component in their low carbon futures, the follow are specific measurable global nuclear expansionary targets and goals that IBNI could establish. The shareholding structure will allow IBNI to provide up to approximately US $ 1 trillion in direct support for nuclear projects which is expected to catalyze global financial market investment and lending activities in the nuclear sector in total nuclear capital investments of potentially US $ 13 trillion or more over the next 30-years. Using existing and proven multilateral IFI models, all of this can be achieved with a collective shareholder initial capital investment of US $ 50 billion[102] or which US $ 25 billion (50%) would need to be paid-in, collectively amongst 50+ initial member shareholder countries.

[102] Based on IBNI-IO SAG's analysis of high world electricity demand growth and high world nuclear penetration growth rates until 2050, IBNI's total capital requirements would likely need to be periodically increased (in order to establish sufficient capitalization and liquidity ratios and therefore 'AAA' category credit ratings) up to approximately US $ 300 billion in about 15 years. Subsequent capital increases could most likely be done with reduced increases in the paid-in capital requirements (SAG has assumed the paid-in ration could be decreased to 25% after year 15, which corresponds to US $ 75 billion in paid-in capital). This is all based on many assumptions, including payment performance, recycling of assets. Many stress tests will need to be considered when the credit ratings are analyzed in discussions with the rating agencies. Rating agency views on the specific credit risks of IBNI will drive the actual conclusions and therefore these projected figures should be regarded as "preliminary and indicative" until further discussions with the rating agencies can occur.

FIGURE 49 - IBNI GLOBAL NUCLEAR SECTOR PERFORMANCE GOALS

*Source: IBNI-IO SAG analysis. * While approximately 2/3's of today's nuclear fleet are 30 years and older, which presents an immediate need to establish conditions necessary to extend the lives of these reactors, the reactors that are 20 years old today or older today may also need to be addressed over the next 3 decades (by 2050). ** Stated in terms of 2021 values. Includes IBNI induced cost decreases in overnight costs (expected based on scale up of global repetitive demand for NOAK designs, commercially available reactor technologies, reactivated supply chains, streamlined permitting and licensing procedures and numerous other factors) decreased costs of capital and life-cycle costs.*

8.3 Proposed IBNI 2050 Key Financial Metrics Targets and Goals

IBNI will incorporate both financial management and ESG principles "from the ground up" within its structure, which will ensure that it will enable it to achieve both the highest possible credit and highest ESG ratings. IBNI also will benefit significantly by being "at a much higher point on the learning curve" in comparison to the entry points of other prior IFIs.

It will be essential for IBNI to establish and maintain 'AAA' category ratings and achieve the highest possible ESG ratings. This will ensure that IBNI will have access to the lowest cost of capital and it will also establish the ubiquitous "risk free" benchmark for the entire nuclear sector. The benefit of IBNI in attaining the lowest possible cost of capital, which will be passed along to the benefit of its members, will be an essential part of all its programs and its core mission.

IBNI will aim to establish a global industry benchmark not unlike the model that has been already established by the International Development and Reconstruction Bank (IBRD) for the MDBs. Above all, IBNI will be well positioned to lead the nuclear sector on the ESG front and will be the leading force driving global capital investment and lending into the nuclear space. It is instructive to note, with respect to IBRD's role in leading sustainable financing, S&P wrote the following.

"IBRD plays a key role in powering the ESG market globally. It acts as a knowledge broker, outlining best-in-class frameworks and guidelines, compiling key sustainable policy indicators that it tracks globally, and offering ESG-related statistical platforms. Its creditworthiness also depends on delivering its mandate by improving environmental outcomes, notably through climate action, and supporting human and economic development. IBRD pioneered the global green bond market in 2008. It helped develop and expand the global sustainable bond market by connecting many of its issuances to raise awareness for the various 2030 U.N. Sustainable Development Goals (SDGs)…"[103]

It is expected that IBNI will be a frequent bond issuer across many capital markets globally and will be highly diversified in terms of currency and market access risk exposures.

The following table summarizes the existing peer major multilateral IFI/MDB community and their associated credit rating profiles.

TABLE 9 - SUMMARY OF COMPARATIVE CREDIT RATING PROFILES OF EXISTING PEER MAJOR MULTILATERAL IFIS

IFI	LT Ratings[a]	RAC Ratio (%)[b]	Liquidity Coverage Ratios (with Planned Disbursements)[c]			Funding Ratio (%)[e]	Enterprise Risk Profile[f]	Policy Importance[f]	Governance & Management[f]	Financial Risk Profile[f]	Capital Adequacy[f]	Funding & Liquidity[f]
			6-months	12-months	12-months + 50% UDL[d]							
AfDB	AAA/Aaa/AAA	18.9%	2.0x	1.5x	1.2x	72.3%	Very Strong	Very Strong	Adequate	Very Strong	Very Strong	Strong
ADB	AAA/Aaa/AAA	37.4%	1.7x	1.3x	0.9x	47.4%	Extremely Strong	Very Strong	Adequate	Extremely Strong	Extremely Strong	Strong
AIIB	AAA/Aaa/AAA	160.5%	15.1x	10.3x	6.9x	11.7%	Very Strong	Very Strong	Adequate	Extremely Strong	Extremely Strong	Strong
EBRD	AAA/Aaa/AAA	30.3%	1.4x	1.2x	1.2x	67.2%	Very Strong	Strong	Strong	Extremely Strong	Extremely Strong	Strong
EIB	AAA/Aaa/AAA	21.0%	1.3x	1.1x	1.0x	81.2%	Extremely Strong	Very Strong	Strong	Extremely Strong	Very Strong	Very Strong
IADB	AAA/Aaa/AAA	21.9%	2.3x	1.4x	1.2x	71.2%	Extremely Strong	Very Strong	Strong	Very Strong	Strong	Strong
IBRD	AAA/Aaa/AAA	24.3%	2.0x	1.1x	1.0x	82.0%	Extremely Strong	Very Strong	Strong	Extremely Strong	Extremely Strong	Strong

Sources: [48] & [49] and IFI and rating agency websites. Notes: (a) Long-term unsecured credit ratings from S&P/Moody's/Fitch, respectively. (b) Risk Adjusted Capital Ratios (RAC) from 2019 or 2020 (source S&P); (c) Liquidity coverage ratios (including derivatives payable) is the measure of the IFI's liquid assets relative to their planned distributions over the subsequent 6-month or 12-month period. (data from S&P. Representing 2019 or 2020). (d) Liquidity coverage ratio includes planned distributions for the subsequent 12-month period + 50% of the outstanding undistributed loans (UDL) (data from S&P. Representing 2019 or 2020). (e) Funding ratio represents the ratio of gross debt to adjusted total assets (data from S&P. Representing 2019 or 2020). (f) Source S&P. Representing 2019 or 2020 rating views.

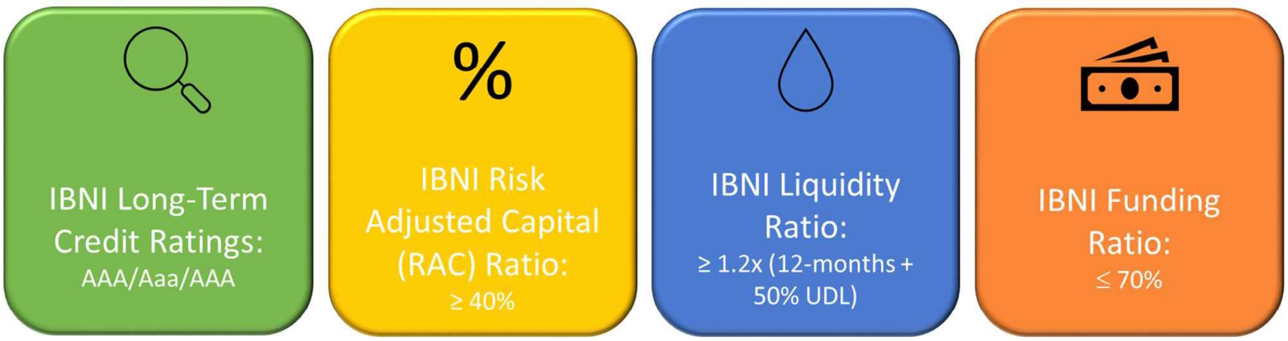
As set forth in Section 6, it is recommended that IBNI would be initially be established by a coalition of no fewer than 50 nations (IBNI Member State shareholder members) with a total capital amount of US $ 50 billion, of which 50% (US $ 25 billion) would be paid-in capital and 50% (US $ 25 billion) would be callable capital. Based on scenario analysis conducted by IBNI-IO SAG, this initial capitalization structure should be

103 Source: [48]

sufficient to maintain the program under any reasonable demand scenario. Furthermore, the proposed shareholder composition will be both large diversified and include shareholder members who are also beneficiaries of the programs. The proposed shareholder and management structure is therefore in line with peer rating review that have received "very strong" and "extremely strong" credit views by S&P.

IBNI will aim to achieve a "best in class" financial and credit profile amongst its peer multilateral IFIs. The following is a summary of the measurable financial metrics that IBNI should strive to achieve and maintain.

FIGURE 50 - IBNI FINANCIAL METRICS TARGETS



Source: IBNI-IO SAG analysis.