LABOR MARKET INTELLIGENCE REPORT

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LABOR MARKET INTELLIGENCE REPORT

FUTURE WORKFORCE PLANNING:

PREPARING FOR NUCLEAR ENERGY REVITALIZATION IN THE PHILIPPINES

Executive Summary

The report provides an in-depth analysis of nuclear energy's evolution, current applications, and potential to contribute to global low-carbon energy targets under the Paris Agreement. It traces the origins of nuclear science from groundbreaking discoveries like X-rays, radioactivity, and atomic fission to its transformation into a pivotal energy source. While nuclear energy produces minimal waste compared to other energy sources, challenges such as safety concerns, waste management, and public apprehension persist, particularly in the aftermath of major incidents like Chernobyl and Fukushima. Nevertheless, advancements in reactor designs, passive safety mechanisms, and recycling of nuclear materials continue to address these issues. Globally, nuclear power generates 10% of electricity, with 440 reactors in operation and 61 under construction, contributing to energy security and economic growth through long-term employment and high-value investments.

In the Philippines, nuclear energy development dates back to the 1984 construction of the Bataan Nuclear Power Plant, which was decommissioned due to safety and political concerns. Recent efforts to revitalize the nuclear energy sector include partnerships with international organizations such as the International Atomic Energy Agency (IAEA) and the U.S., emphasizing capacity-building, regulatory frameworks, and site assessments. Initiatives like Meralco's planned micro-modular nuclear plants aim to address energy needs in remote areas. The government has also formed the Nuclear Energy Program Coordinating Committee to oversee policy and infrastructure development, demonstrating a renewed commitment to exploring nuclear energy as a sustainable option.

The report highlights the critical role of the Technical Education and Skills Development Authority (TESDA) in aligning TVET with the nuclear industry's requirements. Current training programs are insufficient to meet the specialized skills demanded by nuclear energy operations, such as nuclear engineering, reactor operation, and safety management. TESDA is urged to collaborate with industry stakeholders, including the Department of Energy and the Philippine Nuclear Research Institute, to develop relevant training regulations and qualifications. These efforts aim to ensure a skilled workforce capable of supporting the clean energy transition while fostering economic opportunities through the creation of high-value jobs. Several recommendations have been made on how TESDA can provide the necessary skills and competencies needed by the workforce.

I. Nuclear History

The development of nuclear energy was never planned but was an outcome of discoveries through the latter century by scientists. As a starting point, initial discoveries began in Germany, specifically in 1895, where an individual named Roentgen conducted experiments with cathode rays within a vacuum-sealed glass tube. At some point, he had the gadget concealed but observed that the photographic plates placed nearby were illuminating when the device was activated. He recognized that he was observing a novel form of electromagnetic radiation and named it X-ray. He methodically examined these rays and captured the initial X-ray image of his wife's hand a fortnight later, thus establishing himself as the father of modern medical diagnosis.

In 1896, in France, a man named Becquerel observed that uranium salts, when placed on photographic plates, would cause exposure without the need for energizing a cathode ray tube. The energy likely originated from within the salts themselves. Marie Curie and her husband Pierre conducted research on this phenomenon and successfully identified two additional elements, Polonium and Radium, which displayed this spontaneous energy generation. The phenomenon was designated as radioactivity.

Ernest Rutherford began the investigation of radioactivity in England, which resulted in the discovery of two distinct types of rays that differ from x-rays. He referred to them as alpha- and beta-radiation. Subsequently, he uncovered that the majority of an atom's mass is concentrated within its core, leading to the discovery of the atomic nucleus. He is currently recognized as the father of nuclear physics. Subsequently, he uncovers the presence of gamma radiation. In 1920, he hypothesized the presence of a neutral subatomic particle within the nucleus known as a neutron, despite the absence of empirical substantiation for its existence.

In 1932, Chadwick read published findings of Irene Joliot-Curie, indicating that gamma radiation was found to remove protons out of wax. Cautious, he suspected that they observed Rutherford's neutrons and conducted experiments to validate this hypothesis, therefore unveiling the existence of the neutron.

With experiments on "shooting" neutrons at different nuclides underway, notable scientists made discoveries that furthered the path to nuclear energy. Two of these scientists were Hahn and Strassman, who shot neutrons at uranium atoms and observed a strange phenomenon, later recognized by Lise Meitner and her nephew

Frisch as the process of atomic fission, resulting in the release of a significant amount of energy. The term "fission" is derived from the biological process of binary fission.

Szilard recognized fission as a viable means to initiate a chain reaction. He and Fermi conduct neutron multiplication studies and observe that it is indeed feasible. Szilard, Wigner, and Teller compose a correspondence addressed to President Roosevelt, cautioning about the potential dangers of nuclear armaments and enlisting Einstein's endorsement and transmission of the letter due to his greater renown. Roosevelt sanctioned a brief study into uranium. In 1942, Fermi achieved the first artificial nuclear chain reaction at a squash court located beneath the stadium at the University of Chicago. This resulted in the acceleration of The Manhattan Project. Two concurrent bomb development projects were undertaken, one involving enriched uranium and the other involving plutonium.

The Oak Ridge facility in Tennessee had a reactor that produced the first gram-quantities of plutonium for research purposes, while its primary objective was to enrich the uranium. The Hanford, Washington State facility was home to plutonium production reactors, which were the pioneering high-power nuclear reactors, as well as plutonium extraction chemistry plants Another location, located in Los Alamos, New Mexico, is where the technology for transforming weapons materials into actual weapons is developed. Both routes to the explosive device were observed to be effective. The plutonium implosion weapon, similar to Fat Man, was effectively tested at the Trinity location in New Mexico in July 1945, despite its inherently uncertain design.

The choice was made to deploy the atomic bombs known as Little Boy and Fat Man over Hiroshima and Nagasaki, Japan (respectively) on August 6th and 9th, 1945. The cities were severely damaged, resulting in a death toll of up to 250,000 people. Japan capitulated without conditions 6 days later, on August 15th, 1945, which signified the end of World War II. This also marked the initial instance in which the general public became aware of the United States' ongoing development of explosive devices.

In 1951, a liquid-metal-cooled reactor named EBR-I in Idaho was connected to a generator, resulting in the production of the first-ever electricity generated by nuclear power. Prior to the establishment of civilian power plants, Admiral Rickover advocated for the utilization of reactors to provide power for submarines, as they would not require refueling or rely on oxygen for combustion. The USS Nautilus was commissioned in 1954 as the inaugural nuclear-powered submarine. Shortly thereafter, the Soviet Union launched the first non-military nuclear reactor designed to generate power. The Shippingport reactor, which was based on submarine reactor design, was established in 1957 as the first commercial reactor in the United States.

During the 1960s and 1970s, many nuclear reactors were constructed to generate energy, with designs that closely resembled those used for submarines. They exhibit excellent performance and provide cost-effective, emission-free electricity while having a minimal impact on mining and transportation. Many people anticipate a future powered by nuclear energy. In 1974, France made an important push to promote nuclear energy, resulting in 75% of their electricity being generated by nuclear reactors. The United States constructed a total of 104 nuclear reactors, which accounted for approximately 20% of its overall power generation. Ultimately, the scarcity of workers and the prolonged time required for construction began to escalate the expenses associated with nuclear reactors, thereby impeding their expansion.

The 1979 Three Mile Island accident and the 1986 Chernobyl accident further slowed the deployment of nuclear reactors. Tighter regulations brought costs higher. The 1986 passive safety tests at EBR-II prove that advanced reactor designs (besides the ones used initially to make submarines) can be substantially safer. These tests have major failures that occur when no control rods are inserted, and the reactors shut themselves down automatically.

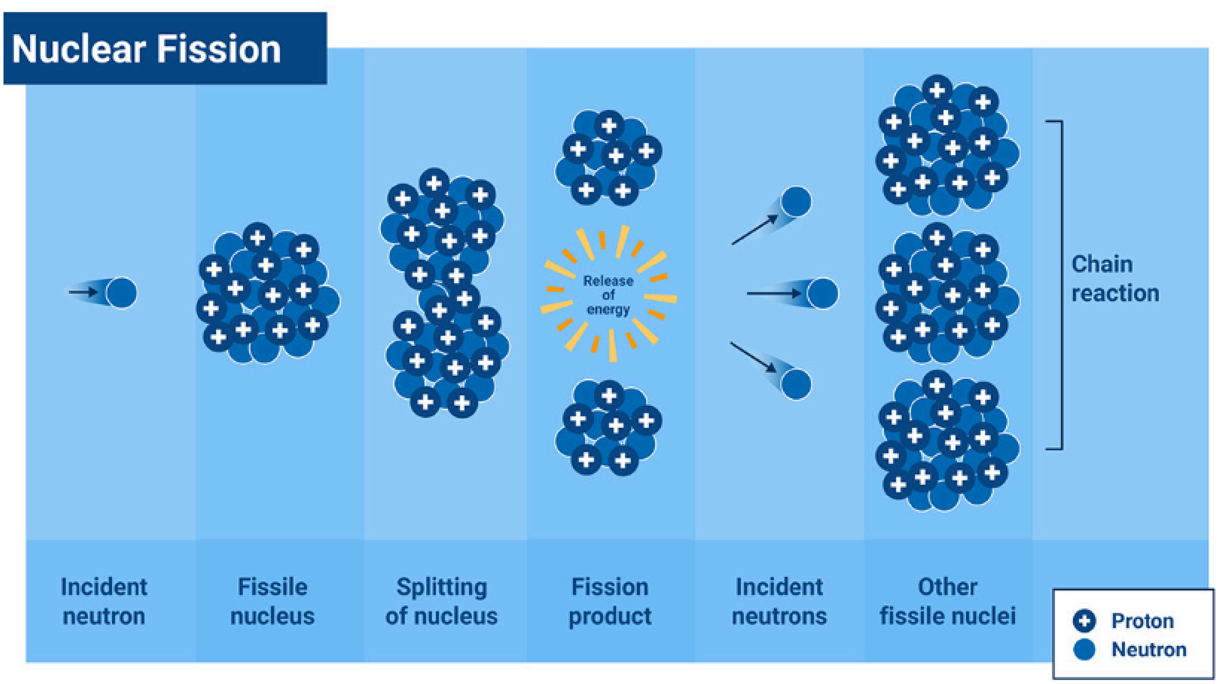
In 1994, the Megatons to Megawatts treaty with Russia was signed to downblend nuclear warheads into reactor fuel. Eventually, 10% of US electricity comes from dismantled nuclear weapons. In the late ’90s and ’00s, the phenomenal safety record of the US commercial reactor fleet (0 deaths) and smooth operation of reactors combined with ongoing worries of global climate change due to carbon emissions brought about substantial talk of a "nuclear renaissance," where new builds might start up substantially again. Meanwhile, strong interest in Asia strengthens and ambitious plans to build large fleets are made to satisfy growing energy needs without adding more fossil fuel.

II. Nuclear Energy Process and Concept

Nuclear energy is the energy that is emitted from the nucleus, which is the central part of atoms composed of protons and neutrons. Currently, all power generated from nuclear energy worldwide is derived from nuclear fission, but the technology to produce electricity from fusion is still in the Research & Development stage.

Nuclear fission is a reaction in which the nucleus of an atom divides into two or more smaller nuclei, resulting in the release of energy. When a neutron collides with a uranium atom's nucleus, it undergoes nuclear fission, resulting in the formation of two smaller nuclei, namely a barium nucleus and a krypton nucleus, along with the release of two or three neutrons. These additional neutrons will collide with other adjacent uranium atoms, causing them to also undergo fission and produce more neutrons through a process of multiplication. This rapid sequence of events results in a chain reaction occurring within a very short period of time—every instance of the reaction results in the emission of energy in the form of heat and radiation. In a nuclear power plant, the conversion of heat into electricity is achieved in a similar manner as the utilization of heat from fossil fuels like coal, gas, and oil for electricity generation.

Figure 1. Illustration of Nuclear Fission Reaction



Source: International Atomic Energy Agency (IAEA)

Upon studying this reaction, scientists and engineers recognized the potential of harnessing nuclear fission as an energy source. Therefore, the establishment and utilization of Nuclear Power Plants.

The plants use a nuclear reactor where nuclear fission occurs. The process of nuclear fission of atoms in the chain reaction releases an immense amount of heat. The heat produced by the reactor is removed by a circulating fluid, usually water. The generated heat is utilized to produce steam, which in turn powers turbines that activate an electric generator, resulting in the production of low-carbon electricity.

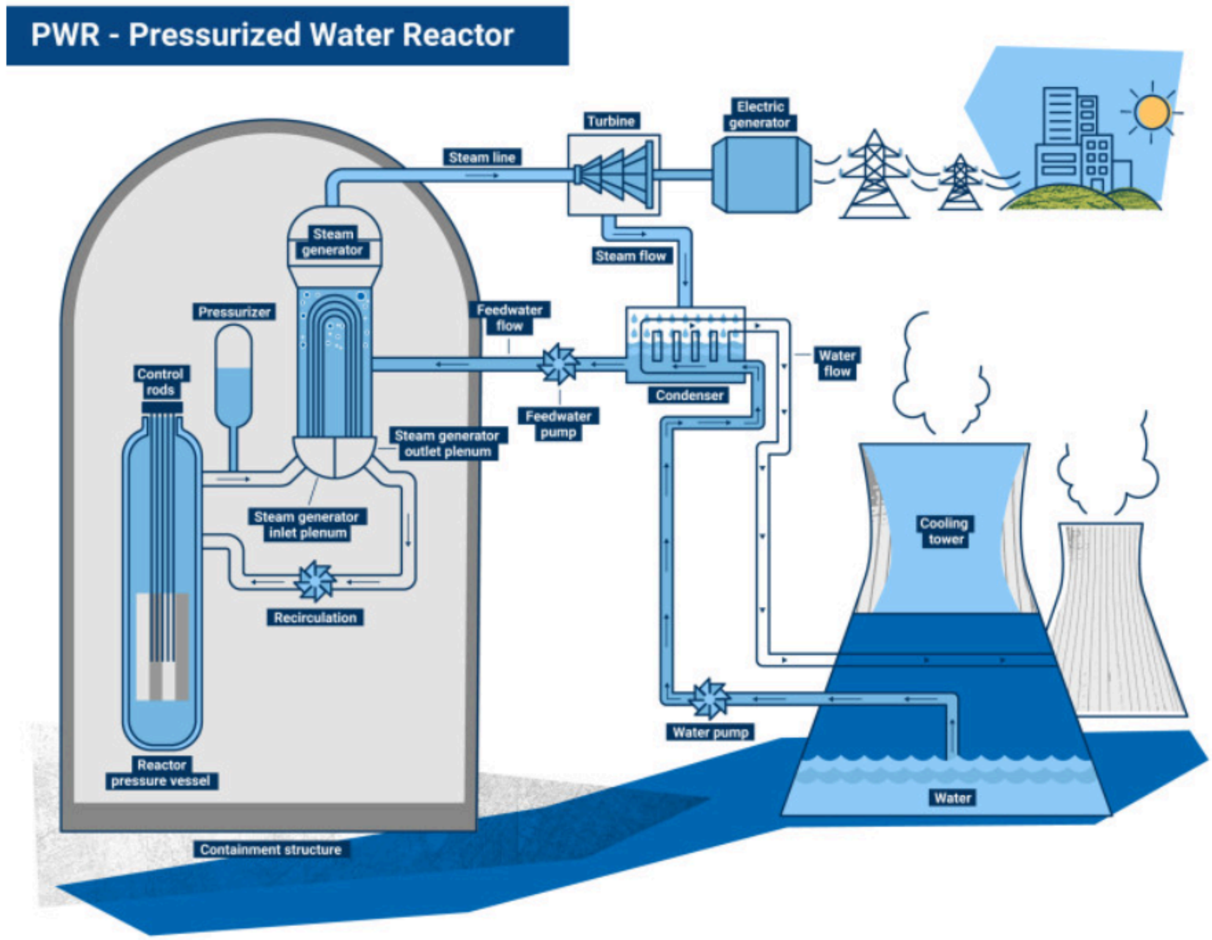
Reactors are equipped with systems that regulate the speed of the nuclear reaction by either accelerating, decelerating, or completely stopping the reaction. Control rods are commonly used for this purpose, and they are typically composed of neutron-absorbing materials like silver and boron.

Nuclear fission in nuclear reactors primarily relies on uranium as its main fuel source. Uranium, despite its global abundance in rocks, is classified as a nonrenewable energy source. Nuclear power plants utilize U-235, a specific kind of uranium, as fuel due to its inherent tendency for fission.

Based on a report from the World Nuclear Association, a pressurized water reactor (PWR) is the most common type of nuclear power plant operating worldwide. The design of PWRs originated as a submarine power plant. PWRs use ordinary water as both coolant and moderator. The design is distinguished by having a primary cooling circuit that flows through the reactor's core under very high pressure and a secondary circuit in which steam is generated to drive the turbine. Essentially these reactors pump water into the reactor core under high pressure to prevent the water from boiling.

The water in the core is heated by nuclear fission and then pumped into tubes inside a heat exchanger. Those tubes heat a separate water source to create steam. The steam then turns an electric generator to produce electricity. The core water cycles back to the reactor to be reheated, and the process is repeated.

Figure 2. Schematic Illustration of Pressurized Water Reactor (PWR)



Source: International Atomic Energy Agency (IAEA)

A nuclear reactor typically consists of a variety of components, common to all types of reactors are:

- Moderator
  - Typically, it consists of water, although it can sometimes include heavy water or graphite.
- Control rods or blades
  - These control rods are made using materials like cadmium, hafnium, or boron, which have the ability to absorb neutrons. They can be put into or removed from the core in order to regulate or stop the nuclear reaction. Special control rods are employed in certain

Pressurized Water Reactors (PWRs) to facilitate the efficient maintenance of a low power level in the core. Secondary control methods use additional neutron absorbers, typically boron present in the coolant. The concentration of boron can be modified as the fuel is consumed. PWR control rods are placed into the core from the top, while BWR cruciform blades are introduced from the bottom.
    - During fission, the majority of neutrons are rapidly released, while a portion of them are delayed. These components are essential for ensuring that a chain reaction system, or reactor, can be controlled and maintained at a precise critical state.
- Coolant
    - A fluid circulates through the core in order to facilitate the transmission of heat from it. In light water reactors, the water moderator also serves as the primary coolant. With the exception of Boiling Water Reactors (BWRs), all other types of reactors have a secondary coolant circuit in which water is transformed into steam.

- Pressure vessels or pressure tubes
    - Typically, a sturdy steel container houses the reactor core and moderator/coolant, although it can also consist of a set of tubes that store the fuel and transport the coolant through the surrounding moderator.

- Steam generator
    - The pressurized water reactors (PWR) utilize a cooling system in which the high-pressure primary coolant, responsible for transferring heat from the reactor, is employed to generate steam for the turbine in a separate secondary circuit. Essentially, a heat exchanger functions similarly to a motor car radiator. Reactors are equipped with a maximum of six 'loops', each including a steam generator.
    - These heat exchangers are designed to transport heat between two fluids. In this case, they transmit heat from the high-pressure main

circuit in a pressurized water reactor (PWR) to the secondary circuit, where water is converted into steam.

- Containment
  - The containment structure is a protective barrier surrounding the reactor and its related steam generators. Its purpose is to prevent any external entry and shield individuals outside from the harmful effects of radiation in the instance of a significant malfunction within the system. Typically, it is a structure made of concrete and steel that is one meter thick.

Nuclear power produces radioactive waste. However, in contrast to numerous other plants, nuclear power produces a minimal amount of waste and effectively contains and manages the waste it generates. Most of the waste generated by nuclear power plants is low in radioactivity and has been effectively and responsibly handled and disposed of for many years. Utilizing nuclear power to meet an individual's annual electricity requirements would result in the generation of around 5 grams of highly radioactive waste, equivalent in weight to a single sheet of paper.

The spent fuel discharged from the reactor can be handled by several methods, such as recycling for energy generation or direct disposal. Numerous countries have been utilizing recycled fuel for several decades to partially power their reactors.

III. Global Nuclear Situation

To date, the topic of nuclear energy has been renewed as the global community pursues their respective targets for reducing their greenhouse gas emissions as outlined in the Paris Agreement. One specific sector in which most countries plan to achieve this is the development and utilization of alternative energy sources including nuclear energy.

With the renewed interest in the utilization of nuclear energy, there has also been a mirrored sense of apprehension among some nations due to nuclear energy’s destructive capability during the Second World War. Aside from this, many also point to the two disasters linked to the failures of two reactors: Chernobyl and Fukushima Daiichi. Environmental waste management is also part of the concerns voiced by some nations.

Although there are still concerns raised about the safety of nuclear power, there are substantial positives to using nuclear energy, such as:

- The ability to produce electricity at a low, predictable, and stable cost due to its low dependence on the price of uranium.
- Reduce energy reliance
- Spent fuel recycling technology (conversion of plutonium, a byproduct of nuclear fission, into mixed oxide, which can be used again as fuel)
- New generator reactors (reduces long-lived fuel waste)
- Nuclear Fusion Technology (Research and Development stage)

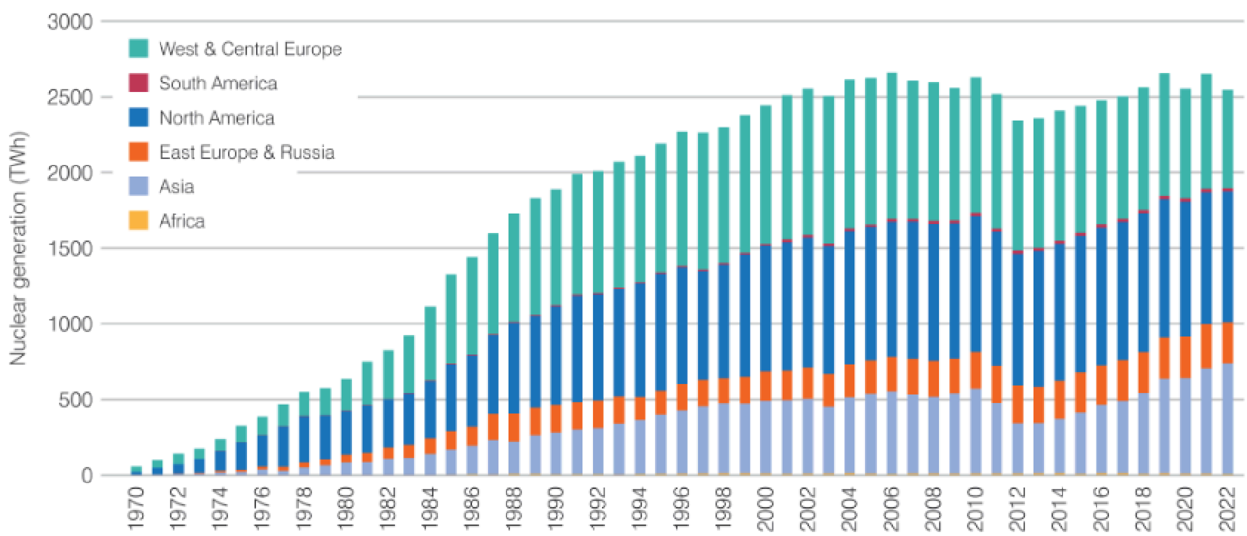
The clean energy transition involves the transformation of energy production from high greenhouse gas emitting sources, such as fossil fuels, to low or zero greenhouse gas emission sources. The Paris Agreement, an international treaty among more than 180 countries under the United Nations Framework Convention on Climate Change (UNFCCC), established the global trajectory towards sustainable energy. The primary objective of the agreement is to restrict the rise in worldwide average temperatures to a level significantly lower than 2°C compared to pre-industrial levels. This will be achieved by promoting the adoption of low-carbon energy sources in order to decrease greenhouse gas emissions.

The International Atomic Energy Agency (IAEA) has provided various studies and briefs with regard to the utilization of nuclear energy in the new clean energy transition initiative. This is part of its overall role as the "world's central intergovernmental forum for scientific and technical cooperation in the nuclear field. It works for the safe, secure, and peaceful uses of nuclear science and technology, contributing to international peace and security and the United Nations' Sustainable Development Goals" (IAEA, n.d.). Additionally, the IAEA stated that in order to achieve the climate goals by 2050, at least 80% of power needs to be generated from low carbon sources. Currently, around two-thirds of the world's electricity is produced by burning fossil fuels.

At the Conference of the Parties, COP28, the IAEA stated that studies confirm that sustained and significant investment in nuclear energy can assist in reaching the 2050 global target of net zero carbon emissions.

Based on the World Nuclear Performance Report 2023, the worldwide production of nuclear energy accounts for around 10% of the total electricity generated globally. This is achieved through the operation of around 440 power reactors, with an additional 61 reactors now under construction. Nuclear reactors produced a combined total of 2545 TWh of electricity, with an expected output of 59 TWh specifically for Ukraine. The current figure of 108 TWh is a decrease of 2,545 TWh compared to the 2021 value of 2,653 TWh. Excluding Ukraine, the overall nuclear generation in 2022 amounted to 2487 TWh, which represents a decrease of 85.4 TWh compared to the same figure in 2021.

Figure 3. Nuclear Electricity Production, 2023



Source: World Nuclear Organization

In terms of employment, the World Nuclear Organization reports that nuclear power plants have the capacity to function for more than 60 years, providing long-lasting employment opportunities with generous remuneration for individuals across all fields and educational backgrounds. Engaging in a nuclear power program is a strategic investment in human resources that yields long-term benefits.

Investing in initiatives that require a large amount of capital often has a positive impact on other industries and sectors of the economy. A contemporary nuclear power plant with a capacity of one gigawatt employs a workforce of 500 to 1000 individuals in direct employment. However, during both the building and operation phases, it necessitates an intricate supply chain that includes various services such as construction, manufacturing, and consultancy. This results in creating appealing employment prospects, both indirectly and as a result of the project.

Additionally, the nuclear industry sustains more than 1.1 million jobs in the European Union. In addition, each gigawatt of installed nuclear capacity generates €9.3 billion in annual investments in nuclear and related economic sectors and provides permanent and local employment to nearly 10,000 people. For every €1 invested, the nuclear industry generates an indirect contribution of €4 in GDP, and every direct job creates 3.2 jobs in the EU as a whole.

IV. Philippine Nuclear Situation

The Philippines has a history in the development of nuclear energy. Specifically, the Bataan Nuclear Power Plant was constructed in 1984 under the administration of Ferdinand Marcos Senior but was never commissioned. The establishment and building of the plant was a direct reaction to the oil crisis of 1973. The facility consisted of two units, each with a capacity of 621 MWe (Megawatts electric), located near Napot Point in Bataan. As a result of financial constraints and safety considerations regarding earthquakes, the plant was never fueled or put into operation. After the Chernobyl tragedy in April 1986, President Corazon Aquino, who had been elected lately, made the decision to decommission the plant.

Figure 4. Exterior Image of Bataan Nuclear Power Plant

Source: Rappler

After over three decades, the Philippines is again studying to revitalize its nuclear program. In 2014, a proposal was approved to use fuel materials from a decommissioned research reactor for training and education purposes. The International Atomic Energy Agency (IAEA) has been providing support for this initiative through a number of technical cooperation projects. In the first project initiated in 2016, the International Atomic Energy Agency (IAEA) supported the Philippine Nuclear Research Institute (PNRI) in enhancing its expertise in reactor design, neutron dosimetry, and regulatory aspects pertaining to research reactors. In 2020, a second cooperation project was initiated with the objective of enhancing capacity in reactor engineering and operation, reactor use, and the establishment of a reactor training program to support ongoing local capacity-building efforts.

Figure 5. Philippine Nuclear Research Institute (PNRI) and International Atomic Energy Agency (IAEA) Collaboration

In January 2023, the U.S. and the Philippines announced preparations for a 123 Agreement. This agreement aims to establish a legal framework for the transfer of

U.S.-origin unique nuclear material, as well as the export of nuclear fuel, reactors, and equipment for peaceful purposes.

Furthermore, the Department of Energy (DOE) formed the Nuclear Energy Program Coordinating Committee in February 2024 to oversee the implementation of the nation's nuclear energy program. The primary responsibility of the newly formed committee is to provide proposals for enhancing the Philippines transmission system in order to accommodate the integration of new nuclear power capacity into the electricity grid. Additionally, the group will be responsible for formulating supportive national laws for nuclear energy, establishing criteria for potential nuclear power plant sites, and ensuring environmental protection measures are in place.

In May 2024, Manila Electric Co. (Meralco) announced that it plans to construct micromodular nuclear power plants with a capacity of up to 300 MW for each unit. The purpose of these plants is to provide electricity to isolated regions in the Philippines during the next four years. Ronnie Aperocho, the executive vice president and chief operating officer of Meralco, confirmed that Pangilinan (Chairman and CEO) has approved the commencement of a comprehensive feasibility study for a duration of six months. This study will be conducted in collaboration with Ultra Safe Nuclear Corp. (USNC), a developer based in the United States.

V. Job Opportunities

Several countries are currently advocating for the expansion of their respective nuclear reactor capacity and the advancement of research in order to develop new and improved reactor technologies. These efforts aim to enhance the nuclear fuel cycle and ultimately increase the sustainability of the energy supply.

In Europe, the European Industrial Alliance is working towards accelerating the progress, testing, and implementation of Small Module Reactors (SMRs) by the early 2030s. The new smaller reactors have a capacity of less than 300 MWe, making them more flexible in terms of site location, construction speed, cooling water requirements, and integration with other renewable energy hubs. Additional frameworks and blueprints are being developed to strengthen the nuclear fleet in Europe. However, specific associations have highlighted the shortage of skilled workers as a crucial factor in Europe's shift towards clean energy. Recently, Électricité de France SA (EDF) and three other subcontractors have launched a recruitment campaign in specific regions of France. They are actively encouraging high-school students who are studying industrial maintenance to consider internships and potential job prospects.

The industry in Europe has also proposed a strategy to enhance vocational training for laborers, technicians, and engineers. Its goal: To hire 100,000 employees over the next ten years. Syntec, which represents approximately 400 engineering firms, recently initiated a promotional campaign targeted towards teenagers. Additionally, they are actively advocating for the expansion of college and training programs. The EDF has been responsible for overseeing the development and construction of the Hinkley Point C nuclear projects in the United Kingdom. However, there have been delays in this project, which is a crucial part of the UK's plan to quadruple its nuclear power capacity by 2050. According to EDF's projections, approximately 123,000 individuals will be needed in the coming decade. In order to address this disparity, the government and industry, which includes EDF, BAE Systems, and Rolls-Royce, have pledged £763 million to enhance apprenticeships and skills training.

The United States (US) has the most significant number of existing nuclear power reactors, with 96 reactors in 2019. These reactors power communities in 28 U.S. states and contribute to many non-electric applications, ranging from the medical field to space exploration. It generates nearly 775 billion kilowatt-hours of electricity annually and produces nearly half of the nation’s emissions-free electricity. This avoids more than 471 million metric tons of carbon each year, which is the equivalent of removing 100 million cars off the road.

The US government emphasizes the significant employment opportunities generated by the nuclear industry, with nearly half a million jobs supported in the United States. Domestic nuclear power plants have the capacity to support a workforce of up to 800 individuals, who are paid salaries that exceed those offered by other sources of energy generation by 50%. In addition, they make significant financial contributions to local economies through the collection of federal and state taxes, amounting to billions of dollars each year. The U.S. Department of Energy has also released an informative guide on the nation's transition from coal to nuclear power. One notable finding in the report is that replacing a coal power plant with a nuclear power plant would result in increased employment opportunities and the creation of long-term jobs in the communities where the plant is located.

In addition, the report also lists jobs needed in the operation and maintenance value chain segment, below are the occupations that are applicable in the operations of a 500 MWe Nuclear Plant.

Table 1. Number of Occupations Needed in the Operations and Maintenance of a 500 MWe Nuclear Power Plant

Occupation Title	Number of Workers
General and operations managers	1
Industrial production managers	2
Architectural and engineering managers	3
Buyers and purchasing agents	1
Management analysts	1
Training and development specialists	4
Electrical engineers	4
Industrial engineers	2
Nuclear engineers	20
Electrical and electronic engineering technologists and technicians	1
Chemist	1
Chemical technicians	1
Nuclear technicians	14
Occupational health and safety specialists	1
First-line supervisors of protective service workers, all other	2
Security guards (Nuclear Training)	14
Production, planning, and expediting clerks	1

Occupation Title	Number of Workers
Executive secretaries and executive administrative assistants	1
Secretaries and administrative assistants, except legal, medical, and executive	1
Office clerks, general	1
Electricians	3
First-line supervisors of mechanics, installers, and repairers	4
Electrical and electronics repairers, powerhouse, substation, and relay	4
Industrial machinery mechanics	4
Electrical power-line installers and repairers	1
Maintenance and repair workers, general	1
First-line supervisors of production and operating workers	7
Nuclear power reactor operators	14
Power plant operators	2
Total	116

Source: U.S. Department of Energy - Office Nuclear Energy 2022

The guide stated that the required number of workers was determined by the U.S. Bureau of Labor Statistics (BLS). It also mentioned that the workforce demand would fluctuate based on the size, design, and operations of the plants. Thus, the number of employees can vary from one plant to another.

Thailand and the Philippines are both planning their respective nuclear energy plans. Thailand looks to unveil in September 2024 a national energy plan through 2037 expected to incorporate small modular reactors (SMRs). The construction and later operation of these SMRs has the potential to generate 70 megawatts worth of capacity, officials say.

The Philippines, as stated in the previous sections, has also looked into the possible research and development of nuclear energy in the country. The country plans to operate a commercial nuclear station, utilizing SMRs, in the early 2030s. The signing of the agreement on civil nuclear power in November 2023 between Manila and Washington, which allows transfers of nuclear material, equipment, and information between the two countries.

The country is actively involved in promoting nuclear science through the hosting of the 1st International Nuclear Science Olympiad, which is primarily chaired by the Department of Science and Technology (DOST). The agency emphasizes the importance of enhancing the teaching of nuclear topics in educational institutions. Additionally, it underscores that the event will increase awareness of the practical applications of nuclear science and technology. Given the increasing demand for young professionals in Asia and the Pacific region who specialize in nuclear and radiation technologies, DOST also seeks to motivate students to pursue jobs in nuclear science and technology in the future.

VI. Gap Analysis

The Philippine nuclear energy sector has seen a resurgence of interest, but significant policy and regulatory gaps remain, particularly in the area of technical and vocational education and training (TVET). A skilled workforce is critical for the safe, efficient, and sustainable adoption of nuclear energy technologies. However, the current TVET infrastructure and programs are not aligned with the specialized skills required by the nuclear industry. This section outlines existing policies, initiatives, and laws, highlighting TVET-specific gaps that must be addressed to support the industry's growth.

Table 2. Summary of Philippine Nuclear Energy TVET Related Gaps

Policy/Initiative/Law	Description	TVET-Related Gap
Philippine Nuclear Research Institute (PNRI)	Provides research and technical expertise on nuclear science	There is no existing collaboration with PNRI and other agencies on

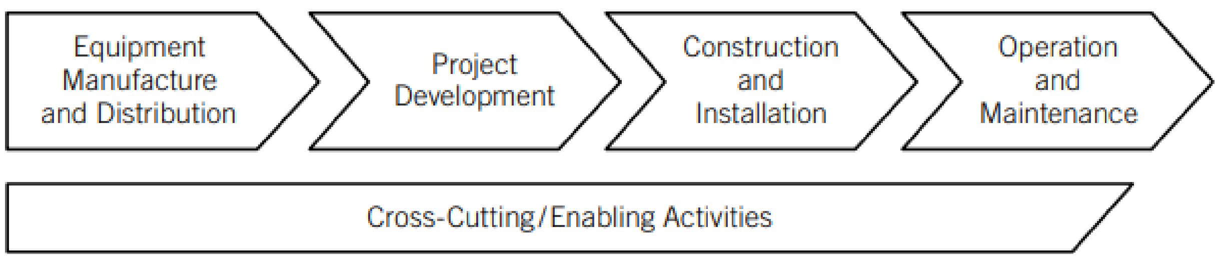
		the development of skills requirement specific to nuclear energy sector.
Executive Order No. 116 (2020)	Created the Nuclear Energy Program Inter-Agency Committee (NEP-IAC) to assess nuclear energy's feasibility.	There are no exiting references on the skills requirements specific for the nuclear energy technology.
123 Agreement with the U.S. (2023)	Facilitates the transfer of nuclear materials, technology, and information for peaceful purposes.	
International Atomic Energy Agency (IAEA) Technical Cooperation Projects	Focused on capacity building, regulatory frameworks, and enhancing reactor technology knowledge.	
Meralco Micro-Modular Nuclear Plants Initiative (2024)	Plans to build small modular nuclear reactors for isolated areas in partnership with U.S. firms.	
Formation of Nuclear Energy Program Coordinating Committee (2024)	Oversees the integration of nuclear energy into the energy grid and formulates related laws.	None inclusion of TVET representatives in the current Committe.

The table outlines key policies, initiatives, and laws in the Philippine nuclear energy sector, identifying significant gaps in integrating TVET to support workforce development. While institutions like the PNRI and agreements such as the 123 Agreement with the U.S. emphasize technical expertise and capacity building, they lack collaboration with TVET agencies to define and develop nuclear-specific skills requirements. Executive Order No. 116 and the Nuclear Energy Program Coordinating Committee focus on feasibility and governance but omit TVET representation in planning and policy formulation. Additionally, international cooperation projects and private-sector initiatives like Meralco's micro-modular reactors highlight the need for targeted TVET programs to address technical skills gaps for emerging technologies. These findings underscore the urgent need for collaboration between nuclear stakeholders and TVET agencies to align skills training with industry requirements, ensuring a competent and prepared workforce for the sector's growth.

VII. Skills Needs

As the Philippines pursues its nuclear energy initiatives on the possible construction of new plants, revitalization of the Bataan power plant, and the possibility of operationalization, TESDA can provide assistance in terms of workers' skills development and training. Based on the International Labour Organization (ILO) report titled *"Skills and Occupational Needs in Renewable Energy"* presents the whole value chain of the renewable energy sector, but it also states that skills anticipation research in renewable energy addresses both renewable energy sectors such as solar, geothermal, wind, hydropower, ocean and other energy sectors including Nuclear Energy.

Figure 4. Renewable Energy Value Chain



Source: International Labour Organization (ILO) 2011

Table 3. Training Regulations in the Nuclear Energy Industry

Renewable Energy Value Chain	Jobs Needed	Corresponding TVET Qualifications
Equipment manufacture and distribution	R&D Engineers (Computer, Electrical, Environmental, Mechanical, Wind Power Design)	No Equivalent Qualification
	Software Engineers	No Equivalent Qualification
	Modellers	No Equivalent Qualification

	Industrial Mechanics	CNC Milling Machine Operation NC II CNC Milling Machine Operation NC III CNC Lathe Machine Operation NC II CNC Lathe Machine Operation NC III
	Manufacturing Engineers	No Equivalent Qualification
	Manufacturing Technicians	Instrumentation and Control Servicing NC II Instrumentation and Control Servicing NC III Instrumentation and Control Servicing NC IV Mechatronics Servicing NC II Mechatronics Servicing NC III Mechatronics Servicing NC IV
	Manufacturing Operators	CNC Lathe Machine Operation NC II CNC Lathe Machine Operation NC III Machining NC I Machining NC II Machining NC III
	Manufacturing quality assurance experts	Laboratory and Metrology/ Calibration Services NC II Laboratory and Metrology/ Calibration Services NC III
	Certifiers	No Equivalent Qualification
	Sales personnel	Contact Center Services NC II Customer Services NC II
Project development	Project Designers (Engineers)	No Equivalent Qualification
	Environmental Impact Assessment Specialists	No Equivalent Qualification
	Economic/Financial /Risk Specialists	No Equivalent Qualification
	Social Impact Specialists	No Equivalent Qualification

	Lawyers (Feed-In Contract, Grid Connection And Financing Contract, Construction Permit, Power Purchase Agreement)	No Equivalent Qualification
	Land Development Advisor	No Equivalent Qualification
	Planners (Permit Monitoring, Amendment And Application)	No Equivalent Qualification
	Land Use Negotiator	No Equivalent Qualification
	Environmental And Social Ngo Representatives	No Equivalent Qualification
	Public Relations Officers	No Equivalent Qualification
	Procurement Professionals	No Equivalent Qualification
	Geographers	No Equivalent Qualification
	Architects (Small Projects)	No Equivalent Qualification
	Physical And Environmental Scientists	No Equivalent Qualification
Construction and installation	Project Managers	No Equivalent Qualification
	Electrical, Civil And Mechanical Engineer	No Equivalent Qualification
	Construction Electricians	Electrical Installation and Maintenance NC II Electrical Installation and Maintenance NC III Electrical Installation and Maintenance NC IV
	Power Line Technician	Transmission Line Installation and Maintenance NC II Transmission Line Installation and Maintenance NC III Transmission Line Installation and Maintenance NC IV Electric Power Distribution Line

		Construction NC II Electric Power Distribution Line Construction NC III Electric Power Distribution Line Construction NC IV
	Construction Worker	Carpentry NC II Carpentry NC III Masonry NC I Masonry NC II Masonry NC III Reinforcing Steel Works NC II Scaffolding Works NC II (Supported Type Scaffold) System Formwork Installation NC II Structural Erection NC II
	Quality Control Inspectors	No Equivalent Qualification
	Instrumentation And Control Technicians	Instrumentation and Control Servicing NC II Instrumentation and Control Servicing NC III Instrumentation and Control Servicing NC IV
	Commissioning Engineer (Electrical)	No Equivalent Qualification
	Heavy Equipment Operators	HEO (various NC)
	Welders	Flux Cored Arc Welding (FCAW) NC I Flux Cored Arc Welding (FCAW) NC II Flux Cored Arc Welding (FCAW) NC III Gas Metal Arc Welding (GMAW) NC I Gas Metal Arc Welding (GMAW) NC II Gas Metal Arc Welding (GMAW) NC III Gas Welding NC I Gas Welding NC II Gas Tungsten Arc Welding (GTAW) NC II Gas Tungsten Arc WElding (GTAW) NC IV

		Shielded Metal Arc Welding NC I Shielded Metal Arc Welding NC II Shielded Metal Arc Welding NC III Shielded Metal Arc Welding NC IV Submerged Arc Welding (SAW) NC I Submerged Arc Welding (SAW) NC II
	Safety And Environmental Impact Specialists	No Equivalent Qualification
	Pipefitters	Pipefitting (Metallic) NC II
	HVAC technicians	Air Duct Servicing NC II RAC (PACU-CRE) Servicing NC III
	Plumbers	Plumbing NC I Plumbing NC II Plumbing NC III
Operations and Maintenance	General and operations managers	No Equivalent Qualification
	Industrial production managers	No Equivalent Qualification
	Architectural and engineering managers	No Equivalent Qualification
	Buyers and purchasing agents	No Equivalent Qualification
	Management analysts	No Equivalent Qualification
	Training and development specialists (Nuclear)	No Equivalent Qualification
	Electrical engineers	No Equivalent Qualification
	Industrial engineers	No Equivalent Qualification
	Nuclear engineers	No Equivalent Qualification
	Electrical and electronic engineering technologists and technicians	No Equivalent Qualification
	Chemist	No Equivalent Qualification
	Chemical technicians	No Equivalent Qualification

	Nuclear technicians	No Equivalent Qualification
	Occupational health and safety specialists	No Equivalent Qualification
	First-line supervisors of protective service workers, all other	No Equivalent Qualification
	Security guards (Nuclear Training)	Security Services NC I Security Services NC I
	Production, planning, and expediting clerks	No Equivalent Qualification
	Executive secretaries and executive administrative assistants	No Equivalent Qualification
	Secretaries and administrative assistants, except legal, medical, and executive	No Equivalent Qualification
	Office clerks, general	No Equivalent Qualification
	Electricians	No Equivalent Qualification
	First-line supervisors of mechanics, installers, and repairers	No Equivalent Qualification
	Electrical and electronics repairers, powerhouse, substation, and relay	No Equivalent Qualification
	Industrial machinery mechanics	No Equivalent Qualification
	Electrical power-line installers and repairers	No Equivalent Qualification
	Maintenance and repair workers, general	No Equivalent Qualification
	First-line supervisors of production and operating workers	No Equivalent Qualification

	Nuclear power reactor operators	No Equivalent Qualification
	Power plant operators	No Equivalent Qualification
Cross-Cutting	Cybersecurity specialists	No Equivalent Qualification
	Policy analysts	No Equivalent Qualification
	Financial managers	No Equivalent Qualification
	Accountants	No Equivalent Qualification
	Administration	No Equivalent Qualification
	IT professionals	Computer Systems Servicing NC II Web development NC III Programming (.Net Technology) NC III Programming (Oracle Database) NC III Programming (Java) NC III

The table includes the occupation under the operational and maintenance value chain segment identified by the US DOE in their coal-to-nuclear guide. It is important to highlight that the Philippines currently lacks the capability of manufacturing nuclear equipment, such as nuclear reactors. Furthermore, every government effort in this country is currently either in the early stages of research and development or being finalized through agreements.

VIII. TVET Statistics

Based on the information provided, TESDA has no specific Training Regulations (TRs) for nuclear energy, but there are qualifications that can address jobs in the other value chain segments, including the construction and installation as well as IT-related qualifications. Below are the corresponding TVET Qualifications related to each job/occupation.

Table 4. Number of Enrolled and Graduates by Qualification (TRs) and Sex as of November 2024

Qualifications (TRs)	Enrolled			Graduated		
	Male	Female	Total	Male	Female	Total
Carpentry II	1,305	6,673	7,978	1,282	6,652	7,934
Carpentry III	2	31	33	2	31	33
CNC Lathe Machine Operation II	0	19	19	0	19	19
CNC Milling Machine Operation II	1	44	45	0	0	0
Computer Systems Servicing II	13,979	16,644	30,623	13,322	15,895	29,217
Contact Center Services II	14,550	5,751	20,301	15,846	6,386	22,232
Customer Services II	62	12	74	98	65	163
Driving (Articulated Vehicle) III	0	253	253	0	264	264

Qualifications (TRs)	Enrolled			Graduated		
	Male	Female	Total	Male	Female	Total
Driving (Passenger Bus/Straight Truck) III	155	2,450	2,605	154	2,593	2,747
Driving II	17,244	37,741	54,985	17,818	39,718	57,536
Electric Power Distribution Line Construction II	1	60	61	0	30	30
Electrical Installation and Maintenance II	2,846	25,015	27,861	2,928	24,972	27,900
Electrical Installation and Maintenance III	68	1,261	1,329	50	1,116	1,166
Electrical Installation and Maintenance IV	0	31	31	0	27	27
Flux-Cored Arc Welding (FCAW) II	2	108	110	1	76	77
Gas Metal Arc Welding (GMAW) I	11	178	189	11	177	188
Gas Metal Arc Welding (GMAW) II	98	996	1,094	104	1,056	1,160
Gas Metal Arc Welding (GMAW) III	0	0	0	0	0	0
Gas Tungsten Arc Welding	94	1,299	1,393	73	1,126	1,199

Qualifications (TRs)	Enrolled			Graduated		
	Male	Female	Total	Male	Female	Total
(GTAW) II						
Gas Welding I	0	0	0	0	0	0
Gas Welding II	0	2	2	0	1	1
Heavy Equipment Operation (Backhoe Loader) II	109	1,895	2,004	111	1,974	2,085
Heavy Equipment Operation (Bulldozer) II	27	638	665	42	784	826
Heavy Equipment Operation (Forklift) II	167	3,373	3,540	159	3,144	3,303
Heavy Equipment Operation (Hydraulic Excavator) II	249	4,379	4,628	220	4,432	4,652
Heavy Equipment Operation (Motor Grader) II	6	383	389	12	494	506
Heavy Equipment Operation (Rigid On-Highway Dump Truck) II	0	26	26	2	88	90
Heavy Equipment Operation (Road Roller) II	31	427	458	30	405	435

Qualifications (TRs)	Enrolled			Graduated		
	Male	Female	Total	Male	Female	Total
Heavy Equipment Operation (Wheel Loader) II	111	1,967	2,078	128	1,996	2,124
Heavy Equipment Servicing (Mechanical) II	2	114	116	1	60	61
Instrumentation and Control Servicing II	20	280	300	20	279	299
Machining I	1	41	42	0	16	16
Machining II	36	571	607	26	462	488
Masonry I	394	2,025	2,419	634	2,429	3,063
Masonry II	991	5,840	6,831	943	5,401	6,344
Mechatronics Servicing II	364	1,033	1,397	314	909	1,223
Mechatronics Servicing III	61	258	319	80	320	400
Mechatronics Servicing IV	2	60	62	2	60	62
Pipefitting (Metallic) II	49	623	672	88	592	680
Plumbing I	206	1,137	1,343	290	1,314	1,604
Plumbing II	343	1,821	2,164	299	1,708	2,007
Programming (Java) III	1,340	1,785	3,125	1,392	2,025	3,417

Qualifications (TRs)	Enrolled			Graduated		
	Male	Female	Total	Male	Female	Total
RAC Servicing (PACU-CRE) III	32	636	668	56	824	880
Reinforcing Steel Works II	20	114	134	20	114	134
Scaffolding Works (Supported Type Scaffold) II	158	1,960	2,118	183	1,925	2,108
Shielded Metal Arc Welding (SMAW) I	2,321	25,542	27,863	2,285	25,174	27,459
Shielded Metal Arc Welding (SMAW) II	2,422	29,071	31,493	2,445	28,690	31,135
Shielded Metal Arc Welding (SMAW) III	146	1,518	1,664	153	1,422	1,575
Shielded Metal Arc Welding (SMAW) IV	27	140	167	27	140	167
System Formworks Installation II	0	21	21	0	2	2
Security NC I	31	127	158	31	127	158
Security NC II	185	590	775	199	692	891
Web Development III	10	13	23	42	54	96

Source: Consolidated Data of Enrolled and Graduated Output from TESDA as of November 2024

Meanwhile, Table 5 lists the following Training Regulations relevant to the value chain that do not have data as of November 2024.

Table 5. Training Regulations in the Nuclear Energy Industry with no available data for both enrolled and graduated as of November 2024.

List of Training Regulations with No Available Data For Enrolled and Graduated, 2023
Air Duct Servicing NC II
Construction Lift Passenger/Material Elevator Operation NC II
Electric Power Distribution Line Construction NC III
Electric Power Distribution Line Construction NC IV
Flux-Cored Arc Welding (FCAW) I
Flux Cored Arc Welding (FCAW) NC III
Gas Tungsten Arc Welding (GTAW) NC IV
Heavy Equipment Operation (Crawler Crane) II
Heavy Equipment Operation (Rigid Off-Highway Dump Truck) II
Heavy Equipment Operation (Rough Terrain Crane) II

Heavy Equipment Operation (Tower Crane) II
Heavy Equipment Operation (Truck Mounted Crane) II
Instrumentation and Control Servicing III
Laboratory and Metrology/ Calibration Services NC II
Laboratory and Metrology/ Calibration Services NC III
Masonry III
Machining NC III
Programming (.Net Technology) NC III
Programming (Oracle Database) NC III
Programming IV
Structural Erection NC II
Submerged Arc Welding (SAW) NC I
Submerged Arc Welding (SAW) NC II
Transmission Line Installation and Maintenance NC II
Transmission Line Installation and Maintenance NC III
Transmission Line Installation and Maintenance NC IV

In terms of existing TVET infrastructure, the following table shows the TVET Infrastructure related to the corresponding TRs identified.

Table 6. Summary of the number of Assessment Centers, Competency Assessors, Registered Programs, and NTTC Holder per Qualification (WTR), as of December 2024 in terms of National Database

Training Regulation	Coverage (March 2024)			
	No. of Assessment Center	No. of Competency Assessors	No. Registered Programs	No. of NTTC Holder
Air Duct Servicing NC II	0	0	0	0
Carpentry NC II	159	180	261	552
Carpentry NC III	11	9	8	37
CNC Lathe Machine Operation NC II	5	5	5	16
CNC Lathe Machine Operation NC III	1	0	1	7
CNC Milling Machine Operation NC II	5	6	6	15
Computer Systems Servicing NC II	361	606	665	2,227
Customer Services NC II	17	21	17	73
Driving (Articulated Vehicle) NC III	39	53	10	80
Driving (Passenger Bus/Straight Truck) NC III	102	165	65	260

Training Regulation	Coverage (March 2024)			
	No. of Assessment Center	No. of Competency Assessors	No. Registered Programs	No. of NTTC Holder
Driving NC II	451	799	796	2,332
Electric Power Distribution Line Construction NC II	6	25	4	32
Electric Power Distribution Operation and Maintenance NC III	0	1	0	2
Electric Power Distribution Operation and Maintenance NC IV	0	1	0	2
Electrical Installation and Maintenance NC II	323	598	532	1,485
Electrical Installation and Maintenance NC III	58	93	61	279
Electrical Installation and Maintenance NC IV	4	4	2	20
Flux Cored Arc Welding (FCAW) NC I	4	0	4	115
Flux Cored Arc Welding (FCAW) NC II	25	25	14	0
Flux Cored Arc Welding (FCAW) NC III	1	0	0	0
Gas Metal Arc Welding (GMAW) NC I	19	11	16	0
Gas Metal Arc Welding (GMAW) NC II	50	66	60	304

Training Regulation	Coverage (March 2024)			
	No. of Assessment Center	No. of Competency Assessors	No. Registered Programs	No. of NTTC Holder
Gas Metal Arc Welding (GMAW) NC III	3	2	2	8
Gas Tungsten Arc Welding (GTAW) NC II	57	72	72	284
Gas Tungsten Arc Welding (GTAW) NC IV	0	0	0	0
Gas Welding NC I	2	2	2	0
Gas Welding NC II	2	1	1	0
Heavy Equipment Operation (Articulated Off-Higway Dump Truck) NC II	1	1	1	0
Heavy Equipment Operation (Backhoe Loader) NC II	35	43	54	107
Heavy Equipment Operation (Bulldozer) NC II	32	39	30	90
Heavy Equipment Operation (Concrete Pump) NC II	0	4	0	
Heavy Equipment Operation (Container Stacker) NC II	0	0	0	
Heavy Equipment Operation (Crawler Crane) NC II	1	2	0	1
Heavy Equipment Operation (Crawler Crane) NC III	7	5	0	1

Training Regulation	Coverage (March 2024)			
	No. of Assessment Center	No. of Competency Assessors	No. Registered Programs	No. of NTTC Holder
Heavy Equipment Operation (Forklift) NC II	77	119	73	212
Heavy Equipment Operation (Gantry Crane) NC II	1	1	0	1
Heavy Equipment Operation (Hydraulic Excavator) NC II	108	123	71	243
Heavy Equipment Operation (Motor Grader) NC II	26	30	20	55
Heavy Equipment Operation (Overhead and Gantry Crane) NC III	5	6	0	2
Heavy Equipment Operation (Paver) NC II	0	0	0	0
Heavy Equipment Operation (Rigid Off-Highway Dump Truck) NC II	7	5	0	5
Heavy Equipment Operation (Rigid On-Highway Dump Truck) NC II	74	88	25	118
Heavy Equipment Operation (Road Roller) NC II	36	16	11	43
Heavy Equipment Operation (Rough Terrain Crane) NC II	1	6	0	6
Heavy Equipment Operation (Rough Terrain Crane)	9	8	0	4

Training Regulation	Coverage (March 2024)			
	No. of Assessment Center	No. of Competency Assessors	No. Registered Programs	No. of NTTC Holder
NC III				
Heavy Equipment Operation (Screed) NC I	0	0	0	0
Heavy Equipment Operation (Tower Crane) NC II	1	3	0	3
Heavy Equipment Operation (Tower Crane) NC III	4	3	0	2
Heavy Equipment Operation (Transit Mixer) NC II	23	15	3	15
Heavy Equipment Operation (Truck Mounted Crane) NC II	4	8	0	15
Heavy Equipment Operation (Truck Mounted Crane) NC III	12	7	0	4
Heavy Equipment Operation (Wheel Loader) NC II	85	83	90	181
Heavy Equipment Servicing (Mechanical) NC II	8	10	2	16
Instrumentation and Control Servicing NC II	10	20	13	49
Instrumentation and Control Servicing NC III	4	4	5	15
Instrumentation and Control Servicing NC IV	0	0	0	0

Training Regulation	Coverage (March 2024)			
	No. of Assessment Center	No. of Competency Assessors	No. Registered Programs	No. of NTTC Holder
Laboratory and Metrology/Calibration NC II	0	0	0	0
Laboratory and Metrology/Calibration NC III	0	0	0	0
Machining NC I	5	5	4	0
Machining NC II	24	33	29	99
Machining NC III	2	0	2	12
Masonry NC I	68	84	92	0
Masonry NC II	149	162	252	460
Masonry NC III	8	5	3	22
Mechatronics Servicing NC II	26	19	31	79
Mechatronics Servicing NC III	6	10	7	26
Mechatronics Servicing NC IV	2	4	1	6
Pipefitting (Metallic) NC II	14	34	17	51
Plumbing NC I	38	33	51	0

Training Regulation	Coverage (March 2024)			
	No. of Assessment Center	No. of Competency Assessors	No. Registered Programs	No. of NTTC Holder
Plumbing NC II	73	82	91	227
Programming (.Net Technology) NC III	0	0	0	2
Programming (Java) NC III	0	0	33	26
Programming (Oracle Database) NC III	0	0	0	0
RAC Servicing (DomRAC) NC II	53	103	32	208
RAC Servicing (PACU-CRE) NC III	1	23	0	1
Reinforcing Steel Works NC II	9	14	5	17
Scaffolding Works (Supported Type Scaffold) NC II	73	94	65	172
Security Services I	9	9	18	0
Security Services II	27	38	33	69
Shielded Metal Arc Welding (SMAW) NC I	393	449	657	0
Shielded Metal Arc Welding (SMAW) NC II	467	625	791	2,170
Shielded Metal Arc Welding (SMAW) NC III	55	76	63	343

Training Regulation	Coverage (March 2024)			
	No. of Assessment Center	No. of Competency Assessors	No. Registered Programs	No. of NTTC Holder
Shielded Metal Arc Welding (SMAW) NC IV	6	10	4	46
Structural Erection NC II	0	0	0	0
Submerged Arc Welding (SAW) NC I	1	0	0	0
Submerged Arc Welding (SAW) NC II	0	0	0	0
System Formworks Installation NC II	3	10	3	10
Transmission Line Installation and Maintenance NC II	0	0	0	0
Transmission Line Installation and Maintenance NC III	0	0	0	0
Transmission Line Installation and Maintenance NC IV	0	0	0	0
Web Development NC III	24	11	15	47

Source: TESDA - Information and Communication Technology Office
Processed by: TESDA - Planning Office

IX. Recommendations

As the current Administration looks into the possible investment in Nuclear Energy, TESDA has the opportunity to provide the possible industry players with human resources equipped with sufficient competencies needed in the specific jobs that will support the development in the area. In line with this, the following are recommended:

- The TESDA should initiate an industry consultation with stakeholders in the nuclear industry.
    - As part of the prioritization process, the office must consult all key players involved in the country's nuclear energy industry. Using the LMIR as a guide may assist the planning office in validating what specific skills, occupations (including possible green skills and jobs), and competencies are needed.
    - The agency should include Department of Energy (DOE), Philippine Nuclear Research Institute (PNRI), and MERALCO in the discussions as they have existing programs and other initiatives in the nuclear industry; thus, their input is vital.

- TESDA should collaborate and partner with the the DOE, PNRI and the members of the Nuclear Energy Program Coordinating Committee.
    - As seen in Table 2, part of the gaps identified was that TESDA or any TVET-related representatives were not included in the Nuclear Energy Program Coordinating Committee. Engagement with them through agreements may advance TESDA's advocacy in terms of providing skilled workers in the nuclear energy sector.
    - Discussions/Agreements may include the following:
        - Possible provision of experts for the development of nuclear energy-related programs;
        - Possible priority training for locals where there is a plan to build a nuclear energy power station/s;
        - The inclusion of TESDA in any future nuclear energy roadmap development.
    - Additionally, TESDA is recommended to establish a TVET Industry Board for the Energy Sector that includes nuclear energy industry. This is to ensure that TESDA may be continually updated on new and emerging energy technologies and skills.

- As Bataan Nuclear Power Plant is located in Region III, the Regional Office shall facilitate the consultation with the local area representatives from the DOE and PNRI on the ongoing activities in the plant.
    - The regional office must also reach out to their government counterparts and know what support from TESDA is needed.
- For other TESDA regional offices and their respective provincial offices, they are shall coordinate and consult with their respected local energy industry. This is to ensure that TESDA can assist any future plans to build and operate new nuclear power plants with:
    - Identification possible industry experts
    - Development of Area-based Competency Standards (CS)
    - Training Providers

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