مؤسسة الإمارات للطاقة النووية
Emirates Nuclear Energy Corporation

شركة براكة الأولى ش.م.خ
Barakah One Company PJSC

شركة نواة للطاقة
Nawah Energy Company

The UAE Peaceful Nuclear Energy Program

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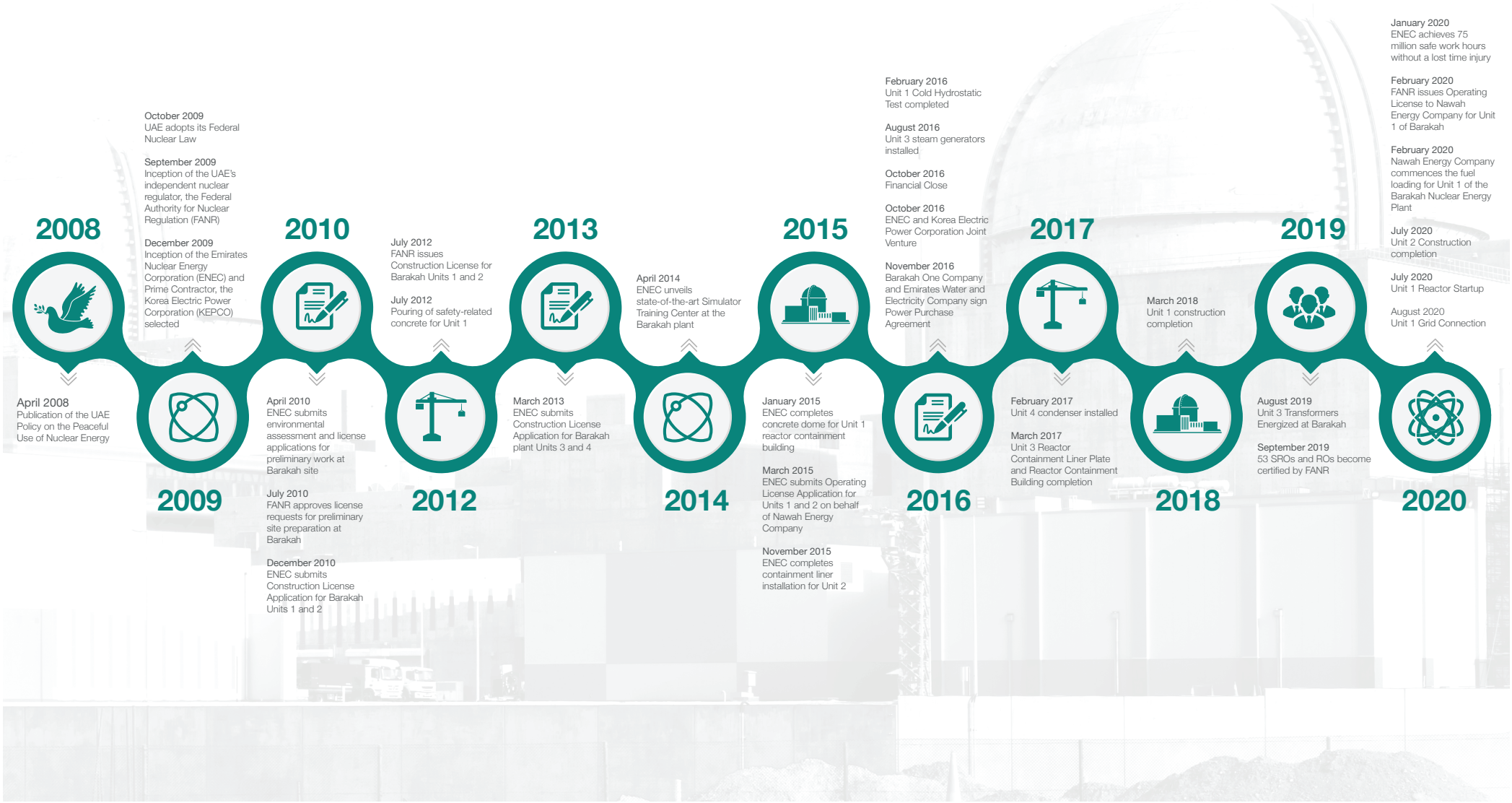
Introduction

Overview of the UAE Peaceful Nuclear Energy Program:

The UAE Peaceful Nuclear Energy Program is a strategic energy infrastructure program of national and international significance. It is one of the largest new nuclear energy plants globally, and will transform the energy landscape in the UAE and wider region. The cornerstone of the UAE Program is the Barakah Nuclear Energy Plant. When fully operational, the plant will produce 5,600 MW of clean, baseload electricity 24/7 - preventing the release of 21 million tons of carbon emissions each year, equivalent to removing 3.2 million cars off the roads annually.

Timeline for the Development of the UAE Peaceful Nuclear Energy Program



Why Nuclear?

The UAE needs electricity to maintain its strong economic growth. Nuclear energy will generate large, stable volumes of baseload electricity every hour of every day of the year, regardless of the weather.
It will enable the Nation to reduce its emissions, diversify its energy supply, increase energy security, and bring the benefits of affordable, clean, reliable electricity to a growing population.

Environmental impact:

- Peaceful nuclear energy is a central component of the UAE's future energy mix. With the addition of nuclear energy, the nation will transition from its reliance on natural gas to 50 per cent renewable and clean energy sources over the next 30 years, in line with the UAE Energy Strategy 2050. National policy targets also include a 70 percent reduction in carbon dioxide emissions and a 40 percent improvement in energy efficiency.

Economic impact:

- The UAE Peaceful Nuclear Energy Program not only employs more than 3,000 people, it has also created a new local nuclear energy supply chain with more than 2,000 local companies involved in and benefitting from the industry. The contracts created with these companies are worth more than $4.8 billion USD.

A Blueprint For Success

2008 national nuclear policy:

- In April 2008, the UAE released its Policy on 'The Evaluation and Potential Development of Peaceful Nuclear Energy'. This policy is built on the most exacting standards of safety, transparency and security, making the country a role model for nuclear energy development worldwide.
- The policy emphasizes six key principles: 1) complete operational transparency 2) the highest standards of non-proliferation 3) the highest standards of safety and security 4) working directly with the International Atomic Energy Agency (IAEA) and conforming to its standards 5) partnerships with responsible nations and appropriate experts and 6) long-term sustainability.

Regulatory oversight – FANR:

- The UAE's Federal Authority for Nuclear Regulation (FANR) is the independent regulatory body responsible for oversight of nuclear safety, security, radiation protection and safeguards, and enforcement of global agreements entered into by the UAE. FANR was established in accordance with Federal Law issued by H.H. Sheikh Khalifa bin Zayed Al Nahyan, President of the UAE.

FANR
الهيئة الاتحادية للرقابة النووية
Federal Authority for Nuclear Regulation

- FANR regulates the design, siting, construction, operation and decommissioning of nuclear energy plants in the country. It also regulates all radioactive material and radiation sources used in medicine, research and other industries, and is committed to its core values of safety awareness and responsibility, competency, independence and transparency. FANR is independent of ENEC, Nawah and its employees.

International partnerships:

- From the start, the UAE has worked in conjunction with the International Atomic Energy Agency (IAEA) on its nuclear policy. Major program milestones such as fuel load can only be taken following receipt of international endorsements from the IAEA and the World Association of Nuclear Operators (WANO), and regulatory approval from FANR.

Key facts:

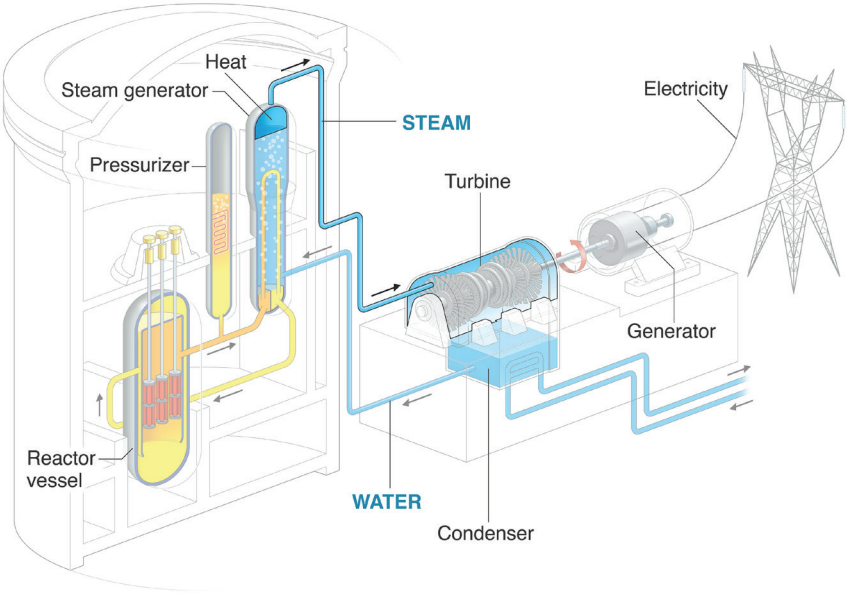
- Since 2009, ENEC and its operating subsidiary Nawah have been subject to more than 280 inspections by FANR.
- More than 40 missions and peer reviews from the World Association of Nuclear Operators (WANO) and the IAEA have been undertaken.
- All of the reviews and checks have ensured the highest international standards are met throughout the development and delivery of the UAE Program.

Commitment To Non-Proliferation

- The UAE Peaceful Nuclear Energy Program has been developed with the sole purpose of providing clean, reliable and abundant electricity, in full alignment to the Nation's Nuclear Law and its commitments to non-proliferation.
- The UAE Nuclear Law takes into account all obligations and commitments that stem from international instruments and obligations. The UAE views the application of a Comprehensive Safeguards Agreement, bolstered by the IAEA's Additional Protocol, as an important component of its model for the adoption of peaceful nuclear energy. This approach is consistent with the UAE's commitment to complete operational transparency and the highest standards of non-proliferation.
- As part of this commitment, the UAE will not enrich uranium or process used fuel assemblies.

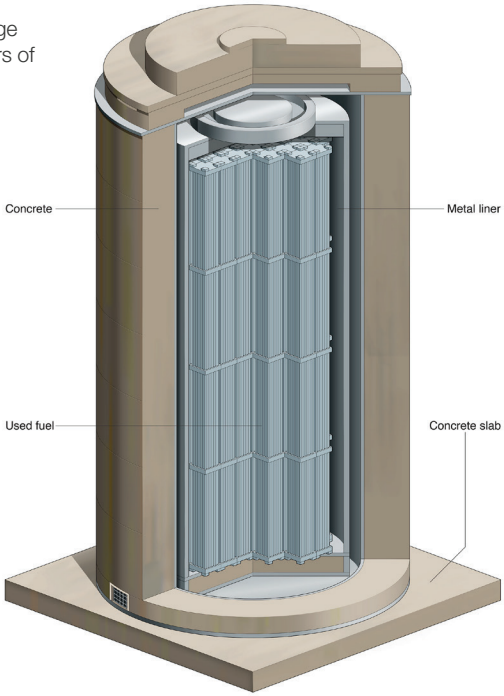
How Does A Nuclear Energy Plant Work?

- A nuclear reactor produces electricity in much the same way as other energy plants.
- The difference is how the heat is created. In a nuclear energy facility, heat is produced from splitting atoms – a process called nuclear fission. This form of heat generation means no harmful emissions are produced during the generation of electricity.
- While carefully controlled, trillions of atoms fission each second in a nuclear reactor. This chain reaction process heats water, which produces steam. The steam travels through pipes to a turbine and spins the blades like a pinwheel. The turbine blades connect to a shaft that spins, turning the steam's energy into mechanical energy. The turbine shaft connects to a generator and the generator shaft spins around inside a set of electromagnets. The magnets create the electrical current that powers our homes and businesses.



What Do We Do With The Nuclear Waste?

- Similar to many other energy generation technologies, peaceful nuclear energy does result in waste, in this case used nuclear fuel assemblies. The technology for managing the used fuel exists and has been safely stored in locations around the world for decades.
- The UAE plans to store used fuel on-site at the plant while it cools in fuel pools, before moving to concrete and steel containers called dry casks. These casks can be securely stored on-site at a nuclear energy plant or at an interim or long-term storage facility. The Barakah plant spent fuel pools have storage capacity for the first 20 years of operations.
- The site for dry cask storage at the Barakah plant has undergone several years of study and investigation to prove its suitability. Once ready, it will be licensed by FANR before it can become operational.



Why Is The Barakah Plant Located in Al Dhafra?

- The Barakah plant is located in the Al Dhafra Region of the Emirate of Abu Dhabi, approximately 53 kilometers southwest of the city of Ruwais.
- This location was selected based on several factors, including environmental, technical and commercial, following a comprehensive evaluation process led by local and international experts.
- The selection process was guided by best practices and standards from FANR, the Electric Power Research Institute, the U.S. Nuclear Regulatory Commission and IAEA.
- Factors that the UAE considered when selecting the site included seismic history, distance from large population centers, proximity to large supplies of water and to existing electrical power grid. It also took into account proximity to industrial and transportation infrastructure, favorable construction, security and evacuation route conditions and ability to minimize environmental impact.

Key facts:

- 53 kilometers southwest of Ruwais.
- The IAEA supported with the site selection through its Site and External Events Design (SEED) mission.
- In July 2010, FANR and the Environment Agency - Abu Dhabi (EAD) approved two licenses for preliminary work to begin at Barakah.
- In July 2012, FANR and the EAD granted final approval for Barakah to be the site of ENEC's first nuclear energy plant.

Why The APR1400?

- Barakah comprises of four Generation III reactors called the APR1400.
- The APR1400 is one of the most technologically advanced nuclear reactor designs in the world and meets the highest international standards for safety and performance.
- ENEC selected the APR1400 reactor technology following an exhaustive evaluation process by a 75-member team of experts.
- In 2009, a panel of international nuclear experts with more than 600 years in collective industry expertise selected the consortium led by the Korea Electric Power Corporation (KEPCO) for construction and delivery.

Key facts:

- The APR1400 is a Pressurized Water Reactor (PWR) and each unit produces up to 1,400 Megawatts of electricity.
- The reactors have an operational life-span of 60 years.
- This advanced reactor is based on the System 80+ design, which was certified by the Nuclear Regulatory Commission (NRC) in the United States of America.
- The APR1400 has been certified by the national nuclear regulators of Korea, the UAE and the USA
- Shin Kori 3&4 are APR1400 technology reactors in South Korea that are the reference plants for the Barakah plant. Unit 3 entered commercial operation in 2016, and Unit 4 in 2019.

Commitment To Safety

- From the outset, ENEC has made the safety of people, communities, environment and the plant an overriding priority. Safety always has, and always will, come first.
- ENEC's work with FANR, the IAEA, WANO and others has ensured that we have built not just a safe plant, but a safety-focused culture.
- A Pre-Operational Safety Review Team (Pre-OSART) from IAEA concluded an 18-day mission on 3 October 2019 to assess operational safety at the Barakah site in Abu Dhabi.
- Pre-OSART missions aim to improve operational safety by objectively assessing safety performance using the IAEA's Safety Standards and proposing recommendations for improvement where appropriate.
- IAEA praised Nawah for its commitment to safety. It said the development of the UAE's National Qualification Authority for nuclear positions will enhance and streamline training and qualification of employees.
- IAEA praised Barakah management for strong relations with off-site organizations and other stakeholders.
- In January 2020, WANO confirmed that Unit 1 of the Barakah plant had cleared the Pre-Start Up Review (PSUR), and was ready to start up. The PSUR is an extensive operational readiness assessment performed by an international team of nuclear industry experts from the Atlanta Center of WANO.

At the Barakah plant, ENEC has implemented a number of safety layers which would prevent anything similar to previous well-known accidents, such as Chernobyl and Fukushima from taking place. These include:

- The modern plant design with the latest safety systems. The APR1400 reactor design is certified by the US-based Nuclear Regulatory Commission
- Operator training and robust policies and procedures that embed safety as the overriding priority
- Promotion of a healthy nuclear safety culture
- Independent national and international regulatory and supervision organizations ensuring that the plant and its staff maintain the highest industry standards of safety and quality

Operational Excellence

شـــركـة نـواة للـطـاقـة
Nawah Energy Company

Nawah Energy Company:

- Established in 2016, Nawah Energy Company (Nawah) will operate and maintain Units 1 to 4 at the Barakah Nuclear Energy Plant.
- Nawah, the world's newest nuclear operator, will harness the power of nuclear energy to provide a safe, reliable, clean and sustainable supply of low-carbon electricity to contribute to the UAE's social and economic development and enhance the quality of life for generations to come.

Reactor Operators:

- In 2019, FANR certified the first 58 Senior Reactor Operators and Reactor Operators who will operate the plant. They have undergone years of rigorous training and assessments, and will continue to undergo regular training throughout their careers to maintain their certified operators status.
- There are now 72 SROs and ROs certified – with 30 Emiratis amongst this team.

Emergency preparedness:

- New plants, such as the APR1400, are designed and built to counter threats, both external - such as terror attacks and internal - such as a loss of power to the systems at the plant.
- ENEC has conducted regular comprehensive safety design reviews, which demonstrated an industry-leading level of plant robustness against both natural and man-made hazards.
- Emergency preparedness plans are in place to protect both plant personnel and the local public. Public notification and emergency response systems have been developed across the UAE.

Our People

- ENEC, Nawah and Barakah One Company employ more than 3,000 highly trained personnel, including the operators, engineers, technicians and support staff responsible for the safe operations of the Barakah plant. More than 60% of these employees are UAE Nationals.
- The Energy Pioneers program aims to attract and train the most talented science students and experienced professionals, providing them with an opportunity to become pioneers of the nuclear energy sector.

Key facts:

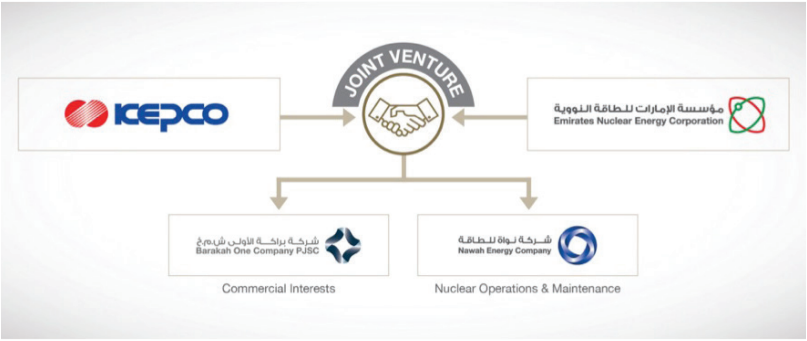
- 380 students have graduated from ENEC's Energy Pioneers Program
- More than 125 students in the pipeline to graduate
- More than 60% of these are UAE Nationals
- More than 20% are female
- Our employees represent more than 50 different nationalities

Our Partners

- KEPCO, South Korea's single largest public power electric utility, was awarded the Prime Contract in 2009 to design, build and help operate the UAE nuclear energy plant.
- In 2016, ENEC signed a Joint Venture partnership with KEPCO, and created two subsidiaries: Nawah Energy Company, the operating and maintenance subsidiary of the Barakah plant, and Barakah One Company which manages the financial and commercial interests of the project. ENEC owns 82% and KEPCO owns 18% of each company respectively.
- KEPCO is recognized by WANO as a leader in safety, plant reliability and efficiency.
- KEPCO was chosen following an exhaustive year-long evaluation conducted by a team of 75 international experts who evaluated a variety of factors, including safety, deliverability and commitment to human resource development.

Other key partnerships:

- ENEC signed an agreement with French National Radioactive Waste Management Agency (Andra) in late 2019 to explore potential collaboration in the field of radioactive waste management.
- ENEC signed an MoU with Enusa Industrias Avanzadas, S.A., S.M.E. (ENUSA), defining a framework for collaboration and the exchange of information and expertise in the field of nuclear fuel services.
- Nawah signed a long-term framework agreement with France's EDF to support Nawah in the operation and maintenance of Barakah with services in areas including operational safety, radiation protection, fuel cycle management and environmental monitoring.



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