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Building a safer and more sustainable energy future for Sabah



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Lessons from China's nuclear power plant

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ENGINEERING MATTERS

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AS the world moves towards cleaner, more reliable and sustainable energy, nuclear power is attracting renewed international attention. With growing electricity demand, rapid industrialisation and increasing concerns over climate change, many countries are exploring advanced energy technologies to strengthen electricity security while reducing carbon emissions.

For Sabah, a reliable and affordable electricity supply remains essential to support economic growth, industrial investment, tourism, technological advancement and improved quality of life.

A recent technical visit to the Fangchenggang Nuclear Power Plant in Guangxi, China under the 2026 engineering capacity building (Energy and Power Engineering) hosted by the Chinese Society of Engineers (CSE) and organized by the Chinese Nuclear Society (CNE) and co-organized by Guangxi Association for Science and Technology. This programme is also supported by Guangxi Fangchenggang Nuclear Power Co. Ltd, on 16 October 2026. This programme provided valuable insights into modern nuclear engineering, advanced safety systems and long-term energy planning. The experience also offered useful lessons relevant to Sabah's sustainable development aspirations under Sabah Maju Jaya (SMJ) 2.0 and the Sabah Energy Roadmap and Master Plan 2040 (SE-RAMP 2040).

Nuclear power around the world

Nuclear energy has been used for commercial electricity generation for more than 70 years. Today, more than 30 countries operate nuclear power plants, including the United States, France, China, Russia, South Korea and Japan.



Globally, nuclear power contributes approximately 9% of electricity generation, providing an established source of low-carbon energy.

Unlike solar and wind energy, nuclear power plants can generate electricity continuously for extended periods, regardless of weather conditions. This makes nuclear power particularly useful in supporting electricity systems that require a dependable supply.

However, nuclear energy also involves substantial construction costs, stringent safety requirements, specialised technical expertise and long-term radioactive waste management.

These considerations highlight the importance of careful planning, effective regulations and responsible engineering practices.

Learning from Fangchenggang Nuclear Power Plant, Guangxi, China

Located in Guangxi Province, Fangchenggang Nuclear Power Plant is one of China's major nuclear energy facilities, operating four reactors with a combined gross installed generating capacity of approximately 4,548 megawatts (MW).

Units 1 and 2 utilise CPR1000 pressurised water reactor technology, while Units 3 and 4 employ China's domestically developed Hualong One Generation III nuclear technology.

Hualong One incorporates advanced engineering safety features,

including multiple protective barriers, redundant safety systems and emergency protection measures designed to minimise operational risks.

The visit highlighted an important principle: successful energy infrastructure depends not only on advanced technology but also on engineering competency, operational discipline, effective management and a strong safety culture.

Modern nuclear facilities apply the principle of defence in depth, whereby several independent layers of protection are incorporated into their design and operation.

These include robust containment structures, automatic safety systems, continuous monitoring, preventive maintenance and emergency preparedness.

Another valuable lesson is the importance of long-term planning. Nuclear power plants require extensive technical studies, design, construction, testing and commissioning before entering commercial operation.

Their successful development depends on effective coordination among engineers, scientists, contractors, regulators and operating organisations.

Although these practices are associated with nuclear energy, the underlying engineering principles are equally relevant to conventional power stations, hydropower facilities, industrial plants and other critical infrastructure.

Sabah's energy development under SMJ 2.0

Sabah has made encouraging progress in strengthening its electricity infrastructure through ongoing initiatives undertaken by the State Government and relevant energy agencies.

In September 2026, the State Government reported that Sabah's electricity generation reserve margin had improved to 19% as of August 2026, reflecting continuing efforts to strengthen electricity supply capacity.

Improvements in electricity supply reliability have also been recorded through investments in generation facilities, transmission networks and distribution infrastructure.

Under SE-RAMP 2040, Sabah's energy development is guided by three important priorities: energy security, affordability and environmental sustainability.

The State Government continues to pursue a balanced energy strategy involving solar power, hydropower, battery energy storage systems, gas-fired electricity generation and improvements to existing electricity infrastructure.

These initiatives complement SMJ 2.0, particularly its emphasis on economic development, infrastructure improvement, human capital advancement and sustainable growth.

As Sabah continues attracting investments and developing new industries, reliable electricity will remain an important foundation for long-term economic progress.

Understanding Small Modular Reactor (SMR) technology

One emerging development in the global nuclear energy industry is Small Modular Reactor (SMR) technology.

Unlike conventional nuclear power plants, which generally have large generating capacities, SMRs are designed to produce up to approximately 300 MW of electricity per module.

Their smaller capacity and modular design may provide greater

flexibility for certain electricity systems and industrial applications. Countries including China, Russia, Canada and the United States are developing or evaluating SMR technologies as part of their long-term energy strategies.

However, many SMR designs remain at different stages of technological development, regulatory assessment and commercial deployment.

Their economic viability, operational safety, radioactive waste management and long-term performance require careful consideration.

For Sabah, understanding emerging technologies such as SMRs is valuable from an engineering knowledge and future energy planning perspective.

Nevertheless, nuclear energy development is a complex undertaking involving national energy policies, comprehensive technical assessments, environmental protection, public safety and stringent regulatory requirements.

Malaysia has been examining nuclear energy as part of its broader long-term energy transition considerations. No decision has been made to construct a nuclear power plant in Sabah.

Therefore, nuclear technology should be viewed as an area for continued scientific learning and technical understanding rather than an immediate alternative to Sabah's existing energy development programmes.

Engineering excellence and international knowledge exchange

The Fangchenggang experience demonstrates the importance of international technical cooperation in advancing engineering knowledge and professional competency.

Countries with established nuclear industries have accumulated valuable experience in complex project management, safety engineering, quality assurance, digital monitoring and infrastructure maintenance.

Such experience provides useful references for engineers involved in

planning, developing and operating major infrastructure facilities.

For Sabah, international knowledge exchange can contribute towards strengthening local engineering capabilities, encouraging innovation and developing skilled professionals.

As technology continues evolving, engineering education, research and continuous professional development will remain important in preparing future generations to manage increasingly sophisticated infrastructure.

Looking towards Sabah's sustainable energy future

The development of nuclear power around the world demonstrates how engineering innovation continues to transform electricity generation and energy security.

The Fangchenggang Nuclear Power Plant in China provides an example of how advanced technology, engineering expertise, safety management and long-term planning can be integrated into major energy infrastructure.

For Sabah, the lessons extend beyond nuclear energy itself. They highlight the importance of sound engineering practices, professional competency, technological readiness and responsible infrastructure development.

The Sabah Government's ongoing initiatives under SMJ 2.0 and SE-RAMP 2040 provide an important foundation for strengthening electricity reliability, encouraging sustainable energy development and supporting economic growth.

Ultimately, the most important lesson from Fangchenggang is not simply about nuclear power, but about the value of forward-looking planning, engineering excellence, strong safety standards and continuous technological advancement.

By building upon its existing achievements and embracing appropriate innovations, Sabah can continue progressing towards a more reliable, resilient and sustainable energy future for generations to come.