

EMERGING ZERO EMISSION ENERGY THROUGH RENEWABLE ENERGY AND NUCLEAR ENERGY PLAN IN CAMBODIA

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HIGHLIGHTS

- Electricity security is vital to well-functioning modern societies and economies. Digital technologies, communications infrastructure, and industrial operations all depend on a reliable and efficient supply of electricity.
- To get on track with the Net Zero Scenario, nuclear power will need to continue expanding to reduce the need for unabated fossil fuels, in addition to rising power output from renewables.
- Currently, Cambodia has neither nuclear power plants (NPP) in operation nor planned for nuclear installation in future.

POLICY RECOMMENDATIONS

- Strengthen policy frameworks to systematically de-risk low-emission projects, including nuclear power.
- Support small modular reactors (SMRs), demonstration projects with direct measures for financing.
- Review national international decarbonization pathways.
- Promote efficient and effective safety regulation.

• Cambodia 's Energy Status 2021

Cambodia's power consumption reached 11,816 GWh in 2021, a year-on-year increase of 4.5%, according to a recent report from the Ministry of Mines and Energy.

The share of the Cambodian energy mix includes 41% coal-powered plants, 44% hydropower plants, 7.6% diesel-powered plants, and 6.5% solar.

The solar energy source usage in 2021 has increased almost double compared to the amount used in 2020. By 2023, 7 solar power plants with a total capacity of 495 megawatts will be operational, contributing about 20% of Cambodia's total energy supply.

ABSTRACT

Cambodia has relatively expensive electricity in comparison to its ASEAN neighbors, in part due to the fact that currently a significant proportion of Cambodia's electricity is imported. Whilst the level of imports has been steadily decreasing over the last decade, the increasing demand for electricity in Cambodia means that alternative sources must be found to keep up with that demand. Domestic green energy production is not only possible in Cambodia, but would also contribute long term to cheaper electricity prices for consumers, a more attractive environment for investment, an increase in stability of supply and provide national security benefits, notwithstanding the positive environmental impact.

By presenting this Long-Term Strategy for Carbon Neutrality (LTS4CN), Cambodia demonstrates commitment to the Paris Agreement on Climate Change and presents a policy scenario to realize a vision of a carbon neutral and resilient society within the next 30 years. The LTS4CN is a new type of policy tool for Cambodia. As a visioning exercise, it is not meant to replace or supersede existing national and sectorial strategies of the Government but rather to guide future policy and investment decisions by all concerned stakeholders.

What is the problem?

• Cambodia's Electricity Demand and Fossil Fuels

Over the past 15 years, Cambodia's rapid population and economic growth have led to a tenfold increase in electricity demand. This has proved challenging, and despite its admirable renewable energy progress, Cambodia is far from total decarbonization. Unfortunately, this trend will continue for some time. In September 2021, the Minister for Ministry of Mines and Energy, Suy Sem, emphasized fossil fuel needs in the near term, reflected in its new Power Development Plan (PDP).

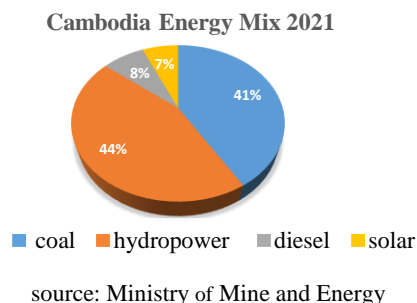
• Electricity Supply and Power System

Furthermore, the country's electricity network lacks stability and often suffers from power cuts. However, cuts are avoidable with ongoing investments, but Cambodia is falling short. According to the Asian Development Bank (ADB), the state-run Electricite du Cambodge (EDC) should have invested USD 600 million for infrastructure upgrades over the last five years, yet failed to do so.

• Energy Prices

Cambodia also suffers from high and often very volatile power costs. Electricity prices, in 2020, reached both their lowest and the highest levels in the last 15 years. Meanwhile, gas prices in 2021 were tenfold higher than their 2020 levels making life for everyday Cambodians even harder. Overall, compared to its Southeast Asian neighbors, the country's electricity tariffs are significantly higher.

The Cambodian government has also recently pledged to reduce greenhouse gas emissions by 42% by 2030. Cambodia will also no longer approve or build coal-fired power plants and dams on the Mekong River, but rather turn to green renewable energy such as solar power.



Solution

With reducing emissions to net zero by 2050 critical to meeting the Paris Agreement goal of keeping the global average temperature increase below 1.5°C, Cambodia is committed to leading the way. The LTS4CN is an important starting point in providing guidance on how it can reach carbon neutrality by 2050.

Why is this important?

Energy Security amidst LTS4CN

LTS4CN objectives and scenarios

The LTS4CN outlines a vision of a carbon neutral economy and provides long-term policy direction on how to reduce emissions in the next few decades. The overall goal of the strategy is to describe a pathway towards a country-wide carbon neutral economy by 2050.

Summary of key mitigation actions in Energy Sector

- No new coal generation capacity beyond already committed projects
- Use of natural gas as a dispatch able transition fuel
- Investments in liquefied natural gas (LNG) import, storage and infrastructure
- Increase in solar, hydro, biomass and other renewables to 35 percent of the generation mix by 2050, of which 12 percent is from solar
- Investments in grid modernization, flexibility and storage
- Energy efficiency measures in buildings and industry

- Fuel switching to electricity for cooking
- Substitution of coal in the industrial and power sector

Cambodia Nuclear Power History

Cambodia became a member of the IAEA in 1958; two years after IAEA's statutory was established. Cambodia maintained membership until 2003 and regained membership again in 2009 after withdrawing for a while. The Royal Government of Cambodia is fully committed to non-proliferation of the nuclear program and takes part to ensure the nuclear safety, security and safeguards at national, regional level and throughout the world. By the 1993 constitution and its subsequent amendments, Cambodia is absolutely prohibited from manufacturing, use and storage of the nuclear, chemical, or biological weapons. Subsequently, there are many other laws are relevant relating to the control of activities involving nuclear and other radioactive materials. Over the years, Cambodia is the party to many IAEA's agreements; treaties; protocols and conventions. For instance, in 1972, Cambodia signed on Nuclear Nonproliferation Treaty and the Southeast Asia Nuclear Weapon-Free Zone Treaty in 1997 and Cambodia has been a party to the Additional Protocol (AP) and Small Quantity Protocol for strengthening the country safeguards commitment in 2015. A comprehensive nuclear law, which covering safety, security, safeguards and civil liability is under preparation by the IAEA's Technical Cooperation project with the inputs, comments from many other international organizations. For those other IAEA's conventions, treaties that Cambodia is not yet a party to, Cambodia is under consideration and hope to do that in the future, such as the amendment to the Convention on the Physical Protection of the Nuclear Materials, the political commitment to the code of conduct and the guidance on import export of Nuclear Material and so on.

The pivotal problem is the allocation of scarce governmental resources; financial authorities cannot easily justify subsidizing nuclear energy at the expense of more pressing needs in health, education, and poverty reduction.

WHAT CAMBODIA HAVE DONE WITH NUCLEAR TECHNOLOGY FOR PEACEFUL PURPOSE?

Currently, Cambodia's nuclear and radiation safety security and safeguards is managed by the Ministry of Mines and Energy and other lines ministries and agencies at the national level who are working with the international organization and other countries on many aspects ranging from legal, application of nuclear and radiation technology in health, industrial sector, agriculture as well as safety, security and safeguard of the nuclear materials and radiation sources.

Cambodia has successfully implemented the technical cooperation projects related the implementation of the peaceful use of nuclear technology in various sectors such as agriculture in soil fertility, crop management and livestock production. IAEA has helped Cambodia to establish the National Cancer Center, which was inaugurated in January 2018, in enhancing better capabilities in cancer treatment and nuclear medicine. The IAEA's technical program also has helped improving our water resources management and provided an instrumental support in launching and the establishment of a future nuclear regulatory authority after the nuclear law will be promulgated in near future. In energy sector, though nuclear power plant program is not there yet, but the government encourages the building of soft infrastructure that include necessary regulatory framework to build an institutional framework and capacity building on human resource development and as well as to establish the safety and security regulations and standards.

During the 61st General Conference, Cambodia and IAEA has reached to another milestone on signing its second Country Program Framework (CPF) for implementation over a period of 2017 to 2023. The new CPF covers on the areas of Legislation frame works including the international legal instruments, Radiation and nuclear safety, Human Health, Agriculture, lives stock production and food irradiation, Waste resources management, Comprehensive energy planning and implementation program, Environmental protection and monitoring and radioactive waste management, Industrial applications, Cultural heritage preservation, and Human resources development and education. Moreover, the Royal Government of Cambodia and the Government of the Russian Federation has come into an Agreement on cooperation in the field of the use of nuclear energy for peaceful use purposes in September 2017. Subsequently, a Memorandum of Understanding between Cambodia's Institute and Russia's Rosatom was signed in August 2018 aims at enhancement of the dialogue, information exchange and communication to promote nuclear science, technologies, and education in Cambodia.

MoU

with the Government of the Russian Federation

- MoU between the NCSD and the State Atomic Energy Corporation (Rosatom) on the cooperation in the use of atomic energy for peaceful purposes, 24 Nov 2015
- MoU on the establishment of a Cambodia-Russia Joint Working Group on Cooperation in the use of Atomic Energy for Peaceful Purposes, Moscow 17 May 2016. The joint working group composed of 19 memberships represented 10 ministries-agencies and 5 academic institutions to cooperate and facilitate with the Russian federation in implementing the Cambodia-Russia Federation MoUs on nuclear cooperation.
- MoU on the establishment of Information Center of Nuclear Energy, Moscow 17 May 2016, to facilitate collaboration in arranging joint awareness-raising activities with the Cambodian people relating to nuclear energy for peaceful purposes, nuclear and radiation safety and other related issues; to explore the way of encouraging the initiation and implementation of projects intended for the development of nuclear industry; and implement programs encouraging the young people towards technical education;
- Agreement between the Royal Government of Cambodia and the Government of the Russian Federation on Cooperation in the field of the use of Nuclear Energy for Peaceful Purposes. Vienna, 17 September 2017, to establish and develop the infrastructure of the nuclear energy and nuclear technologies in the Kingdom of Cambodia; to design and construct nuclear facilities, including water desalination facilities, and atomic particle accelerators; to explore and mine uranium deposits, study of mineral raw material base for the development of its nuclear industry; and so on.

with the People's Republic of China

MoU between NCSD and China National Nuclear Corporation (CNNC) on Nuclear Industry Cooperation for Peaceful Purposes, 12 September 2017. The cooperation divided by 2 phases:

- 1) Development of nuclear industry through human resource development, public awareness raising, and application of nuclear technologies in priority sector; and
- 2) Assessment of the country's capacity and needs required for future development of nuclear energy.

Obstacle to Install Nuclear power plant in Cambodia

If Cambodia is serious about building nuclear power plants, however, it has to realise the mounting tasks ahead. Lack of financial support, manpower, and technical capability are obviously major hindrances to achieving this goal. Formal education on nuclear power is virtually non-existent, even at a tertiary level. Public understanding and technical know-how on nuclear energy issues face serious shortcomings. Interestingly, there was little reaction by the general public (except among intellectuals) toward the government's expressed intention to explore the possibility of generating nuclear power. This does not, however, translate to the absence of resistance at a later stage, especially when the location of the power plants becomes known. As such, it is important that the government engages the public to generate a better understanding about nuclear energy by conducting surveys and workshops, as well as administering an effective information Centre. Meanwhile, the government should start investing in personnel development by seeking or providing scholarships for Cambodians to pursue degrees in nuclear engineering with partnering countries such as China and Russia.

While the upfront financial investment may be difficult to realise, it may be possible to adopt the BOT (Build-Operate-Transfer) scheme, whereby the construction and operation of nuclear power plants is carried out by nuclear companies for an agreed-upon timeframe. This approach raises the question of the technical capability and regulatory oversight power of the government to monitor nuclear power plants operated by foreign companies. To address this, Cambodia must work hard to engage in and learn from regional cooperation on nuclear safety and security, radioactive waste management, as well as emergency preparedness and response, particularly through the ASEAN Network of Regulatory Bodies on Atomic Energy (ASEANTOM).

Overall, the most pragmatic approach for Cambodia given the lack of resources at this point is to adopt a wait-and-see approach and learn from regional experiences. Meanwhile, following the signing of the MoU agreement with Russia, the Cambodian government can lay the groundwork by engaging actively in allaying the public fears concerning nuclear power through public discussion and education about the pros and cons of nuclear energy. Cambodia's energy requirements will grow as its economy continues to expand, it is worth exploring the nuclear option in the long run. Such a strategy would need to be done with transparency and with certainty that the benefits outweigh the costs.

Policy Recommendations

Recommendations for the Policy maker

Strengthen policy frameworks to systematically de-risk low-emission projects, including nuclear power. Financing costs represent a large share of the total cost of nuclear power and other low-emission technologies. Reducing levels of risk presents opportunities to reduce final costs to consumers throughout energy transitions.

Support SMR demonstration projects with direct measures for financing, but also targeted at investment in essential R&D capabilities, talent and the development of licensing frameworks.

Review national and international decarbonization pathways in the light of technological progress for nuclear power, including SMRs, also considering new applications in hard-to-abate energy sectors.

Promote efficient and effective safety regulation. Alongside appropriate waste management, safety regulations remain a crucial aspect of ensuring safe nuclear power generation continues. This requires regulators to have the resources and skills needed to review new projects and develop harmonized safety criteria for new designs. By engaging with both developers and the public, they can ensure that licensing requirements are clearly communicated to all parties.

Recommendations for the private sector

Accelerate the development and deployment of SMRs. Identify opportunities where SMR technologies can become a cost-effective low-emission source of electricity, heat and hydrogen. Funding and investment support for demonstration projects, as well as developing supply chains, will strengthen SMR industries and promote earlier deployment.

Strengthen supply chains and talent pipelines, building on existing nuclear supply chains and on cooperation with other industries that have relevant experience and capabilities needed for SMRs supply chains (e.g. shipbuilding for modular construction).

Co-lead public engagement with all relevant stakeholders and in particular local communities where SMRs are expected to be deployed.

Conclusion

Overall, Cambodia is developing rapidly with increasing energy demand and electrification. Now is the time for Cambodia to plan effectively for a 2040 that includes renewable energy sources and an openness to future technologies such as nuclear energy. A key to achieving this will be integrating viable renewable energy options available now, such as solar PV into the national grid and planning for how energy demand in the country can be met in the most efficient, affordable and sustainable way for the future. For installing nuclear power plan, Cambodia is still Lack of financial support, manpower, and technical capability are obviously major hindrances to achieving this goal. Formal education on nuclear power is virtually non-existent, even at a tertiary level. Public understanding and technical know-how on nuclear energy issues face serious shortcomings. Interestingly, there was little reaction by the general public (except among intellectuals) toward the government's expressed intention to explore the possibility of generating nuclear power. So right now, Cambodia is still on going for Capacity building on nuclear Technology as well as Our Law on Nuclear energy is still in draft, but to reducing emissions to net zero by 2050 critical to meeting the Paris Agreement goal of keeping the global average temperature increase below 1.5°C, Cambodia is committed to leading the way which is The LTS4CN is an important starting point in providing guidance on how it can reach carbon neutrality by 2050.

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