24 SEP, 2023

Satellites help in energy transition

Daily Express (KK), Malaysia

Satellites help in energy transition

Prof Dato' Ir. Dr. Norashidah Md Din

MALAYSIA has developed a comprehensive energy transition plan that aims to shift the country's energy mix towards cleaner, more sustainable forms of energy, such as hydroelectric, solar, and wind energy, while also promoting economic growth and energy security.

The transition to cleaner forms of energy is necessary to address a range of environmental, economic, and social challenges, in providing a more sustainable and prosperous future.

Revolutionizing the national energy infrastructure is a critical step in achieving this transition, on the one hand.

On the other hand, satellite technology is becoming more and more significant for the energy sector because it provides several advantages and opportunities to enhance energy generation, transmission and distribution.

Satellite technology has the potential to transform the energy sector by providing valuable data, insights, and capabilities that can help to optimize performance, increase efficiency, and reduce costs, while also promoting the development of cleaner, more sustainable forms of energy.

There are several types of satellite data that can be used for the study of the energy infrastructure over a wide geographic area.

The three most common types are optical, radar and atmospheric data. The specific data used will depend on the goals required and the types of variables being analysed. Optical sensors on satellites can capture high-resolution images of the Earth's surface, which can be used for a range of spatial studies.

These images can be used to identify land use patterns, map changes in vegetation cover, and detect surface water bodies.

The National Aeronautics and Space Administration (Nasa), which is a United States (US) government agency responsible for US space, aeronautics and aerospace research, provides a wide range of optical imagery of the Earth's surface through various satellite missions and programs.

Satellites equipped with atmospheric sensors can capture data on temperature, humidity, air quality, and other atmospheric variables.

This data can be used for weather forecasting, air quality monitoring, and climate change studies, among other things.

There are several satellites that carry atmospheric sensors, and each satellite may carry a different combination of sensors depending on its specific mission objectives.

Commercial satellite operators such as DigitalGlobe, Airbus Defence and Space, Planet Labs, and others, also provide data with varying specifications and capabilities.

These commercial satellites cater to different customer needs, and the choice of satellite depends on specific requirements, including desired resolution, coverage area, revisit frequency, and budget considerations.

Satellites can be used to remotely monitor and control energy infrastructure, such as power plants, pipelines, transmission lines and other energy assets, providing real-time data and insights that can be used to optimize performance, reduce downtime, and prevent accidents.

The potential of renewable energy sources, such as solar and wind power, can be assessed using satellite data providing valuable information to investors, policymakers, and energy companies.

Real-time satellite data on weather patterns and conditions will enable informed decision to be made for the management of renewable energy sources and the prevention of weather-related disruptions to the energy infrastructure.

Satellites can support disaster response efforts in the energy sector, providing real-time data on the location and extent of damage to energy infrastructure and helping to prioritize repair and recovery efforts.

The Institute of Energy Infrastructure (IEI) at Universiti Tenaga Nasional (Uniten) is leveraging satellite technology to improve what they can in terms of the performance, efficiency, and sustainability of Malaysia's energy infrastructure.

Completed and on-going research projects cover transmission line monitoring, hydroelectric dam break study, wind turbine placement optimisation, geohazard disaster management based on landslide and flood threat to the energy infrastructure, solar irradiance, and corrosion study.

Artificial intelligence (AI) and machine learning (ML) systems were utilized to identify potential problems and anomalies in an energy infrastructure by analysing data from satellite imaging, drones, and ground-based sensors.

This enables proactive maintenance and minimises downtime.

Satellite imagery and drone footage can be analysed using AI and ML algorithms to detect potential issues such as vegetation encroachment, corrosion, and damaged or broken equipment.

These algorithms can also identify potential safety hazards, such as wildlife or people near transmission lines.

By analysing data from ground-based sensors and weather forecasts, AI and ML algorithms can predict potential faults and maintenance needs in energy transmission and distribution, allowing for proactive maintenance and reduced downtime.

AI and ML algorithms can be used to analyse data on the performance and lifespan of transmission line components, allowing for better asset management and replacement planning.

Overall, the use of satellites in power generation, transmission and distribution can be game-changing.

Capacity building in related areas will lead to more efficient and reliable energy infrastructure, reducing costs and improving sustainability.

The Malaysian Space Agency (MYSA) together with research institutes like IEI may play a pivotal role in this.

■ The author is the Director, Institute of Energy Infrastructure, Universiti Tenaga Nasional (Uniten).