

Tech Blueprint Laid out for Transport Sector

By LI Linxu

China has unveiled a five-year plan on developing transport technologies to drive green, smart and digital transformation of the transport sector.

In recent years, the country has made historic progress in its transport system, with its capacity for technological innovation markedly strengthened.

China will focus on technology innovation in the fields of transport infrastructure, equipment and services, according to the plan jointly released by the Ministry of Transport and the Ministry of Science and Technology.

The document, titled the *Five-year Plan for Technological Innovation in the Transport Sector*, puts forward the goals, tasks and measures for the next few years.

By 2025, breakthroughs in transport technological R&D applications will be made, innovation capabilities will be comprehensively boosted, and innovation environment will be significantly optimized, according to the plan.

To achieve these goals, the plan targets 18 key R&D directions in six fields, such as the theoretical method and technology of comprehensive transport, key technologies of major infrastructure construction, infrastructure digital upgrade,



Beipanjiang Bridge in southwest China's Guizhou province. (PHOTO: XINHUA)

intelligent and green transport equipment, high-quality intelligent travel, economical, efficient and intelligent logistics, and convenient urban transport operation and service.

To build a comprehensive transport system that is smart, safe and green is the direction of technology innovation, according to the plan.

In the field of smart transport, in-

novation efforts will focus on the deep integration of transport with a new generation of information technologies, such as cloud computing, big data, Internet of things, and artificial intelligence, and the intelligent application of BeiDou Navigation System, such as high-precision positioning navigation technologies, application standards and codes.

Technologies of safe transport in fields of infrastructure safety monitoring, safety production guarantees and coordinated management control, and transport emergency response and service assurance are emphasized.

Special attention will be paid to green transport technologies, including the innovative application of new energy and clean energy, environmental protection and ecological rehabilitation, as well as comprehensive pollution prevention and control.

The plan also calls for strengthening international sci-tech cooperation and deepening international talent exchange to facilitate the two-way flow of innovation elements.

It pledges to build multi-level and multi-channel international innovation cooperation platforms, including the Global Innovation and Knowledge Center for Sustainable Transport, the Belt and Road International Science and Technology Cooperation Network in Transport Sector, as well as joint labs and research centers, to promote technology transfer, demonstration and application.

A series of major international cooperation projects and talent exchange programs will be implemented, as per the plan.

Policy Watch

Ethical Norms Ensure Scientific Research on Right Way

By CHEN Chunyu

The ethical issues brought by science and technology development concern the security and destiny of humankind. The research ethics, which includes a broad set of standards, values, and institutional arrangements that regulate research activities, will help to ensure that researchers can be held accountable to the public.

According to Zhang Wenxia, researcher at the Chinese Academy of Science and Technology for Development, the research ethics is about maximizing the benefits and minimizing the harm and risks that may occur in R&D activities.

To ensure effective ethical supervision of different sectors, China established the National Ethics Committee on Science and Technology in 2020. In the revised *Law on Progress of Science and Technology*, article 103 states the committee should perfect the ethical norms. Zhang said that strengthening ethical governance is an intrinsic requirement for promoting the sustainable progress of sci-tech innovation in the new development stage.

Enhancing ethics education

Article 103 also states the country would strengthen the ethics education and research, and improve the review, evaluation and supervision system.

Zhang said the research on ethics includes the study on the risks, cultures, laws, social influences and the communication with the public. And the ethical education not only covers the researchers and postgraduates, but also extends to the training of management ability of workers in charge of ethical review, and the cultivation of professional talent teams.

The research associations and societies are expected to play an active role in ethics education in their respective fields, added Zhang.

Completing ethical system

The research institutes, universities, enterprises and other public institutions are responsible for research ethics governance. The ethics review mechanism should be established and improved for reviewing the research activi-

ties, says article 103.

In this regard, Zhang explained that these organizations should establish a regular working mechanism, and be active to analyze and resolve the ethical problems that appeared in research activities in time.

As for the management of research activities, Zhang said the ethical review of research projects and papers involving animal use, human subjects, and living environment should be strengthened before being approved or published.

Zhang pointed out that many provinces in China have established or are establishing their committees for research ethics. To ensure a high-quality review, for the regions and institutes whose qualifications are not sound enough for a committee, a shared committee at a provincial level is an option.

China's ethics is relatively mature in the fields of medicine and life science, and leads the world in artificial intelligence, said Zhang, suggesting that other key fields that are prone to ethical risks should formulate their own ethical norms as soon as possible, and adjust and improve them according to the new situations encountered in practice.

No pursuing benefits blindly

Risks and benefits are the two sides of research activities. Modern sciences, especially emerging technologies, are full of uncertainties.

The study and assessment of potential risks are needed before developing new technologies, and preventive measures should be put forward to tackle any emergency, said Zhang, noting that research should be suspended if the risks are higher than the actual benefits, such as the economic value and application prospects.

It also should be noted that a researcher can't fully get to the bottom of research at the outset, said Zhang, adding that the research is like an iceberg. The deeper the research goes, the more the iceberg will rise to the surface. Facing new uncertainties during research, the researchers are required to have an ethical awareness in making decisions and adjusting strategies accordingly, so as to ensure responsible research for the welfare of humankind.

50 Years On, TCM Curing Malaria Worldwide

By ZHONG Jianli & FU Lili

This year marks the 50th anniversary of the discovery of artemisinin by Chinese Nobel Laureate Tu Youyou and her team. They extracted artemisinin from qinghao, a kind of traditional Chinese medicinal herb, bringing a new cure for malaria and saving millions

of lives worldwide.

Thanks to the magical herb, China has seen no malaria cases since 2017, and the country was officially certified malaria-free by the WHO in June 2021.

Chinese scientists have, however, continued to research artemisinin, as there are still 91 malaria endemic countries and regions in the world, most be-

ing in sub-Saharan Africa.

"What we've been working on is figuring out how artemisinin works, decoding its resistance, and expanding the usage of artemisinin-based drugs," Liao Fulong, Tu's colleague and a researcher at Institute of Chinese Materia Medica of China Academy of Chinese Medical Sciences (CACMS), told *Science and Technology Daily* recently.

Now, the research on the mechanism of artemisinin has made progress. Wang Jigang, a member of the research team at Artemisinin Research Center of CACMS, adopted the chemical biology method and found that the mechanism is a multi-target pattern. In other words, the heme activates the artemisinin, and the artemisinin kills the plasmodium.

This heme-activated multi-target theory has been recognized by the international antimalarial community, which is of great significance for revealing the deep mechanism of antimalarial resistance of artemisinin and promoting more effective clinical medication.

Liao's team is also interested in artemisinin's anti-cancer and other effects. The anti-cancer mechanism of artemisinin is similar to that of anti-malaria. But artemisinin's anti-cancer efficacy

is still in the basic research stage, and whether it can be used as an anti-cancer drug needs more follow-up research.

Other progress made by the team is on using artemisinin-based drugs to treat lupus erythematosus. Dihydroartemisinin has a unique effect on the treatment of lupus erythematosus with high variability. "A phase II clinical trial is currently underway at the KPC Pharmaceuticals, Inc., and relevant results are expected to be revealed in September this year," said Liao.

The discovery and application of artemisinin is a success story of humankind's arduous struggle against diseases. It is also an example of China's commitment to benefiting the world through its development and building a global community of health for all.

By the end of 2021, China had provided billions of units of artemisinin drugs to malaria patients worldwide, trained tens of thousands of antimalarial technicians from developing countries, built malaria prevention and control centers for 30 countries, and sent 28,000 medical workers to 72 developing countries for malaria prevention and treatment, according to Wang Wenbin, spokesperson of the Ministry of Foreign Affairs.



Participants of the International Forum on the 50th Anniversary of the Discovery of Artemisinin stop by an artemisinin exhibition in Beijing. (PHOTO: VCG)

Energy Technology Innovation Plan Unveiled

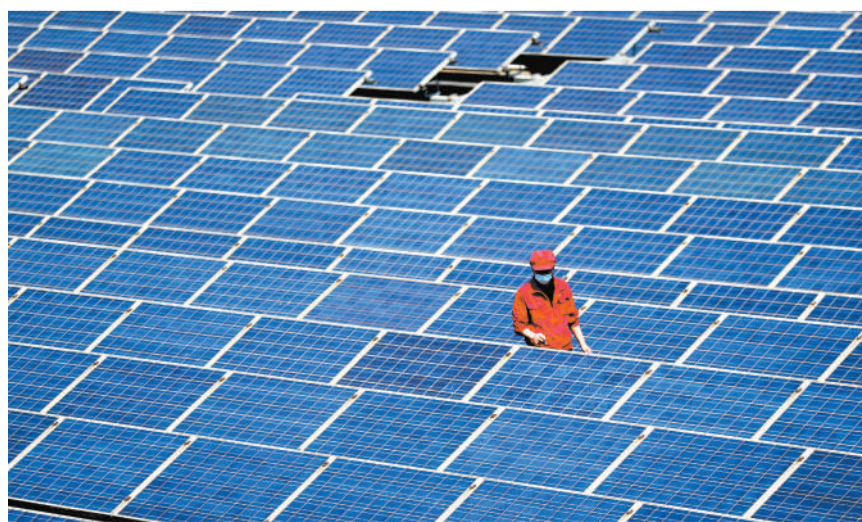
By LI Linxu

An ambitious plan to develop energy technologies that propel the country's green growth and high-quality development was released by the National Energy Administration (NEA), in conjunction with the Ministry of Science and Technology last month.

Energy is critical to a country's safety and development. To achieve goals of carbon peaking and carbon neutrality, the digital transformation of the energy sector has brought both opportunities and challenges to the energy revolution and high-quality energy development, said the plan, adding that technology holds the key to the energy revolution as it will help create future energy.

The document, titled the *Five-year Plan for Technological Innovation in the Energy Sector*, lays out the goals, tasks and measures for the following few years.

It puts forward a series of key goals to be reached by 2025, including establishing new power systems to accommodate more renewable energy resources,



A technician inspects a roof photovoltaic power generation project in Qingdao, Shandong province. (PHOTO: VCG)

developing nuclear power in a safe way, promoting clean, low-carbon and efficient development and utilization of fossil-fuel energy, and creating a more digi-

tized and smart energy sector.

Through technology innovation, breakthroughs are expected to be achieved in new energy technologies, disruptive energy technologies and major energy technological equipment, said an NEA official during a media briefing.

In the field of advanced and renewable generation and utilization technologies, the plan will focus on a more efficient, cost-effective and reliable supply of renewables such as wind, solar, biomass and geothermal energy.

To promote the integrated development of hydrogen and renewable energies, the plan pledges to tackle the key technologies of high-efficient hydrogen production, storage, charging and fuel cells.

In the field of new power systems, the plan calls for making key technology breakthroughs in strategic and prospective power grids, so as to support the construction of an advanced power grid



Ethical norms should be observed for social good by researchers. (PHOTO: VCG)

adaptive to the connection of large-scale renewable energy sources and distributed energy sources.

Meanwhile, it also calls for making key technology breakthroughs in major equipment in order to meet the energy storage needs in various application scenarios of energy systems.

With regard to nuclear energy technologies, the plan proposes to conduct the optimization research of the third generation nuclear energy technologies, enhance strategic and prospective nuclear energy technology innovations, conduct key technology research in radioactive waste disposal and nuclear power plant long-term operation, and promote

sustainable development in the entire industrial chain.

In the field of digitalization technologies, the plan proposes piloting regional smart energy systems and applying digital and smart technologies to such traditional energy sectors as coal mining, gasoline production, power plants and power grids.

To ensure the orderly running of R&D, the plan sets forth a series of measures, including establishing innovation coordination mechanisms, improving innovation platform systems, highlighting the role of enterprises, increasing investment in innovation, and enhancing international cooperation.