

# CHINA SCIENCE AND TECHNOLOGY NEWSLETTER

*Department of International Cooperation*

*Ministry of Science and Technology(MOST), P.R.China*

*No.20*

*October 25 2014*

- **Current Reform of the Management of National S&T Programs in China**
- **China's Scientific and Technological Policies and Actions on Climate Change**

## **Current Reform of the Management of National S&T Programs in China**

Drafted by the Ministry of Science and Technology (MOST) and the Ministry of Finance (MOF), *the Scheme on Deepening Reform of the Management of Central Budget-Funded S&T Programs (Major Projects and Funds)* has been approved by the CPC Central Committee and the State Council and ready to be issued and implemented. The overall objective of this scheme is to strengthen top-level design, tackle segmentation and lack of coordination, develop a goal- and performance-based evaluation system for the management of national science programs, highlight national priorities, respect the rules of science and technology and innovation, efficiently allocate scientific and technological resources, strengthen the ties between science and economy, and motivate researchers to the full extent.

The scheme reflects five principles, including

firstly, shifting governmental mandates in science and technology (S&T) management; secondly, focusing on national strategic tasks; thirdly, integrating science with economy; fourthly, clarifying government-market relations; fifthly, advocating openness, transparency and public scrutiny. The initiation of the scheme serves following policy objectives:

I. Building an open and unified national S&T management platform

MOST will lead an interagency joint meeting with the participation of MOF and the National Development and Reform Commission (NDRC). The joint meeting will set the rules of procedure, review the S&T development plans, outline S&T programs, establish strategic consulting and general review committees, and select professional executive agencies. According to the shifted

Monthly-Editorial Board: Building A8 West, Liulinguan Nanli, Haidian District, Beijing 100036, China

Contact: Prof.Zhang Ning E-mail: zhangn@most.cn hixiaosun@163.com <http://www.caistc.com>

mandates, governmental agencies will no longer be directly involved in the allocation of public funds and daily management of projects, instead map out strategies, develop plans, improve the structure of S&T programs, and inspect the implementation of S&T programs. The management of funds and projects will be undertaken by professional executive agencies.

Strategic consulting and general review committees will be set up to help decision making and provide advice on strategic planning of S&T development and programs. The committee will also provide guidance on project review and organize the review of major projects.

A unified evaluation and auditing system will be developed to provide reference for continuous governmental support, enhance the efficiency of R&D investment and generate more research findings and more talent.

A dynamic adjusting and termination mechanism will be adopted for R&D projects to refine the structure of S&T resources and meet the needs of innovation. To ensure openness and transparency, an information sharing system will be set up to provide technical support for coordination of S&T programs and seek public scrutiny by providing them with the information.

In 2013, the central budget for science and technology was 236.468 billion yuan, accounting for 11.55% of its total. According to the scheme, China's existing central budget-funded S&T programs will be reorganized into five types:

1. National Natural Science Foundation of China. NSFC will enhance research in basic sciences and science frontiers, and support researcher training and team building, in an effort to enhance innovation capability at the source of knowledge.
2. National Science and Technology Major Project. With the focus on developing major products of national importance and facilitating their commercialization and industrialization, the science and technology major projects will bring together multiple stakeholders

in a joint effort to address scientific and technological bottlenecks within a timeframe.

3. National Key R&D Program. With the focus on strategic, basic and forward-looking scientific issues concerning industrial core competitiveness, innovativeness and national security, key generic technologies and products, international programs and projects, and long-term research that is vital to people's wellbeing, such as agriculture, energy, environment and health, this Program will strengthen interagency, cross-sector, and cross-region collaboration in research and development by initiating R&D projects in specific fields, in an effort to spur economic and social development.
4. Technology Innovation Guide Fund. Based on the market rules, the Fund will guide and support enterprises' technological innovation activities through various ways such as risk compensation, post subsidy and venture capital, so as to facilitate technology transfer, capitalization and commercialization.
5. Infrastructure and Talent Program. The Program aims to improve research infrastructure, and promote the sharing of S&T resources, in a bid to create an enabling environment for innovators and research teams.

These five types of programs will be brought under an open and unified national S&T management platform. The central budget will increase support for the platform.

One highlight of the Scheme is the establishment of the National Key R&D Program, which will incorporate several current programs, including the National Basic Research Program (973 Program), National Hi-tech R&D Program (863 Program), Key Technologies R&D Program and International S&T Cooperation Program under the management of MOST, the Industrial Technology R&D Fund under the management of NDRC and the Ministry of Industry and Information Technology (MIIT), as well as scientific research projects for

social wellbeing of relevant departments. The National Key R&D Program is designed to address key S&T issues with strategic importance for economic and social development in priority areas by systematically organizing major S&T projects. The Program covers basic, cutting-edge and key generic technologies as well as systematic design of application and demonstration, aiming to clarify the demand and industrialization direction for basic research and cutting-edge R&D activities, as well as accelerate the shift of the latest research achievements toward downstream innovation activities.

The Scheme will be implemented in three steps. In

2014, the government will initiate the building of a unified national S&T management platform, integrate and optimize S&T programs, and launch pilot projects in priority areas. From 2015 to 2016, the government will basically complete the building of the platform, with the integration of programs and coordination of budgets. In 2017, after the three-year transition period, the five types of S&T programs will be under full operation, while the existing funding schemes will be terminated. The reform of central budget-funded S&T programs will be constantly deepened amid practices.

(Source: Ministry of Science and Technology, October 31, 2014)

---

## China's Scientific and Technological Policies and Actions on Climate Change

Since the 12<sup>th</sup> Five-year Plan was put in place, the Ministry of Science and Technology (MOST) has, following *the National Program on Addressing Climate Change and the 12<sup>th</sup> Five-year Plan for Scientific and Technological Actions on Addressing Climate Change*, coordinated and organized the scientific and technological work on addressing climate change, strengthened related strategy and policy guidance, and conducted scientific research, technological demonstration and application, and promoted international scientific and technological cooperation in the field. Considerable progress has been made in the following aspects:

### **I. Plans, strategy studies and technology dissemination**

In 2012, the 12<sup>th</sup> Five-year Plan for Scientific and Technological Actions on Addressing Climate Change, the first of its kind ever in China, was promulgated, setting out the priorities, R&D directions, and implementation mechanisms for addressing climate

change in the coming five years, and serving as a guide for related agencies and local governments in their efforts to conduct relevant work toward climate change. In the same year, the Ministry of Science and Technology put forward the overall arrangements, goals, main tasks and guarantee measures for basic research concerning climate change, involving the impact of human activities on global changes, climate change impact and adaptation, and earth system models. In 2013, *the 12<sup>th</sup> Five-year Plan for Carbon Capture, Utilization and Storage (CCUS)*, compiled by MOST, was released, setting out detailed arrangements for CCUS research, development and demonstration (RD&D). The government guides large enterprises' involvement in RD&D, and has established CCUS industrial technology innovation alliance to facilitate relevant work.

In strategy studies, the Ministry of Science and Technology has organized top scientists and experts in China to compile the second and third National

Assessment Report on Addressing Climate Change. The documents have made systematic evaluations of the key issues concerning climate change, and provided accurately and objectively a full picture of the most important research progress lately in the field, offering important theoretic and practical references for the efforts to address climate change. In 2011, *Research on China's National Strategy for Climate Change Adaptation* was promulgated, reviewing China's current status and needs for adapting to climate change, raising major issues, priorities and actions, and proposing recommendations for capacity building in the regard. In addition, the Ministry of Science and Technology has launched projects for the purpose, such as Scientific and Technological Actions on Addressing Climate Change, and International Negotiations on Climate Change and Research and Application of Key Emission-reducing Technologies in China, which have informed decision-making on addressing climate change.

In order to implement the State Council's *Work Plan for Controlling GHG Emissions during the 12<sup>th</sup> Five-year Plan Period*, the Ministry of Science and Technology has released *the List of Energy-efficient and Low-carbon Technologies for Commercialization*, greatly facilitating the use of demonstrative low-carbon technologies. Following the list, enterprises have adopted applicable new energy-saving, low-carbon processes and technologies to accelerate upgrading of related industries.

## **II. Climate technology demonstration and application**

During the 12<sup>th</sup> Five-year Plan period, with the aim to improve energy mix, save energy, cut CO<sub>2</sub> emissions and mitigate climate change, China has focused on developing key energy technologies and two strategic emerging industries, i.e. new energy and environment-friendly industry. And China will take further efforts to increase innovation capacity in energy sector on a sustainable basis and provide technological support for the targets of slashing China's CO<sub>2</sub> intensity by 40-45

percent, and increasing the ratio of non-fossil energy in the energy mix to 15 percent by 2020. In order to fulfil the national targets, the Ministry of Science and Technology has deployed climate research projects in several national R&D programs, including Key Technologies R&D Program, 863 Program and 973 Program. Some key projects are listed as follows:

### **1. CCUS technologies**

The Ministry of Science and Technology has drawn up and issued the 12<sup>th</sup> Five-year Plan for Carbon Capture, Utilization and Storage, and set up CCUS Industrial Technology Innovation Alliance, and a group of technology RD&D projects was arranged with aim to boost industrial competitiveness and innovativeness in CCUS field.

For example, China Shenhua Group Co Ltd completed a demonstration project of high-concentration CO<sub>2</sub> capture and geological storage for its coal-to-liquid project with annual output of 300,000 ton, and put it into operation in 2011. Its CO<sub>2</sub> injection capacity has already met the designed requirements of 100,000 tons a year. China Petroleum & Chemical Corp. (Sinopec) has independently developed new efficient amino solvents for CO<sub>2</sub> capture for its coal plant flue gas CCS project, which prove to be much less energy intensive than traditional methods, effectively resolving some problems such as high energy consumption generated during the CO<sub>2</sub> capture process.

Under the program on developing large oil and gas fields and coal-bed methane, two projects, i.e. the key technologies of CO<sub>2</sub> flooding method and storage and technological demonstration of CO<sub>2</sub> flooding method and storage in Songhua-Liaohe river basin, were launched in 2011, developing the method of using CO<sub>2</sub> injection for safe and efficient development of volcanic gas reservoirs and for enhanced oil recovery. This provides technological support for building China's first and the world's second industrial-scale CO<sub>2</sub> flooding method and storage experiment base.

In 2013, under the Key Technologies R&D Program, demonstration projects on CO<sub>2</sub> chemical utilization, CO<sub>2</sub> mineralization, coal plant CO<sub>2</sub> capture, and CO<sub>2</sub> for enhanced coal-bed methane and CO<sub>2</sub> storage were launched. Now, China has launched a series of CCUS technology-development and demonstration projects, including pre-combustion, post-combustion, oxygen-enriched combustion for CO<sub>2</sub> capture, CO<sub>2</sub> injection for enhanced oil and gas recovery, CO<sub>2</sub> chemical utilization and CO<sub>2</sub> mineralization, and CO<sub>2</sub> storage in saline aquifers.

## 2. R&D on emission-reduction technologies in energy and resources

A series of R&D projects have been launched in the field of energy and resources, with the emphasis on clean coal, smart grid and renewable energy technologies. And coal-to-gas and wastewater control, efficient wide-load ultra-supercritical thermal power unit, ultra-clean emission control of large coal-fired plants, efficient combustion and low emission of industrial boilers, smart power meters and comprehensive energy utilization were included in the 2015 project guide. Active efforts have been made to implement the action plan on air pollution control, including the installation of IGCC, 600MW super-critical circulating fluidized beds, ±160KV multi-terminal flexible DC power transmission, and 10 MW solar thermal power towers.

## 3. R&D on emission control technologies in communication

New energy vehicle is an important direction for technological innovation and industrial upgrading in Chinese automobile industry, and an effective means for energy conservation, emission reduction and air pollution control. With continuous efforts of the industry and academia, notable progress has been made in developing key technologies for plug-in hybrid buses, new hybrid coaxial dual-motor systems for new energy buses, motors and controllers for high-density battery-electric cars, and plug-in hybrid city-buses such as the type of TEG6129PEV. So far hybrid buses are basically

commercialized, battery-electric passenger vehicles have gone through large-scale demonstration operation, and independent R&D and manufacturing capability for fuel cell vehicles have been strengthened. In terms of key components and parts, the lithium ion power battery research has made important headway, and the electric drive system has been capable of commercialization. In the building of public platforms, new energy vehicle standards and test beds for whole vehicles, batteries, and motors have been in place. Various business models for scaling up new energy vehicles have been explored, and demonstration operation of new energy vehicles has been conducted nationwide.

## 4. Energy-efficient technologies in the construction industry

In the building sector, R&D projects have been launched in the development of technology and standards, building materials and products, and technological integration and demonstration, aiming to enhance the competitiveness of China's green building technology, service, product and industry. The integration and application of applicable energy-efficient building technologies have been widely promoted, and green building demonstration projects have been developed in 20 provinces and cities nationwide, covering buildings of various styles in different climate zones. With the aim to develop low-carbon cities, China has developed key construction techniques and conducted demonstrations, promoted urban redevelopment and efficient use of land, and improved decision-making over urban planning, making the cities more livable.

Evaluation technology and standards for green building, both at national and local levels, have been put in place, covering different architectural styles. This will provide important support for the release, amendments and post-assessment of *China's Green Building Evaluation Standards*. It is also an important basis for developing *Evaluation Standards on Green Shops and Stores and Evaluation Standards on Green Hospital*

*Buildings*, and for carrying out studies on evaluation indicators for green industrial buildings.

#### 5. Relevant technologies in materials

Due to the required emission reduction for the steel industry, arrangements have been made for several projects including “high quality special steel technology”, “development and application demonstration of technologies for the use of waste residue and waste heat”. It is planned to build demonstration equipment for the recycling of coke furnace smoke, sintering waste heat and converter waste heat. In addition to this, the project has developed a number of emission-reduction technologies through “new generation metallurgy process driven recycling technology”. For example, the technology for controlling the smoke from molten iron pouring out of crucible; technology for the removal of NO<sub>x</sub> and Dioxin from the sintering waste heat. As a result, certain success has been achieved in reducing environmental pollution.

#### 6. R&D on technologies in agriculture and forestry area

During the 12th five-year plan period, arrangements have been made for dedicated research of agriculture climate change adaptation. Through the national technology support plan, the following projects have been carried out, including “forestry eco technology project”, “Key technology research and commercialization demonstration for Greater Khingan forest resources restoration and utilization”, “Key technology research and demonstration for the North East forest carbon emission sinks”, “development of agricultural eco-system fixed carbon emission reduction and greenhouse gas analysis technology”. In addition to the above, through the project “Technology integration and demonstration of emission reduction for the animal husbandry and breeding industry”, some key technologies focusing on the pollutant control of intensive pig farms, and on the environment protection and waste recycling of poultry farms, were developed; foul water treatment and residue treatment system is established to ensure the emission of

the pollutants meeting national standards.

In climate change adaptation, relevant scientific research and technologies development have been carried out in the following aspects:

#### 1) Climate change monitoring, evaluation and forecast technology

Arrangements have been made for earth system model research, including the related high efficiency parallel calculation method and application framework. The first parallel coupler in China was developed, supporting development of the physical climate system model. The new version FGOALS\_G2.0 of climate system model was also developed. Relevant work for the fifth evaluation report (AR5) of the intergovernmental panel on climate change (IPCC) was conducted. In addition to this, a high resolution global ocean current circulation model at resolution of 10km and a high-resolution global atmospheric circulation model at resolution of 25km were developed. The research achievements have been put into application at Beijing Normal University, the National Climate Centre and the Chinese Academy of Science.

In the numerical forecast model area, high resolution, long effectiveness GRAPES global mid term forecast model system was developed, forming a reliable quality data base of nationwide ground, high altitude weather and radiation, achieving important application in reducing and preventing disasters, and providing realtime weather service for important events. The GRAPES\_TMM tropical weather model and GRAPES\_TMM tropical cyclone model were further developed for improving forecast accuracy for cyclone path. In addition to this, dynamic statistical predication method and numerical forecast key technologies were developed for sustained weather anomalies in China.

#### 2) Weather system monitoring, forecast and early warning

In the area of weather monitoring, sandstorm monitoring

achieved a report every six hours world wide, and every half hour for China with its local area. A comprehensive criteria of evaluation system for sandstorm effect in North West China was established, providing integrated North West sandstorm satellite remote monitoring and effect evaluation service system of numerical forecast and GIS. In addition to this, a model with independent intellectual property rights, Asian sandstorm numerical forecast system, has also been established

In the area of weather forecast, city group weather forecast model covering the area of Beijing, Tianjin and Hebei province has been established; a weather report system was also established for high effect weather for regional torrential rain, heavy fog, snow suitable to Beijing, Tianjin and Hebei province, which has greatly improved weather forecast service ability over the area.

Also, research institutes have carried out studies for regional environmental monitoring and land-surface process monitoring, and established a regional remote information system and global ground surface remote data and characteristics parametrical data base.

### 3) Technologies for industrial sector's adaptation of climate change

Due to the need of impact evaluation on climate change in agriculture, water resources, coastline, natural disaster, and the requirement for developing adaptation technologies, arrangements have been respectively made, including "technology and application for climate change effect and risk evaluation in key areas" "technology development and application for adaptation of climate change in coastline regions technology", "technology and application for climate change effect and risk evaluation in the key area of Northern China", "technology development and application for draught condition monitoring and water resources allocation in arid and semi-arid region". Some notable progress have been made in the projects.

Due to the situation of natural disasters such as

draught, flooding, low temperature and forest fire in China, a holistic natural disaster monitoring system shall be built for agriculture, forest and weather system; a monitoring, warning and dynamic evaluation service system shall be developed; a risk evaluation software and regional model shall be worked out; comprehensive risk management policy shall be set down; and scientific evidence for preventing and reducing disasters shall be provided.

Relevant research and evaluation in the area of water resources have been carried out. For example, evaluation on the potential of development and utilization of the Tianshan cloud and water resources, and evaluation on the impact of climate change; evaluation on the effect of regional eco-system caused by rising sea levels. Research results have called for adaptation technologies to protect flood safety, water resources safety and eco-system safety in coastal regions.

In the area of forestry, a high efficiency system combining agriculture and forestry was carried out in the North East, North West, and North, Central South, South West hilly regions and the Yellow River and Huai River plains of China. Experiment and demonstration of protective woodlands around Yangtze River catchments area were also carried out. Based on regional developmental needs, relevant technologies have been utilized, involving forest system for water resource conservation in above-mentioned North regions, forest system for water and soil conservation in yellow soil area and Northern China stone rocky mountainous areas, and forestry system for the safety of regional eco-system.

### 4) Research and demonstration for the elimination of smog

Arrangements have been made through projects in national technology support plan, such as technology development and demonstration for smog monitoring and its numerical forecast", "development and demonstration of key technologies for the control of residential coal burning and dust emission generating in Beijing region",

thus relevant work in regional smog monitoring and its numerical forecasting was effectively enhanced with stronger technology support for reducing and controlling smog events. A project named “air quality monitoring and warning technology and its demonstration over Beijing, Tianjin and Hebei province” was also started to meet needs on the ground, which has greatly improved air quality monitoring for the region. Moreover, research activities were carried out on technology development for air pollution sources identification and predication, regional air quality numerical forecast, regional air quality warning and decision making support, regional air quality improvement by joint actions, and so on.

### **III. International technology cooperation on Addressing climate change**

To fully utilize international advanced technological resources to promote domestic work responding to climate change, the Ministry of Science and Technology actively promotes China-Europe, China-Australia cooperation on carbon dioxide capture, storage and utilization. And through China-US clean energy joint research centre, the Chinese side strengthened the building of technology capability in response to and the adaptation of global climate change, taking initiatives to participate in clean energy ministerial meeting and carbon capture leader forum, facilitating global clean energy technology, low carbon technology, and climate-friendly technology spreading to China.

The Ministry of Science and Technology has been proactively strengthening contacts and cooperation with international organizations. Since 2008, in order to help African countries to enhance their capacity building in responding to climate change, the project “MOST, UNEP and African water action” was launched, utilizing China’s appropriate technologies to help African countries with water resources regulations, utilization , and eco-system protection, draught early warning system and adaptation, increased capability building in draught area for water conservation agriculture, prevention of desertification.

These efforts have achieved evident results, and are highly regarded by recipient government leaders and the international community. In addition to this, since 2011, MOST and UN organizations, including UNDP, UNESCO and UNEP jointly convened three rounds of “Technical Training on South-South Cooperation on Science and Technology to Address Climate Change”, strengthening China-African communications with wide topics, such as China’s foreign policy and actions on climate change adaptation, current situation on climate change adaptation in relevant African countries, African technology requirements and some cooperation case studies. The joint events have effectively promoted South-South Cooperation in the development of appropriate technology for climate change adaptation.

### **IV. Expectations**

Since the twelfth five-year plan period, the Ministry of Science and Technology has been organizing and coordinating scientific research, technological development, and relevant work for addressing climate change, such as formulating strategic planning on addressing climate change, promoting basic research, carrying out technology application and demonstration, strengthening international dialogue, communication and cooperation on the topics of global climate change, effectively supporting the China’s policies and actions for addressing climate change.

Facing the future, the Ministry of Science and Technology will continuously promote China’s green- and low-carbon development. By further developing renewable energies and CO<sub>2</sub>-reduction technologies, improving energy efficiency, promoting CCUS technology development and demonstration project, and strengthening measures to facilitate R&D on risk evaluation and adaptation technologies, China’s scientific and technological work for addressing climate change will go into a new stage and provide a solid support for the country’s social-economic development in a sustainable way.