PAKISTAN ATOMIC ENERGY COMMISSION (PAEC)

Pakistan Atomic Energy Commission (PAEC) has, over the years, built an extensive infrastructure for contributing to the socio-economic uplift of the country. Its activities span a wide spectrum: from nuclear power generation to minerals development, from developing high yielding, stress tolerant crops to the treatment of cancer, and from design and fabrication of industrial plants/equipment to human resource development.

PAEC is now the largest Scientific and Technical organization of the country, both in terms of scientific / technical manpower and the scope of its activities. Starting with a nuclear power plant at Karachi (KANUPP) and a research reactor (PARR-1) at Nilore, Islamabad (PARR-I) and Atomic Energy Mineral Centre, Lahore, the emphasis has been focussed on the peaceful uses of nuclear energy. Consequently research centres in agriculture, medicine, biotechnology and other scientific disciplines were set up all over the country. As the emphasis shifted towards concerns for national security, important projects were also initiated in this area.

PAEC is charged with the promotion of, and research work on the peaceful uses of atomic energy in the fields of nuclear power, agriculture, medicine and industry, as well as the execution of development projects to support and expand the peaceful uses of atomic energy.

Accordingly the commission is engaged in:-

- Programmes to develop nuclear power and fuel-cycle facilities.
- Promotion of use of radiation and radio-isotopes in agriculture, medicine and industry.
- Research, development and training of manpower to support the programmes of nuclear power and radio-isotope applications.
- Contributing to basic research in collaboration with world scientific bodies
- Assisting local industry through Research & Development Based upon the excellence of its research labs and human resource quality, PINSTECH, a research institute of PAEC has been declared Regional Resource Centre of IAEA.

NUCLEAR POWER

Nuclear power is environment friendly (no CO_2 emission) and cost competitive. It is independent of seasonal effects and provides security of electricity supply. Owing to these unique characteristics, it augurs well for sustainable development. PAEC is successfully operating three nuclear power plants with two more under construction, has more than four decades of experience in safe operation of nuclear power plants at its credit and plans to build more nuclear power plants in the coming years to contribute to the energy requirements of the country. According to Energy Intermediate Plan of GOP, PAEC is responsible to generate 8800 MWe from nuclear power plants by year 2030.

Karachi Nuclear Power Plant (KANUPP)

KANUPP, Karachi is a single unit CANDU PHWR with a total gross capacity of 137 Mega Watts. It has been in commercial operation since 1972. Following the withdrawl of vendor support and imposition of embargoes by major nuclear countries in 1976 (four years after commercial operation of plant) KANUPP has faced numerous challenges during its over four decades of operation. A committed self-reliance programme by PAEC and KANUPP, however, kept the plant operational throughout the difficult period.

The safety records have been extremely satisfactory as testified by regular testing and reliability analysis. Average personnel radiation exposure has been well within the prescribed limits of International Commission on Radiological Protection (ICRP).

With the replacements and refurbishing of the nuclear island as well as conventional equipment, the operating life of the Plant is expected to be extended to 2019, i.e. 15 years beyond its designed life of 30 years. KANUPP is still operating and connected to KESC grid.



KANUPP PHOTO

Chashma Nuclear Power Plant

The **Chashma Nuclear Power Complex** near Chashma, is a commercial nuclear power generation complex, consisting of Chashma Nuclear Power Plant-I (C-I) and Chashma Nuclear Power Plant-II (C-2) in operational, and C-3 and C-4 under construction. The nuclear power plants and other facilities are being operated by the Pakistan Atomic Energy Commission.

The construction of C-1 (325 MWe), the second nuclear power plant in Pakistan, was started in 1992 with the help of People's Republic of China. It has been in commercial operation since September 2000. C-2 (340 MWe) is operational since May 2011. Both of these plants are the highest capacity factor plants of the country and supply electric power to WAPDA at most competitive rates (as compared to all thermal power plants. The under construction nuclear power plants (C-3 and C-4) 340 MWe each will be ready for operation by year 2016-17.

To meet the nuclear power target (8800 MWe) given by GOP, PAEC has planned to build more nuclear power plant in the country at different locations.





C-1 & C-2 PHOTO

SCIENTIFIC AND ENGINEERING SERVICES DIRECTORATE (SES)

SES is one of the establishments of Pakistan Atomic Energy Commission (PAEC) which provides Engineering support in Design and Manufacturing of Mechanical Equipment not only to all PAEC projects but to Strategic Organizations and National Industry as well. SES is equipped with specialized facilities to design, manufacture, inspect/test and install a vast variety of mechanical equipment like Pressure Vessels, Storage Tanks, Heat Exchangers, Electric Overhead Travelling Cranes, Steel Structures and other Mechanical Equipment / Components for Nuclear Power Plants, Energy Sector and other Industries. The services provided by SES are extended to training and certification in the specialized fields of non-destructive testing (NDT) and welding.

PAEC is assisting the local industry in its growth and competitive capability by providing:

- Design and fabrication services for the manufacture of large-scale mechanical systems, complete plants and modules
- Training/certification in welding techniques and site services for manufacturing & installation of plants
- Training/certification in Non-Destructive Testing Techniques along with services for testing of manufactured equipment and in-service inspection of plants

SES has three centres of excellence as mentioned below.

HEAVY MECHANICAL COMPLEX – 3

Heavy Mechanical Complex-3 (HMC-3), Taxila is providing design, engineering and manufacturing services to all projects of PAEC specially the nuclear power plants as well as the national and international clients in energy & power, oil & gas, chemical & processing and industrial & engineering sectors. HMC-3 is well equipped with the latest computer aided design set-up and large workshops as well as inspection & NDT testing facilities. HMC-3 is authorized to use A, S, PP, U & U2 stamps of American Society of Mechanical Engineers (ASME) and has National Board's certification. It has certificates of authority of American Petroleum Institute (API). It is registered with Pakistan Nuclear Regulatory Authority (PNRA) to manufacture nuclear grade pressure retaining equipment of all nuclear safety classes. It is working in accordance with ISO-9001 quality management system.



HMC-3 PHOTO

NATIONAL CENTRE FOR NON-DESTRUCTIVE TESTING (NCNDT), Islamabad

National Centre for Non-Destructive Testing (NCNDT) was established by PAEC to meet the specialized NDT/NDE requirements of nuclear facilities. NCNDT is located at Islamabad and provides non destructive testing services to PAEC establishments as well as to various industries and conducts training courses for all public and private sector organizations.

The centre is fully equipped and well staffed for carrying out the following jobs:

i. Training of NDT personnel at various levels.

ii. Certification of NDT personnel at various levels.

iii. NDT services to PAEC establishments and various industrial sector of Pakistan during manufacture, fabrication, Pre-service Inspection (PSI) and In-service Inspection (ISI).

iv. Mechanical testing of materials, weld procedure, and welder qualification.

v. Third party inspection.



NCNDT PHOTO

PAKISTAN WELDING INSTITUTE (PWI)

Welding technology has virtually gained access to every branch of manufacturing industry either large or small. Keeping in view the challenges faced by the entire manufacturing industry in the country, Pakistan Welding Institute (PWI) was established in 1995 with the objectives of becoming a centre of excellence in welding.

Pakistan Welding Institute is committed to uphold and strengthen national standards of excellence in welding technology. PWI offers industry with technical support through various services covering all areas of welding and joining technology. PWI provides training and certification in industrial welding techniques. It also provides support to industry in this field.



PWI PHOTO

PAKISTAN INSTITUTE OF NUCLEAR SCIENCE AND TECHNOLOGY

In the late fifties, when Pakistan embarked upon nuclear program, two major constraints were immediately faced: the dearth of appropriately trained manpower and the absence of even rudiments of a viable scientific and industrial infrastructure. The solution to these problems was the establishment of research, development and training centers. The first major step in this direction was the establishment of Pakistan institute of Nuclear Science and Technology (PINSTECH), at Nilore, near Islamabad.

The major objectives envisaged by Pakistan Atomic Energy Commission in the establishment of this institute are:

- Keeping pace with the ever-expanding frontiers of knowledge in the nuclear field through **research** that meets international norms and standards.

- Serving the cutting edge of the PAEC's technological **development** for peaceful applications of nuclear energy.

- **Producing radioisotopes and radio pharmaceuticals** for catering to the needs of nuclear medical centers, industry and research establishments.

- Promoting **applications of radiation and isotope technology** in various scientific and technological disciplines to support national programs.
- Providing appropriately trained manpower through **training** to the exacting and demanding standards of nuclear sciences.

- Undertaking limited **production** of sophisticated equipment and special nuclear materials.

- Working on important non-nuclear fields which are crucial for the **development of science and technology** in the country.

As nuclear technology is essentially interdisciplinary, the R&D efforts at PINSTECH are focused on nuclear science and technology and the allied fields of physical and chemical sciences through well defined and goal oriented projects. The major thrust of the programme is geared towards direct applications in the peaceful uses of atomic energy.

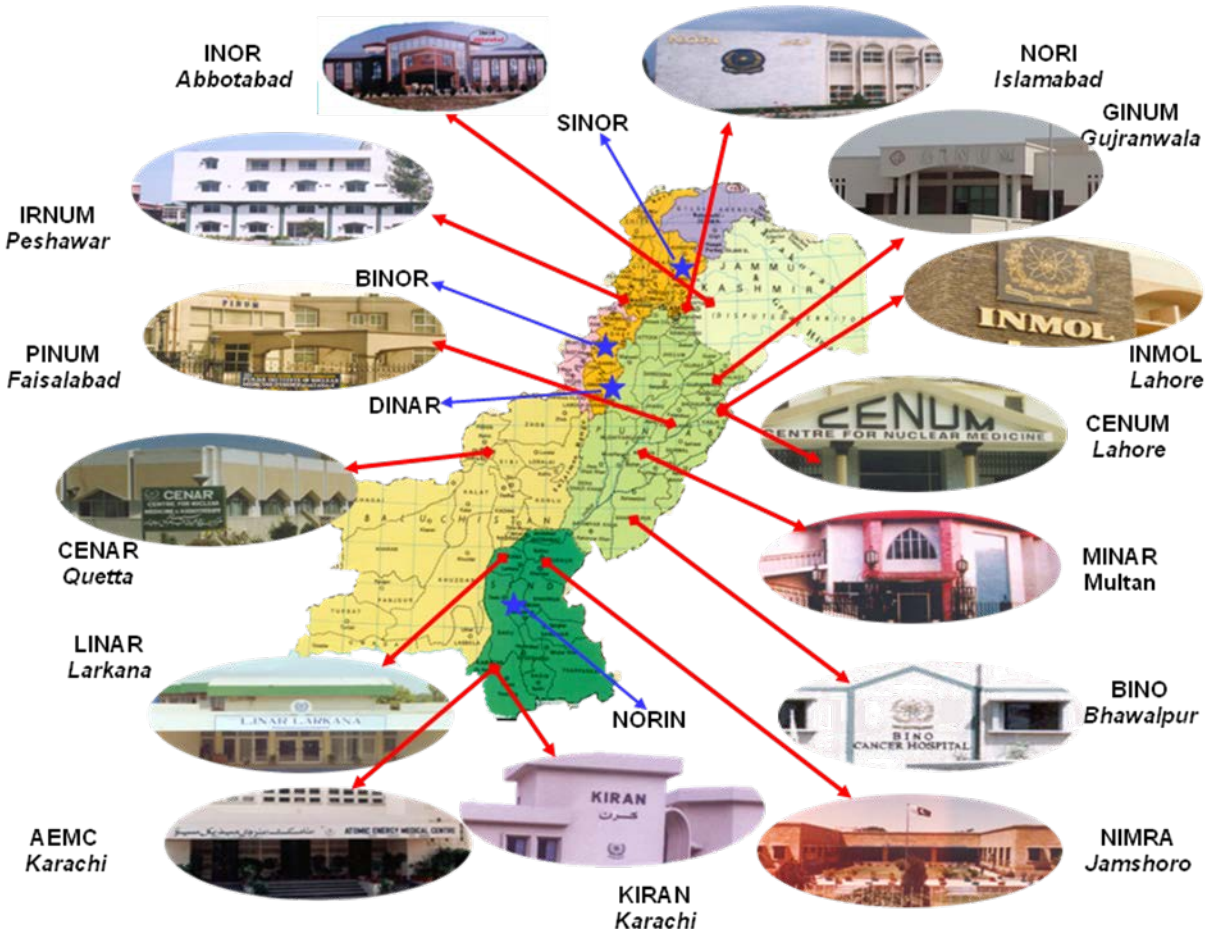


PINSTECH PHOTO

CANCER HOSPITALS

Since its inception, Pakistan Atomic Energy Commission has given high priority to the application of nuclear technology in Health Sectors. Nuclear technology is increasingly playing an important role in the modern diagnosis and treatment of various cancers and allied diseases.

PAEC have established 18 state-of-the-art Cancer Hospitals spanning the country and their number is increasing with time. Currently, 14 Nuclear Medicine & Oncology (NM&O) Hospitals are functioning throughout the country and these NM&O Hospitals provide cancer diagnostic and treatment services to approximately 650,000 cancer patients in Pakistan. Four additional Hospitals, at Swat, Bannu, D. I. Khan and Nawabshah have started OPDs, Filter Clinics and Medical Oncology facilities besides Diagnostic facilities and complete functioning expected by end of December 2012. For the hospital at Gilgit, alternate / appropriate site selection is under process.



MAP / PHOTO showing cancer hospitals
In different location in Pakistan

FACILITIES

Nuclear Medicine: All the Hospitals of PAEC have well established radioimmunoassay labs with latest equipments with effective quality control and overall quality assurance programs. Therapeutic Services by Nuclear Medicine include: Treatment of thyrotoxicosis, thyroid cancer and palliation for bone pains.

Radiotherapy: Radiation and medical treatment is provided at all Hospitals to all types of cancer patients irrespective of stages of the disease. Thus there was an over all 12% increase in patient turn over as compared to the last year.

TEACHING AND TRAINING

Continuous education and training are fundamental ingredients for sustainable human resource development for high quality patient-related services. Thus, PAEC encourages and facilitates its doctors and scientists to avail relevant training courses and workshops within as well as outside the country.

AGRICULTURE & BIOTECHNOLOGY

PAEC has given considerable importance to the promotion of the use of nuclear techniques for the development of agriculture in the country. First Atomic Energy Agriculture Research Center was established in 1962 at Tandojam which was followed by one institute established each in Punjab and NWFP namely Nuclear Institute for Agriculture and Biology (NIAB) in 1972, Nuclear Institute for Food and Agriculture (NIFA) at Peshawar in 1982 and National institute of Biotechnology and Genetic Engineering (NIBGE) at Faisalabad in 1994.





NIFA & NIAB PHOTO

The research in all these centers has been primarily focused on the utilization of nuclear techniques for optimum utilization of available resources to increase production of important crop varieties, development of better methods of conservation of inputs and products, in addition to maximum use of innovative technologies. The research activities at all these institutes are characterized by critical mix of both basic and applied research which has yielded significantly towards agricultural development of the country.

- Over the years, PAEC has developed more than 74 new high yielding, stress tolerant crop varieties, which are fetching additional income to the farmers
- Providing Saline Agriculture Technology for economic utilization of salt-affected lands in the country. Expert services in this area are provided to IAEA member countries
- Offering irradiation services for enhancing shelf life of fruits and vegetables
- Development of an indigenous and low cost Laser Land Leveler, which drastically reduces irrigation water requirement to crops
- Leading role in Bio-Tech research and applications

CROP GERMPLASM IMPROVEMENT

Main objective of the program is to develop improved varieties of crops and develop associated technologies for optimizing productivity to reduce the gap between actual and potential yields. The R&D strategy is focused on breeding for high yield and tolerance against biotic and environmental stresses as well as for higher nutrient and water use efficiency in selected food and cash crops. The applied approaches include conventional breeding, induced mutations, genetic engineering and marker-assisted tools for characterization and selection of the developed germplasm for desirable characters.

PAEC Agriculture Research Institutes being located in different ecological zones have been able to evolve 45 crop varieties of wheat, rice, cotton, sugarcane, mungbean, lentil and chickpea which are characterized by their high yield, resistance to various pests and diseases. Generally, the area covered by such varieties is nearly 60% in Sindh, 50% in NWFP and about 20% in Punjab.

HUMAN RESOURCE DEVELOPMENT

Pakistan Atomic Energy Commission is dedicatedly engaged for the development of trained and quality human resource. PAEC has a network of its own in-house educational and training institutions that encompass all major facets of nuclear science and technology. PAEC continue to update this training programme to face the emerging technological needs.

PAEC's institutes namely Pakistan Institute of Engineering & Applied Sciences (PIEAS), and Karachi Institute of Power Engineering (KINPOE) offer Masters and Ph.D. degree programmes in Chemical &

Materials Engineering, Electrical Engineering, Nuclear Engineering, Information Technology, Medical Sciences and Nuclear Power Engineering.
In all these centres, engineers, scientists and technicians are given fellowships during training and offered job in PAEC after successful completition of training programme.

Pakistan Institute of Engineering and Applied Sciences (PIEAS)
Pakistan Institute of Engineering and Applied Sciences (PIEAS)located at Islamabad, is a Public sector educational institution working under the auspices of Pakistan Atomic Energy Commission.

For the past three decades, PIEAS has served as the premier human resource development centre for the Pakistan Atomic Energy Commission (PAEC). It has conducted a wide variety of educational and training programmes. They ranged from Ph.D. and Masters' level programmes in Engineering and Medicine, to shorter specialized courses for scientists, engineers and technical staff. Hundreds of its graduates today form the backbone of most of the important projects of PAEC. PIEAS has a strong faculty of highly qualified scientists and engineers in diverse disciplines of engineering and sciences and more than 40 faculty members have PhD's from renowned universities of the world.

PIEAS has been ranked 1st in 2012 by the Higher Education Commission (HEC) as No. 1 Engineering University. This is the 2nd time it has achieved this distinction. Earlier it was ranked No. 1 by the HEC in 2006. In the overall category, PIEAS has been ranked 2nd.



PIEAS PHOTO

Karachi Institute of Nuclear Power Engineering (KINPOE)
KANUPP Institute of Nuclear Power Engineering (KINPOE), has been established by the Pakistan Atomic Energy Commission at Karachi to develop qualified manpower for its nuclear power programme for which it provides education and training to scientists, engineers and technicians. KINPOE Offers three academic programs every year

- **Post Graduate Training Program** (PGTP) One Year Program for Engineers.

- **MS in Nuclear power Engineering** Two Years Program for Engineers

- **Post Diploma Training Program (PDTP)** One Year Program for Diploma Holders



KINPOE PHOTO

Chasnupp Center for Nuclear Training (CHASCENT)

CHASCENT's mission is to produce trained human resources for safe and reliable operation of Nuclear Power Plants in Pakistan. It is located adjacent to Nuclear Power Plants at Chashma.

CHASCENT offers one year Post Graduate Training in Nuclear Power Plant Technology for engineers, and one year Post Diploma Training in Nuclear Power Plant Technology for Technicians to meet the manpower requirements of nuclear power plants.



CHASCENT PHOTO