

# Iranian scientists working on a new nuclear concept

By Farhang Sefidvash

**A** NEW nuclear power reactor concept is being developed at Aryamehr University of Technology.

The idea and the work began about six years ago, and today a small but devoted group is pursuing the idea and performing research. Justification for such an attempt is briefly as follows:

Economic wealth is the result of three factors — natural resources, manpower and technological knowledge, the latter being essential to the fulfillment of the others.

In today's world, a nation such as Iran cannot simply buy nuclear power plants and remain dependent on other nations' nuclear technology because among the forms of exploitation that a country may face military, economic, political and technological the last one is the most devastating.

In a world where individual nations consider their own interests above the interests of all others, and a world which is often described as spiritually destitute, morally bankrupt, politically disrupted, socially convulsed and economically paralysed, one cannot expect to accomplish a transfer of nuclear technology in the true sense. Thus the need remains for the development of an independent national nuclear technology.

A careful analysis of present reactor concepts in the light of the knowledge accumulated over two decades, can lead us to a better concept incorporating the best features of existing nuclear power reactors while trying to avoid the faults.

This will result in a concept worthy of development while the technology related to

components can be developed locally or acquired from other nations on a more competitive basis. The Aryamehr concept claims to fulfill these criteria and therefore, it is suggested that Iran support its development and construct a prototype as an indigenous venture.

The construction of the first plant may not be economical in the purely financial sense, but it is highly economical in terms of the technology it will bring with it. Consequently, this reactor may be a proper instrument for the transfer of nuclear technology.

Transfer of technology is only accomplished through involvement in development and construction of the systems. Raw knowledge may be transferred through literature and instructions, but applied technology is not transferable in that manner. Nuclear technology is acquired only through involvement in the development of a prototype nuclear reactor.

The design of this reactor utilises the best features of many existing and the long forgotten reactors. In some respects it resembles the pressurised water reactor in which the reactor is moderated and cooled by light water under pressure.

In another respect it resembles the Candu reactor which uses calandria tubes. But unlike all existing reactors, the nuclear fuel consists of spherical elements floating in the coolant in the form of a fluidised bed.

A change in power is obtained by changing the speed of the coolant pumps, making use of control rods unnecessary. An interesting feature of the reactor is that it

pumps turn too fast or too slow, resulting in an important safety feature.

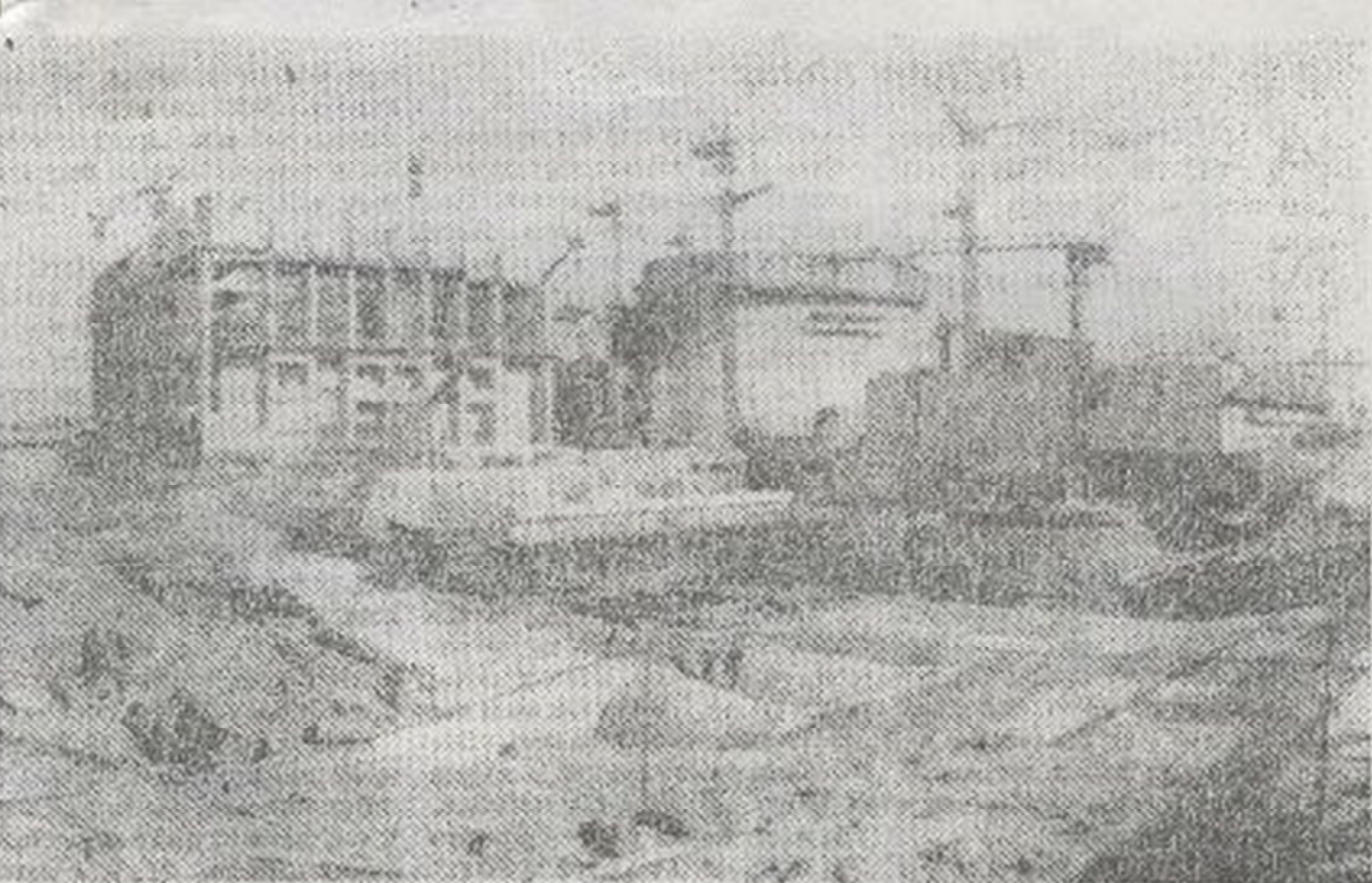
Details of this reactor concept were published in the Iranian Journal of Science and Technology, Volume 7, No. 4, 1978. Results of the reactor physics calculations and hydraulic experiments obtained will soon be published in the Journal of Nuclear Engineering and Design.

Some of the advantages of this concept in comparison with, for example, the pressurised water reactor are as follows:

1. The design is relatively simple and can be developed and built in Iran.
2. Refueling of the reactor is performed continuously, while the reactor is powered, therefore there is no need for the reactor to be shut down for refueling every year.
3. The reactor comprises many independent and identical modules, so one can design and construct a reactor with any power capacity merely by varying the number of modules.
4. Since the reactor is made up of many smaller independent units, the worst possible accident envisaged — the loss of coolant — would not be serious for this reactor because each module contains only a modest amount of energy.
5. The control systems are simple and reliable. The reactor has many inherent safety systems and are also fail safe.
6. The fuel fabrication techniques for this reactor are relatively simple.

There are many other advantages but they are too technical for the scope of this article. Interested readers are referred to the above mentioned sources.

The development and construction of a prototype will result



*The Bushehr nuclear power plant under construction; a traditional nuclear concept.*

Iranian scientists and engineers and will provide them with a deep understanding of power reactor technology and even PWR technology.

It will also give Iran a chance to become a reactor manufacturer in the future.

Today Iran is in a good position to participate in the development of a new reactor concept because it has a large nuclear programme and the material means to support it. In view of Iran's programmes for industrialisation, such a venture will help to set a standard for all other sectors of our industry.

This is due to the high quality control the nuclear industries demand. The first prototype may be designed to work under lower temperatures and pressures than today's modern reactors. Therefore it may be built with fewer

sophisticated features, putting it well within the capabilities of Iranian scientists.

All nuclear scientists realise that the pressurised water reactor so popular today is not the best reactor in existence. The PWR was conceived over two decades ago on the basis of the knowledge available at that time.

Today Iran is at the beginning, and logic dictates that we should develop a new reactor concept based on the latest knowledge rather than pursue a system which is likely to be obsolete by the end of this century.

The proposed reactor concept has been reviewed by scientists at the Reactor Division of the United Kingdom Atomic Energy Authority, Winfrith, the Nuclear Engineering Department of North Carolina State University in the USA, the Nuclear Power group of

the Imperial College of Science and Technology in England, the Institut fuer Reaktorentwicklung der Kernforschungsanlage in West Germany and others who have confirmed its technical feasibility.

At the present time the research and development programme is being carried out at Aryamehr University with the cooperation of interested scientists for other Iranian institutions. The project is supported by a modest research budget supplied by Aryamehr University.

Also participating is the eminent scientist Dr. M.R. Haroon from the Pakistan Atomic Energy Commission who was invited by the university through RCD. There are four groups performing reactor physics calculations, hydraulic experiments, heat transfer calculations and development of fuel fabrication techniques.