

## Feature

## Science and Technology

## Wind Energy

## Prospects and Potentialities in Bangladesh

by Md Fazlur Rahman

## Prospect of Wind Energy in our Hilly Regions:

ENERGY is the vital input for our national development and in particular electricity has a very important role to play in improving the quality of life and to enhance economic growth. The per capita generation of electricity in the country is only 80 kWh, which is much lower than the average of the Asian countries amounting to 600 kWh or the neighbouring countries like India and Pakistan amounting to more than 300 kWh. In Bangladesh only about 12% of the total population has access to electrical power.

Our electrical power supply is mainly based on petroleum fuels, natural gas and coal. Petroleum fuels are imported from other countries. These are very costly. From the information available, of the 1990-91 fiscal year about the production of electrical energy we can see that about 77% of the total electrical energy is produced from our natural gas. Our limited amount of natural gas is also being vigorously used for fertilizer production, petrochemical industries and domestic applications. There is, however, no reason for confusing the extractable stock with the projected total reserve estimated at about 12 trillion cubic feet. Only the amount ready so far for extraction has the capacity to sustain the country for another 19 years. A stock of 50 years, according to the experts is a safe bet. We have also a very modest storage of coal at a depth of 2000 to 3000 ft below the surface and very limited hydro-electric power capability.

If we can reduce the use of natural gas in electricity generation we can use it in other more useful and profitable sectors. So from today it is very much important and wise to focus our attention to other renewable resources. Among which wind energy can play a mighty role in this regard.

Wind energy is one of the most attractive source of renewable energy and potentially valuable source of energy in our country. It can find particular application in the development of integrated energy system in the rural areas where good winds are available and commercial power is not available.

A Danish medium size wind turbine of 250 KW capacity has been considered. The life of the turbine is considered to be 20 years. The total energy produced by the plant per annum is considered to be 490000 kWh. So the total amount of energy produced by the wind turbine is 9.8 GWh. In our local currency the cost of which is about 20 million taka. From the economical

point of view the amount of gas or the amount of petroleum fuel to produce this amount of energy is saved. So the pressure on the gas sector or on our foreign currency, spent for importing crude oil is relaxed.

A journal named "Wind Energy Data for India" by Anna Mani and D A Mooley shows that a wind farm of 4 MW capacity saves 1000 tons of fuel oil per year.

## Application of Wind Energy in Shrimp Cultivation:

There is a great prospect of wind energy in the field of shrimp cultivation. Recently in some national dailies shrimp is designated as "The White Gold" of our country, by exporting which we can earn about 1250 billion taka in foreign currency per year. Our coastal areas are blessed by God with the brightest prospect of shrimp cultivation. The golden prospectus region has been enriched with good winds.

The coupling of these two prospective resources may contribute substantially to achieve the goal of poverty alleviation, the main target of the present Govt. We have energetic winds in our coastal regions from which we can harness energy. In shrimp cultivation we need electrical power for driving aerators, pumps, blowers etc. By wind turbines we can replace the electrical power since the expansion of this very prospective field is great hindered by the limitations of electrical power.

The replacement of electrical power by wind energy may help largely to achieve the goal of shrimp cultivation. We can install different sizes of wind turbines according to the sizes of power requirements of the shrimp cultivation farms. A single wind turbine installed in a shrimp farm may serve all the purposes if we use a vertical axis wind turbine with a flexible

shaft. This type of turbines may be locally produced using local technology and materials.

## Application of Wind Energy in Agriculture:

Bangladesh is an agricultural country. Our national economy mainly depends on the agricultural sector. The agriculture needs supply of

A recent study conducted by the BADC shows that more than 36730 low lift pumps of about 40 feet head and 2 ft 3 discharge were in operation throughout the country. It is claimed that there is a surface water potential for a total of 54700 LPS of 2 cussed capacity. Additional surface water sources have been created

low tube wells are to be run in most cases by diesel engines and in other cases by electric motors. The non-availability of electricity and irregular supply of diesel fuel in remote rural areas affect the existing irrigation schemes adversely. To run these pumps power of the order of 2 KW to 5 KW is required. We can also see from wind power calculation that it is possible to harness 5 KW to 10 KW of power from 100m<sup>2</sup> of swept area of the wind turbine at the height of 10 metres above the ground. It is therefore believed that wind turbines may be used for pumping water. As the wind turbines will have low and variable speeds, centrifugal type pumps will not be suitable. Positive displacement type pumps like Gear pumps, Diaphragm pumps, Cylinder pumps, Jet pumps and Reciprocating pumps are suggested.

## Grid Connection:

During the hottest and the driest months of March, April, May and June we have good winds throughout the country specially in the coastal regions. During that dry period water head for total utilization of all the generators of the Capital-hydra-electric plant remains considerably low. So all the generators are not used.

The wind power of that season can be incorporated in the electricity grid on a substantial basis, by installing the wind turbine farms in the most convenient areas of Chittagong, Patenga and Cox's Bazar. According to the wind data analysis in this paper we can see that we have energy enriched winds in those regions from which we can extract several MWs of electricity.

Thus we can add reliability and consistency to the electricity generated by the hydroelectric plant during those hottest periods.

## Other Important Applications:

i) Due to the adverse effect of the Farakka barrage drought or late raining is our com-

mon feature specially in the northern parts of our country. The entire order of the seasons has been disordered and our environment has become unbalanced. We don't get rains when we need. But during those periods we have energetic winds through out the whole country. We can harness substantial amount of energy from those good winds for irrigation purposes which is a must of those periods. We can utilize that winds to drive low lift pumps and shallow tube wells to satisfy the demands of agricultural irrigation.

ii) Building heating: The energy produced by the wind mills may be used for heating purposes. A wind mill can generate heat directly by water brake, or the electricity produced by a wind turbine may be used for heat generation or by driving heat pumps.

iii) Refrigeration purpose: Wind mills may be used to drive refrigerating machineries directly or by generating electricity.

iv) Battery charging: Wind mills for charging batteries have been common since the beginning of this century and are still produced in large numbers in many countries.

v) Domestic application: The domestic applications of the wind mills have been shown in the following figure.

## Conclusion:

In an energy starved country like ours, it is highly important to focus our attention to other resources of energy as well as alternative energy resources. Sure enough on the immediate count the import of fuel may prove cheaper than exploration of domestic sources, but in the long run, the reverse is true.

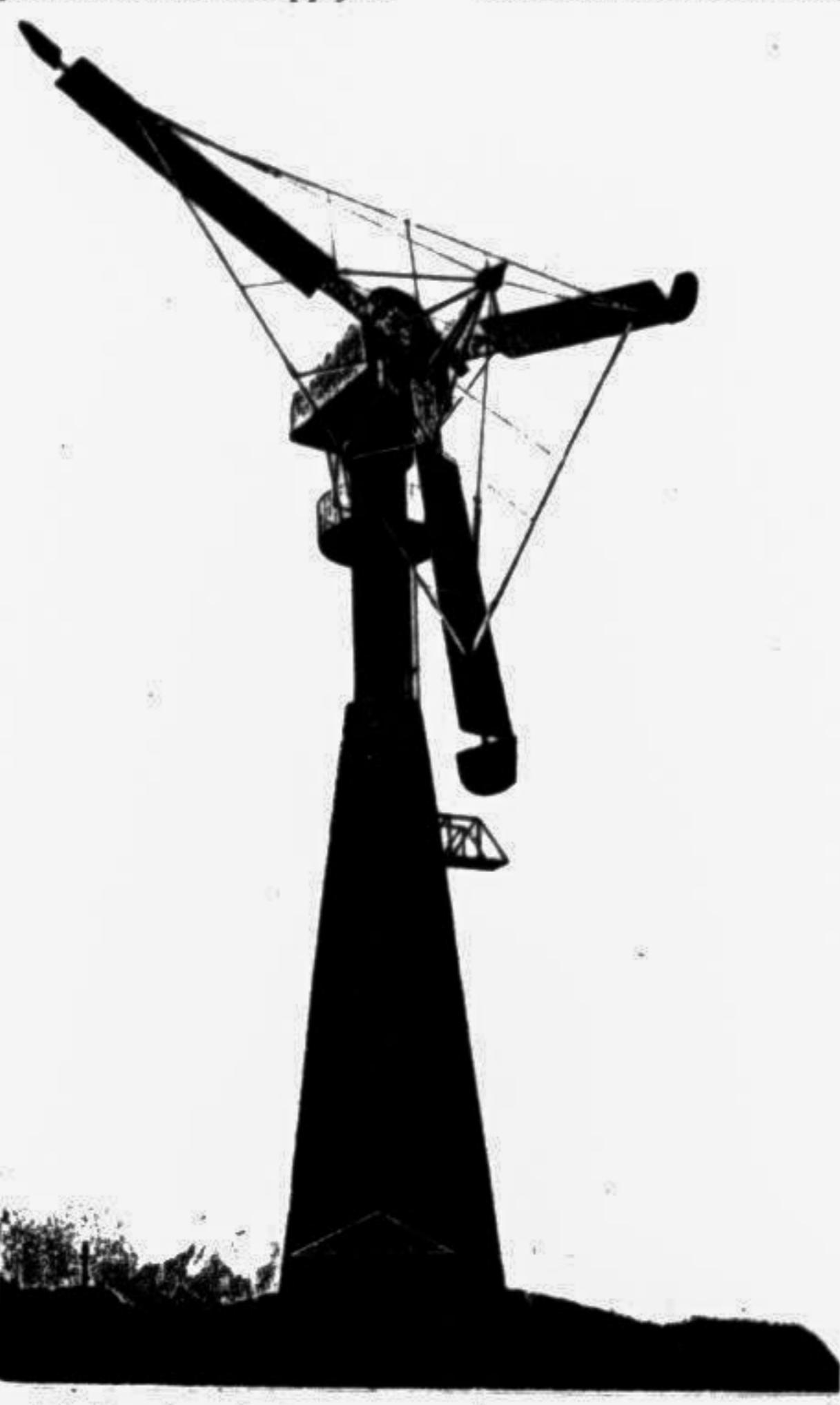
Then it is foolish to rely on the natural bounty or on the imported fuels.

Considering the wind characteristics of our country from the preliminary studies, it is clearly understood that there are reasonably good prospects of wind energy in the coastal areas of Bangladesh which may contribute significantly towards the solutions of energy crisis in the country.

**Research and Development on Wind Energy in Bangladesh:**

Research and development works on wind energy throughout the world has advanced a long way. The technology in this field has improved remarkably in the west and also in the Asian countries. Latest and very sophisticated technologies are being employed in this field. But in Bangladesh R&D works in this field is almost non-existent.

Our government does not have any active policy for extracting power from this everlasting and pollution free energy resource. It has been shown that the poten-



electricity for irrigation purposes for better yielding. Our national economy depends largely on the improvement of the agricultural sector. The government has undertaken many irrigation and canal digging projects to supply water. Many power pumps and hand pumps have been distributed to the farmers.

by excavation and re-excavation works. Recently man powered pumps have become popular for irrigation and every year its supply is increasing. Considering the terrain of the country about 50% of the pumps require to be operated at a total head of 20 feet or less. Most of these pumps along with a number of deep and shal-

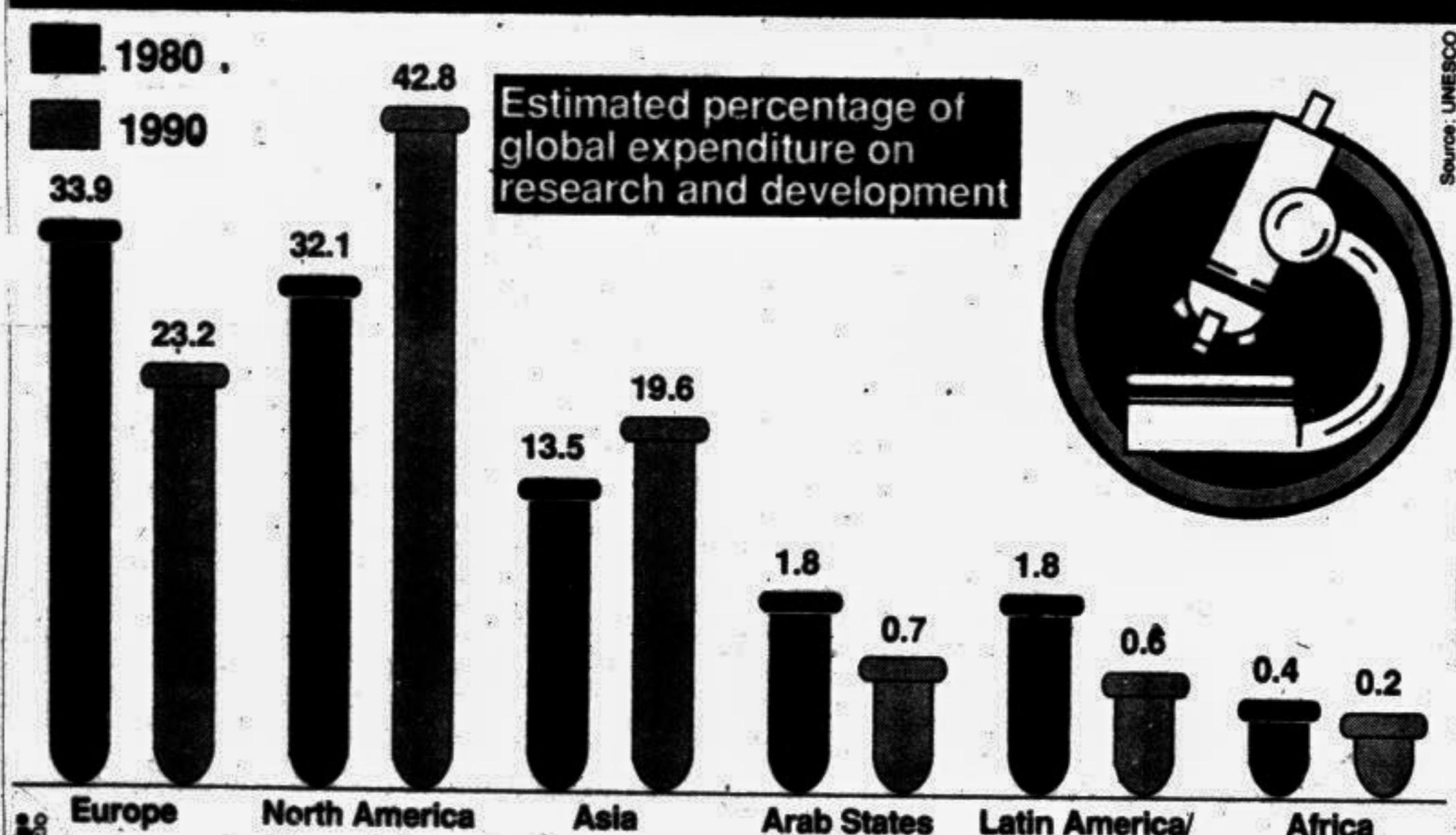
## WHAT IS SCIENCE TO BE, ASKS UNESCO — A TOOL OR A WEAPON?

**M**any scientists in the industrialised world have become prisoners of industrial or military restrictions on their freedom to communicate, warns the first-ever assessment of the state of science worldwide.

Such restrictions, based on the patenting of information or classifying it as secret, and inspired directly or indirectly by national interests, inhibits the open exchange of knowledge, says the just-released World Science Report.

Yet much of this knowledge is essential for development, whether it is for the fight against disease and hunger or

## Investing in science



meeting growing energy needs.

In Africa, the report says, "Poverty in science is even more crucial than the immediate poverty of the material kind — because science can well determine the future."

The report, published by the United Nations Educational, Scientific and Cultural Organisation (UNESCO), points out that African governments have halved their expenditure on scientific research in the past decade.

The prospects are even gloomier, given that spending on education is being cut under structural adjustment programmes.

The effects will be serious. As UNESCO director-general Federico Mayor says, "The gap between poor and rich is a knowledge gap. There can be

huge leap from an agrarian to a manufacturing economy. Investment in scientific research grew from 0.24 per cent of GNP to 2.1 per cent in the same period.

The Korean case, writes Thomas Odhiambo, president of the African Academy of Sciences, "should constitute a beacon to Africa — whose development ship is still drifting in the economic backwaters a generation after independence from colonial rule."

In India, the birthplace of mathematics, science has achieved many successes, but

there is a question mark over its priorities. Jawaharlal Nehru, India's first prime minister, was keen to promote a "scientific temper" and spending on scientific research as a percentage of GNP increased from 0.18 per cent in 1958 to one per cent in 1987, and is planned to reach two per cent by the year 2000.

Thanks to agricultural research, India is now able to feed its increasing population. Improved health services have halved the death rate since 1950 while nearly doubling life expectancy.

In space research, too, India has made impressive strides. Few outsiders realise the country was networked by a national satellite-based telecommunication service well before satellite television reached Europe.

Comments Mayor: "Like a hammer, you can use science correctly (as a tool), or incorrectly (as a weapon)."

GEMINI NEWS

## Planets Outside Solar System!

A US scientist says he has confirmed the existence of the first known planets outside the Earth's solar system.

Alexander Wolszczan, an astronomer at Pennsylvania State University, said in a phone interview February 28 that the latest evidence shows "beyond any reasonable doubt" that at least two planets are orbiting an extremely dense rotating star called a pulsar about 1,200 light years from Earth.

The latest findings, first announced by Wolszczan at an astronomy meeting earlier this year, are due to be published in the journal *Science*.

"All my peers who deal with problems of this kind are quite convinced," Wolszczan said. "I'm a careful person and I wouldn't stick my neck out for something that's not definite at this time."

Other scientists have called the new data scientifically convincing. "We know absolutely for sure now that there are planets there," said Frederic Rasio, a theoretical astrophysicist at the Institute for Advanced Study in Princeton, New Jersey.

Researchers have claimed to discover evidence of planets around some two dozen stars in the past decade. But up to now scientists have not conclusively established the existence of any planetary system outside the solar system.

Because existing telescopes cannot detect objects as small as planets outside the solar system, scientists have searched for planets by looking for wobbles in a star's motion that might indicate the gravitational tug of a nearby body.

Wolszczan and a colleague, using the 305-meter radio telescope at Arecibo, Puerto Rico, first announced in 1992 that they had found such indirect evidence for the existence of at least two planets orbiting a pulsar in the Milky Way Galaxy.

The two bodies appeared to have masses of at least 2.8 and 3.4 times that of Earth, and appeared to orbit the pulsar every 98 days and 67 days, respectively — approximately the size of the orbit of the planet Mercury around the sun.

The new planets both showed up as slight inconsistencies in the regular pattern of radio pulses emitted by the pulsar. Those irregularities appeared to be caused by the pulsar's being pulled to and fro by the gravity of the orbiting planets.

pupils per classroom have a form of reading difficulty, and it is considered that the wearing of glasses with an individually chosen colour tint will help to improve some children's ability. The lenses could also help those suffering from reading-induced migraine and photosensitive epilepsy.

The system, known as colorimeter, was devised after extensive collaborative research by Dr Arnold Wilkins at the British Medical Research Council's Applied Psychology Unit in Cambridge, eastern England and Cerium Visual Technologies, a company based in Kent, southern England.

The equipment, which can be used by opticians, educational establishments, hospitals and psychologists, allows people to choose the appropriate tint quickly and easily.

A pulsar is believed to be a rapidly rotating neutron star — an extremely compact ball of neutrons formed from the central core of a collapsed star.

Wolszczan said the flashes

of radio emission from a pulsar as it spins have an accuracy comparable to atomic clocks on Earth, and scientists have achieved micro-second precision in their measurement.

The gravitational forces from the planets cause the pulsar to wobble in space," he said. "And that makes the travel times of the pulsar's radio pulses to us a little longer and a little shorter periodically. And we can measure that effect."

Wolszczan added that detecting planets by this strategy is 1,000 times more accurate than any visible astronomy technique."

However, Wolszczan said that the findings two years ago did not represent 100 per cent proof that the planets existed because of the possibility that something that mimics planets, such as a "brown dwarf," was causing the irregularities in radio pulses. Brown dwarfs are gaseous bodies too big to be planets but too small to become stars.

Wolszczan said that the latest findings, based on additional study, show that the planets are also tugging gravitationally on each other and thus altering their orbits.

"Now it's not only the effect of the planets on the pulsar that we are detecting, but also the slight perturbations between the two planets that's been detected, confirming that what we see are planet-sized objects," he said. "And at this point it's beyond any reasonable doubt, because the masses of those two objects are quite similar to the mass of the Earth."

Beside the two planets detected originally, the latest data reveals a moon-sized object orbiting nearer the pulsar, and there may be still more orbiting objects, Wolszczan said.

Wolszczan said that the rapidly rotating pulsar, which is basically the dead remnant of a star, doesn't shine with visible light but instead produces a fierce stellar wind that would blast any planet with particles traveling near the speed of light.

He said this heavy dose of radiation would probably make the surface of the newly-discovered planets very inhospitable — something like that of Mercury, the nearest planet to the sun, where temperatures range from 510 degrees Celsius on the sunlit side to minus 210 degrees Celsius on the dark side.

Courtesy — USIS