INAUGURAL ADDRESS BY THE CHIEF GUEST

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Ladies and Gentlemen,

It is commendable that COMSATS has organized a meeting on an important subject of great current interest. I am pleased and delighted to be present at the inauguration.

The world's fresh-water resources are finite and are coming under stress because of increasing population, higher standards of living and recent global climatic change. Furthermore, they are also unevenly distributed in space and time. There is a universal awareness and concern on the availability and sustainability of water, which is a vital strategic resource. In the South; some countries have ample water resources while most suffer from its scarcity.

Life, as we know, originated from water around 3.5 billion years ago; therefore, it is no surprise that all species and ecosystems depend on it for their existence. Ninety seven and half percent of all water on earth is in the oceans, as salt water. The total fresh water is only two and a half percent. Most of this fresh water (68.7%) is in the form of snow and ice, mostly as polar icecaps and is inaccessible. Nearly 31 % is fresh underground water, major portion of it in deep aquifers; the most accessible water contained in lakes, reservoirs and rivers is only 0.26% of the total amount of fresh water or 0.007% of all water. Fresh water in rivers and streams and ground-water recharges by rains are the primary renewable resource for ecosystems and humans. In this renewable water, there is lack of sufficient and reliable data on water-availability in many areas of the world.

The total renewable water resources of the world are estimated to be 42,600 Km^3 (1995 figures). The table compares the water resources by individual continent basis. On the average, water availability per-capita was about 7,600 m^3/year in 1995, the lowest being 4,000 m^3/year for Asia, and highest 38,000 m^3/year for South America.

The ecosystem provides food, wood and other important goods and services to humanity; water having an absolute fundamental balancing functions in the natural processes. Water dissipates the solar-energy variation in space and thus acts as a buffer. It dissolves and carries nutrients to plants and living organisms, it provides chemical services, like oxygen production, carbon dioxide uptake and release of nutrients through biodegradation. Ninety percent of all living organisms live in water, because sun-light can pass through it. Thus, water not only has direct use for drinking, washing and vital input for food and energy production, etc., but it simultaneously has other functions indispensable to life and human welfare. For a holistic perspective, an integrated approach to water-development has to be taken. The past interests have mainly focused on ***Blue water,*** the water available in the streams, lakes and ground water aquifers. The available blue water is about 40,000 km^3 per year. However, water is involved in a host of complex functions, some of which have been listed earlier, in which there is no substitute for it. The water in the ecosystem may be referred to as ***Green water***; i.e. water for non-irrigated vegetation, including forests and woodlands, grasslands and rain-fed crops. ***Green water*** or soil water is estimated as 60,000 km^3 per year. It is the primary source for terrestrial ecosystem. For long-term sustainability, both ***blue water*** and ***green water*** functions have to be balanced.

Table - 1: Potential Water Availability Worldwide				
Continents	**Population in millions**	**Water Resources (in km^3/year)**	**Potential Water availability (in km^3/year)**	
			Per 1 sq.km	**Per capita**
Africa	708	4,040	134	5.7
Asia	3,403	13,508	309	4.0
Europe	685	2,900	278	4.2
North America	448	7,770	320	17
South America	315	12,030	674	38
Australia and Oceania	28.7	2,400	268	84
All Continents	5,588	42,650	316	7.6

Not so long ago, the human population was limited in size and there was no conflict between ***Blue and green water*** use, but a combination of runaway population growth and industrialization has drastically increased the requirement of water. In the previous century the world's population tripled, but human use of water multiplied six folds. Today, perhaps as much as half the world's fresh water is serving human needs. There is a need now to assess in this new century if the world can sustain this high ratio of water-use by the increasing world population.

Whenever water availability is less than water needs for societal functions and plant growth, water is said to be scarce. Water scarcity cannot be directly defined in terms of the amount of water. The climatic conditions play an important role: 1000 mm of rain per year may produce dripping environment in cold regions; the same amount of rain may, however, only produce semi-arid conditions in hot areas due to high evapotranspiration.

Renewable water-resources are not only scarce but are also highly variable in time and space. The arid and semiarid zones of the world constitute 40% of the land-mass, whereas they have only 2% of the global run-offs. Even so, some countries in the semi-arid region suffer form devastating floods in the rainy seasons. Rivers provide about 90% of renewable water; however, stable base river flow only accounts for 37% of total river flow. The rest of the flow depends primarily on the natural variation of climate.

This situation has been compounded during the past decades in many regions of the world, through development in basins where these waters originate. The anthropogenic changes in the climate caused by higher concentration of green-house gases, especially carbon dioxide, has the potential to further affect water-resources significantly. The International Panel for Climate Change (IPCC) which has the support of 3,000 scientists, including several of the world's most distinguished meteorologists, in its third Assessment Report on climate change published in July 2001. states that global warming is happening, and at a much faster rate than was expected: global temperatures are rising nearly twice as fast as previously thought. Their prediction based on computer models is that temperatures could rise by as much as 5.8^{o}C by the end of the century. The climatic models also predict that rainfall will increase in regions that already have sufficient rains, while dry regions will become even dryer, thus aggravating the crisis in dry regions.

Humanity depends on freshwater for life as well as economic activity; water is increasingly becoming a strategic commodity. Although the problems associated with water are world-wide and are required to be tackled regionally and globally; however each country in the south must develop a *comprehensive strategy for water-resource management;* elements of this comprehensive policy should include the following:

1. Resource-Estimation

Estimation of water-resources is the first step to understanding the situation facing any country; a proper and accurate estimate will determine future policy and actions.

2. Forecasting of Demand

The next step in the preparation of a comprehensive water-policy is assessing the present and future needs. In this assessment, the anticipated growth of population as well as change in living standards will be considered. Life style and population-distribution have large impact on amount of water used. Another factor which may also be considered is the anticipated effect of global climate-change.

3. Conservation and Reuse

For countries which have sufficient resources, the need may only be to conserve and, if required, reuse or reallocate water between different areas. For countries in which water is scarce, drastic measures in conservation and reuse may be required, such as recycling waste water, purifying water, water-harvesting, large storages, introduction of drip-technology in agriculture, etc. However, if conservation and reuse measures are inadequate, then investment in a whole host of modern technologies will be required.

4. Modern Technologies

Most modern technologies can be used, directly or indirectly, to solve water-problems. These include such technologies as bio-technology and genetic engineering, nuclear technology and space technology, as well as other innovative approaches like the use of solar energy, laser technology, and cloud-seeding. Space technology, such as satellite remote sensing, can determine vegetation cover, snow cover and areas under heat stress; it can also determine water seepage through channels.

Technologies like Isotope Hydrology can determine leakages in dams and map underground aquifers and aquifer recharge. Bio-technology may be used to develop plants for water cleaning and purification; genetic engineering and nuclear mutation can be used to develop plants that require less water and are suitable for drought areas. Plants that can grow in brackish water may offer an opportunity to use large tracks of saline lands. Desalination, and especially nuclear desalination, may be inevitable in the future. Breakthroughs in membrane technology are having profound effects in many areas, ranging from waste treatment to desalination. Information technology has an important role to play in water management and policy. Laser land-levelers are proving economical, as they optimize water-use in agriculture. Applications of new technologies in agricultural practices thus offer opportunities to grow more food with less water.

5. Awareness and education

Fresh water is scarce, precious, and irreplaceable. Yet this basic profound truth eludes much of humanity. Public-awareness campaigns to educate people on the importance of water and the need to conserve and reuse it should be undertaken in earnest. Participation of the public in planning and management of water-resources is essential to develop the ownership psyche. Children should be taught the worth of water at an early stage in the school. Curricula of technical courses on water-related technologies may be introduced at higher levels of education; some countries like South Africa have already started doing it.

6. Management

The developing countries are particularly lacking in the management aspect of water. For proper management, all agencies involved in water-affairs, starting from the collection of data, processing, dissemination, research and development and implementation, have to be integrated to get the desired results.

The present situation of water-scarcity is global and requires global solution, however, the situations facing most countries in the South are similar. Cooperation between countries in the South, particularly in sharing information and technology, can go some way in addressing the situation. There may be an urgent need now to setup some institutes for water research and related technology by countries in the South.

Many developing countries, including Pakistan, are undergoing industrialisation and are now faced with the full range of modern toxic pollution problems, heavy metals, acidification, persistent organic pollutants (POPs), while still struggling to deal with traditional problems of poor water-supply and lack of sanitation services. The pollution threat, man-made or natural, is particularly serious when it affects groundwater supplies. The arsenic poisoning case in Bangladesh is one such example. Ground-water reserves provide more than 50 percent of domestic supplies in most regions of the country. Water-scarcity has been exacerbated by accelerating contamination of usable water-supplies, especially in rapidly urbanising areas, gravely damaging human health. An important element of national water-policy must be the provision of safe drinking water to the population. Drinking water supplies must have the standards specified by WHO.

Water-availability, water-use efficiency and associated problems such as ground-water depletion, salinity, pollution, contamination etc. are going to be serious in the coming years. These are exemplified by the fact that close to one billion people in 40 countries are prone to famine; almost 70% of the arid lands where agriculture is vital for minimal food-production are subject to desertification. It is estimated that 30% of all the arable lands will be salinized by the year 2020 and 50% by the year 2050.

Pakistan is the fourth largest country, after China, India and USA, in terms of land under irrigation. The river Indus basin, which is the main source for this irrigation, is a semi-closed basin; it offers good opportunities for adding value to water through storage. There is no excess outflow to sea during the low-flow season, but there is excess outflow during the high-flow season. Thus, storing water and reallocating it between seasons can achieve potentially large increases in the value of water. Pakistan is blessed with large glaciers in the North; the need is to access this potential and to understand the anticipated changes in it due to global warming.

The impending crisis is severe. If we take a myopic view, we will be in trouble; however, collective and individual efforts by member COMSATS countries may go a long way in averting the crisis. There is a need to invest in the future; keep a close watch on the impact of global change, both climatic and technological. Meetings like this one organised by COMSATS, I hope, will go some way in identifying the problems and suggesting remedial measures for the sustainable development of water-resources in the South. I note that this is the first meeting on water-resources in the South. I hope that the next meeting will be more specialized, and that it will follow-up on the recommendations made in this one.

In the end, I commend COMSATS for having undertaken the initiative. I compliment Dr. Hameed Ahmed Khan, Executive Director COMSATS, and his team for taking up such an important task.

Thank You.