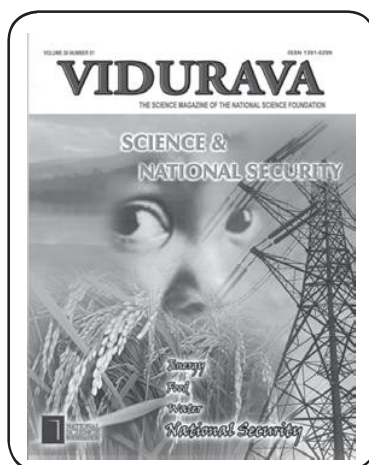




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Cross-Border Threats to National Security

The current volume of Vidurava has taken up a momentous and pertinent issue of grave concern to Sri Lanka. Although several aspects of National Security have been presented in this number, Sri Lanka's recent experiences, as well as its vulnerability to security threats from unexpected sources needs special consideration.

It may be recalled that during the terminal phase of the country's recent war on terror, Sri Lanka was the scene of a massive onslaught of cross-border threats to security. These threats were of two basic kinds. First, the conventional type, where drug peddling and illegal smuggling of sophisticated and dangerous arms, ammunition, weapons, and various combat-related equipment were involved, in attempts to re-arm rebellious groups. The second was the non-conventional threat that originated from vindictive international groups in connivance with the blinkered so-called Human Rights strategists generating baseless, distorted and scurrilous material to provoke a global strategy for intervention in the internal affairs of our country.

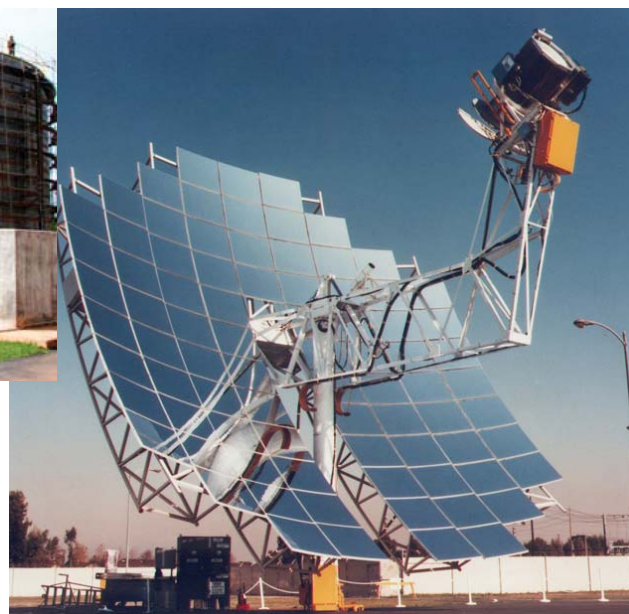
All Sri Lankans are grateful that a sober but bold political leadership has been able to vanquish these inimical elements and prevent the independence, sovereignty and integrity of our small island nation from being threatened and vandalized.

The question before us now is how Science and Technology could contribute towards the prevention or mitigation of such threats to National Security. It is our contention that the biggest contribution that scientists and technologists can make to prevent or cushion such threats, is to do all within their capabilities to make our motherland self-confident, self-sufficient and self-reliant, with home-grown solutions and strategies that will ensure contentment for all our fellow countrymen.

M. Asoka T. De Silva

Energy Security

Mr Asoka Abeygunawardana



Energy is very important for production of food for the mankind. We depend on energy for many of our day to day needs. Without energy, seed production, soil preparation, production of chemical fertilizer, production of pesticides, harvesting, post-harvesting, food processing, food preserving and transportation of food to populated cities will be impossible. Industrial sector also largely depends on energy. For construction of buildings and houses we need a lot of raw materials and goods. Most of these are produced at a distance and large amount of energy is used for transportation. When today's energy usage for consumption and existence per person is compared with the era previous to the industrial revolution, it is an 8 fold increase. (See table below)

In nature energy comes in different forms such as heat, sound, chemical, mechanical, magnetic, electrical and nuclear, etc. Energy sources are mainly of two kinds namely, renewable energy sources and non-renewable energy sources. Sun is the primary energy source and light and heat are the primary phases of it. Due to sunshine temperature changes occur in the atmosphere and in the ocean. Wind creates tidal waves. Wind energy originates due to the temperature variation in the atmosphere.

Ocean thermal energy and ocean currents originate due to the temperature variation in the ocean. In addition geo thermal energy accumulates beneath the earth surface. Hydro power is a renewable energy source which we are using at the moment. Tidal energy and bio fuel too can be used. When solar energy cannot be tapped we can use these renewable energy sources.

Era	Daily energy consumption				
	Food preparation	Agriculture	Industry	Transport	Total
Primary man (Before one million years)	2				2
Hunting man (Before hundred thousand years)	3	2			5
Primary Agriculture man (B.C. 5000)	4	4	4		12
Developed Agriculture man (B.C. 1400)	6	12	7	1	26
Industrial man (From 1875)	7	32	24	14	77
Technical man (From 1970)	10	66	91	63	230

Renewable energy sources are widely distributed, and collecting and conserving this energy is important. After the discovery of non-renewable energy sources, it was used efficiently, resulting in the evolution of the industrial and technical eras.

Fossil fuels such as coal, petroleum and natural gas are non-renewable source of energy. Coal is a solid fuel formed over millions of years by the decay of terrestrial vegetation. Oil and natural gases are formed from the remains of marine microorganisms (microscopic animals and plants) deposited on the sea bed. Fossil fuels are found in deposits beneath the earth in limited reserves. Nuclear energy is the other non-renewable source of energy which man has developed, and is being used at risk.

The present energy consumption pattern clearly shows that societies totally depend on fossil fuels. But due to the limitations of fossil fuel and the consequent threat to society we have to seriously think about the future energy security concerns.

Threats due to Liquid oil and natural gas depletion

Depletion of liquid oil and natural gas deposits is the first and the foremost challenge to dependency on fossil fuels. Present society depends totally on petroleum. Since the 1980s mankind has been using fossil fuels in excess of what is extractable. Major oil producers are aware of the depletion of fuel, and have been trying very hard to find new fuel deposits without much success. Specialists in the field predict that the period 2010-2012 will see the peak in fuel consumption (see graph 2). Therefore the present society should find the means for ensuring energy security for the future without totally depending on fossil fuels.

Challenge of global warming

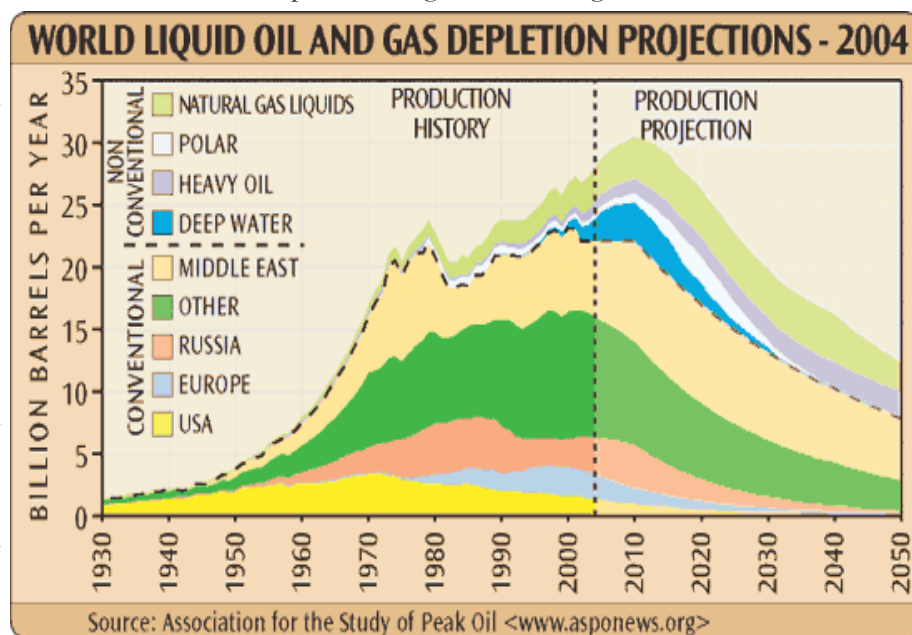
The second challenge which mankind has to face in relation to energy security is global warming. Global warming is due to the burning of fossil fuels, mainly coal.

For ages the earth's cooling process resulted in depositing its element carbon as fossil fuel beneath its surface. But in recent times mankind has released enormous amounts of carbon to the atmosphere by burning this fossil fuel which was hidden underground. As a result last decade became the hottest decade. Among the fossil fuels, coal is the major contributor to global warming. Today we are unable to stop this rise in temperature. According to predictions, by the 2013 summer, all the ice peaks in Antarctica will disappear releasing water to the ocean. By year 2050 carbon emission should be reduced by 50% of the baseline year 1990.

Potential of fossil fuel in Sri Lanka

When we talk of energy security in Sri Lanka special attention should be paid to the fact that still Sri Lanka does not have an assurance of a fossil fuel deposit. Investigations are on with the hope that we will achieve the energy security for Sri Lanka by this process.

We should remember that it may take at least 10 years to get a confirmation about the availability of a fossil deposit through this investigation. In fact even with an



accelerated investigation programme it will take 7 years. Therefore we cannot expect a quick/instant solution for energy security for Sri Lanka. According to the predictions by experts in the field, we could get a fossil fuel supply of one billion barrels. When compared to the present level of energy consumption this will be sufficient for only 30 years. However, if we consider the

current increase in demand for energy consumption, the deposit will be over in 13 years. Since Sri Lanka is not in a position to spend a large amount of money on this project, and has to seek foreign investments from oil companies, this will again reduce our share of the oil even though the deposits belong to us, and consequently our ultimate objective would not be fulfilled.

When considering Sri Lanka's energy security, we should remember and concentrate on our energy necessities. Otherwise we will have to always depend on other countries and face difficulties with world economic fluctuations.

Even though we lack fossil fuels, being a tropical country we are very rich in renewable energies sources.

Sun shine throughout the year, high growth rate of trees, monsoon winds, ample hydro energy are some of them. On the other hand, being an island we have the ocean with its rich energy resources. Since the southern part of the ocean does not have any major land masses up to the southern pole, we have a high potential for use of steady sea waves and winds.

Although we have ample renewable resources, have we made optimum use of these resources? Thanks to Mr Wimalasurendra's` farsighted vision, Sri Lanka has been able to exploit the country's hydro power potential. Presently we have 1325 mega watt of hydro power. In 1995 100% of the electricity demand was fulfilled by hydropower generation. But unfortunately so far the Ceylon Electricity Board (CEB) has not been able to harness any other local energy source. They were concentrating on coal power for the last 20 years, and

as a result government is now taking steps to build a 1400Mega watt coal power plant. CEB also targets to establish another coal power plant of 3300Mega watt by year 2020. Undoubtedly this is an unfortunate situation for our country.

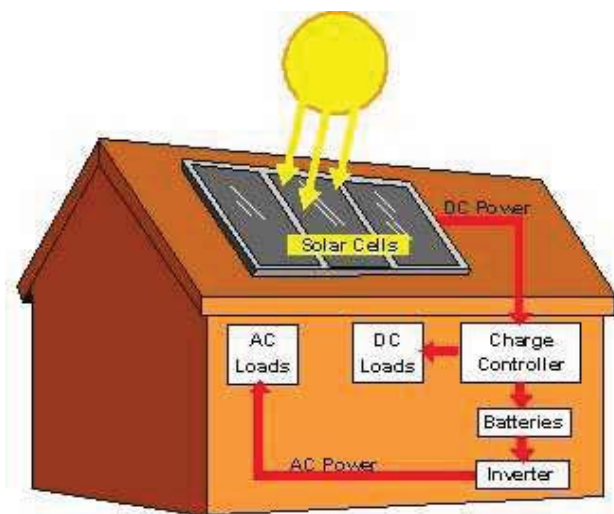
Essential components for Energy Security

CEB has been using various hypotheses for their long term power generation plan. A basic weakness of these is the inadequate attention paid to the key factors of energy security. The CEB has been always recommending import of fuel from foreign countries, and to establish coal power stations in Sri Lanka. This aspect needs an in-depth review.

Hypothesis I: Electricity demand will continuously increase with a rate of 7-10% throughout the next 20 years.

CEB believes that the strategies of energy conservation and the financial crisis due to the ending of a fossil fuel era will not affect the Sri Lankan electricity demand for the next 20 years. This shows a lack of understanding about the concepts of energy conservation.

Hypothesis II: For Electricity generation, coal plant, petroleum fuel and hydropower are the only alternatives.



The assumption that renewable energy sources such as fire wood energy, wind power are not suitable is not acceptable, and by doing so they have totally ignored using local resources for energy security.



Hypothesis III: Liquid oil and Coal prices will not increase during next 25 years.

For calculations of long term power generation plans, the future discount rate has been taken as 10%. By this assumption it has been shown a lower present value for a future expenditure. When using discounting principle the general practice is to estimate the increase of future expenditure parallel with depreciation. Therefore, the above hypothesis is not realistic. This pays injustices to renewal energy sources which has a high capital value with low recurrent cost. On the other hand, it gives undue favour for costly liquid oil and coal plants.

Hypothesis IV: For calculations of expenditure, there is no difference between local and foreign expenditure.

Local expenditure is a circulation of money within the country while import expenditure money goes out of the country. Therefore, import expenditure will directly influence the foreign currency reserve. For instance, when we purchase coal for power plants, it depletes our foreign currency reserve, but if we purchase fire wood from our villages money will go to the poor rural farmers. Due consideration should be paid to this factor.

Hypothesis V: Foreign exchange rate will be constant.

This is clearly wrong. In general rupee value is depreciating. However, assumption of constant foreign exchange rate for the next 25 years will not reflect the real price of the coal and liquid oil.

Hypothesis VI: Lifespan of a hydropower plant is 20 years.

Hydropower plants are functioning efficiently for more than 50 years in Sri Lanka. Therefore the above hypothesis is unjustifiable.

Hypothesis VII: Improving problematic climatic changes and other environmental changes will not affect generation expenditure.

This is a wrong concept. Carbon trading directly influence the net expenditure. If these calculations are added, the net cost of coal will be rapidly increased.

Hypothesis VIII: No difference between central and decentralized power plants.

Coal power plants are centralized plants, while renewable energy sources are decentralized by nature. Therefore, benefits of decentralized plants will go for renewable energy sources while disadvantageous of centralized plants will go to coal plants.

For centralized plants, large capacity transmission systems are required, which involves high capital expenditure, while there is also a high distribution loss. For decentralized systems this is not a problem and even by-products of the plants can be used for other industries. Unfortunately CEB does not see the difference between centralized/decentralized power plants.

To give proper attention to energy security, it is essential to achieve an attitudinal change. Change of attitude should not be limited to only for electricity but for all the other power sectors as well. Electricity is only one such example. In the fields of transport, industry, construction as well as household activities, there should be a similar attitudinal change. It is disappointing to note that while the entire society is moving forward, attention towards energy security is moving in the opposite direction.



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Science and National Security

Mr M.Asoka T. De Silva

The Backdrop

The interdependence of technological advancement, export-led economic growth and consumerism in free market countries that constituted the engine of change over the last two centuries, has now taken a phenomenal downturn prompting serious security concerns at both global and national levels.

A UN study reports that the world economy had grown from USD 5 trillion to USD 30 trillion between 1950 and 2000, while the number of people living on USD 1-2 a day is expected to grow from 2 billion in 2000 to 4 billion by 2025. Further, an additional 3 billion people are expected to be added to the world's population by 2050, enhancing pressure on basic needs of food, water, sanitation, shelter and energy, while natural resources to support growth phenomena are rapidly shrinking. It is also reported that nearly 450 million people in 29 countries live in water-deficit locations, while half the world lacks adequate sanitation. The world population is also aging and moving to urban areas. It is estimated that by 2050 there will be more older people than children. It seems paradoxical that the industrial world became rich before it grew old, while the developing world is destined to grow old before it becomes rich (Glen, J.C. and Gordon, T.J., 2001).

Although a global tendency at encouraging diversity and shared ethical values was emerging, the absence of a sense of collective responsibility and global ethics has failed to stimulate the development of cohesive moral forces for the larger benefit of mankind. In this context it is a relief that the impact

of the global economic downturn has gracefully been less harsh on less developed countries like Sri Lanka.

National security concerns however, go beyond the realm of the current global recession. While global economic turbulences may exacerbate certain aspects of national problems, national security concerns are by and large country specific, and hence need internal solutions. National security is not limited to protection of independence, sovereignty and territorial integrity of the nation, but more importantly addressing the development challenges of poverty and freedom from want, social justice, inequity, inequality, availability of adequate food, clean water, health, safe shelter, sanitation and energy. In addition, as identified in a 2001 UN study, the issue of 'Environment Security', defined as "Environment Viability for Life Support", constitutes

the overall security threat to mankind (Glen, J.C. and Gordon, T.J., 2001).

Threats to national security also arise from weather-related disasters, both natural



and man-made, which may result from floods, cyclones, landslides, storm surges, drought, coastal erosion, salination, sea erosion, lightning, forest fires and industrial hazards. In addition environmental phenomena such as ozone layer depletion, rise in ambient atmospheric temperature and mean sea level, environmental modifications during war situations, desertification, loss of biodiversity, contamination of air through industrial and transport related emissions, oil spills, radiological accidents, and artificial genetic pollution, combine to challenge the environmental viability for life support. These threats are either directly or indirectly associated with uncontrolled and undesirable development activities which have triggered the process of climate change.

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), (2007) has observed that eleven of the last 12 years (1995-2006) rank among the twelve warmest years since 1850, while the global average sea level has risen since 1961 at an average rate of 1.8mm per year, and since 1993 at 3.1mm per year. The IPCC Report provides forecasts on how climate change would affect food production, water availability, health risks and disease prevalence, as well as energy demands, and cautions that “poor people and poor countries are the most vulnerable to climate change impacts because they have the least capacity to adapt”. Let us now focus attention on Sri Lanka’s own domestic concerns on national security

Water Security

Water security implies equitable distribution and accessibility to cheap and clean water, to sustain acceptable standards of food and goods production, and sanitation for all stakeholders, to ensure healthy livelihoods and prosperity. In Sri Lanka, almost 96 % of available water from the hydrological cycle is claimed to be used up in agriculture and food production, which contributes just 16 % to GDP. The estimated average rainfall in Sri Lanka varies from 1800-2000mm, giving a total volume ranging from 118,000–131,220mm³. Evapotranspiration

measurements in 70 (out of a total of 103) drainage basins had registered values of 900-1550mm per year for the wet zone, and 1200-1550mm per year in the dry zone, demonstrating that substantial water surpluses and deficits do occur across the climatic zones of Sri Lanka (Gunatilaka, A. 2008).

We are reminded (Gunatilaka, A. 2008) that security concerns in relation to water were exemplified recently by two unexpected events, which exerted intense pressure on State institutions. The first was the December 2004 Indian Ocean tsunami, which inundated the coastal zone and contaminated over 50,000 drinking water wells, affecting over 500,000 people living in the southern, southeastern and eastern coastal belt. The second was the Mavil Aru incident in the Eastern Province, where water was used as a weapon in a civil conflict, depriving farmers of irrigation water, and causing the destruction of around 30,000 acres of rice harvests.

Sri Lanka is however, privileged to be one of the few South Asian countries absolved of a major water deficit, but complacency and over estimation can precipitate our downfall during the next few decades if appropriate measures are not in place. Specific strategies and plans for rainwater harvesting, storage and conservation, recycling and reuse, desalination, enhancing irrigation efficiency, developing drought resistant as well as low water-use food and commercial crops, protection of river basins and critical watersheds, and finally ensuring integrated water resource management, are some of



the measures recommended to prevent Sri Lanka from becoming a water deficit nation. Nevertheless, issues such as high fluoride levels in ground water and other contaminants need urgent remedial measures. It is a relief that Sri Lanka is considered to be 'on track' to achieve the targets set by the United Nations Millennium Development Goals (MDG's) for 2015, in respect of sustainable access to Safe Drinking Water and Basic Sanitation (UNDP MDG Country Report, 2005).

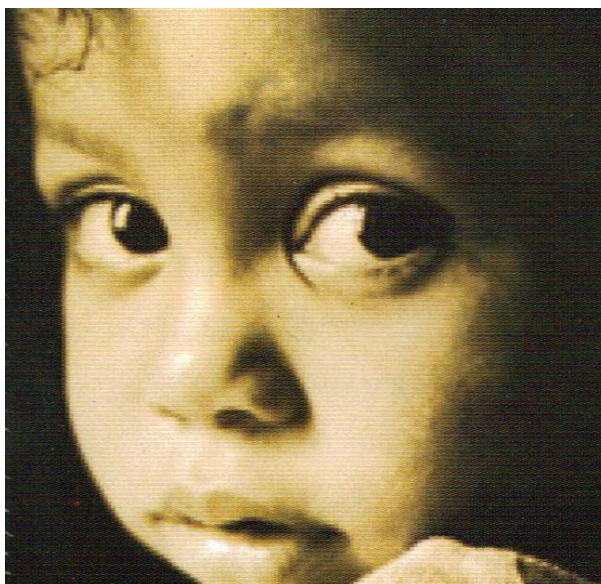
Water security also implies the protection of the hydropower reservoirs, dam sites, and water tanks in the context of changing geological conditions and tectonic movements; monitoring the main water intake and pump stations against salt intrusion (such as at Ambatale on the Kelani Ganga); and protecting the dry zone reservoirs and canal network. None of these have adequate early warning systems, while the potential threat to life and property of these from natural, human, and terrorism induced disasters, justify high standards of maintenance and constant vigilance. A World Bank funded study during 2000 on dam safety and vulnerability of 32 reservoirs, had revealed that 4 dams were at high risk, 10 at medium risk, and the others needed intensified maintenance to contain risk conditions. It may be relevant to note that the Tritium laboratory established at the Atomic Energy Authority (AEA), with technical assistance from the International Atomic Energy Agency (IAEA), has already shown its usefulness in detecting possible leakages, seepages and rates of sedimentation at Samanalawewa, Victoria, Randenigala and Kukule Ganga Projects (Pers. Comm. D.G.L. Wickremanayake, AEA, 2008)

Poverty and Freedom from Hunger and Malnutrition

Presently, the most pressing security concern is poverty and freedom from malnutrition. Hunger has not been of serious concern in Sri Lanka, as prevalence of underweight in children under 5 years of age (an indicator for monitoring), has been declining significantly from 37.7 % in 1993, and is

expected to be under 12 % by 2015, which is well below the target set for achieving the MDG for hunger (Dept. of Census and Statistics, 2006). However, malnutrition continues to remain a serious problem. The proportion of the country's population living below the "National Poverty Line" had declined from 26.1 in 1990 to 22.7 in 2002, while the proportion of population below minimum level of dietary energy consumption had increased from 50.9 in 1990 to 51.3 in 2002. According to the UNDP (2005) Country Report on Millennium Development Goals, Sri Lanka is unfortunately not likely to achieve the 2015 targets set for poverty reduction and malnutrition.

Sri Lanka is known world over as a country that provides the most comprehensive social security system in South Asia. By investing a significant share of public expenditure, amounting to about 4 % of GDP in free education and health services, Sri Lanka has achieved standards in literacy and wellbeing comparable to some of the highly developed countries. In addition schemes such as *Samurdhi*, *Pubudamu Wellasa*, *Rajarata Navodaya*, *Deyata Sevena*, *Gamata thaakshanya*, *Neganabiru Navodaya* etc, as well as the establishment of *Vidatha* resource centres to stimulate technology transfer, Sri Lanka has strived to strengthen the rural economy, and thereby reduce the gap between the rich and the poor. These social support schemes need to be carefully monitored and expanded to ensure that the most deserving and marginalized communities are brought into the mainstream of economic activity.



Food Security

Linked with poverty is the critical issue of food security which implies food availability at affordable prices. Despite massive global inputs into scientific and technological research on agriculture, food prices in 2008 continued to rise to dizzy heights, where poor countries and poor people could ill afford to sustain basic levels of nutrition.

Food security had been addressed for the first time

at the 1996 Food Summit held in Rome. Subsequently, FAO initiated the Global Food Crisis Summit in 2008, which resulted in a consensus statement to awaken the international community to marshal aid to those countries severely affected by soaring food prices (Balawala, C. and Abhayagunaratne, R 2008). Further, studies generated by UN have constantly reported that agricultural subsidies of rich countries have been detrimental to the food production sector in developing countries. While it is easy to blame the relevant authorities of mismanagement of agricultural development, the ideology of looking only at self-sufficiency while ignoring fair returns to the rural farmer has enhanced poverty and hence of a food crisis.



Rice as Sri Lanka's staple food has been the centre of attraction in R & D during the period 1960 to 1980. During this period, against the backdrop of a severe economic crisis and the consequent restrictions on imports of many items including basic food items, Sri Lanka's scientific community, especially the plant breeders, responded magnificently to generate high yielding varieties of rice as well as field crops, some of which were then considered to be among the best in South Asia. In rice for instance, the phased Coordinated Rice Varietal Trials (CRVT) conducted by the Department of Agriculture, resulted in increasing the yield potential of rice from 1.5 t per ha in 1952 to 2.5 t per ha by 1957, to 7.0 t per ha by 1970-73, and to a possible upper limit of 10 t per ha by 1978. In fact, through these efforts Sri Lanka was able to increase self-sufficiency in rice from a position of 45 % in the early 1950's with a population of 7 million, to 95 % by 1980 with a population of 15 million (De Silva, M.A.T. 2000). According to more recent data, the domestic supply of rice in relation to requirements had increased from 97.10 % in 2003 to 100.97 % in 2005, an indication that Sri Lanka continues to sustain a healthy food production drive (Dept. of Census and Statistics, 2006).

It is noteworthy that even before the onset of the recent global food crisis, Sri Lanka began scientific studies on meeting some of the future challenges in food production. In the late 1990's, a research project funded by the Council for Agricultural Research Policy (CARP) was initiated by a team of scientists from the Agriculture

Faculty of the University of Peradeniya and the Rice Research and Development Institute (RRDI) at Batalagoda, to study the effects of increased ambient atmospheric temperature and carbon dioxide concentration, on the productivity of rice varieties. More recently the Disaster Management Centre with UNDP assistance, launched a study on the adaptability of traditional rice varieties such as *Pachchaperumal*, and

Dabanala, as well as of some recently developed varieties of rice, to evaluate tolerance to salinity, - a condition that is likely to occur with climate change. Apart from



these studies, the government has been actively involved in a food production drive through the multi-pronged strategy of “*Api wawamu rata nagamu*”.

Scientific investigations on safe and well conceived stock pilling methods for essential basic food items; development of crop varieties with low water requirements, or plants with capacity to respond to water stressed conditions; conducting foresight and intelligence studies on global food production and distribution trends to forewarn impending imbalances or scarcities in food availability; and vigilance to detect and/or counter unintentional or intentional introduction of plant life threatening pests, diseases, invasive species, genetically modified organisms, chemicals or agents professed to be soil ameliorants, are pre-requisites to counter threats to food security. An excellent example in which Science and Technology helped to resolve a major national crisis, was in the unforeseen and potentially fatal infestation of coconut palms in the early 1970's by the Philippine Leaf Miner *Promecothica cumingii*, whose invasion from nowhere threatened to wipe out one of Sri Lanka's economically viable traditional industries. The then government amidst widespread public outcry, declared a State of National Disaster, and sought the country's entomological talent to step in with vigour to resolve the crisis and save the industry. Fortunately, just 2 years after its first appearance, the infestation was brought under control through an elegantly phased biological control programme developed by these scientists. Whether this infestation was through an unintentional or intentional introduction of a devastating pest has remained a mystery.

Energy Security

Parallel with the food crisis, arose an unforeseen concern to energy security, caused largely by a steep escalation of petroleum prices in the international market. Since Sri Lanka has to depend on fossil fuels to maintain the vital transport sector, resolution of this crisis



is beyond the realm of the government. Although the potential for substitution of fossil fuel with bio-fuels is a possibility, it is most unlikely that a small agriculture-dependent country like Sri Lanka could compromise the food production capability of its land resource for bio-fuel production. On the other hand, if Sri Lanka is fortunate enough to strike oil in the Mannar Basin, where exploration work commenced in 2007, the country would be spared of a fossil fuel crisis in the future.

Sri Lanka however, is not likely to be excessively troubled by a shortfall in electrical energy. Despite persistent objections by environmentalist and stakeholders with other interests, which backtracked by nearly two decades the implementation of two vital power generation schemes, namely the Upper Kotmale Hydropower Project (150MW), and Phase I of the Norochcholai Coal Power Plant (300MW), an emphatic political decision by the present government resulted in their implementation. Apart from these projects, a Combined Cycle Power Plant at Kerawalapitiya (300MW), and several mini- and micro hydro power plants, as well as small scale power generation units with renewable sources (such as dendro-, solar, wind, wave energy etc.) could help Sri Lanka mitigate a shortfall in energy.

Security in Healthcare

Sri Lanka's security in healthcare has been consistently considered to be well managed even from a global perspective. This was very well demonstrated recently by the manner in which the Health Sector responded in preventing any disastrous vector borne or water borne epidemics in the aftermath of the Indian Ocean Tsunami, when fresh water sources along the southern, south-eastern, and eastern coastal zones became extensively polluted. In fact Sri Lanka has been widely cited as an example of a low income country that has achieved remarkable progress in reducing the infant mortality and maternal mortality ratios, which are currently considered to be comparable with some of the developed countries. Sri Lanka is also rated as a

country of “Low Level HIV Epidemic” according to the UNAIDS classification, and in all these aspects Sri Lanka is reported to be on track in achieving the relevant MDG targets by 2015 (UNDP, 2005). However, the prevalence of environment related hazards such as high incidences of kidney failure in the North Central Province, for which no remedial measure has so far been found, is a matter of deep concern, and must be resolved speedily through a multi-disciplinary investigation.

National Security from Weather-Related Hazards

In recent years, Sri Lanka has been experiencing on a more frequent basis, threats to national security from natural as well as man-made weather related disasters. Among these, the unforeseen December 2004 tsunami was the most devastating natural disaster that the country had ever faced. National security from such hazardous events has been the subject of serious deliberations in recent times. The responsibility of early warning of such weather related hazards is now vested with the Department of Meteorology, which is being equipped with modern instruments to provide real time alerts. The setting up of seismographic and real time sea-level monitoring networks with the necessary infrastructure and expertise for data processing and modeling of tsunami scenarios is costly, and requires time. However, considering the urgency of this requirement, the current tsunami warning centres located in Hawaii and Tokyo, have agreed to provide an Indian Ocean Tsunami Advisory Service to the Meteorology Department, which has established within itself an Interim Tsunami Warning Centre (Pers. Comm. Dharmaratne, G.H.P., Meteorology Department, 2008).



In the meantime, with the enactment of the Sri Lanka Disaster Management Act No: 13 of 2005, an inter-ministerial National Council for Disaster Management for advisory purposes, and the Disaster Management Centre (DMC) as the lead operational agency were set up. The DMC has already drafted the National Disaster Management Policy to ensure a uniform widely accepted framework for risk reduction in respect of all types of disasters, which will be respected by all citizens of Sri Lanka (Ministry of Disaster Management and Human Rights, 2008).

Radiology and Nuclear Emergency Threats

The Disaster Management Act also empowers the AEA to establish plans for effective and rapid response to any radiological emergencies and impacts of nuclear reactor accidents in neighbouring countries. A National Radiological and Nuclear Emergency Management Plan have been included in the road map for disaster risk management, prepared by the Ministry of Disaster Management and Human Rights



in 2005. In the meantime IAEA is assisting the AEA through a technical cooperation programme to establish an early warning system for nuclear accidents, and for monitoring of environmental radiation. This programme which is due to be completed in 2011 includes, a) enhancing capabilities for development of baseline environmental radioactivity levels, b) establishment of an early warning system involving online radiation monitoring, and c) development of protocols to determine protective actions and intervention levels. This programme will initially cover the districts of Jaffna, Mannar, Trincomalee and Colombo, as well as the Southern Province (Pers. Comm. Wickremanayake, D.G.L., AEA, 2008).

National Security from Fear and Crime

In recent times security from fear and crime has been the subject of much discussion. In the years 2005 and 2006, out of approximately 60,000 crimes reported each year, in about a third of the cases the accused have not been apprehended, and about 60 % of cases are pending, while successful convictions have been only in about 3.6 % of the cases. This is a serious indictment on the country's public security, and law and order situation, and stresses the need to have a law enforcing system based more on evidence derived from forensic science (Pers. Comm. Ratnasiri, J., 2008).

In this context it must also be noted that the Ministry of Defense, Public Security, Law and Order has developed a country-wide communication and information dissemination facility using mobile and radio telecommunication systems. This public desk facility can transmit messages, especially those involving crime and other emergency situations to all police stations almost simultaneously, so so that prompt action could be taken on a country – wide basis (Mudalige, J. 2007).

Threats from the Use of Weapons of Mass Destruction

Although Sri Lanka has so far not been seriously affected by weapons of mass destruction such as those of nuclear, chemical and biological origin, there is a dire need for vigilance against such forms of weapons, for which international assistance and expertise will be required especially into intelligence information collection and analysis. Sri Lanka has already established links with the Organization for Prohibition of Chemical Weapons under the Convention on Chemical Weapons, which has arranged to train personnel on nuclear,

chemical and biological weapons. It has however, been pointed out that to ensure security from crime, fear, and use of destructive weapons, there is a dire need for exchange and sharing of information on a national scale through a 'National Information Sharing Framework', with information provided on a spatial and temporal domain. There is also a need to ensure ready clearance to access information relating to basic forensic and crime databases. It has been suggested that a policy framework should be formulated encompassing the creation of an information exchange protocol/format through a 'National Information Super Highway' linking government, defense, research and relevant institutions on the one hand, and data classification, security audits and security clearance for individuals in information administration on the other hand. Such an information system has to operate through an apex body for compliance, and to ensure that national security is not compromised (Pers. Comm. Pieris, D., Sri Lanka Navy, 2008).

Cross Border Threats to National Security

Finally Sri Lanka as a small island economy, must also be aware and alert to the possibility of cross border threats to national security. A UN study reports that "transnational organized crime could be the world's fastest growing industry, in which the International Monetary Fund estimates as much as 5 % of the global economy is laundered through international financial systems by international networks of drug cartels, former mafia and former intelligence officers of various countries". To meet this challenge, it has been reported that already 140 nations have signed "in record time" the UN Convention Against Transnational Organized Crime. (Glen, J.C. and Gordon, T.J., 2001). Sri Lanka must therefore take necessary precautions, and be vigilant of such cross-border threats, and enlist the support and guidance under the provisions of this Convention.



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Food SECURITY

Prof. Arthur Bamunuarachchi

Introduction

Man's primary needs are food clothing and shelter. Man can go to quite a bit of an extent without clothing and shelter, but never without food.

Man being a living entity, should perform and exhibit the characteristics of a living organism. The food that man consumes provides the needed constituents to perform the living functions. These include energy giving constituents, growth support constituents, and constituents that provide for the correct functioning of an array of biochemical reactions on which the physiological activities depend. These constituents includes a variety of the so called vitamins and minerals that needs to be obtained through the food that man consumes. These supports activities that occur in the human system from cells, tissue, organs through to the entire human system level, finally reflects his performance in the society, both physical as well as mental. If any of the nutrients are inadequate, then his functioning

with respect to physical and mental performance will be below expectations. Human performance depends on a society's or a country's state or the level of development. Nutrients therefore need to be available in the diet at a proper level, throughout his lifetime. Any inadequacy of nutrients in the diet will result in illnesses, the extent and severity of which depends on the specific component nutrient and the amount. Nutritionists describe these illnesses due to dietary inadequacies as undernourishment or malnourishment. Therefore adequate amounts of nutritious meals should be made available to every individual in a country. We could specify and state that every individual in the family should receive the correct amount of nutritious food daily, weekly, monthly and annually, and throughout each individual's lifetime. This applies to all families of a village, district, province and the entire country.

The responsibility of achieving this target lies with the government. Every government must be sensitive to



this task, and must have on their agenda provision of adequate nutritious food first, and then the other two major human needs, i.e clothing and shelter. In other words the government must have the priority needs of the people right , and then asses needs, plan programs, draw up policies, acquire ability to execute them, execute them practically, evaluate performance, and bring about corrective measures.

Food security defined

Food security can then be stated as a state of adequate and unhindered availability of nutritious food to a society.

The real food needs (including specific nutrients) of an individual depends on factors such as age, sex, pregnancy status(in the case of females), and tasks performed by the individual. i.e. whether high energy consuming and exhaustive work, sedentary etc. , and the corresponding energy needs. Therefore working out food requirements for a society is a much involved process. This process has to take into consideration the above population characteristics in the society, as well as the nutritional composition of the food available in that society. The latter includes levels of carbohydrates, proteins, fats, vitamins and minerals contained in the food. The foods also needs to be that of the particular choice in that society. For example, in Sri Lanka, rice, certain yams/tubers and wheat flour are the main carbohydrate sources, while some seeds/pulses fish, and dry fish are the main protein source. The vitamin and mineral sources are based on the variety of fruits and vegetables available in Sri Lanka. Milk and eggs are also good nutritious foods.

One has to determine the nutritional content of these commodities, preferably at the state when the food is consumed, while at that same time review the population needs to arrive at the nutritious food requirement of the society on a daily, weekly, monthly, yearly basis taking also into consideration population growth.

Through the involvement of special units of global organizations such as the United Nations Organization e.g. "INFOODS" under UNU, much work has been

carried out on global food compositional data, while promoting country based time series data and assessing dietary needs for different countries, and working out specific nutritional needs. These organizations e.g.WHO, have looked at dietary deficiency effects, worked out remedial programs, and suggested ways and means of achieving food needs in different countries. In 1996, the World Food Summit, considering various factors related to food availability, defined food security as "All people at all times having physical and economic access to sufficient, safe and nutritious food to meet their daily needs and food preferences for an active and healthy life".

At this Summit representatives from 185 countries (including Sri Lanka), and the European Union(EU) vowed to achieve food security globally and reaffirmed the "right of every one to have access to safe and nutritious food, consistent with the right to adequate food and the fundamental right of every one to freedom from hunger.

This session also set out a suggestion for an ongoing effort to eradicate hunger in all countries with a time bound measurable goal of reducing the number of hungry people by half by the year 2015. It has been found that at present the number of hungry people the world over is declining at the rate of six million a year, which is far below the twenty two million needed to achieve the set target.

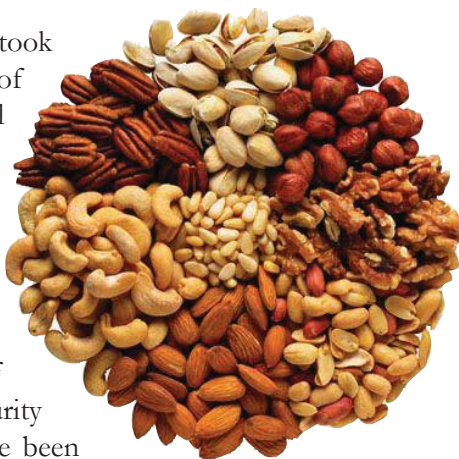
Since persistent hunger was found to continue, further sessions were held in 2001 and also in 2002 in order to monitor the progress.

The 2001 World Food Forum on food sovereignty taking up the issues at that time considered several factors with respect to making food available, and redefined Food Security as the people's right to define their own policies and strategies for the sustainable production, distribution and consumption of food that guarantees the right to food for the entire population, on the basis of small and medium sized production, respecting their own cultures and the diversity of peasant, fishing and indigenous forms of agriculture production, marketing



and management of rural areas, in which women play a fundamental role. This statement targets the poorer countries, i.e. developing countries like Sri Lanka, where the problem really exists.

The 2002 forum took up the dedication of the international community to eradicate poverty, as a primary need to eliminate hunger, and several new programs in favor of achieving food security the world over have been launched.



The global situation

With respect to the global situation, the current world population is said to be just above seven billion. The world's poverty status is said to be around 1.2 billion people. i.e. 22% of the world population. These poverty stricken people live on less than US \$ 1/= per day. Thus hunger effects more than 800 million people.

Seventy percent (70%) of the world population is extremely poor, poverty stricken and food insecure. These people live mostly in the developing or the poor countries, and in the rural areas. These countries are unable to provide the basic needs that rest on several socio economic and political factors.

Over the years the world's food production has seen an increase, which is much over and above the needs for the increasing world population food needs. But there are factors like unequal distribution, availability, and accessibility, international trade and marketing, which lead to food insecurity, malnutrition, instability etc. Specific data on a regional basis are available within the relevant divisions of the UN system.

The Sri Lanka Situation

The current population in Sri Lanka is just above nineteen million. Out of the total number of households in the country around 1/5th do not consume the required minimum calories per day. This inadequate calorie



consumption like in many of the developing countries is related to several factors. These include non-availability of food, inability to acquire, inability to select food based on nutrition (due to lack of food and nutrition knowledge), food distribution factors, wars and political unrest, population movements, natural and man made disasters, food beliefs and myths etc.

Food consumption inadequacies cause food and nutrition related diseases such as stunting, wasting and underweight among children, iron deficiency anemia in females and so on. Several projects related to areas such as meal composition, comparison of recommended and real dietary intake, dietary pattern of school children, food and nutritional knowledge (including stakeholders in the food chains of grain, fruit and vegetable and fishery sectors) in selected areas in Sri Lanka carried out by the Sri Jayewardenepura University Food Technology group shows negative impacts, i.e. the existence of quite prominent and visible low levels than what it really should be.

Sri Lanka being an Island and a small country is blessed with adequate water resources, sunlight and natural environment for good and adequate food production. It commands a very high potential for food crop



production, livestock development and developing and exploiting the country's marine resources for fisheries coupled with the inland fishery potential. Application of available and proven novel technologies in these sectors in order to increase production of foods, ensuring use of correct post-harvest technologies, promoting preservation of these by processing etc., would help in achieving food security. Surveys have also shown that there is around 30 to 40% of food crop losses in post harvest, amounting to more than Rs.10 billion a year, while at the same time causing environment problems. It has been proved that this is due to improper and unscientific post harvest management (practices).

Achieving food security

In any country there are three fundamental norms that need to be addressed in achieving food security.

The first is food availability. This is to be achieved by food production as needed through cultivation of appropriate food crops, livestock and animal farming for meat, milk and eggs as the case may be, and exploiting marine and inland fisheries potential. Different countries do exhibit all these at different capacity potentials. Sri Lanka is fortunate being a small Island country, it has an extremely high potential for these three sectors.

Countries must adopt latest technologies in exploiting these sectors. There are ample opportunities in Sri Lanka to adopt novel scientific technologies for improving production in all these sectors. The need is to pass down knowledge to producers and the rest of the stake holders in the food production system by providing the means to practice with the knowledge.

The second is economic and physical access to food. This need is important at house hold and national level. At the national level if a country is not able to produce all the food needs for food security of the people, it must import food from other countries. For this purpose the country must have adequate financial resources and a solid economy. The country has to earn money through exports, providing services, collecting taxes etc. and also may have to depend on food aid. The latter situation occurs in case of internal conflicts, where the World Food Program(WFP) provides food for the war displaced, and also for unexpected disasters like the Tsunami etc .At the household level production of food at the domestic level should be promoted. Selling some of these or by being in paid employment, accounts for the ability to buy the additional family needs. In the Sri Lankan situation the minimum monthly stipend must be increased by working out on the real needs.

The third factor is correct food utilization. This is critical at the individual level, and important at the household level. This factor brings together nutritional as well as other quality and quantity aspects of the food consumed. Use of clean water improves food utilization by individuals and ensures good health. To achieve this a certain level of food and nutritional knowledge is needed. Studies on this issue in Sri Lanka have shown that such knowledge should be passed on to the people. We have a situation where stake holders from producers to the retailers do know very little or nothing at all with respect to the scientific aspects and the nature of the food commodities that they themselves handle. The result is that there is much food wasted at all levels. Consumers too exhibit problems in selecting, and price comparison, and deciding on what gives the highest nutrients for the lowest price.

Under each of the above three factors, there are several other considerations that can be described for achieving the set targets. A close analysis of the definition of food

security spelt out in 2001 by the international food sovereignty forum, and examining each phrase of this definition with each of the above three factors proposed above for achieving food security, and then planning and executing programs, followed by periodically monitoring and evaluation as well as taking corrective measures, will help a country like Sri Lanka to achieve food security status sooner.

It should be stated that there have been programs launched by the government at various times such as food stamp scheme, provision of a free weaning food like Thripasha, the rural awakening and support programs like Samurdhi(formerly Jansaviya) etc. to ensure supply of food for the needy. The present activities under agro development, promotion of fisheries and the livestock sectors, promoting agro/food processing, promoting small and medium scale industry, home gardening, free school meals, the fresh milk drive etc. are targeted towards poverty reduction and food provision for the masses. Further, the ongoing trade center concept is making market outlets for the producers and providing ease access to the consumer. Sri Lanka is also a partner under the Millennium Development Goals Program, where the activities target human development.

The machinery in my view to achieve food security is in place at present under several of the Mahinda Chintanaya propositions. Some projects are already working to some extent in Sri Lanka. The need is for those responsible in handling them to see to it that the processes are made practical, and then subject for evaluation and correcting. Further, the war is over and perhaps the money being saved and the human resources now available from even the defense system could now be trained and used to win the hunger war.



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WATER SECURITY

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Water Security: An Introduction

Water security can be defined as the regular access to enough safe water for an intended purpose to maintain and enhance the quality of life. Since water is a basic need of life, water security is defined as a human right by international law. In the National Water Resources Policy (approved by the Cabinet in 2000), it is principally accepted that water is a basic need for all living beings. It also includes the provision that the need to ensure access to safe water for the present and future generations is a fundamental right of all citizens. In addition, the draft national policy on drinking water state clearly that the Government of Sri Lanka considers access to safe drinking water as an inalienable right. Further, in section 7.1 of the draft drinking water policy, it is stated that water shall be considered and treated as an economic good, while ensuring basic needs are made accessible to all.

Water security is a rapidly growing issue in many parts of the world including Asia due to inadequate availability of safe water. At the same time, water is a key development ingredient that impacts on a variety of factors that sustain and enhance life. As a critical natural resource, the issues connected with water resources management are inherently diverse and complex. They involve questions of allocation and distribution, equity, conservation, pricing, regulation, education, participation, and

sustainable use. Secure access to safe drinking water is a vital requirement to improve the health and sanitation of societies. The access to water for other sectors such as agriculture, power generation and industries will support the economic development in a country. Water security in the agriculture sector is one of the main factors determining the food security of the nation. Although a healthy biotic environment supports in enhancing the quantity and quality of available water and thereby the quality of life, the environment is considered as the most neglected sector in terms of water allocation. The proper functioning of the environment ensures water allocation in maintaining the minimum environmental flow requirements.

Within the context of this background, it is clear that the issue of water security is of paramount importance to the socio-economic development of the country and sustainability of the environment.

Water as an essential component of life

Water is an essential component of life. Human, animals and plants need water for their biological functions. There is no substitute for water. Water has multiple uses as well as multiple users. The availability and supply of fresh and clean supply of water determines the health and sanitation of a society.



When considering the distribution of water resources in the world, it is a known fact that 97% of the global water is saline and stored in the oceans. Fresh water availability is only around 3%. About 68.7% of the freshwater is stored in icecaps and glaciers and around 30.1% exists as groundwater, 0.3% remains as surface water while the rest 0.9% contributes to other forms of water. Fresh surface water is available in rivers, lakes, wetlands and other aquatic ecosystems. In view of the above facts, it is apparent that only 1% of the world's water is available for the use of human beings. Out of this 1%, a majority exists as groundwater, while only a small fraction is available in surface water bodies and rivers as surface water.

Distribution of water resources around the world is uneven. Hence, the availability of water also shows a significant variability across the countries, irrespective of the population pressure and economic development. This can be determined by analyzing and comparing the specific water availability for a single period of time for different regions and countries. The specific water availability represents the value of actual per capita renewable water resources. According to UNESCO the greatest water availability of 170,000-180,000 m³ per capita is in the regions of Canada, Alaska and in Oceania. In densely populated regions of Asia, Central and Southern Europe, and Africa the water availability is within 1200-5000 m³ per year per capita. In northern Africa and the Arabian Peninsula, this value is around 200- 300 m³ per year per capita. If the per capita water availability is less than 2000 m³ per year it is considered to be low, and less than 1000 m³ per year is considered as catastrophically low. In Sri Lanka, water availability per capita per year is 2500 m³ and this figure is quickly diminishing. The water availability values indicate that very serious problems exist in terms of fulfilling basic water needs of various sectors such as water supply and sanitation, industry and agricultural development. In addition to the uneven spatial distribution of water resources around the world, availability of water shows a temporal variability too. This is mainly determined by the availability of precipitation and the circulation of water on the earth as represented in

hydrological cycle which includes various processes that take place during the circulation of water in the earth system.

The science that deals with occurrence and circulation of water is called Hydrology which is based on physics, meteorology, oceanography, geography, geology, hydraulics and other related disciplines such as forestry, agriculture and ecology. Water available in the land phase of the hydrological cycle covers the sources of water from rainfall, surface water, groundwater, recycled water, fog interception and salt water purified using osmosis.

Multiple uses of water and the water users

Agriculture is the most dominant water user in the world. Agricultural accounts for nearly 70% of the water used throughout the world, and the majority of this water is used for irrigation. In the United States, 49% of the total freshwater is for agriculture and in Africa and Asia, an estimated 85 -90% of all freshwater use is for agriculture. According to



estimates for the year 2000, agriculture accounted for 67% of the world's total freshwater withdrawal, and 86% of its consumption. With the development of irrigation infrastructure such as dams, river diversions and construction of irrigation canals, the potential arable areas which did not receive adequate rainfall for crop growth started receiving water. In Sri Lanka, the Mahaweli development programme established a series of reservoirs in the upper reaches of the Mahaweli river, and from which water was diverted for agriculture in the drier parts of the country. This led to the improvement of food production while increasing the consumption of freshwater resources in the dry parts of the country.

Many of the world's most important agricultural lands consume groundwater at unsustainable rates. In Sri Lanka, indiscriminate extraction of groundwater takes place in large agro wells in the dry zone of the country, and this leads to the gradual decline of ground water, making it into a non-renewable resource. This can make a significant impact of water security of the nation. In management of drainage, water is used to wash off accumulated salts in soils.

Water is essential for biological functions of all living beings. In addition, humans need water for health and sanitation. As a solute, water washes away dirt and it cleans the environment. Hence water is used for drinking, cleaning and washing purposes. Development of ancient civilizations around the major rivers is the

best example to show the importance of water for human existence.

Water withdrawals in the industrial sector vary with the level of economic development. On average the global industrial water use is around 22% and in high income countries it is approximately about 60% of total water use while in low income countries it is only around 8%. The most significant factor with respect to water use by industries is the discharge of used water, which contributes to pollution of water courses. In developing countries, the industrial wastes are dumped into the water where they pollute the usable water supply.

World energy demand is rapidly increasing as a result of socio-economic development. Hydropower is the most important and widely used renewable source of energy. There are about 45000 large dams developed worldwide for multiple purposes including hydropower development. Though, hydropower provides comparatively clean energy, there are social, economic and environmental issues related to the construction of large dams. In addition thermal and nuclear power production also requires a considerable amount of water.

Ecosystems provides multiple benefits such as habitats for plants and animals, moderation of physical conditions like weather, absorption of energy to reduce temperature, infiltration of water, changes in water flow velocity, moderation of the chemical environment such as reduction of carbon dioxide, production of oxygen, absorption of chemicals, etc. Efficiency of these activities depends on the healthiness of the ecosystems. Hence, ecosystems need water to maintain the multiple benefits it provides to the society.

Water is an important element of cultural practices and religious beliefs. Rivers and other water bodies are associated with many cultural functions. In addition, water has non consumptive uses such as navigation, fishing, recreation, etc. Water users in these various sectors have diverse



objectives in utilizing water. Hence they take maximum effort to fulfill their demands. This demand has created a huge pressure on the water resources around the world.

What are the factors that affect water security?

Population growth as well as over exploitation of land and water resources for agriculture and industrial purposes has increased the demand for water during the past three four decades. In addition, these activities have contributed to the deterioration of the freshwater resources around the world too. World freshwater resources are diminishing at an alarming rate as a result of destruction of forests and important ecosystems, disposal of wastes into the water bodies, rivers and streams, human induced soil erosion and landslides, and improper management of water resources. These factors have contributed to the pollution of water and subsequent deterioration of water resources. The quality of water determines its intended use. Water quality standards have been formulated to identify the suitability of water for different purposes such as for drinking, irrigation, recreation, etc. Pollution of water resources adversely affects the water security for all these purposes.

Water pollution has occurred mainly due to point and non point sources. Point sources discharge pollutants from specific known locations so that they are easy to identify, quantify and control. Therefore, most countries in the world have successfully controlled the point sources of pollution. However, in the developing world, this is also a major concern in urban and industrial areas. In contrast, the non point sources are diffused in the environment and hence it is difficult to identify their origins making it difficult to control. Agriculture is considered as one of the important nonpoint pollution sources as the agricultural inputs such as fertilizers, pesticides, heavy metals and sediment generated

from agricultural lands contribute to the pollution of water resources. Eutrophication or excessive growth of algae and aquatic plants in water bodies is the adverse consequences of accumulation of nutrients such as Nitrogen and Phosphorus in water bodies. The algae produces toxic compounds making such water unusable. In addition, aquatic plants block the drainage canals too. Fish cannot survive in eutrophic water due to low dissolved Oxygen levels. In addition, agriculture contributes to the accumulation of salts in soils in areas with high evaporation rates.

Destruction of watershed areas as a result of over exploitation of land for agriculture, urban development and for industrial purposes as well as man made fires are witnessed mainly in the developing world including Asia. Important ecosystems such as forests, mangroves, and wetlands have been degraded as a result of the destruction of watersheds. The health of the watersheds determines the quantity and quality of water they produce. With the degradation of watersheds, poor dry weather flows in the rivers and streams can be seen causing water shortages during dry seasons. In addition, pollution of water increases the water purification costs, which in turn lead to high water tariffs in water supply systems. In addition, water shortages will adversely affect the livelihoods of people such as in fishing.

Large dams are constructed for multiple purposes including drinking water supply, irrigation, hydropower generation, flood protection etc. They will eventually help to improve the water security of different sectors and societies. However, there are many adverse social and

environmental impacts of large dams too which negatively contribute to the water availability for humans, animals and the environment. The water rights of the downstream people are adversely affected due to large dams. The downstream



ecosystems and wildlife also suffer with low water and sediment supply adversely affecting livelihoods. The displacement of people due to large dams can reduce the water security of people in their new settlements. River diversions can also positively and negatively contribute to the water security of the people. The water security of the receiving river basins will be improved while the downstream people of donor river basin may suffer due to shortage of water for drinking, agriculture and other livelihood options.

Temporal variations of climatic conditions also contribute to the water shortages. Water may be adequately available in the wet season while water scarcity is experienced during the dry season. Freshwater resources are highly sensitive to variations in weather and climate. The changes in global climate resulting from the accumulation of greenhouse gases in the atmosphere will affect patterns of freshwater availability, and will also alter the frequencies of floods and droughts. Water security of the people can be adversely affected under both situations. Though water is available during floods, the quality becomes an issue in intended use. The benefit of floods is that they help to flush off waste materials and pollutant rich sediments from rivers to purify riverine ecosystems. Under drought conditions, both quality and quantity will deteriorate and water security of people will be adversely affected.

Wastage of water can be seen all over due to leakages of delivery pipes, unattended taps and overuse of water in almost all water use sectors. A very high percentage of non revenue water loss is a serious problem in the water supply systems in most of the developing countries. These wastages also contribute to the water shortages. In addition to the above factors, water security for different uses is determined partly by the management of water resources. In the past, water was considered a commodity to be controlled and supplied. The potential water availability in an area was considered based on the long term average river runoff. Water requirements were calculated for different water supply purposes. Water use efficiency was overestimated and yet the social, economic and ecosystem considerations of water were poor, highly technical and sectoral. However, due to the interdependent nature of the different components in the watersheds and water supply systems, it is important to consider all the sectoral water uses and water users in

formulating water resources management strategies to protect the water rights and water security of all. This is the basis for new approaches formulated for integrated water resources management.

Water security of Sri Lanka

Sri Lanka is rich in water resources. North East and South West monsoons and convective rainfall are the main sources of surface and groundwater. These are supplemented by fog, dew and mist in some areas. At higher elevations, cloud water also contribute to the surface water flow. The mean annual rainfall of Sri Lanka is about 1900 mm which is about two and a half times more than the world annual mean of 750 mm. Depending on the spatial variability of rainfall, Sri Lanka is divided into Dry, Wet and Intermediate Zones. The Wet zone of the southwest and the central hill country receives rainfall of above 1750mm per year while the Dry zone receives around 1250mm of rainfall. The Intermediate zone receives rainfall within the above two figures annually. However, there is a considerable inter annual variability of rainfall experienced in Sri Lanka.

Sri Lanka has 103 major river basins. Severe floods occur in some of these river basins including Kelani, Kalu and Mahaweli, while occasional floods are experienced in many other basins. Cyclones and monsoon rains can bring severe floods to the Dry zone areas as well. Droughts also occur in almost all parts of the country though the Dry zone is highly vulnerable.

The surface water resources in the country includes rivers, streams, lakes, tanks, man made reservoirs, lagoons and wetlands. Groundwater is also an important resource for the country and the limestone aquifers in the Northern regions are the major water sources in these areas. Shallow groundwater is used for domestic and agricultural purposes in many parts of the country especially in rural areas.

Even though the mean annual rainfall figures are very impressive, different parts of the country face water shortages during dry periods. Even in the Wet zone, settlements located in higher elevations face water scarcity due to deep water tables. Diminishing and deteriorating surface and groundwater resources can be seen in the country as a result of destruction of forest cover in important water source areas, over abstraction

of groundwater, pollution of water resources as a result of intensive agriculture (eg. Kalpitiya, Nuwara Eliya, Jaffna), urbanisation and improper disposal of urban, industrial and agricultural wastes. All these factors have negatively contributed to the water security of various water use sectors in the country.

How to enhance water security?

With the growing population and improved living standards, it is difficult to control the growing demand for water. Within this background, many developing countries face the challenge of providing safe and sufficient water for people due to the degradation of water resources at an alarming rate. However, it is a known fact that most of these countries have rich sources of water. Inadequate measures for law enforcement to protect environmental resources, poor water resources infrastructure, uncoordinated management of land and water resources, lack of government support, lack of political stability and poor community participation have led to a decline in water security in these countries.

Integrated Water Resources Management (IWRM) approach gives consideration to all the water use sectors and the stakeholders in developing strategies for water resources management and has been identified as a highly suitable option for coordinated management of water resources. Within the framework of IWRM, it is important to empower people to value water considering its economical social, cultural and environmental importance. Community participation is needed to control pollution. Risk management should be carried out to provide security from floods, droughts, pollution

and other water related risks. Important ecosystems in the river basins should be protected to improve the water yield and quality. Water supply infrastructure should be properly maintained to minimize leaks and conveyance losses. Rainwater harvesting should be promoted to improve the availability of water for different uses. Groundwater recharge should be improved. It is important to take steps to share water resources to promote peaceful co-operation and develop synergies between different water users at all levels, within and between boundaries and in respect of trans-boundary water resources through sustainable river basin management.

Sri Lanka should also be prepared to face possible climate change impacts on water resources by improving water resource infrastructure, proper land use planning, capacity building in water sector, policy formulation, and imposing strict regulations to protect watersheds, riparian areas, wetlands, etc. In addition, equitable allocation of water resources is also needed to ensure water security of the nation.



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Sanitation & Health

Dr Nalin Abeysinghe

It is observed that when compared with the past, allopathic medicine has advanced substantially. Most of the time these developments are attributed to the latest inventions in diagnostic and treatment aspects of medicine. Yet the subjective sentiment of a healthy life or to be healthy or in other words the personal attitudes in relation to health are far behind these advances. Although the knowledge about diseases and their causation were well understood, the concept of health has not been adequately conveyed to people. Sanitation being a gateway to health, possesses a higher rank in the list that need to be addressed to improve the wellbeing of a community.

World Health Organization (WHO) defines Health as a state of complete physical, mental and social wellbeing and not merely absence of disease or infirmity. In simple terms, this means that health is not a mere absence of disease. It is assumed that one can understand what is meant by physical wellbeing. It may be said that a person is physically well off if his bodily organs are functioning optimally with the absence of any evidence of disease. If one cannot live in harmony with other people, does it reflect one's health? Further, if one is not educated adequately nor experienced or skilled in any kind of manual or non-manual work, and therefore does not possess sustained capacity to earn, do you think that person is well? Well, up to now I have tried to



Faecal contamination of water is an important cause of ill health. Improving sanitation is a priority

arouse your curiosity on the broad concept called health in relation to its physical, mental and social aspects.

From the above discussion, it is clear that health is a state for which one should strive. Although most of us are born healthy we lose it more or less with time due to our unhealthy life style. Sanitation is one of the important factors that determine health.

According to the World Health Organization (WHO), sanitation refers to the provision of facilities and services for the safe disposal of human urine and faeces. The word also implies the maintenance of hygienic conditions through services such as garbage collection

and wastewater disposal. Although this statement may imply that sanitation need to be provided, which to some extent is true, the real responsibility lies with the people experiencing the consequences of both poor and good sanitation.

In Sri Lanka, the proportion of the population having sustainable access to safe drinking water was 86% in 2006. In India this value is nearly three times lower than ours (28%). In Bangladesh this value is 36% while all the developed countries are close to 100%. Proportion of Sri Lankan population with access to improved sanitation was 80% in 2001.

Sanitation comprise several services provided to improve public health. Among these services, provision of safe

water, provision of safe food, planned wastewater management, and disposal of human excreta and garbage play a major role. Most countries around the world have enacted legislative measures to ensure the quality of these services provided to their people. According to the WHO, 40% (2.4 billion) of the 6 billion people in the world possess no acceptable means of sanitation.

Water and sanitation go hand in hand. Good sanitation is not possible where adequate supply of water and proper management of water are not in place. Most of the sanitary facilities are based on the manipulation of water. Hence the authorities concerned as well as individuals should take the necessary precautions to ensure the provision of safe water for drinking and food preparation, prevention of infections due to water-related vectors (e.g. Dengue, Malaria) and water-borne infections (e.g. Typhoid, hepatitis and cholera), and also to ensure the proper management of water for irrigation (45% of the world's food production comes from irrigated agriculture), in order to sustain an equilibrium in the global ecosystems. Diarrhea is the most important public health problem directly related not only to water, but also to sanitation. Are you aware that there are 2.2 million deaths around the world due to diarrhoea and 90% of these victims are children under 5 years of age? What is the solution for this global problem? One simple step is washing hands with soap and water before taking meals and after using the latrine. Very simple, isn't it? Well, recent studies have revealed that washing hands with soap and water can reduce diarrhoea by 35% (that means one-third of diarrhoeas can be prevented saving the life of 500,000 people!). Chlorination of water, legislative enactments and enforcement for the disposal of wastewater and human excreta, destroying of mosquito breeding sites, etc... all of which contribute to the manipulation of water to ensure sanitation.

Water which plays the central role in sanitation, food sanitation, waste and wastewater management, disposal of human excreta and garbage are also

important with regard to maintaining sanitation. In relation to food sanitation, the government of Sri Lanka has taken adequate measures for the provision of safe food for the people. The Food Act No. 26 of 1980 is the key legislation governing food safety activities in Sri Lanka, and its provisions protect the consumer not only from utilizing unsafe food, but also from being misled by incorrect information provided by various manufacturers. WHO has proffered golden rules for safe food preparation, for example on the need to keep the raw and cooked food separately, cook food thoroughly, Keep food at safe temperatures, use safe water and raw materials. National Environmental Act (NEA) provides provisions on waste water disposal, ambient air quality standards and permissible noise levels. It is known that most of the factories discharge their industrial wastewater in to natural waters. NEA has issued standards for the quality of this discharged wastewater, so as to ensure that the natural equilibrium, and biodiversity of these natural water resources are not disturbed. Hospital waste management is by far the most important in preventing severe infections. Disposal of human excreta (urine and faeces) should be done meticulously. Intentional or unintentional disposal of human excreta into natural water sources is a major health hazard, bearing a potential risk of spreading waterborne infections like hepatitis, amoebiasis, typhoid, acute diarrhoeal illnesses, etc.

Concept of health is a broad topic that needs discussion. The gist of health has evolved over centuries being initiated as a concept of individual concern, and later becoming a world-wide social goal. How the concept of health had evolved is described below.

At the turn of the 20th century, health was viewed as 'absence of disease', and this was known as the 'biomedical concept'. This was founded by the 'germ theory of disease' which was well accepted in that era. Nevertheless this concept was found inadequate to solve some of the major health problems of mankind (e.g.



Using even small quantities of water effectively can improve hygiene and health

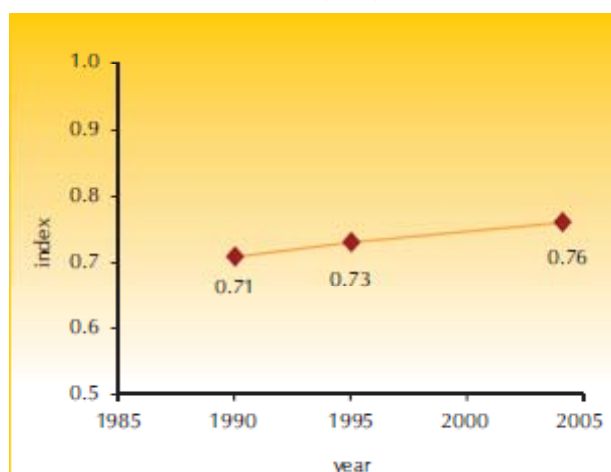
malnutrition, chronic diseases, accidents, drug abuse, mental illness, environmental pollution, population explosion etc.). These deficiencies in the biomedical concept paved the way for ecologists to put forward an attractive hypothesis which viewed health as a dynamic equilibrium between man and his environment, and disease was a maladjustment of human organism to the environment. With the contemporary developments in social sciences the 'psychosocial concept' was stipulated and thereafter the 'holistic concept' – the unified or multidimensional process described above (as the latest WHO definition of health) has been accepted, which implies that all sectors in a society have an effect on health.

As stated earlier Health can be viewed from several dimensions with special reference to human beings' physical, mental and social aspects. Physical dimension conceptualizes health biologically as a state in which every cell and every organ is functioning at optimum capacity and in perfect harmony with the rest of the body. Various tools and techniques have been evolved to assess physical health – both individually (self assessment, clinical examination, biochemical and laboratory investigations), and at the community level (crude death rate, infant mortality rate and expectation of life). In the case of mental dimension of health, it should be understood that this is not mere absence of mental illness, but the ability to respond to a variety of experiences of life with flexibility and a sense of purpose. Mind and body are not independent entities as thought few decades back. It has been proven by modern research that psychological factors can induce all kinds of illnesses including hypertension, peptic ulcer and bronchial asthma. Social dimension of health describes the harmony and integration within the individual, between each individual and other members of society and between individual and the world in which they live. The next dimension though not described in the main context of health, is its spiritual component. It was proposed as a part of the concept

of holistic health and still defies a concrete definition due to its complexity. This is the part of a person that comes out and strives for meaning and purpose of life. In addition to these three main dimensions, certain other – previously not thought as dimensions of health were stipulated viz. emotional, vocational and political.

Consideration of the above conceptual framework, one may think it is a perfectionists who may have evolved this concept of health. This is because, if we take health as a spectrum as described above, perfectionism lies at the positive extremity of this spectrum (other end will obviously be death). Positive state of health remains a mirage in a context where everything changes, but it is a potentiality, and is based on one's ability to modify him/herself continually in the face of changing conditions of life. The concept of relative health appears here, where health is described not as an 'ideal' state, but as a biologically 'normal' state. Therefore health will not remain as a universal standard, but will be defined by its own norms for a given set of prevailing conditions in a given community. In Sri Lanka a birth weight of 2.5 kg will be taken as normal, whereas in developed countries this value may be taken as low (in developed countries the normal birth weight averages around 3.0 kg). Hence, many biological normal ranges have been defined taking into considerations the various parameters determining normal health, where 95% of the normal population is included.

Increment of Sri Lanka's Human Development Index (HDI)



Let's move on to another important concept known as wellbeing that was introduced along with the WHO definition of health. Wellbeing comprises subjective and objective components. The objective component determines how outsiders determine one's wellbeing, and this is described by the means of the standard/level of living. Standard of living refers to the

usual scale of expenditure, the goods consumed and the services provided, and it also includes the status of

health, level of education, employment status, food, dress, house, amusement, social security, observance of human rights and provision of comforts of modern living. The standard of living primarily depends on the per capita GNP (Gross National Product) and this is used to compare the standard of living among countries. Subjective component of wellbeing is referred as 'quality of life' (QOL). I would like to describe this phase as the subjective evaluation of the concept of standard/level of living i.e. how an individual perceives his/her provisions

of standard living. People are now demanding a better quality of life; hence governments all over the world are exerting their efforts to improve the QOL of their citizens by adopting various measures. As a result of attempts to measure QOL, several indicators are now being used, among which the Physical Quality of Life Index (PQLI) and Human Development Index (HDI) are widely recognized. HDI is used by WHO to rank the countries according to their health and socio-economic status. HDI is a

composite indicator that uses longevity (life expectancy at birth), knowledge (adult literacy rate and mean years of schooling) and income (real GDP per capita in terms of purchasing power) into its account. According to HDI ranking, Sri Lanka was ranked at the 96th position out of 177 countries in 2002.

Sri Lanka provides a rare instance where her citizens are granted most of health services free of charge. Government expenditure on health is 4.2% of the Gross Domestic Product (GDP). World Health Organization (WHO), in its Country Health System Profiles states that as a result of the pursuance of the social welfare-oriented state policy over the last five decades, Sri Lanka has outstanding achievements in literacy and health status of its people. Sri Lanka's primary authority involved in providing, assessing and maintaining health is the Ministry of Healthcare and Nutrition. Ministry functions according to the National Health Policy declared in 1996, and we must be proud of our achievements in healthcare, which can be considered

pari passu with the well developed countries of the world. Government's health policy is aimed at increasing the life expectancy and improving the quality of life of the people by improving the preventive health sector, making healthcare more accessible to the community on an equitable basis, development and implementation of national drug policy, development and regulation of private healthcare sector, meeting the emerging health needs and several other provisions for the betterment of the island's healthcare system and its consumers –

the citizens. While the Ministry functions as the local authority for health, World Health Organization is the directing and coordinating authority for health within the United Nations system. It is responsible for providing leadership on global health matters, setting norms and standards, articulating evidence-based policy options, providing technical support to countries and monitoring and assessing health trends.

As I have mentioned in the early part of this article, sanitation is one of important factors that

determine one's health and is the more controllable factor in this regard. Readers should understand that sanitation only addresses the diseases that are infectious or communicable in nature, and therefore comprise only one aspect of health. It should however, be emphasized that maintenance of good sanitary practices will prevent a large number of morbidities and deaths due to infectious diseases. I would like to remind that very basic sanitary practices will make a great impact on preservation of health. May all of you be healthy!



The world health assembly. WHO's 193 member countries meet to decide policy for improving health



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What have you learnt? Scan your own memory!

1. True or False

- (a) When today's energy usage for consumption and existence per person is compared with earlier decades, there is a decrease in usage.
- (b) Ocean thermal energy and ocean currents originate due to the temperature variation in the ocean.
- (c) The present energy consumption pattern clearly shows that societies do not depend on fossil fuels.
- (d) Though we lack fossil fuels, being a tropical country we are rich in renewable energy sources.
- (e) Since the southern part of the ocean does not have any major land masses up to the southern pole, we have a high potential for use of steady sea waves and winds.

2. True or False

- (a) National security concerns are by and large country specific, and hence need internal solutions.
- (b) Sri Lanka is often cited as a country that has failed to achieve a reduction in Infant Mortality and Maternal Mortality ratios.
- (c) Threats to national security also arise from weather-related disasters, both natural and man-made.
- (d) Presently, one of the most pressing security concerns is poverty and freedom from malnutrition.
- (e) As Sri Lanka has so far not been seriously affected by weapons of mass destruction such as those of nuclear, chemical and biological origin, there is no need for vigilance against such forms of weapons.

3. True or False

- (a) Human performance reflects a society's or a country's state or the level of development.
- (b) Food requirements need not depend on the choice of the society.
- (c) The real food needs of an individual depend on factors such as age, sex, pregnancy status(in the case of females), and tasks performed by the individual.

- (d) It has been found that at present the number of hungry people world over are increasing.
- (e) Food availability has been achieved by food production through cultivation of food crops, livestock and animal farming, and exploiting marine and inland fisheries potential.

4. True or False

- (a) When considering the distribution of water resources in the world, it is a known fact that 97% of the global water is saline and stored in the oceans.
- (b) Distribution of water resources around the world is quite even.
- (c) Agriculture is the most dominant water user in the world.
- (d) Water users in the various sectors have similar objectives in utilizing water.
- (e) Important ecosystems such as forests, mangroves and wetlands have been degraded as a result of the destruction of watersheds.

5. True or False

- (a) Although the knowledge about diseases and their causation were well understood, the concept of health has not been adequately conveyed to people.
- (b) In Sri Lanka the proportion of population having access to safe drinking water is less than that of India and Bangladesh.
- (c) Water and sanitation go hand in hand.
- (d) Hospital waste management is by far the most important in preventing severe infections.
- (e) Mind and body are considered independent entities in the health issues.

Answers

1.	2e	3a	4e	5e
2.	3e	4a	5e	6e
3.	4e	5a	6e	7e
4.	5e	6a	7e	8e
5.	6e	7a	8e	9e