

IPAW
Iran power & water

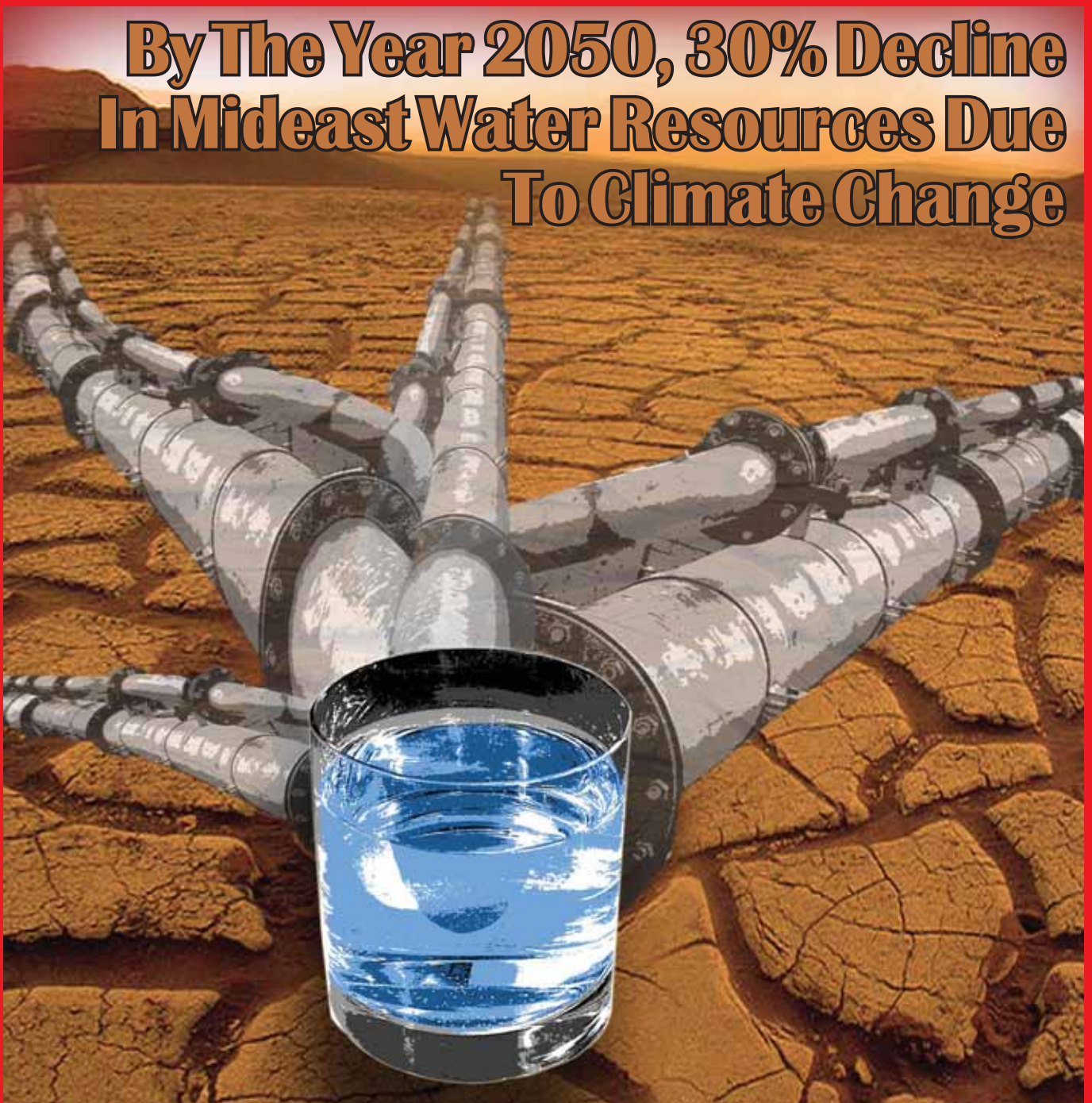
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Oct 2010

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**By The Year 2050, 30% Decline
In Mideast Water Resources Due
To Climate Change**

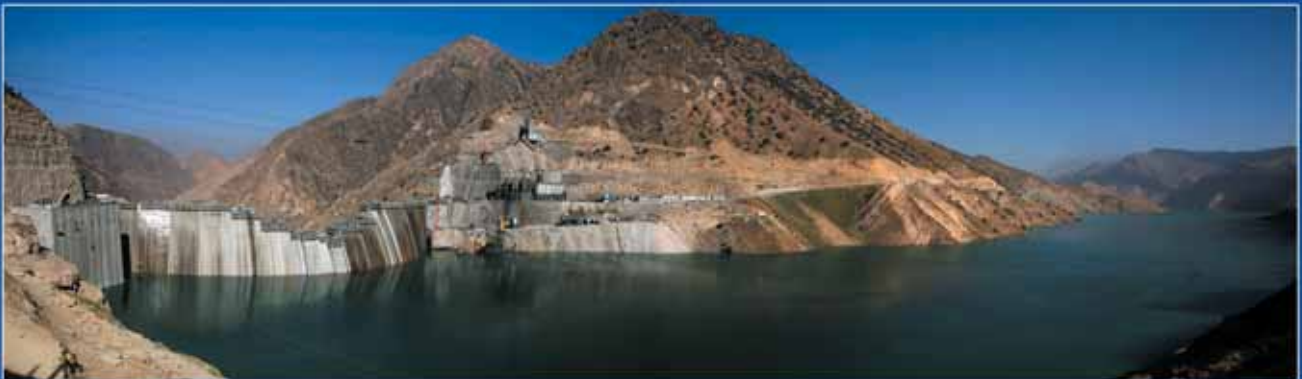


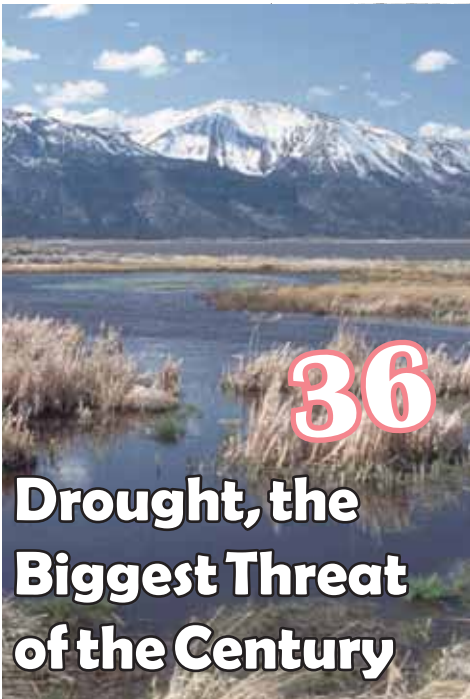


Field of Activities:

General contractor for execution of infrastructural projects in the fields of energy and water industries on a turn-key basis, including:

- Project Management
- Financing Arrangement
- Design & Engineering
- Procurement
- Construction & Commissioning





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Drought, the Biggest Threat of the Century



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Tehran to Play Host to 21st International Congress on Drainage and Irrigation

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In The Name Of God

For centuries humans have been dealing with drought and flooding and any time either of the two has struck man has learned a new lesson about the scope and extent of these two natural disasters. Sometimes drought, which is either natural or caused by human activity, is limited to a small area, but sometimes it has a global extent and brings about massive death and destruction. Such a devastating impact is mostly caused by extreme heat which has its roots in developments on the surface of the sun as well as in major climatic changes and hurricanes. Some of these have been spotted in recent studies by NASA scientists to develop an understanding of the atmosphere. What is certain is that these natural phenomena happened again and again in the past centuries but limited information about them had been in circulation. But in recent years thanks to electronic media, the spread of news and information has been much faster than in the past. In fact, the media revolution has spelled an end to lack of information about natural disasters around the world.

The news coverage of Hurricane Katrina and the devastation it caused to New Orleans, Louisiana and the Caribbean in 2005 and the Asian tsunami which wreaked havoc in Indonesia and or the recent floods in the mountainous areas of north Pakistan along the Indus River are some examples of how fast information about natural disasters travels around the world. In fact, it took the world a few minutes to learn about the flooding which sent billions of cubic meters of water roaring into much of Pakistan. The reasons behind such disasters and ways of preventing the repeat of them have not drawn as much attention though. In times of such disasters, governments build on diplomatic principles and send aid to ease the sufferings of those affected by natural disasters. In fact, the underlying causes of flooding remain unexamined until after disaster has struck again. In fact, in times as such, analysis of the reasons behind flooding, reviews of hydraulic structures, engineering analyses of rivers and cooperation by civil managers to prevent the repeat of such disasters are all overshadowed by prompt measures taken by the governments of affected countries.

When flood waters subside, experts and engineers

of the flood-stricken country or those with international institutions scramble to find out the causes of the disaster. They sometimes release the results of their studies. For instance, they blamed the recent flooding in Pakistan on unseasonable heat in Russia and Japan, simultaneity of a special weather front with monsoon rains and dramatic movements of air over oceans. These are the results of climate change, global warming and erratic movements of air which cannot be stopped by scientists, at least not now. But other issues like engineering analyses of rivers, cooperation of urban managers, and studies which focus on the design period of structures are among issues which either draw little attention or are not covered at all. Failure to spread information about the boundaries of rivers and basins which are off limits to development activity and lack of cooperation on the part of rural and urban managers in clearing up the obstacles in the way of rivers do not draw the attention of donor countries or recipients of aid. There are no plans for immediate evacuation of areas which might be at risk in times of flooding. Besides, there are no flood drills to prepare residents to evacuate when flash floods or those triggered by breaches in dams strike. These questions are ignored when consultants or governments place orders for development projects. A few countries have included emergency evacuation in their dam building studies. That is far from universal. Emergency evacuation in times of flooding, provisional settlement of the evacuees and their return when flood waters subside are socioeconomic questions which should be pushed to prominence as climate change grips communities more and more. A solution should be worked out. Floods strike, whatever the cause: heavy precipitation, climate change, sudden movements of weather fronts, breaches of dams, and or human activity. For as long as they do not damage residential areas or farmland, the impacts of floods are not properly felt. Before the disaster strikes, the public should be educated and provided with information in order to better understand climate change, flooding and drought and adapt themselves to these natural phenomena. This is a process which needs a lot of determination.



By: Gh. Memari



President Inaugurates Abadan Water Treatment Facility

President Mahmoud Ahmadinejad pledged that his government would do its best to serve the people of Abadan, a city in the southwestern province of Khuzestan. Speaking at the inaugural ceremony of a water treatment facility in Abadan, the president said the nation views the progress of Khuzestan as its own. At the ceremony, which coincided with the anniversary of the end of the siege of the city during the Iran-Iraq war in the '80s, the president urged local people to join hands to rebuild the city and the entire country. He said efforts to serve the residents of Abadan are a national and divine duty and vowed that his government would spare no effort in serving local residents. The project to build a water treatment plant in Abadan is one of the biggest run by the Energy Ministry in the southwestern province and added as of March 2010 more than 390 billion rials had been spent on the



facility. That the plant, which is set up in line with the provisions of the 2030 Outlook Plan, is designed to offer services to more than 630,000 residents of the city. That the facility will be able to process up to 180,000 cubic meters of water each

day. After the ceremony the president, the energy minister and the managing directors of the state and provincial water and wastewater companies inspected different parts of the facility and took a first-hand look at the operations there.





Energy Minister Inaugurates Middle east Unique Water Supply System

Energy Minister Majid Namjoo inaugurated the Middle East's first water treatment plant which employs a nano-filtration system.

The facility in Khomarloo in East Azerbaijan province has drawn more than 13.5 billion rials in investment.

At the inaugural ceremony, the energy chief said that water is of great importance in the country. "We need to pay closer attention to water and water supply projects than in the past and such attention is in evidence among the country's high-ranking officials."

He underlined improved productivity in irrigation water consumption and said closer cooperation between the executive and legislative branches is vital to securing the water sector's objectives, fulfillment of which requires three times as much budget as today's.

The energy minister criticized an 8% rise in electricity consumption in the country and said considering the costs the energy machine incurs to supply electricity, such an increase in consumption is unacceptable. "If we fail to bring consumption under control now, we will face serious problems down the line."

He said the most important thing associated with implementation of the Targeted Subsidies Act is that it will help prevent the overuse of water and electricity.

Meanwhile, the managing director of East Azerbaijan provincial Water and Wastewater Co. said 56 towns

across the northwestern province have now access to clean running water.

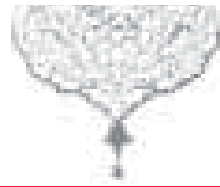
Reza Pour-Rajab further said up until the inauguration of the project, Khomarloo, which was designated as a town in 1999, faced drinking water problems.

He added proximity to the Aras River has given a special status to this town of 2,000 residents.

"Thanks to a rise in population and climate change which led to warmer weather in the area, the old water supply system which was set up 66 years ago was unable to supply enough water to the town. That was why the provincial Water and Wastewater Co. decided to implement a water supply project there," he said.

The water supply project which was awarded to a contractor two years ago is meant to transfer, treat, save and distribute water in the town.

As part of the project two wells which supply 7.5 liters of water per second have been sunk near the Aras River; a nano-filtration system, the first in the Middle East, treating 5.8 liters of water per second has been designed; and a transfer and pumping system which takes water to three tanks 6.2 km away has been built. The main long-term objectives of the project are to supply drinking water to 4,000 residents of the town in 20 years' time, draw 40 liters of water per second from Khoda Afarin Dam, set up a larger treatment plant, and build a 21 km water supply system.



Water Is Instrumental In The Development Drive

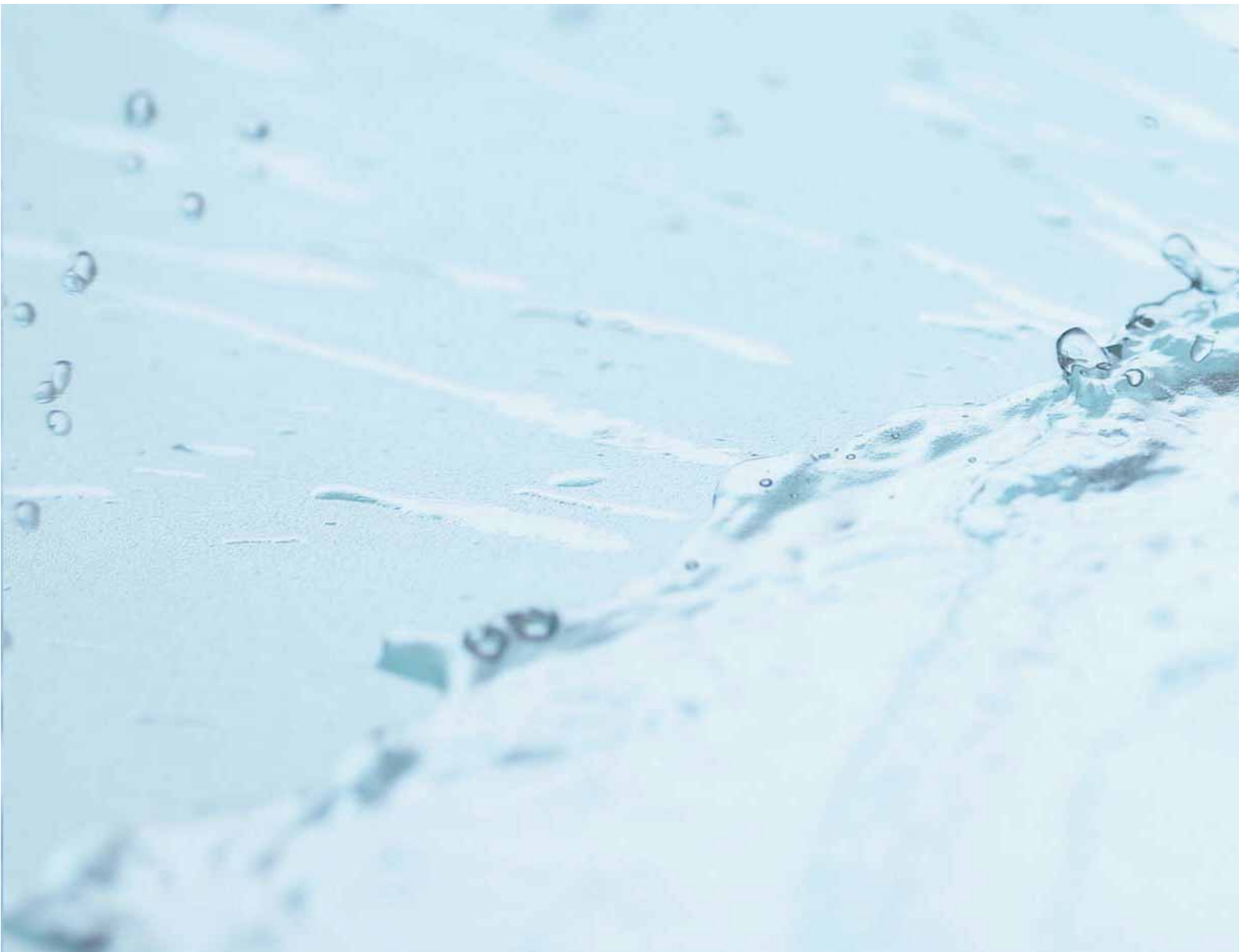
Energy Minister Majid Namjoo said that efforts to expand international ties and make Iranian technical presence felt beyond national borders are a central plank of his ministry's

strategy.

Speaking at a weekly meeting of the Water Council, the energy chief said reports released by neighboring countries indicate that water plays an

important role in their development drive and planning.

Recalling the central role of water in development of all sectors, he said the energy sector seeks to land inter-



national projects.

The energy minister said in light of the fact that Parand Settlement, which has the support of the President, is growing fast, his ministry is working hard to put together a package to supply water and electricity to the affordable housing project.

At the meeting, a report detailing the country's water resources, precipitation levels in various basins over the previous week and the volume of water in reservoirs behind dams was read

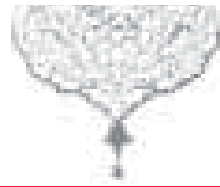
out. The report also featured facts and figures about water resources in Turkey and how they are managed.

At the same meeting, Deputy Energy Minister for Water and Wastewater Mohammad Reza Attarzadeh presented a report on developments in the energy sector over the previous week.

He said during a visit to Lebanon initial agreements were struck to promote bilateral energy cooperation, particularly in the field of dam

building.

According to the report the volume of precipitation during the first days of the new water year could not be viewed as a reliable indicator for the whole year. "Although this year's figures show an improvement over last year, they will not necessarily hold true over the long run." At the end, the energy minister called for the objectives of the ministry to be clearly defined as mechanisms are worked out to secure those aims.



Energy Minister Builds A 200 km of Water Transfer Tunnel

The fact that some 1,080 meters of tunnel has been dug in Qamrood in a one-month period sets a new record in the country's dam- and tunnel-building industry, Former Senior Vice Energy Minister Hamid Chitchian told the opening ceremony of a three-day "Dam and Tunnel" gathering at Tehran University.

He said the Energy Ministry is currently building a "remarkable" 200 km of water transfer tunnels.

He added although Iran has huge water resources and rich mining and mineral reserves, low precipitation levels and back-to-back droughts have given rise to numerous problems.

The Former Senior Vice Energy Minister said the fact that water resources are not proportionate to the country's needs is yet another problem the energy industry faces. "These problems have inspired creativity and

innovation in development of modern technology."

He said qanats and dams, which have been around across the country for centuries, show that Iranians have always gone the extra mile to ride out adverse conditions. Chitchian said prior to the victory of the Islamic revolution in 1979 foreign experts had built no more than 13 dams across the country. "Thanks to efforts by Iranian experts that number has now risen to 280."

He described efforts by Iranian engineers as successful and said such success is manifested in the design and implementation of a project to take the water of Dez to Qamrood, Koohrang and Gavshan. The Former Senior Vice Energy Minister said the gathering is not intended to simply draw attention to the achievements of the past; rather, it looks into questions such as

population growth, growing demand, and the huge potential for dam and tunnel building in the future. He said measures taken by the energy industry should not be confined to within Iranian borders; rather, the industry should have an eye on markets overseas.

"Competiveness which helps keep the dam and tunnel building industry on track is bound to cut costs and decrease the duration of projects. Economic costs are not the only thing that matters. In implementing energy projects, social and environmental



costs should also be taken into consideration.”

In conclusion he said social acceptability of projects is of great importance too and improvement of the living standards of people should be a factor since day one when feasibility studies get under way through inauguration of projects. Meanwhile, Rasool Zargar, an adviser to the energy minister and the secretary of the gathering, said the Islamic Republic of Iran is a pioneer of the dam-building technology.

Recalling more than three decades of efforts by Iranian experts in dam building, he said in the past centuries Iranian have used trailblazing methods in dam building and water supply projects.

He then touched on the question of past experience and modern technology and said dam building and tunnel projects have a lot in common and for the first time a project is integrating the two. He said creation of workgroups is another objective of the gathering. “These workgroups are

designed to tap into the advantages associated with collective wisdom.” Zargar further said another important aspect of the gathering is that it brings together state managers, consultants, contractors and academics. More than 60 companies were represented at the three-day gathering at Tehran University during which 36 articles were presented. The meeting which focused on management, dams and tunnels was organized by non-governmental institutions involved in the dam- and tunnel-building industry.



The managing director of the Iranian Energy Productivity Organization said implementation of the National Smart Measuring Mega-system, the electricity industry's biggest project, is just around the corner.

Saeed Mohzab-Torabi said the project is expected to be implemented across the nation over a seven-year period.

He said the mega-system, which features an integrated system of hardware, software, networks and telecom foundation receives real-time data on consumption, demand, and voltage from customers.

The project which is designed to reform measuring, slash electricity waste and manage consumption was placed on the agenda of Tavanir and the Energy Ministry more than two years ago.

The Energy Productivity Organization was tasked with running the project almost a year ago. Feasibility studies and research into technical aspects as well as planning for implantation of pilot projects are already complete.

"Following orders by the President and the energy minister and the emphasis the Electricity Department of the Energy Ministry placed on immediate implementation of the project, the biggest of the country's electricity industry ever, a number of measures were taken at the Energy Productivity Organization, among them, formation of a steering committee," he said. He added the committee takes care of steering and policy-making, supervision of financing and tenders, coordination with appropriate bodies for imports of equipment, mobilization of forces to implement the project, presentation of suggestions to revise regulations and last but not least operations of the mega-system.

He said the committee which holds regular weekly meet-



Iran Electricity Industry's Biggest Project around the Corner

tion by home appliances. He added under an MOU signed by the Iranian Energy Productivity Organization and the Energy Ministry the former randomly picks electric appliances on the market and examines them as far as energy consumption is concerned. The results of such examination are then reported to authorities. As for measures taken by the Energy Productivity Organization to optimize the use of resources and cut environmental pollution, Mohzab-Torabi said optimization of energy consumption could be achieved through information campaigns aimed at the pub-

ings has already made decisions on the contractor of the project, its organizational structure, its operational plan and financing, cultural preparations to make the project as smooth as possible, permits for the project and formulation of executive regulations.

The managing director of the Iranian Energy Productivity Organization went on to say that under the third and fourth Economic Development Plans the government is required to set certain standards for energy consumption in appliances such as air conditioning units and electric water heaters. "The move is designed to help conserve energy and minimize the impact of energy-intensive appliances on the environment. These standards should be complied with by both local producers and importers. The ministries of energy and petroleum and the Standard Institute are leading the national effort."

Structurally, the task of ensuring compliance with energy standards falls on the Industrial Research and Standard Institute, he said, adding the Energy Ministry has tasked his organization, which is in charge of optimizing energy consumption and reforming the consumption patterns, with regulation of consump-



lic, employment of modern technology, and introduction of proper rules and regulations. To that end the Iranian Energy Productivity Organization has taken extensive measures among them: organizing training courses aimed at raising public awareness about energy consumption, releasing various publications, undertaking technical activity, distributing more than 90 million energy-efficient lamps across the country and testing electric appliances before issuing energy labels. As for environmental pollution, he said transformation of fossil fuels to electricity at thermal power plants involves energy waste which in turn pollutes the environment. "Studies suggest that a small 1% conservation in electricity consumption will reduce the volume of NO₂ released into the atmosphere by 2,000 tons. The figures for SO₂ and CO₂ stand at 5,000 tons and 1 million tons respectively." Mohzab-Torabi further said research by the Environment Protection Organization and the World Bank shows "environmental costs associated with the release of each ton of NO₂ into the atmosphere top 5 million rials. The figure for SO₂ and CO₂ stands at 15 million and 80,000 rials respectively. In other words, 1% conservation in electricity consumption would save over 160 billion rials in environmental costs. Efforts by the Energy Productivity Organization aimed at management of energy resources have been instrumental in cutting pollution at power plants."

In response to a question as to whether the Energy Productivity Organization tests the energy efficiency of electric appliances before they hit the market, he said: "Given the importance of this issue, energy labels have been issued for 17 appliances which measure up to electricity consumption standards. Under the law, the Industrial Research and Standard Institute should confirm such compliance and issue the labels. The partner laboratories of the institute conduct energy consumption tests on these appliances. Besides, under the law electric appliances must bear energy labels." He added his organization keeps an eye on electric appliances available on the market by taking random samples and conducting energy efficiency tests. "That is not enough though. At the suggestion of the Energy Productivity Organization, the government has required customs offices to prevent imports of air conditioning units and refrigerators which do not match up to energy efficiency standards. It seems this is not enough either. A consensus should be struck and the Industrial Research and Standard Institute should lead the way in this regard."



Water Lab to be Launched in Abu Mousa

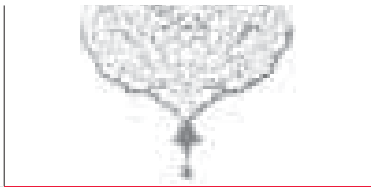
A microbiological laboratory is to be launched on the Persian Gulf island of Abu Mousa.

Five quality control labs – three microbiological labs in Bandar Lengeh, Minab and Bandar Abbas and two chemical and biological labs in Bandar Abbas – are already operational across the southern province.

The facility in the provincial capital of Bandar Abbas has environmental standard certificates.

In addition to microbiological tests, seasonal chemical samples are taken from wells and reservoirs for complementary testing.

Chlorine alarm devices and automatic switch-off systems have been installed at water treatment facilities to enhance safety, adding introduction of REDO systems as a replacement for current chlorinators is also on the agenda.



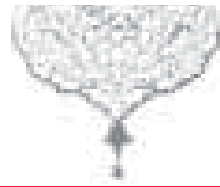


Installed Power Plant Capacity of the Country Hits 58,000 MW Mark

Deputy Energy Minister for Electricity Mohammad Behzad said that pumped-storage power plants are very effective in striking a balance in the country's electricity grid. Speaking at a gathering on pumped-storage power plants, he said the country's installed power plant capacity has now hit the 58,000 MW mark and that hydroelectric power plants generate some 7,700 MW of the total figure. He added pumped-storage power plants are very economical and the so-called economical quotient of Siah Bisheh Pumped-Storage Power Plant stands at 45.3. He said these power plants play an important role in balancing the national grid's charge and frequency because they save electricity when consumption is low and infuse it into the grid when consumption rises. He underlined closer attention to such facilities and said the value of energy generated at peak hours is twice as much as the value of electricity produced when consumption is moderate and four times as much as the value of electricity generated when consumption hits a bottom. Behzad went on to say that consumption peak hours in the country have shifted. "In the 31 days to July 23, 2010 daytime peak consumption stood at 1.41 gigawatt hours while the nighttime consumption peak was 1.4 gigawatt hours. That means consumption peak hours increased from four to eight." He said in such circumstances pumped-storage power plants can play a key role in striking a balance in the grid and more significance should be attached to building such facilities across the country. The deputy energy minister said pumped-storage power plants are the most effective way of generating and supplying electricity and balancing supply and demand. "Up to 400

of 138,000 MW are operational around the world. Many countries such as Japan, the US, Germany, the Philippines and Taiwan are employing such facilities." He concluded that these facilities take fairly short time to become connected to the grid; besides, they help conserve fuel. "These power plants are technologically advanced; so efforts should be made to build more and more of these plants across the country." Meanwhile, the managing director of Iran Power Generation, Transmission and Distribution Management Company (Tavanir) told the same gathering pumped-storage power plants play an important role in electricity exchanges with neighboring countries.

Homayoon Hayeri thanked all those who contributed one way or another to the development of pumped-storage power plants and said during peak hours these facilities help improve the efficiency of power plants which use fossil fuels. He added development of more such power plants would eliminate the need for small-sized facilities which are mostly natural gas-powered and energy intensive. Widescale introduction of these facilities will bring in remarkable improvement in energy consumption and grid efficiency. He added when consumption hits a rock-bottom, thermal power plants can only operate at 75% of their total capacity. "The figure for combined cycle and nuclear power stations stands at 80 and 95% respectively. Failure to keep to these standards would mean the power stations should be disconnected from the grid. Reconnection of power plants entails huge costs. But when it comes to pumped-storage power plants major grid changes can easily be handled thanks to the flexibility of these facilities."



Decorative

Iran Household Lighting Uses 33%

Given that in Iran 33% of all electricity used in households goes to lighting, widespread application of energy-efficient lamps plays a key role in cutting consumption.

The use of energy-efficient lamps around the world in recent years has resulted in an 18% drop in electricity consumption.

Although energy-efficient lamps are originally designed to push down consumption peak, one major advantage associated with these lamps

is that they increase the reactive power of the grid. Most household appliances feature motors which use reactive power. Widespread use of reactive power by energy-intensive home appliances limits the transfer capacity. Application of energy-efficient lamps plays an important role in reducing demand for reactive power. The reactive power produced by three types of energy-efficient lamps available on the market is greater in volume than the power

they use. In other words, widespread use of these lamps can generate a considerable amount of reactive power which is used in homes. That in turn frees up the transmission capacity of power lines, transformers and other equipment at transmission and distribution facilities.

Ten 23 watt energy-efficient lamps in a single household produce up to 270 watts of reactive power which is enough to meet the needs of appliances that feed on reactive power.



Decorative



Decorative

Electricity Generation at Hydroelectric Power Plants to Double

The head of the Energy Ministry's office for operations and optimization of hydroelectric power plants said that ongoing projects are expected to see electricity generation at hydroelectric power plants, which now stands at 7,732 MW, double by 2015. Farid Estiri further said if the projects whose feasibility studies are already under way became operational, the overall capacity of the country's hydroelectric power plants would rise to 30,000 MW. He said presently 44 small, medium, and large power plants which comprise 109 units are operational across the country. "On average they generate 17 million kilowatt hours of electricity. In total hydroelectric facilities account for 10% of the total amount of electricity the country produces."

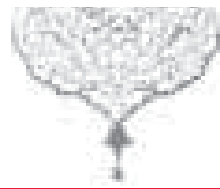
Talvar Dam to be Impounded Later This Year

Construction of Talvar Dam, which got under way in 2003, is now 86% complete. The project in the west-central province is designed to increase the area of land under cultivation, boost agricultural production, create job opportunities, stop the growing trend of rural migration, develop the industries related to agriculture, push up the average income of farmers and pave the way for growth in other sectors.

The total volume of water in the reservoir of the dam will stand at 500 million cubic meters. The dam which is 88 meters in height from its foundation will regulate more than 231 million cubic meters of water.

The dam will supply water to 32,000 hectares of dry-land farms in Zanjan and Kurdistan provinces and additional 82 million cubic meters to Hamedan and Gharveh for drinking and industrial purposes.

As of March 21, 2010 up to 624 billion rials had been spent on the project which has since drawn an additional 283 billion rials. The project is expected to create 20,000 jobs, directly or indirectly. Construction of the water transfer system of the dam and its irrigation and drainage networks which got under way in July is progressing fast. The irrigation and drainage networks which have drawn 163 billion rials in finances are 24% complete.

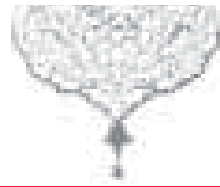


130 Dams under Construction across Iran

The managing director of Iran Water Resources Management Co. said 130 dams are under construction across the country and feasibility studies for an additional 160 are under way. Almasvandi further said irrigation and drainage networks are being built for 390,000 hectares of farmland. "We hope that allocation of budget help us open new projects to cover an additional 600,000 hectares." Recalling the comprehensive studies on the Caspian Sea and the project to take water from one basin to another, he said completion of a canal in Mazandaran is expected to supply water to 360,000 hectares of farmland in the Caspian province and its surplus water is to flow on to neighboring provinces.







Iran and Tajikistan Sign Cooperation MOU





Iran and Tajikistan signed a memorandum of understanding at the close of an eighth meeting of the Iran-Tajikistan, Economic, Technical and Cultural Cooperation Commission. Energy Minister Majid Namjoo, who headed the Iranian delegation to the meeting, and Tajik Minister of Energy and Industry Gul Sherali, signed the document which sets the stage for closer cooperation in a wide array of fields such as: energy, water, industry, mining, technical and engineering services, trade and economy, finance, insurance, agriculture, investment, science, culture, education, health, cultural heritage and tourism, transportation, mapping, telecommunications, and labor and social affairs. Under the memorandum of understanding the two sides also agreed to form a committee within two months to ensure the implementation of the agreements struck during the eighth meeting of the joint commission.

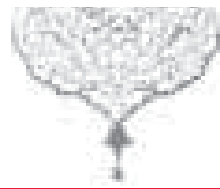
Tehran is to play host to a ninth meeting of the Iran-Tajikistan Trade, Economic, Technical and Cultural Cooperation Commission next year. An exact date has yet to be set for that meeting.

Rich Resources in Iran and Tajikistan Pave the Way for Closer Cooperation – Energy Minister

Energy Minister Majid Namjoo said that abundant God-given resources in Iran and Tajikistan pave the way for closer cooperation between the two neighbors.

Speaking at the closing ceremony of an eighth meeting of the Iran-Tajikistan Joint Economic Cooperation Commission in Dushanbe, the Iranian energy chief said the two countries have a lot of common ground when it comes to religion, culture, civilization, language and history. "These commonalities make relations between the two nations "exemplary and unique" in the world."

He added the fact that the joint commission has met seven times so far and there are high-level exchanges between the two countries proves that the leaders of Iran and Tajikistan are determined to boost cooperation at all levels. The Iranian energy minister went on to say that in the 30 months since the commission met for its seventh get-together in Tehran, ties between the two countries have improved a lot and a number of projects have been





completed. He said public and private institutes have taken “good steps” toward implementing previous deals, although certain administrative obstacles have left some of the agreements on the drawing board. “However, determination among officials and capabilities on either side of the border show that the prospect for bilateral cooperation is bright.” Namjoo added that senior officials of the Islamic Republic of Iran pay very close attention to expansion of ties with Islamic countries and that Tajikistan has a very important place in the regard. “We view the progress and success of neighboring Tajikistan as our own.” He said although the volume of bilateral trade is following an upward trend, economic relations between the two friendly Muslim countries are not as good as diplomatic ties between the nations. The Iranian top delegate stressed the need for measures to encourage both the public and private sector on either side of the border to contribute to bilateral trade and investment as officials in Tehran and Dushanbe throw their weight between such measures. Namjoo went on to say that rich resources such as water and minerals in Tajikistan and Iran’s technical and engineering capabilities and its vast natural and human resources pave the way for closer relations between the two countries. He expressed hope that the cooperation agreement struck during the eighth meeting of the commission would be a turning point in bilateral ties and that broader support for the private sector would set the stage for more exchanges across the border and serve the interests of the two Muslim countries. He also expressed Iran’s readiness to set up plants in Tajikistan to produce glass, dairy products, wool and hide, shoes, canned fruit, and energy-efficient lamps. “Expansion of railroads is set to help promote bilateral cooperation,” he said, adding Iran is interested in setting up a joint electricity transmission grid with Tajikistan and Afghanistan. The Iranian energy minister recalled progress at Sang Toodeh 2 project, which is being implemented by Iranian companies in Tajikistan, and said he was ready to attend a ceremony to mark the impoundment of the dam in November. He said a first 110 MW unit of the power plant is expected

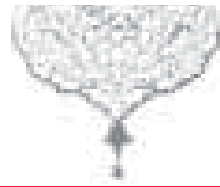
to come on stream as Tajikistan marks 20 years of independence. For his part, Tajik Minister of Energy and Industry Gul Sherali thanked Iranian firms, particularly the contractor of Sang Toodeh 2 project, for their contribution to his country’s march toward growth and expressed hope that Iranian companies would have a more active presence in the Central Asian country, particularly when it comes to building power plants.

Iran, Tajikistan and Afghanistan to Form Joint Commission – Ambassador

Iran, Tajikistan and Afghanistan are to form a joint economic cooperation commission, Iran’s Ambassador to Tajikistan Ali Asghar-Sherdoust said. Speaking at the opening ceremony of an eighth meeting of the Iran-Tajikistan Economic Commission, the Iranian diplomat said Tajik President Emomali Rahmon first put forward the idea of forming the commission at a recent summit of the three Farsi-speaking nations in Tehran. He expressed hope the eighth meeting of the Iran-Tajikistan Joint Commission would look into ways of facilitating the formation of the tripartite commission. The Iranian ambassador to Dushanbe described “high-level ties” between Iran and Tajikistan as “exemplary” on the international stage, citing the fact that the two countries’ presidents have met seven times over the past 30 months.

Iran to Build Hydroelectric Power Plant in Tajikistan

Iran has agreed to build small- and medium-sized hydroelectric power plants in Tajikistan. The agreement came at the close of an eighth meeting of the Iran-Tajikistan Joint Economic Cooperation Commission. As part of the deal, Iran’s Tana Engineering Co. is to build a dam across Varzab or Kofarniqon. The build-operate-transfer (BOT) agreement will also see a 50 MW facility built nearby. A workgroup comprised of experts is to make a final decision on the site of the power plant and prepare a report on the project within a month. Behzad Eslahchi, the managing director of the Iranian company, and Tajik Minister of Energy and Industry Gul Sherali signed the deal in the Tajik capital Dushanbe as the eighth meeting of the commission drew to a close.



Stage is being Set for Exports of Electricity and Hydrocarbons

Energy Minister Tells Fellow ECO Ministers

Energy Minister Majid Namjoo said that Iran is setting the stage for exports of electricity and hydrocarbon to global markets.

Speaking at a second ministerial meeting of the Economic Cooperation Organization (ECO) in the Tajik capital of Dushanbe, Namjoo said Iran has taken effective measures to set up north-south and east-west energy routes to export electricity and hydrocarbon to global markets.

He went on to say that Iran is trying to fill the energy vacuum in the region and stands ready to redouble its efforts to put fellow ECO countries on the fast track to progress. "Challenges and opportunities abound in the ECO region," he said, adding global economic growth is facing many challenges. "To ride out the storm, closer attention should be paid to a number of questions, among them: a lack of balance in global economic growth, the gap between the developing and developed nations, energy restrictions, environmental considerations in economic growth, and support for local industries." The Iranian energy chief said oil and energy are not a regional question; rather, they should be looked at through a global prism because energy is an integral part of economic development. "We need to take account of energy management in order to secure sustainable economic growth. In light of the global economic and financial crises, new mechanisms

should be worked out to secure the flow of capital into projects designed to develop energy resources. We also need to work out new methods to counter and offset unfair, politically-motivated measures which are incompatible with the principles of free trade and are designed to interfere with economic growth in developing countries. To that end, the most important step ECO member states can take is to cooperate with each other to create a stable regional and global market and secure sustainable economic growth through safe and economical resources." He said Iran is a major producer and consumer of energy with huge oil and gas reserves, adding development of electricity generation at nuclear, wind, geothermal and biomass power plants across the country is under way and the prospects of such development are excellent.

Namjoo went on to say renewable and clean energies are an integral part of Iran's energy policy while peaceful use of nuclear technology is an intrinsic part of the country's development drive. "Iran is steadfast on the path to improving productivity and energy efficiency and encourages the application of modern science and technology to conserve energy. This comes as we attach much importance to marketplace."

Recalling the imbalance gripping regional and global trade as well as the energy market, the Iranian energy chief said ECO member states need to promote

intra-organizational trade and help the regional group emerge as a major player in regional and international trade. "Despite remarkable economic progress in ECO countries, the ECO region is still viewed as a densely populated developing region with a weak economic infrastructure and lopsided development indices. There is a long way ahead before welfare and modernization become a signature mark of the ECO region. That means regional countries need to make tireless efforts to secure such a lofty objective," he said.

The Iranian energy minister stated that the ECO region is to make extra efforts to attain its intended objective of economic development. He vowed that member states are determined to do what it takes to make development a trademark feature of the region and rake in the benefits of regional and international development.

He described the Iranians as a peace-loving nation who knows development could only sustain when it is achieved through peaceful means. "As a founding member of the Economic Cooperation Organization, Iran is committed to peaceful development of the region. We seek our progress in the context of international peace and at the same time pursue the cause of global peace via our own development," he said. He assured the participants that the energy action plan approved at the meeting would serve as a

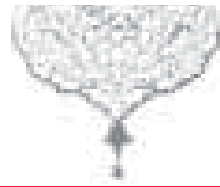


basis for energy cooperation by 2015.

The Iranian energy minister then urged ECO members to use publications to compare notes and advertise their energy and oil capabilities, and said ECO member countries need to keep abreast of latest technological developments in the oil, gas and dam-building industries. He suggested that member states set up a drilling company as regional drilling firm tap into the public sector's cooperation to train specialists. In conclusion, he offered sympathy to his Pakistani counterpart on the devastating floods which

have recently swept the South Asian country and expressed hope the Pakistani government and people would soon be able to leave the sad episode behind. The second meeting of ECO oil and energy ministers was held in the Tajik capital of Dushanbe. The energy ministers of Pakistan, Afghanistan, Kyrgyzstan, Tajikistan and Iran along with the Turkish and Azeri ambassadors to Dushanbe and the director-general of the Turkmen oil market attended the one-day event. The Economic Cooperation Organization, an intergovernmental agency, was founded

by Iran, Pakistan and Turkey in 1985. The organization is designed to promote economic, technical, cultural cooperation in the region. In 1992 seven other regional countries, namely Kazakhstan, Afghanistan, Azerbaijan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan joined the grouping and turned it into a major regional player. It is the second largest regional group in terms of population and the area it covers. Member countries sit on more than 7.2 million square km of land and are home to more than 350 million people.



Iran and Lebanon Sign Energy Cooperation Agreement

The Iranian Energy Ministry and the Lebanese Ministry of Energy and Water signed a memorandum of understanding during a state visit to Beirut by President Ahmadinejad at the invitation of his Lebanese counterpart Michel Suleiman.

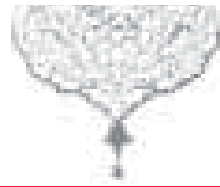
The MOU drafted during an earlier visit to Lebanon by Iranian Energy Minister Majid Namjoo covers four main areas, namely water, electricity, education and investment.

Construction of two combined cycle power plants, modification of the Lebanese grid, transmission of electricity to Lebanon via neighboring countries, development of renewable energies and consulting services when it comes to wind power plants are some other issues envisioned in the deal.

The two sides also agreed to work on a comprehensive water plan, and cooperate in construction of dams and hydraulic structures, small-sized hydroelectric power stations and production of water and wastewater equipment.







Iran and Armenia to Jointly Build a Dam across the Border River



Deputy Energy Minister for Electricity and Energy Affairs, Mohammad Behzad, said operations to set up a third electricity transmission line between Iran and Armenia are under way.

He said the launch of the operations came during a recent visit to Yerevan by an Iranian delegation led by Energy Minister Majid Namjoo.

He added the double-circuit 400 kV line which stretches over 280 km is expected to draw more than €108 million over 20 months. Behzad went on to say that the project is to be jointly financed

by Iran's Export Development Bank, Sunir Co. and the Armenian government. The deputy energy minister stated that the transmission line could take a considerable 600 to 800 MW across the border. "In addition to the transmission line, the two energy chiefs signed an agreement on joint construction of Megri dam and hydroelectric power plant across the Aras Dam."

Iranian and Armenian companies will jointly carry out the Megri project which is expected to generate 260 MW to be equally divided for use across the

border. The cost of the project is estimated at \$400 million.

He concluded that during the two-day visit to Armenia by the Iranian energy minister a number of questions came up for discussion among them: development of new energies, small- and medium-sized hydroelectric power plants, the use of private sector potential to implement projects, efforts to raise power plant efficiency and alleviate power slides in grid, and construction of a pipeline to take oil products across the border.

Expansion of Dam Building in Iran is Astonishing – Kenyan Minister

Kenyan Development Minister Fredrick Gumo said that expansion of dam building in Iran is unbelievable and draws attention to the advanced capabilities of Iranian experts. The Kenyan minister made the comment after inspecting Aidoghmoush and Shahryar dams near Miyaneh, in East Azerbaijan province.

He said thanks to the enhanced capabilities of Iranian experts Iran is now third in the world when it comes to building dams. “There is no doubt about the extensive scope of Iranian capabilities in the field. I hereby invite Iranian firms to play a more active role in projects in my country so

that Kenya could tap into the experience and know-how of Iranian experts.” During the inspection tour, the managing director of East Azerbaijan Regional Water Company said that Shahryar Dam, which is expected to be impounded in December, is designed to prevent the buildup of lime-scale in the Sefidrood River, supply water to farmland in Gilan province and an additional 12,000 hectares of land near Miyaneh, and contain floodwaters in the region. The dam whose reservoir is to hold some 770,000 cubic meters of water is also meant to generate 168 million kilowatt hours of electricity each year.



Iran Takes Part in World Water Congress in Canada

The International Water Association’s World Water Congress and Exhibition was held in Montreal, Canada September 19 – 24. Vice-President for Operations at State Water and Wastewater Company Hamidreza Tashayoi headed the Iranian delegation to the event. Iran is a voting member of the congress which among other things focused on water management, future cities, water and ecosystem, climate and energy, and water and health. On the sidelines of the congress, an exhibition showcasing the achievements of nations in the field of water management was held. Iran sent 22 articles to the World Water Congress, 13 of which were accepted to be presented at the event. The International Water Association is a global network of 10,000 individual and 400 corporate water professionals in 130 different countries.





Yazd Holds Qanat Training Course for Experts from Islamic Countries

Yazd played host to an international training course on qanats in late September. More than 40 experts from Islamic countries attended the six-day event at the International Center on Qanats and Historic Hydraulic Structures.

The course was designed to integrate traditional knowledge on qanats and modern scientific advances in the field.

The course covered topics such as the role of qanats in sustainable development, water-sharing and distribution systems, indigenous methods of digging qanats, and ways of applying modern technology in the field. Academics from Iran, Egypt, Japan, Algeria and the UK attended the training course jointly organized by the Islamic Development Bank, UNESCO and the Iranian Energy Ministry.

Also Yazd Hosts 3rd Governing Board Meeting of Int'l Center on Qanats and Historic Hydraulic Structures

At a third Governing Board meeting of the International Center on Qanats and Historic Hydraulic Structures, Iran's Deputy Energy Minister for Water and Wastewater Mohammad Reza Attarzadeh appreciated the support UNES-

CO lent to efforts to set up the center in Yazd and detailed some of the measures Iran has undertaken to equip the center. He said under an MOU struck with UNESCO, Iran provided a building for the center and trained human resources for it. The chairman of the Governing Board of the International Center on Qanats and Historic Hydraulic Structures further said more than 2 billion rials has been allocated to the center in the new water year. As for efforts to recruit new members, he said the Islamic Republic of Iran has invited all countries with a history of qanat building and operations to join the grouping and that representatives from Afghanistan, Azerbaijan, China, Iraq, Saudi Arabia, Syria, Algeria, Japan and Oman along with a number of observers from European countries such as Britain have now seats on the board and are attending its third meeting. He expressed hope steady allocation of budget by international institutions including UNESCO would boost the effectiveness of the International Center on Qanats and Historic Hydraulic Structures and help qanats make a comeback to the water supply cycle.



Yazd Province, Iran



Decorative

1,381 MW of Electricity Exchanged with Neighboring Countries

The volume of electricity exchanged with neighboring countries since the beginning of the year [March 21, 2010] reached 1,381 MW on October 7.

The largest volume of imports came from Turkmenistan (327 MW) and the biggest amount of electricity exports went across the western border to Iraq (615 MW). The total volume of exports to Afghanistan, Iraq, Naxcivan, Paki-

stan and Turkey during the same period topped 859 MW while imports from Armenia and Turkmenistan stood at 522 MW. In other words, the country's electricity exports outweighed imports by 337 MW.

Iran has electricity exchanges with Armenia, Afghanistan, Iraq, Naxcivan, Pakistan, Turkey, Turkmenistan and Azerbaijan.



Tehran to Play Host to 21st International Congress on Drainage and Irrigation

Tehran is to play host to a 21st International Congress on Drainage and Irrigation, an eighth micro-irrigation congress, a special meeting, a symposium and a number of workshops starting October 15, 2011. The theme of the weeklong congress on drainage and irrigation is productivity in the water sector to secure food safety. It is to focus on productivity-related challenges and water management in dry-land farming. The symposium will focus on the impact of climate change on soil and water resources while the special meeting address modernization of the irrigation water management and the seminar will explore the possibility of applying traditional methods to modern water management systems. The International Congress on Drainage and Irrigation is an event held every three years in a member country. In the 20th century the world population more than tripled. The global population which stands at 6.5 billion now is expected to balloon to 8.9 billion by 2050. During the 20th century water consumption increased twice as much as the world population. Although water shortage has not reached epidemic proportions, the number of areas wrestling with chronic water



shortage is on the rise. By 2025 as many as 1.8 billion people will be living in areas suffering from acute water shortage and up to two thirds of the world population are to likely to be grappling with water-related tension. Thanks to urbanization and the strain it places on soil and water resources, the world's water prospects are bleak.

In most countries the agriculture sector is the main consumer of water. In many regions, irrigated farmlands play an important role in economic growth, in reduction of poverty and in development of rural economy. Although the volume of food produced in the world is enough to feed the entire population, up to 850

million people around the globe are suffering from hunger and malnutrition. In light of the fact that soil and water resources do not grow, current resources should be stretched thin to produce more and more food to meet global demand. Besides, greater demand which has its roots in higher living standards means food production should increase by up to 100%. Higher productivity in the water sector holds the key to future success in the face of water and food challenges. Prospects of water productivity growth are bright. In the decades to come irrigation water productivity is expected to grow steadily. Of course, it should be mentioned that any such improvement will be directly linked to sound policy-making, investment, changes which affect the environment one way or another and rural lifestyle. The 21st International Congress on Drainage and Irrigation is expected to pave the way for production of more food using less water and for better management of floodwater.

The secretariat of the congress has set a December 1, 2010 deadline for submission of the abstracts of articles. Full articles should be sent to the secretariat no later than March 1, 2011.



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MAPNA Boiler Engineering & Manufacturing Co.

MAPNA Turbine Blade Engineering & Manufacturing Co. (PARTO)
Sepahan Equipment Manufacturing Co.
Mavadkaran Co.
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MAPNA Equipment Engineering & Manufacturing Co
MAPNA Power Plants Construction & Development Co. (MD-1)
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Drought and Climate Change in Iran

By Sattar Mahmoudi, adviser to the energy minister

The section "SCOPE" is a newly added section to IPAW. "SCOPE" is to cover the most controversial and challenging topics which happen in the arenas of Energy, water, wastewater and Renewable Energies. This issue's "SCOPE" of IPAW, 127, covers the subjects of "climate change" and "Drought".

"Your comments are welcome".

Water resources are limited and the fact that wastewater and other pollutants are affecting the quality of fresh-water that is available to us is taking the limit to new heights. Unequal precipitations, drops in groundwater levels and excessive use of resources on the one hand and mounting demand to produce food and raise industrial production and offer a wide range of other services on the other, have disrupted the balance in water supply and demand. Meeting the development-related demand for water and implementation of management projects require huge investments in the field. Population growth is one of several factors that push down the per capita water figure. Each year the world population grows by around 30 million. In Iran the population which stood at 6 million around 50 years ago has now risen to more than 73 million. That means per capita water in our country has shrunk by around 90% during the past five decades. Human interference in the climate one way or another has thrown up new obstacles such as droughts in our way. Ever since humans stepped up their unwelcome involvement in the environment by exploiting and damaging resources, drought triggers have increased. By the end of the century global temperatures are predicted to rise by between 1.5 °C and 6 °C. If that happened, droughts and climate change would become more severe. In other words, climatic conditions of the future will be worse than those of the past.

Soil and water resources in Iran and the potential for drought

Some 85% of Iranian land is located in semidry, dry and very dry regions and precipitation variation is extreme. The

volume of precipitation stands at as little as 50 mm in eastern and central areas and as much as 1,800 mm in Caspian provinces in the north. Average precipitation in southern, eastern and central parts of Iran, which account for some 45% of the country's territory, is 200 mm per year. In other words, up to 52% of the country's precipitation falls on 25% of its land.

Up to 68% of the precipitation in question is evaporated. Close to 37 billion cubic meters of water finds its way into the depths of the earth and some 93 billion cubic meters flow on the surface. Part of the runoff water—around 10 billion cubic meters—penetrates the riverbeds. That leaves just 83 billion cubic meters of surface water in the country. Some of these waters form part of the country's groundwater reserves in 611 plains which contain 1,620 billion cubic meters. Of course, up to 25% of these reserves are limestone. The balance of water in around 30% of these plains is negative and some require serious monitoring and further studies. In all, these reserves account for some 2% of the world's groundwater. In light of the fact that water reserves in the country are limited, how they are tapped takes on special importance. One of the main consumers of water in our country is the agriculture industry. Worldwide, it consumes some 69% of the planet's freshwater. In Iran the share of the agriculture sector stands at a staggering 93%. A study running from 1995 to 2008 showed that precipitation levels in the country were falling. That means the future is bound to see a drop in the average 251 mm of precipitation the country now receives.

A review of figures released over

the past 40 years suggests that Iran has grappled with drought with differing intensity and scope for as many as 20 years. In 2008, average precipitation fell to a 40-year low of 138 mm. During the same year, the fallout of drought was more conspicuous than other dry spells over the 4-decade period. Experts believe as much as 80% of dry-land farms and 40% of irrigated farms were affected by the drop in precipitation. Around 120 towns and 6,000 villages felt the bite as well. The impact of the drought was also felt in the industry and services sector.

Impact of drought on food production

Drought leaves an adverse effect on agricultural production. Wheat is a staple item in Iran and people here depend on wheat, which is cultivated through dry-land farming, and dry-land farms bear the brunt of drought. So during dry spells the most pressing concern in the agriculture sector is a drop in wheat crop which leads to a decrease in food production. This has turned wheat into a strategic crop. In 2007 wheat production in the world stood at 616 million tons. That figure should rise to 672 million tons in 2015. The impact of drought on this strategic crop prevents the realization of this objective. The volume of trade in wheat now stands at 83 million tons a year. That figure too should rise to 106 million tons within five years. Failure to achieve this goal is bound to disrupt the economic balance. Today, drought has turned into an undeniable challenge for our country. In 2001 drought imposed as much as 21 trillion rials in damage on Iran's agriculture sector. It also left adverse social effects, set the stage for disputes over water, and led to a drop in



agricultural production and dealt a blow to animal farming.

Drought and drinking water

At present, all towns and more than 35,000 villages across the nation make use of water resources one way or another. Towns and villages on the fringes of deserts with dry and warm climates are immediately affected by drought. Given the important nature of drinking water and the emphasis laws place on its provision, supply of water for drinking water is a priority. Naturally, in times of drought, supply of drinking water draws more attention than other areas of the industry. However, efforts to build the infrastructure to tackle drought, as far as drinking water is concerned, fail to win consumer satisfaction due to time constraint. Despite enormous efforts and investment, consumer satisfaction is far from guaranteed.

That requires a comprehensive review of the status of towns and villages which are vulnerable to dry spells. Drought has now become an indigenous phenomenon in the country. We need to tap into the country's potential to channel investment into efforts to ease crises if and when they happen and make the supply of drinking water sustainable across the nation. Naturally, capacity-building efforts are costlier than measures to temporarily ride out a dry spell. Preventive efforts and measures to guarantee consumer satisfaction are economically justifiable.

Long-term strategies to develop water resources in Iran

Dry climatic conditions, growing demand and consecutive droughts prompted the Cabinet to vote for a set of long-term strategies to develop water resources. The strategies, proposed by the energy minister in 2003, were based on National Strategic Studies on Water Management and in keeping with Article 138 of the Constitution of the Islamic Republic of Iran. The document which takes a comprehensive look at the water sector and emphasizes interdepartmental coordination features the following:

- Formulating plans to develop water resources based on capacities and in keeping with the principles of sustain-

able development

- Reforming the consumption patterns and managing the resources which have so far been ignored
- Making optimal use of land and paying closer attention to environmental issues in different basins
- Setting fair prices and managing polluted resources
- Raising public awareness, decentralizing the management of water in the country, and drumming up the support of individuals who benefit from better management of resources
- Formulating and implementing plans to develop the national capacity to minimize the impact and damage caused by drought

Proposed measures to tackle drought

Some of the proposed measures to reverse the impact of drought are national and some others are local and carried out by the Energy Ministry. Here is a list of national measures:

1. Formulating and implementing land use plans
2. Securing public contribution to the management of the now-indigenous scourge of drought
3. Securing the contribution of policy-makers and experts in other fields
4. Getting international cooperation
5. Offering effective public education as to how drought and its aftermath should be handled
6. Introducing risk management as a replacement for crisis management in implementation of plans to offset the aftermath of drought
7. Controlling the population growth and making settlements in different areas in keeping with their water potential
8. Requiring the government to make more investment in the water sector, particularly when it comes to management of demand

In areas to be handled by the Energy Ministry and its affiliates a number of measures are of great importance:

1. Managing demand and reforming consumption management methods in areas which are viewed as major consumers of water
2. Developing indigenous methods to use rainwater

3. Making use of unconventional resources and recycling water

4. Raising public awareness to set the stage for more optimal consumption

5. Developing technologies to efficiently produce and distribute water and the equipment used by consumers

6. Developing and optimizing standards which apply to water control and distribution, particularly when it comes to consumers

7. Tapping into the knowledge and experience of international organizations to improve the performance of the water industry

8. Developing artificial feeding methods to strike a balance in groundwater reserves

9. Transferring water from one basin to another while keeping environmental considerations in mind

10. Formulating new consumption patterns and reforming the existing ones, particularly in the agriculture sector

11. Seizing the opportunities which are there along with threats in times of drought

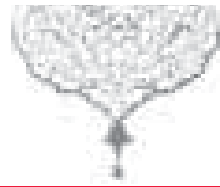
12. Assessing the way drought is managed and making scientific use of the past experience

13. Studying the weaknesses of regions affected by drought again and again and formulating regular plans to prevent the repeat of the past failures.

The opportunities which present themselves during normal or near-normal years, like the 2009-2010 water year, which saw average precipitation stand at 234 mm, should be seized to reformulate plans, implement capacity-building programs, and make optimal use of resources. In our country drought has turned into an indigenous natural phenomenon which makes it impossible to prevent it. It should be managed and such management would be facilitated if those in charge developed a better understanding of the scope and severity of drought and spotted the areas which are regularly affected. Besides, realistic plans should be worked out.

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Drought, the Biggest Threat of the Century

Compiled by the Center for Drought Management Studies and the Center for Studies on How Water Shortage and Drought Affect Agriculture and Natural Resources

In recent decades drought has outdone other natural disasters in affecting the living beings on our planet. In fact, its recurrence, severity, duration, the area it affects, death toll, economic damage and long-term social impact make it worse than other natural disasters.

Fluctuations in meteorological parameters such as precipitation and temperatures are among natural features of atmospheric cycles. Drops in precipitation levels and the dry spells they cause leave a very negative effect on water resources. In fact, dry spells and droughts lead to pollution of water resources as they cause environmental harm and shrink water reserves used for drinking and agricultural purposes. On the other hand, demand for water is bound to rise as global population grows, social transformations are introduced and, lifestyles are changed for better. That lends added weight to efforts to estimate the volume water that is available and to proper planning to use water resources in times of drought.

To paint a clearer picture of the issue at hand, presentation of definitions for droughts is necessary. One conceptual definition views drought as a lasting dry spell which damages agricultural crops and impairs the performance of farmers. It is also known as agricultural drought.

Practical definitions of drought focus on the start, finish and severity of the dry spell. To determine when exactly drought sets in, precipita-

tion variations are analyzed over a certain period of time. Figures released over the past 30 years usually form a basis for such comparison. Droughts are mostly placed in four different categories: climatic, hydrological, agricultural and socioeconomic.

Climatically speaking, when the volume of precipitation in an area falls below the average during a certain period, drought sets in. The less the volume of water, the severer the drought.

The definition of climatic drought should differ from one place to another, because atmospheric factors which affect precipitation levels are not the same in different areas.

Any proper definition of agricultural drought should take account of varying sensitivity of crops all through their life cycle. A drop in moisture levels in topsoil holds up the budding of plants. That in turn shrinks the concentration of plants and pushes down the overall conduct of farmers. However, if the topsoil is moist enough but the subsurface soil lacks enough moisture, plant production would remain unaffected as long as shortage in subsurface soil moisture is compensated for by irrigation or sudden rainfalls. Hydrological drought is measured by the impact precipitation drops leave on the volume of surface water such as rivers, lakes and reservoirs and groundwater reserves. Calculation of the severity of hydrological drought is mostly done in a water-

shed and or a river basin.

Although all droughts are triggered by a shortage of rainfall, hydrologists focus their attention on how the shortage in question makes its presence felt in the hydrological system. Hydrological droughts usually strike after climatic and agricultural droughts. The definitions presented for socioeconomic drought are a combination of supply and demand for certain goods and the components of hydrological, climatic and agricultural droughts. What makes socioeconomic drought different from other droughts is that its occurrence hinges on the timing and place of supply and demand. Supply of several products such as water, fodder, grains, fish and hydroelectric power depends on climatic conditions. Thanks to natural climate change, in some years the volume of water the earth receives is sufficient. In others though, it is nowhere near enough to meet the needs of humans and the environment. Socioeconomic drought strikes when demand for a certain product is greater than supply thanks to the shortage of precipitation. Considering the impact drought leaves on ecological systems and agriculture and its direct link to the income of people, it should be closely monitored before any information is presented to farmers. Drought monitoring, formulation of special prediction models and development of a risk management plan can help experts and researchers develop a better un-



derstanding of drought.

The Center for Studies on How Water Shortage and Drought Affect Agriculture and Natural Resources, an affiliate of the Agricultural Re-

A closer look at maps and PN and SPI drought indicators reveals that drought lost steam in the 2009-2010 water year. A comparison with the year before however suggests that

hydrological drought.

To help improve drought management, the center has worked out plans to monitor precipitation during 15- and 30-day periods across



search Organization, has drawn up a detailed plan on monitoring the country's precipitation and drought status. It has also worked out plans to implement research projects to identify and examine dry spells in Iran. To that end, preparations are in progress at the center to craft risk management systems, and introduce optimal management when it comes to exploitation of resources and work out plans on drought risk management in different regions.

Latest studies on drought

A look at maps, images and climatic indicators presented in the 12 months to September 21, 2010 suggests that during the yearlong period precipitation levels were higher than the year before but lower than the country's long-term average.

drought moved from the west and southwest to central, southern, eastern parts of the country – provinces of South Khorasan, Kerman, Yazd, Hormozgan and Fars – as it lost its momentum. But the hydrological drought is still on because of low precipitation. Of course, we should bear in mind that lower precipitation is not the only factor behind hydrological drought; rather it depends on a number of parameters. In order to get to the bottom of drought, examination of precipitation data is of great importance. Precipitation is one of several factors which affect other drought contributors such as soil moisture and surface currents. Evaporation and transpiration which affect soil moisture levels should also be taken into account in

the nation and present reports on precipitation and drought status, examine the impact of drought on groundwater reserves in Golpayegan, present managerial solutions based on the MODFLOW model, use satellite imagery to review the country's agricultural drought between 2007 and 2009, figure out the PN, SPI, Z, and CZI indicators in different climatic regions across the country, predict precipitation using climatic signals, use modern technological systems to assess the area of land covered by plants, conduct drought risk management and implement a plan in Alamout region in Qazvin Province. It is hoped that the results of these projects will play a role in prevention of drought down the line.

Hot Weather Takes a Toll on Earth

By Alireza Daemi, the Water and Wastewater Macro-Policy Office

In the early days of the summer, the Jet Stream formed over Central Asia and led to concentration of tropical systems over Russia. That in turn triggered fires in Russian forests, pastures and farmland, posing a serious threat to the country. Similarly, in Pakistan, concentrated clouds created by the Jet Stream dumped over 270 mm of rain on parts of the north in just two days, triggering the country's biggest floods on record. Those floods drove some 20 million people from their homes, killed and injured thousands more, damaged farmlands tens of thousands of hectares in area, and submerged entire towns and villages. How vulnerable humans are to such natural phenomena? Even major powers are unable to prevent the widespread change natural phenomena as such introduce to human lives. A weather system can easily destroy major parts of two regional countries and disrupt the lives of several million people. Incidents like these explain why ancient inscriptions dating back a few thousand years prayed to "God to guard the nation against enemy, lies and drought". Iran is a generally dry country and lack of enough water has always created restrictions in the lifestyle and subsistence of its residents. The big drought of 2008, which came hot on the heels of a dry spell which lasted eight years, disrupted the country's climatic balance. Shortage of precipitation and excessive evaporation took a heavy toll on the country's water reserves. Many lagoons, lakes and rivers dried up in this period and major bodies of water like Hoor al-Azim, the Bakhtegan Lake and Hamoon are now on the verge of disappearance. Water levels at the Orumiyyeh Lake have dropped, pushing up the amount of salt in the lake which is no longer home to any animal. Water shortage has prompted humans to redouble their efforts to face up to natural phe-

nomena. Those efforts have triggered dust storms in deserts in Iraq and Syria and prompted the earth to subside in the Iranian provinces of Kerman and Hamedan, leaving a scar on water resources and on the surface of the earth alike. The Tigris is on the verge and the Karoon River is no longer as brimful with water as it used to be. Lakes have turned into salt mines and deserts.



Why is it that the earth is so thirsty and its veins are so empty? Why is it that the country's lagoons have turned into salt mines? Why are the reservoirs of dams empty? I came across a farmer in the southeastern province of Sistan who insisted on opening the floodgates to water his farmland and save the crop. The once mighty Hirmand River was no longer what it used to be. The farmer told me he was ready to risk drowning to prevent the destruction of his land. Villagers in Khuzestan and Khorasan are leaving their land and fruit trees in Fars are turning to dead wood under the watch of their owners. What should we do? Do we have to sit on our hands? Do we have to adapt ourselves? Do we have to raise our hands in prayers for rainfall? Maybe we have

to take on Mother Nature. It has been proved to the Iranians that drought is worse than any other adversary. Over time it drives nail after nail into the coffin of groundwater reserves, rivers, lakes and qanats. We need to join hands to ride out this climatic phenomenon. We need to make optimal use of water on all fronts. We need to conserve water. We should not leave the country's

natural environment alone in tackling drought. We need to formulate new consumption patterns, particularly in the agriculture sector, in keeping with the country's climatic conditions. We cannot copy the consumption patterns of countries with abundant water reserves. We need to build capacities but stretching the resources thin should not be an option. If we manage to comply with the provisions of Article 8 of Macro-Policies on Reformation of Consumption Patterns, many of the problems associated with drought will become a thing of the past. We should not rub salt into the wounds of Mother Nature who is already reeling in the aftermath of drought.

Thirsty Earth is Restless

In recent years climatic conditions and climate change have drawn a lot of attention. Consecutive droughts and deadly floods have prompted the world to delve more to work out cohesive answers to the problems associated with climatic conditions which have harmed water resources in countries, rendering management of such resources all the more difficult. Iran has not been immune to these phenomena. Although recent years have seen dry spells replace wet years in the country, the horrific floods of the past decade should never be forgotten. Over the past decade average precipitation has fallen by 15% while the volume of runoff water in the country has shrunk by 40%. In the meantime, the government has made a lot of efforts to develop water resources and channeled a lot of credit to that cause. Still, experts are not satisfied with the existing conditions and there are fears that if the climate change continued at its current trend, environmental damage would be irreparable. Of course, such concerns should not kill the enthusiasm of officials and experts who should go about formulating detailed plans to make optimal use of water resources, pave the way for optimal management of resources and turn threats into opportunities. The Supreme Leader has judiciously stated this in Macro-Policies for Reformation of Consumption Patterns. Article 8 of the policy document has called for formulation and implementation of a national document on water consumption patterns in order to make optimal use of water resources on all fronts, especially in the agriculture sector.

The Supreme Leader has also underlined advocacy measures and

efforts to promote optimization in extraction, preservation and consumption of water and formulation of standards to cut water wastage, monitor the quality of water, prevent

in keeping with strategic and economic values. In fact, the Supreme Leader has rightfully underlined the formulation of action plans to strike a balance between supply and



the pollution of resources, employ more efficient irrigation methods and set up efficient depots to produce and distribute water. The Leader has also called for detailed planning to optimize water allocation and consumption in the production sector

demand particularly in groundwater reserves with a negative balance and implement climate-friendly drought and flood management. Implementation of these instructions could be a perfect road map for efforts to tackle drought.



Humans and the Scourge of Climate Change

By Gholamali Memari

The last two decades of the 20th century were rife with concerns among governments and communities about unbridled population growth, destruction and depletion of resources, poverty and hunger, global warming, disappearance of the solar cap which pushes up water levels in oceans and puts island nations at risk of disappearance, and disruption to human life. Those concerns prompted the World Commission on Environment and Development to release a report at the UN General Assembly in December 1983. The meeting adopted a resolution that set the stage for the Rio Summit in 1992. The summit focused on all environment-related human activities, problems and solutions, initiatives and spending as well as on agendas to be pursued by governments. Under the document, governments committed themselves to various sustainable development plans including management of water resources. Chapter 18, item 21 stresses management and coordinated development of water resources, assessment of these resources, support for water ecosystems, supply of drinking water, sustainable urban management, and food production in rural areas as it details the impact of climate change on water resources which is also mentioned in chapters 9, 12, 14, 17, and 18 of the document. Effective measures have been taken to minimize the impact of climate change on water resources. The question of climate change was so important that a special convention

was drafted in the same year.

United Nations Framework Convention on Climate Change (UNFCCC)

The United Nations Framework Convention on Climate Change, which focuses on environment and development, was adopted in 1992 and became binding in 1994. Up to 186 countries have signed the convention which is designed to prevent the release of greenhouse gases and ease their devastating effects such as the disappearance of polar ice caps, higher water levels, changes to precipitation patterns, desertification, devastating hurricanes, imbalance in animal and plant habitats, emergence of pests and disease and lower agricultural production.

In order to ensure the implementation of the convention, an independent protocol named after the Japanese city of Kyoto was drafted. The Kyoto Protocol, which took effect in 1997, set a deadline for developed countries to cut their greenhouse gases.

Iran signed the convention in June 1996 after the Islamic Consultative Assembly gave the government the green light to join in. Iran has so far produced reports on a National Initiative on Climate Change and on how greenhouse gases are released into the atmosphere, and a national assessment report on the country's exposure and adaptation to climate change. The National Initiative on Climate Change has been named one of the best national reports in the

Asia-Pacific region.

The convention on climate change is 20 years old. During the past two decades, the international community has organized 15 international Conferences of the Parties (COP). The last one was hosted by Denmark in December 2009. It was designed to assess the global trend to minimize the effects of greenhouse gases and climate change and stabilize the environment. The measures taken so far have been unsuccessful. Many countries are indifferent and only a handful have taken the fight against climate change seriously. During the same period global temperatures have risen by 0.6°C. The Arctic and Antarctic have undergone change and monster storms have ripped through different parts of the world. Global temperatures are predicted to rise by between 1.4°C and 5.8°C by the end of the century and that is bound to be associated with more devastating effects. A number of activities push up the volume of greenhouse gases in the atmosphere, among them: burning more and more fossil fuels, cutting trees, downsizing green areas in towns, decreasing the area of land under cultivation near big cities, making widespread use of chemical materials which release longer-lasting gases into the environment, expanding the cities, releasing aerosols and other pollutants into the atmosphere, and last but not least inversion.

Dangers associated with climate change

Climate change is a result of the



earth's revolution and constant solar currents. Solar energy arrives on the surface of the earth in the form of visible rays. However, thanks to the difference in temperature between the surfaces of earth and sun, the former cannot reflect the solar rays in a visible form. Rather, it reflects the rays in the form of heat. Greenhouse gases interfere with such reflection. Consequently, a large portion of the reflected energy is carried around by air currents. When the volume of greenhouse gases including ozone, water vapor, CO₂, methane, NO and industrial gases increases they serve as an obstacle and prevent the release of energy and trigger global warming.

Burning fossil fuels including coal, oil and natural gas and deforestation, which frees carbons, release CO₂ into the atmosphere.

The volume of CO₂ on earth has risen from 10% in 1800 to around 30%. The volume of NO has risen by 16% as a result of agricultural activity. Chlorine, fluoride, and carbons, which are produced by refrigerators and widespread use of pesticides and artificial solvents, increase by an annual 4%. These hikes and climate change trigger thousands of new trends.

On average, water levels in open seas have risen by between 10 and 20 cm; the area of land covered by snow has shrunk; and a number of islands have been exposed to submersion.

In vast bodies of water in Africa like Lake Chad and the Senegal Lake, the overall volume of water available to be used has decreased by between 40 and 60%.

As a result of global warming, manipulation of nature and human failure to comply with environmental standards the Aral Sea has almost dried up and is at risk of disappearance.

In Iran a number of lagoons have dried up or are at risk of drying. (Environmental catastrophe)

Some parts of the world have been hit by unpredictably severe drought while others have been affected by devastating floods, hurricanes and El Nino.

Some 2 billion people live in countries where water resources are scarce. That number is bound to increase in the future. By 2050 some 7 billion people living in 60 countries will have been grappling with water shortage.

Springs are affected as a result of climate change, lower precipitation levels and shrinking groundwater reserves. Runoff waters contain more mud which flows into lakes along with rocks and other deposits.

The amount of water that goes to waste increases and the quality of water is affected.

Human health is in danger and the number of cardiovascular and respiratory diseases, which are aggravated by heat and pollution, increases. Besides, the number of malaria, yellow fever and encephalitis cases is on the rise.

Up to 27% of African people do not have access to water which meets minimum sanitation standards. And, 13% are deprived of minimum health services.

Up to 70% of the world's land (252 million hectares) is under cultivation, producing food for only 6 billion people.

In developed countries, average water consumption in the agricultural sector and industry stands at 30% and 59% respectively. The remaining 11% is used for drinking and sanitation purposes. In developing countries 82% of water is used in the agriculture sector while the share of industry is no more than 10%. The remaining 8% is used to meet the public need for drinking water.

Global averages for agriculture, industry and drinking stand at 70%, 22% and 8% respectively. In Iran, 92% of all water produced is used in the agricultural sector. The share of in-

dustry is a mere 2% and the remaining 6% is used in households.

Methods

Efforts to raise awareness about natural resources and low productivity took momentum in the '60s. By 1986 the Middle Eastern economy was totally based on the assumption that extra water should be used to meet growing demand in the agricultural and industrial sectors as well as in households. That assumption changed following extensive scientific debates at different water allocation committees. The changes to ways of dividing water among different sectors led to formulation of policies to promote productivity in the water sector. Besides, the experience of the past helped boost ways of better economic adaptation to water scarcity and regulation and containment of population growth.

Each individual needs a yearly 100 cubic meters of water for drinking, household needs and cooking. In the Middle East that figure varies between 27 cubic meters in dry areas and 150 cubic meters elsewhere. That means in the future, the region will require between 100 and 150 billion cubic meters of water just to meet the household needs of its 1 billion residents.

The per capita industrial need stands at 20 cubic meters a year. As for agricultural water, the numbers vary thanks to introduction of virtual water.

In several Middle Eastern countries virtual water is synonymous with the supply of staples through imports. To produce a ton of grains up to 1,000 cubic meters of water is needed. In light of the fact that the transfer of a ton of imported grains is much easier than 1,000 cubic meters of water, virtual water has become synonymous with imports. That assumption led to the emergence of the theory of "water, an international economic and trade source" in 1991. Such ideas are in contrast with con-



sumer expectations that view water as a virtual product.

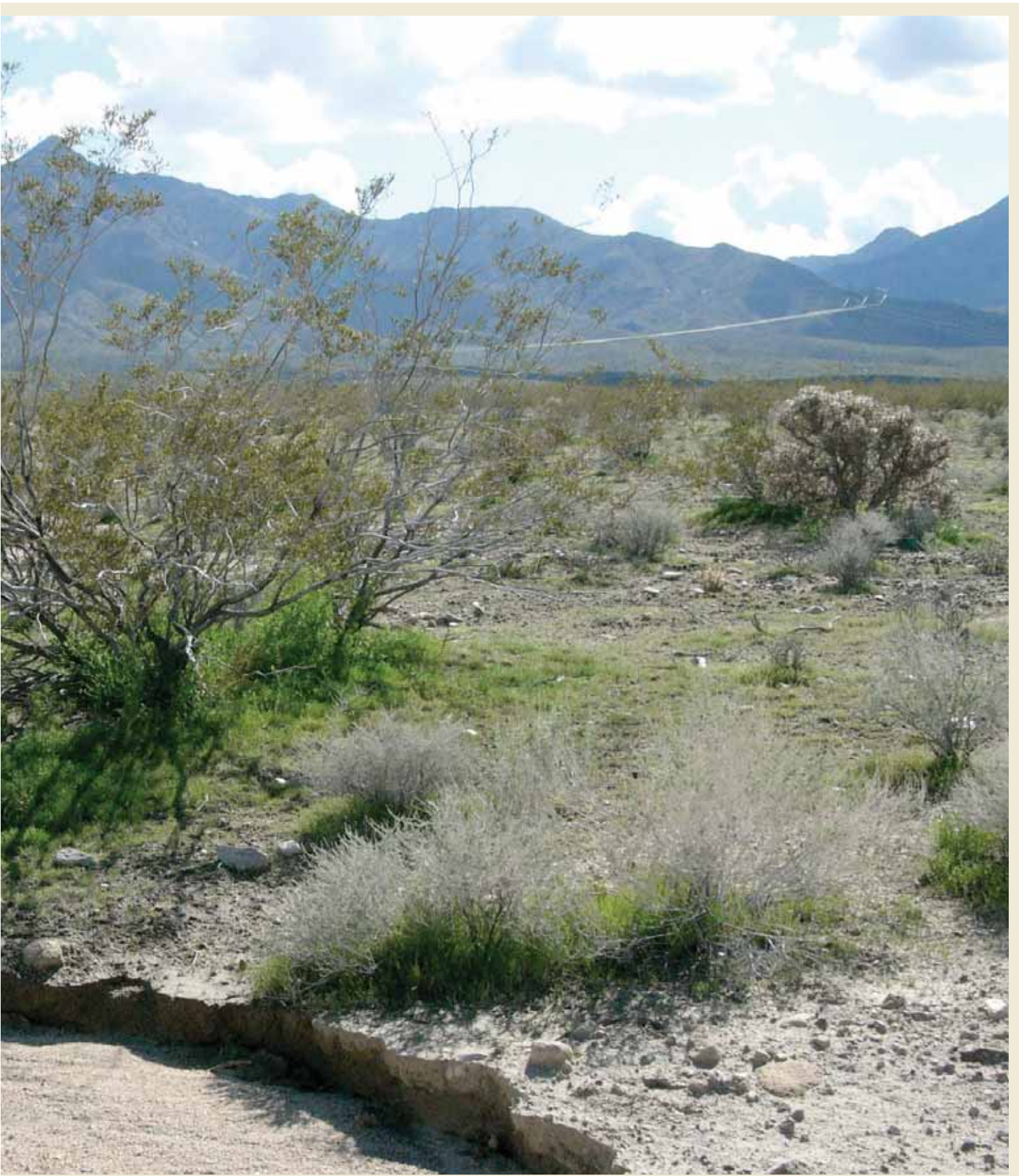
Similarly, the idea that water should be solely used for agricultural purposes is widespread in dry or wet areas for that matter.

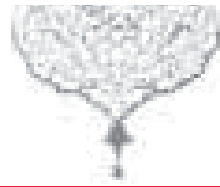
In the early '90s almost 80% of water used in the Egyptian public sector went to the agriculture industry that accounted for about 20% of the GDP. The remaining 80% was used for other sectors which generated almost 83% of the GDP.

Productivity, which plays a role in raising revenues and securing hydraulic achievements, is believed to be a function of proper allocation and management of water. All three factors need to be monitored. In places where freshwater reserves are limited and there is no replacement for resources and thus demand is high, meticulous allocation would be necessary to strike a balance between supply and demand and make up for shortages. But reallocation of water could be affected by political feedback provided by individuals whose interests might be at stake.

There is a close link between water and food shortage in a country. The biggest managerial challenge countries in dry regions face is to work out water policies which, on the one hand, meet public demand for water and, on the other, provide enough water to produce their staple items. In many countries in the Middle East and North Africa, even the supply of a meager 1 cubic meter of drinking water per person per year is very difficult. Naturally, provision of 1,000 times as much water for production of the amount of staple an individual needs is impossible. In Iran, water is used for development purposes, but climate change, drops in precipitation levels, and back-to-back droughts have rendered the supply of timely, sufficient water in dryer regions more sensitive. In order to overcome this challenge new allocation policies and prices should be worked out.







Water conveyance from karaj regulatory dam to Tehran city plan (water conveyance tunnel project)

- The study of water resources management in the western area of Tehran carried out by Tehran regional water company in 2000–2001.

- Feasibility study (phase-I) performed by Tehran Boston consulting English, from Feb. to Dec. of 2002

- Dividing tunnel construction stages, into two lots due to financial policy of project.

- Tender of tunnel for lots-1, was held in 2003.

- Selecting the Ghararghah Sazandeghi khatam-al-Anbia as project contractor, and tender winner, & choosing Lar co. as consulting engineers in tunnel lot-I (16km. length), in 2004.

- choosing the Ghararghah Sazandeghi Khatam-al-Anbia as project contractor, &

selecting moshanir co. as consulting engineers in tunnel lot-2(14 km. length), in 2008.

Project objectives

Main objectives:

- 1) Replacement of the current Tehran water supply & water treatment system.
- 2) Provision of the possibility of inspection, reproduction & modification of Tehran city current water conveyance and water treatment system.
- 3) Water supply to western urban areas, with altitude higher than the present areas covered by water supply and treatment plants. Consequently, the reduction of pumping costs, and saving operation and maintenance expenses of the current water distribution systems.
- 4) Water supply to expanded areas in the north and northwest of Tehran.

5) Increasing the capacity of Tehran water treatment systems.

Secondary objectives:

- 1) Protection of potable water quality obtained from karaj river.
- 2) Enhancement the quality of citizens, potable water.

Project specification

A: tunnel conveyance and excavation system

- 1- Total tunnel length: 29540 meters
- 2- Tunnel length: (lot 2) 13500 meters
- 3- Excavation diameter: 4.665 meters
- 4- Final diameter: 3.90 meters
- 5- Tunnel slope: 0.001377
- 6- Drilling system: full section mechanical

7- Boring machine: double shield TBM
B: lining specification



- 1) Type of cover: universal rectangular segment
 - 2) Number of Precuts concrete segments in each section = 5+1=6 segments
 - 3) Segment thickness: 25cm
 - 4) Pea gravel layer thickness: 13 cm
 - 5) Segment width: 130cm
 - 6) Sealing system type:
Water tight gasket sealing band-injection
 - 7) Segments connection type: bent bolt
 - 8) Segment curing time: 6hours
- C:** project hydraulic details:
- 1) Tunnel conveyance capacity: 16m³/sec
 - 2) Flow type: free flow
 - 3) Section filled Ratio: 70%

Specific conditions of project

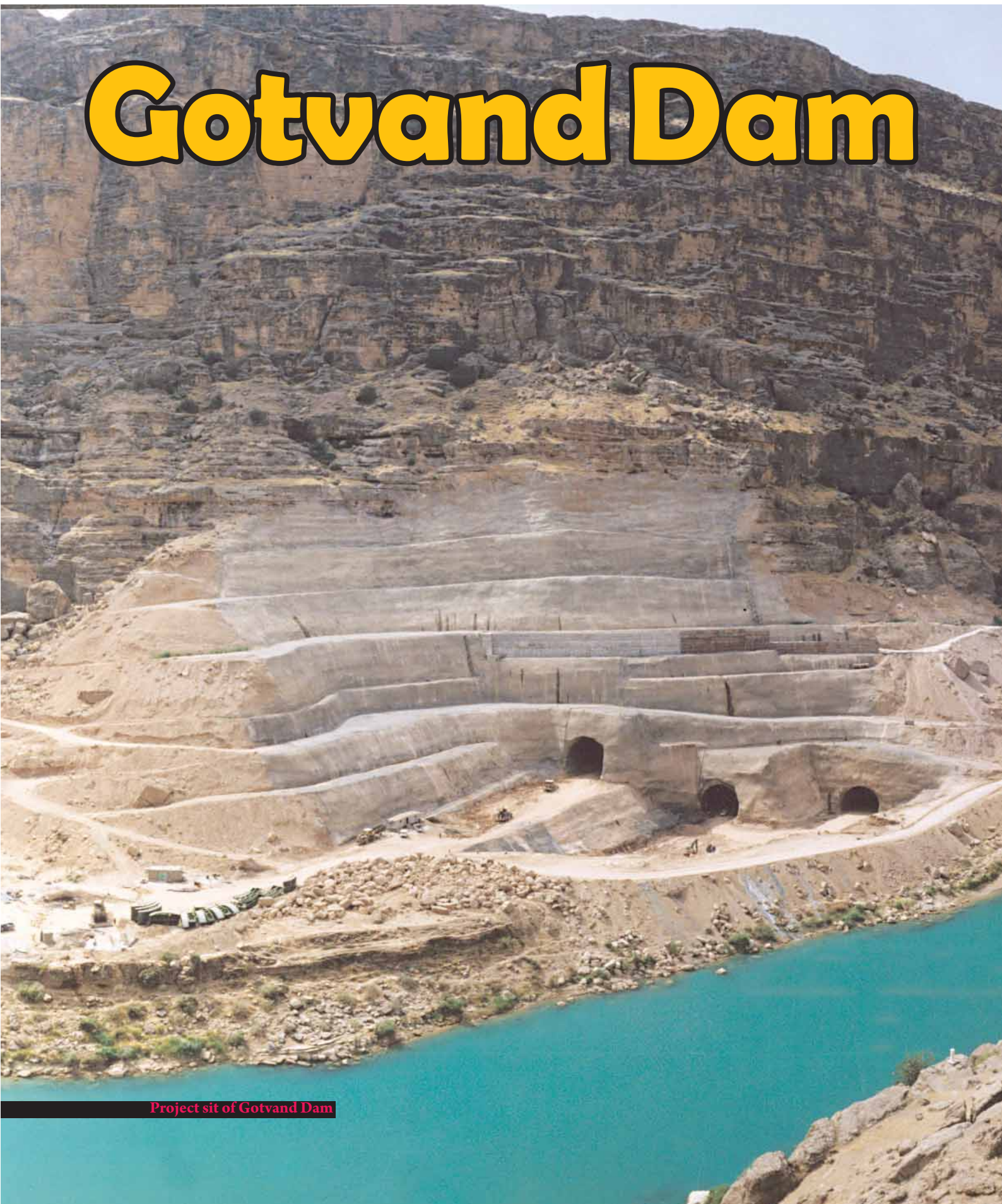
- 1- Max. Overburden (LOT 1): 675 meters.
- 2- Max. Overburden (LOT 2): 850 meters.

- 3- Special arrangement for operation of TBM without foreign experts.
 - 4- Mountainous and impassable area and impossibility of excavating any access tunnels.
 - 5- Lack of space for site mobilization and portal works.
 - 6- Traffic restraint to go to inlet of tunnel, next to karaj-chaloos road.
 - 7- Problems to reaching the tunnel path for exploratory works.
 - 8- Springs – aqueducts – wells, which are around the tunnel path and meanwhile, being concerned about facing with underground water and the decreasing their discharge.
 - 9- Tunnel outlet located close to Tehran urban areas.
- Achievements of tunnel lot 1

- 1- 16000 meters excavation and lining in 1000 days form one entry
 - 2- Daily excavation record 39 meters in May 2007.
 - 3- Monthly excavation record 805 meters in Aug. 2007.
 - 4- Completion of project 8 months ahead of schedule.
 - 5- Accomplishment of project without any increase in primitive price.
 - 6- Completion of project without any partnership of foreign contractors.
- The record of 16000 meters excavation and lining in 1000 days form one entry, considering the use of the universal tetragonal segments is a remarkable achievement in tunneling projects in Iran. In fact it can be publicized and promoted in the other projects all around the world.



Gotvand Dam



Project sit of Gotvand Dam



Dam name: Gotvand
Objective: Diversion
River name: Karun
Dam type: Concrete
Dam location: North Shushtar, 4 km to the north of Gotvand

Crest length: 202 metres

Dam height: 27 metres

Capacity: 104 cubic metres per second

Construction years: 1975–1977.

Area under

cultivation: 28000 hectares

Consultant company: Harza International Company

Contractors: Rapal, Ferkar

Executive company: The Khuzestan Water and Electricity Company

Project history:

During 1967–1992 initial studies were carried out on the construction of a dam between the city of Gotvand and Masjed Soleyman Dam and a number of proposals were made. In 1994, the Moshanir Company and CAITEC (China) were tasked to carry out consultancy studies and executive work began in 1996. Water diversion operations, and work on the dam body, spillways and the power plant began in the spring of 1996.

Overall project specifications:

Dam type: Earth-fill with clay core

Height from foundation:

178 metres (m)

Crest length: 760 m

Crest width: 15 m

Height of dam crest: 244 m above sea level

Volume of dam body: 26.6 million cubic metres

Diversion system: Three 1500 m tunnels with a total diameter of 9.5 m. A seven metre cofferdam, and a 58 m pre-cofferdam.

Total reservoir capacity: 4500 million cubic metres.

Lake length: 90 km at a height of 234 m above sea level.

Spillway type: Gated

Power plant specifications:

Power Plant type: Surface

Power Plant capacity: 1000 MW scheduled to be increased to 2000 MW.

Turbine type: Eight frances turbines with a vertical axis.

Building dimensions: 200 m long and 30 m wide.





Impacts of Drought on Health and Ecological Security

By Alireza Nazarian, the head of the ecology office at Char-Mahal Bakhtiyari Environment Protection Department

KEY WORDS: Environment, security, ecology, drought

Abstract

Normally, droughts are triggered by certain climatic conditions at certain times. But man-made changes to the environment have disrupted or at least affected that normal trend. For countries like Iran which are situated in a dry or semidry region, droughts could be doubly destructive. To offset the impact of drought, particularly as far as it concerns human health, a

closer look at this natural disaster is quite necessary. Efforts made by humans are mostly aimed at improving their living standards and protecting them in the face of adversity. Mere attention to short-term impacts would do nothing to secure the intended results of such efforts. In other words, the mental and physical health of humans would be on the line.

Preface

The proportion of precipitation

in Iran to global averages places our country in a dry and semidry region. That means the country should adapt itself to dry conditions and put together development plans accordingly. Although Char-Mahal Bakhtiyari supplies 10% of the country's overall water supply, more than 80% of the water it uses for drinking, agricultural and industrial purposes comes from groundwater reserves. As a result of overuse and growing demand, groundwater levels there





have dropped. That has placed a number of plains such as Shahr-e Kord Plain, which used to be major suppliers of water, on the list of areas where extraction of water is illegal. Without a doubt, excessive extraction of water from groundwater reserves leaves a mark on water quality and puts the health of those who use the water at risk. Supply of water to 200 towns and villages on board water tankers might lead to the spread of disease. State politicians and poli-

cymakers should pay closer attention to drought and its impact on human health which is a cornerstone of any development drive. In the absence of human health, development loses its meaning.

Ecological security

The question of drought and its relation to human health was conspicuous by its absence in a gathering in October 2009 in Char-Mahal Bakhtiyari province on ways of countering the devastating fallout of

drought. The gathering featured 133 articles and speeches, but no more than a handful of them concerned the impact of drought on human health.

Without a doubt, drought is in some way associated with mental and physical tension, food shortage, suicide, respiratory disease, and lowered levels of psychological security.

The present paper does not seek to define drought or get into the bottom of what causes it; rather, it wants to define health and shed light on the



link between drought and physical as well as mental health of humans.

Health should not be simply defined as the state of being devoid of physical conditions. Mental health is certainly part of a human's overall health. The sight of a scenic landscape could have as much effect on your mental health as chemical drugs in treating a physical condition. No doubt, drought affects the mental health of humans and leads to various physical conditions.

Those in the medical profession and health centers focus the better part of their attention on efforts to prevent physical and mental conditions in a bid to preserve human health. For instance, measures to ensure food and water quality are

in fact designed to prevent diseases from afflicting humans. If such measures are not coupled with a healthy environment, human health won't be ensured.

If the environment were considered the setting of all human measures and if we took account of the fact that throughout history humans have settled in areas with suitable climate and environment and migrated from places where such conditions have been lacking, we would conclude that humans have to help sustain the environment at any cost. Because, those conditions help keep human interest in survival alive. Nomads who are constantly on the move and live in different climatic conditions provide a perfect example

for such adaptation.

Iran is located in a region where insufficient precipitation is quite normal. That means our planning and approaches should be in line with our climatic conditions. On the one hand, it would help minimize the devastating impact of drought if and when it struck, and secure ecological security on the other. Ecological security is now a development indicator just like social, economic, political and food security. One can describe ecological security as a precondition for other indicators mentioned above. Ecological security could be defined as absence of drought, flooding, soil erosion and water scarcity. In other words, development is based on ecological security which guarantees



economic security in industry, agriculture and the services sector and results in welfare for members of the community.

Now that this paper is focusing on drought and its impact on human health and development as well as human efforts to improve their lifestyle and secure social welfare, it should be noted that the question of health has not drawn as much attention as it deserves. First a look at human ecology:

Humans are affected by their surroundings all through their lives, in childhood, in youth and middle age, and in oldness. Ecology is the scientific study of the relation of humans to numerous factors in their surroundings. In other words, our surroundings have a role to play in

the biological, physical and social powers of individuals and could be at the center of various developments in their behavior and health. That environment could also endanger our health which under normal circumstances is the resultant of a balance between us and our surroundings. Such a balance could be credited with striking harmony among generations.

To get a better idea as to how drought affects human health and the environment, a closer look at various types of environment would be necessary.

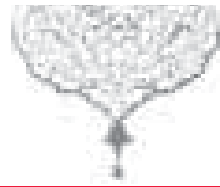
Natural environment is an environment which is solely created by God. Among other things mountains, rivers and jungles constitute

the natural environment also known as Mother Nature.

Human environment is created by humans and Mother Nature plays no role in its creation. Towns, skyscrapers, highways, plants, airports, etc are parts of this environment.

Social environment is an environment built on human interaction. Families, neighbors, salespeople, and colleagues are part of this environment in which individuals affect one another. In fact, the social environment serves as a bridge between natural and human environments and could be defined as human ecology.

The impact drought leaves on each environment is different. What is certain though is that human health and development are affected in this



process one way or another.

Impacts of drought on the natural environment

Our natural surroundings and habitat are the first to feel the impact of drought. Water shortage first affects pastureland and plants before making its ominous presence felt in rivers and springs. It affects the growth of plants as a result of which production shrinks. It should be noted that only 25% of pastureland is grazing ground. The remaining 75% has environmental value. That lends added weight to pasturelands. When the habitat of wildlife is endangered and the food chain is disrupted, wild animals face problem in meeting their needs, thus they may attack cattle, humans, farms and orchards. In addition to the damage such attacks cause, the risk of zoonotic disease rises because the wildlife is a carrier of zoonotic pathogens. Of course, the diseases afflicting animals which cannot migrate or do not tend to do so pose a serious threat. Birds can fly away from undesirable conditions.

When the desirable conditions for the growth of useful plants disappear, weeds come out and bring on pests with themselves. To fight the invasion of planet by pests, excessive use of pesticides becomes inevitable. These chemical agents find their way into the soil and remain there even after the dry spell has come to an end. Then they seep into water reserves and penetrate the food chain of humans. In other words, the ill effects of drought are there to threaten human health for quite some time.

In times of drought soil turns unstable and high winds and animal grazing could result in dust storms which make pathogenic agents airborne and transmissible through respiration.

Increased soil erosion is yet another

negative impact. When the top soil is eroded, heavy rainfall and showers could turn into flash floods, endangering humans, wildlife, domesticated animals, farmland and houses.

Droughts lead to a drop in water levels in rivers, springs, qanats and other runoff and groundwater reserves. That in turn results in large-scale deaths of fish, migration, animal invasion of water reserves close to human settlements, a drop in production, lower income for those involved in fish farming, and physical weakness of the wildlife, and sets the stage for the transmission of pathogenic agents. Less runoff water prompts humans to tap into groundwater reserves, a process which lowers underground water levels and gives rise to desertification. Besides, lower levels of surface water translate into an increase in the amount of salt in waters and thus raise the possibility of disease transmission.

Impacts of drought on human environment

Power plants, factories, towns, plantations, parks and greenbelts are all man-made structures which could feel the bite of drought and lower levels of precipitation. A drop in water levels behind dams could translate into less electricity generation, affecting production at factories. When the amount of water in reservoirs behind dams decreases, green areas in towns and cities are affected and more power outages are reported.

Impacts of drought on social environment

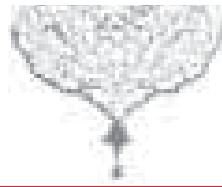
Unfortunately, just like the impact drought leaves on human health, its adverse effects on the social environment have not drawn enough attention. In fact, the social environment bears the brunt of changes drought forces on our surroundings. Drought



can leave a very adverse psychological effect on humans.

As it was mentioned before health should not simply be defined as the state of being devoid of physical defects and conditions. Mental health should be viewed as being part of a human's overall health. That means it is difficult to be healthy without making efforts to offset the undesirable effects of drought and without striving for better psychological health.

Here is a look at some other adverse effects drought leaves on the mental health of humans and the social environment: Farmers lose their land and income to drought; the cattle become emaciated when pasturelands fail to provide enough fodder, so animal farmers are forced to sell their cattle; power failure affects factories and forces lower production, shrinking the income of owners and resulting in layoffs; and destruction of natural



landscapes leaves a mark on humans with the number of tourists whitening down and the income of those involved in the industry dwindling. It also results in a rise in the costs of water supply projects, a drop in government tax revenues, migration from villages to towns and from towns to big cities, unemployment and a subsequent rise in delinquency, higher divorce rates, dust storms and their adverse effects on human environment, a rise in diseases which are directly linked to air and water pollution, and a rise in the number of zoonotic diseases.

Of course, measures taken in other sectors might help blunt these adverse effects, but more attention should be paid to psychological aspects of drought. In the past, only pathogenic agents such as viruses and bacteria would be targeted in treating a disease. But long after full physical recovery the individual

would be feeling unwell. Today, there are as many as 200 triggers for a simple headache, among them tight shoes!

So the end of a dry spell marks the beginning of fresh concerns for individuals; concerns about backlogs, lost opportunities, and financial losses and puts pressure on them to make up for deficiencies. Failure to accomplish this mission doubles the strain and creates an imbalance between body and mind. This might push the individual to the brink of suicide.

When preventive measures are taken in this regard, psychological aspects should be taken into consideration too. Such measures should be aimed at easing or at least minimizing future concerns.

Sometimes humans feel the dire need to embrace Mother Nature and satisfy their needs for calm, tranquility and esthetic by feasting their eyes on the beauties God has created. Drought and its fallout could overshadow all these needs.

Conclusion

The relation between drought and water resources and preventive plans should be sought in water management. Iran's geographical location in a dry and semidry region, with one third of global precipitation levels, means our renewable water resources are not as rich as the rest of the world. Besides, as a direct result of population growth these limited resources are being stretched thin. Naturally, with population growth, demand for fresh increases. In addition, better economic conditions push up per capita water consumption. The fact that in Iran per capita consumption hovers between 500 and 1,000 cubic meters a year means the country is on the list of countries with chronic water tension. If the current trend of population

growth persisted and productivity in the industry did not change much, Iran would have made it to the list of countries with acute water tension – with a per capita consumption of less than 500 cubic meters – by 2050. Growing welfare, urbanization and industrial development in the world, Iran is no exception, has put the globe on the fast track toward using up all that renewable resources have to offer. Growing welfare and higher levels of consumption do not fix the problem of diminishing water reserves; rather, they contribute to the destruction and pollution of water resources, an irreversible environmental disaster that puts human health at risk. Drought adds insult to injury. In combating the scourge of drought, policymakers in the field need to develop a better understanding of the country's climatic conditions and the factors that contribute to droughts which hit once every few years, identify the reasons behind growing demand for drinking, industrial and agricultural water, ensure the country stays on the path to sustainable development and last but not least pay attention to the mental health of society. In other words, in order to have economic, political, social and food security, closer attention should be paid to ecological security which is instrumental to other forms of security.

Suggestion

It seems the best way to secure the objectives laid out in this paper is to take measures that prevent drought in the first place.

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Best Regard,

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Climate Change and Its Impact on Resources in the Middle East

