Water Technology

SUPPLY:

1. Water diversion and dam projects
    - Positive: Water diversion and dam projects can solve flood problems and enhance water supply. Building hydroelectricity plants in dam area can also be a source of clean energy provider.
    - Negative: Water diversion and dam project require huge investment, which can lead the country in debt. It also causes serious impact on the local people, such as resettlement or displacement. Apart from that, construction of water diversion and dam projects can result in enormous environmental effects.
2. Desalination
    - Desalination is now a well-established technology for urban water supply. In the oil-rich Gulf countries, desalination accounts for 40% of the water used for municipal and industrial uses. In Central Asia, desalination water supply mainly for villages. On a global scale, 39% of the world's population lives in costal seas, where desalinated water can generally be supplied at an acceptable cost.
    - Five technologies related to desalination are thermal technologies, membrane technologies, reuse/reclamation technologies, novel technologies and concentrate management technologies.
    - The desalination industry is undergoing rapid changes. The relative cost of desalination has decreased substantially over the past decade, and the private sector plays an increasingly important role in the operation and sometimes the funding of desalination plants.
    - The cost for seawater reverse osmosis has come down, currently in the range of $2-3/1,000 gallon. Brackish water has decreased to $1-1.5/1,000 gallon.
    - Needs:
        a. Reducing costs: The cost of the desalination process is especially critical for small towns. In some places, the cost of desalination processes is so high that local communities are unable to have any kind of development.
        b. Ensuring the quality of reclaimed saline water: Efforts must be made to control the amount of organic or biological materials that remain in reclaimed water.
        c. Enabling the disposal of concentrate: This is of particular concern to inland cities. A possible solution is to develop beneficial uses for the concentrate.
3. Other water supply technologies
    - Airburst: Airbust is a new technology that improves water well capacity tremendously, from zero flow to almost full operation. Test in Abu Dhabi shows that it can even rejuvenated one unproductive, abandoned well. This technology uses air as the "explosive" by using a specially modified tool, which can repeal the well screen or well screen producing area.

DEMAND:

1. Water treatment
    - Low-cost household water treatment possible for poor regions (Susan Murcott)
        a. Coagulation—effective at turbidity removal, but not microbial removal
        b. Biosand Filter (BSF)—the average removal rates for concrete BSF is 55%, plastic BSF is 30%. BSF is relatively expensive and have a limited capacity to handle seasonal elevated turbidity.
        c. Solar Disinfection (SODIS)—SODIS provides high reduction rate for fecal coliform. It performs better in higher water temperature.
        d. Terracotta Filter—results show an average bacteriological reduction of 92%.
        e. Chlorine—Chlorine can be an option for household level treatment.
    - International network to promote household water treatment and safe storage
        a. Sponsored by the World Health Organization, joined by representatives from United Nations agencies, international nongovernmental organizations, research institutions, professional associations and private companies.
        b. Goal: low-cost interventions for home water treatment and storage lead to dramatic improvements in drinking water quality and reductions in diarrheal disease.
        c. The Safe Water System, which combines point-of-use water disinfection with locally produced sodium hypochlorite, safe storage in narrow mouth containers, and community education, has consistently been effective in preventing diarrhea.
        d. The trials of a household-based flocculant disinfectant for water treatment combine a chemical flocculant with a timed-released hypochlorite disinfectant. Through precipitation, coagulation and flocculation, the combined product physically removes a broad range of microbial pathogens and chemicals, including arsenic, and concurrently inactivates remaining microbes with free chlorine.
        e. Studies showed that simple filters made from sari cloth or nylon, combined with appropriate education, reduced cholera by 48%. Locally produced fabricated filters that used imported ceramic candles eliminated all detectable fecal coliform bacteria in household drinking water and reduced levels of diarrhea by 64%.
    - Wastewater sludge and biosolids treatment
        a. Generally, it is believed that sewage sludge can be recycled as fertilizer and soil amendment. However, sludge can inevitable contain industrial and household toxic wastes, which can be harmful to both crops, live stocks and human beings. Science based regulations are needed to ensure safety use of sewage sludge.
        b. Sludge can also be used to produce methane gas.

- The WHO has identified the provision of water disinfection capacity at point of use (POU) as the most cost-effective approach to reducing water borne disease.
    a. Proctor and Gamble has pioneered the development of a coagulating and water purification tablet called PUR. This product, designed for the low-income market, has demonstrated significant reductions in diarrhea disease in test market and will soon be available to join other products to serve as a tool for point source purification of water.
    b. When these technologies are coupled with education and hygiene programs, field experience shows that a 50% or greater reduction in water-related disease can be achieved relatively quickly.

2. Irrigation
    - Drip Irrigation
        a. Drip irrigation delivers water to plants where they need it—at the roots. It uses 30% to 50% less water than sprinklers and does not cause runoff.
    - Furrow Irrigation
        a. The goal of furrow irrigation is to irrigate the entire field as quickly as possible. The number of gates opened or tubes set—the set size—has a significant impact on how fast the water advances across the field and the amount of water being applied. Set size should change during the season and between years to match changing soil intake conditions.
        b. In furrow irrigation, generally apply water when the crop has used about one-half of the available water capacity in the root zone. But don't completely fill or over fill the root zone.
        c. Set time, stream size, lengths of run and intake rates are considered in furrow irrigation.
        d. A relatively new technique for managing furrow irrigation is called surge flow irrigation, which apply intermittently, through the use of an automatic valve, rather than continuously to the irrigation furrows.
    - Sprinkler Irrigation—water supply by the sprinkler head that is actually stored in the soil for crop use can be 70%. This percentage depends upon how evenly the sprinklers distribute water and other factors such as operating pressure, nozzle size and maintenance condition.
    - CPNOZZLE—CPNOZZLE is a computer program developed by the Northeast Research and Extension Center in Concord, Nebraska, to quickly and easily determines potential runoff and its economic impact for center-pivot irrigation systems. It offers two different analyses, the potential runoff analysis and the energy saving analysis.
    - Reuse systems are essential for efficient surface irrigation. Reuse of runoff water decreases the amount of water that needs to be pumped or delivered and can be used to improve water application efficiencies by approximately 20 percent.
3. Industrial water management

- In manufacturing system, water is typically used in three main areas: manufacturing process, cooling water and feed water for the boiler system to generate steam.
- Ondeo Nalco has developed an integrated water management approach should be funded on conservation or reducing use through improved operation of existing equipment and processes.
- Nowadays, some of the technologies used in industrial water management include: reverse osmosis (RO) as the main choice for the boiler feed water system, microfiltration (MF) and ultrafiltration (UF) clarification membranes used in the manufacturing process and membrane bioreactor combined with clarification membrane for wastewater treatment, which can half the amount of sludge and more than 95% removal of biological oxygen demand (BOD).
- Saving water often comes not from new technologies, but from better management of water transmission from one point to another.

4. Filtration
    - Chitosan-Enhanced Sand Filtration (CESF), recognized by the Water Department of Ecology, offers a cost-effective and environmental solution for contractors in US of Washington, and shows promise for applications in many countries. This new technology out performs traditional sand filtration by enhancing their ability to remove suspended solids, some heavy metals and other pollutants from stormwater runoff.