Water, Energy and Security: A Brief Overview

Presentation to

State Energy R&D Technology Transfer Forum

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Outline of Presentation

- A few simple messages
- What is meant by energy security and water security
- The linkage between water and energy
- The global water situation
- Concluding thoughts and issues to be addressed

A Few Simple Messages

- The energy security of the U.S. is closely linked to the state of its water resources
- No longer can water resources be taken for granted if the U.S. is to achieve energy security in the years and decades ahead
- No longer can U.S. and global water security be guaranteed without careful attention to related energy issues
- There are already severe water shortages in many parts of the developing world, and the problem will only become more widespread in the years ahead, including in the U.S.
- Major health and economic development issues are associated with inadequate water supplies

Energy Security-How Is It Defined?

- Although most would agree that energy security is preferable to energy insecurity, no precise definition of energy security exists

- In the literature three broad themes are generally associated with energy security:
  - Physical security
  - Economic security
  - Environmental security

One Approach to Defining Energy Security:

- Energy is a means to an end, not an end in itself
- Energy is important only as it allows us to provide the services that are important to human welfare:
  - heating, cooling, lighting, communication
  - transporting people and goods
  - industrial and commercial processes
- Energy security thus rests on two principles:
  - using the least amount of energy to provide a given service
  - access to technologies providing a diverse supply of reliable, affordable and environmentally benign energy

Implications for Energy Policy

- Priority #1 must be the wise, efficient use of whatever energy supplies are available (fossil, nuclear, renewable)
- Then, focus on new energy supplies that meet sustainability and environmental requirements

Water Security

- As with energy security, there is no widely accepted definition of water security in the literature

- For purposes of discussion, I define water security to mean
  - “the ability to access sufficient quantities of clean water to maintain minimal standards of food and goods production, sanitation and health.”

Are Energy and Water In Short Supply?

- On a global basis, neither energy nor water are in short supply
  - the earth intercepts ~6 million quads/year from the sun (4 parts in 10 billion of the sun's output)
  - the earth is a water-rich planet

- What is in short supply is inexpensive energy and water – energy and water that people can afford to buy

- Energy and water policy can also be expressed in identical terms:
  - Priority #1 is wise, efficient use of available supplies
  - Then, focus on new supplies that meet sustainability and environmental requirements

How Are Water and Energy Related?

- Central to addressing issues of water security is having the energy to
  - extract water from underground aquifers
  - transport water through canals and pipes
  - manage and treat impaired water for reuse, and
  - desalinate brackish and sea water to provide new fresh water sources.

- Many forms of energy production depend on the availability of water:
  - hydropower
  - cooling of thermal power plants
  - fossil fuel production and processing
  - hydrogen economy

- Water and energy issues are inextricably linked

Water and Energy – Indirect Linkages

- Energy production and use can lead to contamination of underground and surface water supplies
- If competing water uses limit use of waterways for transport of goods, rail and truck will require more energy to move those goods
- Water and energy are the critical elements of sustainable economic development – without access to both economies cannot grow, jobs cannot be created, and poor people cannot move out of poverty

Final Linkage-Global Climate Change

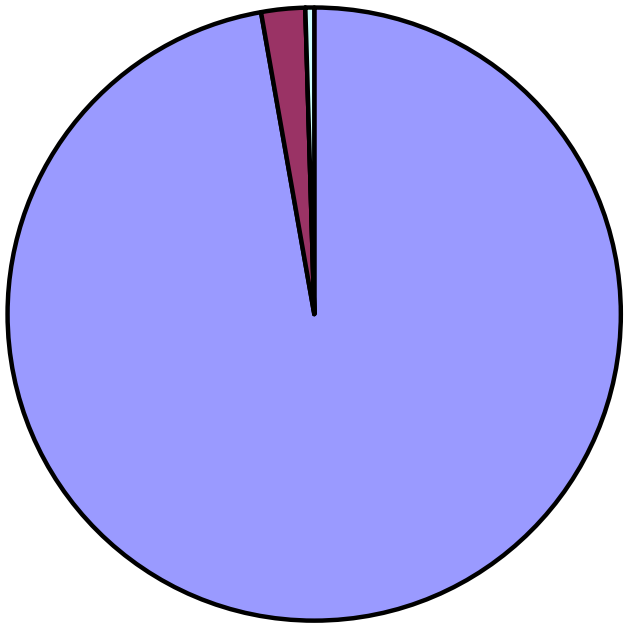
U.S. National Assessment, 1998:

"The scientific evidence that humans are changing the climate is increasingly compelling. Complex impacts affecting every sector of society, including, especially, the nation's water resources, now seems unavoidable…***In many cases and in many locations, there is compelling evidence that climate changes will pose serious challenges to our water systems."***

Earth's Water Supply – Key Facts

Global Water Supply

(329 million cubic miles)*



- oceans (317)
- icecaps & glaciers (7)
- atmosphere (0.003)
- ground water, lakes & rivers (2)

*each cubic mile contains more than one trillion gallons

99.7% of all the water on earth is unavailable for human or animal consumption

Of the remaining 0.3%, much is not accessible due to unreachable locations and depths

The vast majority of water used for human and animal consumption, much less than one percent of the total supply, is stored in ground water

The Growing Demand for Fresh Water

- **Population growth and economic development are driving a steadily increasing demand for new clean water supplies**
- **World water demand has more than tripled over the past half century**
- **Global water use in 2000 is estimated to be about 30% of the world's total accessible fresh water supply**
- **That fraction may reach 70% by 2025**
- **Lack of access to clean water has major health and economic development implications**
- **Many see water security as the key environmental issue of the 21st century**

The Current Global Situation

- The World Health Organization estimates that, globally, 1.1 billion people (17%) lack access to clean water supplies, and that 2.4 billion (41%) lack access to basic sanitation

- 1,000 m^3 is the per capita annual amount of water deemed necessary to satisfy basic human needs:
  - In 1995 166 million people in 18 countries lived below that level
  - By 2050 clean water availability is projected to fall below that level for 1.7 billion people in 39 countries

- Water shortages now plague almost every country in North Africa and the Middle East

Health Impacts of Water Shortages

- Water-borne diseases account for roughly 80% of infections in the developing world
- Nearly 4 billion cases of diarrhea occur each year
- 200 million people in 74 countries are infected with the parasitic disease schistosomiasis
- Intestinal worms infect about 10% of the population in the developing world
- It is estimated that 6 million people are blind from trachoma, and that the population at risk is 500 million

Water and Poverty

- Lack of access to water is one of the defining criteria of poverty
- Job creation within growing economies is key to sustainable development, and without a reliable supply of water and energy economies cannot grow
- Access to clean water is now recognized as the key to poverty reduction

The Senator Paul Simon Water for the Poor Act of 2005

- On December 1, 2005 President Bush signed this act (H.R. 1973), which honors the late Senator from Illinois who was an early advocate of worldwide access to safe water.

- The bill authorizes the President to provide aid to promote affordable and equitable access to water around the world, and calls for the U.S. and 185 other nations to fulfill their joint commitment to two of the U.N.'s Millennium Development Goals: to halve the proportion of people without access to safe water and adequate sanitation by 2015.

Concluding Thoughts

- The problem of global water security is already serious and growing more serious each year
- Energy issues cannot be separated from water issues, and we can no longer take water resources for granted if the U.S. and others are to achieve energy security in the years ahead.
- If we and others are to achieve water and energy security, the linkage between the two must be explicitly recognized and acted upon
- In the U.S. this will require a new partnership between the federal government, which has primary responsibility for energy security, and the states, where water issues have historically been addressed.

Issues To Be Addressed

- Need for education about the water-energy linkage
- Need for adequate financial resources
- Need for R&D to
  - Reduce water use in agriculture
  - reduce energy costs of desalination
  - Reduce power plant cooling requirements
  - Develop improved technology for water treatment/reuse
  - Develop inexpensive water delivery systems for remote locations

Issues To Be Addressed (continued)

- Need to understand the water requirements of emerging technologies (biofuels, oil shales, tar sands, hydrogen economy)
- Need for incentives for wise use of water resources
- Need for understanding global climate change impacts on spatial and temporal variability of water resources
- Need for gender-sensitive approaches
- Need to explore a soft-path approach to water security