Water: The Global Battle for the World’s Most Precious Resource

Tuesday, April 29, 2008
10:55 am - 12:05 PM
Water storage per capita

Water storage (m3/capita)

North America: 6150
Australia: 4729
Brazil: 3255
China: 2486
South Africa: 74
Ethiopia: 43

Water and sanitation: 
The costs of underfinancing

- If we take action and meet the MDG targets, more than 1 million lives could be saved over the next decade.

- The economic benefits of meeting the MDG targets would amount to $38 billion, $15 billion of that in sub-Saharan Africa.

- The economic rate of return for each $1 invested in achieving the water and sanitation target is $8.

- Water and sanitation suffer from chronic underfunding. Public spending is typically less than 0.5% of GDP.

- In Ethiopia the military budget is 10 times the water and sanitation budget—in Pakistan, 47 times.

Per capita water availability

Source: The World Bank, 2006
World Bank “water and growth s-curve”

World Bank: “Water Security” & the “Minimum Platform”

+ Water Secure

Tipping Point

- Water Insecure

Water is a net positive force on a society and economy

Water is a net negative force on a society and economy

MIP: Minimum Infrastructure and Institutional Platform

Implications for human development

• 1.1 billion people lack access to water.

• 2.6 billion people lack access to sanitation.

• Inequality is a central part of the story.

• The lack of water and sanitation leads to diminished opportunities to realize people’s capabilities and human potential.

Irrigation can lift rural poor out of poverty

Average income per capita & irrigation intensity in India (US$)

Hydropower potential tapped

2006

Water resources: many Uses, many users

Why do trans-boundary waters matter for human development?

- There are 263 international basins.
- More than 40% of the world’s population live within trans-boundary basins.
- The number of countries in shared basins is 145.
- Sub-Saharan Africa is the region that best demonstrates the realities of hydrological interdependence.
- Azerbaijan, Croatia, Latvia, Slovakia, Ukraine and Uzbekistan receive between 50% to 75% of their water from outside their borders.
- Hungary, Moldova, Montenegro, Serbia and Turkmenistan receive more than 75%.

Cost estimates for reaching MDG targets for water and sanitation, 2005-2015 (US$ billions)

<table>
<thead>
<tr>
<th>Source of estimate</th>
<th>Water target</th>
<th>Sanitation target</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vision 21</td>
<td>57</td>
<td>42</td>
<td>99</td>
</tr>
<tr>
<td>JMP</td>
<td>63</td>
<td>29</td>
<td>92</td>
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<tr>
<td>Nigam &amp; Ghosh (1995)</td>
<td>51</td>
<td>24</td>
<td>75</td>
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<tr>
<td>Briscoe &amp; Garn (1994)</td>
<td>102</td>
<td>37</td>
<td>139</td>
</tr>
</tbody>
</table>

*Source: International Monetary Fund.*
Water Supply Challenges in Light of “The Urbanization Revolution”

Booky Oren, President and CEO, Arison Water Initiative
Chairman of WATEC Israel

April 2008
The urbanization revolution

• 2007 is the first year in human history when more people are living in cities than in rural areas. (UN-HABITAT, 2006)

• By 2025: expected growth of 40% in the demand for water

Source: Arison Water Initiative.
The challenge: increasing water supply to residential users

Increasing water quantity

Reduce Consumption
- Water savings
- Limitations & regulations

Increase Water Supply
- Treatment & desalination
- New water sources (ground water)

Reduce water losses
- Transportation from a distant site

Limited effectiveness

$ $$ $

Source: Arison Water Initiative.
Water losses in water systems

In over 60% of water utilities, more than 30% of the drinking water is lost.

400 liters per minute / 210,000 M³ annually

Data represents more than 2000 utilities in 85 countries

Source: Arison Water Initiative.
In the U.S. alone there is a gap of over US$ 480 billion in pipe repairs

• Up to 36 million gallons of fresh water leak every day from cracked tunnels delivering water to New York City (AP, April 2008)

Source: Arison Water Initiative.
The urban water and energy “puzzle”

Source: Arison Water Initiative.
Some pieces of the “puzzle” are still not getting the right attention, thus creating a clear opportunity

Source: Arison Water Initiative.
Water Stewardship at
The Coca-Cola Company

Jeff Seabright | Vice President
Environment and Water Resources
Global freshwater crisis

“As we enter the twenty-first century a global water crisis is threatening the security, stability and environmental sustainability of all nations, particularly those in the developing world.”

“Water is the main ingredient in every product... and is also a limited natural resource facing unprecedented challenges from over-exploitation, increasing pollution and poor management.”
A global water scarcity crisis

Water availability (m³/capita/year)

Source: The Coca-Cola Company.
Water… the human impact

• 450 million people that suffer severe water shortages

• 1.3 billion people that do not have access to safe drinking water

• 2.6 billion people without access to sanitation

• 2015: Date for MDG goals to reduce by 50% those without access

• 5,000 daily deaths from waterborne diseases (90% children)

Source: The Coca-Cola Company.
Global water risk assessment
2004

Extreme Scarcity <500
Scarcity 500-1,000
Stress 1,000-1,700
Adequate 1,700-4,000 m³/person/year
Abundant 4,000-10,000
Surplus >10,000
Ocean/Inland Water
No Data

Source: The Coca-Cola Company.
Geospatial analysis – Africa divisions: Plant locations, production, and water use ratio relative to annual renewable freshwater supply per capita

Note: Cape Verde and eastern island of Mauritius not shown

Sources: ISciences, LLC; University of New Hampshire; and, Oak Ridge National Laboratory

Source: The Coca-Cola Company.
Total Water Withdrawals as a Percentage of Renewable Supply

Source: The Coca-Cola Company
Changes in water stress due to climate change

• Use runoff and temperature estimates produced by an ensemble of four premier general circulation models (GCMs, also known as global climate models)

• Construct scenarios of future water withdrawals and consumptive use ratios in 2025, 2050 and 2095 that are consistent with the benchmark Intergovernmental Panel on Climate Change (IPCC) scenarios used to drive the GCMs.

• Compute change in the Water Withdrawal Ratio (WWR) from baseline period (1990-2000)

• Report both “best” estimate and range of estimates for change in WWR for each scenario and time period

Source: The Coca-Cola Company.
Determining changes in water stress due to climate change

**General Approach/Schematic**

- Greenhouse Gas Emissions
- General Circulation Models
- Runoff

- IPCC Scenarios
- Country Downscaling
- Freshwater Withdrawals
- Consumptive Use Ratios

- Temperature
- WWR Model
- WWR

Source: The Coca-Cola Company.
Consumptive use ratio scenarios

• The consumptive use ratio for each sector (domestic, industrial, agricultural) is the fraction of water withdrawn that is not available for reuse within the same watershed due to evaporation, evapotranspiration, or contamination.

• Compute historical trends for 26 “natural economic regions” based on published historical data and projections for 1950-2025 (Shiklomanov¹)

• Extend trends to 2100 with constraints
  – Rate of change slows to 0%/year by 2100
  – Consumptive use ratios forced to stay within an envelope defined as:
    • No more 110% of the maximum projected values for 2025
    • No less than 90% of the minimum projected values for 2025

Source: Cambridge University Press & UNESCO
Change in water withdrawal ratio: 
A1B 2025 (with plants) *Compared to Baseline (2000)*

Source: The Coca-Cola Company.
Change in water withdrawal ratio:
A1B 2025 (with plants) Compared to Baseline (2000)

Source: The Coca-Cola Company.
- Distinctive leadership through strategic partnerships with WWF and Global Water Challenge.

- Help enable equitable access to clean drinking water in underserved communities where we operate.

- Support the protection of watersheds in water-stressed regions where we operate.

- Drive water stewardship with the supply chain.

- Best-in-class in water use efficiency & compliance on wastewater management.

Source: The Coca-Cola Company.
System capability

Global leadership
- WWF, global water challenge
- Community water partnership grants
- Metrics and evaluation tool

Sustainable communities
- Water efficiency tool kit
- Wastewater treatment design and operations
- Water quality support program

Watershed Protection
- Disaster response preparedness
- Drought prediction maps
- Water safety plans

Plant Performance
- Source protection mgmt tool

Source: The Coca-Cola Company.
Our goal is to return to communities and nature an amount of water equivalent to what we use in all of our beverages and their production.

<table>
<thead>
<tr>
<th>Reduce</th>
<th>TCCC will set specific water efficiency targets for global operations by 2008 to be the most efficient user among peer companies.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recycle</td>
<td>TCCC will align our entire global system with stringent wastewater treatment standards which require returning all water that is used in our manufacturing processes to the environment at a level that supports aquatic life by the end of 2010.</td>
</tr>
<tr>
<td>Replenish</td>
<td>On a global basis we will expand support of healthy watersheds and sustainable community water programs to balance the water used in our finished beverages.</td>
</tr>
</tbody>
</table>

Source: The Coca-Cola Company.
Reduce

• With WWF, developed interactive, plant-level water efficiency toolkit, harvesting best practices from throughout our system.

• Between 2002 and 2006, reduced global water consumption by over 6% while sales volume increased by nearly 15%.

Source: The Coca-Cola Company.
Reduce

Source: The Coca-Cola Company.
Recycle

- Wastewater treated in accordance with applicable laws and regulations; where municipal or other external treatment facilities do not exist or do not fully treat wastewater, manufacturing operations must construct on-site treatment systems

- Nearly 85 percent of operations aligned with the standard

- Pledged full alignment with Company’s higher standards by the end of 2010

Source: The Coca-Cola Company.
Recycle

Source: The Coca-Cola Company.
Replenish

- Engage in over 120 community water projects in 50 countries to protect and preserve water resources and help enable greater access to water and sanitation; partners include USAID, CARE, UNDP and WWF
- Published Replenish Report to provide information about community water partnerships
- Working with internal and external stakeholders to define “water neutrality”
- Striving to have a net positive impact on local water resources

Source: The Coca-Cola Company.
Supporting community initiatives: 
Community water partnership sites

Source: The Coca-Cola Company.
• In 2007, announced multi-year partnership to help conserve global freshwater resources
• By 2010, WWF and TCCC are working together to:
  – Measurably conserve seven key freshwater river basins
  – Improve the efficiency of the Company’s water use
  – Support more efficient water use in TCCC’s agricultural supply chain, beginning with sugar
  – Decrease the company’s carbon dioxide emissions and energy use
  – Inspire a global movement engaging industry and individuals to support conservation of freshwater ecosystems, species and water resources

Source: The Coca-Cola Company.
Global awareness and action

• **CEO Water Mandate**
  – Encourages business leaders to recognize the role of the private sector in addressing water challenges faced by the world and enlists companies to make water-resource management a strategic priority

• **Global Water Challenge**
  – Helping bring safe water and sanitation to millions by replicating programs that work
  – Water for Schools – pilot program in Kenya provides safe drinking water, sanitation and hygiene education to thousands of students

• **World Economic Forum**
  – Leading discussions with CEOs to catalyze holistic water management actions

*Source: The Coca-Cola Company.*
Veolia Water
The world leader in water services
**Our business:**
**water cycle management**

*A business focused on 2 segments of the same activity:*

- Management of water and wastewater services for municipal and industrial clients
- Design of technology solutions and construction of facilities required for these services

*2007 revenue breakdown: €10.9 B*

*Source: Veolia Water*
Market positions

- Americas: 6%
  - €763 M

- Africa & Middle East: 9%
  - €705 M

- Asia: 10%
  - €703 M

- France: 45%
  - €4,802 M

- Rest of Europe: 30%
  - €3,114 M

Source: Veolia Water.
Municipal services

- **Water and wastewater services**
  - Distribution networks
  - Water resources protection
  - Consumer services
  - Plants
  - Collection systems

- **Management of outsourced public services**

- **Contract value creation mechanisms:**
  - Contract engineering
  - Productivity gains
  - Measurable improvements in service levels
  - Quality of management teams

- **Average contract term:**
  - With limited investments: 10 to 15 years
  - With structural investments: ≥ 20 years

*Source: Veolia Water.*
Technological solutions and facilities design & construction

2 dedicated subsidiaries: Veolia Water Solutions & Technologies and Sade

- Veolia Water Solutions & Technologies (VWS) covers all treatment technologies
  - Design-build of complete turnkey facilities
  - Supply of standardized technological solution kits
  - Associated services such as after-sales service
  - All the major technology types
  - All types of industry, wide array of solutions

Source: Veolia Water.
Technological solutions and facilities design & construction

2 dedicated subsidiaries: Veolia Water Solutions & Technologies and Sade

- Sade, market leader in Europe for pipe solutions, specialist in trench-less techniques
- Design, installation, replacement and maintenance of water and wastewater pipes
- Construction and installation of other networks:
  - Iced water, hot water, steam, gas, electricity, communication, etc.
- Design and construction of network-related facilities
- Techniques that reduce the volume of earthworks, sound pollution, traffic disruption, and so on:
  - Trench-less techniques, rehabilitation techniques

Source: Veolia Water.
Veolia Water, a player in sustainable development

**Technological and management know-how to protect a rare and fragile resource**

- **Ensuring sustainable management of the water cycle**
  - Combating waste
  - Collecting and treating wastewater to protect resources and combat disease
  - Raising elected officials’ awareness of the importance of top quality sanitation
  - Developing alternatives resources
    - Wastewater reuse
    - Seawater desalination
- **Promoting environmental citizenship**
  - Preventive, awareness-raising and educational actions
- **Supporting solidarity**
  - To give maximum access to water and sanitation (Morocco, Gabon, Niger, etc.)
- **Veolia Water, a Veolia Environnement subsidiary, signed up to the Millennium Goals:**
  - “To halve the number of people without access to safe water and sanitation by 2015”

Source: Veolia Water.
Veolia Water AMI’s main contracts

- Tanger & Tétouan
- Rabat - Salé
- Ashkelon
- Ajman
- Oman
- Karnataka
- Burkina Faso
- Niger
- Gabon
- Girassol
- Windhoek

Source: Veolia Water.
Veolia Water AMI and the Millenium Goals

• Public private partnership
  – Optimize infrastructure
  – Promote adapted tariff policies
  – Design and acceptable price for new connections
  – Adapt technical and commercial solutions to the poor
  – Combine various solidarity systems

• Examples
  – Marocco, Mali, Gabon : Millenium targets met
  – Niger : targets met (in urban areas)
  – Inter-services (water / electricity)

Source: Veolia Water.
Experiencing a new approach with Grameen Group
The arsenic issue in Bangladesh

- Arsenic found naturally in Bangladesh’s soil (Himalayan alluvia)
- Groundwater polluted with arsenic
- 30 million inhabitants concerned (out of 130 million):
  - Skin cancers
  - Children particularly hit

Source: Veolia Water.
Grameen Veolia Water Ltd

- 50/50 joint venture company between VEOLIA WATER AMI and GRAMEEN HEALTHCARE
- VEOLIA WATER to provide technical know-how GRAMEEN HEALTHCARE to provide social and local knowledge
- Social Business model (no losses, no dividends) : a sustainability target

Source: Veolia Water
Main project characteristics

- Distribution of drinking water to 100,000 inhabitants for their essential needs (drinking, cooking)
- 5 villages included in the project
- Global investment: US$ 800,000
- Estimated sale price: 1,5 BDT / 10 liter (0.25 cents / liter)

Source: Veolia Water.
Source: Veolia Water.
• Production from surface water (leave arsenic where it is!)
• Treatment plant capacity: 8 m³/h. (activated carbon filtration and chlorination)
• Distribution system with stand-pipes and bicycle. Delivery in 10 Liter containers. Private connections possible in the future
• Extension to GOALMARI 2: doubling working hours of the plant and extending the distribution network

Source: Veolia Water.
Project schedule

- GOALMARI 1 starting up: end 2008
- GOALMARI 2 starting up: end 2009
- Other villages between 2010 and 2012

Source: Veolia Water.
... and after

- Proof of the efficiency of the business model
- Develop new partners and fundings (SRI funds, etc. ...)
- ... with US$ 250 million, arsenic problem could be solved in Bangladesh

Source: Veolia Water.
Thank you for your attention!

Source: Veolia Water.
Transformation of Water Treatment

Milken Global Conference

April 29, 2008

Andrew Benedek
Membranes in water treatment

- Dissolved salts
- Colloids
- Suspended solids
- Viruses
- Bacteria
- Org. molecules
- Org. macro. molecules
- Parasites
- Polio virus
- Smallest micro-organism
- Cryptosporidium
- Hair

Reverse Osmosis  Ultrafiltration  Sand filtration

Source: Benedek LLC.
Municipal drinking water: Membranes are becoming standard technology

- Mature 19th century technology
- Large land requirement
- Coarse filtration, no physical barrier
- Need multiple steps for coarse filtration
- Labor and chemical intensive
- Dependent on chlorine for disinfection

- Chemical-free treatment
- Physical barrier means more reliable filtration
- Compact footprint
- Fully automated with minimal chemical use
- Cost effective
- Meets public demand for better treatment

Source: Benedek LLC.
Applications of membranes for water and wastewater treatment

- Drinking Water Treatment
- Wastewater Treatment
- Water Reuse
- Desalination
- Distributed Systems

Source: Benedek LLC.
Replacing large central wastewater plants with small local plants

Source: Benedek LLC.
Membranes, the solution for villages

- Residential UF system provides safe water
- Easy to operate, chemical-free
- Coupled with solar panel, becomes energy-less

Water Source: Lake, well or river
Membrane plant operated in village center

Reservoir
Treated Water
Carried to homes
Piped to central Institutions, like hospitals or schools

Source: Benedek LLC.