BRIEFING NOTE

Global Water Partnership

Connecting water and energy

The energy and water sectors have different drivers behind decision-making: energy planners are more focused on diversifying sources of producing low-carbon energy, while water managers have to satisfy a diversity of water users including the environment. Cross-sector cooperation and coordination in policies and planning can maximise the supply of one resource while minimising overuse of the other.

Water for energy, energy for water

Significant amounts of *water* are used in the production of most energy sources – especially for pumping, processing, treating, and cooling in the oil, coal, and gas industries. And significant amounts of *energy* are used to extract, treat, and transport water for human consumption, as well as to collect and treat wastewater.

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Key messages

- **Water and energy are inseparable**. Water is used to generate energy, and energy is used to pump and distribute water. The demand to produce more energy drives up the use of water and the demand for more water drives up energy use. Increasing water use efficiency and managing water demand can save significant amounts of energy, while improving energy efficiency and managing energy demand can conserve water.
- **There is a strong relationship between income and the demand for energy and water.** For poor people, energy and water are used to meet basic needs such as drinking, cooking, and heating. As people become richer, they increase their use of energy and water far beyond basic needs, for example, in water-intensive foods, material goods, and air conditioning.
- **High demand for water and energy threatens ecosystems**. Extracting water for agriculture, energy, and domestic use can lead to a loss of habitat and more pollution.
- **Climate change brings unpredictability**. Too much or too little water will aggravate management of the water–energy nexus.

Demand for water and energy is increasing because of population growth, economic growth (rising incomes), and urbanisation. Even though poverty is still widespread, many people in the developing world are experiencing greater prosperity as countries make the transition from subsistence to industrial or service-based economies. More energy is needed to support this prosperity, and so the pressure on water resources increases.

Increasing energy production also affects water quality. The vast majority of water used in the energy sector is for cooling in power plants. But when that water is returned to rivers or lakes at a high temperature, the oxygen supply is decreased, causing thermal pollution which damages the ecosystem.

Although hydropower plants are often promoted as a source of clean energy, and they regulate river flow during high and low seasonal variations (reducing flood and drought risks), they can also harm ecosystems because they affect groundwater resources, increase sediment, and destroy wildlife habitats.

An integrated approach

It is not unusual for energy planners to make decisions independently of how they affect water use. One example is the shift to low-carbon energy sources (biofuels) which brings greater water consumption and food insecurity. And, hydraulic fracturing ('fracking') has been a boon to extracting more energy but comes with the high cost of contaminating groundwater. From the other side, water managers may decide to pump greater amounts of water for irrigation without considering the resulting demand on energy and the infrastructure required to deliver it. Clearly, water and energy managers must adopt an integrated approach that optimises investments, efficiency, health, and environmental conservation.

Climate change is the spoiler

The combined effects of climate change, population growth, and hydrological variability will result in a greater reliance on energy-intensive options for water supply, such as water transport or desalination plants. Climate change also adds extra importance to how we plan for the multiple purposes of water and energy infrastructure. For example, for hydropower we need full reservoirs but for flood control those same dams need to have room for additional water. And in places such as Sri Lanka, China, and South Africa, hydropower investments must now take account of more frequent and longer droughts.

Pricing the resource

Incomplete information about how energy and water interact means that pricing policies designed to increase efficiency in one sector may be creating problems in the other. If the cost of electricity is subsidised, it is cheaper to install pumps,

which can result in the over-extraction of groundwater for irrigation, as is now happening in India. If the price of water is subsidised, people are likely to use more of it, thus increasing the demand for energy. A more integrated approach requires an understanding of how economic tools impact on each sector.

Regulation of water and energy services

Historically, governments regulated and financed the majority of investments for water and energy services. Today, additional resources from private sector sources and capital markets are essential for complementing national budget deficits and official development assistance. This form of financing will only be effective if the rules of the game (regulatory frameworks and public policies) are clearly defined and transparent.

Managing demand and supply

In the past, energy production focused mostly on responding to increasing *demand*. But now the shift is towards *supply*, with the aim of increasing renewable energy sources. On the other side, the water sector historically has been focused on *supply*, to provide people and industries with water. But more recently, the sector has become more concerned with managing *demand* (reflected in agriculture by the call for 'more crop per drop').

Can these opposite trends be a source of lesson-learning between the sectors? Understanding energy and water data is the first step. Similarly, water and energy audits might help water and energy planners to understand each other.

Conclusion

The climate and environmental impacts associated with energy production have raised awareness of the need for renewables and alternative fuels. But sustainable development through the diversification and localisation of energy sources may only be achieved if the adverse impact on water resources is within tolerance limits. In addition, appropriate pricing mechanisms, policies, and regulatory frameworks are critical for managing demand, promoting behavioural changes, and facilitating innovation.