

Smart Water Grids and Network Vulnerability

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Abstract. The total availability of water resources is currently under stress due to climatic changes, and continuous increase in water demand linked to the global population increase. A Smart Water Grid (SWG) is a two-way real time network with sensors and devices that continuously and remotely monitor the water distribution system. Smart water meters can monitor many different parameters such as pressure, quality, flow rates, temperature, and others. A review of the benefits of Smart Water Grids is presented in the context of water conservation and efficient management of scarce water resources. The pros and cons of a Smart Water Grid are discussed in the context of aging infrastructure. Current distribution systems have large leakage rates. Locating leaks, missing, and/or illegal connections can lead to increase in the revenue. Updating or replacing parts of the current infrastructure can be very expensive. Smart Water Grids cannot substitute for basic water infrastructure. However, these costs could eventually be offset by savings obtained from implementation of Smart Water Grids. Setbacks include higher costs overall and a lack of economic incentives. In some cases, a lack of public awareness resulted in negative public opinion. Citizens may correlate Smart Water Grids as a pathway of government's control and invasion. Some citizens might be concerned with health problems and ailments associated with wireless transmission of data. The concept of network vulnerability is also reviewed to express the need for a clear understanding of the sources of water in terms of quantity and quality. The interface of Smart Water Grids with natural systems such as rivers, lakes, and reservoirs is also a key component of a "smart" approach to the use of water resources. These natural components are subjected to climate variability and single events can disrupt daily operations. Floods, droughts, and disasters such as typhoons and forest fires can affect the water quality at the source. Robust systems may have alternative supply sources when facing scarcity of resources or changes in water quality/contamination. Deep understanding of the network vulnerability and preparedness for disaster prevention may also contribute to the "smart" reputation of water distribution systems. Several projects worldwide have implemented Smart Water Grids into their water distribution systems and have seen promising results. The Mediterranean island of Malta in collaboration with IBM built the first national smart utility grid. These meters helped to monitor many variables, decrease water losses as well as promote water conservation.