Integrated pathways for meeting climate targets and ensuring access to safe water

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IIASA researchers have led work to develop new pathways to developing water and energy infrastructure consistent with both the Paris Agreement and U.N. Sustainable Development Goal 6 (SDG6)—to ensure

availability and sustainable management of water and sanitation for all.

The new analysis is one of the first to develop such global pathways. Meeting the Paris Agreement climate targets to limit global warming to well below 2°C compared to pre-industrial levels is vital to avoid catastrophic climate change. However, the Paris Agreement also demands that mitigation decisions consider impacts on the SDGs. The SDGs, agreed in 2015, have the aim of ending poverty as well as protecting the environment. The SDGs cover a variety of areas, including hunger, energy, equality, education and health, as well as water and energy.

Water and energy goals are interdependent. Energy is vital to water and sanitation provision, for example, in water pumping and treatment. The energy sector is itself a large consumer of water, for example in power plant cooling and fuel processing. Reducing emissions from energy is key to achieving the Paris Agreement, therefore the research, which quantifies the interactions between the Paris Agreement and SDG6, This is useful to policymakers developing strategies for joint implementation.

The research was a collaboration between researchers from IIASA's Energy, Water, and Transitions to New Technologies research programs and undertaken as part of the Integrated Solutions for Water, Energy and Land (ISWEL) Project. The researchers took an integrated approach, looking at all the elements within the water, energy and climate goals in an effort to balance the needs of each.

The international team enhanced the MESSAGEix-GLOBIOM integrated assessment model to account for changes in global water use as a result of socioeconomic change and the SDGs, and to link the projections to water availability, and the cost, energy and emissions impacts of future infrastructure systems. The scenario for population and economic growth was taken from the Shared Socioeconomic

Pathways (SSPs) to explore ways the world and society could progress. Policies consistent with the Paris Agreement and SDG6 were also included in the analysis.

Three water sector development scenarios were developed to compare the costs and impacts—Baseline, which implies "business-as-usual," SDG6-Supply, which incorporates the baseline water use projections but includes the expansion of technologies to mitigate growth in water demand, and SDG6-Efficiency, in which society makes significant progress in reaching sustainable water consumption across all sectors.

The model showed that under a middle-of-the-road human development scenario, around U.S. $1 trillion per year will be needed to achieve the SDG6 goals by 2030. Incorporating the climate targets consistent with limiting climate change to 1.5C will increase these costs further by 8 percent. The cost of operating and transforming energy systems increases by 2 to 9 percent when the SDG6 goals are considered, compared to a baseline situation in which the SDG6 targets are not included. This is largely due to the need for energy-intensive water treatment processes and costs from water conservation measures.

"The results of our analysis show that combining clean water and climate policies can increase implementation costs, but these increases are relatively small in comparison to the cost for implementing each policy on its own. Finding and improving synergies between decarbonization and water efficiency is crucial for minimizing joint policy implementation costs and uncertainties," says Simon Parkinson, a researcher from IIASA and the University of Victoria, who led the study.

For example, water pumping and treatment plants could be operated flexibly to provide important on-demand services to the electricity grid, which supports integration of renewable energy sources such as wind and

solar. The researchers say that water and energy planners need to collaborate to ensure that the development of water and energy systems taps into these and other opportunities and is consistent with the SDGs.

"The results emphasize water conservation across sectors is key to reducing potential trade-offs, particularly in water-stressed regions where the SDG6 targets might require use of energy-intensive water technologies, such as wastewater recycling and desalination," says Yoshihide Wada, deputy director of the Water Program and coauthor on the study.

Keywan Riahi, director of the IIASA Energy Program and study coauthor, says that similar research needs to be extended to other SDGs to understand how climate targets influence broader sustainable development.

"This research demonstrates the important role of integrated assessment models and a nexus approach in finding low-cost global transformation pathways consistent with multiple SDG objectives," he adds.

More information: Simon Parkinson et al, Balancing clean water-climate change mitigation trade-offs, *Environmental Research Letters* (2018). DOI: 10.1088/1748-9326/aaf2a3

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