Environmental and Water Resources Engineering, and Center for Water and the Environment Seminar Series Presents:

TEXAS

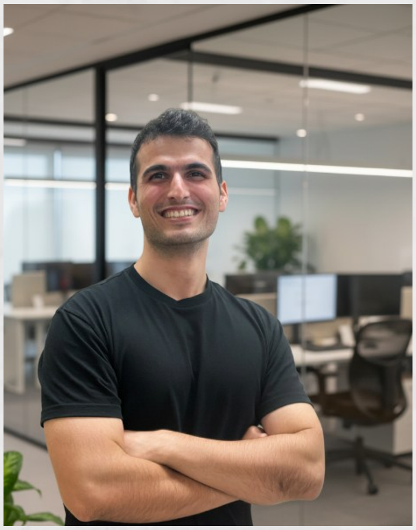
Thursday, April 23rd 2025, 3:30-4:30 pm, ECJ 1.324

Zoom Link: https://utexas.zoom.us/j/81263061920

The Relative Impact of Electricity Price and Water Demand Forecast Accuracy on Water Systems Operations

Hani Ghamkhar, PhD Student

B.Sc. from University of Guilan | PhD at the university of Texas at Austin (Ongoing)
Advisor: Dr. Lina Sela



Dynamic electricity tariffs offer a potential to reduce water system costs by shifting pumping to low price hours. However, this introduces price uncertainty alongside existing demand uncertainty. This study investigates how forecast accuracy in both inputs affects operations. We couple probabilistic day-ahead forecasts of electricity price and water demand with a mixed-integer linear model predictive control framework. We generate scenarios to quantify the effect of uncertainty using realized pumping cost, energy use, and tank imbalance metrics. Results show electricity price forecasts have lower point accuracy and wider uncertainty than demand forecasts. Price uncertainty is the primary driver of cost variability because pump schedules depend on the timing of price fluctuations. However, improved point accuracy does not guarantee lower realized costs. Conversely, water demand uncertainty has minimal impact on energy costs but leads to increased tank deficits and overflows. These findings demonstrate that forecast value should be evaluated through operational performance metrics rather than point accuracy alone.

Evaluating the Operational Resilience of Water Distribution Systems Under Cyberattacks

Tyler Trimble, Master's Student

B.Sc. from The University of Texas at Austin | Master's of Science at The University of Texas at Austin (Ongoing)
Advisor: Dr. Lina Sela

Cyberattacks have emerged as a growing threat in the water sector, with the potential to disrupt distribution systems. Many studies have investigated cyberattack detection, however current methods rely on datasets with simple, readily detectable attacks. Research on more sophisticated cyberattacks often relies on the attacker having significant information about the system it is attacking, and assumes the operator is passive and not changing how it operates the system in response to changing conditions. We introduce an operator-attacker framework that formulates both a decision process for the operator and attacker, and allows both to respond and change their behavior in a near real-time, rolling-horizon manner. Results show that, when the operator hedges against uncertainty, significant disruption requires a dual attack on both tanks and pumps, violation of the system's mass balance, or both. This work contributes to the evaluation and mitigation of cyberattacks on water distribution systems.

EWRE Seminar Committee Members: Ana Lăcău, Ella Junker, Hani Ghamkhar, Julia Barkelew, Tzu-An Lee
Supervising Faculty: Dr. Ben Hodges