

WEN-OKN: The Water-Energy Nexus Open Knowledge Network

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Use case description and societal challenge being addressed

The extreme events of recent decades have highlighted the highly interdependent and complex relationship between water and energy, where disruptions in one sector can trigger cascading failures in the other, as evidenced by the 2012 U.S. drought's impact on power plants and the effects of storms and floods on water infrastructure. However, the current fragmented management and policy landscape for the water-energy nexus, with sub-optimal governance, coordination, incentive structures, and technological trajectories, has prompted calls for an integrated, systems-based strategic approach to mitigate future stresses, achieve resilience, and meet changing supply and demand.

Our long-term vision is to meet this national challenge and develop an integrated, systems-based approach to managing the water-energy nexus. As a critical enabling step towards this vision, this project will develop a Water-Energy Nexus Open Knowledge Network (WEN-OKN) that will (i) free water-energy data from silos by creating a densely interconnected knowledge graph (KG), and (ii) answer a set of questions co-created with our Federal, State and industry Partners along the continuum scale of the water-energy nexus.

Knowledge graph source datasets

S2 / Code / CellID13 / <https://stko-kwg.geog.ucsb.edu/lod/ontology#S2Cell>
Flood Events / Data Commons / GEO_ID/FIPS / <https://www.wikidata.org/wiki/Q25343>
Streamflow / USGS / Feature_ID / TBD, Streamflow Real Time
Depths / USGS / Feature_ID / TBD, Water Depth Real Time
Catchment / IOW / .. / Catchment is the Feature_ID
Area / UFOKN/urmi / .. / ..
Building / UFOKN/urmi/Microsoft Building Footprints / .. / Type: Building
Power Infrastructure / UFOKN/urmi/ .. / ..
Description / UFOKN/urmi/Microsoft Building Footprints / ../Additional Building Description. e.g. power, industrial, residential, commercial
Address / UFOKN/urmi/openaddress / UFOKN_ID / Street Address
X,Y,Z / UFOKN/urmi / UFOKN_ID/..
HUCS / .. / .. / TBD
FIPS / UFOKN/urmi / UFOKN_ID/ ..

Ohio is 132 Megabytes. 292,876,553 statements
CONUS estimate is 3.3 Gigabytes. 7 billion statements

User queries / competency queries for the use case

- Query all power stations within a county using UFOKN and KWG
- Query all industrial buildings within a county using UFOKN and KWG
- Query all power infrastructure within a census tract using UFOKN and KWG
- Query all climate hazards at power station using UFOKN and KWG
- Query all counties around the downstream of a dam using IOW and KWG
- Query all buildings within 5 miles of this power station
- Query all underground fuel storage tanks (USTs) within 5 miles of this building
- Query the history of flooding within 5 miles of this power station
- Query where is the nearest hospital from this building
- Query the history of droughts within 5 miles of this power station