OAK RIDGE NATIONAL LABORATORY

# Assessing U.S. Conduit Hydropower Potential

Existing pipelines, irrigation canals and other water conduits provide opportunities to generate electricity from flowing water. A new report released by the US Department of Energy's Oak Ridge National Laboratory is the first to assess the potential for new hydropower development on conduits nationwide in the municipal, agricultural and industrial sectors.

## Why Conduit Hydropower?

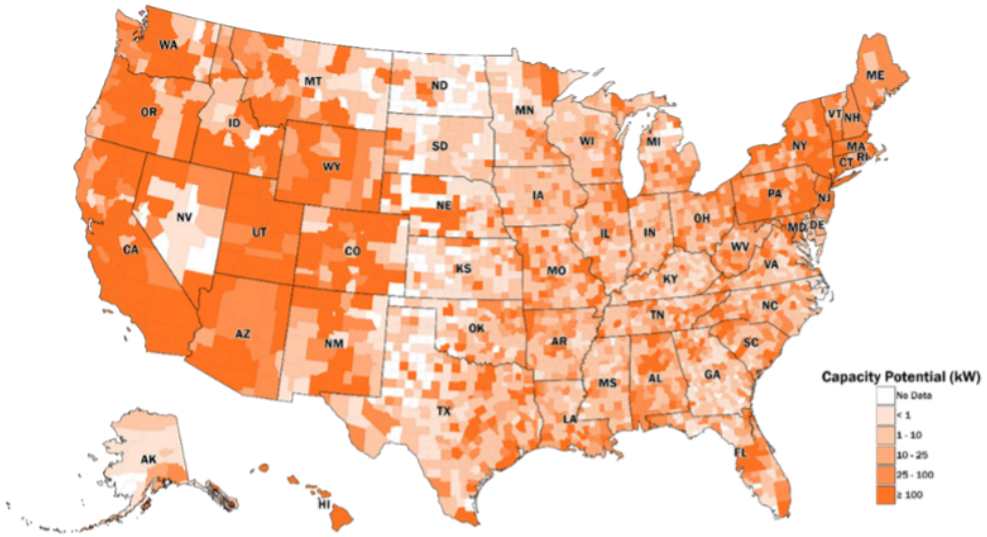
Minimal environmental impact, a simplified permitting process, and the potential to generate new revenue for water system operators are key drivers of hydropower development on conduits. More than 350 conduit hydropower projects have received federal regulatory approval since 2013, when a streamlined permitting pathway was adopted.

## 1.41 Gigawatts of New Hydropower Potential

The analysis conservatively estimates a total of 1.41 gigawatts of new conduit hydropower potential across the United States, more than two-and-a-half times the current installed capacity of 512 megawatts. The agricultural sector accounts for nearly half the potential for new conduit hydropower development (662 megawatts), followed by the industrial (378 megawatts) and municipal (374 megawatts) sectors.

## Potential in Every State

The study found opportunities for conduit hydropower development in every state. In general, the western states have the largest resource potential, with the highest total capacity potential in California, followed by Colorado, Washington, Nebraska and Oregon. In general, the state-level potential reflects suitable topography to provide hydraulic head, and reflects the scale of water supply.




**CONDUIT HYDROPOWER**

Power generated from water flowing in conduits such as pipelines and irrigation canals

**45 DAYS**

Duration of the federal regulatory determination process for conduit hydropower projects

**50**

States with potential conduit hydropower sites identified in the study

**1.41 GIGAWATTS**

Potential for new conduit hydropower capacity nationwide

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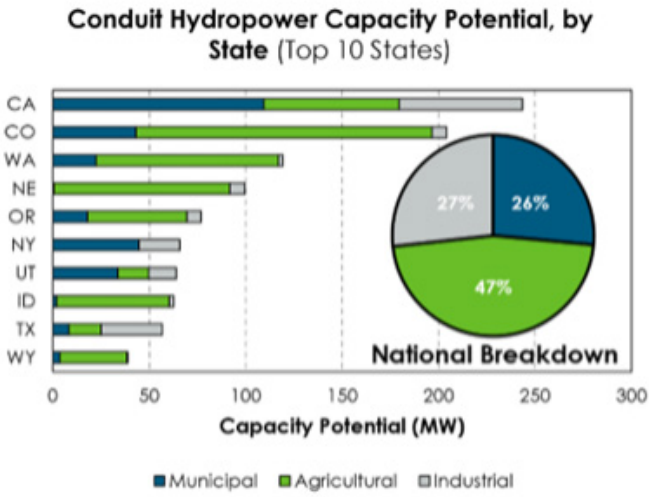
# Systematic Nationwide Analysis

The research team evaluated four categories of conduits:

- Water supply pipelines for municipal and industrial uses
- Wastewater discharge conduits from municipal and industrial systems
- Agricultural water conduits, including irrigation canals, ditches and pipelines
- Conduits for cooling water discharge of thermoelectric power plants




For each type of conduit, the team developed and implemented a method to estimate hydraulic head and annual water flows—and the hydropower potential—at specific sites based on analyses of satellite imagery, topography and existing data sets on water systems and power plants. These methods support a consistent, replicable evaluation of conduit hydropower potential across the nation, though they are not sufficiently accurate to inform project-specific feasibility assessments or investment decisions.

# Assessment by Sector

The potential for conduit development in the agricultural sector was greatest in states with a combination of a large amount of irrigated acreage and hilly or mountainous terrain. Colorado had the greatest conduit potential (154 megawatts), followed by Washington, Nebraska, California, Idaho and Oregon.

In the municipal sector, conduit potential generally scaled with population—which is roughly proportional to flows in municipal water and wastewater systems—and terrain. The study found California to have more than twice the conduit development potential (109 megawatts) than the second-ranked state, New York, which was followed by Colorado, Utah, Washington, Oregon and Pennsylvania.

Municipal water supply systems accounted for 90 percent of the total potential, compared with 10 percent for wastewater systems, mainly because of the greater water pressure in closed pipelines in water supply systems. However, in nine states, primarily in the Midwest, potential from wastewater systems may exceed that of water supply systems.

Industrial conduit hydropower potential was greatest in California, followed by Texas, Missouri, New York and Maryland. Of the three sectors evaluated, the industrial sector had the greatest uncertainty because most of the measured conduit potential (60 percent) was associated with cooling water discharges from thermoelectric power plants. Multiple potential economic and regulatory obstacles to conduit hydropower development exist at such sites, and to the researchers' knowledge, there are currently no projects of this type in the United States (though successful projects have been built in Europe).

# Next Steps

Despite the abundance of potentially feasible sites and the relatively simple permitting process, conduit hydropower faces a number of challenges, including a lack of awareness of the technology. Better understandings are needed of the economics of conduit hydropower projects, site-specific information to inform investment decisions, and technical advances to support the integration of conduit hydropower into water systems as aging infrastructure is upgraded. Further research can help address these needs and promote the growth of this valuable hydropower resource in our future grids.

# Get Involved

If you have questions or would like to be added to the mailing list for updates on this work and notices of public events, please email kaos@ornl.gov or ltryba@kearnswest.com. In the coming year, the research team will be hosting multiple webinars on this work and leading discussions at conferences.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