

WORK-ENERGY & POWER

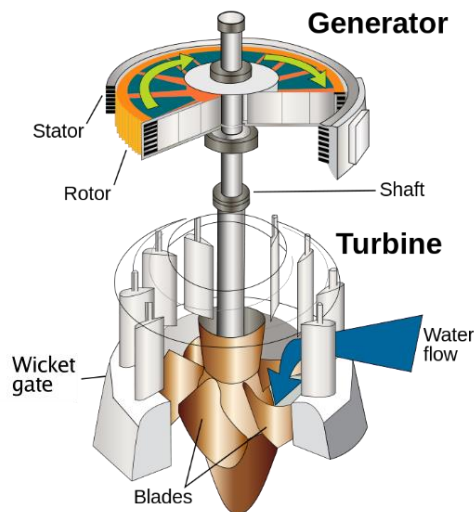
Units 10 & 11 Dr. John P. Cise,

Professor of Physics, Austin Community College, 1212 Rio Grande St., Austin Tx. 78701 jpcise@austincc.edu & New York Times, January 14, 2016 by Lisa Murkowski & Jay Faison. Dedicated to my brother and fellow River Traveler, Dr. Michael David Cise, Retired. PhD in Nuclear & Chemical Engineering, University of Arizona,

Stop Wasting America's Hydropower Potential



Credit Kyle Stecker



INTRODUCTION: The Mississippi River receives water from Ohio and Arkansas Rivers and flows at a average rate of 600,000 ft.³/s. (from Wikipedia). Between Cairo, Illinois (altitude of 315 ft.) and Baton Rouge, Louisiana (altitude of 56 ft.) the River drops 259 ft. This water could be used to generate power. The purpose of this application is to validate that hydroelectric dam conversions on the Mississippi could produce enough power for about 3 million homes. Wikipedia states the average US home uses 2 KW.

QUESTIONS: (a) Convert river flow rate from 600,000 ft.³/s. to lb./s.? (b) Find potential energy lost per second (m g h/ t) by this river flow falling 259 ft.? In ft. lb./s.

Obama can start by supporting legislation to increase the nation's hydropower capacity, one of our vital renewable energy resources.

Hydropower harnesses the force of flowing water to generate electricity. It already produces about 6 percent of the nation's electricity and **nearly half of its renewable energy**, more than wind and solar combined. This is enough electricity to power 30 million homes and, according to the Department of Energy, avoids some 200 million metric tons of carbon dioxide emissions each year. That amounts to taking **about 40 million cars** off the road for one year. But we could be doing much more to harness the huge potential of hydropower, even without building new dams. For instance, **only 3 percent of the nation's 80,000 dams now produce electricity.**

Electrifying just the 100 top impoundments — (primarily locks and dams on the Ohio, Mississippi, Alabama and Arkansas Rivers that are operated by the Army Corps of Engineers — would generate enough electricity for nearly three million more homes)) and create thousands of jobs. And upgrading and modernizing the

turbines at existing hydropower dams could yield a similar amount of additional electricity-generating capacity. [Lisa Murkowski](#), a Republican from Alaska, is chairwoman of the Senate Committee on Energy and Natural Resources. [Jay Faison](#) is the founder and chief executive of the [ClearPath Foundation](#).

QUESTIONS(continued): (c) According to Wikipedia hydropower plants are about 60% efficient. Find potential electric power (in ft. lb./s) produced ([0.6 m g h/t] by this 600,000 ft.³/s falling 256 ft. from Cairo, Illinois to Baton Rouge, LA.? (d) Convert available power in Ans. (c) to Watts? (e) 2 kW/home is power homes need. How many homes can be powered?

HINTS: Power = $P = W/t = m g h/t = [mg/t] h$, 0.738 ft. lb./s = Watt, water weight density = $D = \text{weight}/V = 62.4 \text{ lb./ft.}^3$

ANSWERS: (a) $3.744 \times 10^7 \text{ lb./ft.}^3$, (b) $9.7 \times 10^9 \text{ ft.lb./s.}$, (c) $5.82 \times 10^9 \text{ ft.lb./s.}$, (d) $7.886 \times 10^9 \text{ W}$, (e) $\sim 3.94 \times 10^6$ homes

Authors Comment: Article claims almost 3 M homes can be powered. Calculated available power of 3.9 M homes was a bit higher. Probably total height of 256 ft. is not available in reconstruction of "new" combination LOCK & electric power dams.