

Hydroelectricity

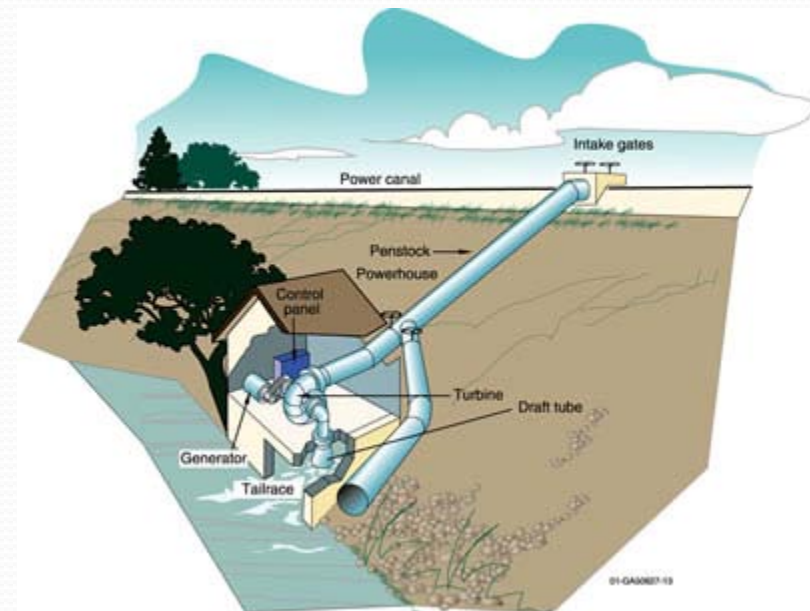


Mike Arvola
Andrew Bever
Joe Brennan
Chris Dora

Team: Watt-er

Introduction to Hydroelectricity

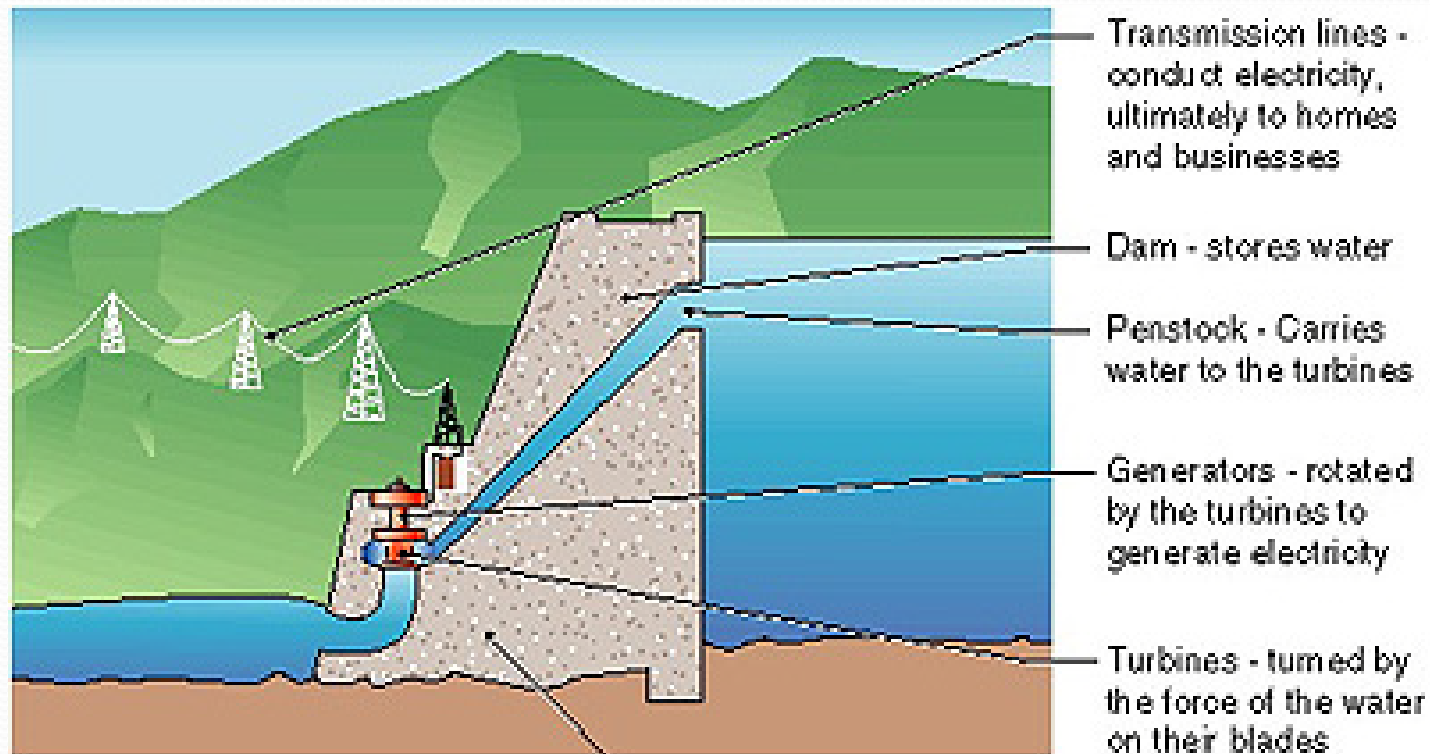
- By Style
 - Impoundment, Diversion, Pumped Storage
- By Size
 - Large, Small, Micro



First Type

- Impoundment

(U.S. Department of Energy, Wind and Power Program, 2005)



Cross section of conventional hydropower facility that uses an impoundment dam

Hydropower Video

- [How Hydroelectric Power Works](#)

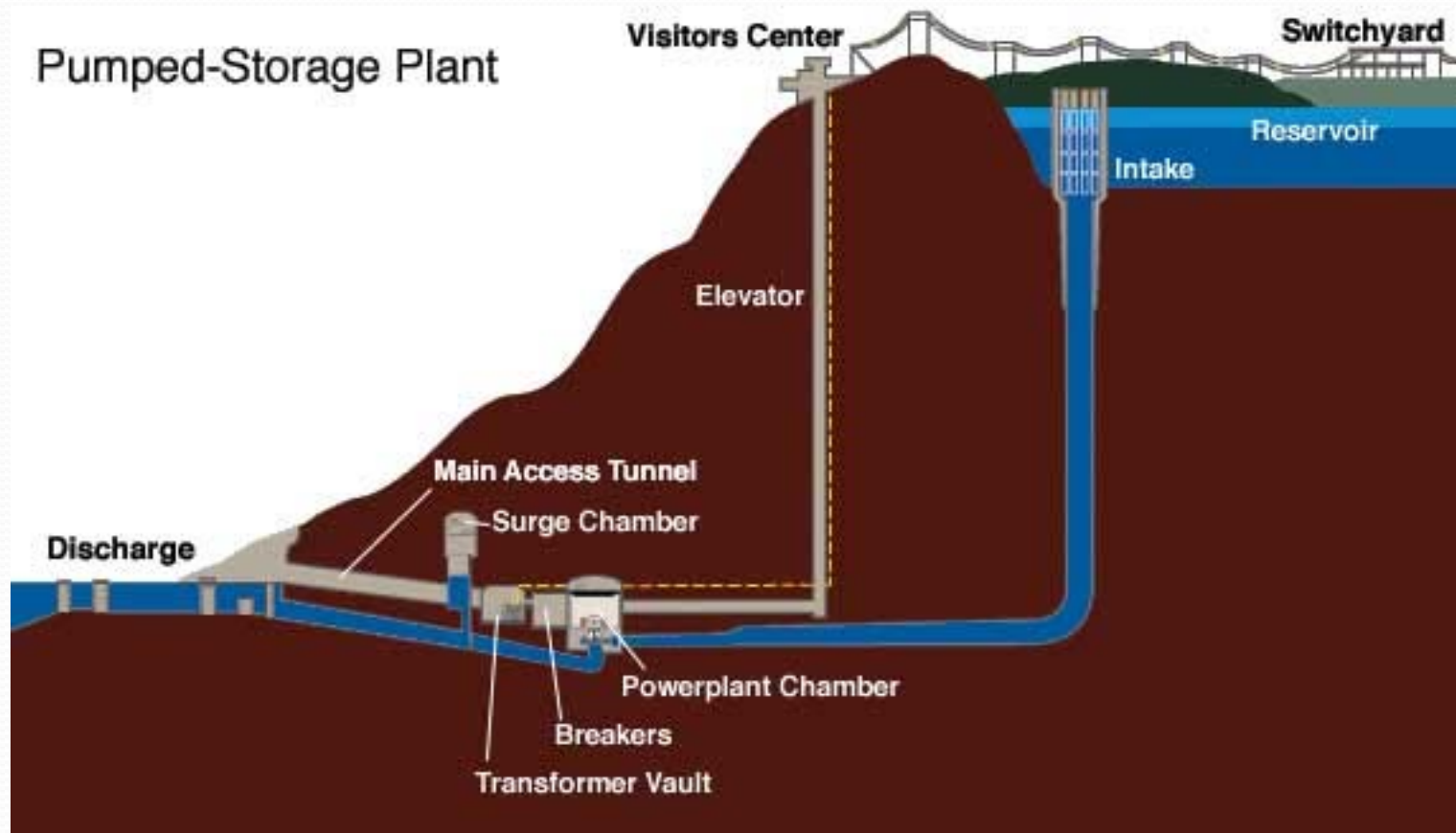
Second Type

- Diversion
 - Also known as “run-of-river”



Pumped Storage

- Like a battery



(Pumped Storage Hydroelectricity, 2011)

Advantages/Disadvantages

- **Advantages**

- **Environmental benefits**
- **Doesn't have to be imported**
- **Efficient**
- **Electric production doesn't destroy water**
- **Low cost**
- **Can be utilized to meet peak demands**

- **Disadvantages**

- **High initial investment costs**
- **Environmental concerns**

Our Investigative Question

- Driving Questions
 - How can Indiana meet its energy needs while still increasing standard of living?
 - Which alternative energy sources make sense for Indiana?
- Is hydroelectric energy feasible for Indiana?
 - Our Process

Feasibility of Building a Hydroelectric Facility

- How much power will be generated?
- Do you want to do these?

$$R_e = \frac{D \cdot V}{v}$$

$$U = -2\sqrt{2gD} \frac{h_f}{L} \log \left(\frac{e/D}{3.7} + \frac{2.51v}{D\sqrt{2gD} \frac{h_f}{L}} \right)$$

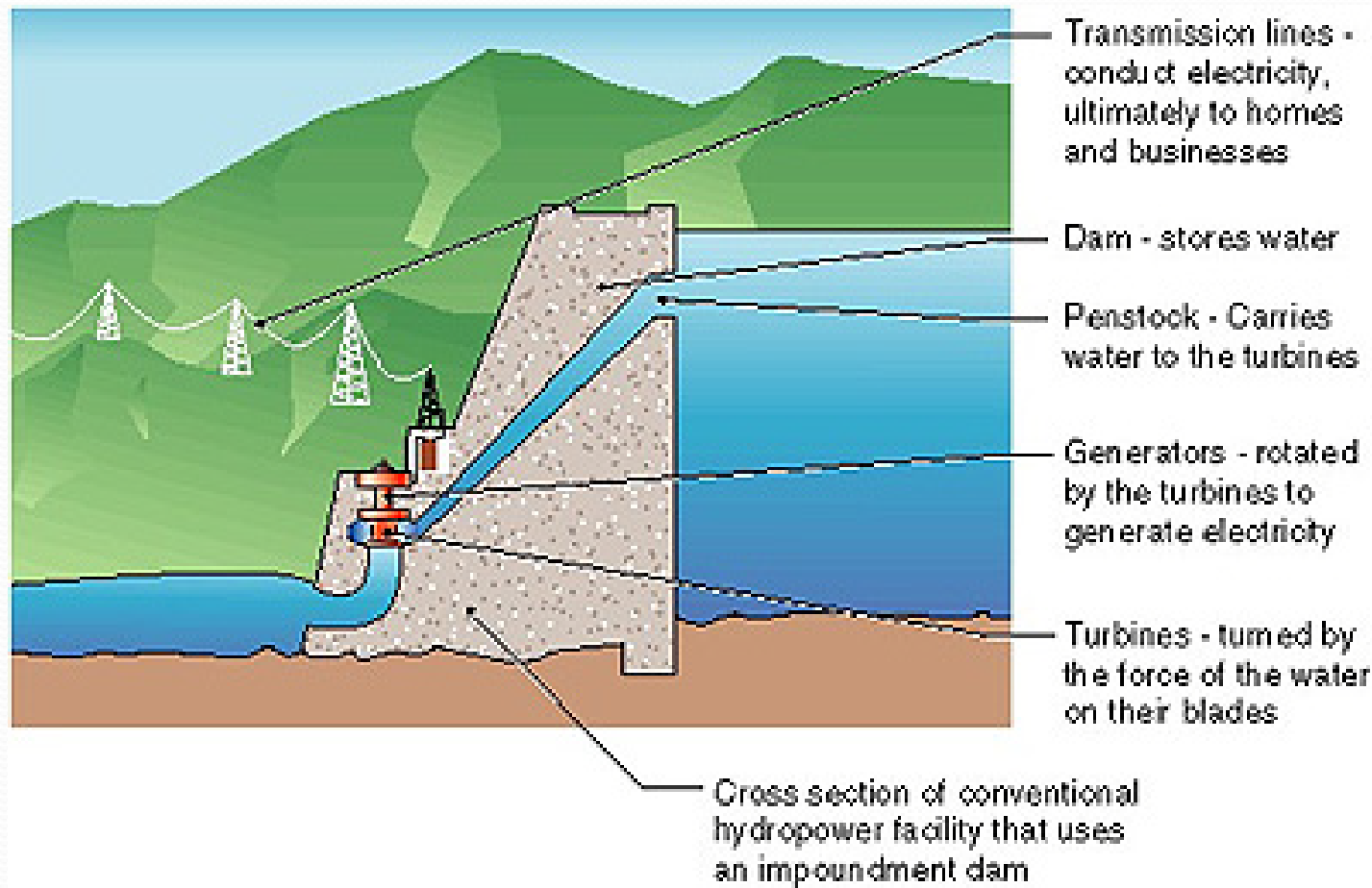
$$H_1 = h_1 + \frac{P_1}{\gamma} + \frac{V_1^2}{2g}$$

$$h_f = f \cdot \left(\frac{L}{D} \right) \cdot \frac{V^2}{2g}$$

(Guide on how to develop a small hydropower plant 2004)

Basic Dam Description

- Head- change in elevation of the water from point a to point b



(U.S. Department of Energy,
Wind and Power Program, 2005)

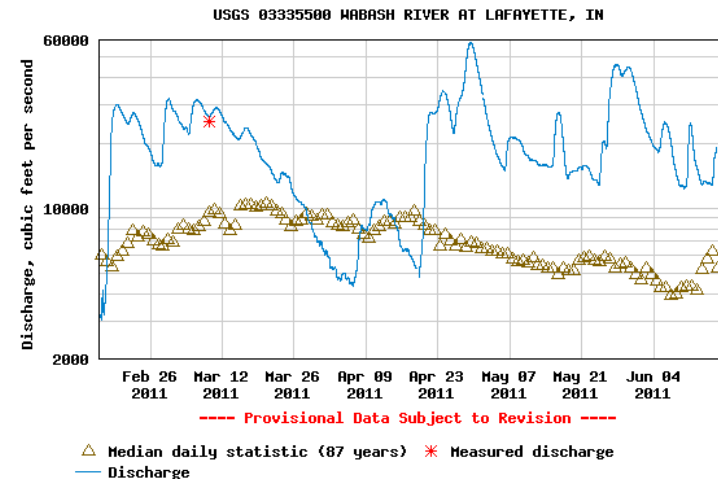
Indiana Rivers

- Four Main River basins with the capability for over 10,000 ft³/s
 - Wabash, Ohio, White, St Joseph
- Dams located on:
 - Tippecanoe, St. Joseph, Ohio

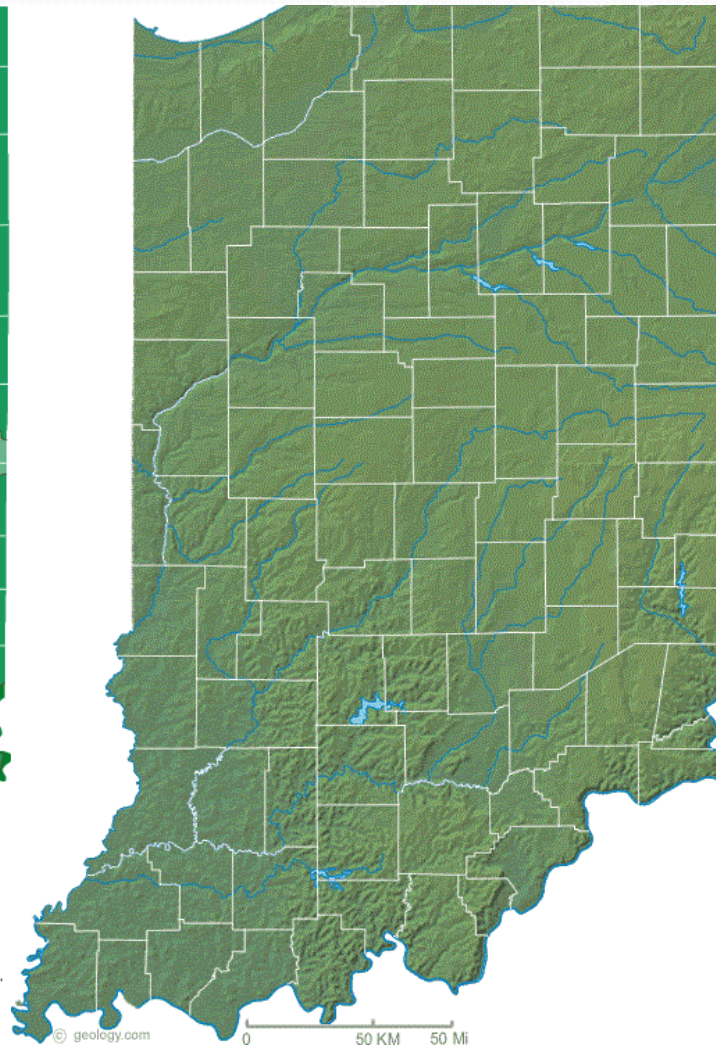
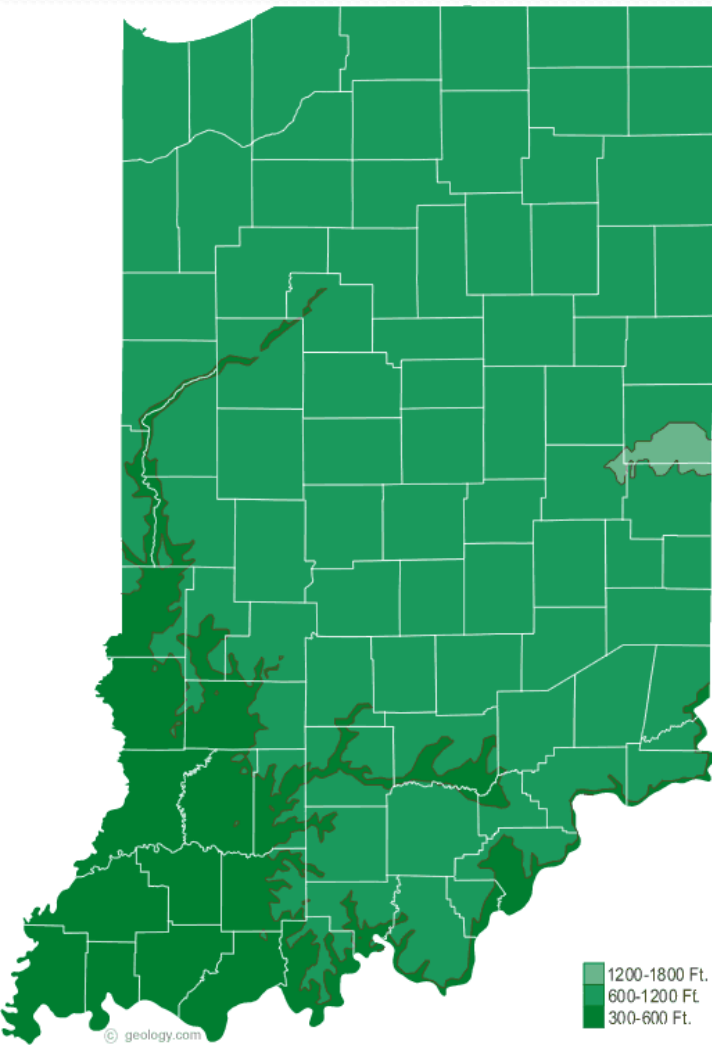


(<http://geology.com/state-map/indiana.shtml>, 2008)

(<http://waterdata.usgs.gov/nw/>, 2011)



Indiana's General Topography



- Wide Ranges
- But you see my point
- Wabash
 - From 692 ft in Lafayette
 - To 400 ft near Mt. Vernon
- in 250 miles

(<http://geology.com/state-map/indiana.shtml,oo8>)

U.S. Hydropower Resource Assessment for Indiana

- Idaho National Engineering Laboratory
 - Hydropower Evaluation Software (HES)
 - Expected Potential for Hydropower for Indiana:
 - 83.5 MW
 - HES Modeled Potential for Hydropower for Indiana:
 - 43.4 MW
- In 2008...
 - Total BTU for Indiana was 2857400×10^9
 - 95.6 GW average power requirement

(Francfort, J. E., 1995)

(Kurtzleben, n.d)

Individual applications

- Individuals near rivers can harness water power.
 - Similar to adding solar panels or small wind turbine
 - River must meet minimum requirements of system
 - Example product



(Smart hydro power. n.d.)

Summary

- Is hydropower feasible in Indiana?
 - Not on a large scale (micro is an option)
- How can Indiana meet its energy needs while still increasing standard of living?
 - Use of micro and conservation on an individual level
- Which alternative energy sources make sense for Indiana?
 - What we have is good; but expansion is impracticable

Sources

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