THE POWER OF WATER
Water

Agenda:

- Introductions
- Theory Part 1
- Activity
- Theory Part 2
- Reflection
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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</thead>
<tbody>
<tr>
<td>10 min</td>
<td>Introductions</td>
</tr>
<tr>
<td>5 min</td>
<td>Theory Part 1</td>
</tr>
<tr>
<td>25 min</td>
<td>Activity</td>
</tr>
<tr>
<td>5 min</td>
<td>Theory Part 2</td>
</tr>
<tr>
<td>15 min</td>
<td>Group Reflection</td>
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Introductions

- Energy Center Manager
  - Illinois Math and Science Academy

- Education
  - Undergraduate from U of I
    - Civil Engineer
    - Structural Engineer + Construction
  - Masters from UIC
    - Energy Engineer
The Theory Part 1 (1)

- Flow
  - Characteristics of water
- Conservation of Energy
  - Potential Energy
  - Kinetic Energy
The Theory Part 1 (2)

- Flow
  - Let’s try to describe it?
- Mathematical description?
  - Flow = Area*Velocity
The Theory Part 1 (3)

- Flow = Velocity * Area

- Area = Constant
  - What would you expect for the velocity?
The Theory Part 1 (4)

- Flow = Velocity * Area

- Area changes
  - What would you expect for the velocity?
The Theory Part 1 (5)

- Flow = Velocity * Area
- Can we measure the potential energy in the water?
Activity

- Work Book
- Project Based Activity
- Challenge Question
  - Can you measure the power of water?
The Theory Part 2 (1)

- Flow = Velocity * Area
- Area reduction = velocity increase
- Can we calculate the energy due to increase in velocity?
The Theory Part 2 (2)

- Flow = Velocity*Area
- Can we measure the potential energy in the water?
The Theory Part 2 (3)

- Flow = Velocity*Area
- Force = Pressure/Area
- Can we measure pressure within the pipe?

Flow_{in} \rightarrow \text{Flow}_{out}
The Theory Part 2 (4)

- What is Energy
- Energy is Work
- \( W_{net} = \Delta PE + \Delta KE \)
- \( \Delta PE = mgh \)
- \( \Delta KE = \frac{1}{2} mv^2 \)

\[
W = mgh + \frac{1}{2} mv^2
\]

\( \Delta PE \) \hspace{1cm} \( \Delta KE \)
Reflections

- Let’s reflect on the activity as a group
- Applications examples
The Theory Part 2 (5)

\[ W = \Delta P \cdot E + \Delta K \cdot E \]

\[ W = mgh + \frac{1}{2}mv^2 \]

\[ F \cdot \text{distance} = mgh + \frac{1}{2}mv^2 \]

\[ m = \text{density} \cdot \text{volume} \]

\[ F \cdot \frac{\text{distance}}{\text{volume}} = \rho g h + \frac{1}{2} \rho v^2 \]

\[ P = \rho g h + \frac{1}{2} \rho v^2 \]
Applications (1)

- Conventional (Dams)
Applications (2)

- Tidal Wave generation