Abstract
The concept of using the energy within tidal currents is examined thoroughly by looking at the costs and benefits of tidal barrages and tidal turbines. Tidal power is a renewable form of energy that is predictable, does not release greenhouse gasses, has costs similar to wind power, and can be paid back within its lifespan. Tidal energy needs to be constructed in certain areas with enough of a tidal range, depth, and tidal velocity to support a profitable amount of energy and a minimal effect on the environment. This project determines the benefits of tidal power first hand by using a small scale model of a tidal turbine to generate energy.

Methodology
- Cost/Benefits
  - Calculate cost per kWh for turbines
  - Calculate payback period
- Requirements for Tidal Power
- Environmental effects
  - Calculable?
  - Depend upon location
- Turbine specifications
- Shape of propeller
- Create geographical map
- Depths and velocity
- Building/Testing Model

Potential Geographical Locations
Tidal Turbine Geographical Requirements:
- Area: At least 300 square meters
- Depth: 30-50m
- Typical Water Speed: 2m/s or more; 4 knots or more
- Water Density: About 1026 kg/m^3

Case Study: San Francisco
Power Output of a Single Turbine Over 24 Hours in the San Francisco Bay

<table>
<thead>
<tr>
<th>Current in m/s</th>
<th>Power In MW</th>
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</thead>
<tbody>
<tr>
<td>50.153</td>
<td>109.826 kW</td>
</tr>
<tr>
<td>50.163</td>
<td>109.826 kW</td>
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<tr>
<td>50.173</td>
<td>109.826 kW</td>
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<tr>
<td>50.183</td>
<td>109.826 kW</td>
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<tr>
<td>50.193</td>
<td>109.826 kW</td>
</tr>
</tbody>
</table>

Equivalent houses
- Single Turbine: 1,021
- 12 Turbine Farm: 12,294

Equivalent Carbon
- Single Turbine: 1516 Tonnes C02/Year
- 12 Turbine Farm: 18286 Tonnes C02/Year

Approximate Cost
- Single Turbine: 5 Million Dollars
- 12 Turbine Farm: 46.8 Million Dollars

Payback Period
- Single Turbine: 10.7 years
- 12 Turbine Farm: 9.4 years

Environmental Effects
Barrage:
- change the salinity by altering the flow of water into and out of estuaries
- destroy the marine life
- a reduction in intertidal area
- slower current
- change seafloor characteristics

Turbines:
- chance to hit fish is pretty minimal
- potential reduction in tidal reach
- will not block tidal flow
- drilling may cause destruction of habitat and marine benthos (small/localized)
- installation of cables may also cause sediment displacement
- potential pollution from leaking

Conclusion
- Must have currents of two meters per second and depths of thirty meters for turbines to function and a tidal range of five meters for barrages to work
- Searching through tidal charts, several possible sites exist in the United States such as San Francisco Bay, East River in New York, and several sites in Alaska
- Payback period for tidal turbines is approximately ten years
- Similar to wind powered turbines both in cost and energy generation
- Tidal energy is renewable and has zero emissions
- Could replace a large coal plant