TIDAL ENERGY ASSESSMENT FOR ROSE DHU ISLAND, GA

Dr. Kevin Haas
Dr. Thorsten Stoesser
Brittany Bruder
Sandeep Bomminayuni

October 30, 2013
Tidal Energy

Converts the kinetic energy of tidal currents into a more useful form
Rose Dhu Island

- Proposed site of Girl Scout “Eco-Village,” powered by renewable resources
- Project was to assess available hydrokinetic energy
- Consisted of boat based tidal measurements of currents, water levels, and bathymetry
- Numerical model, validated by measurements, utilized to predict available power
Preliminary Results

Depth Averaged Velocity [cm/s]
2nd Field Campaign

- Preliminary results adequate for a general assessment of viability but inadequate for model validation and hydrodynamic characterization

- Second campaign did transects in November and December 2011

- Designed to gain timeseries at points of interest

- Obtain volume flux estimates to observe aggregate hydrodynamics
Transect 3-4
Numerical Model

- **Model used:** Finite Volume Coastal Ocean Model (FVCOM) of Chen et al. (2003a)

- **Boundary Condition:** water level forcing using ADCIRC constituents

- **Initial Condition:** Zero motion

- **Bathymetry and elevation data from measurements, NOAA, USGS, and LIDAR Data**

- **Grid Spacing:** 25m at Rose Dhu; 250m at ocean boundary
Model Validation

Utilized two different marsh elevations, LIDAR (A1) and USGS (B1)
Additional Results

Date Simulated: December 22, 2011

- Flow constriction from bathymetry and channel collision
- Clear Influence of Centrifugal Acceleration
- Different spatial variation for flood and ebb tides
Additional Results

Peak Ebb

Peak Flood
Three points in close proximity to the hotspot are selected for power calculations

\[ P_k = 0.5 \rho |\vec{u}|^3 E_f A_s \]

\( \vec{u} \) Velocity at the assumed turbine depth
Cut in Speed (50 cm/s)

\( \rho \) Water density (1025 kg/m^3)

\( E_f \) Efficiency (45%)

\( A_s \) Swept area of devices (5 devices*2 m^2)
Tidal Energy Assessment

7.6 MWh per year

13 MWh per year

3.2 MWh per year
Tidal Energy Assessment

Total kinetic power in the cross-section

- Extraction for Rose Dhu would be a small fraction of total power in the channel, minimizing the environmental impacts.
- Max extraction from G&C estimate would be 6 MW.
Conclusions

- South channel has higher current velocities, more applicable for tidal power assemblies.
- Flow is ebb dominated, dictated by intertidal storage induced by wetlands. Highly dependent on relative elevation to mean sea level and tidal amplitude.
- Energy ‘Hot Spots’ migrate along a channels cross section throughout the tidal cycle.
- There is adequate available hydrokinetic energy for the Girl Scouts needs.