



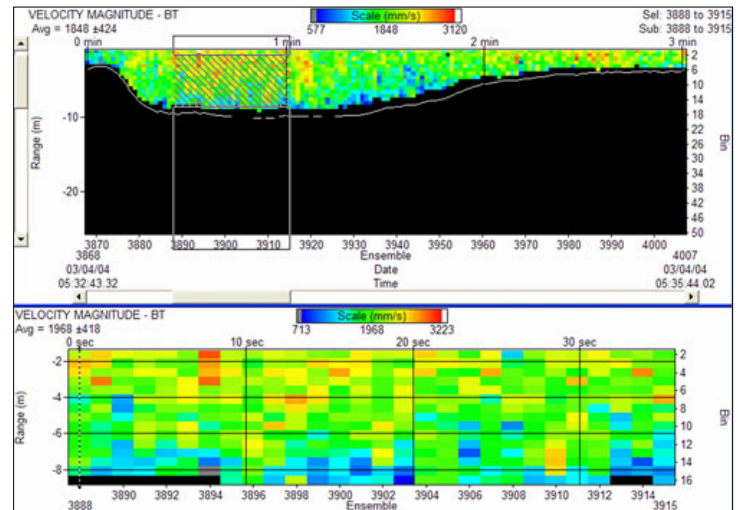
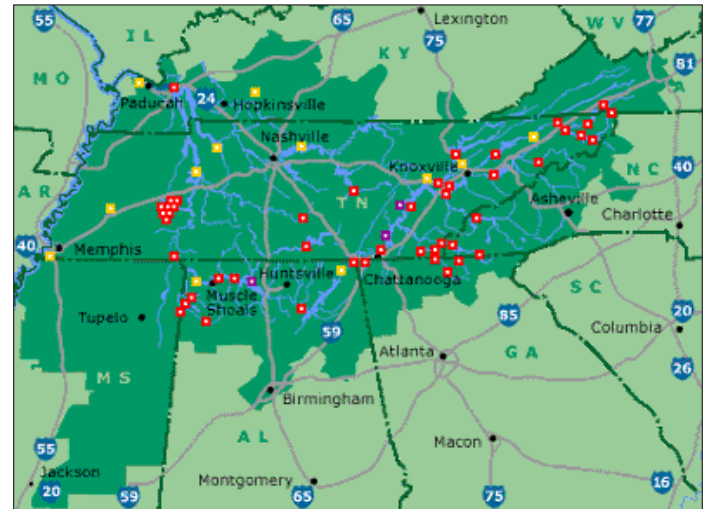
VERDANT POWER

**OREG – Symposium 2005
Mapping the Way Forward
Development of Ocean Energy Sector**

Technology Class: Axial-flow Turbines

October 19, 2005

- Founded 2000: 25 Employees - California, New York, & DC
- PEs, PhDs, MBAs, Scientists
- Energy & Business Experience
- Leadership
 - Ocean Renewable Energy Coalition
 - National Hydropower Association
 - Hydro Research Foundation
- Resource Assessments
 - TVA & Brazil
 - New York & California
- Technology Assessments (EPRI)
- Two of Five Primary Families
 - Cross-flow or Cross-axis Turbines
 - Axial-flow Turbines (inc, ducted)





Key Accomplishments

Built Three Different Working Prototypes

- Funded, Fabricated & Field Tested Three Alternative Turbine Prototype Designs
- Ducted Axial-flow Turbine (Ontario Power Generation)
- Cross-axis Turbine – GHT (MA Tech. Collaborative)
- NYPA's Axial-flow Turbine
- Patented Highest Efficiency & Wide-range Velocity Rotor
- Commercializing System
- Press Recognition (68 print & 4 electronic media)





Key Accomplishments

Building NYC's Tidal Energy Project

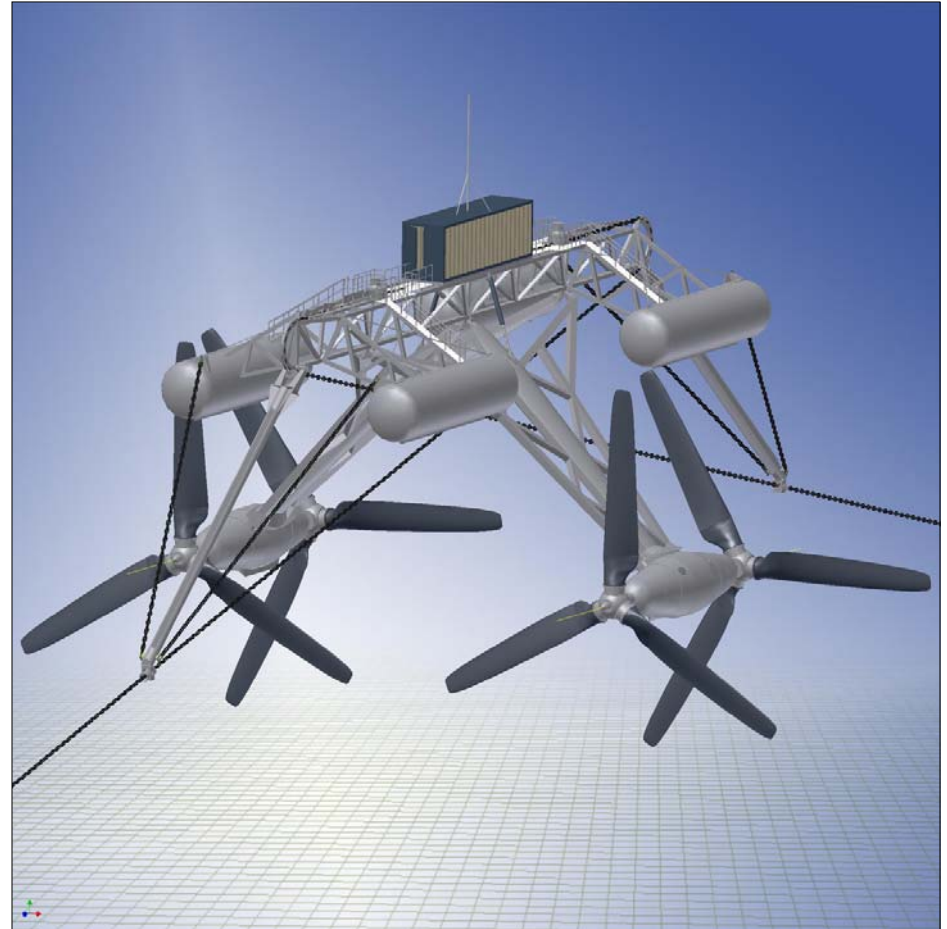


- Developing world's first, DG commercial project in NYC's East River (first Axial-flow Turbine field site < 10 MW)
- First to be awarded \$2M NYSERDA; co-fund site development
- Set historical precedent: FERC "Verdant Declaratory Order"
- First to obtain NYSDEC permit to deploy field, late 2005



Description:

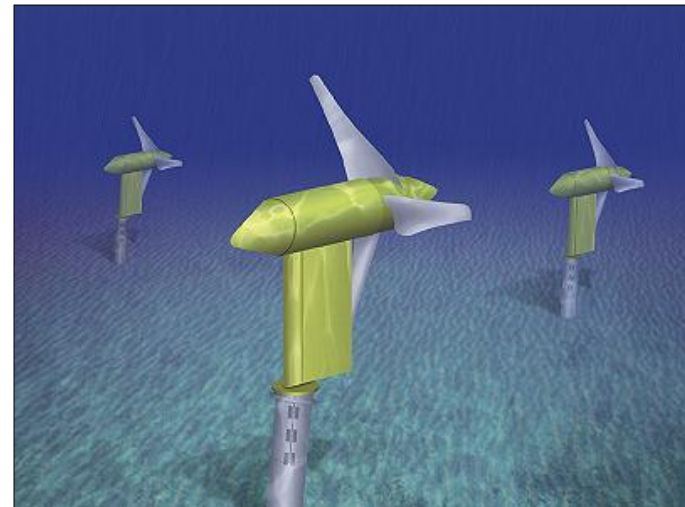
Axial-flow Turbines - Norway



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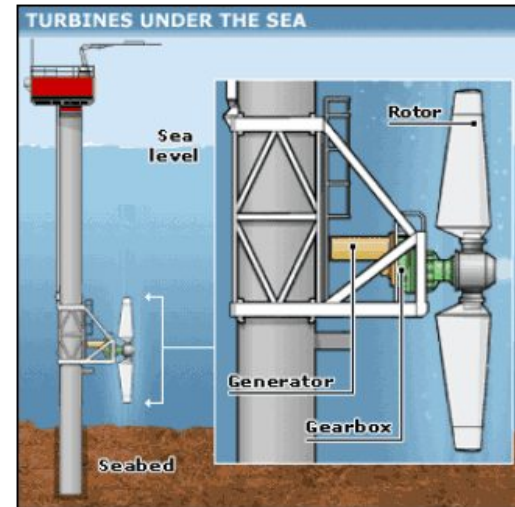
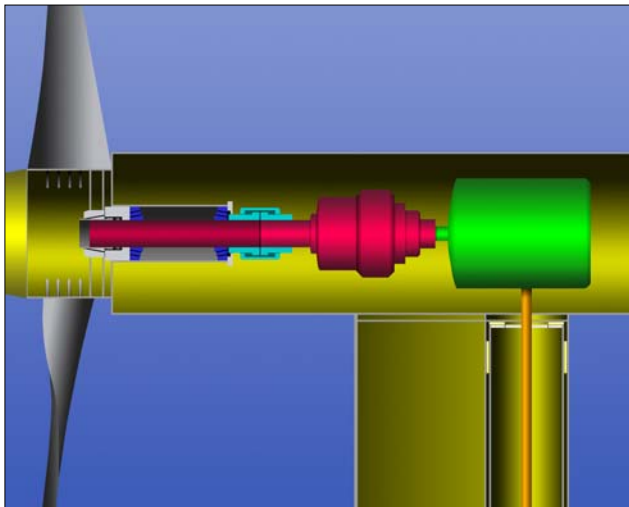
Axial-flow Turbines – US, UK, & Canada

- Horizontal axis
(driveshaft parallel to water bottom)
- Others, Ducted: Clean Current, Lunar Energy
- Multi-bladed rotor
- Water current velocity – 2 meters/sec. or more
- Uni- & bi-directional
- Similar to wind turbines
- Internal generators & gearing





Axial-flow Turbines: Verdant Power & Marine Current Turbines





Applicable Resource Areas: Kinetic Hydro Power System (KHPS)

- Tidal Straits & Estuaries
- Ocean Currents
- Rivers (incremental hydro, too)
- Manmade Channels
 - Canals
 - Aqueducts
 - By-pass Channels
 - Discharge Flumes
 - Head & Tailwaters



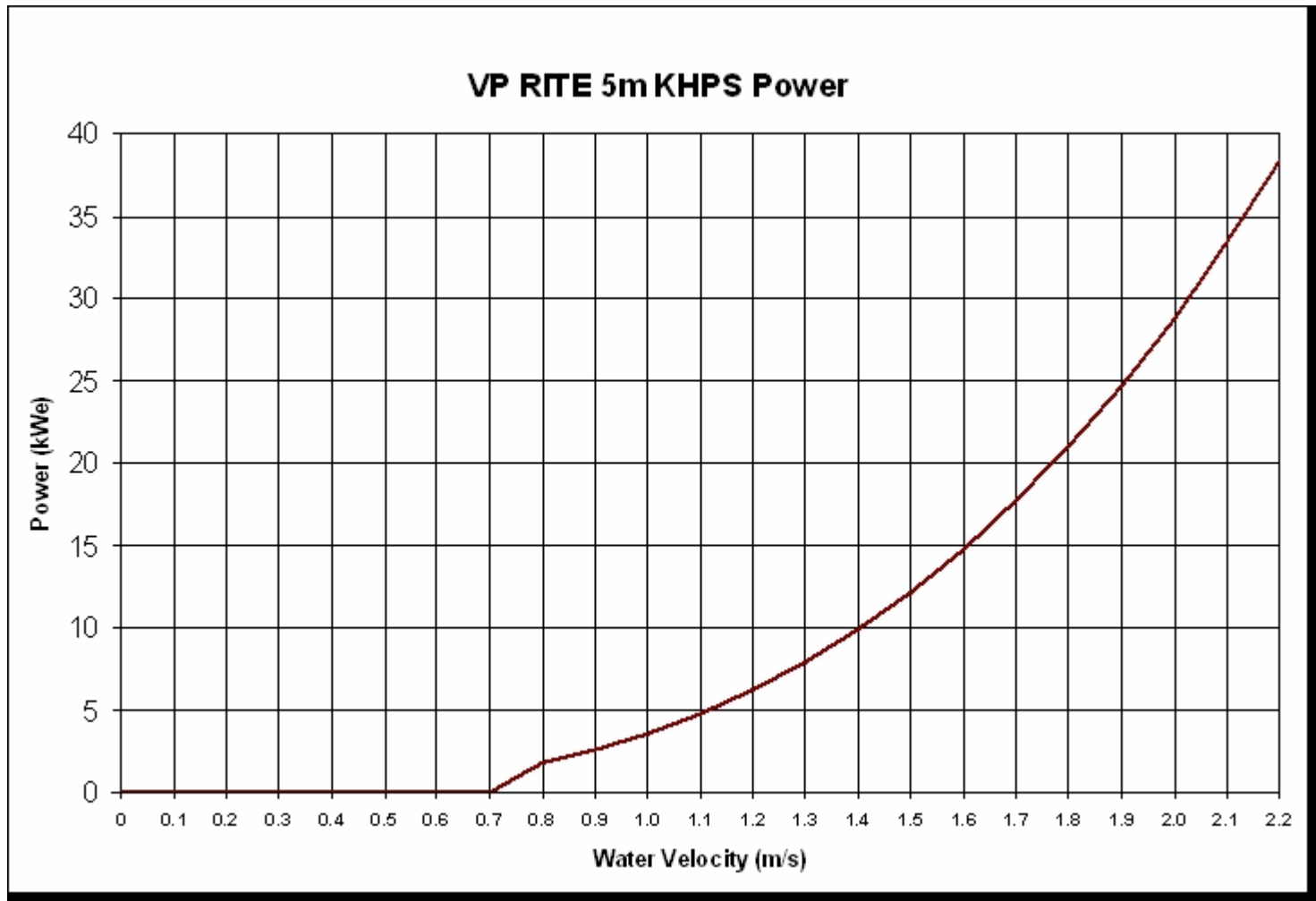


New York's East River: Roosevelt Island Tidal Energy Project





Market Potential: Power Curve - Five-meter KHPS Rotor



Assumptions

- Price: \$4,000/kW in '07 & \$2,500/kW in '10
- Commercialization
- Gross KHPS Potential:
 - >10,000MW – Canada
 - >50,000MW – Developed Nations (inc. Canada)
 - >200,000MW – Developing Nations

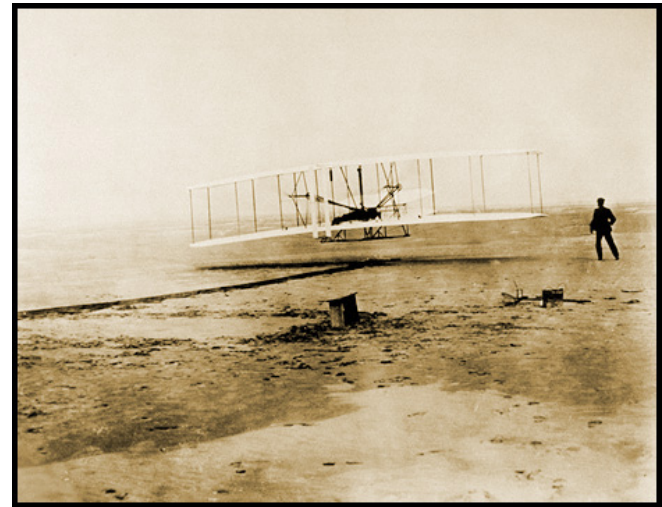


- “Proven & Deployed”
 - Working Prototypes
 - East River Permitted
 - Addressed 87 “Issues”
 - Operational Tests & Fish Monitoring – 11/05 Start
- Deployment Challenges
 - Yaw Bearing
 - Installation Designs
 - Mounting Systems
 - Scaling & Manufacturing



Obstacles to Development: “You need a permit to fly that kite!”

- New Technology Concepts
 - Unrealistic Expectations
 - Unverified Claims
- Test Facilities – Limited
- Natural Streams & Field Tests – Best
- US Regulatory Process – Adversarial & Designed for Existing Technologies



Solutions, as Next Steps: *Canada* – “Mapping The Way Forward”

- Kyoto & G-8 Obligations
- Collaboration
- Canadian Partners / Allies
 - Government / Academia
 - Business / Community
- Our Business Experience
 - Assessments
 - Field-testing
 - Transparency
 - Cost & Financial Modeling
- Customers (DG)





Thank You!

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