



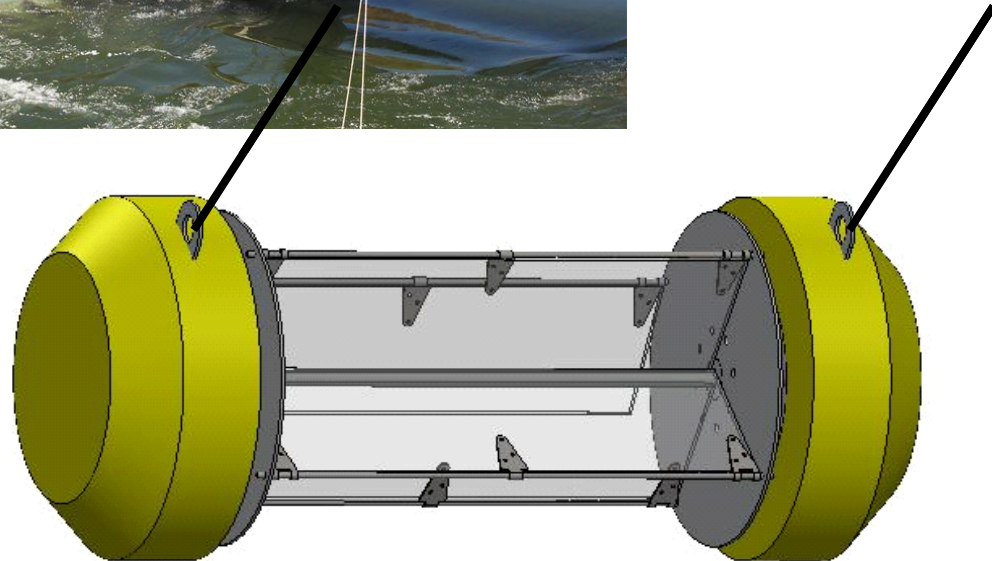
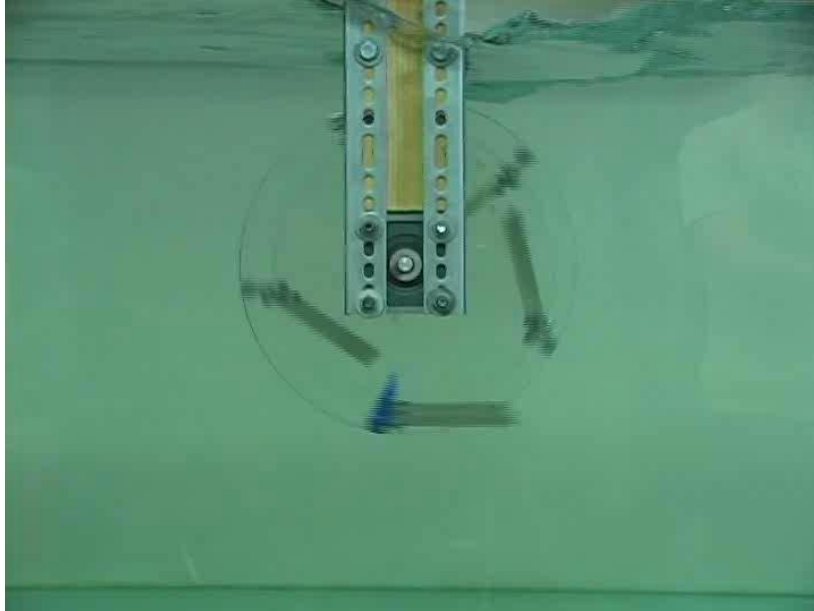
2009 WINNER
ZINGGreen
INVESTMENT FORUM



New Hydrokinetic Technology for Renewable Energy

Burt Hamner, CEO

www.hydrovolts.com



Agenda

- *Hydrokinetic Energy*
- *Types of Turbines*
- *Canal Installations*
- *Energy Generation*
- *Economics*
- *Permits*
- *Demonstration Project*

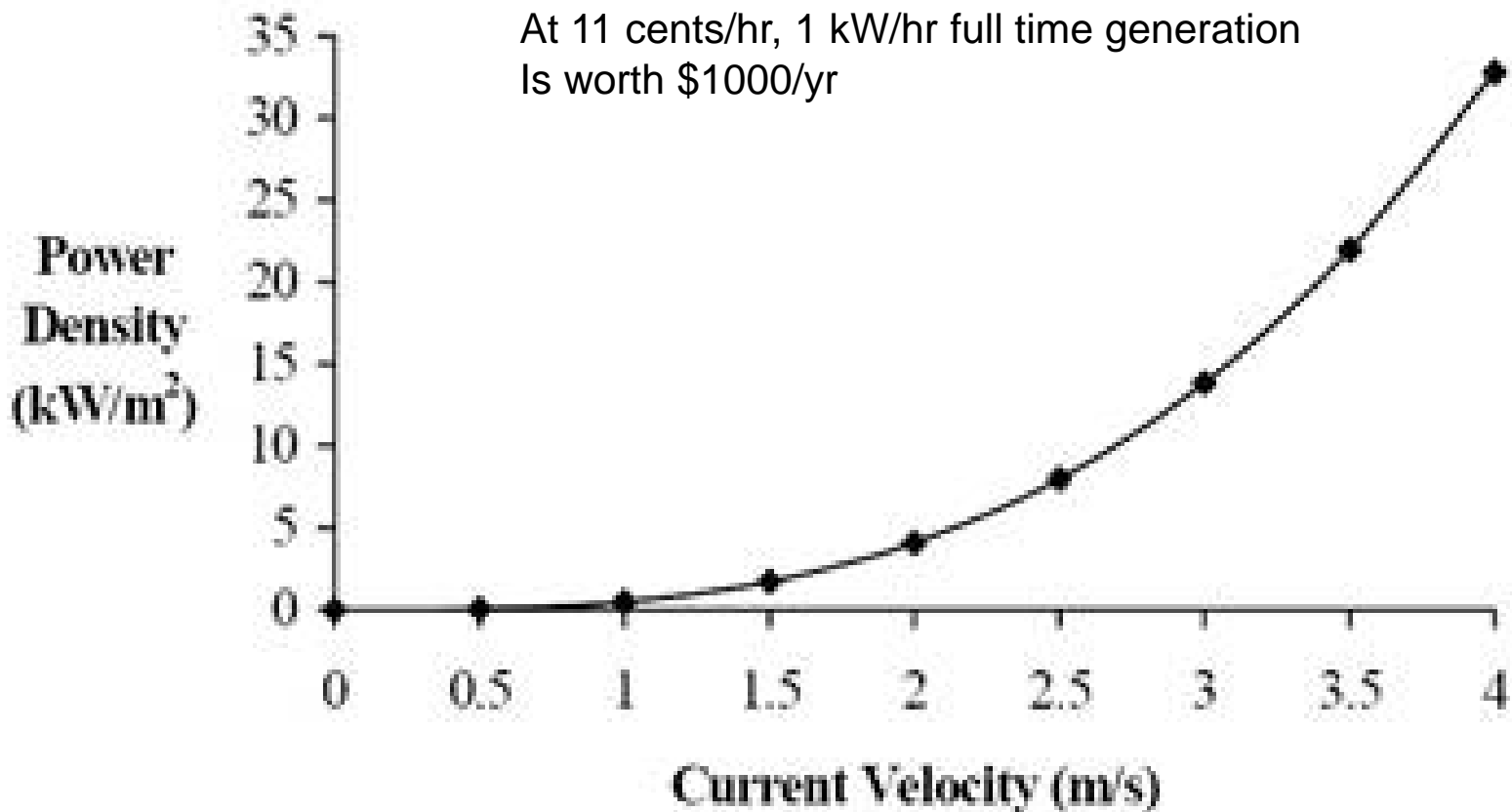




Hydrokinetic Energy

- *Velocity REALLY Matters*
- $kWh / m^2 = 0.5 \times V^3 \times \%E$
 - (m²) Swept Area in m²;
 - (V) Velocity in m/s ; 1 m/s = 2 knots = 3 ft/sec
 - Efficiency: Increases with Blockage

Speed = Power

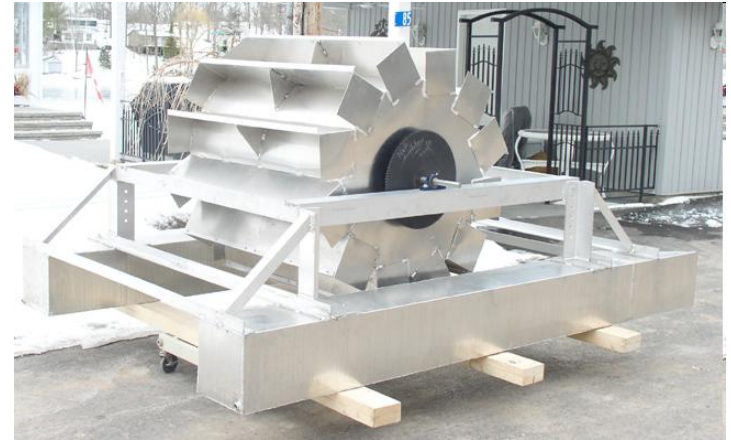




Types of Turbines

- *Paddlewheel*
 - Lots of superstructure and cost; flotsam fouling
- *Axial: Propellers, screws*
 - Hard to install and fit in canals
- *Cross-Axis: Darius, Savonius, Gorlov, Flipwing*
 - Vertical position is hard to install in canals

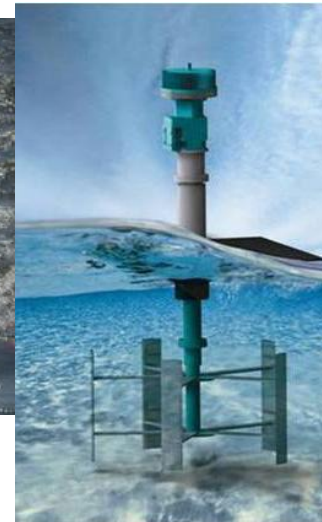
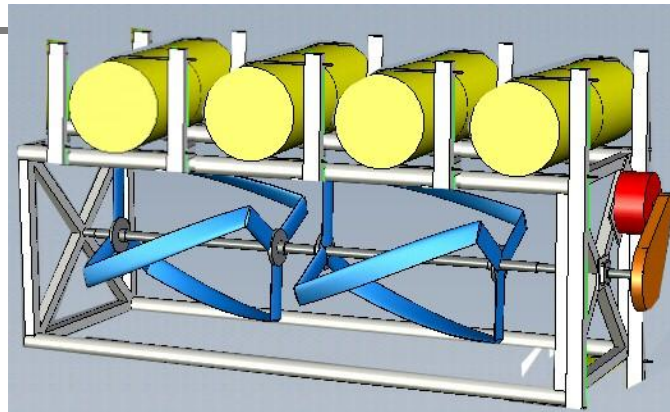
Paddlewheels



Axial Turbines

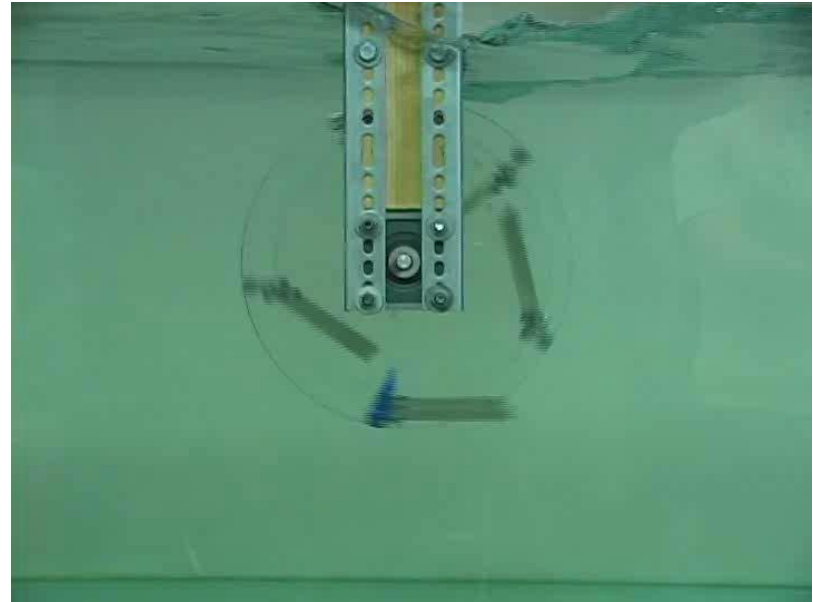
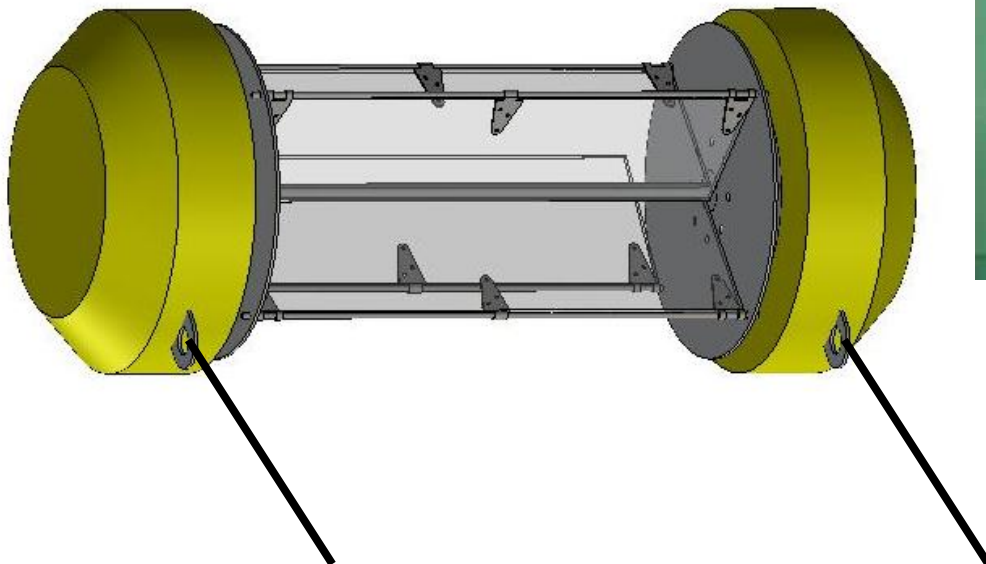


Cross-Axis Turbines



Hydrovolts Flipwing Turbine

- *Unique underwater paddlewheel*
- *Simple construction, easy installation*
- *Level or spillway installation*
- *Can actually be a check structure*



Hydrovolts Turbine

Replaces this:



With this:



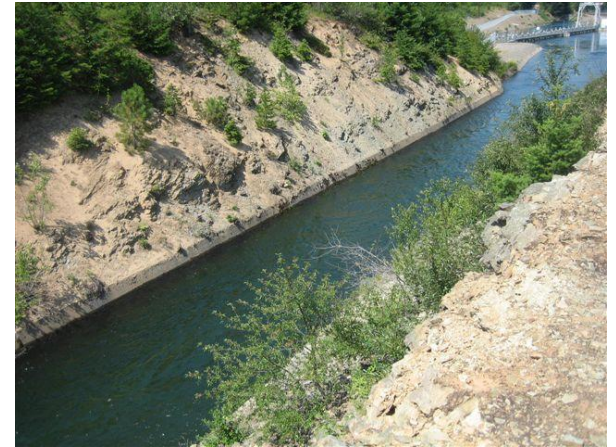
Canal Installations

■ *Level Flow*

- Like river installation - easier
- Lower velocity and energy
- Can block flow if slope is too small

■ *Check Structures and Spillways*

- More complex installation
- Head / height = high velocity and energy
- Turbines cannot block flow





Energy Generation

- *Level Flow Example*
 - 5 kW / turbine x 10 / mile = 50 kW / mile
 - Over 800 irrigation districts supplied just by BuRec
 - About 50% appear to have about 20 miles of suitable canal
 - 400 districts x 20 miles/district x 50 kW/mile = 40 MW
- *Spillway Example*
 - 20 kW / turbine x 20 check structures/canal = 440 kW/canal
- *So: Real Energy, But Depends on Geography*



Economics

- *Key Factors: Velocity, Cap Factor, Energy Cost*
- *Huge Variability Between Regions*
- *Best Value in High-Cost, Off-Grid and Peak Pricing Regions*



Value to Customer

- Standard 10 kW turbine in good site with electricity cost of **11** cents / kW hr earns about \$7000 / yr
- Turbine cost \$20,000, 15 year product life
- Maintenance ~ \$1000 / yr
- Payback is 4 years; then
earn \$6000 / yr for 11 years
- Plus: It's renewable – sell carbon credits, get grants, incentives, financing

Compare Electricity Costs

- Cal. & New England > 16 cents
- UK renewables > 25 cents
- global average: 15 cents
- Remote sites > 80 cents

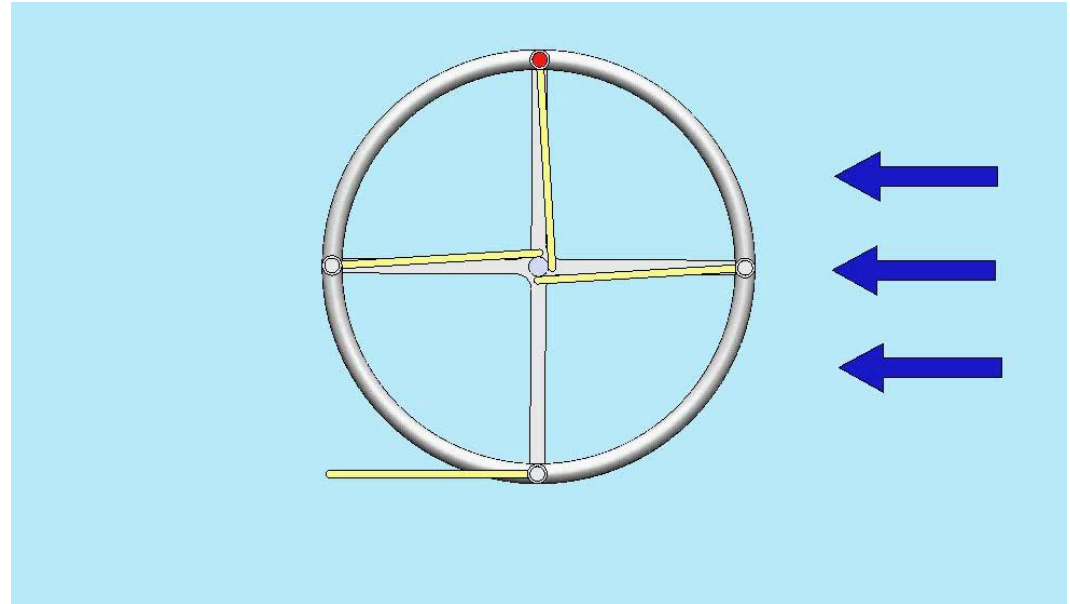


Permits

- *Canal Installations Need Few if Any Permits*
- *Natural Streams/Rivers Need LOTS of Permits*
- *Connected to Interstate Grid?*
 - FERC Conduit Exemption < 5 MW applies in canals
 - Simple application, no fee
- *Interconnection*
 - Individual turbines < 10 to 20 kW = net metering
 - Depends on local utility
 - Like small solar or wind – no big deal (maybe)

Environmental Issues

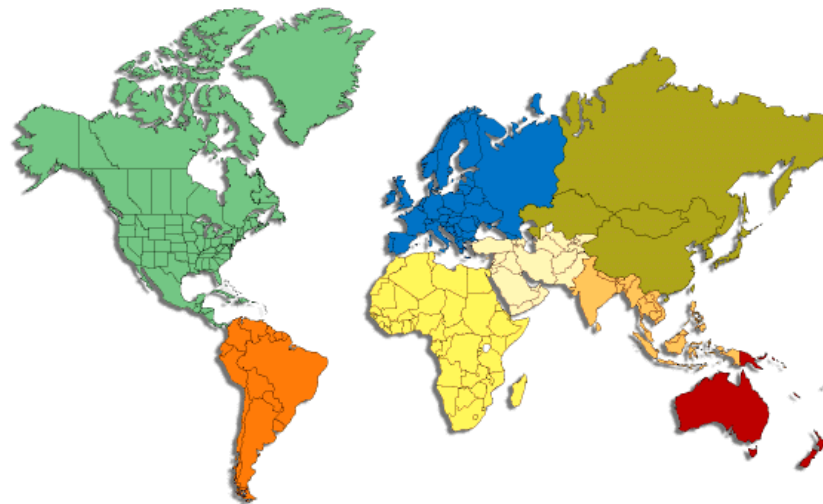
- *Canals have few issues – it depends*
- *Turbine designs have different fish impacts*
- *Drag designs have least impact*



Flipwing Turbine Rotor
Can't Hurt Fish

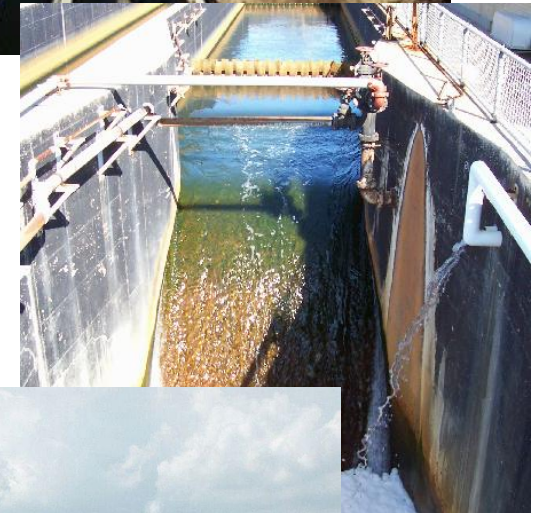
Markets

- Canals are found around the world
- Most regions pay much more for power than NW
- Demand for local renewable power is strong and growing
- Big subsidies for renewables and econ development
- Many int'l orgs ready to promote and fund



Expansion Markets

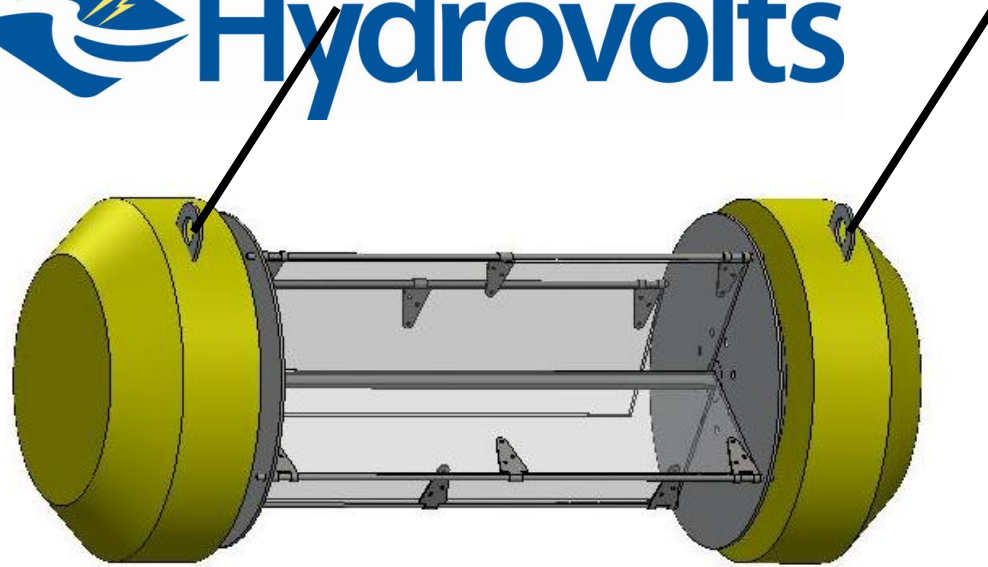
- Regional Systems
 - New England water mills
 - Canals in Europe, India, SE Asia
- Sector-Specific Water Channels
 - Drinking Water Supply
 - Wastewater Discharges
 - Thermal Power Cooling Water
 - Mining





Jobs

- *Small turbines can be mass produced*
- *Volume reduces price increases sales*
- *Since most of machine is sheet metal, build most of it locally near customers*
- *Global market and potentially huge sales*



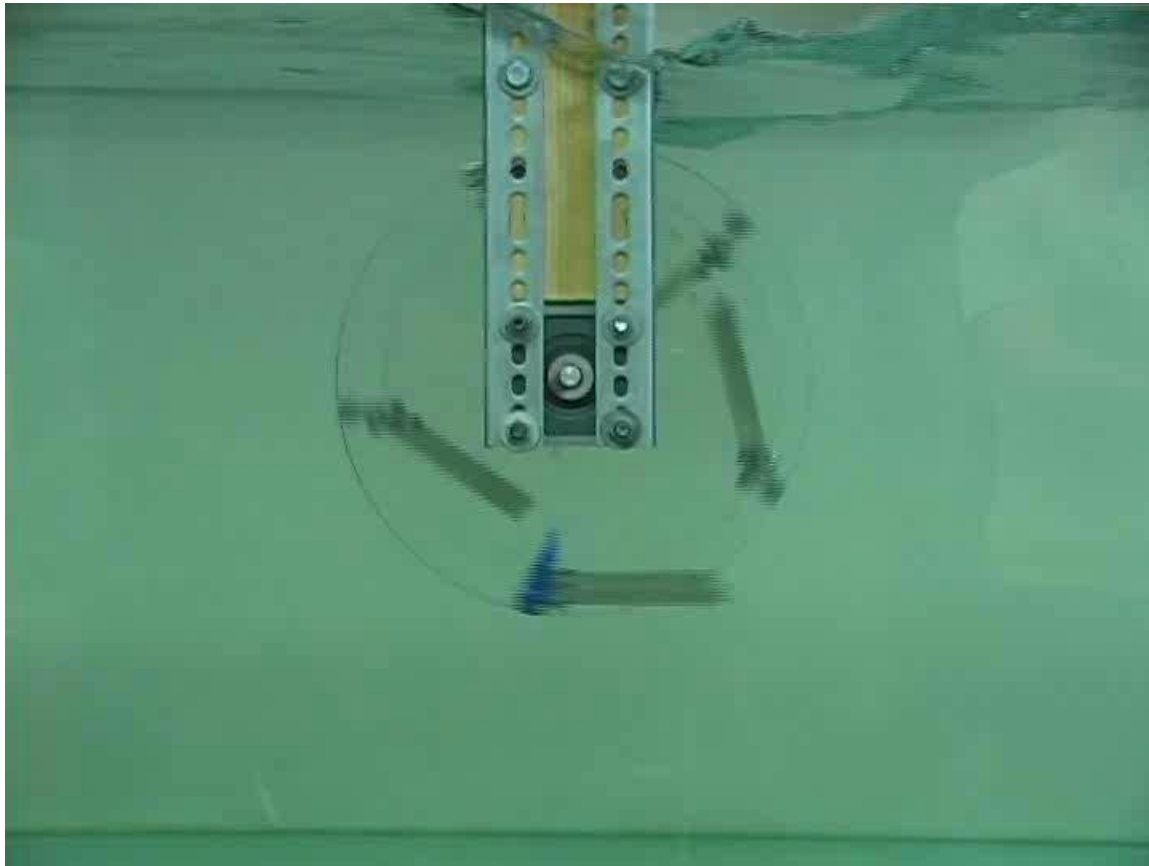
Flipwing Turbine
Canal Demonstration,
Roza Irrigation District,
Sunnyside, WA 7/05/10



Objectives

- Prove that the Flipwing turbine can be installed in a canal in one hour
- Prove that the prototype can operate for 24 hours unattended
- Learn how to improve the turbine and prepare for next demo

Flipwing Turbine



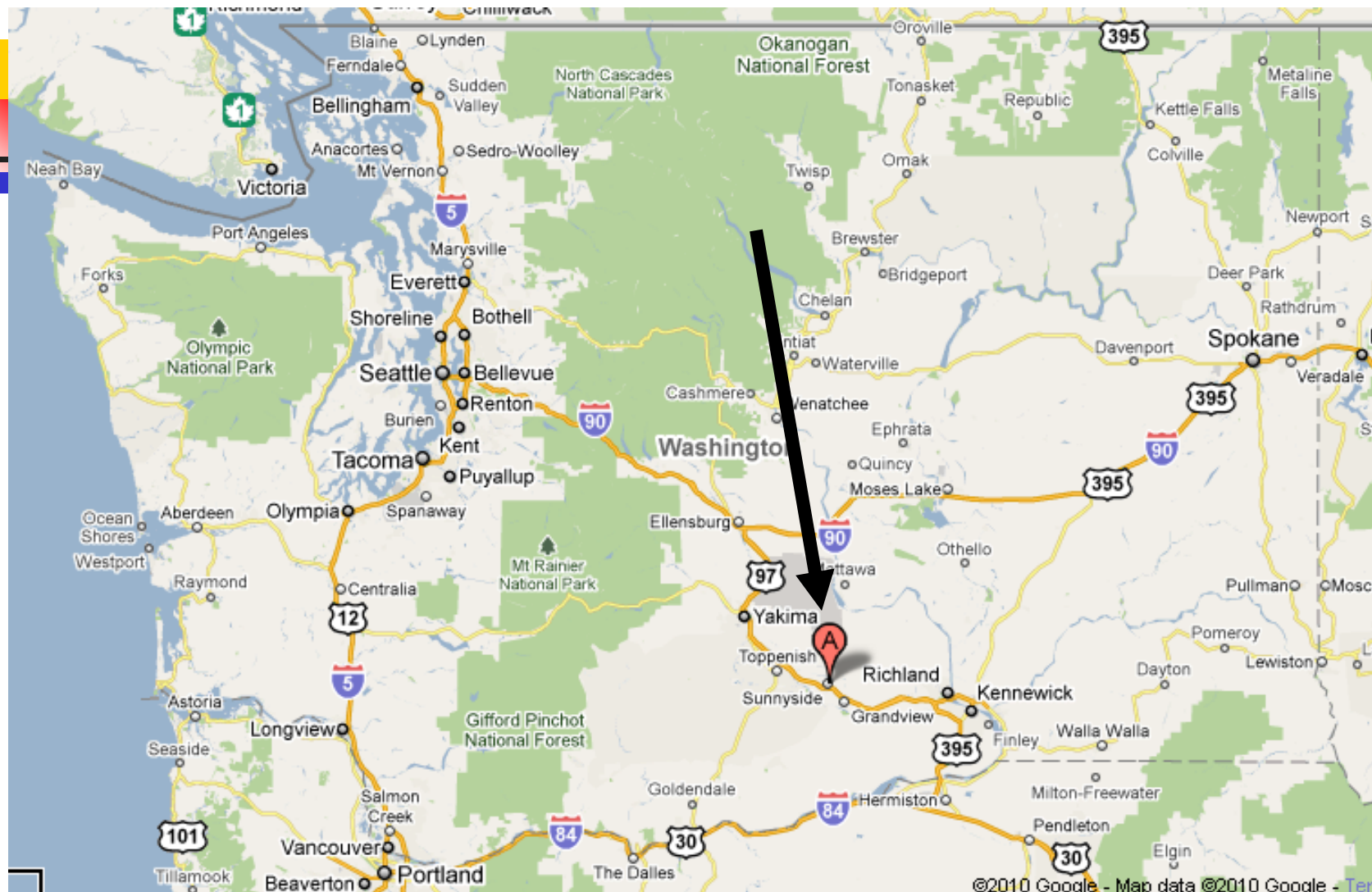
Prototypes





Demonstration Project

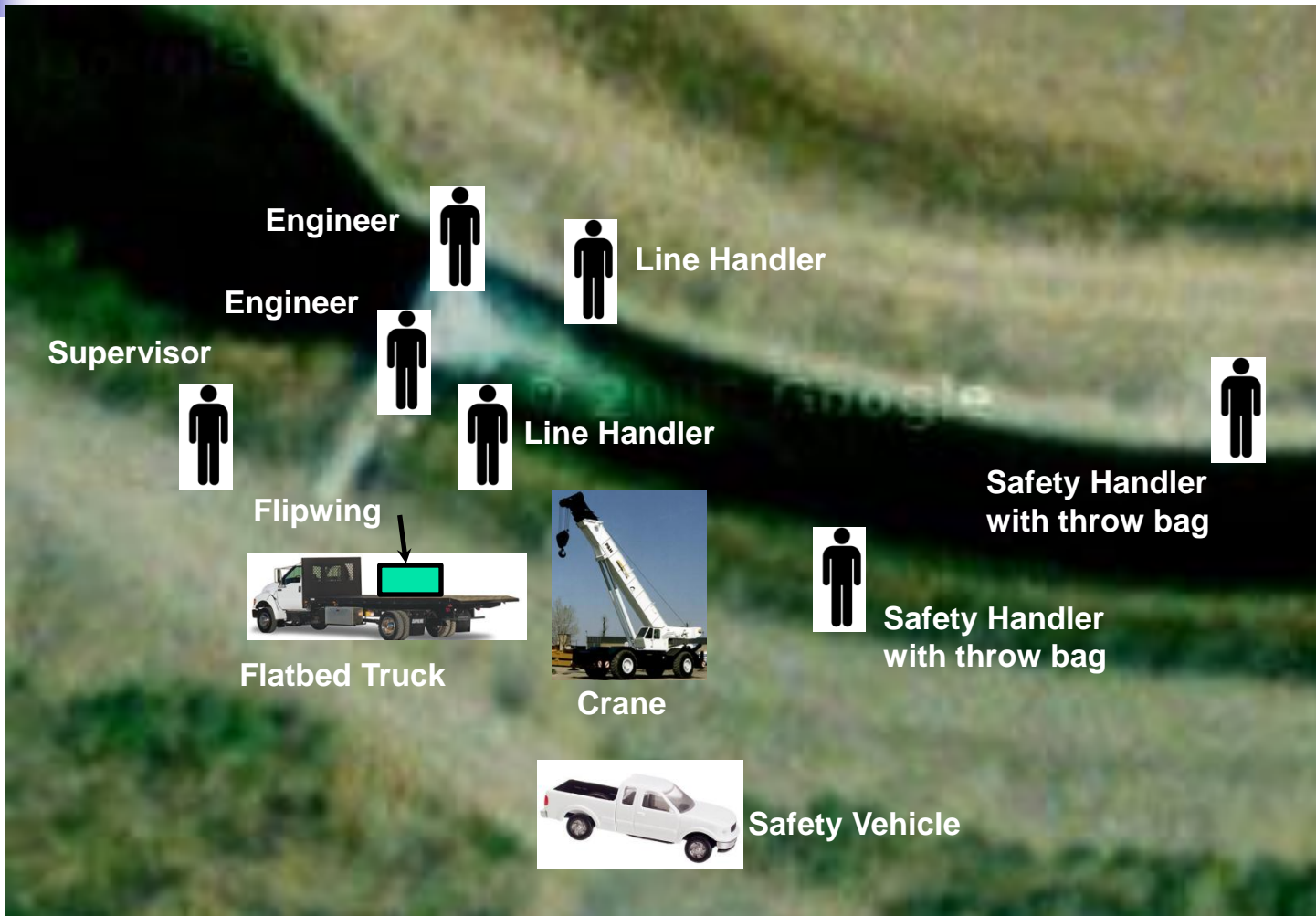
- The Roza Irrigation District operates many miles of canals in the Yakima River Valley
- They like idea of renewable energy from their canals
- They allow Hydrovolts to use their canal as a test site



Demonstration July 2010



Installation Overview



Deploy with Crane





Safety First



**Downstream
Safety Man**

**Life
Jacket**

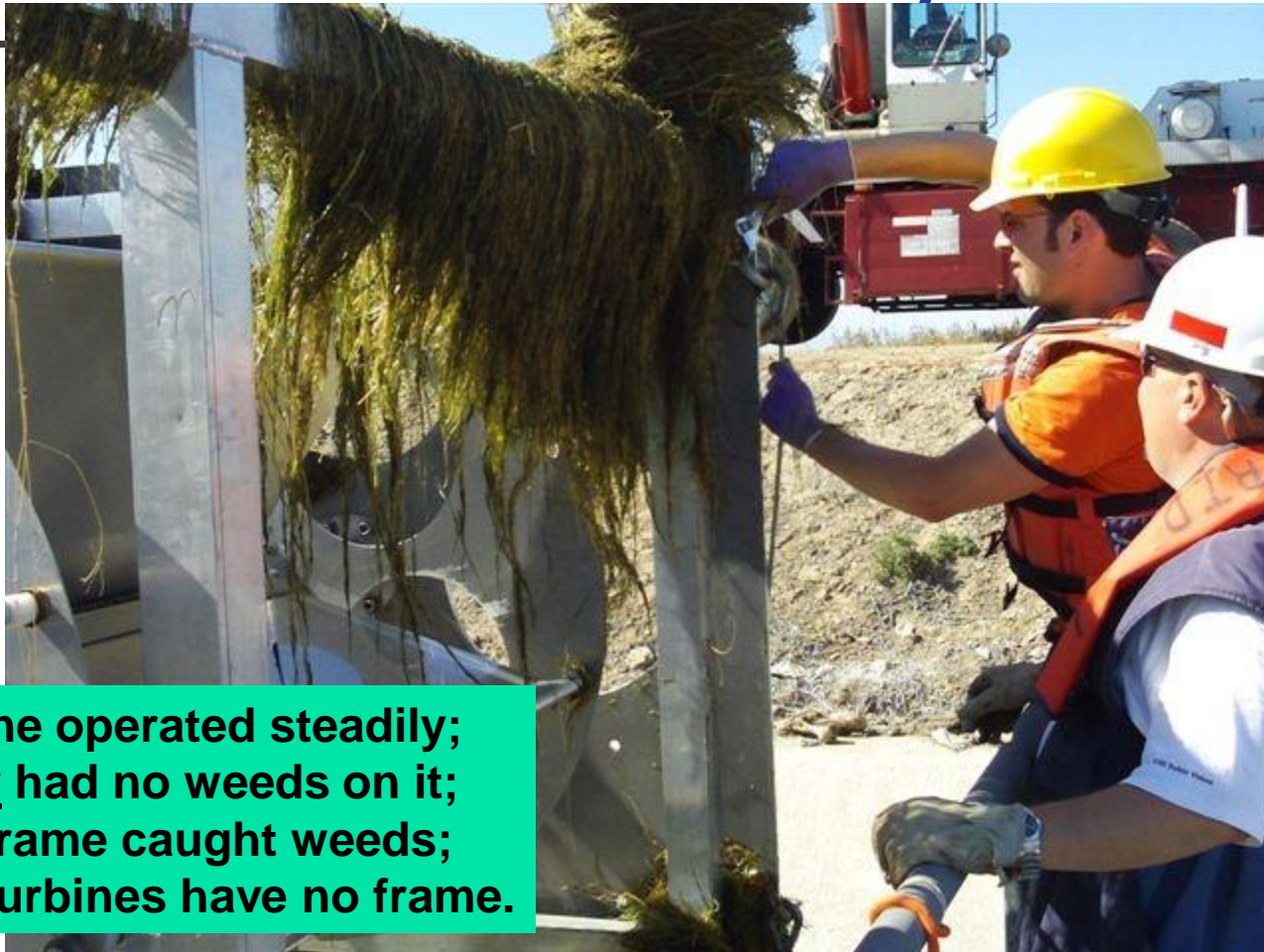
**Rescue
Float**

And a lot more

Installed in One Hour



Removed Next Day



**Turbine operated steadily;
Rotor had no weeds on it;
The frame caught weeds;
Future turbines have no frame.**



Power Generation?

- Flipwing turbine will have fully submersed waterproof generator
- Trade-off analysis
 - Rotor shaft has low RPM
 - Low RPM generators are big, heavy, costly
 - Fast RPM generators are small but need a reliable and waterproof speed increaser
- Hydrovolts has found unique solution (proprietary!) to be released in 2011



What About Florida?

- Tidal channels should be ignored
 - Not enough useful power
 - Extreme permitting and stakeholder challenges
- Artificial water channels
 - Canal structures and concrete-lined channels
 - Large cooling water or wastewater discharges
- Offshore buoys and sensors
 - Use small turbines to power valuable sensors
 - Small turbines can have very high value
 - Good R&D and design application

Hydropower To Go





Hydrovolts



Burt Hamner, CEO
210 S. Hudson St, #330
Seattle, WA 98134
206-658-4380

www.hydrovolts.com
burt@hydrovolts.com

C. Hampton McRae
PO Box 12901
Gainesville, FL 32604
352-497-9581

www.hydrovolts.com
hampton@hydrovolts.com