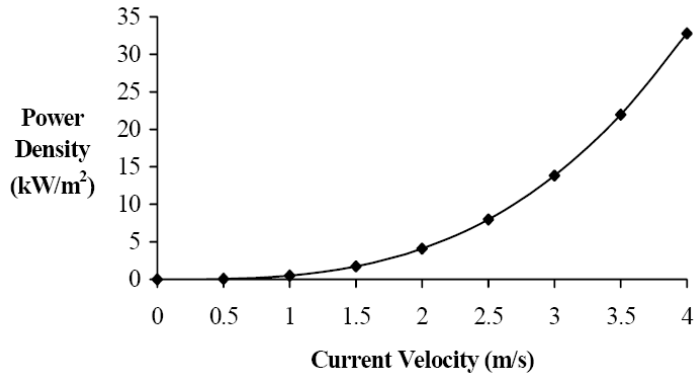
The Opportunity



Fast-flowing water has great power. The energy (kW/m^2) increases as the cube of the velocity (V^3) in meters per second (m/s). Faster currents have much more power. A current of 3 m/s or 6 mph has about 13 kW/m^2 of energy. In this stream a hydrokinetic turbine that is 40% efficient can make about 5 kW of power from one square meter (about 3x3 ft) of flow. This is enough power for two modern American homes, from a device the size of an office desk.

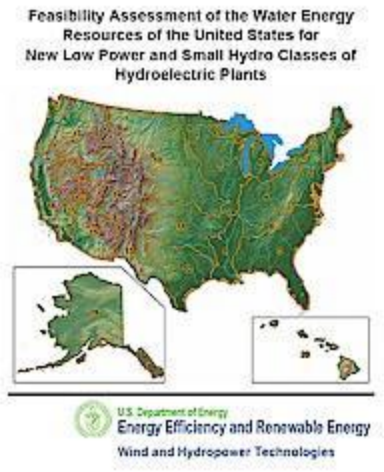
In-Stream Hydrokinetic Turbines that produce 5-20 kW have been demonstrated for at least 30 years by various developers (click link for more information). But the developers have not created successful technology companies because of lack of experience, poor technology designs, and trying to scale up to large systems before they perfect the small ones. Hydrovolts has the experience, new turbine technology and the market focus to create the first successful global business for renewable energy generation from free-flowing water.

Market Size

A 1986 study by New York University of free-flow river power in the USA estimated conservatively that there is 12,500 MW of undeveloped capacity for energy. This is worth about $10 billion in electricity sales today. The study criteria were:

Only rivers with mean flow rate > 4000 cfs and velocities > 4.3 ft/s
Only 25% of width is available
Only 25% of the length of a river reach
Turbine diameter = 80% of mean depth
Turbine spacing of ½ diameter and row spacing = 5 diameters
40% turbine efficiency

The study did not consider smaller rivers and canals where Hydrovolts turbines can also generate renewable energy. The market just in the USA is thus many thousands of megawatts larger that the NYU estimate. Suitably fast flows are found in regions with high altitudes and snow packs, large rainstorms or significant rainy seasons such as monsoons, or where large flows go through narrow channels. In the latter case, it is where there are high tides or seasonal rainfall or timed releases of water from reservoirs and dams into irrigation canals.



The US Department of Energy has already identified over 500,000 potential sites for micro-hydropower in the USA in a National Hydropower Study. This study does not include irrigation canals unless they are very large, so there are many more places than identified in the study.

The DoE created the Virtual Hydropower Prospector to identify sites where hydropower remains untapped in the USA. Try it. In fact our state has the most feasible untapped hydropower in the USA - see the Main Report from the DoE. The Electric Power Research Institute is now conducting a study of potential in-river energy sites as described in this Briefing.

Irrigation canals are major opportunity for renewable energy generation. They are engineered and usually free of endangered species and large floating objects. The USA has about 100,000 miles of large irrigation canals, according to the US Dept of Agriculture. There are millions of miles of canals around the world. During rainy seasons and seasonal snow melt they are rushing with water. Globally, the Food and Agriculture Organization of the United Nations promotes irrigation around the world and has databases of canals, flows, communities and much more. Canals are constructed, therefore there are professional societies of engineers, water transporters and others who know where the high flows and best sites are located.

We are confident there is a market for at least 500,000 Hydrovolts turbines based. In large rivers it can be deployed in large numbers per project, still at low cost.

Market Studies

The Connecticut Center for Entrepreneurship and Innovation published a study in August 2010 on The Emerging Hydrokinetics Energy Market (pdf format).

A good description of the low-head hydropower potential in USA canals was provided to the US Congress in December 2009 in the testimony of Gia D. Schneider, CEO Natel Energy, Inc.

Global Demand

The demand for energy continues to increase around the world. World marketed energy consumption is projected to increase by 57 percent from 2004 to 2030. This projection does not include the impact of electric cars - plug-in hybrids and other electric vehicles could drastically increase electricity use. To meet this demand much more energy must be produced and most of it will come from petroleum, coal and nuclear power. This creates new concerns about climate change and increasing demands for renewable energy sources that create significant opportunities for Hydrovolts in-stream turbines.

Sustainable Development: Around the world governments, energy utilities and power companies, and communities are looking for energy sources everywhere. For developing countries with rural communities the need for renewable energy is critical and even a few kilowatts is enough for lighting, refrigeration, communication and other development needs.

Renewable Power Standards: In the USA and other developed countries the commercial power utilities are increasingly directed by Renewable Portfolio Standards required to include a certain percentage of renewable energy in their portfolios. For example in our home state of Washington the utilities are required to obtain 15% of their energy by 2020 from renewable sources or to buy renewable energy credits for the same amount. Utilities will pay a small premium for renewable energy.

Renewable Energy Certificates: These certificates can be earned and sold separately by renewable energy producers. This earns additional revenue. The development of this market is stimulated by organizations like the Green Power Network.

Net Metering: This national activity allows small distributed generators such as irrigation districts using the Hydrovolts turbines to sell the renewable power directly into the commercial electricity grid and run their electric meter backward, thus saving or even making new money. The key benefit is that a quite high price is paid for the first small amount of electricity - up to $0.50/kW for the first $2000 worth of energy generated.

State Renewable Energy Incentives: These are increasing in states and even local municipalities. The Database of State Renewable Energy Incentives has details. These increase the value of Hydrovolts small turbines.