Mr. Lorne J. Malkiewich, Director  
State of Nevada  
Legislative Counsel Bureau  
401 South Carson Street  
Carson City, NV 89701  


Dear Mr. Malkiewich:  


Pursuant to SB 339, we understand that this Report will be forwarded by you or your office to Chairman Dean Rhoads and the Committee on Public Lands.  

Please contact us at (702) 486-2670 if Chairman Rhoads, the Committee on Public Lands, you, or your staff have any questions.  

Sincerely,  

George M. Caan  
Executive Director  

GMC/JDS/CNP/ja  

By E-mail: malkiewich@lcb.state.nv.us
The Colorado River Commission of Nevada (CRC) respectfully submits this Report in response to SB 339, 2009 Statutes of Nevada, Chapter 225 (SB 339). SB 339 directed the CRC to perform several tasks related to assessing the feasibility of constructing new hydrokinetic energy generators on the Colorado River below Hoover Dam.

Specifically, the operative language of SB 339 states:

“The Colorado River Commission of Nevada shall:

(a) Review and analyze available information, studies and reports to assess the feasibility of constructing a hydrokinetic generation project below Hoover Dam to assist in meeting any existing or future requirements described in subsection 1; and

(b) If the analysis indicates that construction of such a hydrokinetic generation project is feasible, present that analysis to appropriate agencies of the Federal Government and request that those agencies determine whether to construct a hydrokinetic generation project below Hoover Dam.”

“Hydrokinetic generation project” means a project that generates electricity from waves or directly from the flow of water in rivers, streams, channels and other inland waterways.”

“The Colorado River Commission of Nevada shall, on or before July 1, 2010, submit a report to the Director of the Legislative Counsel Bureau for transmittal to the Legislative Committee on Public Lands concerning the feasibility of constructing a hydrokinetic generation project below Hoover Dam.”

Summary and Conclusion:

Past hydropower technologies focused primarily on large scale, high capacity hydropower plants located in reservoir dams that store water for a myriad of purposes including agricultural irrigation, flood control and urban uses. Today, however, most current hydropower research efforts are focused on producing renewable electricity by harnessing the kinetic energy of a free flowing body of water including oceanic tides. The materials reviewed by the CRC show that most, if not all of the current research focuses on two types of technologies, wave energy converters (WECs) or rotating devices. Both of these technologies require either tidal waves or free flowing rivers with
adequate currents, however, neither of these conditions exist below Hoover Dam on the lower Colorado River. Based on the available information, the CRC does not consider that a hydrokinetic generation project of any significant capacity would be economically feasible at this time below Hoover Dam.

**Available Information on Current Hydrokinetic Studies and Projects**

There are many studies and projects currently underway as part of a massive effort to identify and promote “reliable, affordable, and environmentally sustainable hydropower.” Several recent reports have highlighted the potential and limitations of current hydrokinetic energy along with possible locations on America’s waterways and oceans. Most of these reports are issued by federal agencies but other reports and opinions have been offered by universities, public interest groups and private companies.

The Federal Energy Regulatory Commission (FERC) is an independent regulatory commission which “regulates the interstate transmission of natural gas, oil, and electricity. FERC also regulates natural gas and hydropower projects.” FERC is responsible for issuing the necessary permits for project-specific hydrokinetic studies and resultant construction projects on public waterways. FERC publishes information on site-specific projects which have received preliminary permits to study a site and design a facility. Information is also available on projects which are in more advanced stages of development, construction and operation.

One public interest group, the Union of Concerned Scientists, reported, “We now are presented with an opportunity to develop a new generation of water power, one that will harness the abundant energy of our oceans and rivers.”

Other information was obtained from published reports and studies as well as from projects currently operating. We also contacted companies promoting their own new, but unproven patented technologies.

**Current Technologies**

The current research focuses on two types of technologies, wave energy converters (WECs) or rotating devices. The available data specifies that near and off-shore waves “is thought to have the greatest energy production potential amongst these hydrokinetic options.” Oceanic opportunities are outside of our assigned focus so we looked at those studies and projects currently being proposed for or developed on inland waterways. In review of the FERC issued final permits, most of the inland permits were issued to projects along the Ohio and Mississippi Rivers with smaller research projects along the East River in New York. (Figure 1). There is one preliminary study permit issued for a very small 15 kW inland project on an irrigation canal within the Colorado River Indian Tribal Irrigation District along the California – Arizona border south of Nevada.
The most common inland waterway hydrokinetic generator is based on a rotating device. Rotating devices capture the kinetic energy of a flow of water, such as a tidal stream, ocean current or river, as it passes across a rotor. The rotor turns with the current, creating rotational energy that is converted into electricity by a generator. Rotational devices used in water currents are conceptually akin to, and some designs look very similar to, the wind turbines already in widespread use today – a similarity that has helped to speed up the technological development of the water-based turbines. Some rotational device designs, like most wind turbines, rotate around a horizontal axis (Figure 2), while other, more theoretical concepts are oriented around a vertical axis, with some designs resembling egg beaters.
One Electric Power Research Institute (EPRI) study noted, “A technical obstacle needing to be overcome is that instream riverine technologies require currents at 6-7 feet per second (ft/s) to achieve cost effective energy extraction. The average velocities in most manmade channels are 3-4 ft/s. Therefore, some sort of flow concentrator or civil works structure that accelerates flow is necessary to achieve development.” This would likely entail creating another reservoir along the river.

Consistent currents below Hoover Dam do not approach the 6-7 ft/s rate requirement noted above. The conditions below Hoover Dam show a velocity as low as 2 ft/s to as high as 9 ft/s depending upon water releases with mean velocity of only 4 ft/s. The peak velocities below Hoover Dam only occur approximately 5% of the time which would not support prudent use of current instream riverine technologies.

Additionally, any newly installed hydrokinetic generation would need access to electric transmission facilities to transport generated power from any project to the regional grid or end-use customers. This practically restricts any location for new generation installation to just below existing dams with power plants which also have access to existing transmission. Further downstream from Hoover Dam into other areas would require new substations and new transmission facilities at a significant cost. Further, since such new transmission and substation facilities would likely need to be sited on, or cross through, existing National Parks and Recreation areas, the likelihood of securing...
needed sites and rights-of-way is extremely low. Even if such sites and rights-of-way could be secured, extensive resources would need to be devoted to the permitting process that would only add to the costs.

**Estimated Costs**

During and after the energy crisis of the 1970s significant efforts were made to promote hydropower as a way to develop domestic energy supplies. One of these efforts was made by the U.S. Bureau of Reclamation (Reclamation) which looked to uprate many of their existing federal hydroelectric power plants. Many of these power plants were reaching their maximum life spans and it was planned to uprate or upgrade these plants with newer technologies as existing turbines and other equipment required routine replacement.

At Hoover Dam, Reclamation sought to uprate the 17 generating units to achieve an estimated additional 443 MW of generating capacity at an estimated cost of $143 million. After the uprating program was completed in the 1990’s, the actual cost was $168 million, plus financing costs, and the total additional capacity achieved was 626 MW.

The current estimated costs for energy generated at Hoover Dam for 2011 is $0.019 per kWh, while the most efficient hydrokinetic projects (tidal) generate at a present cost of $0.11 per kWh, other hydrokinetic technologies are even more expensive. As noted by the Union for Concerned Scientists, “(t)hese costs are “before accounting for any tax incentives for renewable energy investment or generation – and with opportunities for significant economies of scale to follow as the industry matures…. Despite the promise of hydrokinetic technologies to contribute significantly to our clean energy mix, there are barriers to the speedy development and delivery of this technology. Most pressing of these barriers are the current regulatory structure, and a need for additional financing to support environmental research and project deployment.”

**Current Projects**

As noted earlier, there is one project that received a FERC permit to build and operate a small 15 kW hydrokinetic unit on an irrigation canal south of Nevada near the Colorado River. The preliminary permit was issued to Marine Power and Water, Inc (MPW) which contracted with the Colorado River Indian Tribes Irrigation District. This project is designed to operate on an irrigation canal. Ray Hoffman, CEO/President of MPW described his firm’s new technology, called “Aquakinetics,” as a different design than other inland waterway technologies. Currently there are no Aquakinetic units in operation. This design is above the water and is similar to a water wheel and MPW promises more efficiency than existing rotating devices.

Keith Davis of the Colorado River Indian Tribes Irrigation District explained that the Tribes are not funding the project, but agreed to the project in hopes of receiving a return. On this irrigation canal, there are constant flows between 3 and 4 ft/s. The Preliminary Permit was issued in July 2009 but as of June 2010, construction has not started.
Potential Role of Existing Federal Hydropower Customers

The prospect of additional power from existing hydropower plants and waterways is an ongoing and primary focus of our current search for more energy at competitive prices. Reclamation hydroelectric customers have been and are willing and able to help with the construction and financing of project improvements and upgrades, when cost effective and feasible. Any further feasibility analysis by Reclamation will need to focus on whether installation of new hydrokinetic energy generators along the Colorado River is consistent with all of the conditions along the river.

Report to U.S. Bureau of Reclamation

Despite the lack of any current technologies to allow the CRC to suggest a feasible project below Hoover Dam, we have been in contact with the Bureau of Reclamation, which is responsible for any power generation projects on the Colorado River. The Area Manager for the Lower Colorado River Region has followed of our study and has agreed to accept a copy of this report on behalf of the Bureau of Reclamation.

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1 United States, Department of Energy, Memorandum of Understanding for Hydropower Among the Department of Energy, the Department of the Interior and the Department of the Army (Washington: GPO 2009)
2 FERC website About FERC, http://www.ferc.gov/about/about.asp
4 Dixon, Douglas. EPRI page 5-11
5 United States, Federal Register Notice, Vol 75, No. 21 Issued Feb. 2, 2010
7 Union of Concerned Scientist

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