Sediment and residual water turbine for installation on sluices optimally protecting aquatic ecosystems

Summary

Profile type	Company's country	POD reference
Technology offer	**Austria**	**TOAT20220512013**
Profile status	**Type of partnership**	**Targeted countries**
PUBLISHED	**Commercial agreement with technical assistance**	**• World**
Contact Person	**Term of validity**	**Last update**
Markus MAIR	**12/5/2022** **12/5/2023**	**13/07/2022**

General Information

Short summary

An Austrian SME developed a small hydro power system which complies with the EU Water Framework Directive to protect ecology and biology of rivers (enabling passage of fish and bedload). By usage of overflow and residual water to drive the turbine a high efficiency is expected. A wear resistant coating raises fish protection and enables application as sediment turbine (more efficiency). A world patent was applied for, for which the SME is looking for buyers worldwide except Austria.

Full description

The current Water Framework Directive from the European Union (EU) stipulates, that running water (i.e. a river) has to be open (traversable) from the beginning to the end for fish, sediments and bed load (solid material such as stones, which is transported along with the running water). In addition, at weir systems (mainly for diversion power stations) a certain amount of residual water after the weir has to be guaranteed. As a consequence, approval of new water power plants will be extremely difficult in the future. Existing diversion power plants will have to adapt their residual water flows, thus loosing efficiency.

The Austrian SME developed and successfully tested a system for a small water power plant, which fully complies with the EU directive.
The system can be installed on an (existing) sluice (hydraulic gates) of a weir. It mainly consists of a radial turbine which is arranged downstream of the weir on the sluice below an overflow ramp. In this way the turbine can be moved vertically together with the sluice to fulfill the specified residual water flow in times of low water and to adjust

the surplus water flow in times of high water. This adjustable water flow drives the turbine for power generation. In addition, the turbine is mounted so as to be vertically displaceable on the sluice. This enables fine adjustment of the position of the turbine to optimize its performance and the protection of fish. In times of floodwater the turbine can be moved upwards on the sluice to protect it from heavy bed load.
The shape and arrangement of the turbine blades have been optimized for the passage of fish. Tests of the prototype have confirmed that fish can pass without major injuries.

The next steps in the further development of this system have now been taken and a new world patent has been applied for.
One new feature is an additional overflow ramp at the weir, which opens above the turbine rotor in the area of the downward turning turbine blades. This additional overflow feed of the turbine is intended to increase the efficiency of the entire plant. A deflector wall at the end of the overflow ramp ensures the correct alignment of the overflow water with respect to the turbine blades. A flotsam barrier is placed upstream to protect the overflow.
The second innovation will make it possible to use the system as a sediment turbine for the first time. This should further increase the efficiency of the system (deeper immersion of the turbine in the residual water is possible). The water-bearing parts of the turbine will be coated with a special cement-bound material with a high wear resistance. This protects the turbine from wear caused by the sediment and forms a sliding layer that further minimises the risk of injury to fish. The coating is suitable for application in drinking water as it does not contain any resins or harmful additives.

In order to make use of the whole width of a weir, several modules of the system can be placed side by side on the weir.

Stage of development: A prototype of the original hydro power plant has been installed in a river of Upper Austria and tests have confirmed fish passability without major injuries. Concerning the new coating of the turbine, laboratory tests will be carried out in the second half of 2022 to determine the wear resistance of the coating. A later adaptation of the prototype is also planned.

Technical details of the existing prototype:
- width of module: 2.10 m
- height of module: 2.06 m
- output is depending on water level and residual flow and will be further optimized
- designed for a residual water flow of 2000 l/sec

For this novel hydro power system a world patent (PCT) was applied for. The Austrian SME is looking for buyers of the patent for countries all over the world except for Austria.

Advantages and innovations

Innovative aspects of the system are:
- the vertical adjustment of the turbine, which is installed downstream of the weir directly on the sluice
- the design of the turbine blades for optimized fish protection
- the usage of overflow water together with residual water to drive the turbine
- the wear resistant coating of the turbine with a cement-bound material without harmful substances

The novel water power system:
- fully complies with the EU Water Framework Directive: it is able to protect and restore aquatic ecosystems
- can be applied as sediment and residual water turbine
- will have increased efficiency (by using the turbine with overflow and residual water simultaneously)
- is designed in a modular way and simply and quickly installed on (existing) sluices => low investment and maintenance costs => low priced power generation
- enables downstream passage of fish without injuries
- reduces bed deepening and bank collapsing downstream
- decreases deposition of sediments and bed load upstream; it helps to maintain the volume of the river bed, which is crucial in times of high water to avoid flooding
- is suitable for many rivers and river conditions

For existing diversion power plants, which will have to increase their residual water flows: the resulting loss of output can be compensated by installing the novel system on the weir.

Stage of development

Available for demonstration

Sustainable Development goals

- **Goal 14: Life Below Water**
- **Goal 7: Affordable and Clean Energy**

IPR Status

IPR applied but not yet granted

Partner Sought

Expected role of the partner

Specific area of activity of the Partner:
- manufacturer of hydro turbines
- water power plant construction and/or operation companies
- steel construction for hydraulic engineering (manufacturer of weir panel, sluice, grate etc.)
- manufacturer of agricultural machinery or plant construction companies to build up a new business segment

Task to be performed by the Partner:
The Austrian company is looking for buyers of the patent for countries all over the world except for Austria.
It is also planned to offer trainings about bed-loads and transportation of sediments to patent buyers.

Type of partnership

Type and size of the partner

Commercial agreement with technical assistance

- **SME <=10**
- **Big company**
- **SME 11-49**
- **SME 50 - 249**

Dissemination

Technology keywords

- **04005002 - Hydropower**
- **004002008 - Turbines, fluid machinery, combined heat and power**
- **07001001 - Agriculture Machinery / Technology**
- **10002006 - Ecology**
- **10004010 - Hydrology**

Market keywords

- **08003006 - Power transmission equipment (including generators & motors)**
- **06002004 - Hydro-electric**
- **08003007 - Other industrial equipment and machinery**
- **09008001 - Electric companies**

Targeted countries

- **World**

Sector groups involved

- **Environment**
- **Intelligent Energy**

Media

Images

prototype installed in Upper Austrian river

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schematic drawing

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