Installation of Small Hydroelectric Power Plant in Agricultural Facilities

【Uchikawa Hydropower Plant 】

Rural Development Promotion Division,
Agriculture, Forestry and Fisheries Department
Miyagi Prefectural Government, Japan

○Masahisa Sugano
菅野　将央

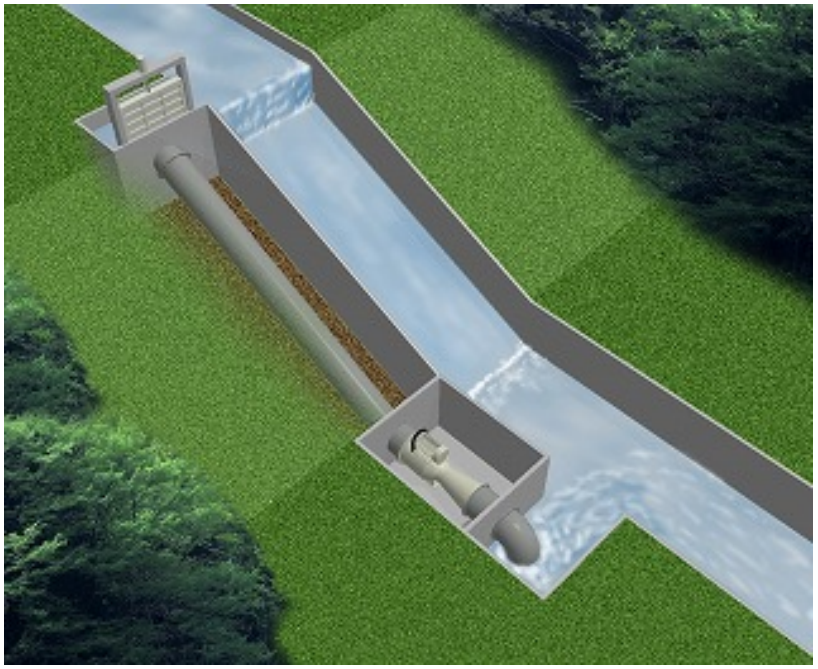
Background of the Installation

- Land Improvement District of Miyagi prefecture in Japan manage many irrigation and drainage pump stations in area of control. Its costs of electricity has increased in recent years. Therefore the management cost of facilities of LID is reduced by the income from sales of electric power.
- It will contribute to saving energy and reducing CO2.
- The type of direct setting of opening canals has some maintenance issues. Research will help improve the technology with the ultimate goal of realizing the desired technology transfer.

Miyagi Prefecture Government constructed the hydroelectric generator as a model, and have been researching for effective in quality improvement.

Small Hydroelectric Generation

Bypass Type



- Installation locations are limited.
- It is not possible to raise in water level in the upper reaches of a canal.

Direct Setting Type

- This type is a small percentage of public works and the setting is easy managed.
- The facilities can adjust water level in the upper reaches of a canal.

Setting Point

1. Name of the River
   Eai River , the Kitakami River System
2. Name of Head works
   Ozeki Head Works
3. Setting Point
   It is 10.0km from the Ozeki Head Works.

・The flow of the Ozeki Head Works
Pudding water period 11.786 m³/s
Irrigation period 6.940 m³/s
Non-irrigation period 2.497 m³/s

・ The flow of the point of the hydropower plant
Pudding water period 3.658 m³/s
Irrigation period 2.060 m³/s
Non-irrigation period 1.568 m³/s

※*Pudding means the first preparation of a rice field before planting*

Specifications of Electric Generation

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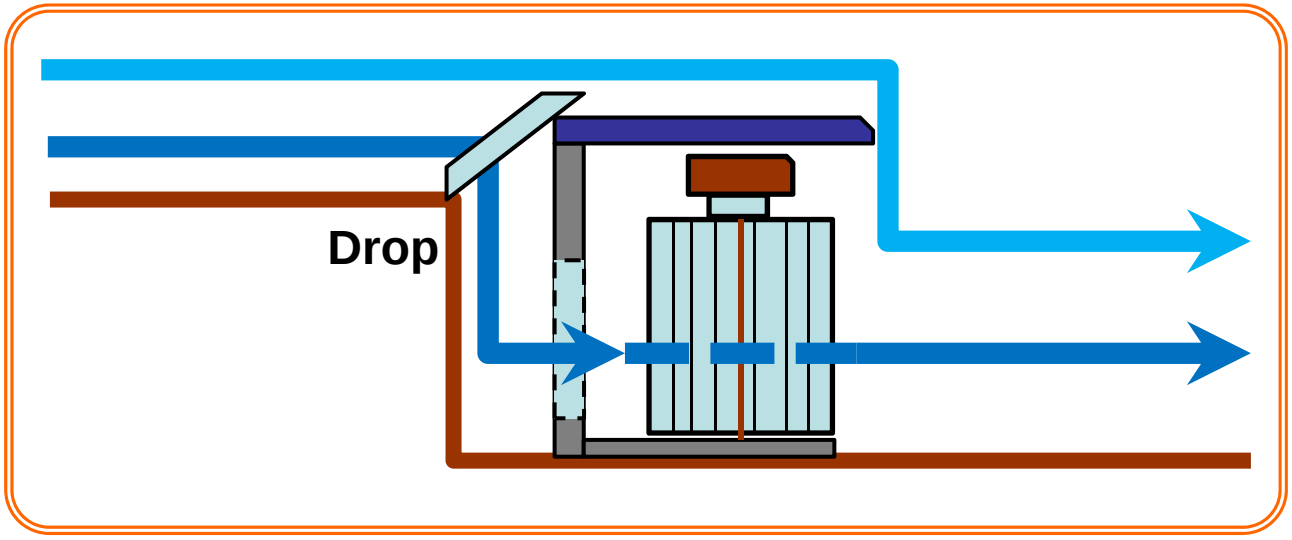
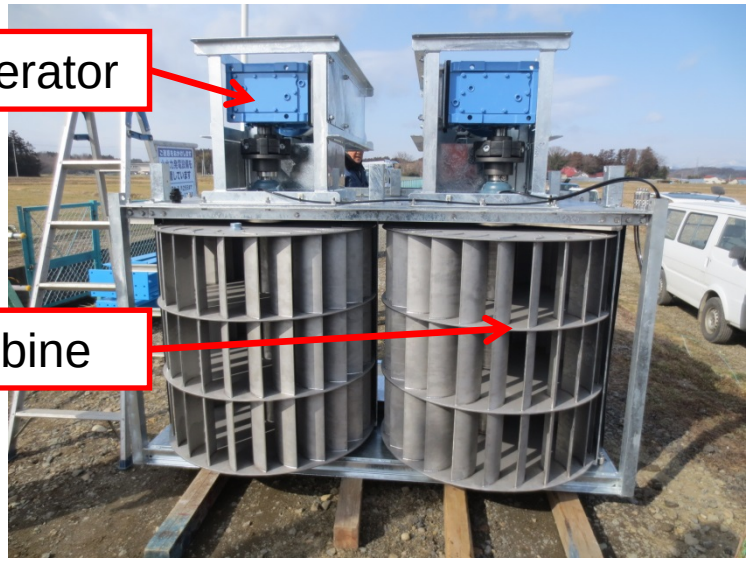
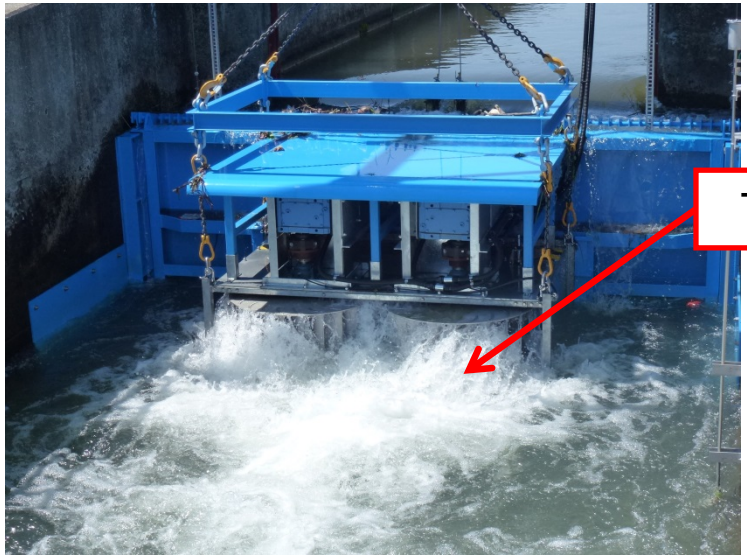
Output : 5.5 KW
Volume of water : 2.19 m^3/s
Head drop : 1.1 m

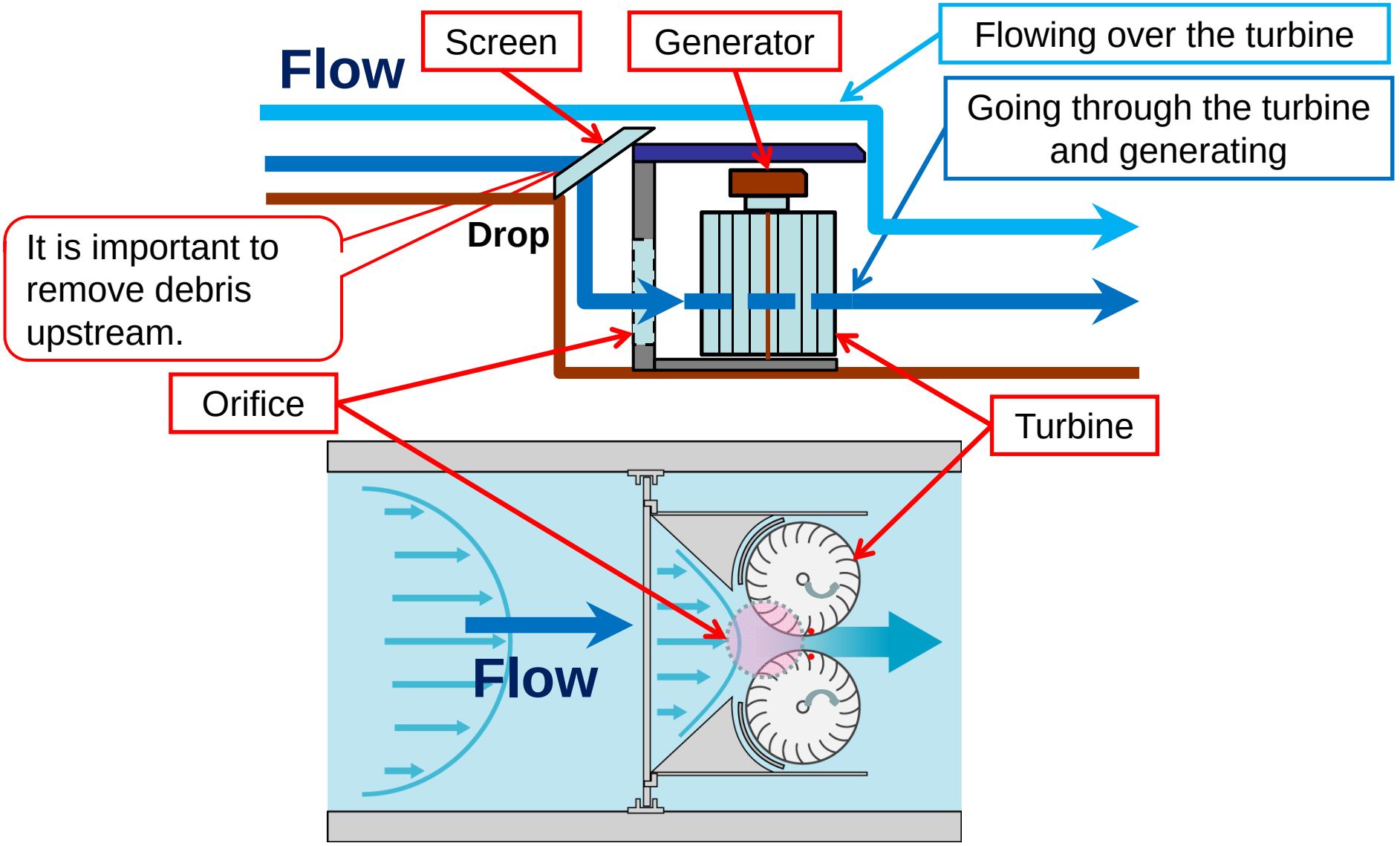


Installation

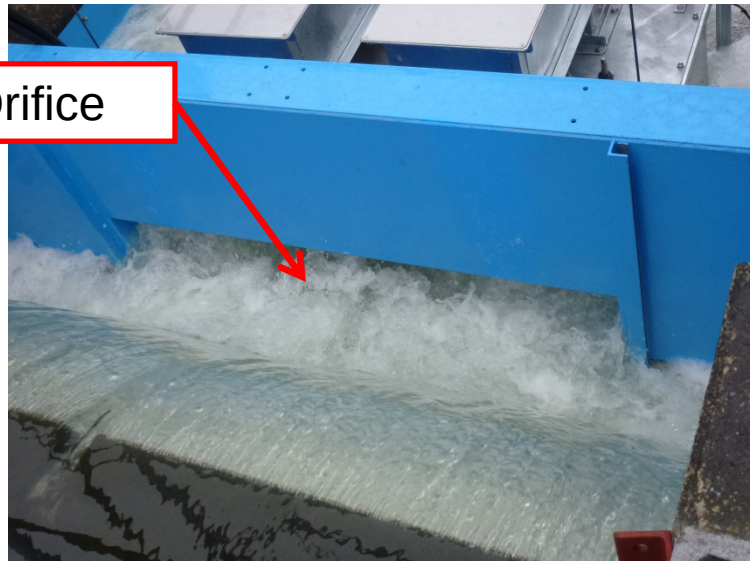


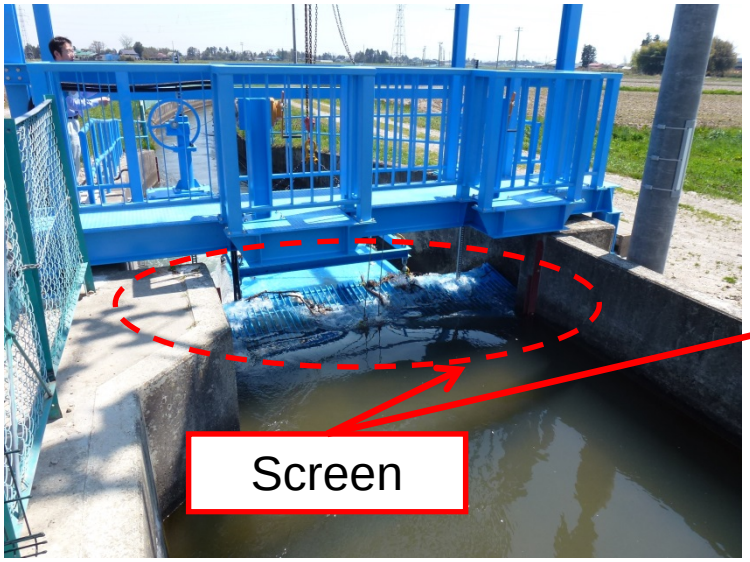


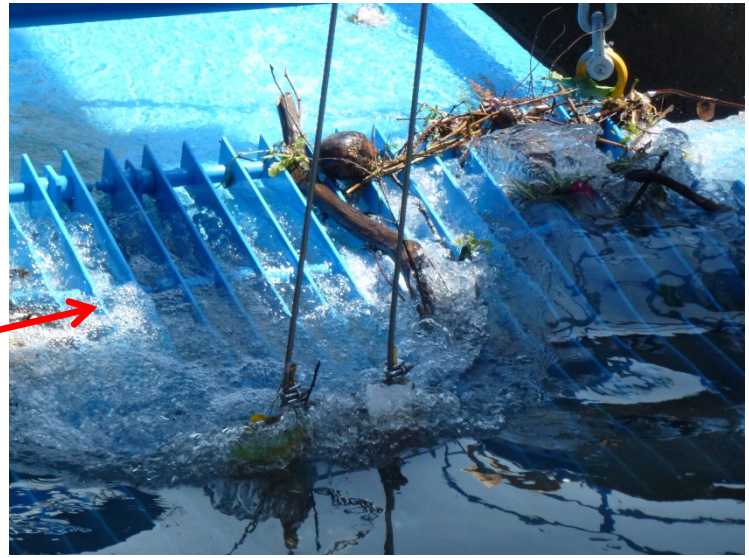
Vertical Shaft Twin Cross Flow Turbine



Installation







Maximum Flow

Operating State of the Generator

Conclusion

●The Operation Record of Electric Generation

Month/Year	Electric Power Generation (KWh)	Revenue (Yen)	Remarks
April 2015	182	6,683	
May 2015	1,404	51,554	
June 2015	2,707	99,401	
July 2015	2,925	107,406	
August 2015	2,409	88,458	
September 2015	2,110	77,479	

※The selling price: 367.2 Yen/10KWh (3.02 USD/10KWh)
※The amount of electricity consumed by one family in Japan in a year is **3,000KWh** on average.
※The CO2-reduction is 0.551kg/KWh

Conclusion

● Issues

1) A reduction in costs of daily maintenance
2) The Debris flowing down from the upstream

● Challenges

Miyagi prefecture Gov. researches the following in 2016.

1) Calculation of labor costs for daily maintenance
2) Investigation of the volume and properties of debris and function improvement of the screen
3) Uchikawa Hydropower Plant suffered from flood on 11th September 2015.We have to fix the plant and improve it to be resistant to disasters.