Current Micro Hydro Generation System

SMALL HYDRO STREAM

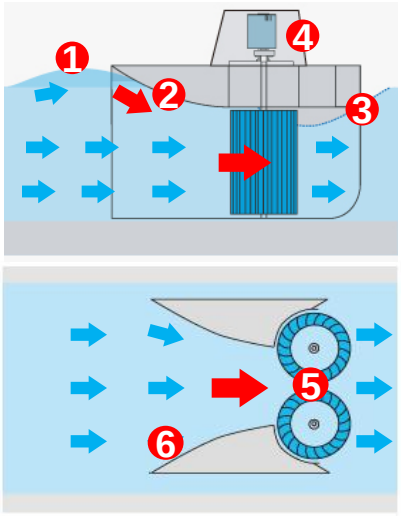
Seabell International Co., Ltd.

What is “Small Hydro STREAM”?

Small Hydro STREAM is
the current small hydropower generation system to utilize open canal, under drain, slope canal, and lower head drop.

1. Sectional micro hydropower generation system to be able to install at the non or lower head drop canal.
   - Small Hydro STREAM is the generation system which doesn’t disturb canal function when it’s installed.
   - Small Hydro STREAM can be installed and generate electricity without non or lower head drop.
   - Small Hydro STREAM doesn’t need large civil work for installation and is movable when it’s in maintenance or emergency.

2. Compact turbine and unit construction system by new patented technology.
   - Small Hydro STREAM is new patented hydro generation system with open vertical dual axis cross flow turbines to increase it’s efficiency in lower head drop.
   - Small Hydro STREAM is high efficient hydropower generation system in lower head drop to utilize the advantages of both impact-type water wheels and reaction-type water wheels.



1. Increasing Energy of generation by rising Current water level to create Potential energy
2. Creating accelerated Gravity falling Kinetic energy of Water current to Turbines
3. Preventing Backwards-flow by Sudden release
4. Providing stable generation by Gear & Electric systems staying always above water
5. Center current as the fastest to Turbine Fin edge by Dual axis structure from Hydraulic characteristics
6. Preventing loss & accelerating Current velocity by Inner body design of Gently narrowing current cross section

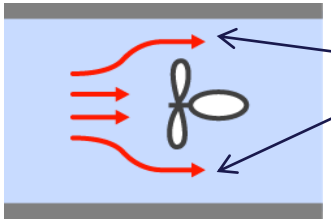
Quite different from conventional hydropower generation system

- It can maintain canal function
- No need dam or civil work for installation / 2 or 3 days for installation
- 24 h/365 days of Reliable Energy Source
- Simple structure for production cost, managing cost and maintenance cost
- New energy system for local production for local consumption
- Patented and optional specification technology by MLIT and Tokyo metropolitan

Comparison of existing hydropower system with STREAM

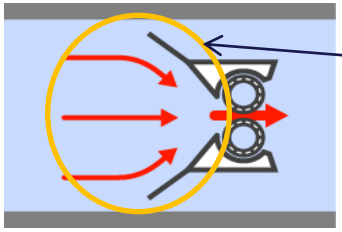
Patent 1：Increase water reservoir（liberating maximized water energy on the tips of water wheels）

Conventional System



The flow of water which hit the water wheels is reduced because the water avoid the water wheels.

Small Hydro Stream

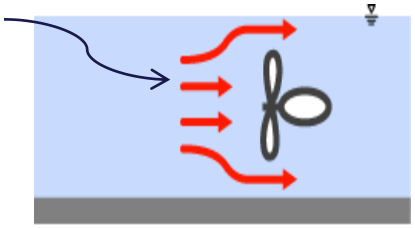


The flow of water which hit the water wheels is increased because it collects water.

Patent 2：Increase potential energy(lift up water surface）

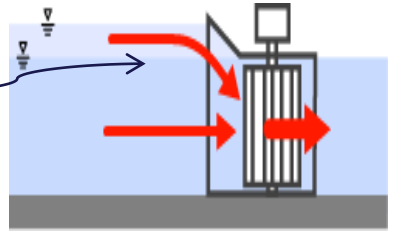
Conventional System

General motion energy(It doesn't increase potential energy)



Small Hydro Stream

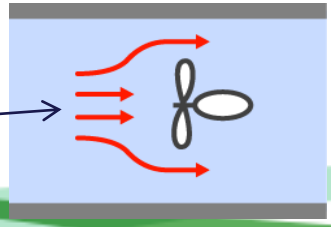
It can lift up water surface and convert motion energy into potential energy.



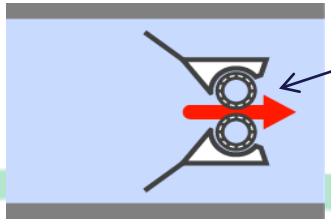
Patent 3：The efficiency is increased by vertical dual axis water wheels

Conventional System

Average hydro-energy



Small Hydro Stream

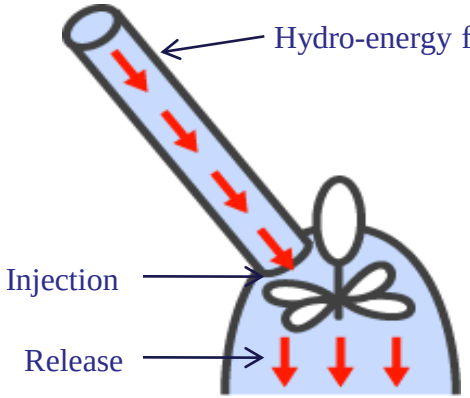


Focus the hydro-energy at the center and hit the tip of both water wheels.

Comparison of existing hydropower system with STREAM

Conventional Technologies

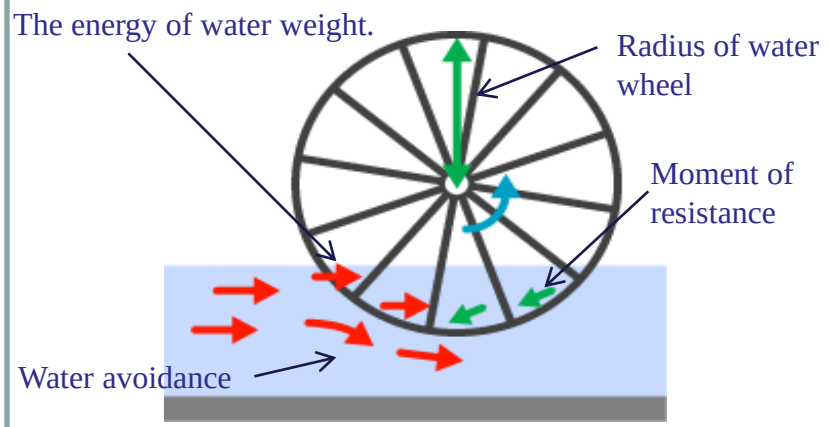
Impact-type



Features

1. Current speed from higher drop.
2. The impact of water from the drop occurs the spinning of water wheels and release the water.
3. It generates power by increasing rotation speed.
4. It is required more than 10m head drop.

Reaction-Type



Features

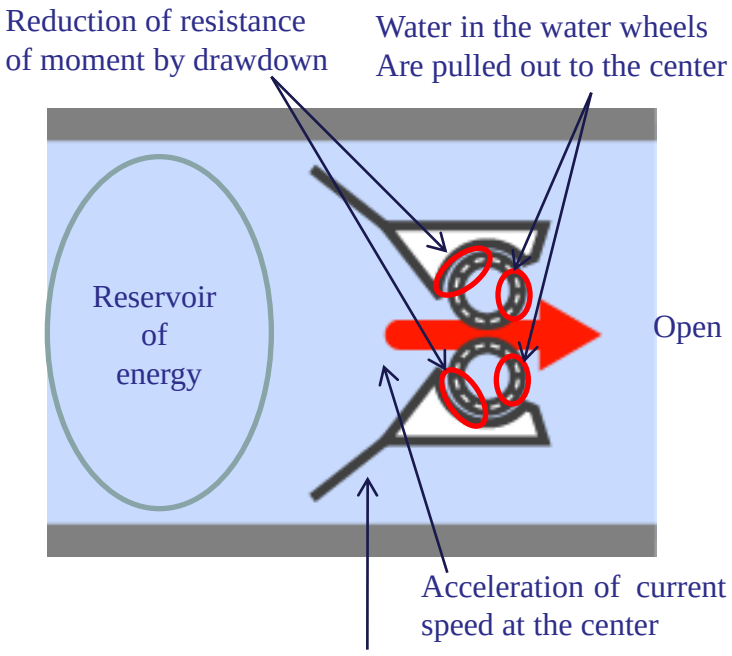
1. The energy of water weight
2. Water volume which hit the fin in important to generate power.
3. It needs to use larger radius of water wheel to increase moment to generate power.
4. The moment of resistance of the fin in the water reduce the energy.

Comparison of existing hydropower system with STREAM

Our Technologies

Patent 4：Increase hydro-energy at the non-slope canal by using the advantages of both impact-type water wheels and reaction-type water wheels.

Small Hydro Stream

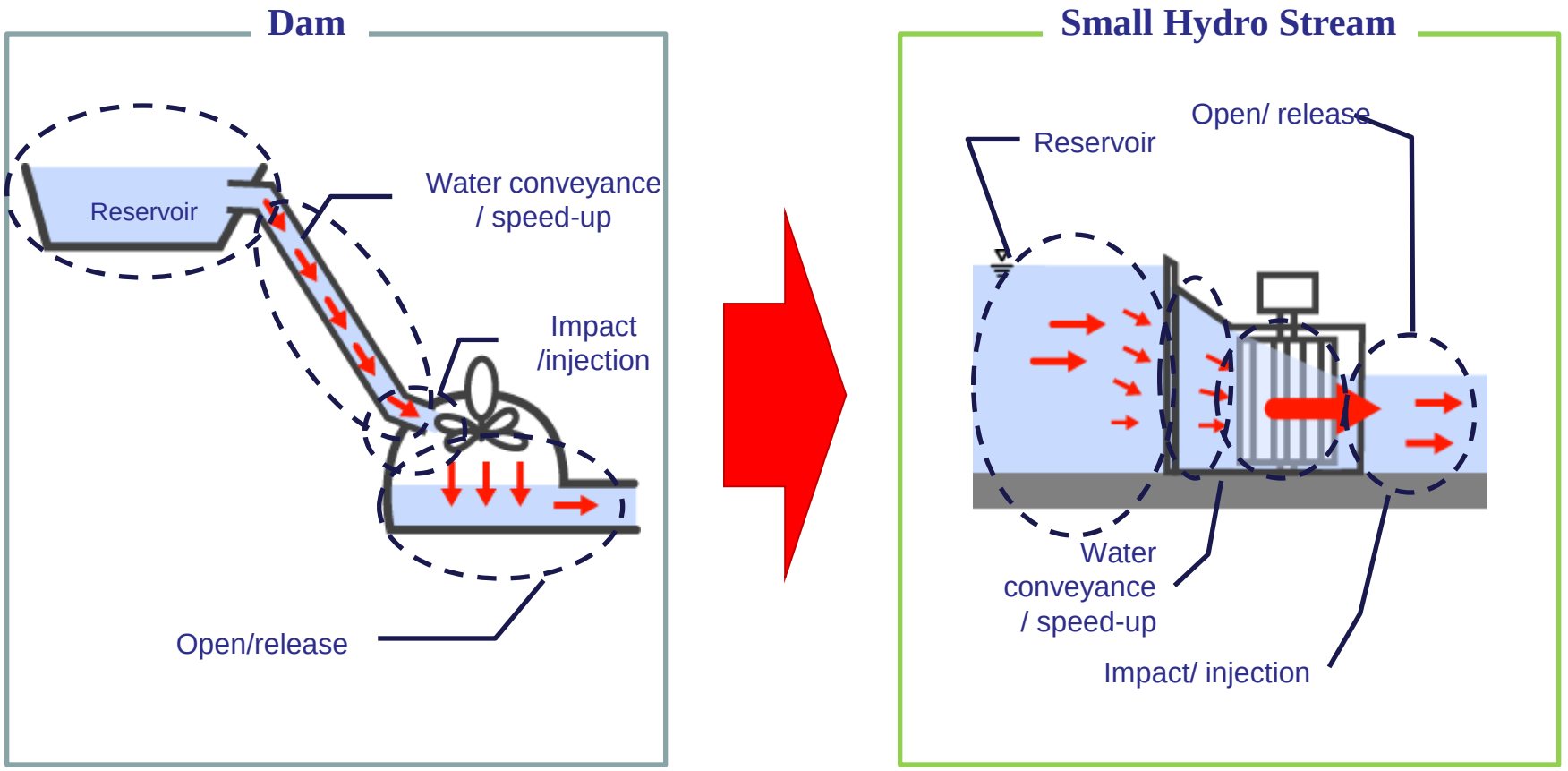


Feature

① Increase reservoir level and potential energy to make a low head-drop.
② Increase the water speed by the typical shape and the water from the orifice create the power and hit the fin.
③ Maximum energy which is created by the dual water wheels hit the tip of fin.
④ The resistance of moment is reduced by the drawdown and it increase its efficiency.
⑤ The water is discharged to the back and it doesn't decrease the efficiency because the behind of this machine is opened and It will flow smoothly.

Comparison of existing hydropower system with STREAM

Small Hydro Stream has the all-in-one structure incorporates all the essential functions of hydro generation dams.



All-in-One Unit

Comparison of existing hydropower system with STREAM

Conventional hydropower

1. Need head drop

At least 5m (usually 30m) head drop is required.

2. Installation location is limited

Usually, it's rural area or mountains.

3. Requires large facilities and more than 500 kW production is effective

Considering installation cost and electric transmission cost,
more than 500kW production is required to maintain cost efficiency.

4. Total cost will increase because of the large civil work cost

Large civil work cost + long construction period

5. Need professional engineers for operation

It's expensive to operate and maintain the system.

Small Hydro STREAM

1. No need head drop

Effective Range: 0~10m

2. No limit for installation location

Compact body suit for any place such as rural area.

3. Utilizing existing canal for installation without civil work

Unitized machine doesn't need civil work and it's lower price.

4. Unitized simple structure which is lower price

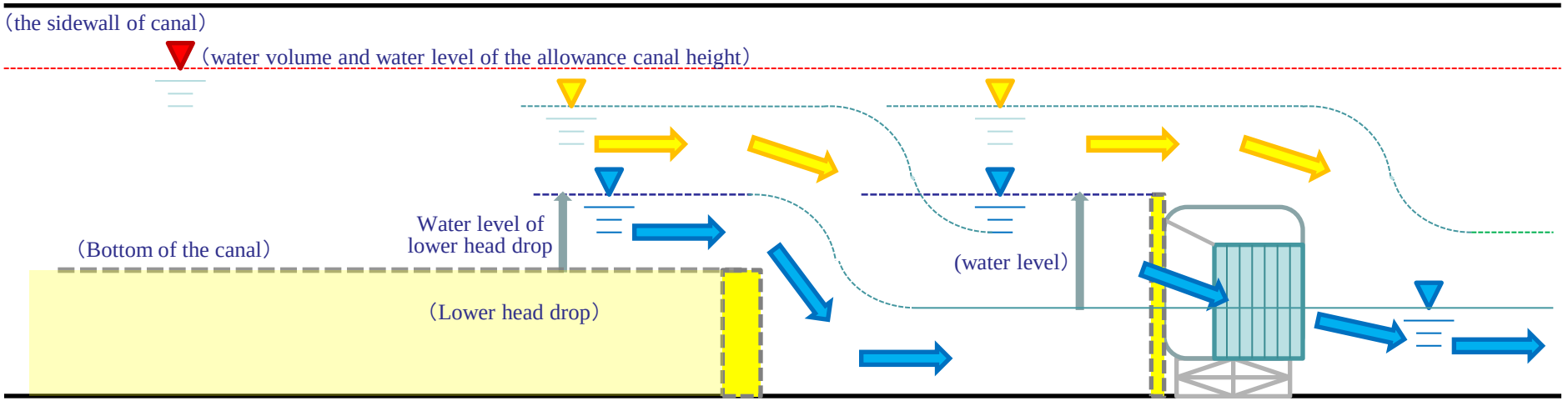
Manufacturing standard model to lower the cost.

5. It's possible to manage and maintain the machine locally.

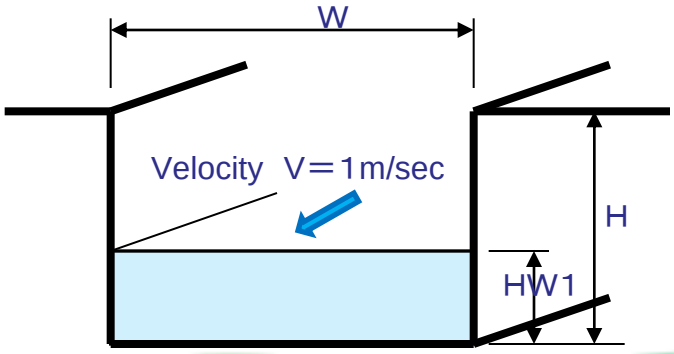
Each part is standardized to manage and maintain the machine easily.

The point to generate electricity by small hydro stream

1. It doesn't impair the existing function of canal.
2. The effective utilization of existing canal structure such as allowance canal height, lower head drop, canal width.



3. Large hydro-energy doesn't mean large potential of hydro power

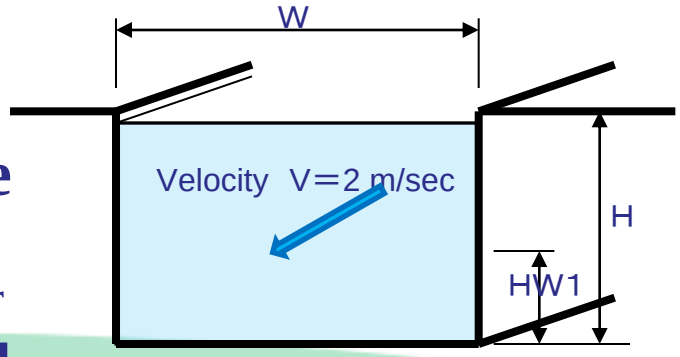


Hydro-energy

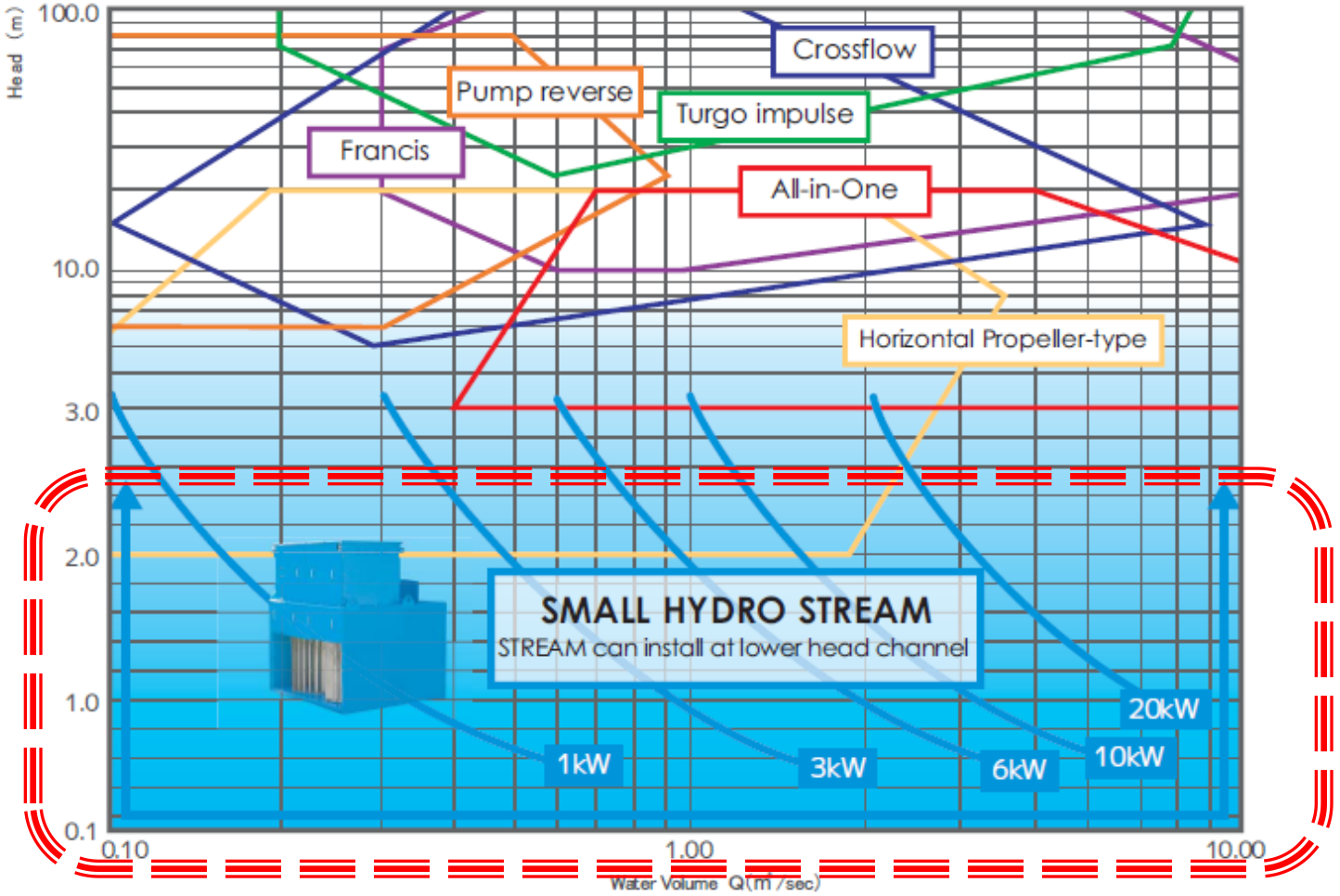
small > large

Potential hydro power

large < small



The range of application of Small Hydro Stream



Adding “Small Hydro Stream” in the chart shown that it is only hydropower generation system that can be applied to streams and waterways of small head-drop and it’s possible to generate power at the lower head-drop canals or rivers.

The potential installation location

Water Plants, Sewerage

Waterworks and Sewerage consume more than 1% of total city power consumption, but their potential hydro energy has not been much utilized for power generation

Power Plant

Potential existence of renewable hydro energy at Cooling water discharge (Thermal / Nuclear) and Water source maintenance discharge (Hydro), etc.

Water waste treatment

Not only purification but also possible to collect hydro energy.
Renewable energy facility would be common in the factory.

River, Agricultural waterway

Current energy is the largest potential energy on Earth, does not run out.
More than 400,000km canal exists in Japan.

Corporate Structure 1

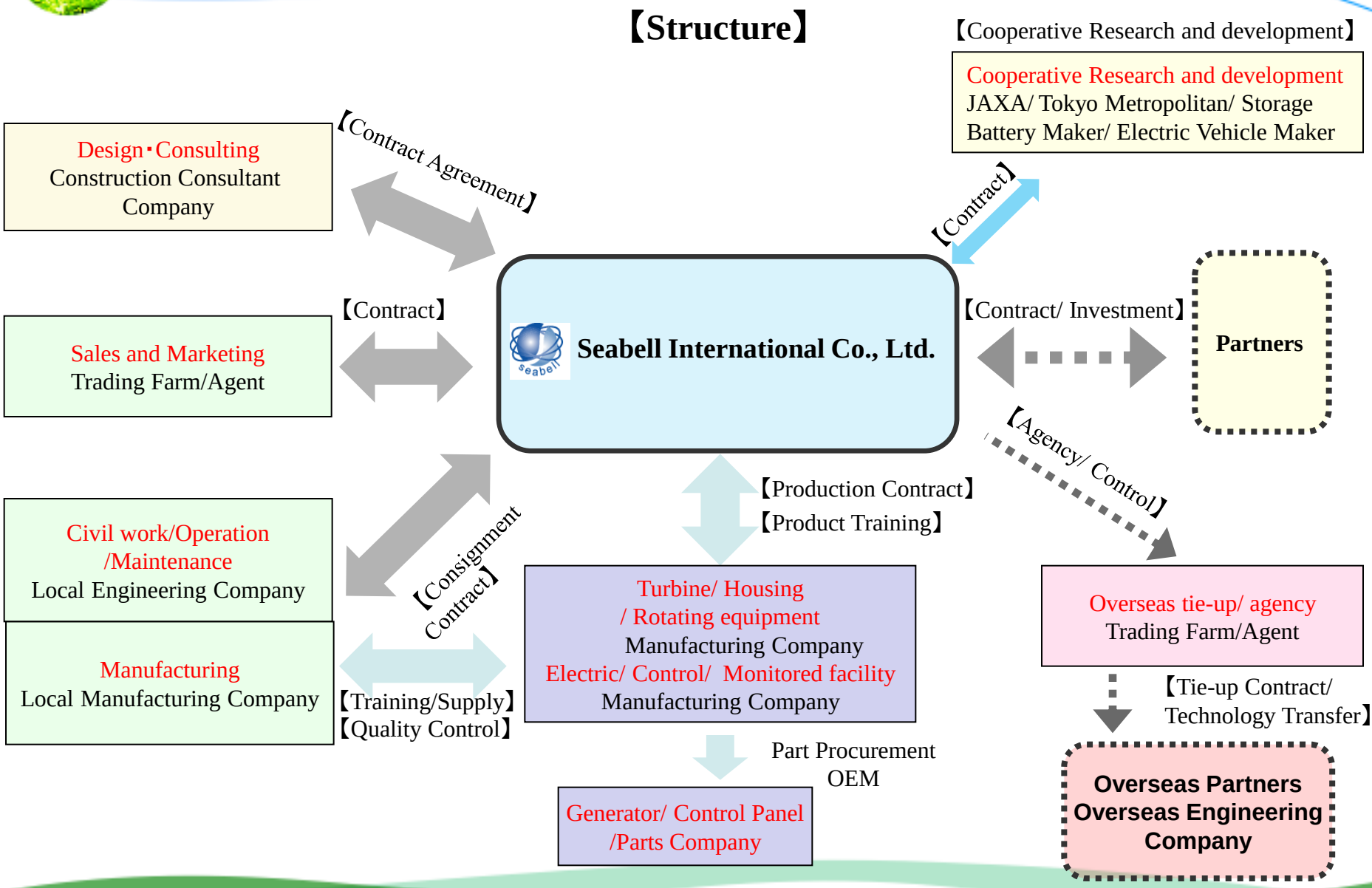
Partnership with local company for local production for local consumption

→ Technology transfer to local company
→ Training how to maintain and operate generator
→ Industry-academic-government cooperative research and development
→ Development of agricultural support and EV infrastructure

Power supply project for off grid area

→ Power supply for off grid area (ODA project)
→ Local power production for local consumption
→ No need large civil engineering work
→ Easy to install and maintain the machine

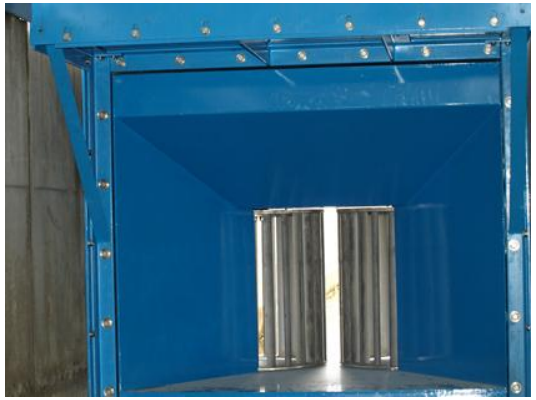
Corporate Structure 2



Installation Update1

Omono River, Akita Pref.

Customer: Ministry of Land and transportation



Date :March, 2010

Location :Omono river

Canal size: Width: 2.0m / Depth: 2.0m（no head drop, only slope） water level before installation: 0.3m

Water volume: 1.15m^3/sec water level-difference: 1.5～1.8m

Water wheel diameter: 800mm height of water wheel: 800mm actual output: 5.8kW（Maximum output 15kW）

Generating efficiency: 34%

Installation Update2

River in Urban district at Maebashi City, Gunma Pref.

Customer: Maebashi City

Date :October, 2009

Location :River in Urban district at Maebashi City

Canal size: Width: 2.0m / Depth: 1.3m（no head drop, velocity 0.5m/sec） water level before installation: 0.07m

Water volume: 0.01m^3/sec water level-difference: 0.5m

Actual output: 80-150W

Installation Update3

Ogase canal in Urban district at Hita City, Ooita Pref.

Customer: Hita City

Date :October, 2010

Location :Canal in Urban district at Hita City

Canal size: Width: 2.1m / Depth: 1.2m（no head drop, velocity 1.0m/sec） water level before installation: 0.22m

Water volume: 0.3m^3/sec water level-difference: 0.35m

Actual output: 150-300W

Installation Update4

Small stream at Niseko Town, Hokkaido Pref.

Customer: Niseko Town

Date :October, 2010

Location :small stream at Niseko town

Canal size: Width: 2.0m / Depth: 0.1-0.3m（head drop=0.5m, velocity 0.3-1.8m/sec） water level before installation: 0.2m

Water volume: 0.25m^3/sec water level-difference: 0.4m

Actual output: 200-500W

Installation Update5

Hino river, Tottori Pref.

Customer: Ministry of Land and transportation

Date :October, 2010

Location :Hino river, Tottori Pref.

Canal size: Width: 2.5m / Depth: 2.8-3.5m（no head drop） water level before installation: 0.2m

Water volume: 1.5m^3/sec water level-difference: 2.76m

Water wheel diameter: 500mm height of water wheel: 800mm actual output: 7.0kW（Maximum output 10kW）

Installation Update6

Agricultural waterway at Nasushiobara city, Tochigi Pref.

Customer: Nasushiobara City

Date :November, 2010

Location :agricultural waterway at nasushiobara city, Tochigi Pref.

Canal size:Width: 3.1m / Depth: 1.5-1.7m（head drop=1.2m, velocity 1.0-1.1m/sec） water level before installation: 0.15m

Water volume: 0.4m^3/sec water level-difference: 0.44m

Actual output: 250-700W

Installation Update7

Kanaya Town agricultural waterway at Koura Town, Shiga Pref.

Customer: Koura Town

Date :November, 2010

Location :Kanaya Twon agricultural waterway at Koura town, Shiga Pref.

Canal size: Width: 4.5m / Depth: 1.5-1.7m（no head drop, velocity 1.0-1.2m/sec） water level before installation: 0.45m

Water level-difference: 0.40m

Actual output: 500-700W

Installation Update8

Aisou Town agricultural waterway at Koura Town, Shiga Pref.

Customer: Koura Town

Date :November, 2010

Location :Aisou Town agricultural waterway at Koura town, Shiga Pref.

Canal size: Width: 0.6m / Depth: 0.6m（no head drop, velocity 0.5-0.6m/sec） water level before installation: 0.05m

Water level-difference: 0.15m

Actual output: 10-15W

Installation Update9

Nakano River at Hita City, Ooita Pref.

Customer: Hita City

Date :December, 2010

Location :Nakano River at Hita City, Ooita Pref.

Canal size: Width: 4.8m / Depth: 2.0m（no head drop, velocity 0.5m/sec） water level before installation: 0.25m

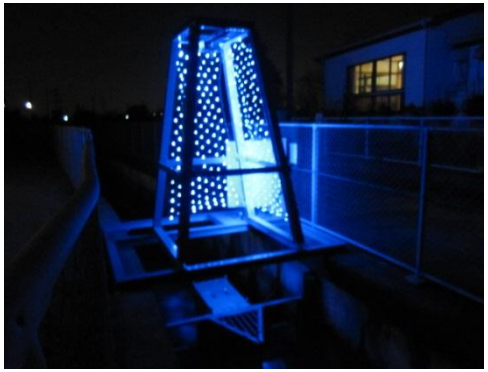
Water level-difference: 0.45m

Actual output: 350-500W

Installation Update10

Kitahirato waterway at Kumagaya City, Saitama Pref.

Customer: Kumagaya City



Date :December, 2010

Location :Kitahirato waterway at Kumagaya City, Saitama Pref.

Canal size: Width: 2.3m / Depth: 1.8m（no head drop, velocity 0.3m/sec） water level before installation: 0.1m

Water level-difference: 0.2-0.4m

Actual output: 10-165W

Installation Update11

Waterway at Kimobetsu Town, Hokkaido Pref.

Customer: Kimobetsu Town

Date :December, 2010

Location :Waterway at Kimobetsu Town, Hokkaido Pref.

Canal size: Width: 5.2m / Depth: 1.8m（no head drop, velocity 1.2-1.3m/sec） water level before installation: 0.15m

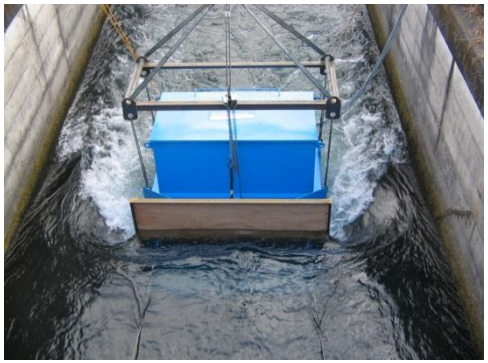
Water level-difference: 0.2-0.4m

Actual output: 50-120W

Installation Update12(Demonstration)

Waterway at Imaichi City, Tochigi Pref.

Customer: Imaichi City



Date :January, 2009

Location :Waterway at Imaichi City, Tochigi Pref.

Canal size: Width: 4.5m / Depth: 3.5m（no head drop, velocity 1.5-1.6m/sec） water level before installation: 1.5m

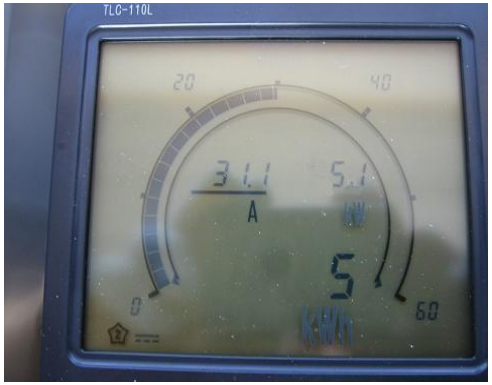
Water level-difference: 0.4m

Actual output: 1.3-1.6kW

Installation Update13(Demonstration)

Agricultural Waterway at Kangae City, Yamagata Pref.

Customer: Kangae City



Date :January, 2009

Location :Agricultural Waterway at Kangae City, Yamagata Pref.

Canal size: Width: 2.2m / Depth: 2.0m（head drop: 0.5m, velocity 1.6m/sec） water level before installation: 0.35m

Water level-difference: 1.1m

Actual output: 5.0-5.3kW

Installation Update14(Cooperative Research)

Agricultural Waterway at Tsuru City, Yamanashi Pref.

Customer: Tsuru City

Date :April, 2008

Location :Agricultural Waterway at Tsuru City, Yamanashi Pref.

Canal size: Width: 2.5m / Depth: 1.5m（no head drop, velocity 1.7m/sec） water level before installation: 0.25m

Water level-difference: 0.8m

Actual output: 0.5-1.2kW

Installation Update15

Agricultural Waterway at Seoul City, Korea

Customer: Seoul City

Date :May, 2009

Location :Agricultural Waterway at Seoul City, Korea

Canal size: Width: 25m / Depth: 2.5m（no head drop, velocity 1.5m/sec） water level before installation: 2.0m

Water level-difference: 0.2-0.3m

Actual output: 0.6-1.0kW

List of supply (sales starts from October, 2009)

Status	Installation location	Installation Date	Customer	Spec.
Installed	Baba River at Maebashi City, Gunma Pref.	October, 2009	Maebashi City	Rated Output 0.3kw（Off-Grid） Diameter of water wheel 300㎜ Single Turbine
Installed	Omono River, Akita Pref.	March, 2010	Ministry of Land and transportation	Rated Output 8kw（Grid） Diameter of water wheel 800㎜ Dual Turbine
Installed	Secondary River at Niseko Town, Hokkaido	September, 2010	Niseko Town	Rated Output 1kw（Off-Grid） Diameter of water wheel 400㎜ Dual Turbine
Installed	Ogase cannal at Hita city, Ooita Pref.	September, 2010	Hita City	Rated Output 1kw（Off-Grid） Diameter of water wheel 400㎜ Dual Turbine
Installed	Hino River , Tottori Pref.	October, 2010	Ministry of Land and transportation	Rated Output 10kw（Grid） Diameter of water wheel 500㎜ Dual Turbine
Installed	Secondary River at Nasushioraba City, Tochigi Pref.	November, 2010	Nasushiobara City	Rated Output 1kw（Off-Grid） Diameter of water wheel 400㎜ Dual Turbine
Installed	Secondary River at Koura Town, Shiga Pref.	November, 2010	Koura Town	Rated Output 1kw（Off-Grid） Diameter of water wheel 400㎜ Dual Turbine
Installed	Secondary River at Hikone City, Shiga Pref.	November, 2010	Hikone City	Rated Output 0.5kw（Off-Grid） Diameter of water wheel 400㎜ Single Turbine
Installed	Secondary River at Kumagaya City, Saitama Pref.	November, 2010	Kumagaya City	Rated Output 0.5kw（Off-Grid） Diameter of water wheel 400㎜ Single Turbine
Installed	Canal at Kimobetsu Town, Hokkaido	November, 2010	Kimobetsu Town	Rated Output 0.5kw（Off-Grid） Diameter of water wheel 400㎜ Single Turbine
Contracted	Yoshino River, Tokushima Pref.	February, 2011	Ministry of Land and transportation	Rated Output 2kw（Grid） Diameter of water wheel 300㎜ Single Turbine
Contracted	Yodo River, Oosaka Pref.	February, 2011	Ministry of Land and transportation	Rated Output 10kw（Grid） Diameter of water wheel 500㎜ Dual Turbine
Contracted	Yada River at Maebashi City, Gunma Pref. EV Prug-in station	December, 2010	Maebashi City	Rated Output 0.3kw（Grid） Diameter of water wheel 400㎜ Single Turbine

（Practical Application1）Plug-in station for electric vehicle

Replaceable Battery Charger

Small Hydro Stream EV plug-in station

EV plug-in station

local production for local consumption type smart village concept

Infrastructure for EV
Small Hydro Stream EV plug-in station

Delivery truck

Mailman’s car

Farm truck

EV（battery charger type)

EV(charging type)

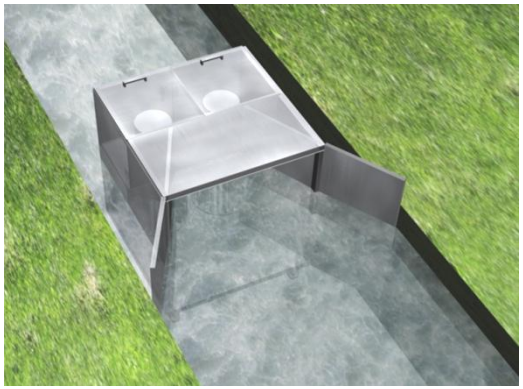
（Practical Application2）Mobile hydro power generator for emergency

Joint research agreement with JAXA(Japan Aerospace Exploration Agency) in April, 2010

Simple installation

Disaster

Blackout, channel explosion, infrastructure collapse



Mobile emergency power at the disaster area

Simple water cleaner

lamp

medical appliance

Cell phone

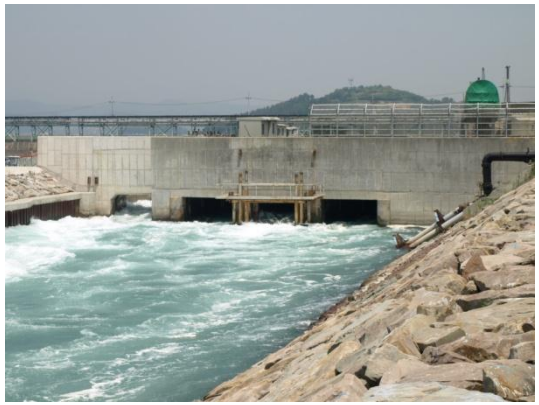
Satellite phone

Antenna

（Practical Application3）Waterway of cooling water at Thermal plant & Nuclear plant

Thermal Plant & Nuclear Plant

Waterway of cooling water



Simulation

Simulation for installation of STREAM at the Thermal Plant waterway

Condition: Water Volume 50 m^3/sec, Water level-difference more than 2.0m

1. Supposed Output: 30-50kW type STREAM(10 m^3/sec for each machine)
2. Numbers of machine: n = 50m^3/sec / 10m^3/sec per machine
   = 5 machines of 40kW type
3. Supposed annual output: W = 40(kW)*5(STREAM)*365(days)*23(hours)
   *95%(efficiency) = 1,664MW

1,664MW corresponds to the output from 2 or 3 large wind-power generations or 3000kW of Solar energy generation.

International conventions / Official commendations

■ Ministry of Economy, Trade and Industry

- Presentation and Round table discussion at APP
  Asia Pacific Partnership on Clean Development and Climate Task Force Meeting
- Clean Energy Expo Asia in Singapore (December, 2010)

■ Prize

- Venture Technology Grandpre of Tokyo 2008 - Prize of Excellence
- Yokohama Business Grandpre 2009 - Judge special prize
- 58th Kawasaki Entrepreneur Audition - Kawasaki business plan prize
- Tokyo Small-Middle Enterprise Support Fund
- Mitsubishi-UFJ Technology Development Foundation

■ Oversea Exhibition

- TOKYO SHOWCASE 2009 Germany, UK
  Tokyo Labor Bureau
- TOKYO SHOWCASE 2011 Germany, UK
- WORLD FUTURE ENERGY SUMMIT2009 Japan Pavilion

Examples of Appearance in Mass Media

Introduced as New Small Hydro Generation system

Gaia no Yoake

NHK-WORLD

World Business Satellite

Nikkei CNBC

Corporate Profile

Seabell International Co., Ltd.

Established	March, 2004
Office	2-8-11 Mansan Bld 4F, Higashikanda, Chiyoda-ku, Tokyo, Japan
TEL/FAX	03-5822-2275 / 03-5822-2274
Capital	95,500,000 yen
Employees	10
Industry	Environment & New Energy Environmental consulting, designing, and proposal
Technology & Products	1. Small/Micro Hydropower Generation Systems development Patent No. 4022244 Current Micro Hydropower Turbine STREAM Completing PCT application (International)PCT/JP 2008/056763 2. Renewable Energy Related Technology Research and Development 3. Small/Micro Windpower Generating Systems Development
Sales Agent	EBARA JITSUGYO Co., Ltd. Fujikizai Co., Ltd. Sinfonia Technology Co., Ltd. Meikyo Electronics Co., Ltd. Seika Corporation
Manufacturing Contract	(Body) Nakayama Iron Works Ltd. (Turbine) Sinfonia Technology (Control Panel) Meikyo Electronics / INTEGRA

Thank You

Seabell International Co., Ltd.

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