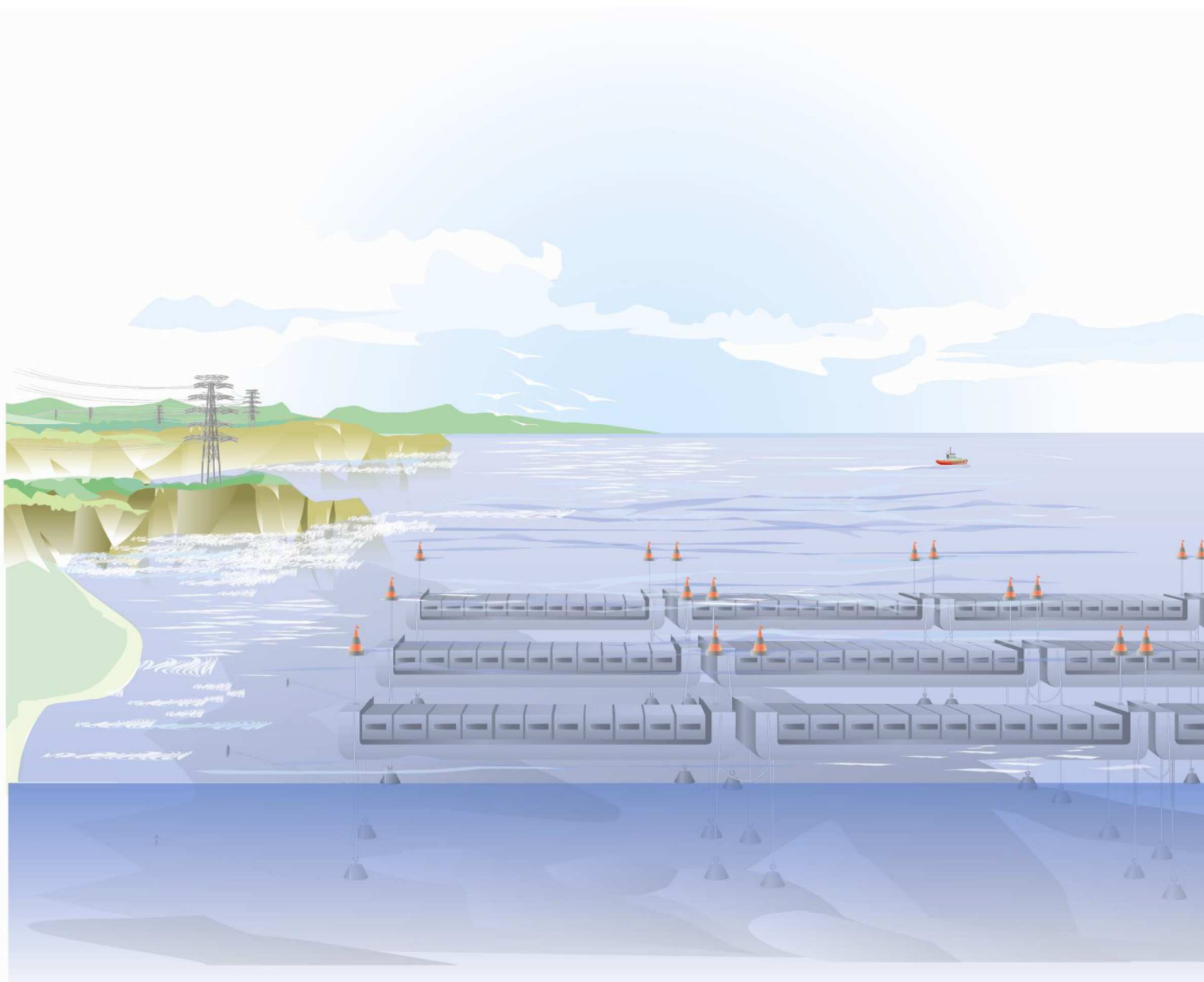


Ocean Current Energy in the U.S - Creating hydrogen product industry (Strategy for the U.S Clean Energy)

By *KUMANO*



Contribute to Health & Environment
Japan Health Care Co.,Ltd.

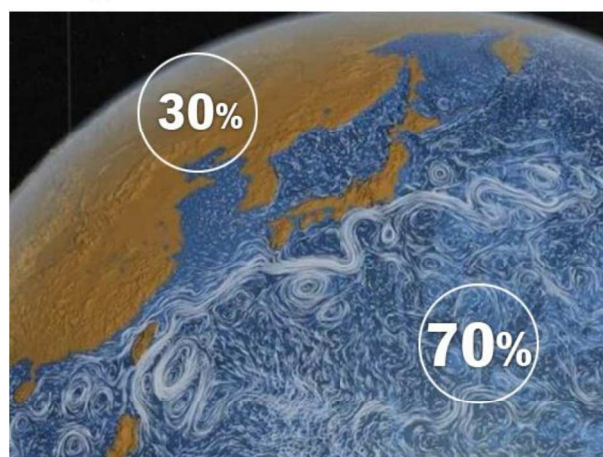
1. Introduction - Why do we need ocean current energy now? -

Humans took place the Industrial Revolution in 19th century, in which they had started using coals. Coals are accretions of energy that the solar energy has accumulated for several hundred million years to billion years. That is, coals are solids accumulated by photosynthesis by the solar energy, and are organic materials (plants) grown by carbon dioxide and water. 19th century exactly was the era of coals, and during this era, people used the accretions (stock) of the solar energy accumulated taking a long time. In 20th century, humans found oil and developed the industries much further with internal combustion energy (engines) that is also used with oil. The oil, same as coals, is liquid that is made from organic materials accumulated by the solar energy taking several hundred million years to billion years. Thus, 20th century is the era of oil as well as using the solar energy that had been accumulated for a long time.

However; in 19th and 20th century, people used too much of the accretions (stock) of the solar energy, and it led the concentration of CO₂ gas increase and caused global warming. For this reason, it can be said that 21st century is the century that we use only yearlong solar energy (flow) without using the accumulated solar energy. Thus, our society is asked to shift to recyclable energy as; biomass energy, which changes plants that are grown by energy that the sun supplies to the earth within a year, to fuel, solar power generation that changes the solar energy itself to electric energy, air flow generated by various solar heat distribution, that is wind power generation operated by wind, the solar energy warms the sea surface, evaporated moisture becomes rain, and hydroelectric power generation using energy of river, which is created by the rain, and so on.

Although there are these necessities, regarding the solar energy that is currently developed, only about 30% that is supplied to the earth is actually used. 70% of solar energy that is supplied to oceans is not used at all. This solar energy is motion of sea water caused by difference of temperature distribution that is energy of ocean current.

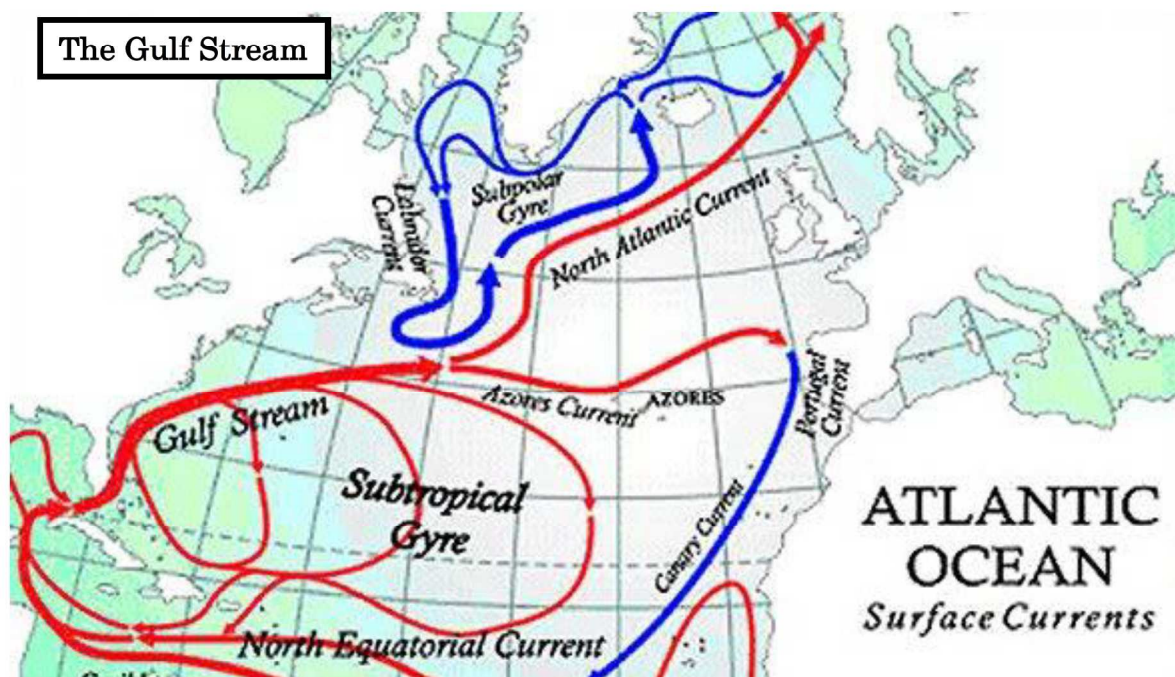
By the ocean current, it would be possible to generate electric power that is more than 500 times of wind power. This is because the mass of sea water is approximately 1,000 times larger than of the air's as well as there are many more locations that are available for the ocean current energy than for wind power.



[Fig.1]

2. The world's largest ocean energy is forthcoming to FL, SC, and NC

The Gulf Stream which is the largest current in the world, is currently forthcoming to the USA. In the United States, the Gulf Stream is running around the states of Florida, South Carolina, and North Carolina. These three states also own the largest sea area (ocean current energy).



[Fig. 2]

3. Inexpensive electric power generation by the Gulf Stream

Main purpose points of ocean current energy are: firstly, generating electric power with lower cost; and secondly, saving and transporting the electric energy efficiently. In order to decrease the cost by ocean current energy, since the production of electricity increases in proportion to cube of current speed, it needs to install electric generating equipment with efficient power generation inexpensively to sites where the fastest Gulf Stream is confirmed.

We, Japan System Planning Co., Ltd. (JSP), have invented an underwater power generator with special wings, which has electric power generation efficiency (Japan patent: No. 4808799). We also have developed a method for installing the power generator with lower cost to sites where the fastest current runs (Japan patent: No. 4422789). The next necessities are saving and transporting the generated electric energy.

4. Chronicle of the development of the KUMANO system of special wing underwater power generator

- - Confirming: installation channels, drainage channels, and basic points of special wing water wheels on *KUMANO*
 - A test at upper stream of the Arakawa river with a permission from Ministry of Land, Infrastructure, and Transport (In 2009, Fig. 3)
- *KUMANO*'s position stabilization submerged tests (Experiment using a water flow pool at JSP)
- - An increase flow speed test using an oblique board at a driving channel
 - A test at the Musashi channel with a permission from Incorporated-Administrative Agency Japan Water Agency (In 2011, Fig. 4)
 - Confirmed quantity of water flowed to the flow channel increased by adjusting the angle of the driving channel on *KUMANO*.
- Test on improving the efficiency of water wheel number of revolution by adjusting the angle of special wings of *KUMANO* National Maritime Research Institute (In 2012, Fig. 5)
- Test on varying flow speed and improving power generating efficiency of *KUMANO* Akishima Laboratory (Mitsui Shipbuilder) Inc. (In 2014, Fig. 6)

To the theoretical value of the largest production of generating electricity 162.8W as flow speed 1.7m/s; with load resistance 300Ω, recorded 50.5W generated power and achieved an efficient production of electricity that is 31% of the theoretical value.

- Operating Test of *KUMANO* under water



Fig. 3. Test at Arakawa River (2009)



Fig. 4. Test at Musashi Channel (2011)



Fig. 5.
Test at National Maritime Research Institute; using a large water tank (2012)



Fig. 6.
Test at Akishima Laboratory (Mitsui Zosen) Inc. (2014)

5. Installing the KUMANO power generator into the sea



Fig. 7.
Image of transporting the KUMANO power generator

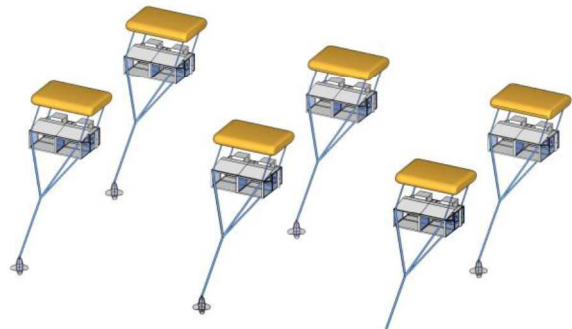
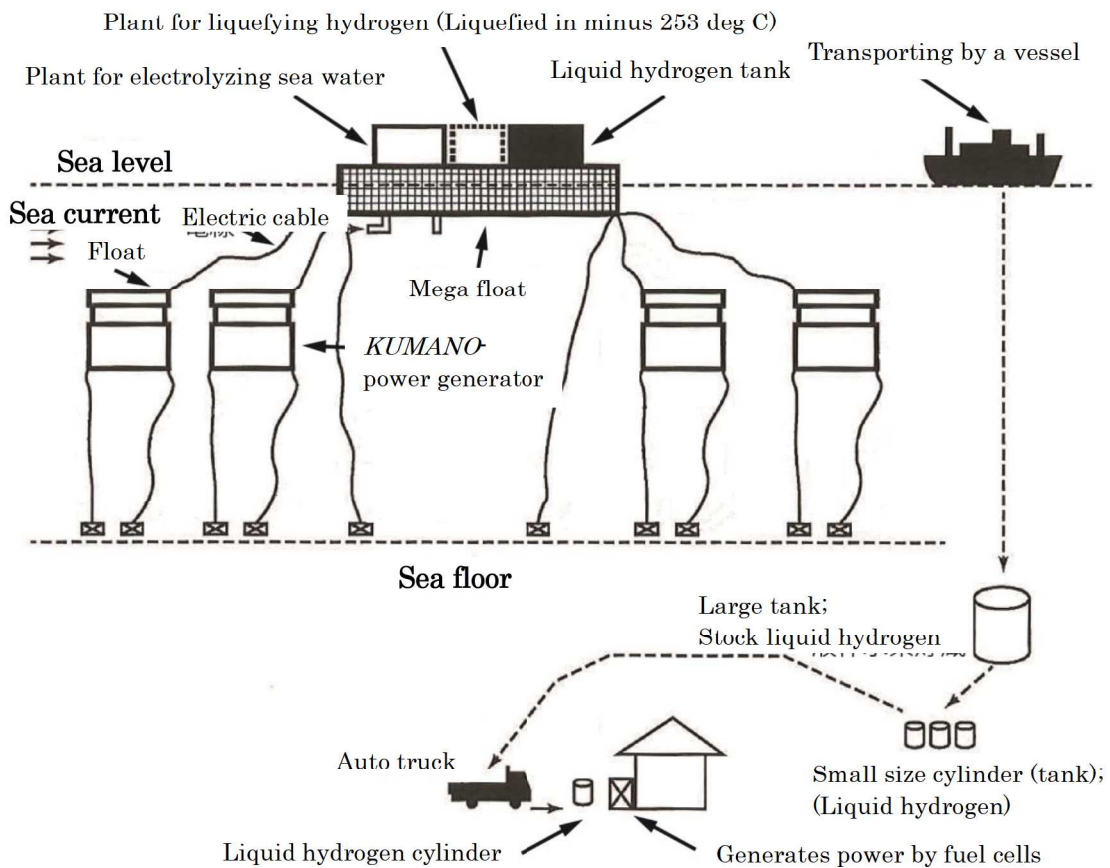


Fig. 8.
Image of the KUMANO power generator installed in the sea by cheap cost

6. Producing hydrogen by the Gulf Stream power generation

It is impossible to send low voltage electricity, which is generated in the ocean far from lands, through transmission lines because the electric transmission loss is large. Also, if this electricity is conserved, cost for batteries would be high and uneconomical. We have invented a technology that utilizes generated low voltage electricity, electrolyzes sea water very efficiently, and generates hydrogen (patent pending). By this technology, if hydrogen is produced by the sea water electrolysis and liquefied, conserved, and transported inexpensively; it would be possible to create a huge energy industry in the three states of Florida, South Carolina, and North Carolina.

[Fig. 9]

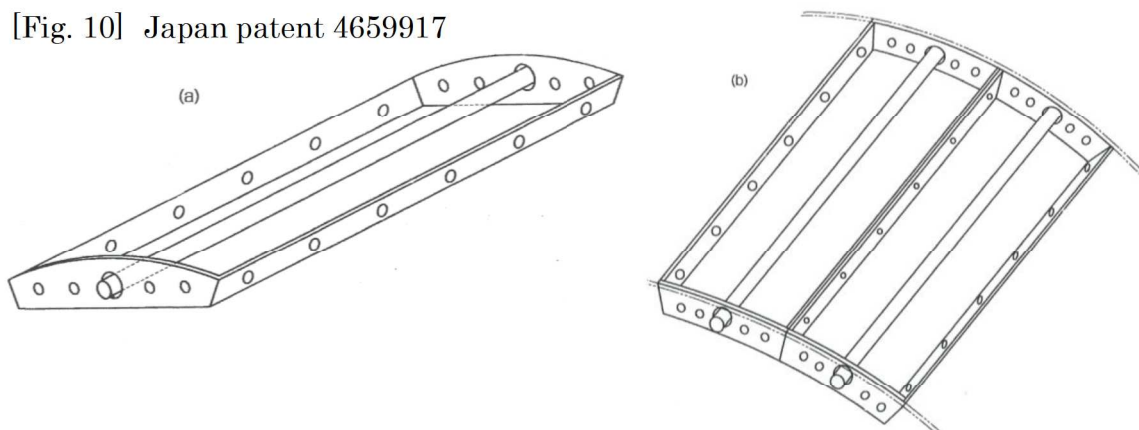


7. New industries grown in the U.S (Plants and Employment)

① Ocean current energy device manufacturing plant (The KUMANO power generator)

The KUMANO power generator cuts down manufacturing cost as much as it can and enhances production efficiency; this is because most of the works can be completed by assembling parts (Fig. 10; Japan patent No. 4659917). Taking advantage of existing technologies and manpower in the U.S, it will lead to employment opportunities for many ten thousand people.

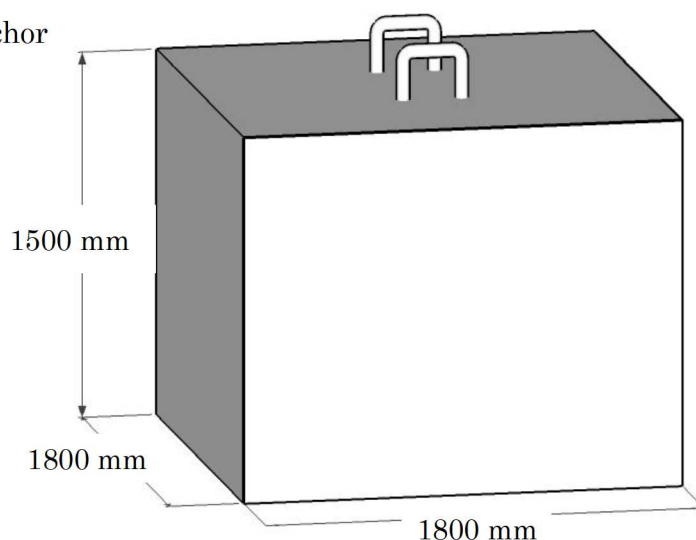
[Fig. 10] Japan patent 4659917



② Anchor manufacturing plant

Anchors that fix the KUMANO power generator in the sea are made of concrete. Employment for several thousand people at dedicated plants are expected.

[Fig. 11] Anchor



③ Wire manufacturing plant

Special nylon wires connect the anchors fixed on the sea floor and the KUMANO power generator. Employment for many hundreds of people at dedicated plants are expected.

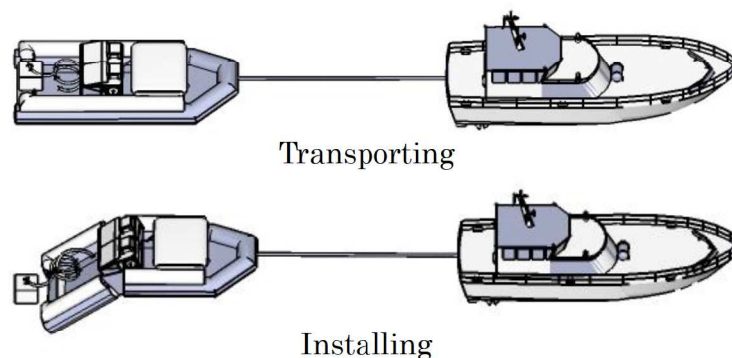
[Fig. 12] Wire



④ Power generator installation

The KUMANO power generator will be installed in the sea by a dedicated company. Employment for several thousand people by establishing a maintenance management company is expected.

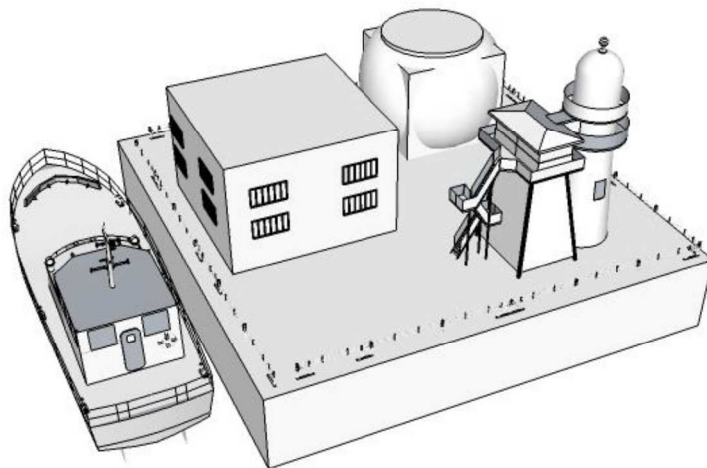
[Fig. 13] Installed by sliding down out of a boat to the sea



⑤ Plant for electrolyzing sea water (hydrogen production)

Operations of sea float(s) for electrolysis, plant(s) for liquefying hydrogen, and sea float plant(s) for hydrogen conservation are expected to lead to employments for many thousand people.

[Fig. 14]



End of report

The U.S Patents on the Ocean Current Power Generation
Obtained by Japan System Planning Co., Ltd.

I have obtained the following Patents in the U.S about my technology on the ocean current power generation.

【INDEX】

<i>Patent No.</i>	<i>Proprietary Name</i>	<i>Date of Patent</i>
US 8,575,771 B2	INSTALLATION STRUCTURE FOR HYDROELECTRIC POWER GENERATION APPARATUS	November 5, 2013
US 8,702,392 B2	WATER WHEEL IMPELLER BLADE TYPE POWER GENERATION	April 22, 2014
US 8,794,904 B2	WATER WHEEL IMPELLER BLADE TYPE ELECTRIC POWER GENERATION APPARATUS	August 5, 2014
US 9,103,314 B2	WATER WHEEL IMPELLER BLADE TYPE ELECTRIC POWER GENERATION APPARATUS	August 11, 2015



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of
America



The Director of the United States
Patent and Trademark Office

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

United States Patent

Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America, and if the invention is a process, of the right to exclude others from using, offering for sale or selling throughout the United States of America, or importing into the United States of America, products made by that process, for the term set forth in 35 U.S.C. 154(a)(2) or (c)(1), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b). See the Maintenance Fee Notice on the inside of the cover.

Sean Stewart Lee

Deputy Director of the United States Patent and Trademark Office



US0085771B2

(12) United States Patent
Kumano

(10) Patent No.: US 8,575,771 B2
(45) Date of Patent: Nov. 5, 2013

(54) INSTALLATION STRUCTURE FOR HYDROELECTRIC POWER GENERATION APPARATUS

2006/0266038 A1 11/2006 Krosne
2008/0258467 A1* 10/2008 Wilson et al. 29034
2009/0134623 A1* 5/2009 Krosne 29043

(75) Inventor: Katsuyuki Kumano, Tokyo (JP)
(73) Assignee: Japan System Planning Co., Ltd., Tokyo (JP)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 16 days.

(21) Appl. No.: 12/849,554
(22) Filed: Aug. 3, 2010

* cited by examiner

(65) Prior Publication Data
US 2011/0025069 A1 Feb. 3, 2011

Primary Examiner — Julio Gonzalez R.
(74) Attorney, Agent, or Firm — Tracy M. Heims; Apex Juris, PLLC

(30) Foreign Application Priority Data
Aug. 3, 2009 (JP) 2009-180256

(57) ABSTRACT

An installation structure for a hydroelectric power generation apparatus, includes: a power generation apparatus accommodation frame body in which a plurality of hydroelectric power generation apparatuses are accommodated in parallel; a first wire having one end connected to a lower portion of the power generation apparatus accommodation frame body; an anchor or weight connected with the other end of the first wire; a buoyancy body provided on an upper side of the hydroelectric power generation apparatus accommodation frame body through the second wire, the hydroelectric power generation apparatus accommodation frame body having an upper side opened, and having a dividing plate between both side plates to form a plurality of power generation apparatus accommodation units, each of the plurality of power generation apparatus accommodation units having a running water inlet side window formed at a front portion, and having a running water outlet side window formed at a rear portion.

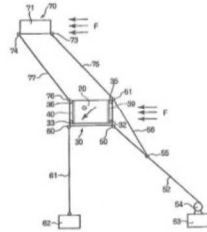
(51) Int. Cl. F03B 13/00 (2006.01)
H02P 9/04 (2006.01)

(52) U.S. CL. 290/43, 290/54

(58) Field of Classification Search
USPC 290/42, 53, 43, 54; 60/398, 641.7, 60/641.6, 415/3.1, 210.1; 405/75; 416/85, 416/191, 192
See application file for complete search history.

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2 Claims, 6 Drawing Sheets

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Michelle K. Lee

Deputy Director of the United States Patent and Trademark Office



US008702392B2

(12) United States Patent
Kumano

(10) Patent No.: US 8,702,392 B2
(45) Date of Patent: Apr. 22, 2014

(54) WATER WHEEL IMPELLER BLADE TYPE POWER GENERATOR

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(75) Inventor: Katsuyuki Kumano, Tokyo (JP)
(73) Assignee: Japan System Planning Co., Ltd., Tokyo (JP)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1315 days.

* cited by examiner

(21) Appl. No.: 12/483,171

Primary Examiner — Ninh H Nguyen
(74) Attorney, Agent, or Firm — Tracy M. Heims; Apex Juris, PLLC

(22) Filed: Jun. 11, 2009

(65) Prior Publication Data
US 2009/0309368 A1 Dec. 17, 2009

(57) ABSTRACT

To surely erect impeller blades at the forward movement side thereof by a rotor and, further, to surely push down these impeller blades at the backward movement side thereof by a rotor. By providing a fluid passage frame body 21 above a rotor 10 to form a fluid passage 20, rotatably disposing impeller blades 15 on rotor 10, forming a fluid receiving part 15a and a stopper part 15b shorter than this fluid receiving part into an L shape, and disposing stopper part 15b on the side of fluid receiving part 15a receiving fluid pressure from fluid passage 20 such as to maintain fluid receiving part 15a in an erected position. An impeller blade erecting passage pipe 30 is formed on rotor 10 such that the diameter of one end thereof 30a is larger than the diameter of the other end thereof 30b. An inclined plate 31 and an impeller blade downward passage pipe 32 is provided on the outlet side of fluid passage 20, this impeller blade downward passage pipe 32 formed such that one end thereof 32a on the inclined plate 31 side has a larger diameter than the other end thereof 32b on an impeller blade passage frame body 22.

(30) Foreign Application Priority Data
Jun. 11, 2008 (JP) 2008-152384
Apr. 23, 2009 (JP) 2009-104591

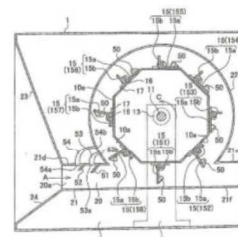
(51) Int. Cl. F03B 3/12 (2006.01)

(52) U.S. CL. 416/119

(58) Field of Classification Search
USPC 416/111, 112, 117, 119; 290/43, 54
See application file for complete search history.

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2 Claims, 14 Drawing Sheets



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Deputy Director of the United States Patent and Trademark Office



US008794904B2

(12) United States Patent
Kumano

(10) Patent No.: US 8,794,904 B2
(45) Date of Patent: Aug. 5, 2014

(54) WATER WHEEL IMPELLER BLADE TYPE ELECTRIC POWER GENERATING APPARATUS

(75) Inventor: Katsuyuki Kumano, Tokyo (JP)
(73) Assignee: Japan System Planning Co., Ltd., Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 623 days.

(21) Appl. No.: 13/101,399
(22) Filed: May 5, 2011

(65) Prior Publication Data
US 2011/0272946 A1 Nov. 10, 2011

(30) Foreign Application Priority Data
May 5, 2010 (JP) 2010-106054
May 17, 2010 (JP) 2010-112732
Jul. 29, 2010 (JP) 2010-170678

(51) Int. Cl. (2006.01)
F03B 3/12 (2006.01)
U.S. Cl. 415/7, 415/224, 416/86, 416/111, 416/119, 416/197 A

(58) Field of Classification Search
CPC F03B 17/065
USPC 415/7, 224, 416/84, 111, 119, 197 A, 416/86, 200/43, 54
See application file for complete search history.

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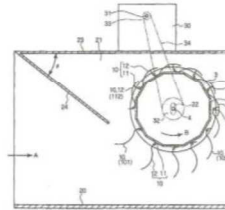
* cited by examiner

Primary Examiner — Ninh H Nguyen
(74) Attorney, Agent, or Firm — Wenderoth, Lind & Ponack, L.L.P.

(57) ABSTRACT

A water wheel impeller blade type electric power generating apparatus with which, on the forward motion side, the hydraulic pressure applied to the impeller blade is reduced, and the mud, sand, dirt, and the like will not be collected into the water wheel. The impeller blade is rotatably disposed on the rotor, and has a stopper part and a fluid receiving part extending from this stopper part and being longer than the stopper part, the fluid receiving part being provided with a length large enough that when the impeller blade is thrust down the fluid receiving part covers the stopper part of an adjacent impeller blade. To a top plate containing a frame body of the apparatus, a fluid guide plate inclined inward being fixed for guiding the fluid to the impeller blades positioned under the rotating shaft of the rotor.

7 Claims, 11 Drawing Sheets



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Michelle K. Lee

Director of the United States Patent and Trademark Office



US009103314B2

(12) United States Patent
Kumano

(10) Patent No.: US 9,103,314 B2
(45) Date of Patent: Aug. 11, 2015

(54) WATER WHEEL IMPELLER BLADE TYPE ELECTRIC POWER GENERATING APPARATUS

(75) Inventor: Katsuyuki Kumano, Tokyo (JP)
(73) Assignee: JAPAN SYSTEM PLANNING CO., LTD., Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 553 days.

(21) Appl. No.: 13/427,020
(22) Filed: Mar. 22, 2012

(65) Prior Publication Data
US 2012/0243987 A1 Sep. 27, 2012

(30) Foreign Application Priority Data
Mar. 24, 2011 (JP) 2011-065957

(51) Int. Cl. (2006.01)
F03B 3/12 (2006.01)
U.S. Cl. F03B 17/06 (2006.01)

(52) CPC F03B 17/067 (2013.01); F05B 22/00 (2013.01); Y02E 10/223 (2013.01); Y02E 10/28 (2013.01); Y02E 10/38 (2013.01)
(58) Field of Classification Search
CPC F03B 3/121; F03B 17/067; F05B 22/0013; Y02E 10/28; Y02E 10/223; Y02E 10/38
USPC 415/191, 7, 224, 906, 208, 1; 416/84, 416/119, 197 A, 243
See application file for complete search history.

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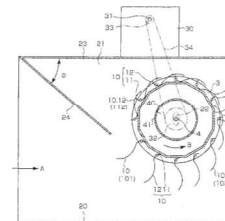
Office Action issued Jun. 14, 2012 in corresponding Japanese Patent Application No. 2011-065957 with partial English translation.
(Continued)

Primary Examiner — Dwayne J White
Assistant Examiner — William Grigos
(74) Attorney, Agent, or Firm — Wenderoth, Lind & Ponack, L.L.P.

(57) ABSTRACT

A water wheel impeller blade type electric power generating apparatus including a rotating shaft for transmitting motive power to a power generator, a rotor fixed to the rotating shaft, an impeller blade provided on the outer periphery of the rotor to receive a flow of fluid for rotating the rotor, and a fluid guide plate inclined from above to below the rotor so as to guide the fluid to the impeller blades located on a lower portion of the rotor. The impeller blade is rotatably disposed on the rotor, a fluid receiving part and a stopper part shorter than the fluid receiving part are formed, the fluid receiving part is disposed in the upstream direction of the fluid in a fluid passage, and a bearing which rotatably supports the rotating shaft is provided on the outer periphery of the rotor.

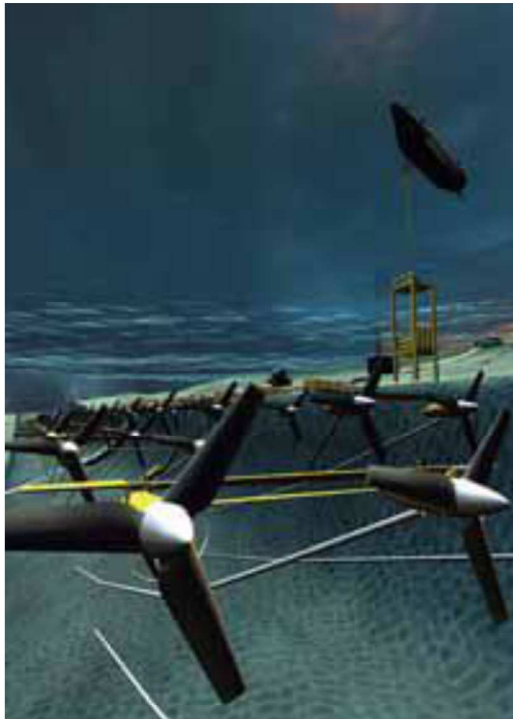
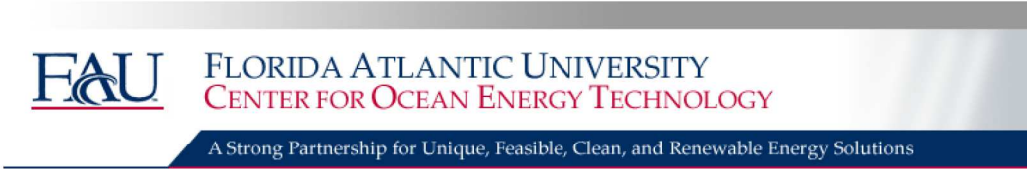
2 Claims, 5 Drawing Sheets



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Japan Health Care Co., Ltd.

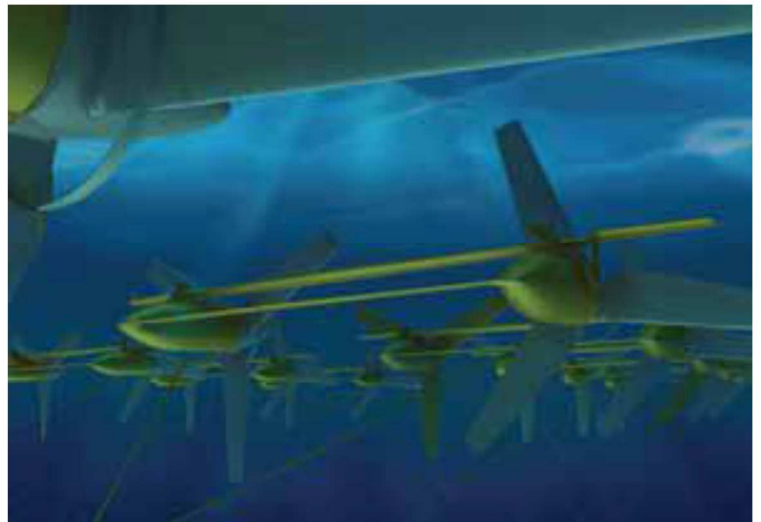
[Ex.] Unsuccessful efforts so far on the ocean current power generation by other party

1. Florida Bay, USA

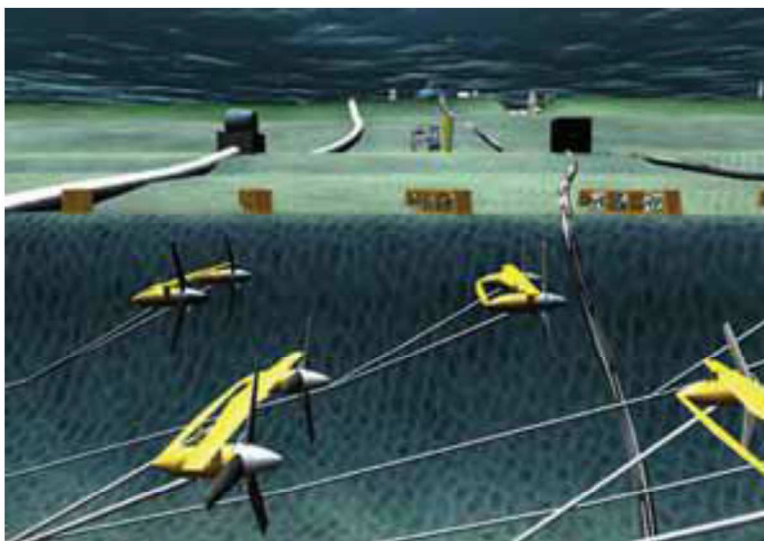


Energy Independence

(Courtesy FAU Florida Center for Electronic Communications)



(Courtesy FAU Florida Center for Electronic Communications)



Vibrant New Industry

(Courtesy FAU Florida Center for Electronic Communications)

<http://coet.fau.edu/?p=mission>



Contribute to Health & Environment
Japan Health Care Co.,Ltd.



BLUE ENERGY **TIDAL POWER**

Green Energy Tidal Power



There are basically two methodologies for creating tidal power: the use of tidal dams or ocean currents. Dams are based on using a barrage at a bay or estuary with a large tidal range. Power is generated primarily at ebb tides as the barrage creates a significant head of water, much like a hydroelectric dam. This technology is very well established at La Rance, France where a 240MW plant has operated since 1966. A 20MW facility has also been present in Annapolis, Nova Scotia since 1984. However, estuaries are amongst the world's most productive and sensitive ecosystems, and the flooding by these barrages causes a great disruption to their natural processes. In the context of ocean energy, barrage based tidal power is not considered a truly sustainable resource.

The sources of Blue Energy's tidal power production are fast flowing tidal currents. The gravitational pull of the moon causes water to flow in from the ocean twice a day on the flood tides, and outward during ebb tides. Additional monthly and annual lunar cycles vary the strength of these currents. Narrow and shallow constrictions produce the fastest and most powerful movements of current, whose energy can be harnessed using the Blue Energy Ocean Turbine. This energy source is independent of weather and climate change and follows the predictable relationship of the lunar orbit that is known many years in advance.



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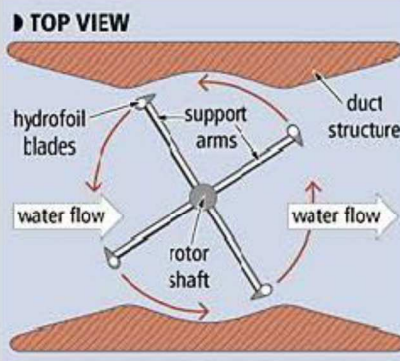
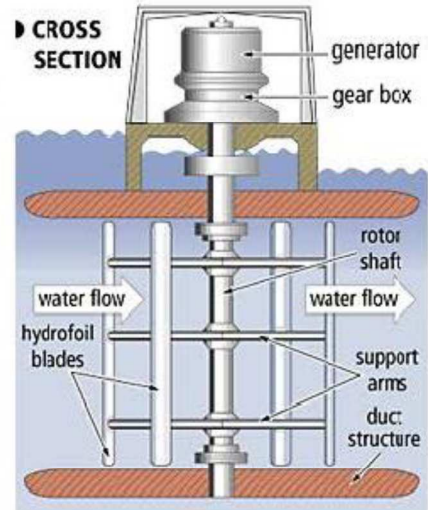
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Blue Energy Technology

The Blue Energy ocean turbine acts as a highly efficient underwater vertical-axis windmill and has several remarkable advantages conferred upon it arising from the following basic science: Sea water is 832 times more dense than air, and it is a non-compressible medium, therefore an 8-knot tidal current provides the equivalent force of a 390 km/hr wind (approximately). Developed by veteran aerospace engineer Barry Davis, the Blue Energy vertical-axis turbine represents two decades of Canadian research and development. Four fixed hydrofoil blades of the turbine are connected to a rotor that drives an integrated gearbox and electrical generator assembly. The turbine is mounted in a durable concrete marine caisson which anchors the unit to the ocean floor, directs flow through the turbine further concentrating the resource supporting the coupler, gearbox, and generator above it. These sit above the surface of the water and are readily accessible for maintenance and repair. The hydrofoil blades employ a hydrodynamic lift principal that causes the turbine foils to move proportionately faster than the speed of the surrounding water. Computer optimized cross-flow design ensures that the rotation of the turbine is unidirectional on both the ebb and the flow of the tide.

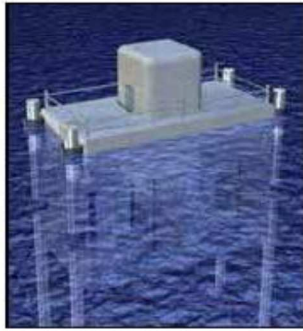


The design of the Blue Energy Ocean Turbine requires no new construction methodology, it is structurally and mechanically straightforward. The transmission and electrical systems are similar to thousands of existing hydroelectric installations. Power transmission is by submersible KV DC cabling and safely buried in the ocean sediments with power drop points for coastal cities and connections to the continental power grid. A standardized high production design makes the system economic to build, install and maintain.

The Blue Energy Ocean Turbine can be arranged in four distinct and flexible platforms:



Micro Power System - This is a 5 to 25kW assembly to service the remote domestic consumer.



Midrange Power System - Using two 250kW Blue Energy ocean turbines, this unit will be off-grid competitive initially, and grid competitive within three to four years time. Suitable for use in remote communities, industrial sites, and resorts in regions with net metering policies or dependence on costly and polluting diesel generation.



Blue Energy Power System - For large scale power production, multiple turbines are linked in series to create a tidal fence across an ocean passage or inlet. These are large scale, site specific, custom engineered energy installations which will vary in size and output by location. These structures have the added benefit as a [transportation](#) solution.



Mega Power System - A scaled-up version of the Blue Energy Power System, the mega class is a tidal fence capable of producing thousands of megawatts of power. These tidal fences can be many kilometers long and can operate in depths of up to 70 metres.

To date, six [prototypes](#) of the turbine have been built and tested under the auspices of the National Research Council of Canada and independent [assessments](#) have verified feasibility.

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Marine Current Turbines

Turning the tide

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Technology

The technology developed by Marine Current Turbines Ltd works much like submerged windmills, but driven by flowing water rather than air. They can be installed in the sea at places with high tidal current velocities, or in places with fast enough continuous ocean currents, to take out copious quantities of energy from these huge volumes of flowing water.

The technology under development by MCT is known as "SeaGen" and consists of twin axial flow rotors of 15m to 20m in diameter (the size depending on local site conditions), each driving a generator via a gearbox much like a hydro-electric turbine or a wind turbine. These turbines have a patented feature by which the rotor blades can be pitched through 180o in order to allow them to operate in bi-direction flows – that is on both the ebb and the flood tides. The twin power units of each system are mounted on wing-like extensions either side of a tubular steel monopile some 3m in diameter and the complete wing with its power units can be raised above sealevel to permit safe and reliable maintenance.



SeaGen in Strangford Lough

Latest News:

Carbon Trust backs Marine Current Turbines to accelerate commercial deployment of its tidal energy technology

14 September 2009



New investment to focus on finding innovative and cost-effective ways to install and maintain large-scale offshore devices

[» More](#)

Marine Current Turbines rated world's No 1 tidal power company by international panel of experts

10 September 2009



Marine Current Turbines has been ranked as the world's leading tidal power company in the CleanTech Group's "Global CleanTech 100" survey, produced in association with the UK's Carbon Trust. [» More](#)

Marine Current Turbines Limited is a company registered in England and Wales with company number 02395158
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4. Northern Ireland

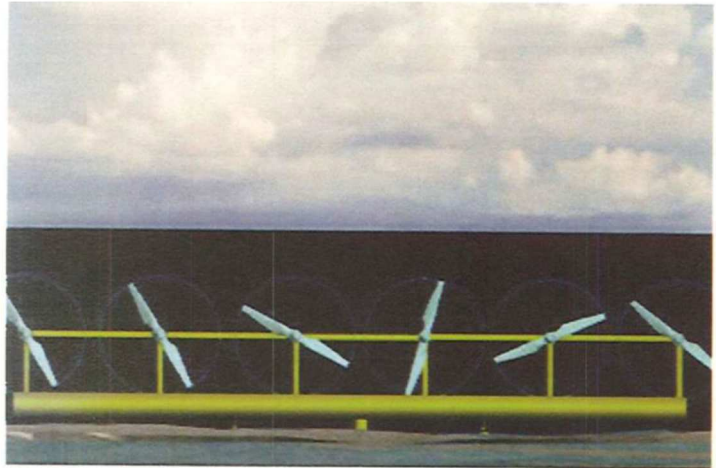
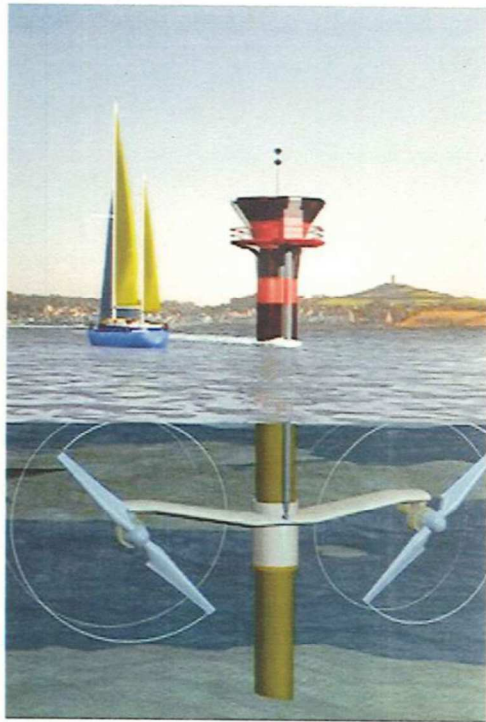


図1. 北アイルランドの例
直径11.5M タクト

5. Korea

