

Renewable Energy Trade

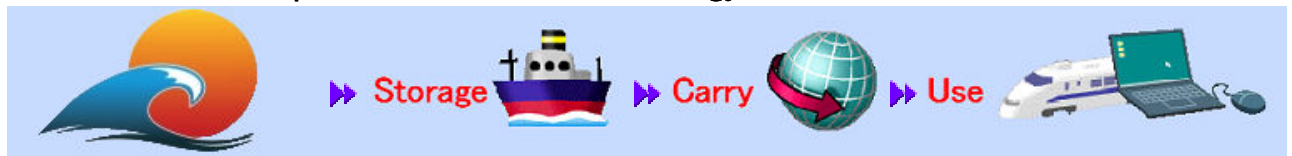
I .Profile

1. Concept

The next generation of energy needs to be environmentally friendly and renewable as well as safe and convenient.

- ① Exporting Countries : Ocean and the desert country. (Production of magnesium, or recycling. Production of ammonia / hydrogen.)
- ② Importing countries : Country's thriving industrial economy. (Use of magnesium alloy, and the use of reproduction-energy.)

2. Commercialization process of the renewable energy

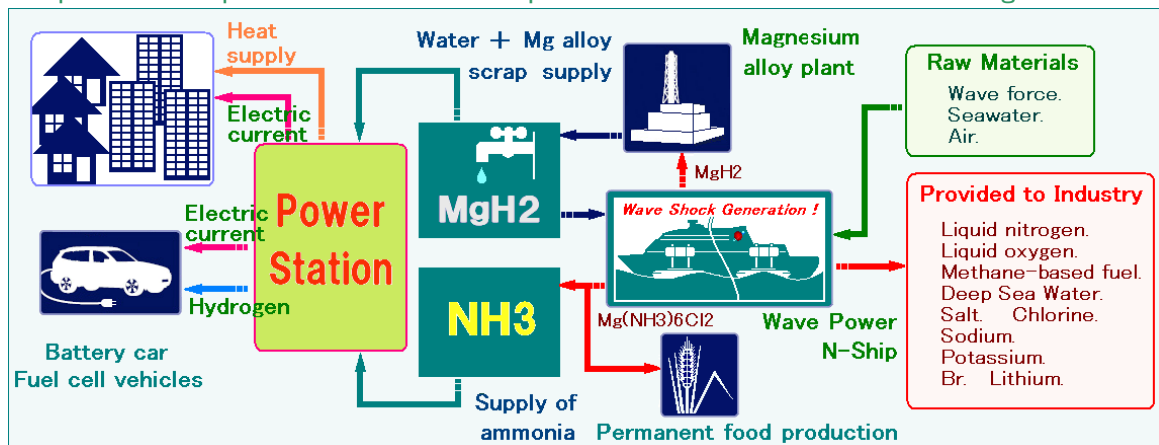


Seawater or Bitter-salt ($MgCl_2$), and renewable energy (Wave power, Solar, Wind, etc.) and, using the established manufacturing process technology, production of hydrogen / magnesium (Or recycling). The production of ammonia is effective, too. And, export to. First magnesium, is used as the material of the structure. A second time, the debris of the structure is used as material for hydrogen production. Third, the materials used in industrial and agricultural production. Or the recycling.

The ammonia uses it in to materials such as manure or the resin or fuel.

● Magcycle Project Overview

Wave power N-ship is a manufacturer to procure all the raw materials floating in the ocean.



3. Background of the natural energy trade realization

We solved a difficult problem called "Ocean renewable energy is not transported to the land. Even if the power transmission to, bulk electric power storage is impossible. Even if the hydrogen transported to, bulk storage of hydrogen is impossible."



By this, a large quantity of "Storage / Transportation / Reproduction of hydrogen / Use" of the renewable energy was realized.

In addition, compared to gasoline, the renewable energy use that a fuel efficiency per the weight doubled was enabled.

Also, both on land and ocean, basic rights of the circulation use of the magnesium with renewable energy was established. Circulation and use it, can offer two industrial (lightweight alloy & energy) materials by one circulation.

4. New Material of the Next Generation

JAPAN (NEDO), development of flame-retardant magnesium alloy. Ignition temperature is **780 °C** and is safe. The ignition temperature of 300 °C in the past, it was the same as cooking oil. (The wood catches fire at 250°C. The iron turns red at 600°C.)

Magnesium alloy, the excellent new material. Is comparable to the strength of steel. In addition, lighter than aluminum and plastics. In addition, Magnesium alloy be superior. Heat dissipation characteristic. Cutting characteristic. Sealed characteristic of electromagnetic wave. Absorptivity of vibration and impact.

Future, as the body structure and lifestyle products such as aircraft, is used safely. Alternative markets, and about 300 million tons / year.

Annual automobile production is 70,000,000 units. The current automotive structural materials can be applied to magnesium alloy is 30%. Magnesium alloy, compared to the iron, strength is strong, and weight is 25%. Aluminum alloy (Duralumin), the light weight of about 30%.

Automotive and fuel prices, there is a proportionately good effect.

Already BMW (Germany) in, E90, which uses a magnesium alloy engine. It is a realization of the lightest cars in the world.

Obviously the market is expanding rapidly.

Industry is confused from lack of a large quantity of magnesium at the same time. Each countries have to fix the self-support system hastily to avoid this.



Automotive and fuel prices, there is a proportionately good effect. Already BMW (Germany) in, E90, which uses a magnesium alloy engine. It is a realization of the lightest cars in the world.

2008 Abstracts. (Source / International Magnesium Association.)

<http://www.intlmag.org/assets/pdfs/2008AbstractsList.pdf>

II. Production / Recycling of Magnesium

1. Manufacturing process of raw materials. (Dryland is most suitable.)

Concentration of the seawater. (Production of the marine mineral water.) ➤ Taken to mix the lime and magnesium hydroxide.

<Magnesium metal smelting process here. P32-P35 http://www.j-protium.com/business/nims_mde_report-jp.pdf>

2. Recycling Process.

In addition to magnesium hydroxide and hydrochloric acid to make bittern. ➤ Using electrolysis equipment, magnesium metal to make bittern. (Power 16kWh. ⇒ Mg/1kg)



production.)

“Magcycle Project”, to generate electricity in a magnesium alloy debris. As a result of electricity generation, the raw material to produce magnesium. **Power generation is the process that is necessary by recycling to remove impurities.**

The conventional alloy scrap wood recycles it directly. It is necessary the difficult problem divides impurities (Ni, Cu, Cr, etc) obstructing corrosion resistance, and to remove it. By the circulation use that is multistage, these impurities do not get mixed.

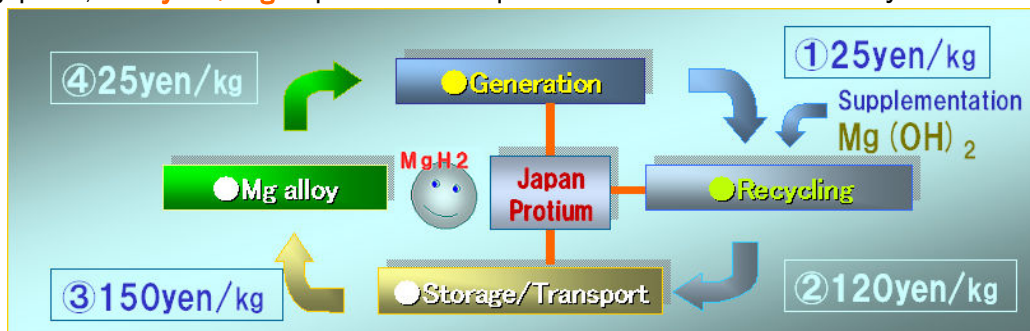
Indicates the price at the time of production to recycling.

① is a price of the supplementation material. ② is a price of Magnesium hydride (MgH₂).

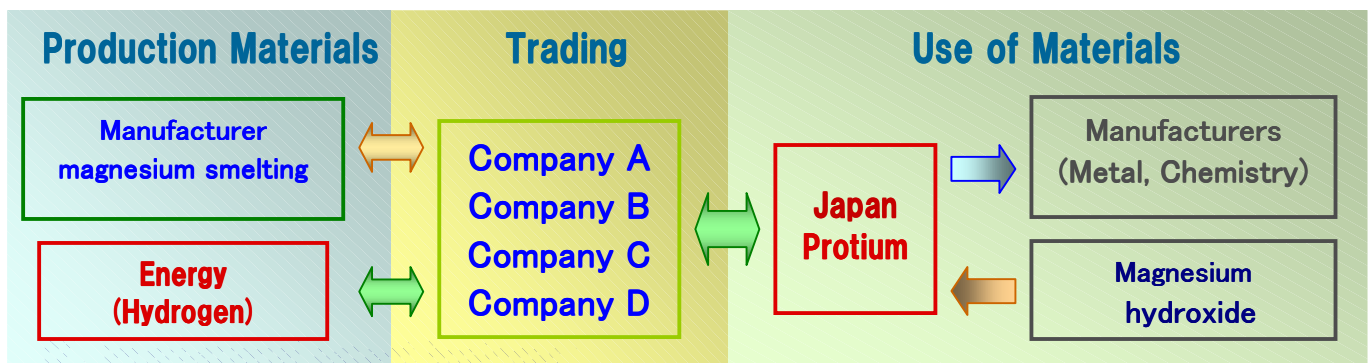
③ is a price of the metal (Mg). ④ is the collection cost.

Magcycle Project, from the price of magnesium alloys, to deduct the purchase price of scrap magnesium alloy, power generation fuel bill basically does not occur. (Licensing business.)

Mg alloy price, **800 yen / kg** is possible. Is equivalent to the aluminum alloy.



III. Role of JAPAN PROTIUM



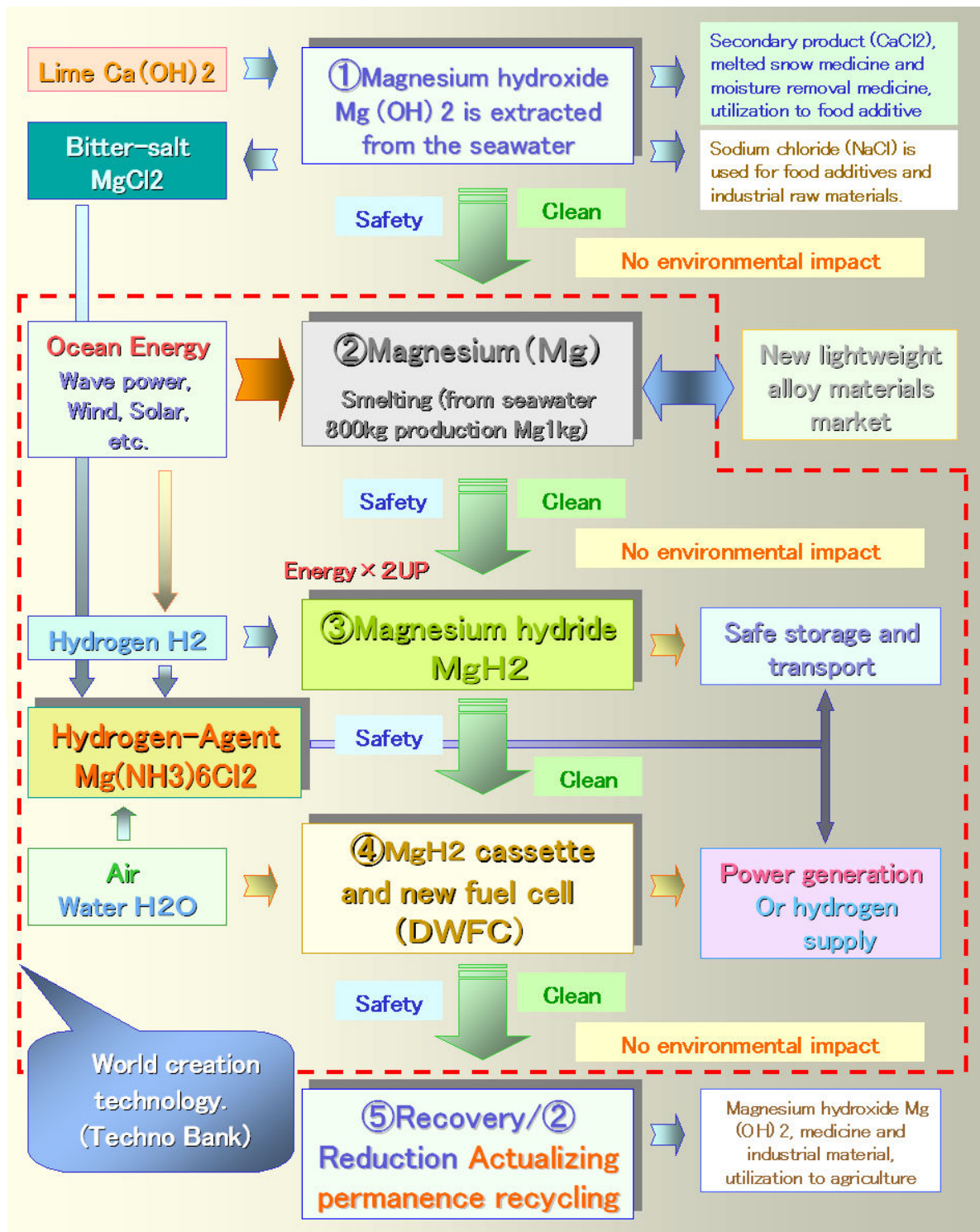
“Magcycle Project” is the world’s largest amount of clean energy (Hydrogen / Electricity) of storage / transportation is realized.

- ① Ocean energy business: A renewable energy – electricity converter, and a marine propulsive engine, and an offer of the clean electricity.
- ② Ocean resource business: Metal and mineral water provided.
- ③ Hydrogen projects: Ammonia, Hydrogen and the offer of the hydrogen generation device.
- ④ Fuel cell business: A fuel cell, and the offer of the fuel cell application device.

Only bitter-salt (MgCl₂) solves the problem “Energy/Environment” of the next generation. It is the world’s greatest new industry.

http://www.j-protium.com/company/eg_patent_magcycle_project.pdf





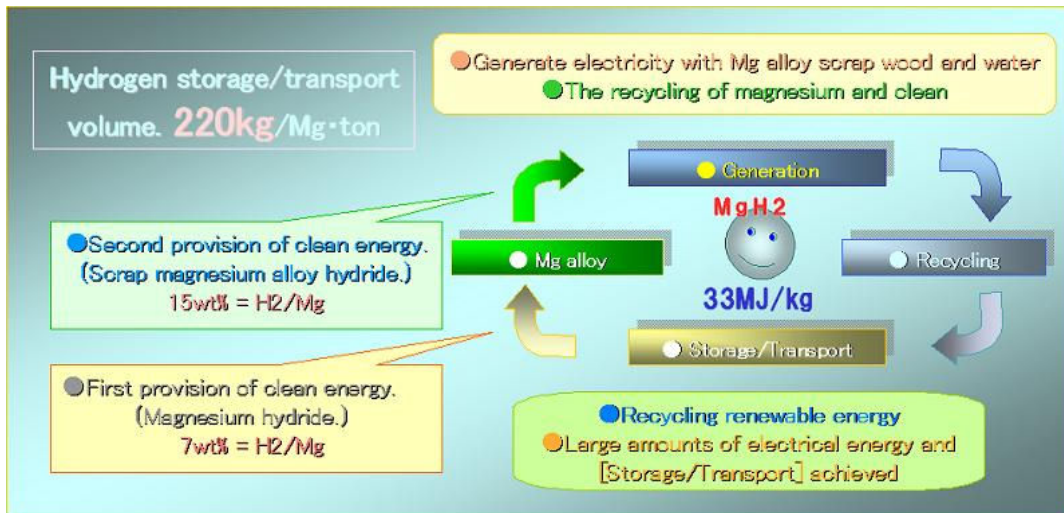
*Technical Details: <http://www.techno-bank.co.jp/>

* Business Details: <http://www.j-protium.com/>

Bitter-salt ($MgCl_2$) and magnesium is the only function of the energy density hydrogen storage container of this. In other words, providing easy to use high-density storage of hydrogen energy transportation. This realization, Techno Bank's latest research is.

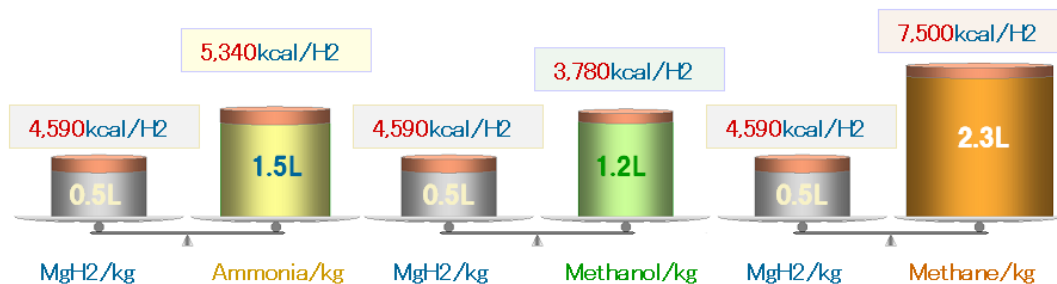
One ton of magnesium, a figure below using the concept of hydrogen storage and transport. In one process of the recycling of the magnesium alloy, hydrogen is generated. Hydrogen storage and transport is a bonus. Bonus is amazing because the highest energy density of hydrogen.





Magnesium hydride(MgH₂), the first use is to achieve efficient industrial use. Extract hydrogen (H₂=7wt%/Mg) from magnesium hydride(MgH₂), used for **power generation**. Then, magnesium(Mg), magnesium alloy manufacturing. The first use of magnesium alloy scrap is used for hydrogenation of magnesium alloy. Manufactured goods, **DWFC hydrogen generation (H₂=15wt%/Mg)** as a material to use.

<Transportation comparison with the next generation energy>



(Heat of combustion of MgH₂, DWFC a case. Methanol and methane, heat of combustion of carbon is omitted.)

V. Magnesium recycling plant and equipment investment.

- 1. Initial Capital Investment** (25,000t/ Annual production facilities, 7-year depreciation): 2 billion JPY.
- 2. Manufacturing Cost:** 150 JPY/kg=Electricity 70 JPY+Facilities, depreciation and amortization expenses 12 JPY+Administrative expenses 68 JPY.
- 3. Sales:** 6.5 billion JPY.
- 4. Gross Profit:** 2.75 billion JPY. (110 /kg JPY=260 JPY/Sales-150 JPY/Cost)

VI. In the desert, a simple estimate of the trade as well as green renewable energy.



Greening the desert is a mission of humanity. Solar energy resources are.
The new business, while the vast desert greening, providing new material for the next generation.

Solar power generation to the desert, there are plans to supply electricity to the country with no energy. In this case, need a greening of the desert at the same time.

Uses solar energy and seawater in the desert, try a simple estimate of the trade surplus electricity from renewable energy.

(1) Production of electricity a day.

2.5km × 2.5km desert and installed solar panels, the production of electricity 80Wh/m², an average of 6 hours and hours of sunshine.

$$6,250,000 \text{ m}^2 \times 80\text{Wh} \div 1,000 = 500,000 \text{ kWh}$$

$$500,000 \text{ kWh} \times 6\text{h} = 3,000,000 \text{ kWh}$$

(2) Production of magnesium per day by the power of this (Amount of energy transportation and storage).

Desalination equipment, and electricity to 20 percent of the sprinkler system

$$3,000,000\text{kWh} \times 0.8 = 2,400,000\text{kWh}$$

$$2,400,000\text{kWh} \div 16\text{kWh} = 150,000\text{kg}$$

(3) The total export revenue of magnesium. **6 billion JPY / year.**

Magnesium is sold, the price of 260 JPY/kg. 42.3 percent margin.

$$150,000\text{kg} \div 1000 \times 260,000 \text{ JPY} \times 365 \text{ day} \doteq 14.2 \text{ billion JPY (Sales)}$$

$$14.2 \text{ billion JPY} \times 0.423 \doteq 6 \text{ billion JPY (Gross margin)}$$

(4) Initial cost

Solar panels cost 150,000JPY/kW

(NEDO/PV-2030 http://www.nedo.go.jp/informations/other/161005_1/gaiyou_j.pdf) as.

$$500,000\text{kW} \times 150,000\text{JPY} = 75,000,000,000 \text{ JPY (Initial cost)}$$

(5) Depreciation and amortization

Budget amortization of 3,8 billion JPY/year.

(Semiconductor products, and 50 years can be amortized.)

$$75,000,000,000 \text{ JPY} \div 3,800,000,000 \text{ JPY} \doteq 20\text{years (Depreciation period)}$$

🚫 Price of the fresh water

(As a by-product of salt becoming the metal raw materials.) = 0 yen / t

<Good point of the water conversion device.>

①: There is not bad influence to the environment.

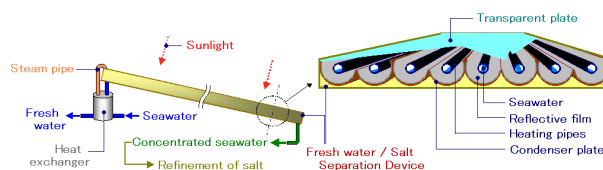
[Responsible state / corporate, marine environmental protection]

(Problems conventional methods: Emissions of chemicals harmful. Rising ocean temperatures due to heat. Salt concentration changes, etc. The cause discarded the seawater which concentrated to the seawater.)

②: High pressure facilities are unnecessary. Solar tracking device is unnecessary.



- ③: Reflector for an inexpensive film, easy to repair.
- ④: System for power saving, low running costs.
- ⑤: Because of the high concentration ratio of seawater, salt refining costs are cheap.
- ⑥: From a pure water, mineral can be formulated later.
- ⑦: Can make delicious water from the sun and muddy water.



<Magnesium metal smelting process here. P32-P35 http://www.j-protium.com/business/nims_mde_report-jp.pdf>

VII. New business by the wave power N-ship. (Exports of ocean resources.)

It is excellent for ocean wave power generation is in a mixed waves of multiple wavelengths.

It is necessary to endure a surge of 5-7m to get electricity on the ocean. N-type Wave power generation, even more than 5m waves, destruction of equipment can be controlled.

In addition, a large amount of power 'Storage / Transport' should be. The wave force, bitter-salt (MgCl₂) and air is three major elements for realization.

[Pacific rim energy design.]

(For economic equalization of the Pacific rim.)

The total amount of wave energy available, more than 500 times for the world's total electricity consumption. The energy density is the strongest, too.

Wave power N-ship, which produces the following resources in sailing. **Hydrogen**, Nitrogen, Oxygen, **Ammonia**, **Methane-based**

Fuel, Deep-ocean water, Salt, Chlorine, Sodium, **Magnesium**, Potassium, Bromine, Lithium.

For example, in the case of approximately 8,400km between Tokyo and San Francisco. The movement factory does a 38-day voyage at an average of 5 knots. Sell the product to the U.S.A., Furthermore, depart for Tokyo and continue producing it.

About business characteristics, anyone understands the thing that is very superior to the conventional system. It does not have fuel and "cost & time" about the transportation.

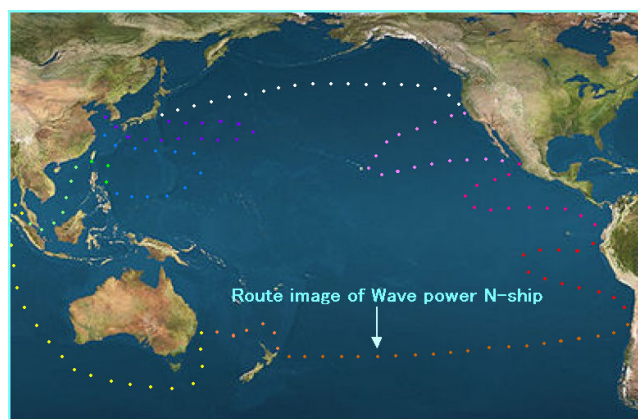
*(http://www.j-protium.com/company/global_change_oceans_wave_power.pdf)

Pacific Ocean is 51% (165,250,000 km²) of the total area of the sea. In addition, unused energy waves of the Pacific Ocean, there is about 60% of the entire ocean.

*See the movement of ocean waves.

(http://www.j-protium.com/business/Strongest_Force_Ocean_eg.ppt)

If power generation is 10% of the area of the Pacific Ocean. [340 billion kW / 16,000,000km²] Incidentally, the world's total power consumption is 1,200 million kW.



The ammonia is the material which is essential for industry. Ammonia production worldwide is now about **150 million tons / year**. This does not include fuel consumption. Production of ammonia, which is produced mainly by natural gas producing countries.

In addition, the content of the hydrogen (H₂) is reviewed as clean fuel by 17.8wt%. Clean the grounds, if the use of hydrogen is only to produce nitrogen and water.

By the way, the content of the hydrogen is alcohol 12.6wt%, natural gas 25wt%.

The carbon dioxide (CO₂) in the air is 0.04% contained. Material to carbon dioxide and hydrogen, the methane-based fuel (C_nH_(2n+2)) can be produced easily.



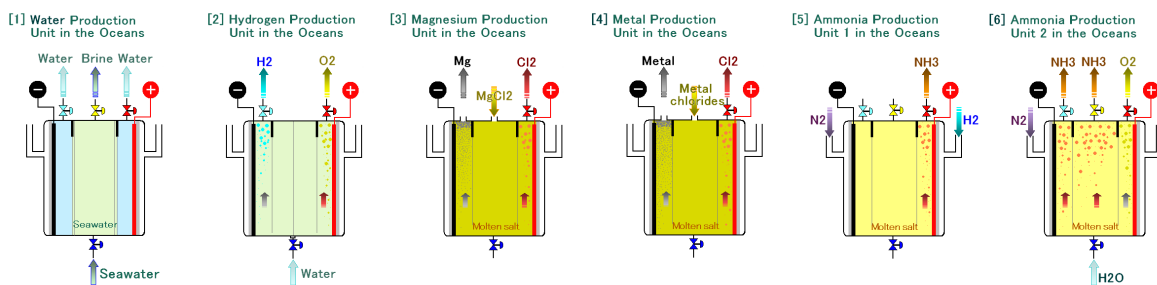
*See the movement of ocean waves.

(http://www.j-protium.com/business/Strongest_Force_Ocean_eg.ppt)

The following image shows the production.

<Conversion technology for the storage / transportation of the ocean energy>

(Multi-purpose device mounted on the wave power N-ship.)

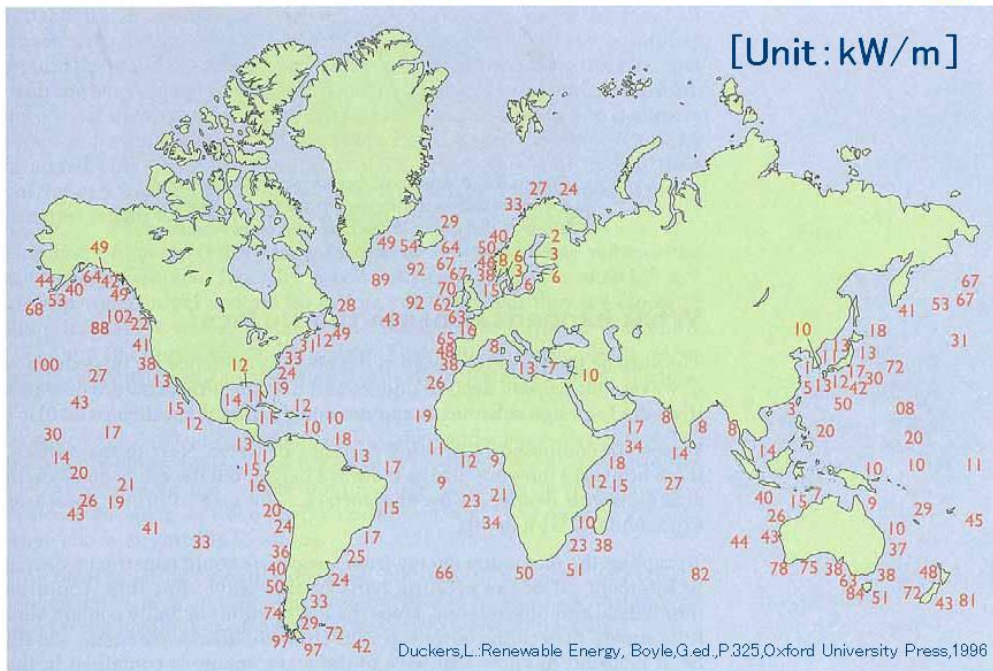


In addition, the use of the submarine cable is possible, too. Can send electricity from the outside of the harbor for 24 hours. In this case, answer the purpose by "Wave power N-ship / N-raft" to satisfy the electricity demand of the whole world of 15 trillion kWh / year.

The advantage does not have an obstacle of the shipping and fishing. The profitability of the business becomes the high profit to have transportation, material production, electricity production.



Extensive Distribution of Renewable Energy



< **570 billion kW** in untapped wave power : Total power consumption of the world's 1.2 billion kW >

Wave height [m]	1~2	2~3	3~4	4~5	5~6	6~7	7~8
Estimated wave energy [kW/m ²]	10	30	60	100	150	210	280

The simple test calculation of the natural energy trade by the wave power N-ship (8,000t / Full length 120m). The wave power N-ship is equipped with 40 floats (N-type Wave power generation device) and is going on a voyage. Each float is floating by seawater weight is 5,000 kg, the width of the upper and lower amplitude 2m, periodicity of the amplitude is 3 seconds, as.

- (1) Quantity of generation per time by the float.

The work load quotes $1 \text{ [kgw]} = 9.8 \text{ [N]}$. The electric conversion efficiency for 0.78.

$$5,000\text{kg} \times 9.8\text{N} \times 2\text{m} \times 1.5\text{sec} = 147,000\text{N}$$

$$147,000\text{N} \times 20\text{time} \times 60\text{min} = 176,400,000\text{N}$$

$$176,400,000\text{N} \times 4.2 \div 3,600,000\text{J} = 205.8\text{kWh}$$

$$205.8\text{kWh} \times 40 \times 0.78 = 6,420\text{kWh}$$

- (2) Day for energy production

The ship's propulsion power as consuming 22 percent.

$$5,000\text{kWh} \times 24\text{h} = 120,000\text{kWh}$$

- (3) Annual production of magnesium by wave power. (Amount of energy transportation and storage)

$$120,000\text{kWh} \div 16\text{kWh} \times 365 \text{ days} \div 1,000 = 2,737 \text{ t}$$

- (4) The gross margin **301 million JPY/year**

Magnesium is sold, the price of 260 JPY/kg, a 42.3 percent profit margin.

$$2,737 \text{ t} \times 260,000 \text{ JPY} \doteq 711 \text{ million (sales)}$$

$$711 \text{ billion} \times 0.423 \doteq 301 \text{ million JPY (gross margin)}$$


(5) Initial cost.

Wave power ship, construction costs of 250,000 JPY / t as.

$$8,000t \times 250,000 \text{ JPY} = 2 \text{ billion JPY (Initial cost)}$$

(6) Depreciation and amortization

200 million JPY depreciation budget/years

$$2 \text{ billion JPY} \div 200 \text{ million JPY/ years} \doteq 10 \text{ years (Depreciation period)}$$

VIII. Of Mega float, a simple estimate of the renewable energy trade

Mega-Float, a technique to reduce the elastic response is important.

N-type Wave power generation device, as a vanishing wave crest, then converted into electricity by absorbing wave energy. This rational technique is indispensable for the ocean energy era.

N-type Wave power generation device is to solve the problems of mega-float in the ocean, which enabled the deep sea business of mining and ocean farms.

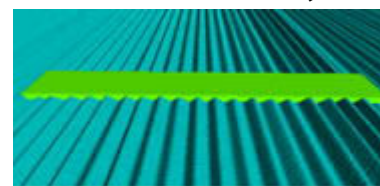
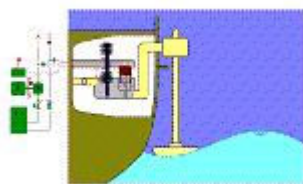
Three walls of deep-sea mining operations.

① A mooring equipment is not usable. <Stationary position is difficult>

② There is not stable big power supply equipment. Expensive fuel is necessary.

<It does not function as a factory>

③ Direct ocean disposal of drilling mud that is impossible. <The extinction of the sea life>



Mega float & Wave Motion

The great wave power, is open year round. In addition, the high energy density per area. Wind (Wind power generation) and wave (Wave power generation) compared to. Wave power is **800-times** higher energy density.

Wave height of 5m, 10-second period, the wave energy is 125kW / m.

Try to compare it to the engine dynamo of the automobile engine (100HP). Between 1 m 2 units will be arranged. For example, the Shinkansen of 700 system (13,200kW) runs when, generator (N-type Wave power generation device) a side of 100m.

Durability of the N-mega float is possible more than 100 years, and it is big charm from the viewpoint of business.

So, by the peaceful waves, try a simple estimate of the natural energy trade.

(1) Production of electricity a day.

Wave energy 5kW / m (Wave height of 1m, 10-second period).

To convert electricity from waves. Output of 10,000 kW to the new system.

$$10,000kW \times 24h = 240,000kWh$$

(2) Annual production of magnesium by wave power. (Amount of energy transportation and storage)

$$240,000kWh \div 16kWh \times 365 \text{ days} \div 1,000 = 5,475 \text{ t} *$$

(3) The gross margin **600 million JPY/year**

Magnesium is sold, the price of 260 JPY/kg, a 42.3 percent profit margin.



5,475 t × 260,000 JPY ≒ 1,4 billion (sales)

1,4 billion × 0.423 ≒ 600 million JPY (gross margin)*

(*About magnesium production. The height of the wave is 4 times in the case of 2m entirely.)

(4) Initial cost.

Wave-power generation facilities, 300 thousand JPY / kW as.

10,000kW × 300,000JPY/kW=3 billion JPY (Initial cost)

(5) Depreciation and amortization

400 million JPY depreciation budget/years

3 billion JPY ÷ 400 million JPY/ years ≒ 8 years (Depreciation period)

● The N-mega float plays an active part in the business of the deepwater drilling of the Pacific.

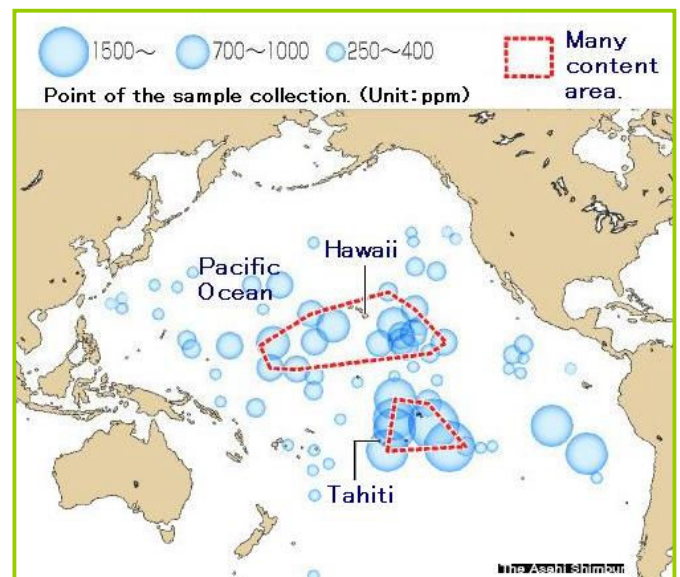
The huge deposit of rare earth elements (Rare earth elements) was discovered in the bottom of the sea of the Pacific.

The deposits of the estimate reach land **1,000 times**. Moreover, the distribution of 2,500 – 6,000 m depth in deep water.

Mega-Float in the deep sea, the “N-type Wave power generation device” is essential.

The N-mega float supplies electricity by wave power generation. In addition, long-term work is possible at the position that was decided in the deep sea.

In other words energy cost is free “Floating Factory”.



The electricity or hydrogen by this wave force becomes the extremely important element in the deep sea mining business.

Drilling mud is not discarded directly into the sea. It is cloudy and the sea with mud, is to kill the sea creatures.

We are using enough electricity or hydrogen to make building materials(blocks, sand) with hard baked mud disposal.

Also, it sunken to the seabed or riverbed, serves as a water purification material.

● Ammonia and the expanding global market problems

Ammonia, by natural gas producing countries, now **150 million tons / year** production has. Hydrogen is the raw material, obtained by decomposition of natural gas. Transportation will be transported by tanker dedicated refrigeration equipment. The main market is the breakdown of ammonia, 80% fertilizer, plastics, textiles and 20% are. In particular, as an nitrogenous ingredient in fertilizer, because there is no alternative, is important.



For renewable energy use, ammonia is active. (Currently, ammonia is not consumed as fuel.) The ammonia takes an important role as means of the storage / transportation of the hydrogen.

The practical use of the system of solid oxide form fuel cell “SOFC” which made ammonia direct fuel has already unfolded.



«Use technology of Hydrogen-Agent "Mg(NH3)6Cl2" [Pacific rim energy design.]»

Hydrogen-Agent "Mg(NH3)6Cl2" is metal ammine complexes. Can using hydrogen of 9.1wt% by the weight ratio. In addition, a large quantity of ammonia has difficulty in transportation and long-term preservation. The storage means using Bitter-salt realizes this by packing with the life material easily. Ammonia poison prevention technology is the next generation of energy points.



Mg(NH3)6Cl2 is, MgH2 was developed in 2005 alongside.

(Techno Bank company. <http://www.techno-bank.co.jp/>)

Hydrogen-Agent is the era of fossil fuel depletion, and the savior of the car.

U.S. Department of Energy (DOE) target of hydrogen storage capacity, 6.5wt%. Hydrogen-Agent, we solve this problem. Hydrogen cars, Hydrogen-Agent is equipped with about 40kg or 66kg to 600km run.

Ammonia (NH3) is reacted with to produce Hydrogen-Agent, and then filled into the cassette. Using hydrogen, waste heat and heat the cassette. The cassettes will be recycled.

Keywords Featuring a low-cost, safe, clean, and recycle. This is realized by an offer of low-cost ammonia. The production of the ammonia is cheap electricity by the wave power and nitrogen included in the air.

Going forward, toward the era of food shortages, to expand markets and increase the amount of ammonia in agricultural production.

The problem of the drying up of the natural gas surfaces sometime soon.

The ammonia production using an ocean energy is advantageous in that it can solve agriculture and a problem of the energy.

Can supply enough power consumed by the world's total. Ammonia production of the age, **15,000,000,000 tons / year** is expected.

Of these, 95% used for energy.

