

Consultation Paper - Consultation on the draft report, Opportunities and challenges to the future security and resilience of the New Zealand power system.

I would like to offer a number of alternative electric power generating systems that do not rely on weather dependent solar panel/wind farm renewables; nor pumped hydro; nor fossil fuel derivatives; nor rare earth/lithium batteries etc.

1.FLOATING POWER STATION

By tapping the extraordinary tidal power of Kaipara Harbour (**tidal volume of 8,000 million cubic metres daily at up to 9kph**), Northland could generate a continuous electrical power back-up supply during Southern dry-lake periods and/or produce significant green hydrogen gas to fuel a hydrogen economy.

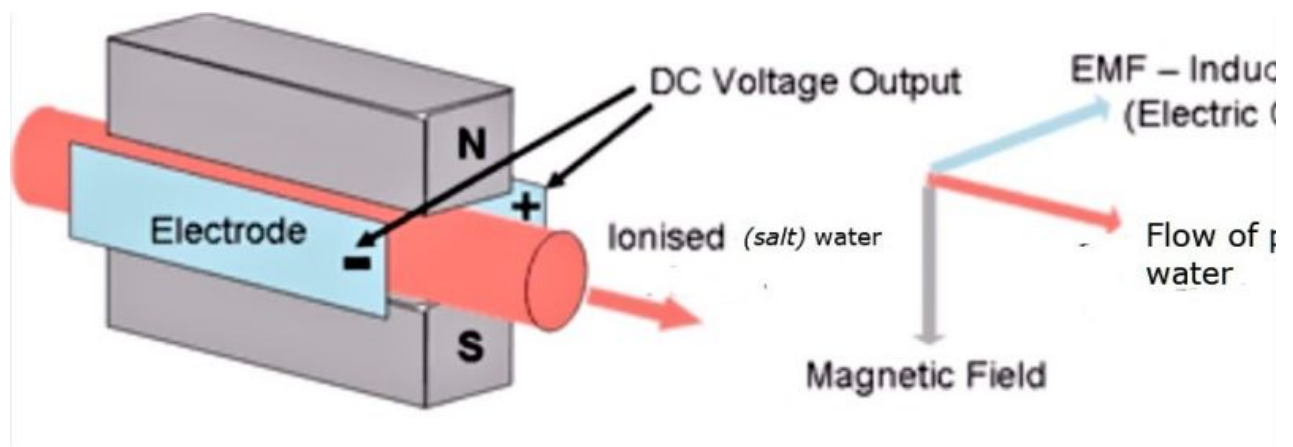
The Kaipara Harbour is in effect, a massive North Island Hydroelectric dam - instead of a massive lake we see a massive harbour; instead of a massive head of water we see a massive tidal potential; instead of a massive spillway we see a massive estuary opening into the Tasman.



2.MHD & THE KAIPARA

Utilising an array of Magnetohydrodynamic (MHD) generators (perhaps slung from a container vessel or dumb barge), the Kaipara diurnal tidal flow of salt water would be directed to pass through submarine ducts forming part of the MHD. This technology has been around since Faraday. It is not disruptive to the sea floor and does not utilise disruptive turbines to generate power from the tide. The flow is executed in the presence of a strong magnetic field using super magnets. As a result, substantial voltage is induced and electrical output can be extracted by the placement of electrodes forming part of the MHD.

Harnessing power by employing an MHD generator utilising salt water as its fluid conductor is hugely advantageous for the following reasons: the power source already exists in abundance; it requires no external energy input to facilitate its operation; it has no moving parts. As such, it requires minimal maintenance and does not contribute to mortality of aquatic organisms. Nor does it generate any pollution. Of course tidal power is totally operational 24/7 irrespective of weather conditions and is totally predictable.



3. REGENERATIVE ENERGY QUAYSIDE

Large container ships tied up at our terminals are restrained by moorings that dissipate their very considerable elastic energy as heat. This potential elastic energy ($= 1/2mv^2$) is generated by many degrees of motion acting on the ship. These motions include waves; wind; wakes from passing ships; currents; tides; and changes in draft. However, this vast elastic energy that is currently wasted could be harvested and converted directly into electricity in a similar way that electric vehicles now scavenge regenerative energy via shock absorbers.

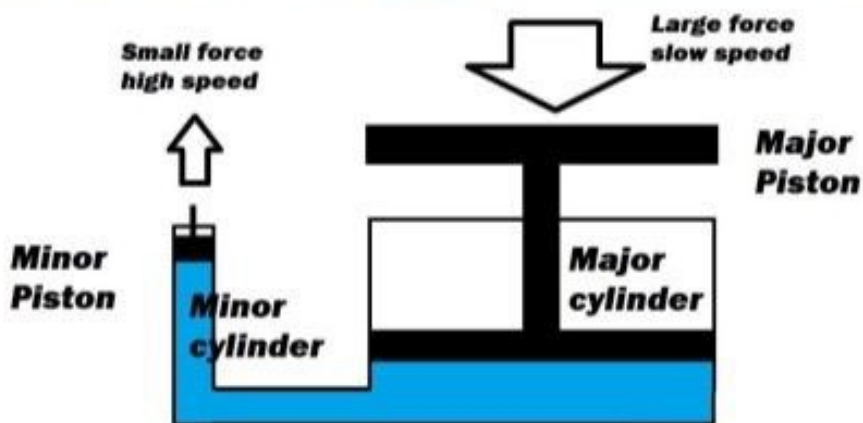


Many ocean energy generation systems have failed due to the extremely harsh conditions in offshore stations; the enormous capital cost of giant buoys; the cost of undersea cabling and distribution; and the many hazards encountered during construction and maintenance.

But if a moored container ship can be seen as proxy for a giant buoy, then the massive capital outlay needed to develop and construct bespoke giant buoys is obviated. And durability and maintenance difficulties are no longer a major issue because quayside weather conditions are bland compared to offshore environments. Furthermore, costly undersea cabling and distribution is no longer necessary because all generated power is produced quayside.

4. THE MASSIVE FORCE OF BUOYANCY & PASCALS LAW

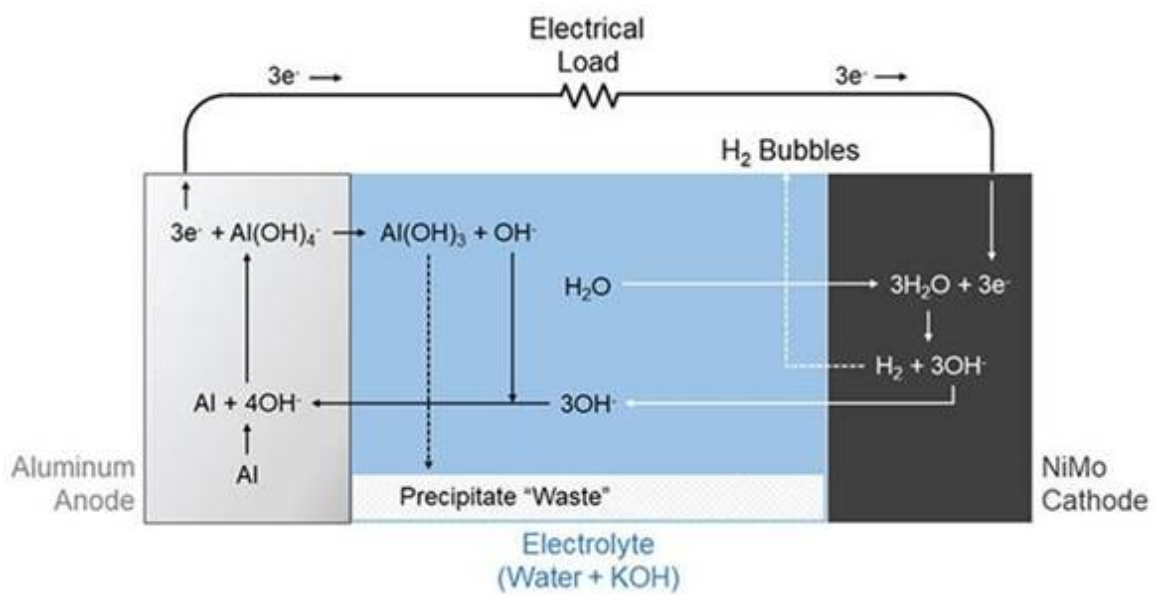
Flipping a normal garage jack operation means a hydraulic lift can be converted to a hydraulic generator. So what can a massive barge generate on a rising and falling tide?



5. ALUMINIUM –WATER BATTERIES (eg as per Open Water Power/L3Harris developers, among others).



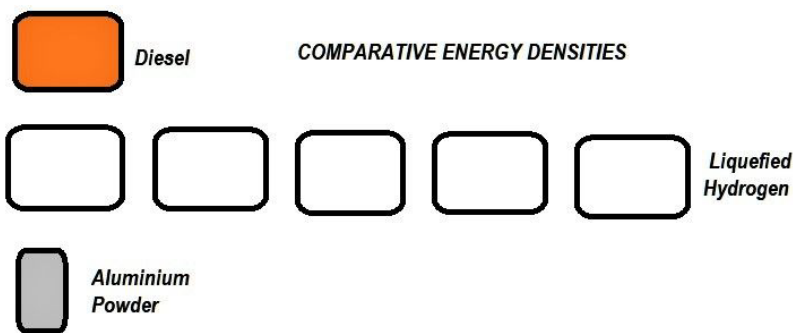
This battery "drinks" in sea water to operate; is safer and cheaper, and provides a tenfold increase in range over traditional lithium-ion batteries. The aluminium/water battery is scalable and consists of an alloyed aluminum anode, an alloyed cathode, and an alkaline electrolyte positioned between the electrodes. **Components are only activated when flooded with seawater.**



Once the aluminum anode corrodes, it can be replaced at low cost (there is currently 200 billion aluminium beverage cans discarded annually worldwide, of which **1/3rd end up in landfill**). Rio Tinto & Meridian Energy would alike confirm that **aluminium is essentially congealed electricity**).



Aluminium powder is also a denser energy carrier than diesel, and certainly far more than liquefied hydrogen. It is safer and easier to store and distribute. Aluminium metal particulates (doped with recyclable gallium) can be combined with water **on-site** to produce the energy equivalent of around 90 lithium-ion batteries of the same mass.



The only by-products of the aluminium/water battery operation are harmless aluminium hydroxide and quite useful quantities of hydrogen gas. The technology **reduces greenhouse gas emissions, provides hydrogen gas** via electrolysis, and is in line with criteria for testing emerging technologies towards decarbonising of say, domestic shipping.

6. FLIPPED HEXAPODS & DECOMMISSIONED OIL PLATFORMS

The Stewart Platform (or Hexapod) is often used for cockpit simulations. It typically employs motorised hydraulic pistons that are fixed to the ground whilst providing 6 degrees of freedom to an elevated cockpit above.



However, if the hexapod is flipped and suitably fixed (perhaps beneath a decommissioned oil platform – and we know there will be, and already are, thousands of such platforms across Mexico, the North Sea, California, Brazil, South China Sea etc), we can convert the ‘cockpit’ portion into a floatation vessel that moves with the 6 degrees of freedom provide by ocean movements.

This means the flipped motorised hydraulic pistons become hydraulic shock absorbers that can then harvest the traditional energies of the sea (such as surge, sway, heave, roll, pitch and yaw). The advantage is that all major structural, servicing and distribution infrastructures are in place if existing decommissioned platforms can be acquired. Furthermore, the actual hexapod generator would sit predominantly above sea level so it would be treated less harshly by the sea than more immersive offshore wave generators.

THE CASE FOR AN ALUMINIUM FUELLED ECONOMY

Aluminium is a store of an incredible amount of electricity.

This means battery storage is not required. No pumped-hydro storage is required. No pressurised hydrogen tanks are required to store the latent energy.

Aluminium is portable. No added electric cabling is required for its distribution. No national hydrogen pipeline infrastructure is required for its distribution. Normal road/rail/shipping networks are sufficient for its distribution.

Aluminium is extremely light and more dense than alternative energy sources. It is cheap and safe to transport.

Aluminium is an abundant metal and is recyclable. New technologies have dramatically dropped cost of production. Furthermore, aluminium scrap takes only 5% of energy required to smelt alumina.

New Aluminium production is virtually green. Because making aluminium from bauxite ore requires massive amounts of energy, traditional coal fired plants have been the biggest contributor to overall green gas emissions (9 times more than hydro sourced power). However, the carbon anodes used in older aluminium smelters were also a major source of CO₂. The latest inert anodes used in the electrolysis process actually emit oxygen as their by-product.

Incidentally, wind, solar and hydro seem to be the only renewable electricity generators under consideration in this country. Yet none of them can avoid the bad weather/dry year syndrome. Why then, has the Kaipara Harbour tidal potential been ignored? The Kaipara is the largest estuary in the world with phenomenal tidal flow velocities and volume. It operates 24/7 and is totally predictable. It runs on moon power and it cannot fail. As a generator in combination with aluminium smelting storage, and distribution; a combination that gives back its electrical power using the electrolysis of seawater; and with salt, oxygen, and hydrogen its only spin-off, who can gainsay it?

