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CREST ENERGY KAIPARA PROJECT

Abstract:

The Crest Energy Kaipara Project will fail for two reasons. Magnetic sands will damage the turbines and reduced tidal currents in the turbine field will result in deposition of sand around the turbines with resulting loss of performance and possible destruction of the undersea cables.

Introduction:

It appears to me that certain issues in relation to this project have been un-noticed, ignored or given insufficient weight by the Environment Court, the Northland Regional Council and the Department of Conservation, the authorities principally concerned with the protection of the environment and the people.

Although much emphasis was put on environmental issues certain technical issues appear to have been largely or wholly disregarded. Among these are the post glacial and historical development of the coast and the harbour, the mineralogy of the sediments in and around the harbour entrance, the nature of the sands forming North Head, the effect of artificial structures in the Graveyard channel and the effect of magnetic particles in the magnetic fields surrounding the turbines.

The principals involved are all so fundamental that I am surprised that they have escaped due attention. In my view a combination of these omissions will lead to the total failure of the project with consequent adverse effects to Northland.

Post glacial history:

Let us consider the Kaipara 20,000 years ago at the climax of the last glaciation. Sea level was nearly 100 metres lower and the coast many kilometers to the west of its present position. The shore was probably fringed with sand dunes much as it is today. The land, now swallowed by the sea, was probably forested. One might surmise that the Kaipara and Northern Wairoa Rivers

meandered through forested valleys to join somewhere north of what is now South Head before flowing west to the sea.

16,000 to 18,000 years ago the climate began to warm and as it did the sea level began to rise. This continued until about 11,000 years ago when the climatic reversal known as the Younger Dryas took place. Warming and sea level rise recommenced about 10,000 years ago before reaching a climatic maximum about 6,000 years ago when sea level was several metres higher than it is now as we can see from the raised beaches at Kaiaua. As the sea rose and inundated the lowland forest the coastal dunes migrated inland to form North Head as it now is.

By now the Kaipara Harbour had formed. As the silting of the harbour was, as yet, little advanced and sea level was higher, tidal flows were greater. The gap between South Head and North Head was probably formed to accommodate this greater flow. As the harbour silted and sea level fell slightly the Tory Shoal and the Southern Shoal formed limiting the main flow through the narrow channel which came to be known in recent times as the Graveyard because of the hundred or so ships that foundered there.

Recent history:

There are now two coastal currents. One flows north along the west coast of the North Island and the other flows south along the west coast of Northland. They converge off Northland. When North Head was formed I surmise that the southbound current predominated. Now the northbound current is dominant off the Kaipara Harbour. These currents control the movement of sand along the coast. I surmise that the southbound current may have been dominant until perhaps until the end of the Little Ice Age. I doubt that the sailing ships of one hundred and fifty years ago with their relatively primitive navigation equipment could have regularly got through the harbour entrance as it now is. I surmise that the shoals that now bound the south side of the entrance channel are of relatively recent formation and due to the increasing dominance of the northbound current. Evidence was given to the Environment Court that the south-west of North Head has been eroded since the harbour was a major port.

Magnetic sands:

There are deposits of titanomagnetite, black ironsand, from Wanganui northwards. This titanomagnetite originates largely from the andesite volcanoes of Taranaki and to a lesser extent

from central North Island andesites and transported down the ancestral Waikato River. This highly magnetic mineral is transported northwards by the northbound coastal current and by wave movement. Evidence was given to the Environment Court that deposits of this mineral occur around the entrance to the Kaipara Harbour after storms. The significance of this evidence escaped due attention. I surmise that the magnetic mineral enters the Graveyard channel, where the turbines will be located, via the southern shoals on a rising tide particularly when there is a strong swell from the south west.

Generators:

A universal characteristic of electrical generators is a very strong magnetic field between the stator and the rotor. The proposed turbine rotors are some metres in diameter with a large hole in the centre. Thus the bearing surface must lie between the rotor and the stator which is the peripheral housing of the rotor. For efficiency the stator and the rotor should be as close together as possible but there must be some gap. How will the design, if indeed it does, prevent particles of titanomagnetite which will vary between 0.1mm and 0.3mm getting into the intense magnetic field between the stator and the rotor? Does the rotor behave like a giant sanding disk when the magnetic mineral adheres to it? What protection do the coils in the stator have? These questions should have been asked. It is not sufficient for the Department of Conservation and the Northland Regional Council to say "It is not our job to question the design". If the ultimate outcome of design failure results in damage to the environment or the population of Northland is adversely affected it is within the job specifications of these authorities.

North Head:

North Head is composed principally of wind blown dune sand. There are two cemented layers within it visible from a boat in the Graveyard channel. These layers are probably, I say probably because I have only seen them from a boat, ancient soil horizons dating from periods of dune stability. The marine chart shows quicksands in the south-west part of North Head. Unconsolidated wind blown sands are particularly prone to erosion by water. That the North Head has been formed as I have suggested earlier can easily be demonstrated with one or more reverse circulation bore holes drilled to about 40 metres below sea level, or perhaps less. Such a bore, or bores, will show, I anticipate, the remains of a forest which can be carbon dated to six thousand years old or a little more.

Channel hydraulics:

Structures, natural or otherwise, on the floor of a channel slow the flow of water. That is a simple fact. The structures that Crest Energy propose to emplace in the Graveyard channel will slow the flow. Crest could not abstract any energy if it is otherwise. The volume of water flowing into and out of the Kaipara Harbour with each change of tide will not immediately be changed by the proposed structures. However, as the velocity is decreased in one part of the channel cross section it will increase somewhere else. That is simple. I suggest that it will increase to the north of the Graveyard channel because the sands are finer and because they are not being incremented by coarser sands passing over the southern shoals. The size of particles moved by currents depends on their size and density as so well described in Stoke's Law. The unconsolidated sand of the southern part of North Head will be removed elsewhere by the faster current and sands will be deposited where the turbines are located. As the water shallows and the velocity declines barnacle, mussel, oyster and weed growth on the turbine substructures increases and further slows the tidal flow through the turbine field while it increases velocity to the north and erodes North Head.

The main cables:

The steadily growing body of sand on the channel floor will cover the mesh of cables connecting the turbines and make it increasingly difficult, and eventually impossible, to maintain the network and lift the turbine generators for maintenance. As the new channel cuts into North Head the main cables will be exposed. These will be, according to the evidence, be held on the bottom with large pieces of concrete. When the bottom is no longer there the cables, laden with their lumps of concrete, will swing freely in the tide some metres above the bottom.

An interesting and quite relevant aspect of the metallurgy of copper is that of annealing and stress hardening. Annealed copper is very soft and flexible. Bend it repeatedly at the same point it becomes stress hardened and brittle. Then it bends no further but it breaks. You may try this for yourselves. Take a short strand of copper wire, about as thick as a pencil lead or a little less, and heat it to red heat. That anneals it. When it has cooled bend it. It will bend easily. Now try and straighten it. It will not straighten at the bend because it has been stress hardened. That will happen to the weighted cables swinging in the tide. I suggest that they will break. You may visualize the consequences.

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