

Energy from the Oceans

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Characters

1. Narrator
2. Vigyaniram
3. Technochand

Vigyaniram and Technochand enter the stage.

VIGYANIRAM: Hello Technochand, what's wrong? You seem to be a bit down in the dumps today.

TECHNOCHAND: You are right...it is a matter of some concern.

VIGYANIRAM: Well, tell me then.

TECHNOCHAND: Of course, I will tell you...in fact there is no one else with whom I can share the news.

VIGYANIRAM: Tell me straight...don't beat about the bush .

TECHNOCHAND: I am really worried about the Energy resources on Earth. You see, at the rate that the world is consuming energy, I foresee a grave situation for the human race in the time to come.

VIGYANIRAM: Yes it is definitely a cause for concern but previously too, we too have jointly been able to come to mankind's rescue, haven't we?

TECHNOCHAND: Yes indeed...the fact had escaped my mind.

VIGYANIRAM: You worry to the exclusion of everything else!

TECHNOCHAND: (jocularly) No, no Vigyaniram, not everything.

VIGYANIRAM: Ah! I sense mischief in the air.

TECHNOCHAND: Yup! I have just remembered an old song that is absolutely tailored for us.

VIGYANIRAM: An old song? Which one? Let's hear it.

TECHNOCHAND: You must have heard it before.

VIGYANIRAM: Which one?

TECHNOCHAND: Hindi song

Tera mera saath rahay

Tera mera saath rahay

(Let us together remain

Let us together remain)

VIGYANIRAM: Ah! And your song has reminded me of a few lines of poetry.

TECHNOCHAND: Come on, let's hear it.

VIGYANIRAM:

Grounds new we break

When joint steps we take

On the roads we make

Every nation seeks a stake.

TECHNOCHAND: How appropriate. You are absolutely correct. You know, your words about breaking new grounds and making new roads have opened my eyes. It is only when we join forces that new avenues open up and the nation makes progress.

VIGYANIRAM: Technochand, it is not just that our nation makes progress. This progress elevates the nation's status internationally too. It is not just new avenues that open up you know, but new directions too.

TECHNOCHAND: Your words sound as if the rest of the poem is simply bubbling inside you...just waiting to escape into verse.

VIGYANIRAM: You read my mind, Technochand.

TECHNOCHAND: And why not. We are so closely related anyway.

VIGYANIRAM: You sound as if you will not rest till I recite the poem.

TECHNOCHAND: Well, you have read my mind now. So, go ahead, please.

VIGYANIRAM: OK..here goes.

*With these new prospects
the nation gains respect.
All happy seem
With fulfilled hopes, and achieved dreams
Join hands now and loudly sing
About the prosperity we bring
As we all gather
To work together
To proceed towards a future bright
Towards dawn after the darkest night*

TECHNOCHAND: Fantastic! Now if we have to chase away darkness and progress along the path of development then we will need lots of energy, won't we?

VIGYANIRAM: Yes, Technochand, you are so right. The tremendous demand for fossil fuels has made the Scientists talk about alternative sources of energy.

TECHNOCHAND: And not just any alternative energy source but those that are "Green" or environmentally sustainable.

VIGYANIRAM: Yes so that the problem of global warming can be solved. Alternative sources of energy that we often hear about include, Solar energy, wind energy, hydel energy, nuclear energy , geo-thermal energy etc. But we hardly ever hear about energy from the oceans.

TECHNOCHAND: Well, let's discuss this topic then.

VIGYANIRAM: But I have some work to do now.

TECHNOCHAND: Actually I have some work to do too...let's talk about it later.

Narrator

The energy crunch is staring mankind in the face. The tremendous demands that are depleting fossil fuels such as coal, petroleum and natural gas have triggered the search for alternative energy sources. The search has met with limited success and the road ahead is a long one. Wind energy, hydel energy, nuclear energy, geo-thermal energy are areas where a lot of research is going on and where some success has been achieved.

There is one other potential source that has captured the imagination of scientists. This is the generation of energy from the oceans. The oceans represent an inexhaustible source of energy. The waves contain huge amounts of energy. Tidal energy is another example of the huge energy that the oceans generate. Scientists are now trying to capture the energy from the waves and from the tides.

Our planet Earth is almost 70 per cent water. It is also a heat sink for the heat that reaches us from the Sun. The upper layers of the sea water get heated up first. The lower layers of the ocean are dark and cold because sunlight does not penetrate after a certain depth and little heat reaches these layers because of conduction. So there is a marked difference in temperature in the surface waters of the ocean and the waters at the bottom. It is this temperature gradient that makes it possible for energy to be generated from the oceans. This process is called Ocean Thermal Energy Conversion or OTEC for short.

In India, as in other parts of the world, OTEC is being explored to generate energy. However, there is still scope to fine-tune the process and enhance its capabilities through more research.

It is pertinent to mention at this point that OTEC has been used to deliver potable water from the saline waters of the seas.

Music to indicate change of scene

VIGYANIRAM: and TECHNOCHAND enter.

TECHNOCHAND: VIGYANIRAM: I can see it on your faceyou want to say something. What is it that you are eager to spill out?

VIGYANIRAM: Not only can you read my mind, it seems you can read my face too.

TECHNOCHAND: Well...am I wrong? I read the message clearly on your face.

VIGYANIRAM: You win...as always. This is what I have been dying to say:

*I see the sky so bright and the ocean so blue
Eternal, endless... no boundaries in view*

TECHNOCHAND: What is all this about the sky and the oceans?

VIGYANIRAM: You see last night it was so hot that I went up to the terrace to sleep in the open. The mosquitoes kept me awake all night so I spent the time counting stars.

TECHNOCHAND: Ah...that explains the fascination with the sky, but why the sudden interest in oceans?

VIGYANIRAM: As I lay on my cot under the open sky it suddenly struck me that 70 per cent of the planet is covered by the seas. And the moment I thought of the seas you came to mind.

TECHNOCHAND: The thought of the seas reminded you of me...how strange! Why?

VIGYANIRAM: I am really concerned now about your memory Technochand dear.

TECHNOCHAND: What sort of a riddle is this Vigyaniram?

VIGYANIRAM: You appear to have forgotten. Last year didn't we have lots of fun on the beaches of Puri?

TECHNOCHAND: Yes...yes...of course and you read out the poems of Samuel Taylor Coleridge.

VIGYANIRAM: Now I have to tax my memory...I read out the poems of Samuel Taylor Coleridge, you say.

TECHNOCHAND: You know...

*“Water, water every where
Nor any drop to drink.”*

VIGYANIRAM: I remember that I had even translated the lines into Hindi.

TECHNOCHAND: Thank God, you have finally remembered. Now tell me ...why this sudden fascination with the sky, sea and water?

VIGYANIRAM: Well...it is so very hot these days. The sky no longer rains water and the earth is parched. The waters of the seas and oceans are not fit for drinking. Now tell me if the sky, seas and water are all interconnected or not?

TECHNOCHAND: OK I concede this point ...but come to the real point, please.

VIGYANIRAM: Yup! Now I will. I have managed to lay the foundation of what I want to say.

TECHNOCHAND: Gosh...what is the foundation you have laid by talking about water and watery things? (laughs)

VIGYANIRAM: You know that better than I do. What is the process of generating energy from the seas if not a watery topic? Aren't we also getting drinking water by this process?

TECHNOCHAND: Yes, you are correct. Now I understand what you are driving at. We had just about begun to discuss the generation of alternative energy from the oceans when we had to leave the discussion midway because we had to attend to some work.

VIGYANIRAM: Thank God you have remembered.

TECHNOCHAND: Not only have I remembered the discussion we had yesterday but I have also gone back to 1881.

VIGYANIRAM: hey! You aren't referring to the French Physicist Jacques Arsene d'Arsonval, are you? He who put forward the principle governing the concept of Ocean Thermal Energy Conversion or OTEC for the first time?

TECHNOCHAND: Yes that is correct, Vigayaniram. It was d'Arsonval who said that the steep thermal gradient between the surface and the deep ocean could be used to generate energy.

VIGYANIRAM: Yes but even 50 years after he first put forward the idea, very little work if any, was actually done on it.

TECHNOCHAND: What you are driving at is that ...the scientific principle existed all right. However, it was not translated into technology for implementation.

VIGYANIRAM: Yes indeed. And yet look...Georges Claude, a disciple of d'Arsonval succeeded in generating 22 kilowatt power in Cuba by successfully implementing OTEC.

TECHNOCHAND: This could be done because the temperature of the ocean waters 500 metres deep was 14 degrees lower than the temperature of the surface waters. Claude installed a pipe **and**.....

VIGYANIRAM: Claude encountered many technical difficulties. A violent storm also destroyed his apparatus just two weeks after it had been set up.

TECHNOCHAND: Yes, the accident led to immense disappointment in scientific circles. This was the reason why this area was not explored any more for quite some time.

VIGYANIRAM: However, in 1973 when the oil-producing countries suddenly jacked up the price of oil, then there was renewed interest, worldwide, in OTEC.

TECHNOCHAND: Absolutely correct. The governments of America, Japan and France introduced Bills on OTEC.

VIGYANIRAM: The importance of OTEC is reflected in the fact that in 1979, the American government made budgetary provisions of 380 lakh dollars, which even in those days was a huge amount.

TECHNOCHAND: Yes Vigyaniram, and two years later, that is in 1981 a Japanese group succeeded in generating 120 kilowatts of energy from the waters at the Island of Nauru in the Pacific Ocean.

TECHNOCHAND: for the OTEC apparatus to work there must be a difference of twenty degrees Celsius between the surface and the deep layers of the water. Apart from the **thermocline beaches of America and Australia**, certain areas of some developing nations are also suitable for setting up the OTEC apparatus. Now these countries, India included, have manufactured the OTEC apparatus

too. However, it is a difficult proposition to save guard the machinery from the ravages of the monsoons or storms at sea.

VIGYANIRAM: Yes Technochand. Apart from the technical difficulties in implementing OTEC there is also the problem of facing natural hazards. This is why the scientific principles of OTEC, valid as they have been proved to be do not appears to be financially feasible.

TECHNOCHAND: That is true, no doubt but I am sure that you know that the machinery can be use, not only to generate electricity but also to de-salinate the water. So doesn't that make it a winning proposition?

VIGYANIRAM: Yes Technochand, it does indeed. That is why Open cycle is used although closed cycle or Rankine cycle is usually the process to generate energy.

TECHNOCHAND: The principle behind the closed cycle is a simple one. The upper surface of the ocean is warm anyway; it can easily vaporize a gas such as ammonia, which has a low boiling point.

VIGYANIRAM: This vapour is then used to turn a turbine, which generates electricity.

TECHNOCHAND: This ammonia vapour is allowed to condense in contact with the cold water from the depths of the ocean and is then reused. This is how the cycle goes on. The closed cycle is called Claud cycle and it can be repeated in a cyclical manner.

VIGYANIRAM: Fibreoptics pipes are used to draw up water from the depths of the oceans.

TECHNOCHAND: These pipes are about a 100 metres long and 1 metre in diameter.

VIGYANIRAM: The pipe carrying ammonia vapour goes deep into the ocean so that the low temperatures of these waters re-condense the vapour, which can then be re-used.

TECHNOCHAND In the open cycle, the surface waters of the oceans are vaporized under low pressure and the steam is used to turn the turbine. The

steam is re-condensed using the cold water of the deeper layers that are pumped up. This gives us water suitable for drinking.

VIGYANIRAM: However, hasn't the emphasis on generating both electricity as well as potable water resulted in a loss of efficiency?

TECHNOCHAND I have to admit you are right. I must also say at this point that Indian scientists have achieved remarkable success by using the closed cycle. However, they have used the open cycle more as a way to get potable water and they have succeeded in this mission too.

VIGYANIRAM: The success story of Indian scientists in generating drinkable water, the OTEC way is inspirational.

TECHNOCHAND And we hope that in the days to come they will, equally successfully, generate additional power as well along with potable water.

Music indicating change of scene

Sometimes the seeds of success lie hidden in failure. The scientists at the National Institute of Ocean Technology, in particular Dr. Subrahmaniam Kathirolu and his team, had set up their OTEC machinery in the Bay of Bengal in 2003 with the intention of generating power. The pipes were about 800 m long with a diameter of 1 m. and these were laid at depths of 1000 m. However, powerful ocean currents swept away the pipes. The next year they set up the machinery again. Again, the pipes were swept away. The point to bear in mind is that even if they had been successful in generating electricity, there were still many hurdles, not just in keeping the machinery secure, but also in designing equipment to conduct the power to the shore.

Without being devastated by two consecutive set back to his plans Dr. Kathirolu and his colleagues decided to directly use the saline waters to provide potable water instead of generating electricity. Their efforts at what materialized as the low temperature thermal desalination plant or LTTD. They set up a LTTD plant at a place between Kanyakumari and Mannar in Tamil nadu with the capacity to produce One lakh litre potable water.

Encouraged by this success, they set up another LTTD plant at Kavaratti in the Lakshadweep Islands in 2005. This had the capacity to produce One lakh litre water per day.

Recently the National Institute of Ocean Development has set up, under the supervision of Dr. Kathioli and his colleagues, a desalination plant that can provide 10 lakh litres of potable water per day.

However, Dr. Kathioli and his team are of the opinion that when they set up the 20 lakh litre per day desalination plant, the cost will drop to 3 paise a litre.

According to Dr. Kathioli, the plant is exclusively devoted to providing potable water using the salt water of the oceans as a resource. Later, efforts will be made to generate power alongside providing potable water. We sincerely wish them good luck as they go ahead with on this commendable mission.