

Innovation Tower

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A new form of cooling tower to be used in thermal power plants. The innovation tower will initially serve as a modification to numerous existing cooling towers until popularity demands dedicated applications. The product aims at maximizing our usage of the current resources available to us. Innovation tower serves to employ the use of a **modified dry cooling system combined with hydro-energy generation** in order to achieve a higher efficiency.

Concept Details (*can be made clearer through a pictorial depiction*): All thermal power plants use a source of heat to convert water to steam, which then run turbines. The steam is then cooled by either evaporating a part of it (**closed-cycle cooling**) or by using a local water body (**once-through cooling**).

The innovation tower uses the **dry cooling** method involving fans to create a pressure difference which causes movement of the steam. Since gravity is negligible in case of gas particles, this pressure difference makes the steam flow in the direction the fans operate in. Steam is made to condense only at the top by manipulation of cooling by changing of the fan speed. Although gravitational potential energy does not exist for gas particles, this is not the case for liquids. **Water in liquid form is dropped from the height which it had reached in steam form to rotate a turbine at the bottom thus converting the potential energy to electrical energy using a generator. This provides us with an additional amount of energy, which improves the overall efficiency of the process and also helps to overcome the loss of energy due to usage of fans in dry cooling.**

Both once-through cooling and wet cooling towers involve the usage and/or consumption of huge amounts of water whereas dry cooling towers have a relatively negligible water consumption rate. **This is because air, rather than water, is used for the cooling process, while Heller system requires the usage of minuscule amounts of water in a closed circuit.** The air that takes the heat away using indirect contact is allowed to go out through the top while channels for cool air are at low heights causing a gradual, differential cooling effect.

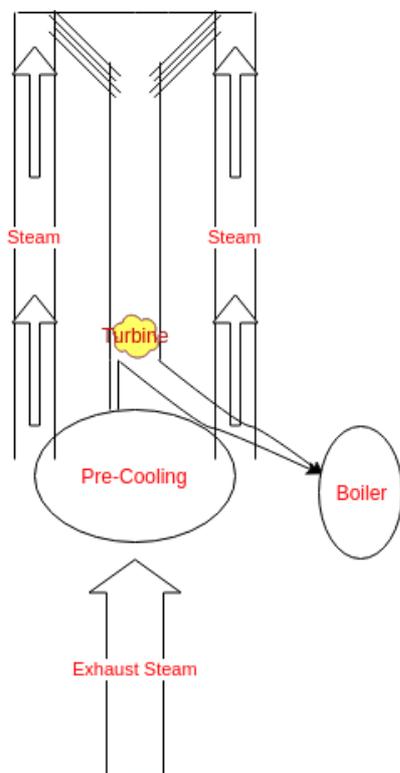
- Heat transfer to the air is an environment-friendly option but it is limited by air's lower heat capacity. Fans are required to counteract this by increasing the amount of air that comes in contact with the pipes.
- The Second Law of Thermodynamics was considered while ascertaining the feasibility of the tower and it was found that the energy required to convert the water to steam can be neglected since it is received as a consequence of the power plants' operation. The energy required to rotate the fans is found to be significantly lower than that required for a pump to send the same volume of water to a height.

In one sentence, Innovation Tower indirectly converts the temperature difference to potential energy to create extra electricity while improving overall plant efficiency by

manipulating water pressure.

Benefits: Such a process will allow us to overcome the parasitic use of energy accompanied with the process of dry cooling; **which will not only help us increase the efficiency of the overall cycle but allow us to produce overall higher power plant output.** This will further encourage the use of dry cooling, a process that requires **miniscule amounts of direct water** usage as compared to conventional cooling mechanisms. As a result, the major problem associated with dry cooling that is **electricity requirement will be removed**, making its use more popular since it does not only increase the efficiency of the cycle, but also contribute towards saving our resources.

We recognize the fact that while thermal power plants are not environmentally better than renewable forms of energy generation, they are fundamental to the energy generation



process. At such a time, when the switch over to better forms of energy is underway, the innovation tower will help to improve the efficiency of an already existing mode of energy production through the **form of a renewable energy**, thus helping the growing energy needs substantially.

Energy crisis is currently prevalent all over the world. With our limited reserves, the energy sector attempts at increasing its efficiency to full extent, a purpose which we wish to facilitate. **Existing Thermal Power Plants have an efficiency of mere 33%** which means that they use tonnes of coal only to produce one third of the electricity from its potential. Developing Nations have an even lower efficiency rate. Besides, the cooling towers in Thermal Power Plants have huge structures with the only purpose to cool the steam, whereas we find now that it could be used for further energy generation as well. The Innovation Tower does exactly this; it uses the liquid after its conversion from steam for further electricity generation with the help of hydropower turbines while providing a more optimized dry cooling process.

Salient Features (Summarised):

1. Coal is a non-renewable resource and thus it will not last for long. Changes are required to increase the efficiency for the usage of the existing coal remaining. Also, this technology will not be completely substituted by renewable energy resources in the coming years and will last for a long time in developing nations, therefore our product is a necessary solution.
2. Significantly increases the output of power plants which use high flow rates of water in their cycles since hydropower produced is directly proportional to flow rate.
3. A much more environment-friendly solution to the problem of cooling since heat produced by thermal power plants is not radiated to water but to air which saves on huge amounts of water which would otherwise be evaporated, causing immense harm to the environment.
4. The dry cooling process which involves the use of electricity operated fans to push ambient air onto the pipes to cool the water has been significantly improved by making the liquid which has been converted from gaseous state fall from a height to produce hydropower.
5. The smart combination of existing infrastructure allows usage of this untapped gravitational potential energy reservoir.
6. Increases the efficiency of the entire thermal cycle by the use of specific turbines which manipulate the pressure of the water.
7. Turns the drawbacks of high flow rates of power plants into an advantage since hydropower is directly proportional to flow rate.
8. Minimizes usage of material by using a hyperboloid structure allowing a taller structure for the same cost.
9. An adaptable design allows for the conversion of existing cooling towers- both Natural Draft as well as Air Cooled Condensers into Innovation Towers to allow initial projects to be very cheap and provide an appropriate test bed.
10. Hydropower turbine efficiencies are the highest in the energy sector and it is the most favored form of renewable electricity production. This form has been integrated into the cycle of thermal power plants.