

# THE ICE STUPA ARTIFICIAL GLACIERS A DESERT-GREENING TECHNIQUE

By Kim Assaël

In 2013 the engineer Sonam Wangchuk built the first six-metre-high prototype of the [Ice Stupa artificial glacier](#) freezing 150,000 litres of water in the arid Himalayan highlands of Ladakh, on the Tibetan plateau. Built during the winter season, the artificial glacier lasted under the full glare of the sun longer than expected, melting five times slower than a frozen pond.

The idea behind artificial glaciers is to collect glacial ice that keeps flowing and wasting away down the streams and into the rivers throughout the winter and use downstream as an irrigation system in spring and summer when ice melts and just when the fields need watering.

In the Ladakh's trans-Himalayan mountains, farmers who live at 3,500 meters face acute water shortages. The secret of life in this high-altitude desert has always been the Himalayan glaciers but warmer temperatures and the consequent water scarcity during seeding season have forced people in Ladakh to look for newer ways to freeze floods of water in the winter. Warmer temperatures in the cold season send a flood of water rushing down the mountains when it's too cold to grow crops. A huge amount of freshwater is lost every year, crops fail and farmers abandon farming and migrate to cities.

The engineer Chewang Norphel initiated studies to find effective methods to store water based on the ancient traditional knowledge on how to take advantage of the glaciers located in the high mountains.

Based on these studies Norphel Sonam Wangchuk started working on a new approach in which the glaciers would be free of location. The new method consists in freezing the stream water vertically in the form of huge ice towers or cones of 30 to 50m height that look very similar to the local sacred mud structures called [Stupa or Chorten](#). These ice mountains can be built right next to the village itself where the water is needed. Very little effort or investment would be needed except for laying one underground pipeline from a higher point on the stream to the outskirts of the village. Normally the head difference is easily 100m over a distance of roughly one to three kilometers.

The water is piped from upstream using gravity, not electricity or machinery. By using simple sprinklers the water is sprayed erupting in fine jets of water and turning into ice before hitting the ground. Numerous frozen water droplets accumulate thanks to the wind until the pyramid is shaped, a process called *seeding*.



The 2015 prototype, the result of a crowdfunding campaign that paid for a 2.3 km pipeline to direct glacial streams down to the village desert, lasted until early July, supplying 1.5 million litres of meltwater to 5,000 saplings planted by the local community. Further experiments are under way to improve the technology, reducing the capital cost of infrastructure per liter of water.

Gigantic ice cones as a water storage method can be frozen anywhere in the desert of Ladakh and prototypes of ice stupas are interesting for various different projects. For example the government of Sikkim in the northeast of India is lowering the risk of a devastating flood by draining water from a dangerously overfull glacial lake, with plans to turn the excess water into towers of ice for farmers to use in the warmer months. Taking into account the interest generated by these ice sculptures, new opportunities are also being explored in order to develop a new form of winter tourism in Ladakh.

In 2016 Sonam Wangchuk won the [Rolex Award](#) for his innovation. With his Rolex Award funds he intends to create up to 20 ice stupas, each of 30 metres high, and initiate a substantial tree-planting program in the desert near the [Himalayan Institut of Alternatives](#), once the new water supply system will be established.

In collaboration with [SECMOL, the Student's Educational and Cultural Movement of Ladakh](#), he has started to work on establishing an Alternative University in the same area. His objective is to engage young people from the Himalayas and beyond in eco-solutions for mountain areas.

### To know more

[Ice Stupa website](#)

[Ice Stupa in Facebook](#)

[Ice Stupa Artificial Glacier in Facebook](#)

[Ice Stupa in Twitter](#)

[Rolex Award](#)

[SECMOL website](#)

[Alternative University website](#)

[Article in National Geographic](#)

[Article in Treehugger.com](#)

[Article in Indiawaterportal.org](#)

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