

Case study: Utilisation of geothermal energy in Changthang, east Ladakh (greenhouse in Chumathang): its impact on gender upliftment

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There is a dearth of fresh vegetables in these cold areas in the winter months. The closure of roads makes it difficult to transport vegetables to rural areas. Moreover the vegetables transported in winter months are double or triple the amount in summers which makes it a luxury item and not something every layman can buy.

Every mountain area makes use of protected cultivation or greenhouse cultivation in the winter months to produce fresh vegetables. The efficiency of these greenhouses depends on the structure, type of glazing material used, whether there is use of insulation or not, use of heating to maintain certain temperature above freezing point etc. A casual chat about geothermal energy utilization about my colleague Sonam Tsering and myself together to showcase the use to the villagers.

A greenhouse was constructed at 14500 ft above sea level in Chumathang in order to utilize the geothermal heat for direct heating of the greenhouse. The greenhouse structure was constructed with the help of subsidy provided for greenhouse by government agriculture department. The land available where geothermal heating is present belongs to local family and so it had to be leased to do anything on it. It took us few months to please the land owner, Phuntsog Sonam, lease the land and construct the greenhouse starting from August till November 2021 when it was finally ready. Prior to starting the research, a meeting was held with the village heads and representatives at various levels to tell them what will be done and to involve them in the project in order to transfer knowledge and to make them aware of this rich energy resource which they have at their doorstep.

Since this was the first greenhouse to utilize geothermal energy, a small inauguration event was done by us wherein the importance of geothermal energy was made known to the villagers not only by geothermal expert but also by the local member of parliament, Jamyang Tsering Namgyal, Religious civil body president, Thubstan Chewang and member minority affairs, Ms Rinchen Lhamo. When working in any remote rural area it is important to let the local people know of what will be doing so that they are aware of the project and don't point any fingers when the project is underway.



Figure 1: meeting with villagers prior to start of the research.



Figure 2: public representatives at the inaugural.

The structure was brought from leh and took 5 days to install with the labors staying and working in tent at the site. The challenge while installation was that of electricity as there is no reliable supply in chumathang and blackouts during the day made it impossible to do the welding works for the structure. So the installation team had to bring in their own diesel generator set to use for the welding work.

The structure is nothing fancy sort of. Made of iron framed structure with polycarbonate as the glazing material. The most common type of greenhouse used by every small household in villages is made of local mudbrick on the northern side, eastern and western with door on the ester wall. Glazing made of polythene on the southern side to gain maximum sun in the winter period. It was suggested by the locals that using local bricks made of mud will not be suitable at the geothermal site due to the moisture trapped inside the greenhouse which will gradually wash away the mud brick. Hence to begin with, the structure was made framed iron with no wall and polycarbonate glazing in dome shape. A team of scientist from GB Pant NIHE headed by Dr Subrat Sharma was there to help with the installation of the hydroponic system, the nutrients etc and to impart the knowledge to the local person who was selected to take care of the greenhouse.



Figure 3: start of construction of the greenhouse.



Figure 4: pipes for the soilless cultivation.



Figure 6: rusting due to the steam inside.



Figure 5: hot water pool inside the greenhouse which resulted in rusting.

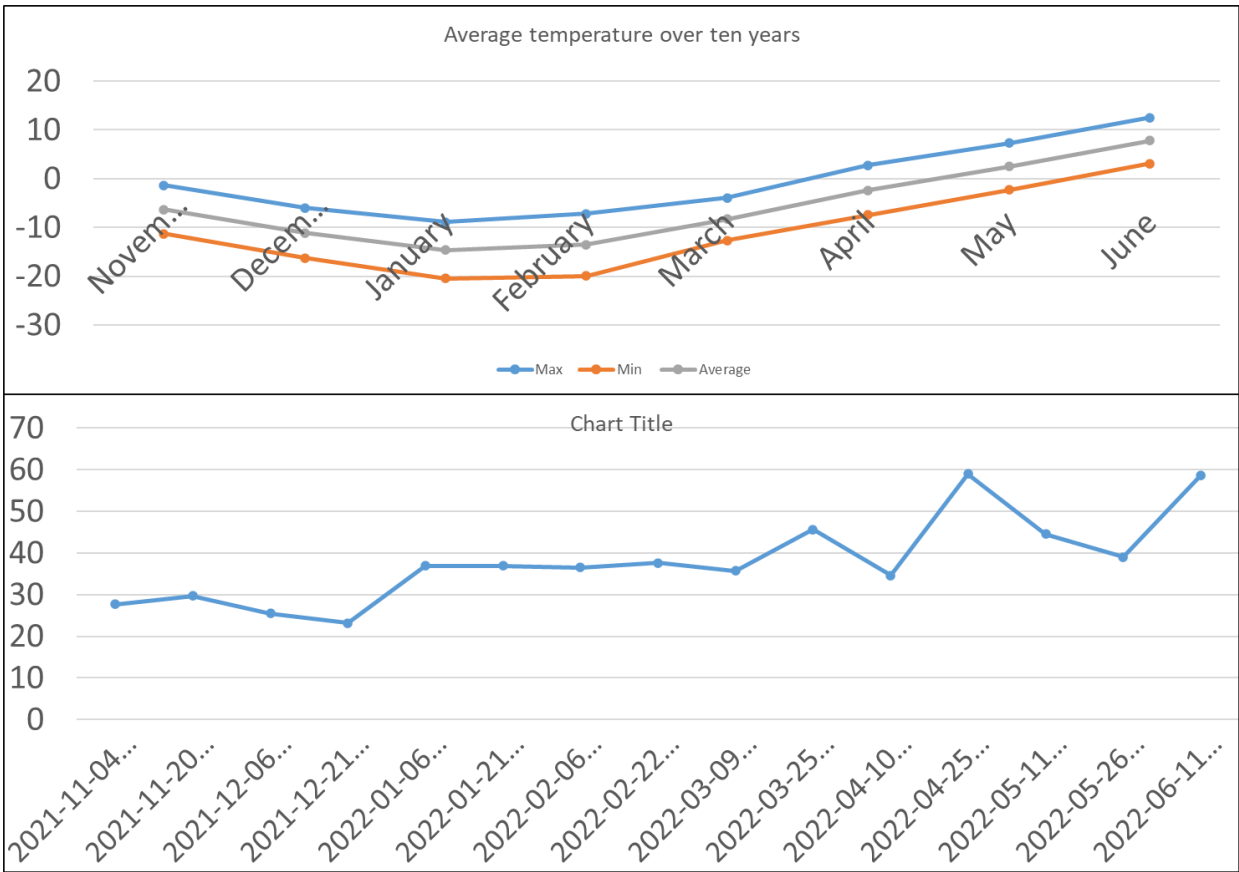


Figure 7: steam disappeared after covering the pool with soil.



Figure 8: the structure

The temperature inside was monitored to check the maximum and minimum when the outside temperature dropped to -25°C . It was amazing to see the temperature inside remaining between 18 to 25°C in the peak winter during Nov to March. Then with the increase in the ambient temperature, there was an increase in the internal temperature too with inside temperatures going above 60°C in May.



Growing of vegetables: the first year was a trial to see what can be grown in an unknown condition. This was the first time geothermal heating was used for crop cultivation in Ladakh so there was no idea what to expect except to experiment.



The growth medium: the land of the geothermal greenhouse area was not fertile for vegetable growth. It is difficult to find agricultural fertile soil nearby so a trial was done for soilless cultivation. PVC pipes were used with holes for vegetation and then saplings were put in the holes. Nutrients were added to the water/ growing medium as per requirements. It was observed that the growth inside was pretty faster than in ambient outside.

Challenges:

1. There is no fresh water available nearby. The Indus river is there but to have correct pH value for the hydroponic, it needs to be treated. As a temporary solution, fresh water was

stored in a 100 Litre container bought from nearby village.

2. Constant monitoring is required daily to check the pH of the water and to add nutrients etc. for this a well trained local was required which was difficult to get but for few months two local literate ladies were there who were shown what and how to do regarding the addition of nutrients etc.
3. During day time the temperature went above 30°C which meant too much heat for the plants. Since there were no fans or other cooling equipments, the natural way to lower the temperature was to open the door and the windows. Again constant monitoring was required for this which was bit difficult. It so happened one night in peak winter in Jan the door was left open and all the plants were dead. Then another lot had to be planted.
4. In the summer months, the temperature inside went so high above 70°C which resulted in melting of the PVC pipes.



Results:

1. Vegetation in the geothermal greenhouse was a success. The constant monitoring system is required for the same so as to maintain the quality of the growing medium, timely opening and closure of the ventilation systems.
2. One can grow summer crops like tomato cucumber in winter months as the temperature

remains above 18°C even in peak winter. The high temperature in summertime can be utilized to produce.

3. More training is required to use technology for geothermal greenhouse.