Innovative Solar Water and Space Heating Systems for Mountains-A Case Study of the Indian Himalayas

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Domestic Solar Water Heating Panel for Mountains (Solar Hamam)

Domestic Solar Water Heating System

Domestic Solar Space Heating System
Schematic Detail of the Domestic Solar Water Heating Panel for Mountains (Solar Hamam)

- Glazing
- Absorber
- Insulation
- Frame

Dimensions:
- OUT: 35 inches
- IN: 39 inches
- 69 inches
- 73 inches

Weight: 35 Kg.
Technical Specifications of Water Coil used in Domestic Solar Water Heating Panel for Mountains (Solar Hamam)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Unit</th>
<th>Alloy code</th>
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<tbody>
<tr>
<td>Density</td>
<td>g/cm³</td>
<td>2.7</td>
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<tr>
<td>Melting Point</td>
<td>°C</td>
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<td>Thermal Expansion</td>
<td>M/K</td>
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<td>Elasticity</td>
<td>GPa</td>
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<td>Thermal Conductivity</td>
<td>W/mK</td>
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<td>Electrical Resistivity</td>
<td>Ohm·m</td>
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<td>Proof Stress</td>
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<td>Tensile Strength</td>
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<tr>
<td>Elongation A50 mm</td>
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<td>Hardness Brinell</td>
<td>HB</td>
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<td>Elongation A</td>
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<tr>
<td>Weldability -Gas</td>
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<td>Excellent</td>
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<td>Availability</td>
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- Glazing - Normal Window Glass
- Absorber Sheet - GI Sheet
- Insulation - Thermocol
- Insulation Cover - Aluminum Sheet
- Innovative Paint - Black with amendments to improve solar absorption

Water Capacity - 18.5 liters

Dimensions:
- 35 inches
- 69 inches
Domestic Solar Water and Space Heating Systems

Innovation & Novelty:

- Fabricated of locally available material by the rural artisan (carpenter).
- Fabricated on wood frame with window glass available in local households with innovative paint to absorb maximum sun energy for water heating.
- In high altitude mountains sun is more bright (>250 sunny days/year) and intense in winter than plains.

Process:

- Water heating panel is installed at 45° angle on the premises facing south.
- Water heater coil hold 18.5 liters of water and is heated to 80-90°C within 30-45 minute of solar illumination.
- Household member can draw 100-120 liters of hot water in clear sunny day for sun rise to sun set for household purpose without burning fire place for water heating.
- Solar heated water is of potable quality and used for cooking as well. This reduced cooking time and save LPG.
- Space heating panel installed in south facing wall of the house and heat air and blow in living space
- Save 40% Fuel wood
Rural Artisan fabricating Domestic Solar Water Heating Panel for Mountains (Solar Hamam)

Wood Frame

Fixing of Water Coil

Insulation

Glazing
Installation in different places of Domestic Solar Water Heating Panel for Mountains (Solar Hamam)

Buchair Anni Kullu, H.P.

Padum Zanskar, Kargil J&K

Shila Zanskar, Kargil J&K

Ladhagi, Anni Kullu H.P.
Sample Performance Testing of Mountain Solar Water Heating Panel in July 2017 with 30 Second Recording Interval for four days at Padum, Zanskar Valley Kargil, J&K
Rural Artisan fabricating Domestic Space Heating System
Display of HRG Domestic Solar Water and Space Heating Systems for Mountains

Dr Lal Singh, Director, HRG explaining details of solar water heating panel to the Secretary, DST (GoI), at BAIF Pune in May 2016

HRG Team, explaining details of panels to the officials and visitors in Ummat Bharat Pavilion, IISF 2016 at CSIR NPL, New Delhi December 2016

DST GoI Displayed HRG Technology in Exhibition at Delhi from 11.1.2018-31.1.2018 at Minister of ST and MoEF Dr Harsh Wardhan’s Residence, New Delhi
Traditional Domestic Water and Space Heating Systems & Practices in for Mountains

Village Sias, Chachyot, Mandi H.P.

Water Heating Dhlair Kullu H.P.

Village in Zankar Valley, Kargil, J&K

Emission from Kitchen and Haman.
Women Collecting Fuel Wood and Dung Cakes in Mountains

Women Collecting fuel wood at village Sarahan, Nirmand Kullu H.P.

At Village Moolkoti, Shimla

Dung cake at Zanskar Valley J&K
Scope and Justification of Innovation for Mountains

- Modern water heating devices like solar water heating systems and electric geysers fail to address the need of mountain communities dependent on fuel wood and dung due to high installation and recurring operational and maintenance cost.

- Areas above 2000 meters and above altitude are cold throughout the year and 50% of the fuel is consumed for water and space heating.

- Fuel collection is one of the major reasons for forests degradation and cause of women drudgery in mountains.

- This innovation will save around 40% fuel wood and mitigate around 5.00 MT/annum/panel of Household Carbon Emission.

- Women save average 3 hours/day of fuel wood collection and significant reduction in indoor level of pollution.

- Himalayan mountain region is inhabited by about 7.00 million households and are dependent on natural resources to meet their demand of fuel.
Popularization of Innovations and Providing New Skills to Rural Artisans

Display and Demonstration to School Children

Display and Demonstration to Community

Effective Extension Needs
i. Socially Acceptable
ii. Need Based
iii. Cost Effective
iv. Minimum Post Installation Maintenance
v. Long Life of Product
Thank you INSIC for Inviting and Making us Participate in this Conference

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