IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 1, April 2026
Impact Factor: 8.2

Heating Technology for Houses in Cold Places Areas

Sahil Balu Phad[1], Anil Waman Gaikwad[2], Vaibhav Ramesh Godse[3]
Omkar Karbhari Ghuge[4], Sarthk Milind Shinde[5], Prof. P. T. Jagtap[6](Guide), Prof. S.S. Shelar[7]
Phadsahil4@gmail.com, anil.gaikwad2434@gmail.com, godse6138@gmail.com
omkarghuge005@gmail.com, Sarthkshinde43432gmail.com, pratibha.jagtap@matoshri.edu.in
shraddha.patil@matoshri.edu.in
Students, Department of Civil[1,2,3,4]
HOD Civil Dept[7]
Matoshri Asarabai Institute of Technology and Research Centre, Nashik, Maharashtra, India

Abstract: *Heating of residential buildings in cold climate regions is a major challenge due to high heat loss through external walls and increased dependence on conventional electric or fuel-based heating systems. This project presents a wall-integrated heating and insulation system designed to improve indoor thermal comfort while reducing overall energy consumption.*

The proposed system consists of a 10-inch thick double brick wall, where an insulated cavity is created between two 4.5-inch brick masonry layers. The cavity contains thermocol (EPS) insulation, a spring-linked electric heating coil, and an aluminium foil reflective layer. The insulation minimizes heat loss, the heating coil generates controlled thermal energy, and the reflective foil directs radiant heat toward the interior of the building. The inner brick layer acts as a thermal mass, storing heat and releasing it gradually into the living space.

The heating system operates with the help of a thermostatic control unit, ensuring safe and energy-efficient operation by maintaining the indoor temperature within the comfort range. This method provides uniform, silent, and spacesaving heating without the need for separate heaters or radiators.

The proposed wall-based heating technology is suitable for cold and hilly regions, offering improved thermal efficiency, enhanced comfort, and reduced reliance on conventional heating appliances. The system demonstrates a practical approach toward energy-efficient residential heating using simple construction materials and controlled electrical heating. .

Keywords: *residential buildings*

I. INTRODUCTION

1.1 Background: Infrastructure plays a vital role in improving the quality of life and living standards of people. Residential buildings are one of the most important components of infrastructure, as they directly affect human comfort, health, and safety. In cold climate regions, maintaining a comfortable indoor temperature inside houses is a major challenge due to extremely low outdoor temperatures.

Heat loss through building components such as walls, roofs, floors, and windows is very high in cold areas. Among these components, **external walls contribute significantly to heat loss**. Traditional residential buildings mainly use single brick walls or uninsulated masonry walls, which are not suitable for cold climatic conditions.

In recent years, civil engineering has shifted from conventional construction practices towards **energy-efficient and sustainable building design**. Modern buildings are expected not only to provide structural strength and durability but also to ensure thermal comfort with minimum energy consumption.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 1, April 2026 Impact Factor: 8.2

Heating systems such as electric heaters, blowers, fireplaces, and radiators are commonly used in cold regions. However, these systems consume large amounts of energy, increase electricity bills, and often provide non-uniform heating. Moreover, they occupy indoor space and require continuous operation.

To overcome these limitations, **wall-integrated heating systems** are gaining importance. In such systems, the wall itself acts as a heating and insulation element. By integrating insulation materials and controlled heating elements within the wall, indoor temperature can be maintained efficiently.

This project focuses on the development of a **wall-based heating technology** using a **double brick wall system with internal insulation and electric heating coil**, specially designed for residential buildings in cold climate areas.

1.2. Problem Statement: In the modern world, energy consumption is increasing rapidly due to population growth, urbanization, and rising comfort expectations. In cold regions, a major portion of household energy is used for space heating.

Conventional heating systems have several drawbacks:

High electricity or fuel consumption

Uneven heat distribution

Increased operational cost

Dependence on external heating devices

Residential buildings lose a large amount of heat through poorly insulated walls. If heat loss through walls can be reduced and controlled heating can be provided through the wall itself, overall energy efficiency of the house can be significantly improved.

The need for this project arises due to the following reasons:

To reduce heat loss through external walls

To provide uniform indoor heating

To reduce dependency on separate heating appliances

To improve thermal comfort in cold climate houses

To reduce electricity consumption for space heating

To promote energy-efficient building construction

To support sustainable and green building concepts

This wall-based heating system is especially useful in **hilly regions, high-altitude areas, and cold zones**, where maintaining indoor temperature is difficult and expensive using conventional methods.

1.3 Objectives of the Project The main objective of this project is to design and study a wall-integrated heating system capable of maintaining comfortable indoor temperature in residential buildings located in cold climate regions.

The **specific objectives** of the project are:

To study heat loss through residential walls

To design a double brick wall with internal insulation

To integrate electric heating coil within wall cavity

To reduce heat transfer from inside to outside

To utilize wall as a space heating element

To improve indoor thermal comfort

To analyze effectiveness of insulation and heating system

To study energy efficiency of the proposed system

To develop a simple and cost-effective heating solution

II. LITERATURE SURVEY

Introduction; A literature survey reviews existing research papers, journals, books, and technical reports related to a project topic. It helps in understanding current technologies, research developments, and practical applications. It also

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 1, April 2026 Impact Factor: 8.2

identifies limitations of existing systems and suggests areas for improvement. This survey focuses on building heating technologies, insulation materials, wall-based heating systems, and energy-efficient construction for cold regions.

Building Heating Technologies: Heating systems maintain comfortable indoor temperatures in cold climates. Common systems include conventional room heaters, central heating systems, underfloor heating, and wall-based heating systems. Wall-integrated heating is becoming popular because it provides better heat distribution and improved energy efficiency.

Heat Transfer Through Walls: Heat transfer through building walls occurs by conduction, convection, and radiation. In cold climates, heat moves from inside the building to the outside environment. Uninsulated walls cause high heat loss, while multi-layer walls with insulation can significantly reduce this loss.

Thermal Insulation Materials: Insulation materials help reduce heat loss through walls. Common materials include EPS (Thermocol), XPS, mineral wool, glass wool, and polyurethane foam. Thermocol (EPS) is widely used because it has low thermal conductivity, is lightweight, inexpensive, and easily available.

Wall-Integrated Heating Systems: Wall-integrated heating systems place electric heating elements inside the wall structure. Heat is transferred to the wall surface and then radiated into the room, providing uniform heating and better thermal comfort.

Heating Elements and Reflective Materials: Electric heating systems use resistance wires such as nichrome or carbon heating cables. Reflective materials like aluminium foil help reflect heat toward the interior, improving heating efficiency.

Cavity Wall Construction: Cavity walls consist of two brick layers separated by a gap filled with insulation. This structure improves thermal resistance and reduces heat transfer, making it suitable for cold-climate buildings.

Temperature Control and Energy Efficiency: Thermostats help control indoor temperature and prevent overheating. Proper insulation and controlled heating systems help reduce energy consumption and improve efficiency.

Research Gap: Existing studies highlight the need for low-cost heating systems, simple construction methods, and better integration of insulation and heating systems in building walls.

Conclusion: The literature review shows that combining wall-integrated heating with insulation can reduce heat loss and improve indoor comfort. Using cavity walls, thermocol insulation, reflective foil, and controlled heating elements can increase heating efficiency and save energy in residential buildings.

III. METHODOLOGY

3.1.Study of Climate Conditions: Analyze temperature, weather conditions, and heating requirements in cold regions.

3.2.Study of Existing Heating Systems: Review different heating technologies such as electric heaters, central heating, solar heating, and radiant wall/floor heating.

3.3.Selection of Heating Method: Choose a suitable heating system based on efficiency, cost, and suitability for houses in cold areas.

3.4.Heat Transfer Analysis: Analyze heat transfer through walls and insulation to understand how heat is maintained inside the house.

3.5.System Design: Design the heating setup including heating elements, pipes/wires, and insulation materials.

3.6.Performance Evaluation: Evaluate the system based on heat distribution, energy consumption, and heating efficiency.

3.7.Result Analysis: Analyze the results to determine the effectiveness of the heating system for cold regions.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 1, April 2026
Impact Factor: 8.2

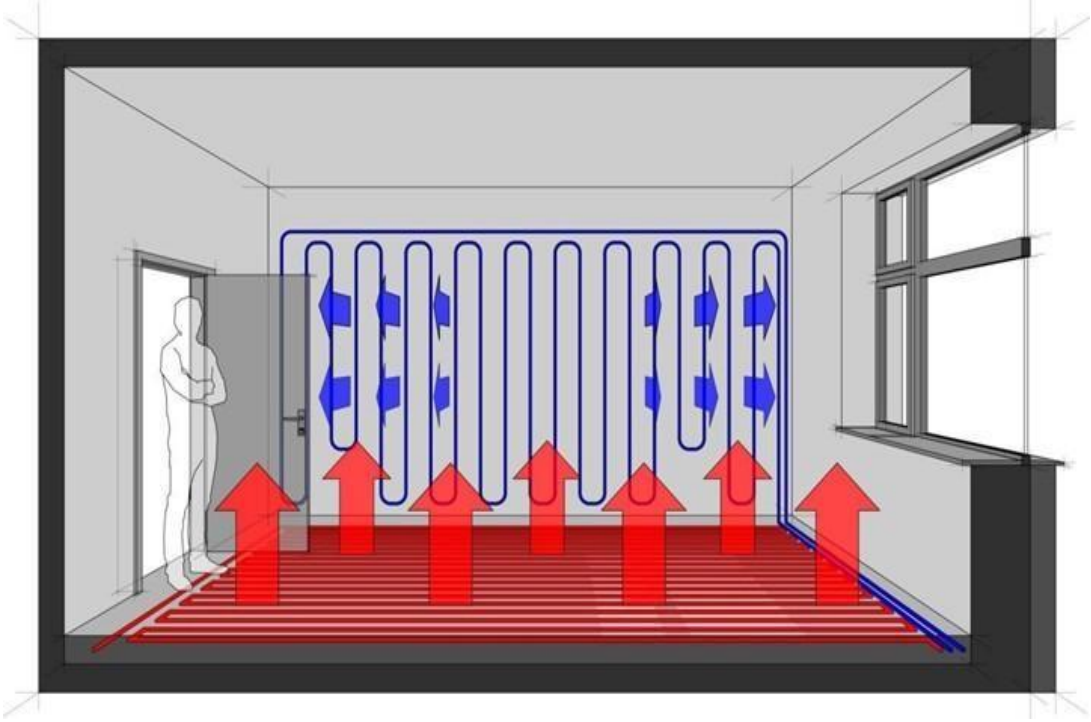

FIG.1 A Room With Floor Heating And Wall Cooling.

IV. CONCLUSION

Heating technology is very important for maintaining comfortable living conditions in houses located in cold areas. Different heating systems such as electric heating, solar heating, and wall or floor-based heating can help maintain indoor temperature efficiently. Proper insulation and suitable heating methods reduce heat loss and improve energy efficiency.

This study shows that using an effective heating system along with good insulation can provide comfortable indoor conditions, reduce energy consumption, and improve the overall quality of living in cold region houses.

REFERENCES

[1]. Building Construction – Arora & Bindra, Dhanpat Rai Publications, Latest Edition.
[2]. Building Materials – S.K. Duggal, New Age International Publishers.
[3]. Heat Transfer – J.P. Holman, McGraw-Hill Education, Latest Edition.
[4]. Heating, Ventilation and Air Conditioning (HVAC) – C.P. Arora and S.C. Domkundwar, Dhanpat Rai & Co.
[5]. Energy-Efficient Buildings – P. Torcellini, National Renewable Energy Laboratory (NREL), Technical Reports.
[6]. Thermal Insulation Handbook – Editors: F.P. Incropera, ASHRAE Publications.
[7]. Research Papers on Wall Heating and Radiant Heating Systems – ScienceDirect Database (Elsevier).
[8]. Research Articles on Thermal Insulation Materials (EPS, XPS, PU Foam) – Springer Journals.
[9]. Energy Conservation Building Code (ECBC) – Bureau of Energy Efficiency (BEE), Government of India.
[10]. National Building Code of India (NBC 2016) – Bureau of Indian Standards (BIS).
[11]. ASHRAE Standards for Thermal Comfort and Building Heating Systems – American Society of Heating, Refrigerating and Air-Conditioning Engineers.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 1, April 2026
Impact Factor: 8.2

[12]. Research Publications on Radiant Wall Heating Systems – IEEE Xplore Digital Library.
[13]. Online Technical Articles and Case Studies on Cold Climate Housing – National Renewable Energy Laboratory (NREL).
[14]. Green Building and Sustainable Construction Guidelines – Indian Green Building Council (IGBC).
[15]. Web Resources and Technical Manuals on Energy-Efficient Residential Heating Systems – Government and Educational Websites.