Contents

Scope

This manual specifies the requirements for the undertaking of the supply, design, installation, set to work, commissioning and handover of solar heating systems to supply domestic hot water, space heating for permanent buildings. While also meeting the specific requirements of the Microgeneration Certification Scheme (MCS) and Installer Standard MIS 300 MIS 3001 version 5.1 issue date 17th April 2025.

The scope of the MCS Installation Standard is limited to installations with a design heat load requirement of up to 70kWth, where multiple MCS certified solar collectors may be used in a single installation, but the individual output for a single appliance shall not exceed 45kWth as defined by the MCS product certification scheme document **MCS 004 – Solar Heating.**

Product Standard

- **Description**: Product-level requirements for solar collectors and related components.
- **Version: 3.4** (Product Standard component)
- **Issue Date: 1 December 2019**
  Note: For current certification of solar thermal products (collectors), this standard defines product testing and acceptance criteria.

Update due: MCS 004 issue 4.0 UPDATED VERSION DUE OUT 1st August 2026.

Updates in response to MCS Standards Project review:

- Modernised document style and updated to new MCS standard text.
- Removed collectors which are not of the liquid flat-plate or liquid evacuated tube type from the standard.
- Testing criteria now includes reference to ISO 9806.
- New definitions for Solar Heating System, Solar Collector Array, Solar Heating Collectors and PV Thermal (PVT) Collector and included informative reference to ISO 9488.
- Update language to 'Solar Heating'. 01/08/2024

Where to Access the Documents

All of the standards and calculators listed above are published and maintained on the official MCS Standards & Tools Library on the MCS website: MCS Standards & Tools Library:
https://mcscertified.com/standards-tools-library/ MCS Certified

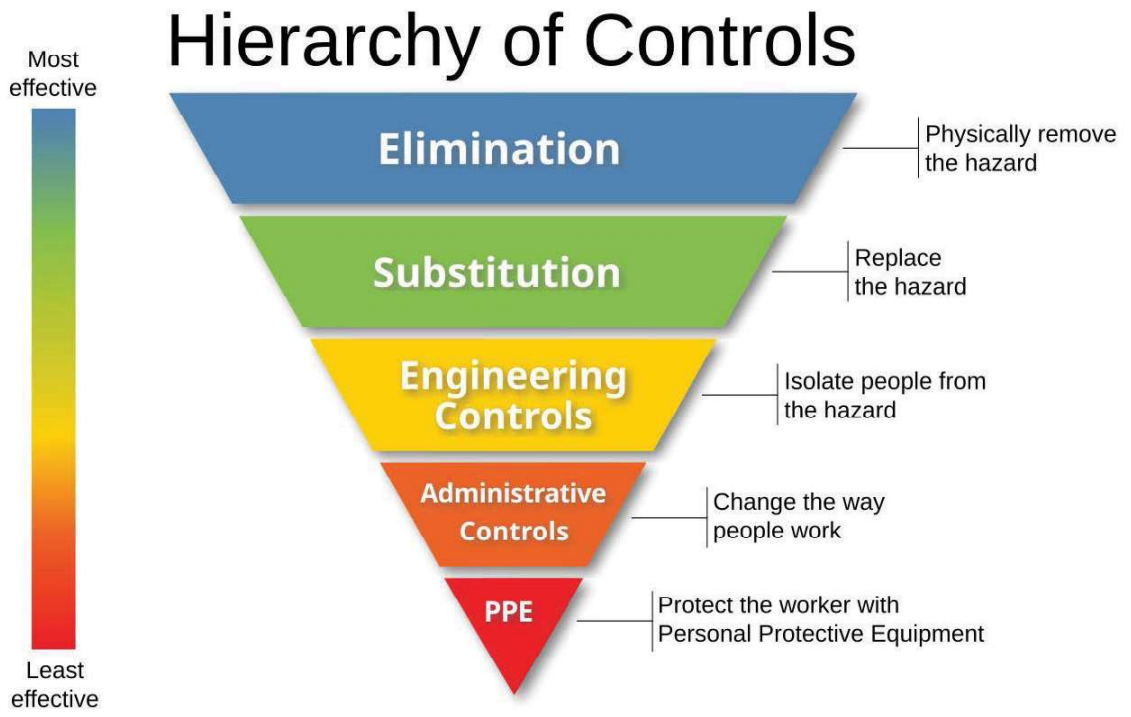
You should download the **PDF versions** of the standards (especially MIS 3001 – Solar Heating Standard) to ensure you refer to the exact technical requirements.

Health and Safety

Health and Safety should always be at the forefront of everything we do. Following is an introduction to Health and Safety activities relating to working on Solar Thermal installations whether Installing, servicing, maintenance or repair.

You must always attend a recognised training programme for Health and Safety to ensure compliance and not rely on hearsay or outdated information.

Never carry out any working activities without correct PPE or Training. Do not forget the hierarchy of control relates to all aspects of Health and Safety and must be applied accordingly.



Working at Height

Under the Working at Heights Regulations 2005, working at height is defined as place where a person could be injured falling from it even if it is at or below ground level. Ladders and stepladders can be a sensible and practical option. They can be used for work at height when the use of other work equipment is not justified because of the low risk and short duration (short duration means working on a ladder for no more than 30 minutes at a time); or when there are existing workplace or site features which cannot be altered.

Remember, You need to be competent. This means having the necessary skills, knowledge and experience to use a ladder properly for the work you will carry out, or, if you are being trained, you work under the supervision of somebody who can perform the task competently. Training often takes place on the job and does not always have to take place in a classroom. What matters is that an individual can apply what they have learned in the workplace.

Ladders can be used for access to scaffolds and working platforms as long as they are of the right type (i.e. a suitable grade of industrial ladder), in good condition and effectively secured (tied) to prevent movement. You should ensure they extend at least one metre above the landing point to allow for a secure handhold when stepping off.

A ladder must be inspected every three months and prior to every use by the person using it.

Harnesses can be used if they have had an Inspection prior to, and after, every use. Check for abrasions, cuts, tears, burns, mould, fraying, discolouration and chemical damage. If the harness has been subject to paint overspray the harness must NOT be used.

Check all stitching for signs of pulling, loosening or cut thread. Buckles MUST be free from rust, cracks, excessive wear or distortion.

Everyone involved in carrying out work on roofs should be aware of the following facts:

High risk: almost one in five deaths in construction work involve roof work. Some are specialist roofers, but many are just repairing and cleaning roofs.

Main causes: the main causes of death and injury are falling from roof edges or openings, through fragile roofs and through fragile rooflights.

Equipment and people: many accidents could be avoided if the most suitable equipment was used and those doing the work were given adequate information, instruction, training and supervision.

Remember: when working at height or on roofs you will need either:
Hand rails or / and guard rails
Toe boards
A safe working platform at roof height

Working at Height recap:

Avoid working at height if possible

Provide safe means for workers for access to where they work

Put precautions in place for fragile surfaces

Account for falling objects

Keep equipment maintained

Use the correct PPE to avoid falls

Don't over-reach on ladders or step ladders

Don't place ladders onto fragile surfaces

Don't overburden the ladders

Don't use ladders or stepladders for heavy tasks, only use them for simple and light work

Don't use ladders for long periods of time

COSHH:

What are hazardous substances?

Any material or substance with the potential to cause illness or injury to people at work who come into contact with them. These can include but not limited to:-

Dust

Vapours

Gases

Liquids

Mists

Fumes

Solids

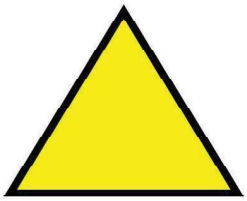
Micro-organisms

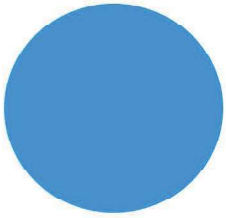
Safety signs and signals:

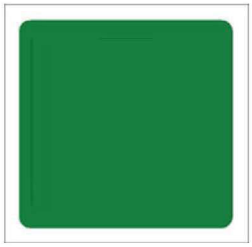
If you do not understand what a sign means, it is your employers' job to explain it to you.

There are four types of safety signs

- Red and White means prohibition
- Blue means Mandatory
- Yellow and Black triangle is a warning sign
- Green means safe condition



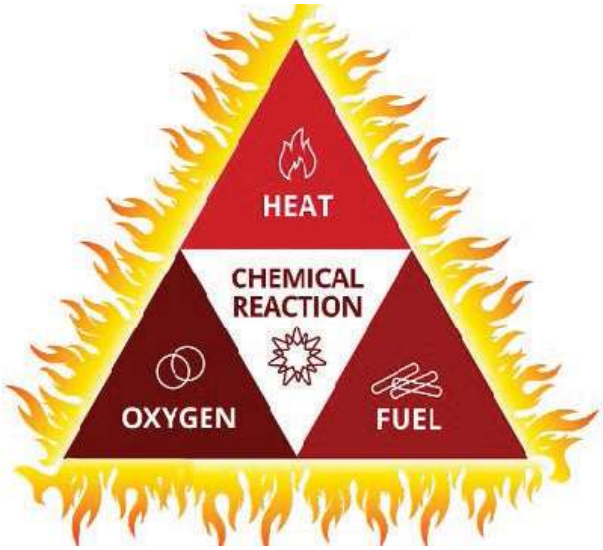


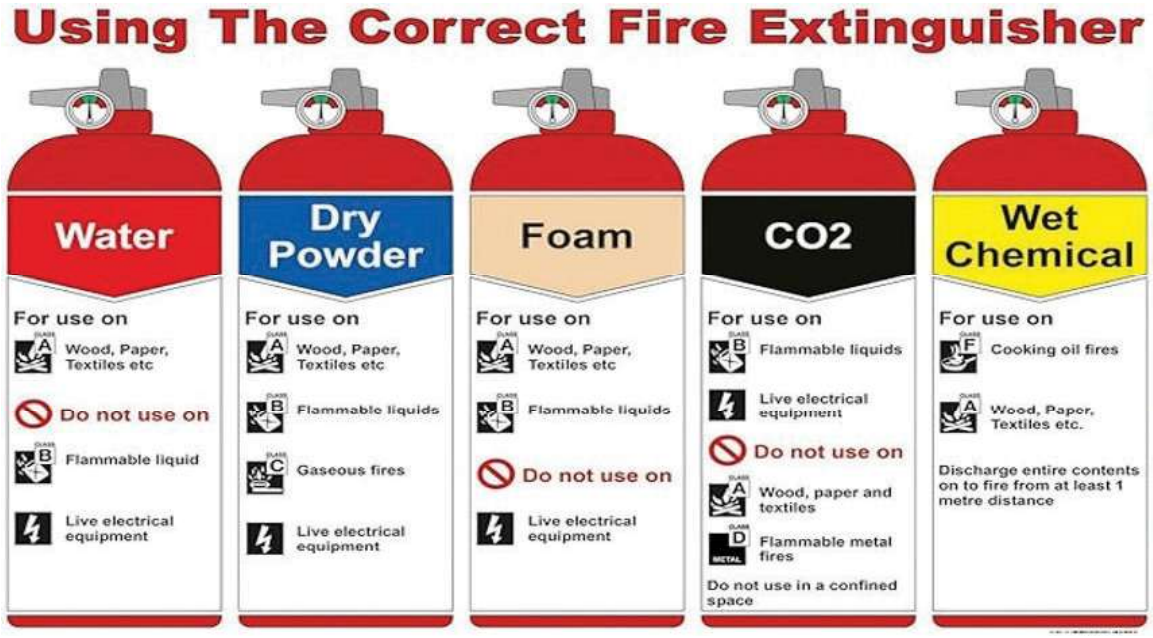


Fire Safety:

Employers (and/or building owners or occupiers) must carry out a fire safety risk assessment and keep it up to date. This shares the same approach as health and safety risk assessments and can be carried out either as part of an overall risk assessment or as a separate exercise.

Based on the findings of the assessment, employers need to ensure that adequate and appropriate fire safety measures are in place to minimise the risk of injury or loss of life in the event of a fire.



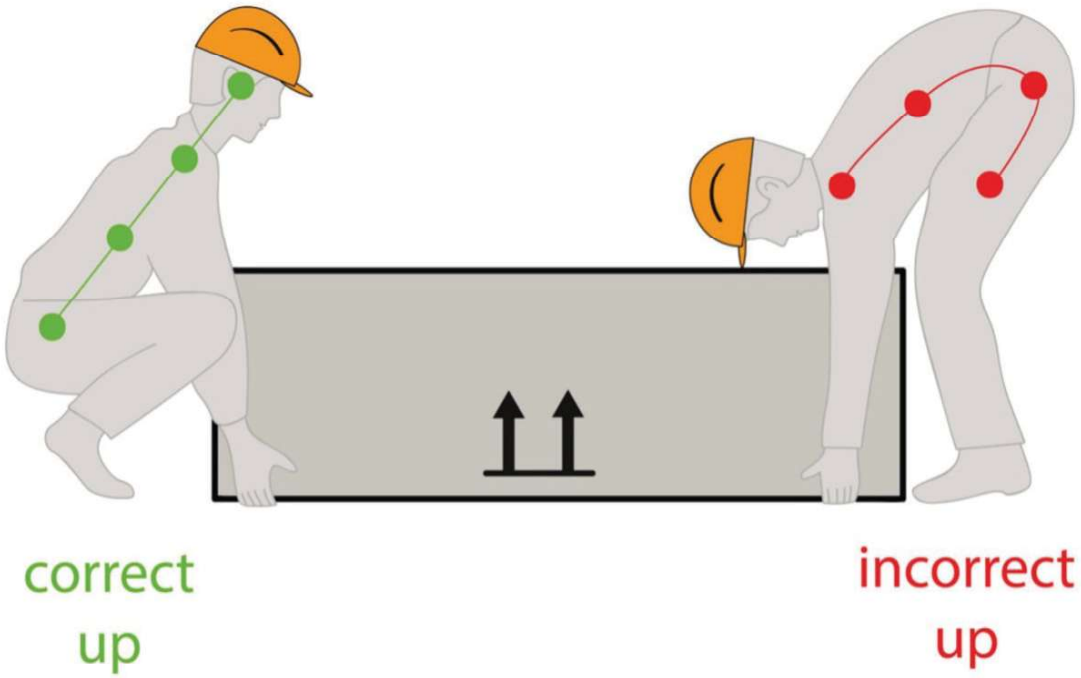


Manual Handling:

Manual handling is covered by the Manual Handling Regulations 1992.

20% of workplace accidents are a result of poor manual handling technique.

You must ensure that all lifting techniques are carried out correctly and training should be sought before undertaking any manual handling activities.



Follow these guidelines

Always keep a straight back

Always bend your knees

Plan your route

Think LITE -Load, Individual, Task, Environment

Always keep the load at waist height & close to your body

Use mechanical aids if possible

Never twist your back

Never bend your back

Don't over-reach when placing the load

Do not lift the load over your shoulders

Do not let the load drop below your waist

Do not lift a load that you are uncomfortable with

Abrasive wheels:

Abrasive wheels are typically used in angle grinders but can also be found in a wide variety of tools and equipment. They are highly efficient at shaping, cutting and grinding hard materials like tile and metal.

What are the dangers of abrasive wheels?

Injuries to the eyes caused by flying metallic and abrasive particles

Injuries due to ejected workpieces or flying fragments

Dust and fume inhalation from dry grinding

Vibration (over time this can lead to hand-arm vibration syndrome, which can cause pain or loss of digits due to restricted blood flow)

Noise , leading to hearing loss

Drawing in from loose clothes & jewellery

Prior to use always conduct a ring test on the wheel with something that is non-metallic. If a part must be replaced only use parts recommended by the manufacturer. If a replacement blade does not fit the spindle properly, nothing can be done to make it compatible. The guard must be no more than 1/8" from the wheel.

Safe Electrical Isolation:

Purpose of Safe Electrical Isolation

Safe electrical isolation is a mandatory safety process used to eliminate the risk of electric shock, burns, arc flash, fire, or unintentional equipment operation when carrying out electrical work. The process ensures that electrical energy is fully disconnected, cannot be inadvertently restored, and is confirmed as absent before work begins.

No electrical work should be undertaken unless safe isolation has been correctly achieved and maintained for the duration of the task. Only persons who are suitably trained and competent shall carry out electrical isolation and verification of dead systems. Individuals must understand the electrical system they are working on and be familiar with the correct use of test equipment and lock-off devices.

The following procedure shall be followed in sequence as per GS 38:

Clearly identify the correct circuit, distribution board, isolator, or equipment to be worked on. Do not rely solely on labels; verify by reference to drawings or operational checks where necessary.

Inform anyone who may be impacted by the isolation that the electrical supply will be disconnected.

Switch off the appropriate isolator, circuit breaker, or protective device to disconnect the electrical supply.

Fit an approved lock-off device to the point of isolation and attach a warning tag stating:

- Name of person applying the lock
- Date and time
- Reason for isolation

Test the voltage indicator on a known live source or testing device to confirm it is functioning correctly.

Using the voltage indicator, test all relevant conductors in the correct sequence: live, neutral and earth to confirm that no voltage is present.

Re-test the voltage indicator on a known live source to confirm it has not failed during use.

Proceed with the work only once dead has been confirmed. Maintain control of the isolation at all times.

On completion of work:

- Ensure all tools and materials are removed
- Replace covers and enclosures
- Confirm the area is safe and persons are clear
- Remove the lock-off device and restore the electrical supply ensuring you re-test the voltage indicators at every stage.

Module 1:

Introduction

Module Objectives

After completing the module, you should be able to:

1. Understand and outline our dependence on fossil fuels for domestic heating and suggest reasons for pursuing low-carbon alternatives.
2. Compare the scale of the solar resource available to other renewable and fossil fuel alternatives.
3. Explain the spatial variation in solar supply with geographical location and its temporal variation over the course of a day or a year.
4. State the approximate scale of seasonal, daily and weather attributed constraints associated with using the solar resource and list the main ways of reducing their impact.
5. Summarise the current scale and growth rate of the European and UK solar thermal markets.
6. Distinguish between active and passive uses of solar energy and between solar thermal and solar photovoltaic technologies.
7. Describe the basic operating principles of a solar thermal system.
8. State the necessary site conditions required to permit the installation of an effective domestic solar thermal system.
9. Suggest a range of future developments for solar thermal technology.

Society has always been dependent on the Sun as the fundamental source of energy on our planet. Even fossil fuels, such as coal, oil, gas and peat are the remains of plants and animals that originally drew their energy from the Sun. Only deep geothermal and nuclear energy are not ultimately derived from solar energy.

Since the industrial revolution, our economies and industries have depended on the stored capital of our carbon fuels to drive continuous growth. The convenience and relatively low-cost of these fuels have enabled a significant rise in prosperity amongst the developed nations.

However, our dependency on carbon-based fuels on a global scale has created environmental problems and concerns about security of their future supply.

Drivers for Change

Among the drivers for change, there are opportunities to be explored, as well as threats, as we seek to use energy more efficiently, to conserve our carbon fuels and to derive more energy from renewable sources with low carbon emissions.

Climate change caused by global warming

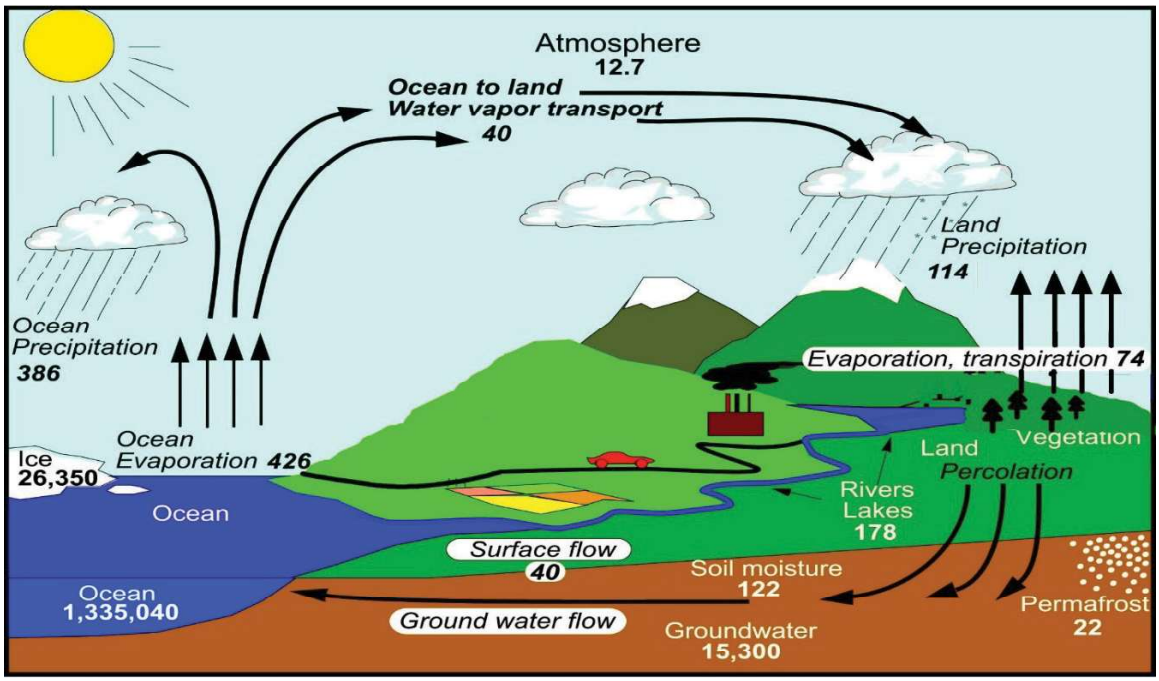
This additional warming of the Earth's climate due to the release of carbon dioxide in vast quantities from causes including the burning of fossil fuels has the potential to trigger catastrophic changes in global weather systems. The resulting flooding from rises in sea levels, the increase in extreme weather events, the desertification of arable land and the mass migration of displaced people are just some of the possible consequences.

An example of this can be seen by the excessive unusually high level of flooding occurring globally shown below.

It takes only a very small rise in global temperature to cause more water to be evaporated which then has to be dropped as precipitation (rain) to cause unprecedented flooding. Add another factor of building and we have less ground area for the precipitation to be absorbed into which causes the torrents we have all witnessed on news programmes from around the world.

The units are in thousand cubic km for storage and km/yr for exchanges.

In geography, the hydrological cycle is measured by quantifying the amounts of water in various **stores** (reservoirs) and the rates of movement, or **fluxes** (transfers), between them. These measurements are typically expressed in units of volume (e.g., cubic kilometres or cubic meters) or volume per unit time (e.g., cubic meters per second).



The hydrologic cycle, also known as the water cycle, describes the continuous movement of water on, above, and below the Earth's surface. It involves processes like evaporation, condensation, precipitation, and runoff, all driven by the sun's energy and gravity.

Importance of the Hydrologic Cycle:

Water Availability: It provides and redistributes water resources, essential for all life on Earth.

Weather and Climate: Plays a crucial role in shaping weather patterns and global climate.

Ecosystem Health: It supports plant growth, animal life, and maintains the health of ecosystems.

In essence, the hydrologic cycle is a continuous, global process that ensures the Earth's water resources are recycled and available for all life, from the smallest organisms to the largest ecosystems.

Energy security

In the UK the peak production of oil and gas from the North Sea has passed and the drive to lower carbon emissions has led to a dependency on large quantities of natural gas imported along pipelines from as far away as Kazakhstan. The vulnerability of such supplies to acts of terrorism, war or changes in geo-political relationships is of concern, particularly since the UK is at the furthest end of the supply pipeline.

Energy supply and prices

As other global economies grow, so does their demand for energy, at a time when fewer new discoveries of oil and gas are taking place. Leaving aside the desirability of exploiting these other resources, their recovery will be more expensive than supplies which have been tapped to date. With expanding demand and restricted supply, not only are energy prices likely to keep rising, but so are the costs of numerous dependent products which are energy-intensive in their production, such as food.

Job creation

On a more positive note, newer low-carbon energy technologies have the potential to provide more jobs than existing fossil fuel based supply mechanisms that they would replace. In 2018 there were 185,000 full-time workers in the UK's low-carbon and renewable energy economy. In 2030 across the UK there could be as many as 694,000 direct jobs employed in the low-carbon and renewable energy economy, rising to over 1.18 million by 2050.

- Environmental consultancy saw employment rise by around 10,000 Full Time employees
- Employment in renewable energy by around 13,000 FTEs
- Low carbon transport sector by around 16,000 FTEs

Legal drivers

The main legal driver for climate change action in the UK is the Climate Change Act 2008. This act sets legally binding targets for reducing greenhouse gas emissions, including a net-zero target by 2050. It also mandates carbon budgets for five-year periods, which the
UK government must create policies to meet.

The UK is part of the Paris Agreement, in which 195 countries agreed to minimise emissions and keep post-industrial global warming to well below 2 degrees Celsius, aiming for 1.5. It hosted COP26 in Glasgow as part of this international framework. Whilst these targets are in jeopardy, there is still hope; we need to take urgent action across society to reduce emissions now and over the next 5-10 years.

Legal frameworks significantly drive the adoption of renewable energy sources by creating incentives and regulatory structures that favour clean energy technologies and projects. These legal mechanisms include renewable energy targets, feed-in tariffs, tax credits, and environmental regulations. They also influence the design and implementation of projects by establishing standards for permitting, grid connections, and environmental impact assessments. From the analysed data, the results revealed that training and education of professionals, efficient energy sector reforms, awareness creation, government support, and increased supply of renewable energy technologies are the top five drivers of renewable energy adoption.

As of 2025 the generated heat from renewable sources in Europe is 25%

Key Legal Drivers:

Renewable Energy Targets:

Governments set targets for a certain percentage of electricity generation to come from renewable sources, encouraging investment and development.

Feed-in Tariffs:

These schemes guarantee a specific price for renewable energy generated by small-scale producers, making renewable energy projects financially viable.

Tax Credits and Subsidies:

Financial incentives like tax breaks and subsidies can further reduce the cost of renewable energy projects and make them more attractive to investors.

Environmental Regulations:

Laws and regulations related to air and water quality, as well as climate change targets, can push for the development of cleaner energy sources.

Permitting and Grid Connection Regulations:

Streamlined permitting processes and grid connection requirements can reduce the time and cost associated with renewable energy projects.

Carbon Pricing Mechanisms:

Carbon taxes or cap-and-trade systems can make fossil fuels more expensive, incentivizing businesses and individuals to switch to renewable energy.

Electricity Market Reforms:

Changes to electricity market structures, such as integrating renewable energy into bidding processes, can promote renewable energy access.

Examples of Legal Frameworks:

Renewable Portfolio Standards (RPS):

RPS in the US mandates utilities to generate a certain percentage of their electricity from renewable sources, according to the US Environmental Protection Agency.

The Energy Transition Act in France:

This Act promotes sustainable energy use, mandates clean energy shares for power companies, and aims to reduce polluting emissions, according to Climate Change Laws of the World.

The UK's Renewable Obligation Scheme:

This scheme incentivises renewable energy production through a mandatory percentage of renewable energy for energy suppliers, according to ICLG.com

Promoting renewable energy through national energy legislation. Energy laws play an important role in promoting renewable energy.

It needs to be noted that these can be unstable and / or volatile due to governmental changes such as the recent ending of the ECO 4 scheme (Energy Company Obligation scheme).

Drivers of Renewable Energy Adoption in the Built Environment

From the analysed data, the results revealed that training and education of professionals, efficient energy sector reform and awareness.