Energy-efficient living

A guide to transitioning to a cleaner, greener solar home

BY JANE SCHAEFER AND MORGAN PIERCE

SolarSmart°

Here's a fact—Irish homeowners are responsible for almost a third of our nation's carbon emissions. On a brighter note, if those same homeowners transitioned their homes to make them more energy-efficient, Ireland's carbon-emission rates would plummet. At SolarSmart, we've made it our mission to help homeowners make that switch.

here comes the sun...

At SolarSmart, we're driving domestic solar adoption in Ireland.

This Guide simplifies the transition to an energy-efficient home.

It's frustrating for individuals, we want to make an impact—we just don't know how. That's why we've launched this guide—it simplifies the transition to an energy-efficient home. It lists the resources available to make that switch—including information on grants, finance, the BER energy performance rating system, and how improvements to your home can move it up the BER scale.

At SolarSmart, we believe every homeowner should endeavour to attain an energy-efficient footprint by 2030—but what does that involve?

A lot depends on the condition of your home today. Most homes now have double or triple-glazed windows. Most attics are insulated—but there is much more that needs to be done. Homes need to be fully insulated, lighting systems upgraded, and eventually, existing heating systems will have to be replaced with clean-energy solutions.

We know it's a big task but at SolarSmart, we can't wait to get started. By 2030, homes relying on energy derived from fossil fuels will be as common as... well, fossils.

Soon, your home, your heating, and your vehicle will all operate on electricity. Today, you can generate your own electricity with solar panels fixed to your roof. Domestic solar systems are so cost-effective that, in some cases, homeowners are returning in excess of 15% on their investment in solar. That's why at SolarSmart, we're driving domestic solar adoption in Ireland.

In this guide, we make the case for solar energy and explain how easy it is to generate your own clean electricity. Solar works really well in Ireland. We enjoy an above-average amount of daylight hours, and our cool climate is perfect for solar panel effectiveness.

Your journey to a zero-carbon home starts here—and SolarSmart will help you every step of the way! Don't hesitate to contact one of our Solar Advisors, they'll answer any questions you might have. Remember, the sooner you switch, the sooner you save!

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ENERGY-EFFICIENT LIVING

Energy & Sustainability in Ireland

SECTION A

Ireland's ranking in the EU

Climate Change is a growing concern, it has been for several decades.

Despite the endless warnings from experts, little seems to have changed on a grand scale, especially in Ireland. Of all the countries in the EU, Ireland ranks third highest in total carbon emissions, and in 2018, 90% of the energy consumed in Ireland came from non-renewable fossil fuels. Ireland is significantly behind its 2020 target renewable energy percentage, and with poorly executed policies and little improvement made in the past few years, it is almost certain that Ireland will fall extremely short of its 2030 target as well.

Homeowners and their vehicles contribute to nearly a third of all greenhouse gas emissions in Ireland. Those same homeowners could reduce that figure —and save money in the long run.

Sustainable Energy Authority of Ireland (SEAI)

The Sustainable Energy Authority of Ireland, or SEAI, was established under the Sustainable Energy Act 2002.

Funded by the government, the SEAI works with policymakers to adopt clean energy legislation and has established and oversees the distribution of national grants in order to support citizens' energy upgrades to their homes.

The SEAI provides Building Energy Rating (BER) assessment standards, and facilitates citizens' access to home and community grant schemes. The home grants cover household upgrades such as insulation, heat pump systems, heating controls, solar water heating, and solar electricity.

In order to upgrade all homes to a low-carbon footprint, or to be rated at least a "B" on the BER scale, the SEAI estimates the average household will need to spend €20,000 on home improvements.

Acknowledging this sum is far beyond the means of most families, a range of SEAI grants aim to cover most expenses. Through the SEAI's Better Energy Programme, more than 300,000 homes have already been upgraded to include cheaper and more sustainable heating systems with the assistance of over €370 million in government aid. The SEAI is likewise available to citizens in terms of **training, advice, and support** on how to improve their homes' energy efficiency.

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The Role of the Irish Government

The Government of Ireland has recently implemented updated energy policies to improve the energy sector, outlined in "The White Paper".

The paper, published by the Department of Communications, Energy, and Natural Resources, discusses the duties and responsibilities the government must undertake from now through 2030 in order to transition to a low carbon future.

To comply with the EU's goal of reducing 1990 level greenhouse gas emissions to 80-90% by 2050, Ireland has vowed to **accelerate renewable energy development, reduce barriers for citizens to readily install energy-efficient systems in their homes, and reduce dependence on fossil fuels.**

Ireland is particularly interested in solar energy, as we could easily install hundreds of thousands of domestic solar systems in the next decade, which would be much faster than installing offshore wind as an alternative, for example.

The government also established the Commission for Regulation of Utilities (CRU) to ensure energy costs are fair and reasonable, and to protect the interests of consumers.

The CRU requires energy companies to be transparent with consumers by including information on energy usage and denoting a description of costs on their energy bills.

The government is also facilitating access to the national grid for renewable electricity products and developing mechanisms for citizens to receive payment for selling electricity back to the grid. The government also supports the idea of shared ownership of renewable energy products in local communities and will ensure policy-related costs the consumer may face are minimised as much as possible.

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From Passive Consumer to Active Citizen

Although the government has a significant responsibility to work towards a low-carbon future, the average citizen's role is arguably just as important.

In order to make real progress in combating climate change, there must be a symbiotic relationship between government and citizens, with both doing their own part to better the environment.

"The White Paper" presents all citizens as *active citizens* having a duty to make informed choices regarding which actions lead to a more sustainable lifestyle. By taking on this responsibility, the energy sector will shift from primarily government and utility-driven, to an industry in which all members of society are included.

At SolarSmart, we believe *active citizens* educate themselves on the sustainable alternatives they can choose in their daily lives—and execute them accordingly.

Likewise, the *active citizen* will become more involved in community engagement in order to partake in energy efficiency projects and to implement more energy-efficient infrastructure in their own homes.

Homeowners who reduce their reliance on the national grid by 70% in 2021 by switching to solar will reduce their carbon emissions by 1.2 Tons per year. By installing a personal solar energy system and implementing other home upgrades, the *active citizen* plays an impactful role in the transition to a zero-carbon future.

Community Energy Generation

Community energy generation is a new concept. It is all about the generation, sharing and distribution of energy among neighbours within a new local grid.

These privatised community grids result in less reliance on the national electricity grid, in that they allow unused solar energy to be sold or purchased among local residents. By building community energy generation as an alternative, we will all have access to a stronger, more reliable national grid.

In the EU, the implementation of community energy systems is increasing, with Germany leading the charge. 50% of the renewable energy produced in Germany is community-owned, as many policies supporting community energy have been instilled over the past few decades.

Some of these policies include profitable renewable support schemes and the obligation to expand the energy grid to renewable sources. In terms of community projects, many wind parks, for example, only produce energy for local residents, and some apartment complexes generate solar energy for all of their tenants at reduced costs.

Compared to other EU countries, Ireland is quite far behind in terms of shared energy systems. In order to see a rise in Ireland, the responsibility falls on all parties—government, industry, and consumer.

It is up to the government to allow easy access for homeowners to independently operate their own energy grid—it is the duty of industry to provide efficient and inexpensive products and services, and it is the role of *active citizens* to recognise and implement the option of community energy generation.

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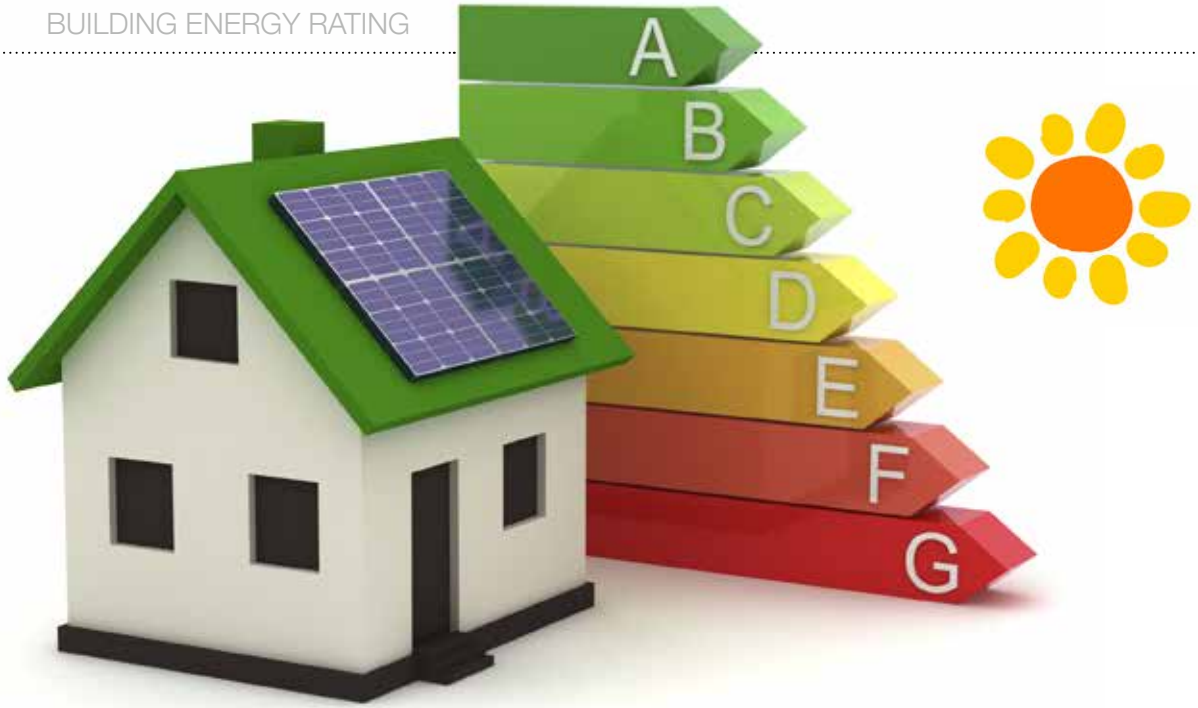
ENERGY-EFFICIENT LIVING

Building Energy Rating (BER)

SECTION B



A home's Building Energy Rating (BER) is the measure of a home's energy efficiency and performance.

Since 2007, Ireland requires that all homeowners obtain a BER certificate before occupying a new home, as well as before renting or selling. When obtaining a BER certificate, a homeowner receives an advisory report highlighting potential areas of energy performance improvements.

A BER pinpoints the exact locations of underperforming systems in your home, so you will know which specific areas to upgrade in order to reduce your energy bills and reduce associated carbon emissions.

As it is now a requirement to list the BER on all property advertisements, a good BER rating is essential to appeal to prospective buyers or tenants. A BER certificate is valid for up to 10 years, and for homes that are yet to be built, a homeowner can obtain a provisional BER certificate which is valid for up to 2 years.

How is BER calculated?

A BER is calculated according to the efficiency of space heating, ventilation, water heating, and lighting—and is expressed in terms of energy use per unit floor area, as well as total annual carbon dioxide emissions. The number of people that occupy a dwelling is also taken into account. Appliances that are not purposed with heating, cooling, or lighting, such as televisions, fridges, or microwaves are not included in the overall calculation.

The energy use per unit floor area is represented on a scale from A-G, with a rating of A being the most efficient and a rating of G being the least efficient.

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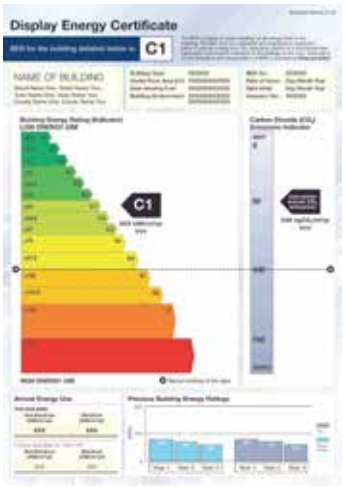
The actual certificate displays a column on the left-hand side, with a red section on the bottom of the scale transitioning into a green section at the top. The scale ascends from G, F, E2-E1, D2-D1, C3-C1, B3-B1, and A3-A1. The calculated energy values show the total kilowatt-hour of energy used per meters of area per year. On the right-hand side of the certificate is a column depicting the annual carbon dioxide emissions associated with a home. The scale ascends from worst to best, with the lowest total emissions amount at the top of the scale.

In order to increase a BER rating, many household upgrades can be made, such as installing insulation, glazing windows and doors, upgrading the boiler, or adding an electricity-based heating solution. As you climb the scale, you will save more on energy bills for each indicator you pass.

Upgrading your home from a D to an A rating can reduce your energy consumption by up to 80% and can save you approximately €1,470 in bills per year. Several Irish banks now offer a Green Mortgage fixed interest rate available to homeowners buying a home with a BER of A3 or greater, or to homeowners taking out loans to upgrade their existing home to a BER of A3 or greater.



[How to check whether you have a BER Certificate]

If you are not certain whether your property already has a BER rating, you can check the national BER registry. You will need your MPRN number which you can locate on your electricity bill.

How to obtain a BER Certificate

A homeowner can obtain a BER certificate by contacting SEAI, who will send an independent assessor to your home. Either yourself or your estate agent is responsible for finding a BER assessor prior to listing your property. You can find a registered list of assessors at **www.seai.ie/ber**

The cost of a BER assessment varies depending on the square footage and location of your home, but prices generally range from €200-€300. The SEAI also offers a grant of €50 for first-time homeowners conducting a BER assessment. If you require further assistance on how to obtain a BER assessment, **contact ber@solarsmart.ie** and we will connect with you an approved BER assessor in your area.

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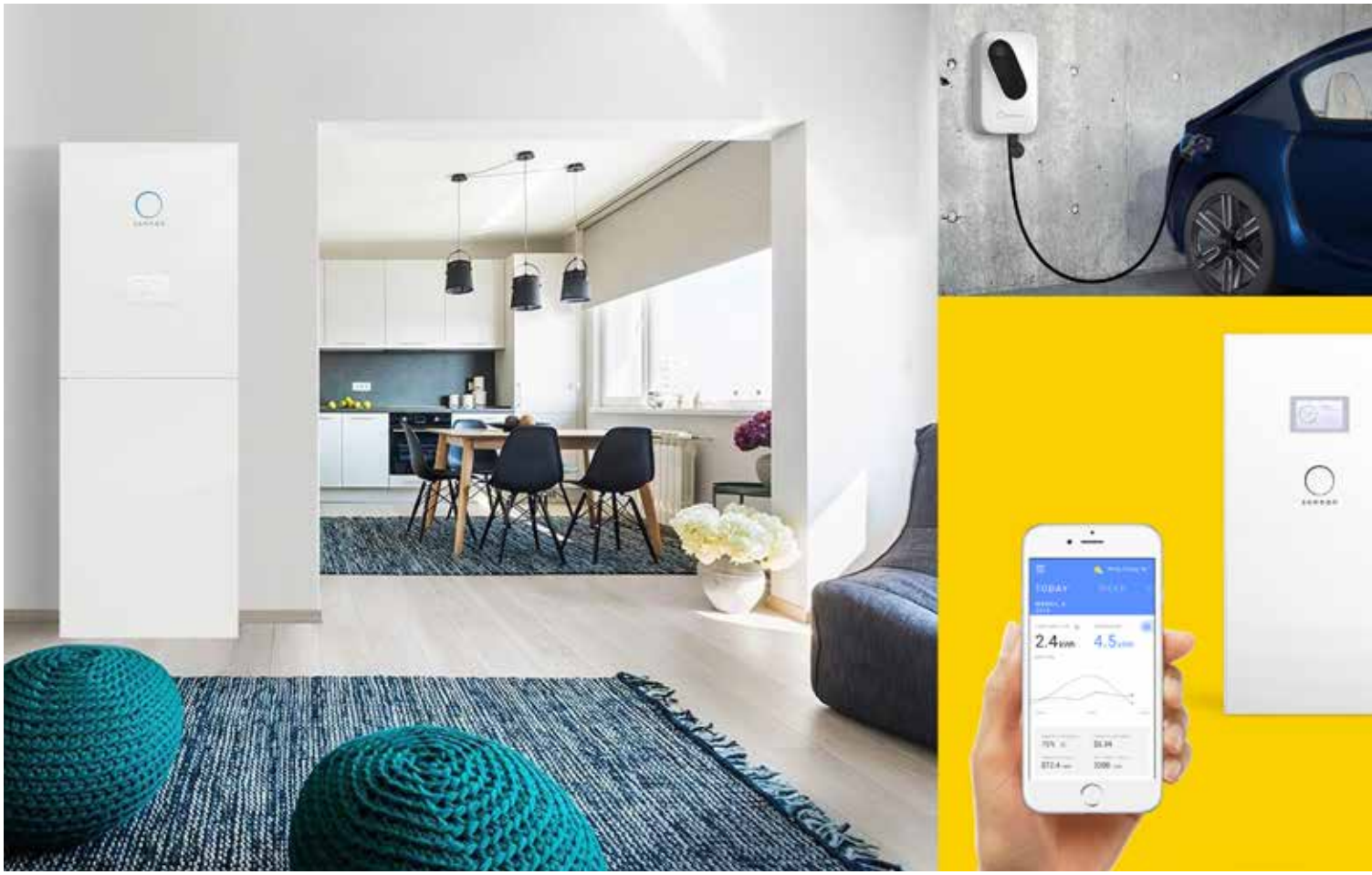

Nearly Zero-Energy buildings

Nearly Zero-Energy Buildings, or NZEBs, are buildings with very high energy efficiency and whose energy demands are mostly supplied through renewable energy sources.

NZEBs categorize all buildings including domestic, commercial, and any other type of energy-consuming building. Calculations are based on heating, cooling, ventilation, lighting systems, as well as windows, walls, roof, and basement efficiencies. The Energy Performance of Building Directives requires that as of 2021, all buildings produce nearly zero energy. For new homes, this means energy efficiency must be 60% more than the energy efficiency of 2008. Likewise, at least 20% of the building's energy sources must be renewable sources.

Attaining a nearly zero energy building can be achieved through receiving a BER assessment and conducting the corresponding household improvements. The major renovations you can make to an existing home should get you to a BER of at least B2, as a general guideline for energy efficiency; however, in order for new dwellings to be considered nearly zero energy, they typically must attain a BER within the A range.

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ENERGY-EFFICIENT LIVING

Upgrading to Energy Efficiency

SECTION C

Insulating your home

Attic insulation

Besides walls, one of the main sources of heat loss in a home is through an uninsulated attic or roof. Heat loss from the top of the house can account for between 20-30% of total heat loss. Attic insulation is one of the most cost-efficient household upgrades you can make to save energy

The standard for attic insulation is 300mm of rock wool or equivalent, so even if you have some insulation installed, adding more insulation up to standard measurements can still improve energy efficiency. Poorly installed insulation can also result in heat loss, as gaps in the insulation material between rafters can result in the insulation being ineffective.

The best insulation method for attic space is to lay a quilt made of mineral fibre, glass fibre, hemp, or sheep wool in two layers and in opposite directions. Installing attic insulation can result in savings of around €200 on energy bills annually. Attic insulation costs vary depending on the type of building, but costs should be around €400. The maximum SEAI grant for attic insulation is €400—so this upgrade is within reach of most homeowners.

Cavity Wall insulation

Adding wall insulation is one of the best ways to improve your BER, as up to 35% of heat in your home can be lost through uninsulated walls.

The three types of wall insulation include cavity, external, and internal. The most common type of insulation is cavity, as most homes built after 1930 and almost every home built after 1980 has cavity walls.

Cavity walls are typically built of brick and consist of two thin layers separated by metal ties holding them together. Cavity wall insulation involves injecting the insulating product from the outside. The simplest way to tell if your home contains cavity walls is to check the brickwork of your walls; if the bricks are the same size, you likely have cavity walls, and if the bricks are different sizes, you likely have solid walls.

If you want to upgrade your home with cavity wall insulation, the average cost of the upgrade for a standard semi-detached house will be between €600-€1000. However, you will save up to €200-€300 per year on heating costs, and the investment in cavity wall insulation will typically be returned after just 3 years.There is an SEAI grant available for cavity wall insulation to the value of €400.

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Insulating your home *continued*

External Wall insulation

If the brickwork of your home contains different sized bricks, you likely have a home with solid walls, which is common in most homes built before 1930. Solid walls require either external or internal insulation. If you are considering upgrading your home with external insulation, the cost will come to about €120 per square meter of wall. This estimate equates to about €9,500 for small apartments and up to €25,000 for larger homes.

The initial investment in external wall insulation is therefore quite large, and as such, the return on investment is the longest of all wall insulation types. Nonetheless, besides increasing energy costs, external insulation can increase the weather resistance, impact resistance, and soundproof quality of your home. You can also upgrade the exterior appearance of your home, as the insulation finish is available in customizable varieties.

Energy upgrade	Grant Value €
Attic Insulation	400
Cavity Wall Insulation	400
Internal Insulation (dry lining)	
Apartment or Mid-terrace House	1600
Semi-detached or End-of-terrace	2200
Detached House	2400
External Wall Insulation (the Wrap)	
Apartment or Mid-terrace House	2750
Semi-detached or End-of-terrace	4500
Detached House	6000

Internal Wall insulation

Internal wall insulation involves applying composite insulation and plasterboard to the insides of your walls. The cost is slightly cheaper than external insulation, ranging from about €4,500-€18,000 for small apartments to large homes, respectively. With internal insulation, you will not receive the protective advantages that accompany external and you will lose interior square footage by adding volume onto walls.

For both external and internal insulation, SEAI grants are available ranging from €2,750-€6,000 for external and €1,600-€2,400 for internal.

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Insulating your home *continued*

Glazing Windows & Doors

Double-glazed windows

Windows are most commonly either single or double glazed, meaning they can have either one pane of glass or two. Double glazed windows have two panes of glass spaced 12-16 milimetres apart, with the air between the panes acting as an insulator. The installation of double-glazed windows can reduce heat loss, reduce noise level, and increase glass durability. Multiple panes between windows can increase the level of insulation even more, but double glazing remains the most popular. The different types of material used for the window frames and the glass means there is a wide range of options, but uPVC, Unplasticised Polyvinyl Chloride, is the least expensive and the most efficient frame material.

Double glazed windows can retain up to 70% more heat inside your home compared to single glazed windows, translating into an average savings of €100 per year, with prices ranging from €2,000-€6,000 depending on the size of your home. For a semi-detached house, the average cost is €4,500-€5,000. SEAI grants are available for replacing single glazed windows for free, for homeowners who qualify for the Warmer Homes scheme.

Double-glazed doors

Double glazing doors is also an excellent option to improve home energy efficiency. Similar to double glazed windows, double glazed doors involve two glass panes with a gap between them. The gap between these two panes is about 9-12 milimetres apart, with uPVC being the most recommended material for the frame, as it is the most economical and most efficient. Likewise, akin to double glazed windows, double glazing doors increase durability and will also reduce outside noise levels.

A variety of door types have the option for double glazing, including front doors, patio doors, French doors, and bifold doors. Although the initial investment is somewhat large, double glazing all old glass in your home is a critical factor in improving home energy efficiency, as glass allows for more heat to escape than both walls and roofs. The average cost for adding two patio, French or bi-fold doors ranges from €1,000-€1,500, but the return on investment is well worth it in terms of heat and energy savings.

Secondary glazing

If double glazing your windows or doors is too far out of your price range, secondary glazing is an affordable alternative, as you can install secondary glazing yourself. Secondary glazing involves adding a thin pane to the existing windows in your home, creating a gap of about 24-28 milimetres between them. The gap traps air within the panes, which in turn acts as insulation, reducing heat loss and external noise. This type of insulation can be applied to any type of window, door, or draft source. Because secondary glazing does not require the installation of new units, the initial investment is only about €1,000. However, lower costs correspond with lower efficiency, as the insulation impact of secondary glazing is much less than double glazing.

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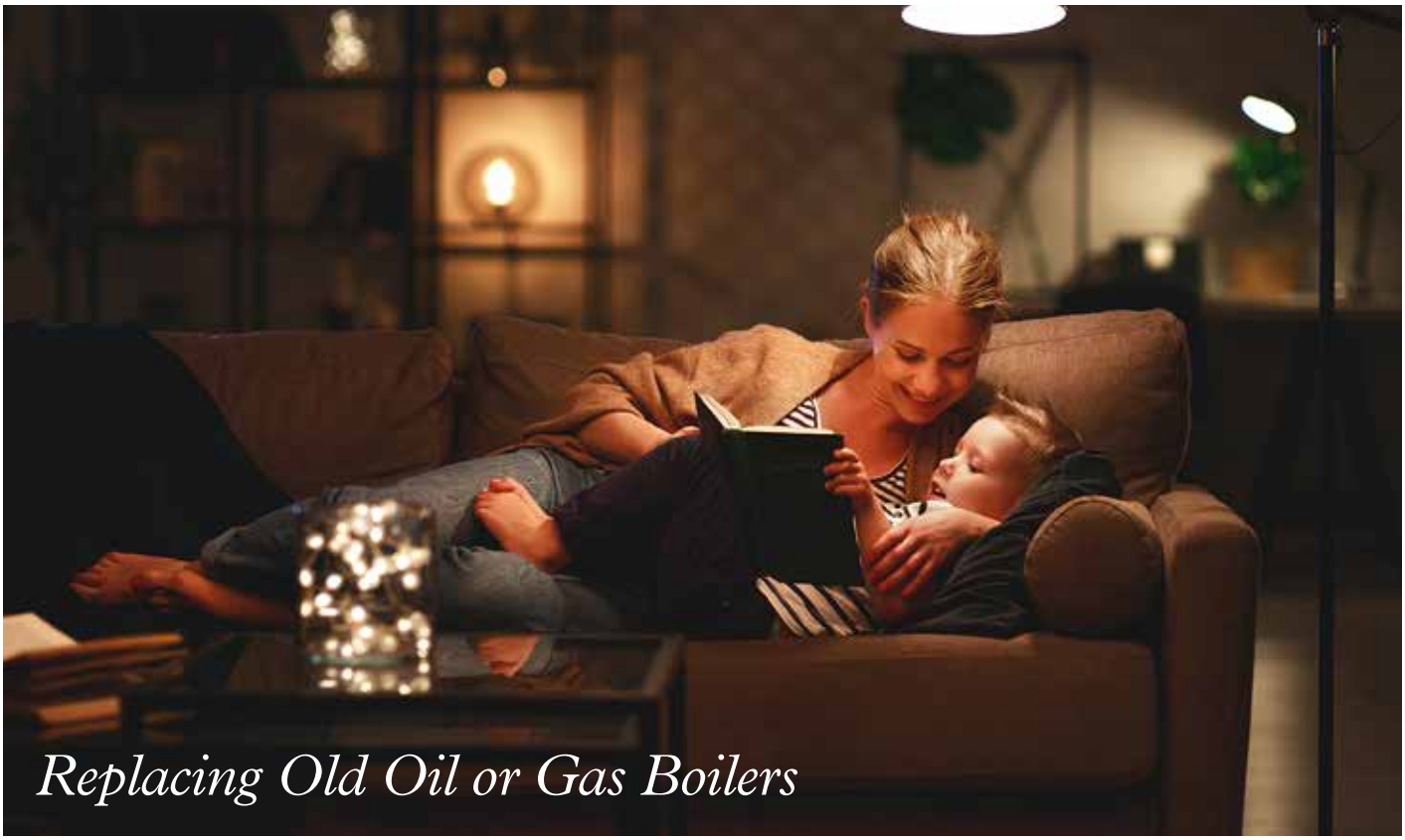
Upgrading your boiler



The SEAI recommends homeowners replace boilers that are more than 15 years old.

But replacing boilers that are only 10 years old will result in considerable savings as well, since 10-year-old boilers may be operating at just 55-70% efficiency level. Likewise, if your boiler begins to smell or leak, this is a clear indication it is time for a replacement.

By installing a new boiler, you will save as much as 35% on fuel or gas bills, which corresponds to a significant increase in energy efficiency. For semi-detached houses, a boiler replacement can save between €150-200 annually on energy bills. Although the initial cost of a new boiler is expensive, if you also install zoned heating controls, a €700 grant is available from the SEAI Smart Heating Controls program.

Upgrading your boiler *continued*

Combi-Boilers

Replacing oil or gas boilers with a combi-boiler improves your home's energy performance—it is no wonder that combi-boilers are one of the most popular options for Irish homeowners.

With combi-boilers, when the temperature in your home drops below your desired level set on a thermostat, the boiler receives a signal to begin heating. The boiler then obtains cold water from your water system and runs it through its heat exchanger, transferring 90% of the heat to the water. It then goes through a radiator until your home is heated to the desired level. As such, water is only heated when taps are turned on or when heat is needed. With this method, hot water is supplied on demand, rather than stored in tanks.

Without the need for an external water tank, you reduce heat lost through pipes—which saves heat and money on energy bills. Combi-boilers are very small in comparison, which saves space in apartments or smaller homes, and makes them easy to install. However, because they are smaller, combi boilers cannot supply consistent water pressure for multiple appliances, so they are not as suitable for large family homes. Modern combi-boilers perform at over 90% efficiency, giving them an A rating in energy performance, so if you are considering replacing an oil boiler, a combi boiler is an excellent choice.

Biomass Boilers

Biomass boilers are also an excellent replacement for an old gas or oil boiler. With biomass boilers, heat is produced by burning small wood pellets, which in turn produces hot gas that travels to the heat exchanger to heat the boiler water.

Wood fuel is the most affordable fuel source for boilers. Biomass boilers are one of the most environmentally friendly boilers, because zero net carbon is released during the heat exchange. Wood pellets are derived from trees, which take in atmospheric carbon dioxide over the course of their lifetime. After the tree is cut and the pellets are burned, the carbon released is the same atmospheric carbon that the tree initially took in.

While electric and oil-based fuel costs an annual average of €3,000 and €2,000 respectively, wood fuel only costs €1,000, which makes Biomass boilers the most affordable of all boiler types. Not only are they cost-effective, but they are also energy-effective, as you contribute zero net carbon in the process of heating your home. Although the initial investment in a biomass boiler can be €15,000, the substantial long-term cost and energy savings make it a very viable boiler alternative.

Replacing your heating system

Geothermal Heat Pumps

Heating systems that currently operate with fossil fuels can be replaced by a heat pump, which is a renewable alternative that works by warming your home with heat from an outside source.

Geothermal heat pumps, specifically, draw heat from below ground and transport it to your home. These types of heat pumps are very compatible with Ireland's climate, as the temperature below ground fluctuates between a range of 3 degrees Celsius. There are two variations of geothermal heat pumps—open-loop and closed-loop. In open-loop systems, heat is extracted from underground water, whereas in closed-loop systems, heat is extracted from thermal energy stored in the earth.

There are two variations within each system that can be implemented. A horizontal system involves installing channels parallel to ground level, which means that you must have at least half an acre of land available for the entire system. As such, horizontal systems are best suited for rural areas or suburban properties with a lot of land. The other type is called a vertical system, which alternatively involves installing channels vertically, perpendicular to ground level. The vertical system, therefore, is more practical for homes with less property area.

Geothermal heat pumps use electricity to transport heat, and for every kilowatt of electricity used, between 3 and 4 kilowatts of heat are produced, which makes them very energy efficient. Installing a geothermal heat pump can reduce your heating bills by 50%, which equates to savings of €790-€1,425 annually. In terms of energy savings, 2,000 - 12,000 kilograms of carbon can be reduced depending on the type of system. The price of installing a geothermal heat pump ranges from €15,000-€23,000, as vertical heat pumps are more expensive to install than horizontal. Nonetheless, SEAI offers a ground source heat pump grant with a value of €3,500 to help ease the initial cost.

Air to Water Heat Pumps

An Air to Water heat pump is another option for a renewable, energy-efficient heating system. This type of heat pump works by extracting hot air from the outside, compressing the air, and transferring the air to a heat exchanger to heat water. The water produced can be used for warming your home or for taps.

There are two main types of air to water heat pumps, split system, and monobloc. A split system has both an outside and inside component and transfers heat from the outside through a refrigerant for it to then be used to heat water. The monobloc system contains only an outside component, heating up the water outside and transferring the hot water back into the water system.

Air to water heat pumps can reduce energy bills by 50%, creating 4 kilowatts of heat for every 1 kilowatt of electricity used to run the system. The initial investment is also relatively inexpensive compared to other heat pumps, costing €9,000 - €13,000. There are SEAI grants available for air to water heat pumps, with a value of €3,500.

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Replacing your heating system *continued*

Air to Air Heat Pumps

Similar to air to water heat pumps, air to air heat pumps extract heat from the air outside and use it to heat your home.

While air-to-air heat pumps are most efficient in warmer climates, they are still more environmentally friendly than the fossil fuel alternative, and if combined with solar panels, solar energy can be used to operate the heat pump. During summer months, air-to-air heat pumps can serve as air conditioners by circulating cold air into your home.

Air-to-air heat pumps can reduce your energy bills by 30%, as every 1 kilowatt of electricity used to operate the system generates 3 kilowatts of heat. The initial cost of Air-to-Air heat pumps ranges from €9,000-€13,000, but you can save up to €1,200 on energy bills annually. Through SEAI, the grant available for air-to-air heat pumps is €600.

Energy upgrade	Grant Value €
Air to Water heat pump	3500
Ground Source to Water heat pump	3500
Exhaust Air to Water heat pump	3500
Water to Water heat pump	3500
Air to Air heat pump	600
Heating Controls upgrade	700

A brighter future

CFL Lighting

Although it may seem like only a small change, the types of light bulbs used in your home can make a significant difference in terms of both energy and finances.

The standard light bulb, the incandescent bulb, is the cheapest cost per unit; however, they actually end up costing you more in the long run. Incandescent light bulbs are the least energy-efficient, as 95% of the energy intake goes towards heat production while only 5% goes towards light emission. Because incandescent bulbs require the most amount of watts to operate, they have the shortest lifespan and yield the highest cost of electricity than other bulb types. As such, replacing any incandescent bulbs in all rooms is an easy upgrade to improve your home's building energy rating.

CFL (Compact Fluorescent Lamp) lighting is a good alternative to incandescent, as it requires less watts, uses less energy, and has a longer lifespan. These bulbs are designed in a spiral shape and use only a quarter of the energy of an incandescent bulb. While incandescent bulbs last for only 1,200 hours, CFL bulbs last for 8,000 hours. Likewise, rather than producing 95% of the energy as heat, CFLs only produce 80% of total energy as heat. Therefore, contrary to the 60 watts of energy used for an incandescent bulb, CFLs only intake 14 watts, therefore reducing the overall cost of electricity in your home.

LED Lighting

While CFL lighting will certainly help improve your BER rating, it is not the most efficient light bulb alternative.

LED (Light-Emitting Diode) bulbs save more energy than both incandescent and CFL and are the best choice for improving energy performance in your home. Each LED bulb lasts for 25,000 hours and requires only 7 watts to operate, thereby reducing electricity costs by the greatest amount.

One drawback is that LEDs have a higher upfront cost than CFLs, however, the difference is insignificant compared to the difference in long-term savings in the form of energy and bill payments. Another disadvantage is that LED lights emit greater amounts of blue light than CFLs and incandescent bulbs, meaning they give off cooler light rather than warmer. If this feature is something that you believe will drastically affect the appearance of your home, you may want to consider CFL lighting instead.

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How upgrades correspond to BER

To describe the BER scale and home improvement upgrades in layman's terms, we've included an outline of each rating with a description of the typical qualities of the home it accompanies.

A1	*Built within the past few years with extremely high energy efficiency in mind; all upgrades in this section included*
A2	*Similar to A1, but excluding one or two small upgrades*
A3	*The majority of new urban homes; typically having solar PV panels*
B1	*Modern home with recent energy upgrades; only 10-20 years old*
B2	*Modern home with smaller-scale energy upgrades*
B3	*Similar to B2, but likely a slightly older home*
C1	*Average 15-20 year old home with attic insulation and double glazing, but no major energy upgrades*
C2	*Typical of rural properties with efficient insulation and heating*
C3	*Typical of 10-15 year old apartments*
D1	*Average 20-40 year old home with double glazing, a gas boiler, and some insulation*
D2	*Similar to D1, but having an older boiler and lacking insulation*
E	*Average 30-40+ year old home; lacking double glazing and insulation*
F	*Very old property; lacking double glazing and insulation*

The figure below displays the cost in fuel required to heat a home for each BER rating. As indicated, energy efficiency upgrades can result in monumental savings on your heating bills, especially for larger homes.

Estimate fuel costs for each BER rating

The estimated annual fuel costs are based on a typical occupancy, and heating of the house to a comfortable level (source: SEAI)

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ENERGY-EFFICIENT LIVING

Upgrading your home to Solar

SECTION D

Misconceptions about Solar Energy in Ireland

When it comes to solar power, people often make inaccurate presumptions regarding how the energy is harnessed, especially in Ireland.

Because solar power is fuelled by the sun, most people assume that panels require constant sunshine in order to effectively operate and that solar panels would therefore be ineffective in Ireland due to its cloudy climate. However, this is not the case.

Solar panels are made up of individual cells, with each containing layers of silicon between two conductive strips. Within the layers of silicon, electrons can flow from one side to another, resulting in a positively charged side and a negatively charged side. When photons of light strike the cell, electrons are drawn to the negatively charged side and are then transferred through external circuits to conduct electricity.

While it is true that sunnier days are more efficient for generating solar energy, solar panels operate on daylight, not sunlight, and Ireland receives over 16 hours of daylight from April through September. The sun's rays are able to penetrate through clouds to reach the photovoltaic cells—kind of like when you get sunburnt on a cloudy day.

Today's solar panels are also equipped with special lenses that maximise the absorption of light that would otherwise not reach the cells. Therefore, even if your home is located in an imperfect environment, you will still be able to generate an abundance of electricity through solar power.

A sunnier disposition than most

Solar irradiance is the energy output received in the form of electromagnetic radiation from the sun. Although it may not seem apparent, Ireland receives similar levels of solar irradiance as France and Germany.

And, we receive only 26% less solar irradiance than Spain, which is not a significant difference considering its hot and sunny climate.

In fact, solar PV panels actually work less efficiently in extremely hot weather conditions, such as Spain's, as too much heat can reduce the efficiency of energy conversion within the panels. When a solar panel is already hot, electrons have more initial energy, and there are fewer electrons available to excite.

When there are fewer electrons to excite, less energy is released —that reduces the total voltage generated. We are therefore nicely positioned compared to other countries due to our relatively mild climate.

Ireland also has long summer days that are ideal for energy generation and storage, and the temperature rarely gets much warmer than 25 degrees Celsius. These facets combined make for optimal solar panel performance and make Ireland an ideal location for solar energy generation.

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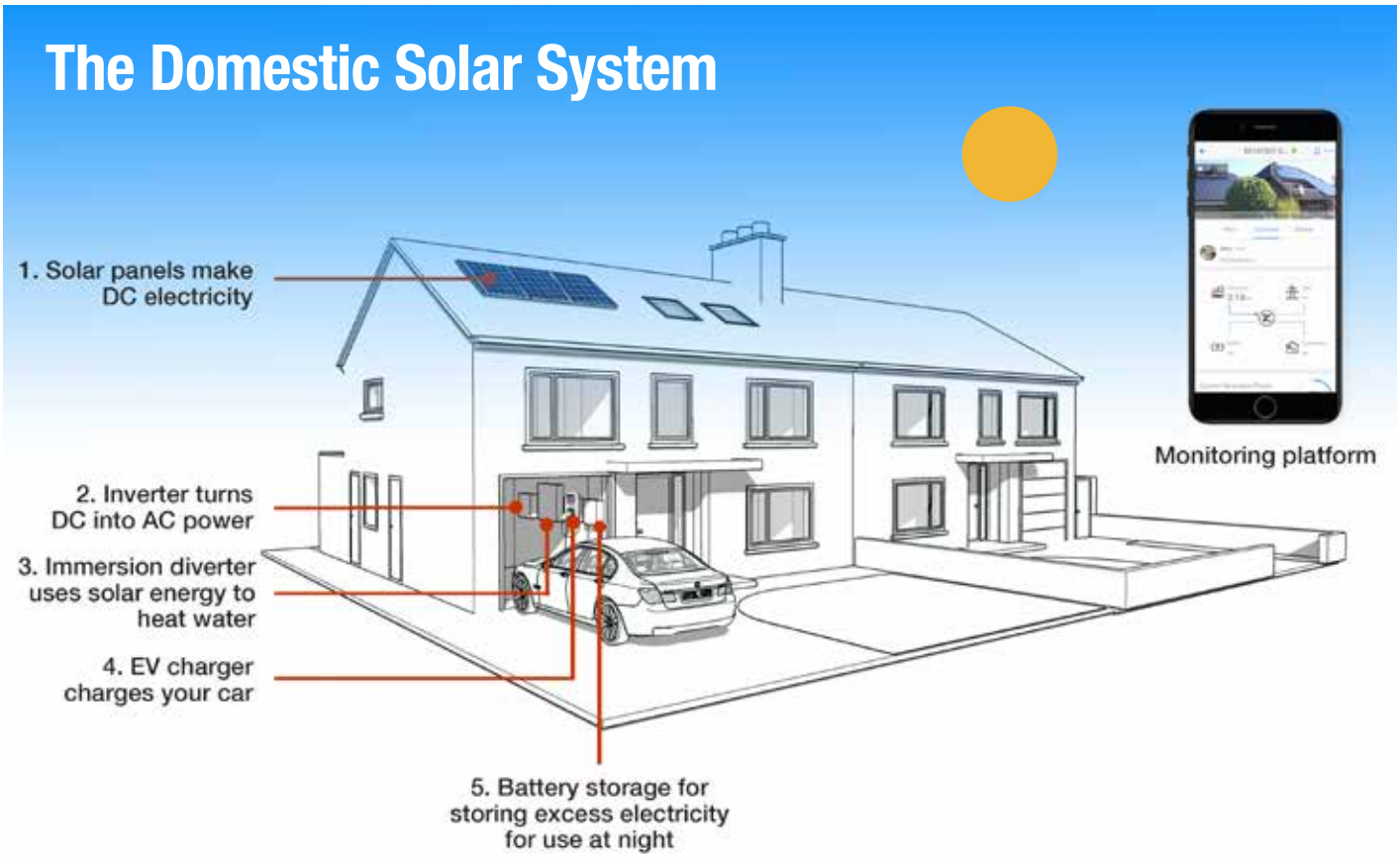

System components

A typical solar PV system consists of these main elements:

- *Interconnected solar PV panels*
- *Inverter(s)*
- *Battery storage system, if energy consumption is high*
- *Immersion diverter to heat water*
- *Electric vehicle (EV) charger*

Panel *sizes* correspond to the amount of energy they produce, measured in *kilowatts* of power.

The Panels

Panels come in two types: *Mono-crystalline* and *polycrystalline*.

The main difference is that mono-crystalline converts solar energy to electricity using a single crystal of silicon, while polycrystalline uses multiple fragments of silicon.

Mono-crystalline is more efficient and sleeker, but comes at a higher price. Polycrystalline is less efficient, as there is less room for electrons to move in each cell, so as a result, they are cheaper than their mono-crystalline counterpart.

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The Domestic Solar System *continued*

Inverter

The inverter converts the solar energy (DC) captured by the panels into electricity that can be used by your home (AC). The inverter also performs various safety functions, constantly monitoring the grid and switching off in the event of a fault or major fluctuation in mains supply.

Inverters come in two types: **String inverters** and **micro-inverters**, and we will also cover power optimisers. String inverters are the most cost-efficient, but because each solar panel is "stringed" together in a circuit-like system, there can be reduced overall performance if one of the panels drops in efficiency. String inverters are best for homeowners with a simple roof design that doesn't suffer from any shading.

Rather than collecting all the energy and then inverting it, as string inverters do, micro-inverters convert DC energy into electricity at the site of each panel. As such, micro-inverters are more efficient than string inverters in the sense that a reduction in energy in one panel will not significantly reduce the energy conversion of the overall system. Micro-inverters are best for complex roof designs or roofs that are likely to suffer from shading, but there is an increase in cost, comparatively.

Power optimisers can be added to string inverter designs to increase the efficiency of panels that may suffer from shading. As such, power optimisers are the best choice for homeowners who do not want to commit to the higher costs of micro-inverters.

Battery storage

A battery storage system allows for unused energy that is generated during the day to be stored so that it can be used at night. Another cost convenience is that during the winter, you can fill the battery at night on a reduced tariff, and use less expensive electricity to power your home the following day!

Battery *sizes* correspond to the amount of energy they can store, measured in *kilowatt hours*.

Immersion Diverter

Your solar panels work best in the summer months, which is precisely when you should turn off oil or gas because you are no longer heating your home. The problem is, how do you heat your hot water? With an immersion diverter, you can divert excess electricity made during long summer days to heat your water. **With an immersion diverter, you can turn fossil fuel heating completely off during summer months.**

EV Charger

If you have or are planning to buy an electric vehicle, you can charge your EV with an EV charger. There is a €600 SEAI grant for the installation of EV chargers.

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Why Solar is a smart choice

SECTION E

Benefits of going Solar

A low-maintenance, high-impact solution

A Domestic Solar System is relatively simple.

The panels are attached to a mounting system which is attached to your attic rafters.

They are wired together with an inverter, that turns the DC power created by the panels into AC electricity. The inverter is attached to the main power source in your home, at the fuse box. If you have a battery, it is wired into the inverter. Excess power can also be diverted to your immersion to heat water.

On a sunny day, the power generated by the system reduces the amount of electricity that needs to be bought from the electricity supply company. On very sunny days, or at times of low electricity load, the panels will generate more power than is needed—the excess is either used to heat hot water, stored in a battery for later use, or restored to the grid.

Solar PV modules can be roof or ground-mounted, ideally facing south, southeast or southwest, with at a pitch angle of typically 35-40 degrees. Solar systems with arrays facing east and west also function effectively because they receive extended hours of daylight.

Once your solar system is installed, it is relatively maintenance-free, except the panels do need to be checked once a year and commercially cleaned in order to operate at

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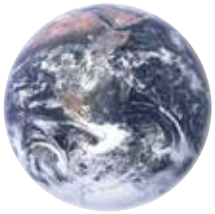
The benefits of going Solar *continued*



By using solar energy for up to 80% of your home's power needs, you reduce the amount of carbon emissions—equivalent to the burning of about 5,000lbs of coal, annually.

Every little helps...

The installation of solar panels offers significant energy savings, helping to reduce your carbon footprint and better the environment.

By drawing energy from the sun to power your home, you pull less electricity from the grid which, in Ireland, is still 70%-powered by the burning of fossil fuels, creating greenhouse gases.

Greenhouse gases are harmful to the environment because they trap heat in the atmosphere by retaining the Earth's outgoing energy. Since this therefore disrupts the natural balance of incoming and outgoing energy, the climate becomes altered, as a result.

With this comes an increase in precipitation, ocean temperatures, and sea levels. The health of plants, animals, and humans all become at risk, as even the smallest changes in temperatures or pollution levels can be detrimental to certain organisms. Increases in drought, heat waves, and floods are also climate change casualties, which can lead to the destruction of environments and food sources.

Green and clean...

Going solar also conserves water, as thousands of gallons of freshwater are used for cooling methods in coal, natural gas, and oil power plants.

Likewise, with power plants, there is detrimental damage caused by air and water pollution, especially in underprivileged communities located near these plants. Generating electricity through solar energy does not emit harmful pollutants, therefore bettering public health and safety.

The benefits of going Solar *continued*

If you produce more electricity than you consume, the excess is restored to the national grid—and starting in 2021, you will receive a rebate on your electricity bill.

There is currently a 2.5-3% rise in electric bills annually as well as a fourfold increase in Carbon Tax, which will soon cost €100 per carbon tonne emitted from your home. However, with solar, you won't have to worry about rising global energy costs or rising carbon tax because solar protects you from both. Solar panels also require very limited maintenance, as the only upkeep generally needed is regular cleaning.

SolarSmart offers a 2-year warranty on installations, in addition to the manufacturer's warranties of 10 years on inverters and batteries and 25 years on panels. We also offer an after-care package where we provide panel cleaning services and regular checks of your equipment and roof mounting equipment once a year to ensure optimal solar generation, so maintenance costs will be minimal.

The SEAI also provides grants for solar installations valued up to €3,000. The solar PV grant offers €900 for every kWp generated up to 2kWp and €300 for each additional kWp generated up to 4kWp. If your solar energy system produces 4kWp, you can receive as much as €2,400. An SEAI grant is also available for battery storage at a value of €600.

As part of the installation service, **SolarSmart** handles the processing of all SEAI grant paperwork.

Switching to solar is not only beneficial to the environment, but it is also beneficial to your finances. Having your own solar energy system saves you money in five ways: Reduced electric bills, energy resale, reduced Carbon Tax, minimal required maintenance, and increased home value.

After installing a solar PV system, you will rely less on the national grid and will therefore see a 40-70% reduction in electric bills.

Lastly, installing solar panels will increase the market value of your home. Sleek and efficient panels with newer technologies can increase your home's value by about 4%. Solar panels are therefore a terrific investment for both the environment and your wallet.

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The benefits of going Solar *continued*

Solar energy's Rate of Return

At SolarSmart we like to think about solar this way—let's say you have **€** *10k sitting in your bank account earning zero interest...*

By installing a *SolarSmart5* System in your home, you start generating your own electricity immediately, thereby saving on the amount you would normally pay your electricity provider.

A typical Irish detached home can generate 60-80% of its electricity needs by going solar. If your monthly electricity bill is €100, that's an immediate savings of €50 to €70 per month—or approximately €700 per year! Not a bad tax-free return on a €10k investment.

And the savings don't stop there...

With a battery, you can convert to a night tariff with your electricity provider, top up your battery at night, and in doing so—cut your electricity cost by roughly another €100 per year.

Starting in 2021, you'll earn for every kilowatt-hour you restore to the grid—that means an opportunity to earn an additional €150 per year. And what's more, you'll also be saving Carbon Tax, due to increase from €20/ton to €80/ton by 2030, and potentially significantly more thereafter, which translates to another €50 per year in savings.

So to sum up—if your home is capable of generating 60% of its own electricity, plus you avail of reduced night tariffs and sell an average quantity of excess to the grid, you'll be saving €700 + €100 + €150 + €50 - that's an attractive €1,000 every year, or a **10% tax-free return on your money.**

That's not to mention more than **20 tons of CO2 emissions** you'll save over the next 20 years by going solar!

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Financing your switch to Solar

Green financing options

There are many options available to finance your solar energy system in Ireland.

If you are in need of a loan for your system, several banks have expressed increased support of lending towards customers that are undertaking any projects that are deemed beneficial to the environment. This can include switching to an eco-friendly car, upgrading your home to increase its BER, and installing solar panels.

Any project that qualifies for an SEAI grant scheme is likely to also qualify for a loan. AIB Bank, Bank of Ireland, KBC Bank, and Permanent TSB have all implemented “green loans” to help customers with energy transition projects.

Credit unions also offer financing if you are looking for an alternative to a bank loan. Credit unions typically have higher interest rates than banks, but have lower fees and better customer service. The Irish League of Credit Unions, for example, offers Green Home Improvement Loans, which applies to anything that increases your home energy efficiency while decreasing bills.

Another option for financial assistance is An Post. Green Hub is an energy upgrade service provided by An Post that allows you to apply for home energy improvement loans between €5,000 and €75,000. The work undertaken must be performed by SEAI contractors and approved for SEAI grant eligibility. An Post operates through Avantcard, a designated activity company regulated by the Central Bank of Ireland.

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About SolarSmart

Based on the latest figures, almost half-a-million Irish homes are solar-ready—that means they are ideally situated to reap the financial benefits that come with switching to solar.

With **SolarSmart**, homeowners not only save thousands of euros per year by generating their own clean, green electricity from daylight—they can earn money by selling their excess back to the grid.

SolarSmart takes the hassle out of going solar by streamlining the process for you—from our initial consultation to full installation. Our solar advisors use the latest technology to accurately configure a system that fits your personal consumption patterns.

Included in our free quote is a clear picture of the year-on-year savings you can expect to make. What's more, we'll even process your SEAI grant application for you so you can avail of your refund immediately.

SolarSmart's leading-edge solar and battery technology guarantees your solar system is future-proofed to meet increasing energy demands. When your system is switched on, we remain your single point-of-contact for all maintenance and performance issues. Our installations come with a no-fuss two-year warranty, while battery systems and panels are covered by 10 and 25-year warranties respectively.

There's never been a better time to switch to cleaner, greener solar power. SolarSmart makes it easy.

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