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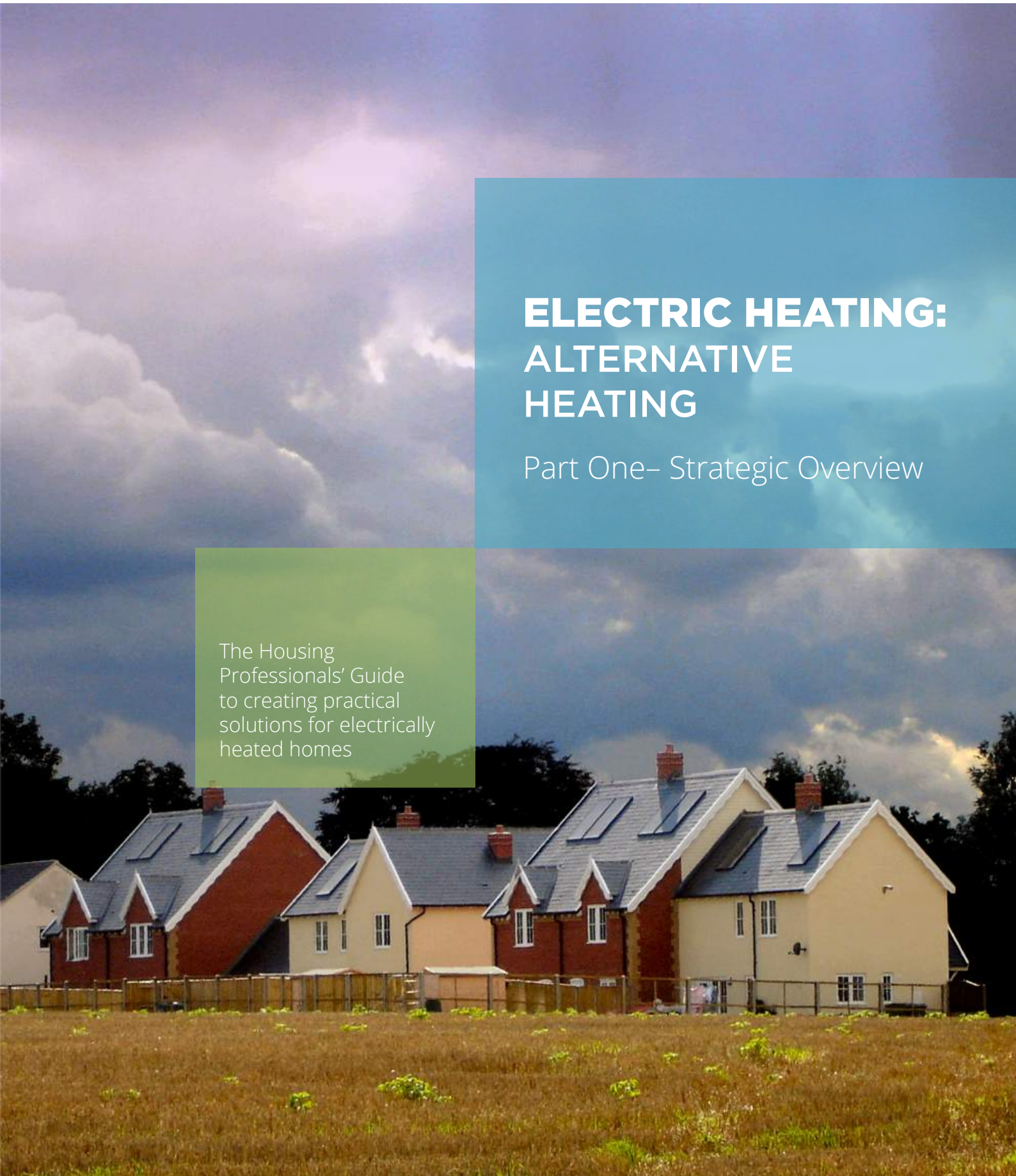

ELECTRIC HEATING: ALTERNATIVE HEATING

Part One– Strategic Overview

The Housing Professionals' Guide to creating practical solutions for electrically heated homes

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INTRODUCTION

Electric heating was and is still being installed in homes for sound reasons, but it can present numerous problems for housing providers. With electricity prices rising, and other use and control issues coming to light, electric heating can lead to issues around affordability, ultimately resulting in customer complaints.

This project was instigated by The Guinness Partnership (TGP) because they recognised electric heating was a growing issue for them and the sector as a whole. TGP has led the sector on developing new sector wide approaches on a range of issues including communal heating and the EU directive on metering and billing.

This Part One Guide is intended to provide a first step in how to deal with homes that are heated electrically. It is supported by Part Two and the Electric Heating Assessment Tool, both of which are available through the Adecoe website.

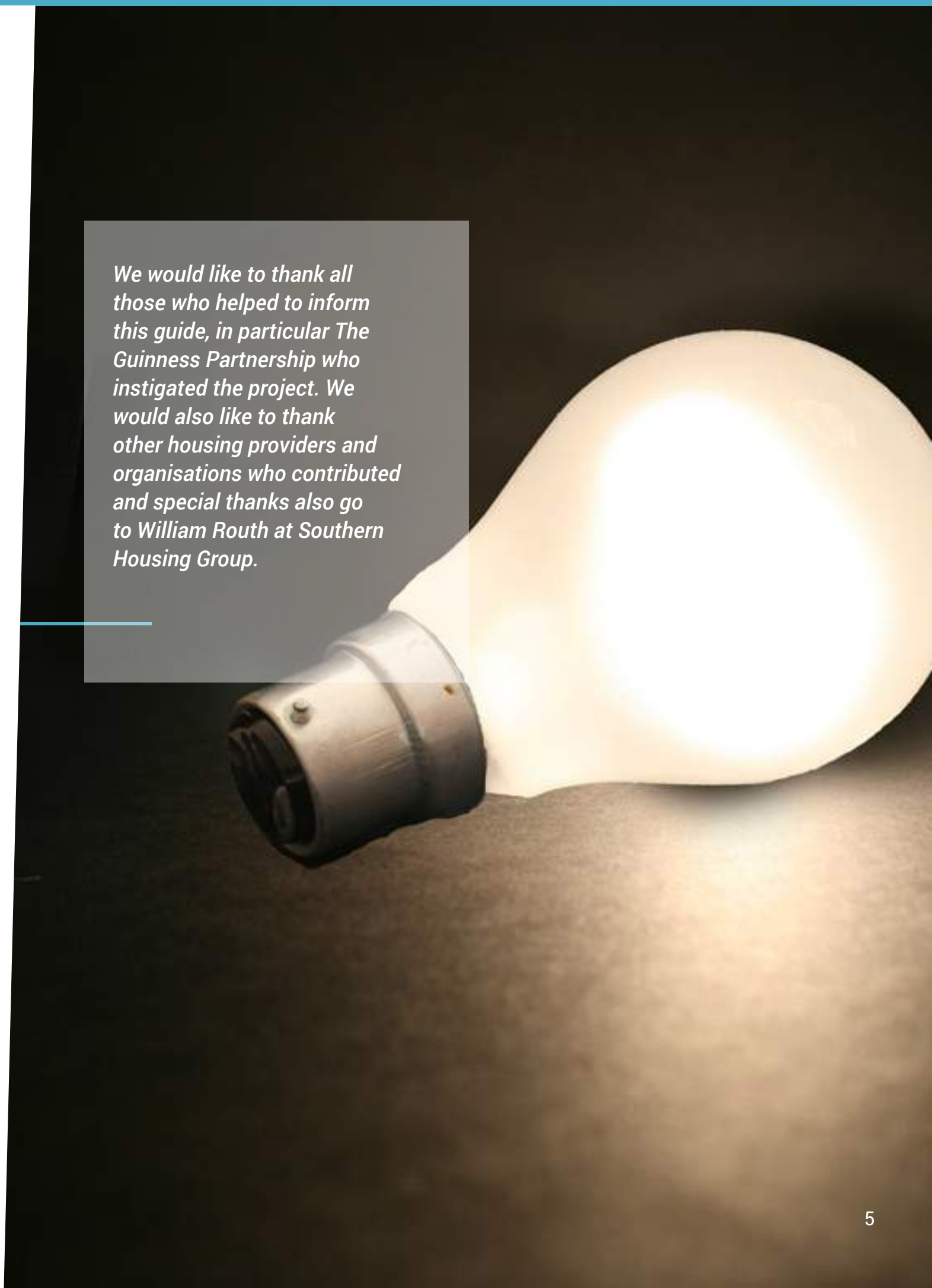
Using these Guides and the Assessment Tool means that electrically heated homes and alternative heating can form an important part of your long term Asset Management strategy. Adopting an approach that balances benefits and costs with organisation and policy drivers means that electrically heated homes can be dealt with pro-actively rather than reactively.

Tackling electrically heated homes is not always straightforward. The specific details and factors at any given site mean that adopting a fixed decision making hierarchy for heating may not come up with the best solution in many cases.

However, there are some key things that can make the decision making process easier. The right solution is linked to your key aims. These can include reducing home energy use, capital or maintenance costs, or energy and carbon savings.

It is important that a proper evaluation is carried out to achieve the best option. Sites with electrically heated homes need to be assessed individually. The ever changing nature of grants and funding will also play a significant role in selecting the best option at any given time.

Within this Guide we provide the typical picture for electrically heated homes in social housing. It is based on real world experience of social housing providers and installations. It is supported by the Assessment Tool to enable you to assess your own circumstances and issues.



We would like to thank all those who helped to inform this guide, in particular The Guinness Partnership who instigated the project. We would also like to thank other housing providers and organisations who contributed and special thanks also go to William Routh at Southern Housing Group.

USING THE GUIDE

This Guide helps housing professionals assess potential solutions for the problems often experienced with electrically heated homes. It is based on real experience of The Guinness Partnership and other housing providers and is composed of three main elements:

- **Part One -** The Housing Professionals' Guide to understanding solutions for electrically heated homes
- **Part Two -** The Housing Professionals' Guide to delivering solutions to electrically heated homes
- **The Electric Heating Assessment Tool**

Part One is a general introduction and will help those readers who need a strategic overview of the issues and options.

Part Two will help guide those that need to take action to address electrically heated properties and is supported by the use of the Assessment Tool for specific schemes.

Part One outlines the main issues around electric heating, how alternatives can be selected and how they can be applied.

Part Two looks at these issues in more depth so that housing professionals can assess and evaluate options for their organisation and their customers. It outlines in more detail what the options are, including heat pumps and solar, and explores their advantages and disadvantages.

The Assessment Tool was developed to allow allow housing professionals to assess the options to meet their key objectives including capital and revenue costs, energy and carbon saving, and costs for customers.

Part One and the Assessment Tool are available through the Adecoe website.

WHAT'S THE PROBLEM WITH ELECTRIC HEATING?

Despite being used for many years, electric heating can still cost more to run and sometimes customers do not like using it. This can to customer complaints or requests for it to be replaced. It can also have a negative impact on energy and carbon saving, on fuel poverty for customers and can present challenges when it is due to be replaced or upgraded..

The main issue for electric heating is that, by its nature, it consumes high cost, and carbon intensive electricity. This can mean:

- Potentially negative impacts on achieving internal SAP energy rating targets (and possible future regulatory drivers)
- Potentially fails to deliver affordable warmth for tenants leading to financial pressures which impact on arrears, let-ability and complaints

Residents also feel that electric heating is sometimes more difficult to control or does not provide the type of heating they are used to or want to have now.

There are a number of types of electric heating. Two of the most common are night storage heaters (NSH) and direct electric heating, such as panel heaters and radiators.

Direct electric heating is problematic because it uses on-peak electricity, a relatively expensive fuel. Storage heater systems should be better because they allow the use of the cheaper Economy 7 (E7) night rate tariff for most space heating and domestic hot water.

However, many older systems are problematic especially with issues around their controllability and 'heat leakage', where heat escapes too quickly rather than when it is required. This can lead to tenants using other heating options (such as plug-in heaters) and paying even more because they then use the more expensive E7 day rate for heating and/or hot water.

Trying to balance the issue of costs for customers and landlords and the impact on energy costs and carbon, whilst trying to meet internal, regulatory or Government targets makes it difficult to make the right decision on electrically heated homes. These Guides and the Assessment Tool have been designed to help address this.

SELECTING THE BEST ALTERNATIVE HEATING OPTIONS

Finding the right solution for electrically heated homes is a balance between the type of home, the site and a balance between costs and benefits.

In the very broadest terms, different types of heating can be ranked as follows with the 'best overall value' at the top. Solar options are not on this list as they are additional options – whereas there must be a primary heating system in place.

1. Gas
2. Ground source heat pumps
3. High Heat Retention (HHR) night storage heaters
4. Air source heat pumps
5. Other direct acting electric heating

Although this is a very simple and basic analysis, it gives us a starting point. This ranking will be different for different organisations, and it will be different for different sites. It will also evolve over time in response to changes in funding regimes and installation costs, your own organisation's priorities and government policy. Further considerations for each of these alternative heating options are given in section 6: a table summarising the advantages and disadvantages of each option is given in section 7.

Not all of potential forms of alternative heating are always applicable to all properties. The potential for an option may well require input from a specialist on a site–by-site basis, for example drilling for ground source heat pumps. The matrix below provides a very broad indication of the applicability of heating types to different homes:

KEY

- **Likely to be applicable**
- **Could be applicable – depending on site specific details or drivers**
- **Challenging, or unsuitable**

	FLATS		HOUSES					
	High rise	Low rise	Low energy performance Solid walls/single glazed	Higher energy performance	Existing Gas	Off Gas	Semi's	Terraced
Gas								
Ground source heat pumps								
HHR night storage heater								
Air source heat pumps								
Photo voltaic								
Solar Thermal								

THE ELECTRIC HEATING ASSESSMENT TOOL

The purpose of the Assessment Tool is to support the decision making process for selecting the right heating option for a site. It aims to give you a way of assessing options according to your objectives, whether that is achieving an energy rating score, minimising capital, revenue or tenants' energy costs. Part Two and the Assessment Tool are available through the Adecoe website.

The Assessment Tool was developed for and with The Guinness Partnership (TGP) and was developed around the needs of TGP at that point. The Tool helps to demonstrate the importance of defining value and how the 'best' heating result depends on what is included within the value assessment.

Things will change over time, such as funding rates, choices about where values might be attributed (e.g. who gets FiT payments) and techonological innovation, and so the Tool will need regular updating. We specifically advise you to review the heating and solar sections to make sure they meet your organisation's needs and that the funding rates are applicable.

Information required:

Site specific factors and site specific costs

Making the right choice for a site involves site specific factors and site specific costs. The Tool also uses inputs from SAP or RdSAP and the most accurate results will be achieved if SAP inputs come directly from recent assessments of the site being reviewed, not from existing or third party sources. These will provide a sound understanding of energy and cost savings provided by various heating alternatives, together with potential SAP results that can be achieved. We recommend expert assistance with this to help you understand the options beyond the limitations of SAP.

Estimates of costs for capital and maintenance

The Tool also requires estimates of costs for capital and maintenance. There are some default values that can be used, but using values from your own experience or from site information will make the results much more reliable. Individual site factors are important in selecting the right option for the site, as the more generic the values used, the less accurate the results of the Tool will be.

Funding

Finally, the Tool requires inputs around funding. As funding regimes can change often, this is also an area that may require specialist input.

SOME IMPORTANT THINGS TO CONSIDER

The right choice of alternative heating at any given site will vary. You should bear in mind:

- Not all options are practicable at all sites (as outlined in the illustrative applicability matrix above).
- Costs vary according to site specifics and can also vary over time.
- A project's drivers, targets and priorities can lead to different solutions. Things like new windows can be very popular with tenants and this could be more important than whether or not they are the most cost effective energy measure.
- Different criteria and/or evaluation methods for assessing schemes can lead to different options. If you are unsure we suggest that the 'tenant saving per lifetime £ spent' is the best metric for assessing overall value.
- Grants, funding policies, regimes and markets are ever-changing; these can have a very significant impact on the viability of options.
- Ensure that you have properly considered the tariff options that are available, including standard and Economy 7.

SO WHAT ARE THE MAIN HEATING OPTIONS?

GAS

Gas central heating has become the default choice in many cases. But while it is at the top of the simple hierarchy for heating systems, there are a number of reasons why gas could be ruled out for your scheme.
For example:

- No mains gas available
- Mains gas is available but connection is too expensive. However, 100% grants have become available more recently and the timescales for the use of grants has become more flexible which helps to put programmes together.
- There' a preference not to have gas in the building, such as in high rise flats
- Gas is expensive to install, for example running new gas pipes inside existing buildings
- Ongoing compliance requirements and cost add significantly to revenue and whole life costs of gas. In addition there are accessibility issues and costs with tenants.

Annual maintenance costs for gas systems (including gas safety checks), mean relatively high annual maintenance / servicing costs. Modern condensing boilers can also be sensitive to the quality of installation work. Poor quality work can lead to significantly reduced boiler life.

The high flow temperatures for gas systems and their prevalence as the most common heating system in the UK make gas systems relatively familiar and easy for tenants to use.

GROUND SOURCE HEAT PUMPS

In theory ground source heat pumps (GSHP) will typically be a better choice than gas, and they are significantly better than HHR night storage heaters. This is because despite having higher installation costs, there are annual Renewable Heat Incentive payments that help to 'pay back' that additional cost, and they provide lower running costs for tenants. However, we have placed GSHP in second place in our simple hierarchy because the benefit over gas is relatively small and there are a significant number of issues to consider, starting with the much higher installation costs.

GROUND SOURCE HEAT PUMPS

GSHP use pipes in the ground - 'ground loops' - to extract heat from the ground. In social housing, these are typically put into boreholes, but trench systems are also possible. The heat pump upgrades this heat so that it can then be used to heat the home and provide domestic hot water. In existing social housing radiators will typically be used to distribute the heat throughout the dwelling heat.

The Renewable Heat Incentive (**RHI**) is a key part of GSHP's high ranking, but that could change as we have seen with other funding streams such as the **Feed In Tariff** and the **Energy Supplier Obligation** for energy efficiency measures (The **non-domestic RHI** might also apply).

One of the biggest issues is whether a ground source heat pump is possible or indeed practicable. Things you should consider include:

- Geology can be an issue because this can have a direct impact on the cost of drilling boreholes
- Is there anywhere to drill boreholes? A horizontal ground loop can be laid in a trench but in social housing boreholes will be much more likely.
- Is there access for machines to drill the boreholes? The rule of thumb is that the harder the rock, the smaller the drilling rig required and so the easier the access. There are drilling rigs that can get through a garden gate, however some projects use very large rigs and generate significant external disruption.
- Where will the GSHP unit be located? This is usually an external 'garden box' but there is not always space and this can be aesthetically challenging. There are now smaller units available that can fit internally (for example in an airing cupboard).

The boreholes should have a very long life expectancy (possibly 100yrs). However annual maintenance system checks are recommended. This will include checking of the ground loop pH. It might be expected that the ground loop fluid could need to be replaced around every 7 or 8 years. This should be checked annually and be replaced when required. The heat pumps should have a relatively long life expectancy, and there should be lower maintenance costs than for gas. However actual costs will vary as there is not yet a fully mature supply chain.

Typical social housing systems may well use standard heat distribution systems (radiators etc) and controls. They might also have relatively high flow temperatures (c.50o). Collectively these features can limit the differences between GSHP and 'traditional' heating systems – making these systems relatively easy for tenants to use. The typically longer time required for 'heat up', and the typical feature of heating hot water and space heating only at different times will mean that effort is required to engage tenants and help them to understand how to use their heating.

HIGH HEAT RETENTION NIGH STORAGE NEATERS

Night storage heaters use a much cheaper Economy 7 night time tariff for space heating and domestic hot water. The heat is stored in the heaters and released later as required. The downside to Economy 7 is that the day-rate electricity is even more expensive than the standard rate for electricity with a normal tariff.

If your scheme already has electric heating, storage heaters are often already being used, which means switching will be technically feasible and relatively easy in most cases. Where storage heaters are not the existing system, for example if direct acting electric heating is in place, then using storage heaters may have additional complications around the electricity meter, the consumer unit and internal wiring: changes or additions may be necessary, all of which can add to the installation cost. This can also be true if a storage heating system is being upgraded, for example if more storage heater units are being introduced than there were in the original design.

There are main issues you need to consider for storage heaters are:

- The ratio of night-rate to day-rate electricity used needs to be high enough for the tariff to work
- To some degree the tenant is guessing how much heat they require in advance.
- Does the storage work – or does the heat leak out when it is not required (potentially meaning that heat is not available when it is required)?
- Do tenants understand their electricity use and the E7 tariff well enough to behave to their own advantage?

High heat retention (HHR) night storage heaters are better insulated and have better controls, which makes them better at storing and releasing heat. These are critical improvements over other storage heaters, particularly compared to older ones coming to the end of their life.

Storage heaters should be low maintenance, though there are heating engineers who still recommend annual checks.

Usability of HHR night storage heaters is better than for older types of storage heater. But there is still a need to try to engage and educate tenants so they can understand how to use storage heaters, and the E7 tariff, to optimise the use of their system.

AIR SOURCE NEAT PUMPS

In theory ground source heat pumps (GSHP) will typically be a better choice than gas, and they are significantly better than HHR night storage heaters. This is because despite having higher installation costs, there are annual Renewable Heat Incentive payments that help to 'pay back' that additional cost, and they provide lower running costs for tenants. However, we have placed GSHP in second place in our simple hierarchy because the benefit over gas is relatively small and there are a significant number of issues to consider, starting with the much higher installation costs.

AIR SOURCE HEAT PUMPS

The Renewable Heat Incentive (**RHI**) is available for air source heat pumps, but the rates could change, as we have seen with other funding streams.

ASHPs could help to reduce tenant's bills and they might be a way of getting a property over a given SAP target. They can often be used where ground source heat pumps cannot.

Air source heat pumps absorb heat from the outside air. This heat can then be used to heat radiators, underfloor heating or warm air systems and hot water. An ASHP extracts heat from the outside air in the same way that a fridge extracts heat from its inside.

Increased experience with ASHPs within social housing could elevate their position in the ranking. It is worth noting that a good ASHP will outperform a poor GSHP, so the execution of a project is key to delivery of the best solution.

Is an ASHP possible or practicable?

- Air source heat pump units are normally located externally. There is not always a suitable location or the aesthetic impact of this may be an issue.
- Noise can be an issue, especially where properties are in close proximity.

Air source heat pumps should be lower maintenance than traditional gas systems, and thus they should also have lower maintenance costs. Annual checks are still recommended.

It is important to consider usability – especially with lower temperature systems. It will be important to engage with tenants around the operation of a lower temperature heating system. Key areas are around (typically) longer 'heat up' times, and the timing of heating hot water (heat pumps typically do not do space heating and hot water at the same time).

WHAT'S THE ROLE FOR SOLAR?

NightWithin solar we include both photovoltaics (PV) which generates electricity, and solar thermal which generates hot water. Typically solar provides supplementary energy: there will normally be another main heating system.

The supplementary role of solar can be very important in helping to achieve key objectives, including lower energy cost for tenants, improved SAP ratings and reduced carbon emissions.

PV performs very well in long term value assessments and it is possible that PV may provide a way to lift energy and carbon targets up to required levels. This might be the case in combination with HHR night storage heaters where they could provide a lower cost means of achieving required SAP scores than using ground source heat.

Photovoltaics require a larger roof area than solar thermal. There may be roofs where photovoltaics are not practicable, but where solar thermal can be used to achieve required SAP targets and/or reduce tenants' bills. At some sites, solar will be possible on some homes but not others.

It is also important to consider lender consent on solar installations. This is will be because they will be considered to be a structural alteration or there may, in the case of third party financed installed, third party interest in the property. While lender consent is no longer seen as a barrier to installations it is important to make it part of the assessment process.

Solar systems are not maintenance free. For PV, inverters typically have a shorter life than panels – so these will typically require replacing. For solar thermal the fluid in the panels will require periodic checking and changing (or inhibitor top up etc).

SUMMARY OF HEATING OPTIONS

MAIN GAS

ADVANTAGES	DISADVANTAGES
• Provides relatively high SAP scores • Lower fuel costs for tenants compared to electric heating options • Relatively low install cost • Well understood with a mature supply chain • Relatively easy to use for tenants	• Long term cost benefit is not as good as that of GSHP • Long term benefit of gas is similar to that of HHRNSH • Gas safety regulations must be observed • Gas boilers sometimes oversized leading to lower efficiency compared to SAP • Disruption of installing wet systems • Relatively high annual maintenance (and gas safety check) costs

GROUND SOURCE HEAT PUMPS

• GSHP provides the highest SAP score of all options investigated • Typically operates on a wet system like gas • More suited to well insulated dwellings • Can attract the Renewable Heat Incentive funding • Long life, relatively low maintenance (& servicing cost)	• High installation cost • Disruptive installation potentially internally and externally • Developing supply chain • Not always well understood by housing staff or customers • Larger radiators with slower heat up times

HIGH HEAT RETENTION NIGHT STORAGE HEATERS (HHRNSH)

• Typically easy to install and relatively low cost • New storage heaters are a significant improvement from the old • Some long term cost benefit • Relatively easy for tenants to use	• Increasing the number of storage heaters can increase cost • Lower SAP scores • Smarter control better today, but still need to predict heat needs • Use of HHRNSH and E7 will work for most tenants most of the time, but not all tenants all the time

AIR SOURCE HEAT PUMPS (ASHP)

• Higher SAP than HHRNSH and possibly gas too • Typically operates on a wet system like gas • Often applicable where GSHP are not • More suited to well insulated dwellings • Can attract Renewable Heat Incentive Funding • Relatively low maintenance (& servicing costs)	• Higher installation cost than gas and HHRNSH • Developing supply chain • Not always well understood by housing staff or customers • Typically ASHP is less efficient than GSHP so higher running costs • Larger radiators with slower heat up times

SUMMARY AND NEXT STEPS

Part One of the Electrical Heating Guide has been designed to give you an understanding of the main issues, approaches and possible solutions to improving homes with electric heating. This was instigated by The Guinness Partnership in response to issues it was having in its own stock and the sector as a whole. While it would be much easier if there was one solution to address all issues and sites this is simply not the case; but there is a solution for the homes you are looking. Broadly the key things you will need to consider are:

- **Identify what issues you a trying to address –** for example addressing fuel poverty and affordable warmth, energy saving, carbon saving.
- **Establish what objectives you are working to –** for example minimising capital expenditure, revenue costs or meeting a corporate energy target.
- **There are a range of technical options to address these** that will replace existing electrical heating or supplement it in the case of solar.
- **The approach you take will depend on the specific site** and where possible get up to date data on the homes.
- **The solution for your homes will be depend on the issues you are addressing, your objectives and the site specifics and Part Two and the Assessment tool can help you come to that solution.**

GLOSSARY

ASHP	Air source heat pump, uses low grade energy from the air and amplifies this to useable heat for space heating and domestic hot water.
GSHP	Ground source heat pump, uses low grade energy from the ground and amplifies this to useable heat for space heating and domestic hot water.
NSH	Night storage heater, an electric heater that uses cheaper Economy7 'night rate' electricity and stores heat for use later in the day.
HHRNSH	High heat retention night storage heater, a storage heater with insulation and controls so that the heat is retained better and the use of expensive 'day rate' electricity is minimised.
PV	Photovoltaic, panels that use energy from the sun to generate electricity. Solar Thermal, panels that use energy from the sun to generate hot water.
SAP	Standard assessment procedure, the National Calculation Methodology, used to provide comparative energy use for domestic properties.
RdSAP	Reduced data standard assessment procedure, a more simple version of SAP used for existing homes.
RHI	Renewable heat incentive, a government funding initiative that provides annual payments for some heat generating renewable energy technologies.
FiT	Feed in tariff, This provides payments for electricity generating renewable energy technologies.
ECO	Energy company obligation, a set of obligations for energy companies that can provide funding for energy saving measures (primarily insulation – but also a wide range of other measures).

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