



MORRISONS



# MORRISONS LITTLEHAMPTON ENERGY STRATEGY

|                                                                                    |                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| <b>DATE</b>                                                                        | 18 <sup>th</sup> July 2012                                                                                                                                                                                                         |
| <b>REFERENCE</b>                                                                   | 04                                                                                                                                                                                                                                 |

## Executive Summary

Pre-occupation Condition 14 of approval for the Morrisons store at Littlehampton (Application LU/271/11/) will be met by achieving a 10% carbon saving using the following technologies:

- A Heat Harvester to use high grade waste heat from low temperature refrigeration for domestic hot water generation.
- 150 m<sup>2</sup> monocrystalline or equivalent capacity solar photovoltaic panels

The achievement of a 10% carbon saving will be demonstrated and independently audited through the achievement of 2 credits under Issue Ene 04 of BREEAM 2011.

This report also addresses Condition 14 by presenting passive design and energy efficiency measures for the store. These are summarised in Table E.a, laid out according to the Morrisons Carbon Hierarchy, under which carbon emissions are avoided and reduced through passive design before being replaced through the use of renewable energy.

**Table E.a Summary of the sustainable energy options for the proposed Morrisons Littlehampton store.**

| CARBON HIERARCHY  | Potential measures for the new Littlehampton Store                                                     |
|-------------------|--------------------------------------------------------------------------------------------------------|
| Avoid emissions   | Minimise HFC losses                                                                                    |
|                   | Daylight in the entrance areas, café and office spaces                                                 |
|                   | Avoidance of the need for cooling                                                                      |
| Reduce emissions  | High efficiency boilers and gas burners                                                                |
|                   | High efficiency refrigeration equipment                                                                |
|                   | Energy efficient T5 fittings for general lighting and high efficacy display lighting in the sales area |
|                   | Trend Building Management System and Optima Energy Management System                                   |
| Replace emissions | Use of waste heat from refrigeration to pre-heat domestic hot water                                    |
|                   | Renewable electricity generation by solar photovoltaics                                                |

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# 1 Introduction

A new Morrisons store is planned in Littlehampton as part of the development of the former Body Shop HQ. Approval has been given by Arun District Council to the planning application for this development (LU/271/11/). Condition 14 of approval is set out below.

## **Condition 14 of Approval for LU/271/11/**



*Prior to first occupation of the food retail store a scheme which details how the development incorporates energy efficiency measures that reduce carbon dioxide and other greenhouse gas emissions shall be submitted to and approved in writing by the Local Planning Authority. The scheme should aim to incorporate on-site renewable energy equipment to meet 10% of expected energy needs of the development from renewable sources and shall be implemented as approved.*

The Morrisons Littlehampton store will be assessed under BREEAM 2011, demonstrating the achievement of the following:

- An overall 'Very Good' rating
- 2 credits under Issue Ene 4 for a 10% carbon saving from low or zero carbon energy.
- Credits for reducing CO<sub>2</sub> emissions (Ene 1), sub-metering (Ene 2), external lighting (Ene 3) and cold storage (Ene 5).

The implementation of a strategy which achieves 2 credits under BREEAM Ene 4 has been proposed to Arun District Council as a means of demonstrating compliance with Condition 14. This

approach was confirmed as acceptable by Cian Cronin (Senior Planner, Arun District Council) in an e-mail of 12/6/2012.

## 2 Morrisons Corporate Sustainability

### 2.1 Energy & Carbon

Morrisons has shown leadership in its corporate approach to reducing carbon emissions. This has been recognised in the following ways:

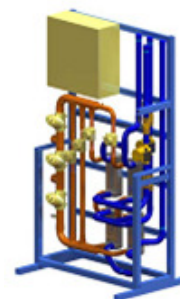
- Morrisons was the first UK supermarket to achieve the Carbon Trust Standard (Figure 2.a.iii) for year-on-year emission reductions.
- Morrisons was third place (the highest supermarket) in the FTSE 350 Carbon Strategy Index 2010.
- Morrisons was winner of the Large End-User of the Year Award at the RAC Cooling Industry Awards 2010 (Figure 2.a.ii) because of its strategy on CO<sub>2</sub> and leakage.

Morrisons has a target of a 30% absolute reduction in emissions between 2005 and 2020. It was the first supermarket to bind itself to an absolute reduction despite plans for expanding its business. This target builds on a 14.6% reduction already achieved by Morrisons in carbon emissions between 2005 and 2011.

The chief contributor to carbon reductions by Morrisons over the last five years has been its programme of refrigeration improvement, which has led to a 43% drop in direct refrigerant emissions. Morrisons has invested over £100 million in new and replacement systems.

Other recent carbon saving improvements by Morrisons have included:

- 6,300 tonnes CO<sub>2</sub> saved through voltage optimisation in fifty sites. A further ninety two sites have now had the technology installed this year.
- 12,200 tonnes CO<sub>2</sub> saved from improving the control of ventilation in existing stores.
- 11,400 tonnes CO<sub>2</sub> saved from installing low energy LED lighting in chilled display cabinets.



(i)



(ii)



(iii)

**Figure 2.a The *Heat Harvester* (i) retro-fitted to refrigeration systems in existing stores, the Cooling Industry Awards 2010 (ii) and the Carbon Trust Standard achieved by Morrisons (iii).**

### 2.2 Water

Morrisons recognises that water resources are limited and that mains water consumption has a significant environmental impact. It therefore includes the following measures in its new store developments:

- Low flow push taps.
- Automatic metering of water consumption which will identify excessive consumption (e.g. due to leaks).

These and other measures led to Morrisons achieving a 19% reduction in mains water consumption between 2005 and 2009. Throughout 2012/13 Morrisons aims to make a further 10% reduction in the cost for water usage through accurate consumption data and greater efficiency at stores

## 2.3 Waste

Morrisons is working to minimise the environmental impact of its own waste and that generated by its customers, and has achieved the following:

- 94% of waste from stores is recycled.
- The *Great Taste Less Waste* campaign (Figure 2.b.i; [www.morrisons.co.uk/GreatTasteLessWaste](http://www.morrisons.co.uk/GreatTasteLessWaste)), which gives storage advice on fresh produce (Figure 2.b.ii), information on the difference between “best before” and “use by” dates, and recipe ideas for food leftovers.



(i)



(ii)

**Figure 2.b *Great Taste Less Waste* campaign (i) and *Best Kept* stickers for fresh produce (ii).**

## 2.4 Other

Morrisons has a large number of other policies in place to increase sustainability. It is the only major UK food retailer with in-house manufacturing and processing facilities, which give it greater opportunities for carbon reduction and other environmental improvements. It also works actively with suppliers, customers and community organisations.

Morrisons supports schools to encourage students to grow fruit and vegetables in its “Let’s grow” campaign (Figure 2.c). This support has been taken up by 26,500 schools and over £12m worth of equipment has been supplied to over 5m pupils across the UK. and The scheme has won a number of accolades and was rated the “Best Green Educational Project” in the 2010 global Green Awards.

All Morrisons fresh meat, poultry, fresh milk and wheat is British. For more details on Morrisons sustainability achievements see its corporate social responsibility reports ([http://www.morrisons.co.uk/Documents/Morrisons\\_CR\\_Review\\_2011-12\\_updated.pdf](http://www.morrisons.co.uk/Documents/Morrisons_CR_Review_2011-12_updated.pdf)).



**Figure 2.c The Morrisons “Let’s Grow” campaign, which won the 2010 global Green Award for “Best Green Educational Project”.**

## **3 Avoid Emissions**

### **3.1 Refrigeration**

Food refrigeration typically uses HFCs as refrigerants, most of which are more than 1000 times more potent greenhouse gases than CO<sub>2</sub>. HFC leakage is a significant element of the Morrisons carbon footprint, as it is for all other food retailers, equivalent to 19% of the organization's total emission.

As described in Section 2, Morrisons has an ongoing policy to reduce HFC emissions from its estate and it has also used alternative natural refrigerants such as CO<sub>2</sub>, with seventy three operational now using CO<sub>2</sub> low temperature refrigeration. CO<sub>2</sub> low temperature refrigeration will be implemented at the Littlehampton store.

New refrigeration systems in Morrisons stores also include leak detection as standard, which automatically alerts maintenance contractors of any problem to ensure rapid response and minimisation of refrigerant release.

Refrigeration is also typically the greatest energy end-use in supermarkets (as shown in Figure 1.b). Section 4 will discuss the energy efficiency of the refrigeration systems. Emissions are also avoided through passive measures such as:

- Doors on all storage freezers and chillers with automatic alarms to show when they are left open.
- High level of insulation for cold storage and refrigerated displays.
- Automatic night blinds to minimise loads on open display refrigerators outside opening hours.

### **3.2 Lighting**

As shown in Figure 1.b, lighting is the second largest energy end-use in new Morrisons supermarkets. However, its use can be avoided through using daylight. It is expected that the design for the new Morrisons Littlehampton Store will achieve good levels of

daylight in a number of areas including the sales area, which is being provided with rooflights.

The use of lighting is also avoided by the control strategy:

- The general lighting illuminance level in the sales area reduces to a third outside opening times
- Display lighting is switched off outside opening hours.
- External lighting is switched off on the basis of daylight levels and for a set period outside trading hours.

### **3.3 Heat Loss**

Heat losses occur via conduction through the building fabric. The Littlehampton store will improve on the limiting requirements for insulation of Part L 2010 of the Building Regulations, achieving lower U-values for each element.

New Morrisons stores as standard also achieve air tightnesses of 5 m<sup>3</sup>/m<sup>2</sup>hr @ 50 Pa, half the leakage rate required by Part L of the Building Regulations.

### **3.4 Cooling and Ventilation**

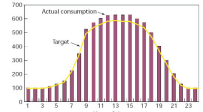
New Morrisons stores almost entirely avoid the need for cooling. The only areas that need it are small internal spaces with high heat gains such as the cash office. In the sales and other areas the ventilation design and control of internal gains (e.g. from lighting) lead to comfort cooling not being required, removing a major potential source of carbon emissions.

While the maintenance of a comfortable environment in the sales area requires mechanical ventilation, this energy end-use can be avoided in some areas. Natural ventilation will be considered for staff areas with windows, taking into account the constraints of noise and air quality.

## 4 Reduce Emissions

Having minimised the need for energy through passive measures, the next stage of the carbon hierarchy is to reduce emissions by ensuring energy is used efficiently. This is achieved through the specification and design of efficient systems, through careful commissioning of these systems and good management of energy in the operational building. Table 4.a summarises the ways in which these measures will be used to reduce carbon emissions from the new Littlehampton store.

**Table 4.a Carbon reduction measures for major energy end-uses in the new Morrisons Littlehampton store.**

|                          |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Refrigeration</b>     |    | <ul style="list-style-type: none"> <li>Morrisons is evaluating cost-effective energy efficiency measures for the refrigeration system as part of detailed design. Options include DC fans for display cabinets and condensers, variable speed drives on compressors, and defrost on demand controls for evaporators.</li> </ul>                                                 |
| <b>Lighting</b>          |    | <ul style="list-style-type: none"> <li>Low energy T5 fittings will be used for general lighting in the sales area.</li> <li>Display lighting will have more than double the efficacy required by Building Regulations.</li> <li>Fittings will be switched using photoelectric control in the café, the entrance and staff areas to capitalise on available daylight.</li> </ul> |
| <b>Heating</b>           |   | <ul style="list-style-type: none"> <li>Space heating will be provided by efficient direct gas burners and a condensing boiler. Domestic hot water will provided by condensing gas heaters, and potentially a Heat Harvester system (see Section 5).</li> </ul>                                                                                                                  |
| <b>Ventilation</b>       |  | <ul style="list-style-type: none"> <li>Variable speed drives are used to balance the ventilation system and modulate the supply of fresh air.</li> <li>Low specific fan power fans used throughout the store.</li> </ul>                                                                                                                                                        |
| <b>Energy Management</b> |  | <ul style="list-style-type: none"> <li>Trend Building Management System.</li> <li>Comprehensive sub-metering of electrical end-uses and data collection using the Optima system.</li> </ul>                                                                                                                                                                                     |

## 5 Replace Emissions

### 5.1 Introduction

The achievement of two credits under BREEAM Ene 4 requires that a 10% carbon saving from the use of local renewable energy is demonstrated using an approved calculation tool, meaning one that follows the National Calculation Methodology (NCM) for Part L of the Building Regulations. A Part L model has not yet been built for the Littlehampton store. However, modelling of other new Morrisons stores in SBEM and IES VECompliance (which implements the 2010 NCM) has indicated that energy demands and emissions of the level shown in Table 5.a will be necessary to achieve compliance with Part L 2010.

The expected NCM outputs shown in Table 5.a indicate that a saving of 15.0 tonnes CO<sub>2</sub> will be necessary from renewable energy to achieve a 10% reduction.

**Table 5.a Predictions of NCM 2010 outputs for the Littlehampton Morrisons store.**

|                       | <b>Part L 2010<br/>Benchmark<br/>(kWh/m<sup>2</sup>)</b> | <b>Predicted<br/>consumption<br/>(kWh)</b> | <b>CO<sub>2</sub><br/>Emissions<br/>(tonnes)</b> |
|-----------------------|----------------------------------------------------------|--------------------------------------------|--------------------------------------------------|
| Mains gas             | 41.7                                                     | 186,002                                    | 36.8                                             |
| Regulated electricity | 48.9                                                     | 218,040                                    | 112.7                                            |
| Total                 | 90.7                                                     | 404,042                                    | 149.6                                            |

### 5.2 Refrigeration Waste Heat for Domestic Hot Water

Morrisons has widely installed the Heat Harvester system in new stores and retro-fitted it in existing stores. The system recovers

high grade (up to 60 °C) heat from the refrigeration system to pre-heat domestic hot water. Table 5.a predicts the energy and carbon savings from the use of the Heat Harvester at the Littlehampton Morrisons store.

**Table 5.b Predicted energy and carbon saving from the use of a Heat Harvester to pre-heat domestic hot water at the Morrisons Littlehampton store.**

|                                                 |                            |
|-------------------------------------------------|----------------------------|
| Baseline gas consumption for domestic hot water | 60,181 kWh                 |
| Gas saving from Heat Harvester                  | 48.145 kWh                 |
| Carbon saving                                   | 6.7 tonnes CO <sub>2</sub> |
| Fraction carbon saving                          | 4.5%                       |

### 5.3 Solar Photovoltaics

A 20 kWp solar photovoltaic array will be installed on the south-facing backs of the Littlehampton store's northlights. If monocrystalline panels are used, it is expected that the array's area will be 150m<sup>2</sup>. Table 5.c predicts the electricity generation by this array and the carbon emissions it will displace.

**Table 5.c Predicted energy contribution and carbon saving by solar PV on the Morrisons Littlehampton store.**

|                               |                            |
|-------------------------------|----------------------------|
| Solar PV capacity             | 20.0 kW <sub>p</sub>       |
| Annual electricity generation | 16,963 kWh                 |
| Carbon saving                 | 9.0 tonnes CO <sub>2</sub> |
| Fraction carbon saving        | 6.0%                       |

## ***5.4 Conclusion***

The results set out in Tables 5.a and 5.b show that the Heat Harvester and solar PV will achieve a carbon saving greater than 10%, meeting the terms of Condition 14 of planning approval. Further Part L modelling as part of detailed design will check the achievement of this target and demonstrate it to meet the requirements of BREEAM 2011 Ene 4.

## 6 Summary

This report has set out a sustainable energy strategy for the proposed development in Littlehampton in response to the sustainability aims set out for the Morrisons store in Planning Condition 14. The energy strategy for the Morrisons store is summarised in Table 6.a, set out according to the Morrisons carbon hierarchy.

**Table 6.a Summary of the sustainable energy strategy for the proposed Morrisons Littlehampton store.**

| CARBON HIERARCHY  | Potential measures for the new Littlehampton Store                                                     |
|-------------------|--------------------------------------------------------------------------------------------------------|
| Avoid emissions   | Minimise HFC losses                                                                                    |
|                   | Daylight in the entrance areas, café and office spaces                                                 |
|                   | Avoidance of the need for cooling                                                                      |
| Reduce emissions  | High efficiency boilers and gas burners                                                                |
|                   | High efficiency refrigeration equipment                                                                |
|                   | Energy efficient T5 fittings for general lighting and high efficacy display lighting in the sales area |
|                   | Trend Building Management System and Optima Energy Management System                                   |
| Replace emissions | Use of waste heat from refrigeration to pre-heat domestic hot water                                    |
|                   | Renewable electricity generation by solar photovoltaics                                                |

As an indication of the store's sustainable design and low carbon energy strategy, the following, independently audited targets will be achieved:

- Two credits under BREEAM issue Ene 4 will be achieved for low or zero carbon (i.e. renewable) technologies.
- Credits will also be achieved by the store for reducing CO<sub>2</sub> emissions (Ene 1), sub-metering (Ene 2), external lighting (Ene 3) and cold storage (Ene 5).

Estimates in this report have indicated that the 10% renewable energy target can be achieved for the Morrisons store by:

- The Heat Harvester system to exploit high grade, low carbon waste heat from refrigeration for domestic hot water.
- Zero carbon electricity generation by a 20.0 kW<sub>p</sub> solar photovoltaic array.

## Appendices

### Appendix 1 – Carbon & Energy Calculations

#### Baseline (Section 2)

| End Use         | Part L Benchmarks (kWh/m <sup>2</sup> ) |
|-----------------|-----------------------------------------|
| Spacing heating | 28.2                                    |
| Hot Water       | 13.5                                    |
| Cooling         | 0.1                                     |
| Auxiliary       | 17.9                                    |
| Lighting        | 31.0                                    |
| <b>Total</b>    | <b>90.7</b>                             |

|                        | Part L 2010 EF |                        |
|------------------------|----------------|------------------------|
| Gas                    | 0.198          | kgCO <sub>2</sub> /kWh |
| Electricity, grid      | 0.517          | kgCO <sub>2</sub> /kWh |
| Electricity, displaced | 0.529          | kgCO <sub>2</sub> /kWh |
| Waste heat             | 0.058          | kgCO <sub>2</sub> /kWh |

|                                  |       |                |
|----------------------------------|-------|----------------|
| Morrisons store conditioned GIFA | 4,457 | m <sup>2</sup> |
|----------------------------------|-------|----------------|

N.B. above figure is GIFA rather than GEA.

|                       | Part L 2010 Benchmark (kWh/m <sup>2</sup> ) | Predicted consumption (kWh) | CO <sub>2</sub> Emissions (tonnes) |
|-----------------------|---------------------------------------------|-----------------------------|------------------------------------|
| Mains gas             | 41.7                                        | 186,002                     | 36.8                               |
| Regulated electricity | 48.9                                        | 218,040                     | 112.7                              |
| <b>Total</b>          | <b>90.7</b>                                 | <b>404,042</b>              | <b>149.6</b>                       |

#### Heat Harvester (Section 3.2)

|                                 |        |        |
|---------------------------------|--------|--------|
| Fraction DHW provided           | 80%    |        |
| DHW Gas Consumption             | 60,181 | kWh    |
| DHW gas saved by heat harvester | 48,145 | kWh    |
| Carbon saving                   | 6.7    | tonnes |
|                                 | 4.5%   |        |

#### PV Array (Section 3.3)

|                      |        |                        |
|----------------------|--------|------------------------|
| Array area           | 150    | m <sup>2</sup>         |
| Array unit capacity  | 7.5    | m <sup>2</sup> /kWp    |
| Array capacity       | 20.0   | kWp                    |
| PV yield             | 750    | kWh/kWp                |
| Annual output        | 16,963 | kWh                    |
| Annual carbon saving | 9.0    | tonnes CO <sub>2</sub> |
| Fraction saving      | 6.0%   |                        |