DUBLIN CITY COUNCIL ENERGY REVIEW 2016

codema
Dublin's Energy Agency

Comhairle Cathrach Bhaile Átha Cliath
Dublin City Council

01. INTRODUCTION

Codema has developed this Energy Review on behalf of Dublin City Council (DCC), which is the largest local authority in Ireland. The aim of this Energy Review is to highlight the total amount of energy DCC consumed in 2016, along with the total cost and carbon emissions associated with this energy use.

This Energy Review also aims to clearly demonstrate where energy is used in the council, what drives its consumption, and where the greatest energy-saving potential is; this will help DCC to identify where it currently is in relation to public sector energy targets, and what areas it needs to prioritise in order to meet these targets between now and 2020.

As part of this process, Codema has analysed DCC's total energy use and broken this down into six Significant Energy Users (SEUs), which are explained in detail within this Energy Review. Codema gives an overview of the current energy use associated with each SEU, and provides recommendations on the actions DCC must take to reduce energy consumption in each SEU area and meet 2020 targets.

PUBLIC LIGHTING

OFFICES & DEPOTS

HOUSING

TRANSPORT

LEISURE CENTRES

FIRE STATIONS

Current Status & Obligations

In 2016, DCC consumed a total of 183.7 GWh of primary energy; this is the equivalent of 40,000 tonnes of CO_2, and Codema estimates the associated cost of this energy use to be approximately €13.2 million.

This information comes from Codema's database which incorporates the data from the Monitoring and Reporting (M&R) system developed by the Sustainable Energy Authority of Ireland (SEAI) and the Department of Communications, Climate Action and Environment (DCCAE). Codema has been entering DCC's yearly data into the M&R system since 2011, in order to comply with the reporting requirements of the European Energy Efficiency Directive 2012/27/EU. The directive has been transposed into Irish Law as Statutory Instrument S.I. 426 of 2014, which sets out several obligations on public bodies regarding their "exemplary role" for energy efficiency by achieving savings of 33% by 2020. This is an average reduction target of 3% per year.

To date, the first estimated data as reported by the M&R system shows that DCC has improved its performance by 26%, compared to the baseline year, which is an average of between 2006-2008. This amounts to a cumulative absolute saving of 38 GWh of primary energy[1] or 8,500 tonnes of CO_2. This means that DCC must improve its energy performance by 7% in its buildings and operations between now and 2020, in order to meet the 33% public sector target.

This Energy Review also looks at the data reported in the M&R system in more detail, as it takes into account the outsourcing of waste collection services from the local authority energy accounts, and also uses Energy Performance Indicators (EnPIs) to track performance.

DCC Energy Overview 2016

CONSUMED 183.7 GWH OF PRIMARY ENERGY

40,000 TONNES OF CO_2 EMITTED

€13.2 MILLION ASSOCIATED ENERGY COST

Public Sector Obligations

ACHIEVE SAVINGS OF 33% BY 2020

REDUCTION TARGET OF 3% PER YEAR

DCC Progress: Baseline - 2016

IMPROVED ENERGY PERFORMANCE BY 26%

8,500 TONNES OF CO_2 SAVED

7% IMPROVEMENT REQUIRED TO MEET THE 33% PUBLIC SECTOR TARGET

1. Primary energy (TPER) is an energy form that has not been subjected to any conversion or transformation process. It is energy received as input to a system. Primary energy can be non-renewable or renewable.

01. INTRODUCTION
(CONTINUED)

Methodology

In order to calculate potential energy savings in DCC, it is necessary to analyse changes in other factors that are directly related to the council's energy use. With this in mind, Codema uses EnPIs to measure DCC's energy performance more accurately. This method determines how efficiently DCC is using energy, as it is normalised to account for changes in the activity level related to the energy use, or the "activity metric", of the local authority. This is a measure of the activity that an organisation undertakes. An EnPI is calculated by dividing the organisation's Total Primary Energy Requirement (TPER) by an activity metric.

In the case of DCC, the overall performance indicator is based on population served; therefore, DCC's overall EnPI is the TPER divided by the population served for that year. This means that the performance of DCC is determined not only by its annual energy use, but also by a rise or fall in population.

When there are multiple variables that drive energy consumption - as is the case with the SEUs - a composite performance indicator is used.The scale of each variable's contribution is defined by a weighting scale. The equation used for calculating the composite performance indicator for the individual SEUs in this report can be seen below:

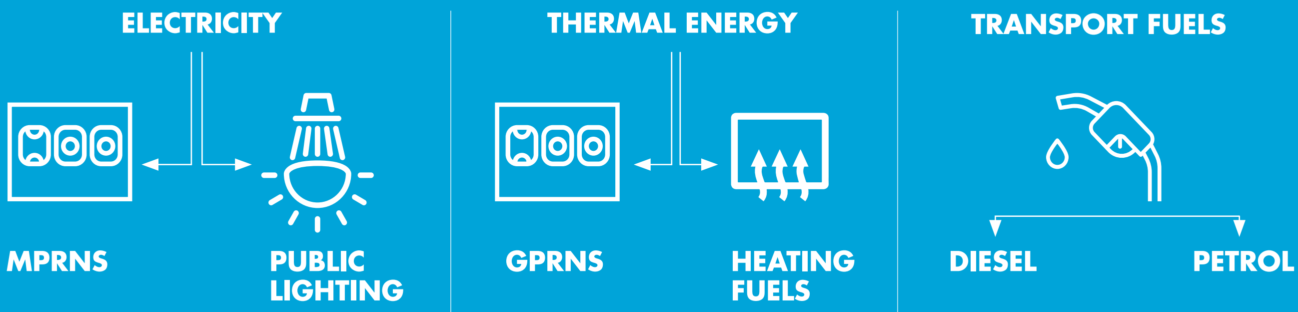
In 2010, the Dublin Local Authorities (DLAs) outsourced waste collection within the region. This Energy Review has provisions to account for this change, in order to accurately track the energy performance within each SEU area from the baseline year to 2016.

Formula for Calculating EnPIs for SEUs

$$\text{ACTIVITY}_0 = \sum_{i=1}^{x} \left(\frac{\text{Subactivity}_i}{\text{Subactivity}_{i\text{ ,baseline}}} \text{ x Weighting}_i \text{ x } 1{,}000 \right)$$

02. DCC ENERGY CONSUMPTION 2016

The energy database shows that DCC consumed 183.7 GWh of primary energy and produced 40,000 tonnes of CO_2 in 2016. Codema estimates the costs associated with this energy use to be approximately €13.2 million for the year. This is broken down into three principal energy categories; electricity, gas/heating and transport fuels. Electricity consumption comprises of metered electrical accounts (MPRNs) from DCC's buildings and unmetered public lights. Thermal energy consumption consists of metered gas accounts (GPRNs) and heating fuels data from buildings, and transport accounts for all the transport fuels within DCC, i.e. diesel and petrol.



02. DCC ENERGY CONSUMPTION 2016
(CONTINUED)

Figure 1: DCC Energy Categories - 2016

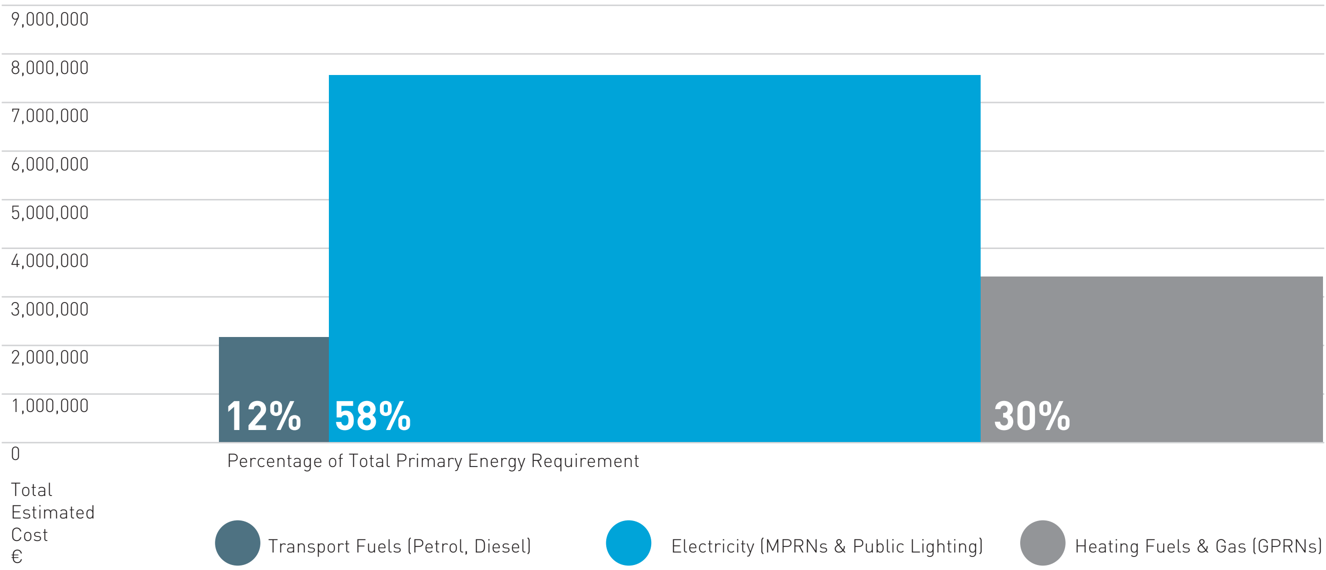


Figure 1 shows the breakdown of the energy categories in DCC. The height represents the total estimated cost of that energy type, and each coloured area highlights what percentage of the overall energy use this energy type accounts for.

Electricity accounts for the largest share of energy consumed at approximately 58%. The reason for this is the large number of public lights in the Dublin City area, and the high conversion factor of electricity from Total Final Consumption (TFC) to Total Primary Energy Requirement (TPER). This is because of the way that Ireland generates and supplies electricity. The reason for the high conversion factor is to account for the high losses on the transmission system in Ireland, and the carbon-intensive method in which Ireland generates electricity.

With regards to the energy cost, the analysis is much more complex, as fuel tariffs vary and the various energy accounts have different suppliers. Also, the local authority's targets are measured in energy efficiency, not cost savings. In order to estimate the total cost of energy attributable to the different energy categories, Codema has used average national prices for electricity, heating gas and the different fuel types sourced from SEAI's commercial fuel cost comparison charts.

The energy database shows that DCC improved its energy performance by 26% between the baseline year and 2016. This represents a cumulative absolute saving of 38 GWh of primary energy or 8,500 tonnes of CO_2 saved from the baseline year to 2016. This highlights a gap-to-target of 7%, meaning that DCC must improve its energy performance by a further 7% between now and 2020, in order to meet its 33% target. This is estimated to be a cumulative absolute saving of 16 GWh[2] in primary energy.

Figure 2 on the next page illustrates DCC's absolute energy consumption compared to the baseline. Figure 3 illustrates DCC's normalised annual energy performance compared to the 33% glidepath. This takes into account the rise and fall of the activity metrics, and tracks them compared to DCC's TPER of all fuel sources.

Figures 2 and 3 also show a significant decrease in energy consumption between 2010 to 2014; this is attributable to all SEUs within DCC, as outlined further on in this Energy Review.

2. Codema calculated this figure using SEAI's gap-to-target tool, which takes into account the potential changes in the conversion factors and percentage increases of the activity metrics up until 2020.

Figure 2: DCC Absolute Annual Energy Consumption

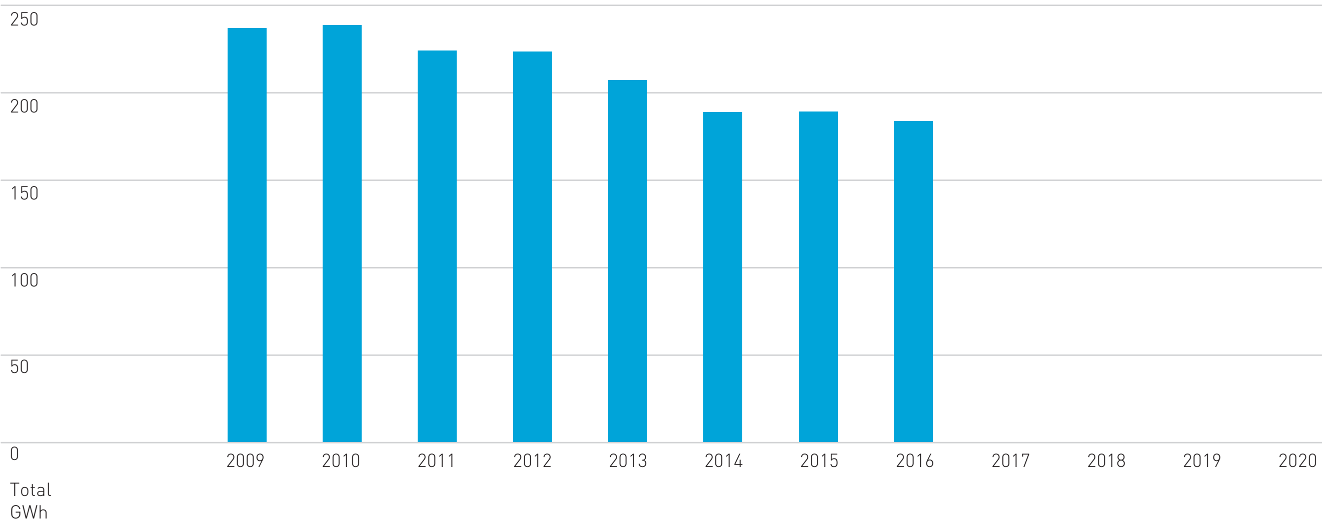
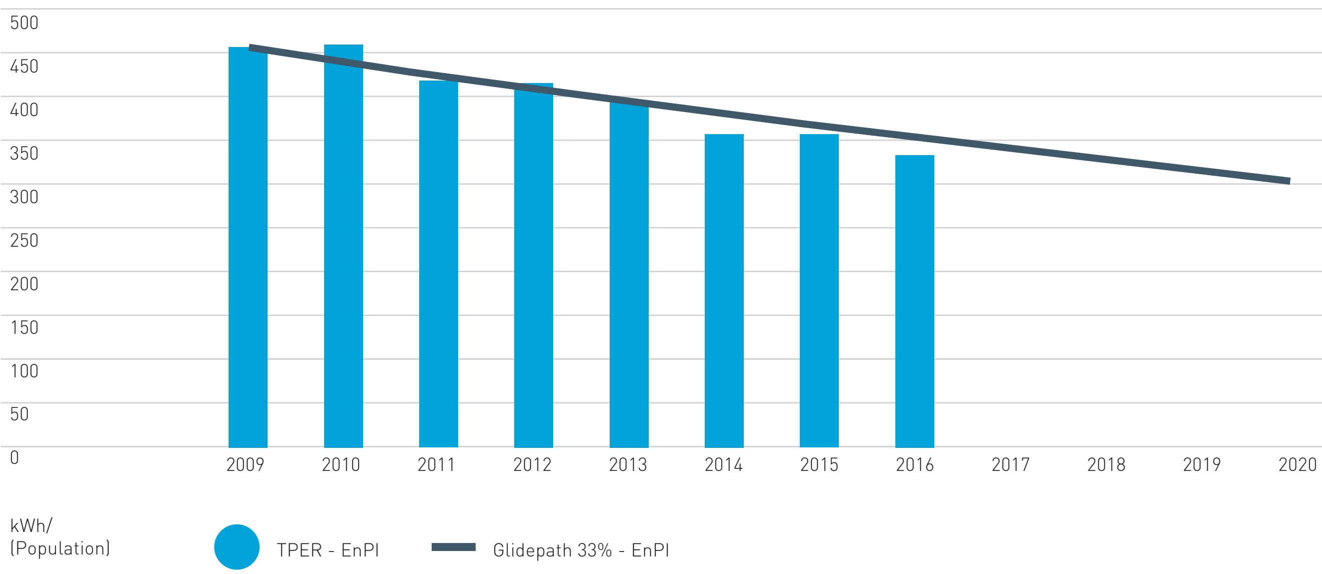


Figure 3: DCC Annual Energy Performance Compared to 33% Glidepath



03. SIGNIFICANT ENERGY USERS

To help better understand DCC's energy use, Codema has broken up the council's total energy consumption into Significant Energy Users (SEUs). These SEUs help identify the measures that will contribute most effectively to energy savings and will have the most positive impact on energy efficiency targets. This approach ensures the most efficient use of resources for maintaining and improving energy efficiency in critical areas within DCC. Codema developed these SEUs by creating an energy database, which includes all the data reported in the M&R system, data compiled by Codema through energy audits, and direct contact with DCC staff.

Codema compiled all of the council's electricity and gas accounts, and developed a full list of buildings by marrying electrical and gas accounts for each of these buildings. DCC's Transport Department provided all of the fuels data, and all data on public lighting was compiled through contact with the Public Lighting Department and the Unmetered Registrar (UMR).

The database gives a breakdown of each of DCC's SEUs into Total Primary Energy Requirement (TPER), CO_2, and cost year-on-year, and compares this back to the baseline. Codema also compares this data to an energy performance indicator to track the energy performance of each SEU.

Through analysis of this data, Codema has identified six key areas, or SEUs, which account for 87% of DCC's total primary energy requirement. These SEUs are:

PUBLIC LIGHTING 30%

OFFICES & DEPOTS 16%

HOUSING 15%

TRANSPORT 11%

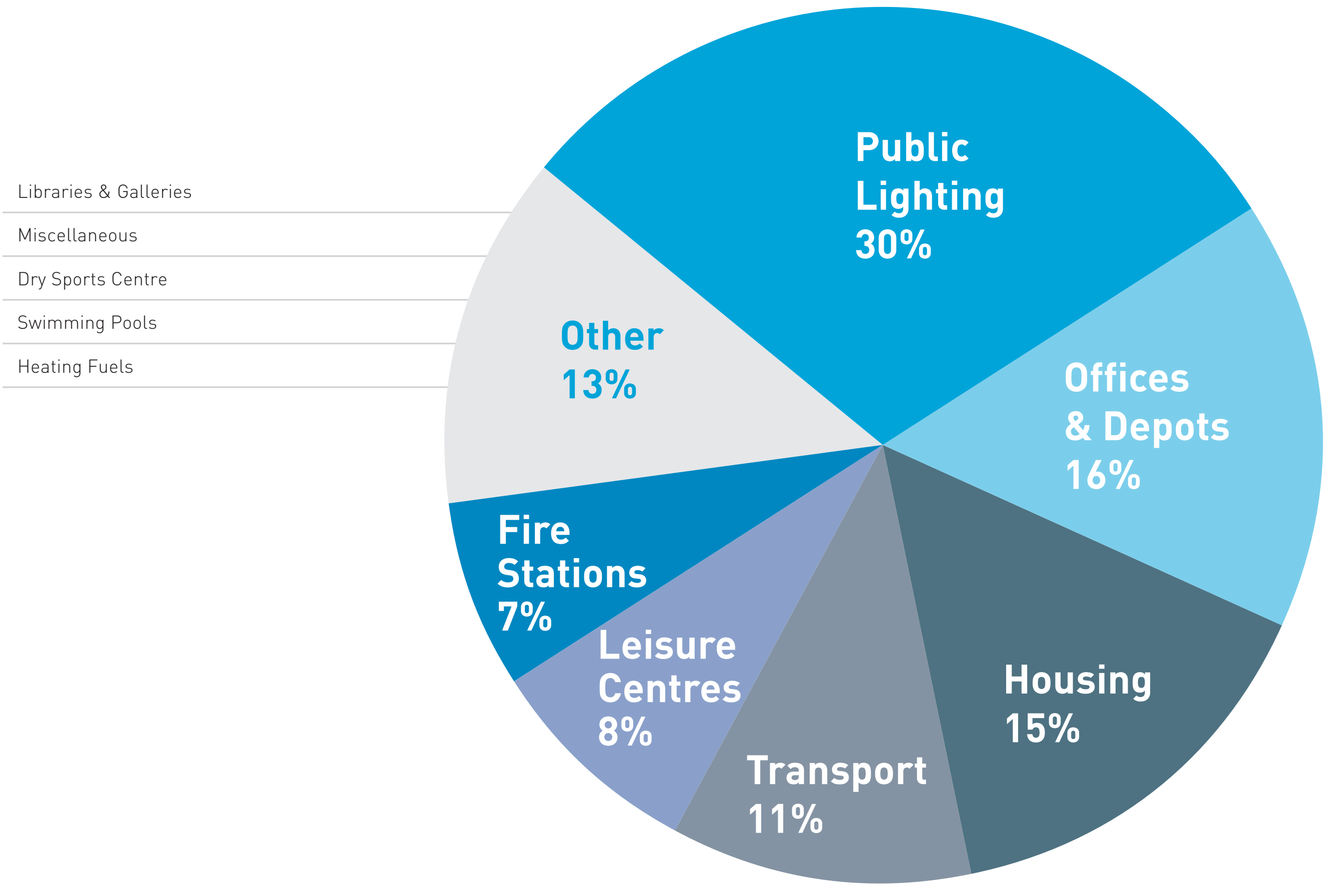
LEISURE CENTRES 8%

FIRE STATIONS 7%

Figure 4 shows the breakdown of DCC's SEUs. Public Lighting is the largest SEU, accounting for 30% of the total load. This is followed by Offices and Depots at 16%, which comprise of all the area offices and depots around the city, and also the Civic Offices on Wood Quay. Housing is accountable for 15%, while Transport accounts for 11% of the total load. Leisure Centres account for 8%, while Fire Stations make up 7% of the total load. The remainder of the consumption is made up of smaller accounts within DCC, such as libraries, dry sports centres, and the smaller swimming pools.

The management of energy in these six SEUs is critical for DCC to achieve its 33% energy reduction target. Small energy reductions in these areas have a much greater effect on overall consumption than seemingly large reductions in the less significant areas. Codema therefore recommends that DCC uses a structured approach at senior management level in order to carefully plan and execute energy reduction projects. This targeted, holistic approach to these SEUs will help maximise their impact and will go beyond the typical energy-saving projects that are usually reactionary or part of routine maintenance.

Figure 4 SEU Analysis

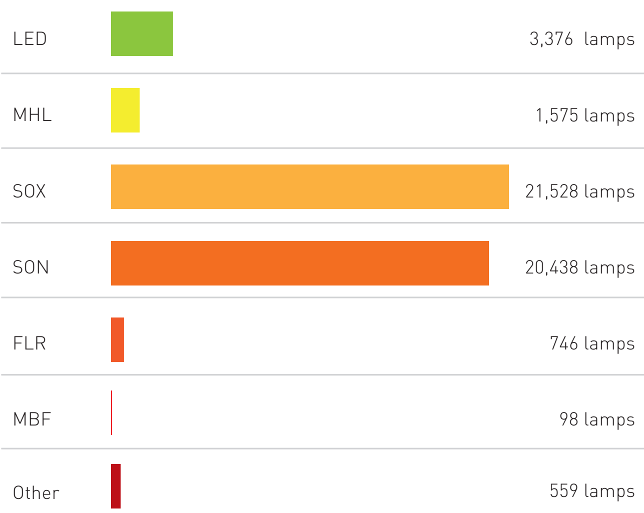


03. SIGNIFICANT ENERGY USERS
(CONTINUED)

PUBLIC LIGHTING

Public Lighting is the largest SEU within DCC. In 2016, Public Lighting accounted for 30% of DCC's primary energy consumption, which amounted to 56 GWh of primary energy, 12,700 tonnes of CO_2 and an estimated €3.3 million in energy costs. Public Lighting consists of over 48,000 street lamps and 9,000 traffic lights. The street lamps are broken up into eight different light sources. Listed below is a summary of these main light sources and their associated quantity; they are also listed in order of their efficiency:

- Light Emitting Diode (LED) – 3,376 lamps
- Metal Halide (MHL) – 1,575 lamps
- Low Pressure Sodium (SOX) – 21,528 lamps
- High Pressure Sodium (SON) – 20,438 lamps
- Fluorescents (FLR) – 746 lamps
- Mercury (MBF) – 98 lamps
- Other – 559



DCC Public Lighting 2016

CONSUMED 56 GWH OF PRIMARY ENERGY

12,700 TONNES OF CO_2 EMITTED

€3.3M ASSOCIATED ENERGY COST

IMPROVED ENERGY PERFORMANCE BY 7% SINCE BASELINE

Identification of Relevant Variables for Public Lighting

In relation to Public Lighting, the relevant variables for the development of EnPIs to track the energy performance are very constant. Public Lighting only consumes electricity and has a predictable load. Public Lighting is charged on a pre-defined number of burn hours per year, and is largely unmetered. Burn hours are reflected seasonally, and don't change from year to year.

One variable that is not a constant, and drives energy consumption in Public Lighting, is the quantity of lights. As the region grows to support a rise in population, the quantity of lights increases. This is reflected in the data received from the Unmetered Registrar (UMR). Therefore, to accurately track

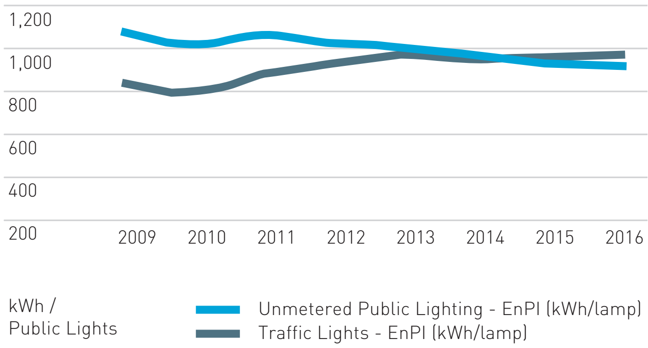
the energy performance, Public Lighting is compared to the number of unmetered public lights for that given year:

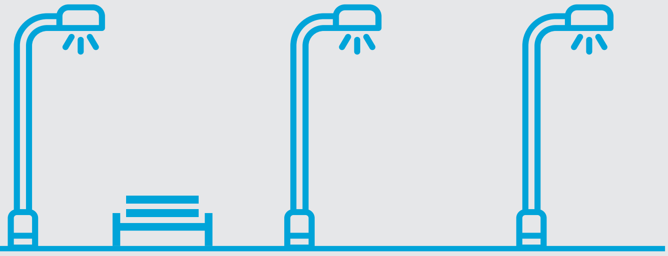
Public Lighting EnPI =
kWh TPER /number of public lights

Energy Performance of Public Lighting

To date, DCC's Public Lighting Department has already retrofitted 3,376 lights with LEDs. The Energy Database shows that Public Lighting has improved its energy performance by 7% since the baseline, based on its EnPI. This is an absolute reduction of 2.8 GWh of primary energy, and 1,200 tonnes of CO_2. This is illustrated in Figure 5.

Figure 5: Public Lighting Annual Energy Performance





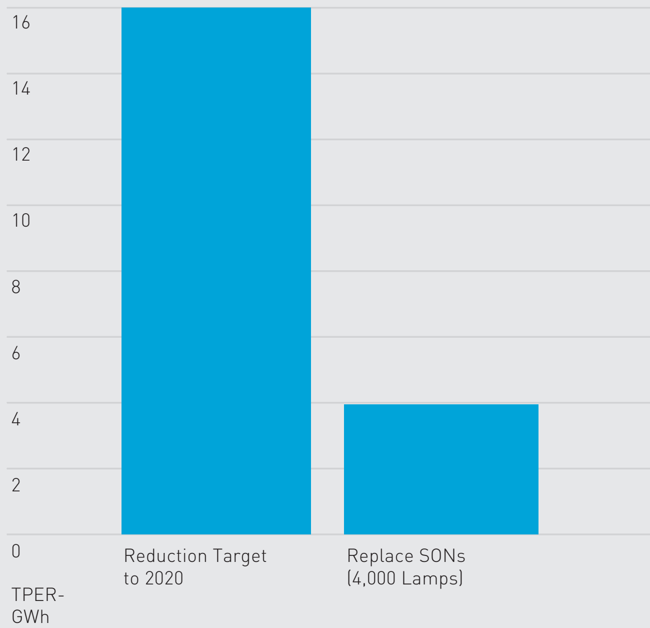
PUBLIC LIGHTING PLAN TO 2020

As Public Lighting is key to DCC achieving its energy efficiency target, it is strongly recommended that the council commits to further energy reductions in this area between now and 2020, and beyond. Energy reduction in electricity has more impact on the council's targets than any other energy type, due to the poor primary energy conversion factor.

In recent years, SOX lamps have been gradually replaced with SONs, which are a high-pressure equivalent. This is because SON lamps are brighter, have higher colour rendering, and are easier to replace. In doing this, there is an improvement in light quality, but this is sacrificed by an increase in energy consumption and maintenance costs, due to a shorter lamp life.

Within DCC's stock of public lighting, the SON lamps are among the least efficient and have the largest billable watt. As mentioned previously, DCC has retrofitted 3,376 of its 48,000 street lights to LEDs. If DCC replaces 4,000 of the remaining 20,000 SON lamps by 2020, this could produce savings of 3.9 GWh of TPER and 900 tonnes of CO_2. This would have a significant impact on the council's 2020 targets. In addition, an ongoing programme to replace the remaining street lighting with LEDs beyond 2020 is strongly recommended.

Figure 6: Public Lighting Plan to 2020



03. SIGNIFICANT ENERGY USERS
(CONTINUED)

OFFICES & DEPOTS

DCC has 108 offices and depots around the city. Of these 108 facilities, there are 38 offices which comprise of local area offices, and the Civic Offices on Wood Quay. There are 70 depots around the city, which comprise of workshops, waste management depots and road depots.

In 2016, these facilities accounted for 16% of DCC's primary energy consumption. This is a consumption of 29 GWh of primary energy, 6,000 tonnes of CO_2, and an estimated €1.75 million in energy spend.

Identification of Relevant Variables for the Offices & Depots

In relation to the office and depot facilities, there are two main energy types, electricity and gas. When there are multiple variables that drive energy consumption, a composite performance indicator is used, as mentioned in the methodology section.

In terms of the electrical consumption, it is difficult to find a single significant driving factor for the energy consumption, as there are many variables which determine this, such as the number of employees, opening hours, floor area, etc. Gas consumption is mainly dependent on the external temperature. Therefore, the composite performance indicator used to measure the office and depot facilities' energy performance is the energy consumed (kWh TPER), divided by a weighting scale of Heating Degree Days (HDD) and the number of full time employees (FTE). This is derived from the formula given in the methodology, as shown below:

Offices & Depots EnPI =
kWh TPER/(HDD)(FTE)

DCC Offices & Depots 2016

CONSUMED 29 GWH OF PRIMARY ENERGY

6,000 TONNES OF CO_2 EMITTED

€1.75M ASSOCIATED ENERGY COST

IMPROVED ENERGY PERFORMANCE BY 24% SINCE BASELINE

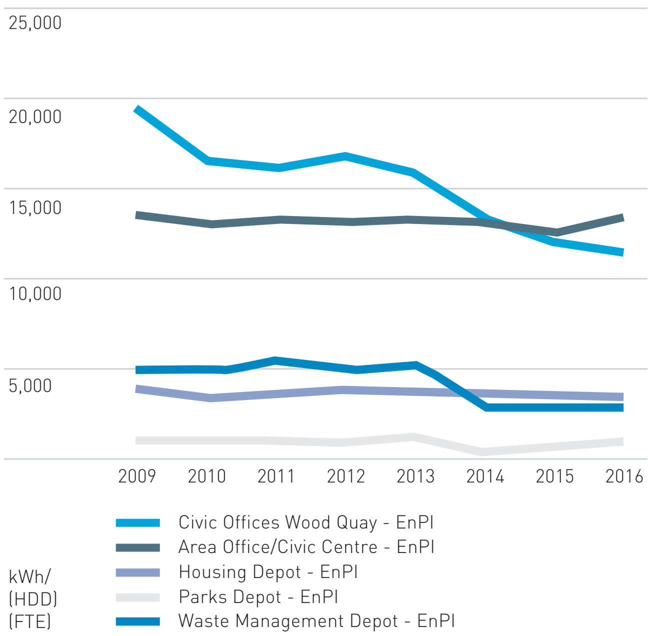
Energy Performance of the Offices and Depots

The database shows that the offices and depots have improved their energy performance by 24% since the baseline year. This is an absolute reduction of 13.6 GWh of primary energy and 2,800 tonnes of CO_2.

The Civic Offices on Wood Quay accounts for 35% of the total energy consumed by the Offices and Depots. Civic Offices has improved its energy performance by 40% since the baseline year. This is an absolute reduction of 9 GWh of primary energy and 1,800 tonnes of CO_2. In analysing the electrical and gas consumption from this facility, the savings came from reductions in both electrical and gas consumption. This is clearly illustrated in Figure 7.

Figure 7 also highlights a decrease in energy consumption in the waste management depots between 2013 and 2014. This was due to the closure of the gas accounts in Marrowbone Lane and Bannow Road depots in 2013, which resulted in absolute energy savings of 1.3 GWh in 2014.

Figure 7: Offices & Depots' Annual Energy Performance



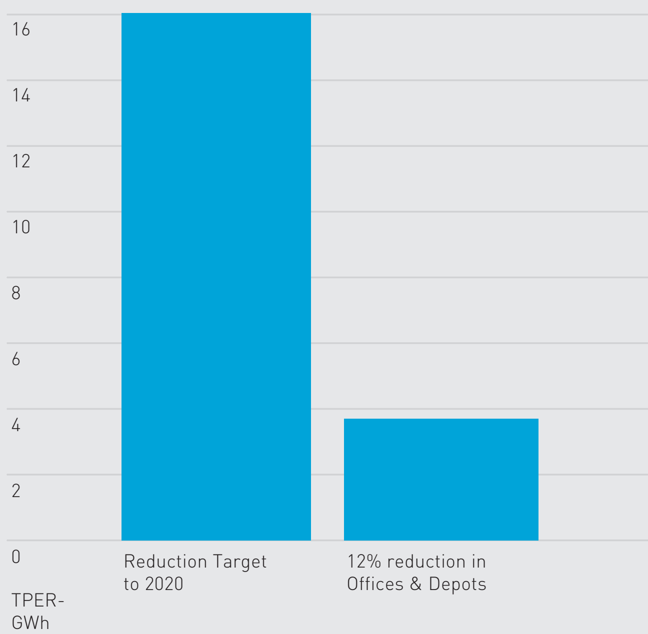
OFFICES & DEPOTS' PLAN TO 2020

Within the office and depot facilities, the top 20 consumers account for 80% of the total consumption. Codema recommends that these top 20 facilities are analysed in more detail, in order to identify potential energy savings. These could include measures such as the retrofit of LED lighting and controls, heating system and control upgrades, and the installation of photovoltaic systems, amongst others. Energy audits will help identify these measures, which can then be prioritised in terms of highest potential for savings.

Codema recommends that DCC develops a framework of contractors for the implementation of any energy saving measures within the office and depot facilities. This framework will incorporate the maintenance and upgrade of energy related systems, with a focus on performance guarantees where suitable. Codema can support DCC with the development of such a framework.

If DCC aims to reduce the overall consumption of these facilities by 12% over the next four years, there is potential to save 3.6 GWh of TPER and 800 tonnes of CO_2.

Figure 8: Offices & Depots' Plan to 2020



03. SIGNIFICANT ENERGY USERS
(CONTINUED)

HOUSING

Housing is the third largest SEU within DCC. In 2016, Housing accounted for 15% of DCC's primary energy consumption, which amounted to 27 GWh of primary energy, 5,500 tonnes of CO_2 and an estimated €1.6 million in energy costs. Housing is responsible for 25,619 properties within Dublin City, which are broken up into apartments, houses, senior citizen units, etc. Housing is not responsible for the energy bills for these properties, but is responsible for areas such as landlord lighting and heating, landlord supplies, water pumping, community centres and the electrical and mechanical systems connected with these properties. These amount to 560 electrical accounts and 117 gas accounts.

Identification of Relevant Variables for Housing

In relation to Housing, there are two main energy types, electricity and gas. Once again, when there are various factors that influence energy consumption, a combined performance indicator is used.

As is the case with many of the other SEU areas, Housing has many different factors which drive its overall energy consumption. Gas consumption is mainly dependent on the external temperature. Therefore, the composite performance indicator used to measure Housing's energy performance is the energy consumed (kWh TPER), divided by a weighting scale of Heating Degree Days (HDD) and the number of the housing stock. This formula can be seen below:

Housing EnPI = kWh TPER/ (HDD)(STOCK)

DCC Housing 2016

CONSUMED 27 GWH OF PRIMARY ENERGY

5,500 TONNES OF CO_2 EMITTED

€1.6M ASSOCIATED ENERGY COST

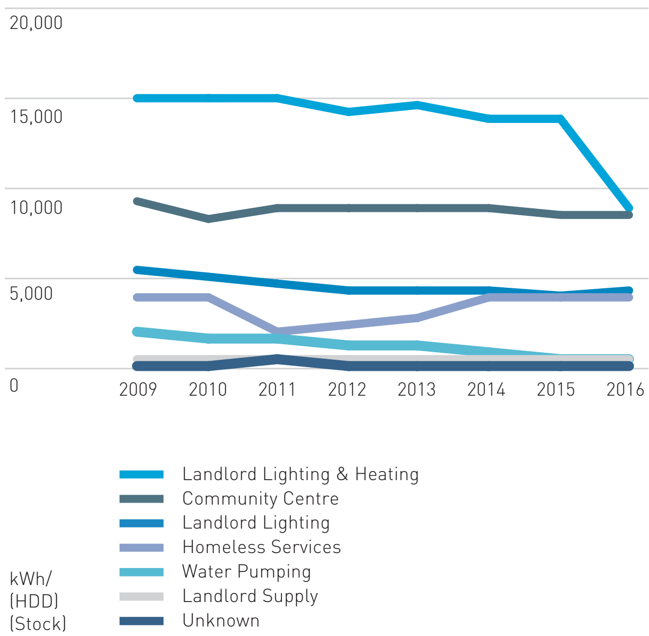
IMPROVED ENERGY PERFORMANCE BY 32% SINCE BASELINE

Energy Performance of Housing

The database shows that Housing has improved its energy performance by 32% since the baseline. This is an absolute reduction of 10.2 GWh of primary energy and 2,300 tonnes of CO_2.

Within the Housing Department, there has been a steady improvement in energy performance between the baseline year and 2015. There was then a significant improvement in energy performance in 2016, which can be seen in Figure 9 on this page. This was due to the closure of the gas accounts in Cromcastle Court in Coolock, where DCC implemented its first Managed Energy Services Agreement (MESA). A MESA commits an Energy Services Company (ESCo) to install, finance, operate, and maintain energy saving measures in a building over an agreed period of time. Under this agreement, the ESCo pays the building's energy bills, in exchange for a series of fixed payments based on the building's historic energy use. The ESCo replaced the old gas boilers with high efficiency heat-pumps, and assumed responsibility for the associated electricity bill, in return for fixed-term payments from DCC. Separately, DCC replaced the windows in Cromcastle with high-efficient, double-glazed uPVC framed windows.

Figure 9 Housing Annual Energy Performance



HOUSING PLAN TO 2020

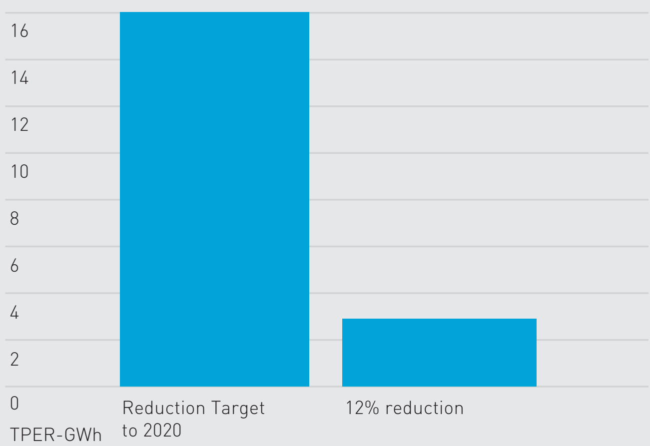
Housing is another area that is key to DCC achieving its targets. Figure 9 shows that the areas with the most potential for energy savings are Community Centres and Landlord Lighting and Heating. Within Landlord Lighting and Heating, Codema recommends that the council implements additional MESA-style projects, as the existing project in Cromcastle Court expects to save over €80,000 per year for the next 10 years, and significant energy savings can be achieved within the landlord lighting and heating accounts. There is also potential for energy savings within the landlord lighting accounts around the city, through the installation of LEDs.

Housing is also responsible for 50 community centres across the city. These range from small community rooms to large community centres. There is potential for energy savings within these facilities with the retrofit of LED lighting and controls, heating system and control upgrades, and the installation of photovoltaic systems, amongst others.

Codema recommends that Housing develops a framework of contractors for the implementation of any energy saving measures. This framework will incorporate the maintenance and upgrade of energy related systems, with a focus on performance guarantees where suitable. Codema can support DCC with the development of such a framework. Codema recently assisted Dublin City Council with the funding and implementation of lighting upgrades in Pearse House, Irishtown Stadium and St Andrew's Resource Centre, as part of an SEAI Better Energy Communities (BEC) project. The upgrades in Pearse House involved upgrading all the public access lighting in Block E to energy-efficient LEDs, which will save 5,849 kWh. This pilot project involved just one block to demonstrate the huge potential for replication across the city.

If DCC aims to reduce the overall consumption of Housing by 12% over the next four years, there is potential to save 2.9 GWh of TPER and 600 tonnes of CO_2.

Figure 10: Housing Plan to 2020



03. SIGNIFICANT ENERGY USERS
(CONTINUED)

TRANSPORT

Transport is the fourth largest SEU within DCC, and comprises of fuels used for council vehicles (including light and heavy vehicles), and fuels used by the park services. In 2016, Transport accounted for 11% of DCC's primary energy consumption. This amounts to 19.5 GWh of primary energy, 4,600 tonnes of CO_2, or an estimated €2.2 million in energy costs.

Within Transport, diesel accounts for almost 98% of the total primary energy consumption. Petrol accounts for just 2%, as it is only used to fuel small equipment. A breakdown of this is shown in Figure 11 below.

Identification of Relevant Variables for Transport

It was very easy to identify the many variables that drive energy consumption within Transport, such as miles travelled, efficiency of the fleet, number of vehicles, etc. However, not all of these variables are consistently monitored, and so there was very little data available to develop a performance indicator for Transport.

With this in mind, Codema decided to use the population served instead. This is viable given that the energy consumption of the fleet is also driven by the area which it serves. Therefore, as the population of DCC grows, so do the areas which the fleet serves. Therefore, the EnPI for Transport is the kWh consumption of primary energy divided by the population of the area, as taken from the 2016 census. This formula is illustrated below:

Fleet EnPI =
kWh TPER / Population Served

DCC Transport 2016

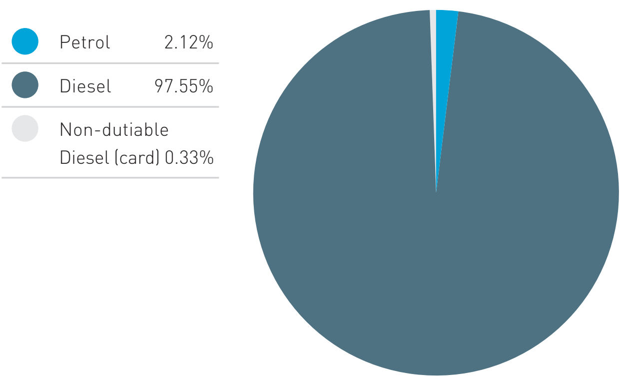
CONSUMED 19.5 GWH OF PRIMARY ENERGY

4,600 TONNES OF CO_2 EMITTED

€2.2M ASSOCIATED ENERGY COST

IMPROVED ENERGY PERFORMANCE BY 22% SINCE BASELINE

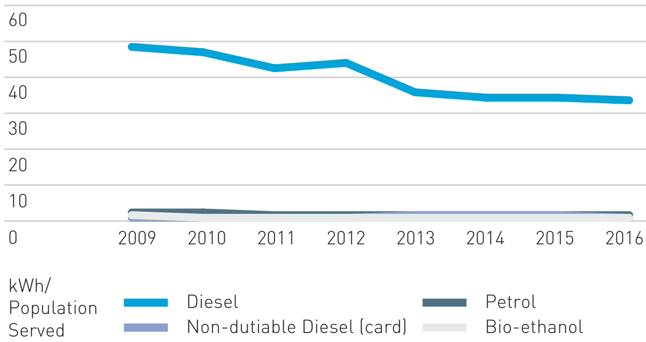
Figure 11: DCC Fuels Consumption for 2016



Energy Performance of Transport

The database shows that the energy performance of Transport has improved by 22% since the baseline. This is an absolute reduction of 3.4 GWh[3] of primary energy and 800 tonnes of CO_2. Figure 12 shows that between the years 2010 and 2013, there was a significant decrease in energy consumption. This is due to the reduction in the litres of diesel consumed by the council's fleet. From consulting with Fleet Management, Codema believes this to be due to the reduction in the fleet's workload as a result of the recession.

Figure 12: Transport Annual Energy Performance



TRANSPORT PLAN TO 2020

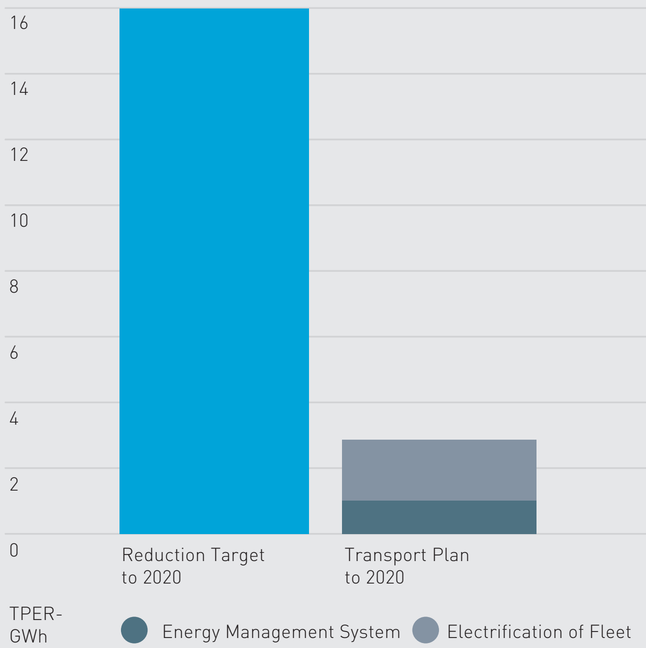
As mentioned earlier, Figure 12 shows a significant decrease in DCC's consumption of diesel between 2010-2011 and then again between 2012 - 2013. This is due to variations in fuel consumption within DCC's fleet vehicles.

The installation of an energy management system to accurately monitor the overall consumption, and develop energy performance indicators to track energy performance is recommended. The council could potentially see savings of approximately 5% (or 1.1 GWh) by implementing such an energy management system.

DCC is looking to test mobility options for staff to carry out their work. Specifically, DCC wants to explore and expand its fleet-electrified vehicles to help reduce its transport emissions. DCC is calling for companies to provide submissions that propose a diverse set of options, which reflect the staff's needs for mobility. To date, DCC has three electric vehicles that can be used by staff, and booked through an online system within the council.

Codema estimates that a partial electrification (i.e. approximately 20%) of DCC's fleet would result in a saving of 1.9 GWh.

Figure 13: Transport Plan to 2020



3. The energy database has provisions incorporated to account for the outsourcing of waste collection, and also to take into account the use of Irish Water within the local authority fleet.

03. SIGNIFICANT ENERGY USERS
(CONTINUED)

LEISURE CENTRES

Leisure Centres are the fifth largest energy consumer within DCC. DCC currently operates five large leisure centres, namely Ballymun, Finglas, Ballyfermot, Markievicz, and the Swan Centre in Rathmines. In 2016, these leisure centres accounted for 8% of the local authority's primary energy requirement. This is a consumption of 15 GWh of primary energy, 2,900 tonnes of CO_2, and an estimated €680,000 in energy spend.

Identification of Relevant Variables for the Leisure Centres

In relation to the Leisure Centres, electricity and gas are the two main energy types. Once again, these Leisure Centres have multiple variables that drive energy consumption, so a composite performance indicator is used to determine their overall performance.

Within the Leisure Centres, various factors such as footfall, opening hours and floor area determine the overall energy consumption. Gas consumption is once again based on the external temperature. Therefore, the composite performance indicator used to measure the Leisure Centres' energy performance is the energy consumed (kWh TPER) divided by a weighting scale of the total floor area (m^2) and Heating Degree Days (HDD). This is shown in the formula below:

Leisure Centres EnPI = kWh TPER/ (m^2)(HDD)

DCC Leisure Centres 2016

CONSUMED 15 GWH OF PRIMARY ENERGY

2,900 TONNES OF CO_2 EMITTED

€680,000 ASSOCIATED ENERGY COST

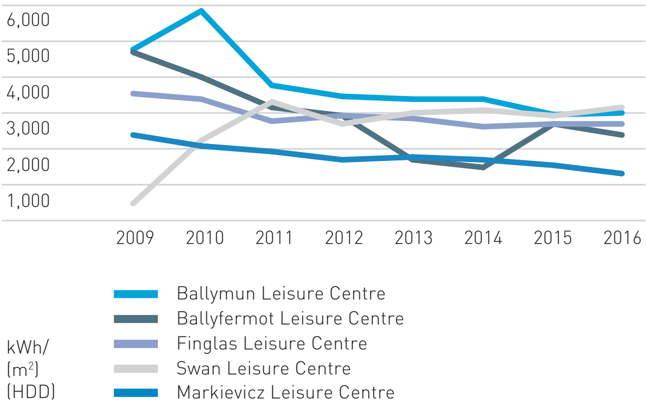
IMPROVED ENERGY PERFORMANCE BY 9% SINCE BASELINE

Energy Performance of Leisure Centres

The Energy Database shows that the Leisure Centres have improved their energy performance by 9% since the baseline, compared to the EnPI. This is an absolute reduction of 3.4 GWh of primary energy, and 580 tonnes of CO_2.

Energy consumption increased between 2009-2010. In analysing the electrical and gas consumption from the facilities to help identify this change, the Swan Leisure Centre in Rathmines opened its doors to the public in September 2010, which would explain the increase in energy consumption during this time. Between 2010-2014 there was a steady decrease in energy consumption amongst the leisure facilities. This reduction could be due to the effect of the recession on the activity levels of the facilities. This can be seen in Figure 14 on this page.

Figure 14: Leisure Centres' Annual Energy Performance



LEISURE CENTRES' PLAN TO 2020

In 2016, Codema helped Dublin City Council to implement the first local authority Energy Performance Contract (EPC) for three of its leisure centres – Ballymun, Finglas and Markievicz. The project is set to save the council over €100,000 on its energy and maintenance costs per year, and will achieve average energy savings of more than 30 per cent per year, through a range of energy-efficiency upgrades. These include:

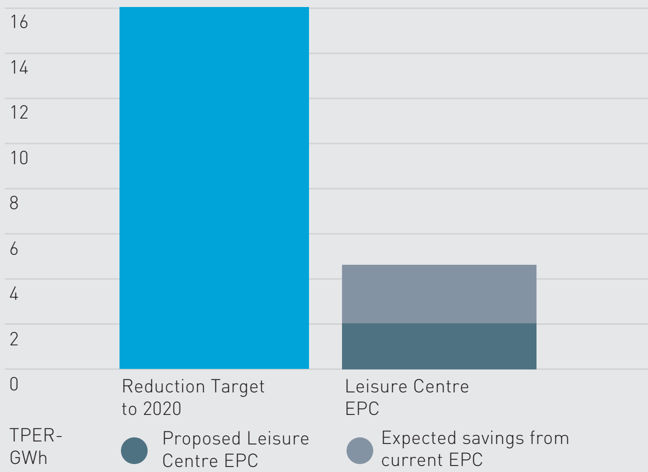
- New LED lighting
- New combined heat and power systems to efficiently heat the swimming pools
- Improved building control systems which will help manage all of the equipment in the centres, to ensure that they are working together effectively

The EPC model puts the responsibility onto the contractor to guarantee energy savings over the lifetime of the contract . Energy savings are verified by a Measurement and Verification (M&V) process developed by both the Energy Services Company (ESCo) and the client. These guaranteed savings are expected to be in the region of 2.6 GWh, as can be seen in Figure 15.

This highlights the substantial contribution that EPC projects can make towards DCC's 2020 targets. Therefore, Codema strongly recommends that DCC considers a similar EPC project to upgrade Ballyfermot Leisure Centre and other larger facilities of similar use, as these types of buildings are particularly suited to the EPC model, and vast energy savings can be achieved.

From analysis of the energy consumption within these leisure facilities, a further 2.1 GWh of primary energy and 420 tonnes of CO_2 could be saved by 2020 by implementing another EPC project in these buildings.

Figure 15: Leisure Centres' Plan to 2020



03. SIGNIFICANT ENERGY USERS
(CONTINUED)

FIRE STATIONS

Fire Stations are the sixth largest energy consumer within DCC. The Dublin Fire Brigade currently consists of the Fire Brigade HQ and Control Centre in Tara Street, the O'Brien Institute on the Malahide Road, Stanley Street Garage, and 14 Fire Stations across the entire Dublin region. In 2016, the Dublin Fire Brigade accounted for 7% of the local authority's primary energy requirement. This is a consumption of 12 GWh of primary energy, 2,400 tonnes of CO_2, and an estimated €700,000 in energy spend.

Identification of Relevant Variables for the Fire Stations

In relation to the fire brigade, electricity and gas are the two main energy types. As mentioned in some of the previouus SEU sections, it is difficult to define a single driver for the energy consumption, as there are multiple factors which determine this, such as floor area, opening hours, etc. Population served is also viable given that the energy consumption of the Fire Brigade's fleet is also driven by the area which it serves. Therefore, as the population of DCC grows, so do the areas which the Fire Brigade must respond to. Gas consumption is mainly dependent on the external temperature. Therefore, the composite performance indicator used to measure the Fire Brigade's energy performance is the energy consumed (kWh TPER) divided by a weighting scale of total floor area (m^2) and Heating Degree Days (HDD) and the population served, derived from the formula given in the methodology:

Fire Stations EnPI = kWh TPER/ (m^2)(HDD)(Population Served)

DCC Fire Stations 2016

CONSUMED 12 GWH OF PRIMARY ENERGY

2,400 TONNES OF CO_2 EMITTED

€700,000 ASSOCIATED ENERGY COST

IMPROVED ENERGY PERFORMANCE BY 28% SINCE BASELINE

Energy Performance of the Fire Stations

The Energy Database shows that the Fire Stations have improved their energy performance by 28% since the baseline, compared to the EnPI. This is an absolute reduction of 3.5 GWh of primary energy, and 800 tonnes of CO_2. Tara Street has the largest energy consumption, but has also achieved the greatest reduction since the baseline. During this time, it reduced its consumption by 820 MWh, which translates to an improvement in performance of 27%.

However, four of the smaller stations (Blanchardstown, Phibsboro, Kilbarrack, and Finglas) improved their overall energy performance by an average of 40%, and saved at total of 1 GWh of primary energy. Figure 16 shows an increase in gas consumption at Stanley Street Garage and the O'Brien Institute during 2014-2015. Stanley Street Garage was having problems with the roof, and this increase in consumption could be attributable to this.

Figure 16: Annual Energy Performance of the Fire Stations

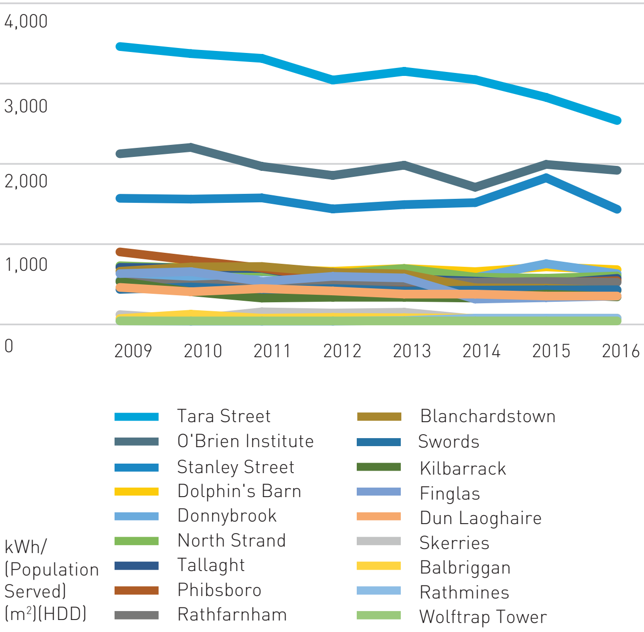
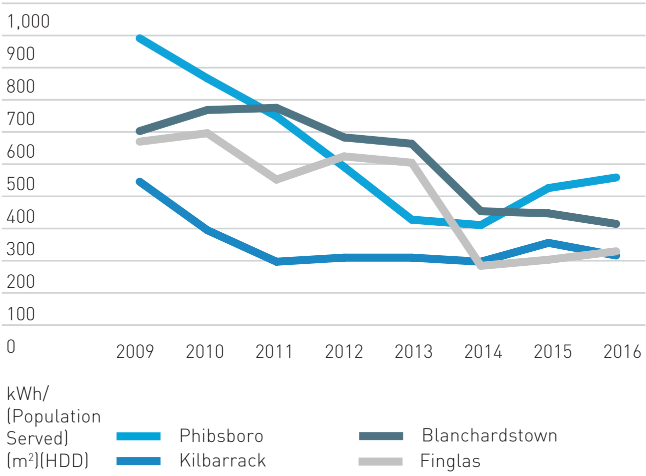


Figure 17: Annual Energy Performance of the smaller Fire Stations

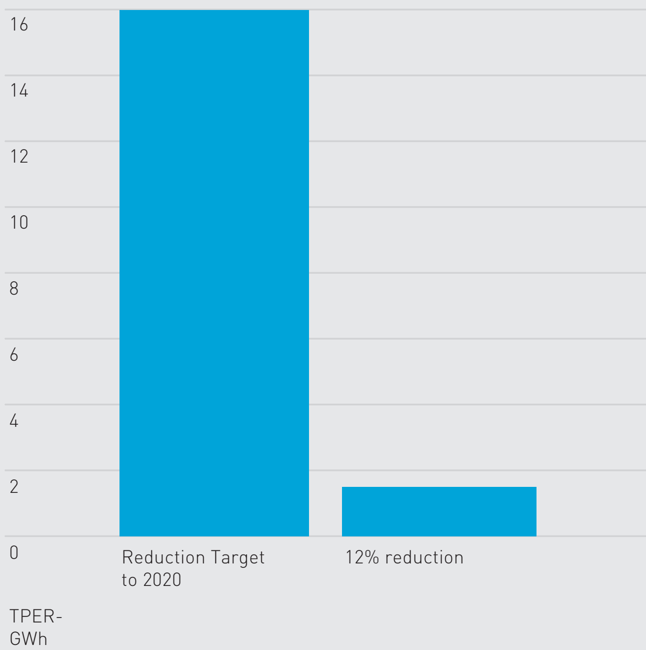


FIRE STATIONS' PLAN TO 2020

Within the Fire Brigade's facilities, the top three consumers account for 53% of the total consumption. Codema intends to look at these facilities in more detail in order to identify potential energy savings. These could include measures such as the retrofit of LED lighting and controls, heating system and control upgrades, and the installation of photovoltaic systems, amongst others. Energy audits will help identify these measures, which can then be prioritised in terms of highest potential for savings.

If DCC aims to reduce the overall consumption of these facilities by 12% over the next four years (or an average of 3% per year), there is potential to save 1.46 GWh of TPER and 300 tonnes of CO_2.

Figure 18: Fire Stations' Plan to 2020



04. CONCLUSION

DCC has achieved energy savings of 26% between the baseline year and 2016. While these savings are substantial, the council still needs to save a further 7% to achieve the 33% energy saving target by 2020. The next four years will be crucial, and will require the most innovative and challenging projects to date, in order to achieve DCC's targets by the 2020 deadline.

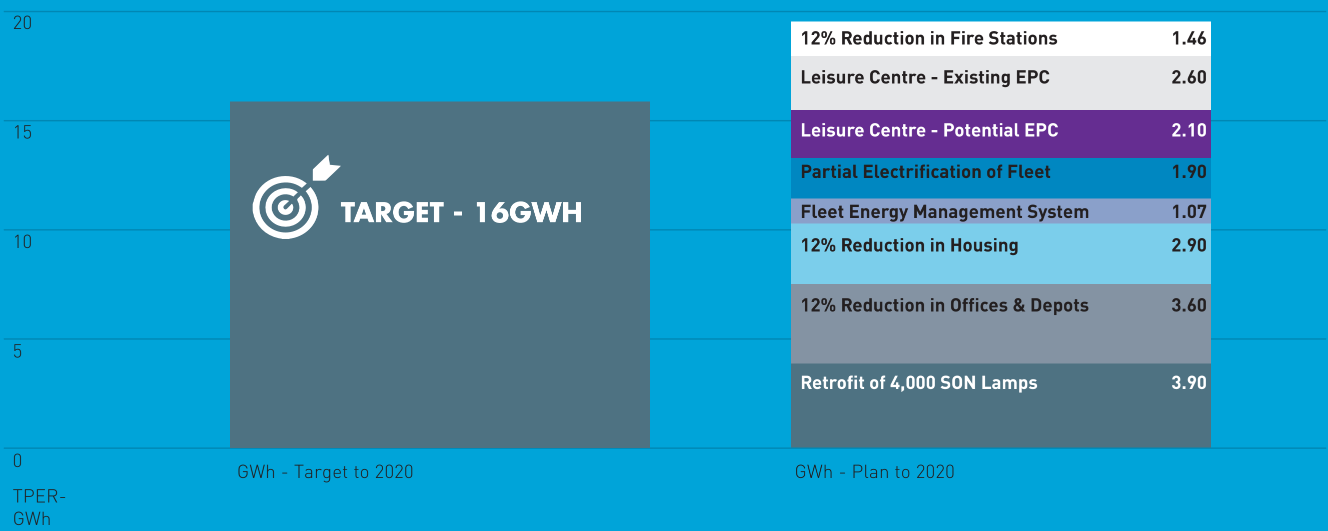
Energy efficiency projects within each of the six key SEUs identified will deliver the required energy savings by 2020.

Small energy reductions in these areas will have a much greater effect on overall consumption than seemingly large reductions in the less significant areas. Codema therefore recommends that DCC uses a structured approach at senior management level in order to carefully plan and execute energy reduction projects. This targeted, holistic approach to these SEUs will help maximise their impact and will go beyond the typical energy-saving projects that are usually reactionary or part of routine maintenance.

In terms of the smaller accounts, which are not highlighted in this report, it is recommended that DCC develops a framework of contractors for the implementation of energy savings measures within these facilities. This framework will incorporate the maintenance and upgrade of energy related systems, with a focus on performance guarantees where suitable. Codema will support DCC with the development of this framework that will focus on the smaller energy consumers within the council. This is important, as it highlights the "exemplary role" to the public, as set out in S.I. 426 of 2014.

Figure 19 illustrates DCC's gap-to-target model for the next four years. If all the projects set out in this Energy Review are completed by 2020, DCC can reach the target reduction of 16 GWh, or 33%, by 2020.

Figure 19: DCC Plan to 2020



SEU AREA	ACTION	ESTIMATED SAVINGS
PUBLIC LIGHTING	REPLACE 4,000 SONS WITH LEDS	3.9 GWH
OFFICES & DEPOTS	MEASURES SUCH AS LEDS, IMPROVED HEATING SYSTEMS & PV PANELS WITH PERFORMANCE GUARANTEES	3.6 GWH
HOUSING	FOCUS ON UPGRADES TO LANDLORD LIGHTING & HEATING AND COMMUNITY CENTRES	2.9 GWH
TRANSPORT	ENERGY MANAGEMENT SYSTEM & PARTIAL ELECTRIFICATION OF FLEET	2.97 GWH
LEISURE CENTRES	EXISTING EPC	2.6 GWH
	POTENTIAL EPC	2.1 GWH
FIRE STATIONS	FOCUS ON UPGRADING THE TOP 3 CONSUMERS	1.46 GWH

05. APPENDICES

SEU Summary

Table 1 SEU Summary

SEU	TPER - GWh	Tonnes CO_2	Cost	% +/- since baseline
Public Lighting	56.01	12,719	€3,306,624	-7.13%
Offices & Depots	29.14	6,215	€1,754,297	-24.00%
Housing	27.35	5,496	€1,583,776	-31.98%
Transport	19.50	4,673	€2,168,180	-21.87%
Leisure Centres	14.97	2,961	€687,285	-9.05%
Fire Stations	11.94	2,463	€695,264	-27.81%
Total	158.91	34,527	€10,195,426	

Project Plan to 2020 Summary

Table 2 Project Plan Summary

SEU	TPER - GWh	Tonnes CO_2
Leisure Centres	4.70	1,060
Public Lighting	3.86	930
Office & Depots	3.62	800
Housing	2.95	607
Transport	2.97	500
Fire Stations	1.46	310
Total	19.56	4,207

Table of Figures

Table of Tables

Abbreviations

DCC	Dublin City Council
SEUs	Significant Energy Users
M&R	Monitoring and Reporting
DCCAE	Department of Communications, Climate Action and Environment
EnPIs	Energy Performance Indicators
TPER	Total Primary Energy Requirement
UMR	Unmetered Registrar
TFC	Total Final Consumption
MESA	Managed Energy Services Agreement
MPRNs	Metered Electrical Accounts
GPRNs	Metered Gas Accounts
CO_2	Carbon Dioxide
kWh	Kilowatt hour
MWh	Megawatt hour
GWh	Gigawatt hour
LED	Light Emitting Diode
HDD	Heating Degree Days
EPC	Energy Performance Contract
M&V	Measurement and Verification
ESCo	Energy Services Company
PV	Photovoltaic
SON	High Pressure Sodium
SOX	Low Pressure Sodium
SXHF	Low Pressure Sodiums with High Frequency Gear
MHL	Metal Halide
MBF	Mercury Vapour
FTE	Full Time Employees
m^2	Metres Squared
BEC	Better Energy Communities
SEAI	Sustainable Energy Authority of Ireland
DLAs	Dublin Local Authorities
FLR	Fluorescents

The Loft, 2-4 Crown Alley,
Temple Bar, Dublin 2, Ireland D02 TK74
+353 (0)1 707 9818
www.codema.ie

Comhairle Cathrach
Bhaile Átha Cliath
Dublin City Council