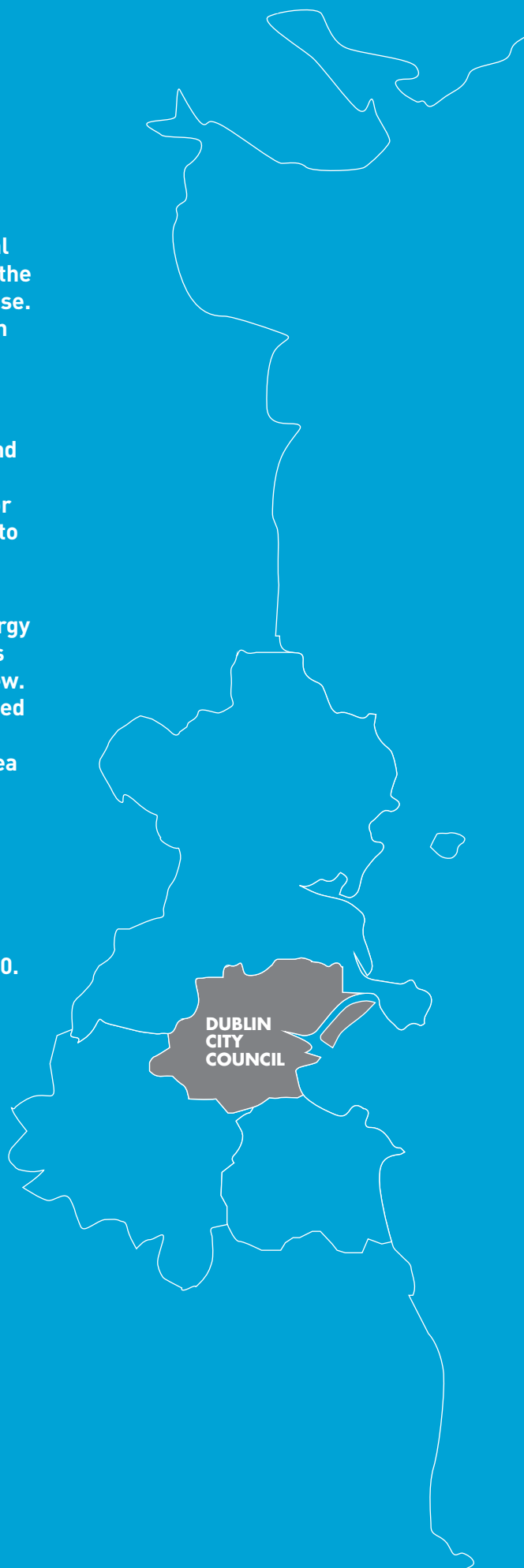
DUBLIN CITY COUNCIL ENERGY REVIEW 2018

codema
Dublin's Energy Agency

Comhairle Cathrach Bhaile Átha Cliath
Dublin City Council

01. INTRODUCTION



Codema has developed the 2018 Energy Review on behalf of Dublin City Council (DCC), which is the largest local authority in Ireland. This is the third such report to be completed by Codema. The aim of the Energy Review is to highlight the total amount of energy DCC consumed in the past year, along with the total cost and carbon emissions associated with this energy use. Further details relating to years prior to 2018 may be found in DCC's 2016 and 2017 Energy Reviews.

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 seven 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 action DCC must take to reduce energy consumption in each SEU area in order to meet public sector targets.

Additionally, for this year and going forward, Codema has included a summary of DCC's progress in terms of its carbon emissions. Under the Covenant of Mayors programme, which DCC signed up to in 2009, DCC has voluntarily set a target of reducing its greenhouse gas emissions (GHGs) by 40% by 2030. This target has also been included in DCC's Climate Change Action Plan (CCAP) 2019-2024, and goes beyond the national target of a 30% reduction in emissions by 2030, which is expected to be set by the Government in the coming months.

PUBLIC LIGHTING

HOUSING

TRANSPORT

SPORTS FACILITIES

OFFICES & DEPOTS

CIVIC OFFICES

FIRE STATIONS

Current Status & Obligations

In 2018, DCC consumed a total of 180 gigawatt hours (GWh) of primary energy; this is the equivalent of 37,982 tonnes of CO_2 and Codema estimates the associated cost of this energy use to be approximately €12 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). It is important to note that these figures may vary, as changes to data within the M&R system for previous years are accounted for, such as the addition of missing accounts or the removal of accounts that are no longer linked to DCC. These changes are made throughout the system, from the baseline year to date, and don't affect the baseline or reduction target.

Codema has been entering this yearly data into the M&R system on behalf of DCC 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 with respect to 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, as reported by the M&R system, DCC has improved its energy performance by 33.1%, compared to the baseline year, which is an average of the years 2006-2008. This amounts to an absolute reduction of 105.2 GWh in primary energy when compared to the baseline, or 15,258 tonnes of CO_2. This means that DCC has now exceeded the 33% public sector target, two years ahead of the 2020 deadline. This is a very significant milestone, and credit must be given to all areas of the organisation for its continued efforts over the past number of years. While this is a great achievement, it must be noted that further 2030 public sector targets are soon to be announced, based on the Government's recently published Climate Action Plan 2019 To Tackle Climate Breakdown. It has been signalled that a new target of 50% energy efficiency improvement by 2030 and

DCC Energy Overview 2018

CONSUMED 180 GWH OF PRIMARY ENERGY

37,982 TONNES OF CO_2 EMITTED

€12 MILLION ASSOCIATED ENERGY COST

Public Sector Obligations

ACHIEVE SAVINGS OF 33% BY 2020

REDUCTION TARGET OF 3% PER YEAR

DCC Progress: Baseline - 2018

IMPROVED ENERGY PERFORMANCE BY 33.1%

15,258 TONNES OF CO_2 SAVED

33% PUBLIC SECTOR TARGET MET, NEED TO LOOK TOWARDS 2030 TARGET

01. INTRODUCTION
(CONTINUED)

30% reduction in CO_2 is to be set. This will demand continued and increased focus on the energy performance of DCC's buildings and operations over the coming decade. As many of the "low hanging fruit" energy saving actions have already been implemented, this will require the development of more ambitious and innovative energy programmes and projects. Until the new 2030 targets are confirmed, it is recommended that DCC continues to target a reduction of 3% per year, in order to maintain its momentum and also get a headstart on the new targets. This represents an annual target energy reduction of 3.8 GWh.

The Energy Oversight Committee was set up in 2017 by Céline Reilly, who is the Executive Manager within DCC's Environment and Transportation Department and is the Council's appointed Energy Performance Officer (EPO). The Committee members continued to meet in 2018 to help progress energy efficiency initiatives in DCC and put a huge amount of time and effort into drafting DCC's first Climate Change Action Plan. Codema will continue to work with the Committee in 2019 to identify further potential energy efficiency and carbon saving projects, based on the findings of this Energy Review and the actions outlined in DCC's CCAP. Significant focus is currently being placed on the development of an internationally-accredited energy management system throughout the whole of DCC as part of this process. DCC is aiming to be accredited with the ISO 50001 standard before the end of 2020.

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 Energy Performance Indicators (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 key activity that has the greatest influence on energy consumption. An EnPI is calculated by dividing the organisation's Total Primary Energy Requirement (TPER) by an activity metric.

When there are multiple variables that drive energy consumption, a composite performance indicator is used. Determining a single performance indicator for complex situations where multiple variables drive consumption can be difficult, because different aspects of the facility consume different amounts of energy and are driven by different variables. In such cases, a composite performance indicator based on more than one variable is used. The scale of each variable's contribution is defined by a weighting scale.

In the case of DCC, the overall performance indicator is based on population served. Therefore, DCC's EnPI is the TPER divided by the population served for that year. Therefore, the performance of DCC is determined not only by its annual energy use, but also by a rise or fall in population in the Dublin City area in the same year. Savings are based on cumulative absolute primary energy and carbon savings from the baseline year to 2018.

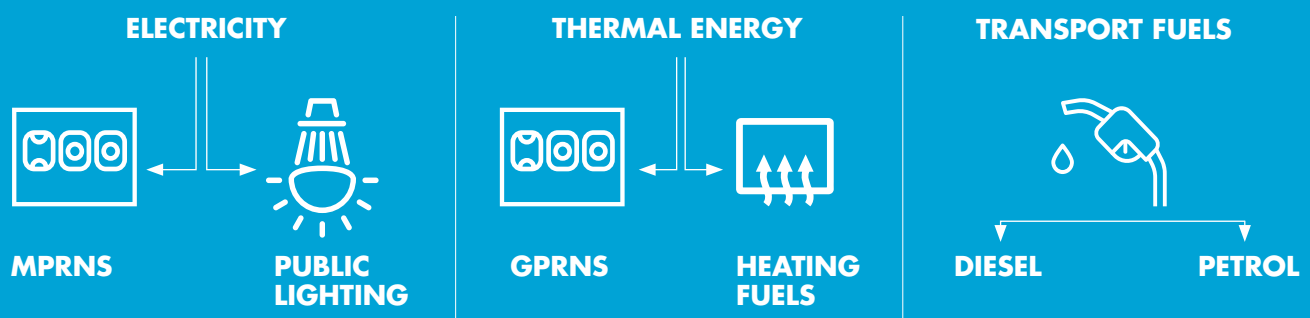
In 2010, the Dublin Local Authorities outsourced waste collection within the region. Also, in 2013, water services within the local authorities were transferred to Irish Water. The M&R system and Codema's database have provisions to account for these changes, and therefore accurately track the actual energy performance of the local authority from the baseline year to 2018, which takes proper account of services that have been outsourced.

Formula for Calculating EnPIs for SEUs

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

02. DCC ENERGY CONSUMPTION 2018

The energy database shows that DCC consumed 180 GWh of primary energy and produced 37,982 tonnes of CO_2 in 2018. Codema estimates the costs associated with this energy use to be approximately €12 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 2018
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Figure 1 on the next page shows the breakdown of the consumption categories. 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 56%. The reasons for this are the large number of public lights in the Dublin City area and the vast amount of electricity accounts within DCC's buildings and facilities.

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 33.1% between the baseline year and 2018. This represents an absolute saving of 105.2 GWh of primary energy or 31,275 tonnes of CO_2 when comparing the baseline year to 2018. This indicates that DCC has now achieved its 2020 efficiency target of 33% two years ahead of schedule.

While this is a very encouraging achievement, it should not be seen as "job done" as regards energy efficiency, particularly with even more challenging 2030 targets just around the corner. Energy savings are not guaranteed from year to year, and effort must be maintained to improve upon these savings through ongoing monitoring and analysis.

Figure 2 illustrates DCC's absolute energy consumption compared to the baseline. Figure 3 illustrates DCC's normalised annual energy performance compared to the 33% glidepath. The glidepath represents the average annual reduction required to reach the 33% target. 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 show a steady year-on-year decrease in energy consumption across DCC between 2017 and 2018, with Public Lighting, Transport and Sports Facilities making the most notable contributions.

All measures that are linked to this energy reduction in the different SEU areas are outlined later in this Energy Review.

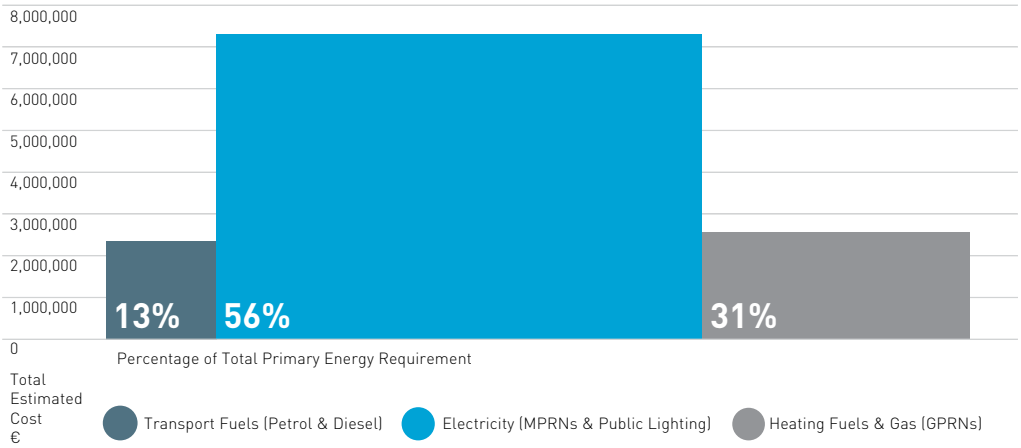


Figure 1: DCC Energy Categories - 2018

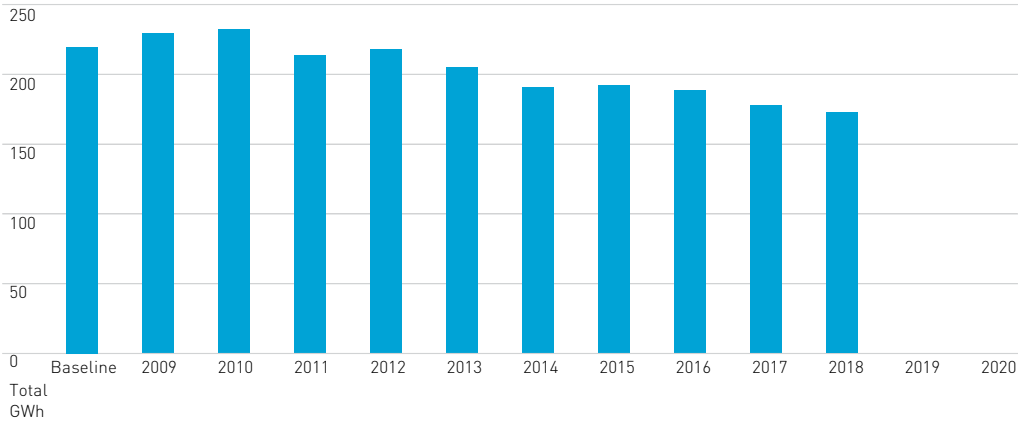


Figure 2: DCC Absolute Annual Energy Consumption

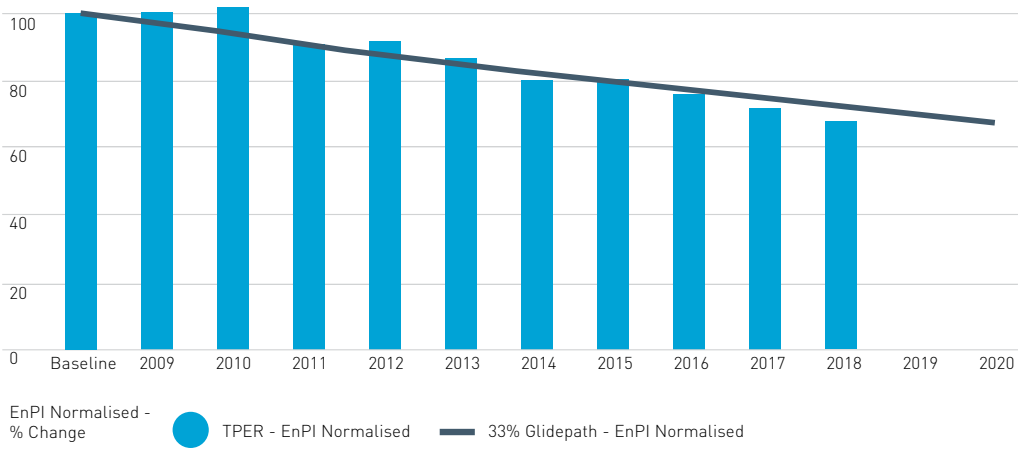


Figure 3: DCC Annual Energy Performance Compared to 33% Glidepath

02. DCC ENERGY CONSUMPTION 2018
(CONTINUED)

CLIMATE CHANGE ACTION PLAN & CARBON EMISSIONS

In 2018 and 2019, Codema prepared DCC's Climate Change Action Plan 2019-2024, in partnership with the Environment Strategic Policy Committee and the Elected Members of Dublin City Council. This plan sets out how the Council will improve energy efficiency and reduce greenhouse gas emissions in its own buildings and operations, while making Dublin a more climate-resilient city with engaged and informed citizens. This will be achieved by a range of ongoing and planned actions in five key areas, which will be continuously monitored, evaluated and updated to 2030 and beyond. The key targets included in this plan are the statutory 33% improvement in the Council's energy efficiency by 2020, as well as a 40% reduction in the Council's greenhouse gas emissions by 2030, as previously set out under the Covenant of Mayors agreement, which DCC signed up to in 2009.

In terms of greenhouse gas emissions, DCC is already making good progress towards its 40% reduction target and is ahead of its glidepath, as presented in Figure 4 below. Compared to the baseline year, DCC's CO_2 emissions in 2018 had reduced by 28.7% to 37,982 tonnes. This leaves a gap-to-target of 6,037 tonnes of CO_2 between now and 2030.

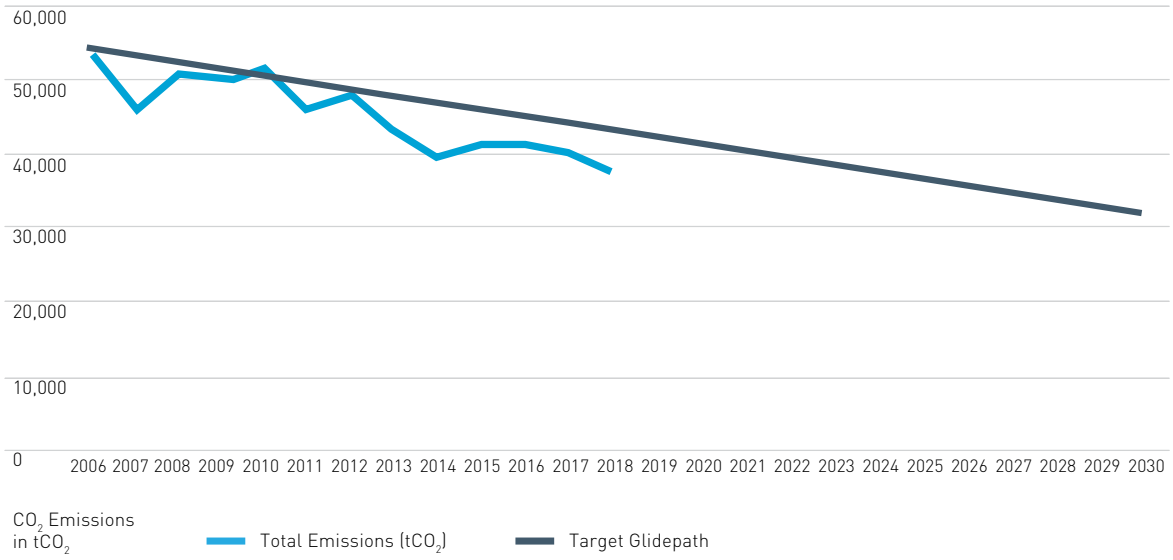


Figure 4: DCC Annual CO_2 Emissions Performance Compared to 40% Glidepath

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.

By analysing this data, Codema has identified seven key areas, or SEUs, within the Council. These account for 88% of DCC's total primary energy requirement and can be broken down as follows:

PUBLIC LIGHTING 24%

HOUSING 17%

SPORTS FACILITIES 12%

FIRE STATIONS 11%

OFFICES & DEPOTS 11%

TRANSPORT 7%

CIVIC OFFICES 6%

03. SIGNIFICANT ENERGY USERS
(CONTINUED)

Figure 5 on the opposite page shows the breakdown of DCC's SEUs. Public Lighting is the largest SEU, accounting for 24% of the total load. This is followed by Housing at 17% and Sports Facilities at 12%. The Fire Stations are at 11%.

In previous Energy Reviews, Offices and Depots comprised of all the area offices and depots around the city, including the Civic Offices on Wood Quay. This year, however, Codema decided to move the Civic Offices from this grouping and place it as a standalone SEU. This leaves the Offices and Depots at 11%, with the Civic Offices making up a further 6%. Transport makes up another 7% of the total. The remainder of the consumption is made up of smaller accounts within DCC, such as libraries, heating fuels and smaller electrical accounts.

The management of energy in these seven SEUs has been critical for DCC in achieving its 33% energy reduction target, and will remain critical in future years to ensure that these savings are maintained and further improved upon. The DCC Energy Oversight Committee continues to target these areas and has identified potential energy saving projects to be implemented in 2019. These projects are highlighted later in the individual SEU chapters of this report.

Figure 6 shows how the SEUs performed in 2018, compared to 2017. While there was a decrease in energy performance in four SEU areas, Transport, Public Lighting and Sports Facilities all recorded significant energy savings in 2018, when compared to 2017. Transport has achieved significant savings through the ongoing programme to replace older vehicles with new, energy-efficient ones. Public Lighting decreased its energy consumption by 3.4 GWh, due to the ongoing upgrading of public lights to LEDs.

Sports Facilities continues to improve its energy efficiency, with a small decrease of 101 MWh in 2018. This is due mostly to significant savings in the dry sports facilities, as well as continued efficiency gains from the Energy Performance Contract (EPC) project in three of DCC's largest leisure centres. Offices and Depots saw its energy consumption increase by 669 MWh, with energy consumption in the Civic Offices also increasing by 810 MWh.

Housing has seen a small increase over 2017, mostly due to increases in landlord lighting and heating and other small accounts. A significant rise in energy consumption was seen in Fire Stations in 2018, with an additional 2.9 GWh of primary energy consumed in 2018 compared to 2017. This is due to two factors: a very large increase in bulk fuel deliveries, as well as decreased energy performance in a number of fire stations, particularly Stanley Street.

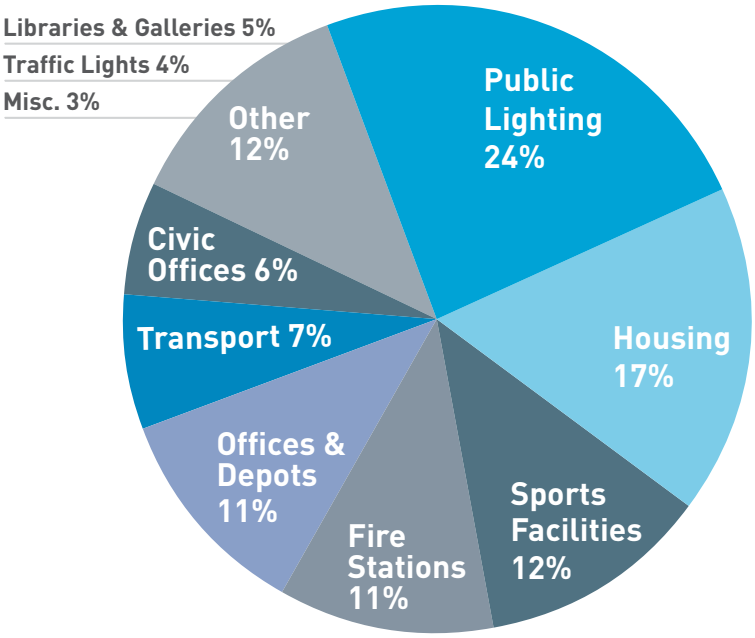


Figure 5: SEU Analysis

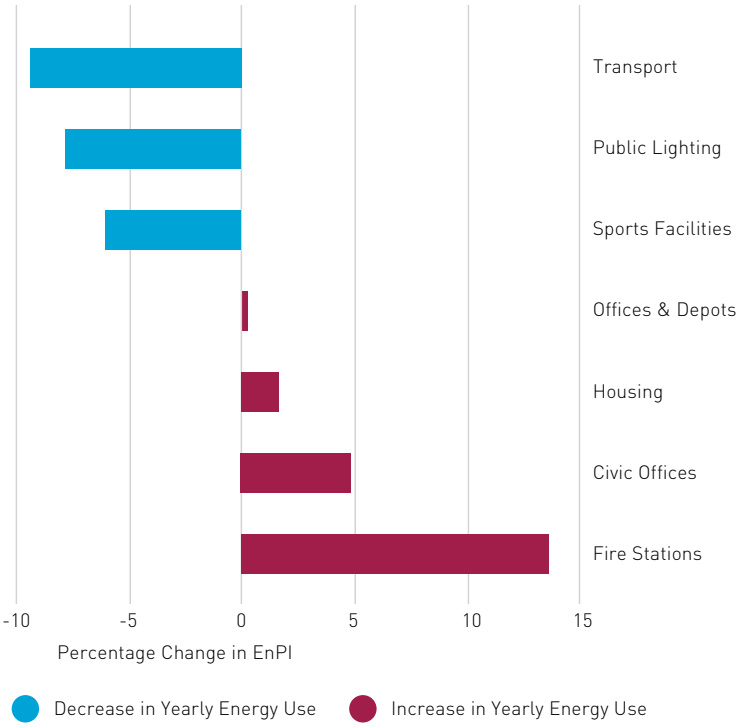


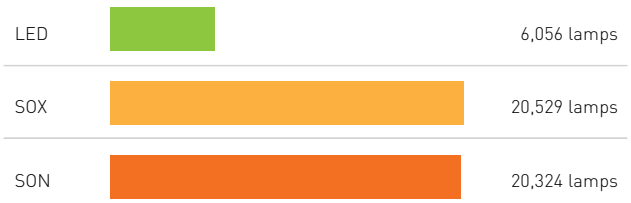
Figure 6: SEU Performance Change Between 2017 & 2018

03. SIGNIFICANT ENERGY USERS
(CONTINUED)

PUBLIC LIGHTING

Public Lighting is the largest SEU within DCC. In 2018, Public Lighting accounted for 24% of DCC's primary energy consumption, which amounted to 43.4 GWh of primary energy, 9,683 tonnes of CO_2 and just over €2.7 million in energy costs. Public Lighting consists of approximately 46,900 street lamps. The street lamps are broken up into three main 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) – 6,056 lamps
- Low Pressure Sodium (SOX) – 20,529 lamps
- High Pressure Sodium (SON) – 20,324 lamps



DCC Public Lighting 2018

CONSUMED 43.4 GWH OF PRIMARY ENERGY

9,683 TONNES OF CO_2 EMITTED

€2.7M ASSOCIATED ENERGY COST

IMPROVED ENERGY PERFORMANCE BY 19.8% 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 also charged on a predefined 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 consistent, 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. This

formula can be seen below:

Public Lighting EnPI =
kWh TPER/number of public lights

Traffic lights have been excluded from this EnPI as they are not under the control of the Public Lighting Department.

Energy Performance of Public Lighting

To date, DCC's Public Lighting Department has already retrofitted 6,056 lights with LEDs, with 800 of these replacements taking place in 2018. The energy database shows that Public Lighting has improved its energy performance by 19.8% since the baseline, based on its EnPI. This is an absolute annual reduction of 9.4 GWh of primary energy, and 2,438 tonnes of CO_2. This is illustrated in Figure 7.

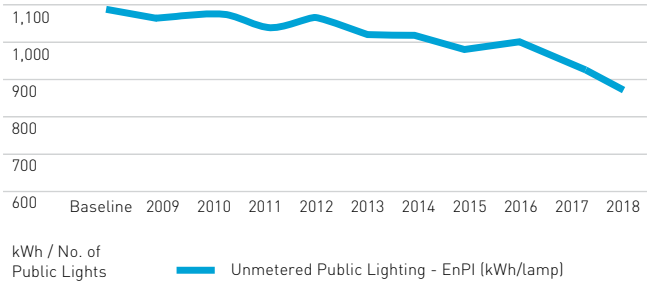
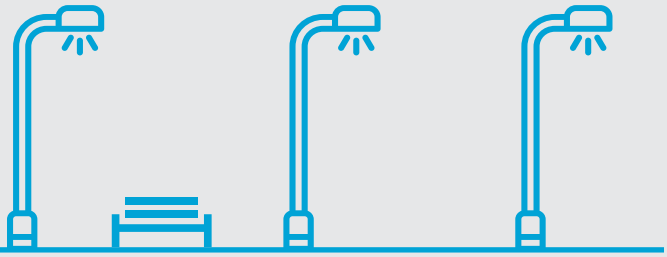


Figure 7: Public Lighting Annual Energy Performance

PUBLIC LIGHTING PLAN TO 2020



As Public Lighting is the largest of DCC's SEUs, it is strongly recommended that the Council commits to further energy reductions in this area between now and 2020 and puts a more detailed plan in place for meeting energy efficiency and CO_2 targets for 2030 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.

Within DCC's stock of public lighting, there are currently over 20,500 SOX lamps. The manufacture of these SOX lamps is in the process of being phased out, so these will have to be replaced, and LED lights, with their very high energy efficiency, are the obvious replacement. DCC has committed to replacing 8,000 of these SOX lamps by the end of 2020, which will produce savings of 3.3 GWh of TPER and 724 tonnes of CO_2. This would have a significant impact on the Council's targets beyond 2020. In addition, an ongoing programme to replace the remaining street lighting with LEDs beyond 2020 is strongly recommended.

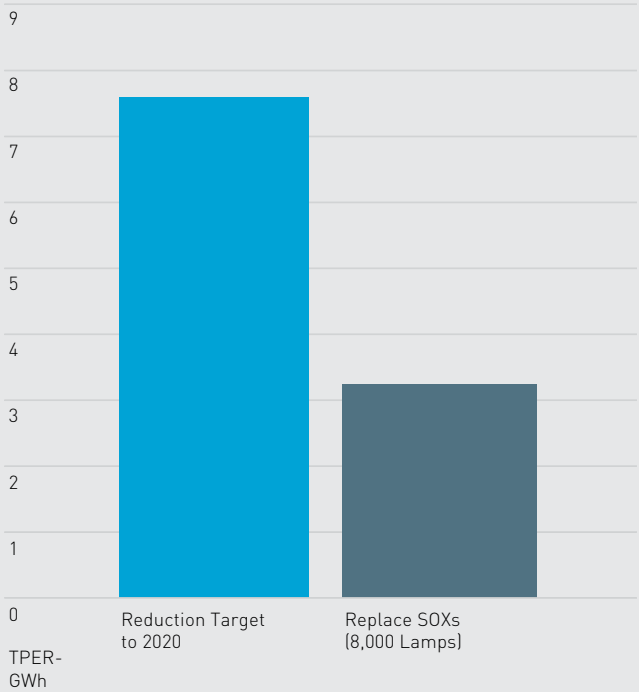


Figure 8: Public Lighting Plan to 2020

03. SIGNIFICANT ENERGY USERS
(CONTINUED)

HOUSING

Housing is now the second largest SEU within DCC. In 2018, Housing accounted for 17% of DCC's primary energy consumption, which amounted to 31.7 GWh of primary energy consumption, 5,624 tonnes of CO_2 and almost €1.6 million in energy costs. Housing is responsible for 25,244 properties within Dublin City, which are broken up into apartments, houses, senior citizen units, etc. Housing is not responsible for the majority of 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.

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 that 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 units in the housing stock. This formula can be seen below:

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

DCC Housing 2018

CONSUMED 31.7 GWH OF PRIMARY ENERGY

5,624 TONNES OF CO_2 EMITTED

€1.6M ASSOCIATED ENERGY COST

IMPROVED ENERGY PERFORMANCE BY 31.2% SINCE BASELINE

Energy Performance of Housing

The database shows that Housing has improved its energy performance by 31.2% since the baseline. This is an absolute reduction of 9.58 GWh of primary energy and 2,805 tonnes of CO_2. Much of this saving is attributable to the Managed Energy Services Agreement (MESA) and Better Energy Communities (BEC) projects undertaken over the past number of years.

However, in 2018 a small decrease in energy performance was seen compared to 2017. This is due to increases in landlord lighting and heating, as well as some increases in other small accounts.

In 2018, the Mechanical and Energy Efficiency Section undertook another BEC project to retrofit a number of DCC buildings across the city. Many of these buildings come under the Housing Department and include Cherry Orchard Community Centre and various senior citizen and social housing complexes throughout the city. The project is expected to deliver a reduction of 2.4 GWh of TPER and 664 tonnes of CO_2. While some energy savings from this project will have contributed towards the 2018 figures, verification of the actual savings achieved will only be possible once a full year's data is available at the end of 2019.

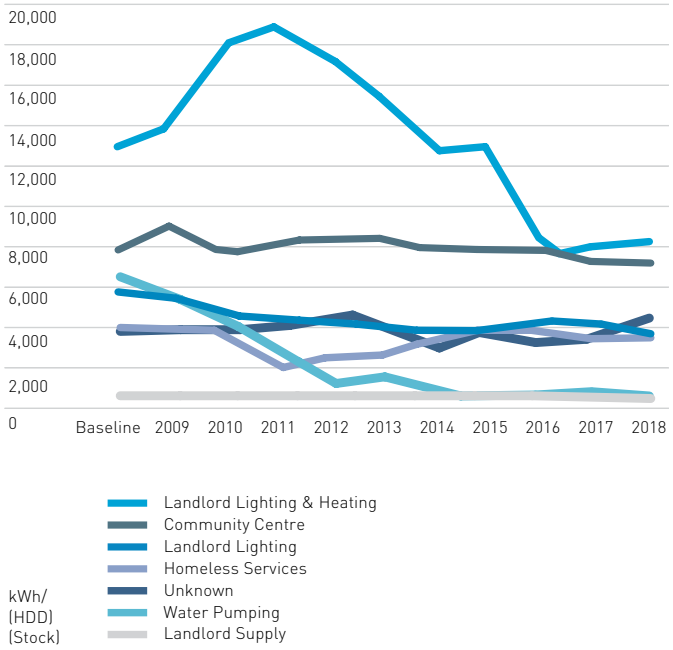


Figure 9: Housing Annual Energy Performance

HOUSING PLAN TO 2020

Housing is another area that is key to DCC achieving its targets to 2020 and beyond. Figure 10 on the next page shows that the areas within Housing with the most potential for energy savings are Community Centres, Landlord Lighting and the Homeless Services. Under Homeless Services, Codema developed proposals for both Maple House and Parkgate Hall recommending further measures to be implemented.

A boiler retrofit of Maple House was included in the 2016 BEC application. Another BEC project application was made for 2019, which largely consists of facilities under the Housing SEU. The project will include fossil fuel boiler replacements with heat pumps, building fabric upgrades, control upgrades and solar photovoltaic (PV) installations, amongst other measures. Parkgate Hall has been included in this application. A saving of 1.9 GWh of primary energy is expected from this project, as well as 365 tonnes of CO_2.

Codema has also developed a proposal to upgrade the public access lighting to LEDs in 15 DCC social housing complexes across the city, which could potentially save 386 MWh of TPER and 93 tonnes of CO_2. In 2016, a Better Energy Communities project upgraded all of the public access lighting in Block E of Pearse House to energy-efficient LEDs, providing better light quality and security for the tenants living there.

Following on from the success of this initial LED project at Pearse House, a project to implement the same measures across the remaining blocks at Pearse House is currently being progressed. This project is expected to save 40 MWh of TPER and 9.6 tonnes of CO_2. Once this project has been implemented, a decision shall be made by DCC in relation to carrying out similar works at the remaining 14 social housing complexes previously identified by Codema.

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 has identified the potential for installation of PV systems on local authority facilities around the city and aims to carry out a detailed feasibility study in 2019 to investigate the potential energy and carbon savings.

If the Housing Department aims to complete both the 2019 BEC and the proposed upgrades in all 15 social housing complexes by the end of 2020, this could result in a total saving of 2.3 GWh of primary energy and 458 tonnes of CO_2.

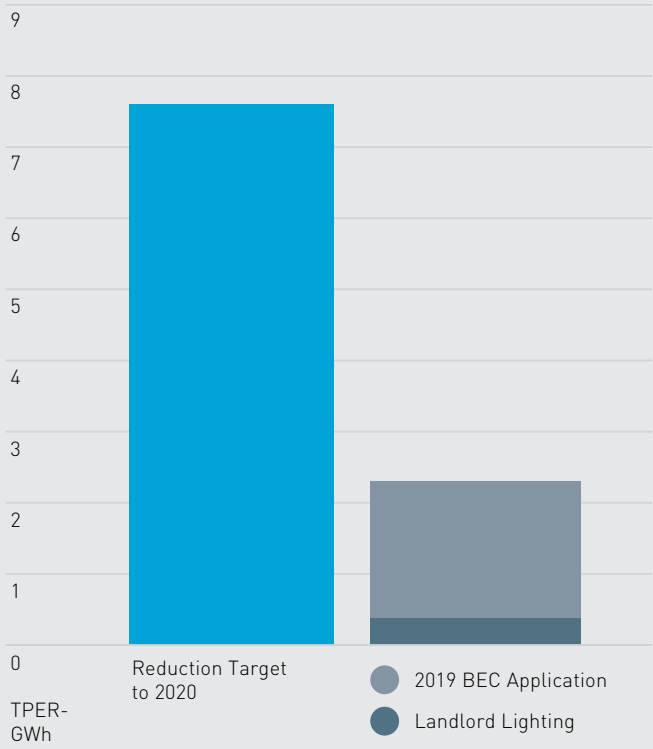


Figure 10: Housing Plan to 2020

03. SIGNIFICANT ENERGY USERS
(CONTINUED)

SPORTS FACILITIES

Sports Facilities are the third largest energy consumer within DCC. DCC currently operates five large leisure centres, four smaller swimming pools and 24 dry sports centres. In 2018, these facilities accounted for 12% of the local authority's primary energy requirement. This represents a consumption of 21.5 GWh of primary energy, 4,231 tonnes of CO_2 and an estimated €1.1 million in energy spend.

Identification of Relevant Variables for the Sports Facilities

In relation to the Sports Facilities, electricity and gas are the two main energy types. With multiple variables driving energy consumption, a composite performance indicator is used to determine the overall energy performance. Factors such as footfall, opening hours and floor area are the significant variables influencing overall energy consumption. Consequently, a composite metric is appropriate, dividing energy consumed (kWh TPER) by a weighted scale of total floor area (m^2) and Heating Degree Days (HDD). This is shown in the formula below:

Sports Facilities EnPI = kWh TPER/(m^2)(HDD)

Energy Performance of the Sports Facilities

The energy database shows that the Sports Facilities have improved their energy performance by 15.6% since the baseline, compared to the EnPI. Due to a significant increase in services provided, most notably the opening of the Swan Leisure facility in 2011, the absolute primary energy consumption for Sports Facilities has increased by 0.6 GWh since the baseline. Carbon emissions have actually fallen by four tonnes, however, due to the reduced carbon intensity of electricity generation on the grid.

There was a decrease in the energy consumed by the smaller swimming pools in 2014. This was due to the closure of Sean McDermott Street, Coolock and Crumlin swimming pools for necessary maintenance works. This can be seen in Figure 11 on the next page. In 2016, there was a significant decrease in electricity consumption in Irishtown Stadium, due to LED lighting upgrades, and also in St Catherine's Community Centre, due to a reconfiguration of the Building Management System (BMS) and improved energy management practices. However, these savings were counteracted by a rise in energy consumption in some of the other dry sports centres.

In addition, Codema helped Dublin City Council to implement its first Energy Performance Contract (EPC) in 2016 for the upgrade of Ballymun, Finglas and Markievicz Sports and Fitness Centres. Works included new LED lighting, improved building control systems and a new CHP system in Ballymun. Codema

DCC Sports Facilities 2018

CONSUMED 21.5 GWH OF PRIMARY ENERGY

4,231 TONNES OF CO_2 EMITTED

€1.1M ASSOCIATED ENERGY COST

IMPROVED ENERGY PERFORMANCE BY 15.6% SINCE BASELINE

is assisting DCC with the ongoing Measurement and Verification (M&V) of this project; in the first two years, DCC has achieved energy savings of 39% and saved almost €390,000 in energy costs. Maintenance costs have also been reduced as a result of this project. Further efficiency gains were made in 2018 in these facilities, with a small increase in energy performance evident in Figure 11. Slight improvements in energy performance have also been noted in the dry sports and swimming pool facilities in 2018.

After the completion of the first EPC project, it became clear that the original CHP unit in Finglas Sports and Fitness Centre was now oversized and underperforming due to the reduced loading on it. In 2018, this CHP system was reconfigured to additionally supply electricity to the adjacent Finglas Area Office. This increased the loading on the CHP unit once more, allowing it to operate at its most efficient and reliable output level. While this has not resulted in significant energy savings, it has led to lower electricity costs for both Finglas Sports and Fitness Centre and the Area Office, while also reducing CHP downtime.

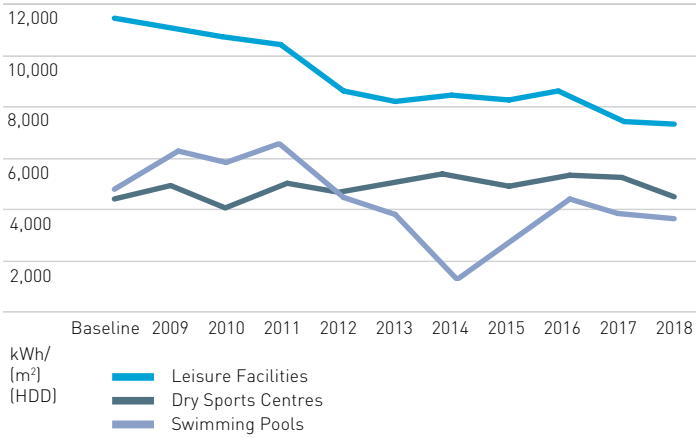


Figure 11: Sports Facilities' Annual Energy Performance

SPORTS FACILITIES' PLAN TO 2020

Due to the success of the pilot EPC project, Codema also helped DCC to procure a contractor for a second EPC (EPCII). This project will involve an upgrade to the existing lighting, heating and ventilation systems across seven Council buildings: Ballyfermot Sports and Fitness Centre, St Catherine's Community Sports Centre, Ballybough Youth and Community Centre, Cabra Parkside, Irishtown Sports and Fitness Centre, Bluebell Community Sports Centre and Poppintree Community Sports Centre. The works phase of this project is expected to be completed before the end of 2019. An analysis of the energy consumption within these sports facilities indicates that the second EPC project will deliver further savings of 2.1 GWh of primary energy and 321 tonnes of CO_2 by 2020.

A significant upgrade to Crumlin Swimming Pool is due to be completed as part of the 2019 BEC application. This will include the installation of a heat pump, PV panels and LED lighting, as well as the addition of wall insulation. Savings of 0.4 GWh in primary energy and 82 tonnes of CO_2 are forecast.

When both of these projects are complete and in service, combined primary energy savings of 2.5 GWh and CO_2 savings of 403 tonnes are expected to be achieved.

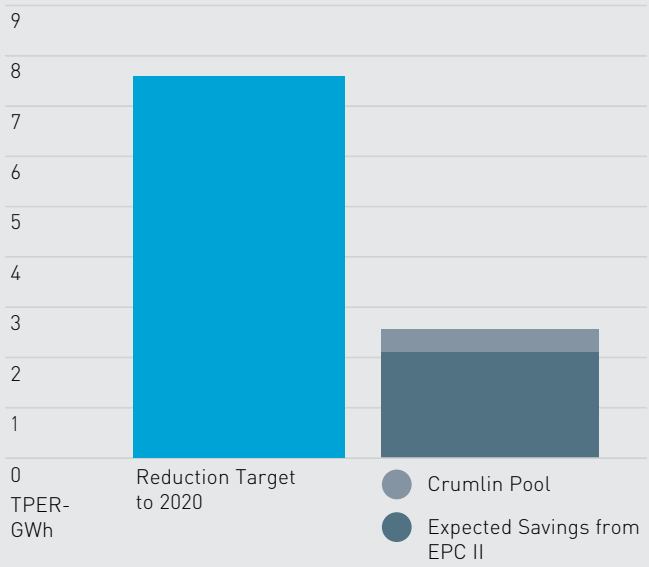


Figure 12: Sports Facilities' Plan to 2020

03. SIGNIFICANT ENERGY USERS
(CONTINUED)

FIRE STATIONS

Fire Stations are the fourth 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. These fire stations are responsible for 49 fire engines and 19 ambulances, which consumed 773,500 litres of diesel in 2018.

Within Fire Stations, diesel consumption accounts for 42% of the total primary energy consumption, gas accounts for 33% and the remaining 25% is electricity. A breakdown of fuel consumption by type is shown in Figure 13. In 2018, the Fire Stations accounted for 11% of the local authority's primary energy requirement. This represents a consumption of 20.4 GWh of primary energy, 4,453 tonnes of CO_2, and €1.6 million in energy spend.

Identification of Relevant Variables for the Fire Stations

In relation to the Fire Stations, electricity, gas and diesel consumption are the main energy types. There is very little data available on the consumption of diesel as it is delivered in bulk to the different stations, therefore a detailed EnPI could not be established in relation to the diesel consumption. As mentioned in some of the previous SEU sections, it is difficult to define a single driver for the energy consumption in relation to gas and electricity, as there are multiple factors that 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 that it serves. Therefore, as the population of DCC grows, so do the areas that the Fire Brigade must respond to. Gas consumption is mainly dependent on the external temperature.

DCC Fire Stations 2018

CONSUMED 20.4 GWH OF PRIMARY ENERGY

4,453 TONNES OF CO_2 EMITTED

€1.6M ASSOCIATED ENERGY COST

IMPROVED ENERGY PERFORMANCE BY 10.2% SINCE BASELINE

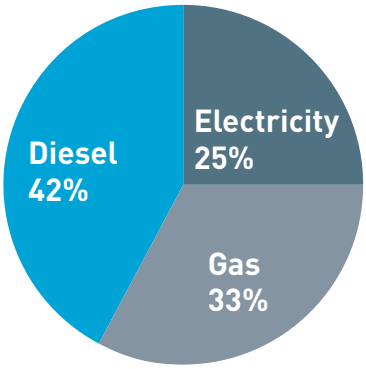


Figure 13: Fire Stations 2018 Energy Consumption Breakdown

Therefore, the composite performance indicator used to measure the Fire Stations' 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)

Energy Performance of the Fire Stations

The energy database shows that the Fire Stations have improved their energy performance by 10.2% since the baseline, compared to the EnPI. This is an absolute reduction of 0.25 GWh of primary energy and 58 tonnes of CO_2.

In 2018, the energy performance of the Fire Stations decreased by 14% compared to 2017. This is mostly due to a 33% increase in bulk fuel deliveries. Bulk fuel consumption has increased by 65% since 2016, and is now 50% higher than the baseline. This may be due to increased vehicle numbers or activity levels, and requires further investigation. The energy performance of Stanley Street has also decreased by 22% in 2018, resulting in a significant impact on the overall energy performance of this SEU. This station is the worst performing in terms of energy savings, with less than 4% performance increase since the baseline.

Tara Street has the largest energy consumption, but has also achieved the greatest reduction since the baseline year. During this time, it has reduced its annual consumption by 1 GWh, which translates to an improvement in performance of 35%. The majority of this was due to the replacement of the old, inefficient boiler system with a new, energy-efficient condensing system with upgraded heating controls. Facility management continues to utilise the upgraded control systems to further drive energy efficiency in the facility, with a 3% increase in energy performance achieved in 2018 compared to 2017. Improved energy management at the O'Brien Institute, another large facility, has also led to savings of 8% in 2018, compared to the previous year.

Of the smaller stations, Skerries, Finglas and Blanchardstown have all achieved energy performance improvements of over 40% since the baseline, with a combined annual reduction of over 0.62 GWh in primary energy. The majority of these savings were in Blanchardstown and Finglas Fire Stations, as can be seen in Figure 15. This was due to a complete boiler replacement in Blanchardstown and a whole facility upgrade in Finglas, which included boiler replacement, fabric upgrades, LED lighting and the installation of solar panels. While savings are being maintained in these facilities, energy consumption in other stations is beginning to creep back up after making some initial savings. These include Phibsboro, Tallaght, Donnybrook and Kilbarrack in particular.

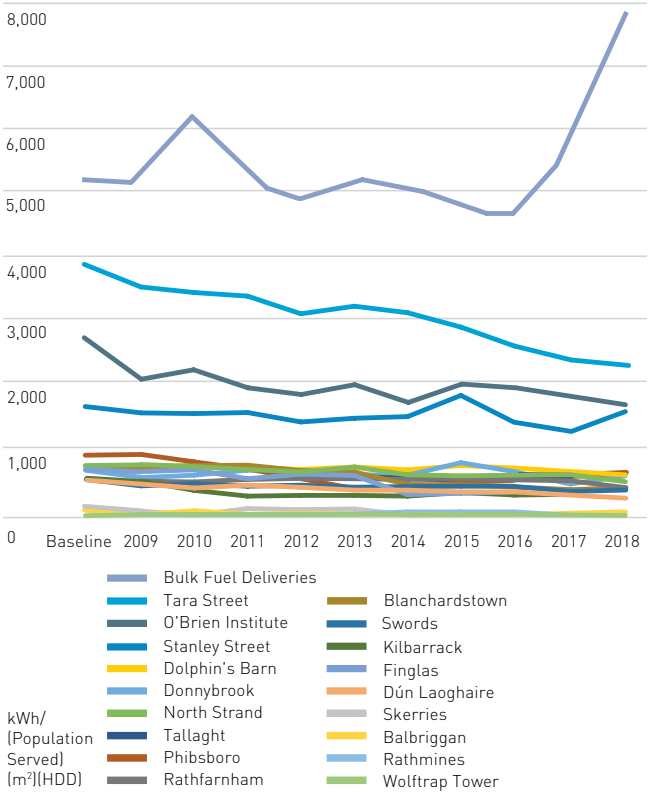


Figure 14: Annual Energy Performance of the Fire Stations

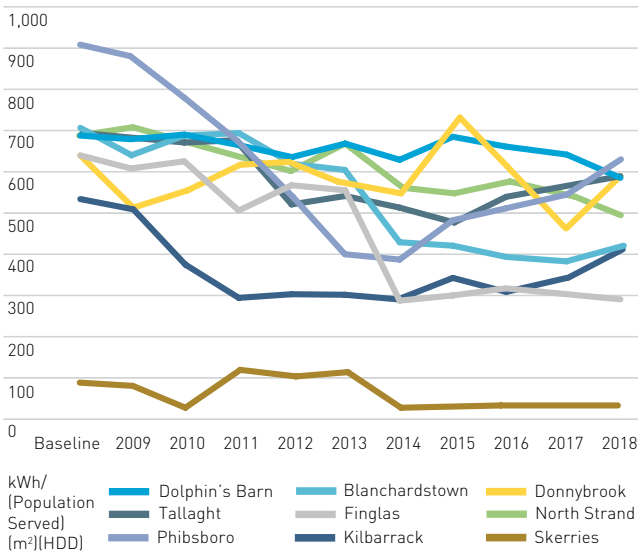


Figure 15: Annual Energy Performance of the Smaller Fire Stations

FIRE STATIONS' PLAN TO 2020

Codema was approached by the Dublin Fire Brigade property maintenance manager to identify the best options for the replacement of the boilers within the O'Brien Institute, which are coming to the end of their lifespan. It was decided that an Energy Performance Related Payment (EPRP) contract would be undertaken for the boiler replacement programme, which will incentivise the contractor to remain involved with the project until pre-agreed energy savings are established, thereby reducing the risk to the Council. Codema has prepared the tender documents for this project in consultation with the Council and it is hoped that the tender process will be carried out over the summer of 2019, with works completed before the end of the year.

Within the Fire Stations' facilities, the top three consumers, Tara Street, Stanley Street and the O'Brien Institute, account for half of the total consumption. With the boiler replacement project already in progress for the O'Brien Institute, Codema intends to look at the Tara Street facility in more detail, in order to identify potential energy savings in the building. The Stanley Street station, which has achieved the smallest reduction in energy consumption of all the Fire Brigade facilities, has recently been earmarked for demolition to make way for a housing development. This vehicle maintenance workshop is expected to be relocated to either the Tallaght or North Strand station sometime in the near future.

Two significant redevelopments are planned for the Dolphin's Barn and North Strand Stations. These facilities will be redeveloped in line with nearly Zero Energy Building (nZEB) design guidelines, and will achieve significant energy savings as a result.

Another station that had been identified for possible upgrades is Swords Fire Station. In 2018, a boiler replacement was undertaken, which will result in significant energy savings from 2019 onwards. In addition to the boiler replacement, further possible energy efficiency measures such as the retrofit of LED lighting and controls, heating system and control upgrades, and the installation of photovoltaic systems, amongst others, could be identified. Energy audits will help identify these measures, which can then be prioritised in terms of highest potential for savings.

The Dublin Fire Brigade is also interested in developing a new maintenance programme that will categorise its facilities according to size, consumption and age profile. In addition, it will also tender for a framework of maintenance companies that will incorporate an energy performance element into the contract, in an effort to drive down energy consumption across all of the Dublin Fire Brigade's facilities. This programme will be phased into future maintenance contracts.

The Dublin Fire Brigade has also committed to retrofitting its lighting stock to LEDs. This will be achieved by integrating a new policy within their maintenance contracts that states that any failed fittings should be replaced with LEDs. These LEDs will also comply with local government procurement rules and will be on the SEAI Triple E register.

If the Fire Brigade aims to replace the boilers in the O'Brien Institute by the end of 2019, it could result in a saving of 198 MWh of TPER and 41 tonnes of CO_2.

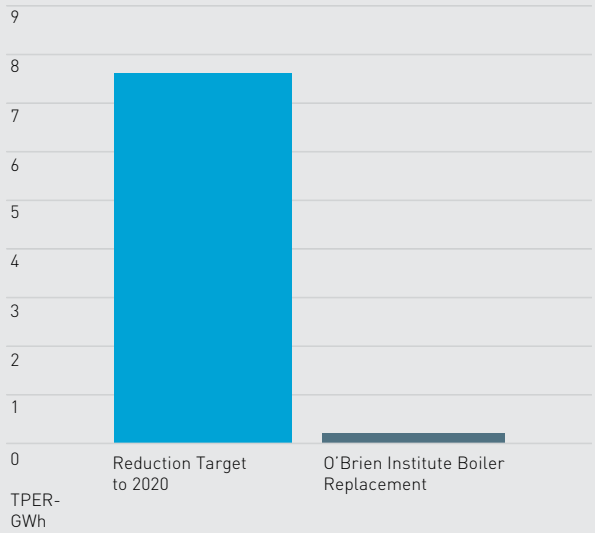


Figure 16: Fire Stations' Plan to 2020

03. SIGNIFICANT ENERGY USERS
(CONTINUED)

OFFICES & DEPOTS

DCC has 108 offices and depots around the city. Due to its size, the Civic Offices on Wood Quay is not included in this section and has been separated out as a standalone SEU. Of the remaining 107 facilities, 37 are local area offices. There are also 70 depots around the city, which comprise of workshops, waste management depots and road depots.

In 2018, these facilities accounted for 11% of DCC's primary energy consumption. This represents a consumption of 19.6 GWh of primary energy, 4,034 tonnes of CO_2 and an estimated €1.3 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 described 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 that 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 Offices and Depots' 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 2018

CONSUMED 19.6 GWH OF PRIMARY ENERGY

4,034 TONNES OF CO_2 EMITTED

€1.3M ASSOCIATED ENERGY COST

IMPROVED ENERGY PERFORMANCE BY 10.4% SINCE BASELINE

Energy Performance of the Offices and Depots

The database shows that the Offices and Depots have improved their energy performance by 10.4% since the baseline year. This is an absolute reduction of 4.2 GWh of primary energy and 1,144 tonnes of CO_2 when comparing 2018 against the baseline year. The savings achieved to date are clearly illustrated in Figure 17. In previous years, the significant savings achieved in the Civic Offices had been masking the lack of performance in the remainder of the offices and depots. It can now be seen that the efficiency gains in this SEU grouping have been quite modest, with great potential for further efficiency improvements.

Figure 17 shows that the main area of energy consumption is in the Area Offices and Civic Centres. Energy performance decreased in both 2015 and 2016, and while a small improvement was seen in 2017, the energy performance has decreased once more in 2018, and is now worse than the baseline year. Similarly, after an improvement in 2017, the energy performance in the Housing Depots has disimproved slightly in 2018. In analysing the energy consumption within these divisions, there was an increase across a number of facilities, which could be attributable to an increase in footfall or activity levels that the energy performance indicator cannot account for at present. This increase will be raised with the relevant facilities managers and explored further, in order to generate more robust energy performance indicators and to prevent further increases in consumption in the future.

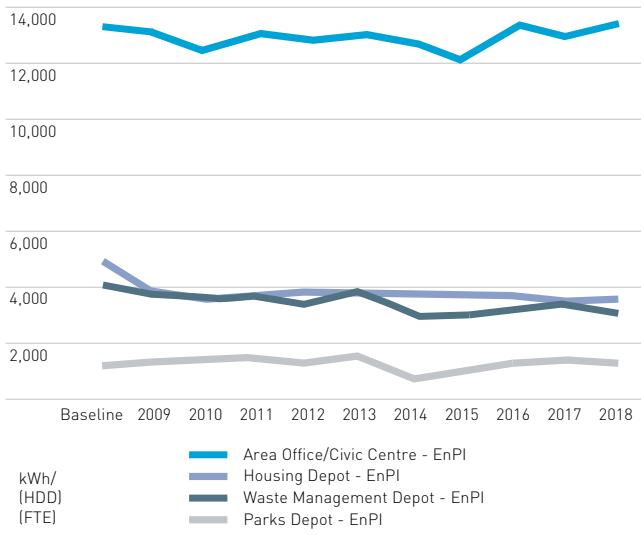


Figure 17: Offices & Depots' Annual Energy Performance

OFFICES & DEPOTS' PLAN TO 2020

As part of this Energy Review, Codema has identified large energy consumers within each SEU to establish possible energy saving solutions for these specific areas. Within the Office and Depots, Eblana House, the Joinery Workshop, the Motor Tax Office in Smithfield and the Ballymun Civic Offices accounted for almost 70% of the total energy consumption within this area. While investigating this further, Codema found that DCC only leases out a portion of the buildings containing the Motor Tax Office and the Ballymun Civic Offices, so there is limited scope for energy savings within these facilities. In 2018, Codema carried out an energy audit on Eblana House, which is the second largest energy consumer under this SEU. This report listed a number of possible energy saving measures, including the installation of a solar PV system to reduce the electrical load of the facility, along with a review of the energy management systems in place in the facility. The primary energy consumption in this facility reduced by almost 0.3 GWh in 2018 to 2.06 GWh. However, this reduction has only brought the energy consumption back in line with what had previously been measured in 2016. A structured energy management programme in the facility may lead to further and maintained annual savings of up to 10%, or 0.2 GWh. This would lead to reduced carbon emissions of 42 tonnes per year and a reduction in annual energy costs of almost €15,000.

Codema has also completed a proposal for the Joinery Workshop, recommending the replacement of the existing boiler system with a new, energy-efficient condensing system with upgraded heating controls, a complete LED lighting retrofit and a possible PV array on the roof of the facility. This project would result in savings of 0.5 GWh of primary energy and 84 tonnes of CO_2, and would reduce costs by €38,000.

In 2018, the Mechanical and Energy Efficiency Section carried out retrofits on a number of facilities' HVAC systems throughout the city under the SEAI's Better Energy Communities (BEC) grant scheme; this included the upgrade of the boiler system and controls in the Cabra Area Office.

The Transformation Unit in Dublin City Council is working with all of the operational areas in developing a consolidated depot model, which will culminate in the construction of two large-

scale depot facilities, one on the northside of the city, and the other on the southside.

The northside depot was granted planning permission in February 2017 and will be located along St Margaret's Road in Ballymun. Fourteen depots from across a variety of divisions such as waste management, road maintenance, housing maintenance and electrical services will be based in this proposed new facility, which will include an office and welfare building, workshop facilities and a central store.

This large-scale depot will be designed and constructed to nZEB standard and the move could result in savings of 2.1 GWh of primary energy, 672 tonnes of CO_2 and a reduction in costs of €211,000.

If all of the projects outlined in this section are completed within the Offices and Depots by the end of 2020, they could collectively save DCC 2.8 GWh of TPER in total and 798 tonnes of CO_2.

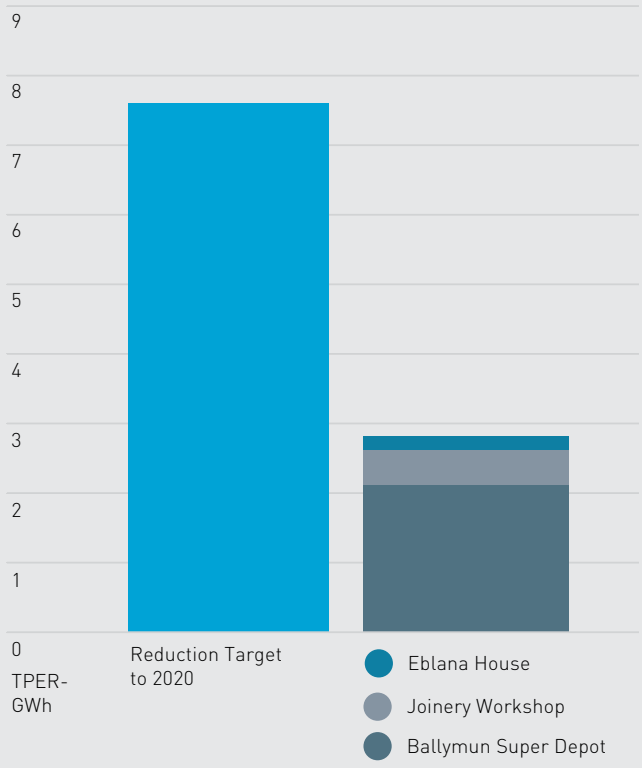


Figure 18: Offices & Depots' Plan to 2020

03. SIGNIFICANT ENERGY USERS
(CONTINUED)

TRANSPORT

Transport is the sixth largest SEU within DCC, and comprises of fuels used for Council vehicles[1] (including light and heavy vehicles), and fuels used by the park services. In 2018, Transport accounted for 7% of DCC's primary energy consumption. This amounts to 12.8 GWh of primary energy, 3,071 tonnes of CO_2, or an estimated €1.4 million in energy costs.

Within Transport, diesel accounts for almost 98% of the total primary energy consumption. Petrol accounts for less than 2.5%, as it is only used to fuel small equipment. A breakdown of fuel consumption by type is shown in Figure 19. Transport consists of 693 vehicles, which are broken up into 22 different vehicle types. Below is a summary of the main vehicle types and their associated quantity:

- Medium sized vans – 238
- Small vans – 192
- Lorries > 7.5 kgs – 37
- Road sweepers – 48
- Large vans – 26

Identification of Relevant Variables for Transport

Due to a lack of robust data relating to kilometres driven or efficiency of the fleet, Codema has used the number of vehicles to develop a performance indicator for Transport. This gives a more true depiction of the energy consumed by the Transport Department than the previous performance indicator of population served. Therefore, the EnPI for Transport is the kWh consumption of primary energy divided by the total number of vehicles. This formula is:

Transport EnPI = kWh TPER/total number of vehicles

DCC Transport 2018

CONSUMED 12.8 GWH OF PRIMARY ENERGY

3,071 TONNES OF CO_2 EMITTED

€1.4M ASSOCIATED ENERGY COST

IMPROVED ENERGY PERFORMANCE BY 30.4% SINCE BASELINE

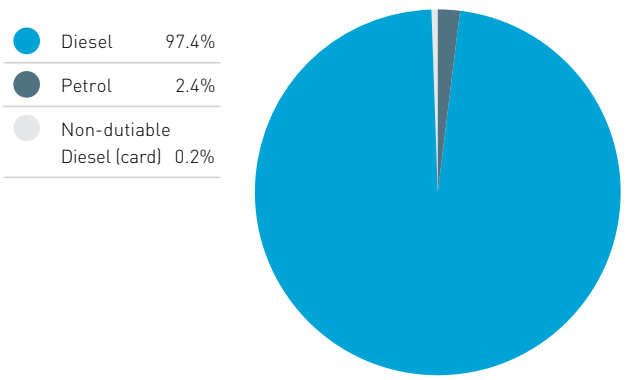


Figure 19: DCC Transport Fuels TPER - 2018

1. The fuel figures do not include the Dublin Fire Brigade or the SLA Divisions working for Irish Water.

Energy Performance of Transport

Based on the new performance indicator, the database shows that the energy performance of Transport has improved by 30.4% since the baseline. This is an absolute reduction of 5.5 GWh[2] of primary energy and 1,327 tonnes of CO_2.

Diesel engines have been getting progressively more efficient over this period, so the fleet has therefore gradually become more efficient as older vehicles are phased out and replaced. Petrol consumption, although only a minor part of the Transport picture, has been steadily decreasing since 2010, and this trend continued in 2018.

2. 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.

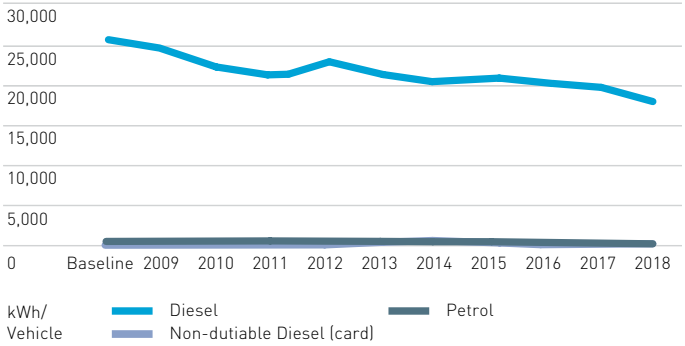


Figure 20: Transport Annual Energy Performance

TRANSPORT PLAN TO 2020

DCC is currently upgrading its light commercial fleet to newer, more fuel-efficient vehicles, which should help continue the downward trend in fuel consumption.

DCC is looking to test mobility options for staff to carry out their work. Specifically, DCC wants to explore and expand its fleet of electric vehicles and encourage cycling to help reduce its transport emissions. In May 2019, DCC launched a Smart Mobility Hub at the Wood Quay Civic Offices. This pilot project is part of a small business innovation research challenge in partnership with Enterprise Ireland and Smart Dublin and is integrating a fleet of e-cars, bikes and e-bikes through mobile apps aiming to improve the options for staff who need to go off-site for work purposes during the day. To date, DCC has three electric vehicles stationed at the Wood Quay Civic Offices that can be used by staff. A number of electrically-assisted and standard push bikes are being made available for staff use at the Civic Offices, with a shower block for cyclists also to be added before the end of 2019.

DCC has also recently procured 14 small electric vans that are used in a number of the Council depots around the city, and will continue to monitor the feasibility of introducing more electric vehicles into its fleet in the future. A trial is currently ongoing with an electric side-loader waste management vehicle, which will help determine its suitability for a wider roll-out. The plan is to continue to replace older vehicles with new, more fuel-efficient vehicles (including electric vehicles where feasible) as vehicles fall due for replacement. Over the past year, 217 light commercial and side-loader vehicles have been replaced, with a further 36 to be delivered before the end of 2019. This should result in Transport energy consumption continuing to reduce to 2020 and beyond. Resulting from this programme, Transport could see further savings of 0.3 GWh of TPER and 69 tonnes of CO_2 by 2020.

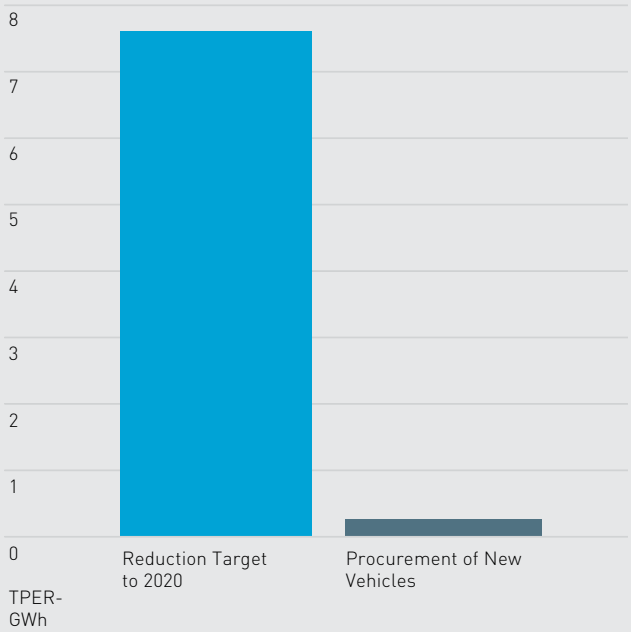
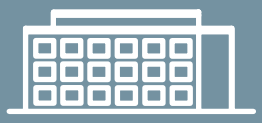


Figure 21: Transport Plan to 2020

03. SIGNIFICANT ENERGY USERS
(CONTINUED)



CIVIC OFFICES

For 2018, the Civic Offices on Wood Quay has been separated out from the Offices and Depots SEU due to its own individual significance in terms of overall energy consumption in DCC. In 2018, the Civic Offices accounted for 6% of the total energy consumed by DCC. This amounted to 10.6 GWh of primary energy consumption, 2,267 tonnes of CO_2 and almost €550,000 in energy costs.

Identification of Relevant Variables for the Civic Offices

There are two main energy types consumed in the Civic Offices: electricity and gas. A composite metric is therefore required due to the multiple variables driving the energy use. It is difficult to find a single significant driving factor for the electrical consumption, as there are many variables that determine this, such as the number of employees, opening hours, floor area, etc. Gas consumption is mainly dependent on the external temperature. The composite performance indicator used to measure the Civic Offices' 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 Civic Offices 2018

CONSUMED 10.6 GWH OF PRIMARY ENERGY

2,267 TONNES OF CO_2 EMITTED

€0.5M ASSOCIATED ENERGY COST

IMPROVED ENERGY PERFORMANCE BY 33.5% SINCE BASELINE

Energy Performance of the Civic Offices

The Civic Offices has improved its energy performance by 33.5% since the baseline year. This is an absolute reduction of 6.6 GWh of primary energy and 1,339 tonnes of CO_2.

There has been a considerable amount of work carried out in the Civic Offices since the baseline year, including continuous retrofitting of lighting to LEDs, the replacement of old, inefficient boilers to a new condensing energy efficient system, and the upgrading of pumps and the heating control system. The Civic Offices was also the first facility within the organisation to implement an energy management system and become ISO 50001 compliant, with huge effort from the facilities management team. A decrease in energy

performance has been noted in 2018, as shown in Figure 22, with the EnPI for 2018 almost 5% higher than that for 2017. This reflects increases in both the electrical and gas consumption in the facility over the previous year.

In 2018, Dublin City Council commenced a Capital Works Programme, which will see over €2.8 million being invested over three years to upgrade the HVAC systems and controls within the Civic Offices. The planned works involve the upgrading of the Air Handling Units (AHUs), and will also include the upgrading of valves, cylinders and pumps within the building. The chiller system will also be upgraded, along with the BMS. In 2018, the R22 air conditioning units were replaced, while a programme to reseal the air circulation ducting within the facility was also undertaken. The remainder of the works are due to be completed over the next two years.

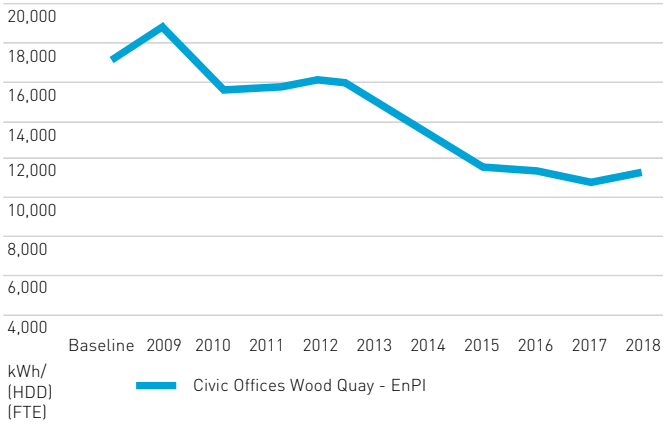
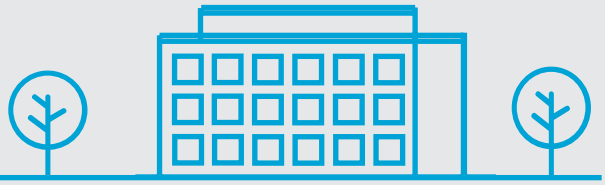


Figure 22: Civic Offices' Annual Energy Performance

CIVIC OFFICES' PLAN TO 2020



DCC is investigating the potential to install a combined heat and power (CHP) unit in its Civic Offices to provide electricity to the building and backup power in the case of a blackout.

This project aims to save 80 MWh of primary energy and 30 tonnes of CO_2. As mentioned above, a three-year Capital Works Programme for the HVAC system commenced in 2018. These works are due to be completed before the end of 2020.

In addition to this, a full detailed energy audit has been commissioned and is currently underway to identify any further energy saving potential in the facility. Initial indications suggest that through the implementation of all the recommendations in this report, as well as the CHP and Capital Works Programme, savings of up to 2.8 GWh of primary energy and 1,344 tonnes of CO_2 may be achieved. The effect of these upgrades towards DCC's energy reduction target can be seen in Figure 23.

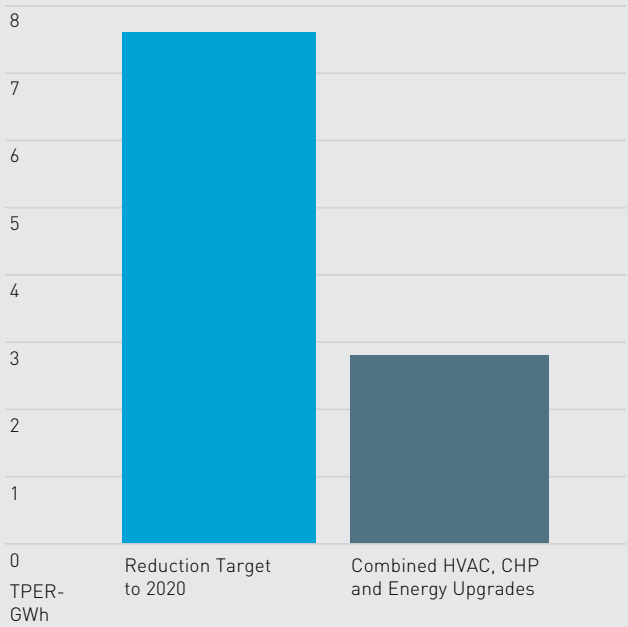


Figure 23: Civic Offices' Plan to 2020

04. CONCLUSION

DCC has achieved energy savings of 33.1% between the baseline year and 2018. This means that DCC has now met its statutory 2020 energy efficiency targets, two years ahead of the deadline.

While this is a highly commendable achievement, it should be noted that these savings are not permanently locked-in and that continuous energy management is required to maintain and improve upon them. It is clear that while huge gains have been made in certain areas, others have seen very little improvement since the baseline year. A new set of 2030 targets are due to be announced shortly, which will require continued efforts to be made to increase energy efficiency throughout the organisation. The Government's recently published Climate Action Plan 2019 To Tackle Climate Breakdown has signalled that this may amount to a 50% increase in energy efficiency by 2030, coupled also with a greenhouse gas emissions reduction target of 30%. It is worth noting that DCC has already committed to a 40% reduction in GHGs by 2030, through its Climate Change Action Plan 2019-2024 and the Covenant of Mayors initiative.

The savings that have been achieved since the last Energy Review can be attributed to the continued investment of DCC's staff and resources towards the achievement of their 2020 energy efficiency targets. This has been aided through the appointment of the Council's Energy Performance Officer (EPO) and the ongoing work of the Inter-Departmental Energy Oversight Committee. This Energy Oversight Committee has been working towards achieving an accredited energy management system for the whole organisation, and will continue to identify and cost potential projects in areas such as Public Lighting, Offices and Depots, Civic Offices, Housing, Fire Stations, Sports Facilities and Transport. This will help the Council stay on track of its 2020 energy efficiency targets and place it in a strong position in advance of the upcoming 2030 targets.

Figures 24 and 25 illustrate DCC's gap-to-target model for the next two years in terms of both energy efficiency and CO_2 emissions. In addition to this, it also includes the further reductions that will need to be made in order to achieve the expected 2030 targets. If all the projects set out in this Energy Review are completed by 2020, they could result in a total saving of 14.2 GWh of TPER and 3,837 tonnes of CO_2. This energy reduction figure goes well beyond DCC's 33% reduction target and places the Council in a great position to get a head start on its 2030 targets. The CO_2 reductions resulting from these measures will also cover over two-thirds of DCC's gap-to-target for 2030, with a further decade to achieve the remaining reductions. If this momentum is maintained, it should be possible for DCC to go well beyond the 40% CO_2 target within the given timeframe. Given the urgency of the climate emergency, it would be a good idea to review this target upwards in an effort to provide leadership on climate action.

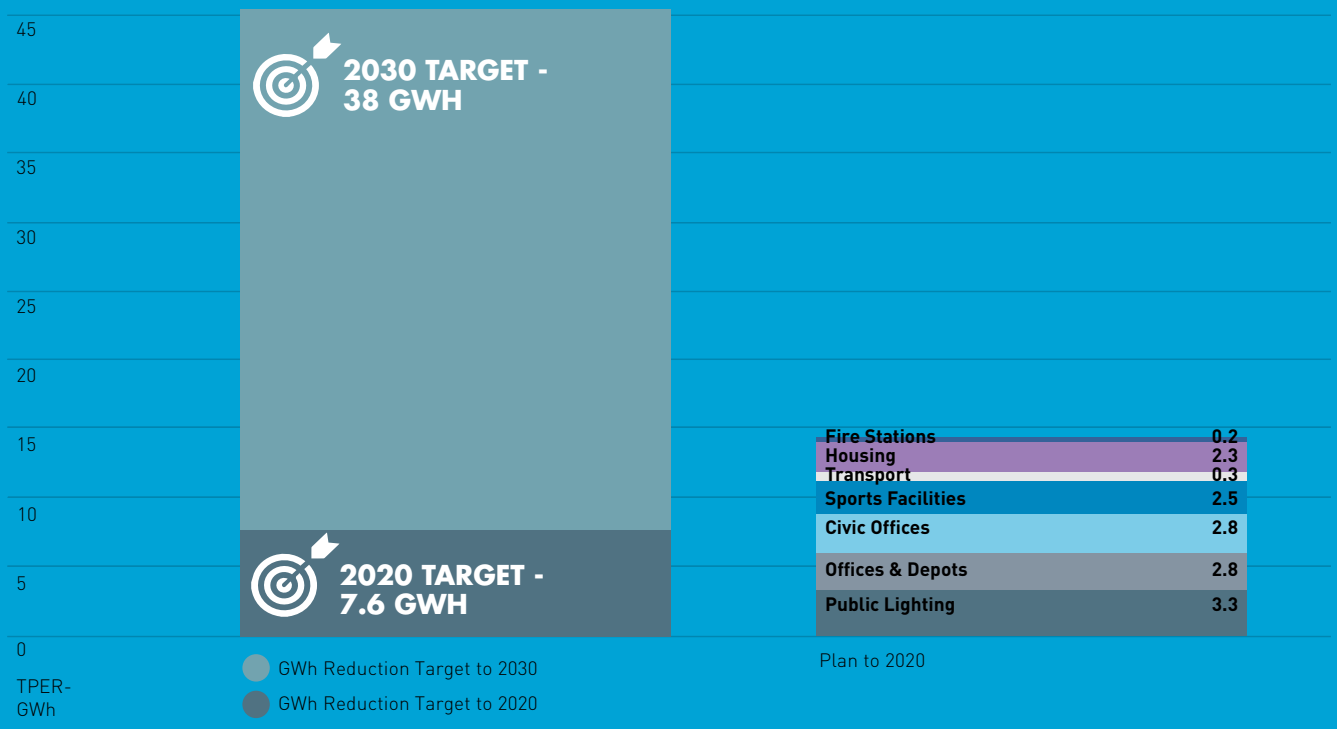


Figure 24: DCC Energy Efficiency Plan to 2020 and 2030

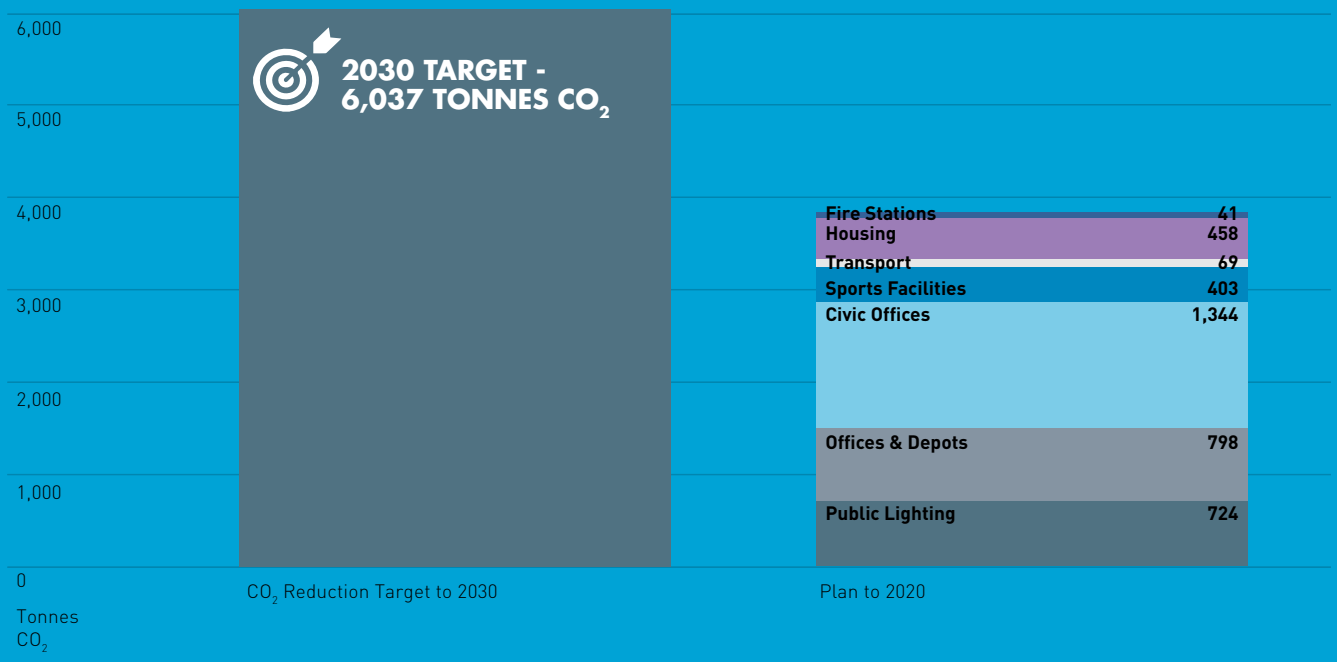


Figure 25: DCC Carbon Reduction Plan towards 2030 Target

SEU AREA	ACTION	ESTIMATED SAVINGS
PUBLIC LIGHTING	REPLACE 8,000 SOXS WITH LEDS	3.3 GWH
OFFICES & DEPOTS	ENERGY MANAGEMENT SYSTEM AT EBLANA HOUSE, UPGRADES TO JOINERY WORKSHOP & DEVELOPMENT OF BALLYMUN SUPER DEPOT	2.8 GWH
CIVIC OFFICES	CHP INSTALLATION / HVAC UPGRADES	2.8 GWH
HOUSING	UPGRADES TO COMMUNITY CENTRES, HOMELESS FACILITIES & SOCIAL HOUSING / SENIOR CITIZEN COMPLEXES	2.3 GWH
TRANSPORT	PROCUREMENT OF NEW ENERGY-EFFICIENT VEHICLES	0.3 GWH
SPORTS FACILITIES	EPC II - UPGRADES TO LIGHTING, HEATING & VENTILATION SYSTEMS ACROSS 7 COUNCIL SPORTS FACILITIES / CRUMLIN POOL UPGRADES	2.5 GWH
FIRE STATIONS	REPLACEMENT OF BOILERS AT THE O'BRIEN INSTITUTE	0.2 GWH

05. APPENDICES

SEU Summary

Table 1 SEU Summary

SEU	TPER - GWh	Tonnes CO_2	Cost	% +/- since baseline
Public Lighting	43.4	9,683	€2,720,032	-19.8%
Housing	31.7	5,624	€1,596,439	-31.2%
Sports Facilities	21.5	4,231	€1,102,307	-15.6%
Fire Stations	20.4	4,453	€1,633,685	-10.2%
Offices & Depots	19.6	4,034	€1,274,810	-10.4%
Transport	12.8	3,071	€1,434,818	-30.4%
Civic Offices	10.6	2,267	€541,979	-33.5%
Total	160	33,363	€10,304,070	

Project Plan to 2020 Summary

Table 2 Project Plan Summary

SEU	TPER - GWh	Tonnes CO_2
Public Lighting	3.3	724
Housing	2.3	458
Sports Facilities	2.5	403
Fire Stations	0.2	41
Offices & Depots	2.8	798
Transport	0.3	69
Civic Offices	2.8	1,344
Total	14.2	3,837

05. APPENDICES
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Abbreviations

AHU	Air Handling Unit
BEC	Better Energy Communities
BMS	Building Management System
CCAP	Climate Change Action Plan
CHP	Combined Heat and Power
CO_2	Carbon Dioxide
DCC	Dublin City Council
DCCAE	Department of Communications, Climate Action and Environment
EnPIs	Energy Performance Indicators
EPC	Energy Performance Contract
EPO	Energy Performance Officer
EPRP	Energy Performance Related Payment
FTE	Full Time Employees
GHG	Greenhouse gas
GPRNs	Metered Gas Accounts
GWh	Gigawatt hour
HDD	Heating Degree Days
HVAC	Heating, Ventilation and Air Conditioning
Kg	Kilogram
kWh	Kilowatt hour
LED	Light Emitting Diode
m^2	Metres Squared
M&V	Measurement and Verification
M&R	Monitoring and Reporting
MESA	Managed Energy Services Agreement
MPRNs	Metered Electrical Accounts
MWh	Megawatt hour
nZEB	nearly Zero Energy Building
PV	Photovoltaic
SEAI	Sustainable Energy Authority of Ireland
SEUs	Significant Energy Users
SON	High Pressure Sodium
SOX	Low Pressure Sodium
TPER	Total Primary Energy Requirement
UMR	Unmetered Registrar

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