

October 2022
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Local Government Climate Action Key Performance Indicators – in an Irish Context



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LGMA Research

ISBN: 978-1-9989960-2-5

This document should be cited as:

Clarke, D. (2022) Local Government Climate Action Key Performance Indicators – in an Irish Context.

Dublin: Local Government Management Agency



Acknowledgements

This research was carried out by Dr. Darren Clarke (Dublin City University) on behalf of the County and City Management Association's (CCMA) Climate Action, Transport and Networks Committee. The author would like to particularly thank the members of the Climate Action KPI Working Group who provided ongoing support and valuable feedback during the research:

Paul Kennedy, Dún Laoghaire-Rathdown County Council

Breda Maher, Eastern and Midlands Climate Action Regional Office (CARO)

Claire Moran, Eastern and Midlands Climate Action Regional Office (CARO)

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Foreword

The CCMA Climate Action, Transport and Networks (CATN) Committee convened a Climate Action Key Performance Indicators Working Group in early 2021. The working group was comprised of representatives from the CCMA CATN Committee, who acted as Chair of the group, local authority staff working in the delivery of climate actions, as well as staff from the Eastern and Midlands CARO, who manage the work programme, and LGMA Research Unit who provide technical assistance. The working group was tasked with developing a set of sectoral climate action indicators to facilitate tracking the delivery of actions under the Local Authority Climate Action Charter.

Much has moved on from a policy perspective since the working group was established, with each local authority now required to prepare a five-year Climate Action Plan to identify mitigation and adaptation measures that need to be implemented and monitored locally. The requirement to report on our actions is welcome as too often in the past, we have undertaken huge amounts of work that went unnoticed or unreported. It is to the advantage of the sector, that we come together and agree the measures against which our work will be evaluated.

Given this, a key focus of the working group has been gathering evidence to inform the development of robust and reliable sectoral indicators. In May 2021 a literature review was published by the group that captured information about the range of KPIs that existed across several jurisdictions. The report highlighted the need to incorporate both 'process' and 'outcome' indicators to ensure the correct foundations were in place across the sector to deliver on our goals. This report moves on to identify a comprehensive list of potential national indicators, the majority of which are 'outcome' focused. However, the indicators can also be utilised locally to monitor aspects of delivery that are unique to each local authority.

The list of potential indicators included in this report are classified under several headings, one of which is the functional areas of local authority work (e.g., biodiversity, corporate/internal operations, environment, parks, planning, etc.). This helps to illustrate the breadth of impact and number of staff that will need to be involved in the delivery and tracking of climate action activities.

Given this, and in light of recommendations in the previous published report, it is a priority that the indicators selected be simple and reliable and that data collection is feasible and manageable. But equally we need to be ambitious and select indicators that enable us to highlight and promote the huge contribution the sector is making to this critical issue.

Paul Kennedy Chair
CCMA Climate Action Key Performance Indicator Working Group



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County and City Management Association

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Executive Summary

The Irish local government sector is a key player with respect to the State meeting its climate change commitment of net zero greenhouse gas emissions by no later than the end of 2050. Its broad operational remit in providing over 1,000 services, many of which require climate proofing, and its close relationship with communities, means that its contribution is critical if national and EU climate commitments are to be met. In light of various policy and legislative requirements in recent years, the sector has committed to monitoring, evaluating and reporting annually on its climate actions under the *Local Authority Climate Action Charter* and the sector's climate action strategy, *Delivering Effective Climate Action 2030*.

This research builds on an initial scoping exercise undertaken in 2021 to understand how the sector can best monitor and report on climate actions through the identification of key performance indicators (KPIs). The current research advances that work and addresses four research objectives to further support the sector in identifying and implementing climate action KPIs. First, it sets the context for the changing role of local authorities on climate action in recent years. Second, it identifies an updated set of KPIs that individual local authorities can select from to track specific local climate action outcomes and that can be aggregated for the local government sector. Third, it aligns each KPI to specific services and functions performed by local authorities. This is guided by the categorisation of services and functions in the *Local Authority Climate Action Plan Guidelines (Draft)*. And fourth, it categorises KPIs under the six thematic areas identified in the local government sector's own climate action strategy, *Delivering Effective Climate Action 2030*.

Research objective 1: Results of the research illustrate that the local government sector has taken on significantly expanded responsibilities for climate action in recent years.

Research objective 2: An extensive literature review integrating both academic publications

and a selection of best practices across municipalities considered at the forefront of climate action globally was undertaken in June 2022. This resulted in 121 KPIs being identified as potentially relevant to the Irish local government sector.

Research objective 3: KPIs were subsequently aligned to 19 pre-defined local authority functional areas. This mapping exercise is a useful starting point for the sector in identifying KPIs based on specific operational services it provides.

Research objective 4: Each KPI was aligned to six strategic goals within the sector's climate action strategy. 15 KPIs met two strategic goals, 64 aligned to three strategic goals, 27 KPIs met four strategic goals, 6 KPIs related to five strategic goals and 9 KPIs aligned to all six strategic goals.

The 121 KPIs offer an opportunity for the sector to review and refine these for future use based on their own particular needs. At a strategic level, this should involve key sectoral stakeholders identifying and agreeing a set of indicators that support the sector's climate action commitments as contained in the *Climate Action Charter* and *Delivering Effective Climate Action 2030*. This research provides a useful baseline in advancing this process.

Overall, this report supports the local government sector to deliver on its national climate action commitments and in demonstrating public sector climate action leadership. Whilst these indicators represent relevant metrics applicable to the sector, it is important to recognise the evolving nature of climate policy at both EU and national levels. Periodic reviews of indicators to ensure they remain relevant, are aligned with international best practice, and are applicable to current policy and local authority operations are crucial.

1 Project Background

1.1 Introduction

The Irish State has committed to achieving a national climate objective of a climate resilient, biodiversity rich and climate neutral economy by no later than the end of 2050. Specifically, this includes a commitment to deliver a reduction in national greenhouse gas emissions of 51% by 2030 and net zero greenhouse gas emissions by no later than the end of 2050 (Government of Ireland, 2021a). By ensuring climate action targets are enshrined into legislation, the State has created one of the most ambitious climate action commitments globally (Government of Ireland, 2021b).

As recognised by the State's commitments, climate action is a public service. Public bodies that are engaged and empowered can not only reduce their own emissions but can also support a societal-wide transition to mitigate and adapt to climate change. Notwithstanding that public sector buildings accounted for only 1.5% of Ireland's greenhouse gas emissions in 2017 (Government of Ireland, 2019), successive national climate policies have placed increased onus on public bodies to not only shape and deliver national climate policies but to also demonstrate best practice in taking climate action to lead a wider societal transition (Government of Ireland, 2019, 2021b). Within the public sector, local authorities produce ~11% of all public sector greenhouse gas emissions (Sustainable Energy Authority of Ireland, 2021). The local government sector is therefore accountable for managing and reducing these emissions in line with 2030 and 2050 national climate commitments. Responsibilities on public sector bodies, including local authorities, are likely to increase in the coming years as work towards the most ambitious climate action commitments ever attempted by the State begins.

1.2 Local government climate action delivery

Whilst all public sector bodies are responsible for ensuring climate actions are embedded in day-to-day operational and strategic plans, the local government sector is likely to play a decisive role if national climate change commitments are to be achieved by 2050. Specifically, the sector's broad operational remit means that it provides more than 1,000 services (County and City Management Association, 2021), many of which require climate-proofing to ensure national and EU climate commitments are met. Climate action policies explicitly recognise the unique position of local authorities if national climate commitments are to be achieved given their close relationships with communities and their ability to mobilise resources efficiently (Government of Ireland, 2019, 2021b).

The ability of public sector bodies, including local authorities, to demonstrate performance on climate action will form a crucial component in successfully illustrating if and how they are leading by example, and what role they are playing in national climate action targets. Crucial to this leadership role is the need for the sector to demonstrate its own performance on climate action to facilitate broader societal change and ensure national climate commitments are met by 2030 and 2050.

1.3 Research aim and objectives

Local authorities have already committed to monitor, evaluate and report annually on the implementation of their climate actions (Department of the Environment, Climate and Communications, 2019). The sector subsequently undertook an initial scoping exercise in 2021 to understand how best it could monitor and report on its climate actions. This scoping exercise identified 60 Key Performance Indicators (KPIs) as potentially relevant (Clarke, 2021). However, since this review there have been advances in national climate research, policy and local authority commitments.

In light of local authorities' commitments to monitor, evaluate and report annually on the implementation of climate actions, the Local Government Management Agency (LGMA), on behalf of the County and City Management Association (CCMA) Climate Action, Transport and Networks committee sought a structured and evidenced-informed report with the following objectives:

1. Outline the evolving role of local authorities on climate action in recent years.
2. Identify an updated set of KPIs that individual local authorities can select from, and that can be aggregated at a sectoral level, to track specific local climate action outcomes given advances in climate research, policy and legislation since the initial scoping exercise in 2021.
3. Align KPIs to specific services and functions performed by local authorities, guided by the categorisation of services and functions in the *Local Authority Climate Action Plan Guidelines (Draft)*.
4. Categorise KPIs under the six thematic areas identified in the local government sector's own climate action strategy, *Delivering Effective Climate Action 2030*.

2 Evolving role of local authorities on climate action in recent years

2.1 Introduction

Climate action can be broadly defined into two related categories. First, there is a need to prevent further climate change from occurring, i.e., mitigation. And second, given current and future climate change impacts, societies need to adjust to anticipated and actual changes in the climate i.e., adaptation (IPCC, 2021, 2022). Adaptation and mitigation are interconnected however (IPCC, 2021, 2022), whereby climate change adaptation can also provide mitigation benefits, and vice versa. This chapter subsequently outlines the current state of mitigation and adaptation legislation and policies that broadly apply at EU, national and subnational scales. It then outlines their relevance to Irish public sector bodies and the evolving role of local authorities on climate action in recent years (objective 1).

2.2 International climate action policies

2.2.1 Paris Agreement

The United Nations Framework Convention on Climate Change (UNFCCC) adoption of the Paris Agreement in 2015 set a historic precedence for countries in limiting rising greenhouse gas emissions to keep global warming well below 2°C of pre-industrial levels, with aims to limit temperature increases to no more than 1.5°C (Intergovernmental Panel on Climate Change, 2018). Since this agreement, global efforts to meet these commitments have advanced, particularly relating to developing appropriate policies that will ensure such targets are achieved. Given the policy challenges that exist to transform societies and entire economies, a global response that is locally relevant is recognised as necessary (European Commission, 2020).

The Paris Agreement recognises the importance of commitment and engagement of all levels of government in meeting climate change ambitions. Specifically, it highlights the need to strengthen the efforts of local communities, encouraging cities and local authorities to enhance efforts and support actions to decrease emissions, build resilience and reduce vulnerability to the negative impacts of climate change (United Nations, 2015a).

2.2.2 Transforming our world: 2030 Agenda for Sustainable Development

The United Nations (UN) 2030 Sustainable Development Agenda outlines the critical role of local authorities in increasing ambition and action, delivering change and providing sustainable human settlements across 17 Sustainable Development Goals (SDGs) of which climate action is part (Goal 13). These 17 goals offer a universal ambition and suitable framework for all levels of government to ensure global, national and subnational policy priorities are aligned such that no-one is left behind (United Nations, 2015b).

2.2.3 Sendai Framework for Disaster Risk Reduction 2015-2030

The UN Sendai Framework details the need for local action in reducing disaster risk. Specifically, risks associated with climate change provide a unique opportunity to improve coordination and coherence within and between all sectors at all levels. It details how disaster risks have local and specific characteristics that require an understanding of how to reduce risk at a local level. It recognises the role of local government in reducing disaster risk through appropriate resources, incentives and decision-making (United Nations Office for Disaster Risk Reduction, 2015).

2.3 European Union policies and legislation

2.3.1 European Green Deal

The European Union (EU) has set an ambitious policy framework for how it proposes to meet its commitments as part of the Paris Agreement. Specifically, in 2019 the EU published the European Green Deal, an ambitious range of measures including significant reductions in greenhouse gas emissions, scaling up adaptation and preserving Europe's natural environment (European Commission, 2019). Within the proposed measures, climate change is a central consideration. This includes:

- Development of a European climate law that requires the 2050 climate neutrality objective to be embedded into EU Law.
- Intermediate targets of reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels for all member states, entitled Fit for 55.
- Publication of a new EU Strategy on climate adaptation, *Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change*, to make Europe climate-resilient by 2050 and fully adapted to the impacts of climate change (European Commission, 2021).
- An EU biodiversity strategy for 2030 to ensure protection of nature and to reverse ecosystem degradation putting Europe's biodiversity on a path to recovery by 2030 through specific actions and commitments.

2.4 Ireland climate action legislation and policies

2.4.1 Climate Action and Low Carbon Development (Amendment) Act 2021

In line with EU efforts, the Irish government is also building a framework to support ambitious climate action to achieve climate neutrality by 2050. *The Climate Action and Low Carbon Development (Amendment) Act 2021* commits the State to a 51% reduction in greenhouse gas emissions by 2030 and to climate neutrality by no later than the end of 2050.

The Act mandates carbon budgets and sectoral greenhouse gas emission ceilings covering successive five-year periods up to 2050, with the first two budgets (2021-2025 and 2026-2030) aimed at achieving a 51% reduction in greenhouse gas emissions by the end of 2030. Commitment also requires publication of an annual national Climate Action Plan and a national long-term Climate Action Strategy. This strategy must have a minimum 30-year time horizon and be reviewed at least every 10 years to support 2050 climate neutrality commitments. The Irish State has yet to publish its first strategy.

2.4.2 Climate Action Plan 2021: Securing our Future

The annual Climate Action Plan broadly details how the State expects to achieve a 51% reduction in overall greenhouse gas emissions by 2030 and net-zero emissions by no later than the end of 2050, as specified in the *Climate Action and Low Carbon Development (Amendment) Act 2021*. The Plan lists required actions to deliver national climate targets and sets indicative ranges of emissions reductions for each economic sector. The Plan will be revised annually to ensure alignment with legally binding economy-wide carbon budgets and sectoral greenhouse gas emissions ceilings. These sectoral emissions ceilings were subsequently published in July 2022. Emissions ceilings now require key sectors (electricity, transport, buildings, industry, agriculture and other) to restrict greenhouse gas emissions to strict upper limits by 2030 (Government of Ireland, 2022).

For 2021, the Climate Action Plan sets out 493 actions for which different sectors are expected to either lead or act as a key stakeholder. Given the breadth of services provided by local authorities, the sector is recognised as a lead or key stakeholder in delivering 88 of the 493 actions (~18%) (Government of Ireland, 2021b). However, indirectly the sector plays a critical role in facilitating other sectors to deliver on their actions. These 493 actions therefore provide an important framework for developing KPIs to monitor and report on local government climate action.

2.4.3 National Adaptation Framework 2018

Ireland's first statutory National Adaptation Framework was published in 2018. It details the context to ensure key sectors and local authorities assess climate change risks and vulnerabilities, implement climate resilient actions and ensure climate adaptation considerations are mainstreamed into national, regional and local policymaking (Government of Ireland, 2018).

2.5 Local government climate action policies

2.5.1 Local Authority Climate Change Adaptation Strategies

As a key sector under the National Adaptation Framework, each local authority subsequently developed its own climate adaptation strategy in 2019 to:

1. Ensure a proper understanding of the key risks and vulnerabilities of climate change.
2. Advance the implementation of climate resilient actions in a planned and proactive manner.
3. Ensure that climate adaptation considerations are mainstreamed into all plans and policies and are integrated into all operations and functions of the local authority.

2.5.2 Local Authority Climate Action Charter

In 2019, the local government sector committed to increase its ambitions and play a key leadership role in delivering effective climate action through the publication of the *Local Authority Climate Action Charter*, which was signed by all 31 local authorities. It subsequently commits local authorities to monitor, evaluate and report annually on the implementation of activities under 23 specific climate actions (Department of the Environment, Climate and Communications, 2019).

2.5.3 Local Authority Climate Action Strategy – Delivering Effective Climate Action 2030

In 2021, the local government sector published its first climate action strategy, entitled *Delivering Effective Climate Action 2030 (DECA)*. The strategy commits to ensuring a coherent approach to climate action across the administrative and political structures of all 31 local authorities. At a sectoral level, the strategy details long-term commitments in delivering effective climate action. It represents a high-level approach to climate action and a strong commitment to the sector's prescribed leadership role. The strategy also provides a roadmap including both mitigation and adaptation responses across six strategic goals to support local authorities in developing their forthcoming Climate Action Plans (County and City Management Association, 2021).

2.5.4 Local Authority Climate Action Plans

The Climate Action and Low Carbon Development (Amendment) Act 2021 requires local authorities to develop five-year Climate Action Plans covering both mitigation and adaptation measures. This will require developing and implementing specific, action-focused, time-bound, and measurable actions to:

- Provide a strong emphasis on place-based climate action, delivering a better understanding of greenhouse gas emissions and climate-related risks at a local level, while addressing context-specific conditions and support for locally tailored policymaking.
- Deliver and promote evidence-based and integrated climate action by way of adaptation and mitigation measures centred around a strong understanding of the role and remit of the local authority on climate action.
- Translate and provide strategic direction at local and community levels on the delivery of the 2050 objective of climate neutrality.

Guidelines for local authorities are structured around a 4-step cycle for the development and implementation of local authority climate action plans, including (i) preparing the ground; (ii) building the evidence base; (iii) developing the framework of climate actions, and (iv) implementation and reporting. The development of KPIs to support monitoring, evaluation and reporting on climate actions is central to this 4-step cycle (Climate Action Regional Offices, 2022). Local authority climate action plans are due for publication at the start of 2024 and will play an important role in framing how the sector will lead by example on climate action.

2.6 Summary

The Irish State in recent years has committed to one of the most ambitious pieces of climate legislation and policy of any country internationally. Arising from this, public sector bodies are expected to lead by example by increasing their own climate action commitments. The local government sector, as a key public sector body, plays a crucial role in delivering on those commitments and has assumed an expanded role on climate action in recent years as this chapter has demonstrated (objective 1). The sector has committed to monitor, evaluate and report annually on the implementation of climate action activities. The role of KPIs are therefore essential in supporting the local government sector to demonstrate its leadership on climate action.

3 National and international best practice regarding the development of climate action KPIs

3.1 Introduction

Identifying good practice in measuring performance is an important aspect of any performance management system. However, defining good or best practice for climate actions in particular remains challenging because, although many cities or municipalities claim to be climate leaders with examples of successful actions (Castán Broto and Bulkeley, 2013), local contextual differences among cities or municipalities prevent classification of consistent themes across jurisdictions (Boehnke et al., 2019). Additionally, those climate actions implemented may be chosen based on relative ease and timeframe of implementation rather than their ability to produce effective results (Corfee-Morlot et al., 2009). Moreover, a challenge for policymakers to redirect their focus towards implementing specific programmes as opposed to creating municipal-level strategic plans means that there is often no direct link between drafting a climate action plan and actual improvements in climate action performance (Castán Broto and Bulkeley, 2013). This is a challenge which Irish local authorities are also likely to face given their different sizes and their diverse environmental, economic, and social characteristics.

To demonstrate good practice in climate action performance, monitoring must be regularly completed to highlight the effects of the implementation of projects and action plans. However, regular project-or-municipal-level data is rarely available, even from major cities considered frontrunners of climate action (Boehnke et al., 2019). Equally, due to complexity and inconsistent definitions often used in climate action metrics, variations in collecting, measuring and reporting can differ greatly both between and within municipalities. Different stakeholders might have different understandings of the meaning of metrics, and attach different relevance to them or the themes

indicators belong to (Boehnke et al., 2019). This may also be related to municipalities often being involved in the management of different sets of issues at local levels, including many that are not under their direct responsibility. Moreover, given the relatively recent attention paid to climate action there are problems with data availability or measurement without interruption (Boehnke et al., 2019). It is in this context that Section 3.2 identifies areas of best practice in developing climate action performance metrics for the local government sector.

3.2 Local government climate action performance management

3.2.1 Goal clarity

The inclusion of a performance component to climate change planning necessitates setting of targets and the development of indicators to ensure clarity of goals. Performance management principles highlight the importance of goal clarity as crucial in informing decisions, monitoring progress and identifying opportunities for quality and efficiency improvements (Ammons and Roenigk, 2015; Jones, 2019; Park and Krause, 2021).

If climate change mitigation and adaptation are to be effective at local government levels, setting clear goals is crucial i.e. actions being measured should be clear and unambiguous to ensure results can be effectively interpreted and compared across jurisdictions and over time (Dupuis and Biesbroek, 2013; Jones, 2019).

There is considerable evidence to suggest that for climate change performance metrics to be effective, and to provide accountability, there is a need to ensure indicators are of good quality such that they serve a strategic purpose (Moynihan, 2009; Park and Krause, 2021). However, where local government climate action indicators are concerned, conceptual

challenges in defining what to measure and how to measure actions often tends to lead to vague indicators or avoidance of measurement elements entirely (Dupuis and Biesbroek, 2013). Evidence subsequently suggests that to ensure effectiveness, indicators should be (1) easily measurable or quantifiable, (2) reliable, (3) valid and (4) relevant to organisational climate change targets (Park and Krause, 2021).

Municipalities that are involved in existing international climate action measurement activities (e.g. ICLEI Local Governments for Sustainability; C40 Cities Climate Leadership Group) may be more likely to keep up-to-date with emerging issues related to developing and implementing measurable climate metrics (Jones, 2019). This is an important point given that measuring climate actions is likely to remain a necessity for the local government sector in the medium-long term. Notably, only one Irish local authority (Cork City Council) is a member of the ICLEI network and no Irish local authorities are members of the C40 Cities programme at present (C40 Cities, 2021; ICLEI, 2021).

3.2.2 Mainstreaming

Organisational support systems, including qualified employees and robust and integrated IT infrastructure, play an essential role in developing and implementing KPIs (Niemann and Hoppe, 2018; Park and Krause, 2021). Where mainstreaming metrics into management processes is achieved it can be used effectively to support policy implementation, accountability, transparency and public trust (Rauken, Mydske and Winsvold, 2015; Jones, 2019). Leading global municipalities measuring climate performance have developed integrated management systems, ensuring mainstreaming and policy co-ordination across functional areas (City of Copenhagen, 2012; City of Stockholm, 2014). Conversely, lack of integration of climate actions across all municipal operations has consistently been identified as a barrier to effective climate action in Dutch cities (den Exter, Lenhart and Kern, 2015).

Notwithstanding differences in local government governance structures, which determines the extent of control municipalities have over developing climate actions and subsequent

KPIs, the need to mainstream climate goals across all municipal operations and assign clear lines of responsibility is widely recognised for climate action metrics (Zeemering, 2018; Jones, 2019; Evans, 2020; Park and Krause, 2021). Specifically, research highlights the importance of connections to climate objectives across all guiding policy documents within a municipality (Bouckaert and Halligan, 2007; Jones, 2019).

Regularly reflecting on performance metrics can ensure climate change is embedded as a core strategic policy within the local government sector (Zeemering, 2018), and can also provide important opportunities to ensure local government climate metrics are aligned with rapidly evolving national and international climate policies and legislation. Evidence suggests that to ensure effectiveness, climate performance information should be used where necessary to upgrade systems and to adjust policy responses (Bouckaert and Halligan, 2007; Park and Krause, 2021).

Performance information also has a key role in motivating employees. Specifically, it provides opportunities to learn and to improve employee performance through examining different ways of undertaking their role. In the context of mainstreaming climate actions however, evidence suggests the need to carefully balance gathering excessive amounts of data with employee perceptions that the process is unnecessarily burdensome or that it significantly increases workloads (Park and Krause, 2021). This is especially important in an Irish local government context given that the sector employees over 29,000 individuals (National Oversight and Audit Commission, 2020), and the requirement to ensure buy-in of all employees across all functional areas if mainstreaming is to be effective.

Finally, ensuring that reporting of climate-related performance data at local authority levels are actively promoted as standalone publications and results are not aggregated within annual reports can demonstrate institutional support, thereby increasing accountability, transparency, public trust and support for climate measures (Niemann and Hoppe, 2018; Jones, 2019).

3.2.3 Stakeholder support and engagement

Research has highlighted concerns over 'reporting fatigue,' leading to discontinuation, radical alteration of sustainability reporting practices or difficulties maintaining public interest over time (Niemann and Hoppe, 2018). Moreover, whilst climate change indicators are typically developed to provide policy directions, their overuse and complexity can make them unattractive for practical use by public officials and policymakers (Boehnke et al., 2019).

Communication to target audiences is also a crucial component in developing climate action metrics. This includes internal stakeholders in local government (e.g., experts, policy officers, practitioners, elected officials) and external stakeholders (e.g., public, industry, NGOs, other governmental departments). For indicators to be effective in raising public awareness about climate change, and to inspire behavioural changes and collective action, discussion forums involving a wide range of stakeholders is essential (Zeemering, 2018; Boehnke et al., 2019). Research shows that effective practices in local climate action are more likely to succeed where municipalities act as facilitators, enabling other actors to implement climate actions (Boehnke et al., 2019; Evans, 2020).

Moreover, the importance of citizens being kept informed of local authorities' climate performance and how these are making a difference is critical (Park and Krause, 2021), especially given the need for local authorities in Ireland to support community capacity building and promote citizen engagement with respect to climate actions and policies. Partnering with citizens, NGOs and businesses in designing, monitoring and updating of climate action performance indicators to ensure buy-in, accountability and trust from the outset is therefore crucial (Palermo and Hernandez, 2020).

3.2.4 Benchmarking and baseline periods

Benchmarking is a common feature that is utilised in performance management and compares an organisation's performance to that of a similar organisation. Research shows that jurisdictions with benchmarking policies typically deliver significant decreases in greenhouse gas emissions. For example, buildings in San Francisco subject to specific benchmarking and energy audit requirements reduced emissions by 17% (C40 Cities, 2015).

Care must be taken in comparing performance across local authority functional areas however given competing policy priorities of different local authorities more generally (National Oversight and Audit Commission, 2020). Whilst there may be differences or factors beyond the organisation's control that may skew comparisons between organisations it can still help municipalities and elected officials understand issues and the degree to which they are being addressed. Consequently, benchmarking of climate change performance metrics across local authorities offers a useful means of comparison, especially given that all local authorities are likely to be required to meet similar climate change performance targets in the future (Evans, 2020). Benchmarking with similar local authorities can identify successes and challenges and the management or service delivery methods used (Sezginalp, 2016). More importantly, it offers a means for sectoral best practices to be identified and embedded at an individual local authority level and to be extended at a sectoral level.

The way in which a target is defined is also an important consideration. For instance, the time period of any target, i.e. whether it is a long-term or short-term goal and whether it requires annual reductions or reductions in a single future target year, ultimately determine how municipalities will work to achieve it (Damsø, Kjær and Christensen, 2017).

C40, a network of global megacities, has published a number of good practice guidelines for climate actions. However, implementation of these guides may require far greater capacities, political support, and budgets than are available to smaller local authorities (Boehnke et al., 2019).

Similarly, the Covenant of Mayors (CoM) has developed several “Benchmark[s] of Excellence”. Despite this however, these are not a codification of good practice, as they provide no guide to implementation or budgets required. Moreover, monitoring whether climate actions have actually been undertaken is difficult as they only contain a statement that an action has been taken without significant further explanation (Boehnke et al., 2019).

Baselines are also required as a starting point for measuring performance, against which to assess future performance. Historical performance is typically used as the starting baseline. Where no historical data exists, performance estimates can be determined. However, baselines should not be arbitrarily set. Specifically, evidence suggests that a baseline period should be set to align with the intended outcome so it can provide insight on whether performance was successful or not (Sezginalp, 2016). This is especially important where climate action performance metrics are concerned given the evolving nature of both climate change and climate policy (City of Vancouver, 2020).

3.2.5 Simplicity

Evidence highlights the need for simplicity where performance measures are concerned. If too many metrics are developed that demand significant human and financial resources, it is likely to result in ineffective performance management (Sezginalp, 2016).

Equally, measures should be clear and concise and allow for universal measurability across organisations. Clear definitions of measures and data will ensure that staff, managers, elected officials and citizens are able to understand and use the information appropriately. Evidence also suggests that performance measurement information should be developed to serve multiple audiences (Sezginalp, 2016), and should be devoid of technical jargon where possible.

3.3 Climate action KPIs across jurisdictions

3.3.1 Introduction

The development of climate action KPIs across international jurisdictions is not uniform. Governance structures and political, environmental, economic and social priorities often differ significantly, not just at a national level but also at subnational levels e.g., regions/local authorities. Specifically, where KPIs are developed to measure progress across these priorities, they are often context-specific to the jurisdiction in which they were developed.

Equally, whilst EU legislation requires member States to achieve reductions in greenhouse gas emissions, member States often have autonomy over how they will achieve such targets aligned to their own unique governance structures and competing political, environmental, economic and social priorities. This section subsequently highlights the relevance of governance structures to the development of climate action KPIs based on international literature and then identifies the primary ways climate actions are categorised by leading global municipalities in developing climate action KPIs.

3.3.2 Comparison of governance structures across jurisdictions

Local authority governance structures differ significantly internationally. Governance in Ireland is characterised by a high degree of centralisation by international standards (Kitchin et al., 2012; Callanan and Tatham, 2014). For instance, in addition to the functions that local authorities in Ireland have responsibility for (building and planning regulations; business rates; social housing; parking; waste collection; environmental health; economic development; sports centres, parks and playing fields), the UK local government sector also has responsibility for education and certain public health and social services (Evans, 2020). Similarly, Danish municipalities have extended powers related to pre-school childcare, eldercare and special needs care, certain healthcare, unemployment and illness, retirement benefits and utilities in addition to the key services provided by their Irish counterparts (Ministry for Economic Affairs and the Interior, 2014).

A review of the literature related to climate action KPIs for this study consequently found that municipalities in other jurisdictions typically had greater control of and responsibility for the development of climate mitigation and adaptation targets than is available for the Irish local government sector. Evidence of international practices in developing climate action KPIs might therefore not align with Irish local government governance structures. Findings in this report are subsequently based solely on Irish local authority governance structures and those functions and responsibilities that apply to the sector.

3.3.3 Development of climate action KPIs

Broadly speaking, both the academic literature and global municipality best practices with respect to climate KPIs align to either mitigation or adaptation metrics. In the context of mitigation actions, an important recurring theme with respect to those municipalities considered at the forefront of global climate action is the framing of their climate action plans around a single guiding KPI i.e. *reducing greenhouse gas emissions by a certain percentage by a certain future date* e.g. 0% carbon emissions by no later than 2050 (City of Copenhagen, 2012; City of Amsterdam, 2020; City of Vancouver, 2020; City of Sydney, 2021). It is on the basis of this single climate action target that these municipalities subsequently develop climate action plans with measurable indicators across all operational areas to assess annual performance against this target. This process ultimately demands that a full greenhouse gas emissions baseline inventory of each municipal operational area is undertaken. Steps can then be taken to mainstream climate action into decision-making and annual performance towards the single guiding KPI can be tracked.

Whilst this approach offers a useful means of classifying actions for the purpose of mitigation metrics, given the nature of adaptation, it is difficult to identify a single metric against which adaptation success can be measured. Nonetheless, considerable work has been completed in identifying adaptation metrics in recent years, particularly for the local government sector (Flood, Dwyer and Gault, 2021).

A metric can often provide both mitigation and adaptation benefits e.g., increased tree canopy cover can absorb CO₂ from the atmosphere (mitigation) and can also provide shade during heatwaves or absorb excess rainfall during flood events (adaptation). For this reason, a clear distinction between mitigation or adaptation metrics is not always evident.

3.4 KPI types

The use of performance metrics to measure climate actions is a relatively recent concept within the climate change literature. Whilst many studies have focused on developing broader sustainability indicators related to social, environmental and economic performance (Li, Gu and Liu, 2018; Chao et al., 2020), few have explicitly examined performance indicators solely related to climate change. Even fewer studies exist which examine or compare metrics for climate actions across public sector bodies or at smaller scales such as local government. In the context of KPIs, it is important to distinguish between impact, implementation and outcome indicators. Impact indicators provide information about the observed impacts of climate variability and change on socio-ecological systems, e.g., number of damaged properties by floods. Implementation indicators provide information to help measure the implementation of actions or strategies. Finally, outcome indicators provide information to measure the outcome of results of actions or strategies (Flood, Dwyer and Gault, 2021). Taken together, they provide a means to develop KPIs that capture all stages of climate action monitoring and evaluation (Flood, Dwyer and Gault, 2021).

3.5 Summary

All performance management systems require the development of robust metrics. Specifically, where climate change performance management is concerned the need for clear climate metrics, mainstreaming climate performance indicators across all aspects of an organisation, ensuring that metrics are used to encourage broad stakeholder engagement, developing appropriate benchmarks and baseline periods, and ensuring any metrics developed are simple, reliable and relatively easy to capture, are crucial.

Municipalities in other jurisdictions typically have greater control over the development of climate planning and targets than is available to the Irish local government sector. Regardless of governance structures however, KPIs across jurisdictions typically align to either mitigation or adaptation metrics. Given the urgent need to mitigate climate change, an important recurring theme with respect to climate action KPIs developed by those municipalities considered at the forefront of global climate action is the framing of their climate action plans around a reduction in greenhouse gas emissions within a certain timeframe. Climate change affects all local government operations. Delivering on commitments to measure and improve climate performance therefore requires that mitigation and adaptation metrics be mainstreamed into decision-making across all organisational functional areas.

4 Methods for identifying appropriate KPIs

4.1 Introduction

This chapter addresses the remaining three objectives of this report. Specifically, in Section 4.2 the approach taken to identify a set of KPIs that individual local authorities can select from, and that can be aggregated at a sectoral level, to track specific local climate actions is provided. The KPIs are subsequently aligned to specific services and functions performed by local authorities in Section 4.3, guided by the categorisation of services and functions in the *Local Authority Climate Action Plan Guidelines (Draft)*. This is followed by a categorisation of KPIs under the six thematic areas identified in the local government sector's own climate action strategy, *Delivering Effective Climate Action 2030*. The mapping of KPIs to local authority functional areas and to sectoral strategic climate action goals provides both operational and strategic direction that should support the sector's climate action commitments.

4.2 Developing an updated list of local authority climate action KPIs: Search strategy

As a first step to identifying potentially relevant climate action KPIs, a thorough review of four databases was undertaken since the initial KPI scoping exercise by Clarke (2021). The objective of this was to review and develop an updated set of KPIs that individual local authorities can select from, and that can be aggregated at a sectoral level, to track specific local climate action outcomes given advances in research, climate policy and legislation since 2021. These databases included Google Scholar, Web of Science, Academic Search Complete and Scopus.

These datasets represent some of the most widely used in academic research. For the initial

search, several search words were identified as relevant. Searches included keywords, topic, title and abstract words containing "climate change" AND "performance indicator" OR "performance metric" OR "key performance indicator" OR "performance management" AND "local government" OR "city" OR "cities" OR "municipal" OR "urban" OR "local authority*"¹ (i.e., as exact word phrases) in all databases. As is common practice, using the exact word phrase standardised the search in all databases and eliminated researcher bias (Linder et al., 2015). Database searches returned the following publications relevant to the keyword searches:

- Google Scholar (N=200²)
- Scopus (N=90)
- Academic Search Complete (N=19)
- Web of Knowledge (N=14)

In addition to the review of academic databases, other secondary sources were examined in detail, including multiple websites of local governments internationally and other relevant websites/reports which provide evidence and examples of climate change performance indicators or metrics applicable to local government (Figure 1, Step 1). All articles were initially screened by title and abstract to assess relevance (Figure 1, Step 2). Database searches were conducted in June 2022 and were not time-period specific i.e., publications across all years were included. Duplicate publications across all databases were crosschecked and removed. A detailed review of each publication then determined its suitability for further consideration (Figure 1, Step 3). An updated review of the literature from the Clarke (2021) study identified 121 climate action KPIs: mitigation (38), adaptation (50) and combined mitigation/adaptation (33) metrics. Table 1 provides an overview of each of the 121 KPIs.

¹ The 'authorit*' search word is a wildcard search function that searches using all words that begin a certain way but which could end in a variety of ways e.g. authorities, authority i.e., the wildcard * function searches for all words that begin with 'authorit' but which could end with anything.

² The first 200 articles in Google Scholar were examined based on the specific word criteria applied to the three other research databases

4.2.1 Sectoral workshop

A scoping workshop was held with local authority employees in July 2022. This workshop included representatives from each of the four CAROs and employees in climate/environment related roles from across all of the 31 local authorities nationally. Each KPI was subsequently reviewed by workshop participants based on its potential effectiveness to capture local authority climate action performance. A key outcome of this process was that whilst some indicators were considered as more relevant than others by participants, it was recognised that further work was needed at a sectoral level in refining indicators and in agreeing KPIs considered as most relevant for the sector. These 121 KPIs therefore represent an attempt to develop a wide set of indicators that individual local authorities can draw from, and that can be aggregated at a sectoral level, to track specific climate action outcomes (objective 2).

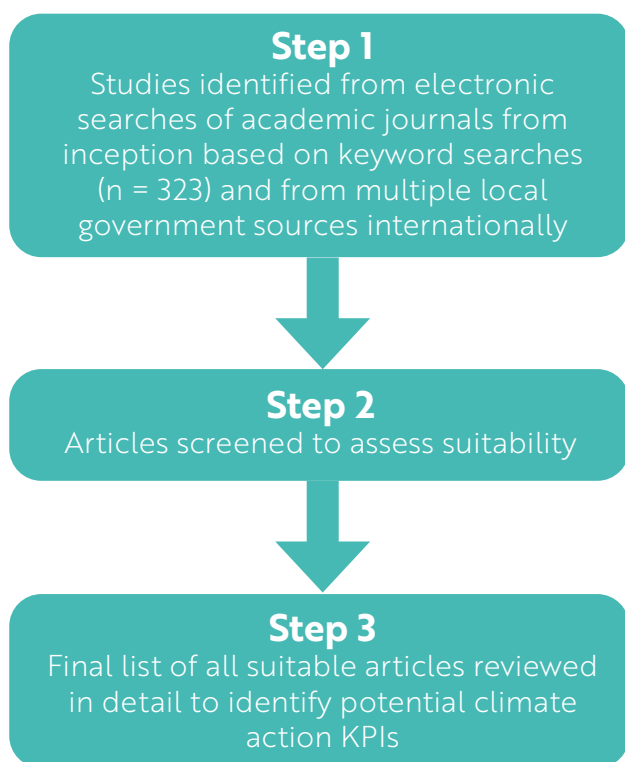


Figure 1: Literature review research methods flowchart

4.3 Align KPIs to local authority climate action commitments

Climate change is a cross-cutting issue that impacts the entire range of functions and activities of local authorities. The *Local Authority Climate Action Plan Guidelines (Draft)* identified 19 areas in which local authorities provide services including, corporate, community development, economic development, information technology, environment and environmental awareness, water services, planning, housing, finance, area offices, roads/transportation, parks/recreation, heritage, energy efficiency, biodiversity, facilities, libraries, arts and culture and fire services (Climate Action Regional Offices, 2022). These categorisations were used to support the initial KPI database search. Each KPI was subsequently categorised based on these functions. Given the cross-cutting nature of local authority functions, some KPIs may align with multiple local authority functional areas (Table 1). From an operational viewpoint, this is a useful baseline for the sector in identifying climate action KPIs that represent all local authority services (objective 3).

Additionally, within the sector's own climate action strategy, local authorities are committed to six shared strategic goals (County and City Management Association, 2021). These include:

1. Foster governance, leadership and partnerships for climate action.
2. Achieve our carbon emission and energy efficiency targets for 2030 and 2050.
3. Deliver on climate adaptation and climate resilience.
4. Mobilise climate action in local communities.
5. Mobilise climate action in enterprise and support transition to an inclusive, net zero and circular economy.
6. Achieve a 'just transition' particularly for communities that may be economically disadvantaged by decarbonising projects.

Each KPI was subsequently mapped to these strategic goals (Table 1). 15 KPIs met two strategic goals, 64 KPIs aligned to three strategic goals, 27 KPIs met four strategic goals, 6 KPIs related to five strategic goals and 9 KPIs aligned to all six strategic goals in *Delivering Effective Climate Action 2030* (objective 4). The mapping of these KPIs against sectoral strategic goals provides direction to the sector in identifying indicators that support its strategic climate action commitments.

4.4 Summary

Drawing on a detailed review of the literature, this chapter identified 121 potentially relevant climate action KPIs for the local government sector. This offers a potentially useful KPI list which individual local authorities may choose from, and that can be aggregated at a sectoral level, to measure climate action performance over the coming years. Identifying a national set of indicators to demonstrate sectoral climate action performance however requires further work. Moreover, sectoral indicators are likely to evolve over the coming years as climate policy and legislation advances. In developing a set of sectoral indicators, it is therefore essential that these are strategic insofar as possible based on the sector's own climate action strategy and the State's 2030 and 2050 climate action commitments. Such a strategic approach reduces the risk of performance metrics becoming redundant within a short period of time.

5 Research review summary

Increased attention in recent years on climate action at international, national and local levels have resulted in greater climate change responsibilities being placed on all Irish public sector bodies, including the local government sector. Demonstrating measurable mitigation and adaptation performance is now required for all public sector bodies, including for local government. This includes monitoring, evaluating and reporting on climate actions at a national level. This report therefore supports the local government sector in identifying KPIs that may be applicable in measuring its own climate action performance. Drawing on both academic literature and municipalities globally, this report identified 121 KPIs related to both mitigation and adaptation that may offer some level of transferability or adaptability for the Irish local government sector.

Chapter 2 provided context of the extensive role local authorities have assumed in recent years arising from climate legislation and policy developments, including a rationale for the development of sectoral climate action KPIs. Chapter 3 then identified national and international best practices regarding the development of climate action KPIs. Chapter 4 presented 121 KPIs taken from both the academic literature and a range of international municipal best practices. These may assist the Irish local government sector in measuring their climate change commitments. These indicators have been aligned to local authority functional areas and to the sector's own climate action strategy. The broad remit of the KPIs identified further supports the need to mainstream climate actions into all local authority services. Sectoral stakeholders now have an opportunity to identify a set of indicators which could be used to demonstrate local government climate action performance.

Data availability is a key area of consideration when developing KPIs. Data for many of the indicators identified in this study may not be

formally captured by the sector at present, and for many indicators, systems and policies may need to be established so that they can be accurately captured in the long-term. As with any performance indicators, the importance of developing a reporting framework to capture these indicators is crucial. Without such a framework, monitoring and reporting will prove challenging to measure.

Fortunately, the sector has the appropriate governance structures in place to oversee, monitor and react to these findings. The CCMA Climate Action, Transport and Networks Committee and the Climate Action KPI Working Group provide the structure through which KPIs can be monitored while also facilitating on-going engagement with staff on the ground locally. The involvement of the Climate Action Regional Offices and the LGMA ensure the national and regional perspectives are also captured. The on-going engagement that the LGMA and CCMA have with the National Oversight and Audit Commission (NOAC) in relation to the Climate Action KPIs ensures the indicators are incorporated into the national performance monitoring system for the sector. This gives them an enhanced profile and ensures the KPIs are monitored outside the sector which increases the level of accountability and transparency.

Finally, whilst the indicators in this study may be relevant in an Irish local government sector context, this research may also provide a useful baseline and practical publication to support local authorities internationally to develop their own climate action KPIs. Some of the KPIs developed may also be relevant and adaptable to other Irish public sector bodies required to monitor and evaluate their own climate action performance.

5.1 Next steps

Public sector bodies are expected to lead by example in the State's climate commitments. Local authorities have made significant advances in recent years in demonstrating leadership on climate action. Delivering on climate commitments within local authority climate action plans will require a structured process of implementing climate actions and ongoing monitoring and progress reporting. KPIs are therefore essential to implementation, monitoring and reporting of climate actions (Government of Ireland, 2021b; Climate Action Regional Offices, 2022).

Evidence suggests that to ensure effectiveness, indicators should be (i) easily measurable or quantifiable, (ii) reliable, (iii) valid and (iv) relevant to organisational climate change targets (Park and Krause, 2021). This is an important point. All 121 identified KPIs potentially meet these criteria and are relevant to the local government sector. Some however might be more effective than others. Thus, rather than being prescriptive the KPIs presented here provide a firm basis for further sectoral discussions on those indicators that might be most effective for the sector in implementing, monitoring and reporting on its climate actions.

At a strategic level, this should involve sectoral stakeholders identifying and agreeing a set of indicators that support its climate action commitments as contained in the *Climate Action Charter* and *Delivering Effective Climate Action 2030*. This research provides a baseline for this process. It may now be useful for the sector to identify local authority functional areas where no KPI was identified within this research to determine if KPIs for those functional areas are necessary and could add to those identified in this report.

The rapidly evolving nature of climate action policy and legislation means that any agreed sectoral indicators will require ongoing review to ensure they remain relevant to sectoral and national climate action strategy. However, this should not delay the identification and implementation of climate action KPIs at either a sectoral or individual local authority level. It is essential that local authorities implement and report on climate actions without delay given the urgency of the climate crisis and the need to lead by example nationally.

5.2 Limitations

Whilst this study aimed to identify climate action KPIs relevant to the Irish local government sector's climate action commitments, given the rapidly evolving nature of climate action commitments internationally it may not fully represent all relevant KPIs for the Irish local government sector. Notwithstanding this, it enables the local government sector to identify both sectoral-relevant and locally relevant KPIs as it begins to monitor its climate action performance. Undertaking periodic reviews of indicators to ensure they remain relevant, are aligned with international best practice, and are applicable to the rapidly changing nature of climate policy at both EU and national levels is essential. In the long term however, being equally ambitious in choosing metrics, and in capturing and improving climate action performance, is also crucial to ensure commitments and targets detailed in national and local climate policy and legislation are fulfilled.

5.3 Concluding remarks

Performance management systems and performance indicators can serve as an effective means of capturing best practices, and in identifying potential areas of improvement for organisations. Increased attention on climate change in recent years however has coincided with organisations seeking to explore, develop and adopt metrics specifically related to climate action performance to demonstrate their commitments and progress in this area.

The Irish local government sector has assumed an enhanced role in terms of climate action commitments in recent years arising from various policy and legislative changes. The KPIs identified in this study may assist the Irish local government sector and offer some level of transferability or adaptability for local authorities in measuring their climate change commitments. Ease of measurability, reliability, validity and relevance to organisational climate change targets are essential with these metrics. As sectoral climate action commitments progress, more data may become available against which performance can be measured. This structured approach may subsequently facilitate meaningful KPIs to be embedded based on sectoral commitments, policies, learnings and best practices. Developing and implementing KPIs without delay is essential if the local government sector it to fulfil its obligations to lead by example on climate action.

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7 Appendices

Local authority functional area as per Local Authority Climate Action Plan Guidelines (Draft)	Mitigation/ Adaptation	Proposed KPI	KPI unit	DECA strategic goal (1-6)	Academic information sources	Leading climate action municipalities utilising this/similar indicator
Biodiversity	Adaptation	Extent (km ²), duration and frequency of protected habitat flooding that can result in habitat damage and species loss	km ² , days, instances/year	1,3	(Flood, Dwyer and Gault, 2021)	
Biodiversity	Adaptation	Extent and economic costs associated with other vegetation fires; normally fires on scrub, farm or marginal land	km ² , €	1,3	(Flood, Dwyer and Gault, 2021)	
Biodiversity	Adaptation	Change in incidence of and area impacted by other vegetation fires; normally fires on scrub, farm or marginal land	km ² , number	1,3	(Flood, Dwyer and Gault, 2021)	
Corporate/ Finance	Mitigation/ Adaptation	Percentage of contracts awarded using green procurement criteria	%	1,2,3,4,5	(Turner et al., 2014)	
Corporate/ Finance	Mitigation/ Adaptation	Value of contracts awarded using green procurement criteria	€	1,2,3,4,5	(Turner et al., 2014)	
Corporate/ Internal operations	Adaptation	Mainstreaming of climate change adaptation into local authority operations	Percentage full-time equivalent/ climate action team established/ climate action SPC/ incorporation into training framework in PDMS	1,3,4,6	(Flood, Dwyer and Gault, 2021)	
Corporate/ Internal operations	Mitigation	Percentage of customer transactions/local authority services completed online, thereby reducing potential need for customer travel	%	1,2		(Evans, 2020)

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Corporate/ Internal operations	Mitigation	Percentage of staff who work at home or remotely for at least 20% of the time	%	1,2,4		(Dorset Council, 2020)
Corporate/ Internal operations	Mitigation	Estimated greenhouse gas emissions reductions as a result of staff working at home or remotely	%	1,2,4		(Dorset Council, 2020)
Corporate/ Internal operations	Mitigation/ Adaptation	Percentage of 1) elected members 2) local authority staff to avail of climate action training as per the Local Authority Climate Action Training Plan	%	1,2,3,4,5,6	(Scott, 2018)	
Corporate/ Internal operations	Mitigation/ Adaptation	Percentage of staff trained in adaptation/ scenario planning	%	1,2,3,4,5,6	(Serdar, Koç and Al-Ghamdi, 2022)	
Corporate/ Internal operations	Mitigation/ Adaptation	Number of capacity building initiatives/ staff engaged in knowledge sharing and information exchange to increase awareness of climate mitigation and adaptation issues across departments and agencies	Number of capacity building initiatives/ Number of staff engaged	1,2,3,4,5,6	(Flood, Dwyer and Gault, 2021)	
Economic development	Mitigation/ Adaptation	Number of green sector businesses supported through Local Enterprise Office initiatives in given year	Numeric value	1,5		(Dorset Council, 2020)
Energy efficiency	Mitigation	Cumulative percentage energy savings achieved relative to baseline year	%	1,2	(Azizalrahman and Hasyimi, 2018; Government of Ireland, 2019; Al Dakheel et al., 2020; Chao et al., 2020; Clarke and O'Donoghue-Hynes, 2020; Friends of the Earth, 2021)	(City of Copenhagen, 2012; City of Stockholm, 2016)

Local authority functional area as per Local Authority Climate Action Plan Guidelines (Draft)	Mitigation/ Adaptation	Proposed KPI	KPI unit	DECA strategic goal (1-6)	Academic information sources	Leading climate action municipalities utilising this/similar indicator
Energy efficiency	Mitigation	Percentage reduction in greenhouse gas emissions from energy efficiencies achieved since baseline year	%	1,2	(Azizalrahman and Hasyimi, 2018; Government of Ireland, 2019; Al Dakheel et al., 2020; Chao et al., 2020; Clarke and O'Donoghue-Hynes, 2020; Friends of the Earth, 2021)	(City of Copenhagen, 2012; City of Stockholm, 2016)
Energy efficiency	Mitigation	Proportion of energy self-sufficiency based on renewable energies use by local authorities	%	1,2	(Azizalrahman and Hasyimi, 2018; Government of Ireland, 2019; Al Dakheel et al., 2020; Chao et al., 2020; Clarke and O'Donoghue-Hynes, 2020; Friends of the Earth, 2021)	(City of Copenhagen, 2012; City of Stockholm, 2016; Ajuntament de Barcelona, 2020; City of Amsterdam, 2020; Dorset Council, 2020; City of Sydney, 2021)
Energy efficiency	Mitigation	Proportion of renewable heat use in local authority buildings	%	1,2	(Azizalrahman and Hasyimi, 2018; Government of Ireland, 2019; Al Dakheel et al., 2020; Chao et al., 2020; Clarke and O'Donoghue-Hynes, 2020; Friends of the Earth, 2021)	(City of Copenhagen, 2012; City of Stockholm, 2016; Ajuntament de Barcelona, 2020; City of Amsterdam, 2020; Dorset Council, 2020; City of Sydney, 2021)
Energy efficiency	Mitigation	Proportion of local authority buildings with a Building Energy Rating (BER) 'B' rating	%	1,2	(Government of Ireland, 2019; Chao et al., 2020)	(City of Copenhagen, 2012; City of Amsterdam, 2020)
Energy efficiency	Mitigation	Energy savings (€) annually (from previous/baseline year)	€	1,2	Government of Ireland, 2019; Chao et al., 2020)	(City of Copenhagen, 2012; City of Amsterdam, 2020)
Energy efficiency	Mitigation	Energy savings (€) annually (from previous/baseline year)	€	1,2	(Turner et al., 2014; Alrashed, 2020; Balaras et al., 2020)	(City of Copenhagen, 2012)

Local authority functional area as per Local Authority Climate Action Plan Guidelines (Draft)	Mitigation/ Adaptation	Proposed KPI	KPI unit	DECA strategic goal (1-6)	Academic information sources	Leading climate action municipalities utilising this/similar indicator
Energy efficiency	Mitigation	Energy savings (KWh) annually (from previous/baseline year)	KWh	1,2	(Turner et al., 2014; Balaras et al., 2020; Marotta et al., 2021)	
Energy efficiency	Mitigation	Percentage of local authority municipal buildings with temperature control systems installed	%	1,2	(Alrashed, 2020)	
Energy efficiency/ Environment and environmental awareness	Mitigation	Annual greenhouse gas emissions in carbon dioxide (CO ₂) equivalent, including Scope 1, 2 and 3 emissions	Metric tonnes	1,2,4,5,6	(Department for Communities and Local Government, 2008; Pearce and Cooper, 2011; Zhou and Williams, 2013; Damsø, Kjær and Christensen, 2017; Azizalrahman and Hasyimi, 2018; Kilkiş, 2018; Li, Gu and Liu, 2018; Boehnke et al., 2019; Government of Ireland, 2019; Alrashed, 2020; Chao et al., 2020; Marotta et al., 2021; van Loon-Steensma and Goldsworthy, 2022)	(City of Stockholm, 2016; Ajuntament de Barcelona, 2020; City of Amsterdam, 2020; City of Vancouver, 2020; City of Sydney, 2021)
Energy efficiency/ Environment and environmental awareness	Mitigation	Cumulative percentage greenhouse gas emission reductions achieved relative to baseline year	%	1,2,4,5,6	(Department for Communities and Local Government, 2008; Pearce and Cooper, 2011; Helmus and Van den Hoed, 2016; Kilkiş, 2018; Boyle et al., 2019; Alrashed, 2020; Marotta et al., 2021; van Loon-Steensma and Goldsworthy, 2022)	(City of Stockholm, 2016; City of Amsterdam, 2020; City of Vancouver, 2020; City of Sydney, 2021)

Local authority functional area as per Local Authority Climate Action Plan Guidelines (Draft)	Mitigation/ Adaptation	Proposed KPI	KPI unit	DECA strategic goal (1-6)	Academic information sources	Leading climate action municipalities utilising this/similar indicator
Environment and environmental awareness	Adaptation	Rate of loss or displacement of sediment and rocks along the coastline due to the action of waves, currents, tides and storm events	m ²	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Adaptation	Economic impact of coastal erosion damage to private and public property	Number of properties affected/€	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Adaptation	Extent of areas protected by and economic investment in coastal protection/management measures to mitigate the impacts of coastal erosion	km ² , €	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Adaptation	Economic investment in programmes to monitor and forecast coastal erosion	€	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Adaptation	Change in damage costs of coastal erosion impacts on built heritage as a result of economic investment in coastal protection/management to mitigate impact of coastal erosion	€	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Adaptation	Change in coastal erosion impacts on protected habitats and species (habitat condition and species impacts) as a result of economic investment in coastal protection/management measures to mitigate impact of coastal erosion	Habitat condition and species numbers	1,3,6	(Flood, Dwyer and Gault, 2021)	

Local authority functional area as per Local Authority Climate Action Plan Guidelines (Draft)	Mitigation/Adaptation	Proposed KPI	KPI unit	DECA strategic goal (1-6)	Academic information sources	Leading climate action municipalities utilising this/similar indicator
Environment and environmental awareness	Adaptation	Percentage of storms where at least one property is flooded	%	1,3,6	(Jones, 2019)	(C40 Cities, 2019)
Environment and environmental awareness	Adaptation	Percentage of properties in local authority which are within each of the following areas: 1 in 10 year, 1 in 50 year, 1 in 100 year, 1 in 200 year flood risk zone	%	1,3,6	(Jones, 2019)	(C40 Cities, 2019)
Environment and environmental awareness	Adaptation	Percentage of population/properties protected by flood protection measures	%	1,3,6	(Villanueva, 2011)	
Environment and environmental awareness	Adaptation	Financial investment in flood protection measures in local authority annually	€	1,3,6	(Jones, 2019)	(C40 Cities, 2019)
Environment and environmental awareness	Adaptation	Number of metres of permeable paving installed annually	Metres	1,3,6	(van de Ven et al., 2016)	
Environment and environmental awareness	Adaptation	Economic costs of coastal flooding damage to private and public property	€	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Adaptation	Total number of properties flooded (residential and commercial) over a given period (annual basis or reporting period)	Number, km ²	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Adaptation	Extent of areas protected by and economic investment in coastal protection/management measures to mitigate the impacts of coastal flooding	km ² , €	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Adaptation	Number of properties in river floodplains protected by existing measures, hard and soft defences	Number	1,3,6	(Flood, Dwyer and Gault, 2021)	

Local authority functional area as per Local Authority Climate Action Plan Guidelines (Draft)	Mitigation/Adaptation	Proposed KPI	KPI unit	DECA strategic goal (1-6)	Academic information sources	Leading climate action municipalities utilising this/similar indicator
Environment and environmental awareness	Adaptation	Number of protected/vulnerable areas/properties to pluvial and fluvial flooding	Number	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Adaptation	Number of vulnerable heritage sites, including architectural and archaeological heritage, located in river floodplains	Number	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Adaptation	Number of private and commercial properties located in river floodplains	Number	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Adaptation	Percentage of river embankments that include height to protect against future flood risk, where an embankment is an artificial bank raised above the immediately surrounding land to redirect or prevent flooding by a river	%	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Adaptation	Change in number of properties at flood risk due to construction of new or enhanced coastal defences, including soft and hard defensive measures	Change in number of properties	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Adaptation	Change in number of vulnerable heritage sites, including architectural and archaeological sites located in river/coastal floodplains	Change in number	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Adaptation	Change in flooding damage cost impacts on built heritage as a result of construction of new or enhanced coastal defences	€	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Adaptation	Percentage change in number of properties located in river floodplain	% change	1,3,6	(Flood, Dwyer and Gault, 2021)	

Local authority functional area as per Local Authority Climate Action Plan Guidelines (Draft)	Mitigation/ Adaptation	Proposed KPI	KPI unit	DECA strategic goal (1-6)	Academic information sources	Leading climate action municipalities utilising this/similar indicator
Environment and environmental awareness	Adaptation	Percentage change in embankments that include height to protect against future flood risk	% change	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Mitigation/ Adaptation	Percentage of days per annum where air quality levels exceeded EU air quality regulations for each of the following: Ozone, Nitrogen dioxide, Sulphur dioxide, PM2.5 and PM10 particles for monitoring stations in local authority	%	1,2,3,4,6	(Institute for Urban Strategies, 2018; Zhang and Zhou, 2018; Lien et al., 2019; Balaras et al., 2020; Marotta et al., 2021; van Loon-Steensma and Goldsworthy, 2022)	(City of Stockholm, 2016; City of Vancouver, 2020)
Environment and environmental awareness	Mitigation/ Adaptation	Percentage of local authority buildings with green roofs	%	1,2,3	(van de Ven et al., 2016; Institute for Urban Strategies, 2018)	
Environment and environmental awareness	Mitigation/ Adaptation	Volume of water retention capacity created through sustainable urban drainage systems (SUDs) in m ³	Numeric value	1,3,6		(C40 Cities, 2019)
Environment and environmental awareness	Mitigation/ Adaptation	Number of SUDs in place, where SUDs consist of a collection of water management practices that aim to align modern drainage systems with natural water processes by making urban drainage systems more compatible with components of the natural water cycle	Number	1,3,6	(Flood, Dwyer and Gault, 2021)	
Environment and environmental awareness	Mitigation/ Adaptation	Change in number of SUDs in place, where SUDs consist of a collection of water management practices that aim to align modern drainage systems with natural water processes by making urban drainage systems more compatible with components of the natural water cycle	Number	1,3,6	(Flood, Dwyer and Gault, 2021)	

Local authority functional area as per Local Authority Climate Action Plan Guidelines (Draft)	Mitigation/ Adaptation	Proposed KPI	KPI unit	DECA strategic goal (1-6)	Academic information sources	Leading climate action municipalities utilising this/similar indicator
Environment and environmental awareness/ Water services	Adaptation	Proportion of bodies of water that meet the environmental quality standards for ecological status	%	1,3		(City of Stockholm, 2016)
Environment and environmental awareness/ Water services	Adaptation	Proportion of bathing waters with water quality in each of the following categories 'excellent', 'good', 'sufficient'	%	1,3	(Clarke and O'Donoghue-Hynes, 2020)	(City of Stockholm, 2016)
Finance	Mitigation/ Adaptation	Dedicated annual climate change spend (€) per capita	€	1,2,3,4,5,6	(Helmus and Van den Hoed, 2016; Boehnke et al., 2019)	
Finance	Mitigation/ Adaptation	Dedicated annual climate change spend (€) as a proportion of total municipal budget (€)	%	1,2,3,4,5,6	(Boehnke et al., 2019)	
Finance	Mitigation/ Adaptation	Climate-related grant funding received (€) annually from government departments/agencies	€	1,2,3,4,5,6		(Dorset Council, 2020)
Housing	Mitigation/ Adaptation	Percentage of low-income households (social housing recipients) whereby more than 10% of household income is spent on energy	%	1,2,3,4,6	(Dilworth et al., 2011)	(Ajuntament de Barcelona, 2020; City of Amsterdam, 2020)
Housing/ Energy efficiency	Mitigation	Proportion of local authority social housing stock with a Building Energy Rating (BER) 'B2' rating	%	1,2,3,4,5,6	(Government of Ireland, 2019; Chao et al., 2020)	(Ajuntament de Barcelona, 2020; City of Amsterdam, 2020; City of Vancouver, 2020)
Housing/ Energy efficiency	Mitigation	Proportion of local authority social housing stock with a Building Energy Rating (BER) in each of the BER categories A-F	%	1,2,3,4,5,6	(Government of Ireland, 2019; Chao et al., 2020)	(Ajuntament de Barcelona, 2020; City of Amsterdam, 2020; City of Vancouver, 2020)

Local authority functional area as per Local Authority Climate Action Plan Guidelines (Draft)	Mitigation/ Adaptation	Proposed KPI	KPI unit	DECA strategic goal (1-6)	Academic information sources	Leading climate action municipalities utilising this/similar indicator
Housing/ Energy efficiency	Mitigation/ Adaptation	Annual reduction in carbon emissions from local authority social housing as a result of retrofitting (based on average national household energy usage)	%	1,2,3,4,5,6		(City of Copenhagen, 2012; City of Amsterdam, 2020; City of Vancouver, 2020)
Parks/ Recreation	Mitigation/ Adaptation	Ratio of population to public green space/ public parks (m ²)	Ratio/%	1,3,4	(Zhang and Zhou, 2018)	
Parks/ Recreation	Mitigation/ Adaptation	Percentage change in fertiliser use by council annually	%	1,3,4		(Dorset Council, 2020)
Parks/ Recreation	Mitigation/ Adaptation	Proportion of citizens with access to public green space/park within x kilometres	Ratio/%	1,3,4		(City of Stockholm, 2016)
Parks/ Recreation	Mitigation/ Adaptation	Estimated CO ₂ removal from/addition to atmosphere through net trees planted/removed	Metric tonnes	1,2,3,4		(C40 Cities, 2019)
Parks/ Recreation	Mitigation/ Adaptation	Net addition/removal to tree cover i.e. no. of trees planted minus no. of trees removed	Numeric value	1,2,3,4	(Csete and Buzasi, 2016; van de Ven et al., 2016; Institute for Urban Strategies, 2018; Scott, 2018; Government of Ireland, 2019; Chao et al., 2020; Clarke and O'Donoghue-Hynes, 2020; Friends of the Earth, 2021)	(C40 Cities, 2019; Dorset Council, 2020; Evans, 2020; City of Sydney, 2021)
Parks/ Recreation	Mitigation/ Adaptation	Tree species percentage breakdown for new trees planted for each of the following: plant family, genus and species	Numeric value	1,2,3,4	(Institute for Urban Strategies, 2018)	(C40 Cities, 2019; Dorset Council, 2020; City of Sydney, 2021)
Planning	Adaptation	Number of private planning applications approved in high-risk areas e.g. flooding, landslide	Numeric value	1,3,6	(Villanueva, 2011; Flood, Dwyer and Gault, 2021)	

Local authority functional area as per Local Authority Climate Action Plan Guidelines (Draft)	Mitigation/Adaptation	Proposed KPI	KPI unit	DECA strategic goal (1-6)	Academic information sources	Leading climate action municipalities utilising this/similar indicator
Planning	Adaptation	Area of land rezoned by local authorities to avoid building on floodplains	km ²	1,3,6	(Flood, Dwyer and Gault, 2021)	
Planning	Adaptation	Change in area of land rezoned by local authorities to avoid building on floodplains, where land is rezoned from residential or commercial use to other land uses	km ²	1,3,6	(Flood, Dwyer and Gault, 2021)	
Planning	Mitigation	EV parking places available for public use in local authority public spaces	Numeric value	1,2,4,6	(Marotta et al., 2021)	
Planning	Mitigation	Number of local authority installed charging facilities for electric vehicles	Numeric value	1,2,4,6	(Helmus and Van den Hoed, 2016; Alrashed, 2020; Marotta et al., 2021)	(City of Amsterdam, 2020; Evans, 2020)
Planning	Mitigation	Percentage of population within x kilometres of local authority installed EV charging facilities	%	1,2,4,6	(Friends of the Earth, 2021)	(City of Vancouver, 2020)
Planning	Mitigation/Adaptation	Proportion of new housing construction placed within x meters/kilometres of public transport	%	1,2,3,4		(City of Stockholm, 2016)
Planning	Mitigation/Adaptation	Proportion of new housing applications in a given year that are within existing urban footprint of local authority	%	1,2,3,4	(Dilworth et al., 2011)	
Pollution/Waste	Mitigation	Bulky household items recycled at local authority civic amenity sites/bring centres (tonnes)	Metric tonnes	1,4,5	(Balaras et al., 2020)	(City of Stockholm, 2016)
Pollution/Waste	Mitigation	Hazardous waste recycled at local authority civic amenity sites/bring centres (tonnes)	Metric tonnes	1,4,5	(Balaras et al., 2020)	(City of Stockholm, 2016)

Local authority functional area as per Local Authority Climate Action Plan Guidelines (Draft)	Mitigation/ Adaptation	Proposed KPI	KPI unit	DECA strategic goal (1-6)	Academic information sources	Leading climate action municipalities utilising this/similar indicator
Pollution/Waste	Mitigation	Percentage reduction in solid municipal waste in local authority municipal buildings annually	%	1,2,4,5	(Bulkeley and Kern, 2006; Zhou and Williams, 2013; Azizalrahman and Hasyimi, 2018; Li, Gu and Liu, 2018; Boyle et al., 2019; Alrashed, 2020; Balaras et al., 2020)	(City of Copenhagen, 2012; City of Stockholm, 2016; Evans, 2020; City of Sydney, 2021)
Pollution/Waste	Mitigation	Percentage of municipal waste recycled from local authority municipal buildings annually	%	1,2,4,5	(Bulkeley and Kern, 2006; Zhou and Williams, 2013; Azizalrahman and Hasyimi, 2018; Li, Gu and Liu, 2018; Boyle et al., 2019; Alrashed, 2020; Balaras et al., 2020; Friends of the Earth, 2021; Marotta et al., 2021)	(City of Copenhagen, 2012; Evans, 2020)
Pollution/Waste	Mitigation	Percentage recovery of construction and demolition (C&D) waste generated from local authority operations	%	1,2,4,5	(Bulkeley and Kern, 2006; Balaras et al., 2020)	(City of Sydney, 2021)
Pollution/Waste	Mitigation	Percentage recovery/recycling of waste from municipal parks/streets/public spaces	%	1,2,4,5	(Bulkeley and Kern, 2006; Balaras et al., 2020)	(City of Sydney, 2021)
Pollution/Waste	Mitigation	Electrical waste recycled at local authority civic amenity sites/bring centres (tonnes)	Metric tonnes	1,4,5	(Balaras et al., 2020)	(City of Stockholm, 2016)
Pollution/Waste	Mitigation	Green waste (trees, shrubs, branches) recycled at local authority civic amenity sites/bring centres (tonnes)	Metric tonnes	1,4,5	(Balaras et al., 2020)	(City of Stockholm, 2016)
Public engagement	Adaptation	Percentage of population covered by awareness building programmes to increase understanding of climate change risks among general public	%	1,3,4,6	(Villanueva, 2011)	

Local authority functional area as per Local Authority Climate Action Plan Guidelines (Draft)	Mitigation/ Adaptation	Proposed KPI	KPI unit	DECA strategic goal (1-6)	Academic information sources	Leading climate action municipalities utilising this/similar indicator
Public engagement	Adaptation	Percentage of population with access to key resources for adaptation compared with baseline measure (early warning systems, shelters, post-disaster financial assistance)	%	1,3,4,6	(Villanueva, 2011)	
Public engagement	Adaptation	Number of local authority climate trainings/community events delivered promoting capacity building to adapt to increased climate risks across all major risks (floods, storms, heatwaves, droughts and wildfires)	Numeric value	1,3,4,6		(C40 Cities, 2019)
Public engagement	Mitigation	Number of local authority climate trainings/community events delivered promoting mitigation actions related to carbon emission reductions	Numeric value	1,3,4,6	(Friends of the Earth, 2021)	(C40 Cities, 2019; City of Vancouver, 2020; Dorset Council, 2020; Evans, 2020)
Public engagement	Mitigation/ Adaptation	Financial aid (€) provided by local authorities to community groups/organisations annually for climate change projects	Numeric value	1,3,4,6		(Ajuntament de Barcelona, 2020)
Public engagement	Mitigation/ Adaptation	Number of citizen science climate change projects initiated by local authority in year	Numeric value	1,3,4,6		(C40 Cities, 2019)
Public engagement	Mitigation/ Adaptation	Percentage of local authority citizens who are aware of local authority climate actions	%	1,3,4,6		(City of Amsterdam, 2020)
Public engagement	Mitigation/ Adaptation	Total number of energy consultations undertaken by energy advisors in local authorities	Numeric value	1,3,4,6	(Friends of the Earth, 2021)	(City of Amsterdam, 2020; Dorset Council, 2020)

Local authority functional area as per Local Authority Climate Action Plan Guidelines (Draft)	Mitigation/ Adaptation	Proposed KPI	KPI unit	DECA strategic goal (1-6)	Academic information sources	Leading climate action municipalities utilising this/similar indicator
Roads/ Transportation	Adaptation	Extent and cost of damage to roads as a result of coastal flooding, including dumping sediment and washing away surfaces	km ² , €	1,3,6	(Flood, Dwyer and Gault, 2021)	
Roads/ Transportation	Adaptation	Change in extent (km ²) and grade of damage to roads due to coastal flooding as a result of proactive road drainage maintenance programme	km ² , level of damage	1,3,6	(Flood, Dwyer and Gault, 2021)	
Roads/ Transportation	Adaptation	Extent (km ²) and grade of damage to roads as a result of pluvial and fluvial flooding events	km ²	1,3,6	(Flood, Dwyer and Gault, 2021)	
Roads/ Transportation	Adaptation	Extent and grade of road and rail bridge damage due to flooding, such as damage to bridge floors and water intrusion into abutments	€	1,3,6	(Flood, Dwyer and Gault, 2021)	
Roads/ Transportation	Adaptation	Road settlement impacts, such as cracking of local roads on peatland due to drought conditions	m, €	1,3,6	(Flood, Dwyer and Gault, 2021)	
Roads/ Transportation	Adaptation	Area impacted and economic costs incurred to roads as a result of coastal erosion	km ² , €	1,3,6	(Flood, Dwyer and Gault, 2021)	
Roads/ Transportation	Adaptation	Road damage due to extreme heat – e.g. rutting (euro costs)	m, €	1,3,6	(Flood, Dwyer and Gault, 2021)	
Roads/ Transportation	Adaptation	Change in road settling impact as a result of proactive road maintenance programme where settling impact is the sinking/deterioration of road surfaces as a result of being built on soft/ limited foundations such as roads constructed across bog land/wetlands	Change in costs (€)	1,3,6	(Flood, Dwyer and Gault, 2021)	

Local authority functional area as per Local Authority Climate Action Plan Guidelines (Draft)	Mitigation/Adaptation	Proposed KPI	KPI unit	DECA strategic goal (1-6)	Academic information sources	Leading climate action municipalities utilising this/similar indicator
Roads/Transportation	Adaptation	Number of climate-adapted bridges, where climate adaptation is associated with strengthened and improved structures	Number and measures taken	1,3,6	(Flood, Dwyer and Gault, 2021)	
Roads/Transportation	Adaptation	Percentage change in road flooding impacts, such as surface damage, deposits of debris	% change in reported impacts	1,3,6	(Flood, Dwyer and Gault, 2021)	
Roads/Transportation	Adaptation	Change in extent of damage to roads due to coastal erosion as a result of coastal protection/management measures including hard and soft defences	Change in km ²	1,3,6	(Flood, Dwyer and Gault, 2021)	
Roads/Transportation	Adaptation	Change in incidence of road settling impact as a result of proactive road maintenance programmes to reduce impacts of pluvial and fluvial flooding	km ²	1,3,6	(Flood, Dwyer and Gault, 2021)	
Roads/Transportation	Adaptation	Change in road surface melting impact (euros) due to use of stiffer binder in road surfacing.	km ²	1,3,6	(Flood, Dwyer and Gault, 2021)	
Roads/Transportation	Adaptation	Extent of roads maintained (to lessen or prevent settling impact)	km ²	1,3,6	(Flood, Dwyer and Gault, 2021)	
Roads/Transportation	Mitigation	Proportion of public lighting using high-energy efficiency/LED lighting	%	1,2,5	(Csete and Buzasi, 2016; Kilkiş, 2018; Boehnke et al., 2019; Alrashed, 2020; Friends of the Earth, 2021)	(City of Copenhagen, 2012)
Roads/Transportation	Mitigation	% reduction in greenhouse gases from LED public lighting energy efficiencies since baseline year	%	1,2,5	(Csete and Buzasi, 2016; Kilkiş, 2018; Boehnke et al., 2019; Alrashed, 2020; Friends of the Earth, 2021)	(City of Copenhagen, 2012)
Roads/Transportation	Mitigation	Energy cost (€) savings from public lighting energy efficiencies since baseline year	€	1,2,5	(Alrashed, 2020)	(City of Copenhagen, 2012)

Local authority functional area as per Local Authority Climate Action Plan Guidelines (Draft)	Mitigation/Adaptation	Proposed KPI	KPI unit	DECA strategic goal (1-6)	Academic information sources	Leading climate action municipalities utilising this/similar indicator
Roads/Transportation	Mitigation	Percentage of travel by different travel modes (i.e. walking, cycling, public transport, private vehicle)	%	1,2,4,6	(Bulkeley and Kern, 2006; Lien et al., 2019)	
Roads/Transportation	Mitigation	Kilometres of permanent segregated cycling network	Kilometres	1,2,4,6	(Balaras et al., 2020; Chao et al., 2020; Clarke and O'Donoghue-Hynes, 2020)	(City of Vancouver, 2020; Dorset Council, 2020)
Roads/Transportation	Mitigation	Kilometres of permanent integrated cycling network	Kilometres	1,2,4,6	(Balaras et al., 2020; Chao et al., 2020; Clarke and O'Donoghue-Hynes, 2020)	(City of Vancouver, 2020; Dorset Council, 2020)
Roads/Transportation	Mitigation	Number of dedicated bicycle parking facilities/spaces	Numeric value	1,2,4,6	(Csete and Buzasi, 2016)	(Dorset Council, 2020)
Roads/Transportation	Mitigation	Percentage of traffic lights that offer bicycle priority	%	1,2,4,6	(Csete and Buzasi, 2016)	
Roads/Transportation	Mitigation	Ratio of shared sustainable mobility infrastructure (e.g. bike share, scooter share) to total population	%	1,2,4,6	(Marotta et al., 2021)	
Roads/Transportation	Mitigation	Percentage change in greenhouse gas emissions of local authority fleet relative to baseline year	%	1,2,4	(Bulkeley and Kern, 2006; Friends of the Earth, 2021; Marotta et al., 2021)	(City of Copenhagen, 2012; Dorset Council, 2020; City of Sydney, 2021)
Roads/Transportation	Mitigation	Percentage of local authority fleet which are electric vehicles	%	1,2,4	(Bulkeley and Kern, 2006; Government of Ireland, 2019; Alrashed, 2020; Clarke and O'Donoghue-Hynes, 2020; Friends of the Earth, 2021; Marotta et al., 2021; Serdar, Koç and Al-Ghamdi, 2022)	(City of Copenhagen, 2012; Dorset Council, 2020)

Local authority functional area as per Local Authority Climate Action Plan Guidelines (Draft)	Mitigation/ Adaptation	Proposed KPI	KPI unit	DECA strategic goal (1-6)	Academic information sources	Leading climate action municipalities utilising this/similar indicator
Roads/ Transportation	Mitigation	Percentage of local authority fleet which are hybrid	%	1,2,4	(Bulkeley and Kern, 2006; Government of Ireland, 2019; Alrashed, 2020; Clarke and O'Donoghue-Hynes, 2020; Friends of the Earth, 2021; Marotta et al., 2021; Serdar, Koç and Al-Ghamdi, 2022)	(City of Copenhagen, 2012; C40 Cities, 2019; Dorset Council, 2020)
Water services	Mitigation/ Adaptation	Number of public drinking fountains installed by local authority annually	Numeric value	1,3,4	(Csete and Buzasi, 2016)	(C40 Cities, 2019)
Water services	Mitigation/ Adaptation	Percentage reduction in local authority annual water usage	%	1,2,3	(Zhou and Williams, 2013; Gordon et al., 2018; Kilkiş, 2018; Alrashed, 2020; Balaras et al., 2020; Marotta et al., 2021)	(Ajuntament de Barcelona, 2020)
Water services	Mitigation/ Adaptation	Rainwater harvested in local authority owned buildings for re-use annually	Litres per annum	1,2,3	(Turner et al., 2014; Csete and Buzasi, 2016; van de Ven et al., 2016)	(C40 Cities, 2019; City of Sydney, 2021)
Water services	Mitigation/ Adaptation	Annual water consumption intensity of local authority	Litres per annum	1,2,3	(Zhang and Zhou, 2018)	

Table 1: Climate action KPIs identified as potentially relevant to local authorities



Local Government Climate Action Key Performance Indicators – in an Irish Context

