CLIMATE ACTION ECONOMIC OPPORTUNITIES

Local Authorities Supporting Enterprise

Exploring Economic and Enterprise Opportunities from Climate Action
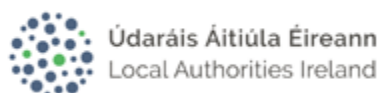
The International Context for Irish Local Government

CCMA
Cumann Lucht Bainistíochta Contae agus Cathrach
County and City Management Association

Údaráis Áitiúla Éireann
Local Authorities Ireland

LGMA
Local Government
Management Agency

CARO

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Ireland

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This project is supported by a range of stakeholders including:
Department of Enterprise, Trade and Employment
Department of Environment, Climate and Communications

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where innovation means business

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Regional Enterprise Plan
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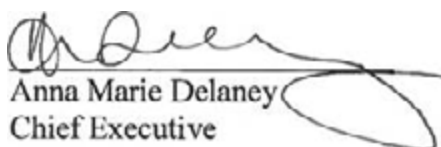SOUTH-WEST

Contents

Contents

Foreword

Anna Marie Delaney, Chair
Economic Opportunities arising from Climate Action
Business, Enterprise, Innovation & Urban/Town Economic
Renewal (BEIUER) Committee
Chief Executive Offaly County Council

Anna Marie Delaney
Chief Executive

We are living in an extraordinary time. The Covid-19 global pandemic has gripped the social and economic fabric of our communities, generating disruptions of a significant scale. Local government in Ireland has worked tirelessly in support of the health and wellbeing of individuals and communities in an environment that competed equally with the need to maintain essential support to safeguard our local economies. This experience has given us an insight into how transformative changes influence the security of a sustainable future.

Securing a sustainable future for the longer term also requires our societies and economies to embark on the transformative changes required to confront the far-reaching challenges and consequences of climate change. The European Green Deal signposts the nature of transformation required across policy areas like energy generation, food production, circular economy, industry, transportation, land use and buildings in the mission to deliver on emission reduction targets to meet the climate neutrality objective for Europe by 2050. The Green Deal is the nucleus for the re-imagination of climate and environmental challenges, turning them into opportunities across all policy areas, protecting jobs and creating sustainable growth and making the transition to a climate neutral future, just and inclusive for all.

We are on the verge of a new era and, in this context, the role of local government is significant, not least in continuing our strong commitments to reducing emissions and building resilience to address climate change, but also to engage positively in activating, promoting and enabling sustainable new opportunities that arise in business, innovation, digitalisation, investment and jobs in our local areas.

Working through the economic and enterprise functions, local authorities can exert their strong climate leadership to support the re-orientation of existing business, to nurture new business and capitalise on investment opportunities that support the green revolution.

Economic Opportunities from Climate Action – *Local Authorities supporting Enterprise* is a project framework established by the City and County Management Association in Ireland, with the support of the Climate Action Regional Offices, to better understand the potential opportunities now emerging that will facilitate us to meet the challenges of climate change.

The project, led by the local government system in Ireland, includes a range of key stakeholders such as government departments and agencies, national, regional and local level bodies and third level institutes.

The project is designed to deliver, through a mix of research, best practice, collaborative ideas and interactions, tailored actions that underpin the economic and enterprise functions of local authorities so they can provide the necessary support to our local economies as transition to carbon neutrality is undertaken. A key aspect of the research is to look at examples of similar actions in other countries across the globe. Consequently, we are delighted to have our colleagues from the Local Government Information Unit (LGIU) contribute to this research.

The LGIU, one of the world's leading local government research bodies, have undertaken extensive research on climate change and local government. Access to this research capacity is allowing the local government system in Ireland to both learn and share how local government systems are supporting economic opportunity based upon addressing the challenges of climate change and making the transformative transition towards carbon neutrality.

In the context of rising climate ambition and the need to promote emerging economic opportunities, local government has much influence to lead transition at local level. This report through its extensive range of case studies, highlights the depth and breadth of where the opportunities may be located. The challenge now is to embrace the journey and all of its milestones towards a climate neutral and sustainable future.

This report will be of considerable interest to those committed to a local government led transition into a post carbon local economy. It comes at a critical point in Ireland as the national effort to advance towards climate neutrality gains traction. Local government is one of the leading pillars on which transition can be achieved and, as the research demonstrates, the system in Ireland is among the most advanced at international level. Importantly, the report provides examples from other advanced actions across local government systems globally from which we also need to learn.

I welcome the publication of this report and look forward to local government in Ireland taking stock from our experience to date and what can be learned from good practices across the globe as local government systems seek to deliver climate neutral local economies.

Executive Summary

The Eastern and Midland CARO is working on behalf of the local government sector to lead out on a specific project that examines the economic opportunities arising from climate action for local authorities, seeking to maximise efforts to translate such opportunities across all functions and operations. The central aim of the Economic Opportunities arising from Climate Action for Local Authorities project is to build an informed framework to assist local authorities in Ireland to both lead and facilitate the identification and realisation of opportunities arising from Climate Action policy and initiatives.

Local authorities across the world are working hard to mitigate and adapt to the impacts of climate change. Often working in partnerships with organisations at a range of different scales, these developments are opening up a plethora of new economic, social and environmental opportunities. Drawing on local government case studies from across nine countries, this report aims to highlight some of these opportunities, to inspire international knowledge exchange and to catalyse local action.

The report begins by developing detailed introductions to climate governance in nine countries: Ireland, Scotland, England, Denmark, United States of America, Finland, Sweden, Australia and New Zealand. While these introductions vary slightly from country to county each provides information about national, regional and local governance frameworks, highlights key trends in environmental policy making and gives an overview of finances at a local level. Many of these introductions are written by associates with personal experience of the country's governance system and they provide detailed insight into local environmental governance across the world.

Building on the analysis of country governance frameworks, the second half of this report takes a deep dive into a series of case studies. These case studies have been drawn from across the nine featured countries and have been sorted according to 14 key themes:

- Energy/power generation
- Just Transition
- Retrofit of commercial and domestic properties
- Transport
- Agriculture/afforestation
- Industrial heat use
- Circular economy and waste
- Hubs
- Innovation Public Realm
- Finance
- Water
- Retail

- SMART City
- Tourism

Each case study provides information about the type of intervention, project outline, role of the local authority, the investment source, details about partners, the types of benefits and insight as to whether the project was focused on adaptation or mitigation.

The penultimate section of this report takes a step back to draw out key trends from these case studies. This analysis is structured according to six key themes: The impact on climate change, types of intervention by local governments, sources of investment, main partners, benefits to the local economy and the importance of place.

Analysis of the case studies in this report highlight some important trends:

Mitigation/adaptation

The first trend is that the majority of the local authority-led climate projects analysed for this report focused on mitigation rather than adaptation. With local, regional and national governments across the world setting ambitions net zero targets this is perhaps unsurprising. Although mitigation is an important piece of the puzzle, the dominance of this narrative across local, national and international climate narratives means that questions of adaptation and biodiversity loss are often overlooked. Given the pressing and very real nature of climate change, this presents a key opportunity to develop local strategies for adaptation that boost jobs, skills and growth.

However, some case studies do show adaptation as the primary objective. These include: Climate Ready Clyde in the Glasgow Region; New York's flood park; and green maritime development in North Jutland. Each of these projects has the capacity not only to protect places from extreme weather but also facilitate a host of other co-benefits such as encouraging active travel, creating employment opportunities, fostering cross-sector collaboration and increasing carbon sequestration.

Types of initiative

While the case studies represent a wide range of sectors and types of initiative, the types of intervention by local government can loosely be categorised into the following:

- Greening of existing business
- Expand green tourism
- Circular economy
- Infrastructure projects
- LA and LEO initiatives
- Partnerships, hubs, incubators, networks.
- Market based solutions
- Ecosystem services

Infrastructure projects crop up the most frequently among the case studies in this report, with more than half representing some form of infrastructure investment. This may be in the form of large-scale investments into projects such as Copenhagen's district heating system, or smaller changes such as the introduction of localised active travel infrastructure involved in Melbourne's 20-minute neighbourhoods.

While public-private partnerships were common, the direct greening of existing businesses was rarer among the studies, and can prove difficult to local governments for the same reason as market-based solutions: a lack of regulatory and legislative power within isolated local authorities.

Benefits

While the explicit goal of most projects has been to reduce emissions and generate economic growth, many, if not all of these developments have helped to develop local economic and social resilience. For example, retrofit and renewable energy projects increase community resilience through reducing energy costs, tackling fuel poverty and generating income/savings for the local economy. Furthermore, these developments all have the capacity to create employment opportunities, thus facilitating a just transition.

Funding and partners

Partnership and collaboration are common themes that run throughout the approaches in this report. The case studies show local government working in partnership with a diverse range of organisations from the public, private and third sector.

While funding sources vary considerably across the case studies reviewed in this research, they can be grouped into five broad typologies:

• Public-private partnerships
• National-regional-local government partnerships
• Local government
• National government
• Public-private-third sector partnership

The main partners in the case studies presented in this report are:

• The European Union, often through sub-organisational funding like Interreg
• National governments
• Businesses
• NGOs
• Other local authorities
• Regional bodies and local enterprise partnerships

Private sector partners are crucial to many of the cases. Local businesses are important for the design and implementation of high street and neighbourhood renewal projects, along with local residents. Local authorities have also worked with partners at different scales and levels of governance. This might include neighbourhood or community level organisations, regional or national bodies, as well as supranational, such as those connected to the European Union.

Benefits to local economy

The benefits to the local economy from acting on climate change can be diverse. At the basic level the initiatives identified create jobs and contribute to local economic growth but they do so in different ways.

An analysis of the case studies identified nine categories of benefit:

- Jobs
- Inward investment
- Economic growth
- Tourism income
- New business
- Business income
- Private sector savings
- Citizen benefits (such as reduced insurance costs)
- Public sector savings

Importance of place

The case studies highlight the importance of embedding projects in place, taking into account local circumstances, building on local assets, and working with established local networks. There are three key aspects of place that are highlighted in the report as important components of successful mitigation and adaptation initiatives: the existing local economy; natural resources and assets; and local skills and knowledge.

Conclusion

The information highlighted in this report shows that local leadership offers enormous potential for boosting and rebalancing economic growth, developing new skills and training opportunities, creating jobs, and rejuvenating local places. As we move towards a more resilient net zero future it's important to remember that we are not starting from scratch. There is a great deal of innovation and inspiring leadership in different local contexts that can be shared, replicated, developed and adapted.

Introduction

Local authorities across the world are working hard to mitigate and adapt to the impacts of climate change. Often working in partnerships with organisations at a range of different scales, these actions are opening up a plethora of new economic, social and environmental opportunities. Drawing on local government intel and case studies from across nine countries, this report aims to highlight some of these opportunities, to inspire international knowledge exchange and to catalyse local action.

The report begins by developing detailed introductions to climate governance in nine countries: Ireland, Scotland, England, Denmark, United States of America, Finland, Sweden, Australia and New Zealand. While these introductions vary slightly from country to county each provides information about national, regional and local governance frameworks, highlights key trends in environmental policy making and gives an overview of finances at a local level. Many of these introductions are written by associates with personal experience of the country's governance system and they provide detailed insight into local environmental governance across the world.

Building on the analysis of country governance frameworks, the second half of this report takes a deep dive into a series of case studies. These case studies have been drawn from across the nine featured countries and are ordered according to 15 key themes.

To jump to a specific section, topic or case study within this report, refer to the interactive contents page.

The themes are as follows:

1. Energy/power generation
2. Just Transition
3. Retrofit of commercial and domestic properties
4. Public realm
5. Forestry/agriculture
6. Transport
7. Heat
8. Circular economy and waste
9. Water
10. Innovation
11. Finance
12. SMART Cities
13. Hubs
14. Tourism
15. Retail

Each case study provides information about the type of intervention, project outline, role of the local authority, the investment source, details about partners, the types of benefits and insight as to whether the project was focused on adaptation or mitigation.

The penultimate section of this report takes a step back to draw out key trends from these case studies. This analysis is structured according to six key themes: The impact on climate change, types of intervention by local governments, sources of investment, main partners, benefits to the local economy and the importance of place.

The concluding paragraphs draw out some of the key trends from the report and examine future research opportunities presented by this research. One such trend is that the majority of the local authority-led climate projects analysed for this report focused on mitigation rather than adaptation. Given the pressing and very real nature of climate change this presents an key opportunity to develop local strategies for adaptation that boost jobs, skills and growth.

The information highlighted in this report shows that local leadership offers enormous potential for boosting and rebalancing economic growth, developing new skills and training opportunities, creating jobs, and rejuvenating local places. As we move towards a more resilient net zero future it's important to remember that we are not starting from scratch. There is a great deal of innovation and inspiring leadership in different local contexts that can be shared, replicated, developed and adapted.

Background to research

The Eastern and Midland CARO is working on behalf of the local government sector to lead out on a specific project that examines the **economic opportunities arising from climate action for local authorities**, seeking to maximise efforts to translate such opportunities across all functions and operations.

The central aim of the Economic Opportunities arising from Climate Action for Local Authorities project is to build an informed framework to assist local authorities in Ireland to both lead and facilitate the identification and realisation of opportunities arising from Climate Action policy and initiatives. The project merges the newly established climate action function of local authorities with the extant economic and enterprise function. The project is informed by the Local Government Strategy on Climate Change[1] and the report A Profile of Local Authority Climate Actions in Ireland[2].

Progress to date includes:

- An analysis of European, national, regional and local policy and initiatives on the creation of economic opportunity from climate action relevant to the economic and enterprise remit of local authorities.
- A survey of Local Enterprise Offices (LEOs) and Directors of Services with responsibility for Economic Development, on their awareness of, and capacity for, supporting the development of economic opportunities through climate action.

The research addressed in this report forms part of the early exploratory stage of the project, to establish how local authorities or governments in other jurisdictions are activating this area of potential and maximising their climate action and economic influence at local, community or municipality levels.

This report presents the findings of a programme of desk-based international comparative research of local government systems and local authorities that are capitalising, economically, on opportunities arising from both adaptation and mitigation initiatives to address climate action. The research highlights specific examples of best practice in different countries and an overview of the role of local government in climate action in each country.

In addition to this report the research will also generate a series of associated briefings and webinars for local government in Ireland and potentially at international level as part of awareness raising and training. Further, there will be a national conference on the economic opportunities arising from climate change on 12/13th October 2021 and it is expected that a paper based upon this research will be presented at that public event.

Chapter 1: Climate change governance frameworks across the world

1.1: Ireland

Governance framework

National

Ireland is a constitutional parliamentary democracy, one of the longest continuous democracies in Europe, having democratic government since 1919. Executive power sits with the Government with the assistance of the civil and public services. Elections are conducted (usually) every five years[3].

Regional and Local

Regional and local level structures comprise three Regional Assemblies and 31 local authorities. The Regional Assemblies exercise a range of powers in relation to spatial planning and economic development and are mandated to coordinate, promote or support strategic planning and sustainable development as well as promote effectiveness in local government and public services. Membership of a regional assembly consists of members of the local authorities within the relevant region[4].

The 31 local authorities maintain responsibility for the delivery of a wide range of services in their local area. The structures, powers, functions and duties of local government are governed by the Local Government Act, 2001 and the Local Government Reform Act, 2014. In addition, the operation of local authorities is affected by a wide range of other legislation, very often dealing with specific services such as housing, planning and economic development.

Local authorities in Ireland make a significant contribution to the physical, cultural, social and environmental development of communities through the provision of services including housing, planning, infrastructure delivery, environmental protection and the provision of amenities and recreation and community infrastructure. They also play a key role in supporting economic development and enterprise at a local level and take the lead role in shaping the strategic vision of their county or city. They also work in partnership with other state, public and private bodies in the delivery of critical infrastructure and shared services[5].

Key climate legislation/targets/regulators

National Climate Action

The Climate Action and Low Carbon Development Act, 2015 represented a significant milestone on climate action policy in Ireland. The Act, signed into Law by the President on 10th December 2015, proceeding by just a matter of days, the historic international accord on tackling climate change, the Paris Agreement. The Act enshrined the National Transition Objective which seeks to deliver a low-carbon, climate resilient and environmentally sustainable economy by 2050.

In the context of the National Transition Objective, the Act gave statutory authority to both mitigation and adaptation activities serving to reduce emissions under a national mitigation strategy and reduce the vulnerability of the State to the negative impacts of climate change under a national adaptation framework[6].

Pursuant to the provisions of the Act, the National Mitigation Plan (NMP) published in 2017 set out commitments to deliver on the National Transition Objective through commitments on achieving a prescribed decarbonisation target across sectors including electricity generation, the built environment and transport, with an approach to carbon neutrality in the agriculture and land use sector.[7] Additionally, the National Adaptation Framework (NAF), published in 2018, set out the national strategy to adaptation in Ireland to reduce the country's vulnerability to the negative effects of climate change and to avail of any positive impacts. Improved coordination, engagement and practical implementation on adaptation planning and actions are key aims of the NAF across all actors in society. In this regard, explicit roles on adaptation planning and implementation were identified for specific sectors covering critical infrastructure, natural and cultural capital, water resources and health and, in particular, for local government[8].

In 2019 the national Climate Action Plan – To Tackle Climate Breakdown (CAP) was published. This plan provided a renewed focus across all of society, on the need to reduce emissions to achieve net zero by 2050. The CAP was informed by the third report and recommendations of the Citizens Assembly – *How the State can make Ireland a leader in tackling climate change*[9] and the recommendations contained in the report of the Joint Oireachtas Committee on Climate Action, entitled, *Climate Change: A Cross-Party Consensus for Action*, published in March 2019[10]. With its 183 actions, the CAP represents an emission reduction pathway, with interim emission reduction targets to 2030, to help deliver on the objective of a net-zero carbon economy by 2050. All sectors including electricity generation, agriculture, waste management, forestry, enterprise and the public sector have clear and prescribed emission targets to achieve and roles to play[11].

Future legislation/target planned

A furtherance to the interim climate targets to 2030 has been brought about more recently by the Programme for Government published in 2020. The programme has raised the level of ambition committing to a 7% emission reduction target per annum to 2030 for a total of 51% emission reductions within the decade[12]. To enable this ambition and build on the provisions of the principal Act, the Climate Action and Low Carbon Development (Amendment) Bill, 2021 has been signed into law by the President, establishing a legally binding framework that enshrines a new National Climate Objective for the delivery of a '*climate resilient, biodiversity rich, environmental sustainable and climate neutral economy*' by 2050. This brings Ireland into line with international climate ambition and EU policy on climate action for the delivery of climate neutrality by 2050.

The Act aims establishes a legally binding framework with clear targets and commitments set in law. It ensures the necessary structures and processes are embedded on a statutory basis to provide for the achievement of national, EU and international climate goals and obligations in the short and long term. In addition to placing the new National Climate objective on a statutory basis the Amendment Bill provides for, inter alia:

- A strengthened role of the National Climate Change Advisory Council
- The introduction of five-year carbon budgets with targets for each sector
- A new national long term climate action strategy
- Statutory footing for annual national climate action plans
- Performance accounting by Government Ministers on the achievement of sectoral targets
- Requirement for local authorities to undertake climate action plans which will encompass both adaptation and mitigation.

The Act brings accountability to achieving targets through an established legal framework around the climate neutrality objective[13].

Furthermore, a revised and updated All of Government Climate Change Plan 2021 will be published in 04/2022. This plan will see a significant in ambition across all sectors, and is the new climate legislation.

Regional and local climate action

The Climate Action and Low Carbon Development Act, 2015 recognised a role for local authorities in both mitigation and adaptation through the reduction of emissions and in reducing the vulnerability of the state to the negative impacts of climate change[14]. The NAF speaks of local authorities as being well placed, or uniquely placed, to deliver on the national transition objective for low carbon and climate resilience. Having that crucial familiarity and essential knowledge of the natural and manmade environment, the delivery of key services and an identified role in managing climate risks already has placed local government at the nexus of effort on climate[15].

Accordingly, and pursuant to the action 5 of the NAF, all 31 local authorities developed and adopted their own Local Authority Climate Change Adaptation Strategy. The adaptation strategies identify key vulnerabilities, risks and opportunities within the communities they serve, helping to build capacity and resilience in these areas and the sector, as well as improve coordination on climate change adaptation with other sectors. In addition, they support the mainstreaming of climate change considerations into all plans, policies and operations of the local authority as well as building capacity and knowledge of local authority staff to consider and enhance mitigation and adaptation activities as part of their overall role.

Local authorities were supported in the development of their adaptation strategies by the Local Authority Climate Action Regional Offices (CARO). Four CAROs were established in fulfilment of action 8 of the NAF within the local government sector, with the support of the Department of Environment, Communications and Climate Action holding a mandate to drive the climate action agenda at the local authority level (this is further outlined in the section on CAROs below).

The CAP 2019 prescribes the scale up in efforts by local authorities on climate action with a conferred 'leadership role' on account of the pivotal role and proximity to local communities, to front public sector leadership and mobilise climate action at local and community levels. Like other sectors, specific targets are prescribed for emission reductions and energy efficiency improvements. Speaking to the regulatory remit, the CAP also recognises that local authorities hold a strong influence in the broader societal move towards decarbonisation and to support other sectors in the delivery of the state targets. The CAP expands the work of the CAROs also, to help widen the scope of local authorities acting as a catalyst for the change required to meet the national transition objective and all of this is to be underpinned by an annual programme of measurable impact.[16]

Action 147 of the CAP introduced a Climate Action Charter for each local authority (Appendix A). The Local Authority Climate Action Charter was signed by the Minister for Communications, Climate Action and Environment, and every local authority in October 2019. The aim of the Charter is to ensure that local authorities embed decarbonisation, climate resilience and sustainable development into every function. The Charter tasks local authorities with delivering on energy reduction targets, carbon proofing major decisions, projects and programmes, partnering and collaborating on climate action initiatives with local community groups, enterprise, schools and higher education institutes as well as building local citizen engagement on climate action[17]. The Charter is available [here](#).

Climate Action Regional Offices (CAROs)

Four CAROs were established in 2018 under the NAF as part of the local government sector. The offices were established to drive climate action at both regional and local levels by promoting and supporting coordination among local authorities, reporting on progress of local government

on climate action, creating effective linkages with other actors, working with the third sector to influence climate related research and generally building climate action capacity across local government.

The composition of the four Climate Action Regions was determined by the geographical and topographical characteristics, vulnerabilities and shared climate risks experienced nationally across all local authority areas. The four CARO regions are as follows:

Region	Climate Risk	
Atlantic Seaboard North	• Coastal flooding • Storms • Groundwater flooding • Rural pluvial	
Atlantic Seaboard South	• Sea level rise • Coastal flooding • Storms • Groundwater flooding • Rural pluvial	
Dublin Metropolitan	• Urban pluvial • Urban freezing • Urban heatwave	
Eastern & Midlands	• Fluvial flooding • Rural pluvial • Groundwater flooding	

The CAROs also represent local government in all cross-sectoral issues relating to climate action and work closely with the relevant stakeholders on policy issues for the sector generally.

Local government sectoral vision on climate action

In April 2021, the local government sector published its higher order strategy for delivering on the commitments of the local authority climate action charter and the national Climate Action Plan. The strategy entitled Delivering Effective Climate Action 2030 contains a Vision, Mission and six high level strategic goals to deliver transformative change and measurable climate action across cities and counties and within local authorities. The six goals include:

(1) fostering governance, leadership, and partnerships for climate action;
(2) achieving carbon emission and energy efficiency targets for 2030 and 2050;
(3) delivering on climate adaptation and climate resilience;
(4) mobilising climate action in local communities;
(5) mobilising climate action in enterprise and support the transition to an inclusive, net zero and circular economy; and
(6) achieving a 'just transition' particularly for communities that may be economically disadvantaged by decarbonising projects.

The strategy highlights that local authorities are community leaders with a wealth of experience in mobilising the multi-stakeholder partnerships and relationships required to tackle complex challenges. The strategy also highlights the additional resources required for local government to coordinate and deliver on the Local Authority Climate Action Charter as well as current and future Climate Action Plans. Local authorities will be increasing staffing resources directed at delivering effective climate action over the coming years[18].

Key ongoing programmes

Local authority capacity building on climate

In response to Action 150 in the Climate Action Plan 2019, calling for the development of Local Authority climate action leadership and capacities, a Local Authority Climate Action Training Plan was developed and put in place. The Plan identified the short-to-long term training needs of the entire local government sector to meet the requirements of the sector's enhanced role in climate action as well as their responsibilities as part of the National Climate Objective. The Training Plan's core objectives include building capacity on climate action within the local authority sector and influencing positive behavioural change at the community level.

Under the auspices of the training plan, the Local Authority Climate Action Training Programme, commenced in 2020. The programme provides an initial series of courses under six training pillars to meet the short-term needs of the sector. A wide range of collaborators, managed by the CAROs, worked together to develop training courses to "*strengthen and empower local authority climate action leadership and build capacity within the sector to further reinforce the delivery of effective climate action[19]*". The six training pillars, namely Championing Leadership, Raising Awareness, Building Capacity, Empowering Change, Delivering Action, and Actioning Policy, provide relevant training for the range of roles of local government staff and elected members. The courses available under these six pillars will evolve as current medium-to-long-term needs are addressed. The Local Authority Services National Training Group (LASNTG) are coordinating the delivery of the training programmes through the existing Regional Training Centre network. The rollout of this initial Training Programme will be completed by 2025.

Local initiatives/programmes

Decarbonisation Zones

Action 165 of the CAP 2019 tasked local authorities with identifying and developing plans for a Decarbonisation Zone (DZ) within their jurisdiction. Local authorities were required to identify a location for their DZ by April 2021 and to have implementation plans developed by the end of the year (2021). DZs align with Government carbon emission reduction targets of achieving an average of 7% reduction in emissions per year to 2030. A range of projects will be undertaken as part of the overall DZ programme, creating economic opportunities for enterprises to help deliver on targets.

Additional decarbonising zones will be identified with implementation plans developed in the future in each local authority area taking learnings from previous DZ projects and in turn creating further economic opportunities as part of the National Climate Objective.

A DZ has been defined for the purposes of this initiative as a *"spatial area identified by the local authority, in which a range of climate mitigation, adaptation and biodiversity measures and action owners are identified to address local low carbon energy, greenhouse gas emissions and climate needs to contribute to national climate action targets[20]"*.

Local partnerships – strategic/operational/professional

GAA Green Club Programme

The Green Club Programme is a partnership between the Gaelic Athletic Association (GAA), the largest amateur sporting organisation in the world, the Ladies Gaelic Football Association (LGFA) and the Camogie Association, and the local government sector representing local authorities across Ireland[21]. The programme is structured around five thematic areas, Energy; Water; Waste; Biodiversity; and Travel and Transport and is operating a pilot stage in 2021 with forty-five clubs. The parent partnership between the GAA and local government has enabled the establishment of many other collaborations with expert agencies in each of the five pillars now working to support the programme. Examples include the Sustainable Energy Association of Ireland (SEAI), the National Biodiversity Data Centre, the Local Authority Waters Programme (LAWPRO), Waste Enforcement Regional Lead Authorities, National Transport Authority, and Irish Water.

Upon successful completion of the pilot stage the programme will be opened-up to all GAA clubs across the Island of Ireland from 2022, thus covering the 2 political jurisdictions, Ireland and Northern Ireland.

Local authorities will engage with participating clubs to assist them with delivering actions under the five thematic areas. While the main aim of the programme is to achieve substantial climate action within club operations, a secondary aim is to raise awareness of climate change and sustainability in their communities. This sharing and engagement with wider communities will pave the way for further engagement with local communities further enhancing existing local authority networks and community reach. Similar strategic partnerships like this can be expected to be established and rolled out by the local authority sector over the next several years.

Economic development

The Local Government Reform Act, 2014 prescribed an enhanced role on local economic and enterprise development for local authorities. This role saw the integration of the Local Enterprise Offices (LEOs) along with a statutory requirement to prepare a Local Economic and Community

Plan (LECP) every five years[22].

The premise of this expanded economic and enterprise remit is two-fold. Firstly, it provides for the translation of national level economic policy, programmes and initiatives to local level.

Secondly, it ensures that there is a cross cutting and integrated policy framework in place across the range of local government functions to deliver an effective environment for enterprise growth and development at local level.

Through the work on mainstreaming climate action into all functions and services, the CAROs are working on projects that will maximise the economic and enterprise remit of local authorities to explore, promote and support the opportunities arising from the transition to a climate neutral society. From the translation of emerging climate informed national policy, local authorities are well positioned to enable and support local business to be innovative and to realise unique economic and business opportunities for a new era.

Financial resources available

Local government day to day revenue is financed largely through its own taxes in the form of commercial rates and local property charges as well as specific service charges and fees. The national exchequer also provides significant resources particularly in the form of capital grants for infrastructure. This can be supplemented with development contributions, sale of property, borrowings or loans. Local authorities also continue to leverage European and National funding sources in the pursuit of particular infrastructural, environmental and public realm projects. Funding streams established as part of Project Ireland 2040, are delivered under the umbrella of the National Development Plan and are targeted for urban and rural regeneration and for Climate Action.

1.2: The United Kingdom

Overview

At the national level there are pieces of legislation that are recognised as England only and there are processes for ensuring that UK-wide legislation can pass through the devolved administrations. The most important piece of UK-wide legislation is the Climate Change Act 2008 (CCA)[23]. It mandated the world's first national carbon budgets, which are produced every five years and steer emissions reduction policy.

The Climate Change Act 2008 is the basis for the UK's approach to tackling and responding to climate change. It requires that emissions of carbon dioxide and other greenhouse gases are reduced and that climate change risks are adapted to. The Act also establishes the framework to deliver on these requirements. The Act supports the UK's commitment to urgent international action to tackle climate change.

Through the Climate Change Act, the UK government has set a target to significantly reduce UK greenhouse gas emissions by 2050 and a path to get there. The Act also established the Committee on Climate Change (CCC) to ensure that emissions targets are evidence-based and independently assessed. In addition, the Act requires the Government to assess the risks and opportunities from climate change for the UK, and to adapt to them. The CCC's Adaptation Committee advises on these climate change risks and assesses progress towards tackling them[24].

The 2050 target

The Climate Change Act commits the UK government by law to reducing greenhouse gas emissions by at least 100% of 1990 levels (net zero) by 2050. This includes reducing emissions from the devolved administrations (Scotland, Wales and Northern Ireland), which currently account for about 20% of the UK's emissions. The 100% target was based on advice from the CCC's 2019 report, 'Net Zero – The UK's contribution to stopping global warming'[25].

The path to 2050: 'Carbon budgets'

The Climate Change Act requires the government to set legally-binding 'carbon budgets' to act as stepping stones towards the 2050 target. A carbon budget is a cap on the amount of greenhouse gases emitted in the UK over a five-year period. Budgets must be set at least 12 years in advance to allow policy-makers, businesses and individuals enough time to prepare. The CCC advises on the appropriate level of each carbon budget. The budgets are designed to reflect a cost-effective way of The Climate Change Risk Assessment and National Adaptation Programme.

The Climate Change Risk Assessment and National Adaptation Programme

The Climate Change Act requires the UK Government to produce a UK Climate Change Risk Assessment (CCRA) every five years. The CCRA assesses current and future risks to and opportunities for the UK from climate change. In response to the CCRA, the Climate Change Act also requires the UK government to produce a National Adaptation Programme (NAP)[26]. The NAP covers England, while the devolved administrations produce their own programmes and policies. The Act also gives powers to the UK Government to require certain organisations to report on how they are adapting to climate change. This is called the Adaptation Reporting Power. Read more about government policy on adapting to climate change.

Tackling the causes of climate change, and adapting to its impacts, touches on all aspects of the economy. The Government has created a Cabinet Committee on Climate Change chaired by the Prime Minister. This is supported by subcommittee's to ensure climate change decision making is across Government. It is for all government departments to include climate change in its thinking when making policy decisions.

The two main UK government departments responsible for climate change are:

- **Department for Business, Energy and Industrial Strategy (BEIS)** – leading on policy for reducing emissions (mitigation). BEIS is responsible for ensuring secure energy and promoting action on climate change in the UK and internationally.
- **Department for Environment and Rural Affairs (Defra)** – leading on domestic adaptation policy (adaptation). Defra is responsible for developing the National Adaptation Programme to address the risks set out in the most recent UK Climate Change Risk Assessment.

In 2019, the UK Treasury announced it will be undertaking a Net Zero Review[27], the first of its kind, which will assess how the UK can maximise economic growth opportunities from its transformation to a green economy.

Climate assembly

In spring 2020, the House of Commons (not the government) convened the UK's first Climate Assembly[28]. The format was based on the Citizen's Assembly model and brought together over 100 UK citizens representative of the population. Over six weekends of presentation and debate the Climate Assembly considered how the UK could reach its target of zero emissions by 2050. The Climate assembly published a report in September 2020[29]. The report made 50 recommendations, some of which were: shift to electric vehicles; limit air travel; buy local food; reduce meat consumption; and use more wood in construction.

National UK context

Nearing completion in the UK parliament is the Environment Bill[30]. This is a landmark post-Brexit bill which encourages market based approaches to solving environmental problems either through direct subsidisation for environmental goods or allowing for the offsetting of environmental harm. The full implications are hard to predict but it could mean that government funds can be used to subsidise the building of dams and reservoirs on farmland, recognising that these structures provide flood protection.

There are a wide range of legislative and policy drivers to enable local action on climate change. Local government has obligations that contribute to resilience, although not all local authorities will have the same responsibilities in an area. These include flood risk management, under the Flood and Water Management Act 2010[31], and commitments to prepare and plan for emergencies under the Civil Contingencies Act 2004[32]. Local Planning Authorities (LPAs) are also required under the Planning Act 2008 to adopt proactive strategies to mitigate and adapt to climate change. They need to take full account of flood risk, coastal change, and water supply and demand considerations. There are also funding requirements to consider adaptation as part of criteria for the Local Growth Fund.

Mitigating and adapting to climate change is one of 10 goals of the 25 Year Environment Plan[33]. Defra is committed to improving partnership working at a local level with local authorities, Local Enterprise Partnerships, Local Nature Partnerships, Defra Group bodies and other key local decision makers to help deliver the Plan's goals.

We will now look more closely at England and Scotland's individual governance structures and climate action.

Scotland

Administrative structure in Scotland

National government

As one of the four nations that make up the United Kingdom, Scotland is represented at Westminster by 59 members of Parliament in the House of Commons and is subject to the UK Parliament in the reserved areas of foreign affairs, foreign trade, defence, the national civil service, economic and monetary policy, social security, employment, energy regulation, most aspects of taxation and some aspects of transport.

The Scottish Parliament at Holyrood, established in 1999, has legislative powers over health, local government, education and training, housing, regional transport, the environment, and agriculture. It also has the power to increase or decrease income tax rate by 3 percent within Scotland as well as some taxation powers e.g. landfill tax and social security.

Local government

Local authorities in Scotland are administrative bodies that act within the framework of laws passed by these parliaments. Local authorities are responsible for a wide range of community services, including:

- waste and recycling
- education
- planning
- education
- roadways and traffic
- public transport
- housing
- parks and recreation
- elections

providing social care for adults and children, older and vulnerable citizens
setting standards for business activities within a local authority in addition to licenses and permits, creating voluntary opportunities and promoting local job creation
local enterprise functions

Scotland is divided into 32 local authority areas, these vary considerably in both geographic extent and population. Highland is the largest council area, encompassing 10,091 square miles (26,136 square km), and, at 25 square miles (65 square km), Dundee is the smallest.

With a population of roughly 600,000 people, Glasgow is the most populous council area, whereas the least populous is the Orkney Islands, with roughly 22,000 residents. On any given day most people in Scotland will make use of at least one local council service, such as education, housing, refuse disposal, social work, licencing entertainment, and 95% of Scottish children go to state schools.

Current status of local government in Scotland

Each of the 32 local authorities is governed by a council, which is made up of councillors directly elected by the residents of the area they are seeking to represent. Sitting alongside these councils are community councils, which bridge the gap between the local authority and the community and are made up of elected volunteers from the relevant community. There are around 1,200 community councils.

Scotland currently has 1,227 elected councillors who are elected every 4 years. The last local elections were held in May 2017. From these elections, 431 SNP councillors; 276 Conservative councillors; 262 Labour councillors; 66 Liberal Democrat councillors; 173 Independent or non-aligned councillors; and 19 Green councillors were elected[34].

The powers of local governments in Scotland are split into 3 categories: Mandatory Duties, these are services that councils are legally obliged to provide and include school age education and social care for children, vulnerable adults and the elderly; Permissive Powers, Councils do not legally have to provide services like economic development strategies and recreation infrastructure. Regulatory powers, of enforcing and amending the local area national law in areas like trading standards and food safety standards.

Local government finance

Scottish councils are given a block grant from the Scottish Government, which amounts to around 85% of their net revenue expenditure.

There is also the Bellwin Scheme, which is a discretionary fund to give emergency financial assistance to local authorities who would otherwise suffer an undue financial burden as a result of providing relief and carrying out immediate work due to large-scale emergencies.

The remainder of expenditure is funded mostly from local taxation i.e. Council Tax, charges for local government services such as entry to swimming pools or charges for home helps and rent charged on council housing. The 2021-22 revenue from Scottish Government is £11.6 billion[35] for all councils.

To find out more about local government finance in Scotland, visit LGIU's website[36].

Climate action

On the 28th of April 2019 the Scottish government became the first in the world to declare a climate emergency and commit to achieving net zero by 2045. This announcement was followed by a wave of Scottish local government climate emergency declarations and pledges with many committing to reach net zero by 2030.

The extent of the country's commitment to this target and the direction local government is taking to address it can best be seen in the Scottish Government's Programme for Government 2020[37] which commits to measures such as:

- Investing £1.6 billion in transforming buildings to ensure that emissions from heating are eliminated by 2040 to remove poor energy efficiency as a driver of fuel poverty. This pledge includes: At least £95 million to decarbonise the public sector estate; Opening the £50 million Green Recovery Low Carbon Infrastructure Transition Programme; Additional £55 million to support scale up of energy efficiency programmes
- Work with local government to take forward ambitions for 20 minute neighbourhoods where people can live, work and learn in communities close to home
- Provide over £500 million over five years for large scale, transformational active travel infrastructure projects, access to bikes and behaviour change schemes
- Introduce Low Emissions Zones in Scotland's major cities in the first half of 2022
- Ensure that by 2040 we live in energy efficient, zero carbon housing with access to outdoor space, transport links, digital connectivity and community services. As a first step, to improve the quality of all Scottish Government grant funded homes
- Identify vacant and derelict sites for green infrastructure initiatives
- £2 million Islands Green Recovery Programme
- Introduce a network of regional hubs to empower communities to develop local solutions to making the transition to net-zero and climate resilient living
- Develop a network of Climate Action Towns
- £70 million fund to improve local authority refuse collection infrastructure and develop a new route map to reduce waste and meet our waste and recycling targets for 2025; and
- The Delivery of a £100 million Green Jobs Fund

Although the vast majority of Scottish government pledges centre on mitigation, the Programme for Government also commits to investing £12 million in coastal change adaptation and an extra £150 million in flood risk management.

While the approach of local government to climate change varies across different social, economic and physical geographies, the measures set out by the Scottish Government give an indication of the broad direction of travel for local climate action in Scotland with key areas of focus centering on housing, transport, the economy and waste management.

England

Introduction

As a result of devolution of certain responsibilities to Scotland, Wales and Northern Ireland the policy framework for climate change is a mix of UK, England only and local initiatives. The structural landscape of English local government is quite complex.

The simplest unit is the Unitary Authority, which is responsible for everything within its geographical boundaries, in some places this is two tier (counties and districts). A recent overlay to this structure is the establishment of combined authorities and directly elected mayors[38], some of whom are responsible for one city and some who represent wider regions. These tiers of local government are expected to collaborate and pool resources to tackle challenges and they can all play a part in addressing climate change. There is no comprehensive regional structure in England.

Local level

Many of the impacts of climate change are felt at the local level and are addressed through the planning system. Local Authorities in England have strategic and development control functions (sometimes these are split over the two tiers). The key planning document for Local Planning Authorities is the Local Plan. The Local Plan is commonly seen as the document which identifies the need and location of housing and infrastructure. However, a Local Plan is much more than this, as it is the place where consideration of climate change impacts can be identified and codified into locally relevant policies[39]. Local Plans are required to complete Sustainability Appraisals and for some sites carry out an Environmental Impact Assessment.

Many local authorities have made 'Climate Declarations'[40]. These are voluntary initiatives that support the UK government's net zero declaration. Some of these declarations relate to the impact of the local authority itself, its purchasing decisions and in the most ambitious cases the whole of the geographical area. There are some informal networks that local authorities have joined to help them think through the challenges of climate change. APSE run APSE Energy[41]. There is a Global Covenant of Mayors run by ICLEI[42], The Local Government Association's 'Climate Emergency Knowledge Hub Group'[43], UK 100[44], The Association of Directors of Environment, Planning and Transport (ADEPT)[45].

Economic development

Although not mandated, most English local authorities have a dedicated officer responsible for local economic development, many have a team. Their roles are varied and in those local authorities who put the most effort into economic development, the strategies will be a reflection of the priorities of the ruling elected group. The recovery from Covid has given new impetus to the development of economic development strategies partly as a way to steer a unique growth path for a place but also as a vehicle for the many government funding schemes aimed at rebuilding the English economy and boosting growth across the country.

1.3: Denmark

Introduction

Denmark is known to be a 'green driver' with very ambitious policies on environmental protection, renewable energy, and, since the 1980s, decoupling economic growth from emissions. However, there is still a long way to go as measured on consumption-based emissions Denmark is among the world's 10 least climate-friendly countries by inhabitant, not least due to a vast outsourcing of emissions to countries like China where much production takes place.

Highly influenced by the Thunberg-movement and school demonstrations around the world, the Danish national election in 2019 put climate top of the political agenda. This resulted in a strong left-wing majority as well as most major political parties committing to ambitious climate policy. As in other countries, governing in the era of climate change has presented the Danish government with tricky new trade-offs; growth vs. emissions reductions, personal freedom vs. the need to change consumption habits etc.

In 2020, the Danish Parliament passed "Klimaloven" ("The climate act") committing Denmark to cut greenhouse gas emissions by 70% in 2030 and net-neutrality in 2050[46]. However, the initiatives suggested by the Social Democratic government to deliver on the targets have been described as ''unambitious' and ''wishful thinking", thus far relying more on carbon credits and new technology delivered through public-private partnerships than actual emission cuts or change in consumption habits.

Local governments stepping up on climate ambitions

For years, the municipalities in Denmark have been working on how to adapt to climate change locally. The visible challenges are primarily more extreme weather, notably more concentrated rain, and rising sea level and the focus in each municipality has been on adjusting traditional municipal infrastructure portfolio to deal with flood protection, smarter sewer systems etc.

However, aiming for net zero emission in Denmark by 2050 requires fundamental changes in society, and all actors on every level must participate to succeed.

Even though direct emissions from municipality activity are not particularly high, Local Government Denmark (the national representative organisation for the 98 municipalities) advocates for leveraging the power of municipalities in climate policy. Given the right financial and legislative terms the Association argues that municipalities have a unique position to drive the development of a greener society. Examples where the municipalities can play a direct role include:

- **Circularity:** At the municipal oversight of businesses sustainable, circular solutions can be found.
- **Planning:** Mitigation can play a bigger part, when the city councils decide the physical planning of urban and rural areas in the municipalities.
- Property: The municipalities are the biggest property owner in Denmark. An energy efficient operation of the buildings will reduce emission and save money. And in the role of public builder, the municipalities can influence the demand for low emission solutions.
- **Employer:** The municipalities are the biggest public employer (0.5 million employees). Through a progressive, sustainable employer policy, the municipalities can influence the employees in terms of waste management, sustainable transport, food waste reduction, and green diets.
- **Procurement:** The municipalities administer most of public procurement. Sharing knowledge about sustainable procurement and improving the option of buying climate friendly goods and services will also reduce the climate impact.
- **Infrastructure:** The municipalities own several important utility companies, and are co-owners of traffic companies, ports, and airports. Local politicians and top civil servants can promote long-term decisions and contribute to a more sustainable operation and development within the energy sector.

However, municipalities are unfamiliar with climate policy. In the streamlined operation that constitutes modern Danish local government, city councils find it hard to prioritise climate action when budgets are tight, and citizens want better services.

One solution being implemented in several city councils is to establish standing committees on sustainability. Their task is to find emission reducing solutions across the different policy areas within the local government, and making citizens and businesses come together on sustainable solutions. However, due to the budget management these committees often become an appendix, writing reports and conducting citizens' engagement but with no actual power to implement change.

To make sustainability committees a success, there needs to be a closer integration between climate policy and local policy. Climate solutions need to be integrated in all policy areas in the municipality. Local Government Denmark puts pressure on the national government to find a financial model, where sustainable investments can be removed from the municipal financial framework, so the city councils are not torn between climate solutions or welfare services for the citizens.

DK2020 – climate action plans for all of Denmark

COP21 in Paris gave, for perhaps the first time, a clear momentum for climate mitigation on a local governmental level. Following the conference, the international C40 cities network published a report with global standards for how cities and municipalities can contribute to achieving the objectives in the Paris Agreement. It also points out that up to 40% of the goals in the Paris Agreement can be reached by implementing the right climate measures in the world's cities and municipalities.

To grasp this opportunity, the municipalities now needed a shift in leadership.
In 2019, Realdania (a philanthropist association in Denmark) started the DK2020 project through which 20 municipalities could undergo a pilot programme supporting them in developing, upgrading, or adjusting their existing work on climate action to global 'best practice', and ultimately developing climate action plans in line with the 1.5°C goal in the Paris Agreement[47]. 20 municipalities received technical support from experts at C40 and the Danish green think-tank CONCITO, so the plans would live up to C40's standard 'The Climate Action Planning Framework' (CAPF). This was the first time this framework was used to make local climate action plans by local governments.

After interest in the pilot program, Realdania formed a partnership with Local Government Denmark and five regional governments, each contributing approximately 2.2 million euro. The project is being expanded and 98 municipalities invited to join the project in two rounds. Green think-tank CONCITO provides overall project secretariat and is the key knowledge partner for the project. The tasks of providing advice to municipalities joining DK2020, and of facilitating their work on developing climate action plans are being organised in collaboration between Local Government Denmark and the five regions.

In the first application round 46 municipalities joined, pledging to adhering to manage all significant sources of greenhouse gas emissions in their local area including transport, agriculture, energy, buildings, urban development and the municipal vehicles and properties. In a climate action plan, each municipality must identify specific climate initiatives that combined will ensure net zero emissions by 2050 for the whole geographical area of the municipality. Before the plan is finally approved by the C40 international cities network, the climate action plan will have to contain specific suggestions for how the municipality will adapt to climate change as well.

The fact that half of all Danish municipalities have joined this voluntary project demonstrates their commitment to take the lead in local climate initiatives, sometimes in spite of the national government, who are criticised for limiting local climate actions.

The next frontier for Danish local government climate action

In several local communities in Denmark, not least major cities, citizens are starting to demand even more climate change mitigation ambition from their leaders. Most notably a green majority in Copenhagen's City Hall in March 2021 demanded that the lord mayor present a revised climate plan for Copenhagen, including among other things, cutting greenhouse gas emissions from all economic activity in the city by 2035. The municipality's own activities only constitute around 1-2 % of all emissions meaning that a completely new set of tools had to be considered to deliver on this new ambitious target. Such tools include educating kids to be climate-conscious consumers, using planning to shape consumption patterns, driving consumption-culture change by introducing citizens to, for example, new ways of eating. The forging of new public-private partnerships with major local industries will also enable the municipalities to decarbonise.

Only a handful of cities including Copenhagen, Amsterdam and Paris have started to use their power to deal with these so-called scope 3 emissions (emissions from all consumption within their local area). This is however an area worth following closely because the new policy tools tested in these cities might be the ones national governments will need to deploy to reach their ambitious climate targets.

1.4: The United States of America

Overall governance framework

In the USA, the state is the default level of governance as defined in the Constitution, in which Article IV sets out the responsibilities of the federal government towards the states and that of the states towards each other.[48] Some powers like coining money, regulating the mail, conducting foreign affairs, and setting naturalisation criteria are exclusive to the federal government. Concurrent powers, shared by the federal and state governments, also exist and include borrowing money, taxation, law enforcement, chartering banks, and eminent domain.

States retain a lot of power and so long as their laws don't contradict federal laws where set out in the Constitution, they generally have the authority to legislate on everything else. Conducting elections, establishing local government, public health, maintaining militia and ratifying constitutional amendments are just a few specific state powers[49].

Unlike the federal relationship between the national government and the states, municipalities in the US are creations of state governments under the authority of state constitutions and have no powers other than what is granted to them by their state government[50]. There are two types of governing authority followed; Home Rule and Dillon Rule, where Home Rule gives local governments the power to legislate on any matters that have not been addressed by the state, and under Dillon Rule local governments can only legislate where the state has issued enabling statutes.

Most states in the US have at least two tiers of local government, counties and municipalities. In some states counties are fully subdivided, and in some states only certain towns and cities have municipal government. There are 50 states and 50 different local government systems. For case studies of governance structures in three individual States see Appendix B.

Climate governance in the USA

International level

The United States signed in 1998, but never ratified the Kyoto Protocol. It later withdrew its signature[51]. Despite the Trump Administration also withdrawing from the Paris Agreement, the Biden Administration re-joined in 2021, signifying a return to international cooperation on climate change by the US. Along with Japan, Australia, China, India, South Korea and Canada, the US is also a member of the Asian-Pacific Partnership on Clean Development and Climate.

Federal level

To date, there has been no comprehensive legislation enacted at the federal level to address the climate crisis, with much current federal policy actually being designed to promote the use of fossil fuels[52]. However, as of 2021, the Biden administration has taken steps to ensure that tackling climate change will be a national priority going forward, issuing an executive order in January 2021 setting out these commitments[53]. In April of 2021 Biden also announced that the US would target the cutting of its greenhouse gas emissions to 52% below 2005 levels by 2030[54].

Governmental authority on climate change and the environment at the federal level is highly fragmented, with almost every executive department having an environmental mandate of some sort. At the centre of this, and with the most comprehensive responsibility, is the Environmental Protection Agency [EPA] – although it still lacks absolute authority over many environmental issues. For example, determining whether an area is classified as wetland and issuing usage permits accordingly is the responsibility of the US Army Corps of Engineers, with the role of the EPA restricted to reviewing these permit applications[55].

It is a well documented that infrastructure throughout the Unites States, from physical transport to internet provision and everything in between, is overstretched and outdated[56]. This immediate and widely-recognised need for investing in infrastructure nationwide – an expected $90 trillion to 2030[57], is acknowledged as a central regeneration platform for the Biden Administration. It presents, perhaps, one of the best opportunities for building climate proofing into the fabric of the country, much of which will be funded and mandated at the federal level.

State level

In the absence of any substantial climate policy nationally, the states have had to lay the groundwork for larger-scale climate action in the USA, including bypassing the federal government especially when under Trump, to cooperate directly with other countries. In 1990, Connecticut became the first state to pass a law to require specific actions for reducing carbon emissions. In 2006 Governor Schwarzenegger of California entered into a research pact with the UK to work together to explore ways of tackling climate change.

In 2015, the first law mandating a transition to 100% clean energy was passed in Hawaii.[58] Hawaii was also the first US state to declare a climate emergency, having done so in April 2021.

Twelve states plus Puerto Rico have now implemented policies with 100% clean energy targets[59]. Energy Efficiency Resource Standards [EERS], policies requiring utilities to meet energy savings targets, are currently being implemented by twenty-seven states[60]. Renewable Portfolio Standards [RPS], regulations requiring energy production from renewable sources, apply in thirty states, accounting for 56% of U.S. retail electricity sales[61].

States have also been working with each other to scale up their impact. The Regional Greenhouse Gas Initiative [RGGI][62], a market-based cooperative between eleven states in the North East to reduce emissions from the power sector, is the first mandatory cap-and-invest initiative implemented in the US. The United States Climate Alliance [USCA] is a bipartisan coalition of 24 States, plus the self-governing territories of Puerto Rico and American Samoa, who have pledged to address climate change in line with the aims of the Paris Agreement.

At the State level, infrastructure development is going to be a key arena for targeting climate change. Even with an ambitions federal infrastructure plan, states are likely to have to take on responsibility for financing and implementing improvements to roads, airports, water treatment plants etc[63]. State governments can and do aid in facilitating the adoption of Natural and Nature-Based Infrastructure [NNBI] investments[64]. For Example, in 2008 Maryland passed the Living Shorelines Protection Act mandating the use of NNBI living shorelines as default for shoreline protection[65].

States also have mandates to regulate and fund banking in their jurisdictions. The State of Pennsylvania regulates over 200 banks which serve only businesses and citizens of Pennsylvania, including 70 community banks[66] and many mutual banks owned by the people in the communities and dedicated to serving community needs – including environmental needs.

The first Green Bank, whose mission defined by the OECD is to "facilitate private investment into domestic low-carbon, climate-resilient infrastructure"[67] in the USA was established in Connecticut in 2011. The states of California, Rhode Island, Hawaii, and New York have also all established Green Banks.

Local level

Cities and counties represent a smaller and often less political arena within which conditions are perhaps more favourable for the governance of climate change. In 2017, The City of Hoboken, New Jersey and Montgomery County, Maryland were the first local jurisdictions to declare climate emergencies. There are now over 150 cities and counties across the US that have declared made similar declarations[68], and across the USA, over 200 counties and cities have either committed to or already achieved 100% clean electricity[69].

Cities with infrastructure mandates can also use NNBIs to ensure that they are tackling climate and environmental concerns while addressing infrastructure needs. As part of the East Side Coastal Resiliency Project to reduce flood risk, New York City has proposed the use of vegetated berms and the conversion of built infrastructure to green space. The cities of San Francisco and Boston have also partnered with Rebuild By Design to implement NNBIs to improve climate change resilience[70].

Municipal bonds are another financing tool well suited to address the infrastructure investment gap in the US, having been used by cities to fund large scale, capital intensive projects since the 1900s[71]. The market for green muni bonds, where the proceeds are earmarked for green investments, has grown over the last decade. In May 2012, the Philadelphia Municipal Authority issued $12.6 million in municipal bonds to fund the upfront costs of the energy efficiency upgrades to buildings in the city[72].

Montgomery County, Maryland was the first county in the US to establish a local Green Bank. Capitalised by the county government plus money from a public utility merger, the Montgomery County Green Bank leverages its funding to provide county residents and enterprises with favourable rates on finance for clean energy projects[73].

1.5: Finland

Overall governance framework

The Finnish State is similar to those of the other Nordic countries, with a three-stage structure; the president and prime minister at the top, then parliament, followed by a legislative branch (including local government). Finland is traditionally known as one of the most decentralised of OECD countries[74]. Local governments are responsible for much more than in some of the neighbouring countries, and much of this self-governance is due to the autonomous history of the country. But as a small welfare state, Finland is also actively seeking to reform its local government to better serve an ageing population.

Current Finnish regional and local government in numbers:

- 309 Municipalities (16 in autonomous Åland island)
- Six Regional State Administrative Agencies,
- 15 Centres for Economic Development, Transport and the Environment (ELY-keskus)
- 11 Police departments
- 11 Local register offices
- 22 Enforcement offices
- 11 Prosecutor's offices
- 15 Employment and Economic Development Offices (TE offices) acting as local state authorities.

Administrative structures in Finland

National level

The highest bodies of the state in Finland include the Parliament of Finland, the President of the Republic and the Finnish Government. The President is elected for a 6-year term and has only residual powers. The President appoints the Prime Minister to their role, after parliamentary elections that generally have been held every four years.

The current Government, led by PM Sanna Marin, consists of the Finnish Social Democratic Party, the Center Party of Finland, the Green League, the Left Alliance and the Swedish People's Party of Finland. The Marin government has 19 ministers[75].

The 12 Finnish ministries are responsible for the preparation of matters and the functioning of administration within its own sector and in total, ministries included, there are about one hundred organisations responsible for policy making[76].

The Prime Minister directs Government activities and oversees decision making, as well as chairing the plenary sessions of the Government and statutory Ministerial Committees. Åland's autonomy grants it the right to pass laws in areas relating to the region and also, control their own budget. The island thus has its own Parliament, which further appoints the government, called "landskapsregeringen"[77].

Regional level

Regional level government in Finland experienced large-scale change in 2010, when the Provincial Government administrations were replaced by two separate institutions. Now, the current 19 regions (18 excluding Åland) are governed by 15 Centres for Economic Development, Transport and the Environment (ELY-keskus) and six Regional State Administrative Agencies (AVI), in which the municipalities are represented on a higher level. This brings the total number of regional level governors to 21. In comparison, local council areas represent the same in Scotland, and there are 32 of them.

The function of the Regional State Administrative Agencies are, according to the definition:

"The agencies' mission is to promote regional equality by carrying out executive, steering and supervisory tasks laid down in the law. To this end, they aim to strengthen implementation of basic rights and legal protection, access to basic public services, environmental protection, environmental sustainability, and public safety and also to provide a safe and healthy living and working environment in the regions."

One noticeable feature of the Finnish system is that the six regional State Administrative Agencies and ELY-centres are actually not accountable for the same regions, but overlap in their responsibilities. Because the Finnish municipalities do not have police or legislative powers, they work together in the ELY-centres and Regional State Administrative Agencies, reaching trans-regional decisions in these matters.

The Regional Government Agencies are responsible for:

• Basic public services, legal rights and permits
• Education and culture
• Occupational health and safety
• Environmental permits
• Rescue services and preparedness

ELY-centres are responsible for[78]:

• Business and industry, labour force, competence and cultural activities
• Transport and infrastructure
• Environment and natural resources

Local level

There are 309 municipalities in Finland (2021). 16 of them are situated in Åland, which is the autonomous island on the southwest coast of the mainland. The municipalities are self-governed by the local government, which is elected by residents every four years. The size of this municipal council is proportional to the size of the town or city. 106 of the municipalities are cities (population over 55,000) and 33 are bilingual (Finnish and Swedish).

The local municipalities in Finland are responsible for[79]:

• **Social services:** securing a basic livelihood, rehabilitative work activities, services for people with disabilities, child welfare, care of the elderly.
• Health services: primary care, specialist care, oral health care and environmental health services.
• **Education and culture:** early childhood education and care, basic education, general upper secondary education, vocational education and training, library and information services, youth work and sports services.
• **Technical services:** planning, maintenance of streets and other public areas, construction of buildings and infrastructure, traffic, and water supply and sewerage systems.

Centralisation of local government is becoming more evident in Finland, as many of the municipalities have been merged together in recent years, following initiatives to provide more cost-efficient and more digitalised services for the residents. From 2005 to 2015, 82 municipalities were joined together. The ongoing Social, Health and Regional Government reform will further change this, when the services now organised by over 200 institutions are centred for 22 areas, which do not necessarily follow any specific regional borders. Despite this large-scale reform, the local government structure in Finland will remain different when compared with the Nordic countries.

Finance

Municipalities enjoy a vast amount of autonomy and their main source of revenue is taxation. Municipal income tax is the largest source of the tax revenue, in addition to property tax (seven per cent of local tax revenue), that each municipality can set individually but within the upper and lower limits set by the central government. The total revenue from taxes forms over 44 per cent of the municipality income, which is much higher than the OECD average of 37 per cent[80].

In addition to tax revenues, municipalities receive subsidies and grants from the central government for the general allowances, health and social care transfers, and education and culture transfers. 22 percent of the other revenues come from fees and charges imposed to the residents, including water supply, power, waste disposal and public transport. Basic education in Finland is free, but there are small charges for public health care.

Climate intervention

As climate change, biodiversity loss and over-consumption are different sides of the same sustainability crisis, the Finnish government is working to tackle the root causes holistically, stating that: "The government will act in a way that will make Finland carbon neutral in 2035 and carbon negative soon after. This will be done by speeding up emission reduction measures and strengthening carbon sinks.[81]"

The measures adopted by the current government include a number of new climate policy decisions, near-zero-emission electricity and heat production by the end of the 2030s, as well as a reduction in the carbon footprint of construction, the promotion of a circular economy and a climate-friendly food policy. In 2019, the main sources of emissions in Finnish municipalities were road transport (25%), agriculture (18%), district heating (15%) and electricity consumption (heating and other consumer electricity 13%[82]).

The focus of taxation will be shifted to the taxation of environmental damage. Biodiversity loss will be halted by reforming nature conservation legislation, strengthening funding for biodiversity protection and promoting the sustainable use of natural resources. Whereas this is a state level commitment, the Finnish government has acknowledged that no net zero targets are met unless the local governments are also actively and effectively working towards those targets.

Finnish municipalities have their own five year municipal climate solutions programme (2018-2023)[83]. The programme supports and finances the climate work of municipalities and regions through procurement and state subsidies. Most of the funding goes directly to assist municipalities and regions with their own climate projects, based on the introduction of best climate practices and the testing of new ones.

In addition, part of the programme's funding will be used for procurement at the national level, which will enable climate work in all municipalities and regions, including the development of common operating models, communication materials, knowledge base and training.

Finnish local governments have become really active in climate action, which has been visible in uptake for environmental project funding. Just recently, Finnish Ministry of the Environment has distributed 2.6m euros (£2.2m) for greenhouse gas reducing projects in municipalities. The Minister of Environment and Climate, Krista Mikkonen, commented on the applications: "The key project themes were clearly highlighted in the grant applications. These were municipal climate management, municipal and corporate climate cooperation and energy efficiency."

And the local level approach seems to be working. Finnish municipalities' climate emissions have dropped 5.5 percent in 2019 compared to the previous year[84]. The largest decrease in emissions was from electricity production, which has seen an increased proportion of wind power generation.

Another great Finnish local government level climate action initiative is called Hinku (Towards Carbon Neutral Municipalities), a climate mitigation network for Finnish forerunner municipalities. The network involves committing to greenhouse gas emission reductions of 80 per cent from 2007 levels by 2030 and now covers over a third of the Finnish population.

The Finnish climate policy, in which many municipalities set themselves more ambitious targets than the state requires, effectively uses technology and digital reporting to measure how progress is made in terms of emissions and waste management, for example. But to be actively seeking a place at the forefront of climate action and its ambitious net-zero goals will require strong action from national, regional and local level actors.

1.6: Sweden

Overall governance framework

Sweden has come a long way to be the welfare state hovering at the top of almost every ranking measuring citizen happiness, political engagement and health. Indeed, governance in Sweden is one of the most decentralised in the world. The country's local government approach offers an interesting insight into the challenges Sweden faces compared to those countries of more centralised political structure. However, the Swedish local government system (which got its form in the late 20th century under Social Democratic Party rule) is facing a series of financial and structural challenges.

Swedish regional and local government in numbers:

- 290 municipalities (kommun)
- 21 regions ((län)
- Half of all municipalities have less than 15,000 inhabitants
- 46,000 political offices in the municipalities
- 3,500 in regions
- 19 per cent; average municipal tax rate in 2019

Administrative structure in Sweden

Sweden is a constitutional monarchy with a parliamentary democracy[85]. The Parliament, called Riksdag, is led by the Prime Minister and elected for a four-year term. The ruling monarch's duties are regulated by the Swedish constitution and the monarch is the country's foremost representative and symbol, with primarily ceremonial duties.

International level

Sweden joined the European Union in 1995, and is a member of the United Nations and OECDS and collaborates with NATO in projects. In a national referendum in 2003, a majority of the country's voters voted not to join the Eurozone, so the country still has its own currency, the Krona.

In general, the support for EU in Sweden is increasing and estimates show that about 60 per cent of the issues dealt with by municipal and county council assemblies are directly or indirectly influenced by European funding or decisions taken by the EU[86].

State level – Riksdag, the Swedish Parliament

The Riksdag is the Swedish equivalent of Ireland's Oireachtas and has legislative power[87]. The government implements decisions made by the Riksdag and further drafts new laws or makes amendments to existing legislation. General elections are held every four years. About seven million Swedes are entitled to vote in these elections. In order to vote, one has to be a Swedish citizen and over 18 years of age. The voter turnout in the previous parliamentary elections of 2018 was 87.2 percent, and the turnout has not been below 80 per cent in Sweden since the 1950s[88].

In local and regional elections, which are held at the same time as general parliamentary elections, it is not just Swedish citizens who have the right to vote. Any EU citizens, citizens of Iceland or Norway and citizens of other countries who have been registered in Sweden for over three years and are registered in their municipality or county are eligible.

Local self-government is a longstanding tradition in Sweden and has important constitutional significance. The principle of local self-government has been stated in the Constitution as an integral part of democratic government in Sweden. Sweden has also ratified the European Charter of Local Self-Government[89]. The latest Local Government Act was introduced in 1992.

Regional level

Local government in Sweden consists of two levels: 290 municipalities and 21 county councils/regions. Municipalities and councils are something that distinguish the Swedish model of public administration from many others. In essence, the model aims to decentralise decision making and the responsibility for services and decision making is placed as close to the people as possible. Regions are county councils that have been given additional responsibility for regional development.

There has been a gradual transfer of functions from central government to county councils during the last 20 years and by 2019 all county councils have been transformed into regions.

The regional councils are elected for four-year terms using a system of proportional representation. It is compulsory for councillors to be members of political parties, and over 90 per cent of them represent the same parties as those in Parliament. Political decision-making is collective so there are no mayors or any other politicians with independent decision-making power.

Local level

The municipal level has more resources and functions than the regions. As they are also closer to the people, their decision-makers are better known by the general public. Each municipality has

their own self-governing local authority, in which an assembly board is elected every four years in the same way as for the regions. An exception to this is Gotland, an island on the south-east coast in the Baltic Sea. The municipality of Gotland is responsible for tasks that elsewhere in the country are associated with regions.

Municipalities vary in size from 2460 inhabitants in Bjurholm, to Stockholm with 939,000 inhabitants. Municipalities have been amalgamated into larger units in order to secure the provision of essential services; first in 1952 and again in the early 1970s. Municipalities are responsible for local infrastructure, including streets, parks, recreation and culture. They are also in charge of land-use planning and building permits. They pay the wages of teachers, social and health employees.

In addition to directly-elected municipality and regional assemblies, there are also subnational state authorities with an interest in the development of the local government. Each region has an administrative board, which is the central government unit for general administration and supervision at regional level.

The state authorities perform control and support functions for example to social services and environmental protection. Other central government actors at regional level include universities and colleges and regional branches of national administrative agencies for transportation, labour market policy, forestry and agriculture.

Local government finance

Like neighbouring Finland but very unlike Ireland, Swedish local government has a considerable level of autonomy and the right to tax their residents. This tax, which is roughly a third of every Swede's salary, forms a remarkable part of the local budgets. Two thirds of this share go to municipalities and the remaining third to the regions.

As much as 54 per cent of the municipalities' revenue come from taxes, followed by grants and subsidies (31 per cent)[90]. The grants and subsidies aim to balance out inequalities between the municipalities and counties by offering both general and specific grants (using the so called, often also criticised "Robin Hood-Tax") to fund local and regional authorities[91].

In practice, this means that the richer municipalities "profits" go into enabling the smaller, poorer municipalities to offer all the basic services.

Sweden has taken autonomy of local government further than many other countries in the world; they account for about half of the government expenditure and a quarter of the GDP.[92] On average in the OECD countries about 40 per cent of the government expenditure and respectively 16 percent of a country's GDP are used on local government functions. The government expenditure reflects the way Sweden's government works: subnational government expenditure in Sweden is as much as 10,000 euro per capita, whereas elsewhere in the OECD area this is merely half of this, on average about 5,000 euro[93].

Climate interventions

Sweden, if any nation, has come to be known as a very environmentally conscious country, leading the new wave of climate activism. With a long history in climate work, the nation rose to international spotlight when Greta Thunberg started striking for the climate in 2018. A year later, millions of schoolchildren around the world were protesting against climate change, and by the end of 2019 Time magazine named Thunberg 'Person of the Year'. Consequently, and rather unexpectedly, it took a teenager for the world to wake up to the climate crisis.

The youth climate movement has urged the Governments around the world to make use of their valuable perspectives and experiences when responding to the challenge. Last December, as a step towards addressing climate challenges, Swedish Minister for Environment and Climate Isabella Lövin, State Secretary Eva Svedling and Ministry of the Environment staff met with representatives of ten Swedish youth climate organisations in a digital forum to discuss Sweden's climate efforts and objectives for the high-level meeting Stockholm+50 from a young person's perspective[94].

Professor Johan Rockström, co-founder of Stockholm Resilience Centre[95], thinks that Sweden could be a model for other countries to follow. 'Sweden has a disproportionate influence in this field and therefore also a large responsibility,' Rockström has said, adding 'Sweden, both in science and in action, should be able to show that combining sustainability with human well-being is a path for success and development.'

Sweden was the first country in the world to pass an environmental protection act in 1967, It also hosted the first UN conference on the global environment in 1972. Since then, Sweden has managed to grow its economy substantially while reducing carbon emissions and limiting pollution. More than half of Sweden's national energy supply comes from renewables and a thorough legislation aims at further reducing greenhouse gas emissions.

In June 2017, Sweden's Riksdag (parliament) decided by a large political majority to introduce a climate policy framework with a climate act for Sweden. This framework is the most important climate reform in Sweden's history and sets out implementation of the Paris Agreement in Sweden. Sweden is aiming to have zero net emissions of greenhouse gases into the atmosphere by 2045[96].

This is visible in the country's climate budgets; Sweden's Social Democrat and Green minority government's 2021 budget contains 9.7 billion Swedish crowns (c.1 Billion Euro) in new spending aimed at fighting climate change. Local government action is addressed in Sweden's climate goals as well. The local authorities monitor their climate actions and have regular exchanges with the state level. Most Swedish municipalities belong to an association called 'Klimatkommunerna' ("Climate towns"). This is an association of cities, frontrunner towns and regions in Sweden, in the transition towards a fossil free future with a good quality of life for their inhabitants. The association has created a 10-step tasklist for local governments taking climate action. It is much in line with the state policies, and urges action in the fields of emissions, transport, finance, renewable energy sources and circular economy[97].

1.7: Australia

Overall governance framework

Australia has a mixed system of government; it is a representative democracy and a constitutional monarchy. It is also a federation of states. Three levels of government work together to provide Australians with the services they need:

- Federal (Australian) Parliament, in Canberra
- 8 State and territory parliaments, in each state and territory capital city
- 537 Local councils, also called shires, across Australia.

The Australian Constitution sets out how the federal and state parliaments share the power to make laws. There is no federal constitutional provision for local government – it sits under the jurisdiction of each state and territory government where it is provided for in all constitutions. Local government elections are held every two years in Western Australia and Tasmania, and every four years in other states and territories.

How is Australian local government structured?

Local governments are subdivisions of the states and the Northern Territory. The Australian Capital Territory [ACT] has no separate councils, and functions in Canberra and the surrounding area which would usually be the responsibility of state and local governments are undertaken by the territorial government of the Australian Capital Territory.

What are the responsibilities of Australian local government?

It varies between the states and territories, but councils in Australia generally have a statutory mandate for providing the following:

- local infrastructure
- water and sewerage services
- community services such as childcare
- health services such as food inspection, immunisation services etc

- care and recreation facilities for the elderly
- cultural and educational establishments
- commercial establishments including parking, cemeteries etc.

At 379,571 square kilometres, the Shire of East Pilbara Council in Western Australia is Australia's largest local government area. At 1.4 square kilometres, and with 1524 residents, the smallest local government area is the Shire of Peppermint Grove Council, Western Australia
Around 55% of Australian councils are regional, rural, or remote councils.

Local government finance

Local government revenue comes from three main sources[98]:

1. Taxation ie. rates which account for approximately 38 per cent of total revenue
2. User charges/sales of goods and services which account for 28 per cent of total revenue
3. Grants from federal and state/territory governments which account for 14 per cent of total revenue.

As noted by the Australian Local Government Association "Individual councils have differing abilities to raise revenue, based on location, population size, rate base and the ability to levy user charges". For individual councils the proportion of revenue from each source may vary significantly. For example, some rural and remote councils are more limited in their ability to own-source revenue raise and grants can account for more than 50 per cent of council revenue.

Federal government grants fall into two categories, the Financial Assistance Grants, which are paid to state governments for distribution to local government via state grants commissions, and funding distributed under a range of Australian Government programs.

Disaster mitigation

- Drought Response, Resilience and Preparedness Plan, providing $212.2m over four years including funding for local government
- Building Australia's Resilience, providing $1.2b over five years for improving preparedness and response to natural disasters
- Disaster Recovery Funding Arrangements, with an allocation of $275.9m over three years.

The state of climate change in Australia

Australia is one of the most vulnerable developed countries in the world to the impacts of climate change. Yet leadership at the federal government level has been notably absent[99]. This is despite the majority of Australians wanting the federal government to cut greenhouse gas emissions to net zero by 2050[100]. Indeed, Prime Minister Scott Morrison has continued to hold out against renewed global calls to set the target.

Despite this absence of leadership at the national level, state and local governments have continued to progress with Net Zero targets, climate change mitigation and adaptation. All of Australia's states and territories have identified the need to increase the use of renewable energy, and to reduce greenhouse gas emissions to zero by 2050 or earlier[101]. Many States and Territories have also set interim targets to measure progress.

At the local level, Melbourne's City of Darebin was the first in the world to declare a climate emergency in 2016. This was followed by Hoboken in New Jersey and Berkeley, California, and quickly became an international movement of predominantly local government actors. By 2021 over 2,000 local governments globally had declared a climate emergency. A third of Australia's population now lives in a municipality that has declared a climate emergency[102].

The Net Zero Momentum Tracker report (2020) assessed the emissions reduction commitments and activities of 57 Australian councils, and documented the extent to which they were on target to achieve net zero greenhouse gas emissions by 2050[103]. The local councils assessed generally represented the most populous local government areas, and collectively comprise around 52 per cent of Australia's population. All the local councils assessed were taking steps to reduce emissions, and many had net zero emissions by 2050 targets or aspirations. Four of the local councils were already carbon neutral: Moreland City Council[104], City of Sydney[105], City of Melbourne[106] and Brisbane City Council[107].

In addition to influencing emissions within their local government area, councils can have a much broader impact through both their own actions and those done in collaboration with other councils and organisations. The Victorian Energy Collaboration (VECO) will see 46 of Victoria's 79 local councils powered by renewable energy having signed an agreement with Melbourne-based energy retailer to supply the councils with a combined 240 GWh of renewable energy each year until the end of 2030[108].

With local government in Australia collectively responsible for over $380 billion in assets and land, environmentally-friendly land management and urban planning is an area where local government can play an important role. A briefing by LGIU provides an overview of the expected changes to the climate for Australia to the year 2100 and discusses the potential physical and chemical impacts on materials and infrastructure[109]. It also looks at adaptation options to reduce climate change impacts, with examples of how this might look in practice.

Looking beyond energy and infrastructure, councils are involved in encouraging active transport[110], waste diversion including taking organics out of the waste stream and supporting a transition to a circular economy[111]. Climate change adaptation and mitigation are becoming increasingly pressing. Urban heat is just one area where the impacts are already being felt by local communities[112].

1.8: New Zealand

Overall governance framework

According to Local Government New Zealand (LGNZ)[113], local government in New Zealand comprises of 78 organisations, consisting of:

- 11 regional councils;
- 61 territorial authorities – 11 are city councils and 50 are district councils; and
- Six unitary councils – which are territorial authorities with regional council responsibilities.

These tiers of government overlay each other and have coterminous boundaries. The elected members of these councils are chosen every three years. Councils typically meet monthly. Many councils have second tier or sub-municipal bodies which are also elected. These are known as community boards or local boards. There are currently 110 community boards and 21 local boards across the country, with the local boards only operating in Auckland. The Local Government Act 2002 (LGA) requires councils to consider and promote the current and future wellbeing of communities. It also introduced new responsibilities and opportunities for engagement and cooperation between councils Iwi, Hapu and Māori.

Climate interventions

New Zealand cemented its reputation as a leader on the environment with the Resources Management Act 1991[114]. The Climate Change Response (Zero Carbon) Amendment Act 2019[115] sets a target of net zero emissions by 2050. This target provides the focus for an independent Climate Change Commission (CCC) which was set up by the Climate Change Response Act 2002[116]. The Commission will recommend to the government the first carbon budget for 2022 to 2025, thereafter the budgets will cover five years.

As well as the carbon budgets, the CCC has a responsibility to advise the New Zealand Government on all matters relating to climate change mitigation and adaptation. The CCC also has a duty to monitor emissions and the progress of the National Adaptation Plan[117].

New Zealand is using economic levers to incentivise emissions reduction. There is an emissions trading scheme for industry and there will be a price placed on emissions from agriculture. This economic underpinning will allow for the implementation of the Emissions Reduction Plan (ERP). The ERP is in fact a combination of sectoral and multi sector plans of which the agricultural sector is key.

Nearly half of New Zealand's emissions are nitrous oxide and methane from agriculture, hence the need to put a price on emissions from 2025 and the provision of funds to help farmers with the transition. An important first step is the Dairy Action for Climate Change, which is a commitment by the dairy industry to carry out pilot studies and research into reducing methane emissions from dairy herds.

Other initiatives include tree planting, support for research and engagement with UN global strategies. While mitigation is important it's recognised that local government's main contribution to tackling climate change will come through adaptation.

New Zealand has completed a climate change risk assessment[118] that identifies the main issues and is in the process of developing a National Adaptation Plan, which will be supported by a Climate Adaptation Act. Local Authorities are important actors in the allocation of land use and resources through their planning and regulatory powers. However, debates at a LGNZ conference in 2021 highlight that the powers in the RMA while ground breaking in 1991 are no longer sufficient and a more comprehensive framework is required to tackle climate change. There is also some concern over the CCC's ability to request information on climate change from local authorities and the burden that may be.

The collective contribution by New Zealand local government is being coordinated through LGNZ. The LGNZ strategy is to help national government in four ways[119]:

- **Reporting and Funding**: Ensuring that reporting requirements can be met and that new funding mechanisms are developed to support adaptation.
- **Community Resilience:** Managing a transition from piecemeal approaches to hazards to something more systemic.
- **Climate Future Fit:** Sharing of good practice
- **Climate Change Project:** A strategic overview that looks at the legal framework for adaptation and how local authorities can work with communities on mitigation.

Economic development

The structure of support for economic development in New Zealand varies across the country, with the Chambers of Commerce playing an important role. At the national level there are agencies focused on inward investment.

At the regional level, the Local Government Act 2002[120] requires local authorities to develop long-term (ten-year) plans which set out priorities and objectives, and provide for integrated decision making and co-ordination of resources. Similarly, the Land Transport Management Act 2003 requires regional authorities to create regional land transport plans (six-year plans). Most regional authorities also have action plans, which identify specific economic activities that will leverage regional opportunities, to increase employment and household income.
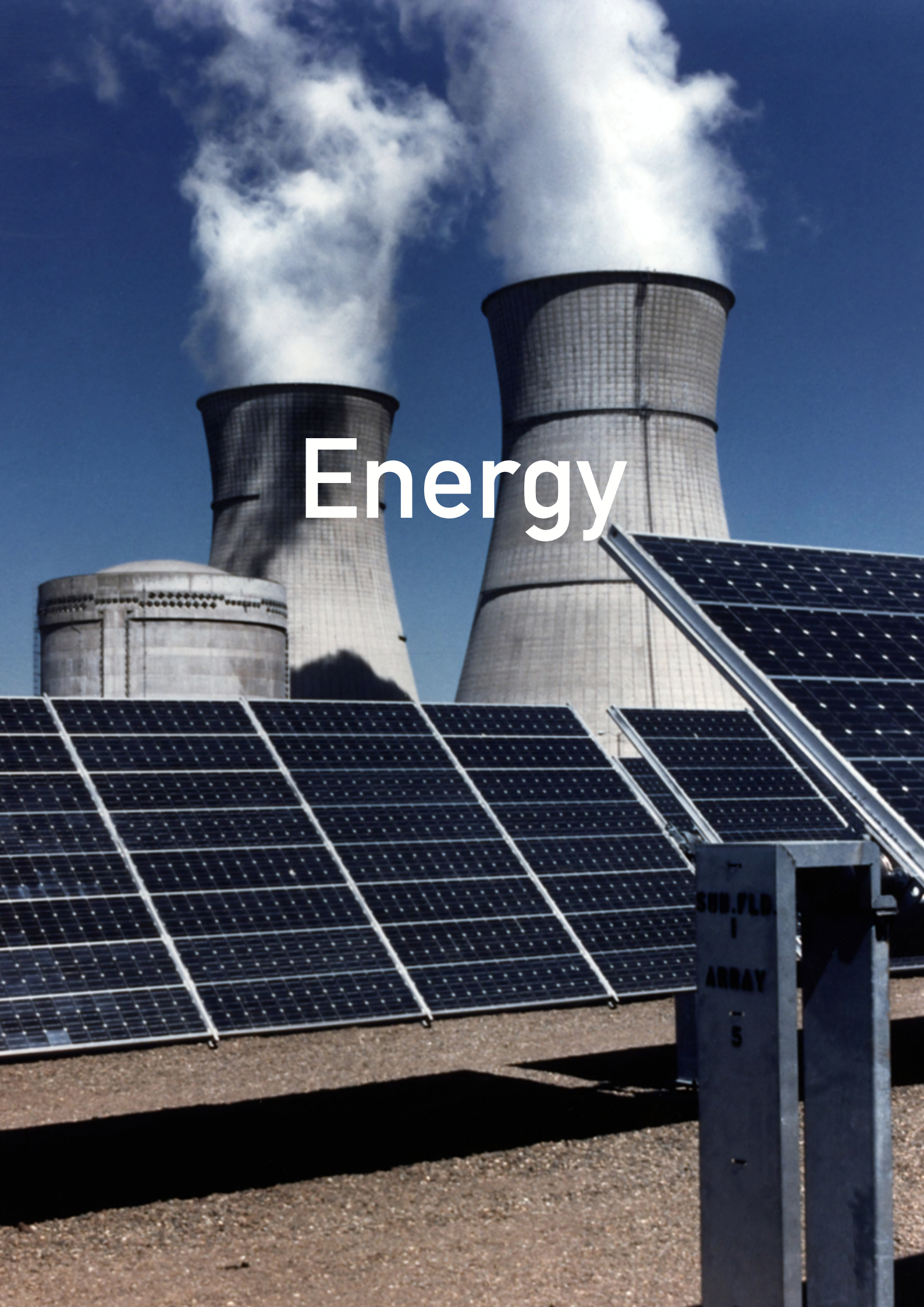
At the local authority level, the emphasis varies according to local need. Some local authorities support regional economic agencies, some have small teams.

Chapter 2: Case Studies
Main Opportunities

Energy

Offshore wind development in Southern Denmark

Much of the information for this case study is drawn from Andersen et al's 2019 paper examining green growth in the Nordic Region[121].

Business sector/type of intervention
The offshore wind energy sector in Esbjerg in the region Southern Denmark

Project outline
With 98 offshore wind farms, Denmark is a pioneer in wind energy[122]. Previously an important centre for fisheries with oil and gas activities, the municipality of Esbjerg is now a major hub for offshore activities in Denmark. The transition from fishing & fossil fuels to renewables marks Esbjerg out as an important example of a just transition. In Esbjerg, 250 companies employ more than 13,500 people in the energy sector[123] with 9,000 of those employed in the offshore wind industry[124].

According to Andersen et al, the off-shore wind energy industry has grown in the region due to transfer of both tangible and intangible resources between the oil and gas industry and offshore wind industry at the individual level (i.e. people moving from offshore oil and gas industry to offshore wind industry), firm level (i.e. one firm using knowledge from one industry to the other) and regional cluster level. In some instances, the transfer of resources has been unidirectional, such as from offshore oil and gas industry to offshore wind industry and from onshore wind industry to offshore wind industry for key components such as rotors, turbine blades, and nacelles.

Esbjerg's port provides a key piece of infrastructure which has helped to catalyse the growth of the offshore wind sector with 75% of Danish wind turbine exports passing through the port each year. The port generates roughly 9.56 million euros in profit per year.

Image: Offshore wind turbines in Denmark. Photo by Bente Jønsson.

Type of local authority intervention

The region of Southern Denmark has initiated the Southern Denmark Growth Forum for stimulating economic development in the region and for improving cooperation between the different firms in the regional cluster. The Growth Strategy 2020[125] focuses on keeping existing jobs in the region and creating new jobs as well through long term investment. The Growth Strategy also focuses on developing the energy sector in the region particularly the offshore oil and gas and wind energy and become an international leader in the development of offshore energy and also has set up 15% growth in the sustainable energy business and 10% growth in technology exports within sustainable energy business area

Investment source

The Nordic infrastructure fund Infranode is set to invest up to DKK 1 billion (circa EUR 134 million) for new infrastructure facilities at Esbjerg's port[126]. The investment is expected to create up to 2,000 new jobs.

While private sector investment is key to the development of the offshore wind sector in Esbjerg, Southern Denmark's regional Growth Strategy is an important guide for attracting investment to the region. Over the next eight years the offshore wind sector is expected to grow by 14%.

It's important to note that, given that offshore wind energy is a global industry, a lot of developments happening in the European offshore as well as global offshore wind energy market, impact developments in the Southern Denmark region. There is currently a lack of clear direction at the local level which is a key barrier to maintaining investments from wind turbine manufacturers.

Partners/stakeholders
- Wind turbine manufacturer (e.g. Siemens Gamesa and MHI Vestas)
- Owners of offshore wind farms owners of offshore wind farms (e.g. Orsted and Vattenfall A/S)
- Esbjerg Business Development Centre
- Local universities (E.g. Aalborg University and University of Southern Denmark)
- The Offshore Centre Denmark has played an important role in facilitating interaction and linkages between the offshore oil and gas and the offshore wind energy industry.
- Offshore wind energy specialized suppliers (e.g. Bladt industries A/S specializing in the development of offshore substations and foundations)
- Maritime and logistics suppliers who supply to the maritime, shipping, fishing, offshore oil and gas and wind energy industry (e.g. Esvagt and Bluewater shipping which have gradually moved from providing general logistics to specialized logistics for the offshore wind and offshore oil and gas industry.
- Esbjerg municipality
- Southern Denmark Region
- National government

Type(s) of benefit

Reduced emissions

Economic growth

Employment

Local economic resilience

Mitigation or adaptation

Principally mitigation, the Danish Parliament is to significantly expand offshore wind capacity by 2020 and secure 50% of electricity consumption by both offshore and onshore wind energy.

Further information

Andersen A. et al (2019). Green growth in Nordic regions Eight case studies. https://nifu.brage.unit.no/nifu-xmlui/bitstream/handle/11250/2601343/NIFUWorkingPaper2019-7.pdf

Renewable energy projects in Warrington, England

Business sector/type of intervention

Renewable energy, solar farms

Project outline

Working in partnership with Gridserve, Warrington Borough Council in England has recently completed construction of two solar farms which will produce enough green electricity to power around 18,000 homes. Warrington expects the two projects to save the Council £1 million a year on its electricity bill, and generate an operating surplus of around £150 million pounds over 30 years to invest in essential services[127].

Electricity from York hybrid solar farm will be sold on the open market while Hull will supply all the council's energy needs. The deal will make it the first local authority to produce all its own electricity. Both together these solar farms cost £58.7 million. The Council have recently raised the funds to develop a third solar farm in Cirencester.

The Council also owns a 50% stake in Together Energy which broke even for the first time in 2020[128]. Over the past two years the company has seen a 284% increase in its customer accounts. The Council's investment enabled the company to supply 100% green energy to its customers. Through this partnership the Council is better able to address fuel poverty and climate change as well as generating income.

Image: A solar farm – two solar farms can produce enough power for 18,000 homes.

Together Energy has continued to recruit through COVID and has established a new office in Warrington. The company has committed to 30 roles in the town, with an additional 20 further positions for young people in Warrington who are at long-term risk of unemployment and the development of an internship programme which will see the recruitment of students – including young people from Warrington – who are care leavers or have been significantly impacted by COVID-19[129].

Type of local authority intervention
The Council leads the solar farm operation and has a 50% stake in Together Energy.

Investment source
Solar farms: Warrington Borough Council has funded solar projects primarily through prudential borrowing. The Council have also raised part of the funds through Community Municipal Investment (CMI).
Together energy: the Council invested £18 million in the company and took a 50% shareholding in the business.

Partners/stakeholders
Solar farms: Gridserve
Energy company: Together Energy

Type(s) of benefit
Both of these projects provide financial returns for the council, a skills boost for the local area and affordable, green energy for local communities.

Mitigation or adaptation
Both of these projects reduce emissions alongside building economic and social resilience to shock.

The Islands Growth Deal, Scotland

Business sector/type of intervention

This funding will be invested in a variety of different projects including those focused on renewable energy & low carbon technologies, creative industries, wellbeing, and skills attraction.

Project outline

The three Island Councils are the smallest in Scotland – a combined population of around 72,000 (1.3% of Scotland's population) – and are some of the most remote communities from the main population centres of Scotland. Despite their size and remoteness, the Islands' profile is global, and, with a plethora of historic and natural heritage sites, they regularly top international travel lists. The islands also account for 50% of Scotland's aquaculture Gross Value Added (GVA), 30% of Scottish sea fish GVA, and 13% of the oil and gas produced in UK waters. With 47% of Scotland's marine estate and 40% of its coastline, these communities have access to significant untapped blue economy opportunities in areas such as offshore renewable wind, wave and tidal energy, sustainable aquaculture and marine biotechnology.

The Islands Growth Deal was agreed in March 2021. This multi-million pound project aims to catalyse sustainable economic recovery and growth, create jobs and attract further public and private investment across Orkney, Shetland and the Outer Hebrides. A range of areas, including tourism, infrastructure, innovation, skills, and renewable energy systems, will be targeted with the funding which will be invested over ten years.

The 10-year programme of investment has the ambitious target of creating up to 1,300 jobs and tackling the depopulation concerns facing many parts of the three island archipelagos[130].

The deal outlines eighteen project proposals spread across the islands. These projects will[131]:

- Demonstrate how to achieve Government net zero carbon targets and be the first parts of the country to do this.
- Create internationally significant new port infrastructure that will play an important role in supporting Scotland and the UK to achieve net zero targets.
- Strengthen the islands' place as unique 'living laboratories' for global innovation in low carbon technologies, wellbeing research and sustainable food production in partnership with their leading universities and research institutes.
- Showcase the islands' outstanding natural environment, heritage, culture and creativity to the world.
- Create the foundation for an innovation-focused recovery from the COVID-19 pandemic and support inclusive growth across all the Island communities.

Some of the planned projects include:[132]

- **The Ultra Deep Water Port** at Dales Voe in Shetland
- **Orkney's World Heritage Gateway project**
- **The Outer Hebrides Food and Drink Programme**
- **The Shell-volution** – a new means of enabling expansion of the sustainable mussel farming sector in Shetland.
- **The Orkney Community Vertical Farm** – focused on agricultural innovation and creating an islands' vertical farm.
- **Islands Centre for Net Zero** – supporting the energy transition for all three island groups and creating sustainable "green" jobs within the islands for 300 people.
- **The Outer Hebrides Energy Hub** – establishing the initial infrastructure necessary to support the production of Green Hydrogen from renewable energy (Onshore and Offshore Wind).
- **The Outer Hebrides Destination Development** – focusing on key aspects of island heritage such as St Kilda and the Callanish standing stones.

Type of local authority intervention

The leaders of Orkney Islands Council, Comhairle nan Eilean Siar, and Shetland Island Council have signed the heads of terms for this deal, which commits both the UK and Scottish Governments to a long-term collaboration with all three island groups. The three island councils will work with both Governments and all other project partners and key stakeholders to ensure delivery of this Deal and adopt an approach to governance that will deliver transformative inclusive economic growth.

Investment source

£100 million (€116 million) from the UK and Scottish Governments alongside an anticipated £235 million (€274 million) from project partners.

Partners/stakeholders

This project draws on the expertise of a range of different partner organisations. Some of these partners include:

- NHS Orkney
- NHS Shetland
- NHS Western Isles
- University of the Highlands and Islands
- Robert Gordon University
- Heriot-Watt University
- The European Marine Energy Centre
- Local community groups

Type(s) of benefit

This deal will deliver a range of benefits, from emissions reduction, skills creation and economic growth, to supporting community wellbeing and strengthening local supply chains. All of these aspects will help to facilitate a just transition away from fossil fuels and towards a greener, more resilient economy.

Mitigation or adaptation

Mitigation – the goal of net zero is the driving force behind this deal.

Further information:

Scottish Government. (2020). Islands Growth Deal Terms of Agreement. https://assets.publishing. service.gov.uk/government/uploads/system/uploads/attachment_data/file/970193/Islands_Growth_ Deal_Heads_of_Terms_SIGNED__English_version_1.1_.pdf

European Marine Energy Centre. (2021). ISLANDS GROWTH DEAL TO RELEASE £335 MILLION INVESTMENT. http://www.emec.org.uk/press-release-islands-growth-deal-to-release-335-million-investment/

Renewable energy and rural development in Wallowa, Oregon (USA)

Business sector/type of intervention

Renewable energy (biomass, solar and hydro), forestry, agriculture, rural economies, community engagement

Project outline

Oregon covers a vast territory that is well endowed with natural resources, and this combined with widespread support for environmentally-friendly policies led to early specialisation in renewable energy. Hydropower produces more than half of the energy in the state[133], and wind and solar power production are on the rise. However, until recently, the state's support for renewable energy had not impacted on regions such as Wallowa County – small rural economies, with limited demand, weak export potential, and an inability to support large development.

In 1996, after a series of job losses in the forestry sector, Wallowa County Commissioners formed Wallowa Resources (WR), a not-for-profit organisation aimed at supporting the transitioning economy and creating local capacity to benefit from arising RE and sustainability opportunities. A series of community planning processes helped local government, businesses and residents work together to shift reliance from sawmills to a diversified economy while maintaining family-wage jobs. With support from state and national schemes such as the USDA's Rural Energy for America Program, the community invested in multiple small-scale projects. Wallowa Resources also has two subsidiaries, Community solutions and Renewable Energy Solutions, which help it incubate and support local businesses and employment opportunities and invest in and implement local renewable opportunities.

Renewable energy policy in Wallowa was carefully contextualised, aimed at employment creation to prop up its failing local economy and coupled with existing rural industries, in this case agriculture and forestry. Timber harvesting and thinning were combined with biomass development for heating, while small and micro-scale hydro was introduced into existing irrigation channels. A 2008 feasibility study by WR indicated that more than 100,000 tonnes of biomass could be harvested from excess woody and agricultural waste from existing projects.

The collection of small but strategic projects and investments have made a large difference to the county, providing gains in employment, reducing business costs, and raising money for the council and community. By the end of 2011, enough renewable electricity was created to power 27% of the County's households, worth 2% of the County's GDP[134]. Roughly 65% of the energy dollars generated by the schemes have been retained in the county through ownership and investment. The impact of RE deployment on employment in the area is difficult to measure, but estimates for job creation range from 600 to 3000 (including manufacturing and related activities.) – population for the county is just around 7,000.

Example of a project: Biomass boiler for the Enterprise School District (ESD), 2008

- Due to rising fuel costs, an existing oil-powered boiler was converted to a biomass facility designed by Wallowa Resources.
- The USDA funded pre-feasibility studies and the ESD entered into an energy savings performance contract to finance the project through energy savings.
- 4 jobs and USD $0.8 million were created in construction, while going forward the annual operating activities will create 4 permanent jobs and USD $0.2 million; a 1:1 job ratio for construction and follow-on employment.

Type of local authority intervention

In this case, the local authority was responsible for bringing together the community to create a vision for the community and identify opportunities for projects from the ground up. Wallowa County was responsible for setting up a not-for-profit (Wallowa Resources) to provide research and handle investments in projects, with reliance on state and national government being mostly limited to investment and subsidies.

Investment source

Much of the funding for these projects was through state or national grant and subsidy programs, such as the USDA's Rural energy for America Program, Rural Business Enterprise Grant and Advanced Biofuel Producer Program. Wallowa Resources, the not-for-profit created by the county, invests in other small-scale projects and opportunities, supporting the local economy and community from the ground up.

Type(s) of benefit

Locally-designed renewable energy policy supporting small-scale intervention enabled a rural community to explore new economic development opportunities and avoid decline. The renewable energy deployment was able to complement existing business and capabilities. Modest subsidies were used but able to create impact by choosing projects best suited to local conditions and commercially viable.

Mitigation or adaptation

Primarily mitigation through greening energy.

Further information:

Wallowa Resources. Creating strong economies and healthy landscapes through land stewardship, education, and job creation. https://www.wallowaresources.org/

Just Transition

Midlands Regional Transition Team (MRTT), Ireland

Business sector/type of intervention

In the early years following independence of the state in the 1920's, with few employment opportunities, emigration was a dominant feature, particularly so in the Midlands Region. In 1946, the government established Bord na Móna (Turf Development Board). Through their remit of harvesting peat as a fuel source for the purposes of energy generation for the national energy supplier, the Electricity Supply Board (ESB), they provided significant employment opportunities.

Bord na Móna transformed the economic landscape of the region, with the Midlands experiencing in-migration, new settlement and community formation in predominantly rural areas, in close proximity to the bogs and the power stations that emerged. Consequently, over time the region has developed an intrinsic connection and reliance on the major employers of Bord na Móna and the ESB in terms of direct and indirect employment, income generation and associated supply chains, training and education, physical, social, and community development. At the height of employment in the 1980's, Bord na Móna and the ESB accounted for some 7,000 jobs, in a very sparsely populated and rural region.

Emerging national climate policy in Ireland prompted significant decisions by both Bord an Móna and the ESB to accelerate their longer term decarbonisation schedules. The combination of the cessation of peat harvesting activities in the region over 2018 and 2019 and the closure of two peat fired power stations in 2020 has resulted in far-reaching socio-economic impacts into communities of the wider Midlands region with associated job losses, both direct and indirect, in over 20 communities where peat harvesting and peat energy generation were principal sources of employment.

Image: LB Power Station: Lanesborough Power Station in Co. Longford, ceased operations in December 2020 due to the acceleration of the decarbonisation programme in Bord na Mona.

The local level response to the cessation of peat harvesting activities and the two power stations has elevated the wider Midlands region above others regarding the imperative for a Just Transition. In 2018 the Midlands Regional Transition Team (MRTT) was established by Offaly County Council with membership representing eight local authority areas, including Laois, Offaly, Westmeath, Longford, Roscommon, Galway, Tipperary and Kildare.

Project/initiative outline

Under the management of Offaly County Council, the MRTT was established to develop a framework for the region to support impacted workers and their communities and leverage financial support for the economic diversification/development of the region through two distinct objectives namely;

- To pursue funding opportunities and actions to mitigate the impact of the Bord na Móna job losses on the individuals concerned, and the impact on the local and regional economy.
- Position the Region to develop alternative forms of employment, attract investment and maximise existing employment opportunities and resources.

Type of local authority intervention

Offaly County Council initiated the establishment of the MRTT, bringing key stakeholders together under the two defined objectives whilst taking on the management and administrative responsibilities. Four working groups have been established as part of the MRTT comprising the various organisations and state agencies/central Government services operating in the Region. The working groups also assist projects on the MRTT Engagement Process Inventory in progressing the project concept, partnerships and/or identification of alternative sources of funding.

The working groups are as follows:

WG1 - Education/Training/Research: Comprising Regional and Local Education and Training agencies including Third Level Institutes.
WG2 - Employment Generation Committee: Comprising State agencies, regional and local entities with responsibility for promoting enterprise, employment and economic development.
WG3 - Employment Continuity Pathways: Comprising Bord na Móna and the ESB with trade union representation and regional skills agencies.
WG4 - Community Assistance Programme/Social Enterprise Interventions: Comprising Local Development Companies and local authority local community representative committees

Investment source

The initiative is not funded directly as a standalone project. The activities of the MRTT, which are coordinated by the Regional Enterprise Development Office, are the result of the coming together of key regional stakeholders who, through their own areas and responsibilities, work collaboratively to achieve positive outcomes for the impacted communities of the Midlands Region.

The initiative does, however, rely on leveraging funding sources and the four working groups mentioned above maintain a strong role in accessing Just Transition funding and other relevant funding/schemes and programmes.

Partners/stakeholders
- Office of Just Transition Commissioner
- Representatives of the Local Authorities of the wider Midland Region, including Council Chairperson and Chief Executive.
- Midlands Regional Enterprise Development Office.
- Regional Assemblies.
- Dept of Environment, Climate & Communications.
- ESB
- Bord na Móna
- Irish Congress of Trade Unions

Type(s) of benefit
Since its establishment, the MRTT has worked across four areas:
1. Securing special status/designation for Offaly and the Midland Region and Funding Opportunities
2. Addressing the needs of those offered redundancy and Emerging Employment Opportunities
3. Emerging Property/Land Opportunities
4. Marketing the Region

Key highlights in these work areas include:

- Acceptance of the Midlands Region into the European Union Coal Regions in Transition Platform.
- Technical Assistance provision under the Secretariat TA for Regions in Transition for the development of a Pathway for Just Transition for the Midland Region.
- National Budget allocations in 2020 & 2021 for the Midlands Just Transition Fund and Midlands Deep Retrofit Programme.
- Engagement with the National Economic and Social Council on the development for A Framework for Action for Transition to a Low Carbon, Digital Future.
- National conference in partnership with CARO and Regional Enterprise Development Office, held in October 2019 – Realising Economic Opportunities from Climate Change.
- Working closely with Kieran Mulvey, the Commissioner for Just Transition.
- Facilitated and promoted the Midlands Engagement Process, inviting communities, public sector and private actors to propose projects that could assist with delivering a Just Transition
- Contributed to the Joint Oireachtas Committee on Climate Change.
- Numerous clinics held in bog communities to assist impact employees.
- Skills, Education & Jobs Fair & Idea Generation Bootcamp held in a local training centre.

- Implementation of the Explore initiative for former Bord na Móna staff, which is a programme designed at upskilling older employees in manufacturing, in areas such as digital skills, personal development and preparation for change etc.
- Advances in educational programmes through auditing and development of bespoke training and on upskilling staff of Bord na Móna.
- Designation secured for training facility on construction methodologies and retrofit in a local training facility.
- Feasibility study carried out to develop Tourism potential of Lough Boora Discovery Park into an Eco-Tourism destination of national and international significance.
- Striving to position the Midlands as the Low Carbon Region of Ireland, retaining its association with energy generation, transitioning to cleaner forms of energy through association with emerging business and technologies in the region.
- Exploration of the expansion of enterprise space in the Midlands Network of Co-working Facilities (MNCF) comprising over 20 facilities.
- Assistance to projects registered through the Midlands Engagement Process with applications and verification checks for the National Just Transition Fund.
- Submissions to the preparation of the National Territorial Plan for the European Just Transition Fund.

Image: Midlands Engagement Process, undertaken as part of the Just Transition process with the EU Coal Regions in Transition Platform

Mitigation or adaptation

The project comes under the Just Transition aspect of climate action. In re-positioning to deliver on the national climate obligations there are unique challenges for the transition to climate neutrality from this distinctive, carbon intensive region. The MRTT remains committed to realising the opportunities that can be availed of through both climate adaptation and mitigation responses to support local impacted communities into the future.

Image: Bog restoration (rewetting) and enhanced amenity value.

Further information:
Midlands pathway to transition: https://ec.europa.eu/energy/sites/default/files/documents/midlands_pathway_to_transition.pdf

Hydrogen for a Just Transition in Aberdeen, Scotland

Business sector/type of intervention

Energy – hydrogen

Project outline

H2 Aberdeen is an initiative centred around facilitating a just transition. The project hopes to bring about a hydrogen economy in the Aberdeen city region (Scotland) by stimulating innovative hydrogen projects and advancing the take-up of hydrogen technologies in the city. The overall aim of the project is to position Aberdeen as a centre of excellence for hydrogen technology by utilising the transferable oil and gas expertise and the exceptional capacity for renewable energy generation in North East Scotland.

The Aberdeen Hydrogen Strategy was published in 2015 and outlines key actions required over a 10-year period to ensure Aberdeen is a world class energy hub leading a low carbon economy and is at the forefront of hydrogen technology.

Aberdeen City Council has developed a cluster of hydrogen activity with two publicly accessible hydrogen refuelling stations (Kittybrewster and ACHES) and one of the largest and most varied fleets of hydrogen vehicles in Europe including buses, cars, vans, road sweepers and waste trucks. In Autumn 2020 the city became the first in the world to deploy a fleet of fuel cell double decker buses from Wright Bus.

In 2020 the Council approved the city's first Hydrogen Hub which is intended to lay the foundations for substantial growth and future investment. The infrastructure will cover housing, heating and transport sectors and is expected to unlock new economic opportunities worth upwards of £700 million gross value

Through the Aberdeen Hydrogen Hub, the city would have an initial requirement to supply its bus and public sector fleets, with demand at 500kg per day. This would be projected to rise to 3.5 tonnes per day of hydrogen by 2030 to meet potential transport uses, such as road, rail and marine, along with heat and industry applications.

Type of local authority intervention

Aberdeen City Council has taken a lead role in hydrogen development and is a lead partner on hydrogen-related projects in the city.

Investment source

The City is currently seeking long-term investment and development partners for a £250 million (€292 million) hydrogen infrastructure development programme. The Council is open to a variety of investor involvement to include debt and equity partners, co-investment, and development funding. Funding for existing projects has come from a range of sources including:

• Interreg Europe Smart HyAware
• Opportunity North East
• Scottish Enterprise

The two refuelling stations have been developed with two separate partners, the Kittybrewster hydrogen refuelling station has been developed with BOC and ACHES has been developed in partnership with Locogen.

Image: ACHES – Hydrogen refuel stationCove. Photo provided by Aberdeen City Council.
added to Scotland's economy by 2030, as well as thousands of high-value jobs in Aberdeen and the surrounding region.

Partners/stakeholders

The City has worked with a number of different partners across a range of projects including:
• Interreg Europe Smart HyAware
• Opportunity North East
• Scottish Enterprise
• BOC
• Locogen
• Centre of Excellence for Low Carbon and Fuel Technologies
• Research Institutes of Sweden

- University of Tromoso – The Arctic University of Norway
- The Agency for Communication, Organisation and Management, atene Kom
- Provincie Drenthe
- Gremeente Groningen
- Aberdeenshire Council
- SUEZ recycling and recovery Netherlands
- Publicly owned venture of the municipality of Duisburg
- ARP-GAN
- Touraine Vallee de l'Indre
- Municipalities
- AGR Waste Management Services
- HAN University of Applied Science

Type(s) of benefit

There is the potential for hydrogen infrastructure to unlock new economic opportunities and attract investment into the city. For example the Kittybrewster hydrogen refuelling station has attracted over £20m of investment into Aberdeen since its completion in 2018.

Perhaps most importantly for Aberdeen the development of hydrogen infrastructure will be an important part of the city's just transition away from fossil fuel economy. Drawing on the expertise of those already employed in the city's oil and gas industry, hydrogen offers an opportunity for employment as the number of jobs in the fossil fuel industry decreases.

These projects will also help to lower emissions from buildings and transport in the city.

Mitigation or adaptation

Primarily mitigation however facilitating a just transition and building a more resilient, sustainable local economy are key aspects of these projects.

Further information:

Aberdeen City Council. (2021). H2 Aberdeen. https://www.aberdeencity.gov.uk/services/environment/h2-aberdeen

Commercial and Domestic Retrofit

Energy efficient new housing in Exeter, England

Business sector/type of intervention

Energy efficiency in public sector construction

Project outline

Mitigating fuel poverty was the driving force for Exeter City Council's Passivhaus council housing development[135]. Sustainable energy efficient development has been the trademark of Exeter City Council for the last 12 years and has resulted in more than 200 council houses built to Passivhaus standards and 1,000 more in the pipeline alongside Passivhaus care village, office buildings and a plan of building a Passivhaus leisure complex announced early this year[136].

Exeter City Council have built on this success by setting up the Exeter Sustainable Energy Efficient Developments (EXESeed) Contractors Framework[137]. This four-year agreement proves a commitment to collaborate with developers to tackle energy inefficiency in housing and fuel poverty.

The framework will be used by the City Council to procure local and national contractors for the Council's pipeline of energy efficient developments including private homes and leisure facilities. The Framework will also encourage contractors to create local apprenticeship opportunities creating additional benefits for the local economy. Exeter City Council would like to encourage other public sector bodies such as local authorities, universities and the NHS to use the Framework to provide access to building contractors committed to delivering low energy sustainable developments.

Going forward, Exeter City Council plan to build a Passivhaus Academy in the City which aims to: '*provide a focal point for the essential skills needed to deliver new buildings, and the requirements for retro-fit, providing a workforce that is skilled, knowledgeable and professional. Training and skills development will be delivered in a purpose built centre in the city, and also through an online platform, to support reach beyond the city and region, sharing our skills and experience to as wide an audience as possible.[138]*'

Over the last five years build costs for Passivhaus projects in Exeter have decreased by 25%[139] and research has shown that on average fuel bills are reduced by 90%[140].

Type of local authority intervention

Much of the investment for Passivhaus development has come from Exeter City Council which has its own private development company – Exeter City Living[141] – which has a pipeline of Passivhaus developments. Profit from this company is re-invested into Council services.

Investment source

Exeter City Council

Exeter City Living

UK Government through the Technology Strategy Board

Partners/stakeholders

- Exeter City Council
- Exeter City Living
- Local developers
- Local engineering & architecture firms

Type(s) of benefit

- Reduced running costs
- Resilient to climate change
- Lower emissions
- Boosting the local economy as residents have more money to spend locally
- Revenue for the Council through Exeter City Living
- Affordable, efficient, comfortable homes for residents
- Increased employment opportunities at the Council, within local, architecture, engineering & construction firms and in the supply chain.

Mitigation or adaptation

Passivhaus construction helps to reduce emissions alongside creating social and economic resilience at the local level.

Further information:

- Exeter City Council. (2020). Stunning new Passivhaus council homes unveiled in Exeter. https://news.exeter.gov.uk/stunning-new-passivhaus-council-homes-unveiled-in-exeter/
- Exeter City Council. (2019). EXEseed Contractors Framework. https://exeter.gov.uk/exeseed/

Public Realm

Local authority public lighting energy efficiency project, Ireland

Business sector/type of intervention

The project aims to retrofit the remaining non-LED public lights for the participating local authorities to efficient LED luminaries[142]. Public lighting accounts for approx. 50% of total energy use of Irish local authorities and without this project it would be very difficult for these organisations to achieve their statutory energy efficiency targets. The project is a collaboration of the participating local authorities to group together their public lighting inventories to achieve economies of scale and standardised public lighting specification.
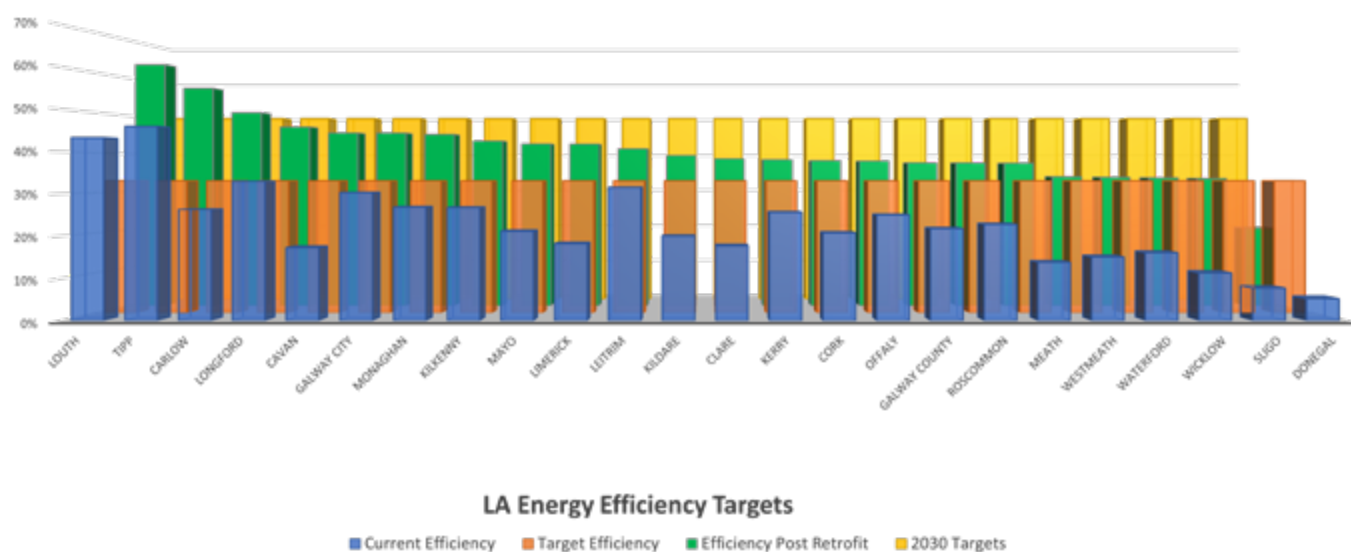

LA Energy Efficiency Targets

■ Current Efficiency   ■ Target Efficiency   ■ Efficiency Post Retrofit   ■ 2030 Targets

Image 1: LED Public Lighting Scheme, achievement of target and gaps to future targets, 2019.
Source: RMO

Project/initiative outline

The project's key objective is to retrofit circa 220,000 public lights to efficient LED luminaires, to help local authorities achieve their statutory energy efficiency targets. The project aims to achieve a minimum of 55% energy efficiency over the existing lighting inventory. This will result in a saving of 60,000 MWh/year in final energy and 18,500 tonnes CO_2/year. As of July 2021, the project is in the final stages of procurement with contracts expected to be signed Q3 2021 for the first of the three regional contracts.

The Road Management Office (RMO) recommends a national project rolled out in regions to allow for multiple contractors in a competitive public lighting industry, supporting local jobs while maintaining economies of scale.

As the sector currently has insufficient resources of experienced designers to service large-scale LED energy saving projects, the RMO has engaged with industry to highlight opportunities for training and employment, where engineering consultancies could partner with contractors.

The scale of work required, plus the consistency and stability of work flow, should incentivise consultancies to prepare to engage with the work stream. The Sustainable Energy Authority of Ireland are providing 5-day ILP training to help meet need within the industry, and are ramping up this provision.

Type of local authority intervention

Local authorities are driving, funding, managing, and resourcing this initiative with support from a number of government departments and state bodies. It was identified early on to drive this project, dedicated personnel would have to be assigned to push the project forward. The Road Management Office, a shared service, was tasked to assign staff to the project and three dedicated engineers are leading the project on behalf of the local authority sector.
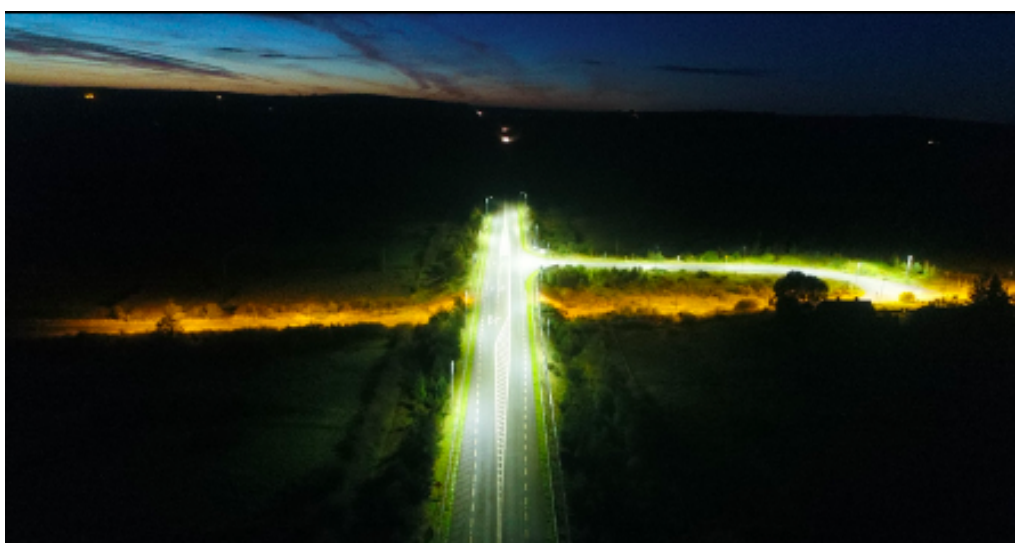

Image 2: Example of LED upgrade at junction on Regional Road. **Source:** RMO

Investment source

The project is being directly funded by local authorities but about 10% of the capital is being provided by the Central Government though a Climate Action Fund. The project has also received grant aid from the European Investment Banks ELENA programme.

Partners/stakeholders

21 of the 31 local authorities in Ireland are participating in the project. Other stakeholders in the project are:

- Road Management Office (RMO)
- Local Government Management Agency (LGMA)
- Sustainable Energy Authority of Ireland (SEAI)
- Department of the Environment, Climate and Communications (DECC)
- Transport infrastructure Ireland (TII)

Type(s) of benefit

The main benefit to local authorities will be reducing energy consumption and reducing carbon emissions to help local authorities reach their energy efficiency targets. In summary, the project will deliver the following benefits to the participating local authorities:

- Save 60,000 MWh/year energy
- Save 18,500 tonnes CO2/Year
- Detailed asset condition survey

Mitigation or adaptation

The primary goal of the project is emission reduction and mitigation of climate change.

Further information:

Local Authority Public Lighting Energy Efficiency Project: https://irl.eu-supply.com/ctm/Supplier/PublicPurchase/145584/0/0?returnUrl=ctm/Supplier/publictenders

Melbourne's 20-minute neighbourhoods (Australia)

Business sector/type of intervention

urban planning, active travel, transport, local services, urban equality

Project outline

20-minute neighbourhoods are areas where people can access "most of their everyday needs within a 20-minute walk, cycle or local public transport trip". This is the description of the concept found in Plan Melbourne 2017-2050[143], a 33-year plan by the Victorian Government. Decentralising city centre amenities into neighbourhoods is key for the future of Greater Melbourne, where the goal is to ensure that residents can access workplaces, shops, schools, healthcare and leisure facilities all from a 20-minute walk from their home. The 20-minute neighbourhood strategy has been adopted across Melbourne for pilot programs. Prior to the launch of the trials, research conducted by the Victorian Government found numerous benefits including:

- **Health** – Living within 800m of social infrastructure improves active travel and wellbeing. 15 minutes of walking 5 days a week results in a 15% disease burden from physical inactivity, or 26% for 30 minutes. If 50% of short car trips were walked instead, the Victorian economy would save $165 million (€102 million) in health, congestion and environmental costs.
- **Social** – Walkable streets and more community spaces enhance social cohesion. Increased greenery and street-scale features provide passive surveillance and improve both actual and perceived safety for residents.
- **Economic** – high walking rates can increase incidental trading in local shops by up to 40%. Household transport costs in walkable neighbourhoods are half those of car-dependent areas. Walking infrastructure provides a greater return than rail or road. The benefit-cost ratio of walking, according to 20 different studies used in the Plan Melbourne, is 13:1 or $13 gained for every $1 spent.
- **Environmental** – greater levels of active travel mean that pollution is reduced by as much as 40% and CO_2 emissions by 10%. Pollution is also removed by street trees and urban greening, and tree cover improves urban cooling.

The 20-Minute Neighbourhood was piloted in January 2018 across three Melbourne local government areas, testing the principle across different metropolitan areas: Croydon South, Strathmore, and Sunshine West.

The projects were delivered in three stages:

1. Place-based engagement to develop community partnerships and understand and be informed by community concerns and ideas.
2. Technical assessments on a neighbourhood's housing density, land use, walkability, transport network and vegetation cover.
3. Future opportunities for infrastructure and policy initiatives across the LGA.

Some of the community priorities identified included better public open spaces and corridors, prioritising pedestrian safety especially for children, and improving the amenity of streetscapes. Communities were found to desire improving pedestrian amenity and housing diversity in and around the centres of their neighbourhood[144].

So far initiatives trialled have included a number of temporary and permanent activations. Temporary road closures led to pop up parks with opportunities for gatherings, trading, outdoor dining, landscaping, art, and events. Additional temporary pedestrian crossings and bike lanes, bike parking, and traffic calming measures such as road paintings were trialled to improve road safety. Maps were created identifying options for improving walking and cycling infrastructure and safety on routes around schools. Wider pavements and streetscaping are planned to improve footfall for businesses[145].

Each council reported the overall relationship with their community had improved, with data obtained during each program showing increased community participation and neighbourhood engagement.

Type of local authority intervention
Local government works in partnership with the Victorian Government in delivering Plan Melbourne. Local government roles in housing, delivering community infrastructure and ensuring community involvement in planning are all critical in achieving the 20-minute neighbourhood.

Investment source
Victorian Government

Partners/Stakeholders
- Victorian Government
- Maroondah Council, Moonee Valley Council, Brimbank City Council (pilot councils)
- Greater Melbourne councils
- The Heart Foundation
- Victoria Walks

Type(s) of benefit
- Lower transport emissions
- Improved population health, wellbeing and equality

Further reading, individual pilot documents:
Victoria State Government. (2021). 20-minute neighbourhoods. https://www.planning.vic.gov.au/policy-and-strategy/planning-for-melbourne/plan-melbourne/20-minute-neighbourhoods

The one-minute city: Stockholm, Sweden

Business sector/type of intervention
Urban planning

Project outline
Researchers and practitioners in Sweden have designed an alternative urban design concept rooted in the practice of community engagement. Termed the 'one-minute city' this approach engages residents, through workshops and consultations, with the place just outside their front doors.

By allowing residents to be the architects of their own streets, this strategy challenges top-down policy approaches associated with the 20-minute neighbourhood. Importantly, the hyper-local one-minute city rejects the deceptively complex and socially exclusive '20-minute' neighbourhood and instead focuses on empowering and understanding the needs of individual citizens.

Designers pioneering this concept have developed a suit of street furniture – including parklets, small play areas, public seating and EV charging points[146] – which are able to fit into the dimensions of a standard parking space. Residents are able to collectively decide the pieces they would like to be installed on their street. These pieces of furniture are designed to be conversation-starters; ways of engaging with and connecting people with their neighbours and the places they live.

This concept reinforces the need for grounded, inclusive planning practices. While many Smart City strategies highlight the importance of technological innovation, the one-minute city acts as a reminder to recognise diversity and to anchor decision-making in meaningful, ongoing community engagement practices including the need for more co-design.

The One Minute City is part of a national government project called Street Moves which is run through Sweden's National Centre for Architecture and Design.

Type of local authority intervention
Although this is both a nationally funded and managed project, developers need to work closely with local municipalities to implement the project.

Investment source
The project is led by Sweden's National Centre for Architecture and Design[147] and funded by Vinnova, the Swedish government agency that administers state funding for research and development.

Partners/stakeholders

- Centre for Architecture and Design
- Vinnova
- Local residents & businesses
- The Stockholm Municipality
- Service providers e.g. waste collection services

Type(s) of benefit

- More accessible, socially connected neighbourhoods
- Reduced emissions by providing more urban greenery, EV charging points & storage for scooters & bikes

Mitigation or adaptation

This concept aims to reduce emissions by increasing active travel, but importantly it helps to connect people to each other and their local neighbourhoods thus increasing social resilience.

Further information

O'Sullivan F. (2021). Make Way for the 'One-Minute City'. https://www.bloomberg.com/news/features/2021-01-05/a-tiny-twist-on-street-design-the-one-minute-city

Image: Stockholm, Sweden.

Forestry and Agriculture

Urban afforestation in Glasgow, Scotland

Business sector/type of intervention

Green infrastructure

Project outline

The economic benefits of green infrastructure have been well documented and include:

- Businesses attract and retain more motivated staff in greener settings
- Views of natural landscapes can add up to 18% to property values
- Green spaces improved people's physical and mental health
- Community-owned green spaces can create jobs and local pride
- Green infrastructure provides vital habitats and jobs managing the land
- Urban green spaces reduce pressure on drainage and flood defences
- Green infrastructure can counter soaring summer temperatures in cities

With this in mind, a number of Scottish councils have undertaken ambitious green infrastructure projects which include major afforestation initiatives and the installment of green architectural features such as living walls and green roofs[148].

Most recently, the eight local authorities that make up Glasgow City Region have announced ambitious plans to 18million trees in the region over the next decade[149]. The ambitious planting pledge lies at the heart of the new Clyde Climate Forest, which is part of the Glasgow & Clyde Valley Green Network.

Image: Young trees planted to create new forested areas.

Type of local authority intervention

This project is being delivered by the Glasgow & Clyde Valley Green Network[150] which brings together the eight regional authorities as well as Scottish Forestry, the Scottish Environmental Protection Agency, Scottish Enterprise, Scottish Natural Heritage, the Glasgow Centre for Population Health and Public Health Scotland.

Investment source

The project secured a £400,000 (€467,000) grant from the Woodland Trust's Emergency Tree Fund as well as £150,000 (€175,000) from Scottish Forestry over the next two years to recruit a project team and kick-start the development of new planting schemes.

As part of corporate social responsibility commitments, businesses within Glasgow City Region are being encouraged to get their staff involved with community tree planting projects.

Businesses and other organisations can also invest in the Clyde Climate Forest if they sign up to a new charter which demonstrates their commitment to reducing emissions across their business supporting the fight against climate change.

The majority of woodland planting will be funded through Scottish Forestry's various grant schemes but also through funding mechanisms that the Clyde Climate Forest can lever. Community groups and individuals can also donate.

Partners/stakeholders
- Glasgow & Clyde Valley Green Network
- Green Action Trust
- TCV
- Glasgow City Region
- Trees for Cities
- Scottish Forestry
- Woodland Trust Scotland

Type(s) of benefit

Sequestering carbon, boosting biodiversity, increasing physical and mental wellbeing, community engagement, flood defence, urban cooling and the creation of jobs.

Mitigation or adaptation

Both mitigation and adaptation

Further information:

Plans to plant ten trees for every person in Glasgow City Region. https://www.glasgow.gov.uk/index.aspx?articleid=27099

Bioeconomy in Central Finland

The information for this case study was largely taken from Andersen A. et al's (2019) paper Green growth in Nordic regions: Eight case studies[151].

Type of intervention

Sustainable forestry/agricultural industry, regeneration, bioenergy, circular economy

Project outline

Central Finland includes the City of Jyväskylä alongside 22 smaller municipalities, with a total population of around 275,000. For over a century, Central Finland has been a forestry and forest industry region.

The green economy (revolving around bioenergy, forestry and forest industry) has been emphasized in regional strategies from the mid-2000s onwards. Bioeconomy is the main organising concept for the region, and estimates suggest that 15,000 jobs in the region are related to the industry. It involves multiple sectors such as forestry, energy, agriculture, waste, water management, research, and education.

MetsäGroup is a Finnish forest industry group who place emphasis on sustainable use of "the best renewable raw material in the world – northern wood – responsibly and efficiently"[152]. They are also one of the largest renewable energy producers in Finland. With a 1.2 billion Euro investment into a new bioproduct mill by MetsäGroup, a new bio- and circular economy concentration began in the area. The mill produces not only soft and hardwood pulps but also tall oil, turpentine, bioelectricity, and sulphuric acid[153].

MetsäGroup is building the first ring of an ecosystem around its bioproduct mill – its products in addition to multiple material flows, side streams, and byproducts and waste from the manufacturing process. Some first ring partners are converting side streams from the pulp production into bio products that either provide additional value to the local community, such as district heat, or are new businesses in their own right (e.g. bioenergy).

Other local development actors are actively involved in constructing the second ring in the ecosystem surrounding the mill. They work to mobilise companies from other industries such as manufacturing, logistics, maintenance, and scientific research and knowledge. These companies are recruited to join the ecosystem and potentially also locate in the region. The bioproduct mill is seen as a platform for other organisations to experiment with and produce their own products.

Some of the drivers of central Finland's bioeconomy are external or naturally occurring/ unplanned. These include:

- Ample wood resources
- A history of knowledge and expertise
- Increased global market demand for traditional products like pulp and packaging materials
- Shift in consumer preferences toward sustainable products and renewable energy

Other factors contributing to the creation and success of the bioeconomy are directly planned. These include:

- Strong, long-term public funding from regional, national and EU structural funds
- Active research into new forest bioeconomy technologies and business solutions at regional and national research organisations as well as through global pipelines
- Public policy initiatives including provision of related training, subsidies, infrastructure building
- Quick public permission processes for the industry
- Political decisions directing consumer demand and public procurement towards sustainability

Type of local authority intervention

While Central Finland's bioeconomy appears largely industry-led, policy push from the regional government (where environmental and green regional economy goals are emphasised in strategic long-term plans) since the mid-90s also created a supportive environment for firms and sense of safety for sustainable business innovation, aiding the transition.

Lower tiers of local government have been involved in the process since 2014, providing planning and construction permits and facilitating construction needs. After the opening of the mill, local policy-makers, working with businesses and research institutions, collaborated to enlarge the industrial business ecosystem.

Investment source

In addition to private sector input, there has been a strong and long-term public funding for bioeconomy in Finland. In the region, public funding sources include EU structural funds and national funding sources. Municipalities have also been involved in funding regional bioeconomy-related projects.

Partners/stakeholders
- The main actors include:
- Two large Finnish forestry companies (Metsä Group and UPM Kymmene)

- Three key Finnish machine and equipment manufacturers (all operating globally): VTT Technical Research Centre of Finland, Jyväskylä University and Jyväskylä University of Applied Sciences
- Government ministries, especially the Ministry of Economic Affairs and Employment, Ministry of Agriculture and Forestry of Finland
- Local authorities/policy-makers and regional development agencies.
- European Union

Type(s) of benefit

regeneration, job creation, circular economy

Adaptation or mitigation

Mitigation

Further information

- Mikkola, K., Randall, L., & Hagberg, A. (2016). Green growth in Nordic regions: 50 ways to make it happen. Stockholm: Nordregio Reports
- Andersen A. et al (2019). Green growth in Nordic regions Eight case studies. https://nifu.brage.unit.no/nifu-xmlui/bitstream/handle/11250/2601343/NIFUWorkingPaper2019-7.pdf

Image: Jyväskylä University, Central Finland.

Transport

Coventry as a centre of excellence for battery storage (England)

Business sector/type of intervention
Transport, green technology, battery storage

Project outline
Coventry is set to become the home of the new £130 million (€150 million) UK Battery Industrialisation Centre[154] which will enable the scale up and manufacture of the batteries that power electric, hybrid, plug-in hybrid and autonomous vehicles.

When complete, the centre will employ 100 people – with additional jobs expected to be generated in the supply chain and further employment and training opportunities created in the future. The Centre aims to be a focal point for training in battery manufacturing in the UK across the skills levels

The aims of the centre are to enable industry via open access and to scale up and commercialise advanced technologies central to the development and manufacture of batteries, initially for the automotive sector but with wider application.

Coventry was chosen as the home for the new Centre after a competitive selection process[155].

Type of local authority intervention
The West Midlands Combined Authority is partly funding the project which will be delivered, in part, by Coventry City Council and the Coventry and Warwickshire Local Enterprise Partnership.

Investment source
The Centre has been publicly funded as part of the Faraday Battery Challenge (FBC), a Government programme to fast track the development of cost-effective, high-performance, durable, safe, low-weight and recyclable batteries. The centre is also part-funded through the West Midlands Combined Authority and is being delivered through a consortium of Coventry City Council, Coventry and Warwickshire Local Enterprise Partnership and WMG, at the University of Warwick.

Partners/stakeholders
UK government through the UK Research and Innovation and the Industrial Strategy Challenge Fund
The West Midlands Combined Authority
Coventry City Council
Coventry and Warwickshire Local Enterprise Partnership
The University of Warwick

Type(s) of benefit

Local employment and skills development opportunities

Attracting further outside investment

Reduced emissions due to increase uptake of electric vehicles

Local economic resilience

Mitigation or adaptation

Primarily mitigation as the centre has been built to facilitate the uptake of electric vehicles.

Further information

UK Battery Industrialisation Centre https://www.ukbic.co.uk/about/

Type(s) of benefit

Local employment and skills development opportunities

Attracting further outside investment

Developing guidance for councils on the climate adaptation of regional and local roads in Ireland

Business sector/type of intervention

Regional and local roads serve an important economic role in an Irish context and also have valuable social and community functions. There are almost 94,000kms of regional and local roads in Ireland, which accounts for 94% of the country's roads network and they carry around 55% of all road traffic. The network of regional and local roads provides mobility within and between local areas and provides vital links to the strategic national road network. Primary responsibility for improvement and maintenance of regional and local roads rests with local authorities (LAs), with state grants, oversight and support being provided by Department of Transport (DoT). Additional funding is provided by LAs from their own resources.

Based on a review of past weather events and a consideration of the projected future climate, the 2019 Local Authority Climate Adaptation Strategies have identified the climatic factors (excessive rainfall, coastal flooding, storms, extremes of heat/cold, etc) that have negative impacts (flooding, landslides, road closures, deterioration of road surfaces and sub-layers, etc) on the regional and local road network and whose consequences will increase due to climate change.

The Climate Action Regional Office of the Atlantic Seaboard South Region (CARO ASBS) is undertaking a project on the development of guidance and resources for the climate adaptation of regional and local roads.

Project/initiative outline

The overall objective of the Project is to develop resources for LAs that will:

* guide local authority staff in the implementation of climate adaptation procedures,
* develop a range of design, maintenance and rehabilitation strategies and approaches to adapt the Regional and Local road network to climate change events.

A two-phase approach has been taken in the project:

Phase 1, Scoping Project: This was undertaken between June 2020 and January 2021. This element of the Project involved a comprehensive survey of experienced practitioners in each of the 31 LAs, a literature review of international best practice and an investigation of current Irish roads asset management systems. The recommendations of the Phase 1 Scoping Project are the provision of:

(i)   Roads Adaptation Guidance documentation,
(ii)   a methodology for identification and recording of vulnerable locations,
(iii)   a system for the mapping of vulnerable locations,
(iv)   a prioritisation methodology for adaptation intervention projects.

Image 1: Horizontal Cracking from extreme and prolonged heat on road over bogland 2018 (Offaly).

With DoT support, a particular focus was placed on the identified requirement for a prioritisation methodology and delivery of this element of the work was expedited. Through engagement with key stakeholders and practitioners, a cost-benefit analysis-based decision making aid resource was developed and has now been used by the DoT in allocating grants to LAs of over €31 million for climate adaptation intervention projects.

Phase 2, Guidance Preparation and Delivery: based on the successful outcome of Phase 1, the DoT has provided funding to CARO to undertaken Phase 2 Project commencing in May 2021.

A National Working Group has been established with representatives of the County and City Management Association Climate Action, Transport and Networks Committee, Department of Transport, Road Management Office, Munster Technological University and LAs nationally.

Image 2: Road Infrastructure compromised during storm event in 2014 (Cork).

Type of local authority intervention

Local authorities, through the CARO initiative, provided governance and support to the Project. The funding of Phase 2 of the Project by the DoT indicates the robustness of the management of the Project and is an excellent example of Central and Local Government working together to deliver a shared goal.

Investment source

Phase 1 Project Scoping was funded and resourced by CARO, while Phase 2 Guidance Delivery is being funded by the Department of Transport.

Partners/stakeholders

The key partners and stakeholders that are involved in the project are the County and City Management Association, DoT, Road Management Office, Munster Technological University and LAs nationally.

Type(s) of benefit

This initiative will deliver guidance and asset management systems to the local government sector to enhance the resilience of the regional & local road network asset.

Mitigation or adaptation

This adaptation Project will allow local authorities to build climate resilience into an important State asset and, at the same time, increase technical capacity and awareness of the local government sector.

Further information

CARO. (2021). Climate Adaptation of Regional & Local Roads. https://www.caro.ie/news/guidance-for-local-authorities-on-climate-adaptati

Heat

Developing a rural heat network: Cambridgeshire County Council, England

Business sector/type of intervention

Energy – district heat network

Project outline

Cambridgeshire County Council is developing a rural district heat network in the village of Swaffham Prior where 70% of homes are currently heated by burning oil.

In 2017, Swaffham Prior Community Land Trust and Cambridgeshire County Council initiated a project to bring renewable energy to Swaffham Prior. Following a series of technical studies, it was decided that a ground source heat pump could provide thermal energy to be pumped through a network, into homes within the village.

The project entails installing an energy centre, using boreholes, air source heat pumps, and solar power to supply thermal energy to an underground heat network, connecting to individual households. Swaffham Prior will become one of the first villages in the UK to retrofit a heating network into an existing community.

The Swaffham Prior Community Heat Project has been designed within five strategic purposes:

1. **100% carbon reduction** for heating and hot water for participants particularly rural communities
2. **No cost barrier to join** the scheme at the *start of the project – opportunity for all households on oil in the village to participate
3. **Low heating costs** – lower than or equivalent to oil prices**
4. A quality assured heat supply service, delivered by a single contractor (Design, Build Operate and Maintain (DBOM))
5. **The development of a new business and governance model** for retrofitting existing oil dependent communities that can be replicated elsewhere.

*If homes join post-construction an access fee will need to be charged to cover costs of connecting.

** Oil prices pre-Covid 19

Type of local authority intervention

Cambridgeshire County Council has played a key role in obtaining funding for this project and will be leading its development.

Investment source

The total capital cost of the project is £7.037m (€8.2m). This project is funded by the Department for Business, Energy and Industrial Strategy through a £3.2million (€3.7m) grant administered by the Heat Networks Investment Project. The residual cost to be funded by Council borrowing would be £5.247m. The Cambridgeshire and Peterborough Combined Authority (CPCA) contributed to

the early phase of the project. The Energy Centre will be fully financed from Public Works Loan Board (PWLB) borrowing by the Council and no third party investment is assumed. In March 2019, the Council submitted a successful bid to the Treasury to borrow over £60m (€70m) at the Local Infrastructure Rate (LIR) for energy investment projects.

Partners/stakeholders

Swaffham Prior Community Land Trust

Local residents

National Government

Peterborough Combined Authority

The Pipe Company – responsible for installing and maintaining the heat distribution network and heat interface connections with customer properties

Type(s) of benefit

The project is expected to generate an average annual net yield of 5.79%; close to the Council's overall commercial portfolio target of 6%[156]. The payback period of 17 years is also comparable to the Council's other commercial energy investment projects. In addition, the project will deliver substantial social and environmental benefits including cleaner air and fuel poverty prevention. The monetised value of the carbon reductions is estimated at £8.6m (€10m). The Social Value of air pollution savings are calculated as a further £1.5m (€1.75m). Income for the Energy Centre is expected to be generated through the following mechanisms:

- **Heat sales to customers** – The outline business case forecasts a 90% take-up within 5 years of commencement of heat generation. The village pub and school have also committed.
- Renewable Heat Incentive (RHI) – to incentivise uptake of low carbon heating solutions, the government set up the RHI for non-domestic and domestic projects. This project will access the non-domestic RHI through the submission of a pre-application to OFGEM to secure the incentive and will be eligible for RHI payments on completion of construction and customer connections.
- **Carbon credits** – the project will save 47,000 tonnes of carbon emissions over 40 years. Work has started with both the Council's commercial team and CUSPE 2020 research project to set up a scheme for the sale of carbon credits to local companies to support Financial Outputs Preintervention Postintervention.
- **Community Infrastructure Levy (CIL)** – An expression of interest has been submitted to East Cambridgeshire District Council to consider the project for its CIL list.

Mitigation or adaptation

This project both reduces emissions and increases community resilience through reducing energy costs and generating income/savings for the local economy.

Further information:

Cambridgeshire County Council. Community Heating. https://www.cambridgeshire.gov.uk/residents/climate-change-energy-and-environment/climate-change-action/low-carbon-energy/

A holistic approach to energy systems in Bristol, England

Business sector/type of intervention
Renewable energy

Project outline
Bristol City Leap takes a holistic view of Bristol's energy systems[157]. The initiative consists of: developing large-scale heat networks, providing smart energy systems through battery storage, electric vehicles, heat pumps and smart meters, the development of domestic energy efficiency hence creating the demand and supply through the local supply chain, enabling commercial energy efficiency, delivering different kinds of renewable energy, offering sustainable transport networks, experimenting with hydrogen, and monitoring, disseminating and evaluating this programme for its replicability within the UK.

The principle underpinning this strategy is a partnership approach to the engagement and deployment of the full range of energy-related technologies (including supply, generation, efficiency and smart) across the city, involving as many citizens and organisations as possible. The objective is to equitably share the benefits arising from this programme through local solutions.

The Bristol City Leap Prospectus aims to attract a range of local, national and international partners to attract, facilitate and deliver at least £1bn (€1.17bn) of low carbon and smart energy infrastructure investment in Bristol's energy system over the next ten years. The intention is to enable the city to "*increase the pace and scale of delivery of these innovative and state-of-the-art projects to meet its carbon neutrality target as quickly and cost-effectively as possible, whilst learning how to strategically coordinate such a diverse range of projects*". The Council's search for a partner is expected to conclude in 2021.

Type of local authority intervention
Bristol city council has invested £50 million (€58m) in low carbon technologies to date and aims to attract a further £1billion (€1.17bn) through the City Leap Partnership which will attract global investment to the city.

Investment source
Bristol City Leap is an umbrella initiative which incorporates a number of smaller projects with a diverse range of funding sources.

The Council has been successful in applying for various grant funding opportunities to support project delivery, including an EIB ELENA grant, EU Horizon 2020 funding (REPLICATE) and the Department of Business, Energy and Industrial Strategy (BEIS). The Council has also deployed co-financing models such including crowdfunding, community groups, social equity and debt investors.

Partners/stakeholders

Three major energy firms are in the running to form this partnership.

Other partners include:
- Bristol Energy
- Bristol Green Capital Partnership
- Bristol is Open
- University of Bristol
- University of the West of England
- Western power Distribution
- Bristol + Bath

Type(s) of benefit

The City Council recognises five key benefits to Bristol[158]:

1. Keep Bristol on course to be run entirely on clean energy by 2050 by delivering up to £1bn of investment in the city's low carbon, smart energy system.
2. Improve the environment to ensure people enjoy cleaner air through supporting the further deployment of renewable energy generation and electric vehicles.
3. Improve physical and mental health and wellbeing by making residents' homes warmer and cheaper to heat, reducing inequalities and the demand for acute services.
4. Tackle food and fuel poverty by reducing energy bills.
5. Create jobs, contributing to a diverse economy that offers opportunity to all and makes quality work experience and apprenticeships available to every young person.

Mitigation or adaptation

Primarily mitigation, however by reducing fuel poverty, creating jobs and supporting the local economy this initiative will increase local resilience.

Further information

Bristol City Council. (2018). Bristol City Leap. https://www.energyservicebristol.co.uk/cityleap/
Bristol City Council. (2018). City Leap Prospectus. https://www.energyservicebristol.co.uk/wp-content/pdf/City_Leap_Prospectus%204-5-18.pdf

Copenhagen's district heating system, Denmark

Business sector/type of intervention
District heating, combined heat and power, renewable energy, circular economy, heating affordability.

Project outline
One of the oldest and most successful of its kind, Copenhagen's district heating system was set up in 1984 by 5 mayors and today heats 98% of the city with clean, reliable and affordable heating[159]. 30% of the annual heating demand is covered by surplus heat from waste incineration, contributing to a circular economy, while the remaining production is from geothermal energy and fuels such as wood pellets, straw, natural gas, and oil.

After deciding to provide a common district heating system, the mayors set up a partnership named the Metropolitan Copenhagen Heating Transmission (CTR), which runs the system in partnership with an affiliated company in the west of Copenhagen, VEKS. A number of municipalities are covered by the system, though due to its population size Copenhagen takes the majority of the heat at 70%.

Image: Amager Bakke, also known as Amager Slope or Copenhill, is a combined heat and power waste-to-energy plant and sports facility in Amager, Copenhagen. It opened in 2017 and doubles as a year-round artificial ski slope, hiking slope and climbing wall.

The system captures the waste heat from the electricity production of incineration plants and Combined Heat and Power plants (CHPs). This heat would normally be released into the sea as a byproduct. Instead, it is delivered to homes through a 1,300 km network of pipes. Four CHP power plants, four waste incinerators, and more than 50 peak load boiler plants, together with 20 distribution companies, are connected in the large pool-operated system, producing 30,000 Terajoules of energy. Compared with oil or gas boiler alternatives, CPH-based district heat reduces CO_2 emissions by 40-50%[160].

The system cuts the average household bill by €1,400, reducing fuel poverty, and saves Copenhagen from using over 200,000 tons of oil every year – equating to around 665,000 tons of CO_2 emissions avoided.

In the 90s, the CHP plants switched from using coal to natural gas and biofuels. Today, CTR & VEKS purchases 70% of its district heating from large sustainable CHPs. These include the impressive Avodere unit 2, which is one of the most energy-efficient and environmentally-friendly units in the world: it it uses 94% of the fuel energy produced and can be powered by several kinds of field, such as wood pellets, oil, or straw, making it a multi-fuel unit.

Tax incentives and planning regulations both played a part in the regulatory context for the network's success, and affordability for households. In the mid-80s, Denmark's federal government introduced tax incentives on fuel for electricity plants – in some cases less than 50% tax – if CHP was used. This allowed companies to pass on lower prices to consumers. Planning regulations introduced in 1979 enabled municipalities to dedicate areas to district heating and make it mandatory for households to connect to district heating, pushing takeup rates to almost 100%. While this was at the expense of consumer choice between providers, costs were slashed to lower than market rates and the energy is now both environmentally-friendly and well-managed, leaving little to complain about.

The system is managed by CTR through an operations centre, using a computer-based monitoring system. Both the CTR and VEKS networks are connected so that excess heat or reserve capacity can be shifted depending on need/surplus. This improves the reliability of the service. Danish culture has a strong tradition of forming collectives of different kinds for community interests. Its socialist, collaborative history likely made it easier for political decisions removing consumer choice for the good of a collective energy system to be accepted.

Type of local authority intervention
The project was the brainchild of the mayors of 5 municipalities in Denmark, created the partnership Metropolitan Copenhagen Heating Transmission, working with VEKS, also a partnership by a different set of local authorities. The entire system is largely owned and run by municipalities and affiliated/owned companies, or by residents.

The planning regulation changes at the federal level gave local authorities power to effectively plan the district heating system themselves. Currently, 21 local authorities are responsible for the least cost heat supply planning of the system in accordance with the Heat Supply Act. All distribution companies are owned either by the municipalities or the consumers, with the aim to maximize the technical, institutional and financial efficiency of heating.

Funding

Since its origin in 1979, investments into the DH network have been financed by competitive loans on the world market initially, and by the fuel reductions by CHP production compared to separate production since. In contracts with the CHP plant owners and heating companies, the first 12 years of production was given to heat companies, after which it was divided equally. This non-profit meant that heat companies could expand the system over time.

Benefits
- Lower cost heat to households, reducing fuel poverty
- Can be delivered to businesses, greening the retail industry and other private sectors
- Flexible in choice of production plant and fuels used
- Environmentally friendly due to use of a byproduct, even more so if sustainable fuels are used
- CHP technology is well-established; 12% of Europe's electricity is generated from useable heat

Main partners/stakeholders
- CTR (owned by the municipalities of Copenhagen, Frederiksberg, Gentofte, Gladsaxe and Tårnby)
- VEKS (owned by Albertslund, Brøndby, Glostrup, Greve, Hvidovre, Høje-Taastrup, Ishøj, Køge, Roskilde, Rødovre, Solrød and Vallensbæk municipalities)
- Waste management company Vestforbrænding
- Distribution companies – owned by municipalities or consumer co-operatives

Mitigation or adaptation

Mitigation

Further information
- C40 Cities. (2011). 98% of Copenhagen City Heating Supplied by Waste Heat. https://www.c40.org/case_studies/98-of-copenhagen-city-heating-supplied-by-waste-heat
- Copenhagen District Heating System. https://www.districtenergyaward.org/wp-content/uploads/2012/10/Copenhagen_Denmark-District_Energy_Climate_Award.pdf
- Keeping the city warm efficiently – City of Copenhagen http://www.youtube.com/watch?v=lV8BYezzQ3Ehttp://

Circular Economy and Waste

Organics as a resource: removing household waste from the waste stream in Melbourne, Australia

The material for this case study comes from a 2020 LGIU briefing[161].

Business sector/type of intervention
Circular economy – household waste

Project outline
Organic waste makes up between 30 and 46 per cent of residential solid waste, and 15 percent of commercial and industrial waste[162] – and methane emissions from organics decomposition in landfill make up about 3 per cent of Australia's total greenhouse gases[163]. Diversion of organic household waste from landfill is an area where local governments can make big inroads into emissions reduction.

Research commissioned by East Waste (a regional subsidiary of seven Adelaide councils) found that if all organics going to landfill were diverted into the green bin, $2.7 million a year would be saved across the seven councils served by East Waste. It found that just 13 per cent of all food organics is correctly binned (the lowest efficiency for any recyclable material) and that more than 27 per cent of the contents of a general waste bin for landfill is food waste that could and should be composted[164].

In response to this, Councils across the country have implemented a Food Organic, Garden Organic (FOGO) collection service. One example is in Melbourne where The Metropolitan Waste and Resource Recovery Group (MWRRG) works with the 31 Melbourne metropolitan councils to reduce waste and maximise resource recovery.[165] To increase the recovery of organic waste, an organics processing network has been developed through collective procurement contracts in Melbourne's North West, South East and East. Collective procurement for organic waste processing is an effective way to encourage industry investment in organic waste processing facilities by being able to commit to significant, aggregated waste volumes.

In Melbourne, the critical first step in the implementation of FOGO was the establishment of a large-scale green waste processing facility by the private company Veolia, as part of its contract with MWRRG and 11 northern and western metropolitan councils. Following that, the MWRRG[166] procured the South East Organics Processing Contract involving eight councils (Bayside, Cardinia, Casey, Frankston, Glen Eira, Greater Dandenong, Kingston and Monash) and three privately owned organics processors, providing food recycling to an estimated 1.2 million residents[167]. The MWRRG also secured an agreement with a further five councils and three preferred bidders in Melbourne's east.

One of these three tenderers is the South East Organics Processing plant, a mechanical and biological waste treatment plant for municipal organic waste in Dandenong South. Established as an outcome of the South East Organics Processing Contract, the $65m composting plant was partially financed by a $38 million loan from the Clean Energy Finance Corporation (CEFC)[168]. The South East Organics Processing Plant project is identified by the CEFC as an "industry-first finance model" that provides councils with access to a project financing structure that has rarely been leveraged across local governments.

The plant, with its capacity to process 120 000 tonnes of waste a year, will be used by eight councils that are charged gate fees to use the facility, ultimately generating compost to be used for landscaping, gardens, parks, agriculture and horticulture.

Access to organic waste processing plants are critical. For councils without local access or capacity, a regional approach and commitment to collective procurement contracts can provide the scale to help attract industry investment to deliver the critical processing infrastructure. The example of the South East Organics Processing Project obtaining CEFC financing suggest this is a funding model other councils could explore.

Type of local authority intervention

Many local governments have implemented an organic waste collection service. Additionally, most Australian states have introduced landfill levies. These have helped promote recycling over landfill, while simultaneously providing revenue to support recycling infrastructure.

Another way to intervene in the private market to achieve public objectives is for governments to regulate organic waste by banning it from landfill and requiring it to be recycled or reprocessed. In Europe, unprocessed organic waste is banned from landfill and must be reprocessed into valuable products, such as compost and energy[169].

A community education campaign is an important part of introducing FOGO services. Penrith Council's FOGO has a low contamination rate, between 1.4-2.6 per cent[170]: a result of their long-term education programs. This involved changing people's habits, from having a general waste bin that is collected weekly to a three bin system where, once materials are sorted into recycling and FOGO, there is much less that needs to go into the residual bin (which is also collected less regularly).

Investment source

South East Organics Processing plant:
• $38 million loan from the Clean Energy Finance Corporation
•   The eight participating Councils are charged gate fees to use the facility

Partners/stakeholders
- The Metropolitan Waste and Resource Recovery Group
- 31 Melbourne metropolitan councils
- Veolia
- Three privately owned organics processors
- Clean Energy Finance Corporation – The CEFC is a statutory authority established by the Australian Government under the Clean Energy Finance Corporation Act 2012 to invest in clean energy technologies.
- Sacyr Group

Type(s) of benefits
It is estimated the facility will produce up to 50 000 tonnes of quality compost each year, cease the release of more than 65 000 tonnes of CO_2 per year into the atmosphere, and the emissions generated by landfill waste will be reduced by 85 per cent – the equivalent of removing 13,900 cars from circulation[171].

Mitigation or adaptation
Primarily mitigation

Further information
Zierke M. (2020). Organics as a resource: removing household waste from the waste stream. https://lgiu.org/briefing/organics-as-a-resource-removing-household-waste-from-the-waste-stream/

Anaerobic digestion

Do the Right Thing – turning Ireland's food waste into renewable energy

Business sector/type of intervention

Green Generation is a Kildare-based renewable energy company, established in 2010. Anaerobic digestion is used to convert food/ agricultural waste to renewable energy that is injected back into Ireland's national gas grid via the injection point at the Causeway Project, Cush, Co. Kildare. Cush is Ireland's first renewable gas injection point, co funded by Green Generation, Gas Networks Ireland and the EU. The company employs 35 people in rural Kildare generating opportunities and revenue for the local economy.

Natural microbial activity is harnessed to break down organic waste into biogas and an organic fertiliser by-product. The biogas is used to produce renewable electricity or upgraded to "biomethane" which is then injected into the natural gas grid to be used as a clean heating or transport fuel. The digestate is used as a high quality eco fertiliser on local farms. Food waste being turned into renewable gas, increases the value of the food waste and diverts any lost value. Food waste packaging is also processed into high value products through a patented process called Enclosed Pressure Moulding with another affiliated company, Paltech.

Project/initiative outline

There are over 1 million tonnes of food waste produced in Ireland every year, either going to compost or landfill. This can be turned into renewable energy and injected back into the national Irish gas grid to be used by Irish citizens or used as a fuel for the HGV sector. If Ireland is to meet its carbon emissions goals, all sources of indigenous energy, wind, solar, hydro and renewable gas will need to be capitalised upon.

Type of local authority intervention

The local authority has been key in building and supporting the company's business ecosystems. Kildare is a hub for both homegrown and multinational companies, and while the benefits of anaerobic digestion and waste to energy are not new, getting the message out there is essential. Kildare County Council and the Kildare Chamber are great gateways to these companies.

Investment source

Majority private funding with some external (Science Foundation Ireland) grants.

Partners/stakeholders

Green Generation, Costello Group, Tesco, Paltech, Irish BioEconomy Association (IrBea), Gas Networks Ireland (GNI)

Type(s) of benefit

The company and its processes implement a circular economy which is essential to the future of sustainability efforts in Ireland. According to the European Commission, Ireland has the highest per capita potential for renewable gas in Europe (Image 4). Substituting renewable gas for natural gas is one of the ways Ireland can cut carbon emissions and significantly reduce dependence on fossil fuels. The aim of this project aligns with the UN's Sustainable Development Goal 7 ensuring access to affordable, reliable, sustainable and modern energy. Green Generation turns food waste into biomethane, a renewable form of gas. The fuel has significant potential to transform business and transport over the coming years. It is a direct replacement for natural gas, used seamlessly in the same heating systems and appliances.

A 2016 paper from CRE and IrBea showed four significant CO_2 reduction pathways associated with the production of biogas, demonstrating the major role that could be played by AD industry in CO_2 reduction. Image 6 and Image 7 outline the total CO_2 savings that could be achieved in Ireland if the right policies and supports are available.

Mitigation or adaptation

Mitigation. Building awareness of the benefits of anaerobic digestion and using waste material as a raw material. Denmark has a similar land mass as Ireland, and just under 1 million more people but they are miles ahead in terms of harnessing the potential of their bioeconomy. We should look to replicate the Danes and follow our European cousins in order to win the climate race.

Further information

Green Generation injects biomethane into the Irish gas grid https://www.renewableenergymagazine.com/biogas/naturgy-ireland-injects-biomethane-into-the-irish-20200623

Water

Floodable parks: Hunter's Point South Park, New York (USA)

Type of intervention

Flood resilience, flood park, public green space, sustainable urban drainage systems, nature-based infrastructure, urban ecology, tourism and recreation.

Project outline

Given the threats climate change poses to infrastructure in New York, resilience to flooding from sea level rise and storms is high on the agenda of city planners. New York is currently considering designs for a 10-mile barrier of flood resilient urban landscaping to stop a repeat of the damage Hurricane Sandy's tidal surges did to lower Manhattan. However, the inadvertent pilot park for the current plans was Hunter's Point South Park, on the edge of New York's East River, which proved successful at withstanding Hurricane Sandy's 4-foot storm surge in 2012 – phase I of the park was completed in the same year.

Built on an 11-acre former industrial area of Long Island City, Hunter's Point South Park has been heralded as a new type of urban waterfront development, for not just including anti-flooding defences and resilient planting, but being entirely centred around the idea – without sacrificing design and sociality. The design functions as a prototype for innovative sustainable design, using urban ecology and landscaping alongside smart infrastructure choices. Phase I was opened to the public in 2013, while Phase II completed the park in 2018.

The park was built above water level without catchment areas as a preventative measure. The paving areas use a porous type of concrete to resist flooding damage, and planted border areas have well-hidden channels for draining stormwater quickly. Avoiding overloading the urban sewer system, the park instead takes a "catch and release" approach, purposefully collecting water in certain areas and using a planned run-off system to drain it at a steady pace. The park intercepts, infiltrates, and evaporates 73% of average annual rainfall in permeable pavers and a biofiltration swale. 760ft of rock-filled gabions run the length of the park's east side along a biofiltration swale, slowing large volumes of stormwater and filtering sediment so that storm drains do not become clogged. The system increases flood storage capacity by 557,800 gallons, or a 6-ft storm-surge flood event.

Designers sculpted the peninsula to feel like an island, with a narrow bridge taking you over to the park where the beautiful landscaping and art installations are surrounded by a salt marsh – twice a day, high tide rolls in to transform large areas of the park into a marsh. Along the existing beach, riprap and marsh plantings are used to create an attractive infrastructural soft edge. Solar panelling on the roof also generates 37,000 kWh of energy annually, enough to support the pavilion and park lighting[172].

Aside from successfully providing flood resilience, the beauty and sociality of the park's design has also helped to boost visitors to the area, raise property prices, and improve tourism – ferry trips on the East River route have increased from 19,055 in 2010 to 200,000 in 2018[173] and the park is frequently tagged on social media platforms.

Image 1: The infrastructural soft edge and resilient marsh planting of Hunter's Point South Park.

The amenities of the park include: a café; playground; dog park; wooden 'rafts' for relaxing; a shaded picnic area; fitness terraces; a water ferry stop; a kayak launch site to host boating programmes; a large, oval-shaped open space for relaxing and games (synthetic turf, to withstand regular flooding); and a 30-foot high steel-clad viewing platform – the design of which is a nod to the site's industrial history – that provides impressive sweeping views of the river and cityscape.

Partners/stakeholders
Spearheaded by the New York City Economic Development Corporation (non-profit), on behalf of the New York City Department of Parks and Recreation.
Designed by SWA/Balsley and WEISS/MANFREDI with ARUP as the prime consultant and infrastructure designer.

Funding
The park was funded through the NYCEDC as part of Mayor Bill de Blasio's Housing New York plan; alongside the park new housing units are being built, including affordable housing.

Role of local government
The project was coordinated and funded by the Government of New York City, the city council.

Adaptation/mitigation
Adaptation

Further information
- ARUP. (2013). Hunter's Point South waterfront park opens. https://www.arup.com/news-and-events/hunters-point-south-waterfront-park-opens
- Pictures, video, design. Weiss Manfredi. Project: Hunters Point South Waterfront Park. http://www.weissmanfredi.com/project/hunters-point-south-waterfront-park

North Jutland: Green maritime development

Business sector/type of intervention
Maritime, regeneration, regional green growth

Project outline
This case study looks at the greening of the maritime industry in North Jutland, Denmark. The North Jutland region consists of 11 municipalities – total population 590,000 – bordering the north sea. North Jutland is close to the national average in terms of share of and number of employees with green skills, with 0.59% of workforce working in the green sector, and in fact has lower levels of green R&D innovation compared to other Danish regions[174]. However, it has seen success in its shift from a declining shipbuilding industry into a hub for green maritime equipment manufacturing and service provision.

The primary driver of green growth in the region has been the successful development of maritime manufacturing and service network, following the gradual closure of shipyards in the region. Aided by partnership networks, the maritime equipment service providers have worked on new pilot and demonstration projects by working with other suppliers in the region. In addition to employment to replace job losses, the spinoff businesses and collaboration from the shipyards over the years have created deep competencies and specialisations, developing a vibrant industry with linkages across sectors such as metal, robotics, ICT and sustainable energy. The region also highly concentrated groups of knowledge and educational institutions organisations who have aided the development of new competencies and skills for the workforce of the maritime industry.

The main drivers and enablers of green growth in the area were identified as:

1. **International and national regulations** – Regulatory initiatives at the international (International Maritime Organization) level, alongside EU and national level, provided a blueprint for greening the sector. Different bodies have developed regulations within sector areas, e.g. oil spills, energy efficiency, ballast water damage, reduction of marine ecosystem damage.
2. **Industry self-regulation and voluntary initiatives** – a significant driver was self-regulation, industry-wide partnerships and voluntary regulation, e.g. a clean shipping index was created by a collaboration of maritime stakeholders. Shipping firms undertook voluntary greening due to increasing demands from customers and cargo owners.
3. **Innovative pilot and demonstration projects and green business models** – Maritime equipment manufacturers and service providers and intermediate organisations actively engaged in developing new, green services, often working in partnerships to share knowledge and expertise. Examples of innovative projects have included retrofitting ferries with green technologies, electric ferries, developing sulfur scrubbers to reduce emissions from smoke, and using liquefied natural gas as vessel fuel.

The main barriers identified for regional green growth are: slow regulatory developments in the maritime sector due to consensus required between so many actors; lack of incentives for greening as regulation makes investment in the industry uncompetitive; lack of co-operation between maritime stakeholders due to conflicting interests – the multi-jurisdictional nature of the industry also makes enforcement difficult.

Type of local authority intervention

In 2007, as part of Danish Municipal Reform, traditional counties were abolished in favour of larger regions. Smaller municipalities were also merged to be larger and with more power, but less in number (North Jutland has 11). Alongside this was the setting up of Regional Growth Forums, with the purpose of monitoring development and finding opportunities for business development and regional growth. While many of the directives for greening are nation-wide, North Jutland's handling of green growth was largely the result of regional and local government policy, including the production of the important "The North Denmark of Opportunities – Strategy for Regional Growth and Development 2015–2018"[175] which stimulated regional growth. The regional authorities were also responsible for "Blue Northern Jutland", which promoted development of the maritime industry activities in a cluster of fishing, oil, has, and wind energy. In 2019, the regional council of North Jutland introduced an ambitious climate action plan to make North Denmark the greenest. The plan will focus on reducing energy consumption and waste, greening transport and improving recycling.

Investment source

Funding through national government contributes to individual projects in the region and grants for innovation but much of the financing and incentivisation has been business-led; voluntary standards and partnerships provide collective benefit to stakeholders.

Partners/stakeholders

Regional and municipal authorities, Business Region North Denmark, national government agencies and regulatory bodies, EU and international bodies, industry associations, large firms within in the industry, industry partnerships, NGOs, financing agents, educational institutions and research

Types of benefit

Increased employment and economic growth for an area previously in decline, meeting increased demand for greening by consumers and regulatory bodies, improving resilience and contributing to climate change adaptation.

Mitigation or adaptation

Primarily mitigation through greening of the entire sector, but also building resilience to economic shocks through getting ahead of green consumer trends and regulatory clampdowns.

Further information

Andersen A. et al (2019). Green Growth in Nordic Regions: Eight case studies. https://nifu.brage. unit.no/nifu-xmlui/bitstream/handle/11250/2601343/NIFUWorkingPaper2019-7.pdf

Innovation

Incorporating natural and nature-based infrastructure methods into coastal infrastructure, USA

Business sector/type of intervention
Infrastructure projects, coastal and flooding protection, ecosystem protection, cost-efficient adaptation

Overview and context
Coastal communities in the US are at increasing risk of storm events, flooding, and sea level rise – the latter two risks being shared with much of Ireland. Investments in coastal infrastructure are urgently needed to ensure community safety and prosperity, however the repairs and infrastructure projects chosen should not risk ecosystems or damage natural resources that underlie economic wealth and wellbeing.

In many cases, built infrastructure in the US (e.g. dams, undersized culverts, seawalls, water-diverting levees and canals) have caused significant decline in the diversity and abundance of aquatic habitats, such as in the Florida Everglades[176]. The removal of such infrastructure is an option: in Taunton, Massachusetts, heavy rain caused the near-failure of a neglected dam, leading to costly evacuations. To reduce the threat of similar incidents, the dam was removed and the river restored, successfully enhancing resilience to future natural hazards and ecosystem damage.

However, beyond reverting areas with traditional "grey" infrastructure back to their natural state, engineers and scientists have made progress in building infrastructure with natural landscape features in mind, harnessing the benefits of "hybrid" or nature-based solutions. Examples of natural and nature-based infrastructure (NNBI) include "living shorelines" for erosion protection of waterfront properties and stream-design culverts to restore natural tidal flow and reduce flood damage to properties and roads.

Project outline
Natural coastal infrastructure (e.g. beaches, dunes, marshes) can reduce wave energy, coastal erosion, and flood hazards. USA insurance industry models estimate that during Hurricane Sandy, wetlands saved more than $625 million (€530m) in property loss, and neighbourhoods behind marshes saw 20% less property damage[177]. Opportunities in combining built and natural infrastructure designs can also provide additional protection against erosion and flooding compared to traditional built infrastructure. Coastal NNBI co-benefits can include:

• creating commercially and recreationally valuable fish habitats
• improved biodiversity maintenance and enhancement of biodiversity
• improved aesthetics and access to "nature" that can increase tourism and recreation
• improved water quality

The benefits of NNBI are estimated to be valued at over $100 billion annually across the USA[178]. Other examples of NNBI include "living shorelines" for erosion protection of waterfront properties and stream-design culverts to restore natural tidal flow and reduce flood damage to properties and roads.

The decision to use traditional built infrastructure over NNBI is often based on initial construction costs, but fails to account for longer term maintenance and repair costs, which are much lower for NNBI, or account for the co-benefits that NNBI can offer.

Type of local authority intervention

While legislation at national and state levels has been key in facilitating NNBI – for example Maryland's Living Shorelines Protection Act making living shorelines and natural solutions to erosion the default unless extensive proof is provided that these methods wouldn't work. In taking care of planning and environmental issues, local governments along shorelines have a large role in identifying need, planning and managing infrastructure projects and protection of coastal areas. Major US cities such as Boston and San Francisco have partnered with organisation Rebuild by Design[179] to develop climate resilience plans with a reliance on NNBI.

Image: Rock wall for protection from erosion and tidal surges in Chesapeake Bay, Maryland

Investment source

Notably, municipal, state, and federal branches of the U.S. government have already begun using incentives effectively to promote the adoption of NNBI.

For example, FEMA's Community Rating System (CRS) provides 5–45% discounts on insurance premiums in communities that take some combination of risk-reducing actions, including the preservation of natural areas in high flood-risk areas.

Although there remains a need for funding mechanisms for NNBI, good example programs already exist. Green bonds are already in use in Massachusetts to acquire and conserve land, and infrastructure banks are commonly used for transportation projects – both would be well placed to extend to this type of project.

Key benefits

Reducing flooding and coastal erosion risk to property, ecosystem protection, long-term financial returns for council, tourism boost.

Adaptation/mitigation

Primarily adaptation against flooding and erosion but also mitigation though also ecosystem protection and greener construction methods

Further information

Sutton-Grier, A.E. et al. (2018). Investing in Natural and Nature-Based Infrastructure: Building Better Along Our Coasts. http://www.mdpi.com/2071-1050/10/2/523/htm

Climate Ready Clyde – Glasgow, Scotland

Business sector/type of intervention
Cross-sector adaptation partnership

Project outline
Climate Ready Clyde (CRC) is a cross-sector initiative funded by fifteen member organizations and supported by the Scottish Government to create a shared vision, strategy and action plan for an adapting Glasgow City Region.

CRC works in partnership with external partners to set out a long-term vision for a climate ready Glasgow City Region. In doing so this group identifies necessary elements required to achieve this vision and some guiding principles for how it should be achieved. The group has recently developed its first regional Adaptation Strategy and Action plan for Glasgow City region as well as the Clyde Rebuilt project, which will identify levers of change, work external partners to to exchange knowledge, and develop a portfolio of innovation projects to develop a more resilient region.

Type of local authority intervention
This project is a jointly-funded partnership between public, private and third sector organisations. A number of local authorities sit on its board.

Investment source
The 15 members of the partnership with support from Scottish Government.

Partners/stakeholders
The partnership is governed by a board of expert individuals from:
The James Hutton Institute
University of Glasgow
University of Strathclyde
City of Glasgow Council
East Dunbartonshire Council
NHS Greater Glasgow and Clyde
SEPA
North Lanarkshire Council
South Lanarkshire Council
East Renfrewshire Council
Strathclyde Partnership for Transport (SPT)
West Dunbartonshire Council
Transport Scotland

SGN
Renfrewshire Council
Inverclyde Council

Other key partners include:
- The Scottish Government
- Sniffer
- EIT Climate-KIC
- Creative Carbon Scotland

Type(s) of benefit

Most recently the partnership developed a briefing paper on what a green recovery could look like, identifying quick (resilience) options that could deliver jobs and economic growth. This informed the Scottish Parliament's work on a Green Recovery, and the Glasgow City Region Economic Recovery Plan, as well as emerging programmes such as the City Region housing retrofit programme and the Clyde Climate Forest, and the Regional Sustainable Procurement Strategy.

The partnership has also co-produced a toolkit for screening capital investments and major projects. The toolkit enables a common approach to embedding adaptation into new investment to maximise its performance. In doing so, it:

- helps organisations embed systematic appraisal of climate risk and adaptation into delivery of capital investments;
- Supports the creation of financeable projects by better aligning with lenders and financiers requirements on climate risks; and
- Raises the standard of commissions and briefs for climate risk assessment.

More broadly, the CRC has developed meaningful and effective partnerships between cross-sector organisations across the Glasgow City Region.

Mitigation or adaptation

Adaptation

Further Information

Climate ready Clyde: http://climatereadyclyde.org.uk/

Chapter 3: Case Studies
Further Opportunities

Finance: Green municipal bonds, USA

Business sector/type of intervention

Municipal bonds, green finance

Context: municipal bond issuance

The use of municipal or 'muni' bonds to raise funding for capital spending by local governments has been immensely successful across parts of the USA, though is less common in Europe – including Ireland – where tradition remains to borrow from central government or national/specialised banks. However, in recent years of recovery following the 2008 financial crisis, european countries have been experimenting with the model. In 2017, Aberdeen City Council in Scotland issued a municipal bond to raise £370 million to fund its infrastructural capital investment projects out to beyond the year 2050. The Council secured a 'high grade investment' bracket Aa2 credit rating by Moody's, however this was not without challenge: they had to submit highly detailed financial information including debt profiles, strategic plans, information on Scottish local government, and meet legal and regulatory requirements.

However, when looking for best practice, the USA remains an experienced frontrunner in the issuance of green muni bonds – essentially identical to normal muni bonds except for being labelled as green by their issuer, and earmarked for green investments. Part of the US' success in can be attributed to municipal bonds' tax-free status as granted by federal government. The table below, sourced from the Green City Bonds Coalition, outlines types of green municipal bonds with examples mostly at state-level. For this case study, we will look at Massachusetts.

Table 1: Types of Green Muni Bonds:

TYPE	PROCEEDS RAISED BY BOND SALE	DEBT RECOURSE	EXAMPLE
General Obligation Bond	Earmarked for green projects	Full recourse to the issuer; therefore, same credit rating applies as to the issuer's other bonds.	State of California issued $300 million in Aa3/A green bonds with final maturities in 2037. The September 2014 issuance was backed by the State's General Fund, 90 percent of which is derived from personal income tax, sales and use tax, and corporation tax). Proceeds went to fund a variety of projects across several categories, including air pollution, clean water and drinking water, and flood prevention.
Revenue Bond	Earmarked for green projects	Revenue streams from the issuer, such as taxes or user fees, provide repayment for the bond.	Iowa Finance Authority issued $321.5 million of State Revolving Fund revenue bonds in February 2015, with 1- to 2-year tenors, 1 to 5 percent coupon, rated AAA. The green bonds were backed by water-related fees and taxes. Proceeds were earmarked for water and wastewater projects.
Project Bond	Ring-fenced for the specific underlying green project(s)	Recourse is only to the project's assets and revenue.	No issuance seen in the market yet
Securitized Bond	Either (1) earmarked for green project or (2) go directly into the underlying green projects.	Recourse is to a group of financial assets that have been grouped together as collateral.	Hawaii State Government issued $150 million, AAA-rated of green asset-backed securities in November 2014. The securities were issued in two tranches: $50 million, 8-year, 1.467 percent coupon and $100 million, 17-year, 3.242 percent coupon. The bonds were backed by a Green Infrastructure Fee applied to the bills of the State Utility's electricity customers. Proceeds went to loans to install distributed solar panels, connectors, and storage.

Page 3 | GREEN MUNI BONDS PLAYBOOK   GREEN CITY BONDS COALITION

Source: Green City Bonds Coalition (2015): Green Muni Bonds Playbook.

Available at: https://www.climatebonds.net/files/files/Green%20City%20Playbook.pdf

Project outline

The Commonwealth of Massachusetts successfully completed its first green bond issuance in 2013, to the amount of $100 million. The proceeds were earmarked for projects such as clean drinking water, state building efficiency, river revitalization, and habitat restoration. After the success of the 2013 issuance, Massachusetts set out to pursue a larger program in 2014[180].

Massachusetts found the issuing of green bonds to be relatively simple, although completing the groundwork properly was important. While some companies find the tracking and reporting from use of proceeds for green bonds to be cumbersome, as a public institution Massachusetts were already tracking these for all expenses as part of due diligence. The only additional burden was preparing reports for investors, which were created in-house. Their reports track spending on the various projects without the need for metrics on the exact "green impact" of the projects themselves.

> **Bond details**
>
> **Issue date:** September 2014
> **Size:** $350 million
> **Maturity:** 5 to 17 years
> **Yield:** 2.45 percent Rating: AA+ Fitch / Aa1 Moody's / AA+ S&P

The Commonwealth of Massachusetts was issuing both regular and green bonds at the same time, but found issuing green bonds easier; they were able to tell investors a more persuasive story about the projects it would fund. Additionally, local retail investors who had not previously considered municipal bonds were attracted to the green angle. The result was that the sale was 3x oversubscribed and so sold at lower yields than the market's AAA yield curve. The bonds received an unprecedented amount from retail investors, who reported that, as residents, they appreciated the knowledge of how specific projects would benefit the community.

Type of local authority intervention

The issuance of green bonds by local governments allows large amounts of capital investment to be raised to fund green infrastructure projects, without the need to rely on loans from central banks or government. A maturity date set far enough into the future also support slong term planning. As an added bonus, the green nature of these municipal bonds provides extra benefits compared to regular municipal bonds, as the popularity of green projects among local and national/foreign investors can lead to lower yields, making borrowing cheap.

Benefits

The issuance of green bonds by local governments allows large amounts of capital investment to be raised to fund green infrastructure projects, with a maturity date set far enough into the future to support long term planning. As an added bonus, the green nature of these municipal bonds provides extra benefits compared to regular municipal bonds, as the popularity of green projects among local and national/foreign investors can lead to lower yields, making borrowing cheap.

Further information

US Green City Bonds Coalition. https://www.climatebonds.net/get-involved/green-city-bond-campaign/us

SMART Cities: Nordic Healthy Cities

Sector/interventions

SMART cities, data collection & visibility, improving urban environments, reducing pollution, health and quality of life

Project outline

The Nordic Smart City Network (NSCN), a collaboration between 20 Nordic cities across five countries to create liveable and sustainable cities, is operating a project to support urban environments and residential health and wellbeing through urban planning and management practices. The 10,200,000 NOK (€1.011 million) Nordic Healthy Cities project sees the NSCN partner with private companies to deliver a sustainable and integrated health region across the member cities. The project has received 5.000.000 NOK (€495,431) from Nordic Innovation, an organisation under the intergovernmental Nordic Council of Ministers, which incorporates Denmark, Finland, Iceland, Norway, and Sweden.

The Nordic Healthy Cities initiative is divided across five smaller projects, each of which will trial innovative policies to address health issues in future urban areas. One city from the NSCN heads the management of each project, with further members of the network also participating. If successful, the projects will be scaled to other partner cities.

The five projects are:

Sleep Monitoring of citizens with cognitive impairments – Aarhus, Reykjavik, Helsinki
A trial that will use sleep monitoring technology to improve the sleep quality of nursing home residents with cognitive impairments such as dementia. The City of Aarhus, who is leading the project, previously worked on a similar national project in Denmark which investigated using data technology to monitor the quality of sleep of nursing home residents. The study found that using data could improve the sleep and overall care of citizens who cannot verbally express problems with their sleep, such as awakenings, restlessness and poor quality of sleep[181].

The national project found that many of the sensors employed by nursing homes failed to be able to monitor the quality of sleep and meet data protection requirements, ensuring new technology needed to be developed to be GDPR-compliant across Nordic countries.

The trial will aim to adjust these existing sensors to better monitor residents' sleep while meeting these data protection requirements while additionally creating new technology that can evaluate efforts to improve sleep and promote a healthier circadian rhythm, and improve sleep monitoring knowledge across Nordic cities.

Nordic Liveable Neighbourhoods – Helsinki, Vantaa, Stavanger, Copenhagen, Kristiansand

A project to create greener and more inclusive neighbourhoods, with an aim of developing liveable healthy neighbourhoods from the perspectives of green infra and foodscapes. Nordic cities will utilise agile piloting – a management model to experiment on and co-develop early prototypes of real life urban labs. Three agile pilots will be run during the scheme: Trials of digital skills to support green infrastructure in urban planning, block level solutions for urban farming and innovative food solutions. The project is set to run until Autumn with participating cities calling for community participation in the pilots' 'neighbourhood labs'.

Reduction in Pollution – Tórshavn, Stockholm, Copenhagen, Reykjavík, Stavanger

This project aims to use data to reduce pollution and exposure to pollution while improving traffic flows and public access to transport information. The project specifically looks to create a working model for measuring and reducing pollution while enabling better traffic flow through data and urban planning. The project will initially focus on three main transport areas: Parking, Traffic (vehicles, cyclists and pedestrians) and Bus Travel. Radar technology will be employed across all three sections of the project. GDPR approved radar systems will provide transportation data which, when coupled with pollution measurements, will provide an environmental lens to transport decision making.

Agile piloting and market discussion will be employed simultaneously to get additional input from stakeholders and businesses and trial innovative products related to the project.

Crowdsensed Data– Stavanger, Århus, Helsinki, Vejle and Copenhagen

A community project where city residents provide non-sensitive environmental and health data to help boost the overall health and liveability of cities. The project will look to distribute environmental sensors to members of the community, for metrics such as sound and air quality, and launch partnerships with wearable tech companies such as FitBit and Polar. The concept is that large amounts of data can be collected by citizens using modern devices and wearable tech, an untapped market of crowdsensing data that could improve public health.

The collected data is hoped to inform better places, better urban planning and more targeted health projects. The project will be trialled across 1-3 pilots in the partner cities, with an eye to scale successful pilots to other cities.

Image: wearable modern devices are an untapped source of data for local authorities

Health Data – Tampere, Syddjurs, Vejle

This project will look to introduce data, automation and digital support to address the strains on state healthcare systems caused by longer life expectancies and changing age distributions. The NSCN argues the current service offering model isn't viable financially or resource-wise. The project will look to get a holistic view of health data by obtaining a range of public and private data sources.

This data will be employed to create predictive and prescriptive healthcare to improve the time and cost effectiveness of healthcare services. Additional measures will be trialled to make citizens more aware of their own data use and how to use it safely. Pilots will be run across the three participating cities, where anonymised data will be collected from trial groups.

Type of local authority intervention

The 20 urban municipalities, particularly their respective urban planning departments, worked under the Nordic Smart City Network to deliver the projects within their own area, in partnership with private companies.

Investment source

The 10,200,000 NOK (€1.011 million) Nordic Healthy Cities project sees the NSCN partner with private companies to deliver a sustainable and integrated health region across the member cities. The project has received 5.000.000 NOK (€495,431) from Nordic Innovation, an organisation under the intergovernmental Nordic Council of Ministers, which incorporates Denmark, Finland, Iceland, Norway, and Sweden.

Partners/stakeholders

Run by Nordic Smart City Network and its respective cities
Nordic Innovation – Organisation under Nordic Council of Ministers (intergovernmental organisation of five nations)

Type(s) of benefit

Improved data on health and health inequalities, benefits to urban planning capabilities, population health and wellbeing.

Further information

Nordic Healthy cities: https://nscn.eu/NordicHealthyCities

Hubs: Liverpool's Maritime Knowledge Hub, England

Business sector/type of intervention
Maritime sustainable development

Project outline
By 2030 the global maritime industry is estimated to be worth $3 trillion. To take advantage of this growth, the Wirral Council has partnered with a number of other private and public sector organisations to create the Maritime Knowledge Hub[182]. This Hub will be an industry-led research, education and development centre of excellence which aims to put the Liverpool City Region (LCR) at the heart of the maritime and marine industries. The hub offers a solution to the industrial skills shortage in the region and is designed to support growth in the sector.

Liverpool City Region is already a world-leading centre for renewables. The region is a UK Government-designated Centre for Offshore Renewable Engineering (CORE); Liverpool Bay has one of the largest concentrations of offshore wind assets in the world, with over 270 turbines in operation[183]. It also boasts the first operational deployment of the world's largest wind turbines.

The Maritime Knowledge Hub will feature:

- The Maritime Technology Centre
- The Offshore Survival Training Centre
- The Marine Simulation and Training Centre
- A HydroLab
- 60,000 sq ft of collaborative space
- State of the art research and development facilities

The hub will focus on the issues of decarbonisation and digitalisation which are key challenges for the sector and closely linked to the council's own net carbon targets.

Type of local authority intervention
The Council is a key partner in this development. Wirral Council currently owns the site of the proposed Hub and has committed to partially funding its development.

Investment source
The Hub is set to cost £23million and grant funding has been approved by the Wirral Waters Investment Fund. This investment fund has been created by the Council on the basis of reinvesting uplifted business rates and/or prudential borrowing against future business rates into the Enterprise Zone up to 2037, to support new projects through grants and loans and generate further business rates income[184].

Partners/stakeholders

Mersey Maritime

Peel L&P

Wirral Council

Liverpool City Region Combined Authority.

Type(s) of benefit

The Maritime Knowledge Hub aims to:

- Create hundreds of immediate job opportunities.
- Help with generating 4,000 jobs in the maritime sector.
- Support and boost the regional maritime economy which, at present, has a £4.2bn (€5bn) turnover and supports 52,000 jobs.
- Create a ripple-effect, boosting the wider LCR business ecosystem.
- Deliver additional benefits to maritime businesses based within the MKH thanks to Wirral Waters' Enterprise Zone status.
- Be delivered by the maritime industry, for the maritime industry.

Mitigation or adaptation

Primarily mitigation, however job creation will help to create local social and economic resilience.

Further information

Wirral Waters. (2021). Maritime Knowledge Hub. https://www.wirralwaters.co.uk/projects/maritime-knowledge-hub/

Tourism: Kaikoura's small community ecotourism, New Zealand

Intervention type
Ecotourism, waste management, biodiversity and conservation

Overview
Kaikoura is located on the east coast of New Zealand's South Island, with a municipality covering little over 2000 square kilometres and just 21 council employees (up from 12 in 2005). Despite a population of just 3,912, more than 137,000 people visit annually and Kaikoura topped Airbnb's global trending destination list in 2019[185]. The area is famed for its beauty and abundant marine life – whale tours are particularly popular. In 1980, the area was in economic decline, however the tourism industry boomed over the decades, reviving the economy. 2016 Regional Tourism Estimate (RTE) data shows that total visitor spend in Kaikoura was $120.1 million (€71m), of which $72.5 million (60.4%) was by international visitors and $47.6 million (39.6%) was by domestic visitors[186].

Image 1: Kaikoura, a coastal town on the east coast of New Zealand's South Island

Kaikoura's reasons for branching into sustainable tourism included:
- The threat of diminishing visitor experience following unmanaged, incredibly high levels of tourism in the 80s and 90s.
- Local concern for the environment.
- Reaching capacity in accommodating waste.
- A local incident of a chemical spill into the sea – despite minor environmental damage, urgent pressure for reassurance from around the world and a potential loss of trade was recognised.

Project outline

To create a strategy for tourism, the district council worked with community representatives and Lincoln University to create the Kaikoura Tourism Strategy (1998). The strategy is being implemented on the ground through a Tourism and Development Committee including councillors, representatives from the tourism and fishing industries, and community and indigenous (Maori) members. Community involvement was a key aspect of the strategy.

The tourism strategy itself focused on addressing the seasonality of the industry, length of stays, and economic returns to the community. Priorities included attracting a more diverse base of tourists, developing local facilities, and investing in offering more land-based ecotourism activities. Rather than solely focusing on tourism, the initiatives chosen were aimed at managing Kaikoura's environment, with tourism stakeholders seen as primary participants and beneficiaries, i.e. choosing environmental management techniques that may also benefit tourists rather than tourism strategies that may also benefit the environment.

Initiatives

Waste management: Innovative Waste Kaikoura is a non-profit joint venture representing a successful partnership between the District Council (49%) and a community trust (51%). The community ownership ensures charitable fundraising while the political commitment of the council offers financial security. Rubbish collection was stopped and immediately replaced by a recycling service, leading to 30% less landfill[187]. This rose to 65% thanks to measures including: investment in a refuse press and composting unit; commercial recycling collection; introducing a Waste Management Protocol for businesses helping them to reduce waste – a requirement for new developments; opening a second hand shop. As for tourism, promotional events such as the Trash to Fashion Show helps attract visitors in the low season, while emphasis on low landfill contributes to the ecotourism destination draw for those concerned over their own tourism impact.

Destination certification: In 2001 Kaikoura became a pilot community for certification as a sustainable destination by the Green Globe 21 scheme. After comprehensive measurement and benchmarking across 10 topics were agreed, Kaikoura set out to demonstrate it was meeting the standards, and work to fix areas where it wasn't. Particularly difficult was trying to obtain data to reliably measure tourism and resident impact, but certification was achieved in 2004. Certification has proved valuable in raising the profile of Kaikoura in the tourism marketplace as an ecotourism destination.

Biodiversity, land and coastal management: Introducing traditional Maori practices of land management, including a self-imposed ban (rāhui) prohibiting the taking of any fish resources from the Wakatu Quay area, have improved biodiversity of the area. Areas of international importance to biodiversity have been identified and land owners are incentivised through rate relief and private covenants to assist in protection. As a result of this emphasis, conservation working holidays have taken off in the area and further raised the profile of Kaikoura as a natural haven.

Type of local authority intervention

Kaikoura District Council is behind the active efforts to transition to ecotourism, seeking out transformative projects, enforcing local environmental regulation, and ensuring conditions to meet certification –making sure to involve the community and relevant industries in projects.

Investment source

Primarily Kaikoura District Council, with aid from community fundraising for individual projects.

Partners/stakeholders

Kaikoura District Council

Lincoln University

Innovative Waste Kaikoura

Tourism and Development Committee (including councillors, representatives from the tourism and fishing industries, and community and indigenous (Maori) members)

Community Trust

Further information

- Stuart J. Dymond (1997) Indicators of Sustainable Tourism in New Zealand: A Local Government Perspective, Journal of Sustainable Tourism, 5:4, 279-293, DOI: 10.1080/09669589708667292
- UNEP (2005) Making tourism more sustainable: a guide for policy makers. United Nations Environment Programme, Division of Technology, Industry and Economics.

Retail: How local government activity can enable commercial change

The retail sector is vital to many towns and cities as it provides employment, recreation and access to goods. However, it is rarely highlighted as a primary beneficiary of local authority climate change initiatives. Instead the local authority tends to be an enabler or retail is seen as a partner in a wider programme. In addition, the new narrative around town centre regeneration isn't overly helpful with experts planning for life after retail. Nevertheless, retail has a big contribution to make to addressing climate change and in this context could be a major beneficiary of actions by local authorities to address climate change.

The following case studies show how quite diverse initiatives can benefit retail:

In Copenhagen, the city government has embarked on a strategy of branding as a Green City. Among the district heating and renewable energy infrastructure the retail offer is considered important. The Visit Copenhagen website dedicates a section to sustainable retail and its clear that the relationship is mutually beneficial. The emphasis in Copenhagen is on high-end products which are sourced sustainably and/or produced by artisans. There are also plenty of shops selling second hand clothes and reconditioned 'pre-loved' furniture.

Image: A second hand shop, Australia. Photo by Prudence Earl

Branding a place as green and matching the retail offer to the brand is also a strategy employed in the green tourism industry. **In New Zealand they are now looking at the next step – Regenerative Tourism.** The philosophy is that the place visited is better as a result of tourism and one of the initiatives is to support local food producers and farmers markets.

Local authorities can boost their 'buy local' plans by developing tools to keep wealth in their area. One such tool is through local currency. Though often developed in big cities they can be applied in small towns to help support local retailers and their supply chain. The impact of COVID-19 on retail is giving this idea new impetus in the USA, such as in the town of Tenino in Washington, where the credibility of the currency relies upon the backing of the local authority.

Direct intervention in retail by local authorities can be important, but the main relationship between local authorities and retail is through the planning and development functions of the local authority. Town centre regeneration schemes often have the aim of boosting retail and that is no different if the regeneration scheme is driven by climate change. **In the UK, there are 4,670 retail customers connected to heat networks.**

Local authorities in Australia are being urged to consider climate change in urban regeneration projects. The 'Climate Ready' initiative encourages the inclusion of urban greening, urban forests and imaginative use of water to address the potential for floods, sea level rise and heatwaves. The resulting urban landscape is not just more resilient, it is also a nicer place to be and encourages retail offers that complement improved wellbeing.

The growth of 'minute' neighbourhoods is a result of the desire of urban dwellers to have community near to them. If well-managed, these **'minute' neighbourhood initiatives can boost retail thanks to features such as public realm improvements, walkability increasing footfall, and green infrastructure such as charging points.**

If you google 'green retail' you will inevitably find a plethora of online retailers offering goods and services that address climate change, usually through the development of an ethical supply chain. This dynamic presents a dilemma for local authorities. Climate change is being addressed, but **online retail can harm local, place-based, bricks and mortar shops.**

While local authorities can provide high quality spaces and encourage local buying, they cannot make shoppers abandon online purchases. In these circumstances, there **may be opportunities in the supply chain. Even though a business is predominately online it can still be local and source its products from the local area**. Creating a supply chain that addresses climate change, is ethical and still profitable is not easy and local authorities could help with support. **A retailer may know about their own energy use, waste practices, climate change policy and stance on modern slavery but how can they be confident that their whole supply chain complies?**

Enterprise development in Ireland: Green for Micro

Business sector/type of intervention

The Green for Micro programme[188] is a new initiative from the local authority Local Enterprise Offices with support from Enterprise Ireland. The aim of the programme is to help prepare small businesses (with up to 10 employees) for the low carbon, more resource efficient economy of the future.

Project/initiative outline

The Green for Micro programme provides advice and technical support for small businesses towards understanding their carbon footprint, resource efficiency and implementing an environmental management system. While the programme is suitable for all micro-enterprises it is particularly suited to businesses operating in the following sectors: Manufacturing, food, plastics and packaging, construction and the built environment, retail, textile and fashion, and electronics. The programme consists of two stages. Stage 1 provides a webinar which highlights the Green for Micro supports available as well as a case study of a business that has successfully implemented the green initiatives. Stage 2 provides mentoring, over a 2-day period, by a specialist green consultant who will provide the business with recommendations on the steps they can take.

Type of local authority intervention

The LEOs are part of the local authority structures. This programme is being administered through the LEO network and all local authorities.

Investment source

The programme is funded by Enterprise Ireland and administered through local government and the Local Enterprise Offices.

Partners/stakeholders

Green consultants will be chosen from the Enterprise Ireland Green Directory or from the Local Enterprise Office mentor panel.

Type(s) of benefit

By implementing the learnings from the Green for Micro programme small business can realise the following benefits, including:

· Reduced environmental footprint and greenhouse gas emissions
· Improved resource efficiency (for example: using less energy, water, and materials)
· Increased resilience to climate change impacts
· Increased cost savings
· Opportunities for higher and additional value on products and services
· Increased access to customers, improved corporate image

Mitigation or adaptation

The programme aims to build capacity, awareness and provide direction to micro-enterprises for taking both mitigation and adaptation measures such as emission reductions and increasing resilience to the impacts of climate change.

Image: Green for Micro – Local Enterprise Office

Further information:

- Introducing Green for Micro. https://www.localenterprise.ie/green
- What is Green for Micro? https://www.localenterprise.ie/Green/What-is-Green-for-Micro/What-is-Green-For-Micro.html
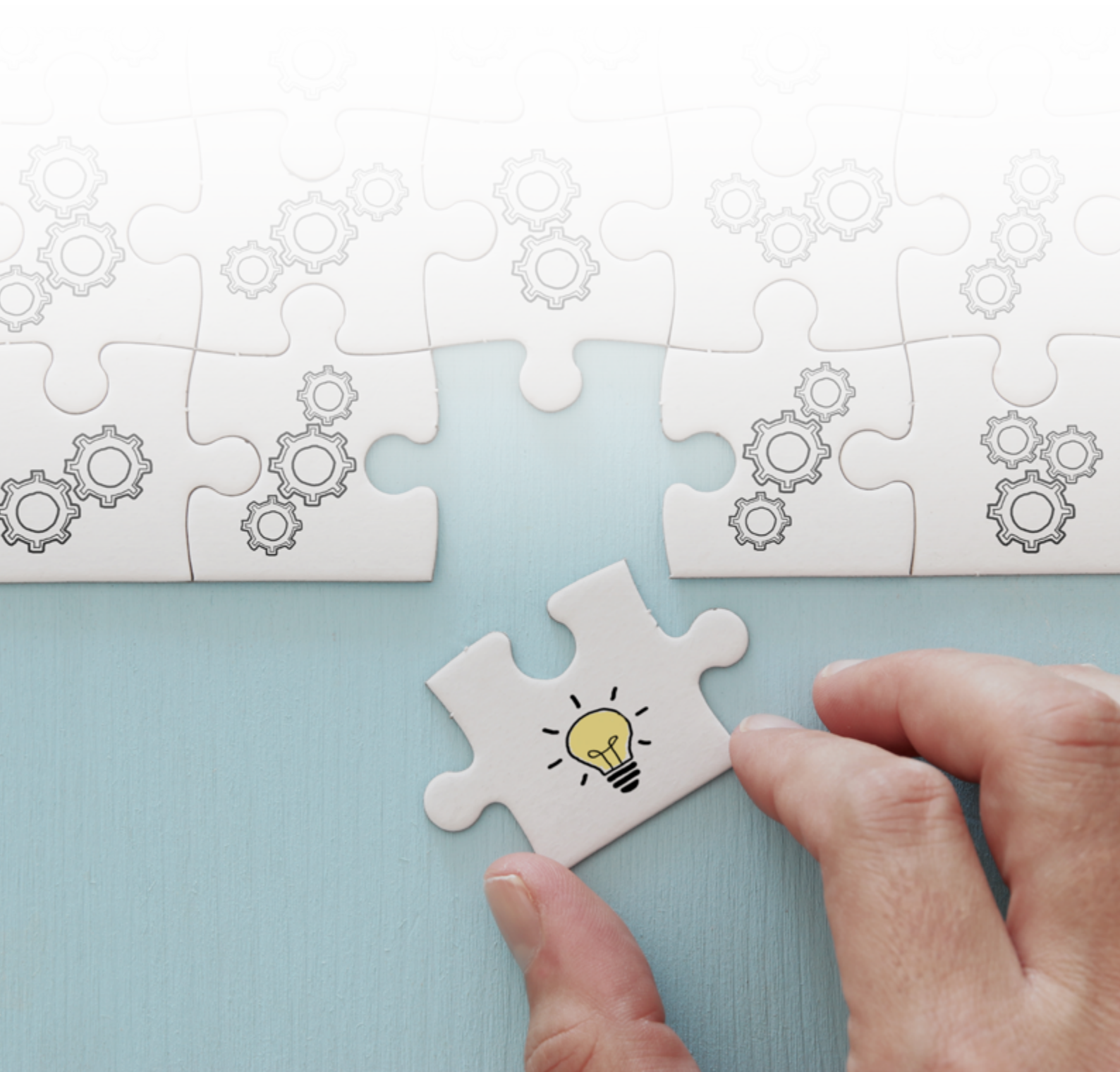
Analysis

4.1 Impact on climate change

With local, regional and national governments across the world setting ambitious net zero targets it is perhaps unsurprising that the vast majority of the case studies analysed in this research focus on mitigation. In the UK and Europe, the race to meet net zero targets is explicitly noted as a key driver for investment in projects such as the Islands Deal, Bristol City Leap, and the offshore wind developments in Southern Denmark. Given the complexities of carbon accounting and the fact that many of these projects are relatively new, it is difficult to report on what has been the most effective method of reducing emissions at this stage. It is safe to say, however, that renewable energy projects and district heating networks are among the most common methods of reducing emissions at a local level.

Although mitigation is an important piece of the puzzle, the dominance of this narrative across local, national and international climate narratives means that questions of adaptation and biodiversity loss are often overlooked. Facilitated by an outdated mindset which sees GDP growth as the key measure of progress this trend has legitimised a 'business as usual', technocratic approach to addressing climate change[189]. In the UK, for example, a recent report by the House of Commons Environmental Audit Committee found that the biodiversity crisis is not being taken seriously, with more money currently being spent destroying the environment than protecting it[190]. Within this research project it has been clear that mitigation and the pursuit of green growth are dominant drivers of climate action.

While the explicit goal of most projects has been to reduce emissions and generate economic growth, many – if not all – of these developments have helped to develop local economic and social resilience. For example, retrofit and renewable energy projects increase community resilience through reducing energy costs, tackling fuel poverty and generating income/savings for the local economy. Furthermore, these developments all have the capacity to create employment opportunities, thus facilitating a just transition. This can be seen clearly in cities such as Aberdeen and Esbjerg where previously fossil-fuel reliant economies are pivoting to focus on hydrogen (in the case of Aberdeen) and offshore wind (in Esbjerg). In these cases, local governments are working in partnership with private and public sector bodies to utilise existing skill sets and expertise within these emerging sectors.

While the vast majority of case studies reviewed in this research do focus explicitly on mitigation and economic growth, there are some where adaptation is the primary objective: Climate Ready Clyde in the Glasgow Region, the incorporating natural and nature-based infrastructure methods into coastal infrastructure, New York's flood park and green maritime development in North Jutland. Each of these projects has the capacity not only to protect places from extreme weather but also facilitate a host of other co-benefits such as encouraging active travel, creating employment opportunities, fostering cross-sector collaboration and increasing carbon sequestration.

The boundary between adaptation and mitigation is often unclear and all of the projects analysed for this research straddled these two categories to a certain degree.

One project, however, explicitly set out to tackle both mitigation and adaptation. Glasgow City Region's ambition to plant 18 million trees in the region over the next decade is one that explicitly facilitates mitigation through natural carbon sequestration and adaptation by way of increasing green infrastructure within one of the UK's wettest City Regions.

4.2 Types of intervention and facilitation by local governments

While the case studies represent a wide range of sectors and types of initiative, the types of intervention by local government can loosely be categorised into the following:

- Greening of existing business
- Expand green tourism
- Circular economy
- Infrastructure projects
- LA and LEO initiatives
- Partnerships, hubs, incubators, networks.
- Market based solutions
- Ecosystem services

Infrastructure projects cropped up the most frequently by far among the case studies in this report, with more than half representing some form of infrastructure investment. These may be in the form of large-scale investments into projects, such as a district heating system, or smaller changes, such as the introduction of localised active travel infrastructure in Melbourne's 20-minute neighbourhoods.

Comparatively rarer was the use of market-based solutions. With the exception of the raising of green bonds and some of the incentives and agreements in the North Jutland green maritime case study (though still with national directives), market-based solutions did not form the basis for other case studies. The use of traditional market-based climate solutions – such as taxation, removal of perverse incentives, or emissions trading – are a less common feature in local government toolkits globally.

Similarly, while public-private partnerships and agreements were common, the direct greening of existing businesses was rarer among the studies – Ireland's Green for Micro project stands out for directly targeting businesses, providing free advice and consultancy work for small businesses to shift to a low carbon economy. Similar initiatives have taken place in Copenhagen.

Besides providing advice to local businesses, it can prove difficult for local authorities to change private sector behaviour, again due to a common lack of regulatory and legislative power among local governments globally to enforce something like technology and performance standards. Where these powers do exist, they are often in large metropolitan areas of across regions – London's expansion of its Ultra Low Emissions Zone will see owners of older cars pay £12.50 per day to drive them anywhere in the inner city[191], while Copenhagen forces all large companies to report on their non-financial performance. Larger, more established local authority areas with no risk of losing economic competetiveness can often take more radical action.

However, on a smaller scale, collective local action and charters or other voluntary agreements are open to local authorities of all sizes. Successful local authority initiatives that played a role in greening existing businesses included Kaikoura's (New Zealand) use of eco-certification alongside a charter to reduce waste, and agreements in North Jutland. Other successful ways of greening existing businesses came much more indirectly – through greening the infrastructure and services that businesses relied upon, such as Cambridgeshire and Copenhagen's heat networks.

Partnerships and networks were also frequent in a large number of case studies, which highlights local government's important role in bridging relationships between local private actors and charities and regional or national government. While not necessarily representative of all initiatives globally, the presence of partners for either funding or project management/design in such a high number of cases, alongside the relative scarcity of local authorities initiating and managing entire interventions, could point to a lack of either devolved powers or funding for local government, creating a common need for collaboration in order to achieve action. However, it is worth noting that the case studies in this report are not a representative sample of all possible initiatives in the space. Partnerships are further explored in a below section.

4.3 Sources of investment

While funding sources vary considerably across the case studies reviewed in this research, they can be grouped into five broad typologies:

- Public-private partnerships
- National-regional-local government partnerships
- Local government
- National government
- Public-private-third sector partnership

Firstly, partnerships between the private and public sector are one of the most common sources of investment for climate-related projects. From the set of case studies selected for this analysis this type of partnership was particularly prevalent within renewable energy projects. In England for example both the energy projects led by Warrington Borough Council and Bristol City Council have been mobilised in partnership with private sector investment. Similarly, while Aberdeen City Council has been leading the way in the development of Hydrogen infrastructure in the city, both the existing projects and planned developments rely heavily on private-sector investment. Beyond the UK the private sector is a key stakeholder in projects such as Esbjerg's offshore wind development where a host of private and public actors at different geographical scales have collaborated to develop the region's renewable ambitions.

Such partnerships are however not limited to energy projects. Across the case studies selected for this research, private sector stakeholders were key partners in projects such as Copenhagen's district heating system, Glasgow Region's adaptation strategy and Melbourne's circular economy.

The second typology is that of national, regional and local government partnerships. This is demonstrated in projects such as the energy efficient housing development in Exeter, battery storage ambitions in Coventry, Cambridgeshire County Council's rural heat network and coastal flooding projects in the USA. While some of these projects draw in external stakeholders, all are built on important funding agreements between national, regional and local governments.

A number of case studies sit under the umbrella of the third typology of local government funding. Projects such as those focusing on renewable energy and rural development in Oregon, flood parks in New York, 20-minute neighbourhoods in Melbourne, Solar Farms in Warrington and Liverpool's Maritime Knowledge Hub are all examples of projects where the local authority has been the primary source of funding. This funding is generated using a range of different methods. In Warrington, for example, funding for the solar farms has been generated primarily through prudential borrowing alongside the mobilisation of Community Municipal Investment (CMI) while in Liverpool funding has come from the Council's own investment fund which has been created on the basis of reinvesting uplifted business rates and/or prudential borrowing against future business rates into the 'Enterprise Zone' up to 2037. This fund has been created to support new projects through grants and loans and generate further business rates income.

In some cases the national government is the primary source of financial support. This is evidenced in Stockholm's One Minute City project which is led by Sweden's National Centre for Architecture and Design and funded by Vinnova, the Swedish government agency that administers state funding for research and development.

Lastly, some projects have been funded by partnerships between various bodies in the public, private and third sector. Scotland is home to two examples of this. The first is Glasgow's urban afforestation project which is primarily funded through a £400,000 grant from the Woodland Trust's Emergency Tree Fund as well as £150,000 from Scottish Forestry (a Scottish Government body). Additionally, businesses and other organisations can also invest in the Clyde Climate Forest if they sign up to a new charter which demonstrates their commitment to reducing emissions across their business supporting the fight against climate change. Individuals and community groups are also able to donate. The second development is the Island's Growth Deal. Although primarily funded by Scottish and National governments, this funding within this deal draws on stakeholders from across different sectors such as local authorities, the NHS, private sector energy groups and local third sector organisations.

4.4 Main partners

Partnership and collaboration are common themes that run throughout the approaches in this report. The case studies show local government working in partnership with a diverse range of organisations from the public, private and third sector.

Local authorities have also worked with partners at different scales and levels of governance. This might include neighbourhood or community level organisations, regional or national bodies, as well as supranational, such as those connected to the European Union.

The main partners in the case studies presented in this report are:

- The European Union, often through sub-organisational funding like Interreg
- National governments
- Businesses
- NGOs
- Other LAs
- Regional bodies and local enterprise partnerships

The Aberdeen Hydrogen case study highlights the broad local and international range of partners involved in adaptation projects. Business groups like Scottish Enterprise, renewable energy specialists like Locogen, several research universities and city councils are supported by EU funding through Interreg, which is designed to support international collaborations. The Islands Growth Deal in Scotland brings together local health bodies with three Scottish universities, local community groups and the European Marine Energy Centre.

NGOs also have an important partnership role in many of the case studies, such as the North Jutland Green Maritime project, which also brought together regional growth bodies, national government and EU support.

Private sector partners are crucial to many of the cases. Local businesses are important for the design and implementation of high street and neighbourhood renewal projects, along with local residents. But they are also important elements of larger scale rejuvenation for industrial areas like the North Jutland project. This also brought in new enterprises and specialists in green or sustainable business.

The offshore wind programme in Southern Denmark exemplifies this range of partnerships. It includes local universities, specialist suppliers and logistics organisations, municipal, regional and national government, with support from the Esbjerg Business Development Centre.

Some case studies show the potential of smaller scale networks and may involve one or two partners working with a local authority either to deliver, support or fund projects. The nature of these collaborations is linked to the opportunities and the assets available at different scales. There may be natural assets, local skills or industrial bases that can be developed, there may be business interests to facilitate, or funding and investment opportunities at local, regional or international scales. European and national funding is regularly tied to partnership working, often with local government or NGOs in lead facilitative roles.

4.5 Benefits to local economy

The benefits to the local economy from acting on climate change can be diverse. At the basic level the initiatives identified create jobs and contribute to local economic growth but they do so in different ways. An analysis of the case studies identified nine categories of benefit.

Jobs

The installation and running of a biomass boiler in the USA resulted in 4 construction jobs and then 4 permanent positions. The offshore wind sector in Denmark has created 9,000 jobs and the development of a hydrogen industry could result in thousands of new jobs.

The nature of the jobs is also important. Developing new industries using new technologies creates highly skilled permanent work. In Exeter, the City Council is establishing an Academy to support construction of new Passivhaus standard housing.

Sometimes a more holistic view shows benefits. The Nordic Healthy Cities initiative primarily tackles health problems including those that will grow as the climate changes. Healthcare sector is a very innovative space and new jobs are being created all the time.

Inward investment

Municipal bonds are a way of securing investment directly into the locality. Billions of US dollars have been secured this way and Aberdeen City Council has secured £370m. Investment by the state or agencies was a feature of many initiatives, the Scottish Islands Growth Deal secured £375m. These state interventions then unlock private sector investment of £20m into a Hydrogen refuelling business.

Economic Growth

Green maritime development in Denmark has facilitated the transition of the shipbuilding industry into a leader in shipping and the environment, resulting in the reversal of economic decline. The Hydrogen industry in Aberdeen similarly uses the old oil industry as a starting point and expects to see £700m GVA.

In responding to climate change many of the jobs are in manufacturing and tourism, meaning that they are grounded in the locality and the money stays in the region.

Tourism income

In New Zealand investment in small community eco-tourism resulted in NZ$ 120m of income into the area in 2016 of which NZ$ 72m was international.

New businesses

The promotion of new technologies results in the creation of new businesses. In Denmark the offshore wind industry has created 250 new companies. The Bio-economy region in Finland has spawned new businesses to use the resources generated as by-products.

Business income

The creation of 20 minute neighbourhoods in Australia has increased footfall and increased local shop trading by 40%. The port servicing the offshore wind industry in Denmark has raised €9.5m profit.

Private sector savings

Many of the actions that help an area adapt to climate change are in effect reducing the risk of business interruption. As these are costs avoided they are hard to quantify but are most visible in static or even reducing insurance premiums as illustrated in the US Nature-Based Infrastructure projects.

Citizen benefits

Private citizens will also benefit from reduced insurance costs as a result of adaptation measures. Some schemes also deliver more direct benefits. District heating in Copenhagen guarantees cheap green energy removing vulnerable people from fuel poverty. Energy efficient housing in Exeter reduces fuel costs to a very low base.

Public sector savings

The Nordic Healthy Cities programme illustrates how timely intervention by municipalities can reduce costs further downstream. The public sector benefits from cheap energy in Copenhagen like everyone else.

4.6 Importance of place

The case studies highlight the importance of embedding projects in place, taking into account local circumstances, building on local assets, and working with established local networks. There are three key aspects of place that we highlight here: the existing local economy; natural resources and assets; and local skills and knowledge.

Existing local economy

The Green Maritime project in Denmark builds on the local shipbuilding industry in an effort to reverse the negative effects of deindustrialisation. The area has transitioned into an important hub for shipping and the environment. In a similar vein the Aberdeen Hydrogen case study demonstrates how the existing assets relating to the oil industry can be used as a starting point for significant and successful adaptation.

Existing partnerships, infrastructure and funding models can be adapted and channelled into new ventures in more far reaching ways than might be achieved when starting from scratch.

Natural resources and assets

Understanding and utilising the access to natural resources that are particular to place is crucial. Wind, solar and other forms of energy generation are key examples. Boosting tourism is a clear benefit of some case studies, as is the use of forests in Finland. Some, like the coastal infrastructure programme in the USA have sought to improve the quality of natural areas and access for tourists as a central aim. Similarly, the National Plan for Scotland highlights the importance of natural resources for local development and adaptation.

Local skills and knowledge

The Aberdeen Hydrogen and South Denmark maritime projects both build on and develop local skills and knowledge in existing and historic industry at the local level. Other case studies also demonstrate the importance of skills and training routed in place or targeted towards local communities. The Coventry battery storage programme, the Finnish bioeconomy work and the Maritime Knowledge Hub in Liverpool, all involve working with local education providers for training and skills development. Again, this highlights the importance of partnerships and embeddedness in place for the long-term sustainability of these interventions.

4.7 Conclusion

The case for adapting to and mitigating the effects of climate change is clear, and in this report we have highlighted case studies showing how these efforts can be led locally.

But local leadership also offers enormous potential for boosting and rebalancing economic growth, developing new skills and training opportunities, creating new jobs, and rejuvenating areas that have suffered from economic downturn or deindustrialisation. Inward investment and boosts to the local tourist economy have also been demonstrated, along with important social, community and citizen benefits that come from inclusion in projects.

Of course the environmental benefits are crucial, and the case studies show how these are possible, according to a huge range of targets. Many of these social, economic and environmental impacts will take time to materialise fully. Site visits, field trips and in-depth interviews with some of the actors involved in the projects would add to the understanding of how they were developed and what forms of support or barriers were encountered. This would also help to monitor the impacts as they appear and add to our knowledge of best practice.

We can see from the research presented above that we are not starting from scratch. There is a great deal of innovation and inspiring leadership in different local contexts that can be replicated and adapted. The case studies collated in this report highlight some of the range of approaches that municipal authorities have taken, in partnership with organisations from the public, private and third sectors.

Projects work effectively when they are embedded in place. While partnerships with the private sector, either in the form of private investment or collaboration, is the most common form, the case studies show an impressive range and demonstrate the importance of tailoring the relationships to the local place and context. Where possible this should build on the skills and knowledge base among the local population, as well as existing infrastructure in local areas.

The focus of the work highlighted in the report skews heavily towards mitigation rather than adaptation and there is a huge opportunity to develop strategies for adaptation that boost jobs, skills and growth. This can be a challenging area to break into but local governments can play an

important role here by designing policy infrastructure that encourages partnerships and funding for adaptation projects. Further research should begin to map out the current support and incentives that exist for adaptation around the world. More in-depth work on individual sites could also build up a detailed picture of the appetite and strategies for adaptation, supplementing the best-practice detailed already in this report.

References

1   CCMA, Local Authorities Ireland, CARO (2020). Delivering Effective Climate Action 2030.

2   Clarke and O'Donaghue Hynes (2020). A profile of Local Authority Climate Actions in Ireland. CCMA/LGMA

3   Oireachtas (2021): Available at Houses of the Oireachtas website [Accessed 2nd July 2021]

4   Government of Ireland 2021: Available at gov.ie - Regional Assemblies (www.gov.ie)

5   Callanan, M. (2018): Local Government in the Republic of Ireland. Institute of Public Administration. Dublin.

6   Oireachtas (2015) Climate Action and Low Carbon Development Act 2015, Government of Ireland.

7   Government of Ireland (2017): National Mitigation Plan, Department of the Environment, Climate and Communications, Government of Ireland. Available at: gov.ie – National Mitigation Plan (www.gov.ie)

8   Government of Ireland (2018): National Adaptation Framework, Department of the Environment, Climate and Communications. Government of Ireland. Available at: gov.ie - National Adaptation Framework (NAF) (www.gov.ie)

9   Citizens' Assembly (2018) Third report and recommendations of the Citizens' Assembly – how the state can make Ireland a Leader in tackling Climate Change, April 2018. Available at www.citizensassembly.ie

10   Government of Ireland, Houses of the Oireachtas (2019) Report of the Joint Committee on Climate Action, - Climate Change: A Cross Party Consensus for Action, March 2019. Available at: 2019-03-28_report-climate-change-a-cross-party-consensus-for-action_en.pdf (oireachtas.ie)

11   Government of Ireland (2019) Climate Action Plan 2019 – to tackle Climate Breakdown, Dublin. Available at: gov.ie - Climate Action Plan 2019 (www.gov.ie)

12   Department of An Taoiseach (2020): Programme for Government 2020. Available at: gov.ie - Programme for Government: Our Shared Future (www.gov.ie)

13   Oireachtas (2021) Section Climate Action and Low Carbon Development (Amendment) Bill 2021, Government of Ireland. Available at: b39a21d.pdf (oireachtas.ie)

14   Oireachtas (2015) Climate Action and Low Carbon Development Act 2015, Government of Ireland. Available at: Climate Action and Low Carbon Development Act 2015 (irishstatutebook.ie)

15   Government of Ireland (2018): National Adaptation Framework, Department of the Environment, Climate and Communications, Government of Ireland. Available at: gov.ie - National Adaptation Framework (NAF) (www.gov.ie)

16   Government of Ireland (2019) Climate Action Plan 2019 – to tackle Climate Breakdown, Dublin. Available at: gov.ie - Climate Action Plan 2019 (www.gov.ie)

17   DECC, (2021) Local Authority Climate Action Charter, Department of the Environment, Climate and Communication, Government of Ireland. Available at: https://www.gov.ie/en/publication/d914a-local-authority-climate-action-charter/

18   CCMA, (2020) Delivering Effectiveness Climate Action 2030: Local Authority Sector Strategy for Delivering on the Climate Action Charter and Climate Action Plan, City and County Management Association.

19   LASNTG, (2021) Local Authority Climate Action Training Programme, Local Authority Services National Training Group, Tipperary County Council.

20   CARO (2021) Local Authority Decarbonisation Zones, Climate Action Regional Offices. Available at: https://www.caro.ie/news/local-authority-decarbonisation-zones

21   GAA, (2021) What is the Green Club Programme?. Gaelic Athletic Association. Available at: https://www.gaa.ie/my-gaa/community-and-health/green-clubs-sustainability/

22   Oireachtas (2014) Local Government Reform Act 2014: Available at Local Government Reform Act 2014 (irishstatutebook.ie)

23   UK Government. (2008). Climate Change Act 2008. Available at: https://www.legislation.gov.uk/ukpga/2008/27/contents

24   Climate Change Committee. Corporate and Business Plan 2020 – 2023. Available at: https://www.theccc.org.uk/publication/corporate-plan-for-2020-2023/

25   Climate Change Committee. (2019). Net Zero – The UK's contribution to stopping global warming. Available at: https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/www.theccc.org.uk/publication/corporate-plan-for-2020-2023/

26   Department for Environment Food and Rural Affairs (2018). The National Adaptation Programme and the Third Strategy for Climate Adaptation Reporting. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/727252/national-adaptation-programme-2018.pdf

27   HM Treasury. (2020). Net Zero Review: Interim Report. Available at: https://www.gov.uk/government/publications/net-zero-review-interim-report

28   Climate Assembly UK. https://www.climateassembly.uk/

29   Climate Assembly UK (2020) The Path to Net Zero. Available at: https://www.climateassembly.uk/recommendations/index.html

30   UK Parliament. (2021). Environment Bill. Available at: https://bills.parliament.uk/bills/2593

31   UK Parliament. (2010). Flood and Water Management Act 2010. Available at: https://www.legislation.gov.uk/ukpga/2010/29/contents

32   UK Parliament. (2004). Civil Contingencies Act 2004. Available at: https://www.legislation.gov.uk/ukpga/2004/36/contents

33   UK Government. (2018). Policy paper 25 Year Environment Plan. Available at: https://www.gov.uk/government/publications/25-year-environment-plan

34   LGiU. Local Government Facts and Figures. Available at: https://lgiu.org/local-government-facts-and-figures-scotland/

35   Scottish Government (2021). £11.6 billion for local councils. Available at: https://www.gov.scot/news/gbp-11-6-billion-for-local-councils/

36   McKinlay, F (2021). Reading the tea leaves of post-election public finances in Scotland – what, if anything, can we understand?. Available at: https://lgiu.org/briefing/reading-the-tea-leaves-of-post-election-public-finances-in-scotland-what-if-anything-can-we-understand/

37   Scottish Government (2020). Protecting Scotland, Renewing Scotland: The Government's Programme for Scotland 2020-2021. Available at: https://www.gov.scot/publications/protecting-scotland-renewing-scotland-governments-programme-scotland-2020-2021/

38   House of Commons Library. Directly-elected mayors. Available at: https://commonslibrary.parliament.uk/research-briefings/sn05000/

39   UK Government. (2014). Climate Change. Available at: https://www.gov.uk/guidance/climate-change

40   Declare a Climate Emergency. (2021). List of Councils who have Declared a Climate Emergency. Available at: https://www.climateemergency.uk/blog/list-of-councils/

41   APSE. (2019), Local Authority Climate Declarations. Available at: https://www.apse.org.uk/apse/index.cfm/local-authority-energy-collaboration/apse-energy-publications1/local-authority-climate-emergency-declarations/

42   ICLEI. The Global Covenant of Mayors for Climate & Energy (GCoM). Available at: https://www.iclei.org/en/GCoM.html?gclid=Cj0KCQjw6NmHBhD2ARIsAl3hrM3D-GyFdR_JMaPYY7qtyB7hM7m3ABHqM1FnPxWNCx2k8wJ1dWkIHv0aAr8iEALw_wcB

43   Local Government Association. (2021). Climate Change Hub. Available at: https://www.local.gov.uk/our-support/climate-change

44   UK 100. International Net Zero Local Leadership Summit & Conference. Available at: https://www.uk100.org/

45   ADEPT. https://adeptnet.org.uk/

46   Ministry of Climate, Energy and Utilities (2019). Broad agreement on ambitious and binding climate law. Available at: https://kefm.dk/aktuelt/nyheder/2019/dec/klimalov

47   Realdania. (2019). DK2020. Available at: https://www.realdania.org/whatwedo/grants-and-projects/dk2020

48   Constitution Center. (2021). States, Citizenship, New States. Available at: https://constitutioncenter.org/interactive-constitution/article/article-iv

49   Khan Academy. (2021). The relationship between the states and the federal government. Available at: https://www.khanacademy.org/humanities/us-government-and-civics/us-gov-foundations/us-gov-relationship-between-the-states-and-the-federal-government/a/relationship-between-the-states-and-the-federal-government-article

50   Russell J, & Bostrom A. (2016). Federalism, Dillon Rule and Home Rule. Available at: https://www.alec.org/app/uploads/2016/01/2016-ACCE-White-Paper-Dillon-House-Rule-Final.pdf

51   Maizland L. (2021). Global Climate Agreements: Successes and Failures. Available at: https://www.cfr.org/backgrounder/paris-global-climate-change-agreements

52   UCLA Luskin Centre for Innovation. (2019). PROGRESS TOWARD 100% CLEAN ENERGY IN CITIES & STATES ACROSS THE U.S. Available at: https://innovation.luskin.ucla.edu/wp-content/uploads/2019/11/100-Clean-Energy-Progress-Report-UCLA-2.pdf

53   White House. (2021). Executive Order on Tackling the Climate Crisis at Home and Abroad. Available at: https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/

54   Plumer B. & Popovich N., (2021). The U.S. Has a New Climate Goal. How Does It Stack Up Globally? Available at: https://www.nytimes.com/interactive/2021/04/22/climate/new-climate-pledge.html

55   Environmental Protection Agency (2021). https://usepa.servicenowservices.com/ecss?id=kb_article_view&sys_id=5d9917ea1b799c1013bdb913cc4bcb4a

56   McBride J & Siripurapu A. (2021) The State of U.S. Infrastructure. Available at: https://www.cfr.org/backgrounder/state-us-infrastructure

57   New Global Commission on the Economy and Climate. (2018). Unlocking the Inclusive Growth Story of the 21st century: Accelerating Climate Action in Urgent Times. Available at: https://newclimateeconomy.report/2018/wp-content/uploads/sites/6/2018/09/NCE_2018_FULL-REPORT.pdf

58   Hawaii Capitol. (2015). A Bill for an Act: https://www.capitol.hawaii.gov/session2015/bills/HB623_CD1_.htm

59   UCLA Luskin Centre for Innovation. (2019). PROGRESS TOWARD 100% CLEAN ENERGY IN CITIES & STATES ACROSS THE U.S. Available at: https://innovation.luskin.ucla.edu/wp-content/uploads/2019/11/100-Clean-Energy-Progress-Report-UCLA-2.pdf

60   American Council for an Energy Efficient Economy. (2019). State Energy Efficiency Resource Standards (EERS). Available at: www.aceee.org/sites/default/files/state-eers-0519.pdf

61   Barbose G. (2019). U.S. Renewables Portfolio Standards. Available at: https://eta-publications.lbl.gov/sites/default/files/rps_annual_status_update-2019_edition.pdf

62   Regional Greenhouse Gas Initiative - https://www.rggi.org

63   McNichol E. (2019). It's Time for States to Invest in Infrastructure. Available at: https://www.cbpp.org/research/state-budget-and-tax/its-time-for-states-to-invest-in-infrastructure

64   Sutton-Grier, A. Et al. (2018). "Investing in Natural and Nature-Based Infrastructure: Building Better Along Our Coasts" Sustainability 10, no. 2: 523. https://doi.org/10.3390/su10020523

65   Maryland Government, (2008). Water Management Administration – Living Shoreline Protection Act of 2008. Available at: https://dnr.maryland.gov/ccs/Documents/ls/2008_LSPA.pdf

66   PACB, 2021 - https://www.pacb.org/

67   Green Bank Network. (2020). What is a Green Bank? Available at: https://greenbanknetwork.org/what-is-a-green-bank-2/

68   Climate Emergency Declaration. (2021). Climate emergency declarations in 1,990 jurisdictions and local governments cover 1 billion citizens. Available at: https://climateemergencydeclaration.org/climate-emergency-declarations-cover-15-million-citizens/

69   UCLA Luskin Centre for Innovation. (2019). PROGRESS TOWARD 100% CLEAN ENERGY IN CITIES & STATES ACROSS THE U.S. Available at: https://innovation.luskin.ucla.edu/wp-content/uploads/2019/11/100-Clean-Energy-Progress-Report-UCLA-2.pdf

70   Rebuild By Design. Building Regional Momentum For More Resilient Communities. Available at: http://www.rebuildbydesign.org/our-work/bay-area-challenge

71   Green City Bonds (2015). How to Issue a Green Muni Bond. Available at: https://www.climatebonds.net/files/files/Green%20City%20Playbook.pdf

72   Lawrence Berkeley National Laboratory. (2012). Using Qualified Energy Conservation Bonds for Public Building Upgrades: Reducing Energy Bills in the City of Philadelphia. Available at: https://www.energy.gov/sites/prod/files/2014/06/f16/public-building-qecb.pdf

73   Montgomery County Green Bank. https://mcgreenbank.org/about-us/

74   OECD. (2016). Finland. Available at: https://www.oecd.org/regional/regional-policy/profile-Finland.pdf

75   Finnish Government.(2021). Government of Prime Minister Sanna Marini. Available at: https://valtioneuvosto.fi/marinin-hallitus/ministerit

76   Finnish Government. How does Government Work? Available at: https://valtioneuvosto.fi/en/government/how-does-the-government-work-

77   landskapsregeringen. https://www.regeringen.ax/

78   Centre for Economic Development Transport and the Environment. Available at: https://www.ely-keskus.fi/en/web/ely-en/

79   Association of Finnish Municipalities. (2017). Functions of municipalities and joint municipal authorities. Available at: https://www.localfinland.fi/expert-services/finnish-municipalities-and-regions/functions-municipalities-and-joint-municipal-authorities

80   OECD. Country profiles: regional facts and figures. Available at: https://www.oecd.org/regional/regional-policy/country-profiles.htm

81   Finnish Government. "Finland has good opportunities for ecological reconstruction in accordance with sustainable development". Available at: https://valtioneuvosto.fi/marinin-hallitus/hallitusohjelma/hiilineutraali-ja-luonnon-monimuotoisuuden-turvaava-suomi

82   Carbon Neutral Finland. Municipalities' climate emissions decreased by 5.5% in 2019. Available at: https://www.hiilineutraalisuomi.fi/en-US/Current/News/Municipalities_climate_emissions_decreas(60852)

83   Ministry of the Environment.(2018). Municipal Climate Solutions Program 2018–2023. Available at: https://ym.fi/kuntien-ilmastoratkaisut-ohjelma-2018-2023

84   Carbon Neutral Finland. Municipalities' climate emissions decreased by 5.5% in 2019. Available at: https://www.hiilineutraalisuomi.fi/en-US/Current/News/Municipalities_climate_emissions_decreas(60852)

85   Government Offices of Sweden. (2014). How Sweden is Governed. Available at: https://www.government.se/how-sweden-is-governed/

86   County administrative boards of Sweden.(2017). Democracy and participation - the Swedish model. Available at: https://urbact.eu/sites/default/files/media/report_democracy_and_participation_-_the_swedish_model.pdf

87   Sverige Riksdag. How the Riksdag works. Available at: https://www.riksdagen.se/en/how-the-riksdag-works/

88   Järnbert M. (2018). Participation in the general elections. Available at: https://www.scb.se/contentassets/6d0a96c916144051a5cb1f8b372fe80f/me0105_2018a01_br_me08br1901.pdf

89   Government offices of Sweden. Local Government Act. Available at: https://www.government.se/contentassets/9577b5121e2f4984ac65ef97ee79f012/the-swedish-local-government-act

90   OECD. (2016). Sweden. Available at: https://www.oecd.org/regional/regional-policy/profile-Sweden.pdf

91   Sverige Radio. (2012). Politicians demand changes to "Robin Hood" tax. Available at: https://sverigesradio.se/artikel/4986806

92   OECD. (2012). Country Fact Sheet. Available at: https://www.oecd.org/effective-public-investment-toolkit/Sweden.pdf

93   OECD. (2018). Regions and Cities at a Glance 2018 – SWEDEN. Available at: https://www.oecd.org/regional/SWEDEN-Regions-and-Cities-2018.pdf

94   Government Offices of Sweden. (2020). Youth organisations gave the Government input on climate policy, consumption and a high-level environmental meeting. Available at: https://www.government.se/articles/2020/12/youth-organisations-gave-the-government-input-on-climate-policy-consumption-and-a-high-level-environmental-meeting/

95   Stockholm Resilience Centre. https://www.stockholmresilience.org/

96   United Nations. The Paris Agreement. https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

97   Klimatkommunerna. Klimatkommunernas' 10-task-list for local governments https://klimatkommunerna.se/in-english/klimatkommunernas-10-task-list-for-swedish-municipalities/

98   Australian Local Government Association. (2021). Background on Local Government Funding. Available at: https://alga.asn.au/policy-centre/financial-sustainability/background-on-local-government-funding/

99   Zierke M. (2020). So you've declared a climate emergency. What next? Available at: https://lgiu.org/briefing/so-youve-declared-a-climate-emergency-what-next/

100   Crowe D. (2021). Voters want Australia to set a net zero 2050 emissions target, but no carbon tax. Available at: https://www.smh.com.au/politics/federal/voters-want-australia-to-set-a-net-zero-2050-emissions-target-but-no-carbon-tax-20210615-p5813w.html

101   Wall C. (2020). How states are moving forward on renewable energy and reducing emissions. Available at: https://lgiu.org/briefing/how-states-are-moving-forward-on-renewable-energy-and-reducing-emissions/

102   Cedamia. Call on ALL levels of government to do what is now necessary. Available at: https://www.cedamia.org/sign/

103   Proudlove R., Bravo C., & Denis-Ryan A. (2020). Net zero momentum tracker – local government report. Available at: https://www.climateworksaustralia.org/resource/net-zero-momentum-tracker-local-government-report/

104   Moreland City Council. We slashed our carbon emissions targets. Available at: https://www.moreland.vic.gov.au/my-council/news-and-publications/news/we-slashed-our-carbon-emissions-targets/

105   City of Sydney. (2021). Net zero by 2040: Ambitious new emissions target set. Available at: https://news.cityofsydney.nsw.gov.au/articles/net-zero-by-2040-city-of-sydney-ambitious-new-carbon-emissions-target-set

106   City of Melbourne.(2021). Carbon neutral operations. Available at: https://www.melbourne.vic.gov.au/about-council/vision-goals/eco-city/Pages/carbon-neutral-operations.aspx

107   Brisbane City Council. (2020). Carbon Neutral Council. Available at: https://www.brisbane.qld.gov.au/about-council/governance-and-strategy/vision-and-strategy/reducing-brisbanes-emissions/carbon-neutral-council

108   Victorian Energy Collaboration. Available at: https://veco.org.au/

109   Balston J. (2020). The impact of climate change on local government assets and infrastructure. Available at: https://lgiu.org/briefing/the-impact-of-climate-change-on-local-government-assets-and-infrastructure/

110   Wright K. (2020). Cyclepaths to Recovery: Fast-tracking active travel and public realm investments. Available at: https://lgiu.org/briefing/cyclepaths-to-recovery-fast-tracking-active-travel-and-public-realm-investments/

111   Zierke M. (2021).Organics as a resource: removing household waste from the waste stream. Available at: https://lgiu.org/briefing/organics-as-a-resource-removing-household-waste-from-the-waste-stream/

112   Zierke M. (2021). Benchmarking urban Heat. Available at: https://lgiu.org/briefing/benchmarking-urban-heat/

113   Local Government in NZ. Available at: https://www.lgnz.co.nz/local-government-in-nz/

114   New Zealand Legislation. (1991). Resource Management Act 1991. Available at: https://www.legislation.govt.nz/act/public/1991/0069/latest/DLM230265.html

115   New Zealand Legislation. (2019). Climate Change Response (Zero Carbon) Amendment Act 2019. Available at: https://www.legislation.govt.nz/act/public/2019/0061/latest/LMS183736.html

116   New Zealand Legislation. (2002). Climate Change Response Act 2002. Available at: https://www.legislation.govt.nz/act/public/2002/0040/latest/DLM158584.html

117   He Pou a Rangi Climate Change Commission. Available at: https://www.climatecommission.govt.nz/

118   He Pou a Rangi Climate Change Commission. National Climate Risk Assessments. Available at: https://www.climatecommission.govt.nz/our-work/national-climate-risk-assessments/

119   We are LGNZ. Climate change. Available at: https://www.lgnz.co.nz/our-work/our-policy-priorities/climate-change/

120   New Zealand Legislation. (2002). Local Government Act 2002. Available at: https://www.legislation.govt.nz/act/public/2002/0084/167.0/DLM170873.html

121   Andersen A. et al (2019). Green growth in Nordic regions Eight case studies. Available at: https://nifu.brage.unit.no/nifu-xmlui/bitstream/handle/11250/2601343/NIFUWorkingPaper2019-7.pdf

122   4C Offshore. (2021). Offshore Wind farms in Denmark. Available at: https://www.4coffshore.com/windfarms/denmark/

123   4C Offshore. (2021). Offshore Wind farms in Denmark. Available at: https://www.4coffshore.com/windfarms/denmark/

124   World Energy Cities partnership. ESBJERG, Denmark. Available at:

https://energycities.org/member-cities/esbjerg-denmark#:~:text=Employment%20in%20Esbjerg%20switched%20from,currently%20accounts%20for%209%2C000%20jobs.

125   European Commission. (2020). Regional development strategy for Southern Denmark 2020-23. Available at: https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/policy-document/regional-development-strategy-southern-denmark-2020-23

126   Skopljak N. (2020). Port of Esbjerg Getting EUR 134 Million Investment for Offshore Wind Facilities. Available at: https://www.offshorewind.biz/2020/05/14/port-of-esbjerg-getting-eur-134-million-investment-for-offshore-wind-facilities/

127   Dhillon A. (2018). Possible U-turn on Cirencester solar farm deal. Available at: https://www.warringtonguardian.co.uk/news/16980431.possible-u-turn-cirencester-solar-farm-deal/

128   Dhillon A. (2020). Council-backed Together Energy breaks even for first time. Available at: https://www.warringtonguardian.co.uk/news/18862623.council-backed-together-energy-breaks-even-first-time/

129   Warrington Borough Council. (2021). Growth for Together Energy. Available at: https://www.warrington.gov.uk/news/growth-together-energy

130   European Marine Energy Centre. (2021). ISLANDS GROWTH DEAL TO RELEASE £335 MILLION INVESTMENT. Available at: http://www.emec.org.uk/press-release-islands-growth-deal-to-release-335-million-investment/

131   Scottish Government. (2020). Islands Growth Deal Terms of Agreement. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/970193/Islands_Growth_Deal_Heads_of_Terms_SIGNED__English_version_1.1_.pdf

132   Scottish Government. (2020). Islands Growth Deal Terms of Agreement. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/970193/Islands_Growth_Deal_Heads_of_Terms_SIGNED__English_version_1.1_.pdf

133   U.S. Energy Information Administration: Oregon state profile and energy estimates. Available at: https://www.eia.gov/state/analysis.php?sid=OR

134   OECD Green Growth Studies: Linking Renewable Energy to Rural Development 2012, Chapter 11.19

135   Exeter City Council. (2020). Stunning new Passivhaus council homes unveiled in Exeter. Available at: https://news.exeter.gov.uk/stunning-new-passivhaus-council-homes-unveiled-in-exeter/

136   Osmundsen E. (2018). Passivhaus: Exeter City Council leading by example. Available at: https://www.apse.org.uk/apse/index.cfm/news/articles/20181/passivhaus-exeter-city-council-leading-by-example/

137   Exeter City Council. (2019). EXEseed Contractors Framework. Available at: https://exeter.gov.uk/exeseed/

138   Exeter City Council. (2020). Building Exeter Back Better. Available at: https://committees.exeter.gov.uk/documents/s75960/Recovery%20Report.pdf

139   The UK Passive House Organisation. (2019). Passivhaus Construction Costs. Available at: https://www.passivhaustrust.org.uk/UserFiles/File/research%20papers/Costs/2019.10_Passivhaus%20Construction%20Costs.pdf

140   Sustainable Cities Platform. EXETER'S NEW PASSIVHAUS DEVELOPMENTS. Available at: https://sustainablecities.eu/transformative-actions-database/?c=search&action_id=e1re16j0

141   Exeter City Living. (2021). Building Homes for our Future. Available online: https://exetercityliving.co.uk/

142   Public Lighting - Local Authority Public Lighting Energy Efficiency Project. Available online:

https://irl.eu-supply.com/ctm/Supplier/PublicPurchase/145584/0/0?returnUrl=ctm/Supplier/publictenders

143   The State of Victoria Department of Environment, Land, Water and Planning, 2017. Available at: https://www.planmelbourne.vic.gov.au/the-plan

144   The State of Victoria Department of Environment, Land, Water and Planning, 2019. 20-Minute Neighbourhoods: Creating a more liveable Melbourne. Available at: https://www.planning.vic.gov.au/__data/assets/pdf_file/0031/428908/Creating-a-more-liveable-Melbourne.pdf

145   Victoria State Government, Maroondah City Council. 2021. Living Locally - Activating Croydon South. Available at: https://www.planning.vic.gov.au/__data/assets/pdf_file/0028/482527/Croydon-South-full-plans-2021.pdf

146   O'Sullivan F. (2021). Make Way for the 'One-Minute City'. Available at: https://www.bloomberg.com/news/features/2021-01-05/a-tiny-twist-on-street-design-the-one-minute-city

147   ArcDes. https://arkdes.se/en/about-us/

148   UK GBC. (2020). Making the Case for Green Infrastructure: Lessons from Best Practice. Available at: https://www.ukgbc.org/wp-content/uploads/2020/02/08635-Making-the-Case-for-GI-FINAL-Web.pdf

149   Glasgow City Council. Plans to plant ten trees for every person in Glasgow City Region. Available at: https://www.glasgow.gov.uk/index.aspx?articleid=27099

150   The GCV Green Network. (2019). The Partners. Available at:https://www.gcvgreennetwork.gov.uk/guide-to-the-partnership/the-partners

151   Andersen A. et al (2019). Green growth in Nordic regions Eight case studies. Available at: https://nifu.brage.unit.no/nifu-xmlui/bitstream/handle/11250/2601343/NIFUWorkingPaper2019-7.pdf

152   Metsä. https://www.metsagroup.com/en/about-us/Pages/default.aspx

153   Andersen A. et al (2019). Green growth in Nordic regions Eight case studies. Available at: https://nifu.brage.unit.no/nifu-xmlui/bitstream/handle/11250/2601343/NIFUWorkingPaper2019-7.pdf

154   UK Battery Industrialisation Centre. Available at: https://www.ukbic.co.uk/about/

155   Coventry City Council. (2019). New Battery Industrialisation Centre powers up with additional cash boost. Available at: https://www.coventry.gov.uk/news/article/3170/new_battery_industrialisation_centre_powers_up_with_additional_cash_boost

156   Cambridgeshire County Council. (2020). SWAFFHAM PRIOR COMMUNITY HEAT PROJECT. Available at: https://cambridgeshire.cmis.uk.com/

157   Bristol City Council. (2018). Bristol City Leap. Available at: https://www.energyservicebristol.co.uk/cityleap/

158   Bristol City Council. (2020). Decision Pathway – Report. Available at: https://democracy.bristol.gov.uk/documents/s54742/City%20Leap%20-%20procurement%20update%20and%20contract%20extension%20notification%20decision%20pathway%202020%20FINAL.pdf

159   C40 Cities. (2011). 98% of Copenhagen City Heating Supplied by Waste Heat. Available at: https://www.c40.org/case_studies/98-of-copenhagen-city-heating-supplied-by-waste-heat

160   Global District Energy Climate Awards – Copenhagen DH – Application 2009. Available at: https://www.districtenergyaward.org/wp-content/uploads/2012/10/Copenhagen_Denmark-District_Energy_Climate_Award.pdf

161   Zierke M. (2020). Organics as a resource: removing household waste from the waste stream. Available at: https://lgiu.org/briefing/organics-as-a-resource-removing-household-waste-from-the-waste-stream/

162   Australian Government Ministry for Agriculture and Rural Affairs. (2013). National organic waste profile. Available at: http://www.environment.gov.au/protection/waste/publications/national-waste-reports/2013/organic-waste

163   Environment Victoria. (2016). Organic Waste. Available at: https://environmentvictoria.org.au/resource/organic-waste/#:~:text=Burying%20organic%20waste%20in%20landfill%20is%20a%20big,more%20potent%20a%20greenhouse%20gas%20than%20carbon%20dioxide.

164   Moffat, C. (2020). SA Bin Audit: 75 per cent of edible food waste in landfill. Available at: https://www.insidewaste.com.au/index.php/2020/06/02/half-of-all-landfill-waste-is-unrecovered-resources/

165   Victoria State Government. (2021). Organics processing procurement. Available at: https://www.mwrrg.vic.gov.au/procurement/organics-processing-procurement/

166   Waste management Review. (2018). MWRRG's FOGO guide for councils. Available at:

https://wastemanagementreview.com.au/mwrrg-fogo-guide/#:~:text=The%20first%20step%20
occurred%20in%202013%2C%20when%20Veolia,MWRRG%20and%2011%20northern%20and%20
western%20metropolitan%20councils.

167   Victoria State Government. (2021). Organics processing procurement. Available at: https://www.
mwrrg.vic.gov.au/procurement/organics-processing-procurement/

168   cefc. (2021). Innovative solution for organic and food waste targets landfill and emissions.
Available at: https://www.cefc.com.au/case-studies/innovative-solution-for-organic-and-food-waste-
targets-landfill-and-emissions/

169   Ritchie, M. (2019). The state of waste in Australia – a 2019 review. Available at: https://www.
insidewaste.com.au/index.php/2019/08/14/a-review-of-the-state-of-waste-in-australia-in-2019/

170   Georgiadis, C. (2020).Food Organics Garden Organics. Available at: https://www.abc.net.au/
gardening/factsheets/food-organics-garden-organics/12193822

171   Inside Waste. (2019). New waste treatment plant to aid eight Melbourne councils in waste
management. Available at: https://www.insidewaste.com.au/index.php/2019/05/24/new-waste-
treatment-plant-to-aid-eight-melbourne-councils-in-waste-management/

172   NYC Parks 'The Daily Plant' Issue Thursday, August 29, 2013. Available at: https://www.
nycgovparks.org/parks/hunters-point-south-park/dailyplant/22981

173   DuRussel, Lisa, and Aastha Singh. "Hunter's Point South Waterfront Park, Phase 1 Methods."
The Landscape Performance Series. Landscape Architecture Foundation, 2018. https://doi.
org/10.31353/cs1371

174   Andersen A. et al (2019). Green Growth in Nordic Regions: Eight case studies. Available at:
https://nifu.brage.unit.no/nifu-xmlui/bitstream/handle/11250/2601343/NIFUWorkingPaper2019-7.pdf

175   North Denmark Region. The North Denmark of Opportunities – Strategy for Regional
Growth and Development 2015–2018. Available at: https://s3platform-legacy.jrc.ec.europa.eu/
documents/20182/232200/DK_Nordjylland_RIS3_201508_Final.pdf/86701df5-c5b1-4045-851d-
4fa976fe8f7b

176   Harvey et al. Effects of Canals and Levees on Everglades Ecosystems. Available at: https://croc-
doc.ifas.ufl.edu/publications/factsheets/canalfactsheet.pdf

177   Narayan, S et al. Coastal Wetlands and Flood Damage Reduction: Using Risk Industry-
based Models to Assess. Natural Defenses in the Northeastern USA; Lloyd's Tercentenary Research
Foundation: London, UK, 2016; pp. 1–25

178   Sutton-Grier, A.E. et al. (2018). Investing in Natural and Nature-Based Infrastructure: Building
Better Along Our Coasts. Available at: http://www.mdpi.com/2071-1050/10/2/523/htm

179   Rebuild By Design. http://www.rebuildbydesign.org/

180   Adaptation Clearinghouse. Massachusetts Green Bonds. Viewed 28 June 2021. Available at:
https://www.adaptationclearinghouse.org/resources/massachusetts-green-bonds.html

181   Nordic Smart City Network. Nordic Healthy Cities. Accessed June 2021. Available at: https://
nscn.eu/NordicHealthyCities

182   Wirral Waters. (2021). Maritime Knowledge Hub. Available at: https://www.wirralwaters.co.uk/
projects/maritime-knowledge-hub/

183   Invest Liverpool. (2018). Offshore Wind. Available at: https://investliverpool.com/wp-content/
uploads/2019/01/offshore-wind.pdf

184   Wirral. (2021). ECONOMY REGENERATION & DEVELOPMENT COMMITTEE. Available at:
https://democracy.wirral.gov.uk/documents/s50073938/Appendix%202%20Wirral%20Waters%20
Enterprise%20Zone%20Investment%20Fund%20ERDC%2004.03.21.pdf

185   Tourism export council of New Zealand, 2019. Available at: https://www.tourismexportcouncil.
org.nz/kaikoura-has-topped-airbnbs-global-trending-destination-list-for-2019/

186   Simmons, D.G. et al, Ministry of Business, Innovation & Employment, 2017. Kaikoura: Tourist travel behaviour and recovery framework. Available at: https://www.mbie.govt.nz/assets/320b9705da/kaikoura-tourist-travel-behaviour-and-recovery-framework.pdf

187   UNEP, U., (2005). Making tourism more sustainable: a guide for policy makers. United Nations Environment Programme, Division of Technology, Industry and Economics.

188   Local Enterprise Office. Introducing Green for Micro. Available at: https://www.localenterprise.ie/green

189   Smith, C. (2021). Swift Read: Valuing priceless things – the economics of biodiversity. Available at: https://lgiu.org/briefing/swift-read-valuing-priceless-things-the-economics-of-biodiversity/

190   House of Commons Environmental Audit Committee. (2021). Biodiversity in the UK: bloom or bust? Available at: https://committees.parliament.uk/publications/6498/documents/70656/default/

191   Transport for London. ULEZ: Where and when. Available at: https://tfl.gov.uk/modes/driving/ultra-low-emission-zone/ulez-where-and-when

192   Pennsylvania General Assembly. The Constitution of Pennsylvania. https://www.legis.state.pa.us/cfdocs/legis/LI/consCheck.cfm?txtType=HTM&ttl=00&div=0&chpt=3&sctn=20&subsctn=0

193   Zaffuto S. (2019). What is a Municipal Authority? https://highswartz.com/legal-insights/municipal-law/what-is-a-municipal-authority/

194   Creighton C et al. (2018). Colorado Local Government Handbook: https://leg.colorado.gov/sites/default/files/2018_local_government_handbook_with_cover_0.pdf

195   McGeady Becher P.C.(2015). Special District Law: https://specialdistrictlaw.com/frequently-asked-questions-about-special-districts/#:~:text=function%20after%20organization%3F-,A%20special%20district%20is%20a%20quasi%2Dmunicipal%20corporation%20and%20political,law%20and%20public%20audit%20requirements

196   California State Association of Counties. (2014). County Structure & Powers: https://www.counties.org/general-information/county-structure-0#:~:text=The%20California%20Constitution%20authorizes%20a,collect%20taxes%20authorized%20by%20law

197   Mojave Desert Air Quality Management District. Available at: https://www.mdaqmd.ca.gov/about-us/district-boundaries

198   Central Coast Water Authority – https://www.ccwa.com/about-us

Appendix A: Local Authority Climate Action Charter

The signatories share the common understanding that:

(a) the evidence of global warming is unequivocal and the effects of climate change are clearly evident;

(b) it is important to take action and to work together to share best practices, to reduce Greenhouse Gas (GHG) emissions and address the impacts of climate change

(c) reducing GHG emissions and preparing for climate change impacts will generate environmental, social, economic and health benefits for individuals, families, and communities

(d) it is important to take action to adapt to the now inevitable consequences of climate change and to work collectively to ensure that the local authority sector is positioned to build resilience against negative impacts and avail of the positive effects that may occur.

The signatories acknowledge that a whole of government approach is essential in addressing climate change and recognise that:

(a) Central Government has a lead role to play in developing policy and ensuring resources are made available to realise Ireland's commitment to achieving a net zero carbon energy system objective for Irish society and in the process, create a climate resilient, vibrant and sustainable country

(b) Local Authorities are ideally placed to provide robust leadership in advancing this objective at the local and regional level. Support and resources will continue to be provided through the National Development Plan allocations, in addition to their own resources, which will aid them in developing and implementing relevant activities under this charter.

(c) Central and Local Government need to work in partnership and collaboration to ensure an effective response to the challenges presented by climate change.

This Charter acknowledges that local authorities will, with the support of Central Government:

(a) be advocates for Climate Action in our own policies and practices, and in our many various dealings with citizens and to underpin this role through the corporate planning process;

(b) adhere to the UN Sustainable Development Goals, in particular Goal 13 Climate Action;

(c) aim to measure the carbon impact of our various activities as accurately as possible and report as required so as to inform relevant local, regional and national policies;

(d) implement, in so far as is practicable, measures which reduce our carbon emissions in line with national objectives, and develop a method for planning and reporting on these actions;

(e) deliver a 50% improvement in energy efficiency by 2030 (on the 2009 baseline);

(f) ensure that policies and practices at local government level lead us towards low carbon pathways and put in place a process for carbon proofing major decisions, programmes and projects on a systematic basis, including investments in transport and energy infrastructure moving over time to a near zero carbon investment strategy;

(g) Ask suppliers as part of the procurement process to provide information on their carbon

footprint and on the sustainability practices and steps they plan to reduce its impact;

(h) implement green public procurement strategy and procedures across all business areas;

(i) support our employees to undertake changes in their lifestyles both at work and at home, to reduce carbon impact and encourage work-based employee-led groups to identify and implement ideas for improvement;

(j) put in place, and resource, a long term training strategy (technical and behavioural) for LA staff to provide appropriate capacity for the sector to deliver on climate action;

(k) encourage clients/customers/service users to undertake lifestyle changes to reduce their carbon impact, with a particular emphasis on supporting those clients/customers/service users who may face difficulties in funding such measures;

(l) cultivate and actively participate in partnerships with enterprise, community and voluntary groups so as to, improve the use of resources and reduced climate impact;

(m) play a key role in helping to build and implement a sustained localised citizen engagement model in supporting the various initiatives under the National Dialogue on Climate Action;

(n) exercise our planning and regulatory roles to help improve climate outcomes in the wider community and beyond the public sector, by developing and implementing robust evidenced based policy and standards on climate action, through appropriate and relevant adaptation and mitigation measures;

(o) continue to identify and develop specific actions to be taken to reduce the risks associated with negative climate change impacts and build resilience to these impacts through effective implementation of climate adaptation strategies/ Climate Change Action Plans ;

(p) support elected officials in ensuring all council led activities are climate proofed in terms of achieving effective low carbon and climate resilient outcomes;

(q) Explore opportunities to partner or collaborate on climate action initiatives across the public, private and education sectors;

(r) Support Enterprise through LEO/LCDC offices to exploit opportunities which will arise from meeting the challenges of Climate Change (s) work with relevant stakeholders to source funding for implementing climate action projects;

(t) liaise with 3rd level institutions & the research community both nationally and internationally with a view to developing centres of excellence where appropriate;

(u) develop links with young citizens to give voice to their understanding and concerns on climate change and to enhance their awareness and the actions that they can take;

(v) continue to develop and strengthen links with both central government (relevant departments and agencies) and regional bodies to help ensure a coordinated and coherent approach to the delivery of the national climate action agenda;

(w) Monitor, evaluate and report annually on the implementation of activities under this charter Signed on behalf of the Government.

Appendix B: USA state-level governance structure and responsibilities, case studies

Pennsylvania

The constitution of Pennsylvania lists six types of local government. The whole state is divided into 67 counties, which are then subdivided into 2561 municipalities of five further types; town, borough, city, township or school district[192]. Both counties and municipalities are further classified by population, with powers, governance structures and organisation dependent on the class of the jurisdiction.

Every county and municipality in Pennsylvania has the right to adopt a Home Rule charter. Currently seven counties have adopted such charters, including Philadelphia which is a coterminous city-county where the city government administers all county functions.

Everybody in the state lives under the jurisdiction of at least two types of sub-county municipal government. One type (city, town, borough, township) is responsible for the provision of services such as police, fire, roads, water, sewage, planning, zoning, parks, waste management, libraries, licencing etc. The other (school district) is responsible for just the local schools. Pennsylvania also has 1,885 special purpose governmental units called Municipal Authorities. These state agencies are alternate vehicles for accomplishing certain local public purposes without the direct action of counties or municipalities[193].

Colorado

Colorado is divided into 64 counties, which are important units of governance as there are no secondary subdivisions. In unincorporated areas, counties provide law enforcement, social services, and are responsible for infrastructure and control of land use.

There are also 272 incorporated municipalities in Colorado, which include statutory cities/towns and Home Rule municipalities. State law provides statutory cities and towns a broad range of administrative, police, and financial powers to address citizens' needs. Home Rule charter provides a municipality with even further authority to regulate local matters outwith what is specifically mandated by the state, and on such matters these powers will generally supersede conflicting state laws[194].

A Special District is a "quasi-municipal corporation and political subdivision of the State of Colorado formed to provide necessary public services that the county or municipality cannot otherwise provide", often dealing with issues of health, safety, prosperity, security, and general welfare[195]. There are approximately 2,300 special districts in Colorado.

California

There are 57 counties in California, and 481 incorporated cities (or towns - under state law the terms are interchangeable). In the areas that are unincorporated, the county is responsible for the provision of local governance, and the state legislature can devolve, and take back, any of its own functions to counties[196]. There are two types of county in California; charter counties which have some Home Rule policymaking autonomy, and general law counties which do not and are instead governed by the California Government Code.

Cities generally have greater powers of self-government than counties do, for example they have broad revenue raising authority that counties don't have.

California also has 4,763 Special Districts, which are state agencies created to provide specific local functions within a defined area. Examples of these include the Mojave Desert Air Quality Management District – one of 35 air districts in the state responsible for regulating stationary sources of air pollution within its jurisdiction[197], and the Central Coast Water Authority which is responsible for water resources management in portions of Santa Barbara County[198].