Submission to the Climate Action Plan 2024 Consultation

Prepared by Codema - Dublin's Energy Agency

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Summary

Codema welcomes the opportunity to make a submission on this consultation. The feedback below is drawn from Codema's knowledge and experience working in Dublin at a local level on climate and energy solutions, while also being informed through Codema's participation in European knowledge-sharing networks on international best practices and case studies.

Codema's key feedback to the Climate Action Plan 2024 is below.

1 - Nationally coordinated support is essential to enable Decarbonising Zone Implementation

- The Decarbonising Zone (DZ) action group should be convened as soon as possible - its work is critical to support DZ delivery. The DZ action group work should be publicly available.
- A framework, with guidance and support for the next steps for decarbonising zone implementation is needed for DZ delivery.
- National funding is required to support DZ implementation.
- A DZ peer support network 'community of practice' should be created to support the spread of best practices within all DZ's.

2 - To build support for and co-create climate policy, engagement should accessible, relevant and conducted at a local level

- To build support for climate action at a local and national level and to co-create climate policy, it is crucial to engage the public in meaningful ways (e.g. longer-term, representative, deliberative processes).
- To ensure a just transition, it is paramount to identify those that will be most impacted by climate policy and prioritise engaging these communities of people.
- Support trusted intermediaries to share useful, accessible information and engage local communities on climate action.
- Remove barriers to engagement and meet people where they are currently congregating (e.g. integrate climate action information and engagement into existing networks and events).

3 - Funding available for community climate action should be more accessible

- Applications for funding should be simplified in such a way that any member of society may easily access and understand the process of the application.
- Community funding applications should be standardised across different local authorities.
- To increase participation and applications, resources should be provided to local communities to promote and support the application process.
- It is recommended that future funding streams allocate funding towards resources to accommodate for people's time.

4 - Ireland needs an updated approach for multi-level governance on climate action

- Ireland should follow European best practice for multi-level governance, as proposed by Energy Cities (the European Association of local authorities in energy transition)[1].

5 - Thermal Storage is a key enabler for Ireland's future energy system

- Thermal energy storage should be fully evaluated and included in electricity system flexibility analyses.
- Thermal storage is an order of magnitude cheaper than battery storage. Thermal storage also has a lifespan in excess of 35-50 years that far exceeds battery storage systems of 5 - 15 years and experiences comparatively little degradation in performance over its lifespan.
- Thermal storage associated with district heating has very significant potential - can potentially reduce wasted wind energy (curtailment) by up to 70-86% based on current national district heating targets. This DH thermal storage should be recognised in the same way as Industrial heating facilities in the Climate Action Plan where methodologies to enable these storage assets "to participate in flexible demand initiatives from 2024".
- European case studies highlight the potential of thermal storage for seasonal energy storage.

[1] Explore Best Practices of Multi-Level Governance, Energy Cities

6 - The district heating (DH) industry needs significant further support to enable scaling of district heating networks

- Regulatory, policy and planning developments are needed to enable DH developers to deliver new DH schemes. Clarity on heat zoning, and connection policy for heat demand and heat supply is needed, alongside updates to the Planning and Development Act to facilitate pipework installation, and clarity on the planning permission process for district heat developers.

- Governance support, and market development support is needed to enable DH developers to deliver new DH schemes. Clarity of market roles and market supports for public sector developers and private sector developers is needed, as well as implementation of the DH Centre of Excellence in SEAI, as key elements to drive delivery of DH schemes in Ireland.

- National funding and resources are required to drive the development and delivery of DH schemes in Ireland. Dedicated funding support is required for project development and capital investment, and also consideration of support measures to address electricity and gas price differentials. Additionally, significant human capacity will be needed for public sector organisations tasked with developing district heat networks.

Response to Consultation

1 - Nationally coordinated support is essential to enable Decarbonising Zone Implementation

The Decarbonising Zone (DZ) action group should be convened as soon as possible.

- Climate Action Plan 2024 calls for a DZ action group to explore the "*strategic challenges and opportunities*" of DZ implementation. For DZ implementation by 2030 it is critical that this action group is convened as soon as possible.

- For the benefit of the many cross-sectoral DZ stakeholders (local authorities, public sector, commercial bodies, and communities) it is essential that information relating to this group is publicly available.

- Codema, as a key supporter of the four Dublin Local Authorities, are interested in being part of this group as a key regional and local stakeholder supporting DZ development.

- Community representatives from Decarbonising Zones, who have been involved in the process so far, should additionally be a part of the DZ action group. Their experience and input is invaluable and will aid in the implementation of the DZ plans.

A DZ peer support network 'community of practice' should be created

- A knowledge network for stakeholders involved in decarbonising zones should be created - a 'community of practice' where best practice can be developed and shared.

- This promotes the replication and dissemination of successful ideas, approaches, and 'demonstrator projects' across all DZ's in Ireland.

- This additionally supports collective problem solving, upskilling and knowledge development and sharing for all stakeholders.

A framework, with practical guidance and support for the next steps for decarbonising zones is needed for DZ implementation.

- Currently through the Local Authority Climate Action Plans (2024 - 2029), each local authority has begun the planning process for decarbonising zones, according to the Local Authority Climate Action Plan guidelines[2].

[2] Guidelines for Local Authority Climate Action Plans, DECC, 2023

- However, there are currently no information supports for Local Authorities that underpin the implementation phase of decarbonising zones - this is a critical resource gap. Without information supports on next steps many local authorities will progress more slowly in DZ implementation.

- To ensure that the implementation of Local Authorities' DZ plans are fair, just and equitable, specific guidelines should be developed and provided addressing: 1) Accessibility and transparency of the DZ plan 2) Best-practice engagement, participation and communication throughout the implementation process 3) Project management and governance 4) Funding opportunities 5) Collaboration and support (see Appendix 1 for more detail).

- Additional to this, success criteria for DZ's have not been outlined in detail. Discussion of, and creation of DZ success criteria (supplemental to the 51% emissions reduction target), will support DZ implementation.

Funding is required to support DZ implementation

- Currently funding is not available to support the implementation phase of DZ's. Funding sources for DZ's are a critical element that is required to enable their delivery.

- The appointment of a local Decarbonising Zone Plan coordinator or liaison officer from the local community is recommended. This should be a paid, permanent position.

    - Responsibilities of this coordinator would be: 1) to support the community in seeking funding for local projects related to the DZ implementation plan 2) to act as a liaison between the community and Local Authority and 3) to manage, advance and monitor the implementation of the DZ plan.

    - The candidate should be recruited from the community within the DZ. Adequate training should be provided to the successful candidate to ensure they are equipped to successfully carry out these responsibilities.

2 - To build support for and co-create climate policy, engagement should accessible, relevant and conducted at a local level

To build support for climate action at a local and national level and to co-create climate policy, it is crucial to engage the public in meaningful ways. Furthermore, to ensure a just transition, it is paramount to identify those that will be most impacted by climate policy and prioritise engaging these communities of people.

Zero Together (an initiative led by Codema) in partnership with Think-tank for Action on Social Change (TASC), published research at the end of 2023[3] exploring the ways that vulnerable communities in Dublin may be affected by the energy transition and how they can be supported to take action going forward. The recommendations are as follows:

- The perceived **absence of information relating to benefits and access to support** is a measure which could be rectified by providing information that is accessible to community groups and is specific to their local needs.
- A focus must be placed on co-creating local climate solutions that can help reduce emission creation and **address the challenges impacting community groups in their everyday lives.** Therefore, it is necessary to utilise expert knowledge relating to the development of climate solutions alongside the **local knowledge of community groups.**
- Develop and support a network of local community groups to act as a linchpin for local climate action.
- One of the benefits of engaging with local, trusted community groups is that it can help to identify where community members are already interacting with one another. This could help leverage existing networks and community meetings to **share useful information and engage people** on the energy transition, **removing the expectation for individuals to turn up** to specific events focused on energy and the transition to net zero.
- **Connection with the providers of support services**, such as those provided by local development companies, could also enhance the prospects of engaging with groups that may be overlooked in decision-making processes.
- A possible issue for securing a transition to net zero may be **the inaccessibility of language focusing on net zero.** This aligns with the perception that the communication of the benefits of net zero must focus on tangible outcomes, such as the financial benefits it would have in reducing energy costs, among others.

[3] https://zerotogether.ie/research-how-the-energy-transition-will-affect-communities-in-dublin

- When engaging with community members, **language should focus more so on identifying what communities like about their local area** alongside challenges facing a given community. From this, and with the assistance of experts in areas relating to a climate solution, measures can be taken to support the delivery of new initiatives with a climate and community benefit.

Codema proposes moving beyond traditional means of engagement and investing in a best-practice tool of participation to ensure effective and meaningful engagement with the citizens of Ireland. **We propose implementing a series of regional mini-public's on the energy transition across the country.**

- Ireland's energy transition will involve complex trade-offs as well as the need for wide-scale societal buy-in and behavioural change. Implementing this type of forum across the country would demonstrate recognition of the scale of this challenge and **provide the public with an opportunity to deliberate on some of the most complex of issues, providing solutions that have their support and are reflective of their lived experience.**

Conducting regional mini-publics on the energy transition is an opportunity to 1) garner local knowledge and solutions, 2) build trust and 3) include those most vulnerable (see

- Appendix 2 for more detail).

3 - Funding available for community climate action should be more accessible[4]

- Applications for funding should be simplified in such a way that any member of society may easily access and understand the process of the application.

- Community funding applications should be standardised across different local authorities.

- Resources such as a handbook, training and engagement programmes should be developed for community groups, to support engaged actors in promoting and involving other members of the community in the funding application process. This will aid in increasing participation from local community members in applying for funds, beyond the usual candidates.

- It is recommended that future funding streams allocate funding towards resources to accommodate for people's time. This may allow smaller and voluntary organisations the opportunity to comfortably apply for and participate in Community Climate Action Projects.

4 - Ireland needs an updated approach for multi-level governance on climate action

Ireland should follow European best practice for multi-level governance

- Climate Action Plan 2024 calls for development of *"more effective governance structures between EU, national, regional, and local climate action policy and programmes"* as a critical step *"in helping Ireland to meet its climate ambitions in the coming years"*

- At a European level multi-level governance and consultation is required as part of the process of creating National energy and Climate Plans (NECPs), among other initiatives. It has been noted by Energy Cities (the European Association of local authorities in energy transition) that: "*Local and regional authorities are important for the implementation of energy and climate policies. However, very few Member States demonstrate concrete evidence of how they involve them in the process of preparing the draft updated NECP and even fewer are building on an established multilevel dialogue for this process*".

[4] https://zerotogether.ie/research-how-the-energy-transition-will-affect-communities-in-dublin

- Best practice recommendations[5] on multi-level governance have been developed by Energy Cities - this should be used to inform the development of multi-level governance structures in Ireland.

[5] "Report on good practices and interactive good practices map", 2023, NECPlatform - Strengthening multi-level governance in national energy and climate policies

5 - Thermal Storage is a key enabler for Ireland's future energy system

Thermal energy storage must be fully evaluated and included in electricity system flexibility analyses.

- Thermal Energy Storage (TES) has underutilised, and cost effective, potential to support decarbonisation in Ireland. It can be a key enabler for the delivery of the Climate Action Plan 2024 goal of accelerating Ireland's future energy through building out low-carbon flexibility opportunities - however the potential of thermal energy storage is not fully recognised in Climate Action Plan 2024.

- Thermal energy storage is most typically an insulated hot water tank, but may come in many forms. It can be a crucial enabler of emissions reduction, sector integration and flexibility in the heat and electricity sectors according to SEAI, the European Commission[6], and several Irish studies. Critically, current evaluations show TES is an order of magnitude cheaper than battery storage (with a lifespan significantly longer).

- Thermal storage can reduce the curtailment of renewable electricity generators by acting a dispatchable demand during low demand periods and boost the proportion of renewables on the grid, providing frequency response to keep the grid stable as the proportion of renewable generation increases, providing flexibility in demand to reduce congestion on the network (particularly in peak winter when peak heat and electricity demand coincide), and providing a means of reducing electricity network constraints by delivering more efficient heat production and through by-passing large sections of the lower voltage electricity grid compared with individual building heat pumps for example.

Thermal storage is an order of magnitude cheaper than battery storage.

- Heat storage is significantly more cost and space efficient than battery energy storage. Large-scale thermal energy storage such as that currently being deployed by district heating & cooling networks in Ireland typically have a cost that is 0.65% - 4.4% that of best-case large-scale battery storage in Ireland.

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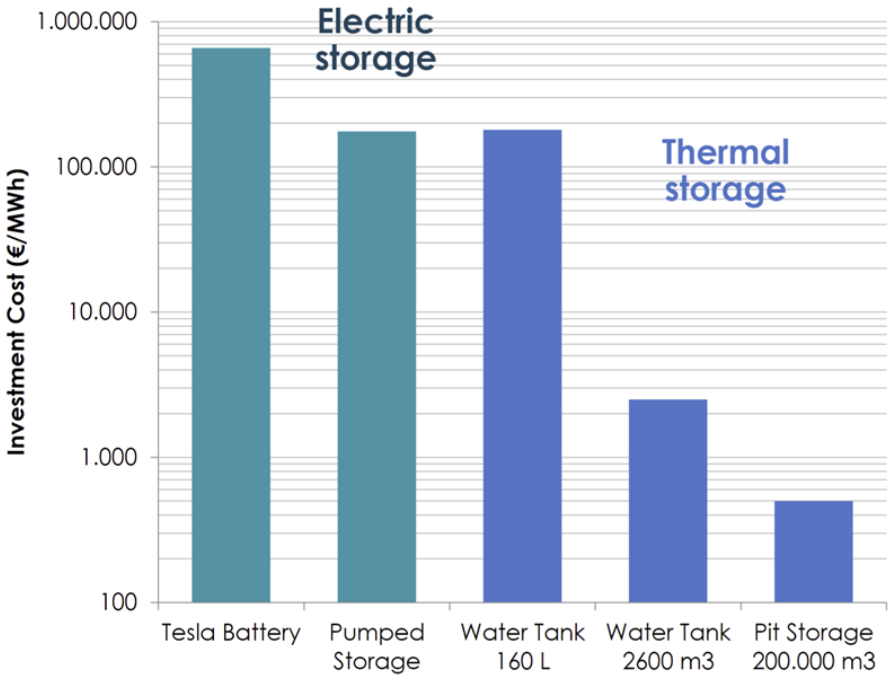
[6] National Heat Study, SEAI, 2022
Dublin Region Energy Masterplan, Codema, 2022
Integration of heat, electricity and transport: use of curtailed renewable energy in Poolbeg, 2023, Codema
An EU Strategy for Energy System Integration, European Commission, 2020
Recommendation on Energy Storage – Underpinning a decarbonised and secure EU energy system, European Commission, 2023

- It is also worth noting that in many cases these large-scale thermal storage assets will already exist to allow DHC networks to utilise lower night-time electricity rates and in this case the capital cost of the storage would only relate to the cost of the controls required to link its operation to signals sent from the electricity grid operator at the required response times.

- Large-scale TES also has additional benefits when it comes to its reduced levels of degradation it experiences through the charge and discharge cycles over its lifespan when compared with battery storage.



Energy Storage Technology Cost Comparison[7]

Thermal storage associated with district heating has very significant potential

- According to the European Commission Recommendation on Energy Storage – Underpinning a decarbonised and secure EU energy system[8]; *"in particular large thermal storage in district heating systems, can provide flexibility and balancing services to the electricity grid and therefore provides a cost-saving system integration solution by absorbing variable renewable electricity production"*

[7] https://www.en.plan.aau.dk/digitalAssets/288/288024_2016smartstorageijsepm--1-.pdf

[8] Recommendation on Energy Storage – Underpinning a decarbonised and secure EU energy system, European Commission, 2023

- Recent SEAI funded Codema and Mullangrid research[9] has additionally highlighted that heat storage has the potential to significantly and cost effectively reduce electricity curtailment, for example district heat (with heat storage) can potentially reduce wasted wind energy (curtailment) by up to 70-86% in 2030 if the national district heat target of 2.7 TWh was achieved. This potential does not include the additional thermal storage potential of industrial, commercial or domestic sectors, which can significantly add to Ireland's overall thermal storage capacity.

- Codema are currently undertaking an SEAI RDD project which looks to enable this demand flexibility and the provision of further electricity grid services such as frequency response and will be happy to share findings from this research, when concluded[10].

European case studies highlight the potential of thermal storage for seasonal energy storage

- Danish case studies on seasonal thermal energy storage such as Pit thermal Energy Storage (PTES) installations in Vojens[11] and Aalborg[12] in Denmark or Aquifer Thermal Energy Storage (ATES) such as that located in the De Bruggen and the University of Utrecht in the Netherlands[13] highlight the potential for long-duration energy storage.

- Pit storage is also extremely cost effective at 0.065% of the cost of battery storage but requires significant land area and favourable ground conditions for its development.

- Aquifer thermal energy storage does not require large areas of land but does require specific sub-surface conditions i.e. an aquifer covered with a clay layer for the aquifer to be used in this way.

- As with most forms of thermal storage discussed in this submission this is a one-way storage system where the electricity is converted to heat for use as heat at a later time rather than for generating electricity.

- District heating networks with thermal storage which utilise electrical heat production are also the main method of ensuring a stable electricity grid in Western Denmark through the provision of frequency response services. The table below[14] shows the breakdown (in Megawatts) of the assets used to provide this service by the Western Denmark electricity

[9] Integration of heat, electricity and transport: use of curtailed renewable energy in Poolbeg, 2023, Codema

[10] SEAI RDD grant - Heat NEWS, Codema, 2023

[11] World largest thermal heat storage pit in Vojens, State of Green, 2014

[12] Pit Thermal Energy Storage (PTES), Aalborg CSP,

[13] HIGH TEMPERATURE AQUIFER THERMAL ENERGY STORAGE (HT-ATES), 1e Nationaal Congres Bodemenergie, 2011

[14] Hot/Cool, DBDH, No.2, 2024

Transmission System Operator (equivalent of Eirgrid). District heating networks using electric boilers account for 86% of this capacity.

DK1 - West	FCR	aFRR	mFRR
Flexible consumption	1.0		
Battery			0.4
Electric boiler	56.0	138.0	10.0
Heat pump		0.7	
Power plant	8.0		20.0
Diesel engine			3.8

6 - The district heating (DH) industry needs significant further support to enable scaling of district heating networks[15]

Regulatory, policy and planning developments are needed to enable DH developers to deliver new DH schemes

- Clarity on policy and regulation for heat demand is needed to reduce risks for DH scheme developers. This includes considerations on DH connection policy for large public sector and private sector heat demands. Codema supports mandatory connection policy to DH networks for large heat demands in zoned areas (areas where DH is the most cost-effective means of decarbonising heat demand).

- Clarity on policy and regulation for waste heat supply is also needed, which can support DH network development. Codema supports mandatory supply of waste heat to DH networks for large waste heat supplies in zoned areas. In line with the DH Steering Group report recommendation where "industrial facilities supply waste heat to district heating where the total rated energy input is at least 1 MW", and requirements in Article 26 of the EU Energy Efficiency Directive[16] for thermal electricity generation stations, data centres, industrial sites, wastewater treatment plants.

- Updates to the Planning and Development Act[17] (as included in the current proposed draft update) are required to ensure DH developers can be permitted to lay pipework in a manner consistent with other utilities.

- A clear process for planning permission is required for both public and private DH developers. This may include licensing and consenting provisions for "fit and proper" persons to allow them to install DH pipes in roads etc.

- Heat zoning regulations, and updates to the planning process will require support and resources at a local planning level. This would also support the development of local heating & cooling plans which are required under the latest EU Energy Efficiency Directive for any municipal area of 45,000 inhabitants or more.

- Some updates to Part L of the Building regulation have already been undertaken to include district heating networks which utilise waste heat from Energy-from-Waste plants and data centres. This will need to be updated to include a broader range of renewable and waste heat sources to ensure the technology-agnostic nature of DH networks can be realised. The current figures being used are also somewhat conservative and will need to

[15] Transition Roadmap City of Dublin, Codema, Decarb City Pipes, 2023
Dublin Region Energy Masterplan, Codema, 2022
[16] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023L1791
[17] Planning and Development Act, 2000

be updated as metered data from the operation of networks becomes available. In terms of future-proofing new buildings for connecting to planned DH networks at a later date, some barriers exist in the Part L process when it comes to adopting centralised low-carbon heating technologies for large sites. Specifically, there is a lack of large-scale heat pumps in the DEAP and NEAP database resulting in a more labour-intensive process of proving compliance for sites which plan on installing larger centralised solutions as an interim heat supply prior to connecting to a network. This is becoming an issue in areas such as Dublin where it is a requirement to evaluate a district heating enabled heating system for new large developments in certain development zones.

Governance support and market development support is needed to enable DH developers to deliver new DH schemes

- Clarity of pathways, market roles, and market supports for public sector developers and private sector developers is needed to support DH scheme developers. To scale a district heating industry in line with Ireland's district heating targets will require delivery of schemes by public sector and private sector scheme developers.

- Implementation of the District Heating Centre of Excellence as outlined in the District Heating Steering Group Report 2023[18], with the following roles;

    - provision of technical support for DH project development
    - provision of process guidance and support for DH project development
    - provision of templates for key elements of project development including business cases, contracts and procurement.

- Clarify medium- and long-term phase down plans for the gas distribution network for building heat supply (residential and commercial heat) as highlighted in the SEAI National Heat Study[19]. Clarity on this process can drive the transition to low-carbon alternatives including DH industry development.

National funding and resources are required to drive the development and delivery of DH schemes in Ireland

- Dedicated funding support is needed for feasibility studies and project development costs.

- Dedicated funding support is needed for capital investment on DH schemes.

- Grant support is needed for building owners connecting to a DH network for the installation of heat exchangers (for a similar purpose that grants are available for heat pump installation for building owners).

[18] District Heat Steering Group Report, 2023, DECC

[19] National Heat Study - Summary Report, SEAI, 2022

- Operational support or structural changes to address the price difference between electricity and gas is required to incentivise heat customers to support low-carbon heat technologies. Without this there is a price risk for customers (large and small) committing to district heat networks (and heat pumps), which acts as a barrier to low-carbon heat market development.

- Additional human capacity is needed for public bodies tasked with developing DH schemes. In addition to this external support from organisations such as the DH Centre of Excellence to develop DH networks will be key in driving projects forward.

About Codema

Codema - Dublin's Energy Agency is a not-for-profit company limited by guarantee and was founded in 1997. We are the energy agency to the four Local Authorities in Dublin, and our mission is to accelerate Dublin's low-carbon transition through innovative, local-level energy and climate change research, planning, engagement and project delivery, in order to mitigate the effects of climate change and improve the lives of citizens. We are the Dublin Local Authorities' one-stop-shop for developing pathways and projects to achieve their carbon reduction and climate targets. Examples of Codema's work include decarbonising zone planning, energy master-planning, district heating system analysis, energy performance contracting, management of European projects, energy saving behavioural campaigns, best-practice public engagement, and detailed energy reviews. Codema is well networked in Europe and has been very successful in bringing European projects to Dublin with a local implementation for the Local Authorities.

Codema's Expertise

Codema's Experience in local level energy planning

Codema are Ireland's leading experts in the area of spatial energy master-planning. As part of our work on the Dublin Region Energy Masterplan[20] (DREM) we have assessed cost-optimal, technically feasible decarbonisation pathways for the heat, electricity and transport sectors in Dublin to 2030 and 2050. The masterplan addresses all energy sectors of electricity, heat and transport, and the interaction between these sectors from a spatial perspective as well as from a technology perspective.

The analysis is at a granular spatial level called the 'small area' level. This project also identifies and supports the use of low-carbon sources indigenous to Dublin, develops and harnesses new local level energy policy practices, and strengthens Ireland's integrated energy system modelling capabilities.

The pathways developed as part of the masterplan are based on detailed local-level, spatially driven energy scenario modelling, which has not been carried out before for any county in Ireland. This innovative local-level energy planning methodology builds upon leading international-class energy research in the area, and findings from the DREM have already been directly applied and demonstrated by the Dublin Local Authorities.

This work presents a set of clear, evidence-based pathways, which will enable the Dublin region to create effective, long-term energy policy in areas such as spatial planning, land-use, and

[20] Dublin Region Energy Masterplan, Codema, 2022

public infrastructure. In addition to this the work also presents a geographic analysis of the current situation for energy use, along with additional spatial data layers to facilitate contextual analysis. The results of the DREM will allow local authorities to effectively create evidence-based policies and actions to affect CO2 emissions county-wide, by using the local authority's powers in spatial planning, land-use, planning policy and public infrastructure.

Codema's Experience in Decarbonising Zones

Building on Codema's expertise in local level energy planning, outlined above, Codema developed and participated in development of the following key aspects of decarbonising zone planning;

- Developing Decarbonising Zones in Ireland - A Briefing Paper for the Local Authority Sector, CARO & Codema, 2020
- Guidelines for Local Authority Climate Action Plans, DECC, 2023
- Developing CO_2 Baselines - A Step-by-Step Guide For Your Local Authority, Codema & SEAI, 2017

Additional to this, Codema have been a key supporter of the five decarbonising zones in Dublin, managed by Dublin City Council, Fingal County Council, South Dublin County Council, and Dún Laoghaire-Rathdown County Council, which has included support in:

- Identifying and profiling candidate decarbonising zones.
- Development of the decarbonising zone chapter in the Local Authority Climate Action Plans 2024 - 2029 for the relevant Local Authorities in Dublin.
- Designing and implementing best-practice community and stakeholder engagement in Dublin's Decarbonising Zones.

Codema's Experience in District Heating & Thermal Storage

Codema is Ireland's leading expert in District Heating research and project implementation. We have built the evidence-base to support the roll-out of DH in Dublin, developing the first heat demand and heat source maps in Ireland, based on European best practice methodologies. We have identified potential projects across Dublin and, working with Local Authority project champions, have brought projects from idea to reality; from pre-feasibility, techno-economic analysis, business case through to securing funding, procurement, contracting and delivery. We are the Dublin Local Authorities' one-stop-shop for the roll-out of DH projects. Additionally, Codema is a founding member of the Irish District Energy Association (IrDEA).

Codema's expertise in thermal storage is drawn from our experience in District Heating development, our participation in European district heating knowledge networks, and our recent experience in SEAI funded Irish research in thermal storage and sector integration.

Codema's experience in Public and Stakeholder Engagement

Codema has extensive experience in the area of energy awareness and engagement in Ireland. Our research and practical experience of citizen and stakeholder engagement allows us to advise on local level citizen decision-making processes. We have led on several projects facilitating more inclusive and deliberative spaces to build consensus on pathways to meet our collective emission-reduction targets. For example, we applied DRIFT's transition management methodology[21] to the Zero Together initiative which involved the recruitment of a diverse range of stakeholders across the energy sector to build consensus on the best pathways to meet Dublin's emission-reduction targets. This resulted in a collaborative, evidence-based, ambitious roadmap for the Dublin region addressing the energy transition. Additionally, we worked closely with Dublin City Council to design and implement a best-practice engagement process in Dublin City Council's Decarbonising Zones; Ballymun and Ringsend and Poolbeg. This extensive community and stakeholder engagement resulted in a DZ plan that was reflective of the concerns, views and lived experience of community members in both DZs.

As well as implementing innovative engagement activities, we have published and commissioned best-in-class research to understand how best to engage communities at a regional and local-level. For example, we published the Zero Together Citizens' Survey in 2021[22] which found that 71% of respondents felt that their views and concerns in relation to how we produce and use energy in Dublin are rarely or never taken into account. Additionally, 68% of respondents stated their desire to be engaged in representative, deliberative processes in relation to Dublin's energy transition. In 2023, we commissioned research with the Think Tank for Action on Social Chance (TASC) to understand the communities that are most vulnerable to the energy transition and how best to engage them going forward.[23] We understand that involving people in decisions that impact their lives is a core principle of democracy and therefore strive to be at the forefront of innovative, democratic engagement processes. With this in mind, Codema recently became a member of the All-Island Better Democracy Network[24] to learn and share best-

[21]https://drift.eur.nl/wp-content/uploads/2016/11/DRIFT-Transition_management_in_the_urban_context-guidance_manual.pdf
[22] https://www.codema.ie/projects/local-projects/dublin-energy-transition-roadmap
[23]https://zerotogether.ie/research-how-the-energy-transition-will-affect-communities-in-dublin
[24] https://betterdem.org/

practice with practitioners across the Island of Ireland. Furthermore, members of Codema's engagement team have attended training by leading experts across the EU, in the field of deliberative democracy to learn how to effectively design and implement representative, deliberative processes.

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Appendices

Appendix 1

Codema's Engagement Team supported the development of Dublin City Council's Decarbonising Zone Plans by designing and implementing an extensive stakeholder and community engagement plan in 1) Ballymun and 2) Ringsend and Poolbeg. The goal of this engagement was to ensure that the outputs of the five key stages of the Decarbonising Zone Plan as outlined in the Technical Annex D Guidelines were reflective of those living, working and studying in each area and that they addressed some of the most prevalent needs of both communities. Through a series of facilitated workshops and local events from July 2023 to January 2024, core elements of the plan were co-created with members of both the Ballymun and Ringsend and Poolbeg communities such as the vision, mission, community objectives, SMART actions and recommendations for implementation. Through this process, Codema has gained valuable insight and knowledge from both communities, not only on their communities' strengths and concerns relating to decarbonisation but their feedback on how to implement the DZ plan.

As the Draft Climate Action Plan 2024 states the intention of developing a DZ Action Group, it is important to share some of the insights gained and recommendations for the implementation of DZ plans going forward. It is also recommended that Codema is represented on the DZ Action Group, alongside members of DZ communities involved in the process so far.

The recommendations below were shaped by involving the community to gather insights on their preferences for the DZ project management, coupled with informed research on best practices in transition management. As is recommended in Annex D of the Local Authority Guidelines and the UK Industrial Decarbonisation Research and Innovation Centre (IDRIC), these recommendations are grounded in the principle of implementing decarbonisation efforts through locally based solutions in a fair, just and equitable manner.

1) Accessibility and Transparency

To ensure the community is well-informed and actively involved in the DZ plan, it is crucial that project-related information is accessible, compiled and available in plain English on a user-friendly platform. The next phase of the DZ should involve developing an accessible version of the DZ plan to ensure that every community member is well-informed about the completed and future work. It is recommended that Local Authorities establish a dedicated website portal for the project and the DZ plan should be accessible for all levels of literacy and accessibility. The main purpose of the website throughout the project would be to keep the community informed about project updates or delays. Additionally, it should include an option for community members to communicate any concerns or suggestions that may arise. To observe the differing levels of literacy in the community, it is suggested to consider establishing a community consultation hub to address any questions related to the DZ Project.

2) Engagement, Participation and Response

Well-executed community engagement should be viewed as a key tool in the advancement of the DZ plan. Acknowledging the importance of the community's perspective throughout the engagement process and responding to the community's concerns gives them ownership over the DZ plan. This will help to accelerate acceptance of planned DZ initiatives. In line with best-practice transition management methods, it is advisable that Local Authorities sustain engagement with key players within the community (the DZ team), and if necessary, engage with additional stakeholders, as they serve as connectors to disseminate information about the DZ among their networks. Continued engagement with both the community and local stakeholders will be essential for monitoring and understanding any underlying issues as the DZ plan is implemented. It is advisable that any representative from the relevant Local Authority or intermediary body is trained in best-practice facilitation and engagement skills. It is advised that the Local Authority employs a range of engagement tools to support two-way communication with and participation from the community. These tools may include:

- Facilitated workshops aimed at educating the community on climate action, the DZ itself, grant applications and project pitching
- Attendance at wider community events to raise awareness about the DZ project
- Regular public forums held by the Local Authority allowing Q&A sessions
- A local Citizens' Assembly

While the community engagement process will yield valuable insights, it is crucial to ensure that once concerns are voiced, they are visibly addressed; if that is not feasible, it is essential to provide an explanation for this. Once again, this will bolster a sense of trust in the Local Authority, community ownership over the process and will legitimise the process.

3) Project Management

When considering the internal management of the project, it is necessary to focus on aspects such as the governance structure to be implemented, internal communications and collaboration, project delivery timelines, and accountability. Additionally, when selecting projects, priority should be given to DZ initiatives that align with the broader needs of the community, focusing efforts and support on the most vulnerable members of the DZ. To ensure the timely and effective implementation of the DZ plan, it is crucial that every involved party understands their role within the project. It is recommended to assign roles and responsibilities to members of the Local Authority and the community to establish effective and regular lines of communication. Additionally, council departments should engage in regular meetings to collaborate on issues or concerns emerging from within the DZ. Ideally, a community representative could attend these inter-departmental meetings to voice community concerns and answer questions on behalf of the community. Establishing and adhering to project delivery timelines will enhance the transparency of the process and foster community trust, particularly when projects are completed within specified timeframes. To ensure projects advance in a timely and well-managed manner, it is recommended to appoint a capable individual to a paid position

responsible for monitoring project progress. Adequate support and training should be provided to the individual in fulfilling this role to ensure the successful completion of their responsibilities.

4) Funding Opportunities

The relevant Local Authority should actively inform community groups within the DZ of any existing or forthcoming funding opportunities they can pursue. In addition to this, regular application workshops should be held in the area. Adhering to the principle of transparency in the DZ project, the Local Authority should clearly communicate the availability or absence of funding streams directly related to the DZ.

5) Collaboration and Support

To advance the DZ plan, it is essential to take note of existing external projects and organisations already operating within the DZ. This encompasses community groups and larger organisations operating in the area. It is recommended to collaborate with these organisations to further advance the education and raise awareness of the DZ project. Additionally, larger organisations operating in the DZ should be considered as potential sources for funding, especially if they are seeking to mitigate their own impact in the area. When exploring collaboration and support opportunities beyond the DZ, it would be advantageous to facilitate a connection between DZ communities. This would enable them to share ideas and offer mutual support to each other throughout the process.

6) Community Recommendations

Throughout the engagement process in Ballymun and Ringsend and Poolbeg, both communities were asked how they could be supported to contribute to the implementation of the DZ plan.

Key themes that arose from this question included:

- The appointment of a local Decarbonising Zone Plan coordinator or liaison officer from the local community
- Community-led education and training
- Establishment of climate or Decarbonising Zone Plan champions or stewards
- Resources and support from the relevant Local Authority
- Increased consultation and engagement

Community members emphasised the need to appoint an individual, potentially a community member, to a paid position to act as a coordinator for the DZ. The group also expressed the benefit of appointing an individual that is well-known and trusted within the community. Such an individual would support the community in seeking funding and would act as a liaison between the community and the Local Authority, managing and advancing the DZ plan.

Adequate training would need to be provided for this role to successfully carry out the required responsibilities. The community members strongly emphasised the need for the position to be funded for the entirety of the project (i.e. up to 2030) indicating that there would be a net-cost saving, as proper coordination would lead to timely project completion. Additionally, the longevity

of such a position would deepen the individual's understanding of the community and the DZ project, helping to further build trust between the community and the Local Authority.

Appendix 2

Proposed initiative: *A series of regional mini-publics on the energy transition*

It is clear that levels of citizen engagement sit on a spectrum from passive to active engagement. However, broadly speaking, public engagement can be defined as "direct public involvement in decision-making processes whereby people share in social decisions that determine the quality and direction of their lives".[25]

According to Climate Outreach's Theory of Change "achieving rapid social change, with the consent and participation of the population, requires effective communications and the active engagement of the public, or it will not succeed".[26] Similarly the Climate Change Action Plan 2021 states that "local communities need to be empowered to address the challenges that they face in transitioning to a carbon neutral economy and society."[27]

We are living in an unprecedented time with the decisions made in the next seven years impacting the lives of the people living, working and studying in Ireland for decades to come. Codema has provided ground-breaking research to support these crucial decisions both regionally and nationally but as Climate Outreach states, the rapid and urgent change that is needed will not succeed unless we effectively engage the public in the decision-making process.

Codema proposes moving beyond traditional means of engagement and investing in a best-practice tool of participation to ensure effective and meaningful engagement with the citizens of Ireland. **We propose implementing a series of regional mini-public's on the energy transition across the country.**

Regional mini-publics on the energy transition address a wicked problem

By conducting regional mini-public's on the energy transition we are moving beyond conventional means of how we traditionally engage with the public. Ireland's energy transition will involve complex trade-offs as well as the need for wide-scale societal buy-in and behavioural change. Implementing this type of forum across the country would demonstrate recognition of the scale of this challenge and provide the public with an opportunity to deliberate on some of the most "thorny" or complex of issues, providing solutions that have their support and are reflective of their lived experience.

[25] Sanoff H. Community Participation Methods in Design and Planning. John Wiley & Sons; 1999. 326 p.

[26] https://climateoutreach.org/about-us/theory-of-change/

[27] https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/

Regional mini-publics on the energy transition leverage the "power of local"

The power of local refers to the impact of a local approach to and view of policymaking, public engagement and data analysis. The energy transition challenge is immense and will require a whole-of-society effort. There is no "one-size-fits-all" solution to Ireland's energy transition, as every region across the country presents differing societal and technological challenges and needs (i.e. limited options for public transport in rural areas, high percentage of rentals in urban areas, areas more affected by large onshore and offshore wind developments) requiring a response that is fit for purpose.

As Weeks and Quinlivan state in their book All Politics is Local, local authorities are the "mouthpiece of shared community interests" and can act as a "laboratory of democracy" responding quickly to situations and developing innovative solutions and strategies.[28] This is precisely what is needed to respond to the ongoing energy crisis and to plan for the transition away from fossil fuels.

Conducting regional mini-publics on the energy transition is an opportunity to 1) garner local knowledge and solutions, 2) build trust and 3) include those most vulnerable.

1) Local Knowledge & Solutions

Ireland is known for commissioning national citizens' assemblies but what we don't have are examples of local level mini-publics which, many would argue, are what is most needed. This regional approach to deliberative democracy would be a **first of its kind to deal with the climate and energy crisis at a local level and would greatly contribute to future scalability and replicability of this forum to deal with other pressing issues across Ireland**. As the national Climate Action Plan 2021 highlights, it is imperative to **empower local communities in the transition to net-zero**.[29] Similarly, the National Climate Dialogue 2021 found that participants "want to see national policy ambition reflected where they live".[30] There is a need and an appetite for action to be local. Therefore, we have an opportunity to harness local knowledge and understand local-level barriers and solutions in moving communities across Ireland away from fossil fuels.

In September 2021, Codema published a survey to capture the views of people living, working and studying in Dublin around how we can move the region away from fossil fuels. Over 1000 people

[28] Weeks L, Quinlivan A. All Politics is Local: A Guide to Local Elections in Ireland. Collins Press; 2009. 244 p.

[29] https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/

[30] https://www.gov.ie/pdf/?file=https://assets.gov.ie/204202/322402d7-f115-401d-9d28-0fc97ca5a391.pdf#page=null

from across the capital responded.[31] Two key insights are worth noting; 1) 71% of respondents of the Zero Together survey felt their views and concerns on how we produce and use energy in Dublin are rarely or never taken into account 2) 68% of respondents stated a desire to be engaged through a mini-public to rectify this. This demonstrates that people want to be engaged and have their views included in how their county reduces emissions and moves away from fossil fuels at a local level.

Traditionally mini-publics are commissioned by the national government and implemented at a national level. However, over the last few years localised mini-publics have been growing in popularity, especially across the U.K. A list of resources and examples are provided at the end of this submission.

2) Building Trust

Research conducted by the EPA garnered insight from citizens on trusted sources in relation to climate action. The participants' responses depicted a significantly low level of trust in local authorities (3%).[32] This is a concern as the local authorities are "key intermediaries" in relation to climate action and citizens' lack of trust adds another dimension of difficulty to the transition process. The research also revealed an overwhelming "frustration with powerful actors" combined with feelings of powerlessness from citizens. Similarly, TASC's Talking Green Survey and Codema's Zero Together survey revealed low levels of trust in national government, local authorities and elected members.[33]

One way of building trust is to actively bring citizens into the decision-making process, reassuring them their voices will be listened to, and to view them as equals rather than subordinates. McCabe (2020) states that higher levels of trust in projects are evident where citizens' "local knowledge" is included in the decision-making process.[34]

A report published by the OECD (2020) found that deliberative processes such as mini-publics, when implemented properly, "can lead to better policy outcomes, enable policy makers to make hard choices and enhance trust between citizens and government".[35] Furthermore, evidence

[31] https://www.codema.ie/projects/local-projects/dublin-energy-transition-roadmap

[32] https://www.epa.ie/publications/research/climate-change/research-344-citizens-views-of-climate-action-in-ireland.php

[33] https://www.tasc.ie/assets/files/pdf/tasc_-_talking_green_-_the_irish_survey_-_for_publishing_011121.pdf

[34] McCabe S. The People's Transition: Community-led development for Climate Justice [Internet]. Dublin Ireland: TASC; 2020 Nov [cited 2022 Nov 22]. Available from: https://www.tasc.ie/assets/files/pdf/feps-tasc_the_peoples_transition_-_2020f.pdf

[35] OECD. Innovative Citizen Participation and New Democratic Institutions: Catching the Deliberative Wave [Internet]. Paris: Organisation for Economic Co-operation and Development; 2020 [cited 2022 Nov 22]. Available from: https://www.oecd-ilibrary.org/governance/innovative-citizen-participation-and-new-democratic-institutions_339306da-en

shows that mini-publics can aid in galvanising support and trust from the wider public who are more likely to buy into a decision that is delivered by ordinary people, like themselves.[36]

3) *Including those most vulnerable*

The energy transition is a multi-dimensional issue and to recognise this is to understand that equity is at the core of the process. Discernible examples of inequity are the extent and severity of energy poverty in regionally and nationally, and the elevated exposure to air pollution for those living or working in lower socio-economic areas.[37] These inequities are predicted to become more pronounced, even with the implementation of actions defined in the Government's Climate Change Action Plan.[38]

This is important to recognise because, traditionally, the people most affected by the injustices of the energy sector have not been engaged and in order for future energy policy to reflect their voices, they need a seat at the table[39].

When we speak of "equity" we are acknowledging that we are not all starting from the same place. We are recognising that action and inaction within the energy transition will disproportionately affect different cohorts of people across Dublin. If the energy crisis has shown us anything it is that it is hurting the most vulnerable and the climate crisis is no different.

For example, according to Codema's Dublin Region Energy Master Plan there are 12 areas across Dublin that are most at risk of energy poverty, which equates to over 52,000 people[40]. **A key recommendation from the Master Plan is to prioritise energy efficiency upgrades in these areas. To do so, is to engage with these communities and understand their experience at a local level.** A mini-public can include those most vulnerable by ensuring that recruitment of the regional mini-publics focus on specific areas most impacted by the energy transition. For example, in the case of Scotland's Climate Assembly 80% of households were randomly selected

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[36] Ferehjohn J. Conclusion. In: Warren M, Pearse H, editors. Designing deliberative democracy: the British Columbia Citizens' Assembly. Cambridge, UK ; New York: Cambridge University Press; 2008. (Theories of institutional design).

[37] Social Justice Ireland. Social Justice Matters Policy Brief - Participation [Internet]. Dublin Ireland: Social Justice Ireland; 2021 Jul [cited 2022 Nov 22]. Available from: https://www.socialjustice.ie/content/publications/social-justice-matters-policy-brief-participation

[38] https://www.friendsoftheearth.ie/assets/files/pdf/still_left_out_in_the_cold_-_full_report.pdf

[39] McCabe S. The People's Transition: Community-led development for Climate Justice [Internet]. Dublin Ireland: TASC; 2020 Nov [cited 2022 Nov 22]. Available from: https://www.tasc.ie/assets/files/pdf/feps-tasc_the_peoples_transition_-_2020f.pdf

[40] https://www.codema.ie/images/uploads/docs/Full_Report_-_Dublin_Region_Energy_Master_Plan.pdf

across the whole of Scotland and 20% of households were randomly selected from deprived areas.[41]

Other mechanisms such as providing childcare, covering expenses and offering a stipend can make the process more appealing and accessible in a bid to include the less engaged cohorts and those most affected by the energy transition.

Regional mini-publics on the energy transition provide three pathways to impact

In Ireland, mini-publics have become increasingly popular as a means of bringing pertinent policy issues to the public for deliberation. Previous forums, also known as Citizens' Assemblies, have proposed recommendations on a range of topics such as climate change, gender equality, marriage equality and the eighth amendment to the Constitution. More recently, Citizens' Assemblies on a Directly-elected Mayor and Biodiversity have been commissioned and implemented.

The recommendations proposed and views brought forward by citizens' assemblies have led to constitutional change and opened up important dialogue amongst the public and the State. For example, Ireland's referendum on Marriage Equality and to repeal the 8th Amendment of its constitution were both preceded by a Citizens' Assembly which recommended these reforms. Ireland is considered a frontrunner in deliberative democracy often held up as best-practice on the global stage demonstrating a new and innovative approach to public engagement, decision-making and democracy.

This form of public engagement has significant potential. **This potential can be viewed through the lens of three pathways to impact:**

1) the policy landscape

2) wider society

3) participants of the mini-public

We know from national and international examples that this kind of public participation and engagement can impact the policy landscape, it can impact wider society in building a social

[41] https://webarchive.nrscotland.gov.uk/20220321134004/https:/www.climateassembly.scot/full-report

mandate for action and it can open dialogue and build trust amongst participants and government.

Appendix 3 - Heat Transition Roadmap

DECARB CITY PIPES 2050

Transition Roadmap City of Dublin

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 893509

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Transition Roadmap of Dublin

Introduction & Context

Heating is a hugely important sector in Ireland when it comes to decarbonisation as it represents approximately 40% of energy demand (twice the demand of electricity) and is the worst performing sector in terms of renewable proportion (currently at 6.3% of total heat production) behind both electricity and transport.

The district heating networks potential to enable greater uptake of renewable and waste heat sources is shown in the figure below, where there is a strong correlation between DH and renewable heat proportions. This relationship is now being recognised in national heat policy.

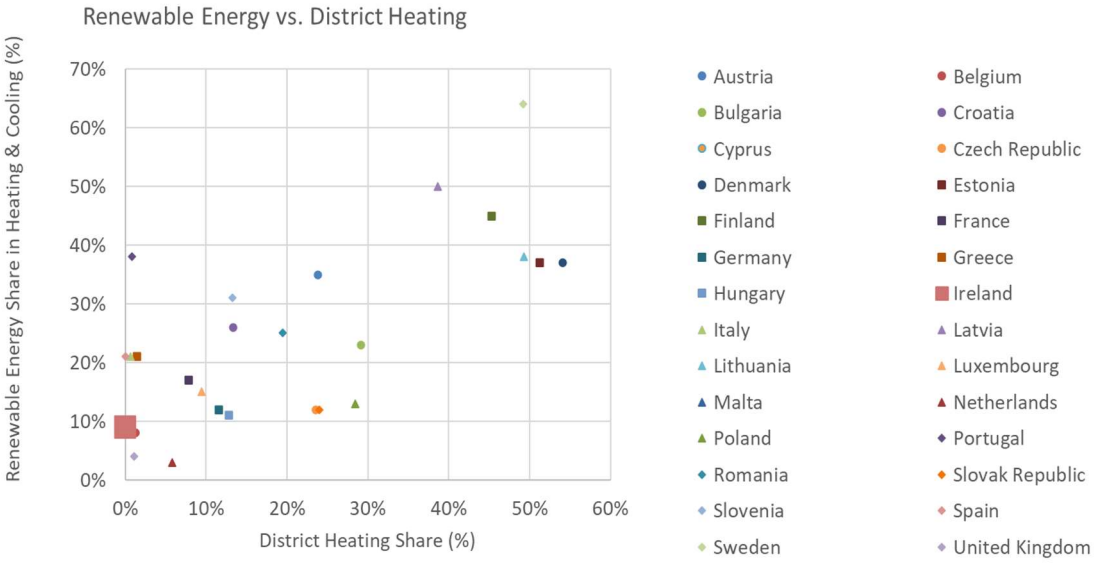

FIGURE 17: RENEWABLE ENERGY VS. DISTRICT HEATING IN EUROPE

The majority of buildings in Dublin currently use gas-fired heating. The gas grid covers practically the whole city, developed at national level by semi-state-owned companies without considering where DHC grids may be a better option. Figure 18 shows the breakdown of types of heating technologies currently installed in Dublin. Gas is by large the dominant heat fuel followed by direct electric (not heat pumps), particularly in the inner city where many apartments are heated in this way. The current distribution of fuel sources in residential dwellings reads: Gas 74% (assumedly mainly individual boilers), Electric 18% (mainly direct electric rather than heat pumps), Oil 7%, and Coal/Biomass 1% (percentages relating to the share of dwellings supplied by each respective fuel source).

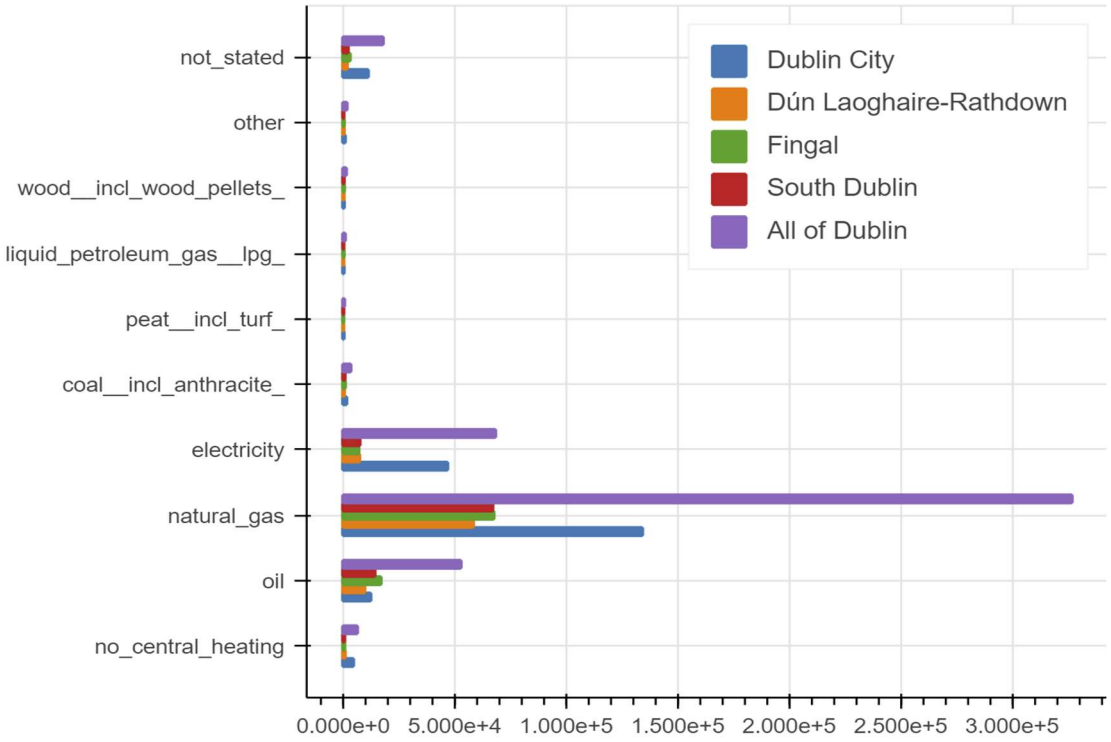

FIGURE 18: TYPES OF HEATING TECHNOLOGIES CURRENTLY INSTALLED IN DUBLIN

Currently, the heating sector has a very low penetration of renewable energy, and Ireland is the worst performing country in the EU in this regard with a renewable heat proportion of just 6.3%. The Climate Action Plan states that all buildings will need to switch to heat pumps or district heating by 2050, meaning that the gas grid will no longer supply existing homes and commercial premises.

District heating is a new technology in Ireland, currently representing less than 1% of the heat market but with potential for this to be between 57% and 54% based on a 2019 study performed by the Heat Roadmap Europe researchers and results from the SEAI's National Heat Study[12], respectively. The potential for DH has been recognised in the national Climate Action Plan 2023 where a target of 2.7TWh of heat is to be supplied via DH by 2030 (and 0.8TWh by 2025). This 2.7TWh target represents 10% of all residential and commercial heating in the country.

To support this roll out of DH, there are also actions in the Climate Action Plan 2023 where the government will:

- Support through the Climate Action Fund
- Establish a system of governance for the development of district heating policy
- Perform research to support the rollout of district heating in Ireland
- Develop a regulatory framework to protect customers & suppliers
- Ensure planning framework encourages and facilitates the development of DH – zoning of areas for DH
- Identify appropriate financing mechanisms to support delivery of DH including financial incentives similar to retrofit grant programs

[12] https://www.seai.ie/data-and-insights/national-heat-study/

- Update relevant regulatory & legislative tools to enable roll out of DH infrastructure

There is an agreement today that more bottom-up effort is required, but municipalities have a very low level of autonomy trying to find paths through their limited remit to influence the use of energy and emissions in their regions and limited municipality resources.

Importantly, Dublin has used its local working group – newly established specifically for this project – to identify actions to advance Dublin's heat transition, policy and buy-in to the low-carbon heating/cooling transition needed to overcome barriers to the roll-out of other alternatives to gas grids. The Dublin Local Working Group is made up of local, regional & national level stakeholders who are fundamental to the success of the roll-out of low carbon grids in the city.

Dublin has become a pioneer in Ireland for local level energy planning and DHC implementation, both of which are completely new practices in Ireland. Codema, as the energy agency for Dublin, has been building these skills and practices with the Dublin municipalities through numerous EU & national level projects. The municipalities have now committed to developing a city-wide DH scheme, outlined in the "Dublin City Climate Change Action Plan 2019-2024". Using learnings from the Policy Experiment (WP5) of the Decarb City Pipes 2050 project, Dublin City Council have also introduced a requirement, as part of the City Development Plan, for Energy Statements to be produced for any developments greater than 1,000 m^2 (commercial space) or 30 dwellings. The ongoing learnings from implementing this policy are also being used to refine this process.

Dublin has made significant progress in DH in the last few years. The first large-scale DH network in the county (Tallaght DH Scheme) is now operational. This DH network is the first not-for-profit public utility in the country and the first to use data centre waste heat as its heat source.

The development of a much larger DH network in the Poolbeg & Docklands area of the city is also progressing. This network will use waste heat from the Dublin Waste-to-Energy (WtE) plant as its inital primary heat source. A preliminary business case report has been produced for this project as well as extensive engagement with customers and energy service companies (ESCOs) who may be responsible for the construction and operation of the proposed network. This project is expected to go out for procurement in 2023. There has also been significant progress made in planning policy in the city to support DH, with requirements for buildings to "futureproof for connection (making buildings technologically ready to connect to DH) in certain areas of the city. €20 million in funding has also been secured for this project's development.

A feasibility study for another DH network using data centre waste heat has also been developed for the Blanchardstown area and the results of this study are currently being considered by the local municipality.

Further opportunities in areas such as geothermal DH and greater sector integration with the electricity sector (using DH + thermal storage to reduce the curtailment of renewable electricity generators) are also being progressed within Dublin.

City Profile

The table below summarises the profile of Dublin which can quickly allow other cities to see where they might have similarities.

Is heat planning mandatory in this city?	No but it has been carried out as part of the Dublin Region Energy Masterplan. Output maps on heating are available here - https://codema-dev.github.io/posts/
% of heat supplied by DH	<1%
Predominant heat source for DH	Waste heat from Data centres & WtE plant
What generation of heat networks?	3rd and 4th generation
DH ownership	Currently mainly publicly owned
National or regional targets for DH?	National target of 2.7TWh of DH by 2030 and 0.8TWh by 2025
Is there strong local engagement	Commitment from Dublin City Council to deliver DH in Dublin. This is reflected in the most recent City Development Plan where new developments of a certain size are required to be DH-enabled where feasible. Also, DCC are developing their own DH network using waste heat from Waste-to-Energy plant.
Predominant existing heating type	Individual gas boilers
Heat sources with the highest potential in Dublin	Power plants, wastewater treatment plant, geothermal, surface water, sea water

Dublin's H/C Plan – The 2050 Goal

Dublin's Heat Decarbonisation Pathway

The sections below summarise the heat sources available for use in DH networks and what are the preferred heating technologies for different areas of Dublin. This pathway was determined by the lowest cost of carbon abatement in the heating sector for DH vs ASHPs (air source heat pumps), (including Capex, Opex, Repex and CO_2 equivalents from methane and refrigerant leaks) for the period up to 2030 and 2050 (i.e. not just in that year). The key metric used was the €/tCO_2 saved. The results of this analysis can be seen in Figure 19.

The areas coloured blue are most suited to heat pumps and the areas coloured red are most suited to district heating. The darker the colour the more suited that area is to either technology.

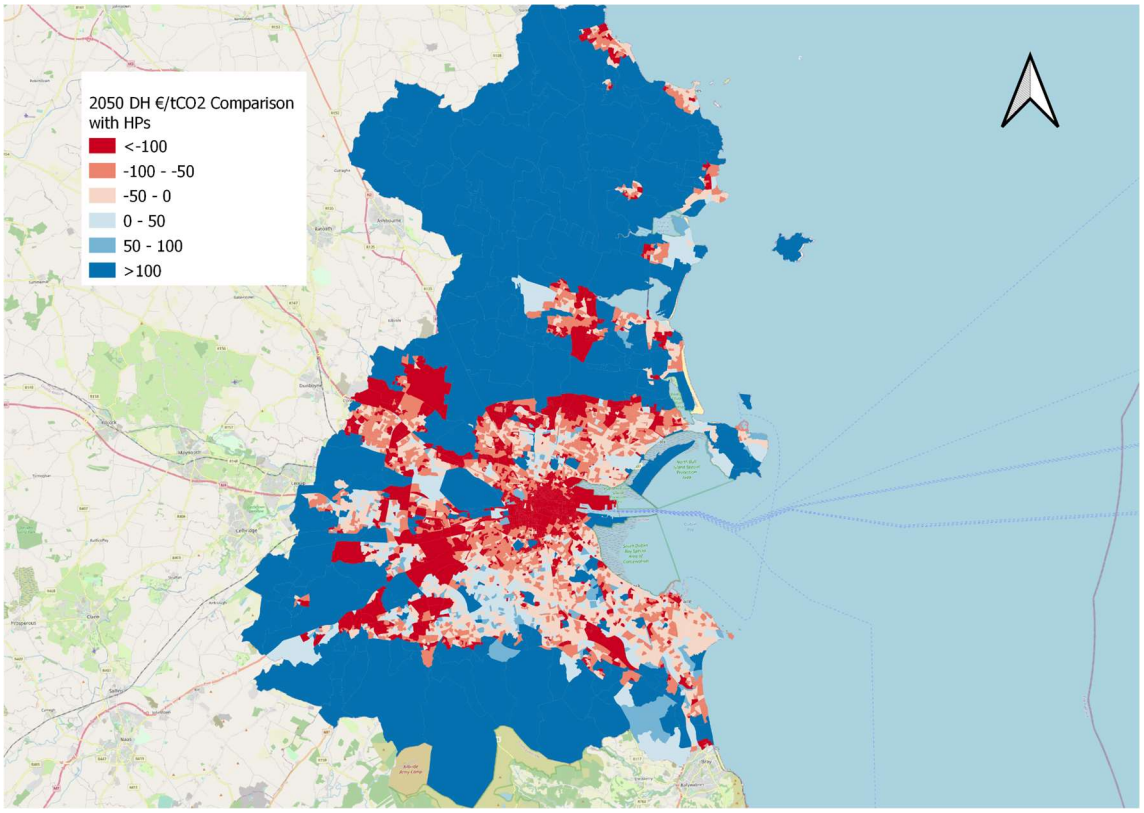

FIGURE 19: 2050 DH AND HP PRIORITY AREAS BASED ON LOWEST NON-DISCOUNTED CARBON ABATEMENT COST

By 2050, district heating represents the best option for 9.06TWh (87%) of heat demand in terms of cost-effective decarbonisation. By 2050, it is assumed that the required supply chain is in place to deliver on the full DH potential outlined. This would save 1,550.1 $ktCO_2$ in carbon emissions and 617.6 $ktCO_2eq.$ in equivalent emissions in the year 2050.

The underlying assumptions and analysis which informed this map and resulting contribution fo both DH and individual heat pumps are discussed in the analysis section below.

Underlying Analysis

The decarbonisation of the gas grid is limited by the capacity to produce biomethane and by the current technical restriction on using hydrogen in existing gas infrastructure (see emissions factors in Figure 20).

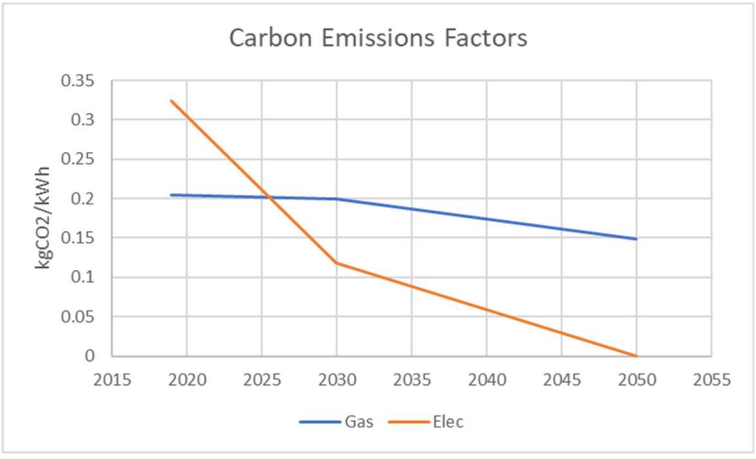

FIGURE 20: CARBON EMISSIONS FACTORS

Green hydrogen not considered suitable for low-exergy applications such as space heating and hot water preparation due to inherent inefficiency when compared with alternatives. It is also assumed that all future buildings will be nZEB, and various fabric upgrade options were considered for existing buildings.

Heat Sources in Dublin

The graph below shows the range of 18 heat sources investigated by Codema for heat planning purposes and also includes typical temperature ranges for each heat source, and highlights how that matches up against potential end-use temperature requirements.

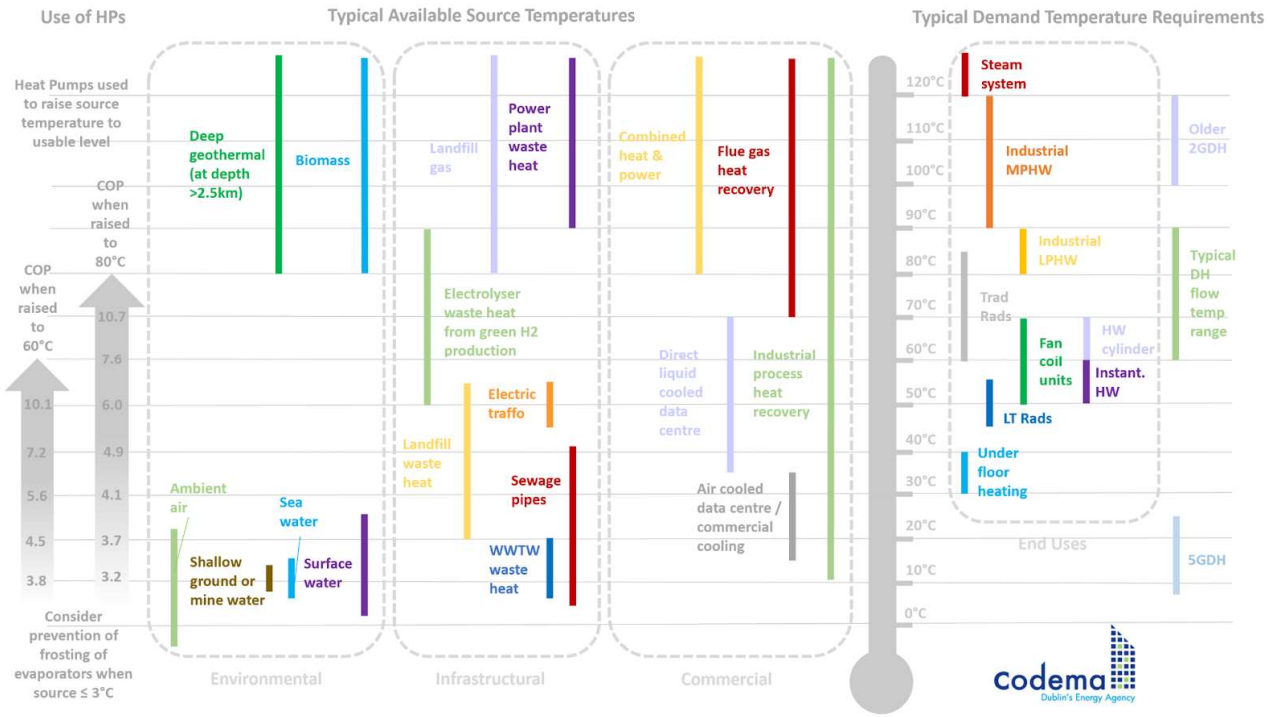

FIGURE 21: HEAT SOURCE AND END-USE TEMPERATURES

Figure 22 shows the breakdown of heat sources available in Dublin for the current and future scenario. It can be seen from this graph that the main changes over this period is the significant reduction in heat available from power plants as renewable electricity generation increases. This reduction is offset by increased heating potential from data centres and from renewable electricity generation which would otherwise be curtailed. Identifying some the main potential heat sources has helped to define some technology-specific actions in the this transition roadmap, particularly for data centres and geothermal.

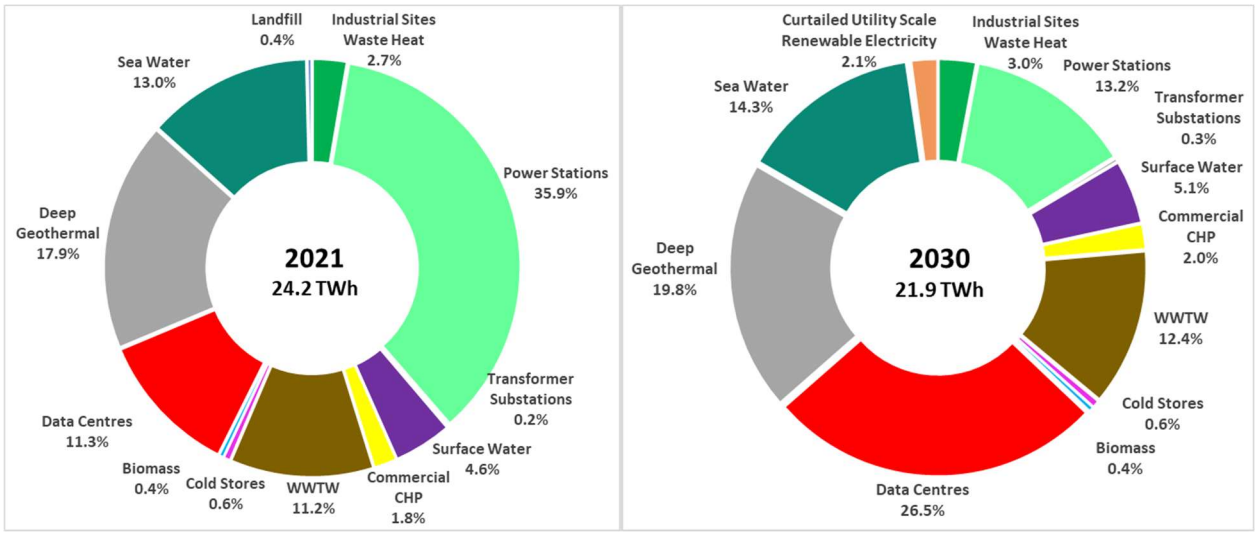

FIGURE 22: HEAT SOURCE BREAKDOWN FOR 2021 AND 2030

The location of these heat sources (totalling approximately 530 sources) is set out in the map below (Figure 23) and can also be found online[13].

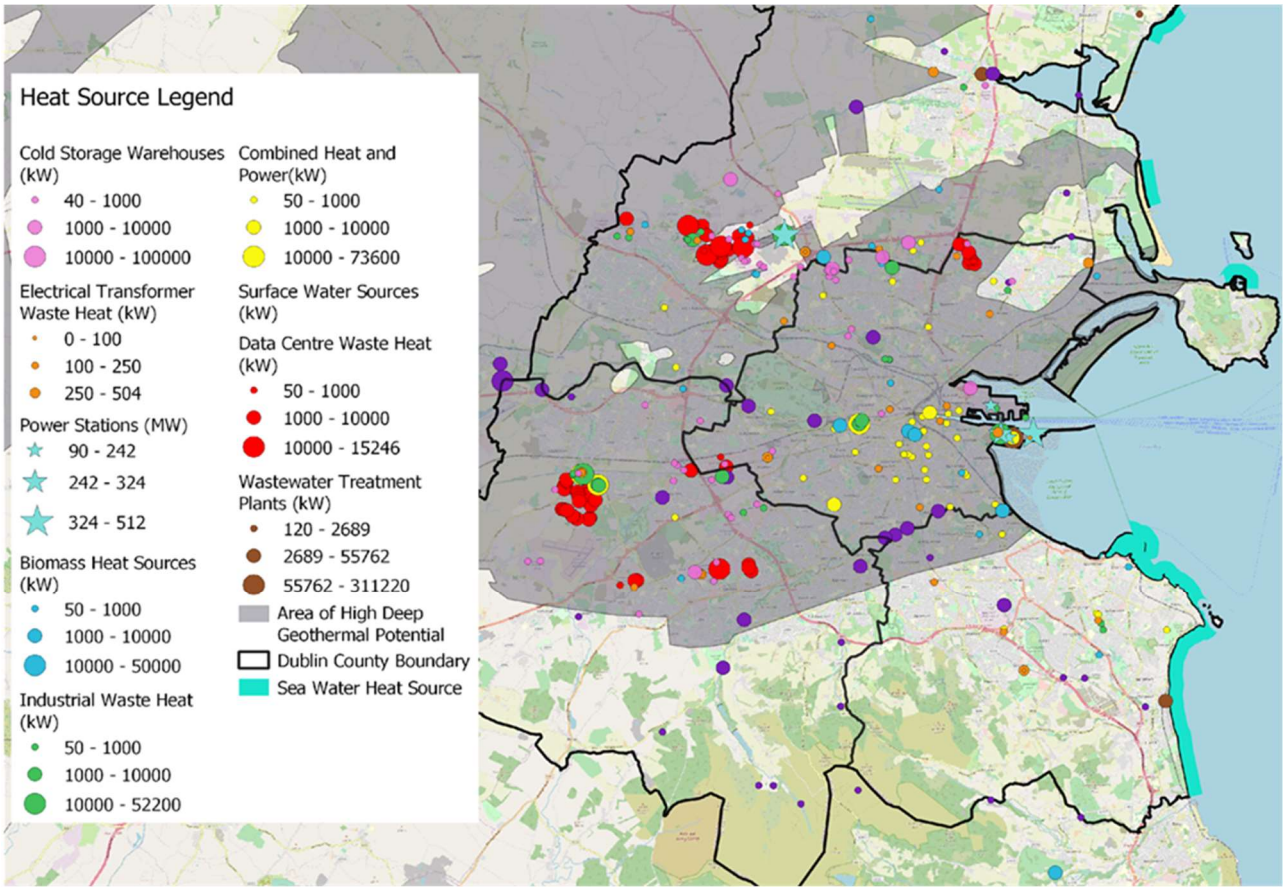

FIGURE 23: HEAT SOURCE MAP OF DUBLIN

These sources have been broken down based on their average supply temperatures in the graphs below (Figure 24). This provides an indication of the quantity of higher temperature heat that could be utilised for direct use in DH networks (>60°C) without requiring heat pumps. The medium temperature sources which can supply heat between 20°C and 60°C would likely require a heat pump to bring them up to a usable temperature for typical DH networks but these could achieve very high COPs (coefficients of performance), likely to be

[13] https://codema-dev.github.io/map/heat-source-map/

above 3.5 and perhaps up to 12 (i.e. 12 units of heat for every 1 unit of electricity). The low temperature range (<20°C) would require heat pumps to raise their temperature to a usable level. Even when using the same sources as individual building heat pumps, these large-scale heat pumps generally provide better COP than the smaller alternatives. This is due to a number of reasons: these large-scale HPs are continually monitored to ensure their performance is optimised, they have continual maintenance to ensure efficient operations, the diversity of loads being supplied lends itself to less short-cycling of the heat pump improving efficiency and the HP's lifespan, and the economies of scale allow for use of two-stage compression, which improves efficiency when using lower temperature sources.

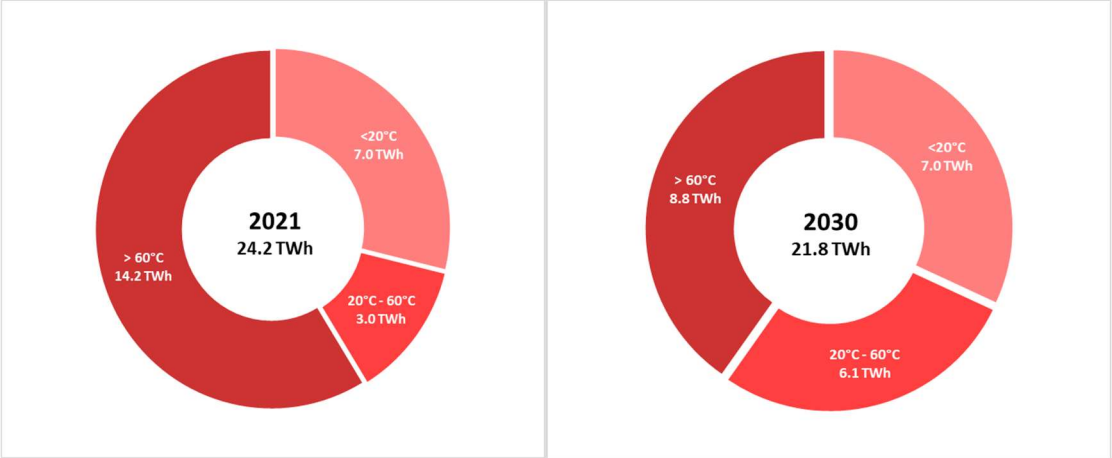

FIGURE 24: HEAT SOURCE BREAKDOWN BY TEMPERATURE FOR 2021 AND 2030

Initial Assessment of Heat Demand

The heat demand was calculated using domestic building energy rating (BER) information for the dwellings for which this was available and these demands were then extrapolated to the full buildings stock based on the age and location of the dwellings for which the BER was not available. Codema created a synthetic building stock model to facilitate this and to allow future fabric upgrades to be analysed. This building stock model allows for the u-value (a measurement of heat transfer) of various elements of a dwellings envelope (walls, windows, etc.) to be adjusted and for a new heat demand to be generated based on these changes. Commercial building heat demands were calculated using the building floor areas and CIBSE [14] benchmarks. Public sector heat demands were based on metered consumption.

The map in Figure 25 shows the heat demand density in TJ/km² for each CSO[15] small area in the county. This metric is one of the key indicators for DH suitability. An interactive version of these maps is available on the Codema-dev GitHub page[16]. The breakdown of demand categorised as very feasible, feasible, not feasible, etc. can also be found on this webpage. Table 8 below provides indicative figures for DH suitability based on this heat demand density metric alone. The DH vs HP assessment in the next section of this report builds on this analysis and directly compares the two low-carbon heating options based on the cost of carbon abatement. Interestingly, the carbon abatement cost analysis shows district heating as a better option for even more of Dublin than the analysis based on demand density alone.

[14] https://www.cibse.org/
[15] Central Statistics Office - Ireland's national statistical office
[16] https://github.com/codema-dev

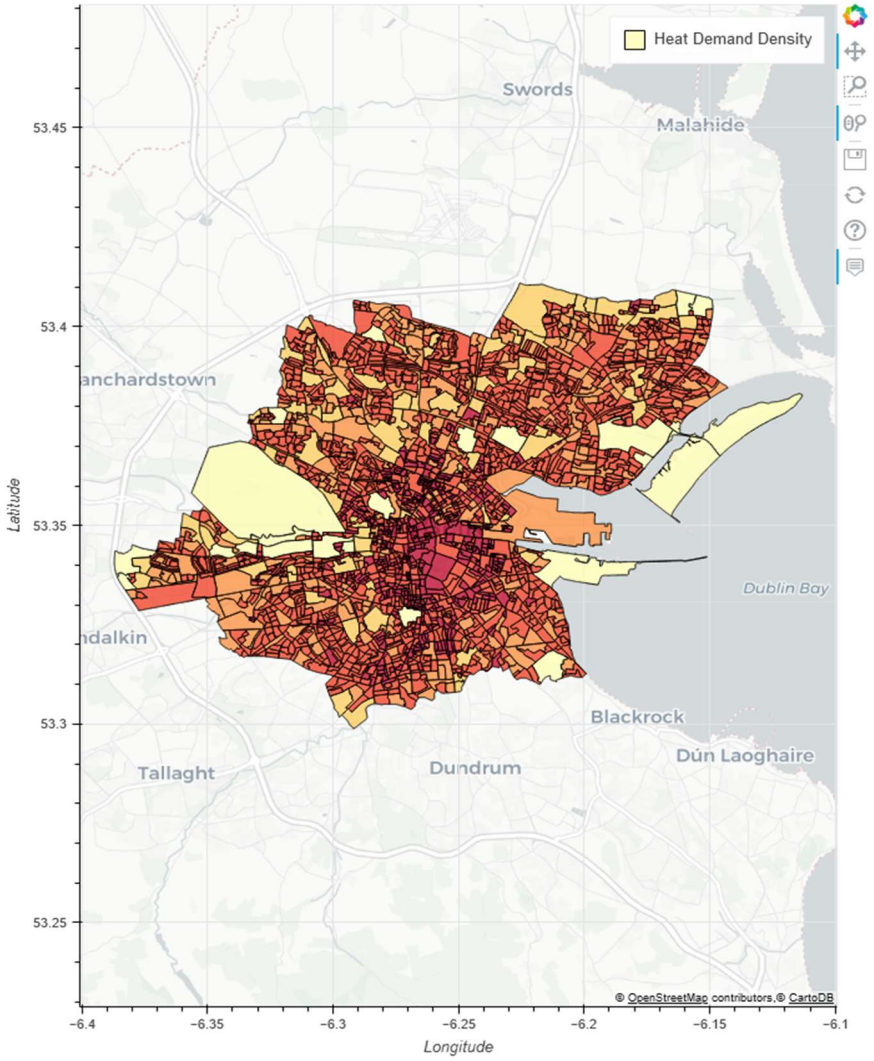

FIGURE 25: EXAMPLE OF HEAT DEMAND DENSITY MAPS PRODUCED

The table shows that 83.5% of heat demand in Dublin city is suitable for DH (above 120TJ/km^2) and that this could increase to 96.6% with supporting regulations in place.

TABLE 8: BREAKDOWN OF SUITABILITY FOR DUBLIN CITY

Feasibility	Residential [MWh/year]	Non-Residential [MWh/year]	Total [MWh/year]	Band [TJ/km²year]	% Share [MWh/year]
Not Feasible	23733	7803	31535	<20	0.7
Future Potential	89688	34996	124683	20-50	2.7
Feasible with Supporting Regulation	430562	172766	603327	50-120	13.1
Feasible	2229477	431259	2660736	120-300	57.7
Very Feasible	627162	561711	1188872	>300	25.8

Final Assessment of DH vs Heat Pumps

Two main heat decarbonisation strategies were assessed; one based on the adoption of district heating networks and the other looking at the widespread adoption of air source heat pumps. This analysis was performed for every CSO small area. The total number of CSO small areas in Dublin is 4,884. The determining factor in choosing one technology over the other was the cost of carbon abatement. The technology with the lowest carbon abatement cost (€/tCO$_2$ abated) was chosen as the preferred decarbonisation pathway. The cost and carbon abatement figure was calculated based on local conditions within each small area as discussed below.

District Heating Costs

The network length within each small area was determined through the use of random sampling. In this sampling exercise, indicative networks were drawn on multiple areas of a certain urban fabric. An example of the network routes drawn can be seen in the map below in red. The network length was then compared to the road centre line lengths from open street map (OSM). This relationship was then used to estimate the network length required within each small area.

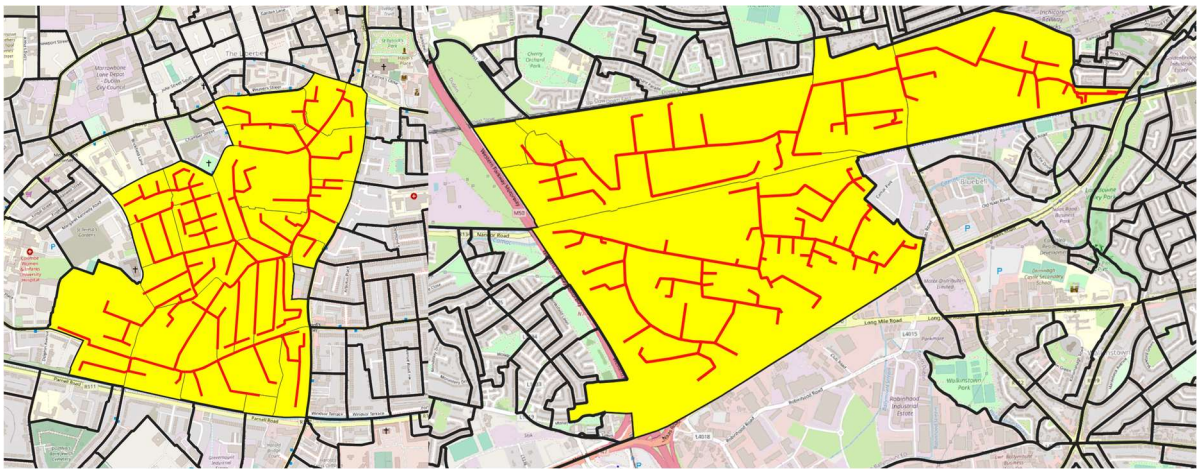

FIGURE 26: EXAMPLE OF NETWORK LENGTH ANALYSIS PERFORMED

The average DH pipe diameter rounded to the nearest standard pipe size was estimated for each small area based on the linear heat density using the following relationship[17]:

Average DH Pipe Diameter (mm) =
*(0.048*ln(Linear Heat Density in MWh per metre) + 0.063)*1000*

The capital cost of the heat production equipment was estimated based on a representative €/kW figure, which includes the capital cost of the main heating plant, backup heating plant, and auxiliary and automation equipment. The kW used to determine the cost was based on an average diversified peak heat demand for each domestic dwelling plus the diversified peak commercial demand based on the calculated annual heat demand and a typical equivalent run hours for commercial buildings.

The cost of heat interface units and heat substations were also included for the DH option based on an average kW peak demand per building.

Heat Pump Costs

The capital cost of the heat pump option was calculated using a figure of €1,200/kW thermal output. This figure assumed air source heat pumps (air to water) were fully installed including fittings, buffer tank, new cylinder (existing cylinders are not deemed compatible with efficient heat pump operation due to the relatively small surface area of their coils) and controls, but excluding the heat distribution system. Excluding the distribution system may mean the cost estimate for an efficiently-operating ASHP system may be slightly underestimated in some cases.

[17] https://hre.aau.dk/wp-content/uploads/2018/09/STRATEGO-WP2-Background-Report-6-Mapping-Potenital-for-DHC.pdf

It is understood that once heat pumps start to represent a significant proportion of the heat market, the cost of heat pumps will reduce as supply chains improve, installation overheads reduce and the equipment cost itself also reduces. This cost reduction is captured in this analysis through the annualised replacement expenditure (Repex) cost, which assumes a 20% reduction will occur[18] within the first lifecycle of the heat pumps, i.e. before 2036.

Whilst not included in this analysis, it is also worth noting that the floor area consumed by the required hot water cylinder also has a cost associated with it. For a build-to-rent apartment in Dublin, this cost is estimated at €2,350 per dwelling, for example. This cost benefit for DH was excluded as the majority of buildings in Dublin are existing buildings and already have hot water cylinders of a similar footprint installed and are designed in such a way that the floor area freed by removing these units is of limited value.

Electrical Grid Upgrade Costs for Heat Pumps

The installation of heat pumps in homes will also have an impact on the electricity grid which, in certain areas, upgrades will be required to serve these new loads. The cost of these upgrades has been estimated for the low volatge (LV) & medium voltage (MV) grid and also for the high voltage (HV) grid using two different approaches for domestic and commercial buildings.

The LV & MV grid upgrade cost adopted was based on costs from ESB Statement of Charges[19]. For existing homes whose current connection (typically 12kVA) will need to be upgraded (assumed to 16kVA) to service additional load from the heat pump (but also potentially EV charging and greater use of electric cookers). This connection upgrade charge is stated as being €1,539 for a single urban connection. This includes MV network costs but excludes trenching within the boundary of the site. Assuming a power factor of 0.95 for the heat pump load, this translates to a LV & MV upgrade cost of €405/kWe. The additional trenching cost is estimated at €6/m based on typical rates. This trenching cost would apply to all new connections but considering that Dublin consists of predominantly existing buildings and the limited impact of such a low cost, this trenching cost has been excluded from the analysis.

For commercial buildings, the impact of heat pumps on the building's maximum import capacity (MIC) was assessed in order to determine if the HP installation resulted in the building breaking its existing MIC threshold and thus incurring additional cost for falling within a higher MIC band. In the vast majority of cases, it was determined that the addition of a heat pump would not result in the building reaching the next MIC price band, but where it does the cost has been included.

[18] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/498962/150113_Delta-ee_Final_ASHP_report_DECC.pdf

[19] https://www.esbnetworks.ie/docs/default-source/publications/esb-networks-dac-statement-of-charges.pdf

Emissions from DH, Heat Pumps and Gas

The graph below shows the emissions (CO_2 and CO_2 equivalents) for the predominent existing heat supply option (gas boilers), individual heat pumps and DH networks (based on heat source mix from DH netowrks being rolled out in Dublin). These figures were combined with the cost information above to develop the cost of carbon abatement which was used to determine the preferred heating option for each small area in Dublin.

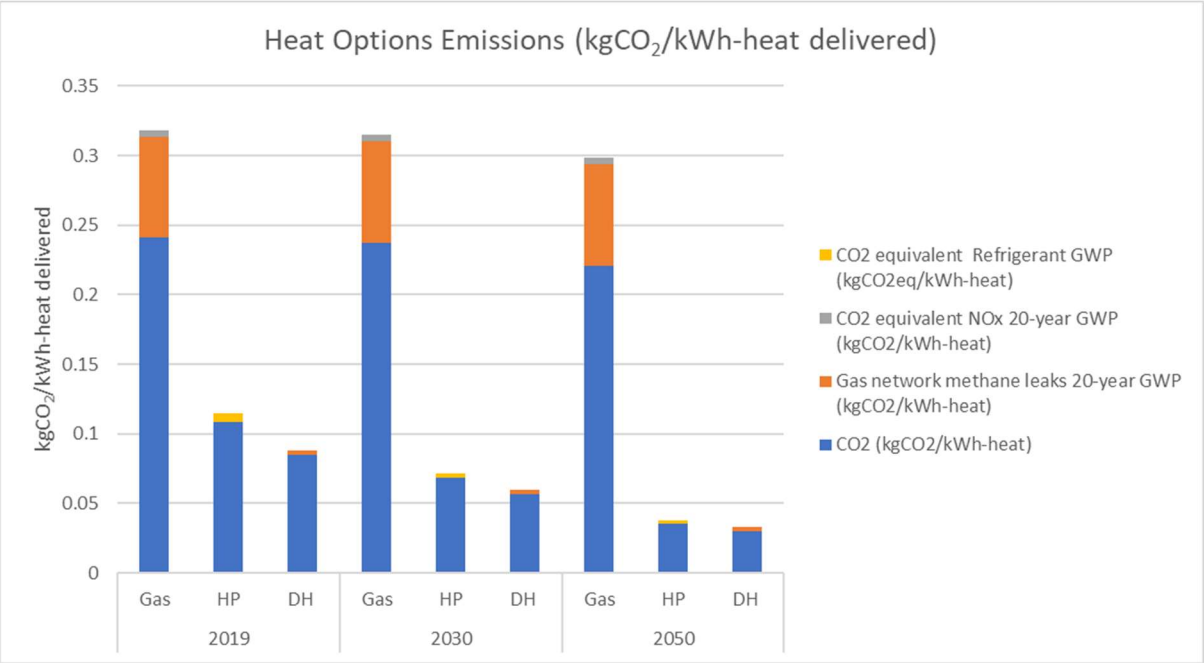

FIGURE 27: EMISSIONS (INCLUDING EQUIVALENTS) PER HEAT DELIVERED BY TECHNOLOGY

Transition Roadmap Development

The development of a transition roadmap (TR) sets out the steps towards achieving the vision from the city's H/C Plan. It is important that the TR is developed in collaboration with key local stakeholders (local working group) to ensure due consideration is given to local conditions and that the actions have the support of those who will be key to its implementation.

In the course of the Decarb City Pipes 2050 project, Dublin developed its Transition Roadmap using the following process:

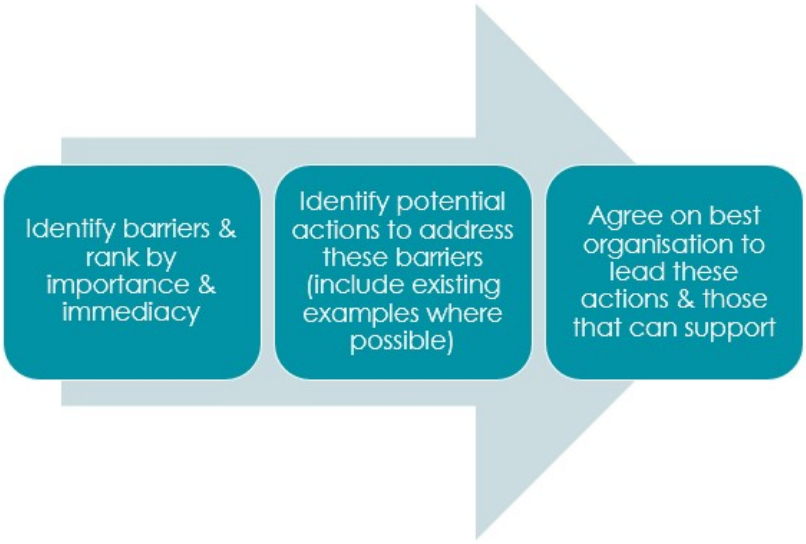

FIGURE 28: TRANSITION ROADMAP DEVELOPMENT PROCESS

The first step was to identify the barrier that would prevent each city from achieving its heat transition targets at the speed and scale required. These barriers were identified through group workshops. In order to help facilitate this process the challenges were considered under some of the headings shown in Figure 29 - political, economic, socio-cultural, techological, environmental, legal (commonly referred to as PESTEL) or under knowledge & skills, resources, regulation policy & planning, technology, mindset awareness & engagement, governance structures & authority and other.

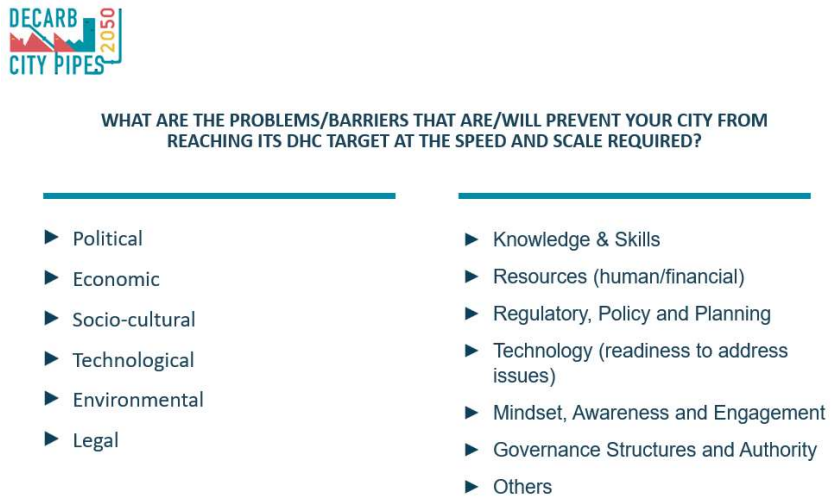

FIGURE 29: PROBLEMS AND BARRIERS THAT PREVENT ACHIEVING A CITY'S DHC TARGET

Following their identification, the barriers were placed into a hierarchy based on their priority and the timeframe in which they should be addressed. The figues below shows the matrix used for this process and some pictures from the workshops where this process was carried out.

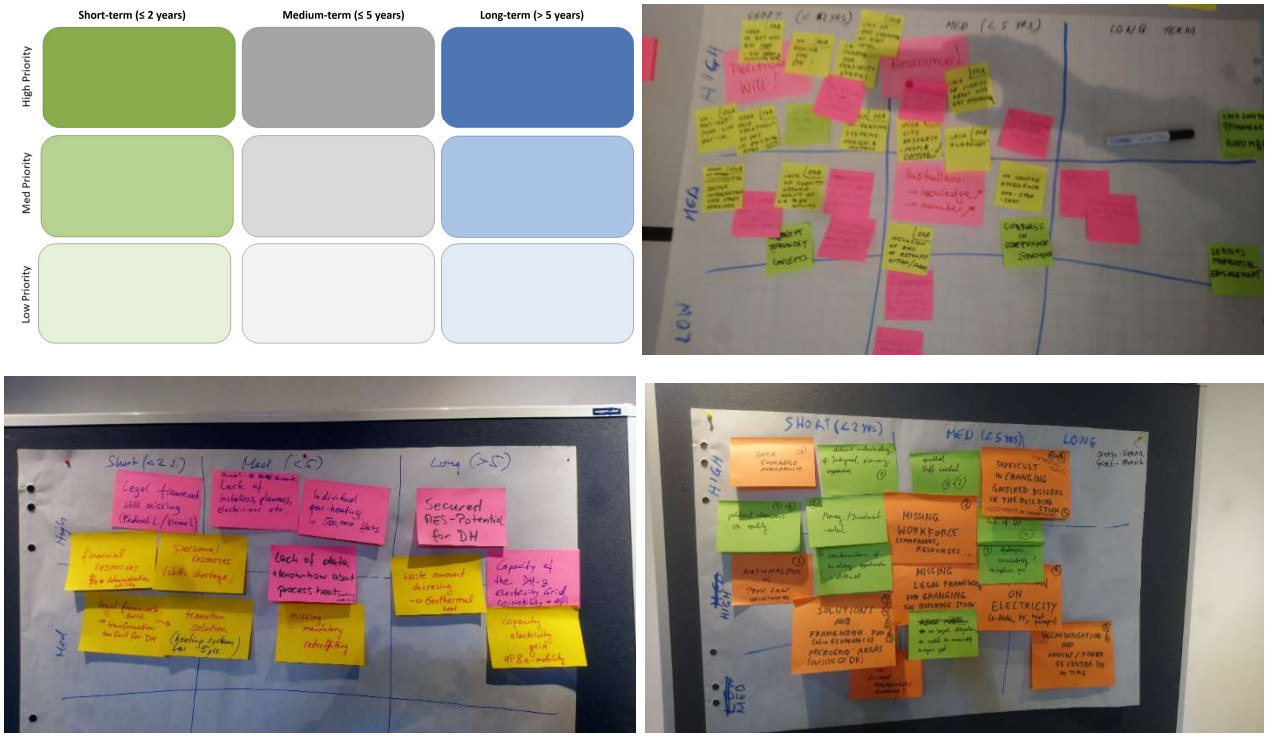

FIGURE 30: PESTEL ANALYSIS

Throughout the development, it is important to have local stakeholders involved in this process. This can often be best facilitated through online workshops using tools such as Miro. The image below shows a Miro board from such local stakeholder engagement which followed the same process as set out above.

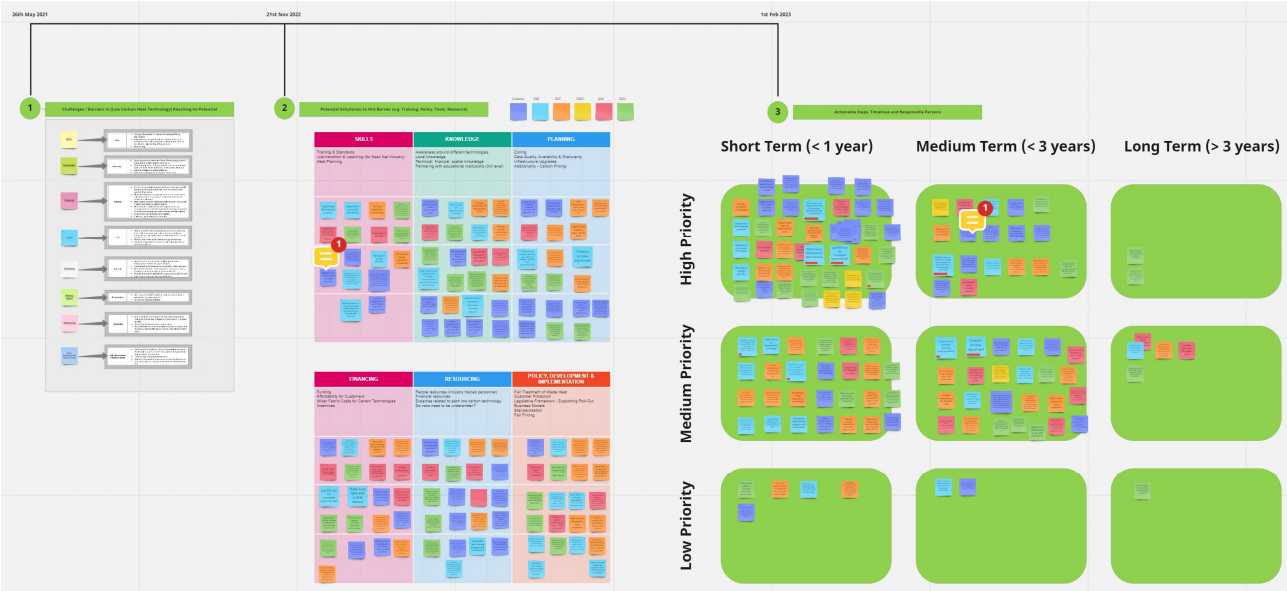

FIGURE 31: SCREENSHOT FROM LOCAL WORKING GROUP ONLINE SESSION ON BARRIER AND ACTION IDENTIFICATION

The outputs of these workshops were then used to form an action list spreadsheet. This spreadsheet lays out the actions in the format shown in Figure 32 (this is also replicated in the Transition Roadmap Actions section of this report). The main information included in this spredsheet includes:

- **Category** – the category in which the action fits (Knowledge & Skills, Resources, etc.)
- **Action** – a brief outline of the action to be taken
- **Completion Date** – Proposed date for when the action needs to be completed
- **Proposed Lead** – The organisation(s) proposed to lead the delivery of this action
- **Proposed Support** – The organisations proposed to support or provide key input into the delivery of this action
- **Supporting Information** – Resources which can be used to inform the delivery of the action e.g. international examples and case studies, further reading, additional context, etc.

Additional columns have also be added to set out indicators for successful implementation (these should be SMART – specific, measurable, achievable, relevant and timebound) or for breaking down actions in smaller, more manageable intermediate steps, these additional columns have not been included in the tables below to allow greater clarity of content. In Dublin it is envisaged that these actions would feed into the wider transition roadmap (for all sectors, not just heat) which would be managed through Dublin's Zero Together project.

Category	Action	Completion Date	Lead	Support	Supporting Information
See list on right hand side	Describe the action to be taken	Date action needs to be completed by	Organisation responsible for delivery of the action	Organisations that need to provide input	Examples/case studies, useful tools, experiments, resources, etc.

- Knowledge & Skills
- Resources (human/financial)
- Regulatory, Policy and Planning
- Technology (readiness to address issues)
- Mindset, Awareness and Engagement
- Governance Structures and Authority
- Legal
- Environmental
- Others?

FIGURE 32: OUTLINE OF THE ACTION LIST BASED ON THE PESTLE ANALYSIS

Transition Roadmap Actions

The action list developed for this transition roadmap is broken into 8 categories:

- Knowledge & skills
- Resources (human & financial)
- Regulatory, Policy & Planning
- Technology
- Mindset, Awareness & Engagement
- Governance Structures & Authority
- Legal
- Environmental

This action list is a living document that will be updated throughout its life as actions get delivered, new actions which address currently unknown barriers are added, and priorities, responsible organisations and dates are refined. It is proposed that the actions below are incorporated into the ongoing management of Dublin's energy transition through the proposed governance process being developed as part of Dublin's Zero Together project.

TABLE 9: REGULATORY, POLICY & PLANNING ACTIONS

Action	Completion Date	Lead	Support	Supporting Information
Develop a transition roadmap for the heat sector in Dublin as part of the Decarb City Pipes 2050 project - Regional strategy for decarbonising heat	2023	Codema	LWG	The final Heat Transition Roadmap for Dublin will be published in Q2 2023 and will be available on the Decarb City Pipes Website
Streamline the planning consent process for heat networks to be considered on a par with other utilities and reflects the role DH can play in tackling CO_2 emissions in the heat sector	2023	DHLGH	DHSG	Further detail on this topic and the options available can be found in the Irish District Energy Associations "District Heating Planning Guidance" report which was produced by MKO. This report is available upon request from IrDEA (email: info@districtenergy.ie)
Update Planning Act to ensure DH developers have the same powers as other utilities to lay pipework. This could potentially be achieved by expanding the definition of "statutory undertaker" to facilitate planning exemptions for this critical infrastructure.	2023	DHLGH	DHSG	Further detail on this topic and the options available can be found in the Irish District Energy Associations "District Heating Planning Guidance" report which was produced by MKO. This report is available upon request from IrDEA (email: info@districtenergy.ie)

Update Part L of the Building Regulations to ensure the fair treatment of waste heat (in line with the RED). DEAP and NEAP shall also include link to online map of existing and planned heat netowrks along with contact details of person/organisation who is responsible for network expansion to raise awareness of this heating option.	2023	DHLGH	SEAI, DECC, Codema, DLAs	Initial method developed but will require some updating over time to include additional heat sources and update intial conservative default figures (Primary Energy Factors & Carbon Factors). Barriers for DH enablement can also be considered such as the lack of data for larger heat pumps that could be used in DH-eneabled/futureproffied group heating schemes. Please see paragraph on district heating on relevant pages of the SEAI website: https://www.seai.ie/home-energy/building-energy-rating-ber/support-for-ber-assessors/technical-support/domestic-ber/space-heating/ Link to the guidance document: https://www.seai.ie/home-energy/building-energy-rating-ber/support-for-ber-assessors/technical-support/domestic-ber/space-heating/Default-district-heating-factors-for-BERs.pdf
Require energy statements to be filled out by large developments to provide information for the purpose of energy planning and to help ensure these are DH enabled. This information shall be maintained in a database	Underway	DCC Planning & DH Teams	Codema	The Dublin City Development Plan 2022 - 2028 States "In order to ensure the future development of District Heating in Dublin City, it will be necessary to ensure that significant new residential and commercial developments, particularly in SDRAs are 'district heating enabled', where feasible, in order to ensure that they are capable of being connected with local or citywide District Heating systems. Where this is not feasible, the proposed energy and heating solution should offer a similarly efficient and low carbon solution". - https://www.dublincity.ie/residential/planning/strategic-planning/dublin-city-development-plan/development-plan-2022-2028
In order for industrial sites which are being developed or expanded a report outlining the potential for waste heat should be submitted with the planning application and in the case where a network is planned/existing in the area heat recovery equipment should be installed	2023	DLA planning teams	Codema	SDCC planning requirement text which enabled waste heat use for the Tallaght Dh project can be found in Section 3.1 of the South Dublin Transition Roadmap - https://www.codema.ie/images/uploads/docs/HeatNet_NWE_Transition_Roadmap_Report_Final_-_Digital.pdf See policy recommendations from D6.3 of SoWhat project for potential further policy supports - https://sowhatproject.eu/wp-content/uploads/2022/11/D6.3-%E2%80%93-Policy-instruments-to-promote-industrial-whc-recovery.pdf

Make renewable heat projects exempt from the Multi-Unit Development Act to allow greater certainty of demand for projects in excess of 3 years	2024	DECC/ Dept of Justice/ DHLGH	IrDEA	The current limit of three years acts as a barrier to heating projects which have larger up-front capital but lower operational costs.
Ensure the role of DH in tackling CO_2 emissions in the heat sector is reflected in the National Planning Framework	2024	DHLGH	DHSG	
Legal requirement for utilities to provide fuel consumption information for their specific location (eircode or coordinates) for heat planning purposes.	2024	CRU, DECC	GNI, ESB, Oil Suppliers	Regulations in Baden-Wurtemberg require utilities (such as gas utilities) and those providing maintenance for heating systems to share their data for energy planning purposes. This law has priority over GDPR. This will enable higher quality heat planning which will be a requirement under the new EED. A similar law also exists in neighbouring province of Hessen - https://www.rv.hessenrecht.hessen.de/bshe/document/jlr-EnGHE2012V2P13 https://www.lea-hessen.de/kommunen/kommunal-waerme-planen/
Introduce more ambitious Renewable Heat Obligation (RHO) for fossil fuel suppliers and ensure DH infrastructure (using high shares of renewable or waste heat) is eligible to earn credits under any proposed RHO. This could also be a framework which Heat Purchase Agreements could use to increase investment in low-carbon heating solutions.	2023	DECC		Further thoughts from Codema on the proposed RHO can be found here - https://www.gov.ie/pdf/?file=https://assets.gov.ie/204794/50fbf420-af6f-4b9e-9a79-2c84209820ad.pdf#page=null This RHO could also act as a framework under which Virtual Heat Purchase Agreements (where a broader set of companies could pay for heat credits) could be facilitated to allow for greater private financing of low-carbon heat solutions.

Assign areas for district heating and cooling (based on viability mapping e.g. from H/C Plan and stakeholder engagement) where large public buildings would be required to connect to DH and other buildings would need to provide proof of why it might not be viable to connect ot DHC as their low-carbon heat supply - Futureproof for connection, link to availability of grants for different technologies to ensure cost parity for customers.	2024	DECC	Codema, DCC, SEAI, IrDEA	Codema's research comparing DH zoning approaches in Scotland, England and Denmark is available upon request and is due to be published on the Codema website in 2023 Dublin City Council have also introduced similar elements in the latest City Development Plan which requires developments of 30 dwellings or 1,000m2 of commercial floor space to produce and energy statement and future-proof for DH connections where feasible. Can also take learnings from the implementation of the UKs 28 DH zoning pilot areas.
Ensure areas identified as suitable for DH (through the energy planning process) are highlighted and supported in Local Development Plans in accordance with regional policy objectives set out in the regional policy objectives from the EMRA	Underway	DLAs	Codema, OPR, EMRA	National and regional suitability maps already exist such as the Codema DH viability and heat source maps https://codema-dev.github.io/posts/, the IrDEA Heat Atlas https://districtenergy.ie/heat-atlas/ , and the SEAI DH candidate area map https://gis.seai.ie/districtheating/
Initiate a DH zoning pilot in the Dublin area to learn by doing. Can also take learnings from 28 UK pilot zoning schemes.	Underway	DCC	Codema	As part of the Decarb City Pipes project a policy experiment on zoning for DH was considered. Some of the learnings from this process are now incorporated in the City Development where new larger developments across the city are required to consider DH as a heating solution and future proof for DH where this is feasible.
Develop a national stance on green hydrogen that outlines this should only be used for hard-to-abate uses where lower cost low-carbon alternatives do not already exist such as use a feedstock for industry, aviation etc.	2023	DECC		Green Hydrogen should be used for high-exergy applications or as a feed stock for industry where other sustainable alternatives do not exist. Therefore, it is not foreseen that green hydrogen will play a role in the provision of space heating or hot water preparation. Further thoughts on this can be found in Codema submission to Ireland Hydrogen Strategy Consultation - https://www.codema.ie/images/uploads/docs/Codema_Submission_on_Hydrogen_Strategy_Consultation.pdf

Lower taxes on electricity used for supplying low-carbon renewable and waste heat	2024	DECC		The large differential between electricity and gas prices can be an impediment to the adoption of technologies such as heat pumps. Information on the current "Spark Gap", in countries across Europe can be found in Section 3.3 this report by the IEA HPT TCP Annex 48 - https://heatpumpingtechnologies.org/publications/final-report-annex-48-industrial-heat-pumps-second-phase/ Fairer levies on electricity can help reduce this gap and make heat pump more cost competitive. This report by the Regulatory Assistance Project "Levelling the Playing Field " report https://www.raponline.org/wp-content/uploads/2022/07/Taxes-and-levies-final-2022-july-18.pdf
Review level of consensus and legal requirements to allow buildings with multiple privately-owned dwellings to deliver whole-building heat solutions or connect to DH networks	2024	DECC/Dept of Justice/ DHLGH		In some European countries, only a majority (more than 50%) consensus of tenants is required to adopt a new whole-building heat solution and in others this % is much higher. Need to better understand the thresholds required in Ireland and review if these are found to be prohibitively high thresholds.
Review the heat loss threshold required to secure grants for heat pumps - look at potential for increasing the allowable heat loss index to allow more homes to be eligible for support but without exceeding limits that would result in poor heat pump performance. It should also be allowed that measured heat loss figures from a heat loss survey of the building be used to prove the buildings heat loss for grant eligibility purposes.	2024	SEAI		Further study needs to be done on determining a suitable heat loss indicator for heat pump adoption. This refined HLI threshold should also be related to the type of emitters used in the building and the associated flow temperature in these emitters. DEAP is not a robust means of calculating real world heat loss. This is due to a number of factors, such as models not capturing the as-built details of the building due to data gaps (undocumented changes to the building etc.). Having a grant system that is based on this logic is similarly not robust and could lead to unnecessary and expensive retrofitting works being carried without a real need. To this end, real world measurement of heat loss should be an acceptable alternative to the HLI calculated through the DEAP software. This type of heat loss measurement is carried out by companies such Veritherm https://veritherm.co.uk/testing/

Ensure customers are protected. Particularly ensure that residential customer currently on gas-based communal schemes are not subject to commercial gas price increases as these systems are often confused with Efficient DH networks	2023	CRU	EPA on licencing?	The Heat Trust (https://www.heattrust.org/the-scheme) is a voluntary regulatory standard for DH in the UK and is not being subsumed into Ofgem (the utility regulator in the UK) the learning from this process could inform similar development of the heat network regulatory process in Ireland. The regulator may also act as the licencing agency for developing and operating heat networks in the country.
Require local authorities which have 45,000 inhabitant or more to produce heat plans in line with the latest EU Energy Efficiency Directive.	2024	DECC		Final threshold is to be determined as part of the EU trialogue by end of Q2 2030 and is likely to be between 35,000 and 50,000. IN either case this would make heat planning a requirement for at least 30 of the 31 local authorities in the country (Leitrim being to only exception).
Phase-down plan for gas networks which are currently used to provide space heating and hot water. This shall include specific closure deadlines for fossil fuel infrastructure for specific geographical locations e.g. gas boilers will be banned in 5 years and gas network will be turned off 10 years after DH starts to be developed in a given zone.	2024	GNI	CRU, DECC	Winterthur law example where a shut of date for gas to flow through the gas network has been set for 2032 and gas boilers have been banned as of 2020 - https://www.zh.ch/de/politik-staat/gesetze-beschluesse/gesetzessammlung/zhlex-ls/erlass-730_1-1983_06_19-1986_07_01-118.html?search=energiegesetz ACER report on Future Regulation of Natural Gas Networks https://www.acer.europa.eu/sites/default/files/documents/Media/News/Documents/Future%20Regulation%20of%20Natural%20Gas%20Networks%20-%20Final%20Report%20DNV.pdf The Future of Gas (EASAC) https://easac.eu/fileadmin/user_upload/EASAC_Future_of_Gas_Web.pdf
Ensure that remaining gas customers are protected from gas network capacity charge increases when the gas infrastructure is being phased down until they get to transition to low carbon technologies.	2026	CRU	GNI, DECC	Gas phase down should be coordinated with the introduction of alternative heating technologies. This could be one of the roles of the Integrated Heat Planning Team discussed under the "Governance Structures and Authority" actions.

TABLE 10: RESOURCES ACTIONS

Action	Completion Date	Lead	Support	Supporting Information
Establish a dedicated fund at the required scale for the delivery of DH networks.	2023	DECC/ DH Programme Office	DPER, NTMA, Delivery Unit	The long-term source of funding for this could come from carbon tax funds, the proposed renewable obligation, or other sources. Aside from delivering networks this will also provide a market signal to attract private sector involvement and spark investment in training. Current funding methods such as the CAF have limits which can curtail the development of larger networks.
Resource a DH delivery unit to support the roll out of DH networks - support (technical, financial, legal) to local authorities, community groups or other organisations looking to develop networks	2023	DECC	SEAI, Codema	
Provide resources to allow public sector organisations (LAs, CRU, DECC, etc.) to hire dedicated full-time staff to facilitate the roll-out of DH (e.g. heat planners, project coordinators, regulator, licencing, etc.)	Ongoing	DECC/ Delivery Unit	Relevant public sector organisations	It is important that these staff members have heat decarbonisation as a key element of their role and that this is supported at all levels of management. The report developed by Energy Cities on the Human Capacity in Local Governments: The Bottleneck of the Transition provides indicative numbers for Local Authorities as well as innovative ideas on how to attract talent and foster peer-to-peer learning between Local Authorities https://energy-cities.eu/wp-content/uploads/2022/05/EnergyCities21_PolicyPaper_CapacityNeeds_EN_FINAL-2.pdf
Produce a private investor pack for DH to provide background information on the investment opportunity for Dh in Dublin -	2024	Codema	DH Investors	This short document could include information on supporting policy and targets, example returns, source of other part-funding, risk & mitigation. The findings from the Dublin H/C Plan can help inform this piece of work. The UK Heat Networks Overview brochure provides a good example of a clear and engaging format for such a document https://heatnetwork.zone/documents/BEIS_Heat%20Networks_The_UK%20market.pdf

Develop a national level insurance scheme to underwrite some of the risks associated with waste heat use which are not naturally the responsibility of the waste heat owner or the DH company.	2024	DECC	DPER	An example of such a situation would be if waste heat owner goes out of business. This may be too big a burden for smaller DH companies to shoulder and therefore be a barrier to development of a project. Similar schemes exist in relation to de-risking drilling geothermal projects in the Netherlands. - https://www.rvo.nl/sites/default/files/2020/04/Handleiding-risicos-dekken-voor-aardwarmte-2020.pdf
Ensure that building owners are supported through grants to install heat substations in their building in the same way that heat pumps are supported.	2024	SEAI		

TABLE 11: KNOWLEDGE & SKILLS ACTIONS

Action	Completion Date	Lead	Support	Supporting Information
Engage with educational institutions and existing private sector organisations (ESCo, consultancies, etc.) to deliver training and certification to build indigenous capacity to deliver the heat networks required in areas such as DH pipe installation, heat pump system design, etc.	Ongoing	Codema	SEAI, Engineers Ireland, 3rd Level Institutions, ETB, FETAC, HETAC, DFHERIS, QQI	Engagement with local Education and Training Boards, Manufacturers, Technical Universities, and Professional bodies such as Engineers Ireland has already begun to help deliver local skilled workers to facilitate the roll out of DH. Further engagement is required to deliver formal training in areas where skills are currently lacking. The skills gaps for DH in Ireland are expected to be similar to those in other countries where DH currently has a lower market penetration like the UK. The following documents outline some of these skill shortages. Heat Networks Skills Analysis for Scotland - https://energysavingtrust.org.uk/wp-content/uploads/2020/10/Heat-Network-Skills-Analysis-for-Scotland.pdf Energy Savings Trust Skills Initiative Report - https://energysavingtrust.org.uk/wp-content/uploads/2020/10/Heat-Network-Skills-Initiative-PDF-1.pdf BEIS Heat Network Skills Review 2020 - https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/919521/heat-network-skills-review.pdf Initial steps have been taken by Codema to introduce the area of DH

				to relevant bodies with the development of the "Fundamental of District Heating" course which Codema delivers on behalf of Engineers Ireland which draws on the experience of Codema in developing heat networks in Ireland - https://www.engineersireland.ie/Events/event/7887
Develop an online platform where highly skilled designers and installers can share their knowledge and provide ongoing support for those encountering challenges on the ground as they arise	2025	DH Delivery Unit	IrDEA	This can provide additional support when real world situations are encountered that cannot easily be accounted for in more formal training courses.
Raise awareness and provide additional training for those workers with complimentary skills currently working in the fossil fuel industry or other related industries such as facility management & ESCo's to enable them to work on the development, operation and maintenance of DH networks.	2024	DH Delivery Unit	Codema, IrDEA, SEAI	
Provide financing to small businesses looking to upskill workers to install less familiar low-carbon installations (heat pumps, DH pipework & substations, lower temp secondary heating systems and controls). This would allow workers to upskill without significant drop off in earnings and without putting the financial burden of attending the training and the initial lower productivity on the small business owner when learning a new skillset. This is important in a highly competitive labour market. Alternatively, this could be delivered by means of a tax credit for workers who are upskilling.	2024	DH Programme Office/DECC/DPER/DFHERIS/SEAI/DH Delivery Unit		This would look to soften to impact of potentially lower earning potential when someone transitions to a new sector and initially has a period of lower productivity due to being less familiar.

Hold heat planning workshops to upskill planners, etc. in the area of heat planning to ensure high level of quality for such plans for each LA area - Share tolls re heat sources available etc.	Ongoing	Codema	DLAs	Codema heat & energy planning workshops and other European workshops such as Hotmaps, Act!on Heat etc. This will become more important as the requirement for Municipalities (of greater than 45,000 inhabitants) to carry out heat planning under the proposed EU Energy Efficiency Directive. This would cover all but one municipality in Ireland.
Develop a guide for developing feasibility studies for DH projects including supporting tools and templates in order to develop a pipeline to investment decision stage. This will include standardised installation cost information, carbon pricing, etc.	2023	Codema /SEAI	Relevant Stakeholder groups	Codema are currently deploying this guidance on behalf of SEAI and in conjunction with key stakeholder groups - further information on this can be found by contacting Codema or visiting the project page on the Codema projects page - https://www.codema.ie/projects
Wider dissemination of key design principles and highlight standardised efficient designs for M&E installation in buildings (DH connections, heat pumps, etc.)	2024	IrDEA/ Codema		The overarching design principles are currently discussed in the Fundamentals of District Heating course - https://www.engineersireland.ie/Events/event/7887 (currently delivered by Codema on behalf of Engineers Ireland and with discussions to deliver similar content in conjunction with local ETBs) and in CIBSE CP1 Training course. https://www.cibse.org/training/search-courses/heat-networks-code-of-practice-cp1-full-course Other useful guidance include the BEIS Het Network optimisation videos (covers topics such as managing water flows, water quality, flow and return temperatures, complexity, insulation and plant room efficiency) https://www.gov.uk/government/publications/heat-networks-optimisation-guidance-to-help-operators-improve-performance/heat-network-optimisation-guidance-videos , Bristol & Plymouth Guides for Technical Designers of Heat Network connections https://www.plymouth.gov.uk/sites/default/files/ConnectingToThePlymouthHeatNetworkPart2.pdf. Tools like Hysopt can also be used to optimise hydronic system designs and controls for specific systems.
Networks that are being developed should be contractually obliged to make time (a defined	2023	DH Delivery Unit	IrDEA	

number days) available to local tradespeople etc. to learn by seeing in order to help build local capacity for delivering networks and help those transitioning to gain familiarity with DH procedures				
A minimum requirement in terms of local workers should be considered to stimulate the local supply chain and create local wealth where possible.	2026			
Incentivise contractors from the EU to come to Ireland to share knowledge. This can be supported through the development of ambitious targets & Investor/contractor information sharing and engaging with Embassies or directly with multinational companies.	2023	DECC/ IrDEA	Euroheat & Power, IDA, Embassies, International ESCo's & contractors	
Use output led approach to the procurement of DH projects in order to leverage knowledge and experience from external organisations	Ongoing	DH Developers	Codema	This approach was used for the Tallaght DH network and can help engage/leverage international experience to a greater degree. Further details on this approach are available from Codema (email: codema@codema.ie)
Support new DH regulator by supplying specialist DH knowledge and experience to ensure safe, affordable and reliable heat supply.	Ongoing	District heating steering group/ IrDEA		This is key to ensuring high quality of service and building confidence with potential heat customers
Government grant to be made available for those looking to complete registered courses relevant to building capacity in the DH sector	2024	DFHERIS	DPER	UK example - Training providers: register to offer the Heat Training Grant for heat networks - https://www.gov.uk/government/publications/training-providers-how-to-offer-the-heat-training-grant-for-heat-networks
Ensure best practice examples or projects and approaches from around Europe are shared with Irish stakeholders through sharing reports and holding knowledge sharing sessions - Decarb, Celsius, DBDH, EH&P, IEA TCP, etc.	Ongoing	Codema /SEAI/ DH Delivery Unit	DH Developers	An example of this is the HeatNet NWE project which looked to promote the development of 4th Generation DH in 6 countries across north-west Europe. The resources developed as part of this project can be found on the following online platform - https://guidetodistrictheating.eu/ Other useful platforms include the Celsius Toolbox

				https://celsiuscity.eu/category/toolbox/

TABLE 12: TECHNOLOGY-SPECIFIC ACTIONS

Action	Completion Date	Lead	Support	Supporting Information
Heat recovery equipment for the capture of waste heat to be eligible for support under the SSRH or similar support scheme such as CAF	2023	SEAI, DECC		
Consider inclusion of the recommendations outlined in the "From Data Centres to District Heating & Cooling: Boosting waste heat recovery to support decarbonisation" paper at a national level	2023	DECC	Codema/ EH&P	A link to this paper produced by Euroheat & Power with input from Codema and other representatives from both the DH and data centre industries is available here https://www.codema.ie/media/news/codema-supports-new-recommendation-paper-from-data-centres-to-district-heat
Support the development of deep geothermal heat source to provide indigenous, renewable and secure heat supply for DH and industrial applications. This can be done through provision of funding for exploration/research (e.g. seismic surveys & exploratory boreholes) to better quantify the resource and ensure this information is available for DH project development.	2023	DECC/ GSI/DPER	Codema/ SEAI	

TABLE 13: MINDSET, AWARENESS & ENGAGEMENT ACTIONS

Action	Completion Date	Lead	Support	Supporting Information
Effectively communicate the details of how to apply for funding under the proposed heat network fund described above.	2023	DECC/ DH delivery unit	IrDEA members	

Develop material to highlight pathways for those currently working to fossil fuel industry (many of whom have complimentary skills - pipe installs, metering & billing, asset management, etc.) to transition into DH	2024	Codema	GNI, GSI, etc.	Those who work in the fossil fuel industry may have concerns about the future of their industry and the impact it is having on emissions and the resulting climate change. These people possess many transferrable skills that can be utilised to build capacity within the low-carbon sector. However, pathways for transitioning people from the fossil fuel to the green sector are not well known or communicated.
Raise awareness of Thermal Energy Storage for providing services to the electricity grid in the form of grid balancing/demand flexibility, frequency response, etc.	2024	Codema	Energy Storage Ireland, ESB, Eirgrid, CRU, NNLC	Codema electricity storage consultation submission (Jan 2023) - https://www.codema.ie/images/uploads/docs/Codema_Submission_on_Developing_an_Electricity_Storage_Policy_Framework_for_Ireland_-_Final.pdf Further study has also been carried out by Codema into the potential contribution of thermal storage to delivering a more resilient Irish energy system as part of the Poolbeg RDD Project. This study focused on curtailment mitigation of renewable electricity generators such as offshore wind and found that thermal storage can provide energy storage at approx. 1% of the cost of battery storage and requiring less than 10% of the land. Further details on this project can be found here - https://www.codema.ie/projects/local-projects/integration-of-heat-electricity-and-transport-use-of-curtailed-renewable-en EU Commission Recommendation Paper on Energy Storage states that "in particular large thermal storage in district heating systems, can provide flexibility and balancing services to the electricity grid and therefore provides a cost-saving system integration solution by absorbing variable renewable electricity production (e.g. wind and solar energy)". - https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023H0320(01)

Early engagement with the public to raise awareness of heat networks - will help avoid misinformation, highlight the comparative benefits of DH, liaise with waste heat owners (industrial sites etc.) - share case studies, publish prices with a comparison with alternatives, host tours of DH networks, facilitate sessions with other regions in Europe to share knowledge	2023	DECC	IrDEA, SEAI, Codema	Ongoing engagement in European project and forums is hugely important for knowledge sharing. The Decarb City Pipes project itself is a great example of this. This also helps promote best practice as outlined in the "Knowledge & Skills" actions.
Conduct a citizen engagement survey in relation to district heating. This will help gauge likely connection rates and key concerns of potential customers to ensure these are addressed.	2023	ESRI/ Codema /SEAI		See example from Communication Works "Winning the Hearts and Minds" report - https://communicationworks.eu/eng/wp-content/uploads/sites/2/2017/08/UK_District_Heating_Communication_Works_2017-1.pdf
Maintain an online map of both existing and planned heat networks including contact details of person/organisation responsible for each network's expansion (a link to this information should be provided in any DEAP or NEAP software)	2024	Codema		Cities like London already have a map of both planned and existing heat networks along with heat sources https://maps.london.gov.uk/heatmap Dublin has heat source https://codema-dev.github.io/map/heat-source-map/ and DH viability maps https://codema-dev.github.io/map/district-heating-viability-map-v2/ but as networks are rolled out it is important that the existing and proposed networks are also mapped so potential customers/stakeholders can see if they have a network nearby
Investigate the potential for certifying sites as a waste heat supplier to support corporate social responsibility objectives or comply with waste heat utilisation policy. Site provide data on waste resource and make their heat available for DH when developed.	2024	DH Delivery Unit / DECC	Local Authorities	Such a certification scheme could be a waste heat version of something like Origin Green (used in the food industry). As part of this WH owners would provide data to help characterise their resource and sign a MoU to make this heat available if a DH network were to be developed in the area. This scheme could also act as eligibility criteria for LAs to reduce rates for companies which sign up to this initiative. As part of the EED Data Centres of 100kW or more will be required (March 2024) to publish the proportion of their waste heat being utilised. Could this be expanded to other waste heat owners such as waste water treatment plants etc.

Develop tool to identify likely suitable business model for DLAs and other organisation who may be interested in developing DH networks	2023	Codema	DLAs	A methodology for assessing this is being explored as part of the District Heating Feasibility Study Guide being developed by Codema on behalf of SEAI
Develop a best practice guide for customer service in heat networks including minimum customer protection standards.	2025	CRU	DH Companies, Other utilities	This could include discussion on items like: Complaints department structuring (assigned rep who contacts the various depts on behalf of customer rather than customer being kept on hold), rewards & incentives for desirable customer behaviour and/or engagement, etc.
DH networks that are developed should host regular tours of their installations to act as demo sites for customers, policy makers etc. to have real life sites to visit	2023	DH developers	DH Programme Office, Dh Delivery Unit, Codema, HeatWorks, IrDEA, SEAI	Rewards & incentives for good customer behaviour e.g. sets up direct debit, turns down thermostat (could gamify against neighbours)
Engage with Sustainable Energy Communities and local business organisations to raise awareness about DH potential in their area & how to progress potential community projects	2023	Codema	SEAI, LA	Directly asking customer what they would like to see e.g. various future heat source options - pay more for certain tech but might have more price security etc.
Publish heat prices publicly with comparisons to alternative heating solutions to help with potential misunderstandings on the difference between heat price and fuel price.	2024	CRU	DH developers	Heat Trust comparison tool https://www.heattrust.org/heat-cost-comparator Published Danish heat prices - https://forsyningstilsynet.dk/tal-fakta/priser/varmepriser The Tallaght DH network will also be publicly publishing its heat price to improve transparency, engagement and trust. These prices will be published in the HeatWorks website https://heatworks.ie/
For rental properties where split incentives between landlords and tenants are an issue. Rental prices inclusive of estimated heating costs from the building BER/EPC should be required to be published when advertising the premises for rent.	2024	DHLGH	SEAI	SEAI behavioural insights unit report on behavioural barriers to retrofitting - https://www.seai.ie/news-and-media/behavioural-barriers-to-r/

Map and facilitate stakeholder (supply and demand side) engagement and particularly engagement with local authorities to test approaches, gather feedback and refine outputs at a more local level.	Ongoing	Codema, Delivery Unit		GIS maps produced for Tallaght and Blanchardstown. Certain data available from Codema upon request.

TABLE 14: GOVERNANCE STRUCTURES & AUTHORITY ACTIONS

Action	Completion Date	Lead	Support	Supporting Information
Set up a national delivery unit which will be responsible for providing technical and financial support to those looking to develop networks and ensure high standards of design, installation, feasibility etc.	2023	DECC		Thoughts on what such a unit could look like including key roles and responsibilities are available from Codema & SEAI
Create an integrated heat planning team for the heat transition including all relevant utilities (gas, electric, DH).	2023	Codema	Decarb City Pipes LWG	This will also help with ensuring roll-out of low-carbon heating and the phase down of fossil fuel infrastructure is aligned i.e. low-carbon commissioned before FF supply is turned off. This should also help with the flow of data and knowledge and help avoid each utility thinking in their own silo and potentially missing integration opportunities and cost-efficient solutions that come from holistic planning. This may also allow the process of securing an electricity grid connection for heat pumps and electrode boilers to be more streamlined which is currently one of the biggest risks for delays. This could be a potential ongoing role for the LWG (perhaps in conjunction with the Zero Together team. Trench sharing and coordination of installation works can also be optimised as part of an expanded group which could include highways teams, broadband installers etc. as well as the ability to make strategic decisions on technology pathways such as biomethane or the role (if any) for existing gas network infrastructure. An effective structure is already in place in cities like Vienna. Greater detail on this structure is available from Codema.

Need to implement a system of measurement and verification to track targets and contribution to CO_2 emission reductions.	2024	DH Delivery Unit	DH developers	Where the ongoing operation of the network is being carried out by private ESCo's this sharing of data should be included as a requirement at contract/procurement stage

TABLE 15: LEGAL & ENVIRONMENTAL ACTIONS

Action	Completion Date	Lead	Support	Supporting Information
Develop template contracts to reduce the legal burden of developing contracts for DH projects from scratch	Ongoing	Codema	SEAI, Philip Lee	An Irish DH contract template has been developed by Philip Lee solicitors in conjunction with Codema and SDCC based on the contracts developed as part of the Tallaght DH network Examples from other jurisdictions include the SOMS templates (UK) https://tp-heatnetworks.org/heat-contract-templates/ Examples from the R-ACES project https://r-aces.eu/tools/legal-decision-support-tool/
Provide guidance on developing contracts for DH networks need to include important performance criteria such as the carbon content of the heat produced and the level of service provided to customers (e.g. limit the number and duration of outages)	2024	DH Delivery Unit	CRU	
Develop mechanisms through which 3rd parties can provide renewable or waste heat to the DH networks	2027	DH Delivery Unit	CRU	
Consider the potential to take advantage of economies of scale by performing an Environmental Assessment and Appropriate Assessment for all areas identified as suitable for DH if required	2024	DHLGH, EPA	SEAI	

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