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Preface

This project has been funded by the Swedish Energy Agency. We want to give a warm THANK YOU **to all who participated** in the events and also all those who made them possible to conduct:

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Sheffield and Lund, 29 September 2021

Aimee Ambrose and Jenny Palm (project leaders)

Innehållsförteckning

Sammanfattning

Omställningen till ett koldioxidsnålt samhälle kräver delaktighet från många olika aktörer, inte minst medborgarna. Det vardagliga engagemanget och de ofta oreflekterade aktiviteterna i hemmet är betydelsefulla för en omställning. Uppvärmning och varmvatten svarar för en betydande del av hemmens energianvändning och trots det så är användningen osynliggjord. Energisystemen är i hemmen så pass osynliga att det är svårt att koppla ihop energianvändningen med de aktiviteter vi gör i vardagen. Denna osynlighet har varit projektets startpunkt.

I projektet har vi utvecklat och använt metoden "Walking with Energy" (WWE) som ett verktyg för att skapa en engagerad diskussion om vardagens värmesystem och koppla det till den pågående debatten om behovet av en klimatneutral uppvärmning. WWE metoden bygger på deltagande aktionsforskning, där forskare och deltagare promenerar längs med ett fjärrvärmesystem eller går igenom en värmeproduktionsanläggning och pratar energi. På grund av Covid-19-pandemin justerades metoden under projektets gång och vandringarna förvandlades till virtuella evenemang där deltagarna deltog i ett webbinarium där en film visades av hur värme producerades, vilket följdes av diskussioner med deltagarna.

Resultaten från de tolv promenader som genomförts visar att det finns ett stort intresse från en rad olika medborgare att lära sig mer om värmesystemens funktion och användning och att många vill bli en del av den allmänna debatten om dess miljöpåverkan. En majoritet av deltagarna har varit relativt välutbildade, med ett intresse för miljön, men vi har under projektets gång aktivt kontaktat olika grupperingar och i slutändan fick vi en blandning av deltagare.

I projektet såg vi att det finns en stor vilja att delta i debatter om hur vi genererar energi idag och i framtiden, vilket går emot föreställningen att detta är ett ämne med lågt allmänintresse. Alla våra promenader resulterade också i lärande av någon form, där deltagarna frikostigt delade med sig av erfarenheter och åsikter. WWE är dock en resurskrävande metod som kräver personal och tid. Det tar tid och resurser att identifiera lämpliga evenemang att delta i, marknadsföra promenaderna och även att genomföra en promenad. Det har varit många forskare, NGOs, paneldeltagare och fjärrvärmebolag involverade för att genomföra eventen. Deras obetalda engagemang har varit en förutsättning för projektet och ett ovärderligt stöd.

Promenaderna har givit deltagarna en möjlighet att bli aktiva och medvetna om värmeproduktion och värmeanvändning och hur en omställning av systemen kan se ut. Detta är också det projektet har kunnat ”ge tillbaka” till både deltagarna och de som hjälpt oss organisera eventen.

Vår huvudsakliga slutsats från projektet är att ett aktivt energimedborgarskap inte bara kräver aktiva medborgare, utan också aktivt faciliterande, där mötesplatser och arenor skapas för att ge medborgarna möjlighet att engagera sig och reflektera över hållbara värmesystem.

Summary

The transition to a low-carbon future requiring the enrolment of a wide range of different actors. The engagement and actions of citizens is critical and domestic energy use is of particular concern. Space and water heating in buildings in Sweden accounts for two thirds of the total energy consumption in the residential sector. Yet, our relationship with our own domestic energy consumption suffers from 'double invisibility' - it can no longer be seen nor connected to everyday actions. This invisibility has been in focus for this project.

This report presents the methodology, 'Walking with Energy' (WWE), that has been used and developed in the project as a tool to help reconnect citizens with the heating system and to (re)engage them with key debates surrounding decarbonisation and heating. The method is an act of research participation where the researcher is walking alongside a heating system or in a production plant and talking about energy with the facilitator and other participants. Due to the Covid-19 pandemic, the method was adjusted and the walks were turned into virtual events where the participants attended a webinar showing how heat was produced and took part in online discussions.

We find through the twelve events offered that there is significant appetite across a range of lay audiences to learn more about how heat and power are generated and the surrounding debates. A majority of the participants have been relatively educated, with an interest in the environment, but we have during the projects actively approached different groups and in the end we got a mix of people involved. We identified significant willingness to engage with debates about how we generate energy now and in the future- a topic that many assume there is no public interest in. All our walks resulted in social learning practice, where the discussions encouraged the sharing of personal experiences, storytelling, and lessons learned. WWE is a methodology with a focus on research participation and it needs a lot of resources to identify suitable events to participate in, promote the walks and also to conduct a walk. There have been many researchers, NGOs, panelists and heating plants operators to guide and run the walks. The project has been dependent on many actors unpaid contributions, and we are grateful for all the support we have got.

The walks have contributed to empowering individuals to become active and aware of heating production and consumption at a time of transition. This is also the 'pay-back' to the participants and our co-organisers from the project.

A main conclusion from the project is that active energy citizenship requires not only active citizens, but also active facilitation that gives citizens the opportunities to engage and reflect about their heating experiences.

Introduction

Cities face challenges to rapidly decarbonise requiring the enrolment of a wide range of different actors. The engagement and actions of citizens is critical in this respect, with domestic energy use an increasingly urgent priority. Heat is a particular concern in this context as space and water heating in buildings in Sweden accounts for two thirds of the total energy consumption in the residential sector (IEA, 2019). Yet, our relationship with our own domestic energy consumption has been said to suffer from a so-called 'double invisibility' - in so far as it can no longer be seen nor connected to everyday actions (Burgess and Nye, 2008, Hargreaves et al, 2013). This invisibility distances us from our consumption and the consequences of our actions in this regard. This represents a particular problem in the context of the increasingly urgent pressure on urban citizens to make more conscientious decisions about our resource consumption. Some resources are a very tangible part of our everyday lives, such as water, paper or petrol, for example and whilst it may not always follow that we are better at reducing our consumption in relation to these more visible resources, visibility does help us to connect our instinctive everyday actions to their resource implications. Heat on the other hand is, since the advent of district and central heating, almost entirely invisible with the exception of the interface that we use to control it.

Existing research provides evidence regarding our lost connection with energy. For example, research by Sherriff et al (2019) undertaken in Australia revealed how citizens have lost touch with simple, low energy practices for managing the effects of extreme temperatures. For example, where in the past residents would have opened the windows, slept on the lawn, painted roofs white etc. to cope with the heat; they now relied on air conditioning to keep them cool and struggled when it was unavailable. These studies disclose that we demand heat and cool as we need it with little or no consideration for the resource implications and with little or no awareness of how it is being generated and the associated ethical, environmental and economic implications. It could be argued that energy (and heat in particular) is even more invisible in Sweden because it is affordable, whereas in the UK, there is widespread fuel poverty due to a combination of low incomes, high energy prices and the poor energy performance of buildings.

This report presents the methodology, results and reflections from a project where an emerging method, 'Walking with Energy' (WWE), has been used as a tool to help reconnect citizens with the heating system and to (re)engage them with key debates surrounding decarbonisation and heating (Ambrose, 2020). The method is a novel act of research participation where the researcher is walking alongside a heating system or in a production plant and talking about energy with the facilitator and other participants. Using case studies of energy from waste (burning refuse to generate heat to distribute through district heating networks and electricity) and later nuclear power, the WWE method educates the public about the realities of urban energy generation and the consequences of their consumption by bringing them face to face with energy generation processes, sometimes for the first time in their lives. Due to the Covid-19 pandemic, the

method was adjusted and the walks were turned into virtual events where the participants attended a webinar showing how heat was produced and took part in online discussions.

In this report we will present the results from both energy walks undertaken in person before Covid-19 and the results from the virtual energy walks conducted during the pandemic and compare the potential of WWE in person and virtually. This report also outlines the findings from two sub strands of the project which focused respectively on:

- exploring the extent to which existing decision making and management processes around heat infrastructure and generation allow for citizen participation and engagement.
- better understanding our changing relationship with domestic heat sources and the emergence of energy invisibility through a series of oral history interviews in Sweden and the UK.

Methodology

Introduction

The method underpinning WWE was inspired by the case for deeper and more meaningful citizen involvement in energy related decisions, the concepts of 'social learning' (exchanging ideas in a group setting) (Bull, Petts and Evans, 2008) and the appeal made by Wilhite and Wallenborn (2013) for a greater level of embodiment, experimentation and risk taking in our quest to develop more effective energy policy. The project methodology is influenced by walking interviews, the importance of embedding research in the landscape and the application of these ideas in an energy context by Castan Broto (2019). It also takes account of the value of oral history approaches in helping us to understand individual experiences of energy transitions and how these have impacted on our contemporary relationship with energy.

Taking account of these influences, WWE offers a new research methodology that is social (offers opportunities for social learning), embedded (in the landscape in question), embodied (engages body and mind) and that is sensitive to the past. The resultant approach was tested through a pilot study which sought to better understand how our relationship with energy has evolved to become so distant and assess whether acts of research participation can promote a greater level of interest in and engagement with energy policy amongst 'ordinary' citizens by enabling immersive first-hand encounters with energy generation.

As noted in the introduction, it was necessary to adapt the project significantly to enable it to continue following the onset of the pandemic. This affected our methodology significantly. We have therefore divided this section of the report into two sub sections, one focussing on pre-pandemic in person events and the other on online events.

In person events (pre-Covid)

We originally proposed to run ten in person events in Sweden and the UK, aiming to engage 100 people in total over the course of the project. From August 2019 to February 2020, the project largely followed its intended path and methodology, which involved organising in person walking tours which took in the hinterland of power stations producing heat (mostly energy from waste facilities) and culminated in a tour of the power station to view and understand the heat source, or a variation of this format. Some events adopted a different format in order to accommodate the needs of different audiences- see the accounts of each event below for further details.

In order to monitor who participated in the project (in terms of demographics and views on environmental issues), a short survey was issued to all participants. The survey also sought to establish how participation impacted on them (i.e. did they learn anything new, did their views change, did it help them to engage with debates about energy from waste and energy policy more broadly, were there any signs of increased environmental citizenship). This was assessed using a post participation survey that contained a series of open questions which participants could answer in free text. Records of discussions between participants and

researchers will also contribute to evidence around impacts. The pre and post participation survey also linked to an experimental visual survey known as an Implicit Association Test (IAT). An IAT is a cognitive test to quantify implicit attitudes towards environmental issues, levels of environmental citizenship and how project participation impacts on these. In practice, it involves participants being asked to use their keyboard to react (without any consideration at all) to images of clean and dirty energy sources. This helps us to understand participants implicit attitudes towards energy issues and associated environmental issues and by repeating the test after the event, it's possible to see if any change has occurred.

During this relatively short period, we successfully organised seven in person events (five in Sweden and two in the UK), linking into larger public engagement programmes wherever possible (i.e. Future Week, hosted by Lund University and the UK's Festival of Social Science (FoSS)) to maximise publicity and attendance. The seven events can be regarded as broadly successful in terms of the project aims to engage a diversity of ordinary citizens in events to help them better understand where their heat is coming from and raise their awareness of the linked ethical and environmental consequences of different approaches to energy generation. Details of the seven events are provided below:

Event 1- Pilot: Sheffield, UK. This was the first event to trial the WWE methodology in practice and was held as part of the UK's Festival of Social Science- a programme designed to engage the public with social science research on a wide variety of topics. The event involved members of the public who signed up to the event (first come, first served) meeting in a cafe which sits on Sheffield's district heating network for a short presentation about the project and the aims of the event. They were also asked to complete the pilot IAT. We then embarked on a walk which followed the route of 1.5km of the city's district heating pipeline, tracing it to it's source at the Veolia energy from waste plant on the edge of the city centre. As we walked, the walk leader (Aimee Ambrose) pointed out prominent buildings supplied by the district heating network and shared interesting related facts. The event attracted a lot of interest. Participation was capped at 15 due to the health and safety policies in place at the power plant but we had to start a waiting list due to the high level of interest.

Energy from waste facilities are relatively rare and poorly understood in the UK which contributed to the novelty and appeal of the event. After touring the facility and having the chance to ask questions, we held a short focus group with participants to gather their impressions of what they had seen and heard. We asked them to complete a follow up survey and IAT over email. The pilot was considered a success in terms of the level of interest and engagement in it and the impact it appeared to have on participants (as detailed in the Findings section). However, we concluded that participants were expected to complete too many different activities during the event and in response, we sought to streamline the format for future events a bit. The audience for this event were largely white, middle class in terms of income and background but varied in age from 24 to 84. The group was educated with professional or skilled backgrounds. Ideally we

would have liked to attract a more diverse audience but this mix reflects the general audience for FoSS, despite widespread advertising through multiple channels (national and local newspapers, radio, social media, posters and leaflets in public places). The event was filmed for an item on a regional news programme (Look North) about our changing relationship with energy. The philosophy behind the event was also featured as an op ed in a regional newspaper (The Yorkshire Times).

Event 2- Heat exchanger: Lund University, Sweden. One challenge with walking along a district heating pipeline and through a heat generating plant is that you need to have the strength and mobility to participate. A lighter version of the walk was tried out in Sweden during 'the Future week' organised by Lund University in 2019. During this week we organised a walk where the general public were invited to the IIIEE's building, a beautiful old building from 1909, to have a presentation about Lund's district heating system and the building's heat exchanger. The event started with a presentation of the project and the aims of the day's event. After the presentation, the participants were divided into three groups, each having one discussion leader who was a researcher. A group discussion was initiated where we asked the participants to introduce themselves, their living situation, how they heated their home, how they would like to heat their home in future and how they perceived sustainable heating systems. Around 10 minutes into the talks the first group was guided down to the basement where a researcher showed them the heat exchanger and talked through posters detailing the local heating system with its plants and pipes. After the tour of the basement, the group went back to the classroom for a final group discussion to reflect on what they had seen, if they had learnt something new and if their perceptions had changed in any way. The event was marketed through the Future Week organisation which used channels like newspapers, the university's website and social media. The participants needed to register beforehand via the website and the number of participants was limited to 12. We had 10 participants registered for the event, of those eight turned up. There were 3 women and 5 men.

Event 3- Language café: In an attempt to reach a wider audience, we targeted a socio-economically challenged area in the city of Malmö, Sweden, where they actively work with immigrants and their integration into the society. We contacted the municipal area manager who distributed an invitation to citizen representatives in the area. The idea was to meet in a community hall in the area and walk to a very conspicuous gas fired heat production plant within the neighbourhood. The people attending were all part of a language café for immigrants that is located in the same building and included 5 women plus their teacher. The women attending had not fully understood the information about the event and were not willing to walk to the plant. The weather was bad and they did not feel that it was safe enough to do the walk. They were, however, willing to participate in a group interview to discuss the heating system in Sweden and in their country of origin. We lacked a common language, which was a huge barrier. The teacher could not speak the women's language but supported communication in other ways. The mobile phones also became very useful to show what we were talking about, both

from the researcher's and the women's side. All participants were immigrants aiming to learn Swedish and were aged between 20 and 50 years old.

Event 4- Mistra Urban Futures: In autumn 2019, a large international conference (Mistra Urban Futures), which focusses on sustainable transitions, was held in Sheffield. The organisers liked the interactive format of our events and asked us to run a walking tour for the delegates as an optional session. 13 delegates signed up to the event, most of which were officials from municipalities in various African nations who were considering the pros and cons of developing energy from waste facilities in their countries to support the dual aims of waste management and power generation. A smaller number of delegates were from municipalities in Sweden. The event followed the same format as Event 1 but with a different audience and without a focus group at the end to make it shorter. Following the event, Aimee Ambrose was invited to write a blog about it for the Mistra website: Feeling the heat: tracing Sheffield's district energy network to its source | Mistra Urban Futures.

Events 5&6- Oral history workshops with older people at 2 elderly centers in Lund: To reach elderly people that might have difficulty traveling to our events we decided to visit two elderly centers and try out a walk more based on the participants' own history and life experiences. In January 2020 we contacted two different elderly centers in Lund and the managers of these centers contacted the elderly and arranged meetings. In the first center, we visited their afternoon fika, where we presented the project and then divided the attendees into three groups to have focus groups interviews. Three of the attendees could in the end not participate due to impaired hearing. In the other case, we decided to organise individual meetings where we met one or two elderly at a time to avoid the noise problem that occurred when several people gathered in the same room. Both the group and the individual interviews followed the same interview guide where we asked the participant to tell us about how they were heating their homes from their childhood to today and asked them to reflect upon how it has changed over time. In total 15 elderly participated and 12 could be interviewed. It was 3 men and 9 women and they were between 72 and 95 years old.

Event 7 – guided bus tour together with Kraftringen in Lund. In September 2020 we decided to together with Kraftringen in Lund to conduct a walk conducted as a guided bus tour. We invited 30 students at Lund University to participate in a guided tour to four of Kraftringens facilities in Lund. One of the researchers (Åke Thidell) introduced the students to Lund's energy system and participated also during the bus tour. Due to the covid restrictions, only one researcher participated during the event. During the tour four plants Södra Verket, Ångkraftverket, Gunnesboverket and Örtoftaverket were visited. Due to Covid - 19, it was not possible to enter the plants, but staff from Kraftringen was guiding and presented the facilities and how the heat was produced and distributed. The participants could ask questions during the whole tour. The participants did the IAT test before and after the tour.

In the pre-Covid phase of the project we made rapid progress, successfully engaging 84 people over seven events, taking us almost all the way to our target of engaging 100 people over 10 events.

Virtual events (post-Covid)

Following the introduction of restrictions internationally from March 2019, we were forced to abandon a number of in person walks under development. After some consideration, we decided that we would attempt to keep the project running during the pandemic through virtual events. As the world was rapidly adjusting to remote working and energy was on people's minds as energy bills rapidly increased (due to more time spent at the home), the time seemed right to attempt this. We did not know how successful a virtual programme would be but it turned out to be a positive move and enabled us to engage more people with the project than it would ever have been possible to reach through in person events and to expand engagement with the project internationally. However, we are aware that in switching to an online format, we will have favoured those who are digitally included and who are confident enough to participate in a webinar. On the other hand, we have opened the events up to those who would struggle to attend in person events because of their location, caring commitments, time pressures or mobility problems. We have so far run four virtual events and have another scheduled for November 2021, as part of the UK FoSS 2021.

The methodology for the project had to be adapted significantly for a virtual format. We used film to try and emulate the first hand encounter with energy generation offered by the walking tours as closely as we could. We commissioned specialist energy communications charity Act4, based in Paris, to work with us to make a film of an energy generation plant in Sweden, taking in the hinterland of the facility and the process of generating energy from waste, just like the in person events had. A facility operated by SYSAV in Malmo was used as the basis for the film and in light of the restrictions, existing footage supplied by SYSAV was used to create the film, with fresh narration and infographics to ensure alignment to the WWE concept. Some original footage was generated by filming a family living in Copenhagen generating waste and using energy in their home- this was done to emphasise the link between the distant power plant and our everyday lives. The film can be viewed here: https://www.youtube.com/watch?v=I8_i1gU3gRg. In September 2021 the film has been viewed over 18 000 times, which indicate a big interest in having more information about how energy from waste is generated.

Virtual event 1: UK Festival of Social Science, November 2020. The SYSAV film was premiered at the 2020 FoSS. The event was held on Zoom and numbers capped at 50 to help ensure the technology did not fail. In the event, 54 people participated. The event began with a presentation about the aims of the WWE project and an explanation of the methods followed by the showing of the film. After this, a panel of experts with different positions on energy from waste were asked to debate the pros and cons of the approach and its place in our energy

future. The audience could ask questions at each stage and there was a good level of activity in the chat. The panel comprised of an environmental activist and University lecturer (John Grant); a social scientist and circular economy expert (Graeme Sherriff) and a chemical engineer (Anh Phan), therefore providing a socio-technical perspective on this approach to heat and power generation. Participants were asked to complete the IAT before and after the event via an email link.

Virtual event 2: Young Energy Professionals Network, March 2021. We were invited to run a small WWE event for the YEP network which comprises of early career professionals working in UK and international energy companies. The event followed the same format as the previous virtual event, featuring the same experts and was attended by 10 people.

Virtual event 3: Nottingham, UK. April, 2020. This online event was hosted by Nottingham City Council's Carbon Reduction, Energy and Sustainability department and Nottingham Trent University (NTU), a partner in the project. The event followed a similar format to the previous virtual events but with an additional presentation from Wayne Bexton, Director of Carbon Reduction at Nottingham City Council who spoke about how energy from waste and the associated district heating network in the city formed part of the city's net zero carbon strategy. For this event, the panel comprised of a different set of experts including: a sociologist (Jenni Cauvain), the manager of an energy from waste plant (Anthony Greener), Wayne Bexton and Jenny Palm.

17 people attended the event and it attracted a mix of those with a professional interest in the topic, some students from SHU and NTU and in general attracted an older audience than the previous online event. Representatives of local community organisations were also in the audience.

Virtual event 4: The Sustainability week organised by Lund municipality and Lund University in May 2021. The SYSAV film was shown, but instead of turning the sound on and hear the presentation in English, one of the researchers did the presentation but in Swedish. The event was held on Zoom. In the event, 16 people participated. The event began with a presentation about the aims of the WWE project and an explanation of the methods followed by the showing of the film. After this, the audience could ask questions and discuss the film, their positions on energy from waste and debate the pros and cons of the approach and its place in our energy future. Mentimeter was used to ask questions to the audience and the responses were viewed and discussed. Also in this event it was a good level of activity in the chat. Participants were asked to complete the IAT before and after the event via an email link. 16 people attended.

Virtual event 5: the UK Festival of Social Science (planned for November 2021). At this event, to be featured in the programme for FoSS 2021 (the timetable for which is aligned to COP26), we will premiere a second short film to emerge from the project. The film was shot at Ringhals nuclear power station in Sweden and will explain how nuclear energy is produced, summarising the key environmental and ethical debates around nuclear power. This will form the basis for a panel

debate and questions from the audience about the extent to which nuclear energy should be part of our future energy mix in the UK and Sweden.

During the period of the pandemic we have so far directly engaged 97 people across four virtual events.

In total, over the course of the project we have organised eleven events attracting a total of 181 people with a final event planned for November 2021. A further 18,100 people have viewed our film about energy from waste via You Tube. We have therefore exceeded our target of reaching 100 people across ten events, through the project.

Who participated?

Only 50% of those who participated in the events completed the short attribute survey we asked them to, so our understanding of precisely who engaged is more limited than we had hoped and is better for some events than others. The following groups were represented amongst those who participated across the twelve events:

- Older people who have lived through previous energy transitions
- Younger people
- Those in skilled and professional jobs
- Retired people
- Immigrants living in Sweden
- Academics and University students interested in environmental issues and methodological innovation
- Policy makers, policy researchers and practitioners working in roles related to energy and climate change
- Members of local communities and community groups involved in local environmental initiatives.
- People participating as independent citizens, purely out of interest.
- Campaigners and activists interested in environmental issues.
- Journalists interested in environmental issues.
- Representatives of organisations in the energy sector such as UK energy providers and the World Nuclear Association.

As this list indicated, the events tended to appeal to those with a professional interest in environmental issues or those who were invested in environmental causes, such as activists as well as those involved in community initiatives. However, through the FoSS and Future Week events, we attracted a greater proportion of participants who were simply curious about energy generation or energy from waste specifically. Opportunities arose during the project to engage with older people around their memories of previous energy transitions and with immigrants living in the shadow of power station in Malmo. Events which focussed on specific audiences were generally less well attended than those linked to popular science programmes that were widely publicised.

According to the available IAT data, across all events (in person and online), 56% of participants were female and 44% male. The events attracted participants aged between 22 and 83 with a median age for attendees of 30. Most participants were from either the UK or Sweden, which is not unexpected given the location of the events, but countries including Denmark, Germany, France, Colombia, the United States and a number of African countries were also represented, mostly through the online events. Nearly half of respondents to the surveys lived in rental accommodation (47%) although a substantial number were owner occupiers (35%).

We also asked questions which sought to try and establish participants views in relation to environment and waste. With regard to their views on the extent to which they felt their government was acting to protect the environment, 73% disagreed or strongly disagreed that their government was doing all it could to protect the environment. Reflecting this, 77% stated that they are extremely concerned for the environment and the remainder were concerned to some extent. 68% of participants felt that recycling is very important with the remainder feeling that it was important to some degree. The responses to these questions suggest that those attracted to WWE events, or at least those who completed the survey, tended to be concerned by environmental issues, which is consistent with our findings from the pilot event. Given the niche focus of the events, we expected them to appeal primarily appeal to those who are environmentally aware.

Results

The results of the project will be set out in detail over the course of the published and emerging outputs as well as future publications yet to be initiated but below we offer a summary of the most significant findings to emerge from our analysis to date. This summary is arranged under three headings:

- Those relating to the core proposition of the project around the potential of research participation, particularly that involving first hand encounters with the subject matter, to promote interest in and engagement with energy policy and heat production in particular, amongst ordinary citizens.
- Findings regarding the extent to which existing decision making and management processes around heat infrastructure and generation allow for citizen participation and engagement.
- Findings from the oral history component of the project relating to our changing relationship with domestic heating.

(Re)engaging citizens with heat production using in-person and virtual methods

The overall aim of the project was to boost citizen engagement with how the energy we so often take for granted in our everyday lives is generated and in doing so, promote awareness of and engagement with debates about our energy future at this pivotal time of transition towards a low carbon energy system. In other words, we were seeking to boost energy literacy amongst participants with a view to building their capacity to help shape our energy future and thus perhaps forging a stronger sense of energy citizenship. Energy is an area of policy making where public awareness of and engagement with the key challenges and debates is low and mechanisms to enable engagement beyond so-called ‘expert’ communities are very limited. Energy policy significantly affects all of us in terms of our health, wellbeing, prosperity and the quality of the local and global environment, yet crucial decisions about our energy future are made behind closed doors.

We felt that, as researchers, we were in a position to do more to enable citizen engagement with energy issues at this pivotal time, providing innovative ways of shifting participation in energy transitions beyond the reactive ‘Decide, Announce, Defend’ model that characterises energy policy (Komendatova and Battaglini 2016, Cohen and Durrant 2019) towards a more deliberative and proactive form of engagement. Through the project, the research team stepped beyond their comfort zone and into emerging roles as process facilitators, knowledge brokers and change agents (Horlings et al. 2020), as researchers are increasingly expected to do. We were spurred on by the calls made by Wilhite and Wallenborn (2013) for the research community to take the 'epistemological risks' required to reinvigorate energy policy.

We decided to focus specifically on heat as the most relatable form of energy use in our daily lives (at least for those living at higher latitudes) and as a form of

energy use which accounts for a majority of household energy consumption in both the UK and in Sweden (Palm et al 2020b), therefore forming a key target for carbon reduction efforts. More specifically, we decided to make a case study of energy from waste, as a fairly controversial and poorly understood form of heat and power generation that would a) provide a talking point amongst participants and b) is an example of energy generation accessible to both the research teams based in Sheffield, UK and in Sweden. Both Sheffield and Lund have energy from waste plants in the immediate vicinity and in nearby cities which also supply heat via district heating networks to domestic, commercial and institutional customers locally. The focus on energy from waste also helped highlight the interrelationships between different forms of consumption (i.e. waste and energy demand).

In terms of developing the methodology for the project, a review of the literature around citizen engagement pointed to the need for effective engagement efforts to incorporate social learning as a critical component in building capacity to enable collaborative work on complex environmental issues (Kilvington 2007). There were also compelling arguments for promoting embodiment of the topic through first-hand, sensory encounters enabled by situating research activities within the (energy) landscape (Castan Broto, 2019), something which we felt was best achieved through walking methods, where data is gathered through discussions between researcher and participant whilst walking in a setting related to the research. These influences culminated in the development of the WWE method which was intended to be creative, immersive and appealing to a wide range of participants due to its novelty and interactive nature.

The pilot event

A pilot of the method undertaken in November 2019 (see Event 1 above for details), revealed great potential. On the basis of the data generated through that event, it can be said with some certainty that participation in the event moved all participants from a position of relative apathy and being poorly informed to a position where they were keenly seeking information in order to make a (in the majority of cases) well-reasoned assessment of whether energy from waste was a 'good' or 'bad' thing. Moreover, by the end of the event, most had taken the view that energy from waste was, on the whole, a positive approach to combining lower carbon energy generation with the responsible management of waste whilst retaining sensible reservations about this acting as a perverse incentive to waste reduction.

“We're consuming more and more, and I don't know how you tackle that, but at least this way you can stop the waste building up and deal with it usefully and keep it out of harm’s way.” (M, 45)

There was therefore a clear sense that the event was successful in engaging participants with ethical and environmental considerations around this particular (and often contentious) form of energy generation and that the dual focus on waste management and heat and power generation that energy from waste

necessitates, had encouraged reflection on the interconnectedness of different forms of consumption.

"I think it's good that there is an event like this. It's important to get more people involved and just get them thinking about it and becoming aware of it, just prompting them to consider a bit more, just awareness I think is an important first step." (M, 51)

"You realise when you come here that it's all linked up. What we buy, what we waste, how we heat and how much we heat etc. So the more energy we demand, the more waste they need to collect. There's lots of focus on reducing waste but this is always looked at in isolation of its impact on energy. You can save energy by consuming less but systems like this rely on us consuming more or the same maybe. None of this had occurred to me before this evening."(F, 83)

Participants took on board new information, asked challenging questions and used this new knowledge to reach a position - hopefully sparking a curiosity and a confidence that will remain with them. Although we have no way of knowing how long these impacts will last, the findings of Bull et al (2008) provide indications that it is possible for meaningful public engagement to generate lasting increases in environmental citizenship. Of course, the exercise that Bull et al refer to was a more in depth process that went on for many months and was in response to a specific and controversial proposal. It is therefore important to acknowledge the more limited 'quality of learning' and scope for impact associated with a one off event lasting a few hours. However, the contentions of Wilhite and Wallenborn, Lave (1991) and others that practical, social and embodied experiences offer greater scope for learning and challenging preconceptions than traditional forms of learning, should also be borne in mind in this context- suggesting that the quality and depth of the encounter may be more significant than its length.

In the time available there appeared to be sufficient scope for participants to acquire and consider a reasonable depth of information regarding energy from waste. However, the event was arguably less effective (as would be expected) in terms of prompting participants to reflect critically on how EfW compares to other approaches to generating heat and energy and the overall energy mix we subscribe to. This suggests that if we are aiming to build skills and knowledge amongst the general public to engage with strategic debates about our energy futures then short, one- off events will not be sufficient. However, this is arguably an unrealistic goal when we consider that the mechanisms to engage at that strategic level do not readily exist unless you are engaged with a pressure group or adept at gaining the support of politicians. Therefore, the reality of how most people engage with energy issues and decisions will be at the local level and probably in response to specific proposals or developments. In this context, WWE may offer a creative and effective means of engaging the public in debates surrounding particular local proposals, equipping them with the knowledge to contribute to them, thus increasing their credibility amongst the expert community taking the lead in relation to energy policy decision making. The results also suggested that

the views of citizens and experts will not always be at loggerheads, which may be the fear within the expert community.

Given that the event had several components (the walk, the tour, the debrief), it is also worth reflecting on the functions fulfilled by each element of the event and whether any of the parts were more instrumental than others in reaching the identified outcomes. It was certainly clear that the tour of the incinerator was the most powerful aspect of the event for most participants and the multi-sensory nature (unfamiliar sights, sounds and smells) of the experience inside the incinerator appeared to captivate participants with many expressing surprise at various points and demonstrating a keen interest by asking lots of questions. It was during this part of the event where the bulk of the information was received and views on the benefits and disbenefits of energy from waste crystallised. However, the different components of the event fulfilled different functions. The walk along the pipeline appeared effective in preparing the ground for the first-hand encounter with energy production that lay ahead. In particular, the walk provided the opportunity for participants to engage in a social encounter with other participants where stories of heating histories were exchanged. This made for a rich exploration of participants energy histories where the researcher could step back and absorb the relevant data emerging from the group discussion. It also familiarised the group with the hinterland of the power plant, raising awareness of the role that the facility plays in heating many of the city's most frequently used buildings as well as raising awareness of the unseen infrastructure beneath our feet and all around us. The debrief was critical in terms of understanding the impact of the event and for giving participants the space to digest and reflect upon what they had been told and had seen. Therefore, all components of the event are considered to have contributed to the outcomes identified.

The event proved popular with more than 30 people on a waiting list to join the event (with a capacity of 15), suggesting that there is public interest in both the topic and the format and a clear appetite for understanding more about where our energy comes from. It could, of course, be argued that this interest emanated from the 'usual suspects'- a group of educated and interested citizens but an initiative like this will nearly always start with a group like this and this is not necessarily a disadvantage given that they are well positioned to act on the new knowledge they've acquired. Once the concept is proven, more work can be done to widen the reach of such initiatives including varying their forms and working outside of initiatives like FoSS that have a clear middle class leaning. In this vein, a key priority for the project has been to consider how more disadvanted groups might respond to these types of events.

Delivering WWE events on a bigger scale across different countries and contexts- what did we learn?

Following the promising indications from the pilot event, we were keen to test and develop the approach further and to bring WWE events to a broader set of audiences within Sweden and the UK. To test the potential of the method to boost interest and engagement with ethical and environmental debates linked to heat production and the future of heat, we endeavored to experiment with different event locations, formats and target groups whilst trying wherever possible to

adhere to the guiding methodological principles of social learning, embodiment and embeddedness within the energy landscape. To a large extent, we were guided by opportunities that arose to link WWE events into larger programmes (i.e. FoSS/ Future Week) or work with existing groups (i.e. the language café), recognising that it would be difficult to attract reasonable numbers of participants if seeking to publicise events like this from scratch. After a while, the project gained profile and we started to get approached by groups requesting that we run a WWE event for them. These requests tended to come from groups with quite a specific remit and often with a professional interest in the project (i.e. Mistra Urban Futures, Young Energy Professionals), but broadened our audience further and led to participation from groups we hadn't expected to engage with, such as delegations from municipalities across Africa (through Mistra).

Of the different formats we tried, the events linked to the larger programmes of events were by far the most successful in terms of the size and diversity of participants and also achieved good levels of engagement with the topic, as indicated by the number of questions asked and level of debate during in person events and activity in the chat at online events. Where these events were held virtually, they achieved greater numbers still, with our Festival of Social Science 2020 event being our best attended of the whole project (capped at 54 people). However, the online events lacked the degree of social learning that was possible through the in-person events, where participants debated what they were seeing and hearing in a natural and reflexive way. The group setting encourages the sharing of personal experiences, storytelling, and the sharing of best/worst practices and lessons learned. Participants dynamically interact with each other, contributing to an engagement in the subject. The researchers inform the participants about the heating system, but the social interaction in the form of dialogue between actors is vital for the information to be interpreted and integrated into the participants' experience.

Although well attended by a broad international audience, it was much more difficult to assess whether the online events had achieved the same level of impact that the pilot event had in terms of raising participants awareness of the key dilemmas and issues associated with energy from waste and enabling them to reach a well-reasoned conclusion. It was also much harder to achieve the same degree of immersion, embodiment and embeddedness in the energy landscape through the online events, despite the film providing behind the scenes footage and attempting to emulate a tour of the facility. In this sense, many of the key tenets of the methodology intended to promote a deeper level of engagement and deliberation around the topic were diluted by the move online. Yet, the chat function did provide an arena for the audience to exchange views, ideas and questions and provided the researchers with some indication of the extent to which the event was successfully encouraging participants to engage critically with and react to the information being conveyed. Downloaded data from the chat functions during online events do provide some evidence of social learning (albeit in a sometimes disjointed manner as questions and responses fall out of sync) and critical engagement with the topic, for example:

14:06:38 From participant A: What proportion of fossil-based waste (plastics) are in the combusted waste stream?
14:06:46 From participant B : what does actually happen to the 'slag' and other solid end products?
14:07:03 From (researcher) : https://zerowasteeurope.eu/2020/03/understanding-the-carbon-impacts-of-waste-to-energy/
14:08:19 From (chair of the event) : @participant B -- SYSAV sells metals to other recyclers and what can't be processed goes into landfill
14:08:53 From participant B: that's what I thought :-(

Overall, there were some significant benefits to online delivery in terms of being able to reach more people from a wider range of locations and also gather together panels of experts that would be unlikely to be able to come together in person so easily. A larger number of young people were also attracted to the online format. Crucially, the creation of the films has also enabled us to engage with a much wider audience of many thousands beyond the events and has created a legacy for the project, extending its potential impact into the future and forming a key stone of the website.

The benefits of the smaller, more intimate events held with groups that face more barriers to participation (such as recent immigrants and older people living in residential complexes), must also not be overlooked. Indeed, these events may represent the kind of approach required to enable participation amongst groups for whom mass events would present a range of barriers. For those attending the language café, walking the neighbourhood was not appealing, so we were led by them and ended up finding a way to exchange stories of our experiences of home heating past and present using images on mobile phones. Despite not going according to plan, this event was successful in terms of reaching beyond the usual suspects and yielding insights into home heating in other cultures and the challenges of adapting to a very different approach to heating when starting a life in another country. There was evidence of both social and mutual learning with exchanges of different experiences of heat between those brought up in Sweden and those from elsewhere characterising the event. Overall, this reminds us that when trying to foster participation and engagement, flexibility and responsiveness to the needs and preferences of participants will deliver a deeper level of engagement, regardless of how carefully crafted the intended methodology may be.

The following exert from the transcript of the language café event indicates that memories and experiences of heating and cooking provide a topic that everyone can relate to, creating common ground amongst those from different cultural backgrounds. One image of a stove acted as the stimulus for the exchange of memories of heating solutions past and present and provided a workable alternative to the visual stimulus provided by touring a power station.

For example, a woman showed a photo of a stove used in her home country on her phone. This led to information about what fuel the woman had experience of and also how the heating appliance was used:

Interviewer: "*What is this called?"*
Woman A: [says a word in Arabic]
Interviewer: "What does that mean?"
Teacher language café : "Stove?"
Woman B: "Diesel and oil stove."
Woman A: "It's old. All the children sat around, and you make tea, coffee and food there."

These events are acts of research participation and, as such, they have the potential to educate the public but also provide valuable input into research on energy citizenship in relation to heating. The research in itself contributed to encouraging citizens who are active (Devine-Wright, 2007), aware (Huh et al., 2019; Wuebben et al., 2020), and more empowered to take part in both the heating market and policy-making (Hanke and Lowitzsch, 2020; Wuebben et al., 2020). As discussed in earlier research, it is important to make citizens part of the transition process and re-engage them in both heating production and consumption choices that they lost touch with when we stopped burning solid fuels in the home to generate heat (Ambrose, 2020). However, this is not a straightforward process. There are many barriers to citizen participation (e.g. Elsawah et al., 2020) and it has not been easy to identify and motivate people to participate in the walks, and to move beyond the 'usual suspects' of the educated middle classes. The researchers needed to spend a great deal of time identifying good programmes to link the events into, getting access to the events, engaging different heating plant operators, and marketing the events. The walks needed several researchers to lead and facilitate group interviews or the chat in online events. Professionals were also needed to facilitate the walks, such as the plant operators, to offer tours and explain the systems, and panellists to bring different perspectives and balanced views to the events, which prompted reflections and discussions. We can conclude that energy citizenship requires not only active citizens, but also active facilitators who give citizens the opportunities to engage and reflect on their heating experiences.

As expected, the results show that different groups benefit from different kinds of approaches (compare Palm et al., 2020a). The simpler walks to conduct also have a tendency to reach the usual suspects, i.e. educated, white people with a middle-level income (Ambrose, 2020; Lazoroska and Palm, 2019; Monno and Khakee, 2012). It is clear that marginalised groups like the immigrants we engaged with often need other tools when communicating. Another finding is that the women we met (as participants in the language café) appreciated that we continued to try to communicate in Swedish with them rather than call in an interpreter. They welcomed being treated as any Swedish citizen and did not give up due to the lack of a common language. The event ended with a decision to meet again (which has not yet taken place due to Covid-19) which underlines the importance of creating

lasting relationships and an arena for repeated meetings when fostering long-lasting energy citizenship. The language café did not contribute in-depth research data to analyse, but offered a model for participation action research (Elden and Levin, 1991) and that that we reached out to a group that is quite invisible otherwise both in research and in policy (Hanke and Lowitzsch, 2020; Lennon et al., 2020).

Survey results

Through the qualitative remarks made in the surveys distributed after the events, which were completed by 83 people, we were able to understand more about the impact of what participants had seen and heard during their event and the extent to which it had impacted on their level of knowledge and their views on energy from waste. The free text answers left by participants were overwhelmingly positive regarding the usefulness of the events, regardless of whether they were delivered in person or online. Most respondents reported that they had learned something new from attending a WWE event.

"Yes, I'm not very familiar with the topic overall so I'm happy to have gotten more information." (Participant, in person event)

A number of comments also suggested that participants were now more aware of and able to understand the purpose of the energy infrastructure around them, as a result of taking part.

"I did learn, mostly about how to identify the different....parts of a power plant (from the outside). Normally these plants would go by unnoticed to me but I think from now on I'll be able to identify and reflect on what I'm actually seeing and what is happening inside a power plant when I approach one."
(Participant, in person event)

Crucially, the comments indicated that participants were thinking in more depth about things previous taken for grant, such as how homes are heated, whether from a technical, environmental or economic point of view:

"I guess I can consider my thinking better on the ways warming homes occurs. Before I never really thought about it: now I'm way more aware of the whole process behind turning on heaters and having the possibility of living in warmed environments during winter." (Participant, in person event)

"Yes. Heating houses is actually not as simple as I thought, it requires a lot of energy, and depending on the energy sources many other factors are determined such as prices and energy monopolies." (Participant, in person event)

One benefit that was reiterated by several participants was how their knowledge of energy from waste in other countries had been improved, aided by the

comparative nature of the events (for example, where case-studies from both Sweden and the UK were discussed).

”Loved it. Great to see examples of what other jurisdictions are doing. Liked the discussion around waste and getting into the 'bigger questions' after zooming in on the case studies from Sheffield and Sweden.” (Participant, virtual event).

Similarly to the pilot event, there were clear indications from the qualitative comments that participation in the events (whether in person or online) had helped participants to arrive at an informed view on energy from waste and the extent to which they supported it.

”The requirement of the Swedish EFW plant to burn that amount of waste per hour to keep the power flowing was quite a revelation. After this I don't believe that EFW is such a saviour technology. It's helping, but we need to deal with our waste streams better.” (Participant, virtual event).

“Previously, I had thought that burning waste was a no-no because of the emissions involved.” (Participant, virtual event).

Sometimes their views remained unchanged as a result of participation but all those who left comments indicated that they were better informed as a result of participation.

“I have visited the incinerator so knew about the district heating in Nottingham. I didn’t know about the more widespread use of such schemes in other countries. I wasn’t aware that so many recyclable materials, especially paper, were exported and that it was so difficult to get people to recycle correctly.” (Participant, virtual event 3).

In response to the survey question ’Do you think that energy from waste should be part of how we heat buildings and generate power in the future? If yes, why?’ We received detailed responses from most people completing the survey, all of whom gave clear and assertive answers which were generally supportive of energy from waste as part of the future energy mix to some degree. However, as identified in relation to the pilot event, this position was often motivated by the potential of energy from waste to divert waste from landfill and turn it into something useful. Answers to this question demonstrated a good awareness of the key dynamics of the debate around energy from waste and combined with the fact that most participants who completed the survey felt they had learnt something new through participation, suggests that the event (whether in person or virtual) had played a part in developing their knowledge and ability to arrive at this well reasoned position.

“Yes. Although recycling is the way forward, we can't recycle everything. Landfill is detrimental to earth. The burning of waste is much safer now with the systems

that are used to burn the waste. Turning waste in to energy is a great use of the waste." (Participant, virtual event).

"I think it is working well for now, but in future, we can come up with better innovation which would be more efficient, wouldn't release any harmful gases and 100% renewable." (Participant, in person event)

"Yes, in as much as it deals with the problem of waste disposal and not using the waste derived energy to offset other sources would be madness. However, the ideal situation would be one where we close the loop, build a circular economy…. making them [energy from waste facilities] obsolete (eventually / hopefully)." (Participant, virtual event).

It was never our intention to steer participants towards any particular view on energy from waste, but we did hope that by giving them a better insight into how it operates and the benefits and disbenefits of the approach, that we would enable them to reach a considered view. The qualitative data from the survey provides good indications that this was achieved, at least amongst those motivated to complete the survey.

The Implicit Association Test

The data from the IAT exercise may shed more light on the extent to which participation in the events might have challenged implicit attitudes regarding energy and allied environmental impacts. This data is yet to be analysed due to Covid related delays but has now been cleaned to remove partial completions. Whilst not everyone who participated in the events took the time to complete the IAT but after cleaning, we ended up with 39 completed IATs. We are now ready to conduct analysis to establish if any pre vs post effect is in evidence. Early indications suggest that some evidence of a shift between implicit attitudes between pre and post participation is discernible. However, numbers of completed IATs were very small so confidence in these findings is unlikely to be high. Yet, if a quantitively measures change is identified, then this at least proves that this kind of cognitive test can be usefully applied to the context of energy and environment and that this happened for the first time within this project.

Citizen engagement in local energy decision making

Parallel to the programme of events, we conducted a literature review and small set of stakeholder interviews exploring the extent to which existing decision making and management processes around heat infrastructure and generation allow for citizen participation and engagement. This was a small but important element of the project as it allowed us to assess how and to what extent citizen participation is actually possible (in the context of Sweden and the UK), where we succeed in creating increased appetite and capacity for it through our events.

This element of the project involved answering the following research questions (in relation to Sweden and the UK):

- What is the national policy framework for engaging citizens on decision-making for heat infrastructure?
- To what extent and how do citizens and citizen-focused stakeholders (e.g. employees, community groups, and other representative bodies) participate in local heat infrastructure decision-making, to enable citizen involvement and representation in these processes?
- What strategies do heat infrastructure developers /operators use to engage with these stakeholders? And what are their motivations for doing so?

A summary report entitled “Citizen engagement in local energy decision-making: literature and policy background” was published on-line in May 2020, which set out a critical review of the contemporary literature on citizen engagement and district heating. This was then supplemented by primary research conducted in Nottingham, Sheffield and Sweden (Malmö and Helsingborg). Alongside documentary analysis of relevant websites and journal papers pertaining to these cases, semi-structured interviews were secured and undertaken with 5- 10 key stakeholders related to each site, including those running and operating energy from waste plants and associated heat networks, customers of the network, local authority representatives and elected officials. Each interview was undertaken utilising semi-structured approach, that is with the spirit of a ‘conversation with a purpose’. A broad set of questions were utilised based on the literature and then the interview, each lasting between 30 mins and 1 hour, was transcribed and analysed via Nvivo 12. The following types of stakeholders were interviewed in

- Nottingham: Head of district heating network at the city council, local authority energy officers (x2), elected official, representative of the company operating the local energy from waste facility and district heating network.
- Sheffield: Energy from waste plant and district heating network managers x 3, local authority officers, large customers of the network, residential customers of the network, national and city energy leads.
- Malmö: local authority officer, district heating network manager, elected official, regional governance official, large customer of the network.
- Helsingborg: district heating company representative, board members x 2 (chair & deputy chair), politicians x 2 (deputy mayor and opposition), civic activist, industrial heat provider.

This summary paper set out to review the lay of the land in terms of both what we mean by citizen engagement, and how and to what extent we are seeing greater citizen-focused stakeholders participating in local heat infrastructure decision-making. The benefits of engagement are clearly seen in the literature but there is currently no clear and consistent policy led implementation of stakeholder engagement policy, especially for heat infrastructure. The case studies explored what strategies heat infrastructure developers and operators use to engage with their stakeholders and how these different levels and ways of participating in decision-making impact on the pro-environmental behaviours of these stakeholders (both citizens, employees and policy makers). Nottingham proved to

be a fascinating and distinctive case study with regards to its approach to energy from waste, heat networks and ambitions for carbon neutrality. Whilst there was no evidence of any innovate citizen engagement, its strength lays in a unique governance structure that enables them to make strong and collaborative decisions. But there are challenges as the financial and contractual arrangements do not lend themselves to agile decisions. The next few years will see a new 30-year contract that will determine the future of the city in terms of carbon neutrality, waste and energy. How they engage the public in these decisions for now, remains a challenge.

In Sheffield, a multi-national private contractor leased energy generation and heat distribution infrastructure from Sheffield City Council on a 35 year lease set to expire in 2035. Governance was therefore a further step removed from local citizens, who were largely engaged with the network as contracted customers. Even then citizens tended to be contracted to energy service providers through – for example – housing management companies. There were few plans to extend the network or change generation methods, with few citizen engagement initiatives undertaken or planned. Instead, moments of citizen engagement with the network arose at points of 'rupture': for instance a pricing dispute at a large flat development which led to a citizen-led campaign to prevent a proposed heat price rise. In Malmo, the heat network was also privately owned and citizen engagement around district heating in general was minimal. However there were public engagement campaigns relating to new heat innovations, including an initiative to promote engagement around a proposed geothermal heat generation plant.

Helsingborg was an outlier in that energy infrastructure (including a large district heat network) was owned and managed by a municipal company, Öresundskraft. Citizens were indirectly engaged through election of councillors to the local authority, some of whom in turn sat on the board of Öresundskraft, but the heat system was largely seen as a settled part of the urban landscape and citizens were not historically involved or interested in its operations. That was until a proposed sale of the company to a private buyer in 2018, which led to political and citizen-led campaigns to prevent its sale and ultimately resulting in a local referendum on its future. An overwhelming 96% of voters voted against its sale, and more broadly the importance of local energy infrastructure was reasserted within citizens' imaginations. Again, a point of rupture was a key source of citizen engagement with heat infrastructure.

Due to delays in conducting the interviews with stakeholders across the three case studies, analysis of these findings remains ongoing and is expected in mid-autumn, forming the basis of an academic output.

Understanding our changing relationship with domestic heating (oral histories)

As outlined previously, opportunities arose on two occasions for the project team to engage older people in the WWE project. In both cases, a walking tour was felt to be inappropriate for this audience so instead participants were encouraged to share their memories of how their homes used to be heated and reflect on how domestic heating has changed over their lifetimes. This approach both suited the audience and helped us to gain deeper insights into around our changing and increasingly distant relationship with home heating, an idea that formed a key motivation for the project. The focus groups undertaken over the course of two events in Sweden (which involved 15 people in total) provided a complement to an earlier set of 15 oral history interviews undertaken with a similar aim in the UK between 2016 and 2019, enabling comparative analysis between the two countries.

Our analysis of these interviews has formed the basis of an academic paper currently under development which focuses on the pivotal role of heat in our everyday lives, revealing intersections with housing, health, political allegiances and ideology, gender politics, economic restructuring, social relations; educational outcomes and so forth. A key aim of the paper is to 'flesh out' grand narratives about our heating histories, providing more granular insights into our changing relationship with home heating during the second half of the 20th century and early 21st. We explore how heating transitions have played out in the everyday lives of 'ordinary' people across place and time and how they have made societal, economic, cultural and political change manifest in the heart of the home. We argue that that the heating transitions we have undergone in this period have brought us to the point where energy suffers from a ‘double invisibility’ in our lives, in the sense that it can often no longer be seen nor connected to our everyday actions (Hargreaves et al, 2013), militating against urgent efforts to reduce energy consumption (Ambrose, 2020). We link these findings back to the WWE project by discussing how first-hand encounters with heat production, like those offered through the project, might offer opportunities for embodiment and for re-connecting citizens with their energy consumption.

The data provided some interesting insights into the nature of participants’ changing relationship with home heating throughout their life course, with broader societal changes reflected in their individual trajectories. One of the most significant themes to emerge was the changing expectations which seemed to influence how participants remembered the often cold homes of their childhoods and early adult lives, and their attitude towards heating their current homes.

The majority of participants from Sweden grow up in the 1940s or 50s, while the UK participants were younger and grew up in the 1950s, 60’s or early 70’s. In both cases they were brought up prior to widespread adoption of district heating in Sweden and gas central heating in the UK. Many reported that their expectations of comfort were relatively low at that time and that there was simply no expectation of being warm at home and it was not really regarded as hardship. And even in wealthier household, cultural attitudes to warmth and heating meant heating the home to a higher temperature was not a priority. Looking back, many speculated about how uncomfortable it must have been getting into bed in a cold

bedroom and getting up on winter mornings when there was ice on the inside of the windows (a common memory amongst participants) but felt that they probably accepted this at the time. In Sweden several remarked that the problems with over-heated houses never occurred in their childhood, but this is a more modern problem.

As participants recollections moved through time, there was a very clear sense of the process of heating the home becoming less tangible. Deliveries of coal and wood and the labour of moving the fuel into storage began to die out as central heating was rolled out from the 1960s in Sweden and 1970s in the UK or electric heaters became available. The advent of district heating and central heating led to families that had previously huddled together in one room of the house to avoid the costs and labour of maintaining multiple fires, dispersed around the home once it was possible to heat the whole home fairly affordably. Managing home heating and linked tasks such as washing clothes by boiling water using fires (usually in a copper boiler with a fire underneath) was reportedly firmly the domain of women, some of whom felt more able to take on paid work once the work of maintaining the home fires reduced. Moreover, for the first time and there was no need to regularly check the coal store to carefully ration fuel. However, in the UK families were still nervous about the costs associated with new forms of gas and electric heating and participants reported feeling fearful of using too much but also of finding it difficult to know how much they were using, leading to a degree of anxiety around energy bills which, for many, endures to this day, particularly amongst those on a lower income. The ability to heat the home at the flick of a switch delighted many participants who can recall it being introduced but anxiety about cost were never far away. This anxiety was not reflected in the Swedish interviews, and here it was the convenient with the district heating system that was in focus and the costs seem be less of an issue. The Swedish tradition to have the heat included in the rent most likely contribute to this discrepancy between the UK and Sweden.

In recent times, respondents talked about how another motivation for limiting heating use had emerged with the majority of participants concerned about climate change and feeling motivated to conserve energy where they could. Several participants in the UK underlined that using the central heating, when it was not deemed essential, felt wasteful despite the fact that most respondents were now fairly comfortable financially and could afford to heat the home to a higher temperature. Many saw this as an extension of the values they carried with them from childhood but were unsure that younger generations were so concerned about the careful use of resources. In Sweden the same concerned arose, but then it was mainly in relation to electricity consumption and the electricity bill. This again was probably related to that the Swedish interviewees had the heat included in the rent and that most saw district heating as clean, at least compared to their past experiences with coal and oil.

Interestingly, there was evidence of many participants coming ‘full circle’ in terms of their relationship with home heating as demonstrated by a growing preference for log burners in living rooms to provide the sort of focal point that

they remembered from childhood. Those who had installed them wanted to regain the sensory experience and comfort that came from burning solid fuel in the home. However, in the modern context, no one was relying on these fires as the main source of heat and central heating was still the main way of heating the home. In one of the Swedish elderly center they had a fireplace movie running on the TV monitor on the wall. This was seen as both cosy and relaxing by the participants.

Discussion

Through the oral history component of the project, we found further evidence of energy invisibility. Over their lifetimes, participants had moved from handling and rationing solid fuel and maintaining fires as a key feature of daily routines, to clicking switches and twisting dials to access heat and giving it little other consideration. For all respondents, home heating was now a background issue, no longer a defining part of daily routines. Exceptions to this only occur where heat is unaffordable. This is the case for approximately 3.5 million households in the UK but a very small number of households in Sweden (Ambrose, 2020, Thomson and Bouzarovski, 2019). Those who struggle to afford to heat their homes to a healthy level will think more about the economic aspects of heating provision but are still unlikely to think about the connections between how their heat is being generated, which fuel(s) are being used and how much they are paying. So, overall the study adds further evidence to the argument that energy is now largely invisible and taken for granted in our daily lives (Ambrose, 2020, Hargreaves et al., 2013). However, the data also identified the interesting trend towards the reintroduction of solid fuels into the heating mix in UK households amongst those that could afford to install log burners, stoves and similar supplementary heat sources. These are usually used in the main living area to help create a 'cosy' environment and evoke memories of the positive sensory experience of gathering by the fire. However, in the modern context this heat source was not relied upon to keep the home warm, as would have been the case prior to central and district heating.

In that latter finding there is a hint that, amongst some households at least, there is a desire to re-establish a more direct connection with fuel and heat and to bring back some of the comfort associated with burning fuel in the home, if not the inconvenience. Installing such heat sources also brings the advantage of being able to heat just one room, as not all modern heating systems offer zonal controls, making it hard to control which area of the home you are heating.

Similarly, we find through the twelve events offered that there is significant appetite across a range of lay audiences, although predominantly those who are relatively educated and with an interest in the environment, to learn more about how heat and power are generated and the surrounding debates. It's not easy to tell whether this interest is general or sparked by the particular focus on energy from waste, which can be considered a controversial approach to waste management/energy generation and links to broader debates around sustainable consumption and major public campaigns around plastic pollution. However, what precisely motivates participation is not really important, what matters is that we identified significant willingness to engage with debates about how we generate energy now and in the future- a topic that many assume there is no public interest in. This is a surprising assumption given that heat is so crucial and central to our everyday lives, even if it is invisible. Without it we are exposed to discomfort and health risks and as the oral history interviews support, sources of heat play a key role in formative memories of home and can induce something similar to a Proustian rush when these memories are evoked. Therefore, it is

hardly surprising that we found that participants had plenty to talk to each other about in relation to home heating- it is common ground for everyone, even those who don't share a common language and are from different cultural backgrounds (as exemplified by the language café example). Home heating is a topic that binds us together and in relation to which, we all have views, experiences to recount and something to share.

Although our shared interest in heating is undoubtedly a factor in the success of the events, it also seems likely that the fact that energy and its generation has become so remote from our everyday lives has led to a sense of curiosity about it, which has only been fuelled by our focus on lesser known and understood approaches such as energy from waste. And we do know from the remarks made by participants that curiosity was a factor motivating participation. Another factor motivating engagement appeared to be now widespread understandings about the links between energy production, consumption, and climate change, reflected in the fact that we attracted a very environmentally motivated audience.

Regardless of whether the events were delivered in person or online, we consistently found that participants learnt something new from the events and that participation helped them to arrive at a clear and informed view on the example of energy from waste or introduced new knowledge and perspectives which challenged existing views. However, it is undoubtedly the case that the shift to online deliver will have narrowed the range of people we were able to engage with, despite the increases in audience size. Events such as the language café and the oral history sessions were critical in terms of moving beyond the usual suspects but proved impossible to continue with in the context of the pandemic. Therefore, a mixed approach to delivery seems most appropriate to appeal to as wide a range of audiences as possible. An interesting challenge for future events will be to reach beyond those who are environmentally motivated, but this will raise challenges regarding how we might motivate engagement amongst those for whom the environment is not a priority. One way to do this is to reach out and visit people in their everyday locations such as the elderly centers or language café.

Overall, we have found that there is an appetite to learn more about heat and power and engage in the associated environmental debates. We don't know how widespread this is and a large-scale survey about energy awareness and levels of interest in learning more might be a priority for future extensions of the project but indications from the project are that levels of interest are healthy. Through the events we have boosted the energy literacy of participants and sent them back out into the world more informed and curious and perhaps with more capacity and motivation to engage in the myriad decisions currently being made about our energy futures. Unfortunately, we also find that, as established by the sub-project on structures and opportunities for engagement in heat provision, tangible opportunities to get involved in shaping our energy futures are limited. It seems that the decide, announce, defend model (Horlings, 2020) remains dominant and that decision makers tend only to encounter citizens when things go wrong (i.e. price increases or a burst pipe) or when there is opposition to plans and proposals

locally. Where heat generation facilities are in public ownership, there is indirect influence for citizens as local taxpayers contributing funding to the scheme and through the election of local councillors involved in its governance. However, although an outlier, the Helsingborg example provides an excellent example of the power that local citizens can exert over their energy futures when they engage and organise. Although, as inspiring as this example is, it is essentially another example of citizen engagement emerging in response to a problem or unpopular proposal. Yet thinking beyond the specific context of heat and power, opportunities to participate in new participation structures emerging in response to the climate emergency are increasing with initiatives like citizens assemblies on the rise and pressure groups such as Extinction Rebellion rapidly expanding their activities. These movements might offer destinations for those who have left our events feeling motivated to get more involved and seek to influence their energy futures.

We can say with some confidence that Walking with Energy has the potential to provide a more pro-active way forward for citizen engagement with debates around energy production and consumption and our energy futures. It's creative and engaging format can provide an alternative approach to engaging local populations in decisions and debates about energy (and indeed other topics) locally, improving energy literacy and providing a forum for deliberation and debate between decision makers, 'experts' and citizens, as we have seen demonstrated across many of the events where all these parties were present. The format might also provide a helpful complement to consultation exercises around policies and proposals, helping to familiarise consultees with the key facts and debates and thus enabling more informed engagement.

If we were to continue with this programme of research, we would be keen to test how far an initiative like WWE can go in terms of the range of audiences it can reach and successfully engage with, the range of energy related topics and debates it can respond to and crucially, the extent to which it can contribute to lasting changes to environmental citizenship amongst participants (something that IATs might assist in assessing if used over a longer period of time). Achieving these aims would require expansion of the project and a more carefully designed programme of events that more systematically tests the compatibility of the format with a wide range of different audiences, approaches to energy generation/ energy issues, setting and contexts. It would also require, as would have been desirable in relation to this project, more systematic monitoring of who hears about the event, who attends, and the degree of engagement achieved against a broad range of demographic factors and EDI indicators. The quantitative and qualitative monitoring of outcomes and impacts associated with engagement would also be crucial and would ideally take place at regular intervals over a long period following participation.

Publication list (own publications in the project)

Articles, reports and book chapters:

- Palm, J and Ambrose, A. (forthcoming, under review), Exploring energy citizenship with the 'Walking with Energy' methodology. Submitted to *Energy policy*

- Ambrose, A., Palm. J., Parkes, S and Speake, B. (forthcoming), From tangibility to obscurity? Understanding our changing relationship with home heating in Northern Europe. To be submitted to *Energies*

- Ambrose, A, Palm, J and Bull, R. (forthcoming), Walking with energy: Reflecting on uneven fossil energy transitions. Book chapter in *Low Carbon Inclusion* by Ambrose, A., Horne, R, Walker, G and Nelson, A.

- Ambrose, A. (2020). Walking with Energy: challenging energy invisibility and connecting citizens with energy futures through participatory research. Futures, 117, 102528. http://doi.org/10.1016/j.futures.2020.102528

- Eadson, W., & Bull, R. (2020). Citizen engagement in local energy decision-making: literature and policy background. Sheffield Hallam University. http://doi.org/10.7190/cresr.2020.8937358309

- Palm, J., Reindl, K., & Ambrose, A. (2020). Understanding tenants' responses to energy efficiency renovations in public housing in Sweden: From the resigned to the demanding. Energy Reports, 6, 2619-2626. http://doi.org/10.1016/j.egyr.2020.09.020

Other outputs:

- www.walkingwithenergy.today
- The film made specifically for the project on energy from waste in Sweden: https://www.youtube.com/watch?v=I8_i1gU3gRg.
- Podcast for The Energy Talk series, a globally available podcast series. The Energy Talk - Walking With Energy: Dr. Aimee Ambrose on Stitcher
- Blog for the Mistra Urban Futures Blog series: Feeling the heat: tracing Sheffield's district energy network to its source | Mistra Urban Futures
- Blog for the Sheffield Institute for Policy Studies: Secrets of the Power Station: why now is the time to understand and have a say in how your energy is generated – The Sheffield Institute for Policy Studies
- Newspaper article in the Yorkshire Post: https://www.yorkshirepost.co.uk/news/opinion/aimee-ambrose-climate-

change-emergency-shows-we-need-to-know-more-about-how-we-heat-our-homes-1-9445086

- Coverage of the pilot event for BBC regional news programme Look North: https://markansell.blogspot.com/2019/01/incinerator.html

- Interview in the Conversation: https://theconversation.com/no-barnaby-the-uk-energy-crisis-has-nothing-to-do-with-its-net-zero-target-and-to-suggest-otherwise-is-outrageous-16886

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Appendix

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