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Sustainable Energy Community Dublin

Dublin District Heating Seminar 21st May 2014 Proceedings Report



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Dublin District Heating Workshop: Proceedings Report

The Convention Centre Dublin

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Acronyms

DH – District Heating

DHC – District Heating and Cooling

CHP – Combined Heat and Power

SEAI – Sustainable Energy Authority of Ireland

EU – European Union

DCC – Dublin City Council

RES – Renewable Energy Sources

RES-H – Renewable Energy Sources to supply Heat

RES-E – Renewable Energy Sources to supply Electricity

PPO – Pure Plant Oil

Introduction

This report contains a summary of the proceedings of the Dublin District Heating Workshop, hosted by Codema at The Convention Centre Dublin on the 21st of May, 2014. The workshop was held as part of the SEAI's 'Emerge – Sustainable Energy Community Dublin' project. The purpose of this project is to provide a platform for communications among stakeholders from the public and private sector, academia and the community, in order to establish a more sustainable energy future for Dublin City.

Context

The European Union (EU) have set targets of 20% reduction of EU GHGs from 1990 levels, 20% of energy consumption to come from Renewable Energy Sources (RES), and 20% improvement in Energy Efficiency (EE), by 2020, also known as the "20-20-20" targets. The EU are ensuring Member States (MS) meet these targets through directives which specify targets for RES and GHGs and binding measures for EE for each MS. While work is still ongoing to reach these targets by 2020, the EU have just announced (January 2014) new targets for 2030, which will aim for a 40% reduction of EU domestic GHG's from 1990 levels (European Commission, 2014).

Ireland has adopted and transposed these EU directives into Irish legislation, and has targets of 16% of the country's gross final consumption to be supplied by RES and a 20% reduction of non-ETS GHG's from 2005 levels by 2020 (EPA, 2011). Although there are no set targets for EE, there are binding obligations set out in the EU Energy Efficiency Directive 2012/27/EU. Ireland has committed to 20% energy savings along with a 33% target for the public sector. These targets are proposed to be met through various methods, majority of which are outlined in two main relating documents; the National Renewable Energy Action Plan (NREAP), and the National Energy Efficiency Action Plan (NEEAP). The NREAP sets targets of 40% electricity from RES, 10% in transport, and 12% in heating sector (DCENR, 2010).

Thermal demand in Ireland accounted for 34% (4,468 ktoe) of total primary energy demand in 2012, and only 5.2% of total thermal energy is produced from RES. In the same year, thermal energy from renewables accounted for 2.1% of gross final consumption and over 94% of primary energy used for thermal purposes came from fossil fuels, with 45% from oil. (SEAI, 2013 (a))

District Heating (DH) is an established method of increasing energy efficiency, lowering fossil fuel use, and utilising waste heat sources. It has been successfully implemented in many other European countries, particularly in Scandinavia. DH can potentially contribute toward meeting national level targets of energy efficiency and renewable energy in the heating sector in Ireland, but as yet, large scale DH has not taken a foothold in the Irish market. It is for the reasons outlined above that Codema hosted the Dublin District Heating Workshop, in order to gather stakeholders interested in the development of DH to establish what are the opportunities and barriers to successful implementation of large scale DH in Dublin.

Workshop running order

10:00 Welcome

Gerry Wardell, Codema

10:30 Key Note: District Heating from a European Perspective

The Role of District Heating in the European Energy System

Assistant Professor David Connolly – Aalborg University, Denmark

11:00 District Heating from an Irish Perspective

Policies Affecting District Heating in Ireland: What needs to change?

Donna Gartland – Codema

11:15 Case Study of an Established District Heating System in Ireland

Mitchels-Boherbee Community Regeneration Project

Tim Mc Swiney – Tralee County Council

11:30 Case Study of a Developing District Heating System in Ireland

Grangegorman: Challenges and Opportunities of a Sustainable Urban Campus

Paul Horan – DIT, & James Rooney – GDA

12:00 Discussion

1:00 Lunch

Report Format

This report outlines the proceedings of the workshop, the key issues raised in each presentation, and the key points addressed during the subsequent panel discussion.

The format includes;

- Summary of each presentation
- Key issues and discussion points raised
- Conclusions and next steps
- List of organisations represented
- Contact details of speakers

Please note the full presentations are available in electronic format, if you would like a copy, or have any other queries, please email Declan Mc Cormac at dec.mccormac@codema.ie.

Opening Presentation: District Heating from a European Perspective

The Role of District Heating in the European Energy System

Assistant Professor David Connolly – Aalborg University, Denmark

David is part of a research group at Aalborg University who, along with Halmstad University, Ecofys Germany GmbH and PlanEnergi, have recently completed a study titled "Heat Roadmap Europe 2050" for Euroheat & Power. The study includes an analysis of how widespread use of District Heating across Europe can help to achieve energy related EU targets. These reports are available to download from the Euroheat & Power website at <http://www.euroheat.org/Heat-Roadmap-Europe-165.aspx>.

David introduced the presentation by showing the current energy balance situation in Europe, which highlighted the large losses involved in electricity production and how they make up the majority of the difference between primary and final energy consumption across all energy sectors. It also shows the energy lost between final consumption and end-use is mostly in the transport sector, but also a large proportion is in heat losses.

The presentation sets out the dispel four key myths surrounding DH in Europe;

- DH is only for cold parts of Europe
- DH is a local solution for a local problem
- DH is expensive
- Buildings will not use heat in the future

DH is only for cold parts of Europe

Heat is consumed throughout Europe, and studies have shown that there is only +/- 20% difference throughout Europe in heat demand. Buildings are designed differently in different countries; some in colder climates are designed to retain heat while others in warmer climates are designed to expel heat. DH can supply ~50% of the heat demand in Europe, and 30% of heat demand in Ireland is currently feasible for DH. Any heat demand above 100TJ/km² is suitable for DH, and those above 50TJ/km² are suitable for low temp DH in the future.

DH is a local solution for a local problem

District heating has a major role to play in the overall energy system. By integrating the heat and electricity markets using DH with CHP, heat pumps and thermal storage, DH can help to integrate more wind power onto the grid. Heat pumps can be used when wind power is high, and thermal storage used to store heat to use later. DH is an essential part of the future energy system; thermal storage is much cheaper than electricity storage, and as an example, Denmark has twice the energy storage of Britain through thermal storage on DH networks.

DH is expensive

The Heat Roadmap Europe 2050 study comprises two reports; the first analyses if DHC is beneficial in a business-as-usual scenario, and the second analyses if there is 50% CO₂ reduction achieved is DHC beneficial in a low heat demand scenario.

The first study shows that, in a business as usual versus 50% heat demand supplied by DH instead of conventional fossil fuels, the results show that the latter option provides;

- Cheaper heat – decrease energy costs by ~€14 billion in 2050
- Lower fuel consumption – particularly fossil fuels, and therefore lowers CO₂
- More jobs created – 220,000 additional jobs over period 2013-2050
- More renewable energy sources – DH can integrate more RES

If the EU does meet targets of 50% reduction of CO₂, the second study analyses this situation with and without DH as part of the solution. The analysis looks at a combination of 50% DH in cities, 50% heat pumps in rural areas, and 35% energy savings in all locations, and the results show that this scenario would cost €100 billion per year less than energy savings alone. This shows that DH is not as expensive as people expect.

Buildings will not use heat in the future

The idea that we will build buildings that do not use heat in the future has caused much debate in Europe right now, and has brought up the question of exactly how much heat savings should be put into buildings now. The answer is we should put in heat savings until the price of sustainable heat supply is less than the marginal price of additional savings. In Denmark, there is data on individual buildings scale, which includes year built, heat demand, size, condition etc. Using this data, an analysis has shown when this crossover of additional heat savings and price of sustainable supply occurs. The results show this happens after 30% to 50% heat savings have been implemented, after this point, it is cheaper to supply sustainable heat than to continue reducing demand. A key point is that DH will continue to develop and the technology is improving all the time.

David has just published a paper called “Green Plan Ireland”, which outlines how Ireland can transition to a 100% renewable energy system without increasing the costs of energy, but while creating 100,000 additional jobs at the same time. The paper is available at <http://dconnolly.net/greenplanireland/>.

Second Presentation: District Heating from an Irish Perspective

Policies Affecting District Heating in Ireland: What needs to change?

Donna Gartland – Codema

Donna introduced the presentation with an overview of the Irish energy sector, highlighting that although the amount of primary energy used in the heating sector is almost equal to that used in the electricity sector, the national renewable energy targets for heating are much lower. Also highlighted was Dublin City households’ energy use, with 83% of their annual energy demand used for space and water heating, the majority fuelled by gas and oil sources. There are currently no large scale DH systems in operation in Ireland. DH is outlined as a key strategy to meet national CHP, energy efficiency, and RES-H & RES-E targets. In the last national level study of DH, carried out in 2002 on behalf of the SEAI in order to inform the government stance on DH, the results found there were “*numerous and insurmountable*” barriers to DH in Ireland.

The presentation went on to dismiss some of the barriers found in the study. The Irish climate is often cited as a barrier to DH, and although Ireland does not experience the same extremes of temperature as Scandinavian countries, there are also benefits to this in terms of DH; it means the production units sized for base-load can therefore cover the majority of the demand, and smaller peak load units are required. Also there should be more focus on heat demand density rather than population density, as although Ireland may not have the population density of other European countries, our heating demand is just as high, if not higher. The energy used for heating in a Danish household versus a Dublin City household is 11.6MWh/year versus 18.2MWh/year, largely due to older and less efficient housing.

There were others factors which are legitimate barriers to DH in Ireland. Barriers to DH which were discussed include;

- Low levels of CHP implementation – latest figures show only 4MW installed between 2011-2012
- No policies or regional planning guidelines directly related to DH

- Economic recession – no financial supports
- Low construction levels – easier to implement DH in new developments
- Lack of local knowledge
- Issues connecting to the grid
- Infiltration of gas grid in city

Opportunities for DH which were discussed

- New EU Energy Efficiency Directive focuses on efficient heating and potential for DH in Member States
- Indirect policies that can support DH
- Dublin has many areas of high heat density, $>150\text{TJ}/\text{Km}^2$
- DH is a way to integrate renewable energy into an urban landscape
- Positive interest in DH in Dublin

The presentation showed the results of a detailed techno-economic energy system analysis, carried out by the speaker, of a large scale DH system in Tallaght proposed by South Dublin County Council. The analysis found there was an economically feasible scenario which would see the use of a wood chip fuelled CHP unit for base-load requirements, and a back-up gas boiler for peak demand. The system would provide heat at a price competitive to the current price paid for gas, and payback in 15 years. It would use 86-93% renewable fuel, and lower CO₂ emissions between 80-90% annually. The presentation showed there are many socio-economic long term benefits of DH, such as;

- Increase self sufficiency
- High efficiency
- Reduce CO₂
- Lower cost for customers
- Utilise waste heat
- Increase employment

The presentation ended with the question; If these benefits of DH are known and DH is shown to be technically and economically feasible in Ireland, what needs to change in order to see large scale implementation?

Third Presentation: A Case Study of an Established District Heating System in Ireland

Mitchel's-Boherbee Community Regeneration Project

Tim Mc Swiney – Tralee Town Council

Tim started with an introduction to the Mitchel's-Boherbee Regeneration Project, which was approved by the Department of Environment Community and Local Government in 2008. The area was in decline, and the project sought to address infrastructural, social and economic related issues. Fuel poverty was identified as a major issue. The area has been designated a 'Sustainable Energy Zone'. The council have implemented a district heating system in the area which utilises a 1MW plant to supply heat to Tobar Noafa, which is made

up of 56 housing units and a day care centre. The council have also implemented many other projects in order to reduce heating demands, such as external insulation.

The DH distribution pipelines are 2km long, the plant is made up of two 500kW wood chip boilers with an auger feed system, and are linked to two 5000l thermal store buffer tanks. The average cost of the pipeline was €300/m; €750/m for main distribution, €350/m for local distribution, and €130/m for household pipeline connections. The system now feeds 100 housing units, a library, primary school, day care centre, apartments and a new integrated services building. The cost of producing heat is 5.4c/kWh, including costs for fuel, electricity for pumping, maintenance and losses. The woodchip produces ~3.01MWhr/ton, and the system uses 1500 ton of wood chip per year, which is approximately 4500 MWhr produced annually. The average annual bill is €750/year for hot water and space heating. The woodchip supplier is paid by kilowatt hour of heat produced, rather than by tonne delivered, meaning it is then their priority to deliver good quality low moisture chips.

The system implements a 'Pay as You Use' prepayment system, which guarantees payment before heat is actually used, and also addresses fuel poverty, as no energy debts are accumulated. This system is now in use in 250 units in Tralee. The housing which has been retrofit and connected to DH have seen their heat demand reduce drastically. Some new builds have achieved BER of A2 and have annual energy consumption of only 2043kWh, which is around €200/yr.

Key drivers of the project are;

- All of Kerry's energy is imported – huge bill leaving the country
- Have 55,000 hectares of forestry available – 60% privately owned
- Opportunities to create employment
- Reduce fuel poverty

Tim outlined the big issue for Kerry forestry is the industry is not thinning as they should due to transport costs, and if these thinnings could be used closer to the source, it will reduce that cost. A comprehensive study of the forestry sector in Kerry showed that there is security of supply of pulpwood within >50km, and if thinning were to be utilised effectively, it would give 25% more income to farmers. If woodchips are used locally to displace oil as a fuel, 90% of the money generated stays in the local community.

The planned expansion of the DH system will cost €35.4 million, at an investment rate of 6%. The project has a payback of 13 years and an IRR of 7.6%. The project did not consider power production, as the REFIT for power will be dropped soon, so by the time the project is ready to be connected, the support is not likely to be there. The new expansion will see a 22MW boiler plant connected to 37km of DH pipeline. The cost of fuel is 4c/kWh, and heat sold at 10c/kWh, with a standing charge of 30c/day.

Tim finished the presentation by outlining the next steps in the project, with the most important being how it is going to be financed. The council are looking at options of grants, ESCO's, energy efficiency fund, PPP etc., and combinations of these, in order to fund the project.

Final Presentation: A Case Study of a Developing District Heating System in Ireland

Grangegorman: Challenges and Opportunities of a Sustainable Urban Campus

Paul Horan – DIT, & James Rooney – GDA

Paul introduced the Grangegorman site, which is a new development inside Dublin City centre, and is being implemented by the Grangegorman Development Agency (GDA). The site is a mix use development, with facilities such as a college campus, student accommodation, health services, sports grounds, parks etc. The college campus, DIT, makes up the majority of the development. Paul outlined the aims are to mimic the Danish government and aim toward being carbon neutral, and outlined other key themes involved in the GDA sustainability strategy, like transport, which is important factor with so many students travelling in and out of the area every day.

The priority is to reduce the need for energy first, and has been addressed in the planning through maximising use of natural light and natural ventilation, and the buildings will aim for A rated BERs. The GDA also want to maximise the on-site energy production. The development is happening in a phased way, with each individual building project coming along at different stages of the development with individual finances, and normally have funding for their own heating plant. The challenge is therefore how to front load the costs of a DH network when some buildings will not be delivered for 10 or 15 years.

The Grangegorman development did not have the revenue for DH pipelines, so they had to 'bury' the costs into the total costs of the site infrastructure. The government was not willing to fund the network, but the GDA have managed to include it in the package of funds that have been agreed.

James then went on to present the Energy Strategy of the development. The strategy is to reduce the demand through building performance and energy control systems, then to produce as much of the sites energy requirements onsite. Firstly a study was carried out to establish what is a better solution; centralised or dispersed energy production, and it was found the centralised system was the best solution. Various systems and technologies were considered for the site, and it was concluded that wind and geo-thermal were not suitable for the site, but a combination of solar thermal, solar PV, CHP and DH would be used.

The choice of fuel to be used in the CHP and boilers is currently under analysis. The fuels analysed are natural gas, woodchip and Pure Plant Oil (PPO). James outlined that when you are on a natural gas line, it is a barrier to using other more sustainable fuels as it is a much cheaper solution. There is a downside to woodchip use, due to the increased traffic with deliveries and therefore there are hidden CO₂ emissions. The GDA ruled out the use of wood pellet fuel as there are no indigenous sources, no suitable forestry here in Ireland, and therefore it must be shipped over from places like America, which is not environmentally friendly. PPO is linked to the food industry and therefore increases the price of the fuel.

James showed a comparison of 6 different fuel choice combinations, and considered many different parameters such as capital costs, maintenance, CO₂, sustainability, fuel price stability etc. The fuel choice combinations were firstly compared giving a heavier weighting for capital and operational expenditures. This analysis found that the combination of gas fuelled units is the optimum solution. The second comparison placed a heavier weighting on considerations of CO₂ emissions, and this resulted in the combination of PPO boilers

and PPO CHP as the most preferable solution. With balanced weightings for both costs and emission considerations, the results show the PPO fuelled combination and the gas fuelled combination come out fairly evenly on top. The GDA are planning to use a gas fuelled system in the first phase over the PPO option due to issues with PPO fuel supply, and are still deliberating what biofuels to use in further phases.

James also mentioned the issues with using design-build-operate arrangements with ESCO's as they will naturally choose to use natural gas as it is the cheapest solution and therefore more sustainable fuels are not considered. There are currently pipes being laid in the ground at the Grangegorman site.

Discussion

Key issues and discussion points raised

Following the presentations, the floor was opened to comments and questions for the panel of speakers, who were also joined by Michael Phillips, Assistant City Manager & City Engineer, and Mark Coyne from Dalkia.

Questions

The questions asked focussed on how to go about **planning for future of DH** in Dublin, the **best ownership models** for DH from Denmark, state **guarantees on finance**, a **combined voice for DH**, **need for specific technical guidelines** & issues with **grid connections**.

Responses

Planning for DH:

David Connolly, Aalborg University, responded;

- Firstly, it has already been done, so not starting from scratch
- Identifying areas of heat demand and suppliers is fundamental
- High level direction needed; not just focus on individual developments
- Water delivering heat opens up possibilities to use all different fuels, e.g. surplus heat.

Ownership Models in Denmark:

David Connolly, Aalborg University, responded with the following points;

- Important to differentiate scales, i.e. cities and smaller towns have different ownership structures in Denmark
- City DH networks owned by the likes of Eirgrid or a large public body, who operate it just like an electrical distribution system
- In smaller towns, the end users typically own the network, and it is run as a not-for-profit; any profit that is made has to go back into reducing prices or developing the network
- In Denmark, DH is a national level agenda, the responsibility for implementing is then passed down to municipalities to find the best areas for DH and provide low interest finance to locals to invest.
- Less risk for government in providing low interest loans as people will always need heat.

Guarantees on Finance:

David Connolly, Aalborg University, response;

- There is a need for long term guarantees
- Long term stability needed to ensure DH will be there in 15-20 years' time
- Cheap finance and institutional stability and commitment is how it was developed in Denmark
- Pipelines have very long lifetimes, up to 40 years, and longer

Combined Voice for DH:

David Connolly, Aalborg University, response;

- Naturally happens in EU when a DH association gathers and represents all operators

Need for Specific Technical Guidelines:

David Connolly, Aalborg University, response;

- DH can be done well, like in Scandinavia, and can be done badly, like in China
- There needs to be knowledge exchange between those who have implemented DH well

Grid Connections:

Grangegorman Development response;

- Didn't need to connect to grid as they will use all electricity onsite in the college, and therefore have no issues with private wire network regulations
- Not in the business of being power producers
- They see no barriers to connecting to the grid

Tim Mc Swiney, Kerry County Council response;

- The current REFIT is an 'amber light going red', and it appears it will not be there for long, so using this incentive is not an option for them.

Comments

The first comment was from Tom Bruton, BioXL, and he raised concerns regarding the fuel use proposals at the Grangegorman development. Tom is the former president of the Irish BioEnergy Association, and stated there are three Irish producers of certified sustainable wood pellets, which produce over 150,000 tonnes per year. He also gave some examples of heating systems which are currently run on wood pellets in Dublin, namely Leinster House, Charlestown Shopping Centre and Ikea. Tom also mentioned his experience in using PPO and believes it is not a sustainable fuel for thermal use.

Dave Connolly, from Frontline Energy, told the workshop how Frontline are rolling out DH at the moment, and they have experience in the UK, where the policy framework is more joined up, unlike in Ireland at the moment. David spoke of how things are happening around DH in London faster, mainly due to the Mayors influence. He mentioned the Siemens "Green Cities" Report, which ranks Dublin 23rd, mostly due to the transport sector and lack of DH.

Damien Nee, from the Micro Electricity Generation Association, stated funding is key, and is interested in providing funding for energy projects through new national pension funding schemes. He told the workshop how the west of Ireland is hugely vulnerable to energy security, and we need to take a long term view now in order to create a sustainable nation by 2030.

Mark Coyne, from Dalkia, was invited to give some feedback on the workshop proceedings. A large part of Dalkia's business is DH, of their 8.9 billion annual turnover, 3 billion is in DH. Mark compared the size of the pipelines at Grangegorman, which are 4km long, to the 2000km Dalkia have implemented, most of which are in France. Other key points Mark mentions are;

- DH is hugely capital intensive
- Access to lower cost input energy into a sustainable DH system is needed
- Kerry is a good example as the main fuel that was in use was oil, and so the business-economics are favourable
- DH is feasible in Dublin, especially with low cost heat from the likes of a waste to energy plant which would allow a discount on the price of heat currently based on gas
- There is a vast amount of heat wasted, particularly in industry
- DH enables us to capture heat from diverse sources
- Large scale enables lower costs

Conclusions and Next Steps

Michael Phillips, Assistant City Manager & City Engineer, rounded up the workshop proceedings. Michael has been involved with the council in DH since 2001, and some of the points he made include;

- Customer worries – giving away control, worries still there even when saving money as there is no track record of DH in Ireland
- Design for long term, but build in flexibility in the short term so all can combine in future
- NDFA have created barriers to financing; more money spent on paperwork, lawyers etc.
- Ownership of DH by the local authority is a good idea, accepted more by public
- Denmark is a great example of forward thinking
- Need to look at holistic picture and long term vs short term
- Dublin City Council will support any upcoming DH projects

There was also a consensus among some participants to collaborate with Codema in making a submission to the consultation phase of the Energy Policy Green Paper for Ireland, which was recently released on the 12th of May, and the deadline for submissions is the 31st of July.

Codema are currently compiling the submission, and wish to ask those interested to send the key issues you would like to see us cover concerning District Heating, and if possible refer to the relating question and priority outlined in the Green Paper.

Please send your response to Declan Mc Cormac at dec.mccormac@codema.ie. Codema will then circulate a draft of the submission to all those who attended, and anyone who wishes to put their name to the submission will be added. We are aware Tipperary Energy Agency are also submitting a response regarding District Heating, and we will also support that submission.

Companies and Institutions represented at the workshop include;

- Aalborg University, Denmark
- BioXL
- Codema
- CDM
- Dalkia
- DCU
- Dublin City Council
- DIT
- ESB
- Energy Solutions
- Fingleton White
- Frontline Energy
- Fingal County Council
- Grangegorman Development Agency
- Green Way
- Integrated Environmental Solutions
- ITT
- Kerry County Council
- Meath County Council
- Micro Electricity Generation Association
- RPS Group
- SEAI
- South Dublin County Council
- St. James Hospital
- Smart Eco Hub
- Tipperary Energy Agency
- Uponor

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