



THERMOS

Baseline Replication Assessment Report – Pilot Cities

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1 Introduction

The Baseline Replication Assessment Report aims to map-out and assess the national and local framework conditions for a successful adoption of the THERMOS model.

This document constitutes the final issue of the Baseline Replication Assessment Report and focuses on the four Pilot Cities of the THERMOS project: Granollers, Islington, Jelgava and Warsaw, and the 4 Replication Cities: Alba Iulia, Berlin, Cascais and the Greater London Authority.

Throughout this document the most relevant characteristics and features that should be considered for the adoption of the THERMOS tool are analysed. The analysis covers the following elements in each of the four Pilot Cities studied:

- **Heating and Cooling in the local context:** this section contains an analysis of the local energy system (energy mix, key performance indicators on power and thermal supply and demand), the key energy policy and legislation, the adoption of Renewable Energy Sources (RES) in the city and the existing energy objectives and plans, among others;
- **Stakeholder Identification and Engagement:** the main local and national stakeholders that should be engaged for a successful adoption of the tools developed throughout THERMOS are listed in this section, together with the roles that they can hold towards the THERMOS model replication and the strategies to be followed for their engagement;
- **Towards THERMOS Uptake:** in this section the principal barriers that could prevent the adoption of the THERMOS tool and the solutions to overcome them are examined;
- **THERMOS Case Study:** finally, the document focuses the analysis on a single opportunity in a city district or quarter where the THERMOS tool will initially be applied.

This report is therefore meant to establish a baseline and serve both as a guide and a set of practical examples on the information that should be gathered and the stakeholders that should be engaged for a successful replication and adoption of the THERMOS tool.



2 Greater London Authority

2.1 Introduction

London is the capital and most populous city in England and the United Kingdom, as well as the largest city in the European Union. It accounts for 13.4% of the UK's population. Greater London is a region of England which forms the administrative boundaries of London. London is organised into 33 local government districts¹: the 32 London boroughs and the City of London. The Greater London Authority, based at City Hall in Southwark, is a strategic regional government body



and consists of the Mayor of London and the London Assembly. The region covers 1,572 km² and had a population of 8.7 million in 2016. Greater London is under the strategic local governance of the Greater London Authority (GLA). It consists of an elected assembly, the London Assembly, and an executive head, the Mayor of London. The headquarters of the GLA is at City Hall in Southwark. The Mayor is responsible for developing a number of Strategies including the London Plan, Transport Strategy, Economic Development Strategy and the Environment Strategy. The GLA family also include: Transport for London, the London Fire and Emergency Planning Authority, Mayor's Office for Policing and Crime, London and Partners, London Legacy Development Corporation and Old Oak and Park Royal Development Corporation.

2.2 Heating and Cooling in the Local Context

2.2.1 Local energy system

The vast majority of London's energy demand (approximately 94 per cent) is currently sourced from outside of the city. London can never be fully self-sufficient in energy even if energy demand is reduced and more renewable energy is generated within the city boundaries, because of limited space. That's why London's zero carbon scenario is intrinsically linked to the decarbonisation of the UK's electricity and gas grids.

In London, electricity demand accounts for almost half of the total CO₂ emissions. This fraction has been decreasing rapidly in recent years due to decarbonisation of the national electricity grid. Total UK renewable electricity generation has increased to record levels of around 25 per cent in 2015, up from 19 per cent in 2014, while coal generation has reduced from 30 per cent of generation in 2014 to 22 per cent in 2015. There is a proposed national pathway to further

¹ Image from <http://directory.londoncouncils.gov.uk/images/boroughmap.gif>



decarbonise the electricity grid, with generation from renewable and nuclear energy sources projected to double by the early 2030s.

There is, however, no equivalent pathway towards the decarbonisation of the national gas grid, making gas, and by association heat one of the major challenges in realising a zero carbon future. Gas use in London represents around half of total energy consumption, contributing 30 per cent of London's total emissions. Most of this gas is used for heating in buildings.

A key way to support decarbonisation of both electricity and gas grids in London is by increasing the proportion of renewable and local decentralised energy. Local energy generation and communal heating networks currently supply the equivalent of six per cent of London's energy, with approximately a quarter of this from renewable generation including solar and wind power.

Energy infrastructure will need to be transformed so that it is smarter and more effective. This will enable supply and demand of energy to be better matched, reduce consumption and enable people to take advantage of cheaper electricity.

While this is a national issue, in London the supply of more local, decentralised, low carbon energy can be maximised. Decentralised energy ranges from small production, such as electricity from solar PV panels, to larger scale systems based on local energy resources utilising heat pumps that supply communal or district heating (or cooling) through a network of underground pipes connecting it to homes and buildings.

For London to become zero carbon by 2050, the energy system will need to move away from using natural gas to being fuelled more from municipal waste, renewable energy and the heat that is wasted from industrial and commercial processes.

The changing nature of energy supply will mean that the way energy is used, and the infrastructure that supports supply, will need to become more flexible integrating different types of energy and responding to demand at different times of the day. A smart approach is therefore required which uses real-time data and technologies such as smart meters to ensure that the energy system can operate in a way that will reduce system peaks. Combined with the increasing use of energy storage and balancing electricity, heat and cooling demand with the available supply, a smart system will deliver the optimum cost savings, reduce resource consumption and promote environmental benefits. The Mayor will work to increase delivery of decentralised energy in London and identify and map the opportunities to create a smart, flexible energy system.

2.2.2 Key Heating and Cooling policy and legislation

In addition to what was already mentioned by the London Borough of Islington with regards the heating and cooling legislation in the UK and the [current London Plan](#), the Mayor is taking a range of actions to improve the environment now, setting London on the path to create a better future.



The state of London's environment affects everyone who lives in and visits the city – it helps Londoners to stay healthy, makes London a good place to work and keeps the city functioning from day to day. Today London is facing a host of environmental challenges. Toxic air, noise pollution, the threat to our green spaces, and the adverse effects of climate change, all pose major risks to the health and wellbeing of Londoners.

With the aim of tackling the most urgent environmental challenges facing our city as well as safeguard London's environment over the longer term, in August 2017 the Mayor has published the draft [London Environmental Strategy](#). This is the first strategy to bring together approaches to every aspect of London's environment and is divided into the following areas:

- Air quality
- Green infrastructure
- Climate change mitigation and energy
- Waste
- Adapting to climate change
- Ambient noise

This Strategy has several objectives, policies and proposals that impact on heating and cooling in London, with particular regards to decentralised energy and district heating, and including but are not limited to:

- Objective 6.2 – Develop clean and smart, integrated energy systems utilising local and renewable energy sources
 - Policy 6.2.1 - Delivering more decentralised energy in London
 - Proposal 6.2.1a - Help implement large scale decentralised and low carbon energy projects, including stimulating demand from the GLA group
 - Policy 6.2.2 - Planning for London's new smart energy infrastructure
 - Proposal 6.2.2a - Encourage the identification and planning of decentralised energy in priority areas
 - Proposal 6.2.2b - Undertake demonstration project and trials to improve London's energy systems
- Objective 8.4 – London's people, infrastructure and public services are better prepared for and more resilient to extreme heat events
 - Policy 8.4.4 - Reduce the impacts of heat on streets



- Proposal 8.4.4b - The Mayor will work with TfL to put in place initiatives that will minimise heat on the underground and bus networks

In addition to the LES and the London Plan currently in force, the [Draft New London Plan](#) (DNLP) is currently open for consultation. This will be a new plan and will run from 2019 to 2041. In developing this strategy, in accordance with the legislation and associated regulations, the Mayor has had regard to a number of topics, including climate change and the consequences of climate change.

[Policy SI3](#) of the DNLP – titled Energy Infrastructure – requires the following conditions:

A. Boroughs and developers should engage at an early stage with relevant energy companies and bodies to establish the future energy requirements and infrastructure arising from large-scale development proposals such as Opportunity Areas, Town Centres, other growth areas or clusters of significant new development.

B. Energy masterplans should be developed for large-scale development locations which establish the most effective energy supply options.

C. Development Plans should:

1. identify the need for, and suitable sites for, any necessary energy infrastructure requirements including upgrades to existing infrastructure
2. identify existing heating and cooling networks and opportunities for expanding existing networks and establishing new networks.

D. Major development proposals within Heat Network Priority Areas should have a communal heating system

1. the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:
 - a. connect to local existing or planned heat networks
 - b. use available local secondary heat sources (in conjunction with heat pump, if required, and a lower temperature heating system)
 - c. generate clean heat and/or power from zero-emission sources
 - d. use fuel cells (if using natural gas in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)
 - e. use low emission combined heat and power (CHP) (in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)
 - f. use ultra-low NOx gas boilers.



2. CHP and ultra-low NO_x gas boiler communal or district heating systems should be designed to ensure that there is no significant impact on local air quality.
3. Where a heat network is planned but not yet in existence the development should be designed for connection at a later date.

The DNLP promotes the use of the [London Heat Map](#) and all other relevant mapping tools from the GLA group.

2.2.3 Heating and Cooling within urban development and renovation programmes

Nearly three quarters of the energy used in London's homes is for heating and hot water, and the overwhelming majority of this demand is met using gas-fired boilers. Already one in ten electricity substations are approaching full capacity and the redevelopment of large parts of the city will increase demand for energy and the infrastructure required to distribute it. One in ten households in the city currently lives in fuel poverty.

On the other hand, climate change is set to lead to heatwave conditions every summer by the middle of the century, and the Urban Heat Island effect makes the centre of London up to 10°C warmer than the rural areas around the city. Increasing heat risk could make homes, workplaces and public transport uncomfortable for all and dangerous for the most vulnerable. Increasing demand for cooling may put stress on power supply networks, threatening London's sustainability and increasing emissions.

The objectives, policies and proposals mentioned in Section 9.2.2 aim at ensuring that the supply of more local, decentralised, low carbon energy in London is maximised by adopting highly efficient generation systems coupled with district heating schemes, or individual building heat pumps where the installation of heat networks is not feasible.

District heating networks and renewable energy supply account for approximately half of London's decentralised energy systems, delivering the equivalent of two per cent of total demand. There is the opportunity to increase this type of energy supply to 15 per cent of demand by 2030. There are a number of opportunities for further decentralised energy projects including large-scale solar PV installations and heat networks utilising technologies such as heat pumps in combination with secondary heat sources.

Amongst the several programmes and initiatives being delivered by the Mayor, it is worth mentioning Sharing Cities², a European Commission initiative that aims to make and put in place new and innovative solution to city issues and showcase them in three cities of London, Milan and Lisbon.

A range of smart technology is being piloted such as smart lampposts, infrastructure for electric vehicles and Sustainable Energy Management Systems, which promotes sustainable and energy saving projects.

² For more information please visit <http://www.sharingcities.eu/>



2.2.4 Financing Opportunities and Instruments

To facilitate implementation the Mayor will provide support to boroughs and the private sector through the Decentralised Energy Enabling Project (DEEP)³.

Over the next two years, this programme will help implement large-scale decentralised energy projects in London, which the market is currently failing to develop. DEEP will provide technical, commercial, financial and other support services to assist public and private sectors to develop, procure and bring into operation these large-scale projects.

The redevelopment of the London Heat Map⁴, expected to be completed by the end of 2018, will also fall under the remit of DEEP.

This new version of the London Heat Map will be updated and improved to reflect the changes in technology since its first launch in 2009 as well as be made more user friendly for the user. Some of its features may be related to, or developed in conjunction with, the THERMOS tool.

2.3 Stakeholder Identification and Engagement

2.3.1 Local stakeholders

2.3.1.1 London Boroughs

The 32 London boroughs and the City of London Corporation own and manage across the Greater London territory a large number of existing and proposed buildings with significant heat loads. A vast proportion of such buildings are, or will be through planning requirements, communally heated and represent a major base heat load for decentralised energy project in London.

2.3.1.2 Developers

Both the London Plan and the draft London Environmental Strategy pose conditions on new developments to connect to local heat networks where feasible.

2.3.1.3 Housing Associations

Housing associations are private, non-profit making organisations that provide low-cost "social housing" for people in need of a home. They provide a wide range of housing, some managing large estates of housing, and are now the United Kingdom's major providers of new housing for rent⁵.

³ DEEP will provide technical, commercial, financial and other advisory and support services to assist public and private energy suppliers to develop, procure and bring into operation larger-scale DE schemes that deliver significant greenhouse-gas emission reductions at market competitive prices. It will deliver CO₂ reductions of 17,400 tonnes per annum by September 2019 through projects it directly supports, and aims to enable 90 MW of capacity installed by 2023. It will prioritise key locations where the feasibility is most suitable. For more information please visit <https://www.london.gov.uk/what-we-do/environment/energy/energy-supply>

⁴ <https://www.london.gov.uk/what-we-do/environment/energy/london-heat-map/view-london-heat-map>

⁵ Text from https://en.wikipedia.org/wiki/Housing_association



2.3.1.4 ESCOs

Energy Services Companies (ESCOs) provide a range of energy solutions including design, finance and implementation of energy projects.

2.3.1.5 Thames Water

Thames Water Utilities Ltd, known as Thames Water, is the monopoly private utility company responsible for the public water supply and waste water treatment in large parts of Greater London, Luton, the Thames Valley, Surrey, Gloucestershire, Wiltshire, Kent, and some other areas of the United Kingdom⁶.

2.3.2 National stakeholders

As mentioned above in Section 3.3.2, the main national stakeholders are the Department for Business, Energy and Industrial Strategy (BEIS), with its Heat Network Development Unit (HNDU) and Heat Network Investment Project (HNIP), and the Association for Decentralised Energy (ADE), a trade body for district heating providers.

The Heat Trust, operated by Heat Customer Protection Ltd - a not-for-profit company – is a customer protection scheme for heat consumers connected to a district heating network and could represent a valuable stakeholder.

Distribution network operators (DNOs) are companies licensed to distribute electricity in Great Britain by the Office of Gas and Electricity Markets. UKPN and SSE hold licences in the areas in and around London⁷.

2.3.3 Existing stakeholder participation processes

GLA engages with a range of district heating stakeholders through the London Heat Map and the planning process where large developments that are referred to the Mayor have to submit energy statements to illustrate how its energy demand is being minimised and the residual demand is being met. Relationships with district heating related stakeholders have got closer since the GLA developed its Decentralised Energy Project Delivery Unit (DEPDU) and then its successor the Decentralised Energy Enabling Project (DEEP). These projects have worked with a range of public and private stakeholders involved in district heating to support them in developing district heating projects.

2.3.4 THERMOS Local Liaison Group

The initial members of the London Local Liaison Group (LLG) members have been identified in addition to the GLA and are detailed in the table below. The local authorities are those covering the heat network priority zones for London.

ADE	Trade body for decentralised energy in the UK
BEIS	Government department responsible for heat networks
Brent Council	Local authority in London

⁶ Text from https://en.wikipedia.org/wiki/Thames_Water

⁷ For more information please visit https://en.wikipedia.org/wiki/Distribution_network_operator



Camden Council	Local authority in London
G15	Group of the largest non-council social housing providers in London
Greenwich Council	Local authority in London
Hackney Council	Local authority in London
Haringey Council	Local authority in London
Sutton Council	Local authority in London
Waltham Forest Council	Local authority in London
Westminster Council	Local authority in London
Islington Council	Local authority in London

2.3.5 Stakeholder Engagement Strategies

The GLA, with the joint support of the London Borough of Islington, will help promote and roll out the use of THERMOS, with regular workshops to borough officers, developers and consultants.

2.4 Towards THERMOS Uptake

2.4.1 Barriers

The most significant barrier for the implementation of decentralised energy (DE) projects is finance. Other barriers, particularly within local authorities, are represented by general the lack of know-how in all phases of the project implementation, from specification writing, to understanding the planning requirements, to procurement.

Then the barriers to THERMOS will be that users are not aware of it, how it can be used, how it can help them and how it can feed into the pre-feasibility and feasibility work that they will be doing to develop optimum routes for heat networks in any given district or neighbourhood.

2.4.2 Proposed solutions

Since 2009, with the launch of the London Heat Map and the roll-out of a number of programmes and small-grant schemes, the GLA has provided continuous support to local authorities and other entities to facilitate the development and delivery of DE projects. As part of this work it will widely promote and extol the virtues of the THERMOS Tool to relevant stakeholders.

The THERMOS tool would allow borough officers to carry out a first technical and financial analysis and option appraisal of potential DE projects; the GLA would represent a key stakeholder in delivering a thorough training programme to local authorities to ensure an effective rollout of the tool.

The GLA and the London Borough of Islington will deliver a training programme aimed at facilitating the promotion and dissemination of the THERMOS tool to the relevant stakeholders.

Such training programme is thought to commence in Autumn 2018 and will continue throughout the THERMOS implementation programme.



2.4.3 THERMOS exploitation opportunities

The THERMOS tool will allow the relevant stakeholders to carry out preliminary techno-economic appraisals and prioritisation of DE opportunities which may arise in heat network priority zones, such as OAPFs.

The GLA will continue to promote the use of the tool at events it attends to raise awareness of how it can help stakeholders in the district heating sector to understand and make maximum benefit of the THERMOS Tool. It will also be linked to the London HeatMap so that organisations that use the London HeatMap can also explore how THERMOS could support their activities a swell.

2.5 THERMOS Case Study: DEEP - Decentralised Energy Enabling Project

2.5.1 Objectives

DEEP has been established to provide public sector intervention and support to larger-scale DE projects in London that the market is failing to develop and realise.

DEEP procures strategic, technical, commercial/financial and legal advisory support services through an OJEU framework to help beneficiaries bring larger-scale DE schemes into operation in order to significantly reduce CO₂ emissions at market-competitive prices and increase renewable energy generation capacity in London.

2.5.2 Key stakeholders

To be developed – ALL DISTRICT ENERGY RELATED STAKEHOLDERS PUBLIC AND PRIVATE

A procurement briefing document has been provided describing how to procure a supplier from a sub-lot of the framework.

2.5.3 KPI indicators table

It is expected that DEEP will deliver CO₂ reductions of 17,400 tonnes per annum by September 2019 through projects it directly supports, and aims to enable 90 MW of capacity installed by 2023.

Key performance indicator (core scheme)	
Number and type of energy generation units	n/a
Solar thermal energy generation (MWh/ year)	n/a
Heat pump energy generation (MWh/ year)	n/a
Biomass energy generation (MWh/ year)	n/a
Waste heat potential (MWh/ year)	n/a
Buildings' energy consumption in the residential sector (MWh/ year)	n/a
Buildings' energy consumption in the commercial sector (MWh/ year)	n/a



Buildings' energy consumption in the industrial sector (MWh/ year)	n/a
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2.5.4 Financing status/ opportunities

The £3.5m-project is 50% funded by the European Regional Development Fund (ERDF). The framework is available to use and the contract award is published.

Beneficiaries can call off services from the framework which – subject to GLA agreement – will be funded by the project. The project will fund all work [not capital] related to DE projects from early stage heat mapping/energy master planning, taking project ideas from concept through to feasibility, business case, procurement and commercialisation.

2.5.5 Exploitation of the opportunity

Prospective beneficiaries interested in receiving services from the project should sign a Support Agreement (SA). From signing a SA and agreeing a scope of works with the GLA that aligns with Mayoral priorities – as well as beneficiary priorities – a specification will be jointly written between the DEEP project and beneficiary.

Please note that all public bodies within England & Wales can make use of the framework for their own procurement activities.

In 2017 DEEP commissioned 5 pieces of work with at least 1 other organisation outside London utilising the framework for its own DE procurement undertaking. We expect to commission at least another 3 pieces in early 2018 with further mini-competitions taking place throughout the year.

Information updates on the project are made periodically in the London.gov website.