Scenarios to 2050: London Energy Plan

Scenario narrative

Background

The London Energy Plan allows us to model London's energy demand, supply and infrastructure to 2050, under several scenarios. All scenarios are based on top down and bottom up modelling of London's characteristics. We are not just applying national pathways to London; these are specific to the capital.

If London's population continues to grow as it has recently, it will be in excess of 11 million by 2050. The London Energy Plan brings together existing evidence and data, and creates new data and models to help London identify the impact of a growing and evolving city on our energy infrastructure. It suggests options for how we can reduce and meet existing energy demand and minimise and meet new demand whilst keeping costs down and hitting our climate change targets.

Purpose of this document

The London Energy Plan looks at four scenarios for the city's energy infrastructure to 2050. These scenarios allow us to explore the opportunities that are available for the city. London is a densely populated urban environment which presents a range of opportunities for the energy system that are unique to this type of environment.

The scenarios are:

- High demand, centralised supply
- Mid demand, mixed supply
- Low demand, decentralised supply
- Low demand, centralised supply

This document provides a summary of each of these scenarios and the main underlying assumptions that we have made in each case. This provides a user guide to the London Energy Plan interactive map which shows the spatial trends for each of these scenarios across a variety of data layers ranging from heat demand, power demand, potential heat networks, transport power demand and local generation.

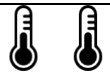
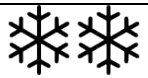
Across all scenarios there are some constant projections. These include:

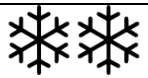
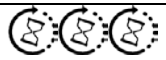
- Population increase
- Projections of new domestic and non-domestic buildings
- Temperature change – using a medium climate scenario[1]. This predicts a mean temperature increase of 2.2^{o}C in winter and 2.7^{o}C in summer.
- Transport demand changes (rail and underground)

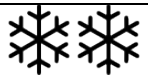
For more information please see www.london.gov.uk/londonenergyplan

[1] Prometheus weather files, based on UKCP09 climate projections

High demand, centralised supply 2050	
Context	This scenario reflects a similar energy system to the one we have today in 2050. This involves a reliance on energy from central supply networks and assumes that the increase in population coupled with more homes and workplaces will increase energy demand across London. An assumption of low energy prices in this scenario means that buildings have high energy demand as investment in energy efficiency retrofit has not been incentivised. This scenario results in an estimated reduction of 60% in CO_2 emissions from 1990 levels.
 Heat demand	Marginal reduction in building energy demand from 2015 levels with 30% of existing domestic properties receiving low cost energy efficiency retrofits (loft and cavity wall insulation) and 15% of properties receiving high cost energy efficiency retrofits (solid wall insulation and double glazing). 58% of pre-1990 non-domestic building stock will have undergone retrofits which bring the buildings up to 2013 building regulation standards.
 Cooling	By 2050 it is predicted that temperatures in the UK will have increased. This combined with high building demand means that there may be a significant cooling requirement for buildings. Some of this will be accounted for through solar shading and passive measures however there is estimated to be up to 20% increase in the energy required for cooling between 2015 and 2050.
 Appliances	The improved efficiency of appliances and lighting in buildings is assumed to be driven by EU regulations. There is approximately 10% improvement in efficiency for appliances and a 40% improvement for lighting by 2050 however this is coupled with increased usage due to new buildings, increased population and more appliances being adopted in homes and workplaces.
 Transport	Some diesel (hybrid) is still assumed to be used in HGVs and LGVs however there is a high level of electric, hydrogen and hybrid vehicle uptake in private and public transport and energy demand for rail travel is expected to increase across the city. The major driver for this will be air quality concerns and improved mobility experience. A charging network will be implemented to support the additional demand.
 Heating systems	Power demand for the city increases significantly between 2015 and 2050 which reflects the increased population with limited interventions to reduce the overall demand of buildings. New buildings will have electric heating such as building level heat pumps while a large number of the existing gas boilers will have been replaced by heat pumps. Increased electricity demand across the city is likely to require reinforcement of the electricity network and additional substations.
 Heat networks	Around 10% of London's heat demand will be met using heat networks. For the installed heat networks there will be a diverse range of fuel sources including gas-fired CHP but as we move towards 2050 there will be an ever increasing amount of renewable energy and secondary heat sources being used, including fuel cells, heat pumps and local waste heat sources such as energy from waste plants and data centres.
 Demand side response	This scenario assumes that there are relatively small changes to energy prices, products and services to 2050 and that additional supply will be required to meet the increased demand of the city caused by increased population. Based on this there is an assumption that there will be limited uptake of demand side response technologies and services.

Mid demand, mixed supply 2050	
Context	This scenario shows small scale changes to the way London's energy infrastructure is designed between 2015 and 2050. It considers that energy prices are at a medium level which leads to some reduction of building demand and there is a move towards a balance of heat demand being met by local heat networks and electric sources from the grid. This scenario results in an estimated reduction of 75% in CO_2 emissions from 1990 levels.
 Heat demand	By 2050 heat and power demand from London's buildings has reduced but is still of a medium level with 60% of existing domestic properties receiving low cost energy efficiency retrofits (loft and cavity wall insulation) and 40% of properties receiving high cost energy efficiency retrofits (solid wall insulation and double glazing). 88% of pre-1990 non-domestic building stock and 42% of post 1990 stock will have undergone retrofits which bring the buildings to 2013 building regulation standards.
 Cooling	By 2050 it is predicted that temperatures in the UK will increase. By reducing the overall building demand the impact of increased temperatures will be mitigated however there will still be an increased cooling requirement for buildings. Some of this will be accounted for through solar shading and passive measures however there is still estimated to be up to 20% increase in the energy required for cooling between 2015 and 2050.
 Appliances	The improved efficiency of appliances and lighting in buildings is assumed to be driven by EU regulations. There is approximately 30% improvement in efficiency for appliances and a 70% improvement for lighting by 2050 however this may be coupled with increased usage due to new buildings, increased population and more appliances being adopted in each home or workplace.
 Transport	Some diesel is still assumed to be used in HGVs and LGVs however there is a medium level of electric vehicles in private and public transport across the city. The major driver for this will be air quality concerns and improved mobility experience - a charging network will be implemented to support the additional demand.
 Heating systems	Electricity demand for the city increases by up to 15% between 2015 and 2050 under this scenario which reflects the increase in population and increase in power demand from building level heat pumps which will be adopted in buildings that are not heated by heat networks.
 Heat networks	Around a third of London's heat demand will be met using heat networks. The installed heat networks will become increasingly low carbon and the fuel sources will reflect this through the increasing use of renewable energy and local secondary heat sources such as energy from waste plants and data centres. This will reduce the demand placed on the national electricity and gas networks.
 Demand side response	Increased uptake of demand side response technologies, this is driven by an increase in electricity prices and new energy products and services which will drive consumers to use electricity more efficiently to reduce peak time usage. Also, increased demand side response will limit the overall capital investment required in the energy supply infrastructure.

Low demand, decentralised supply 2050	
Context	This scenario demonstrates significant change to London's energy infrastructure from how it is today. It considers that high energy prices have led to a significant reduction in building energy demand and that London has made a conscious decision to implement heat networks at a large scale. The heat networks use secondary heat sources to provide heat to buildings therefore utilising low cost heat sources within the city. This scenario results in an estimated reduction of 80% in CO_2 emissions from 1990 levels.
 Heat demand	By 2050 heat and power demand from London's buildings has been minimised with 10% of existing domestic properties receiving low cost energy efficiency retrofits (loft and cavity wall insulation) and 90% of properties receiving high cost energy efficiency retrofits (solid wall insulation and double glazing). 100% of the non-domestic building stock will have undergone retrofits which bring the buildings to 2013 building regulation standards.
 Cooling	By 2050 it is predicted that temperatures in the UK will increase leading to an increased cooling demand from buildings. Some of this will be accounted for through solar shading and passive measures however there is still likely to be up to 30% increase in the energy required for cooling between 2015 and 2050.
 Appliances	The improved efficiency of appliances and lighting in buildings is assumed to be driven by EU regulations. There is approximately 50% improvement in efficiency for appliances and 80% improvement for lighting by 2050 however this is coupled with increased usage due to new buildings, increased population and more appliances being adopted in each home or workplace. Overall, there is assumed to be a significant reduction in appliance and lighting demand, up to 30%.
 Transport	Some diesel (hybrid) is still assumed to be used in HGVs and LGVs however there is a medium level of electric vehicles in private and public transport across the city. The major driver for this will be air quality concerns and improved mobility experience. A charging network will be implemented to support the additional demand.
 Heating systems	Where heat networks are not viable due to low heat density in certain areas then it is assumed that building level heat pumps will be installed. This is expected to be a low number in this scenario as large portions of the city are served by heat networks. It is estimated that electricity demand will reduce by 15% across the city in this scenario.
 Heat networks	Around a third of London's heat demand will be met using heat networks. The installed heat networks will become increasingly low carbon and the fuel sources will reflect this through the increasing use of renewable energy and local secondary heat sources such as energy from waste plants and data centres. This will reduce the demand placed on the national electricity and gas networks.
 Demand side response	Increased availability and reduced cost of demand side response technology coupled with increased electricity prices, and new energy products and services means the uptake of demand side response is high under this scenario.

Low demand, centralised supply 2050	
Context	This scenario reflects a similar energy system to the one we have today in 2050 which primarily relies on national supply however it assumes that there has been significant interventions to reduce building demand. These are likely to have been driven by regulatory requirements. It includes a significant uptake in electrification of heat and transport. This scenario results in an estimated reduction of 80% in CO_2 emissions from 1990 levels.
 Heat demand	By 2050 heat and power demand from London's buildings has been minimised with 10% of existing domestic properties receiving low cost energy efficiency retrofits (loft and cavity wall insulation) and 90% of properties receiving high cost energy efficiency retrofits (solid wall insulation and double glazing). 100% of the non-domestic building stock will have undergone retrofits which bring the buildings to 2013 building regulation standards.
 Cooling	By 2050 it is predicted that temperatures in the UK will increase leading to an increased cooling demand from buildings. Some of this will be accounted for through solar shading and passive measures however there is still likely to be up to 30% increase in the energy required for cooling between 2015 and 2050.
 Appliances	The improved efficiency of appliances and lighting in buildings is assumed to be driven by EU regulations. There is approximately 50% improvement in efficiency for appliances and 80% improvement for lighting by 2050 however this may be coupled with increased usage due to new buildings, increased population and more appliances being adopted in each home or workplace. Overall, there is assumed to be a significant reduction in appliance and lighting demand, up to 30%.
 Transport	Some diesel is still assumed to be used in HGVs and LGVs however there is still a high level of electric vehicle uptake in private and public transport and increased energy demand for rail travel across the city. The major driver for this will be air quality concerns and improved mobility experience - a charging network will be implemented to support the additional demand.
 Heating systems	In this scenario there is significant uptake of building level heat pumps. This reflects an increased population and a reliance on electricity from the grid rather than locally generated power within London. It is assumed that the electricity grid has been decarbonised by 2050 and this has led to electric heating becoming more attractive through reduced costs.
 Heat networks	Around 10% of London's heat demand will be met using heat networks. The installed heat networks will have a diverse range of fuel sources, including gas-fired CHP**,** but as we move towards 2050 there will be an ever increasing amount of renewable energy and secondary heat sources being used, including fuel cells, heat pumps and local waste heat sources such as energy from waste plants and data centres.
 Demand side response	Increased availability and reduced cost of demand side response technology coupled with increased electricity prices, and new energy products and services means the uptake of demand side response is high under this scenario.