

ENABLING INFRASTRUCTURE: GREEN, ENERGY, WATER AND WASTE INFRASTRUCTURE TO 2050

MAYOR OF LONDON



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This document is part of a suite of documents supporting the Mayor's consultation on London's long term infrastructure requirements. 'London Infrastructure Plan 2050 A Consultation' sets out London's strategic requirements to 2050 across transport, green, digital, energy, water and waste infrastructure, how much it will cost and how we might pay for it all. It invites responses on a range of issues, including those looked at in this document. Readers are encouraged to respond through the [consultation page](#) at London.gov.

This document set outs the GLA's analysis of the issues, opportunities and challenges across:

- **Green infrastructure** – London's network of parks, green spaces, trees and features such as green roofs
- **Energy** – Electricity, gas and renewable, nationally and locally produced
- **Water** – Water supply, drainage (rain and waste water), wastewater and flood risk management
- **Resource management** – Recycling, re-use and disposal facilities

This analysis has underpinned the conclusion reached in this document and the overall consultation report.

The current situation and our vision for 2050 are set out in Chapter 2; Chapter 3 then looks at the common challenges facing infrastructure provision. Chapters: 4-7 describe the analysis and background to each sector and set out the proposed way forward.

The transport and digital analysis are set out in separate papers published alongside this document. The 'London Infrastructure Plan 2050 A Consultation' report brings the analysis together and sets out London's strategic infrastructure needs to 2050, how we will ensure effective delivery, the likely magnitude of costs involved and options for funding and financing our requirements.

We have approached the task of planning for London's infrastructure requirements to 2050 from the point of view of infrastructure being a key enabler of housing growth as well as supporting the economy. Providing enough housing to meet demand from London's rapidly increasing population is likely to remain London's greatest challenge. Infrastructure, particularly transport, will be a key factor in unlocking housing growth across the city. We have considered where transport has the potential to unlock housing growth. We have then considered infrastructure requirements beyond transport.

The infrastructure considered in this document is crucial for London's continued and sustainable economic growth, the resilience of the city, and for improving Londoners' overall quality of life.

By 2050, London will:

- Have a secure, sustainable and affordable water and energy supply
- Have completed the transition from 'take-make-dispose' to a circular economy
- Be resilient to all but the most extreme weather
- Have a city wide green infrastructure network that is planned, designed and managed to absorb floodwater, keep the city cool, encourage healthy lifestyles, and enhance biodiversity and ecological resilience.

The actions outlined below will be key to ensuring these objectives are met. Many of the actions are outside the Mayor's direct control. Concerted action by City Hall, the boroughs, infrastructure providers, Government and the regulators will be required.

The Mayor will take action to ensure a step change in the amount of joint working to deliver London's infrastructure, including through convening a London Infrastructure Delivery Board made up of the key players in delivering London's infrastructure. The Board will consist of senior representatives from all the main infrastructure providers in London to create links across sectors and to utilise their expertise on best practice delivery. To find out more about the Delivery Board see the 'Improving Delivery of London's Infrastructure' paper published alongside this document.

This must be supported by action at the national level too. The Mayor will seek action from the relevant Government Departments, Infrastructure UK, regulators and other parties to take forward the proposals below.

Population growth

While London has been growing continuously for thirty years, the rate of growth has increased in the last decade. This growth is expected to continue to such an extent that it is projected that London's population growth will mean that:

- The previous population peak of 8.6 million (in 1939) will be surpassed early next year
- By the 2030s London's population will reach 10 million
- By 2050 the city's population will have increased by 37% to 11.3 million (based on GLA Intelligence Unit's central projection).

The projections are set out in more detail in the GLA Intelligence Unit report 'Population and Employment Projections to Support the London Infrastructure Plan 2050' published alongside this report. These are projections and subject to a great deal of uncertainty, for which reason high and low projection have also been produced – projecting that London's population could stand between 9.5 million and 13.4 million at 2050.

The analysis below is based on the central population projection, but consideration has been given to the implications of alternative trajectories.

London's growth alone will increase demand, both for existing and new infrastructure. There are other challenges that will only increase the need for investment and/or changes to how we approach infrastructure delivery.

Lack of investment and strategic planning

There has, in general, been a backlog of investment and historically low levels of capital investment compared to other countries. A relatively recent survey¹ found that 'historic levels of underinvestment' have placed UK businesses at a disadvantage. OECD figures indicate that the UK's public investment since the millennium has been consistently below that of the majority of OECD countries².

Across the piece, our infrastructure has a relatively poor perception and performance compared to our other global cities peer group. In the World Economic Forum Global Competitiveness 2013-2014 report,³ the UK was ranked only 28th on perceptions of 'quality of overall infrastructure'.

¹ CBI/KPMG infrastructure survey September 2013 (based a survey of 526 business leaders)

² CBI/KPMG infrastructure survey September 2013 - analysis based on OECD statistics

³ The Global Competitiveness Report 2013-14, World Economic Forum 2013. The infrastructure ranking is based on range of data sources and the WEF's own annual Executive Opinion Survey.

London is one of the greenest big cities in the world - a consequence of a land-use planning framework that has sought to protect London's diversity of green spaces over many decades.

However, green infrastructure is still not considered as infrastructure in its own right. A lack of a strategic, London wide approach that makes investment decisions considering the whole range of benefits green infrastructure brings (drainage, shade, walk and cycle ways and much more) has resulted in below optimal investment. This is reflected in the Economist Intelligence Unit's Green Infrastructure Index⁴ which puts London in 11th place.

Uncoordinated delivery

As we have learned from successful infrastructure projects such as the Olympic Park, infrastructure delivery works best when delivery is integrated across sectors. However, joined up delivery does not tend to be the norm. Delivery and governance are disjointed. For example:

- Water is supplied by four monopoly suppliers⁵, which are regulated by Ofwat. Water management is rarely integrated, and water supply, wastewater treatment and flood risk management are treated as separate issues, leading to ingrained silo-thinking and missed opportunities.
- The energy sector is made up of private companies, regulated by Ofgem.
- Waste disposal is not coordinated at a London level, and there are a variety of standards and practices across the city.
- No single body or set of bodies manages London's green space from a network perspective. The boroughs and the Royal Parks manage many public parks and open spaces, and much of London's green infrastructure is managed by a variety of other organisations. The capacity of green space to reduce flood risk is rarely factored into the planning or design of parks.

⁴ The Index measures cities on 30 indicators, of which about half are quantitative such as CO₂ emissions per capita and recycling rates. Qualitative indicators include commitments to policies such as air quality codes.

⁵ Thames Water, Affinity Water, Essex and Suffolk Water and Sutton & East Surrey Water, with one sewer undertaker, Thames Water.

While the GLA's statutory planning document, the London Plan, sets out growth forecasts for London, many of bodies above do not need to plan on the same basis.

Mechanisms are not in place for infrastructure providers such as the water and energy companies to talk to each as infrastructure projects are being planned or in the early stages of being delivered. To overcome this, the Mayor will convene a London Infrastructure Delivery Board composed of senior representatives from all the main infrastructure deliverers in London. The members of the Board will work to better join up delivery, forge links across sectors and share expertise on best-practice delivery.

Regulated industries

Energy, water, and waste are all regulated industries. The regulatory frameworks determine how companies in these sectors invest in infrastructure and deliver services to consumers. The regulators' main interest is in protecting consumer interests, in particular against unnecessary price rises, and given the UK enjoys some of the lowest prices in Europe, their work has been successful and we would not argue with the underlying principles they have adopted.

However, many of the current challenges facing these sectors in London stem from the fact that:

- regulations are designed to manage a 'steady state' and do not have the flexibility to respond to the scale and pace of change in London (the consequences of some regulations in effect disincentivise investment ahead of demand)
- the regulatory structures treat all parts of the country in the same way with no differentiation made between small towns and rural areas and the UK's largest and growing cities
- the regulators do not work together towards achieving integrated outcomes (e.g. Ofwat and Ofgem do not incentivise the dual retrofitting of water and energy efficiency)
- uncertainty over future regulatory changes discourages new investment
- There are few incentives for utility companies to help consumers reduce their demand for scarce resources. Broadband is the utility where usage is to be encouraged but there is no universal service requirement or incentives to roll out fibre to some parts of London that are currently unserved
- Large investments with a guaranteed rate of return can be favoured over cost saving measures.

These challenges raise a number of issues for London and are covered in more detail below. They include:

- A lack of possibilities for investment ahead of need in electricity infrastructure, which delays developments and increases associated costs
- The water companies have greater incentives to invest in significant new resources (e.g. a new reservoir) rather than in maintaining existing infrastructure (such as ageing pipes).

The Mayor calls on the regulators to join up their planning and procedures. The Mayor can provide the mechanisms for co-ordination within London. However, greater co-ordination is needed at the national level too. Joined up planning across regulators, and therefore utility providers, will be a valuable step towards improved – more timely and cheaper - delivery of infrastructure in London.

The following sections consider these issues in more detail and set out our proposed way forward for green, energy, water and waste infrastructure.

A clear economic case is emerging for investment in green infrastructure, with benefits far beyond provision of space for recreation. Around the world the benefits from, for example, reduced flood risk, improved health outcomes and increased ecological resilience are being quantified. Specific evidence on costs and benefits for London are starting to become available, but more is needed.

Many cities around the world are beginning to acknowledge that investing in their green infrastructure can appreciably improve the environmental performance, sustainability and quality of life of urban districts. For some city authorities the driver is more stringent regulation of water or air quality; for others it is a response to the apparent and potential impacts of climate change, or a desire to ensure quality of life is maintained in the face of increasing population and urban density. Whatever the perspective, investment in green infrastructure is also seen as an increasingly important foundation for a city's economy and its competitiveness.

Green infrastructure provides a variety of functions beyond providing space for recreation. In many cases green infrastructure provides better value, more sustainable, complementary solutions to challenges, such as flood risk alleviation and transport provision than traditional infrastructure responses. For example:

- Sustainable drainage systems (SuDS) comprising a chain of interventions such as green roofs, rain gardens, swales and detention basins planned and implemented at a catchment-scale - can significantly reduce the amount of run-off being discharged to the piped network thus reducing the need for upgraded hard infrastructure and delivering additional benefits such as improved water quality, enhanced biodiversity and increased amenity.
- Greener cycle and walking routes can encourage an even greater modal shift to cycling and walking thus helping to reduce congestion on the road network and increased overcrowding on public transport as the population grows, whilst providing additional benefits such as better health and improved air quality.

Current provision, policy context and funding arrangements

London's current network of parks, green spaces and other green features (such as street trees) are managed by over 40 different public authorities and agencies. This results in an approach to planning, management and maintenance of a suite of assets that does not fully appreciate or realise the range of functions and potential benefits that could be provided by a more integrated green infrastructure.

Furthermore, most of the existing network was not designed to address current environmental imperatives such as floodwater management, improving air quality, urban cooling and ecological resilience, albeit they do provide some of these benefits by default.

Over recent decades policies and programmes in London have been reasonably effective in ensuring the protection and preservation of parks and green spaces to provide Londoners opportunities for outdoor sport and recreation and access to natural and heritage landscapes.

However, the traditional parks and green space network has been subject to cycles of capital investment followed by periods of underfunding in management and maintenance. This is largely due to the fact that parks and green spaces are mostly funded from the public purse, are not properly recognised as assets and there is no statutory duty for local authorities to provide them.

This inherent structural problem has been consistently acknowledged in a series of reports including:

- [Greener Spaces, Better Places](#)⁶ (2002), the report of the Urban Green Spaces Taskforce;
- [Enhancing Urban Green Space](#)⁷ (2006) published by the National Audit Office;
- [Making the Invisible Visible](#)⁸ (2009) a report by CABE Space
- [Park Land](#)⁹ (2013) a report by Policy Exchange.

Common themes running through these reviews of the funding for parks and green spaces are:

- Insufficient appreciation, and consequent undervaluation, of the existing benefits provided;

⁶ http://www.ocs.polito.it/biblioteca/verde/taskforce/gspaces_.pdf

⁷ <https://www.nao.org.uk/report/enhancing-urban-green-space/>

⁸ <http://webarchive.nationalarchives.gov.uk/20110118095356/http://www.cabe.org.uk/publications/making-the-invisible-visible>

⁹ <http://www.policyexchange.org.uk/publications/category/item/park-land>

- low levels of asset value calculations being conducted; and
- a lack of shared objectives and common standards by those with responsibility for the design, management and maintenance of the existing resource.

Consequently, there is growing recognition that the traditional concept of parks and green spaces results in an underutilised resource which could deliver a much wider range of functions if understood, designed and managed as a network of green infrastructure. Furthermore, this core network could be augmented by green features (such as green roofs) that can be incorporated successfully and cost-effectively into the built environment.

Towards a more effective and cost-efficient approach

As the population grows and the city develops there will be a need to increase the functionality of the existing network in order to deliver the benefits of an integrated green infrastructure.

This requires a physical restructuring of much of the existing green space network over time to improve its overall performance. This will entail capital enhancements (such as reconfiguring green spaces to absorb and store flood water) and a commensurate uplift in maintenance expenditure to ensure the asset value of the improved infrastructure is maintained.

The increased cost of implementing this functional green infrastructure is likely to be offset by the economic benefits of increased resilience and the societal benefits of enhanced quality of life, health and well-being.

Developing and mainstreaming the green infrastructure approach could result in reduced cost to public authorities by minimising the expense of managing negative externalities - such as stormwater and air pollution - and by diversifying the funding sources for the provision of public goods - such as improved health and well-being and ecological resilience. Furthermore, there are important synergies with other infrastructure needs (especially in relation to transport and water) and it is expected that actors in these sectors will contribute to the cost of establishing a more coherent green infrastructure.

Around the world the concept of green infrastructure is becoming mainstream. A number of well-researched reports and assessments are illustrating the economic benefits derived from the services provided by green infrastructure. These include:

- The city of Chicago has estimated that investment in “greening” only a small percentage of the city’s rooftops has significantly reduced air pollution. Converting 10 per cent of Chicago’s rooftops removed 17,400 Mg of nitrogen dioxide each year. In turn, Chicago estimates that this investment could result in avoided public health costs of \$29.2m to \$111m annually (around £17m to £65m).¹⁰
- In 2011 the city of Philadelphia created the [Green City, Clean Waters](#) program, a 25-year, \$2.5 billion (around £1.47bn) plan to protect and enhance the city’s watersheds by managing storm water with innovative green infrastructure. The city estimates that the use of green infrastructure in lieu of traditional approaches will save \$8 billion (around £4.7bn) over the life of the programme. This bold initiative is a paradigm shift in approach that treats urban water resources as a key pathway to a sustainable future for the city.
- Copenhagen has recently published a [Cloudburst Management Plan](#)¹¹ which aims to significantly reduce serious surface water flooding resulting from extreme rainfall events through green infrastructure interventions (alongside other measures). The Plan envisages an implementation cost of DKK 3.8bn (around £410m), but this is set against a DKK 5-6bn (around £600m) cost to the city resulting from just one extreme downpour event in 2011.

Despite the increasing library of international studies illustrating the economic case for green infrastructure, it is acknowledged that many of the assumptions and valuation models employed to derive costs and benefits are quite specific due to their different environmental, policy and fiscal contexts. Consequently, assessments and valuations informed by London’s unique character are required.

Relevant case studies for London’s green infrastructure are beginning to emerge. The quarter being created in and around the Olympic Park is demonstrating how the services and benefits of green infrastructure can be provided through good planning and design of urban regeneration. Installing sustainable drainage, encouraging active lifestyles, enhancing ecology, and blurring the distinction between parkland and urban form, were principles that informed the design and

¹⁰ Clark, C et al., *Green Roof Valuation: A Probabilistic Economic Analysis of Environmental Benefits* January, 2012.

¹¹ http://en.klimatilpasning.dk/media/665626/cph_-_cloudburst_management_plan.pdf

construction of the parklands and which are being transposed into the development of the new housing and social infrastructure. This will form an important part of the evidence base for London.

In order to articulate a clear and compelling economic rationale for future investment in green infrastructure, the Mayor will undertake, or support others to undertake, a series of bespoke assessments. As explained below, assessing the evidence on the economic case for investment in green infrastructure will be a consideration of the Green Infrastructure Task Force.

Quantifying London's green infrastructure requirements

The London Plan has already identified some long-term green infrastructure requirements which relate to addressing the potential impacts of climate change. These include:

- 30% of London's area to be under a tree canopy – a 10 percentage point increase from the 2008 baseline
- a 10% increase in green cover (e.g. green roofs) in the Central Activities Zone (CAZ).

It can reasonably be assumed that with the latest projections for population growth, the requirement to increase green cover by 10% in the CAZ should be applied to other parts of the city that are likely to assume the same levels of density.

Furthermore, the projected increase in population would also require the equivalent of 9,000 hectares of additional green space to be established in order to maintain the status quo (existing London Plan standards) in relation to accessible green space. This quantum of additional green space is unlikely to be met entirely through a traditional approach to provision. Consequently, in the existing densely developed parts of the city, and in those parts of the city identified for increased densification, the provision of green space may need to be met by novel forms of greener public realm such as, for example, linked roof-gardens or the greening of streets converted to shared space.

Delivering London's green infrastructure needs

There are many challenges in moving from the current approach to green space provision to one which engenders a more integrated approach that could optimise the benefits of London's green infrastructure and provide it in ways which are more efficient and more sustainable.

The [All London Green Grid](#) provides a spatial planning policy framework to achieve this; but there is a need for a clearer direction of travel with regards to governance, co-ordination and investment, to realise the benefits of the existing network managed as a green infrastructure, rather than as series of self-contained spaces. This will help to:

- Inform the functions required from London's green infrastructure as London's urban form changes over time.
- Identify and prioritise the objectives for the different elements of the network which have to be considered at a more strategic level.

Next Steps

The Mayor is establishing a 'Green Infrastructure Task Force' (similar to the Roads Task Force) with a remit to consider the current challenges facing London's parks and green spaces, and to advise on a long-term strategy for London's green infrastructure and the options for governance and funding. The Task Force will explore:

- Whether the underutilisation and underfunding of London's existing green infrastructure is a consequence of the lack of appropriate asset management protocols that apply to other essential infrastructure.
- How the existing network of parks and green spaces might be upgraded to improve performance - designed and managed to provide additional services whilst maintaining their amenity benefits.
- New financing mechanisms and investment vehicles for green infrastructure to obviate the default position whereby most of the existing resource is considered a public good provided through the public purse - despite there being no statutory duty for local authorities to provide parks and green spaces, and even less so a green infrastructure.

- The potential institutional and governance arrangements required to produce the necessary shift in policy, strategy and operational management.

The 'Task Force' will be established in the Autumn and will be made up of individuals who represent the key user interests and/or have the expertise that can help advise the Mayor on this issue. During 2015 it will meet regularly to consider the key issues and challenges facing London's green infrastructure in the medium and long term. It will be supported by the GLA and will commission research and analysis as necessary. By the end of 2015 it will report on its findings, including recommendations for the governance and funding arrangements required for planning, co-ordinating and investing in green infrastructure programmes and strategic projects.

In addition to establishing the Task Force, the Mayor will accelerate the implementation of green infrastructure, especially in those parts of London subject to the most rapid regeneration and change by ensuring green infrastructure is considered in all of the major infrastructure and regeneration initiatives that are already being planned for London.

To ensure this, the Mayor will:

- lead by example by ensuring that development projects lead by the GLA or TfL will embed the concept of green infrastructure at project inception.
- promote new standards that will ensure that, in those parts of the city that are subject to increased densification, there will be a minimum 10% increase in the amount of green cover.

London is growing at unprecedented rates, and it is essential we see further step changes in the rate of house building. In the short term this will require investment ahead of need in an electricity infrastructure system which is already reaching capacity in some areas, to ensure that development is not obstructed or stalled.

In the longer term, London's energy infrastructure needs to be developed in the most cost effective and sustainable way.

A diversity of national sources of energy supply, including shale gas, will improve the security and affordability of our energy supply. However, energy generated locally from a diverse range of sources, including gas and waste heat, will significantly reduce carbon dioxide emissions, and provide further energy security and resilience.

It is essential we have an effective energy strategy in place to ensure the city continues to increase London's resilience to volatility in international energy prices and provide long-term confidence in the availability and affordability of energy to businesses, investors and residents. Without this London may be exposed to spiralling energy costs, and its ability to grow and to attract inward business and development investment would be at risk.

Our overarching objective is to ensure that the correct strategy is adopted to achieve the effective balancing of three interconnected objectives:

1. Security and reliability of supply;
2. Affordability and cost-competitiveness of energy;
3. 80 per cent carbon dioxide emissions' reduction by 2050 in line with Mayoral and national government policy.

Current energy supply

Energy is supplied to homes, businesses and transport in London primarily in the form of electricity and gas for buildings, and petrol and diesel for transport. Electricity is primarily used for lighting in buildings, and gas is used in individual boilers in homes and buildings for heating and hot water.

Current energy consumption in London is primarily fulfilled by gas (45%) and electricity (30%); petrol, diesel and aviation fill in another 23%; 2% of total consumption is satisfied from other sources¹².

¹² *London Energy and Greenhouse Gas Inventory 2011*

Electricity infrastructure takes the form of centralised power stations located throughout the country, with electricity cables providing the bulk transmission of electricity at high voltage from the power stations to the local distribution networks that in turn supply electricity to the end users at lower voltages. The power stations are operated by licenced generators, the transmission network by National Grid (a regulated monopoly) and the distribution networks by Distribution Network Operators (DNO – also regulated monopolies). Electricity is sold to end users by Licenced Electricity Suppliers (LES). The responsibility of ensuring the overall system works and has enough generating capacity to meet demand at all times lies with National Grid. A similar arrangement of transmission and distribution exists for the gas network.

In London the DNOs are UK Power Networks (UKPN) and Scottish & Southern Energy Power Distribution (SSEPD) for electricity and National Grid Gas and Southern Gas Networks for gas. Smaller networks also exist operated by other licenced operators (so called 'inset' networks) and some private network operators that sit outside the current regulated environment.

For gas, National Grid owns and operates the high-pressure National Transmission System (NTS) which transports gas from terminals to Local Distribution Zones (LDZ) including those supplying London, which generally operate at lower pressure and to which the majority of consumers are connected.

From 2016, UK coal-fired electricity generation plants will be shutdown to comply with European emissions regulations and ageing nuclear plant will be decommissioned prior to the introduction of new nuclear. Ofgem estimates that a considerable level of investment (up to £200 billion over the next ten years, more than twice the amount spent over the last ten years) will be needed to replace the UK's ageing infrastructure to meet the UK's energy needs¹³. Other estimates range from £200bn-£400bn.

¹³ Ofgem, *Project Discovery Energy Market Scenarios*, 2009

International energy markets

The UK is a net importer of gas and other fuels, and London's energy supply is reliant upon international energy supplies and markets. Energy prices in Europe are high, and set to increase relative to other regions. In some regions cheap energy is available. For example, the USA's energy consumption is twice that of Europe, but its gas price a third less. In other developing countries energy is heavily subsidised to promote development.

The International Energy Agency's (IEA) World Energy Outlook 2013 provides a stark warning to European energy consumers on the need to 'read the game' in terms of maintaining international competitiveness in a highly dynamic world energy market. 'Reading the game' for London means that its future infrastructure strategy, in terms of international competitiveness, should not focus on providing the means to supplying more units of increasingly expensive energy (relative to other world country energy costs), but on infrastructure that is energy efficient, highly effective and based on a local and national supply. This will require reduced energy use from buildings, more efficient use of primary energy input, the high utilisation of infrastructure capacity through the application of SMART systems and energy storage, and the use of local-to-London energy resource where economically viable to eliminate the dependency on imported energy from the world market.

To address the challenges of the need to replace the UK's ageing energy infrastructure, increasingly expensive energy in Europe, and electricity infrastructure in London reaching capacity in some areas, action will need to be targeted in key areas.

Investment ahead of need in electricity infrastructure

The rate and density of population growth and new building development in key areas of London is unprecedented. The electricity distribution network is already at capacity in some areas of London, and significant new investment is needed in substations and wires, particularly in areas identified for Opportunity Area Planning Frameworks. The current regulations governing the planning and provision of new electricity distribution infrastructure are out-of-step with the rates of demand growth and network stress in key areas of London.

It is estimated that the current system is blocking over £200m in electricity infrastructure investment that would unlock new development areas¹⁴. This is leading to excessive, unexpected and inequitably distributed costs for developers and other electricity users.

Distribution network operators (DNOs) agree investment plans with Ofgem through their regulated business planning processes. In London, UK Power Networks has recently submitted its business plan for 2015-2023 to Ofgem setting out its proposed investment plan. In general, DNOs will not 'invest ahead of need' outside of the regulatory framework because of the risk of that asset then not being fully utilised, and the inability to recover those costs from the customer base. Where new, unplanned-for connection requests are made by a number of parties in an area of insufficient capacity, and/or where new capacity is not in the business plan, the DNO recovers the full costs from the party that makes the request for connection. This can lead to the 'first mover' bearing the full costs of new substations. This can stall or reduce the viability of new developments and discourages early engagement by developers with the DNO.

It is estimated that the electricity investment requirement to meet new demand is £210m over 8 to 9 substations¹⁵.

Government has recognised the need to address this, and we are working with No.10, other departments of government, Ofgem, UK Power Networks and other major cities in the UK to find a solution to the regulatory system that allows investment ahead of need, but in a way that does not have any material impact on business or consumer bills. The solution will be based on the following principles:

- more investment ahead of need would be permitted if the risks of the new infrastructure being left substantially unused and stranded are minimised and borne by developers benefiting from the forward investment;
- in the event that the predicted rate of use of the additional new infrastructure installed turns out to be significantly optimistic, the burden of carrying the excess cost involved would be borne substantially by developers. If the cost to developers is excessive, then consideration will be given to involving the interested local authorities in contributing to the balance of unrecovered cost.

¹⁴ *London Electricity Infrastructure Review. Technical Working Group Report' produced by Ramboll for the GLA, March 2014*

¹⁵ GLA modelling

We believe this is a critical component to maintaining London's energy supply, housing London's growing population, and supporting economic growth. We will be working with UKPN, developers, the boroughs, Ofgem and Government to ensure a solution is agreed and enacted.

Efficient production of energy that is local to demand

To ensure that the costs of London's energy infrastructure are minimised, an approach that utilises local, flexible and resilient energy supplies will be required.

The government's current decarbonisation pathway, based on displacing the use of gas with new nuclear power stations and renewables requiring the electrification of heat, would require an increase in the peak capacity of the electricity distribution network by an additional 110 percent from 2011 to 2050, compared to a scenario with a combination of 50 percent locally produced energy and 50 percent nationally supplied¹⁶. In addition, electricity consumption would be 30 percent higher by 2050 under the centralised scenario compared to the 50/50 scenario¹⁷.

To ensure London is moving towards a model where 50% of energy supply is from locally produced sources, a number of actions are required:

- Local energy projects need to be developed from smaller scale to large scale projects capable of providing significant amounts of energy to London
- Local providers need fairer access to the electricity supply market
- Detailed energy infrastructure planning is needed across London, that map out opportunities and includes local energy production.

¹⁶ Arup, 2014

¹⁷ Arup, 2014

We will take forward action on each of these areas, as described below.

Developing large scale local projects

Despite a pipeline of local energy projects there are a number of challenges to attracting private sector investment. These include a lack of development capacity, knowledge and coordination across the range of stakeholders involved in planning local energy projects. There are also significant commercial risks to investment in this re-emerging market.

The Mayor's energy programme is currently supporting a pipeline of strategic local energy projects providing affordable, low or zero carbon heat. This is taking place through the European Union funded Decentralised Energy Project Delivery Unit' (DEPDU). The £3 million four year programme is providing technical, financial and commercial advisory services to help others develop larger scale local energy projects in London. It has so far built a pipeline of projects worth over £350 million. This project will come to an end in July 2015.

From summer 2015 the Mayor will build on DEPDU's work and establish a new organisation that will bring together the GLA's diverse range of activity related to energy supply.

The organisation will play a key role researching, planning, developing, and operating London's energy supply. It will support a wide variety of local energy producers by addressing planning, regulatory and other barriers as well as skills shortages (working with other parts of the GLA, boroughs and national government).

Fairer access to the electricity supply market

The energy market, as it currently operates, prevents local energy producers from:

- getting the retail value of their electricity output over the local electricity distribution network due to the high costs of holding a full electricity supply licence.
- creating efficiencies and realising economic value from consumer demand flexibility. For example, organisations that want to reward businesses using off peak energy are being held back by the lack of supportive regulation to open-up this market.

To overcome these challenge, electricity market reform will be required to overcome the market barriers faced by new, small-scale market participants. This can be achieved by:

- Leading the move for greater market access for decentralised energy generators by becoming the first active '[Licence Lite](#)' holding energy supplier, enabling local energy suppliers in London to be properly rewarded for the electricity they generate.
- Working with the government's newly established 'Smart Energy GB' Group and interested parties to secure wider access to anonymised smart meter data and to promote regulatory reform to reduce cash-flow risk, regulatory cost and simpler customer acquisition for new, smaller market participants.
- Using the London Enterprise Panel, low carbon innovation prizes and demonstration projects to facilitate, fund and demonstrate new market models that can realise value within London.

Effective energy infrastructure planning

Planning for the future development of new buildings, transport infrastructure, electricity networks and gas networks is currently developed through a number of inter-linked documents, including the London Plan, the Mayor's Transport Strategy, and DNO business plans. To support the cost-effective hybrid approach to energy infrastructure requires a coordinated and spatial approach to planning which integrates future infrastructure development.

To address this, we will produce a detailed spatial London energy infrastructure plan by the end of 2015 that accounts for infrastructure requirements and costs, supply decarbonisation and distribution capacity over time. We intend to produce it in collaboration with the DNOs. It will establish options for cost-effective energy demand and the contribution that London as a whole can make to reducing the costs of decarbonisation and increasing system resilience.

Reducing our energy demands

London has some of the oldest and most energy inefficient building stock in Europe and it is expected that 80 per cent of these buildings will still be standing in 2050. Insulating this stock would reduce heat demand, increase affordability, reduce CO₂ emissions and free-up energy infrastructure capacity. Smart controls would also reduce heat and electricity demand. However progress is slower than required and national government insulation schemes are not working for London's housing stock. This may mean that alternative energy supply solutions may be more cost-effective in the long-term for certain hard-to-treat building types.

To ensure that London's energy infrastructure costs are minimised, we will support the reduction of energy demand by increasing levels of energy efficiency measures in London's buildings. In homes this could be achieved by encouraging government to focus post-2017 energy company obligations on solid-walled properties, particularly flats, social housing and private rented properties. It is also recommended Government gradually increases minimum energy efficiency standards for private rented and owner occupier properties. We will continue to support demand reduction through RE:NEW, RE:FIT and business energy efficiency programmes.

For the purpose of this infrastructure plan, 'water' infrastructure includes systems and networks that provide potable water, collect, convey and treat sewage, drain rainwater and manage flood risk. Integrated management, within London and at the national level, of all these aspects of water would result in more effective, cheaper and sustainable outcomes.

Demand for water is expected to exceed supply – by as much as 10 per cent by 2025. We will support Thames Water to introduce new technologies to repair leaks, roll out water meters combined with more sophisticated tariffs, implement water efficiency measures and, in the longer term, encourage waste water reuse. We want to see better long-term drainage management across the city, with 25 year plans for drainage and flood risk management as well as water supply.

Current water supply, governance and regulation

There are four privatised water companies that supply water to London: Thames Water (serving 78 per cent of Londoners), Affinity Water, Essex & Suffolk Water and Sutton & East Surrey Water. Thames Water is also the sewerage undertaker for London (meaning that it collects, conveys and treats London's sewage).

The water industry is regulated by three main regulators: Ofwat, the economic regulator, which sets the limits on the annual increases in water and sewerage prices and encourage competition within this monopolised industry; the Environment Agency which regulates the abstraction of water for supply and the quality of water in rivers and other water bodies; and the Drinking Water Inspectorate, which regulates water quality to ensure that customers receive high quality drinking water.

Water companies are legally required to demonstrate that they can maintain an appropriate level of service (e.g. frequency of supply restrictions such as hosepipe bans) in their supply of drinking water to their customers. They are required to develop Water Resource Management Plans (WRMPs) that set out how they will balance the supply and demand for their area over a 25-year period taking account of future challenges. Their Business Plans set out the first 5 years' targets for delivery and price increases relating to 25-year plans. Recently, the Environment Agency has recommended that sewerage companies should produce a 25-year drainage plan, though the 5-year Business Plan also covers wastewater and drainage.

Through their bills, customers pay entirely for water companies' operating costs and investment in new and replacement water infrastructure. Their bills also provide a return on the investment required to deliver the capital programmes of these businesses.

Flood risk management. The Environment Agency are responsible for managing flood risk from the sea, main rivers and groundwater. Local Authorities are responsible for managing flood risk from minor watercourses, heavy rainfall (surface water flooding) and groundwater; and Thames Water, who have responsibility for preventing sewer flooding. Most tidal, fluvial and surface water flood risk management projects are wholly or part-funded by the EA's Flood Defence Grant in Aid (FDGIA) programme or through the Local Flood Levy. Both funds are financed through taxation. Sewer flood risk alleviation works are funded by the sewer undertakers (Thames Water in London).

The Environment Agency have a well-developed tidal flood risk management plan (Thames Estuary 2100) and are confident in the costing of the programme to 2035. However, the fluvial and surface water flood risk management programmes are less well developed and most of the projects could only be cost effectively delivered through being integrated into wider regeneration projects. The Environment Agency is leading on collating projects for a six-year flood risk management plan for London through the Regional Flood and Coastal Committee.

Integrating water management

Water management is rarely integrated – water supply, wastewater, water quality and flood risk are routinely treated as separate issues, leading to missed opportunities and inefficiencies in delivery. This is exemplified in the way we manage rivers, where flood risk, water quality and water extraction are all managed under separate plans with little or no shared approaches or funding.

Furthermore, there is no national policy framework to support the creation of strategic water infrastructure and encourage its integration.

More integrated water management, in policy and practice, would lead to more effective, cheaper and sustainable outcomes. Strategic water infrastructure, such as a new reservoir supplying several water companies, should be recognised as National Strategic Infrastructure Projects in a new National Policy Statement for water.

The Mayor will push for more integrated delivery in London, through the London Infrastructure Delivery Board. However, action is needed at the national level to bring about real change.

The Mayor will work with DEFRA and CLG to ensure that the [proposed water supply National Policy Statement](#) should encourage a more integrated approach to water management and specifically support strategic water supply infrastructure as National Strategic Infrastructure Projects to enable the strategic water infrastructure London requires.

Water security

By 2015, our demand for water is expected to exceed our supply and without action this deficit will increase over time – see Fig 5.3. Thames Water projects a 10 per cent deficit (213 megalitres per day) by 2025 rising to 26 per cent (522 megalitres per day) by 2050 in London – that's equivalent to the demand for water from Birmingham, Leeds, Manchester, Liverpool, Nottingham and Newcastle today. At the same time, there is likely to be less available water: either as a requirement to improve the quality of our rivers (less water abstraction) or because of climate change, which is likely to change the patterns of rainfall in the future.



FIGURE 5.3
PROJECTED WATER SUPPLY DEFICIT TO 2050

Source: Thames Water

Thames Water proposes¹⁸ closing the predicted gap between their supply and demand through a range of measures (see Figure 5.4). Through the 'Water Resources in the South East Group', the Environment Agency is leading discussions with water companies in the South East on identifying the most sustainable regional water supply options for the longer term. These options will include new reservoirs, using canals to bring water to the South East from other parts of the UK, purifying effluent from sewage treatments works and potentially more desalination.

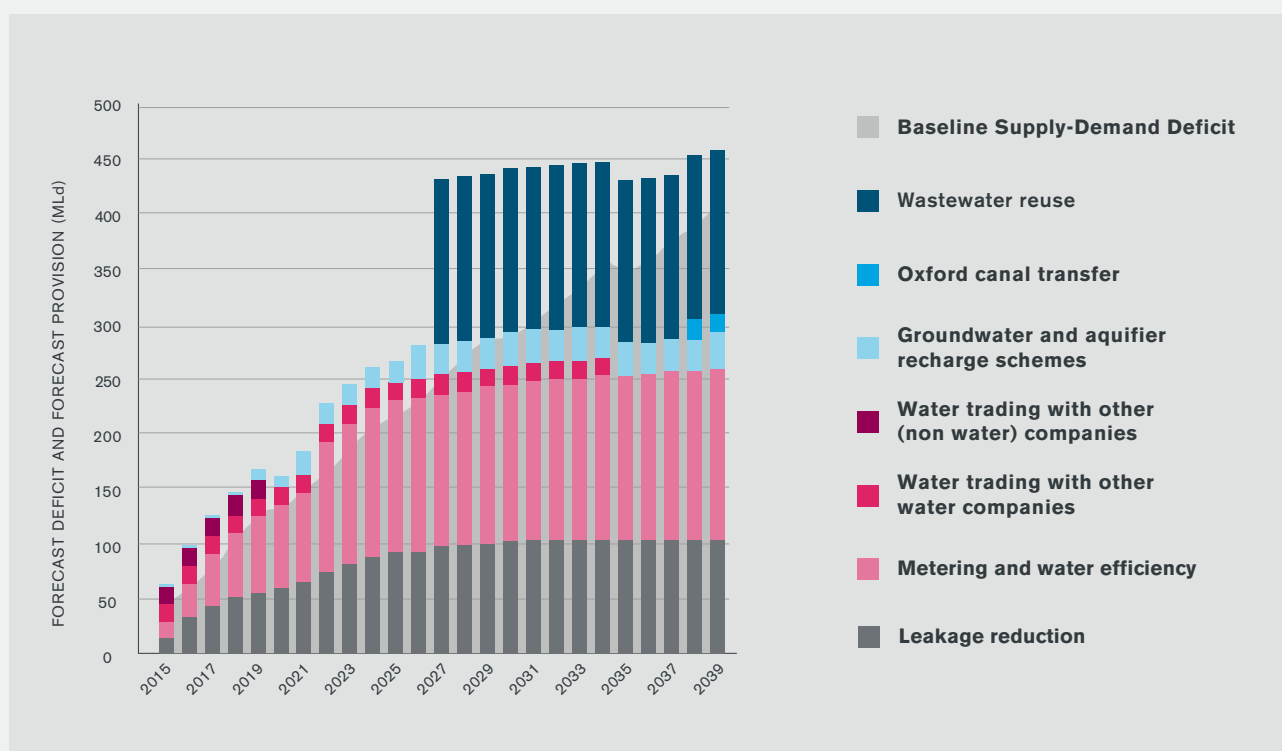


FIGURE 5.4
MEASURES PROPOSED BY THAMES WATER TO CLOSE
THEIR SUPPLY-DEMAND GAP

Source: Thames Water, 2014

¹⁸ http://www.thameswater.co.uk/tw/common/downloads/wrmp/Section_0.pdf

London must have sustainable and affordable water security. We should invest in our water infrastructure to ensure that Temporary Use Bans are experienced no more frequently than once every 10 years. We should recognise and value the role that water efficiency will play in reducing our carbon emissions and reducing the volume of sewage

The Mayor expects that London's water companies will improve the security and sustainability of London's water supply and will work with them to achieve this. This will be a key issue for the London Infrastructure Delivery Board to consider.

The actions the Mayor expects to see include:

- London's water companies actively investigating and investing in new technologies and approaches to using the water we have more wisely, particularly with regard to metering flats, raising consumer awareness of the economic benefits of water efficiency and significantly cutting the costs of reducing leakage
- London's water companies investing more in the existing infrastructure, supported by regulators encouraging water companies to take a longer term perspective
- London's water companies taking a resilience-based approach to assessing the options for their long-term water resource management plans for London, such as applying the 'flexible adaptive pathways' approach developed by the Environment Agency for the Thames Estuary 2100 project.

The Government also needs to take action. The Mayor is strongly of the belief that the Government must ensure that the proposed [water supply National Policy Statement](#) encourages and enables a more integrated approach to water management. It must specifically enable the strategic water supply infrastructure London requires.

Drainage and sewerage

London is drained by a network of rivers, drains, sewers and combined sewers. Thames Water, the Boroughs, Environment Agency, TfL and the Highways Agency and private land owners all have drainage responsibilities.

Some sections of the combined sewerage network are already operating at near capacity. This means that as little as 2mm of rainfall can lead to Combined Sewer Overflows, which discharge largely untreated but diluted sewage into our rivers.

The quality of our waterways is also generally poor, largely due to pollution leaking between the drainage and sewerage systems and the heavily modified nature of London's waterways. Only 1 of London's 47 water bodies is in a 'good' condition – the rest are 'acceptable' or 'poor' condition according to information from the Environment Agency/DEFRA.

Our current drainage capacity is insufficient for future challenges. Without further intervention, an increase in population is likely to mean more sewage will flow into the sewerage network. An increase in impermeable surfaces (from new development not managing run-off) will mean more storm water run-off. In addition, we have been losing an area of permeable land cover equivalent to 2.5 Hyde Parks every decade through incremental, minor land use changes, e.g. front gardens becoming parking. The green infrastructure network proposals above are important to redress this.

Climate change is predicted to increase the frequency and intensity of heavy rainfall events, which will further challenge the drainage and sewerage systems. Combined these challenges are likely to lead to an increase in fluvial, sewer and surface water flood risk.

The Mayor will lead on developing a sustainable drainage action plan for London that will set out the proposals and actions to manage the risk of surface water and sewer flooding. This will be published in late 2014 for consultation, with a final plan in place in by the middle of 2015.

As part of the plan, the Mayor will work with partners to establish incentives to encourage landowners to capture more rainwater on new and existing development, open and green and spaces.

Again, action is needed by the water companies. The Mayor expects Thames Water to develop 25-year plans for wastewater and drainage plans to complement their 25-year water resource management plans and will lobby for such plans to be required in law and regulations.

Wastewater and Energy

Sewage and wastewater has the potential to provide significant energy through a range of sustainable technologies, e.g. heat exchange, anaerobic digestion of sewage creating biogas, the conversion of fats, oil and greases (FOGs) into biodiesel. The removal of high energy potential materials (e.g. FOGs) before they are put into the sewer would reduce their collection cost and reduce maintenance costs of the sewers (Thames Water currently spends £18million per year cleaning FOGs from their sewers).

London should optimise the energy potential of sewage and wastewater. The Mayor will encourage and work with water companies and other partners to identify, optimise and deliver opportunities to recover materials and generate energy from waste and wastewater. We are looking at potential projects to take forward.

Flood risk

London is vulnerable to flooding from the sea, rivers, surface water (heavy rainfall), sewers, reservoirs and groundwater. The standard of flood protection across London varies hugely from in excess of 1 in 1000 for the tidal Thames to below 1 in 15 on some rivers and drains.

1.4 million people are at risk of flooding from heavy rainfall (1m at low, 230k at medium, 140k at high risk). Taking account of defences, 48,800 properties are at high or medium risk of flooding from rivers or the tide. Of these 11,400 are at high risk of river flooding, 2,000 at high risk of tidal flooding and a further 1,000 at high risk of both. At least 30,000 basements are at risk of sewer flooding.

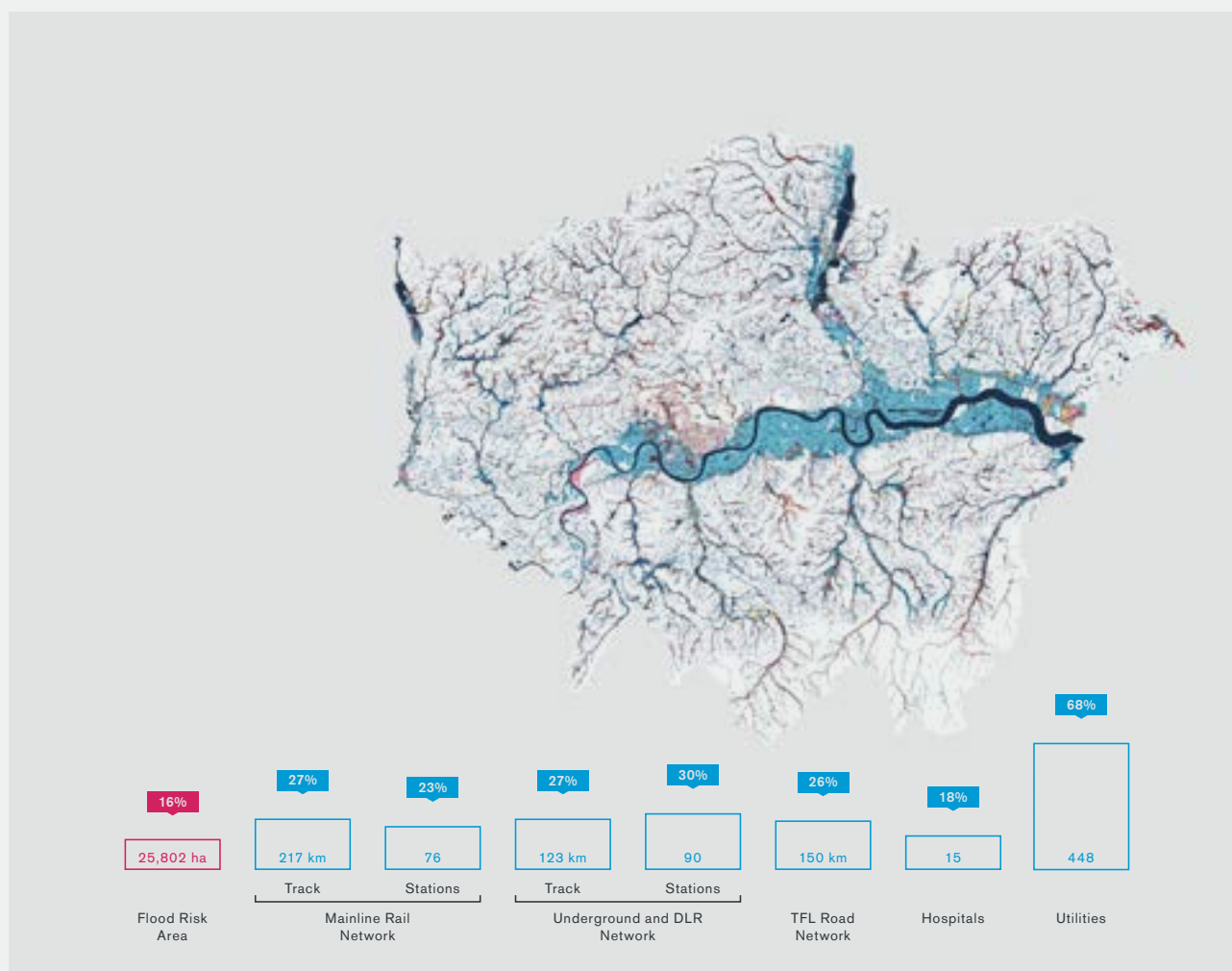


FIGURE 5.5
FLOOD RISK IN LONDON

Flood risk will increase due to a combination of climate change, ageing flood risk management assets, urban creep and more people and assets in areas at risk. The Association of British Insurers estimate a significant tidal flood in London could have an economic impact on London 'equivalent to the scale of the recent recession'.

There is a lack of proper flood risk management planning and funding for all flood sources, except for tidal risk. The Environment Agency's six-year flood risk management programme for the Thames area (London and the Thames Valley) contains over £1bn worth of projects, yet many of these projects are under-developed and under-funded. National guidelines on the disbursement of the national flood defence budget focuses mainly on the cost effectiveness of protecting homes and provide a lower value on economic development and infrastructure. In addition, because of its urban form, London

is a more expensive place to implement schemes to manage risk from rivers and surface water, so the capital fails to secure investment to manage the risks we face.

There is a strong case for developing long-term (25 years), climate resilient, multi-source, flood risk management plans, and identifying synergies with planning policy, regeneration and redevelopment.

The Mayor will work with the Environment Agency, London Boroughs and other stakeholders to develop a prioritised 25-year flood risk management and investment plan for each catchment area in London, covering all flood sources.

The Environment Agency will work through seven strategic Flood Risk Partnerships in London to develop and monitor the long-term plan. This will combine the actions identified in borough, water companies and GLA flood risk and water management plans

Maintaining flood risk at an acceptable level will require significant investment. To ensure that we have the funding and finance in place to deliver improvements in the standards of our flood protection, London needs to receive its (risk-based) 'share' of the national flood budget. The Mayor will ensure this is raised in discussions with Government.

Furthermore, The Environment Agency should work with the Mayor, boroughs, water companies and other stakeholders to identify alternative, complementary means of funding and financing the required level of flood defence expenditure for London.

An additional issues is that flood risk is poorly recognised and valued, leading to it being deprioritised as an issue. Flood risk management opportunities are frequently missed and are often poorly integrated with regeneration and development. Flood risk has wider potential consequences for London's infrastructure and therefore the resilience of infrastructure to flooding is a critical issue to be considered in long term planning.

People living and working at flood risk should be aware of both the risk and what to do to manage it. Flood risk management organisations should identify and prioritise households, businesses and infrastructure at flood risk and develop coherent flood risk management plans and monitor implementation. Stakeholders in London should work with the Major to

ensure that long-term plans take into consideration resilience planning, based on guidance from the Cabinet Office and other Government agencies.

Awareness of flood risk needs to be raised with both politicians and the communities most at risk. The Mayor will work with the relevant organisations to raise awareness in high-risk areas, including with:

- The Thames Regional Flood and Coastal Committee members to ensure that flood risk is recognised and prioritised at a political level
- The Environment Agency and London Boroughs to raise awareness of flood risk with communities and business at risk. This should be taken forward by including communities in the development of Local Flood Risk Strategies).

The London Infrastructure Delivery Board will include flood risk implications in its work to ensure best practice integrated delivery.

The current waste management system is designed to manage the “take-make-dispose” economy, with high waste collection costs. The circular or re-generative economy approach, which is based on re-use and re-assembly, offers a more sustainable alternative with real economic benefits.

Innovative product designers and business leaders are already venturing towards this approach. If London could be at the forefront of this movement it would reap the benefits. While the move will be private sector led, the GLA, the London Waste and Recycling Board (LWARB) and boroughs will examine what we can do to accelerate the move. Improved waste collection is needed across both under the current system and to support the circular economy.

The current waste management system is designed to manage the “take-make-dispose” economy. London's 32 boroughs and the City of London have responsibility for the collection, recycling and disposal of household and some commercial waste. 21 boroughs discharge their disposal functions through four statutory joint waste disposal authorities, while the other 12 manage disposal themselves either individually or through partnerships.

Waste produced by businesses is largely managed by the private sector. A small amount of waste produced in London is industrial waste and may require specialist treatment.

LWARB was established to promote and encourage a reduction in waste, increase the proportion of waste that is reused or recycled, and promote methods of collection, treatment and disposal of waste that are more beneficial to the environment. Its objective is also to attract private investment to new waste infrastructure projects.

The Mayor has statutory powers with regard to London's municipal waste management. The GLA Act 2007 requires the London waste authorities to act in ‘general conformity’ with the Mayor's Municipal Waste Management Strategy.

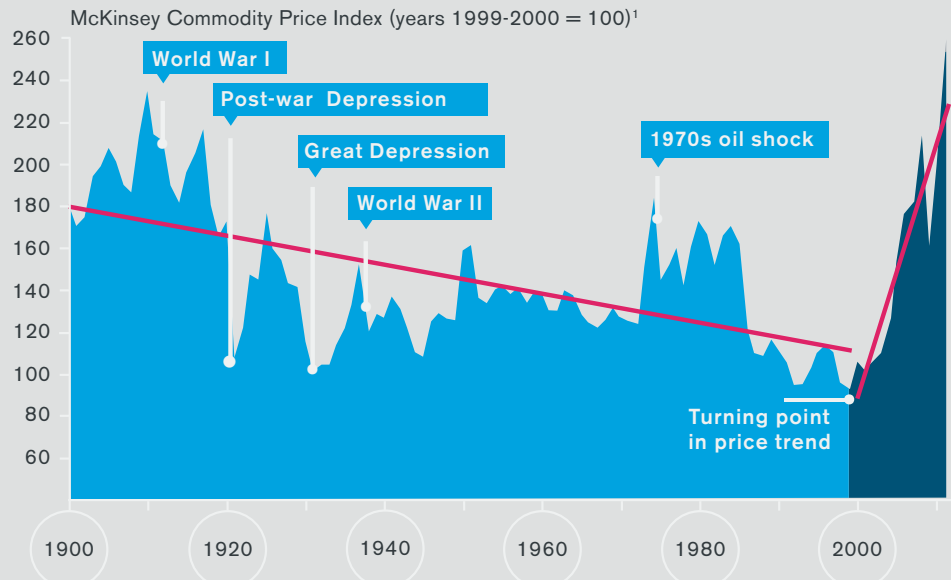
Cost of waste disposal is a real issue. More than 65 per cent of London's municipal waste is sent to landfill or incineration each year costing London's boroughs in excess of £250m a year in gate fees alone. Unless recycling and reuse rates dramatically increase by 2050 the cost of managing London's municipal waste will double.

The total cost to Londoners of managing local authority collected waste, including the collection, transport, treatment, and final disposal activities, is approximately £500 million. This figure represents about 15 per cent of London's total council tax bill of £3.42bn or 3-4% of total local government expenditure.

As commodity prices continue to rise, alongside inter-related pressures on energy, water and food production, in order to remain competitive London's economy is going to have to become more resource efficient. An analysis by McKinsey¹⁹ has shown that, since the turn of the century, global commodity prices have risen sharply, wiping out the previous 100 years of declining real prices. A growing middle class, created through global urbanisation, will stoke demand for products at a time when virgin material extraction is becoming more expensive as easier to reach material supplies are depleted.

¹⁹ McKinsey & Company, *Towards the Circular Economy: Economic and Business Rationale for an Accelerated Transition*, Ellen MacArthur Foundation, 2013, pp. 17-18

Sharp price increases in commodities since 2000 have erased all the real price declines of the 20th century



¹ Based on arithmetic average of 4 commodity sub-indices: food, non-food agricultural items, metals, and energy; 2011 prices based on average of first eight months of 2011.

SOURCE: Grilli and Yang; Pfaffenzeller; World Bank; International Monetary Fund; Organisation for Economic Co-operation and Development statistics; UN Food and Agriculture Organization; UN Comtrade; Ellen MacArthur Foundation circular economy team.

FIGURE 5.6

Source: Ellen MacArthur Foundation

Many major companies have been adversely affected by increased exposure to higher resources prices and supply disruptions. The solution that many of the world's largest and most successful companies are adopting is the move to a circular economy. A circular economy is an industrial system where waste is largely designed out of products, which are made to be disassembled and reused, with the aim being to produce product whose components can be swiftly returned to use with the minimum of effort and energy.

There are many challenges in moving from the current system to a full circular economy. Our emphasis will be on ensuring the right market and financial conditions exist to enable transition. The achievement, not least the success, of a circular economy is most likely to be business led with the desire to ensure security of materials being the main driver. The role of the public sector is to identify barriers to private sector delivery and remove them.

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London will see the emergence of a new economic sector employing thousands of Londoners, involved in reuse, disassembly and remanufacture. If London was to accelerate its transition to the circular economy this would result in savings of up to £5 billion.

McKinsey, in a report for the Ellen MacArthur Foundation^[1], calculated the savings possible for 8 manufacturing sectors across the EU. These sectors are responsible for the manufacture of medium complexity, medium life products. McKinsey model a transition scenario and an advanced scenario. For the transition scenario, it is estimated that material and energy cost savings are between USD 340 billion to USD 380 billion.

The Mayor will develop a series of circular economy measures, in waste and other areas, which will seek to take advantage of opportunities for the development of new infrastructure required to deliver the circular economy. Infrastructure required to deliver the circular economy will predominantly include repair workshops, dis-assembly lines, recycling and reprocessing facilities. In addition, the Mayor will examine where London can take full advantage of the growth in remanufacturing industries, to maximise the benefits to the London economy.

Movement towards a circular economy in some areas is being led by large retail and manufacturing companies, but there is little or no public awareness or comprehension of the huge economic and environmental benefits. In order to make our economy more resilient to price and supply shocks, ensuring sustainable economic growth, a faster transition is required.

The Mayor wants London to be a world leader in the development of the circular economy so that London is best placed to reap the rewards of this transition.

To incentivise consumers and businesses to adopt the circular economy model to accelerate transition, the Mayor will work with all parties to understand, improve and promote the market for a circular economy:

- The London Waste and Recycling Board will work with the private sector and the London Infrastructure Delivery Board to understand the regulatory and fiscal environment that needs to be in place to accelerate the move to a circular economy. It will do this by developing a Route Map to the Circular Economy for London which will identify partners, actions and opportunities along the path to the Circular Economy. The Route Map will be available early 2016.
- The Mayor will ensure that the GLA Group leads by example by examining its use of procurement and material handling, and by mapping leakages out of the current linear set up. By applying the GLA groups buying power, it can help to encourage suppliers to move to more circular systems.
- The next full alterations of the London Plan will consider the land and infrastructure necessary for a circular economy, in particular circular economy hubs, where small and medium sized businesses can collaborate to test out circular systems prior to scale roll out, plus the need for regionally significant infrastructure.
- The Mayor will work with Government to ensure that incentives are in place to allow, promote and encourage more widespread adoption of circular economy systems.
- The Mayor will enable the sharing of good and best practise through active participation in circular economy networks.
- The Mayor will work with stakeholders and industry so that all the benefits of circular business models are understood to encourage FTSE 100 companies to adopt them.

Simplified waste collection

London has 33 waste collection authorities that each collect different recyclables and organic materials and collect them differently. This is confusing to London's more transient population.

If waste were managed in a more consistent way it is estimated that at current prices £180m could be saved directly through financial savings (£90m) and through negotiating a better price for recyclates (£90m).

A recent report by the Circular Economy Taskforce²⁰, a business led group, estimates that a more consistent approach could result in an annual saving per household of £61.

Efficient and consistent collection services will better allow for the capture of materials from Londoners and London's businesses. An efficient collection system will need to be in place that prioritises the capture of material rather than waste. The system or systems will need to ensure that material is captured, transported and sorted in a manner that ensures the integrity of the material right through to the repair/reprocessing facility.

The Mayor, through LWARB, will work with London's boroughs to help provide a more consistent reuse and recycling service to Londoners, taking into account local differences and priorities.

Infrastructure to support a circular economy

The existing waste management infrastructure is not suitable for a move to a circular economy and there is a lack of financing mechanisms to help develop the necessary facilities.

LWARB has helped to establish the [London Reuse Network](#), which has made reuse easier. However, the existing waste management infrastructure in London does not yet have the capacity to;

1. handle, process and distribute materials collected in London
2. repair, refurbish and remanufacture durable items collected in London
3. generate renewable energy from waste food disposed of in London.

²⁰ Benton & Hazell, *Wasted Opportunities: Smarter Systems for Resource Recovery: A Report for the Circular Economy Taskforce*, July 2014

It will also be necessary to provide facilities for the management of secondary materials in the circular economy.

London will require millions of tonnes of annual capacity in order to disassemble, remanufacture, repair and reuse components, and for waste material separation and reprocessing. The fundamental nature of this change in the nature of production and manufacture makes projections difficult. The impetus for this shift will be commercially led and as such it is also difficult to foresee how the logistics of collecting secondary materials will be managed, and what the waste / secondary resource industry will look like.

However, our modelling indicates that there are likely to be around 40 new facilities required in addition to London's existing facilities and most of these will be required to help reuse and recycle materials.

The diminishing landfill tax receipts arising from London waste and received by treasury should be hypothecated for a revolving investment fund for the waste sector through a combination of development loans, equity investments and land purchase administered by LWARB, which has a proven track record of investing in this sector. LWARB would work alongside the [Green Investment Bank](#), the [London Green Fund](#) and the private finance community to provide finance to develop this new infrastructure.

