

Appendix A Methodology

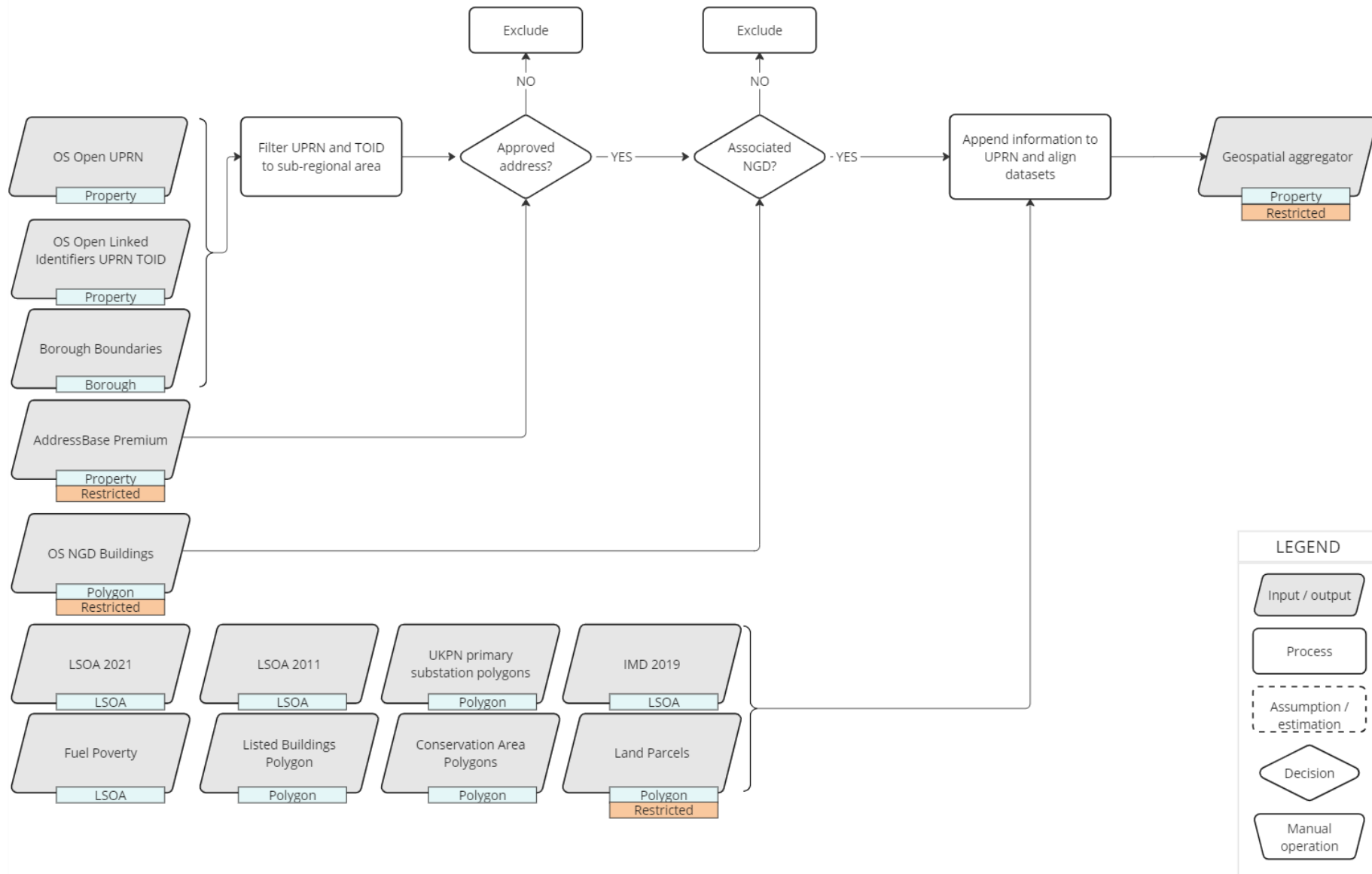
Appendix A – Methodology

This appendix provides an overview of the methodology used for the subregional LAEPs for both the South and CEIN subregions. This is in the form of flow charts with a record of the key data on the page following each flow chart. Twenty-four different model flows are presented in the following pages, the table below provides their order and a brief description of their theme.

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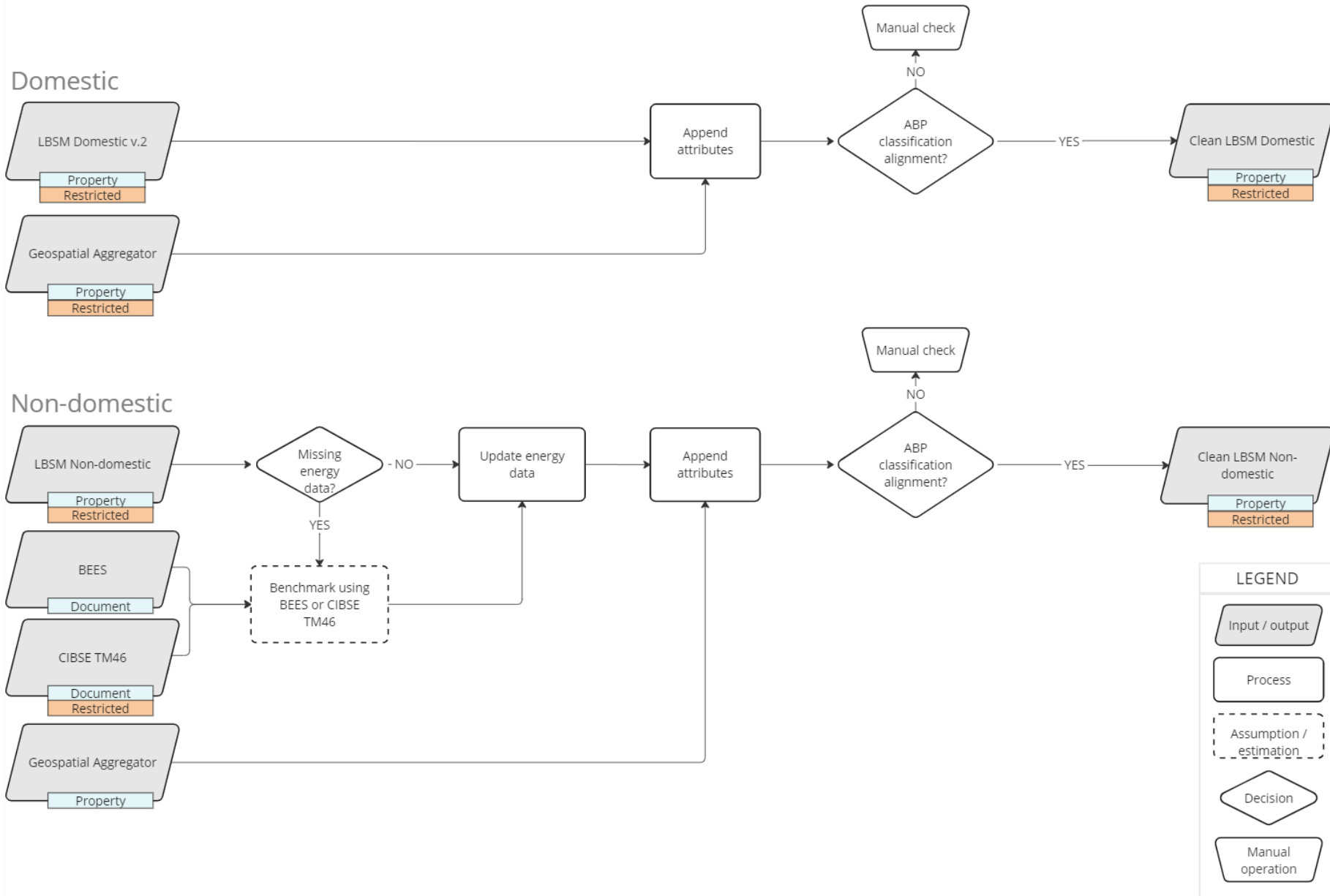
BUILDING STOCK - GEOSPATIAL AGGREGATION



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Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
OS Open UPRN	Unique Property Reference Number (UPRN) point layer with X Y coordinates clipped to London boundary.	Point	GPKG	https://www.ordnancesurvey.co.uk/products/os-open-uprn	February 2024	Six weekly	Open
OS Open Linked Identifiers UPRN TOID	Linked Identifiers provides authoritative relationship between Unique Property Reference Numbers (UPRNs), and Topographic Identifiers (TOIDs).		CSV	https://www.ordnancesurvey.co.uk/products/os-open-linked-identifiers	March 2024	Six weekly	Open
Borough Boundaries	Polygon layer of Local Authority Boundaries, clipped to the borough of interest.	Polygon	GPKG	https://www.ordnancesurvey.co.uk/products/boundary-line	February 2024	6 months	Open
AddressBase Premium	Provides geographical and delivery addresses and postcodes for each Unique Property Reference Number (UPRN) in United Kingdom.		CSV	https://www.ordnancesurvey.co.uk/products/addressbase-premium#technical	April 2024	Six weekly	Restricted
OS NGD Buildings	Ordnance Survey (OS) National Geographic Database (NGD) Building Polygons.	Polygon	GPKG	https://www.ordnancesurvey.co.uk/products/os-ngd	May 2024	Daily	Restricted
LSOA 2021	2021 Lower Super Output Areas (LSOA) and Data Zones (DZ) borders for United Kingdom.	Polygon	GEOJSON	https://geoportal.statistics.gov.uk/datasets/0f80c523f3cd4d0fab5111572f84a2fb_0/explore	March 2024	Aligns to Census	Open
LSOA 2011	2011 Lower Super Output Areas and Data Zones borders for all UK.	Polygon	GPKG	2011 Census Geography boundaries (Lower Layer Super Output Areas and Data Zones) - Features in Shapefile format - UK Data Service CKAN	March 2024	Aligns to Census	Open
UKPN Primary Substations	Polygons with corresponding details on primary substations including primary substation areas and headroom.		XLSX	https://ukpowernetworks.opendatasoft.com/explore/dataset/ukpn_primary_postcode_area/information/	March 2024		Open
IMD 2019	The Index of Multiple Deprivation (IMD) datasets are small area measures of relative deprivation across each of the constituent nations of the United Kingdom.	Polygon	GPKG	https://data.cdrc.ac.uk/dataset/index-multiple-deprivation-imd	March 2024	Varies	Open
Fuel Poverty	Fuel poverty 2021 data measured as low income low energy efficiency (LILEE).		XLSX	https://www.gov.uk/government/statistics/sub-regional-fuel-poverty-data-2023-2021-data	March 2024	1-2 years	Open
Listed Buildings	Polygons of listed building with properties including grade, building preservation notices and certificates of immunity.	Polygon	GPKG	https://historicengland.org.uk/listing/the-list/data-downloads/	March 2024	Daily	Open
Conservation Areas	Conservation areas exist to manage and protect the special architectural and historic interest of a place - in other words, the features that make it unique.	Polygon	GPKG	https://historicengland.org.uk/listing/the-list/data-downloads/	March 2024	Monthly	Open
Land Parcels	Geospatial polygons representing publicly owned land, and all owned land along with relevant ownership information.	Polygon	GPKG	https://use-land-property-data.service.gov.uk/datasets/ccod/tech-spec	March 2024	Monthly	Restricted
Data output	Description	Geometry	Format	Output File Name			
Geospatial Aggregator	Collated data for the sub-region		CSV	N/A			

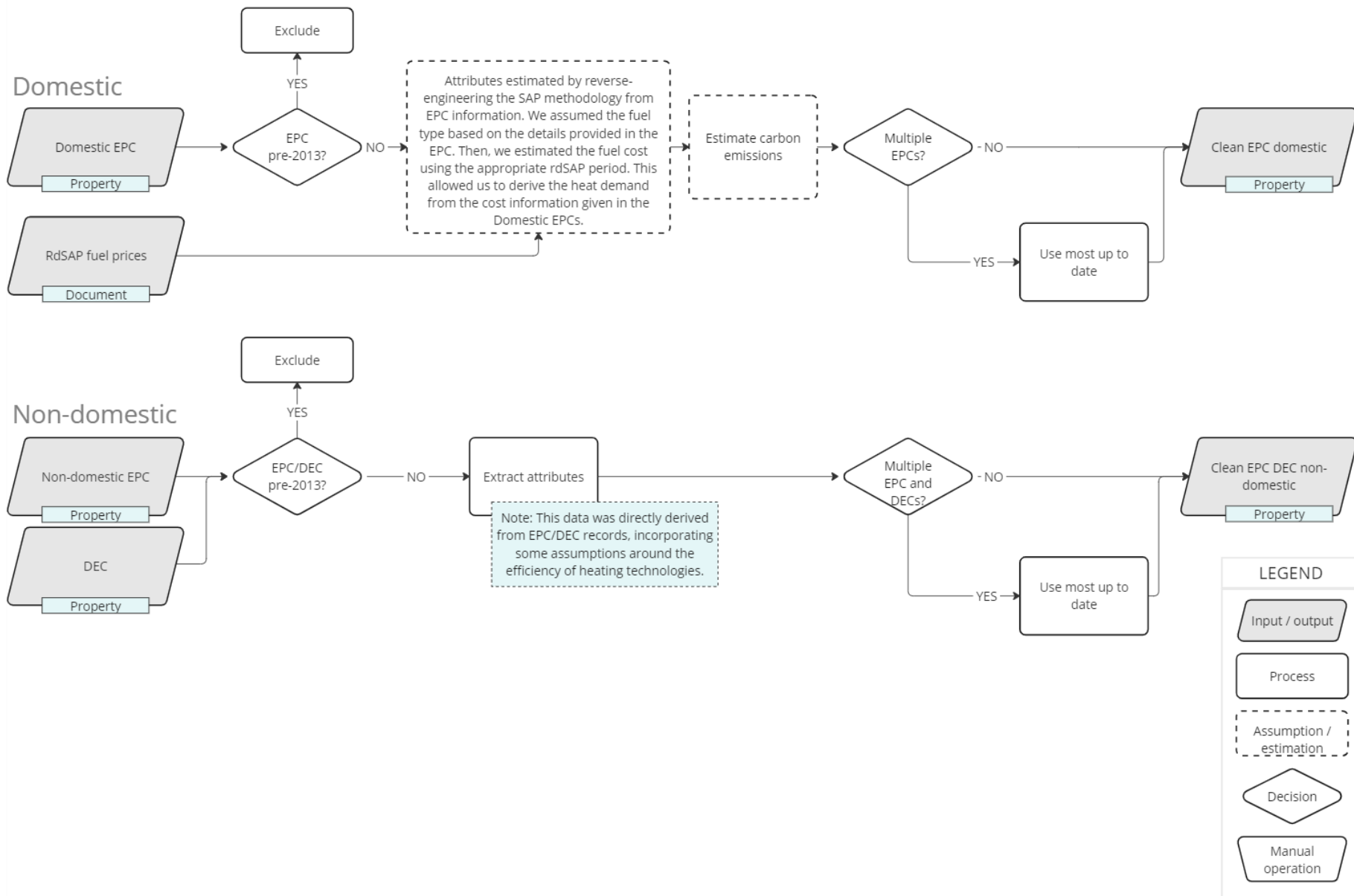
BUILDING STOCK - PREPROCESSING



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Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
LBSM Domestic v.2	Domestic stock dataset for every building London with with energy and carbon data collected through the Mayor's energy programmes and policies and updated for LAEP and updated by GLA.		CSV	Greater London Authorities	April 2024		Restricted
Geospatial Aggregator	Output from previous flow.						
LBSM Non-domestic	Non-domestic stock dataset for every building London with with energy and carbon data collected through the Mayor's energy programmes and policies and updated for LAEP and updated by UCL.		CSV	University College London	April 2024		Restricted
BEES	Building Energy Efficiency Survey (BEES) overarching report is used for benchmarking non-domestic stock.		PDF	https://assets.publishing.service.gov.uk/media/5a75964540f0b67f59fce0d4/BEES_overarching_report_FINAL.pdf	April 2024		Open
CIBSE TM46	Chartered Institution of Building Services Engineers (CIBSE) TM46 Energy benchmarks is used for benchmarking domestic stock.		PDF	https://www.cibse.org/knowledge-research/knowledge-portal/tm47-operational-ratings-display-energy-certificates	April 2024		Restricted
Data output	Description	Geometry	Format	Output File Name			
Clean LBSM Domestic	Appended data to building stock.		CSV	N/A			
Clean LBSM Non-domestic	Appended data to building stock.		CSV	N/A			

BUILDING STOCK - EPC/DEC PROCESSING

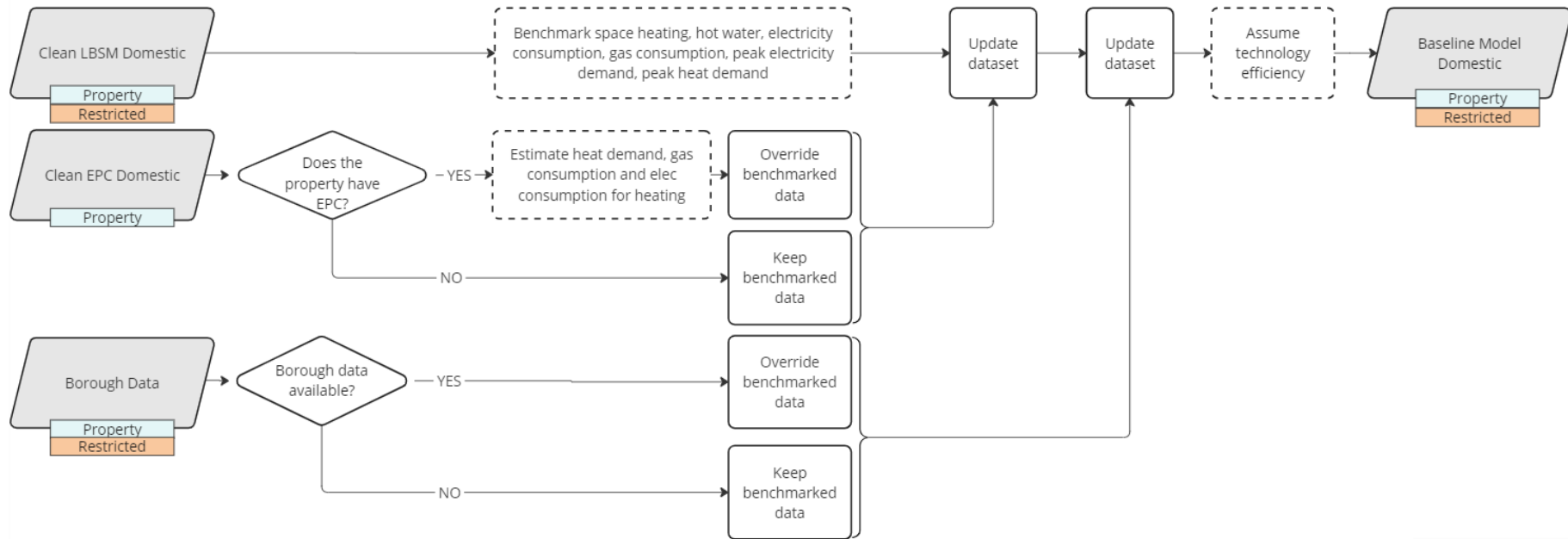


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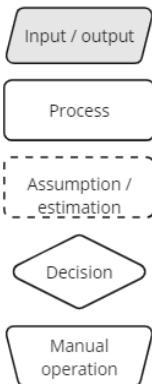
Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
Domestic EPC	Energy performance certificate (EPC) for domestic properties.		CSV	https://epc.opendatacommunities.org/	March 2024	Monthly	Open
RdSAP Fuel Prices	Fuel prices used to estimate the cost of energy use in domestic energy performance certificates (EPCs).		XLSX	https://files.bregroup.com/SAP/RdSAP-fuel-prices-from-15th-February-2023.xlsx	March 2024		Open
DEC	Display energy certificate (DEC) for non-domestic properties.		CSV	https://epc.opendatacommunities.org/	March 2024	Monthly	Open
Non-domestic EPC	Energy performance certificate (EPC) for non-domestic properties.		CSV	https://epc.opendatacommunities.org/	March 2024	Monthly	Open
Data output	Description	Geometry	Format	Output File Name			
Clean EPC Domestic	Pre-processed domestic Energy performance certificate (EPC).		CSV	N/A. Final EPC values are included in 01_buildings.			
Clean EPC DEC Non-domestic	Pre-processed non-domestic Energy performance certificate (EPC).		CSV	N/A. Final EPC values are included in 01_buildings.			

BUILDING STOCK - DOMESTIC BASELINE

Domestic



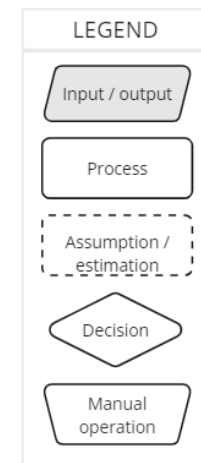
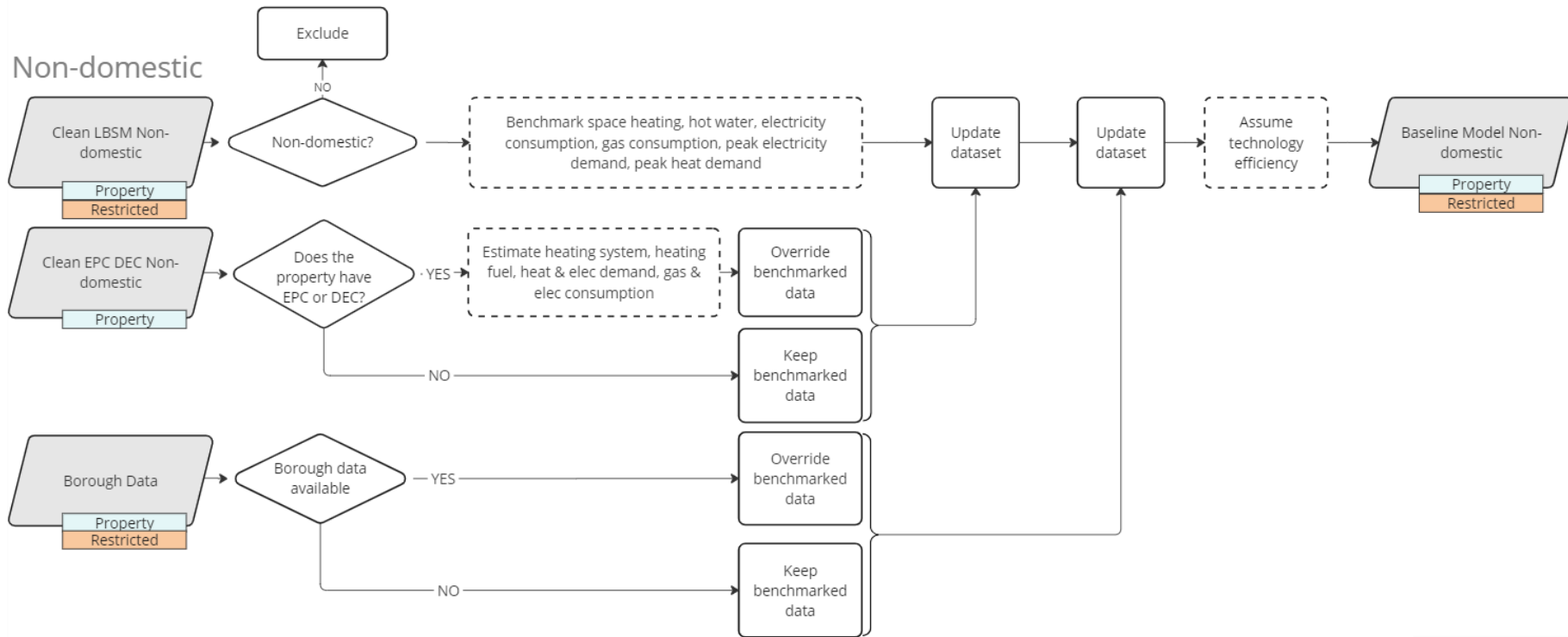
LEGEND



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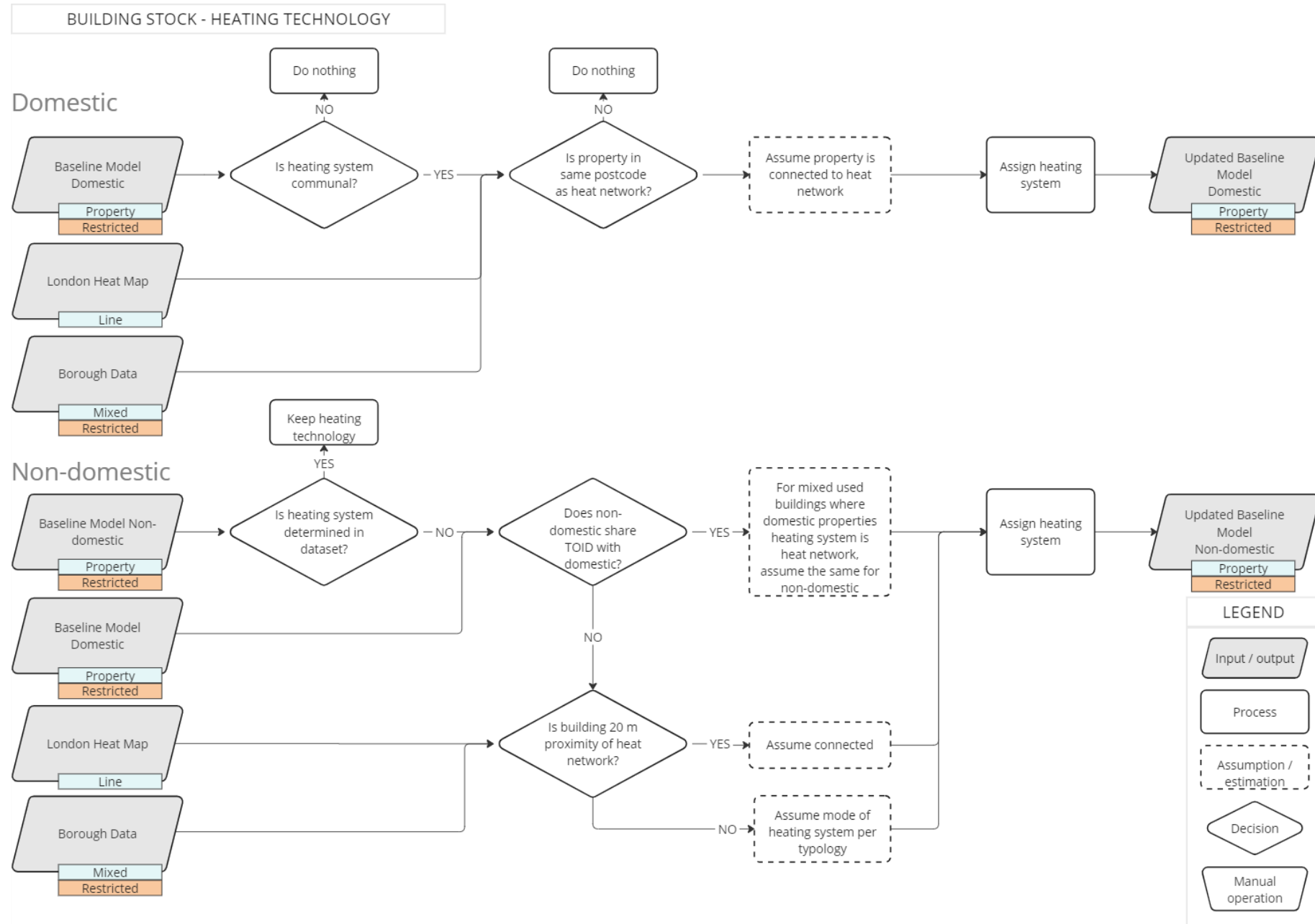
Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
Clean LBSM Domestic	Output from previous flow.						
Clean EPC Domestic	Output from previous flow.						
Borough Data	Through a request for information process the boroughs provided data, which was integrated in the modelling, where possible.		CSV	Boroughs	March 2024		Restricted
Data output	Description	Geometry	Format	Output File Name			
Baseline Model Domestic	Pre-processed domestic model with relevant attributes included.		CSV	N/A. Final values are included in 01_buildings.			

BUILDING STOCK - NON-DOMESTIC BASELINE



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Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
Clean LBSM non-domestic	Output from previous flow.						
Clean EPC non-domestic	Output from previous flow.						
Borough data	Through a request for information process the boroughs provided data, which was integrated in the modelling, where possible.		CSV	Boroughs	March 2024		Restricted
Data output	Description	Geometry	Format	Output File Name			
Baseline model non-domestic	Pre-processed domestic model with relevant attributes included.		CSV	N/A. Final values are included in 01_buildings.			

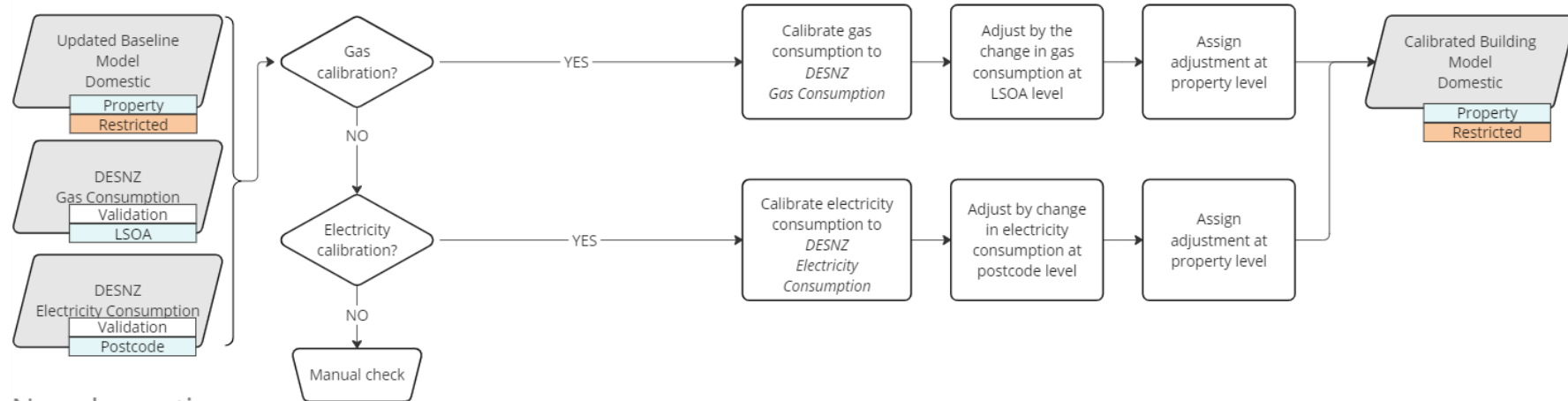


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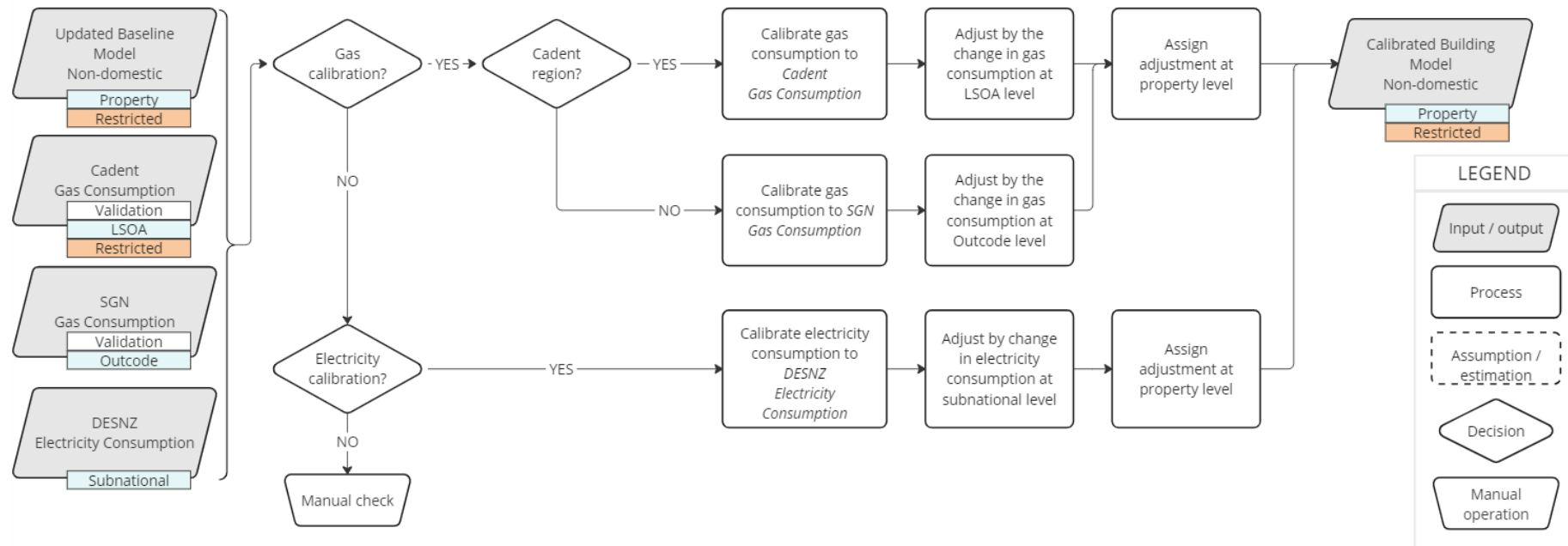
Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
Baseline Model Domestic	Output from previous flow.						
Baseline Model Non-Domestic	Output from previous flow.						
Borough Data	Through a request for information process the boroughs provided data, which was integrated in the modelling, where possible.	Mixed	Mixed	Boroughs	March 2024		Restricted
London Heat Map	London Heat Map highlights existing and proposed networks.	Line	GPKG	https://apps.london.gov.uk/heatmap/	April 2024		Open
Data output	Description	Geometry	Format	Output File Name			
Updated Baseline Model Domestic	Baseline model with heating system assigned.		CSV	N/A. Final values are included in 01_buildings.			
Updated Baseline Model Non-domestic	Baseline model with heating system assigned.		CSV	N/A. Final values are included in 01_buildings.			

BUILDING STOCK - VALIDATION AND CALIBRATION

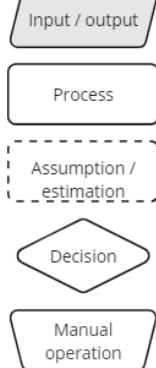
Domestic



Non-domestic

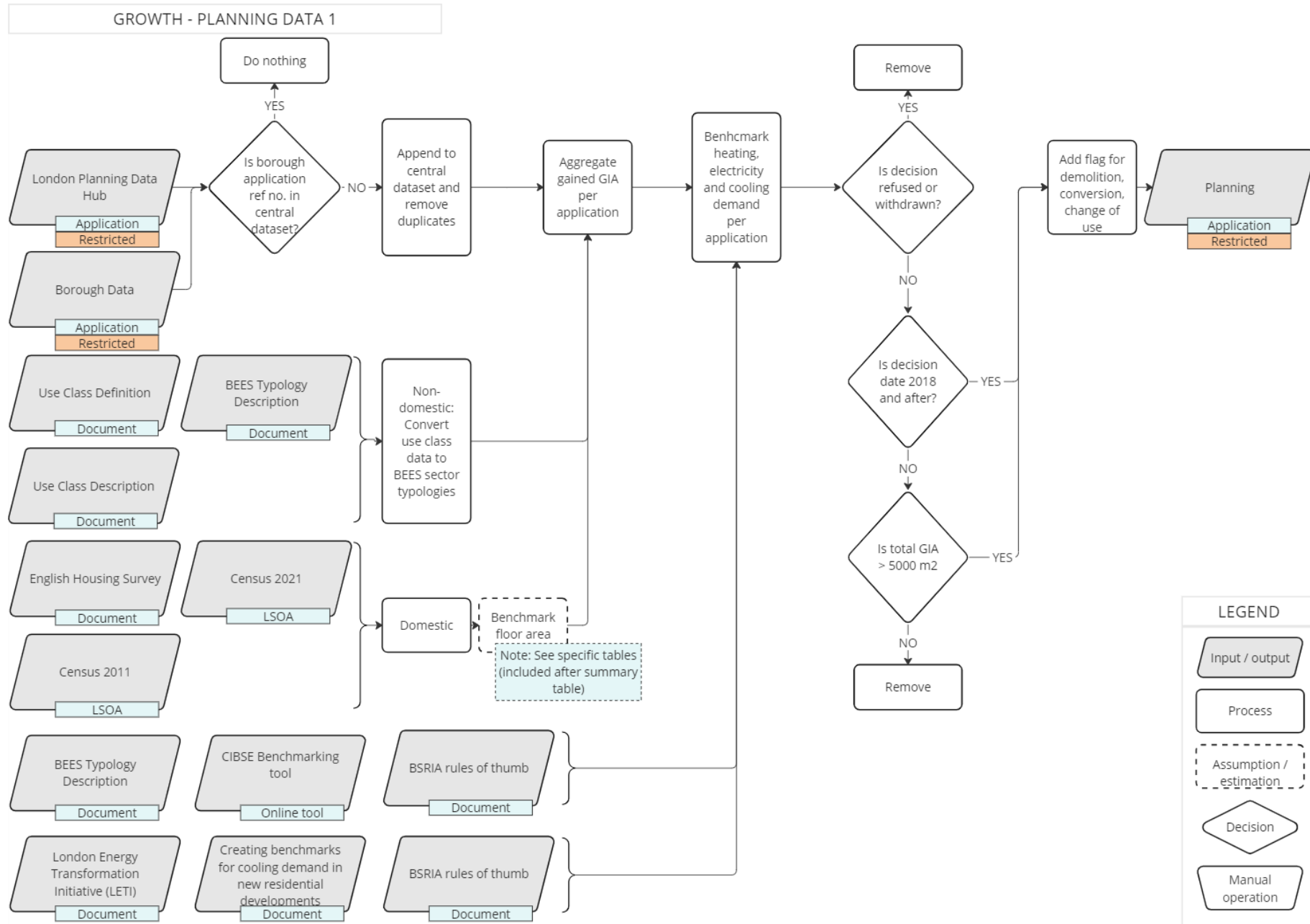


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Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
Updated Baseline Model domestic	Output from previous flow.						
Updated Baseline Model Non-domestic	Output from previous flow.						
DESNZ Gas Consumption	Sub-national gas consumption data produced by DESNZ.		XLSX	https://www.gov.uk/government/collections/sub-national-gas-consumption-data	June 2024		Open
DESNZ Electricity Consumption	Sub-national electricity consumption data produced by DESNZ.		XLSX	https://www.gov.uk/government/collections/sub-national-electricity-consumption-data	June 2024		Open
Cadent Gas Consumption	Cadent provided consumption data which was used to validate the property level consumption data.		CSV	Cadent	April 2024		Restricted
SGN Gas Consumption	Consumption data provided by SGN.		CSV	https://www.sgn.co.uk/open-data-sharing-portal	April 2024		Open
Data output	Description	Geometry	Format	Output File Name			
Calibrated Building Model Domestic	Baseline model with heating system assigned.		CSV	N/A. Final values are included in 01_buildings.			
Calibrated Building Model Non-domestic	Baseline model with heating system assigned.		CSV	N/A. Final values are included in 01_buildings.			



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Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
London Planning Data Hub	Planning growth central dataset which captures development proposals in the planning process, enabling monitoring of how the City is changing.		XLSX	https://www.planningportal.co.uk/permission/comm-on-projects/change-of-use/use-classes	March 2024		Restricted
Borough Data	Through a request for information process the boroughs provided planning growth dataset data, which was integrated in the modelling, where possible.		XLSX		March 2024		Restricted
Use Class Definition	The Town and Country Planning (Use Classes) Order 1987 (as amended) puts uses of land and buildings into various categories known as 'Use Classes'.			https://www.planningportal.co.uk/permission/comm-on-projects/change-of-use/use-classes	March 2024		Open
Use Class Description	Planning use class description (appendix D).		PDF	https://static.geoplace.co.uk/downloads/GeoPlace-Data-Entry-Conventions-Best-Practice-for-Addresses-V-3.4-2016.pdf	April 2024	2016 dataset was used	Open
BEES Typology Description	Building Energy Efficiency Survey (BEES) sector typology description.		PDF	https://assets.publishing.service.gov.uk/media/5a75964540f0b67f59fce0d4/BEES_overarching_report_FINAL.pdf	April 2024	Published 2016 not being updated since	Open
English housing survey	Average floor area by dwelling type (built form).		PDF	https://assets.publishing.service.gov.uk/media/5b4750e6e5274a3770774693/Floor_Space_in_English_Homes_main_report.pdf	April 2024	Yearly (Some EHS is data is updated annually). Floor area benchmark was published at 2018	Open
Census 2011	The dataset presents the count of households, categorised by dwelling type or built form, at the Local Authority level for 2011.		CSV	https://www.nomisweb.co.uk/census/2011/ks401uk	April 2024	Aligns to Census	Open
Census 2021	The dataset presents the count of households, categorised by dwelling type or built form, at the Local Authority level for 2021.		CSV	https://www.ons.gov.uk/datasets/TS044/editions/2021/versions/1	April 2024	Aligns to Census	Open
CIBSE Benchmarking tool	Used for non-domestic energy benchmarking in new development.		XLSX	https://www.cibse.org/knowledge-research/knowledge-resources/knowledge-toolbox/benchmarking-registration	Apr-24	As needed	Open
Creating benchmarks for cooling demand in new residential developments	A set of benchmarks created for typical dwelling types currently being developed in London.		PDF	https://www.london.gov.uk/sites/default/files/gla_cooling_benchmarking_study_final2.pdf	Apr-24		Open
BSRIA rules of thumb	Guidelines for building services. Used for estimating the peak heat/electricity demand in new builds.		PDF	http://ndl.ethernet.edu.et/bitstream/123456789/40265/1/185.pdf	Apr-24	As needed	Open
London Energy Transformation Initiative (LETI) Climate Emergency Retrofit Guide	Used for estimating the future energy demand (heat and electricity) in residential properties.		PDF	https://www.leti.uk/_files/ugd/252d09_c71428bafc3d42fbac34f9ad0cd6262b.pdf	Apr-24		Open
Data output	Description	Geometry	Format	Output File Name			
Planning	Pre-processed planning data		CSV	01_buildings_planning_data			

Domestic Floor Area Estimates

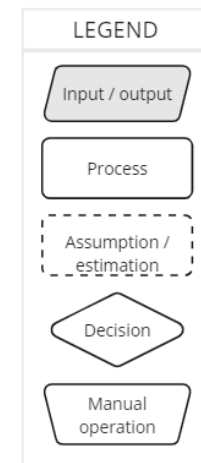
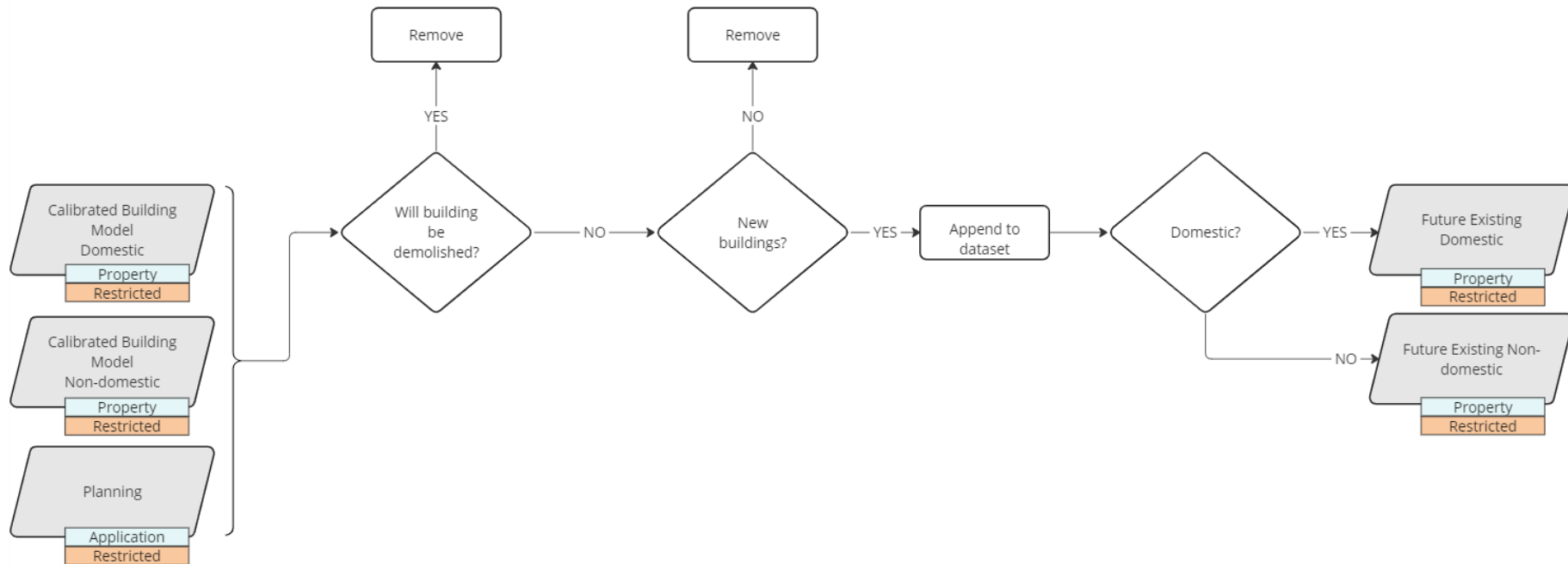
New table

Northern Boroughs	Floor area per residential unit (m2)
Camden	71.7
City of London	61.1
Enfield	85.4
Hackney	70.5
Haringey	68.5
Islington	69.9
Kensington and Chelsea	65.7
Newham	63.6
Tower Hamlets	58.3
Waltham Forest	65.6
Westminster	62.9

New table

Southern Boroughs	Floor area per residential unit (m2)
Croydon	66.1
Greenwich	63.2
Kingston upon Thames	69.5
Lambeth	70
Lewisham	64.2
Merton	72.9
Southwark	64.1
Sutton	67.9

GROWTH - PLANNING DATA 2

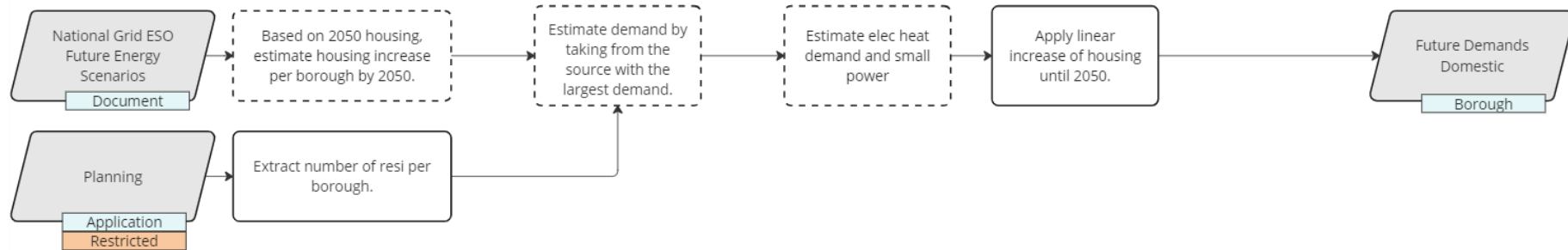


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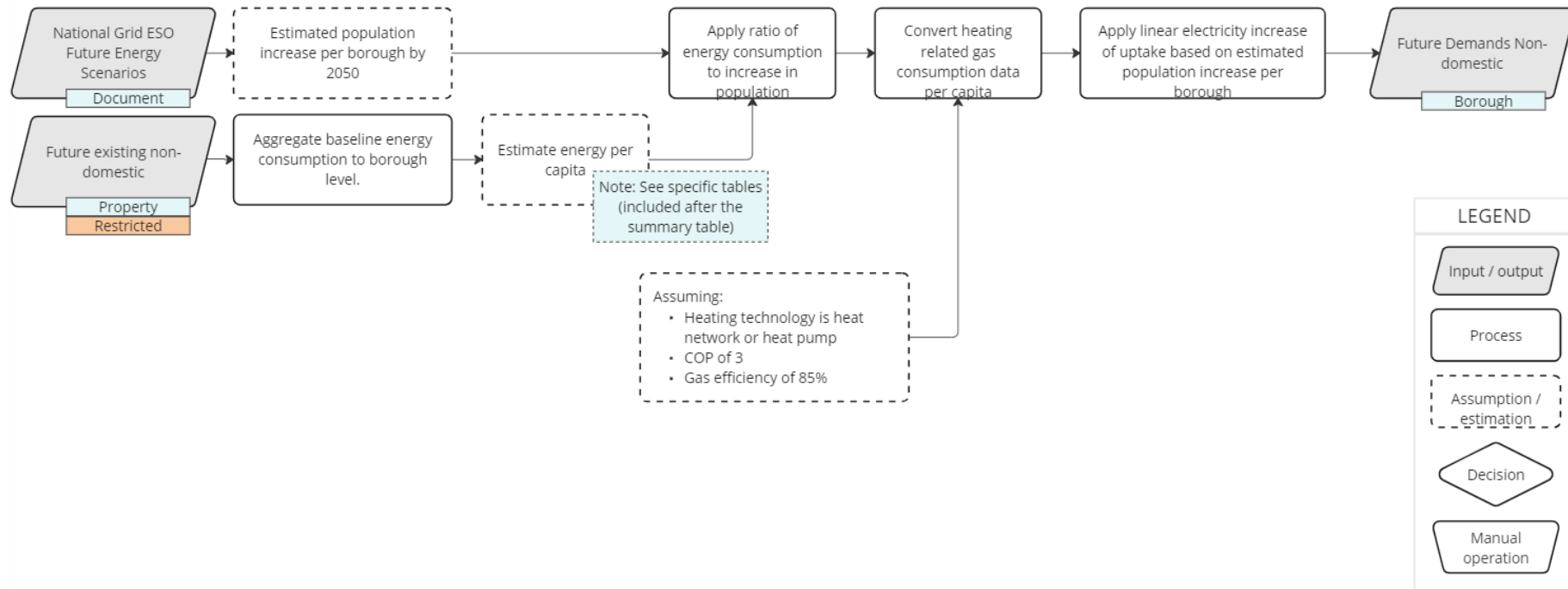
Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
Calibrated Building Model Domestic	Output from previous flow.						
Calibrated Building Model Non-domestic	Output from previous flow.						
Planning	Output from previous flow.						
Data output	Description	Geometry	Format	Output File Name			
Future Existing Domestic	Domestic building stock, including changes captured in planning data.		CSV	01_buildings			
Future Existing Non-domestic	Non-domestic building stock, including changes captured in planning data.		CSV	01_buildings			

GROWTH - FUTURE DEMANDS

Domestic



Non-domestic



LEGEND

Input / output

Process

Assumption / estimation

Decision

Manual operation

Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
Future Existing Domestic	Output from previous flow.						
Future Existing Non-domestic	Output from previous flow.						
National Grid ESO Future Energy Scenarios	ESO Pathways to Net Zero represent different, credible ways to decarbonise energy system towards the 2050 target.		PDF	https://www.nationalgrideso.com/document/323296/download	July 2024	Annually	Open
Data output	Description	Geometry	Format	Output File Name			
Future Demands Domestic	Domestic increase of demand.		CSV	01_buildings_future_demands_domestic			
Future Demands Non-domestic	Domestic increase of demand.		CSV	01_buildings_future_demands_non_domestic			

Non-domestic energy per capita

Note: Estimations below are using baseline energy consumption per borough and borough population - and assuming any future consumption would be electrified.

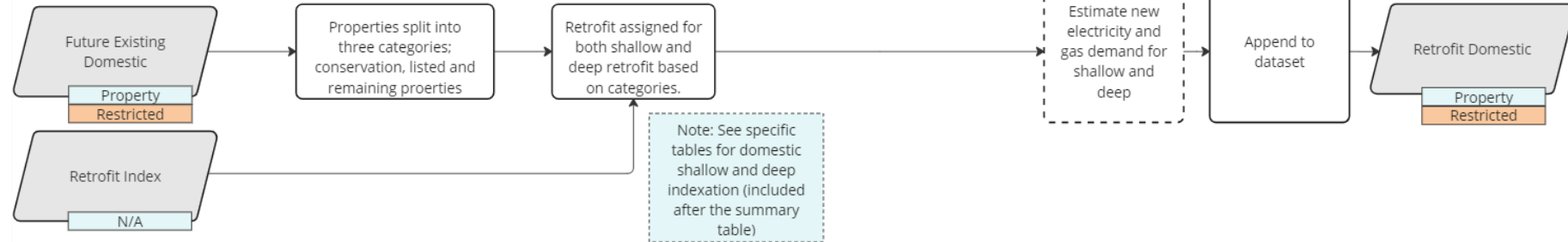
Northern Boroughs	Estimated annual electricity consumption per capita - future growth (MWh)
Camden	7.5
City of London	203.9
Enfield	2
Hackney	2.4
Haringey	1.9
Islington	3.9
Kensington and Chelsea	7.8
Newham	3.6
Tower Hamlets	6.8
Waltham Forest	1.4
Westminster	16.6

Note: City of London has a high value as a result of high demand and small population.

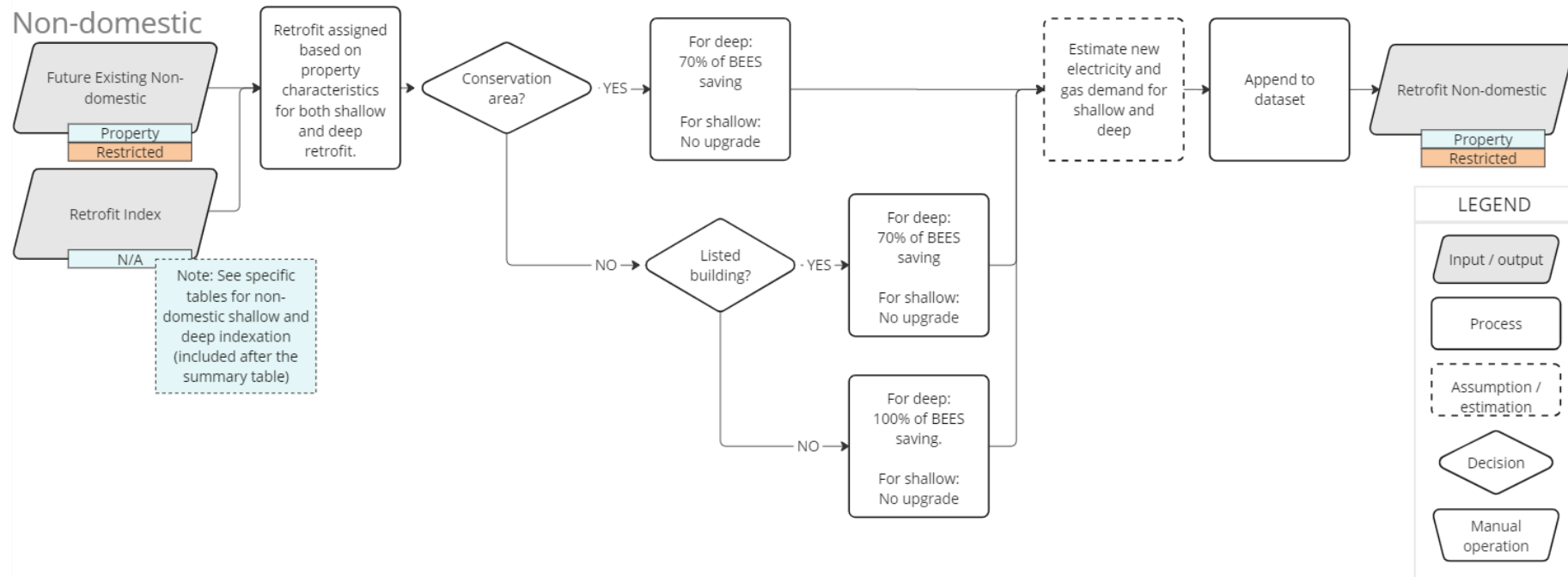
Southern Boroughs	Estimated annual electricity consumption per capita - future growth (MWh)
Croydon	1.9
Greenwich	2.1
Kingston upon Thames	2.2
Lambeth	2.6
Lewisham	1.4
Merton	2.5
Southwark	4.1
Sutton	1.9

BUILDING STOCK - RETROFIT

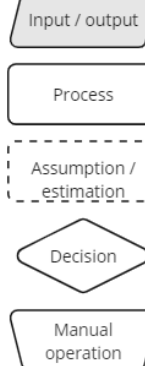
Domestic



Non-domestic



LEGEND



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Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
Future Existing Domestic	Output from previous flow.						
Future Existing Non-domestic	Output from previous flow.						
Retrofit Index	Indexation created to indicate upgrades based on property characteristics.		CSV				
Data output	Description	Geometry	Format	Output File Name			
Retrofit Domestic	Domestic building stock, including retrofit output.		CSV	N/A. Final values are included in 01_buildings.			
Retrofit Non-domestic	Non-domestic building stock, including retrofit output.		CSV	N/A. Final values are included in 01_buildings.			

Domestic Retrofit Indexation

Domestic									
Shallow retrofit	EPC	Solid wall insulation	Cavity Wall insulation	Single Glazing upgrade	Secondary glazing upgrade	Double/triple glazing	Loft insulation	Small Power saving	Draught proofing
Conservation	A - B	N	N	N	N	N	N	N	N
	C	N	Y	N	N	N	Y	N	Y
	D	N	Y	Y	Y	N	Y	N	Y
	E-G	N	Y	Y	Y	N	Y	N	Y
Listed	A - B	N	N	N	N	N	N	N	N
	C	N	Y	N	N	N	Y	N	Y
	D	N	Y	Y	N	N	Y	N	Y
	E-G	N	Y	Y	N	N	Y	N	Y
Remaining properties	A - B	N	N	N	N	N	N	N	N
	C	N	Y	Y	N	N	Y	N	Y
	D	N	Y	Y	Y	N	Y	N	Y
	E-G	N	Y	Y	Y	N	Y	N	Y

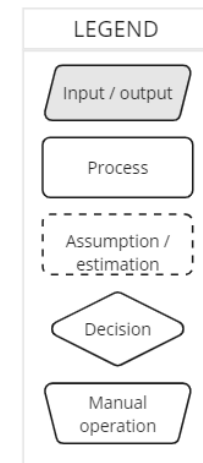
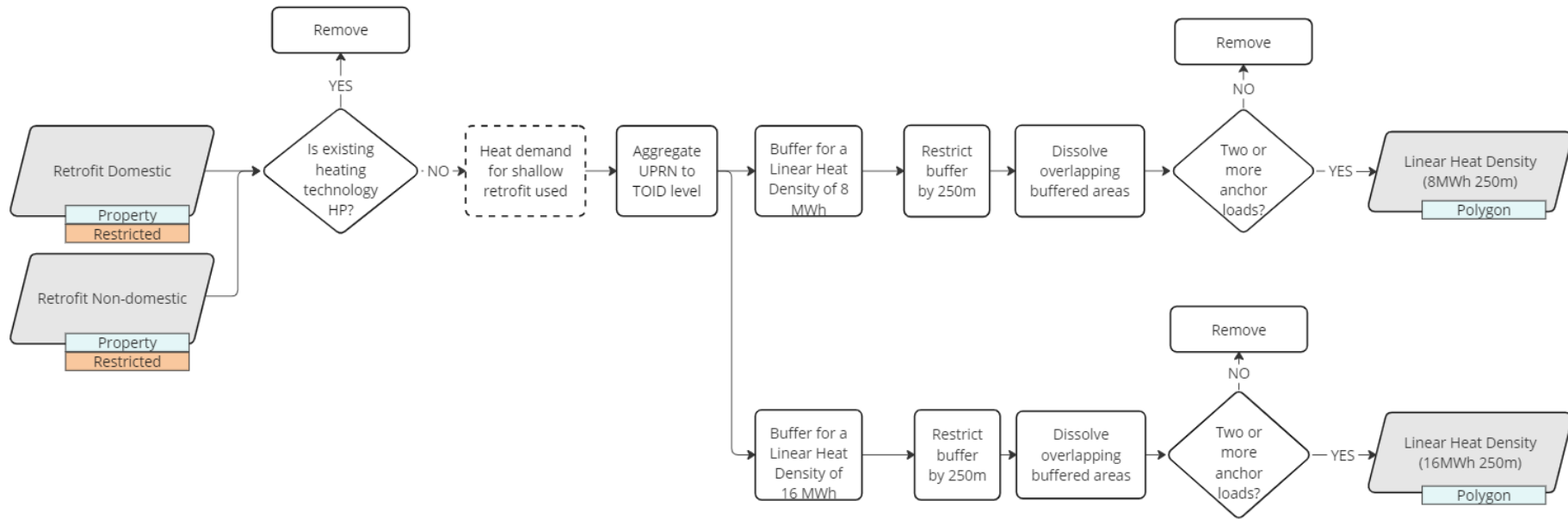
Domestic									
Deep retrofit	EPC	Solid wall insulation	Cavity Wall insulation	Single Glazing upgrade	Secondary glazing upgrade	Double/triple glazing	Loft insulation	Small Power saving	Draught proofing
Conservation	A - B	N	N	N	N	N	N	N	N
	C	N	Y	Y	Y	Y	Y	N	Y
	D	Y	Y	Y	Y	Y	Y	N	Y
	E-G	Y	Y	Y	Y	Y	Y	N	Y
Listed	A - B	N	N	N	N	N	N	N	N
	C	N	Y	Y	N	N	Y	N	Y
	D	N	Y	Y	N	N	Y	N	Y
	E-G	N	Y	Y	N	N	Y	N	Y
Remaining properties	A - B	N	N	N	N	N	N	N	N
	C	Y	Y	Y	Y	Y	Y	N	Y
	D	Y	Y	Y	Y	Y	Y	N	Y
	E-G	Y	Y	Y	Y	Y	Y	N	Y

Non-domestic Retrofit Indexation

Non domestic (All properties)				
Shallow retrofit	A - B	C	D and below	Unknown
Energy Efficiency (fabric)	N	N	N	N
Heating	N/A	N/A	N/A	N/A
Building energy management (inc. control, distribution, carbon and energy management)	Y	Y	Y	Y
Air conditioning and cooling	Y	Y	Y	Y
Ventilation	N	N	N	N
Electricity saving (small power, lighting and cooled storage)	Y	Y	Y	Y

Non domestic (All properties)				
Deep retrofit	A - B	C	D and below	Unknown
Energy Efficiency (fabric)	N	Y	Y	Y
Heating	N/A	N/A	N/A	N/A
Building energy management (inc. control, distribution, carbon and energy management)	Y	Y	Y	Y
Air conditioning and cooling	Y	Y	Y	Y
Ventilation	Y	Y	Y	Y
Electricity saving (small power, lighting and cooled storage)	Y	Y	Y	Y

HEATING TECHNOLOGY - LINEAR HEAT DENSITY

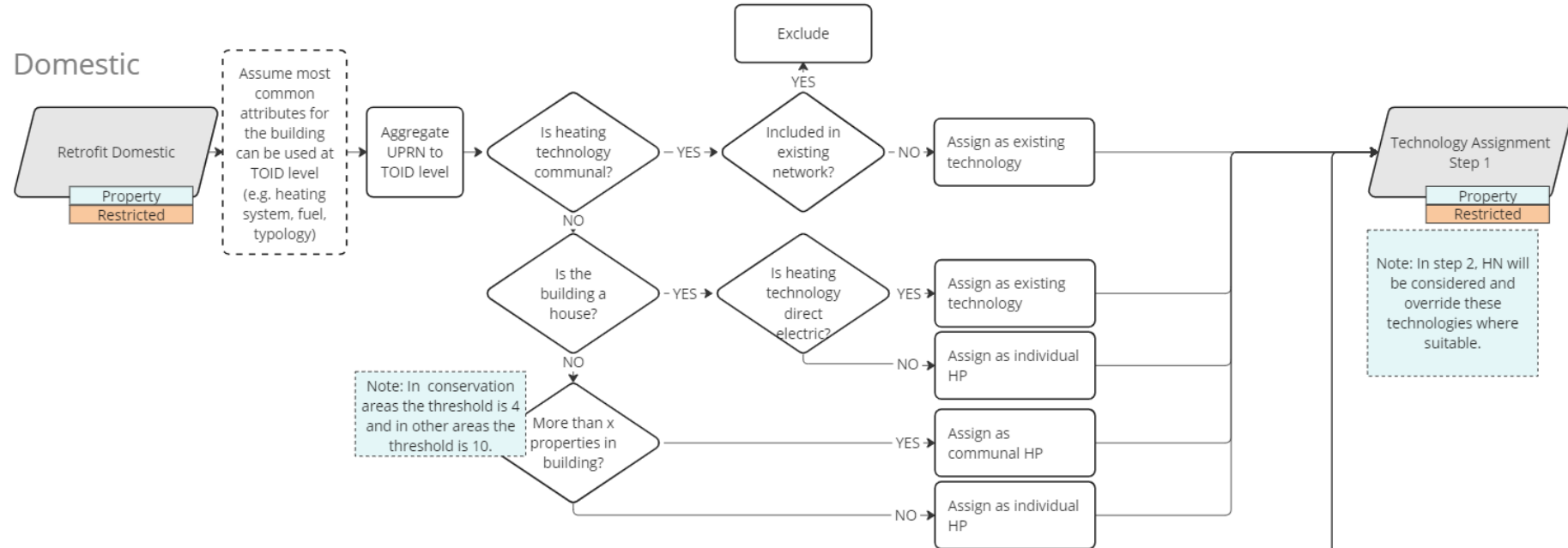


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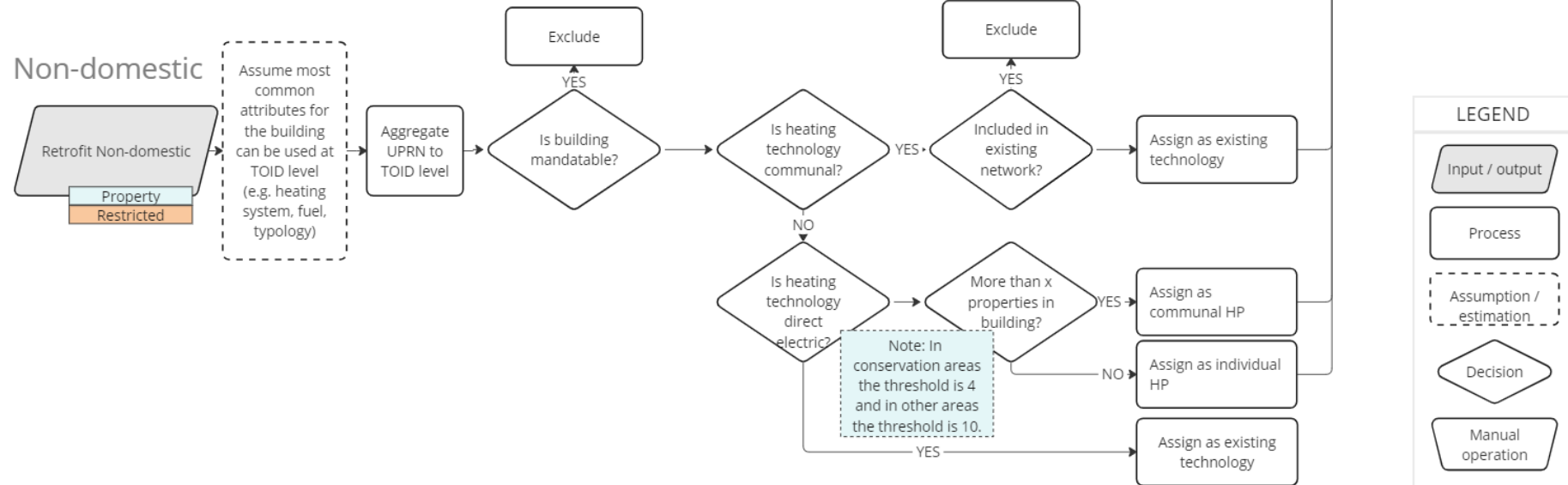
Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
Retrofit Domestic	Output from previous flow.						
Retrofit Non-domestic	Output from previous flow.						
Data output	Description	Geometry	Format	Output File Name			
Linear Heat Density (8MWh 250m)	Linear heat density for the sub-region, comprising of minimum of two anchor loads at 8MWh and restricted to 250m.	Polygon	GEOJSON	04_heat_networks_South_8mwh_250m, 04_heat_networks_CIEN_8mwh_250m			
Linear Heat Density (16MWh 250m)	Linear heat density for the sub-region, comprising of minimum of two anchor loads at 16MWh and restricted to 250m.	Polygon	GEOJSON	04_heat_networks_South_16mwh_250m, 04_heat_networks_CIEN_16mwh_250m			

HEATING TECHNOLOGY - TECHNOLOGY ASSIGNMENT (EXCEPT HEAT NETWORK)

Domestic

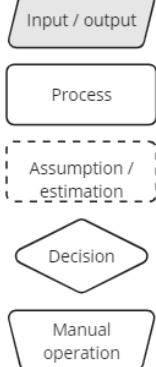


Non-domestic



Note: In step 2, HN will be considered and override these technologies where suitable.

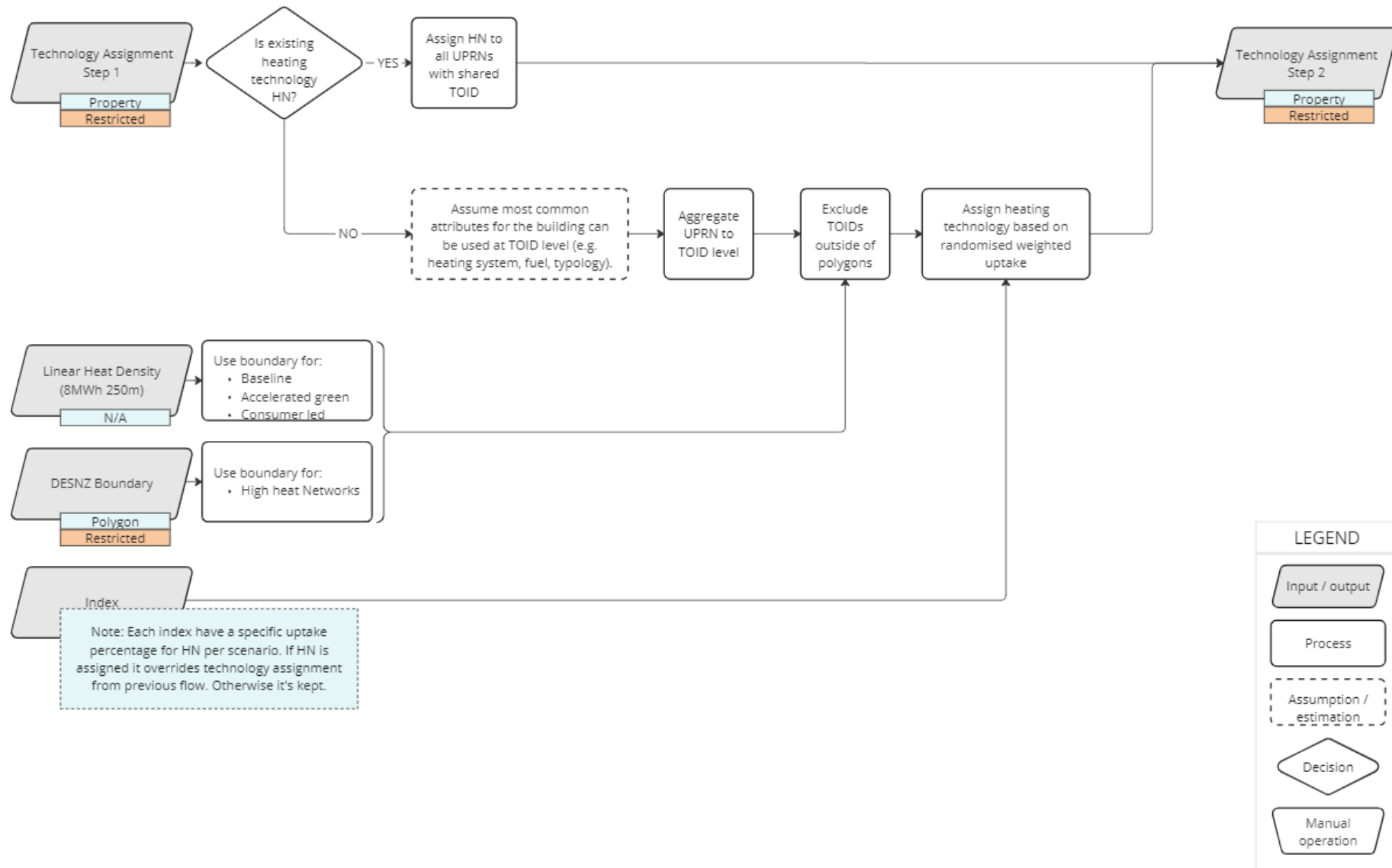
LEGEND



BURO HAPPOLD

Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
Retrofit Domestic	Output from previous flow.						
Retrofit Non-domestic	Output from previous flow.						
Data output	Description	Geometry	Format	Output File Name			
Technology Assignment Step 1	Technology assignment for all properties if they were to not connect to heat network.		CSV	N/A. Final values are included in scenario outputs for buildings: 01_baseline, 02_consumer_transformation, 03_accelerated_green, 04_high_heat_network			

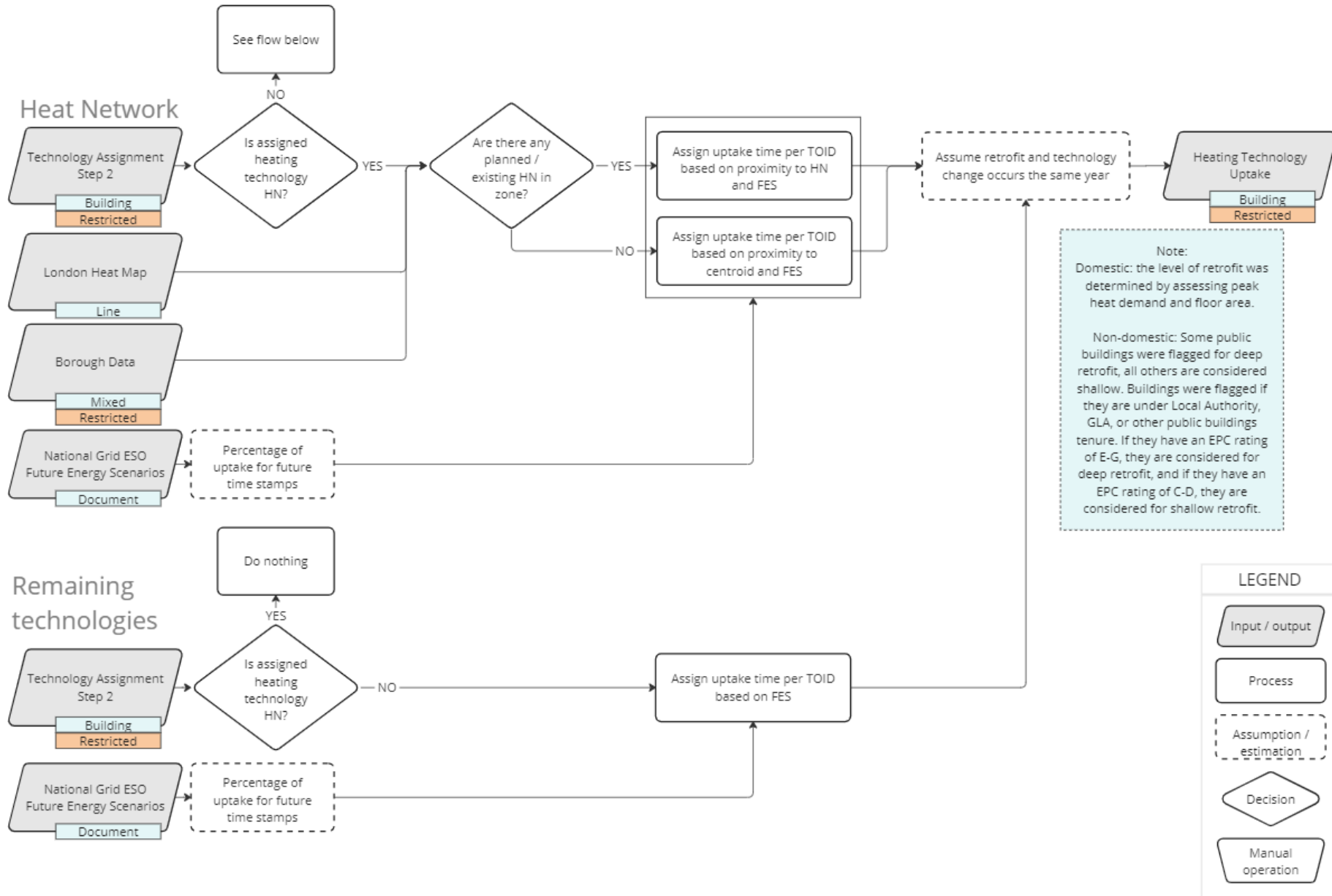
HEATING TECHNOLOGY - SCENARIO ASSIGNMENT



BURO HAPPOLD

Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
Technology Assignment Step 1	Output from previous flow.						
Linear Heat Density (8MWh 250m)	Output from previous flow.						
DESNZ Boundary	Heat network zoning boundary provided by DESNEZ for the subregional area.	Polygon	GPKG	DESNZ	February 2024	Likely to go through updates, open version have now been publish.	Restricted
Index	Indexation created to establish probability of HN uptake per scenario based on a number of factors. If HN is assigned it overrides technology assignment from previous flow. Otherwise previous assignment is kept.		CSV				
Data output	Description	Geometry	Format	Output File Name			
Technology Assignment Step 2	Technology assignment for all properties.		CSV	N/A. Final values are included in scenario outputs for buildings: 01_baseline, 02_consumer_transformation, 03_accelerated_green, 04_high_heat_network			

HEATING TECHNOLOGY - SCENARIO UPTAKE

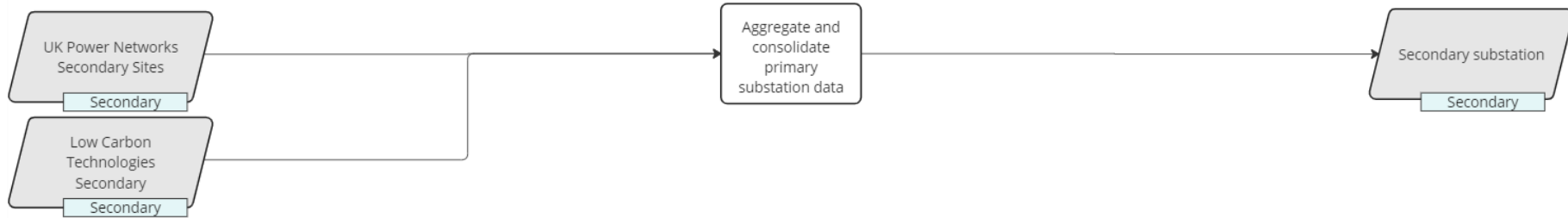


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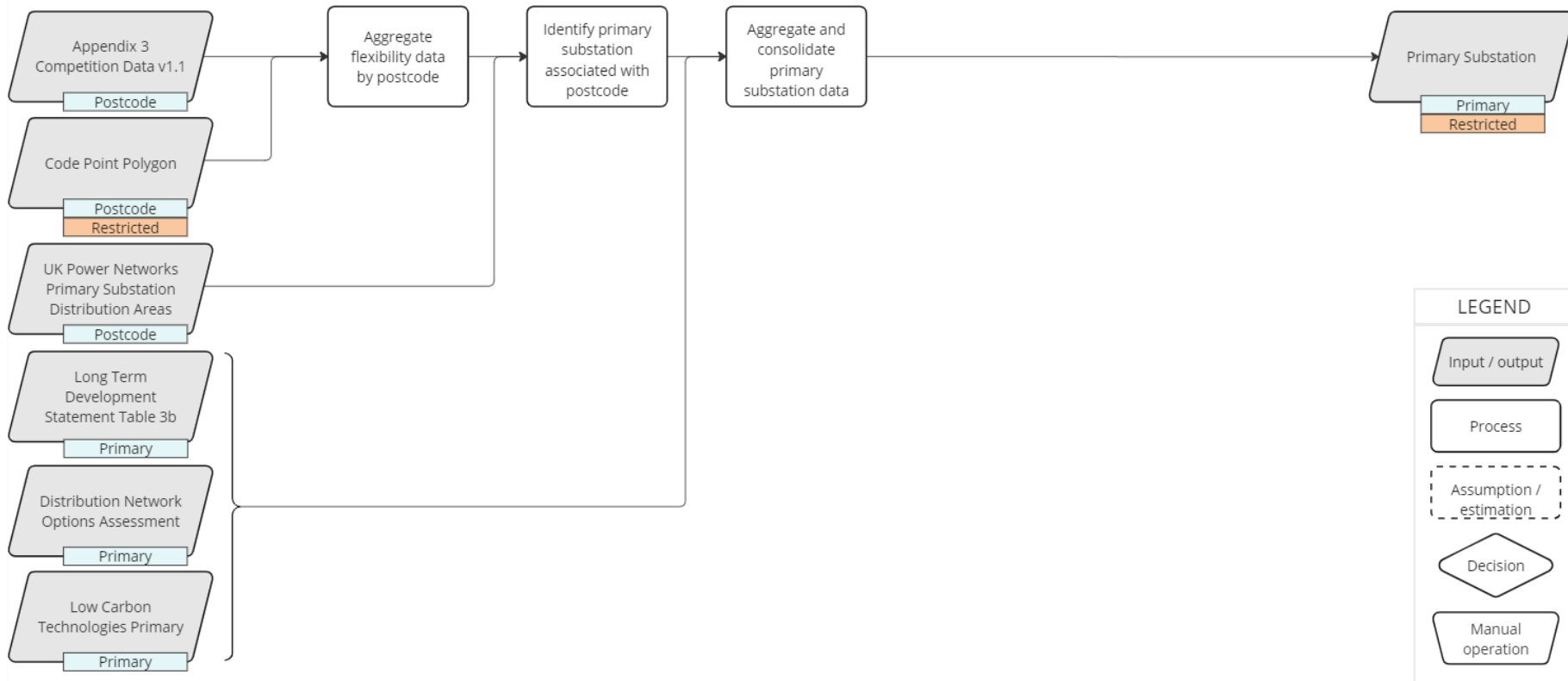
Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
Technology Assignment Step 2	Output from previous flow.						
Borough Data	Heat network specific data provided by boroughs.	Mixed	Mixed	Boroughs	March 2024		Restricted
London Heat Map	London Heat Map highlights existing and proposed networks.	Line	GPKG	https://apps.london.gov.uk/heatmap/	April 2024		Open
National Grid ESO Future Energy Scenarios	ESO Pathways to Net Zero represent different, credible ways to decarbonise energy system towards the 2050 target.		PDF	https://www.nationalgrideso.com/document/323296/download		Annually	Open
Data output	Description	Geometry	Format	Output File Name			
Heating Technology Uptake	Uptake year of technology assigned for each property.		CSV	scenario outputs for buildings: 01_baseline, 02_consumer_transformation, 03_accelerated_green, 04_high_heat_network			

POWER - SUBSTATION DATA

Secondary substation



Primary substation



LEGEND

Input / output

Process

Assumption / estimation

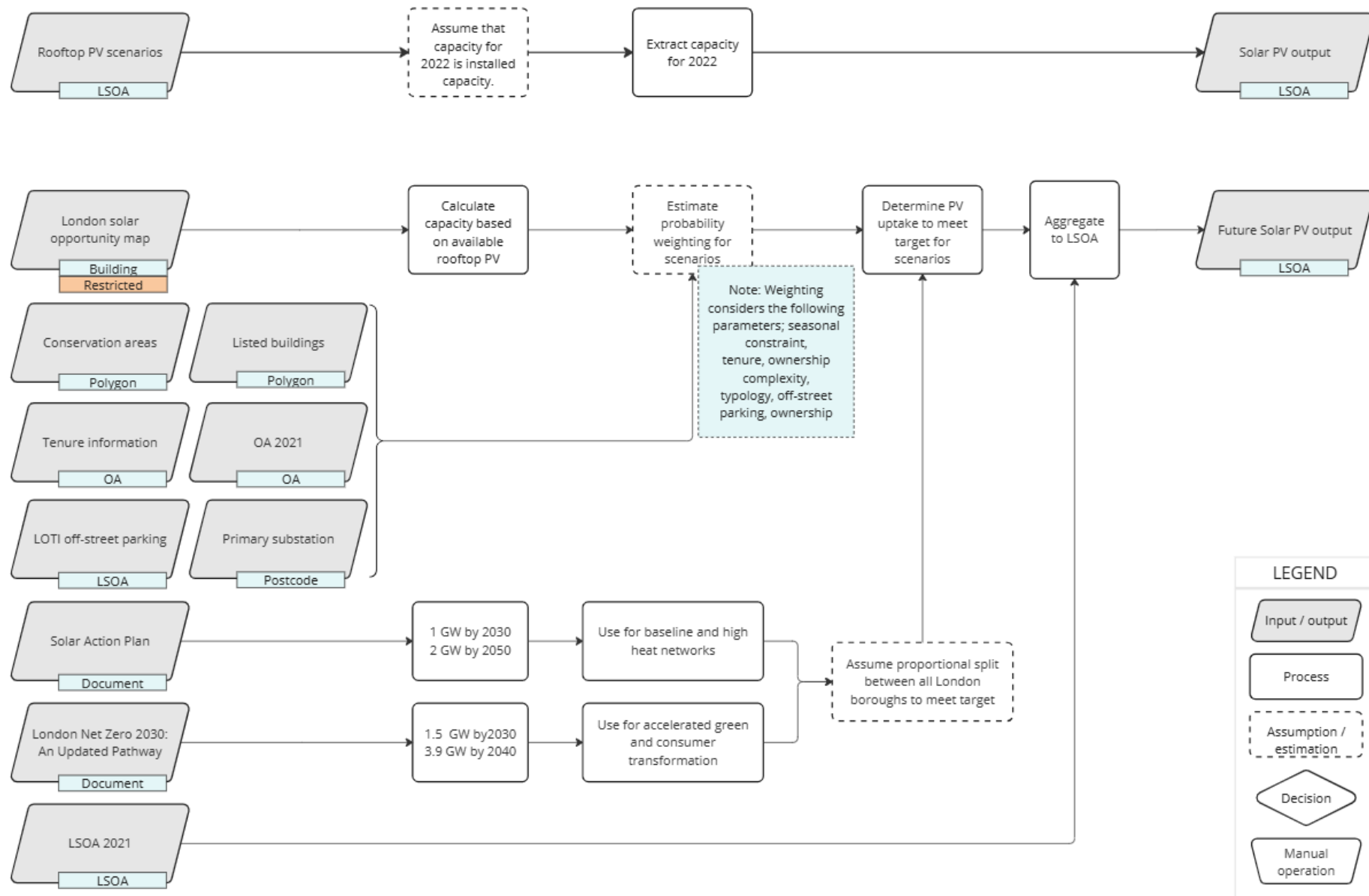
Decision

Manual operation

BURO HAPPOLD

Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
UK Power Networks Secondary Sites	Details on secondary substations including primary substation locations and ratings.		XLSX	https://ukpowernetworks.opendatasoft.com/exploration/dataset/ukpn_primary_postcode_area/information/	April 2024		Open
Low Carbon Technologies Secondary	Volume of Low Carbon Technologies (LCT) for both generation and demand (under 1MW) connected to UK Power Networks by Secondary Substation.		CSV	https://ukpowernetworks.opendatasoft.com/exploration/dataset/ukpn-low-carbon-technologies-secondary/information/	April 2024		Open
Appendix 3 Competition Data v1.1	Flexibility procurement historical competition data.		XLSX	https://dso.ukpowernetworks.co.uk/flexibility/tender-hub?category=previous-tenders	July 2024	6 months	Open
Code Point Polygon	Ordnance Survey (OS) National Geographic Database (NGD) Building Polygons.	Polygon	GPKG	https://www.ordnancesurvey.co.uk/products/os-ngd	April 2024	Weekly	Restricted
UK Power Networks Primary Substation Distribution Areas	Details on primary substations including primary substation areas and headroom.		CSV	https://ukpowernetworks.opendatasoft.com/exploration/dataset/ukpn_primary_postcode_area/information/	June 2024		Open
Long Term Development Statement Table 3b	Details of forecasted loads on the network and envisioned network developments over a 0-5 year period. Shows true substation peak demands with correction added for demand served by generation.		CSV	https://ukpowernetworks.opendatasoft.com/exploration/dataset/lds-table-3b-load-data-true/information/?disjunctive.season	August 2024	6 months	Open
Distribution Network Options Assessment	Distribution Network Options Assessment. Details future network constraints, the recommended solution and the current status in the solution progress.		CSV	https://ukpowernetworks.opendatasoft.com/exploration/dataset/ukpn-dnoa/information/?disjunctive.constraint_season	May 2024	Annually	Open
Low Carbon Technologies Primary	Volume of Low Carbon Technologies (LCT) for both generation and demand (under 1MW) connected to UK Power Networks by Primary Substation.		CSV	https://ukpowernetworks.opendatasoft.com/exploration/dataset/low-carbon-technologies/information/?disjunctive.category&disjunctive.type	April 2024		Open
Data input	Description	Geometry	Format	Output File Name			
Primary Substation	Consolidates all incoming primary substation data by merging it based on the relevant geographic identifier, with the SiteFunctionalLocation serving as the primary key.		CSV	06_power_primary_substation			
Secondary Substation	Consolidated data set for secondary substation. Includes substations demand, location, capacity of LCTs connected and import, export capacities for LCTs		CSV	06_power_secondary_substation			

RENEWABLES - ROOFTOP SOLAR

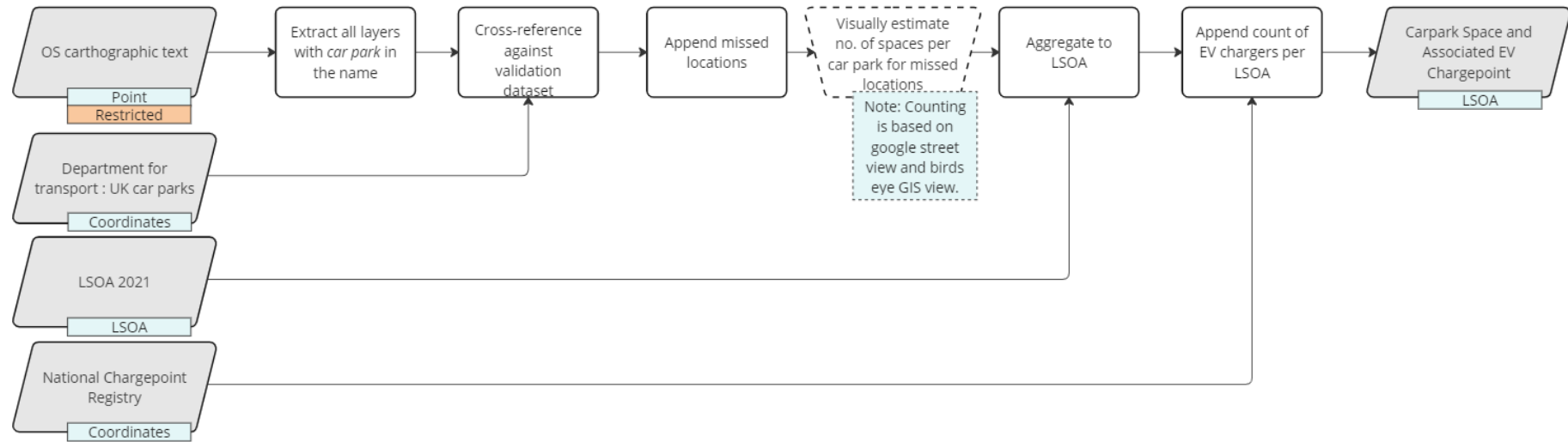


BURO HAPPOLD

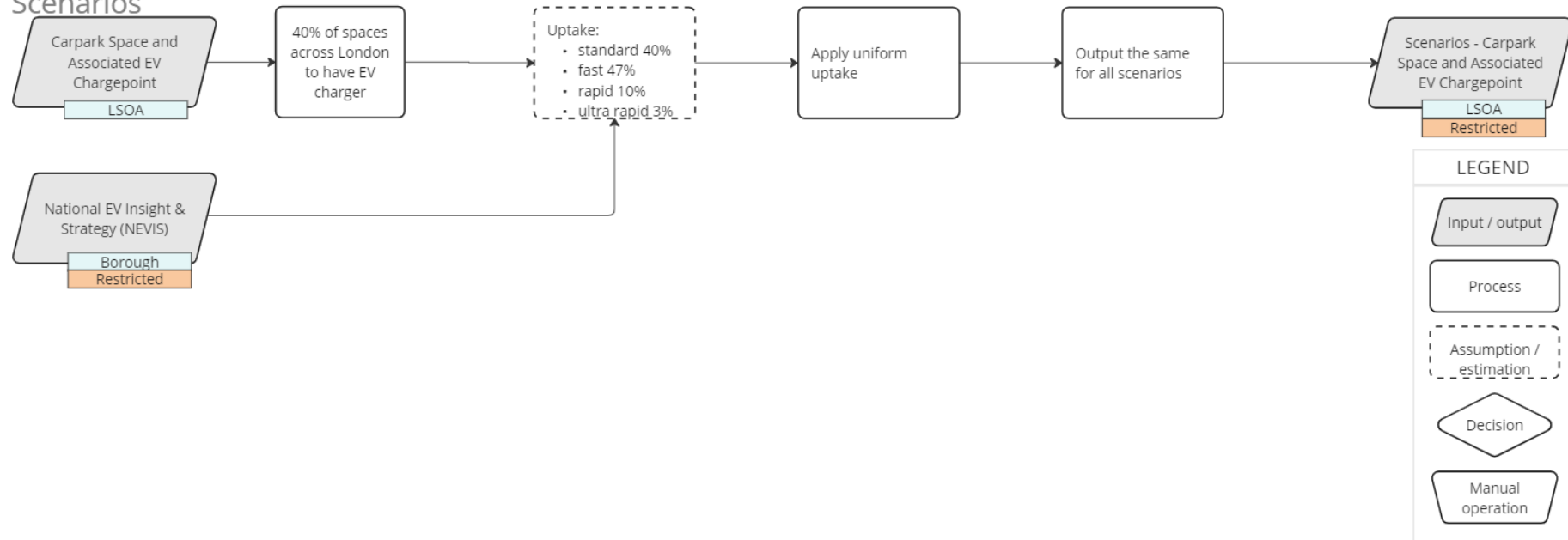
Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
Rooftop PV scenarios	Capacity of rooftop PV forecast which is used as part of the Distributed Future Energy Scenarios.		XLSX	UK Power Networks	April 2024		Open
London Solar Opportunities Map	Estimates the solar irradiance potential and viable roof area for PV at building level. Uses TOID as identifier.		CSV	University College London	April 2024		Restricted
LSOA 2021	2021 Lower Super Output Areas and Data Zones borders for United Kingdom.	Polygon	GEOJSON	https://geoportal.statistics.gov.uk/datasets/0f80c523f3cd4d0fab5111572f84a2fb_0/explore	March 2024	Aligns to Census	Open
OA 2021	2021 Output Areas and Data Zones borders for United Kingdom.	Polygon	GPKG	https://geoportal.statistics.gov.uk/datasets/ons::output-area-2021-to-lsoa-to-msoa-to-lad-december-2021-exact-fit-lookup-in-ew-v3/explore	June 2024	Aligns to Census	Open
Tenure Information	Details on property tenure at output area level i.e owned, social rented, private rented.		CSV	https://www.ons.gov.uk/datasets/TS054/editions/2021/versions/4/filter-outputs/e6ac6489-fb40-4465-b4ee-0df6415458e4?get-data#get-data	June 2024		Open
London Office of Technology and Innovation (LOTI)	% of households with off-street parking per LSOA and % of households with a car.		CSV	https://loti.london/	January 2024		Restricted
Primary Substations	Output from previous flow.						
Listed Buildings	Polygons of listed building with properties including grade, building preservation notices and certificates of immunity.	Polygon	GPKG	https://historicengland.org.uk/listing/the-list/data-downloads/	March 2024		Open
Conservation Area	Conservation areas exist to manage and protect the special architectural and historic interest of a place - in other words, the features that make it unique.		GPKG	https://historicengland.org.uk/listing/the-list/data-downloads/	March 2024		Open
Solar Action Plan for London	Mayor of London's target for Solar PV.		PDF	https://www.london.gov.uk/sites/default/files/solar_action_plan.pdf	July 2024	Published June 2018, not been updated since	Open
London Net Zero 2030: An Updated Pathway	Accelerated green target for Solar PV.		PDF	https://www.london.gov.uk/sites/default/files/london_net_zero_2030_-_an_updated_pathway_-_gla_response_1.pdf	July 2024	Published January 2022, not been updated since	Open
Data output	Description	Geometry	Format	Output File Name			
Solar PV output	Solar PV output		CSV	05_rooftop_solar			
Future Solar PV output	Solar PV output for future scenarios		CSV	scenario outputs for rooftop solar pv: 01_baseline, 02_consumer_transformation, 03_accelerated_green, 04_high_heat_network			

TRANSPORT - CAR PARKS AND ASSOCIATED EV CHARGEPOINTS

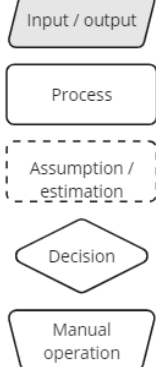
Baseline



Scenarios



LEGEND

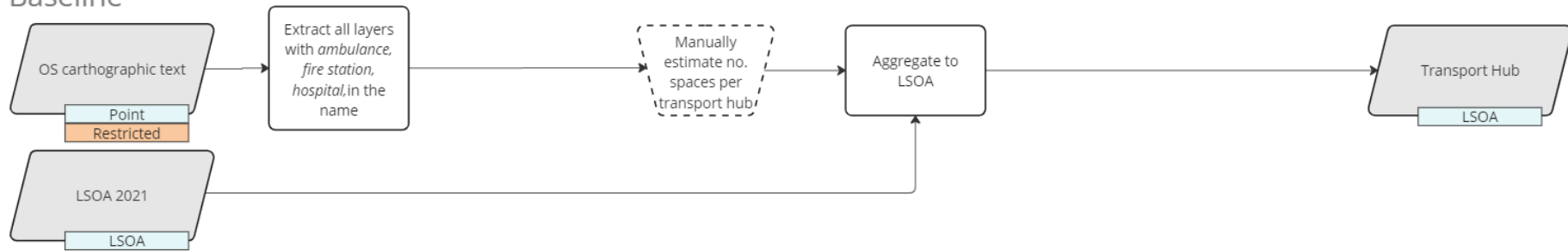


BURO HAPPOLD

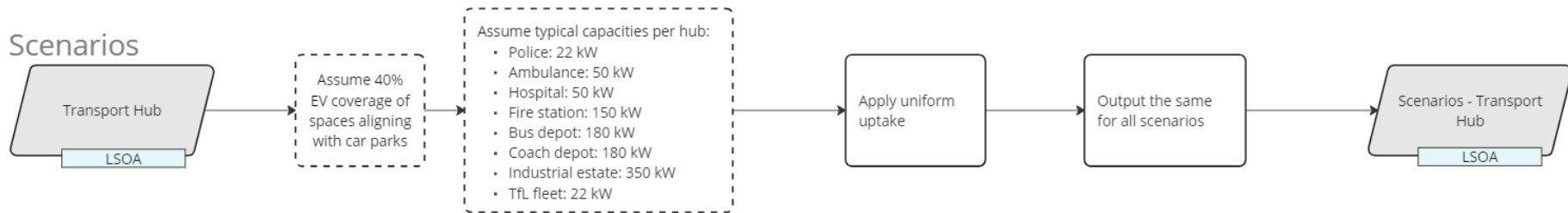
Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
OS Carthographic Text	Part of OS MasterMap Topography Layer which links relevant information to point data.	Point	GPKG	https://www.ordnancesurvey.co.uk/products/os-mastermap-topography-layer	Mar-24	Six weekly	Restricted
Department For Transport : UK Car Parks	Dataset for UK Car Parks in great Britain, which was created for the Transport Direct Journey planning website.		CSV	https://hub.arcgis.com/datasets/bd03477bcb2f46e3a034bcbfc7664a5e/explore	March 2024	None since Feb 2016	Open
National Chargepoint Registry	Data on the National Chargepoint Registry (NCR) on public electric vehicle chargepoints in the UK.		CSV	https://www.gov.uk/guidance/find-and-use-data-on-public-electric-vehicle-chargepoints	May 2024	Monthly	Open
LSOA 2021	2021 Lower Super Output Areas and Data Zones borders for all UK.	Polygon	GEOJSON	https://geoportal.statistics.gov.uk/datasets/0f80c523f3cd4d0fab5111572f84a2fb_0/explore	March 2024	Aligns to Census	Open
National EV Insight & Strategy (NEVIS)	Deployment of Electric Vehicles (EVs) and Electric Vehicle Infrastructure (EVI).		CSV	https://nevis.cenex.co.uk/toolkit-data	April 2024	Quarterly	Restricted
Data output	Description	Geometry	Format	Output File Name			
Carpark Space and Associated EV	Carpark Space and Associated EV charge point per LSOA		CSV	03_transport			
Scenarios - Carpark Space and Associated EV Charge Point	Future carpark Space and Associated EV charge point per LSOA		CSV	scenario outputs for transport: 01_baseline, 02_consumer_transformation, 03_accelerated_green, 04_high_heat_network			

TRANSPORT - TRANSPORT HUBS

Baseline



Scenarios



LEGEND

Input / output

Process

Assumption / estimation

Decision

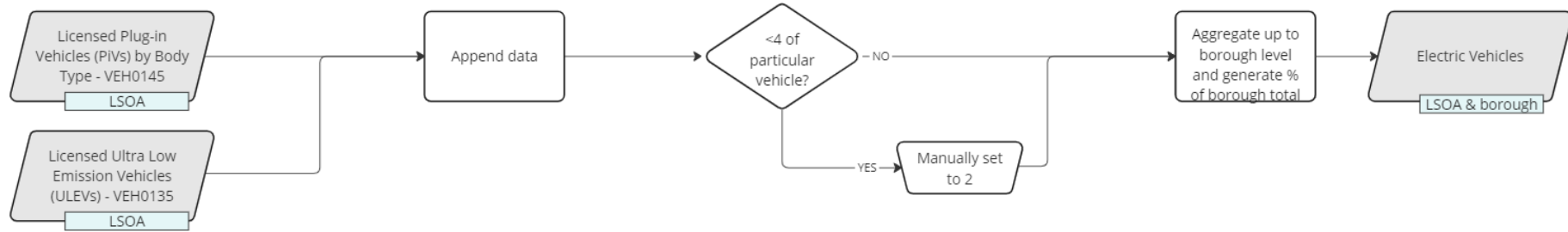
Manual operation

BURO HAPPOLD

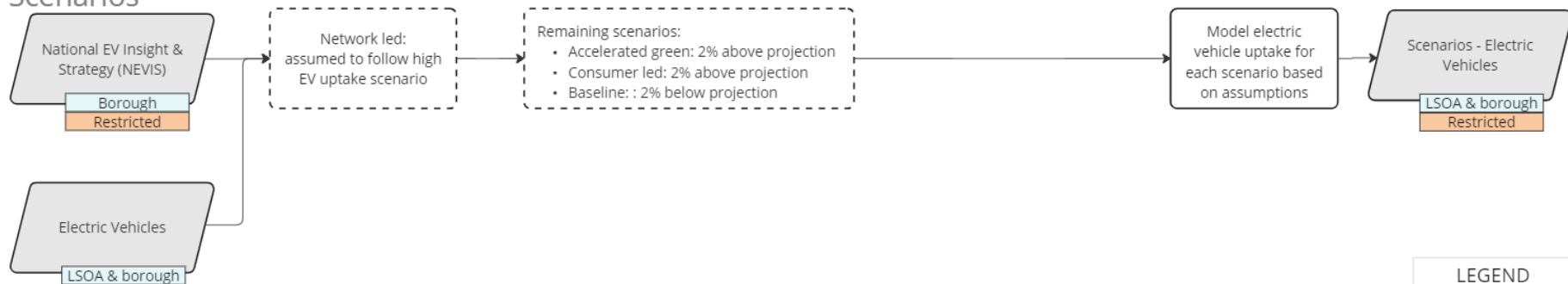
Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
OS Cartographic Text	Part of OS MasterMap Topography Layer which links relevant information to point data.	Point	GPKG	https://www.ordnancesurvey.co.uk/products/os-mastermap-topography-layer	March 2024	Six weekly	Restricted
LSOA 2021	2021 Lower Super Output Areas and Data Zones borders for all UK.	Polygon	GEOJSON	https://geoportal.statistics.gov.uk/datasets/0f80c523f3cd4d0fab5111572f84a2fb_0/explore	March 2024	Aligns to Census	Open
Data output	Description	Geometry	Format	Output File Name			
Transport Hub	Baseline for transport hub per LSOA.		CSV	03_transport			
Scenarios - Transport Hub	Scenarios output for transport hub per LSOA.		CSV	scenario outputs for transport: 01_baseline, 02_consumer_transformation, 03_accelerated_green, 04_high_heat_network			

TRANSPORT - ELECTRIC VEHICLES

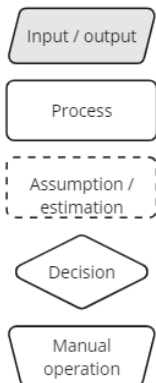
Baseline



Scenarios



LEGEND

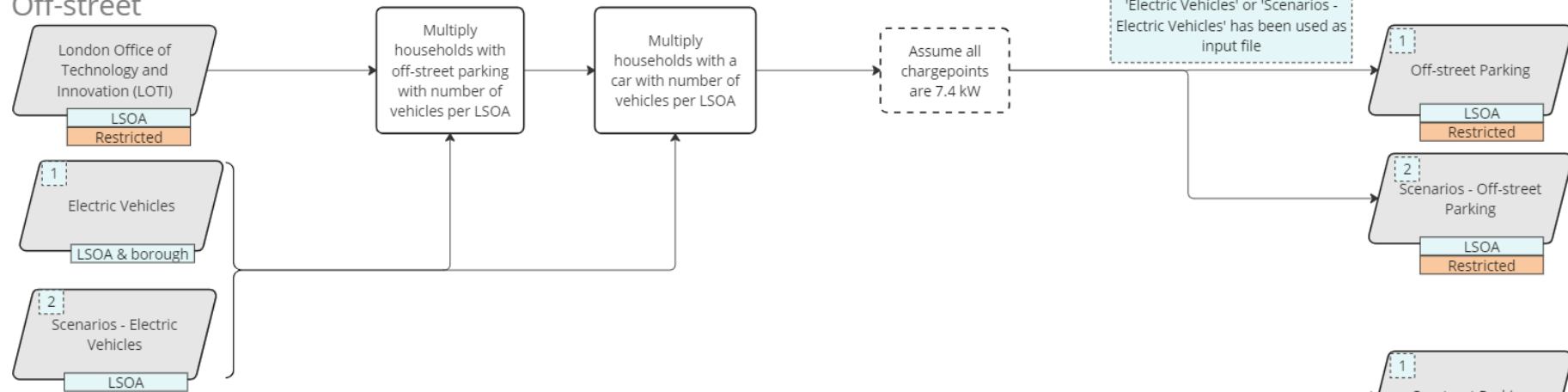


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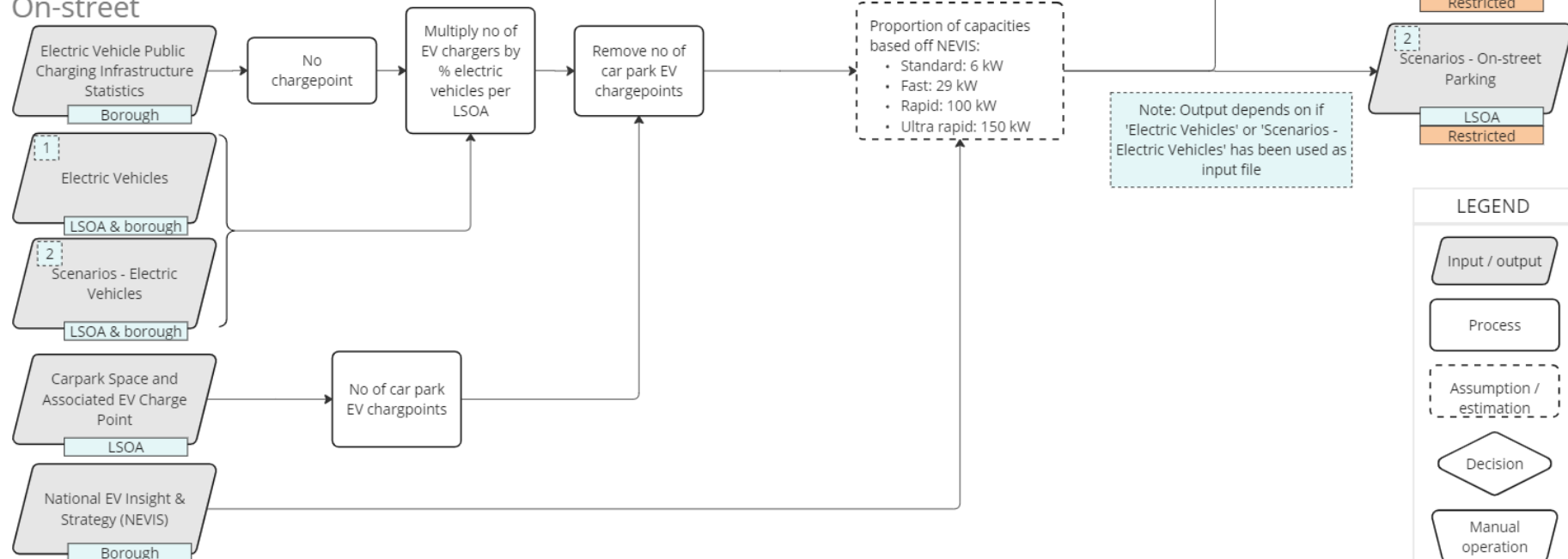
Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
Licensed Plug-in Vehicles (PIVs) by Body Type - VEH0145	Licensed plug-in vehicles (PIVs) at the end of the quarter by fuel type, keepership and LSOA: United Kingdom		CSV	Vehicle licensing statistics data files - GOV.UK (www.gov.uk)	March 2024	Quarterly	Open
Licensed Ultra Low Emission Vehicles (ULEVs) - VEH0135	Licensed ultra low emission vehicles (ULEVs) at the end of the quarter by fuel type, keepership and LSOA: United Kingdom		CSV	Vehicle licensing statistics data files - GOV.UK (www.gov.uk)	March 2024	Quarterly	Open
National EV Insight & Strategy (NEVIS)	Deployment of Electric Vehicles (EVs) and Electric Vehicle Infrastructure (EVI).		CSV	https://nevis.cenex.co.uk/toolkit-data	April 2024	Quarterly	Restricted
Data output	Description	Geometry	Format	Output File Name			
Electric Vehicles	Baseline electric vehicles per LSOA along with associated borough %.		CSV	03_transport			
Scenarios - Electric Vehicles	Scenarios electric vehicles per LSOA along with associated borough %.		CSV	scenario outputs for transport: 01_baseline, 02_consumer_transformation, 03_accelerated_green, 04_high_heat_network			

TRANSPORT - OFF-STREET AND ON-STREET PARKING

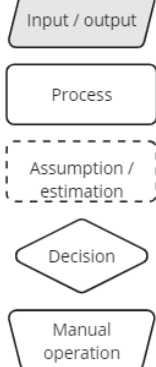
Off-street



On-street



LEGEND

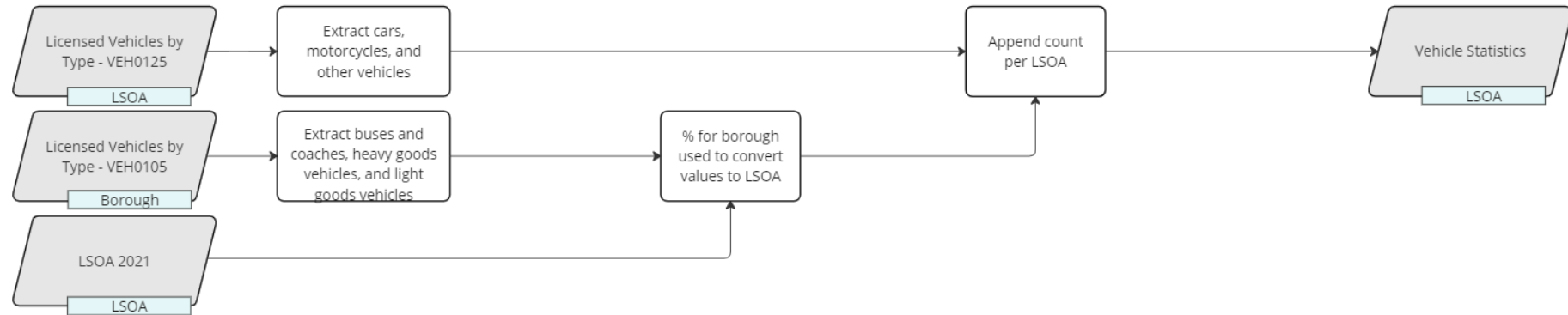


BURO HAPPOLD

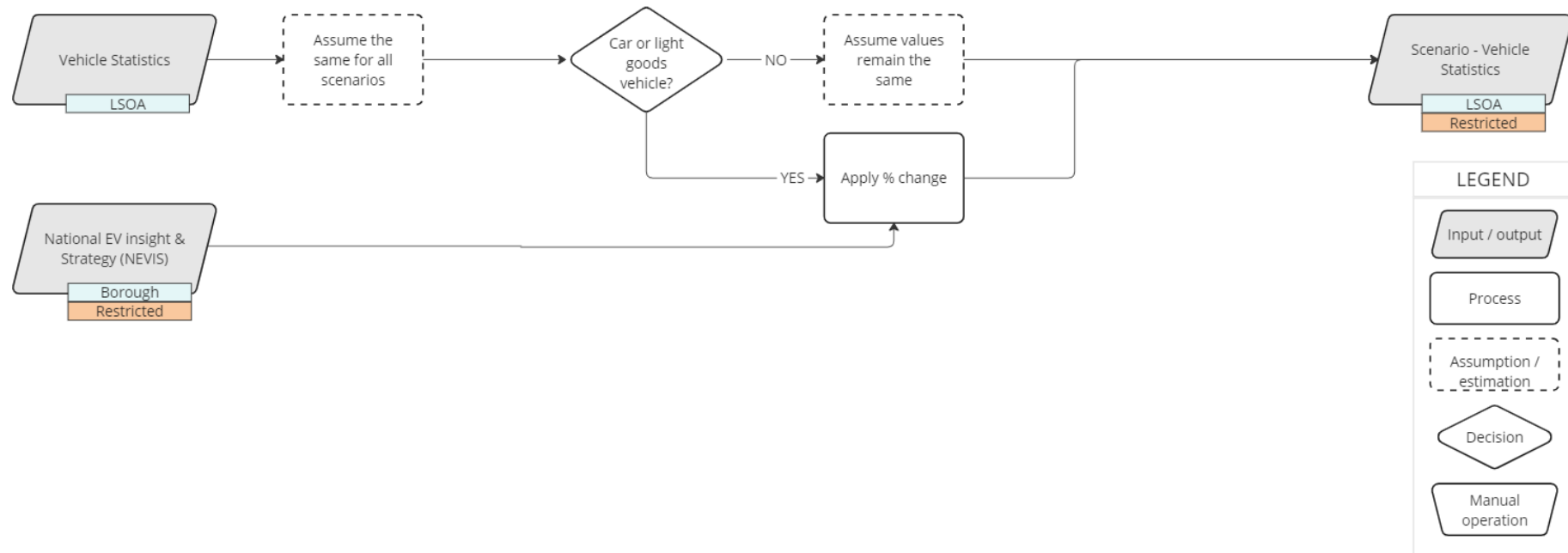
Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Access
London Office of Technology and Innovation (LOTI)	% of households with off-street parking per LSOA and % of households with a car.		CSV	GLA	January 2024	Census Dates	Restricted
Electric Vehicles	Output from previous flow.						
Scenarios - Electric Vehicles	Output from previous flow.						
Electric Vehicle Public Charging Infrastructure Statistics	The number of publicly available electric vehicle charging devices in the UK.		XLSX	https://www.gov.uk/government/statistics/electric-vehicle-charging-device-statistics-january-2024	March 2024	Quarterly	Open
Carpark Space and Associated EV Charge Point	Output from previous flow.						
Data output	Description	Geometry	Format	Output File Name			
Off-street Parking	Baseline number off-street parking by LSOA.		CSV	03_transport			
On-street Parking	Baseline number on-street parking by LSOA.		CSV	03_transport			
Scenarios - off-street Parking	Scenarios number off-street parking by LSOA.		CSV	scenario outputs for transport: 01_baseline, 02_consumer_transformation, 03_accelerated_green, 04_high_heat_network			
Scenarios - on-street Parking	Scenarios number on-street parking by LSOA.		CSV	scenario outputs for transport: 01_baseline, 02_consumer_transformation, 03_accelerated_green, 04_high_heat_network			

TRANSPORT - VEHICLE STATISTICS

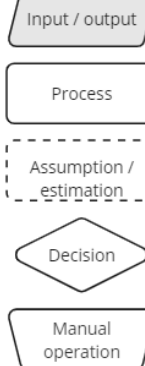
Baseline



Scenarios



LEGEND

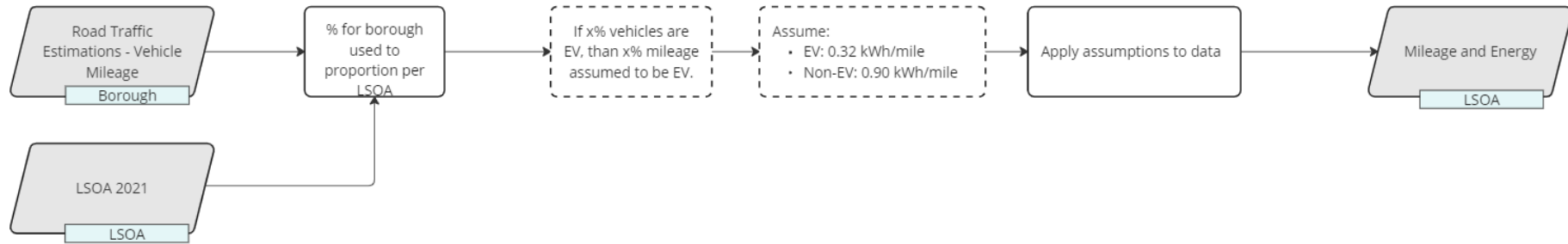


BURO HAPPOLD

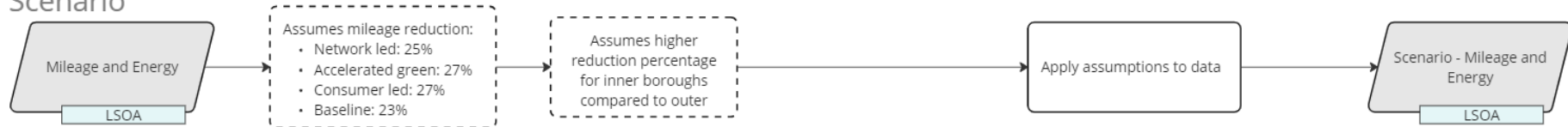
Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Licence
Licensed Vehicles by Type - VEH0105	Licensed vehicles by body type, fuel type, keepership and upper and lower tier local authority.		CSV	https://www.gov.uk/government/statistical-data-sets/vehicle-licensing-statistics-data-tables	March 2024	Quarterly	Open
Licensed Vehicles by Type - VEH0125	Vehicles at the end of the quarter by licence status, body type, keepership and lower super output area (LSOA).		CSV	Vehicle licensing statistics data files - GOV.UK (www.gov.uk)	March 2024	Quarterly	Open
LSOA 2021	2021 Lower Super Output Areas and Data Zones borders for all UK.	Polygon	GEOJSON	https://geoportal.statistics.gov.uk/datasets/0f80c523f3cd4d0fab5111572f84a2fb_0/explore	February 2024	Aligns to Census	Open
Data output	Description	Geometry	Format	Output File Name			
Vehicle Statistics	Breakdown of vehicles per LSOA.		CSV	03_transport			
Scenario - Vehicle Statistics	Breakdown of predicted vehicles per LSOA.		CSV	scenario outputs for transport: 01_baseline, 02_consumer_transformation, 03_accelerated_green, 04_high_heat_network			

TRANSPORT - MILEAGE AND ENERGY

Baseline



Scenario



LEGEND

Input / output

Process

Assumption / estimation

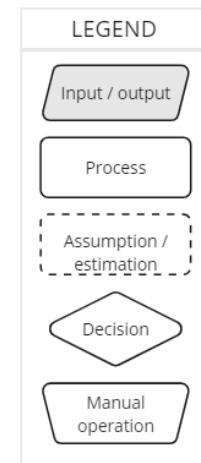
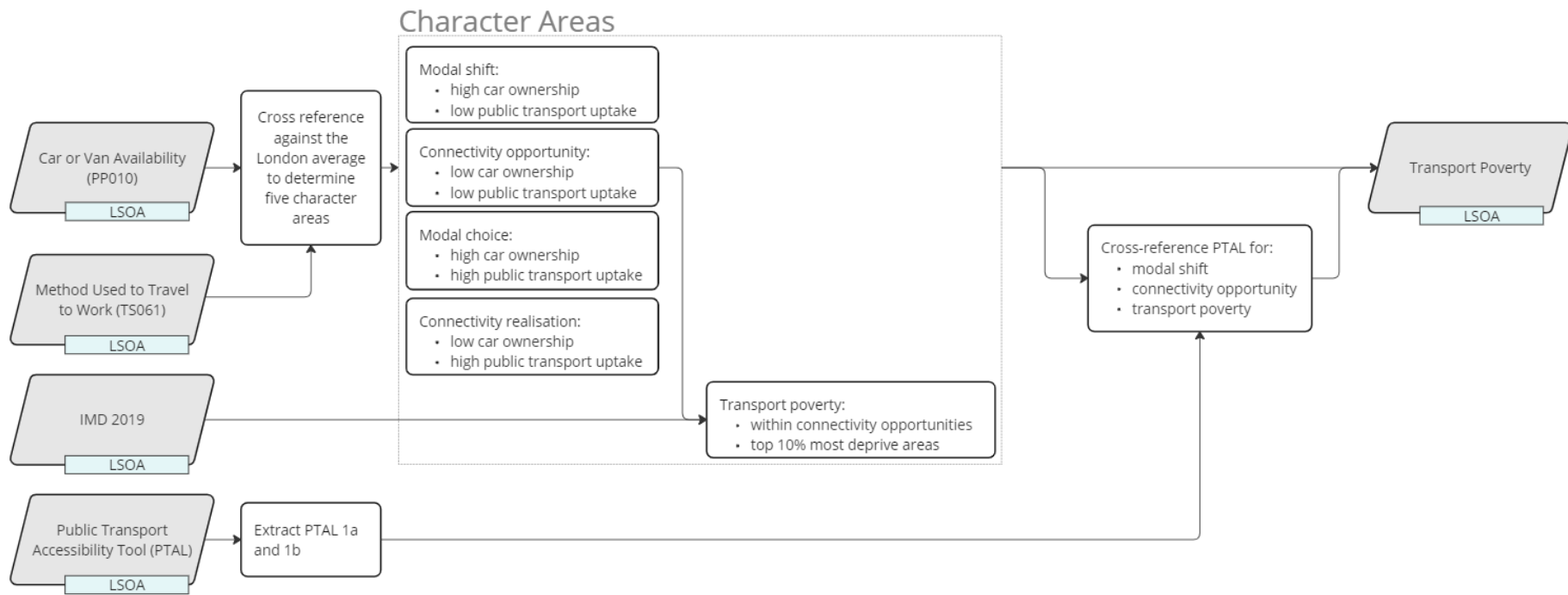
Decision

Manual operation

BURO HAPPOLD

Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Licence
Road Traffic Estimations - Vehicle Mileage	Road traffic estimates for Great Britain broken down by vehicle type and road type for 2022.		XLSX	https://www.gov.uk/government/statistics/road-traffic-estimates-in-great-britain-2022	April 2024	Yearly	Open
LSOA 2021	2021 Lower Super Output Areas for United Kingdom.	Polygon	GEOJSON	https://geoportal.statistics.gov.uk/datasets/0f80c523f3cd4d0fab5111572f84a2fb_0/explore	February 2024	Census Dates	Open
Data output	Description	Geometry	Format	Output File Name			
Mileage and Energy	Mileage and energy per LSOA.		CSV	03_transport			
Scenario - Mileage and Energy	Future mileage and energy per LSOA.		CSV	scenario outputs for transport: 01_baseline, 02_consumer_transformation, 03_accelerated_green, 04_high_heat_network			

TRANSPORT - TRANSPORT POVERTY



BURO HAPPOLD

Data input	Description	Geometry	Format	Source	Date of Harvest	Update frequency	Licence
Car or Van Availability (PP010)	Census 2021 estimates that classify households in parishes England and Wales by car or van availability.		CSV	https://www.nomisweb.co.uk/datasets/c2021pp010	July 2024		Open
Method Used to Travel to Work (TS061)	Census 2021 estimates that classify usual residents in England and Wales by their method used to travel to work.		CSV	https://www.nomisweb.co.uk/datasets/c2021ts061#:~:text=Method%20of%20travel%20to%20workplace%20	July 2024		Open
Public Transport Accessibility Tool (PTAL)	PTALS are a detailed and accurate measure of the accessibility of a point to the public transport network, taking into account walk access time and service availability.		CSV	https://tfl.gov.uk/info-for/urban-planning-and-construction/planning-with-webcat/webcat	July 2024		Open
IMD 2019	The Index of Multiple Deprivation (IMD) datasets are small area measures of relative deprivation across each of the constituent nations of the United Kingdom.	Polygon	GPKG	https://data.cdrc.ac.uk/dataset/index-multiple-deprivation-imd	March 2024	3-4 years	Open
Data output	Description	Geometry	Format	Output File Name			
Transport Poverty	Five character areas to identify transport poverty and opportunities.		CSV	03_transport_character_areas			

Borough readiness - Phase 2 LAEP

Readiness to deliver a borough-led Local Area Energy Plan and/or Net Zero Projects has been mapped under six indicators. Officers have provided their insight on their borough's progress under key decarbonisation themes in terms of projects, data and resource and existing activities and policies to drive decarbonisation without progressing to a full borough-led LAEP. The completed assessment included officer insights added to the Miro board and our policy, data and projects assessment as presented during the 1-2-1 borough engagement workshops.

Readiness indicators		RED - Limited action to support the commissioning and successful implementation of a Phase 2 LAEP	AMBER - Some action to support the commissioning and successful implementation of a Phase 2 LAEP	GREEN - Significant action to support the commissioning and successful implementation of a Phase 2 LAEP
Net Zero Pipeline Projects	Projects and opportunities that have been identified in your borough (including cross-borough projects)	Limited Some Significant		
	Implementation of projects that have been identified e.g., resource and partner organisations	Limited Some Significant		
	Data to identify more projects	Limited Some Significant		
Borough-led LAEP (Phase 2)	Identifying a team to commission Phase 2	Limited Some Significant		
	Buy-in from stakeholders in the council	Limited Some Significant		
	Existing studies and policies to support or reduce the need for a formal LAEP	Limited Some Significant		

Borough readiness - LAEP delivery (borough-led LAEP completed)

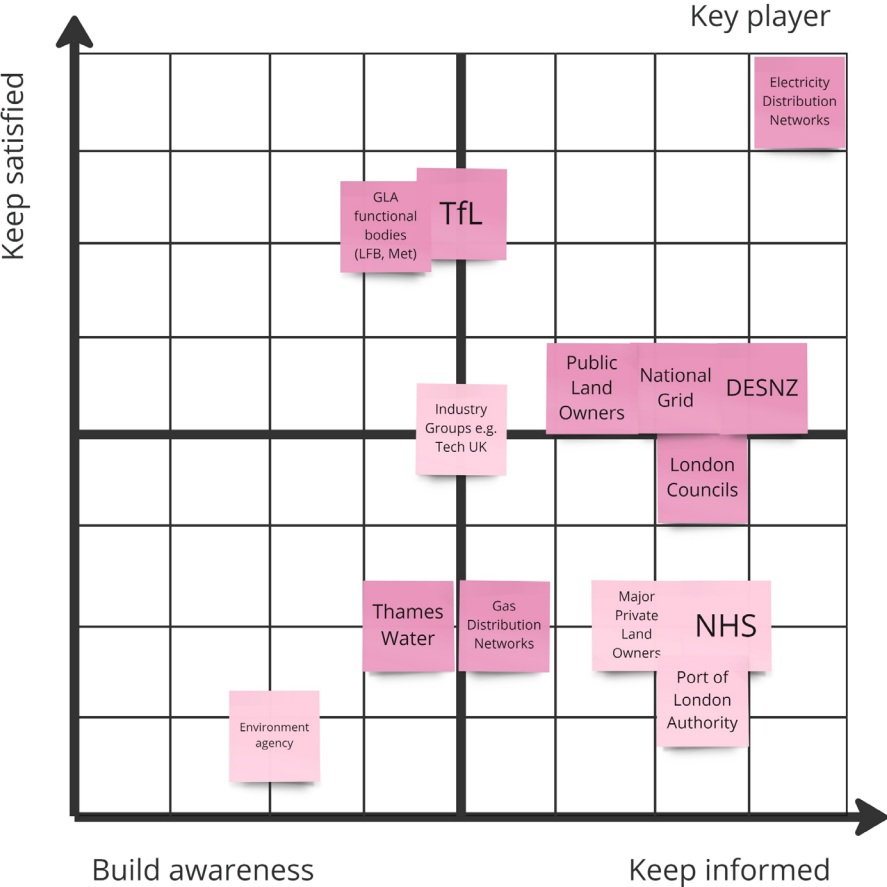
Readiness to deliver the outcomes of a borough-led Local Area Energy Plan and/or Net Zero Projects has been mapped under six indicators. Officers have provided their insight on their borough's progress under key decarbonisation themes in terms of projects, data and resource and existing activities and policies to drive decarbonisation. The completed assessment included officer insights added to the Miro board and our policy, data and projects assessment as presented during the 1-2-1 borough engagement workshops.

Success indicators		RED - Limited action to support the successful implementation of a Phase 2 LAEP	AMBER - Some action to support the successful implementation of a Phase 2 LAEP	GREEN - Significant action to support the successful implementation of a Phase 2 LAEP
Net Zero Pipeline Projects - priority intervention areas	Enabling actions			
	Projects identified under key priority areas			
	Data to identify more projects			
	Stakeholder engagement / partnerships to deliver the proposed actions			

Appendix B Stakeholder engagement and mapping

Subregional LAEP Phase 1 – Stakeholder mapping

Stakeholder engagement is a core component in the development of the LAEP at different levels for subregional and borough-level LAEPs. For the subregional LAEP scale the focus is on larger stakeholders, such as central government, individual boroughs and utilities (such as network operators). A key aspect of the subregional engagement included the mapping of Phase 1 stakeholders. The map below was presented and discussed during borough 1-2-1 engagement to map subregional stakeholders for engagement during the Phase 1 work.



Key



Primary stakeholders are key players that have influence over the LAEP development and delivery



Secondary stakeholders are those that will be kept informed about the LAEP outcomes

Acronyms

- DESNZ - Department for Energy Security and Net Zero
- TfL - Transport for London
- LFB - London Fire Brigade
- Met - Metropolitan Police

Appendix C Smart DCC report

Enabling better use of smart meter data to enhance Local Area Energy Planning

Overview

This report forms a deliverable as part of the wider Subregional LAEP study being delivered for the GLA by Buro Happold.

The report summarises the key aspects of smart meter system data use, for the first time, in the LAEP planning process. Smart meter system data refers to the transactions taking place across the smart meter network (rather than message contents - such as consumption profiles). In high level summary, system data has been used to establish insights in relation to:

- Borough 'readiness' - the rate of smart meter installs and projected trajectory on a borough-by-borough basis which enables greater understanding of areas that are more or less able to benefit as the energy system transition continues and time of use tariffs and flexibility services continue to increase in availability.
- Fuel poverty indicators – analysing an anonymised sub-set of system data transactions from pre-payment meters to establish output areas in which there are increased indicators of financial difficulty, self-disconnections for example.

Whilst the benefits of use of the data set are growing, limitations are acknowledged in relation to data coverage (~27% of installed pre-payment meters) and granularity in particular.

Suggested next steps to further capitalise on the availability of smart meter data and the insights that can be drawn include:

- A detailed workshop to resolve key consideration around data access, data legislation and regulatory change needed to enable enduring data use
- A benefits mapping exercise to establish key metrics for successful data integration and use
- Formation of a working group of built environment practitioners to establish a standardised approach to the incorporation of smart metering data sets into the LAEP process

Context

In response to the climate crisis, most local authorities are targeting net zero before 2050 and the need for consistent, repeatable and robust planning processes is widely recognised.

Local Area Energy Planning (LAEP) has evolved to meet this need, ensuring that strategic investment is deployed in the right local areas to unlock net zero in an accelerated, cost effective and efficient way. As LAEP methodologies mature, it's recognised that digital and data led approaches will play a critical role in ensuring that 'place-based planning' approaches are accurate, dynamic and scalable. Utilising accurate and timely smart metering data will be key

to this, helping overcome multiple data quality, information asymmetry and access challenges that exist today.

For example, current benchmarking on building efficiency and heat system performance based on EPC data is flawed. Significant errors in determining technology / asset sizing at both building level and across the networks are compounded through lack of visibility of consumer behaviour including potential ‘rebound’ effects (i.e. Consumers go on to use more energy than anticipated through financial savings made through energy efficiency).

The planning process does not reflect the capabilities and selection of the right mix of low carbon technologies, nor their value from a consumer and network perspective. This misalignment holds the potential to be compounded further as system flexibility potential (and participation) is not factored into the planning.

In parallel, the digitalisation of the energy sector is happening at pace creating an abundance of data at a vast scale. Smart metering data forms a key part of this transition. Over 30m households and small businesses have a smart meter installed and this volume of devices, combined with the functionality of the system is generating over 2.2bn data transactions across the smart meter system every month.

More broadly, much government policy (within the energy sector and beyond) is seeking to enable better use of data to deliver a multitude of public benefits. [ref what]

Overlaying the challenges and issues identified in current LAEP processes with the emerging availability of smart meter data presents a substantial and timely opportunity to deliver improved plans, more accurate and lower cost investment, and better consumer outcomes.

The Opportunity

Smart meter data and routes to access

Smart metering is commonly considered in context with accurate recording of energy usage, enablement of automated meter readings and improved accuracy of energy bills. In practice the capabilities of the smart metering system and the data generated are far more expansive.

Today the network supports over 150 distinct types of messages (Service Request Variants - SRVs) of which more than 2 billion are sent across the DCC’s network each month. As figure 1 highlights, an important distinction must be made between two distinct categories of smart metering data that flows through the DCC’s system:

- ‘Message Contents’ (for example energy consumption data) is fully encrypted and only accessible to organisations who have ‘onboarded’ to the DCC
- ‘System Data’ (information about the messages) is retained centrally within the DCC’s system and is used primarily to maintain and manage the performance of the network. System data has huge potential to offer insights for a variety of use cases and applications – including, for example, fuel poverty identification.

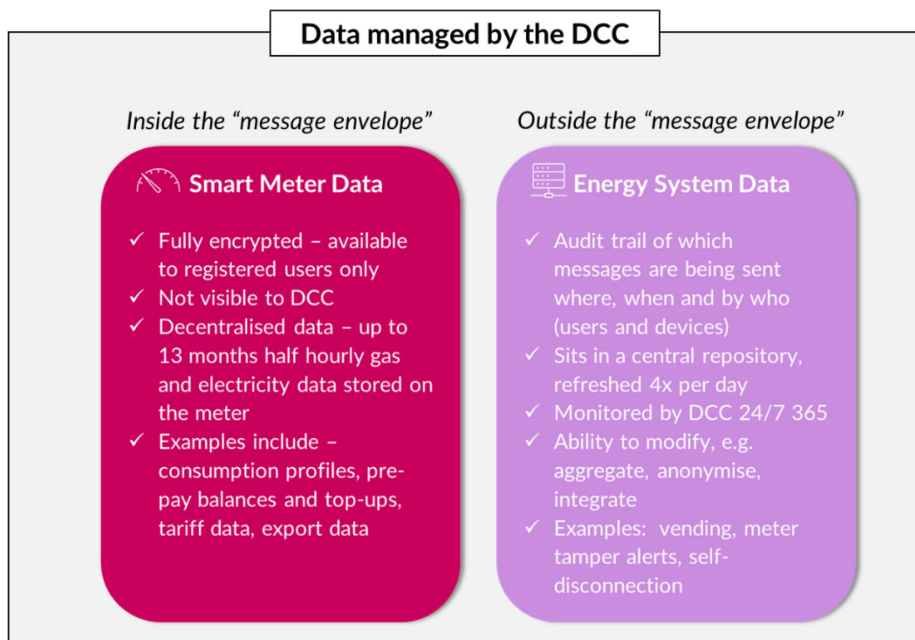


Figure 1: Inside and outside the 'message envelope' data categories managed by the DCC.

The route to accessing smart meter data depends on which data category it falls into:

Access to 'Message Content' data

At present, message content data (such as smart meter consumption data) can be accessed at a household level, with the explicit consent of the consumer, in two ways:

1. through integration with the smart metering system directly via the DCC ('onboarding')
2. via a third party 'Managed Service Provider' (MSP).

The functionality of the system allows users to interact with specific meters and devices and retrieve data, including half-hourly consumption profiles. Organisations that have integrated in this way include energy suppliers, distribution networks (DNO) and a growing segment of 'Other Users' – a term used to describe any other organisation who has onboarded to the DCC but is not an energy supplier or DNO. Alternatively, data can be retrieved via a 'Consumer Access Device (CAD)', a supplementary read-only device which is connected to the home area network. Connecting a CAD can only be undertaken by a registered user of DCC's systems.

Access to 'System data'

System data is derived from a combination of registration data, device inventory data and the audit trail of message transactions. The data sits centrally in DCC systems and is refreshed around 4 times a day. The data includes a temporal range from 2020 onwards (the point by which a relative mass of meters was installed).

To date, there is no defined access mechanism for smart meter 'system data'. In the case of this project, special agreement has been provided by Ofgem to allow the DCC to share this data, shared in raw form to GLA and through analytics and insights to Buro Happold.

Accessing data for this project

As integration and on-boarding to the smart metering system is a considerable undertaking (minimum 6-month duration) it was not possible for message contents (consumption data) to be incorporated into the project. Instead, focus was placed on smart meter 'system data' which was used, in an anonymised form to ensure compliance with regulatory approvals and

wider data legislation. The key categories of data utilised and the granularity at which they were analysed is provided below:

Data category	Granularity	Data format
Smart meter penetration rates	Borough level	% of premises that have a smart meter installed
Smart meter penetration rate projections	Borough level	% of premises that have a smart meter installed – projected to 2028
Smart meters operating in pre-pay or credit mode	Borough level	% split of meters operating in pre-pay / credit (at a single reporting point)
Smart meters operating in export	Borough level	% of premises that have a smart meter that have operated in export mode
Fuel poverty system data - insights (as approved under the Ofgem Permitted Purpose)	LSOA / Output Area (subject to anonymisation approach on an area-by-area basis)	- Proportion of households and frequency of 'credit exhausted' alerts - Proportion of households and frequency reaching low credit thresholds - Average number of pre-payment transactions
Fuel poverty system data – raw anonymised data, accessible to GLA only (as approved under the Ofgem Permitted Purpose ¹) See figure 2 below for full list of data categories	LSOA / Output Area (subject to anonymisation approach on an area-by-area basis)	- See below for full list of data categories

Message Type	Service Reference Variant / Alert Code	Description
N/A		2011 Census Output Area Classification
Service Reference Variant	1.5	Update Meter Balance
Service Reference Variant	1.6	Update Payment Mode
Service Reference Variant	2.1	Update Prepay Configuration
Service Reference Variant	2.2	Top Up Device
Service Reference Variant	2.3	Update Debt
Service Reference Variant	2.5	Activate Emergency Credit
Service Reference Variant	4.13	Read Prepayment Configuration
Service Reference Variant	4.14	Read Prepayment Daily Read Log
Service Reference Variant	4.18	Read Meter Balance
Service Reference Variant	4.3	Read Instantaneous Prepay Values
Service Reference Variant	4.4.2	Retrieve Change Of Mode / Tariff Triggered Billing Data Log
Service Reference Variant	4.4.3	Retrieve Billing Calendar Triggered Billing Data Log
Service Reference Variant	4.4.4	Retrieve Billing Data Log (Payment Based Debt Payments)
Service Reference Variant	4.4.5	Retrieve Billing Data Log (Prepayment Credits)
Service Reference Variant	6.2.9	Read Device Configuration (Payment Mode)
Alert	0x810D	Combined Credit Below Low Credit Threshold (prepayment mode)
Alert	0x810E	Credit Added Locally - Not Smets1
Alert	0x8119	Emergency Credit Has Become Available (prepayment mode)
Alert	0x8168	Supply Disabled then Armed - Activate Emergency Credit triggered
Alert	0x81AA	Emergency Credit Exhausted
Alert	0x81AB	Emergency Credit Activated
Alert	0x8F0F	Credit Below Disablement Threshold (prepayment mode)
Alert	0x8F83	Disablement of Supply due to insufficient credit has been suspended
Service Reference Variant	3.2	Restrict Access For Change Of Tenancy
Service Reference Variant	8.1.1	Commission Device
Service Reference Variant	8.3	Decommission Device
Service Reference Variant	8.5	Service Opt Out - Not Smets1
Service Reference Variant	8.6	Service Opt In - Not Smets1
Service Reference Variant	8.7.1	Join Service (Critical)
Service Reference Variant	8.7.2	Join Service (Non- Critical)
Service Reference Variant	8.8.1	Unjoin Service (Critical)
Service Reference Variant	8.8.2	Unjoin Service (Non-Critical)

Figure 2: Full list of data categories available under this scope.

¹ Consent granted to DCC under Conditions 9 and 10 of the Smart Meter Communication Licence, and Section M4.3 of the Smart Energy Code - August 2023 | Ofgem

Future smart meter data categories

Whilst unavailable today, in addition to smart metering consumption and system data, further smart metering data sets are currently being explored via DCC's innovation projects and services. Each offer future potential to enhance the LAEP approach further. Subject to timelines and regulatory feasibility, these avenues will be explored in all future phases of LAEP delivery, including subsequent phases of current sub regional LAEP activities (ie phases 5-7).

These include:

- backhaul of additional data such as temperature and humidity through the system as part of the Smart Meter System Based Internet of Things programme
- data from the DCC Centralised Switching Service – Retail Energy Location data which provides a 'gold standard' address data
- Potential creation of a Centralised Asset Register of low carbon technologies through the Automatic Asset Registration project.

Initial smart metering findings / applications to support the LAEP approach

Data insights and analytics provided into the project were grouped into two key areas 1) 'borough readiness' indicators and 2) fuel poverty data indicators.

The following section provides a short summary of how smart metering data has been applied across these categories and in turn how these insights can underpin practical applications and interventions, derived from the wider LAEP approach.

Borough Readiness Indicators – insights from smart meter installations

In accepting a smart meter, households can benefit immediately from accurate billing, remote meter readings, easy supplier switching and direct financial reward for changing energy usage behaviours through participation in the Demand Flexibility Service.

As the energy system transition continues, industry is moving quickly toward Half-Hourly Settlement, Time of Use Tariffs are becoming more prevalent and increasingly sophisticated demand-side response services are materialising. The ability to participate in these services will become increasingly important for households to ensure the best deal from the energy system and a reduced cost of living.

Ensuring equity in take up of new services is crucial to a just transition and better data use will provide greater confidence in the expected cost-savings as low carbon technologies, heat pumps in particular and avoid technology and system specification that could potentially increase energy bills.

The degree to which boroughs and their residents are 'ready' to participate in these services will be determined by the willingness and ability to take a smart meter, factors limiting take may be driven by attitudes, demographics, geography and technology limitations. Further understanding of the limitations (and motivations) to smart meter installs can help boroughs to design pro-active campaigns and schemes to increase adoption.

Current.install.rates

Across Great Britain, the average rate of smart meter installations has reached around 60%. Taking this average as a baseline, relatively straightforward analysis of smart meter installs enables an assessment of particularly local authorities that are behind this curve.

Plotting the anticipated trajectory of installs through to 2028 identifies where anomalies may be exacerbated (or potentially resolved over time). Further insights can be derived from:

- meter operation including density of meters that have operated in export mode indicating generation technology installed
- propensity of meters operating in credit vs pre-payment mode.

The current overall level of smart meter connected homes to all homes in London is 50%. However, this does vary by local authority with Sutton and Bexley having the highest levels with 59% and Westminster and Kensington & Chelsea having only 31% and 32% respectively. Of the smart meters, 11% are currently operating in prepayment mode.

The levels of smart meter penetration by local authority are shown on the following two maps:

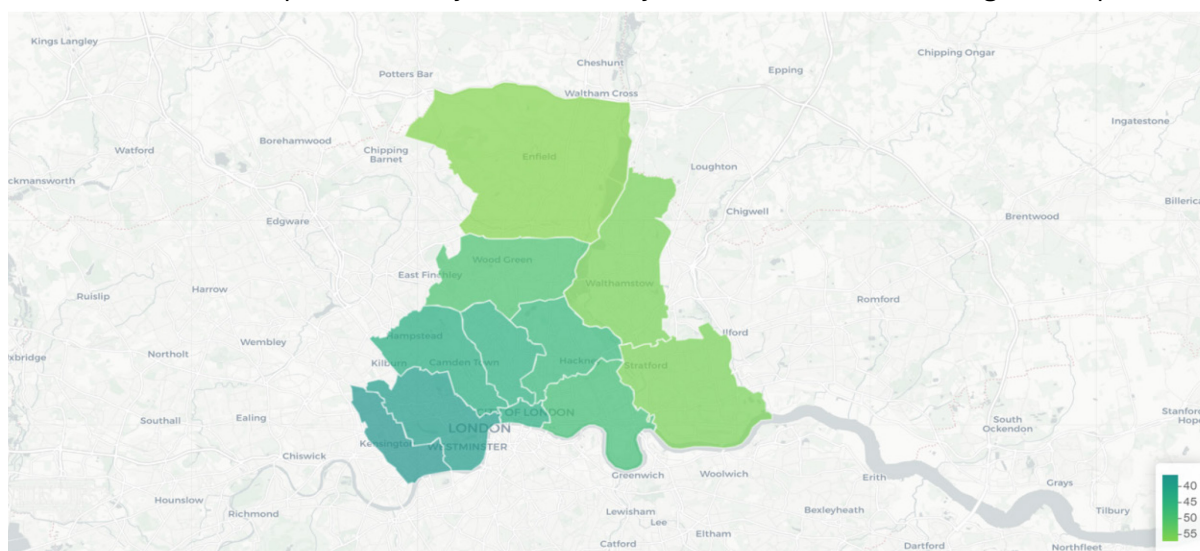


Figure 3: Smart meter penetration by local authority, percentage of electric meters that are smart in the CIEN subregion.

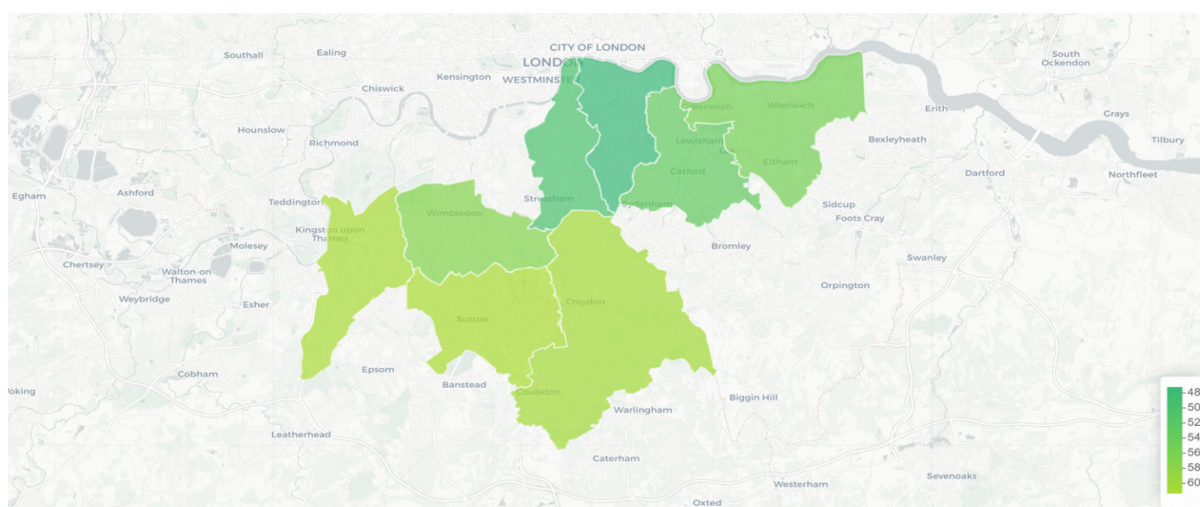


Figure 4: Smart meter penetration by local authority, percentage of electric meters that are smart in the South subregion.

Over the next two years, the number of connected homes are forecast to continue to increase with Haringey, Camden and Enfield having the highest rates while Hillingdon, Bromley and Redbridge are expected to have the lowest. However, even the slowest rates are expected to see the amount of homes connected tripled from the levels of January 2022, with the fastest growth areas reaching four times those January 2022 levels. The proportion of prepayment to credit meters are not expected to significantly change whilst economic uncertainty and energy prices remain high.

Fuel poverty indicators – insights from smart meter system data

The potential of the smart meter system data to combine with existing Greater London datasets and reveal fuel poverty indicators was explored. This work needed to balance the requirements to gain the most information from the data whilst maintaining the anonymity of the personal data and so aggregated all data to census output area. This allowed data from many sources to be linked together as shown in Figure 3 below.

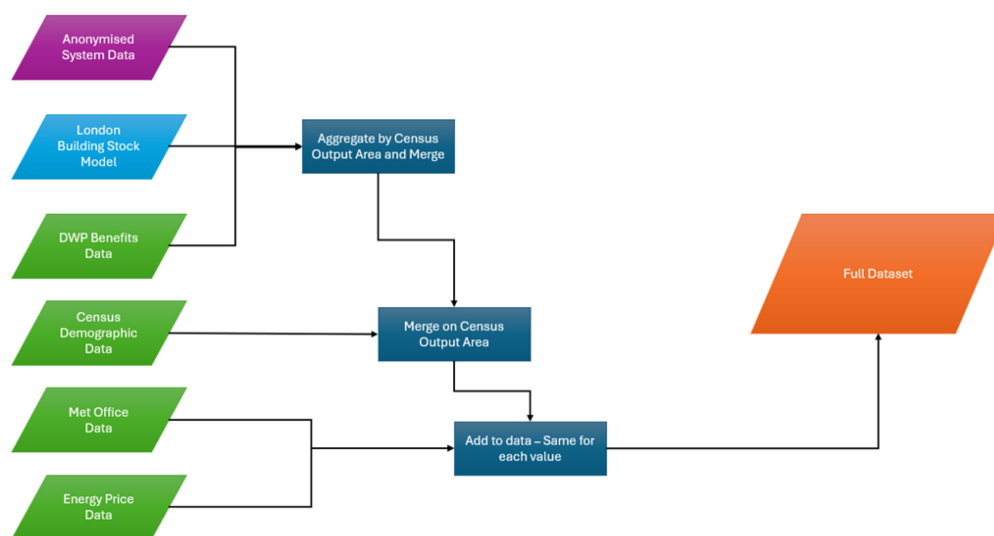


Figure 5: Datasets used to inform fuel poverty modelling and analysis.

Within the smart meter system data set, certain alerts were found to indicate issues with fuel affordability for consumers, for example the alert sent by a smart meter when the emergency credit is exhausted. The combined data was found to dovetail with these indicators so that, with machine learning, models could be created that predicted the occurrence of these alerts for a given month. This has applications in forecasting which locations will be impacted in the future as well as how changes to the environment, energy price, temperature and building energy performance, could impact consumers.

Limitations to the data.

It is important to note that use of smart meter data in LAEP remains nascent with insights being received from continued exploration and linkage of the data with existing models. Whilst the overall smart meter statistics are based upon the entire smart meter estate, only 27% of consumers could be included in the fuel poverty indicator modelling. Work is continuing with the energy suppliers to gain greater participation in this.

It is also important to note that the fuel poverty indicators used in this model are different from the official definition of fuel poverty. As these reflect real usage patterns however, these can be

more powerful in showcasing behaviour and could potentially be updated frequently to allow for help to be delivered to areas promptly and before the issues become overwhelming. However, solutions that use this data must allow for the fact that the dataset only covers smart meters, so visibility of issues will be reduced in areas with lower levels of metering.

Future potential

The broadest impact from smart meter data for local area energy planning can be achieved through delivery of dynamic data at the lowest possible granularity into the planning process on a frequent basis. Figure 4 sets out how both existing and future smart meter data will be able to deliver LAEP insight and impact to local and regional authorities across all phases.

In parallel, opportunities exist to drive collaboration around data access usage across a broader set of actors who are aligned around the same priorities – not least community energy groups (as a priority group identified by the incoming Labour government) and social housing providers.

Figure 4 (activities within the red dotted box indicates what's possible to achieve today):

Multiple opportunities exist for smart meter consumption data, system data and other network capabilities to support Local and Regional authorities in their Net Zero planning, delivery and monitoring journey

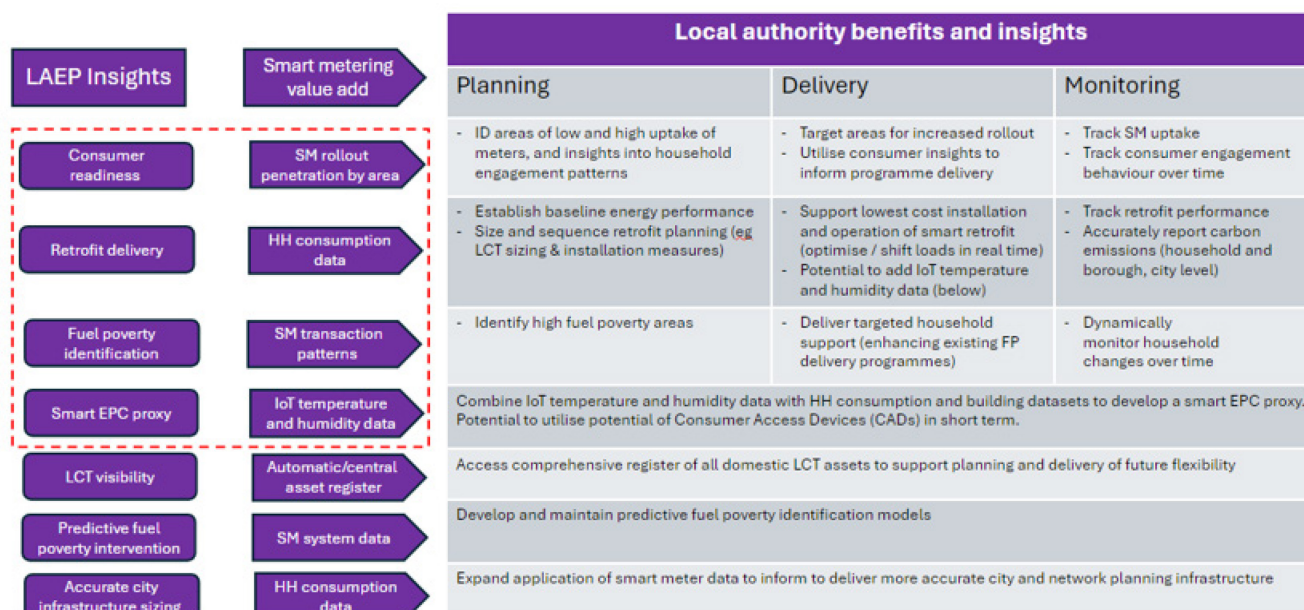


Figure 6: Existing and future smart meter data future potential for local authorities.

While this represents a worthwhile goal to work towards, fully realising this vision will require resolution of a range of mid-long term regulatory, legal and technical considerations (set out in section 6).

In the meantime, significant near-term opportunities exist to build on the findings of this phase of work and ensure a continued (and continually improved) flow of smart meter ‘system data’ into the LAEP planning process. Key questions to explore with relevant stakeholders include:

- How can outputs from this project phase be used as a foundation to support the next stages of LAEP delivery in London (i.e. stages 5-7 of the LAEP methodology – led by boroughs themselves)?
- What are the roles and responsibilities of the DCC, GLA, London’s boroughs and the wider delivery chain in delivering this over the mid-long term (i.e. fully unlocking the value of smart meter data for fuel poverty identification and support in London)?

With today’s current data flows, access and governance arrangements (see figure 5 below) in mind, further dialogue is needed with the GLA and London boroughs to resolve the following questions:

- What does an enduring data ecosystem (and associated data sharing framework) look like?
 - o Clarify what datasets will need to go to who? Is a single point of contact (via SharePoint) the best way to share relevant dataset / model / report in a set format each period, to be incorporated into local applications? How will the GLA and London boroughs work collaboratively on this?
- Have the benefits been sufficiently crystallised (i.e. why this is worth doing, how the information can enhance existing processes)? If not, what further evidence is needed?
 - o For example, to capitalise on the real time value of this data, would DCC need to provide the data at a set schedule (weekly?) so that local authorities pro-actively investigate hot spots in a preventative manner?
- How would the fuel poverty identification model be refined and kept up to date?
 - o Retrain with each new dataset?
 - o What are the implications from an IPR, model code / service perspective?

Current data flows, access and governance

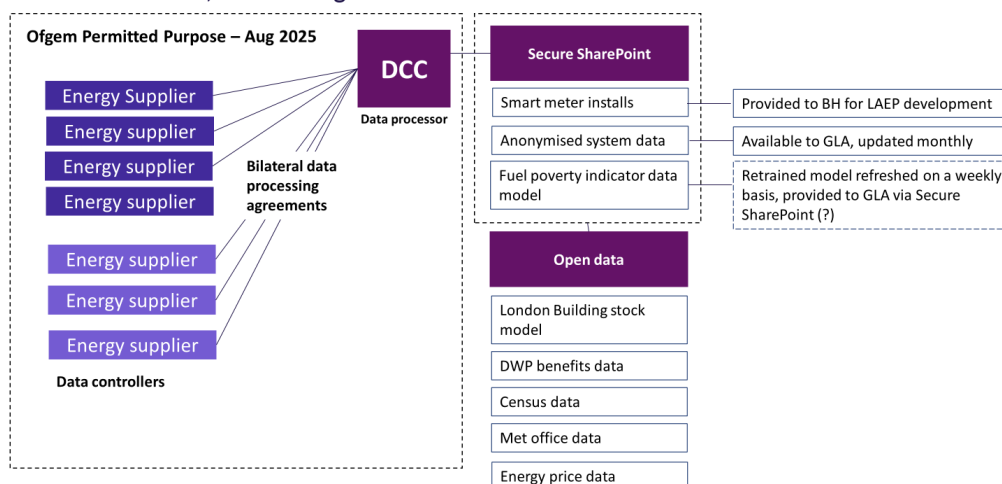


Figure 7: Current data flows, access and governance

Unlocking data for future use

With implications beyond the scope of this project, multiple considerations will need to be addressed to unlock the wider opportunity that the smart metering network presents. These are set out below, consolidated across four key areas:

Regulatory considerations – access to smart meter system data is not explicitly permissible under DCC's current regulatory framework. The current access regime is underpinned through a Permitted Purpose consent from Ofgem, which is timebound and due to expire in August 2025. There are several routes through which regulatory compliance could continue beyond this date:

- an extended / expanded Permitted Purpose – Ofgem have already shown willing to explore this route
- development of a Smart Energy Code modification – this would coalesce industry around the changes needed for DCC to provide access to smart meter system data for specific use cases
- expansion of Ofgem's Energy Data Best Practice Guidance – through this mechanism, DCC as a licenced entity may be mandated to treat energy system data as 'presumed open'
- enabled through the renewed DCC licence. The current DCC licence is due to expire in 2025 (with an expected 1-2 year extension). Ofgem is exploring as part of the future licence period, through to 2040) to what degree provision of access to smart meter system data should be treated as mandatory business for the licence holder.

Data legislation - irrespective of the regulatory mechanism through which data access is made viable, data legalisation will remain a key consideration.

The current approach, which places energy suppliers as Data Controllers and DCC as a Data processor has been resource intensive to set up and scaling or establishing new use cases, underpinned by different data categories is not scalable or sustainable. In parallel, a desire to increasingly lower the granularity of data to maximise utility creates further considerations from a data privacy perspective.

Areas of consideration in context with enduring data access include:

- Potential use of a Trust Framework approach to increase efficacy in data governance
- Implications of Ofgem's plans for a centralised consumer consent management solution
- Increasing sophistication of privacy enhancing technologies to maximise utility whilst retaining data privacy
- Enduring models of data governance, developed in tandem with new data access regimes – as described below.

Technical considerations – the current access regime relies on access to data via CSV files, hosted within a secure SharePoint site. Over time, there will be a need to automate and enhance the sophistication of data access, particularly where data flows are underpinning dynamic data models.

Key considerations include:

- The potential for development of API data access to smart meter system data for self-service, controlled, data access. DCC is exploring the development of this functionality

for its core customer base (energy suppliers and DNOs) and access could be extended to broader users, alongside an appropriately robust access regime.

- New access regimes such as the creation of a Smart Meter Energy Data Repository – this is a government funded innovation project which is testing the technical and financial viability of such an approach.

Standardisation and commercial considerations – it is important that smart meter data is used create robust insights that are interpreted and acted on consistently.

Lack of standardisation and uniformity risks creating further misalignment and fragmentation across a multitude of planning approaches, which could in turn exacerbate rather than resolve current issues with LAEP. Further work is needed to validate data insights, establish consistent definitions and best practice methodologies for future applications.

This should be explored in context with commercial considerations i.e. it should not inhibit the opportunity for built environment practitioners to access data and provide commercial services for LAEP. Rather future services should be developed from a base-line industry acceptance of the data integrity and uniform agreement on the insights that can (or can't) be derived from it.

Recommendations

This initial suite of activity has sought to demonstrate the potential value of including smart meter system data into the LAEP process. As identified above, several key considerations need to be addressed in order to create a repeatable and scalable process that ensures a dynamic flow of the right data categories to the right organisations.

Suggested activities to achieve this include:

- A workshop with project participants to ensure shared learning of the insights being derived and prioritising the use cases that can be supported. A proposed (in person workshop) with Buro Happold and the GLA Energy and Infrastructure teams would enable the GLA to identify and capture synergies across all GLA smart metering related initiatives (if not already), and determine a unified smart meter data ingestion, analysis and exploitation strategy.
- Through alignment with the regulatory pathway mapping exercise (bullet below), this would deliver a comprehensive smart metering exploitation plan for London. Questions to address (building on those outlined in section 5 above) include:
 - a. How will GLA ingest smart metering datasets (eg data hub?) and what are the data flows within GLA for both smart meter system and consumption data (NB initially these will require different access routes). Eg how will the London building stock model and other energy planning applications interface with data hub? Includes what security protocols need exist to support safe, secure data sharing How will London boroughs and other interested stakeholders access smart metering data from the GLA, and what are the technical, regulatory and legal implications of this (ie what granularity of data [or insights] can be shared with whom, for what purposes, and what data sharing mechanisms will be required)
 - b. What analytics will be needed, and who will have responsibility to do so (incl DCC analytics required to share data in useable format, GLA analytics needed for internal purposes, and third-party analytics needed to derive additional value from the datasets)

- c. What data classification strategy will the GLA adopt for different data categories, and how will this be communicated / disseminated to the public (eg via London data store?)
 - d. What additional policies and initiatives will be needed alongside the above in order to extract necessary value from SM data (eg consumer awareness / engagement campaign, additional funding avenues etc)
 - e. What does a fit for purpose governance framework look like, that satisfies the smart energy industry requirements (eg SEC) but also works for the GLA and London boroughs
 - f. What does a pan London consent management approach look like (necessary for accessing consumption data today)
- Establishing a benefits mapping exercise to demonstrate how the value of smart meter data can be quantified against the current approach. This would help to underpin future regulatory change and secure buy-in from necessary partners (e.g. energy suppliers).
- Setting out a clear pathway for access to smart meter data in the short, medium and long term. The current regulatory derogation from Ofgem will enable GLA access to anonymised smart meter system data through to August 2025. Wider planning including timelines for on-boarding to the DCC for access to consumption data can ensure a co-ordinated approach to data access, considering related policy developments such as Ofgem's plans for a central consent management solution.
- Convening a working group / forum of built environment practitioners. As discussed above some degree of standard interpretation of the insights derived from smart meter is needed to minimise misalignment between organisations involved in the planning process. Collaboration in this area can help industry to coalesce around standard practice enabling better outcomes and minimising duplication - with the formation of a working group a potential first step to achieve this.