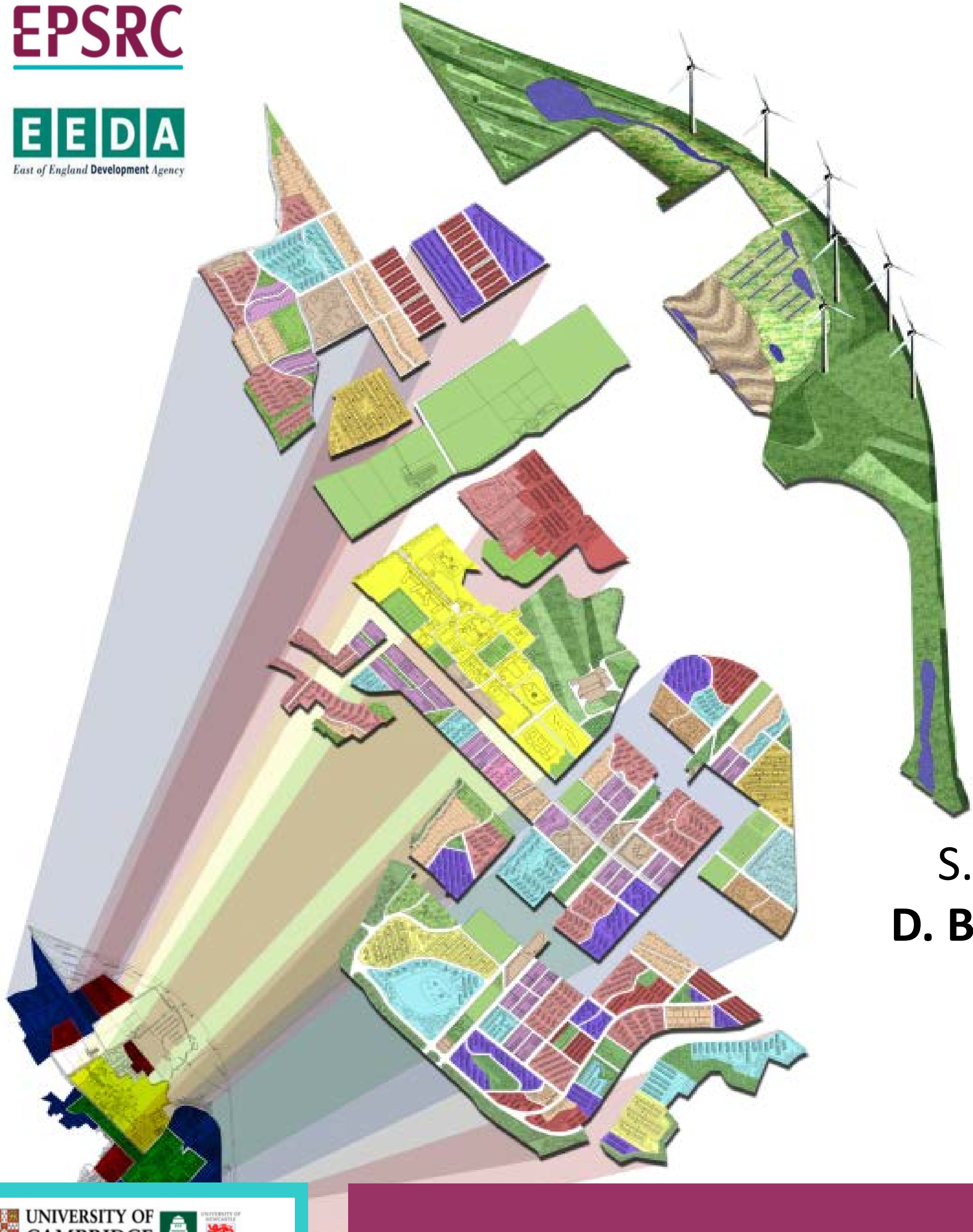
ReVISIONS

Regional Visions of Integrated Sustainable Infrastructure Optimised for Neighbourhoods



Towards an Integrated Modelling Framework for Sustainable Urban Development

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UDM, 06-09-12, Belgrade, Serbia

Outline

- Aim & objectives
- Overall methodology
- Modelling framework
- Water optioneering model
- Preliminary findings – local, regional
- Conclusions

Aim

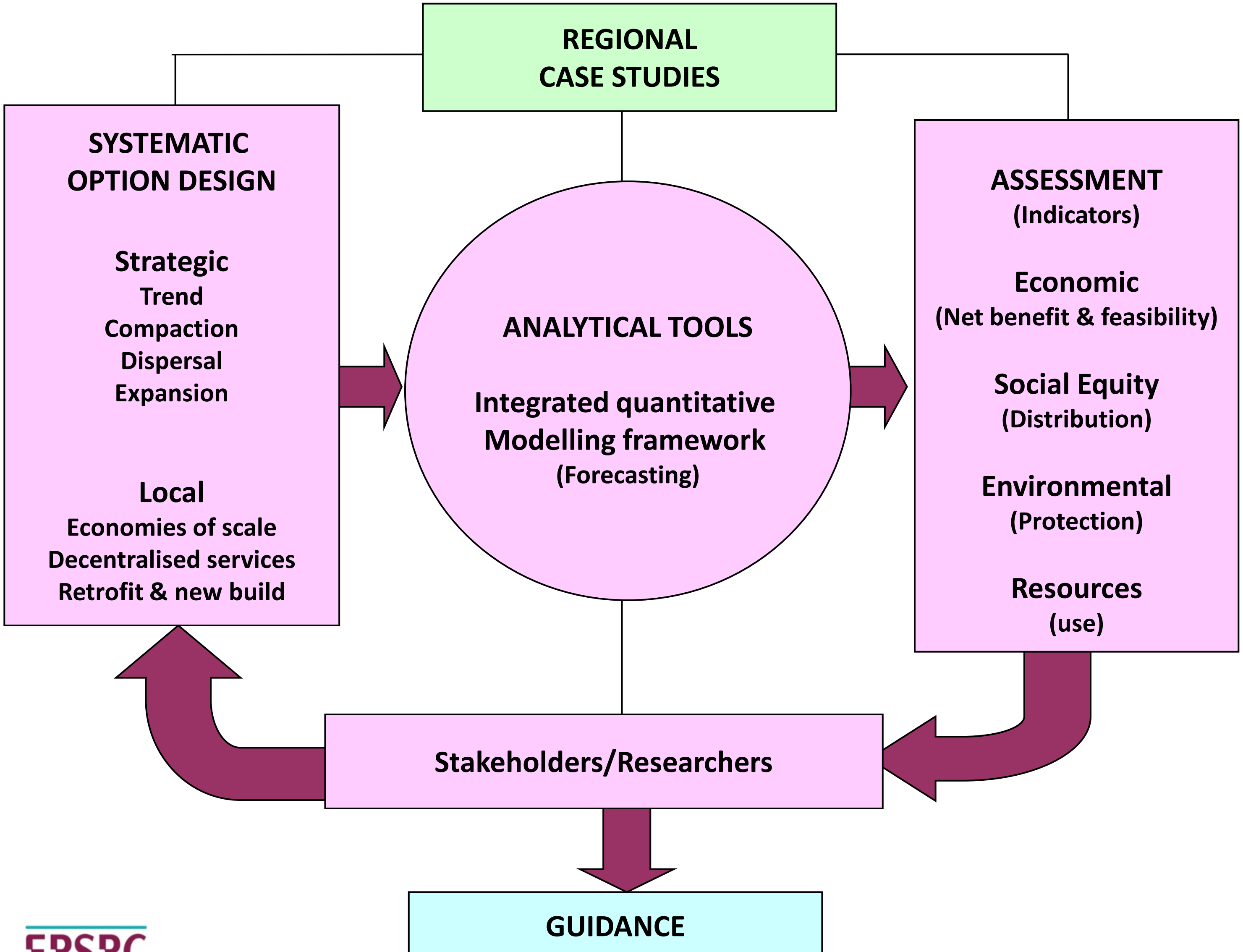
ReVISIONS: **Re**gional **V**isions of **I**ntegrated **S**ustainable **I**nfrastructure **O**ptimised for **N**eighbourhoods

To support the **planning** of regional infrastructure for **transport, water, waste, and energy** in a more coordinated and integrated way to maximise economic competitiveness, reduce environmental and resource impacts, and enhance the quality of life in urban areas.

Objectives

- to develop a holistic and practical integrated framework for the **analysis and assessment of the sustainability** of regional spatial development.
- to devise and test **alternative regional spatial strategies** integrated across infrastructure sectors and spatial scales to investigate to what extent **infrastructure selection**, investment, regulation, and pricing can help to achieve more **sustainable** ways of living.
- to explore the **inter-relationship**s between infrastructure policies and measures at the **regional** and **local** scales and explore the tensions and interactions that exist across these **scales**, and between **sectors**.

Methodology & Scenarios



Tech Scenarios
Trend
Environmental
Austerity

Land Scenarios
Trend
Market Led
Compaction
Planned

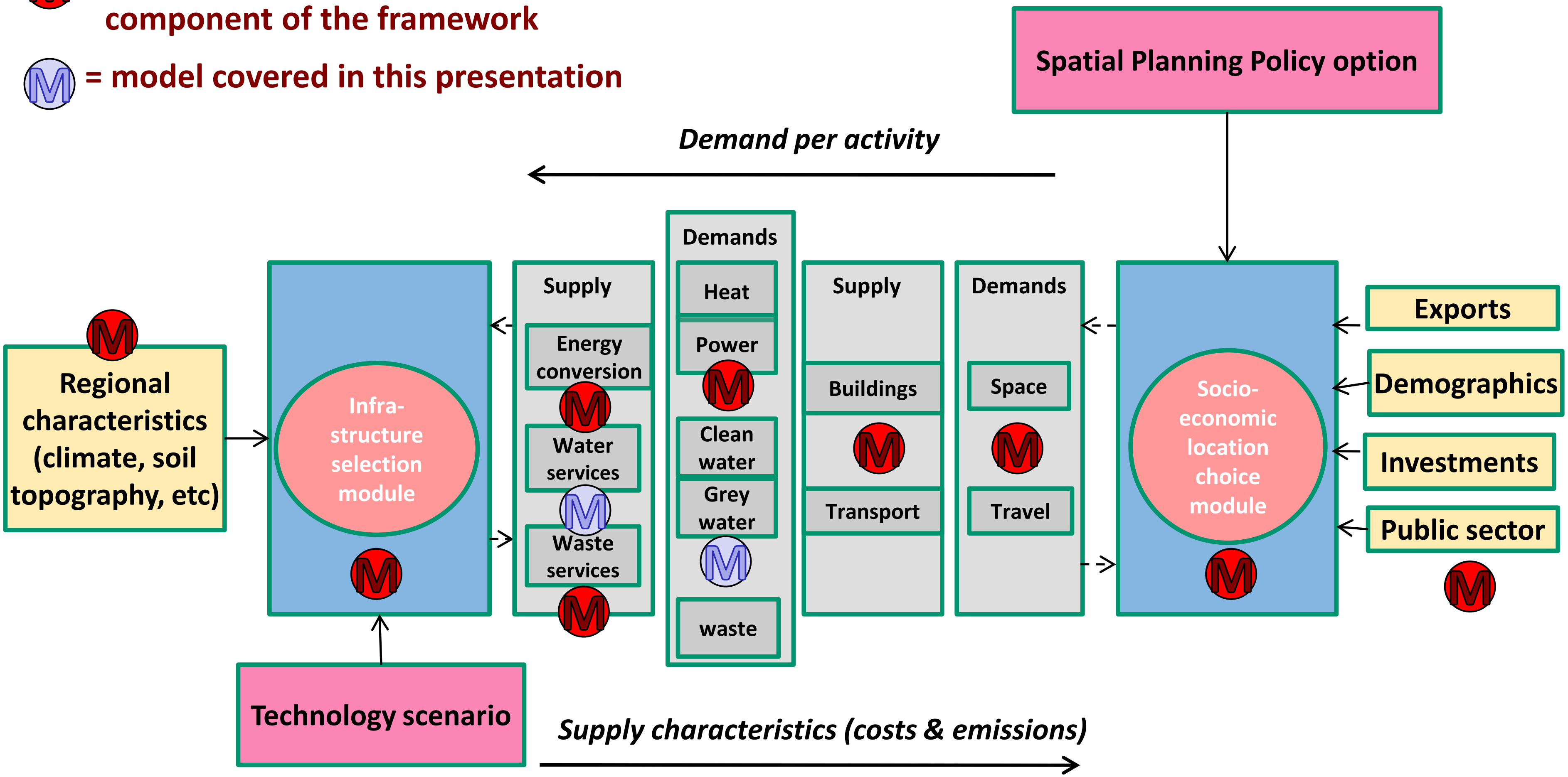
Climate Scenarios
Present
Future - UKCP09 90%

Years
2001
2031
2051

Modelling Framework

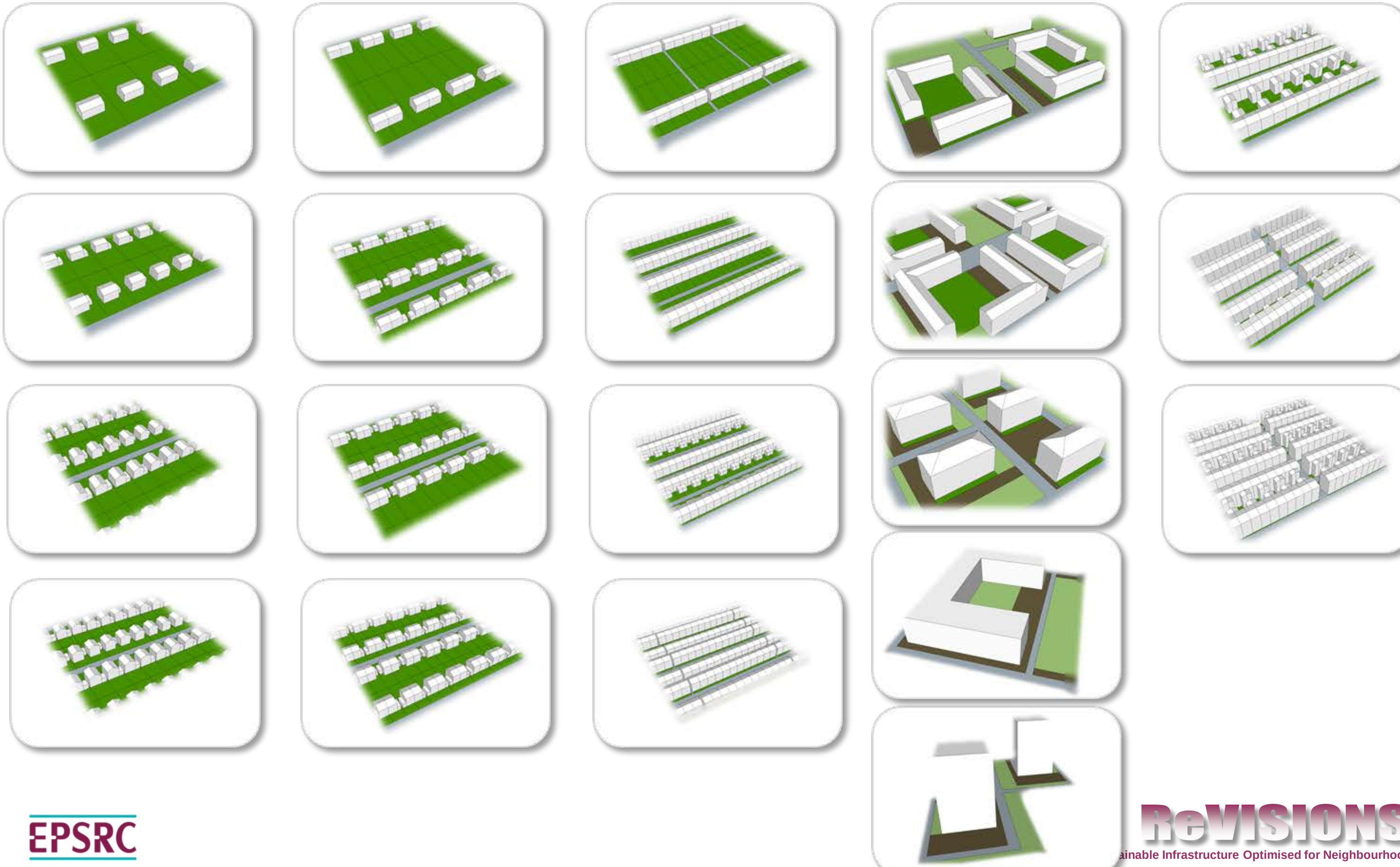
M = model has been developed for this component of the framework

M = model covered in this presentation



Scaling Methodology: Generic 'Tiles'

Detached | Semi-detached | Terraced | Flat (purpose-built) | Flat (converted)



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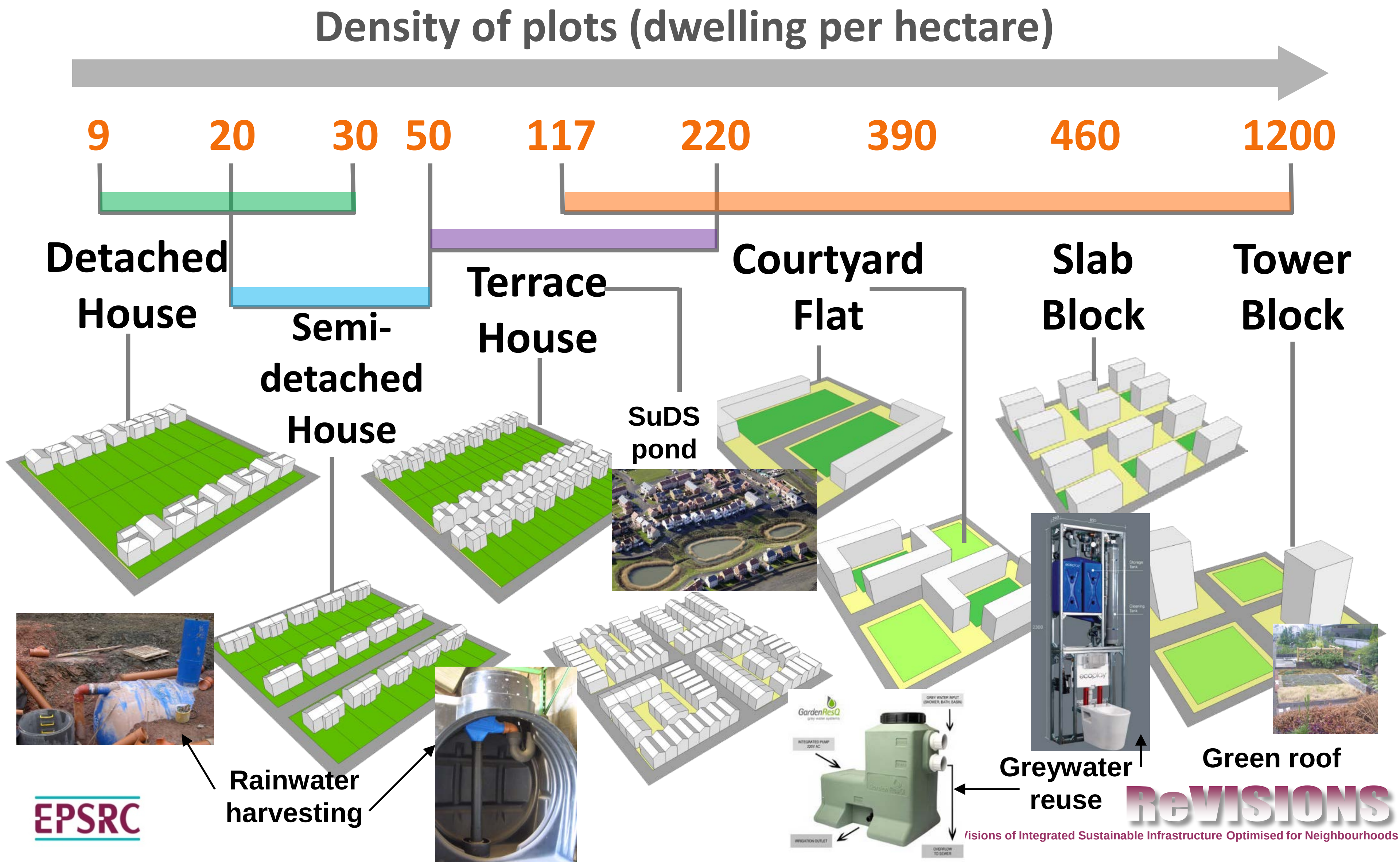
Generic Tiles: Example Dataset

Tile S4: Semi-detached

Gross Density (dph)	41.7	
Net Density (dph)	60.0	
Floor area (m^2)	85	
Building height (m)	6 (2 storeys)	
Land Use (%)	Domestic building	20.04
	Domestic garden	49.68
	Greenspace	0
	Road and path	30.28
	Other land	0
Domestic energy demand (kWh/year/dwelling)	Space heating	8780
	Water heating	1846
	Cooking – gas	627
	Cooling – electricity	385
	Electrical appliances	2036
	Lighting	506
	Total	14180

Tiles and dwelling density



Water Technology Optioneering Methodology

Suitability assumptions:

- % of roof available as catchment
- % of ground for runoff attenuation
- % of land/building area required to accommodate technology
- Water quality needed for end-use

	Area type			
	Central	Urban	Suburban	Rural
New Build	GWR (I), RWH (C), GR, PermPave, Swale	GWR (I), RWH (I/C), GR, PermPave, Swale	GWR (I/C), RWH (I), RWH (C), GR, Pond, PermPave, Swale	All
Retrofit	GWR (I), GR, PermPave, Swale	GWR (I), GR, PermPave, Swale	GWR (I), RWH (I), GR, Pond, PermPave, Swale	All except RWH (C) and GWR (C)

Data-based assumptions:

- Average PCC per water company area (Ofwat June Return data)
- Micro-component/alternative water system demand profiles (Market Transformation Project data)
- Roof-runoff calculations/runoff coefficients/tank sizing (BS 8515: 2009)
- Rainfall (Met Office data)
- System costs, energy requirements, carbon emissions (Centre for Water Systems (UEXE), Green Roof Centre (Sheffield), HR Wallingford, UKWIR & WERF and Environment Agency research data)

An example tile-area-build-technology assessment grid (only for retrofitting rainwater harvesting)

Build Type	Ward Area Type	Tile Type																			
		D1	D2	D3	D4	S1	S2	S3	S4	T1	T2	T3	T4	F1	F2	F3	F4	F5	C1	C2	C3
Retrofit	Central	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	1
	Urban	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
	Suburban	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
	Rural	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0

Water Technology Optioneering Model

Calculate All

Run from micro-component input

Run from GWR

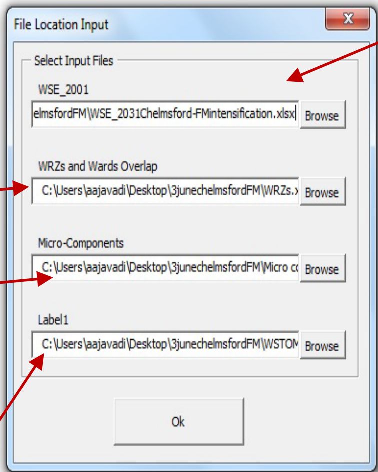
Run from RWH

Run from SuDS

Boundaries

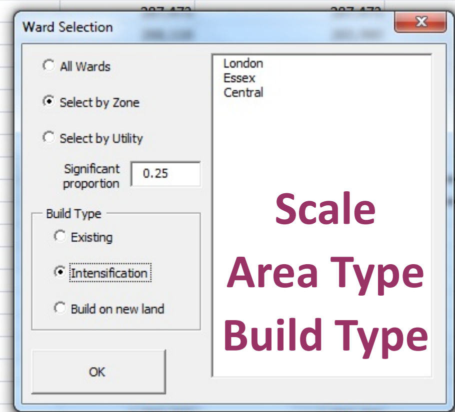
Demand Inputs

Alternative Tech Inputs (costs, energy, tile data)



Economic Inputs (land use, population, tile data)

L	NAME	Water Utility	WRZ_Name	Ward Area (m2)	Ward area in WRZ (m2)	Fraction of Ward in WRZ
	Aldersgate	Thames Water	London	129,865	129,865	1
	Bishopsgate	Thames Water	London	563,889	563,889	1
	Cripplegate	Thames Water	London			1
	Farringdon Within	Thames Water	London			0.992032774
	Farringdon Without	Thames Water	London			0.985883761
	Portsoken	Thames Water	London			1
	Queenhithe	Thames Water	London			0.942301035
	Tower	Thames Water	London			0.946510011
	Walbrook	Thames Water	London			0.935572988
	Abbey	Essex & Suffolk Water	Essex			0.02
	Abbey	Thames Water	London			0.98
	Alibon	Three Valleys Water	Central			0.3
	Becontree	Essex & Suffolk Water	Essex			1
	Chadwell Heath	Essex & Suffolk Water	Essex			1
	Eastbrook	Essex & Suffolk Water	Essex			1
	Eastbury	Essex & Suffolk Water	Essex			1
	Gascoigne	Essex & Suffolk Water	Essex			0.977332631
00ABGE	Goresbrook	Essex & Suffolk Water	Essex			1
00ABGF	Heath	Essex & Suffolk Water	Essex			1
00ABGG	Longbridge	Essex & Suffolk Water	Essex			1
00ABGH	Mayesbrook	Essex & Suffolk Water	Essex	1,850,769	1,850,769	1
00ABGJ	Parsloes	Essex & Suffolk Water	Essex	1,243,277	1,243,277	1
00ABGK	River	Essex & Suffolk Water	Essex	3,135,581	3,116,283	0.993845503



Scale

Area Type

Build Type

	A	B	C	D	M	N	O	P	Q	R	S	T
1					Standard RWH Technology						Low Carbon RWH	
2		General Ward Information			Water saving from RWH		RWH Costs		RWH CO2		RWH Costs	RWH CO2
3	Ward	WRZ	Total Dwell	Total Pop	HH (m3/day)	Comm (m3/day)	HH Cost (£)	Com Cost (£)	HH CO2	Com CO2	HH Cost (£)	HH CO2
4	Essex & Suffolk Water											
5	00ABFZ	1	4381	10841	64	61	4706400	1621370	374711507	42483	2952400	4407791
6	00ABGA	1	4072	9361	62	60	4523550	1545555	355364493	40488	2827200	4180209
7	00ABGB	1	4043	9921	68	65	4988625	1690333	388217913	44289	3109800	4566669
8	00ABGC	1	4334	10108	56	53	4168450	1381472	322876111	36204	2595200	3798043
9	00ABGD	1	4141	9235	3	0	214650	0	14784039	0	129600	173907
10	00ABGE	1	4124	10271	9	52	556500	1345370	38328990	35259	336000	450870
11	00ABGF	1	4245	9701	11	46	739350	1211188	50922801	31731	446400	599013
12	00ABGG	1	3483	8812	55	52	4141950	1292334	300061236	33852	2533200	3529668
13	00ABGH	1	3920	9412	11	53	707550	1371435	48732573	35973	427200	573249

Results

Water Technology Optioneering Web-Interface

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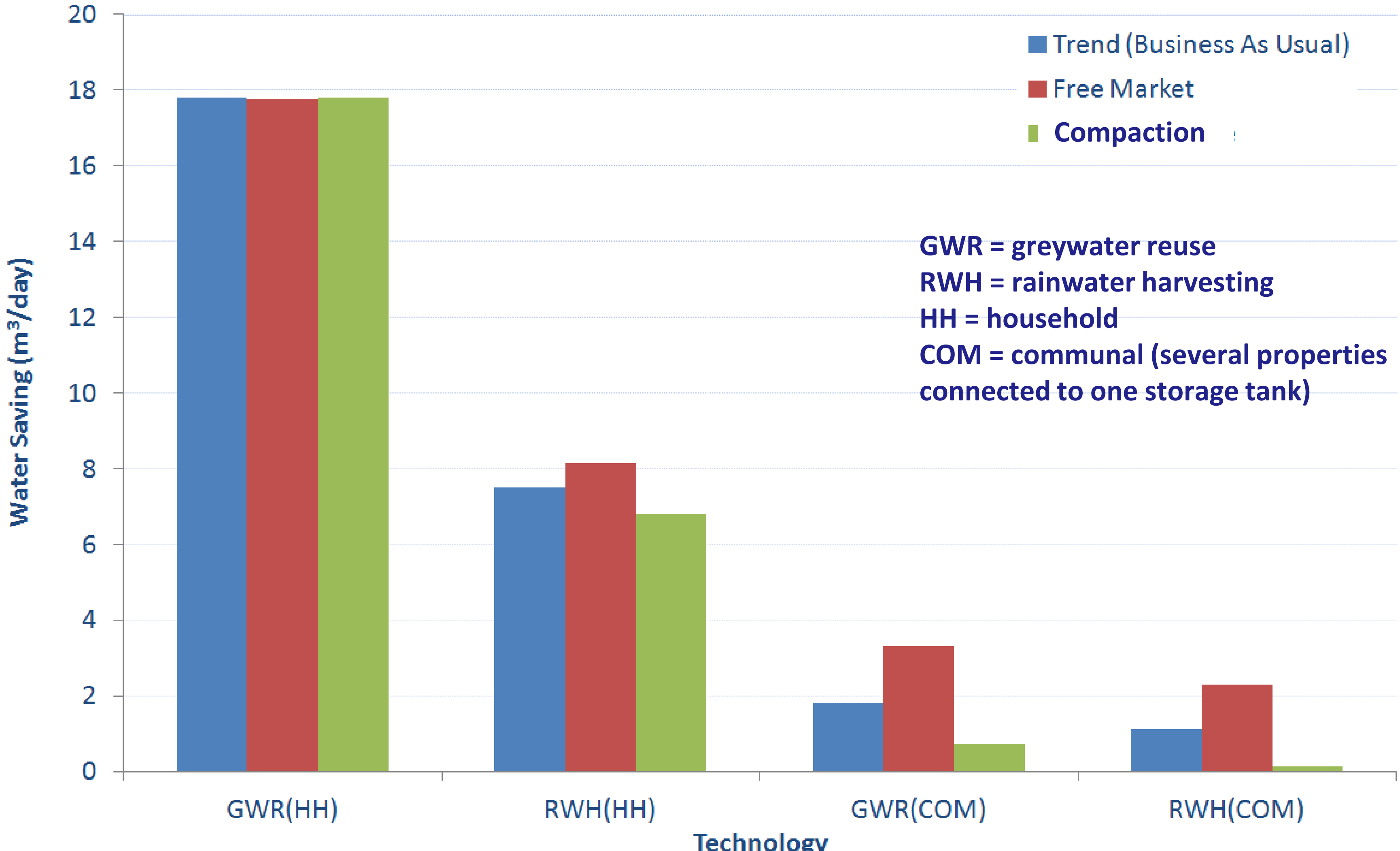
Preliminary Results – Local

Interaction of technology & urban growth Scenarios: Chelmsford



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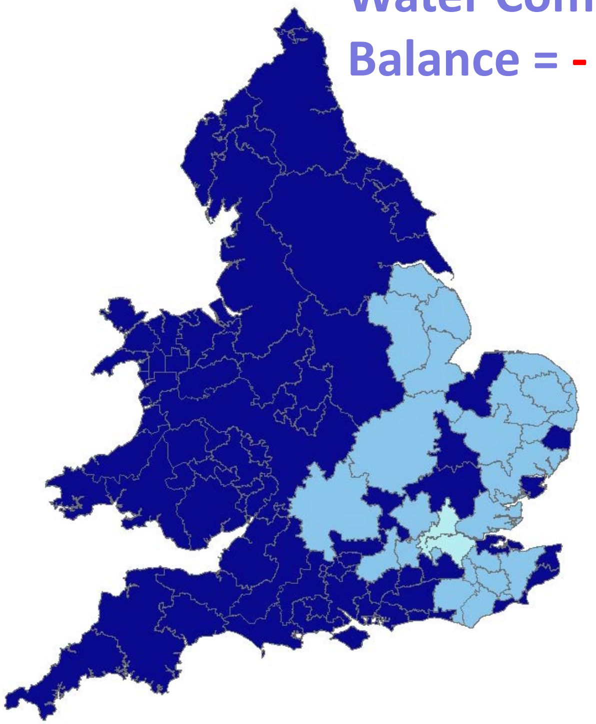
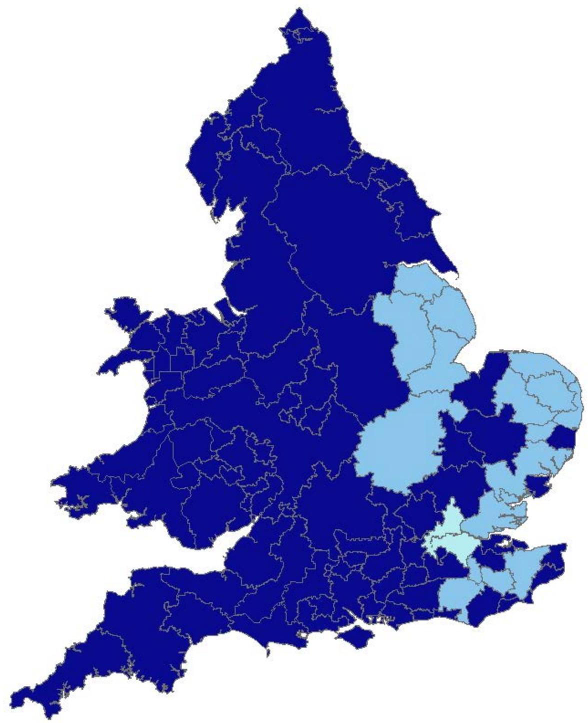
Preliminary Results – Regional

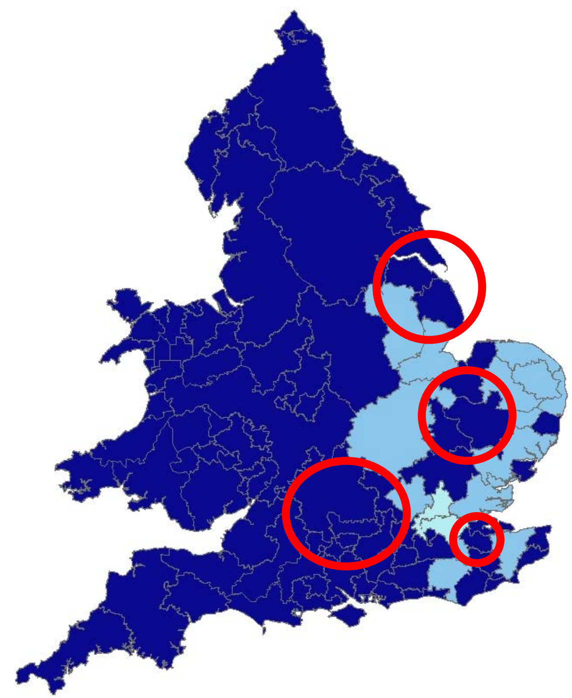
Wider South East Supply-Demand Balance (2031)

Water Company Projections:
Balance = - 606 Ml/d





WTOM: Water efficient appliances + Greywater Reuse:
Balance = 98 Ml/d



WTOM: Water efficient appliances + Rainwater Harvesting:
Balance = 63 Ml/d

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Conclusions

- An integrated modelling framework is being finalised to allow assessment of the influence of infrastructure on the sustainability of urban areas under different spatial strategies.
- This builds on an established planning LUTI to incorporate service supply and demand, infrastructure options and local (tile) scale solutions.
- A flexible, web-based tool has been developed to aid quantification and visualisation of planning and infrastructure strategies.
- A water technology optioneering model has been developed to:
  - Explore the impact of spatial planning on water services and
  - Explore the influence of water services on spatial planning.
- Limitations: robust whole life cost data for alternative techs
- Future work: full scenario testing & comparison

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EEDA
East of England Development Agency

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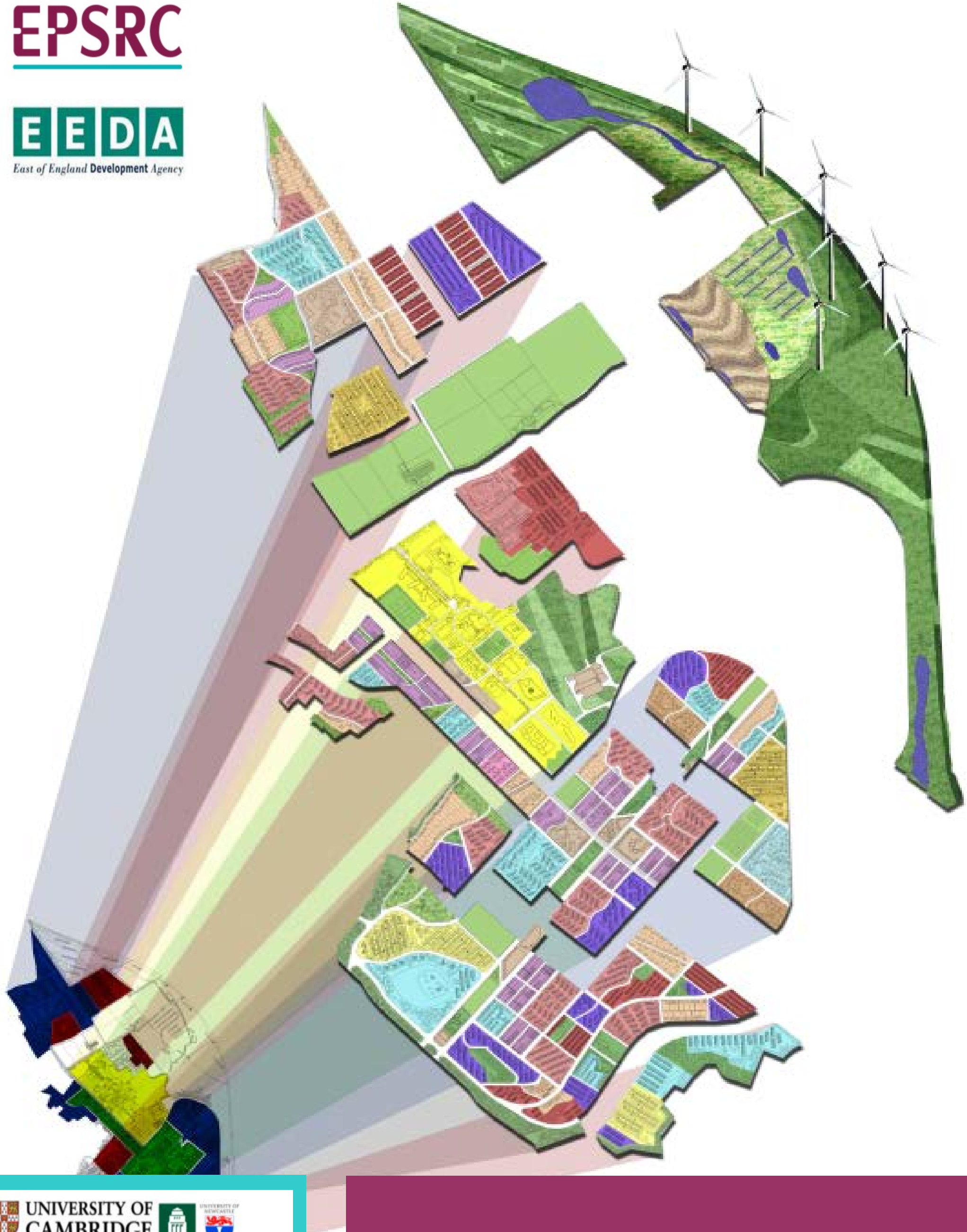

Towards an Integrated Modelling Framework for Sustainable Urban Development

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