This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730254

Sustainable Urbanisation Global Initiative (SUGI)
FOOD-WATER-ENERGY NEXUS

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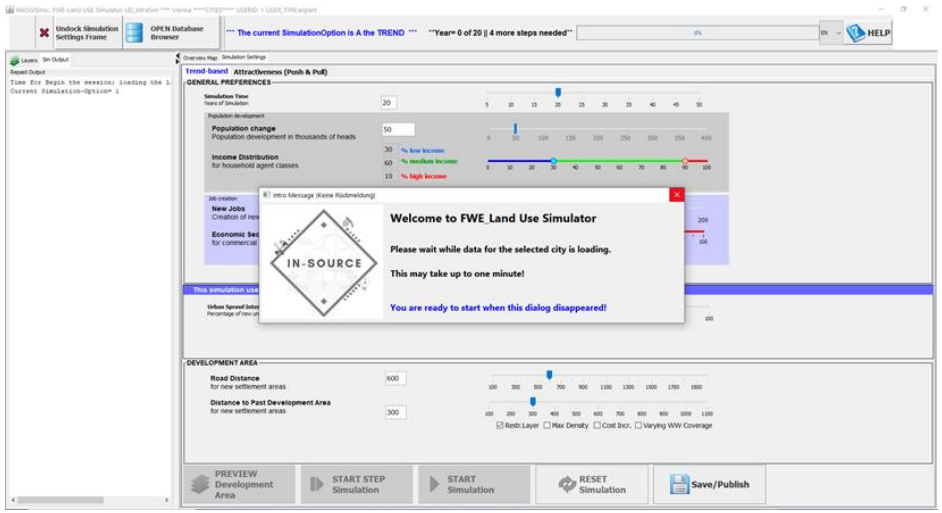
FWE Land Use Simulator

developed for the Case Study Vienna



15. September 2021

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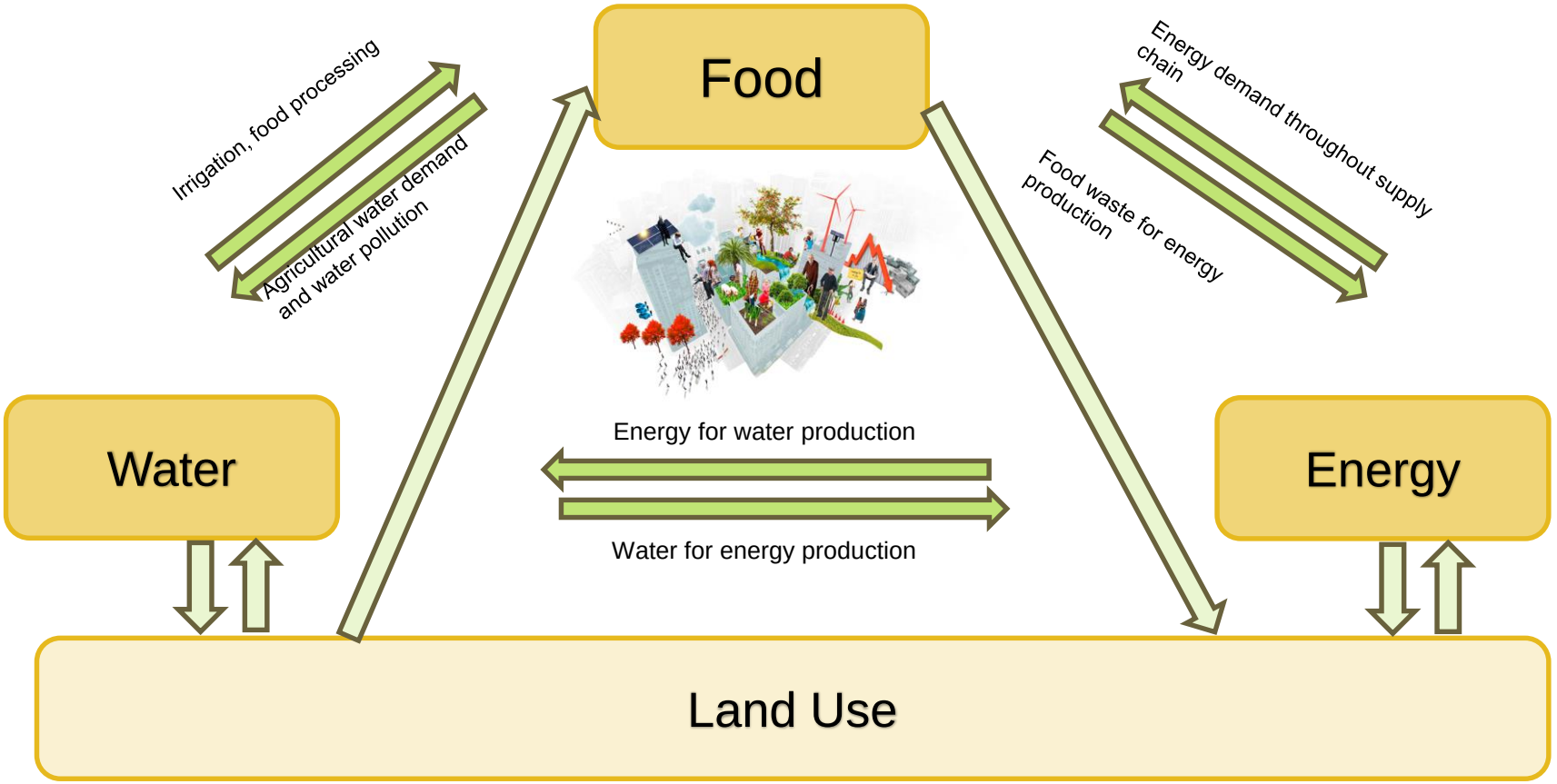
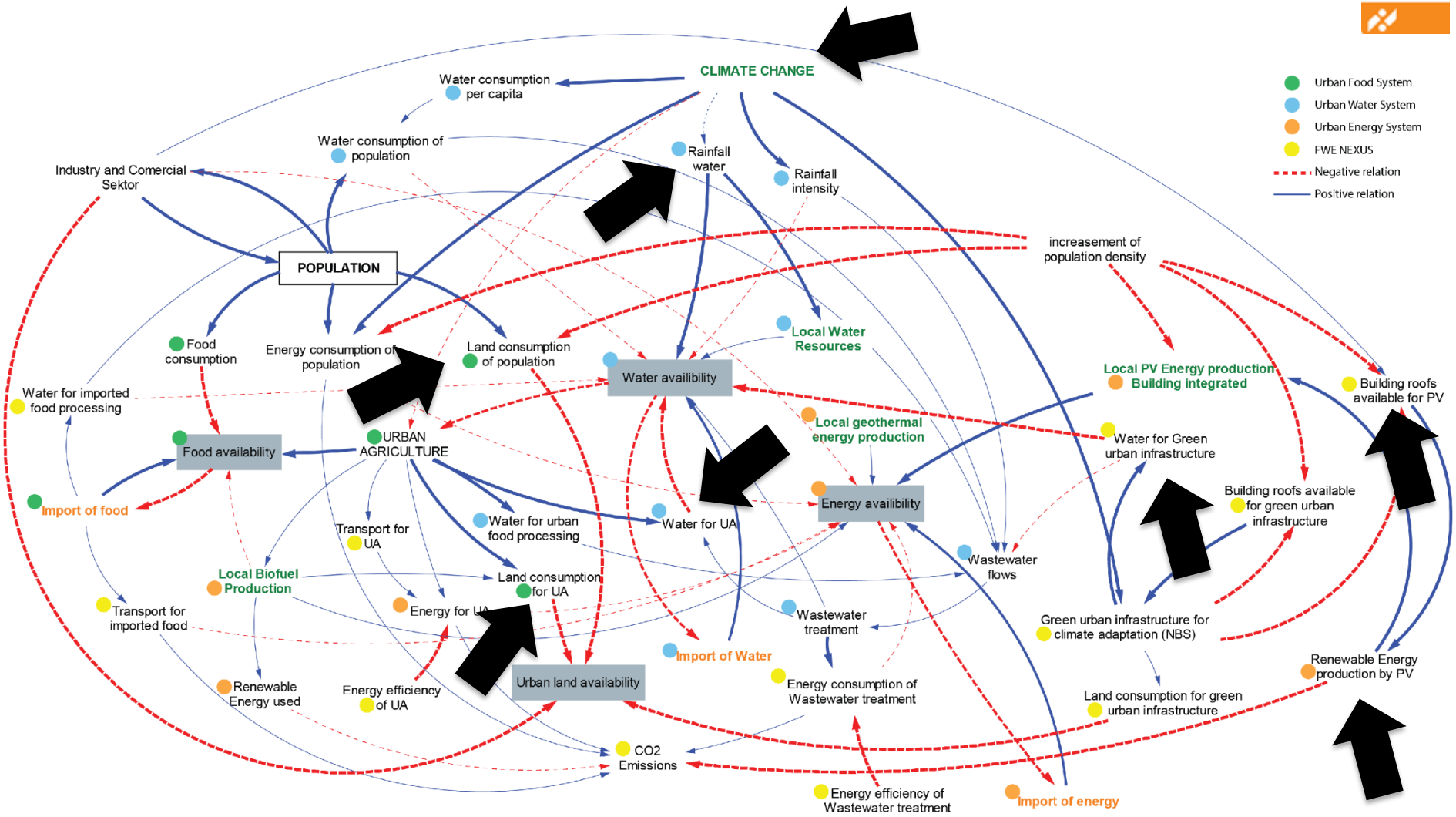
Urban Food – Water – Energy - Nexus



Food-Water-Energy: CLD



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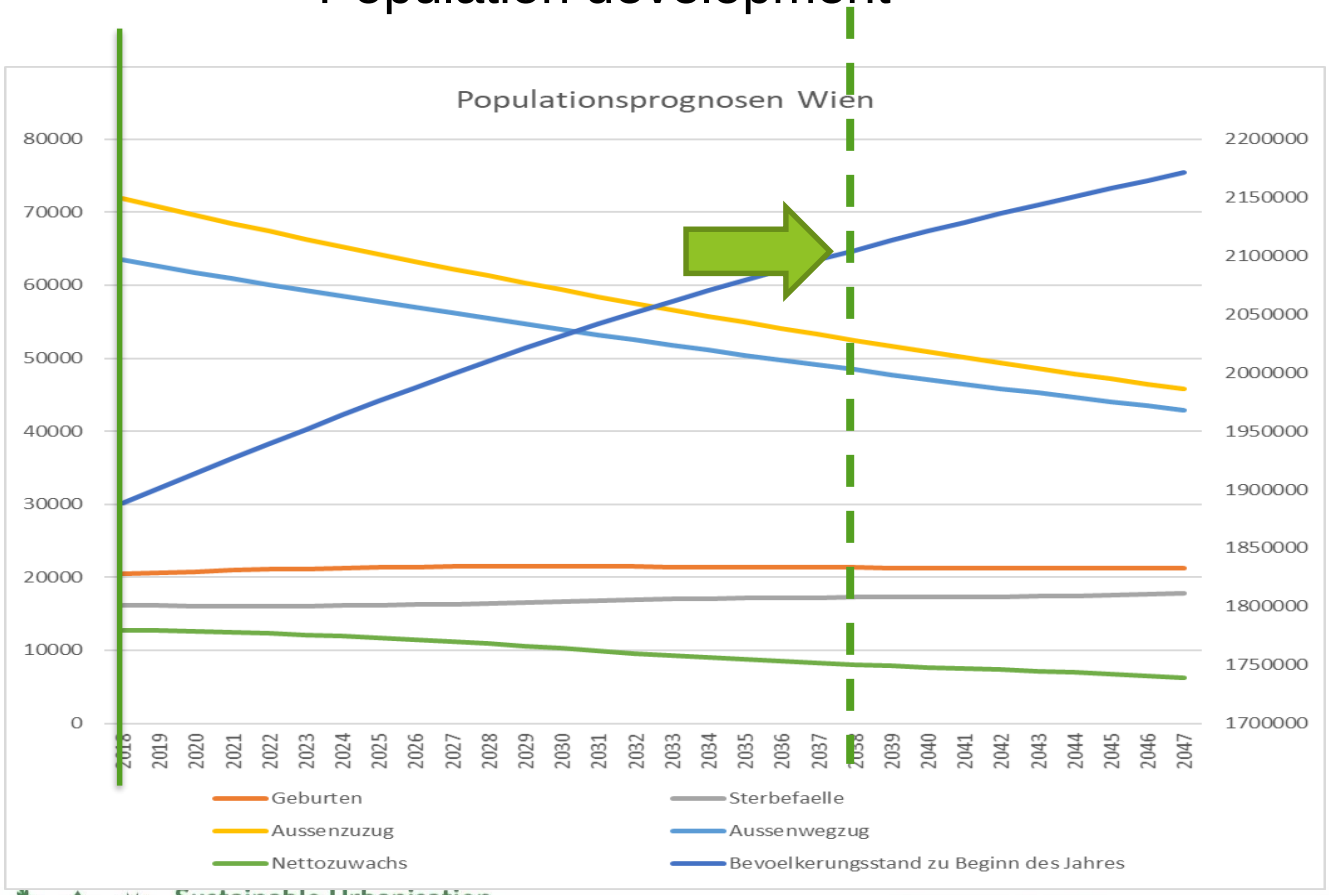
WATER & LAND USE: Scenarios

- INPUT
  - Population development



+150k-200k in 20 years

LAND USE Scenarios

- INPUT
  - Real Land Use Data from Vienna 2008-2016 (2018)
    - TREND residential land use
  - New planned residential development areas

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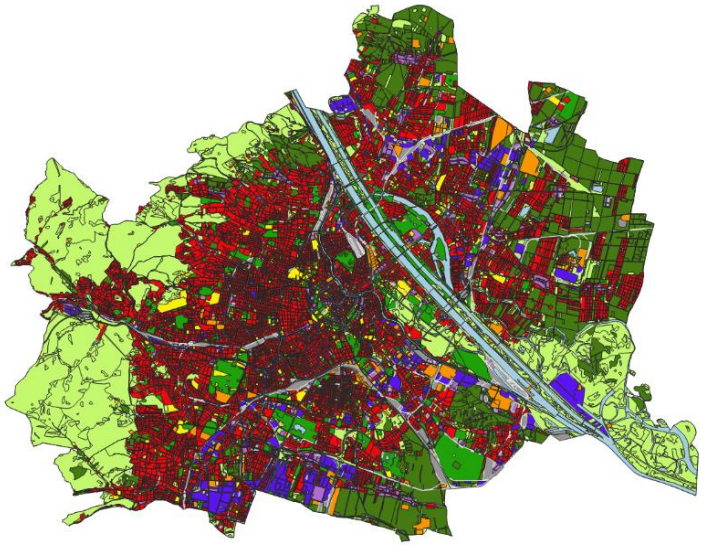
Land use based water demand for Vienna

Introduction

Basis current land use in Vienna
(*Realnutzungskartierung Wien*)



- Water demand per land use category

  ➔ Estimation of entire water demand for Vienna

- Simulation: change of water demand due to **land use change**

Per capita Demand for dwelling categories

GIS-Analyse:

Real Land USE 2016

Av. daily consumption

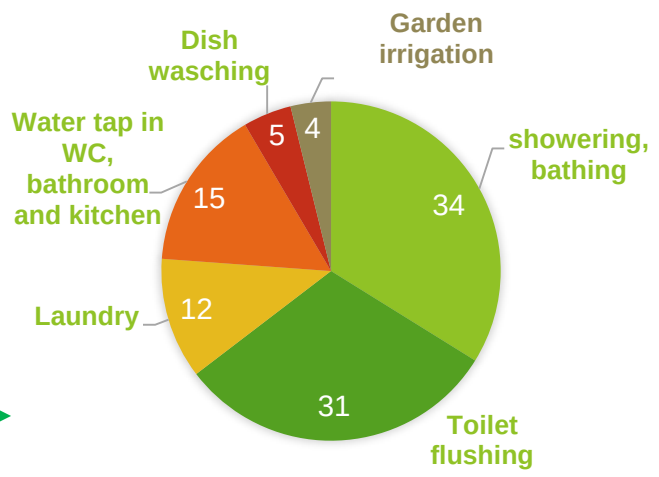
Inhabitants/area

→ Demand per area and year for diff dwelling categories

Category	m3/ha, year	l/capita, day	dwelling category
dense mixed residential area	12083	116	Wohnhaus-anlage
Garden city	3098	140	Reihen-haus
large-volume solitary housing	19605	116	Wohnhaus-anlage
sparsely populated residential area	1902	173	Einfamilien-haus
mixed use, low density, old town centre	1338	130	-
Quelle	*GIS-Analyse*	*Neunteufel 2010*	

Average daily water demand per capita:

130 l/capita, day *(BmNT 2019, Stadt Wien 2019)*



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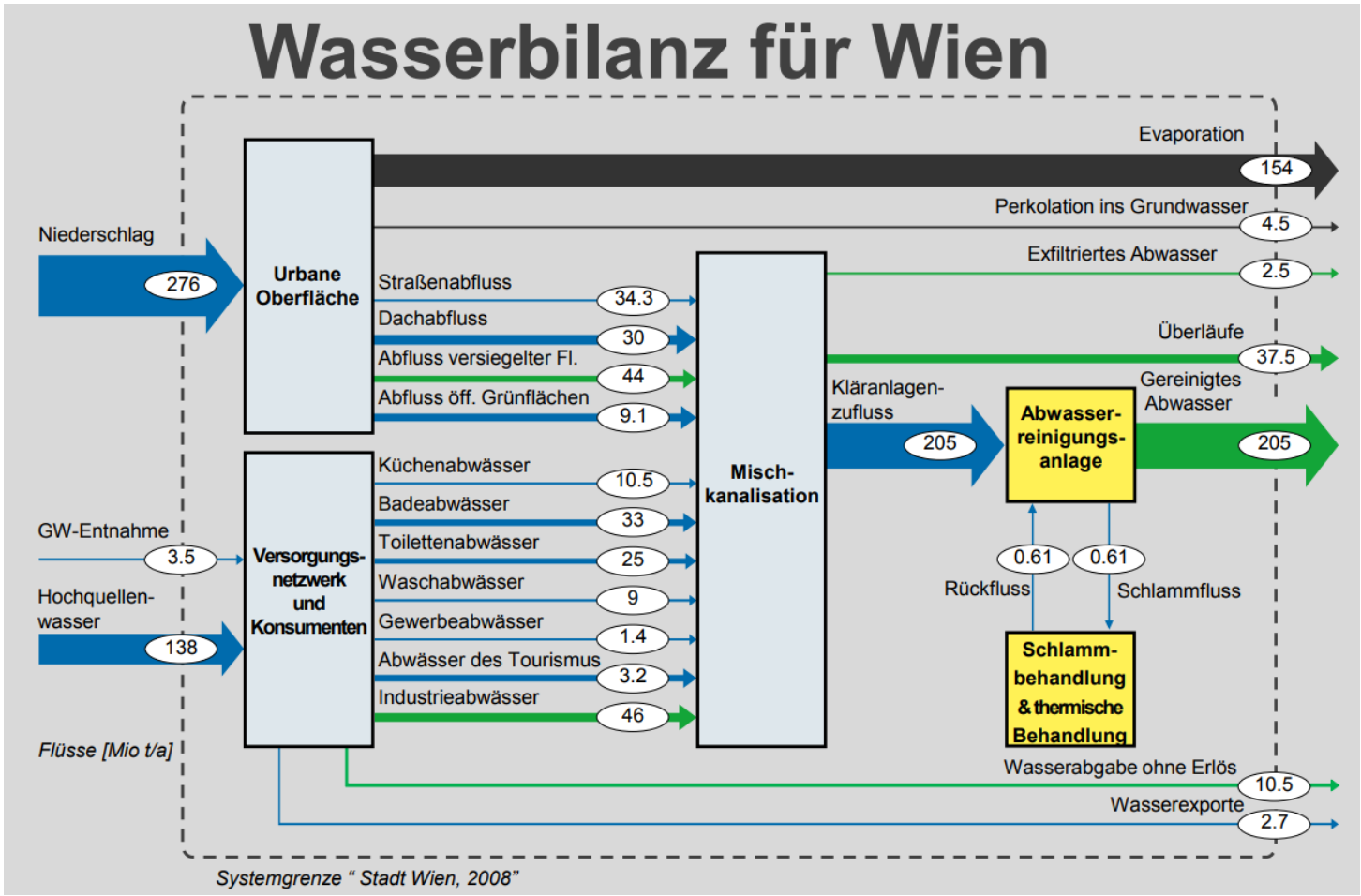
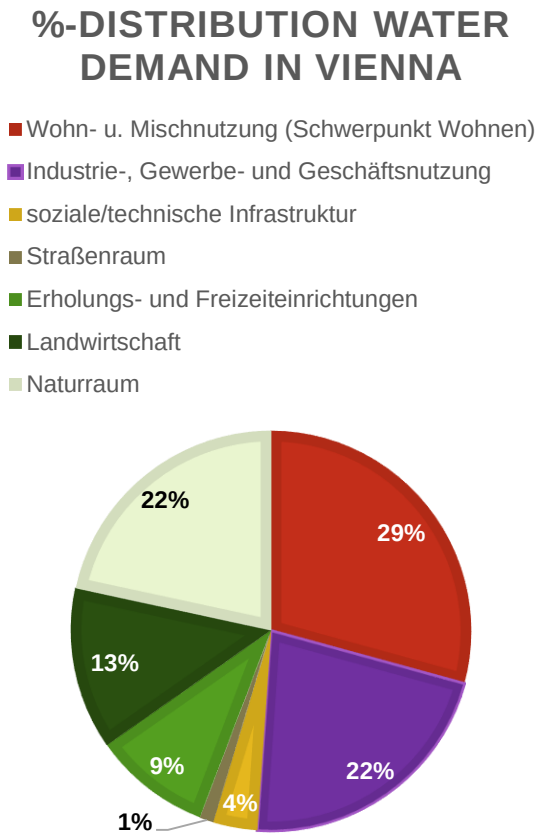
Water balance of Vienna



Source: Leitner 2013

Total water demand Vienna

Kategorie	Wasserbedarf in Mio. m^3/Jahr
Wohn- und Mischnutzung*	66,08
Geschäfts-, Kern- und Mischnutzung*	3,29
Industrie- und Gewerbe*	46,00
Soziale Infrastruktur*	7,09
Technische Infrastruktur*	0,94
Straßenraum*	2,56
Erholungs- und Freizeiteinrichtungen*	21,48
Landwirtschaft	29,56
Naturraum	48,81
Gesamt	**225,81**
*Davon ÖV	147,44



Total Water Demand per Year 226 Mio. m^3
*Davon ÖV: 147 Mio. m^3
(*Stadt Wien: 141 Mio. m^3*)

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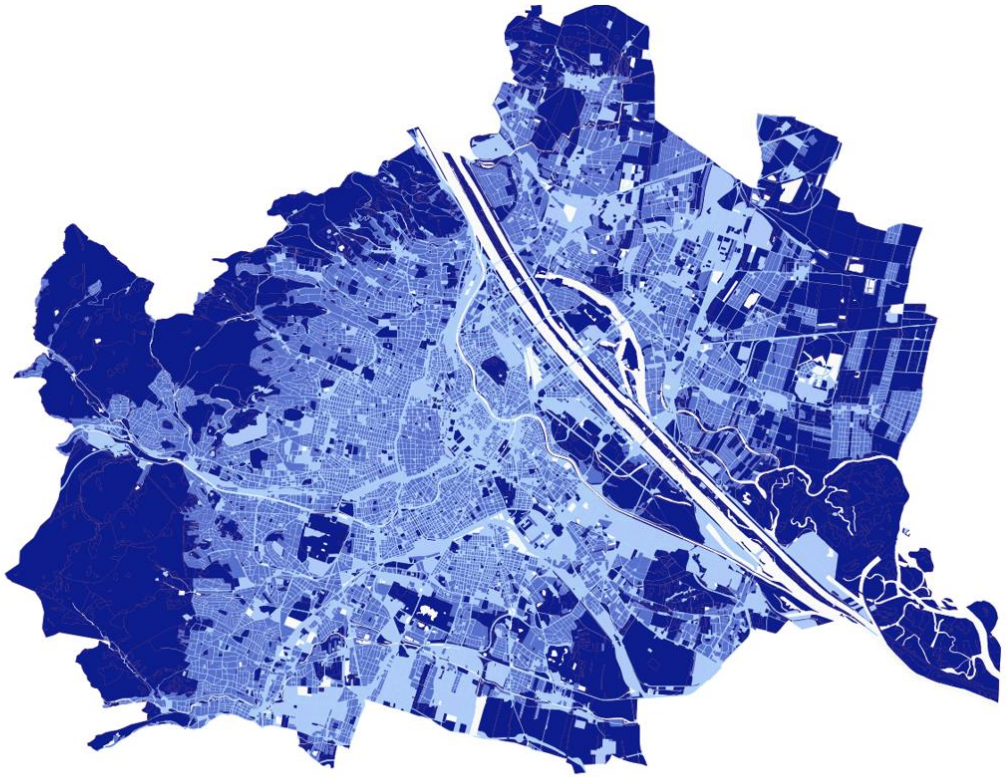
Water demand Vienna

	Land use category	Mio.m^3/a
Infrastructure	Industry & Service	46
	Social Infrastructure	7
	Mixed use	3
	Streetscape	3
	Technical Infrastructure	1
	Total:	**60**
Residential	Residential & Mixed use	**66**
Agriculture and Natural area	Recreational and leisure facilities	21
	Agriculture	30
	Natural area	49
	Total:	**100**
Total		**226**



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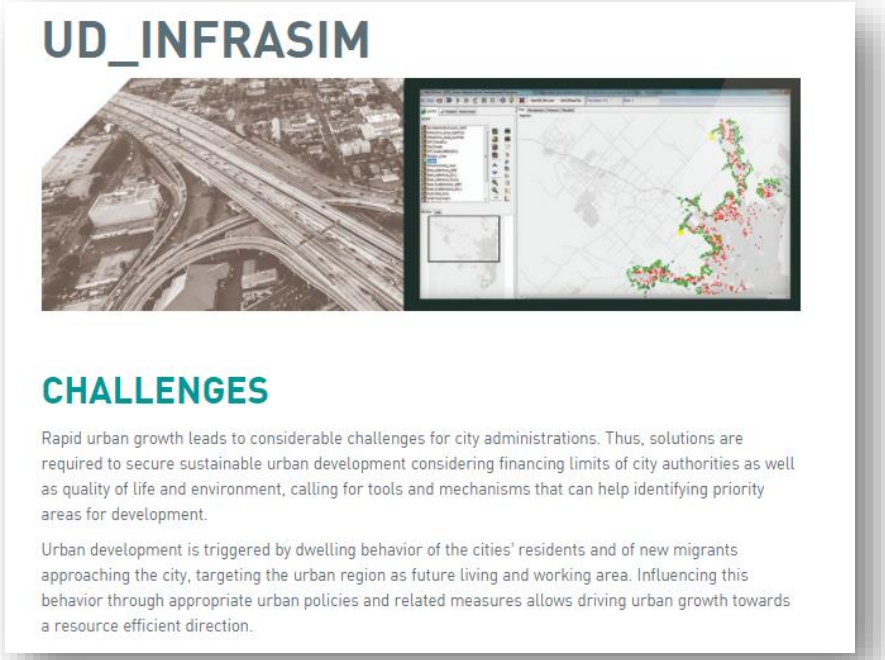
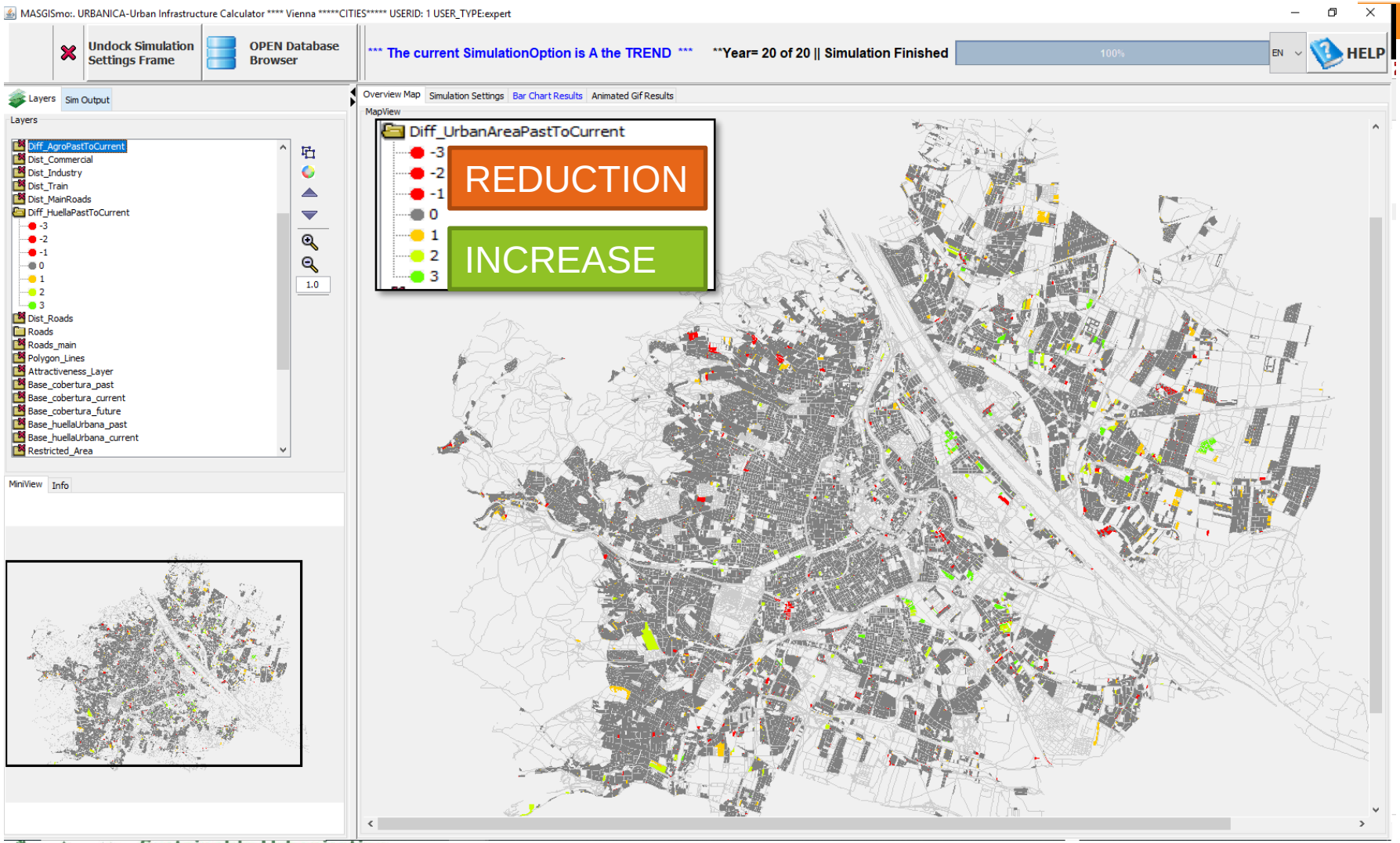
LUC Modelling with UD_InfraSim



https://www.ait.ac.at/en/ud-infrasim

Change of real use classes: residential



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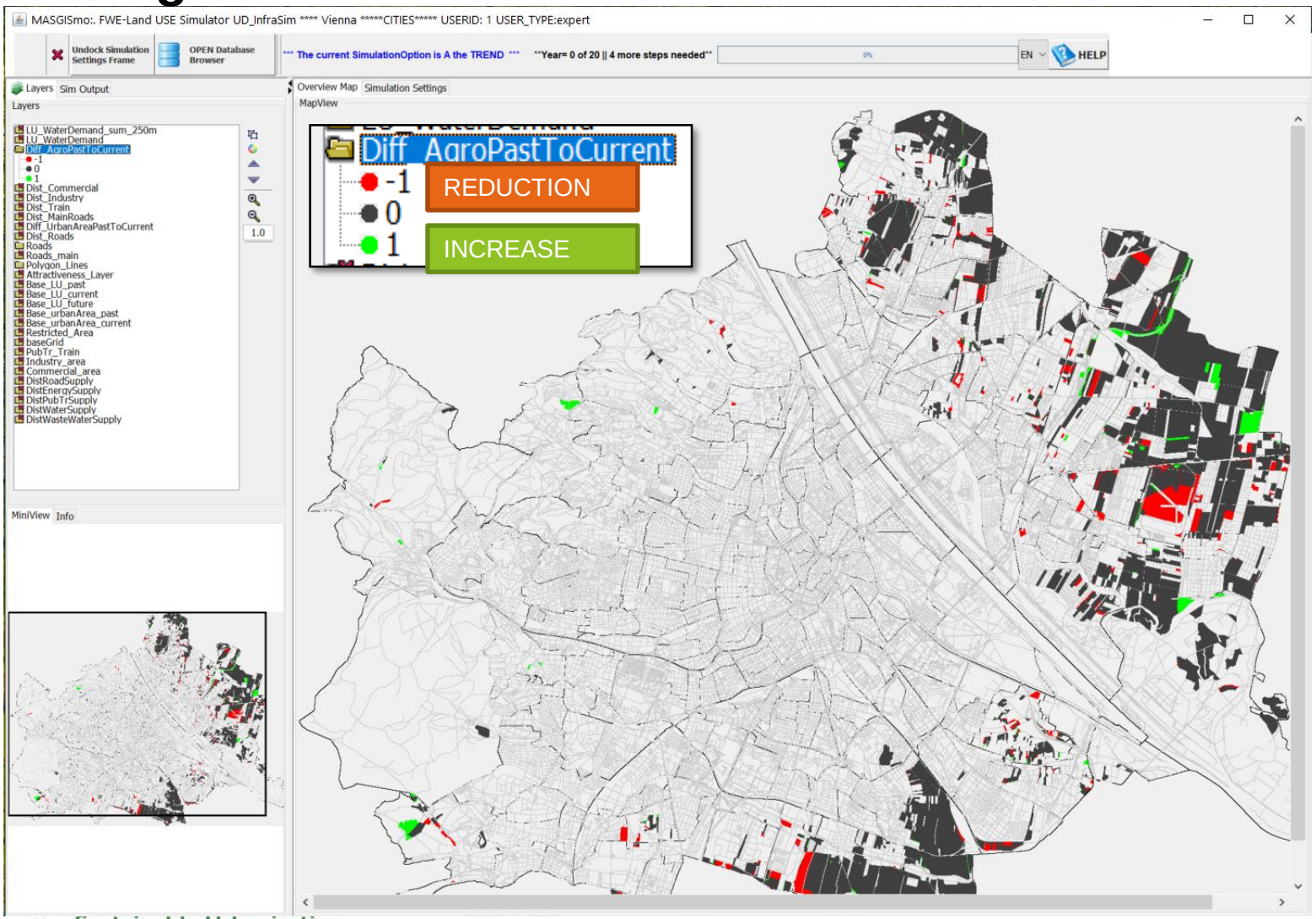
Change of real use classes: arable land



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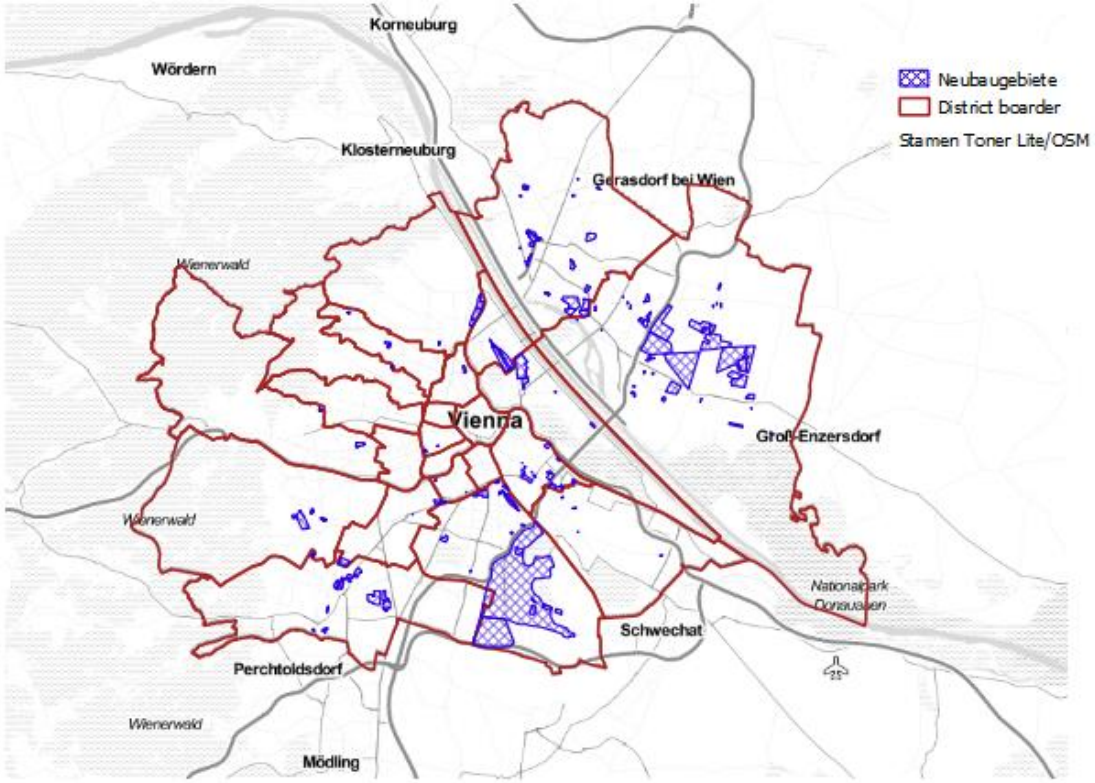
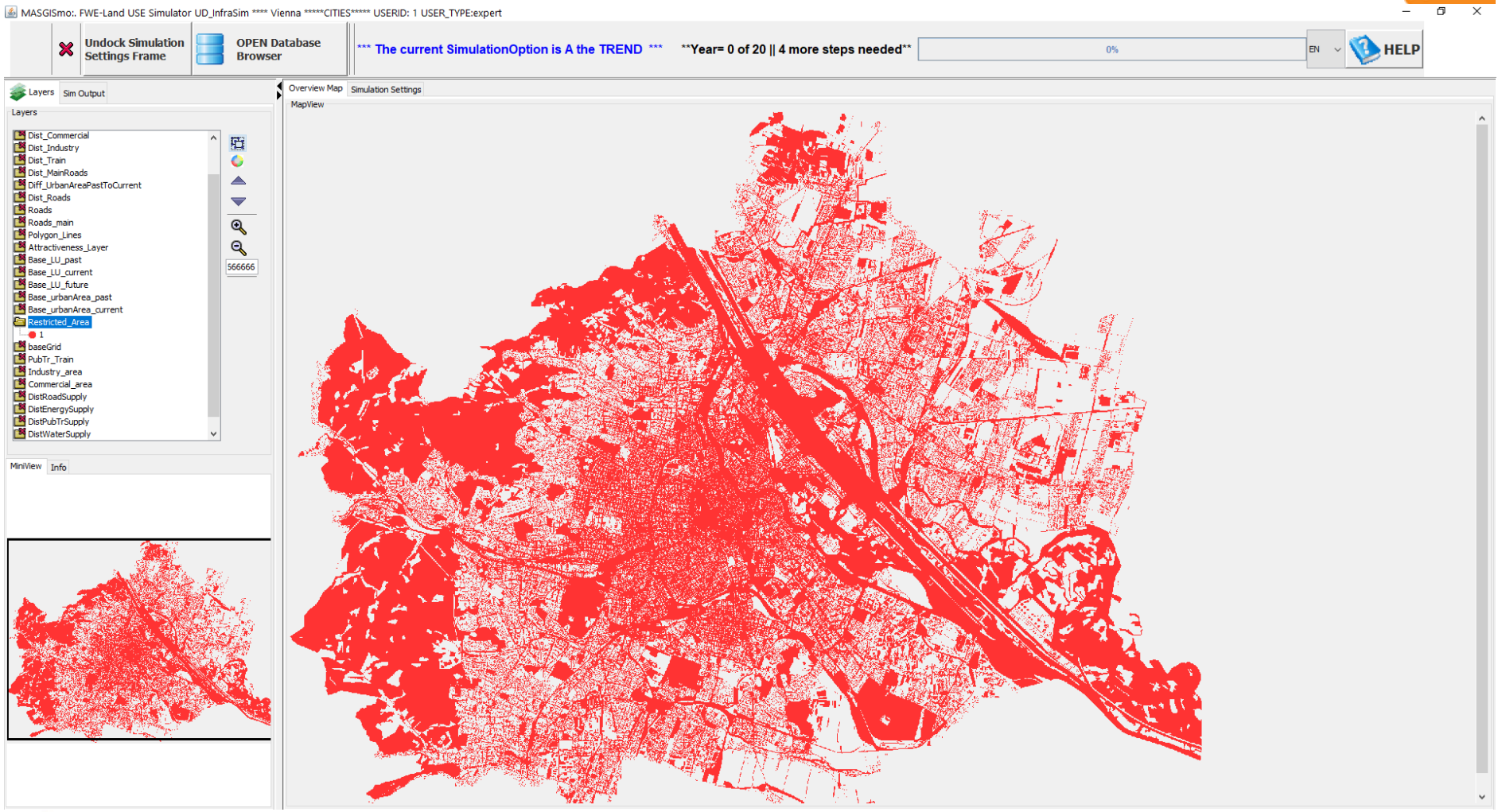
WATER & LAND USE: Scenario INPUT

- INPUT
  - Geplante Neubaugebiete in Wien!



Restricted Growth Areas



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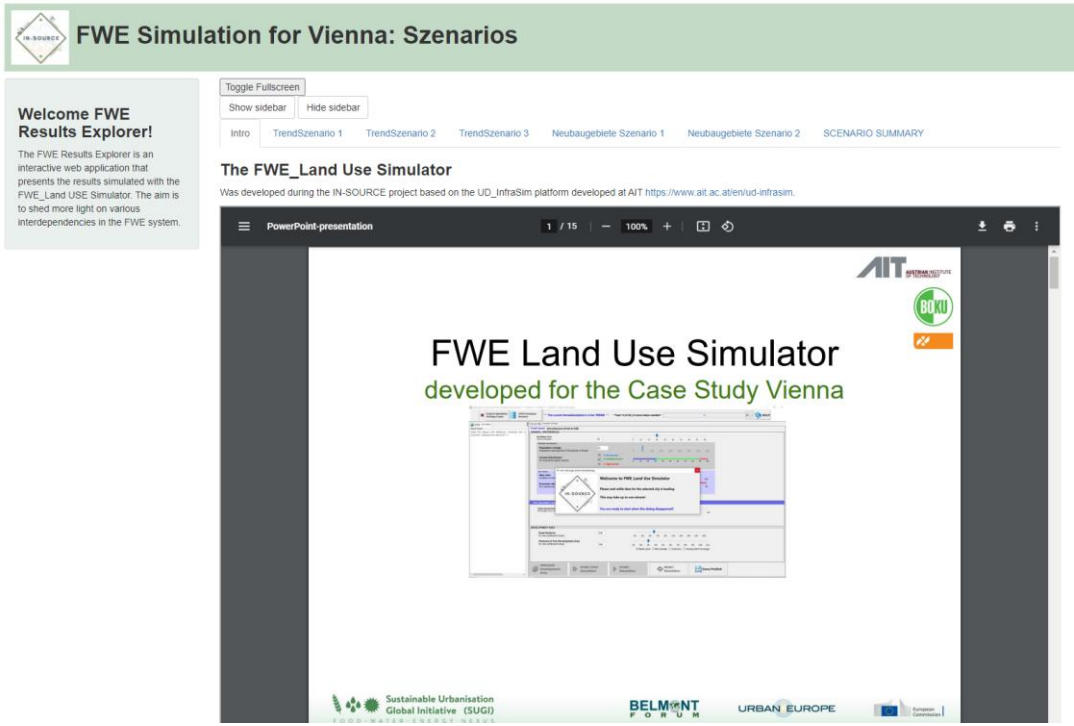
FWE SIMULATOR RESULT EXPLORER

Web-Application to interactively analyse the simulation results (HTML-file)



IN-SOURCE OUTPUT: EXPLORE HISTORICAL LAND USE CHANGES

FWE Simulation for Vienna: Szenarios

Toggle Fullscreen | Show sidebar | Hide sidebar

Intro | TrendSzenario 1 | TrendSzenario 2 | TrendSzenario 3 | Neubaugebiete Szenario 1 | Neubaugebiete Szenario 2 | SCENARIO SUMMARY

IN-SOURCE SZENARIO REPORT

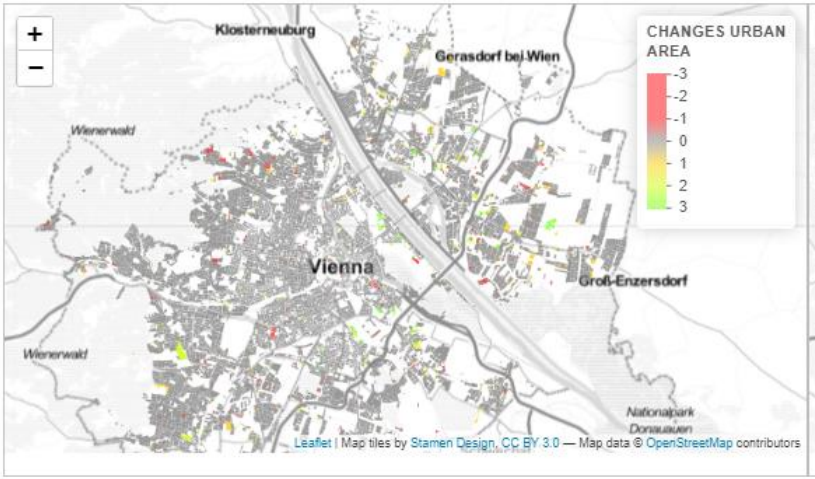
AIT-Ernst Gebetsroither-Geringer

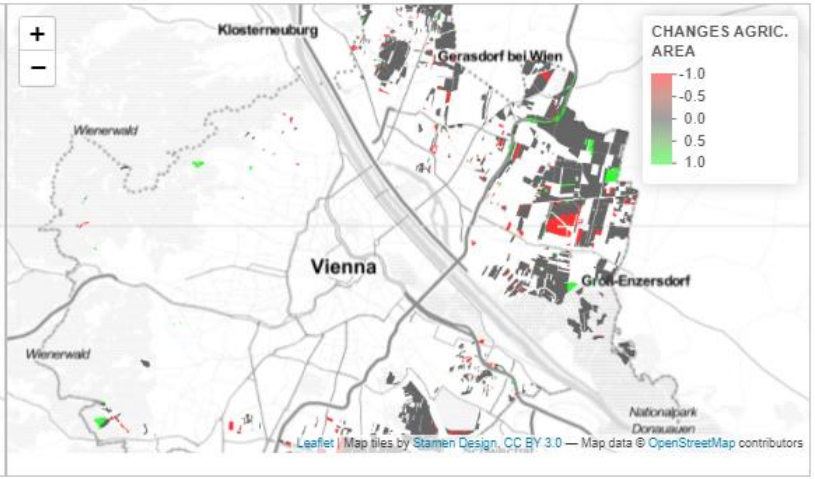
September 2021

Szenario: TrendSz1

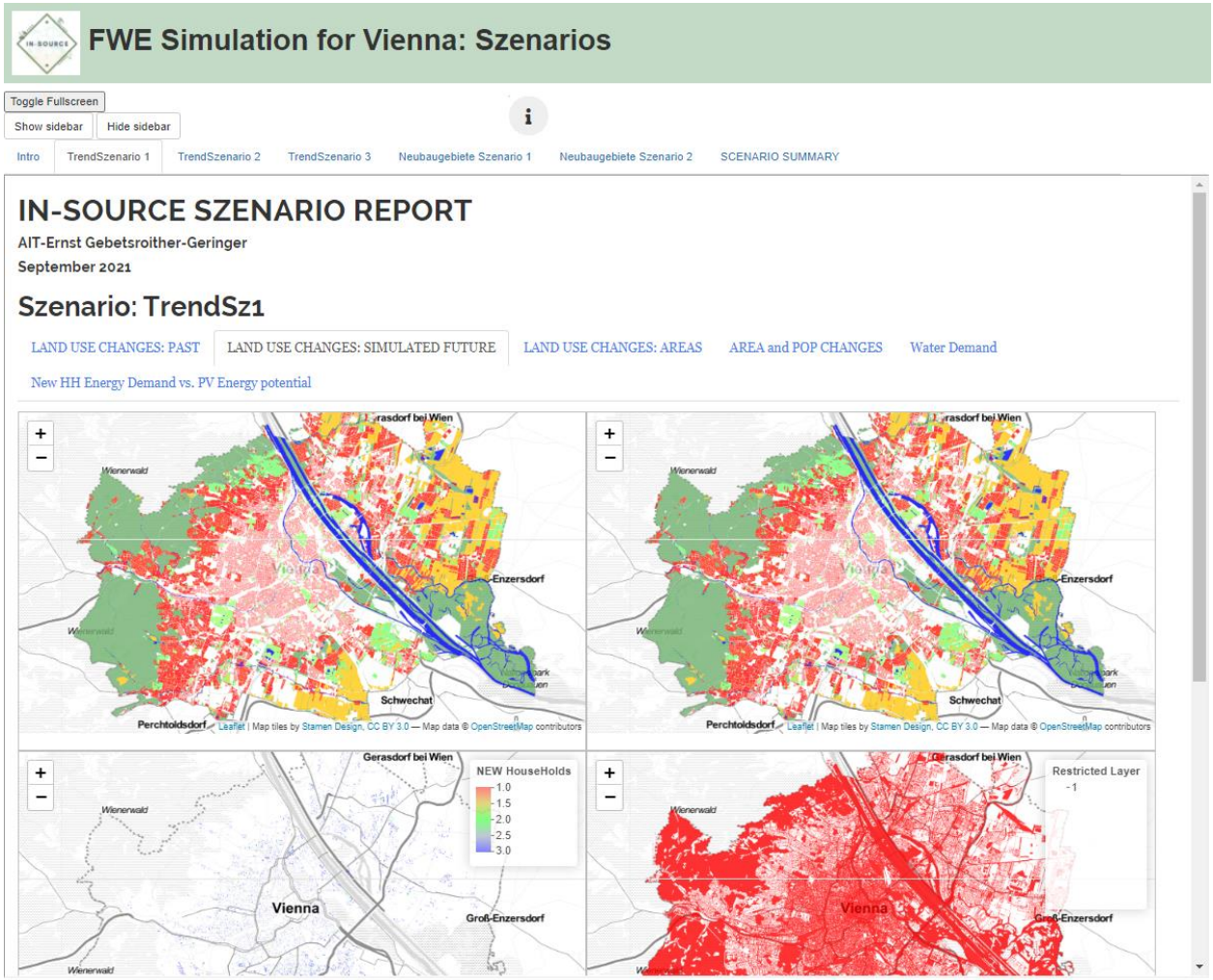
LAND USE CHANGES: PAST | LAND USE CHANGES: SIMULATED FUTURE | LAND USE CHANGES: AREAS | AREA and POP CHANGES | Water Demand

New HH Energy Demand vs. PV Energy potential





IN-SOURCE OUTPUT: EXPLORE SIMULATED LAND USE CHANGES -MAPS



IN-SOURCE OUTPUT: EXPLORE SIMULATED LAND USE CHANGES -CHARTS

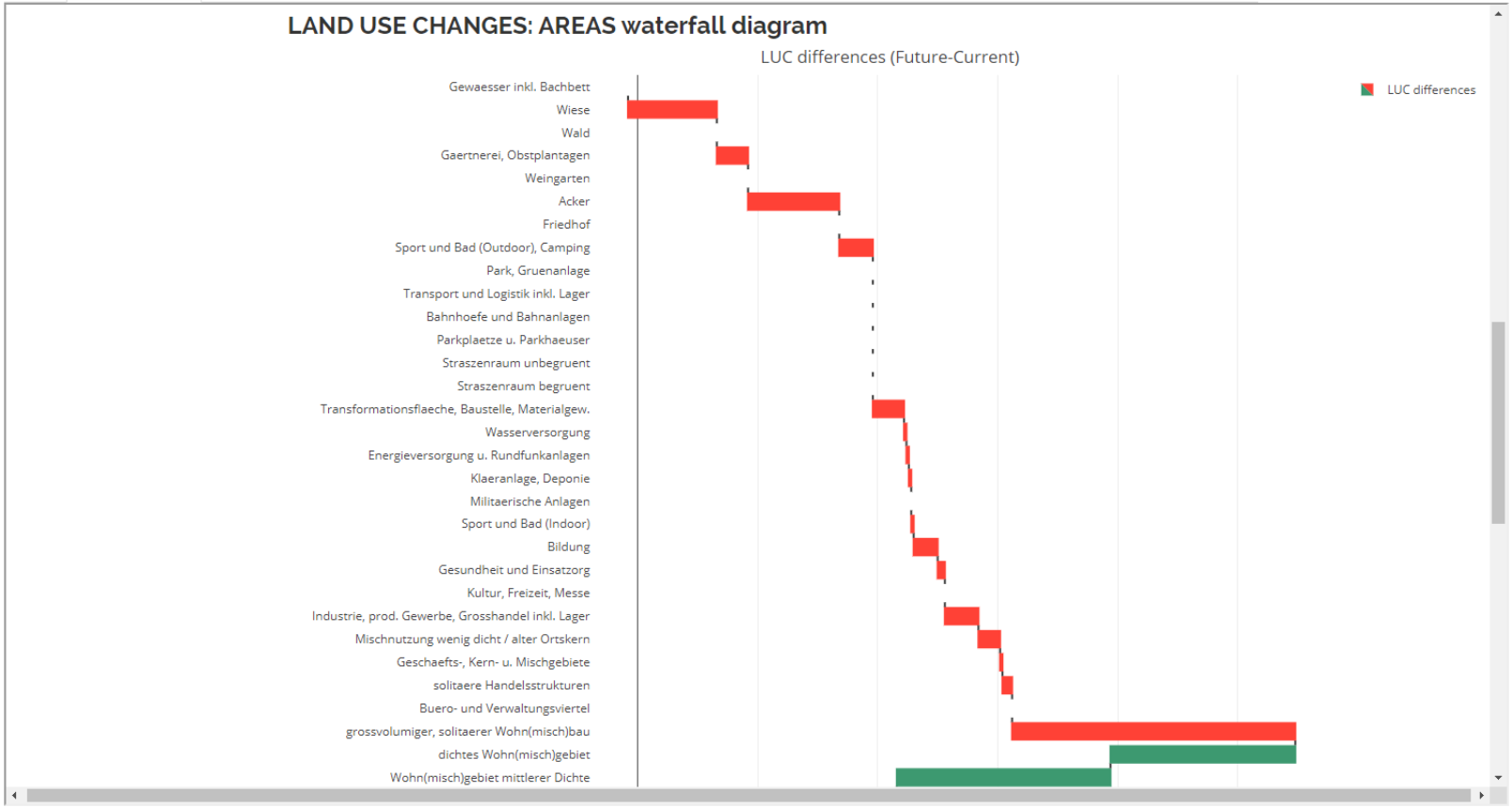
FWE Simulation for Vienna: Szenarios

Toggle Fullscreen

Show sidebar | Hide sidebar

Intro | TrendSzenario 1 | TrendSzenario 2 | TrendSzenario 3 | Neubaugebiete Szenario 1 | Neubaugebiete Szenario 2

LAND USE CHANGES: AREAS waterfall diagram



IN-SOURCE OUTPUT: COMPARE SIMULATIONS

FWE Simulation for Vienna: Szenarios

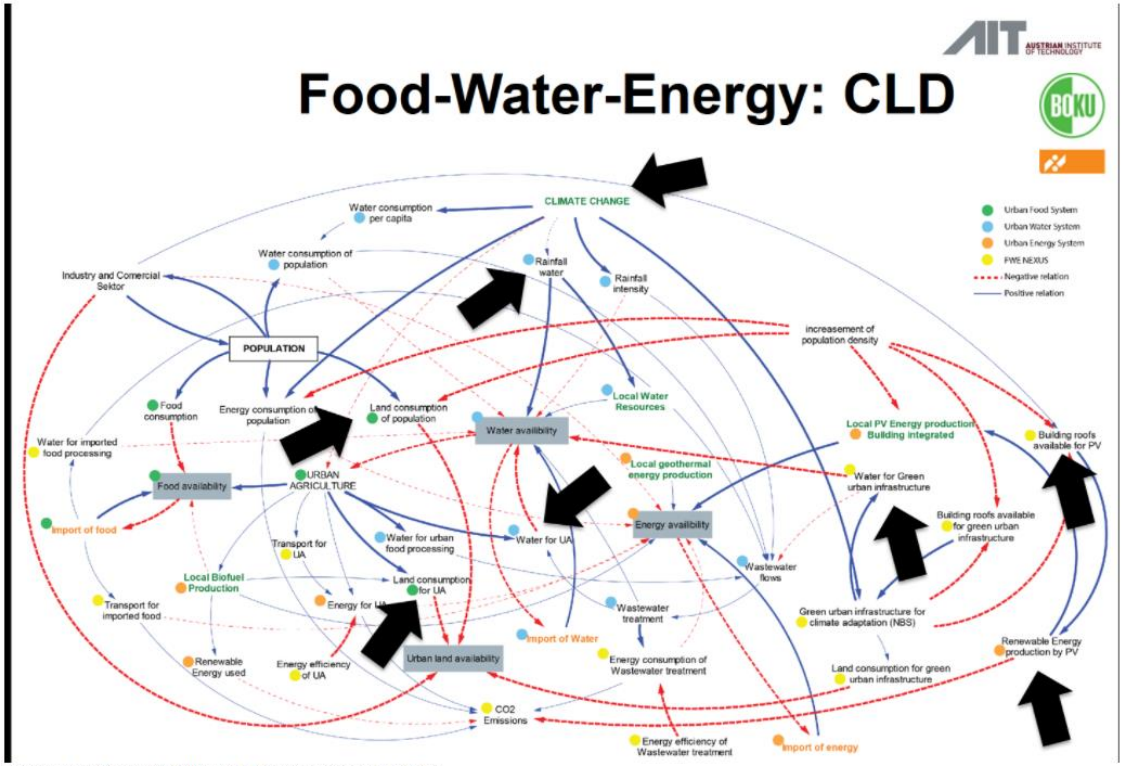
Welcome FWE Results Explorer!

The FWE Results Explorer is an interactive web application that presents the results simulated with the FWE_Land USE Simulator. The aim is to shed more light on various interdependencies in the FWE system.

Toggle Fullscreen | Show sidebar | Hide sidebar

Intro | TrendSzenario 1 | TrendSzenario 2 | TrendSzenario 3 | Neubaugebiete Szenario 1 | Neubaugebiete Szenario 2 | SCENARIO SUMMARY

CAUSAL RELATION



The causal relations within the FWE Nexus have been quantified

IN-SOURCE OUTPUT: COMPARE SIMULATIONS

FWE Simulation for Vienna: Szenarios

Welcome FWE Results Explorer!

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Toggle Fullscreen | Show sidebar | Hide sidebar

Intro | TrendSzenario 1 | TrendSzenario 2 | TrendSzenario 3 | Neubaugebiete Szenario 1 | Neubaugebiete Szenario 2 | SCENARIO SUMMARY

HH development

IN-SOURCE OUTPUT: COMPARE SIMULATIONS LU

Comparison of aggregated LUC

Barchart of aggregated LUC in [ha]

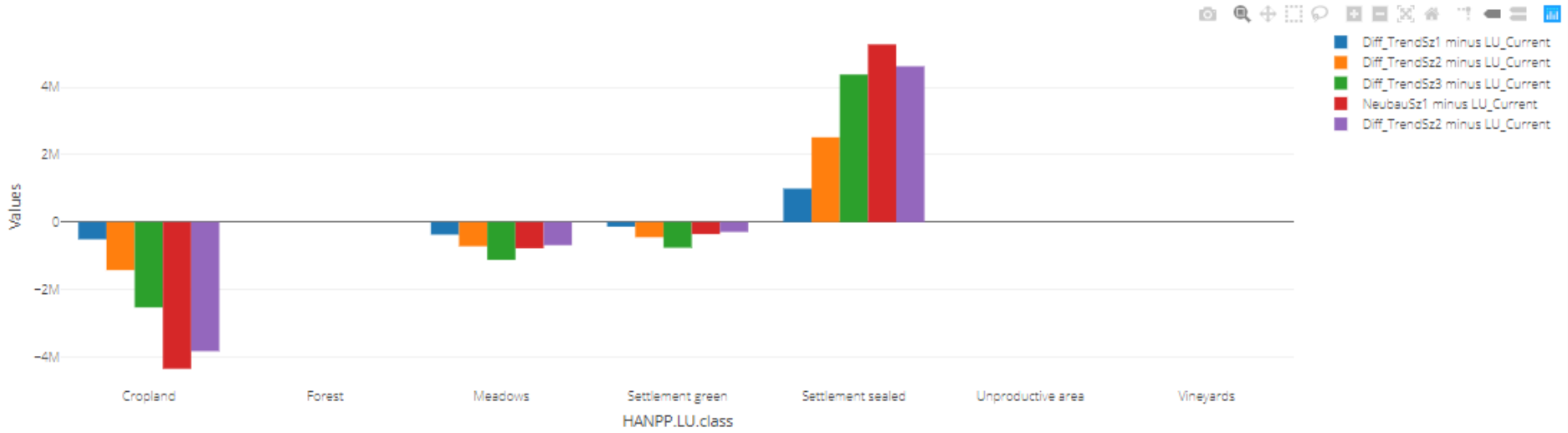


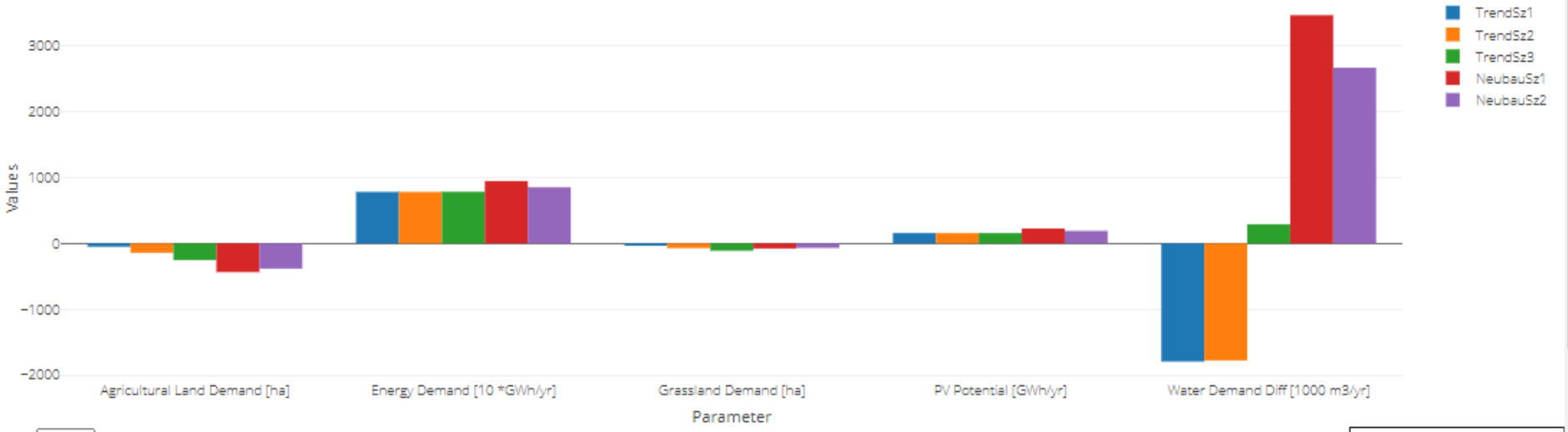
Table of aggregated LUC in [ha]

Show 10 entries Search:

	LU class agg	LU Current	TrendSz1 - LU Current	TrendSz2 - LU Current	TrendSz3 - LU Current	NeubauSz1 - LU Current	NeubauSz2 - LU Current
1	Settlement sealed	202993019	993071	2515102	4378502	5272386	4622656
2	Settlement green	31487475	-136950	-451427	-761338	-354788	-293349
3	Cropland	49931530	-510962	-1424385	-2534783	-4355560	-3832885
4	Vineyards	7099049	0	0	0	0	0
5	Forest	81654938	0	0	0	0	0
6	Meadows	22494404	372137	719630	1121314	776203	686922

IN-SOURCE OUTPUT: COMPARE SIMULATIONS KPI

Some Keyindicators



Show 10 entries

Search:

	Parameter	Trend Sz1	Trend Sz2	Trend Sz3	Neubau Sz1	Neubau Sz2
1	Energy Demand [10 *GWh/yr]	782.3	782.2	783.9	946.4	852.4
2	PV Potential [GWh/yr]	157	156	157	226	190
3	Water Demand Diff [1000 m3/yr]	-1794	-1777	289	3465	2668
4	Agricultural Land Demand [ha]	-51	-142	-253	-436	-383
5	Grassland Demand [ha]	-37	-72	-112	-78	-69

Showing 1 to 5 of 5 entries

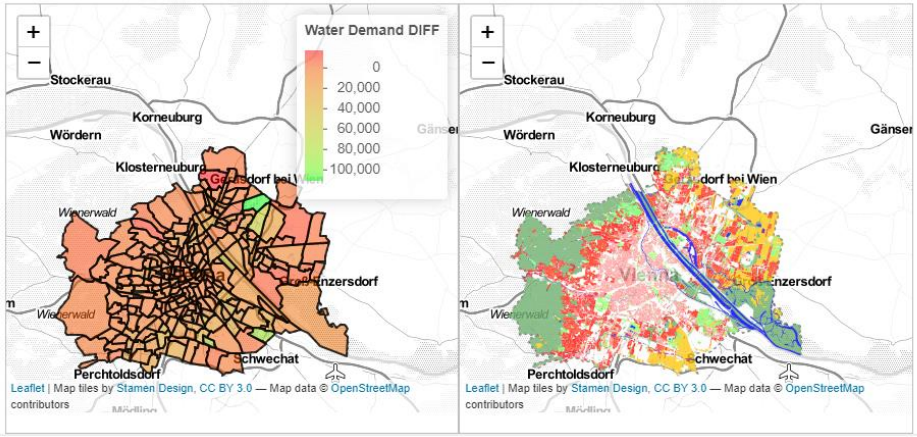
Previous 1 Next

TRENDSz1

```
## [1] "The future water demand is: 223617061 [m3/yr]"
```

```
## [1] "The differenz in water demand is: -1793593[m3/yr]"
```

Water Demand changes within "Zählgebiete" in Vienna

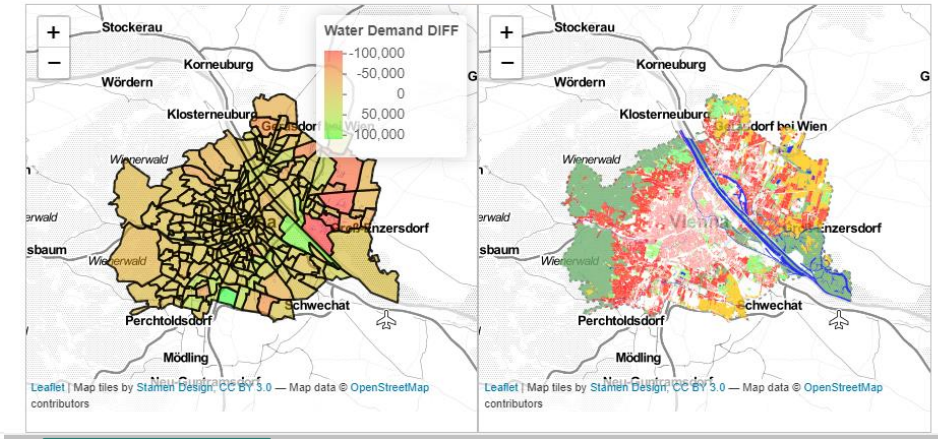


TRENDSz3

```
## [1] "The future water demand is: 225699991 [m3/yr]"
```

```
## [1] "The differenz in water demand is: 289337[m3/yr]"
```

Water Demand changes within "Zählgebiete" in Vienna

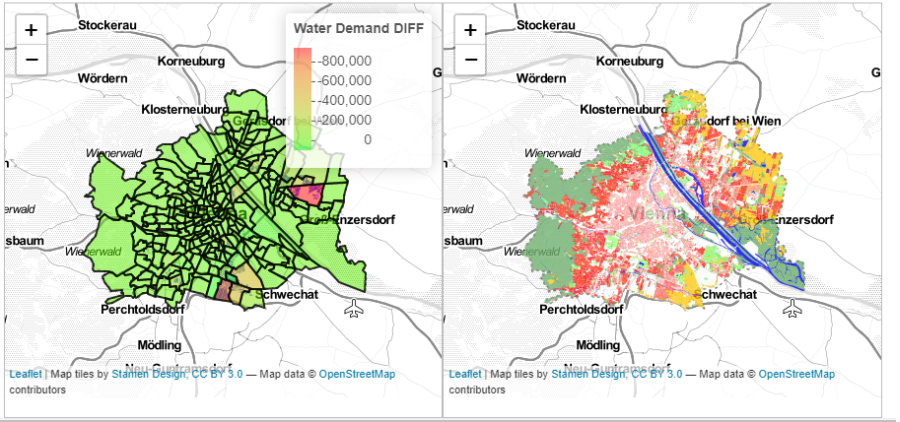


NeubauSz1

```
## [1] "The future water demand is: 228876127 [m3/yr]"
```

```
## [1] "The differenz in water demand is: 3465473[m3/yr]"
```

Water Demand changes within "Zählgebiete" in Vienna

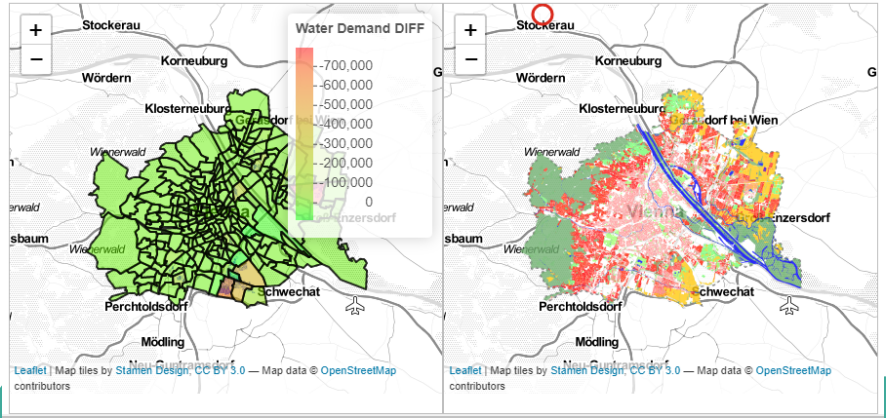


NeubauSz2

```
## [1] "The future water demand is: 228078760 [m3/yr]"
```

```
## [1] "The differenz in water demand is: 2668106[m3/yr]"
```

Water Demand changes within "Zählgebiete" in Vienna



Thank you for your attention!!!

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