



# XXVII FIG CONGRESS

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Geospatial excellence  
for a better living

## Optimizing and simplifying the process of energy-efficiency estimation for urban redevelopment areas by using open source GIS solutions

**Hamidreza Ostadabbas (die STEG Stadtentwicklung GmbH)**

**Dr. Frank Friesecke (die STEG Stadtentwicklung GmbH)**

**Prof. Dr. Franz-Josef Behr (Stuttgart University of Applied Sciences)**

**Alexander Vincent (die STEG Stadtentwicklung GmbH)**

**Mohammad Hosseingholizadeh (Stuttgart University of Applied Sciences)**

**Sanchalita Bandyopadhyay (die STEG Stadtentwicklung GmbH)**

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## Introduction

### Why should energy efficiency be estimated?

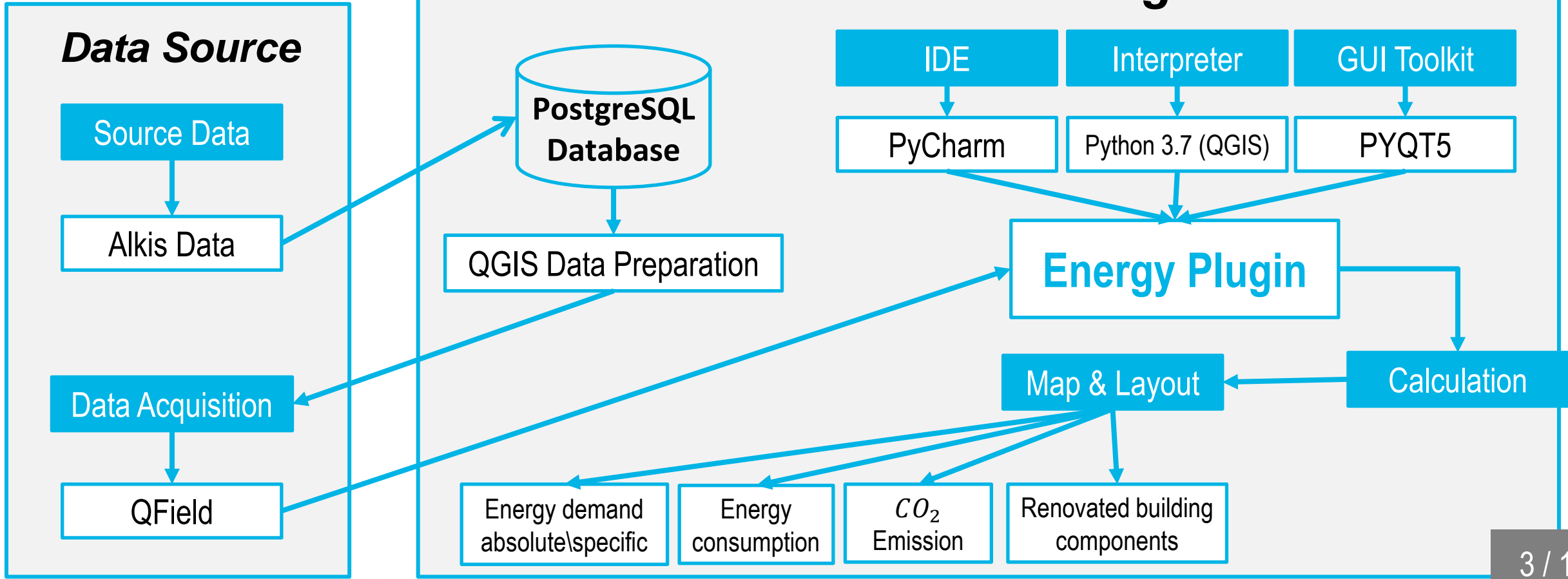
- Increasing energy efficiency and reducing CO<sub>2</sub> emissions are key tasks to confront **climate change**
- Germany's Climate Action Law: a virtually **climate-neutral** building stock by **2045**
- Roughly **75%** of Germany's **43 million** residential units use gas and oil

**So, Is it essential to evaluate the energy-efficiency factor for each building?**

**If yes, how to estimate the energy-efficiency factor at the district level for the entire community (Gemeinde)?**



## Workflow



## How to calculate energy demand?

- Heat demand for domestic hot water ( $Q_w$ )
- Heat losses through the transmission ( $Q_{tr}$ )
- Heat losses through ventilation ( $Q_{ve}$ )
- Heat gains through solar radiation ( $Q_{sol}$ )
- Heat gains through internal heat sources ( $Q_{int}$ )
  
- The energy demand for building heating ( $Q_{ht}$ )
- CO<sub>2</sub> emission

## Which parameters are required?

### Construction

- Building age classes
- The number of stories
- Floors height, socket height [m].
- Roof shape, roof angle [°].
- Number of attics/levels

### Energetic

- Windows
- Outer walls
- Cellar ceiling
- Roof
- Building entrance door

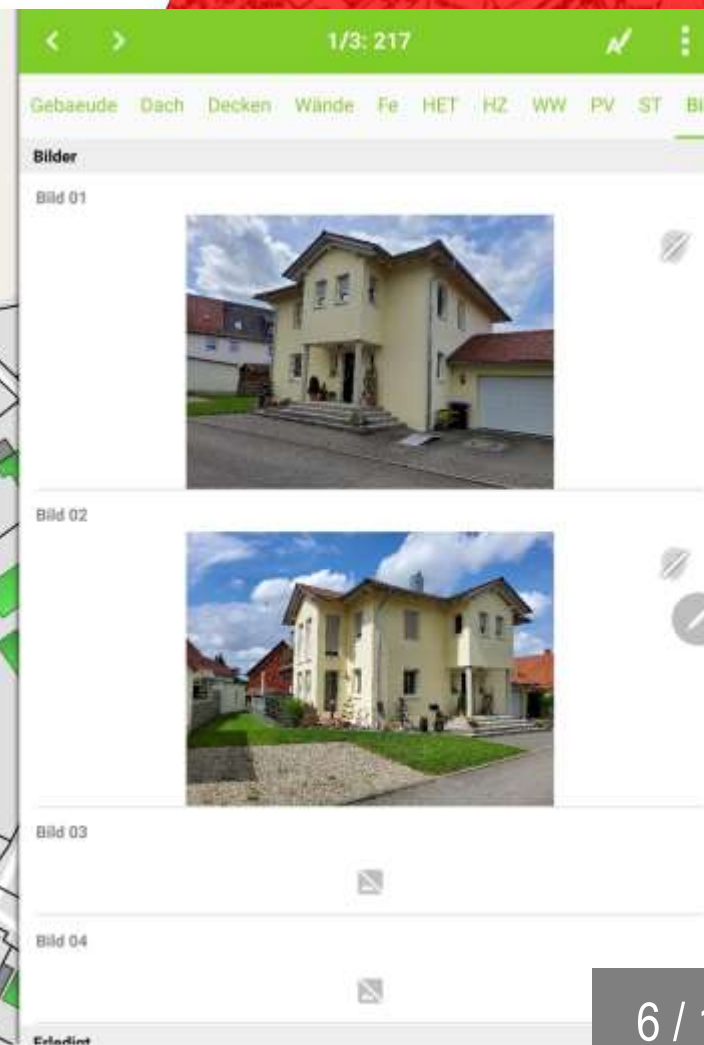
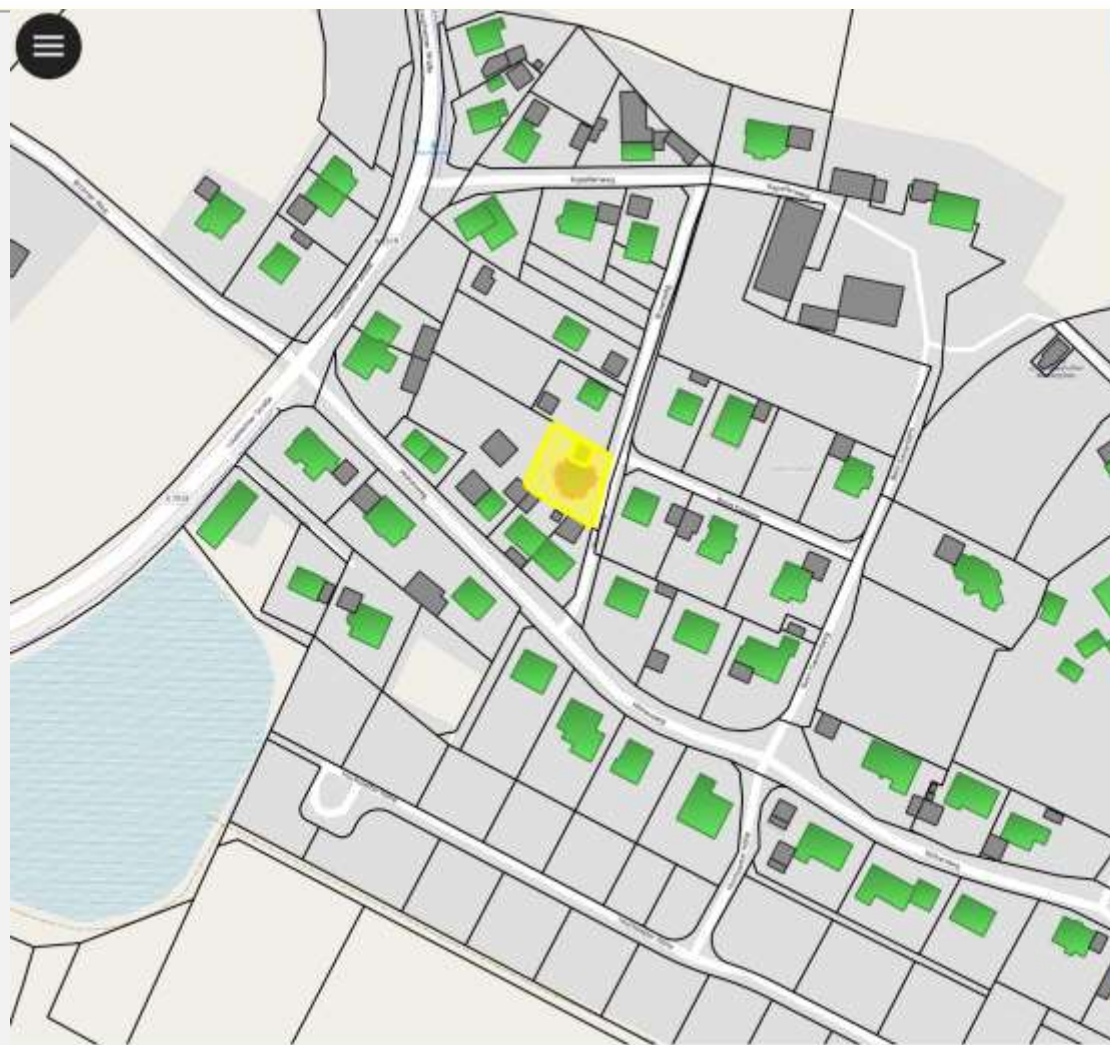
## Data preparation

- ALKIS Data
- Attribute form
- Export to QField



## Data acquisition

- Surveyed buildings
- Attribute form categories in Qfield
- Finalizing survey by capturing building images



## How to calculate energy demand for each building from captured data?

- More than **70 parameters** are needed to estimate energy demand with 2D data
- A **developmental solution** is required to calculate all these parameters in a couple of seconds if any data or formula needs to be updated
- Besides all calculations, the maps and layouts should be **reproduced again** with any changes

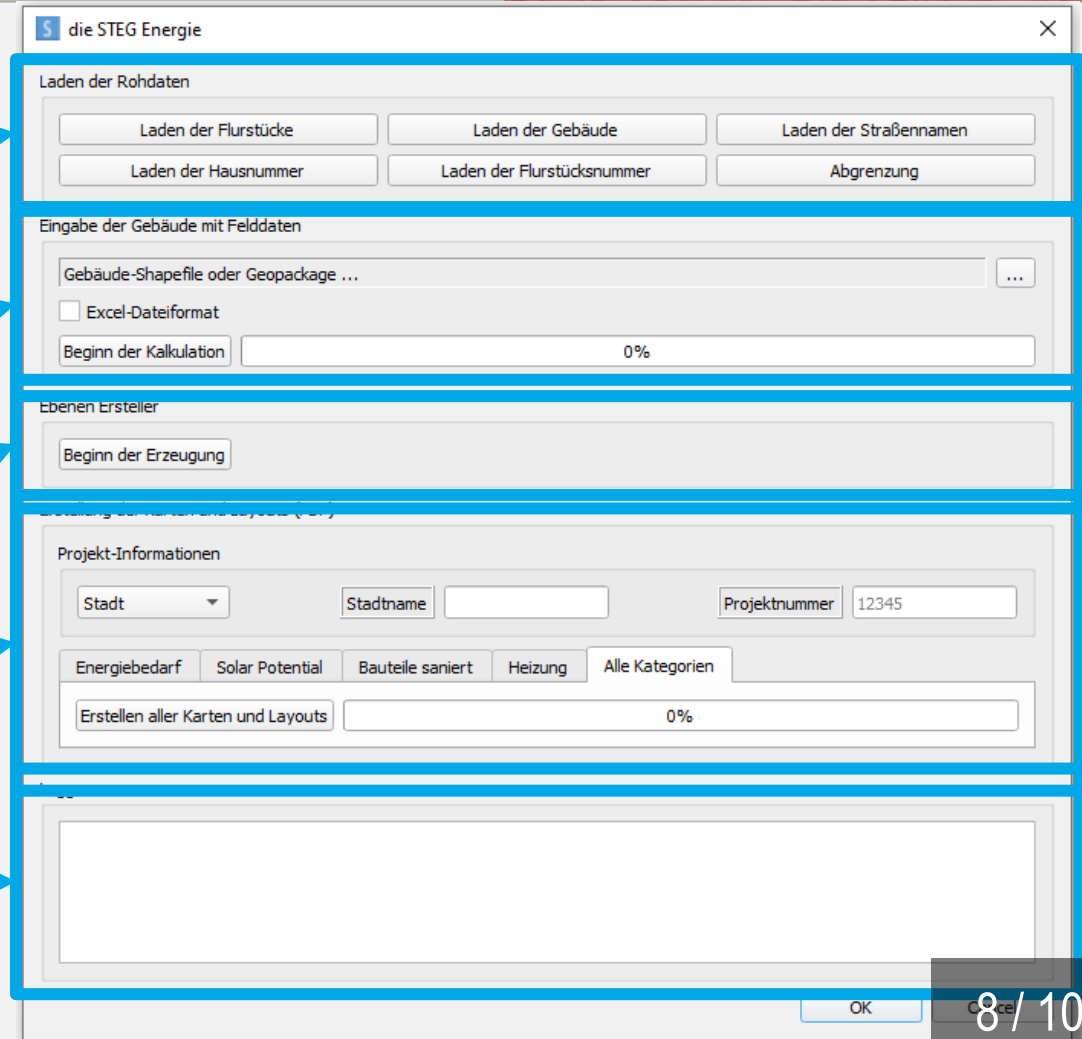
# How?

## QGIS plug-in



## Plug-in structure

- Import raw data
- Import field data and start calculation
- Generating layers with their own symbology
- Automatically pdf map generating
- Logger



die STEG Energie

Laden der Rohdaten

Laden der Flurstücke    Laden der Gebäude    Laden der Straßennamen

Laden der Hausnummer    Laden der Flurstücksnummer    Abgrenzung

Eingabe der Gebäude mit Felddaten

Gebäude-Shapefile oder Geopackage ...

Excel-Dateiformat

Beginn der Kalkulation    0%

Ebenen ersteller

Beginn der Erzeugung

Projekt-Informationen

Stadt    Stadtname    Projektnummer 12345

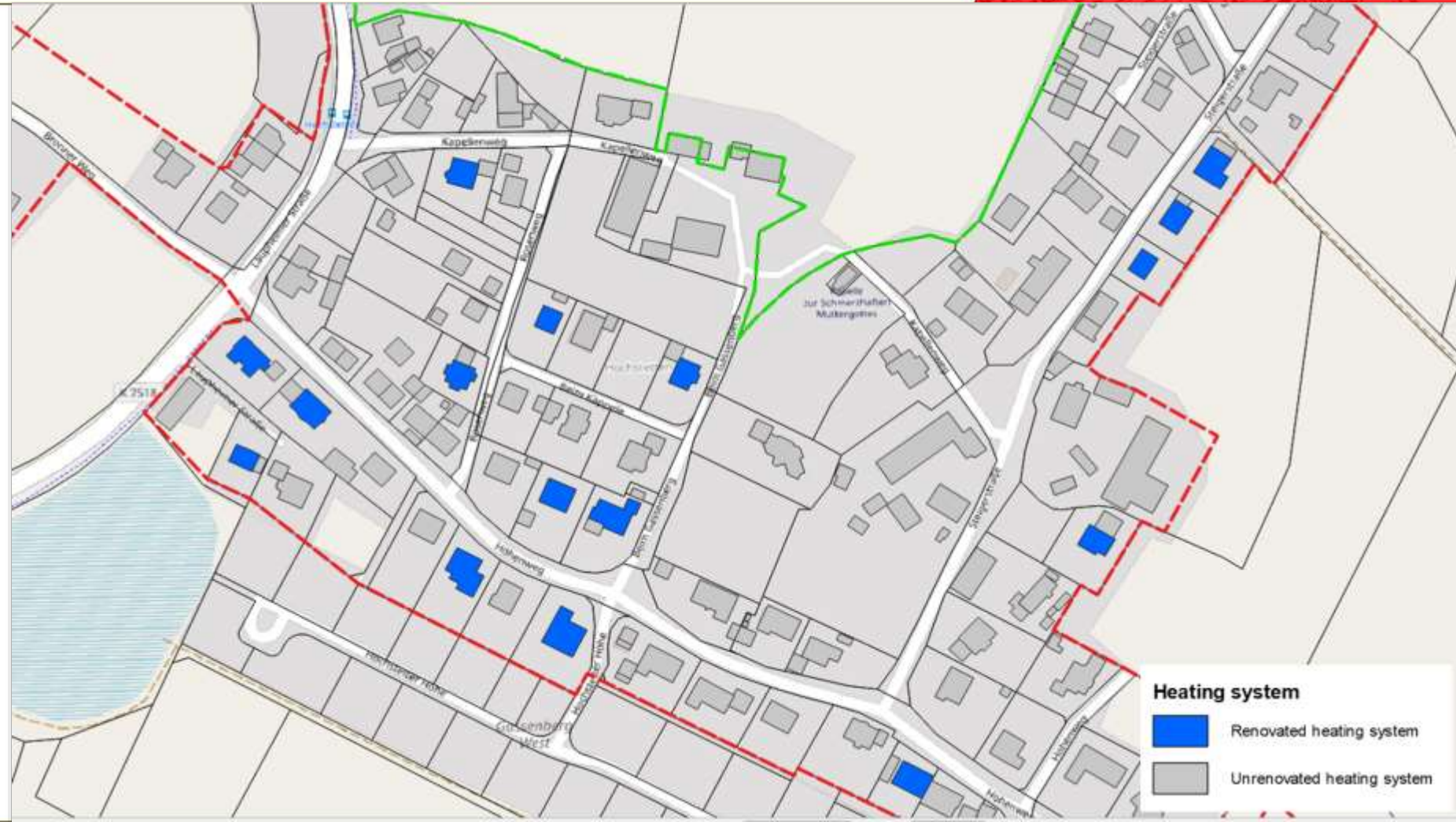
Energiebedarf    Solar Potential    Bauteile saniert    Heizung    Alle Kategorien

Erstellen aller Karten und Layouts    0%

OK    Cancel

## Some of results

- Building age classes
- Energy demand absolut
- Energy demand specific
- Energy consumption absolut
- Existing photovoltaic moduls
- Renovated windows
- Renovated heating system



# Thank you so much for your attention

die STEG Stadtentwicklung GmbH

Hochschule für Technik Stuttgart

[www.steg.de](http://www.steg.de)

[www.hft-stuttgart.de](http://www.hft-stuttgart.de)