DESENT: Smart decision support system for urban energy and transportation

Intermediate results of the project DESENT

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Agenda

- Introducing the project DESENT
- Methodology and Data Acquisition
- Smart Decision Support System
- First preliminary results for the city of Weiz
- Conclusion and outlook
Introducing the project DESENT

Project Description

- **Start**: 25.03.2016    **Ende**: 24.03.2019
- **Duration**: 36 months
- **Funding scheme**: ERA-NET Cofund Smart Cities and Communities
- **Consortium**: 8 partners
  - Eindhoven University of Technology (Lead partner)
  - 4ward Energy Research GmbH
  - SINTEF Energi AS
  - Reiterer & Scherling GmbH
  - City of Weiz
  - Weizer Energie Innovations-Zentrum GmbH
  - City of Helmond
  - City of Steijnker

The project is operated within the framework of JPI Urban Europe on behalf of the Federal Ministry for Transport, Innovation and Technology (BMVIT) and with support from the European Union’s Horizon 2020 research and innovation programme.
Introducing the project DESENT

Project goals

- Models for building energy and transport energy prediction
- Integrated framework for building energy simulation at district level
- Reduce uncertainties concerning future energy demand
- Enable energy infrastructure / service provision decisions
- Develop enhanced decision support systems
- Investigate the effects of new products and services in transport and energy demand
- Demonstration in case studies of the 3 demonstration cities
Model structure is subject to constant changes
Methodology and Data Acquisition

Basic-Models and Tools I

Tools:
- Identify missing data points
- Fill missing data with statistical values
  - National/regional statistical values
  - Actual data of the region considered

Data:
- Gebäude- und Wohnungsregister (GWR)
- Survey
- Statistical Data
- Geo-referencing
Methodology and Data Acquisition

Basic-Models and Tools II

Tools:
- Calculate energy values
  - for each building
  - using available data
  - calculate effects of changed parameters
- Annual and ¼ hour values

Data:
- Standardised load profiles
- Statistical Data
- Real (Time) Data
**Methodology and Data Acquisition**

**Basic-Models and Tools III**

### Tools:
- **TU/e**
  - Simulate transport movement behaviour:
    - Effects of vehicle type change
    - Calculate transport energy demand and emissions
    - Spatial distribution and allocation

### Data:
- Mobility Questionnaire
- Road and network data
- GPS-tracking
- Mobile-App
Methodology and Data Acquisition

Basic-Models and Tools IV

Tools:
- Aggregate Results on 4 different resolution levels
- Visualise Data
- Create basis for analyzation of:
  - Demand / System changes
  - Technology changes
  - Service changes
Methodology and Data Acquisition

Models and Tools (current state)

**Standardisation Tool**
Standardises RawData to fit the data format of the other tools called by the Processor

- Building Type
- Construction Data
- Heating Type
- Number of people / pupils
- Available Roof Area
- Gross Floor Area
- Cooling System
- Existing PV

**Imputation Tools**
Imputes missing raw data on basis of standardised values

- Cooling Demand
- Electricity Consumption
- Heat Consumption
- Industrial Building
- PV-Potential

**Energy Calculations**
Tool for calculating the energy consumption and generation data as well as additional linked data

**RawData**
Standard input fields for each building (obligatory + optional inputs)

**Processor**
Standardises data, calls imputation and calculation tools, reminds the user which steps are necessary to create basic data sample

**BaseData**
Standardised RawData, with missing spots filled and energy data calculated

**Aggregator**
Aggregates BaseData according to the demand to the user

**Visualisation**
Central user hub for visualisation of results, start of calculation, energy planning etc.

**Aggregated Data**

**Data Request: Aggregation Level**

**Exchange request: Parameters for change**

**Exchanger**
Creates a new Data-Set with changed parameters according to the input from the user

**Data-Set (multiple)**
Standardised Data, with calculated changes according to changed parameters
Step 1: Current Data

**STEP 1: Acquisition of current status**

- Mobile App
- Analyses (energy, CO2, costs, etc.)

**BUILDING ENERGY DEMAND**
- Heat consumption
- Electricity consumption
- Cooling demand
- Industrial buildings
- PV yield calculator

**TRANSPORT ENERGY DEMAND**
- ALBATROSS

**Aggregation tool**

**Imputation tools**

**SYSTEM LEVEL**

**BUILDING LEVEL**

**CO2 Medium**

**CO2 High**

**CO2 Low**
Smart Decision Support System

Step 2: System Planning + Future

STEP 2a: System planning

- PV cadastre
- Electricity dispatch tool
- ALBATROSS extensions

Change of parameter

STEP 2b: Investigation of future effects

- Definition of Scenarios
- System planning

Transport energy demand
- ALBATROSS

Building energy demand
- Heat consumption
- Electricity consumption
- Cooling demand
- Industrial buildings

Electricity grid tool

Aggregation tool
First preliminary results for the city of Weiz

Available Data

4077 buildings registered
First preliminary results for the city of Weiz

Energy Data on High Resolution

Visualisation for Weiz
Resolution: High

**Heating: Total Energy Consumption [GWh_therm]**
- 129 to 814
- 814 to 1499
- 1499 to 2183
- 2183 to 2868
- 2868 to 3553

**Electricity: Total Energy Consumption [GWh_el]**
- 0 to 2
- 2 to 5
- 5 to 7
- 7 to 9
- 9 to 11
First preliminary results for the city of Weiz

Energy Data on High Resolution

- Project DESENT
- Visualisation for Weiz
- Resolution: High

New PV: Potential [kWp]
- 73 to 3903
- 3903 to 7733
- 7733 to 11563
- 11563 to 15393
- 15393 to 19223
First findings and next steps

First findings:
- Data quality is one of the key factors
- Relevance of output data needs to be defined (What to show to whom)

Next steps:
- Implementation of energy planning tool
- Add transport energy data
- Validate Data and Results
- Implement other demonstration cities
Ich freue mich auf die Diskussion!

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