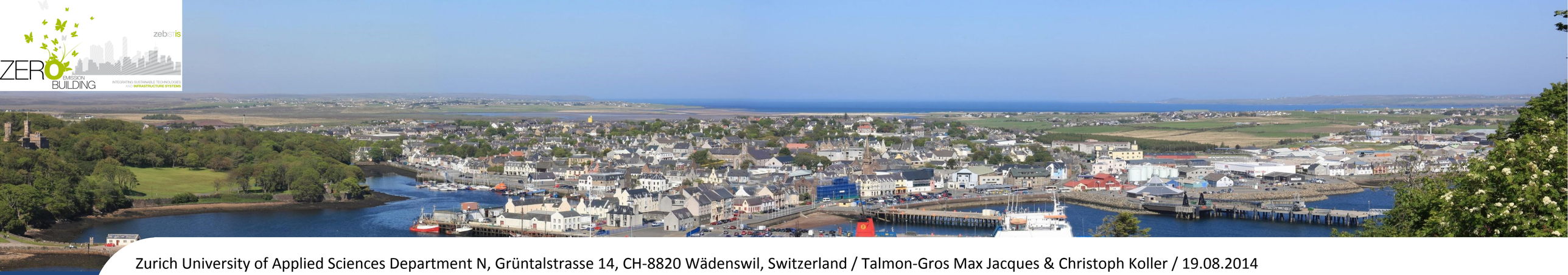

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ZEBISTIS Tools and Technologies for Energy

Energy Toolbox (based on a case study)

Motivation

One target of the ZEBISTIS-project was to find frame values for the planning of Zero Emission Buildings (ZEB) in the contributing countries (Germany, Switzerland, Korea, and Turkey). According to this separate toolboxes for energy, water, and biomass were defined. The energy toolbox refers to the “backbone” of every ZEB, which should lead to a massive reduction of the energy consumption.

Although several excellent energy simulation programs exist, these require specialised in-depth knowledge both for the building structure, and the program itself. The target was to make a tool that gives a “rule of thumb” for designing the energy systems of a ZEB at the design phase of architectural process. This tool should be simple enough to be used by non-specialists.

Structure of the toolbox (first approach)

1. COMPENDIUM OF TECHNOLOGIES for the building structure, based on the Passive House (D) and Minergie (CH) standards. Frame conditions of the building and its structure.

2. CLIMATE DATA and usage of passive gains
   - Heat-/cooling demand and max. heat load oriented on the yearly period with the two coldest/hottest days in a row
   - Temperature for different buildings
   - Methods to lower the energy demand: shading, winter garden, reservoirs for sun heat (earth wall, stone etc.), building shape (shading in summer for cooling, no shading in wintertime)

Parameters
- Energy demand per m2, conditioned area
- Thickness of insulation, area of windows for passive gains
- Rough simulation of the building based on a ”cube”: Area of building parts (roof, floor / against cellar, area of building exterior)
- Quality heat recovery (ventilation system)
- Information for insulation materials with little or no “embodied energy”
- Climate data for Zurich, Berlin, Istanbul, Seoul
- residential, school-, public- building (Room temperatures based on SIA Norms - Swiss norms for architects)
- Saved energy through passive gains in %
- type of building - orientation on SIA norms (Swiss norms for architects); heat recovery - yes/no?
- LED technology, effectiveness of electrical consumers

3. ENERGY CONSUMPTION
   - Hot water demand (HDW) & Electrical demand for lights and facilities

OUTPUT – ENERGY DEMAND OF THE BUILDING

4. COMPENDIUM OF TECHNOLOGIES to cover the energy demand
   - Heat pump sytems: air-to-air/water-to-water heat pump with different source temperatures (geothermal energy etc.)
   - Solar thermal collectors
   - Storage technologies especially for water

5. COVERING THE ELECTRICAL ENERGY DEMAND with photovoltaic
   - Electrical consumers: Heat pump systems, facilities

Parameters
- Different annual **C**oeffiency **o**f **p**erformance (COP)
- Type size and orientation of the collectors:
  Angle of attack and position (facade/ roof etc.), cardinal direction (W, E, S, N); size of the storage tanks
- Orientation of the panels
- Type of the panels: Mono-/ polycrystalline
- Net zero building or self-obtaining

OUTPUT – NEEDED AREA FOR PHOTOVOLTAIC- / SOLAR COLLECTOR PANELS AND GEOTHERMAL SYSTEMS, ROUGH DIMENSION OF THE HEATING SYSTEMS