NORTH SEA
SUSTAINABLE
ENERGY
PLANNING

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An energy data-base – laying the foundations for local community action-plans

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1 Preliminary remarks

Energy costs have soared in the last few years. Even though fossil fuel costs have not continued to rise they will, in the long term, remain at current high levels. In response to this trend, hard questions must be asked about energy consumption and the currently available potential for energy saving must be exploited. Rising energy costs put public finances under increasing pressure. Moreover, many small towns and rural communities are suffering population loss. This leads to a vicious circle: The communities have to provide public services at ever-increasing expense while they see their revenues shrink in size. Although the problem has long been recognized by political decision-makers, to date there have been no attempts to apply energy policies at the local or regional level or to implement appropriate measures. This is where the project **North Sea Sustainable Energy Planning** („North Sea-SEP“, http://www.northseasep.eu) takes its lead. The project focuses on the specific challenges faced by local communities in the area of renewable energy and energy efficiency. The project was initiated by a wide range of organizations and groups: representatives of “green industries”, regional planners, regional and local development bodies as well as universities and universities of applied sciences. In summer 2010 the Jade University of Applied Sciences, lead-partner of the North Sea-SEP project, developed a concept for an energy data-base which could be used for providing independent energy and renovation advice to house-owners. A data-base created by the community of Ritterhude, a sub-partner in the project, was taken as a basis and customized to meet requirements.

In the area of building re-development and renovation, especially, there is great potential for reducing green-house gas emissions. If house-owners have access to qualified advice the added value has a cumulative effect from which the local community itself can benefit. The aim is to bundle diverse processes. So when, for example, an energy audit is carried out practical recommendations for renovation work can be passed on at the same time and then included in the data-base.

The concept thus responds to one of the important requirements of the EU-Building Guidelines (GUIDELINE 2010/31EU OF THE EUROPEAN PARLIAMENT AND COUNCIL of 19 May 2010 on overall energy efficiency of buildings, published on 18.06.2010) and provides pragmatic approaches for implementation:

“The recommendations included in the energy performance certificate shall be technically feasible for the specific building and may provide an estimate for the range of payback periods or cost-benefits over its economic lifecycle.”

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2 Current Situation

As part of the integrated climate protection concept drawn up by the community of Ritterhude in 2000, a data-base was created which lists the

heat-energy requirements of private households in the community. This was calculated on the basis of house-plot areas taken from the land registry, population figures from the citizens' registry office as well as estimates for heat requirements. The results are therefore only extrapolated values for energy requirements and have not been checked against real consumption data. In addition, information about roof construction and orientation were also recorded in order to gauge the approximate potential for solar energy exploitation. Since that time the database was not updated. The community of Ritterhude foresees significant demographic changes leading to new life-style patterns and wishes to meet the demands with new and attractive housing solutions. The community intends to make independent energy advice available to all private households and thus support and encourage reconstruction work that may be necessary. The data-base provides the advisors with the basic information they need to answer citizens' enquiries. At the same time the data-base should be improved to allow consumption figures, building renovation status and improvements (for example, new heating installations) to be recorded and processed.

The aim is to

- provide high-quality energy advice over a long time-span (documentation of advice given and measures taken)
- to make a comprehensive estimate of energy requirements for all the area in question and
- a spatial evaluation of energy requirements in order to identify specific, local issues, pool resources and exploit new forms of energy generation and usage (combined heat and power units, distance heating and heat recovery from waste water etc.).

Of particular importance is that the scheme should be, as far as possible, transferrable to the needs of the communities in the district of Osterholz and beyond.

3 Areas of Application

Potential uses of a basic data-base

The energy data-base can be used to access information about the energy requirements of each individual house in a community. This theoretical energy requirement can be calculated using the following parameters:

- Area of the plot (based on the boundary data from the land registry and its automated registry map ALK soon to be renamed ALKIS)
- The number of floors (or simply the maximum permissible number of floors according to the official land-use plan)

- Classification of the building (building type and age)
- The number of residents (link to the citizens' registry office data-bases)

Furthermore, the local climatic conditions are used to calculate specific energy requirements as well as the hours of occupancy for each type of building.
Based on these reference values, rules of thumb can be derived to arrive at rough global values for the following energy needs:

- Heating energy consumption for living rooms
- Hot water consumption
- Total heating energy consumption

This data can only be considered as reference values on the basis of which preliminary estimates of heat energy requirements in a community can be made.

Gathering more comprehensive information and its use in advising citizens

The energy data-base is suitable for use by independent energy consultants when advising citizens. In the course of the consultation, the citizen is able to supply further information about the building, such as:

- The actual consumption of fossil fuels
- Information about energy-saving measures which have been carried out (i.e. more efficient heating systems, exterior wall insulation, use of sustainable energy sources such as solar panels etc.)
- Information about the building itself such as the type of construction, number of floors and residents, the roof area and orientation…

With the help of this additional information preliminary (independent) tips can be given for further measures which would make sense, such as:

- The possibility of installing a solar power unit based on information about the roof area and orientation
- The viability of exterior wall or roof insulation based on construction type

Taking the latest studies into account such as, for example, „Energieeffizienz im Altbau: Werden die Sanierungspotenziale überschätzt? Ergebnisse auf Grundlage des ista-IWH-Energieeffizienzindex“(Energy efficiency in old buildings: Has the potential for modernisation been over-estimated? Results based on the ista-IWH index of energy efficiency), a study from the Institute for Economic Development in Halle, Germany (Institut für Wirtschaftsforschung in Halle) and „Leitfaden zur nachträglichen Hohlraumdämmung“(Guidelines for cavity-wall insulation in existing buildings) published by the Jade University of Applied Science, it is possible to make a realistic cost-benefit appraisal of any proposed modernization measures.

4 Concept for Implementation

In the next step a model for a data-base will be developed. It will include a spatial analysis and support function and should fulfill the following criteria:

1. A central data-base with open access for personnel in the advice centers.

2. Spatial analysis and support tools using internet-based geographical information systems (WebGIS-Technology)

These two applications are to be linked so that, following every analysis, spatial information can be added to the data-base. It will also be possible to graphically represent (in the form of maps) data-base information according to selected criteria.

Prototype of a data-base model

The data (geographical features and attributes as well as meta-data) will be stored and interlinked in a data-base. The data should be structured in such a way that redundant information is avoided so, for example, standardized orthography of place and street names is essential.

Moreover, the reference values for the specific heat energy consumption for various building types and hours of occupation will be included. The energy data-base of Ritterhude calculated specific heating energy requirements using the thermal insulation regulations valid at the time and adjusted for the age of the building. These values are given in three ranges (from …to) for each type of building. The model should take into account new developments such as the German energy saving regulations of 2009 (EnEv 2009). To assist in the classification of building types, the guide „Gebäudetypologie Deutschland – Stand 2003“(German building types – 2003) will be used. It may, however, be necessary to make adjustments for regionally specific building types and for reference values to take regional particularities into account.

Cartographic back-up and analysis

For collecting basic information and for client consultations the use of a web-based geographical information system (Web-GIS) will be of considerable assistance:

- unambiguous identification of buildings; supplemented when necessary by land registry and house-owner data
- clarification of the surrounding situation using aerial photography, zoning plans and all available digital spatial data
- geo-statistical calculation of the given heat requirements and graphic representation on a grid-map. The graphic representation of these values makes it possible to recognize local energy requirement peaks in the community. In this way it is possible to draw conclusions about the areas in which energy-saving measures are most necessary and where, for example, the synergies of decentralized heating systems can best be exploited.

Permanent up-dating of building-stock data

In order to keep the building-stock information up-to-date, it makes sense to make use of online geographical services. By accessing the district land-registries or local community data, house coordinates and ground-plans can be combined. The system then registers any discrepancies with the corresponding building in the data-base and makes a list of the entries which have to be checked.
Alternatively, the building ground-plans can be taken from ALK which is available either from the district or local community.
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5 Potential fields of application

The actual situation in local communities varies immensely. Currently, some integrated energy and climate protection concepts (German abbreviation - InEKK) are providing some initial data for the heating requirements of houses. In exceptional cases, spatially-specific heat requirement data is available (e.g. in Greifswald; please see: „GIS-gestützte Abbildung der Wärmenachfrage auf kommunaler Ebene am Beispiel der Stadt Greifswald“/”GIS-based representation of heat demand at a community level taking the example of the city of Greifswald”)

The content of the energy data-base of the community of Ritterhude constitutes a good basis which can be expanded in the course of client consultations. Other local authorities can, in a similar way, make use the data-base- framework for recording client consultations and can, in this way, build up a rudimentary data-base. In conjunction with the GIS analysis of the

building stock this would quickly provide a community with an overview of the spatial distribution of the local heat requirement.

Depending on the local situation, the energy data-base can be usefully employed by local authorities in a variety of ways, but the success of the scheme can only be ensured if all stakeholders work closely together: local authorities, energy suppliers (e.g. public utility providers), energy advisors and other local companies. Data protection regulations must, of course, be observed, but depending on the specific structure of each scheme, it would be possible to grant read-and-write data-access to the staff involved.

In rural areas it makes sense for groups of local authorities to work together to spread the work-load.

Over and above the conceptual planning work, the Jade University of Applied Sciences would also be able to assist in setting up a data-base and a working prototype. This assistance would be in the form of bachelor and master theses as well as R&D projects. A prototype could then be tailor-made to suit real local requirements.

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