PROJECT PROPOSAL

I. **Eliminating user malfunction through an optimized building control system for energy management**

II. **The intelligent interconnection of energy users, producers, and storage potential in building structures**

III. **Involvement of energy producers in the supply demand management system**

IV. **Building structures as active market players**

V. **Bottom Up - instead of - Top Down**

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I. Eliminating user malfunction through an optimized building control system for energy management

1. Brief summary and state of the art

In order to achieve the energy efficiency goals of the European Union, the emphasis has previously been placed on energy intensive processes. The energy storage or savings potential of existing building structures has been somewhat overlooked. Even when the final energy consumption in the trade, commerce and service branches in 2012 noticeably decreased from 482 TWh to 388 TWh (terawatt hours) there is still much potential in this area. In the year 2012, the two sectors, trade, commerce and service (GHD) and private households accounted for 53% of German electricity demand and for 43% of the final energy consumption. The energy usage of the majority of these (smaller) buildings has been hand controlled since an expensive central building control system and the impact of an automatic control was until now, not deemed cost effective. However, by eliminating user malfunctions even these smaller buildings can achieve substantial savings. Lighting accounted for practically 20% of electricity consumption in the trade and commerce sector. Through automatic controls and the usage of daylight a savings of 30% is feasible. An automatic control system would also make possible the implementation of comprehensive nocturnal savings, as hand-controlled systems, practically speaking, are normally not carried out at night. In addition, voltage spikes or glitches could be avoided as heating, cooling or lighting would no longer simultaneously start up.

2. Additional advantages:

- Reduction of energy needs
- Convenience through automatic lead times
- Overview of defects with error alert
- Better system control possibilities
- Simple, time-saving operation control
- Knowledge of energy processes

This is already being implemented in real estate structures from 100 to 20,000 square meters in size.

II. The intelligent interconnection of energy users, producers, and storage potential in building structures

1. Brief summary

The high efficiency and good workload production of individual facilities makes it possible to save large quantities of energy. Even when the individual systems of many producers operate continually better and more effectively the interactions between the various components of a real estate property are rarely taken into account. This manifests itself in spikes, when several systems are started up simultaneously or the heating and ventilation operate at the same time. Often a manufacturer will offer a control system for their own product and the client has then to manage each of his different control systems individually.

The building control system can link up (although not all) the usage, storage, and energy production of a building and thus optimize all those areas, regardless of the manufacturer of the control systems. In this way, a centralized building control system goes above and beyond the current systems, which are mainly concerned with recording energy data. The consumer has the possibility of saving energy costs. The cost effectiveness is reflected also in savings in primary energy.

2. State of the art

Condensing gas boiler, combined heat and power or thermal power, and photo-voltaic allow the cost to continually decrease in price and because they are decentralized, more effectively produce energy than in a large power station. Unfortunately many individual plants of different manufacturers are mostly not compatible or synchronized with each other, and as they are not coordinated with each other they thus work at cross purposes. Through lack of communication

between the manufacturers, consumers and storage of a building, so much energy is lost or it is not properly directed to where it can be most effectively used. Thus, it can occur, that ventilation, heating and air conditioning units run simultaneously or the buffer tank of the heat pump is being loaded although in the foreseeable future no heating will be needed.

In addition, a data logger is missing in many products, which would give important information and make possible a more effective and efficient control system for energy management.

3. Project innovation

The scope of this project is to develop an energy management system for buildings which will survey and control all of the important energy production, energy usage, and storage of non-used energy.

The production structure will encompass:
Condensing boilers, block heating and power systems, air-conditioning, ventilation, solar thermal energy and photo-voltaic units, heating pumps, as well as electric boilers, electric heating rods and pellet heating systems. Electricity can be stored in several possible ways, in addition to the conventional warm and cold buffer tanks also battery storage can be considered (permanent or mobile, meaning electric car battery)

The system energy management must be independent in terms of manufacturer, should have the capacity to be continually expanded and adjusted and should be individually customized to fit the needs of each particular building property. It is important to note, that the internal management of the system should not be modified so that warranty claims can be upheld and system errors avoided.

Every seven and a half minutes the temperature gauges, electricity, gas, and heating meters should be selected and recorded by a data logger and sent to a web- server where the data is stored and can be graphically edited. Thus, it will be possible for the user to better manage the entire system and actual energy needs can be better and more effectively met.

The combination of documentation and active management of individual appliances and units offers a multiplicity of advantages. In addition to the notable energy savings, a long-term load course can be projected which will aid in planning for future energy production and energy needs.

The energy system controls function as a smart meter and can theoretically serve as feedback control to allow for dynamic energy price comparison and selection. This function is currently not

envisaged due to present political energy decisions in Germany which have not yet been made. This is currently in the planning stages for the international market.

III. Involvement of energy producers in the supply demand management system

ImmoGrid

The production of electricity in Germany is increasingly becoming decentralized. In light of this, demand management as a resource for effective load coverage and the absorption of excess energy from European Union members as well as system servicing (energy regulation), serve as an important contribution to cost-efficient and the effective integration from renewable energy resources in local and regional energy concepts (the so-called red and yellow signal-light phases). This is particularly valid for economical load coverage (the so-called green light phase) through the communication of energy prices on the energy-only market (direct) or through dynamic tariffs (indirect). The project immoGrid identifies and quantifies the specific market flexibility of different types of building structures and evaluates their marketing opportunities. The technical innovation of this consortium partner enables the tapping of allotted, sub-utilized flexibility and can transform them to active energy market players.

Within the project immoGrid the following areas are to be scrutinized, how substantial the flexibility is in chosen types of structures and combinations, and how economical their active marketing measures under the present market conditions are, how the accounting and billing as well as the trading of said flexibilities can be automatized and how cost effective the development of this potential can be on a national level (avoidance of regulated energy, grid cost reduction).

In the year 2030, 88% of the Germans living in cities and communities will use more electricity than they produce themselves (demand surplus). At the same time, the majority of the installed production sites (photo-voltaic and wind energy) will be outside the cities. Therefore, cities are the key to managing the energy fluctuations. Business or commercial buildings possess high potential for storage and energy transfer. Today this sector represents 30% of the European load transfer and these buildings can, on the average, displace from 4 to 15% of their energy load. In addition, the flexibility in commercial structures is easier to access than that of the private (smaller and non-elastic loads) and the industrial sectors (often inflexible and complicated production processes). The automatized development of this potential has, until now, not been realized and under the current market and regulatory requirements framework, poses a high risk factor from the entrepreneurial point of view.

Application domains

- Low-rise apartment buildings
- Combination business buildings (production and offices)
- Combination buildings (small businesses and residential space)
- Industrial structures (production, offices, showrooms, salesrooms)
- City-owned utility and service companies
- Data-processing centers
- Chain-stores
- Grocery stores
- Camping sites

The production configuration includes block heating and power systems, condensing gas boiler, electric boilers, heating pumps, air conditioning, combined heat and power or thermal power, as well as thermal solar facilities and photo-voltaic units.
We are presently seeking active regions/objects to participate in realizing this endeavor.

IV. The Building Structure as an active Market Player

Adherence to the Energy Saving Ordinance of Germany and certification according to international standards have become significant cost drivers for new buildings or reconstruction in the housing industry. In view of the fact that electricity generation (photo-voltaic, wind, heating pumps, block heating and power systems, etc.) is continually being decentralized, the management of energy demand in building structures promises to be (a) a resource for effective load coverage, (b) for absorption of excess energy from European Union members as well as (c) system servicing (energy regulation) and thus offers a measure of added value potential. This allows, for example, through the commercial exploitation of inexpensive local heat and electricity, the possibility of raising basic rent amounting to the saved energy costs. This in turn, can increase the property value. The project immoGrid would like to identify and quantify the specific flexibility resources of different types of building structures in terms of their marketability.

V. Bottom Up instead of Top Down

All regular energy control systems are working according to the Top Down principle: Energy producers are being switched on/off through a cloud system via a data logger in each single building to market the potential of energy. This procedure contains two main risks: Safety and acceptance. If the energy producers can be switched on/off in one building, so that applies also for 1 million other buildings, which can be controlled at the same time. The building will be under

external control without considering the requirements of the user, what will not be accepted in a mid-term period.
The more purposeful way is to connect the energy producer and consumer in each building and to bundle the resulting potential of supply and demand energy via a server structure, which will be provided for the energy market (grid) in real time. The object requirements are optimally fulfilled and acceptance is given sustainably.
The increasing fluctuation (fluctuations caused by power input and withdrawal of electricity) in the grid has to be compensated with regular energy. The compensation can be done within seconds (“Primary Reserve”), within 5 minutes (“Secondary Reserve”) or within 15 minutes (“Minute Reserve”). This is where the approach of a decentralized relief within a balancing group through intelligent supply and demand control its own to ensure grid stability at the lowest level.

Prerequisite for the implementation is the total package of intelligent control: Everything will have to be combined by nearly all manufacturers with everything.
By bringing together all the objects created the virtual power plant - Bottum Up instead of top down.

Are you interested in developing the ideas with us and translate it into objects?
I would be very happy to get in touch with you.

Ralf Steppeler