Estimating the efficiency of the power in modern residential houses

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Research summary:

The research is considered an assisting step in solving the energy problems and trying to reach self-sufficiency and decrease the level of consumption using the architectural control and modern technics that have been developed since the beginning of the current century to formulate a future that aims for sustainable development. With full clarification of the relation between the residential houses and energy and utilizing it inside the buildings with every possible means and technics. The search is concerned about explaining the guide lines related to the energy efficiency in buildings and the purpose is to assist designers and participants in the combining works and supplying the required data during the various stages of the designing operation and identifying the building that were prepared by the building designers, those guide lines are applied on the new buildings and applicable on the air conditioning supplies and the heat station in the new building, as it is assumed that it is essential to keep the circumstances of the internal space within the limits of comfort regarding the temperature, moisture, quality of airing, noise, lighting and the considerable systems in evaluating the power efficiency

Insert data from the general principles→ specifications: regulations, clients, negative and positive concepts as regarding the power efficiency and cost effectiveness.

Compatibility with the project definition, first stage→ guiding lines for efficiency and the required targets by kilowatts per hour units or by the level of energy in the required data charts, systems to be considered, the chances of using local resources.

Shape 1: illustration of the sequence of the designing process including the power efficiency in the building

Key words:

Designing process- location analysis- the building casing- the power systems- the integrated energy- the primitive energy.

1- Introduction:

Since the beginning of time, human thinks about energy resources to ensure his basic needs to develop the housing technics and life styles and the technical realization. He managed to use the power of wind in sailing and running air and water mills, by then he didn't realize that the sun is the source of all energies on that planet and he used many renewable energy resources to serve him and during the industrial revolution, man discovered steam at many fields which is considered the first stage in using a new energy resource for wider future ambitions. At the year 1870 the internal ignition machines were invented, afterwards was the discovery of the non-excavated energy resources such as gas and oil which were heavily used later and then energy could be transmitted giving freedom to act and move and expanded the human

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movement, generating electricity was discovered. After the second world war, nuclear energy was considered as a new source of energy, years later they started to build electricity stations that are relied on atomic energy. Nowadays each country according to it's needs of current and future energy is planning to save them from new resources whether they are locally available or imported.

From here we have to point that man throughout history wanted to develop his living and more prosperous life which made him more caring about to fulfill those demands through the used energy in all fields, the level of energy consumption for individual has become one important aspect that indicates the progress of the society.

One of the disadvantage of expanding the energy use that way in the present time is the environmental issues and pollution, which resulted in negative impacts on the surrounding environmental elements and on human. The search focused on finding clean, alternative energies that provide comfort and demands and match the progress in the living styles.

The research methodology:

The research is relying on identifying the relation between the residential houses with energy and study the contributing elements in energy consumption, and means and ways of the consumption limitation, and the new present technics as a solution to the problem of consumption, rationalization and expressing the indicators of the efficiency of the energy by studying the factors related to the building casing- the integrated energy indicators-the primitive energy indicators) and study those on the designing process during the stages of (designing concept- illustration design-detailed design-final design) by designing and constructing the building on a specific level of qualification, starting with the general methodology to benefiting from the negative sides, the process of design and constructing should involves the participation of the highest measuring standards of the systems(such as the airing, heating systems-air conditioners- lighting-hot water systems and means of their control) and matching among those high standards of those systems and the building structure.

The energy efficiency during the designing stages:

The purpose is to introduce the right variables at any of the four stages of the designing process.

The next table identifies a summary for the operations with the references that give the general principles that simplify the idea of the building that is completed in the project as shown in the table.

results	System+ operation	The building	The stage
		Identifying the demands and specifications with considering the target which is the power efficiency of the building or the ultimate values of the delivered energy.	The project introduction
Are not considerable at this stage.	Choosing the building performance, the involved systems and analyzing the possibility of lowering the required energy then checking the possibility of linking it to the renewable energy, guidelines could be introduced to enlarge the use of the effective solar energy; the deviation degree, directions and comparing the integrated strategies (ceilings, walls)-heating, cooling-airing, air conditioners – lighting-electric power-water services.washing-cooking-storing.	From the general view to the negative aspects of the building- check list for the inputs and outputs for the highest and lowest levels of the categories of the energy requirements	Stage 1; primitive design
Are not considerable at this stage.	The basic design of the system, simple calculations for the consumption should be available.	Accepting the design choice for the power systems after comparing the systems.	Stage 2; the primary design
	Separate design for the system ,the available calculations for the power consumption at this stage.		Stage 3; the detailed design
Adding measurements that point to the requirements of the power efficiency for the equipment.	Completing the system design by introducing the products and offering the demands for starting and working.	Confirming realizing the goals regarding the power consumption.	Stage 4; the final design

Table 1- the various stages of design that meet the power demands.

3 general steps for the calculation methods;

3-1- steps related to the performance of the integrated power for the buildings included systems.

Indicators 1a 1b 1 c might be integrated to the factors of the building performance that represent the building capability to achieve the demands.

Indicators 2a 2b 2c are taking into consideration for the general performance of the building regarding the energy use and the quality of the involved systems.

The general quality of the building is identified by the ratio between the whole delivered energy to the building E_d and the used energy E_r.

The whole energy E_d is the sum of the whole delivered energies to the building (gas-fuel-electricity) expressed by kilowatt per hour.

E_d is the total delivered energy to the building, based on the annual consumption some systems like (the common generating systems) might generate power to be used outside the building.

Two possibilities are shown: if the system capacity is identified and it was designed to fit the required energy for the building so the exit energy reduce the energy consumption in the building.

If the system is designed to supply power for different buildings and isn't connected to the building power system (the photoelectric cells that are directly connected to the electricity network) the energy supplied to the power generating system is considered a separate source of supply, in that case, if the part of the power is supplied to the building, the system is considered a separate power generation system.

; the indicator 2a represents the amount of the supplied power to the building which is linked to the annual variation.

; the indicator 2b is The density of the supplied power and could be used to compare among buildings that have the same category.

; the indicator 2c is the whole quality for the energy systems which works at the interior design.

; the indicator 2a is the supplied energy in kilowatt per hour.

2b indicator is The strength of the integrated used energy =.2 For each area unit kilowatt per hour per m2.

Indicator 2c is the quality of the building (the effective)=the used energy E/E_d (the delivered energy).

2-3 steps related to the primary energy performance:

Where buildings are connected to sources to supply them with power, they have to be related to the evaluation of the building performance including the total performance of the energy sources, which represent the primary energy definition and in that case it is any given amount of energy supplied from or to the building, evaluation according to the local standards specific for each energy holder.

E_d primary energy1= E_d energy1*c_p energy1
Where c_p energy1is the factor of converting the meant energy.
3a indicator; the evaluated supplied energy $\sum E_d$ primary energy1 in unit (kilowatt per hour).
3b indicator: the strength of the evaluated integrated power=a3 for each floor with unit (kilowatt per hour/m^2).
3c indicator; the quality of the power in the building expressed by the primary energy concept PEERB.
PEERB=$\sum E_r / \sum E_d$ primary energy 1.

Figure 2 shows the illustration of the whole basic energy.
By the previous figure explaining the whole energy we find the coming results arranged according to the numerical key of the illustration;
1- The required energy to fulfill the users demands from heat, cooling and lighting according to the specific levels for calculation purposes.
2- The energy gaining (the natural)- the negative solar energy- airing-cooling-daylight-etc. in addition to the internal gaining (occupiers-lights-electric equipment) etc. those gaining reduce the energy needs in the winter but increase the needs in summer.
3- The net used energy in the building that was supplied from 1,2 when compared to the criteria of the building itself (in winter 2 is better than 1- vice versa in summer).
4- The delivered energy is represented separately for each card holder, includes the assisting used energy in cooling, heating, lighting, airing, warm water with considering the renewable energy resources and the common generation of the various resources, it could be expressed as power units or units (kg, m^3, kilowatt per hour) etc.
5- The renewable energy produced inside the building and its attachments.
6- The produced and generated energy in the building and its attachments and being marketed to others (if the system was found). And part of number 5.
7- Represents + the use of the primary energy or eruption of carbon dioxide coming out of the building.
8- Represents the primary energy or the radiations accompany the generation at the location which is used in the location itself and then it won't be subtracted from number 7.
9- Represents the primary energy or getting rid of carbon dioxide accompanies the operation of exporting energy which has been subtracted from number 7.

4; The research goals:

Decrease the demand on energy by the process of design which is considered as a general attitude of the building including a location analysis and identification of the building casing, energy systems and all components, that is done by:
- Collecting and supplying all information that are related to the power quality of the building under study.
- Proceeding the repeated operations to ensure the improvement of the power quality.
- Get the targeted values for the ratio of the used energy quality for the users.
- The next goals are achieved through the search:

1- Best maintenance and use for the energy.
2- Identifying the ways of architectural integration with energy.

3- Putting basics to realize the perfect performance of the residential housings with the least possible cost.
4- Providing convenient healthy atmosphere for the building users.

6; results and recommendations:

6-1- results:

1- The demand for energy is decreased when the thermal protection is convenient (the isolation) with the external climate and the local circumstances (general negative attitude).
2- The location to reduce the energy upload through the solar energy gaining by directing the building, windows, sunrays coverings, and the devices collecting the solar energy (solar cells and solar combinations).
3- The photoelectric cells connected to the electric net (if there is) aren't to be considered as a way to reduce the required energy for the building (and increase the power performance).
4- To reduce the energy load (the demand) the solar energy systems should be integrated with the systems of cooling, airing, air conditioners, lighting and the outer casing of the building to realize the targeted values for the building energy quality.
5- Natural airing and thermal isolation for the outer casing are solutions that could achieve thermal comfort (at summer) with decrease of the thermal load for the heating, cooling and airing systems (negative solar heating)
6- The integration of the photoelectric system is a way to reduce the delivered electric power, a distinguish between the photoelectric system connected to the electric net (if there is one) and the other used internally inside the building to reduce the required electric power needs, as the components and the ingredients of both systems might vary.
7- When the photoelectric system is the type connected to the net, a certain amount of energy could be reduced to run the cooling machines and lighting to the limit that where balance between the curve of the daily electricity needs and the capability generated from the photoelectric system.

2-6 recommendations

1- The following information should be specified for the project to identify the power quality; the building location, the building criteria. The weather, time table of the building occupation in hours and as percent from the total number of occupiers, putting into consideration the designing number for the number of occupiers.
2- The time sequence for the sun radiation (along the day) and the power demand to calculate clearly the actual amount of the produced photoelectric energy.
3- At the stage of final delivery, we should check that the targeted values for the power performance in the building were achieved.
4- The solar energy gaining should be considered and day light for the positive and negative aspects- the positive is considered parallel to the load of lights and heating.
5- The indicators of the power performance might be used in the action of the building card specific for the whole power consumption with offering the building rank or the data card.
6- The energy indicators could be used for all the systems present in the building structure to get the best collection of the systems.

7- The measured variables should be considered in the new buildings (the measured climate- the use (the building category- the location)
8- Any climate changes should be fitted or used and be considered in addition to the client desire.

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