IFHE-EU Working group 3 : ENERGY

A. Introduction: see my power point presentation Paris may 2011

B. Energy sources:

What exists now , how about insulating building (walls , basements and roof):

See PP Paris may 2011

C. To think about:

1. How reducing energy-invoice: Building

1a. Building: site layout: south orientated =sunshine into building

1b. Windows: big surface is sunshine inside + good insulated glass

1c. Building materials:

-walls: -stone/concrete/wood/wood + stone or concrete

-wall cavity (gap) : insulated or not insulated , wall thickness

-basement: stone or concrete

- roof: - flat roof : insulation / green roof/ solar PV cells/…

- saddle roof : insulation / solar PV cells/….

2. How to reduce energy-invoice: technical point of vieuw, environment proofed

2.1: producing own energy : see point D

2.2 : energy efficient technical installations and apparatus

2.3: way of using energy: f.i. lighting efficiency by: - own discipline

- motion detectors

3.Excisting government rules:

We have to take account with energy figures like:

- Energy coefficients (energy loss) coupled at the kind of building
- Rules of good practice like Breaam, ….
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4. Future :

Energy-less (free ?) consumption by using the following principles:

- Oriëntation of the new buildings
- Green energy sources (as much as possible)
- Recuperation of energy (air, ,….)
- Lightning and relighting
- Insulation
- Energy storage (necessary for peak consumption,…)

- Behavior about energy consumption
- Automatic steering of electrical energy consumption

Looking to European and local governments in order ;

- To create general rules
- Local special rules (fi. About natural energy sources)
- May about funding systems
- Creating CO2 kindly buildings – CO2/NOx-label !!!

Environmental safety: to take in mind for the future

1. nuclear power plants costs much money to assure warranty. 100 % safety is difficult. One mistake can cause an environmental disaster.
2. Conventional power plants: be carefull for CO2 and NOx and depletion of earth fossils(coal) ,oil and natural gas

D. Types energy sources

1. Existing and used sources:
   - natural gas
   - fuel
   -electricity
   -sun power
   - co-generation
   - energy (heat or electricity) coming from incinerators
   -Geologic energy sources:
      -BES (bore-hole energy storage)
      -energy storage in underground water resources
      -ground tubes (air pre-treatment)
2. Alternative energy sources possible to use in the institutions:
   - sun : - electricity + storage systems
      - hot water + storage systems
   - hydro when possible : electricity + storage
   - wind : electricity + storage
   -H^2 (hydrogen) installations for power plant . In Belgium we have H^2 power plant chemical industry, H^2 for trucks of big distribution food company.
   - cooling energy out of water : -outside water resources
      - distributed water

- cooling air: - night ventilation (fresh air during the night into the building)
  -directly 12°C air via ground tubes air-exchangers(geologic)
  (air cooling in summertime ,air warming up in wintertime
  -indirectly via geologic sources) :
  -BES + heat exchangers
  -Energy storage in water carrying layers (underground water resources)
- wood pellets for central heating (needs to plant forests with special wood)

3. Collective alternative energy sources used as delivery to institutions:
   - wind : hosted by -private organization
   - municipality
   -hydro: hosted by -private organization
   - municipality
   - incineration companies hosted by:
   - private organizations
   - municipality
4. Other new natural energy sources for the future:
   - Energy recuperation out of water waves :hosted by - private organizations
   - government/provinces/
   -energy from the cosmos: may be some frequencies (high …)can be transformed into usable energy via special transformation modules.

E. Technical ideas to reduce energy invoice.

1. Cold storage: “ice water” in big insulated tanks
   produced by : cooling machine (electricity cost!!)
   external water tubes (‘ colder countries’)
   heatpumps : cold= storage
   heat: preheating water
2. Hot water storage: in big good insulated water tanks
   warm water produced by: -heatpumps
   -recuperation extracted air
   -co-generation
   -sun collectors
3. Installations:
   a. Lightning: -type of lamps (energy saving, led’s, Hg (mercury vapour),…
   -design of the lamp luminare
   -only normal “lux intensity” at the working place

Other places (corridors,…) : less luminance
Lees lamp luminairs
Lightning via fiber-technic (optic): one source for different
Light-points (fi. Corridors,…)

b. Apparatus with good energy “audit” : less consumption
c. automatic peak control of electrical and heat consumption coupled at the technical installations in order to interrupt them for a few seconds or minutes.
d. high efficiency burners for wood pellets (with good CO2 and NOx) with automatic feeding systems.
e. central heating who needs only low temperature water (floor heating, concrete core activation, ….)

F. Getting energy – green energy

1. Own production of green energy (sun, wind, waste, geologic sources , heatpumps,…. See C, D and E)
2. Buying energy (green + conventional)
3. Combining : own production and buying : as much as possible own production (= first energy source)and conventional energy to be used as needed (second energy source as standby).

G. Costs and benefits own production versus buying

1. Own production (alternative green energy)
   a. Costs: - Investment costs
      - Maintenance of installations
      - Exploitation costs
   b. Benefits
      -Less energy to buy (electricity, fuel, gas,..)
      -Less depletion of earth
      -less environment pollution (CO2, NOx….)
      -encouragement from government (local and/or EU)
   c. Calculation price/kwh
2. Buying energy (combination conventional and green energy) from energy-distributors:
   a. Costs: - buying energy
   b. Benefits: - compensation for part green energy (by governments ?)

- no maintenance
-energy safety: good if power supply connection with a cable system in loop (=power supply from two sides : "power-cable system" provided by distributor)

c. Calculation price/kwh

H. Future from practical perspective

1. New buildings or total renovations of existing buildings

   As an example : combination of following

   a. Continue sources
      - Very good insulated building
      - Sun orientated (for new buildings)
      - BES systems
      - Ground tubes systems
      - Enough Co-generation to produce heat and electricity. Gas is needed! This is a continue energy source
      - Wood pellets for central heating (needs pellets storage…!)
      - Energy recuperation (heat out of extracted air usable for preheat ting fresh air or preheating sanitary warm water)

   b. Discontinue sources
      - Sun power : PV cells for electricity as much as possible
        Solar panels for hot water as much as possible
        This is a discontinue power source: so storage is needed
      - Wind energy for electricity : storage is needed

   c. Emergency : - alternator with diesel motor to produce electricity
      - Calculation for nearly 100% take over of the total electrical Capacity needed to run the institution!!
      -needs fuel

2. "Normal renovations"
   - BES, ground tubes and windmills : if there is free space enough!
   - Co-generation
   - Sun power
   - Good insulation - renewing windows with super insulating glass
     - roof insulation
     - wall insulation
   - energy recuperation

- high efficiency central heating (woodpellets – storage !!)

3. Technical aspects:

   Either in new buildings , total renovations and normal (smaller) renovations: it is always necessary to use “high tec” about:

   -lighting
   - automatic energy steering systems
   - building control systems with alarms
   -weather stations
   -….

4. Energy consumption behavior

   It is necessary to give a good education together with instructions to avoid wasting energy. Many small instructions can give a lot of energy savings.

I. What to do.

Energy will cost more and more money
Environment and earth depletion will be charged more and more
So we have to :

- Building concept: low-energy or zero-energy
- Use more and more green energy by own production(and/or via distributor)
- Build very good insulated buildings
- Look for implementation of high tec installations
- To look for new systems about :
  - -lightning
  - -sterilization
  - -energy storage
  - -higher efficiency of energy consumers:
    - -wood pellets burners
    - - all kind of apparatus
    - - ventilation systems
    - -cooling energy (fi. night ventilation….)
    - ……..
- About pellets:
  - -Production of special wood

-government support for wood cultivation (environment !)
- using waste wood for pellet-production

Last but not least:

1. Looking for a combination of different departments in not only in local countries but also in the EU. Two departments can help each other: healthcare and environmental departments
2. Stimulation for green energy (own production) and also for low energy buildings by means of financial compensation (from government and EU). For excemple: part of the budget of environmental department can be used for healthcare institutions using "green-energy" in their low-energy or zero-energy buildings.
3. Proposal for aim about energy consumption

   The first aim will be : auto supporting with environmental-kindly energy.

   Only use of conventional energy if necessary(only as back up and safety). The emergency group can also be used for this back up.

   Other possibilities to ensure energy for vital departments (like Intensive care, …..) by looking for a small part of electricity production in dual production and also storage…

J. Practical point of view:

The point is to have a reference which we can use to create an energy management in order to obtain an energy kindly building. The same reference can we use also for comparing different energy-consumption systems and also for calculation the result of different energy-saving activities (mentioned before in this paper).

So this parameter will be the CO^2 /m^2 usable surface heated/cooled (kg CO^2/m^2)

Indeed we have to look per m^2 because this is the most relevant parameter to create a energy-poor building, men can "see and feel "this.

The parameter CO^2/KWH is interesting to know when we buy "external energy sources" like natural gas, nuclear energy, central town energy-plants (waste incineration,..), ….Then we can use this figure CO^2/KWH for calculation the CO^2/m^2 usable surface.

Also the parameter NOx is also relevant.

We have to look first for healthcare institutions (hospitals,…) in different EU-countries who have already calculated or will calculate in the nearest future . We can compare this figures together with a short description of the building concept and energy-saving activities.
Via this kind of benchmarking, we can propose a "wanted" CO^2 level (and may be also for NOx level).
So we need a ' quick check-up list' for this benchmarking.

This way of working will be easier to make a proposal to the different local governments and also to EU government and/or other EU - organizations.

Proposal consisting :

- Building concept
- Energy management
  -kind of energy sources versus CO^2 level and versus pay-back period of the investments
  - controlling energy consumption (automatic)
  - defining temperatures in different rooms
  -environmental considerations according the depletion of earth energy sources
- Financial compensation (f.i. compensation for good CO^2 parameter)

K. Benchmark and Results

1. CO^2 parameter.
   Information: Benchmark of 10 hospitals Belgium (engineering office Ingenium,Belgium)
   We have to consider the type of energy source: <u>gas , electricity</u>
   The CO^2 footprint of gas consumption at the place itself is much smaller than the CO^2 footprint of electricity consumption at the local place because the production of electricity (electrical power plants) has a low efficiency . Hydro-energy is of course better!

   So it is good to keep this two sources separate concerning calculation CO^2.
   <u>CO^2 gas energy</u>: we can handle with the building conditions (like good insulation, sun orientated,….) in order to use less gas.

We can calculate the CO^2 emission : local consumption x 277 kg CO^2/MWh/year
CO^2 electricity energy: it is more difficult to handle with this energy because modern hospitals need more and more electricity for all kind of apparatus , lighting, ventilation, airco,….
The second point is the rather low efficiency of the electrical power plants, the different losses due to the transport of electricity (high tension and low tension lines, transformation plants), ….
To calculate the CO^2 production : local consumption electricity x 617 kg CO^2/MWh/year

Benchmark figures : existing CO^2 parameters : Hospitals starting from 187 beds (18888 m^2) up to 1062 beds (318827 m^2) and 1472 beds (252060 m^2)

Average values of kg CO^2 / year:

CO^2 emission due to ***gas energy***: **51, 25 kg CO^2/m^2** or **7.950 kg CO^2/bed**
CO^2 emission due to ***electrical energy***: **91 ,32 kg CO^2/m^2** or **12.957 kg CO^2 /bed**

TOTAL emission: **142,56 kg CO^2/m^2/year** or **20.907 kg CO^2/bed/year**
You see the importance of CO^2 emission due to the electrical energy consumption.

To have an idea of the importance of the building construction (gas energy) and electricity consumption. Two cases as example:

1. ***Hospital of 35.667 m^2 with 189 beds:***
   CO^2 levels gas per year
   per m^2 : 34,90 per bed: 6.593
   Total : 1.248.162 kg CO^2
   CO^2 levels electricity per year
   per m^2: 69,40 per bed: 13.097,38
   Total : 2.475.404
   This hospital produces totally **3.723.566 kg CO^2 per year**

2. ***Hospital of 318.827 m² with 1062 beds***

CO^2 levels <u>gas</u> per year

per m²: 67,92 per bed: 20.392

Total: 21.655.860 kg CO^2

CO^2 levels <u>electricity</u> per year

per m²: 68,44 per bed: 20.546

Total: 21.820.205 kg CO^2

This hospital produces totally **43.476.165 kg CO^2 per year**

Conclusion: much is depending from building to building (energy-concepts, insulations, installations, types of hospitals and institutions, design,…).

Objectives, targets: practical examples:

Decrease of influence of CO^2 by using co-generation : produces own electricity and heat at the same time, so less CO^2-electricity and less CO^2 -heat .

We also can use other "alternative" energy sources (see above).

We can design energy kindly buildings….

May be we can start with our own buildings and try to reach a target like CO^2-decrease 10 or 20 % by combining different tools like renovation buildings, using alternative energy sources, efficient way of using energy, energy friendly ventilation, heat recuperation in ventilation, other combined heat/cold/electricity installations,….

Good starting point for this examination will be the checklist (IHS)

2. Energy-Checklist (from IHS)

   See in attachment (German, French and English version)

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