PowerBOX
www.powerboxbg.com

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Energy efficiency hybrid systems

Designed to revolutionize the energy industry

The energy reality

The trend in the energy sector is a permanent rise in energy prices and the increases for consumers. In Bulgaria, which relies heavily on conventional energy sources, the trend is no different. The relationship between the prices of these sources and energy bill becomes evident if we look at the price data for the energy balance of the country:

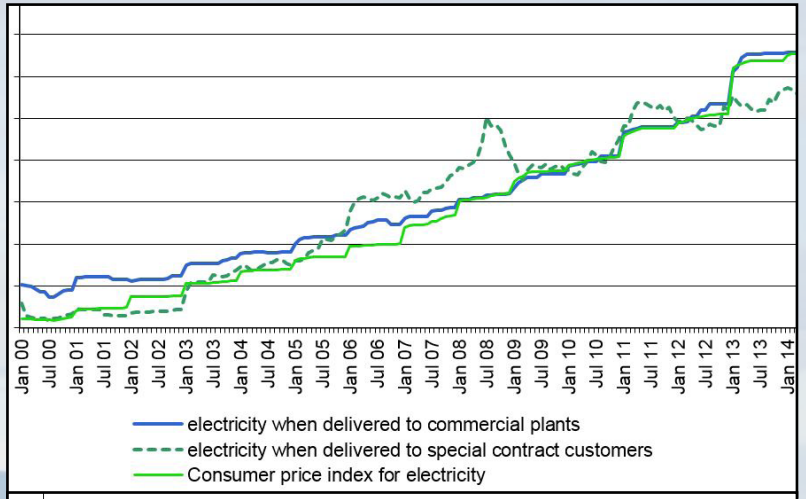
Bulgaria imports raw materials for the production and conversion of energy, and about two thirds of imported energy sources is used by plants to produce electricity and heat.

1. Producer price indices for electricity when delivered to commercial plants, special contract customers and customer price index for electricity.

2. Import price index for natural gas, producer price index for light heating oil, producer price index for natural gas when delivered to the industry and consumer price index for natural gas.

3.Consumer price for supergrade petrol, diesel fuel and light heating oil and import price indices of mineral oil.

1.



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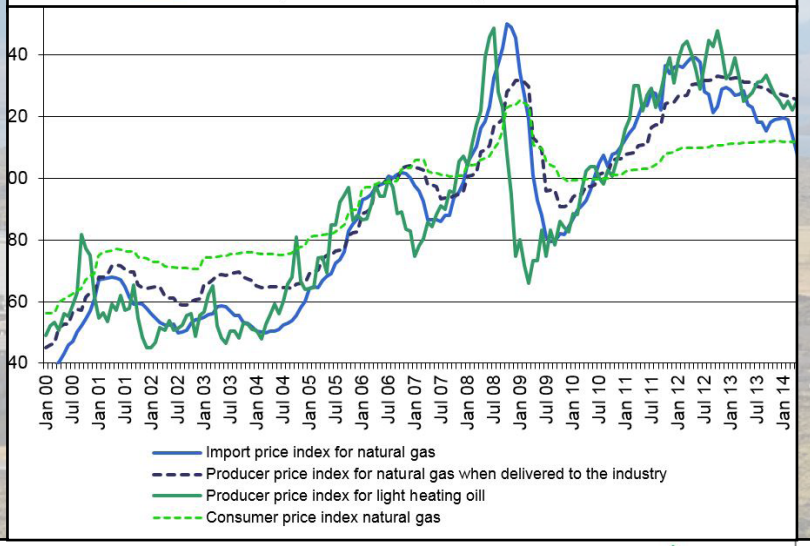

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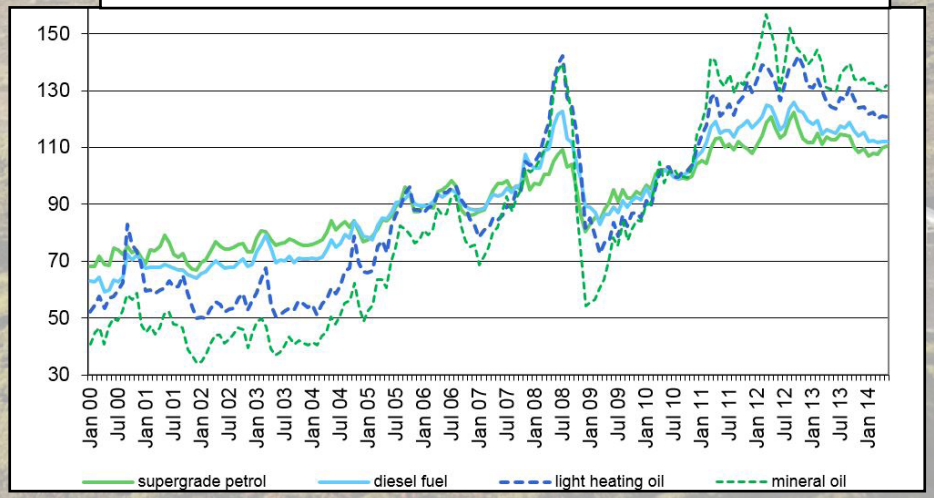


Sources by IEA(International energy agency)

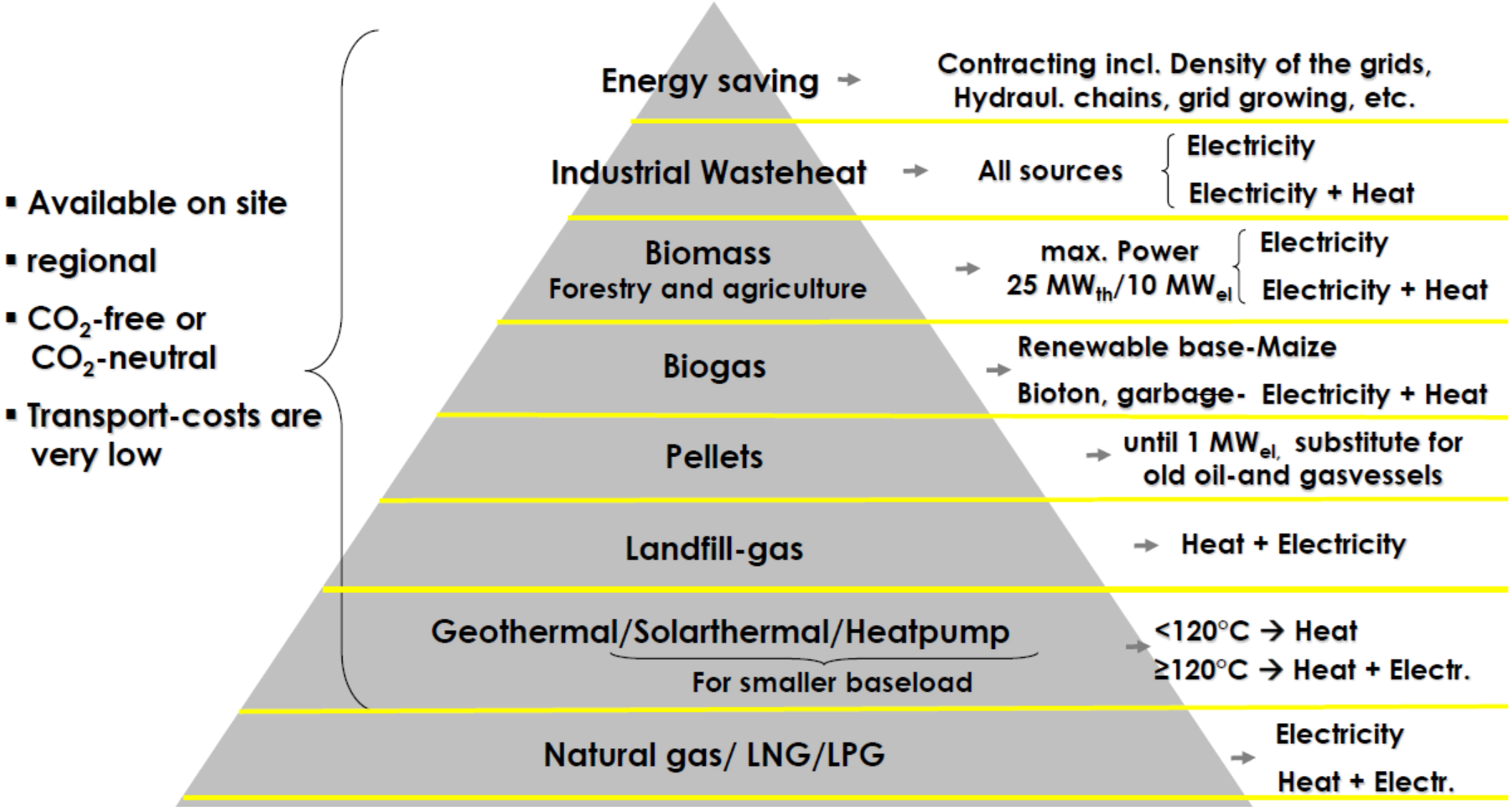
In comparative terms, the trend of increasing prices is not only European but rather global. The jump in energy prices is directly related to higher rates of exhaustible energy sources in the world: From year 2000 until now, the price of gas has doubled, coal has tripled and oil is four times more expensive.

Bulgaria is almost 100% depended on Russia, and the transport of energy carrier is expensive and risky. Siberian gas passes through all Russia, Ukraine, Romania and finally - Bulgaria.

Other influential factors to our bills are the “peak demand” or the peak consumption which concerns to the biggest amount of electricity consumed at any time throughout the network.

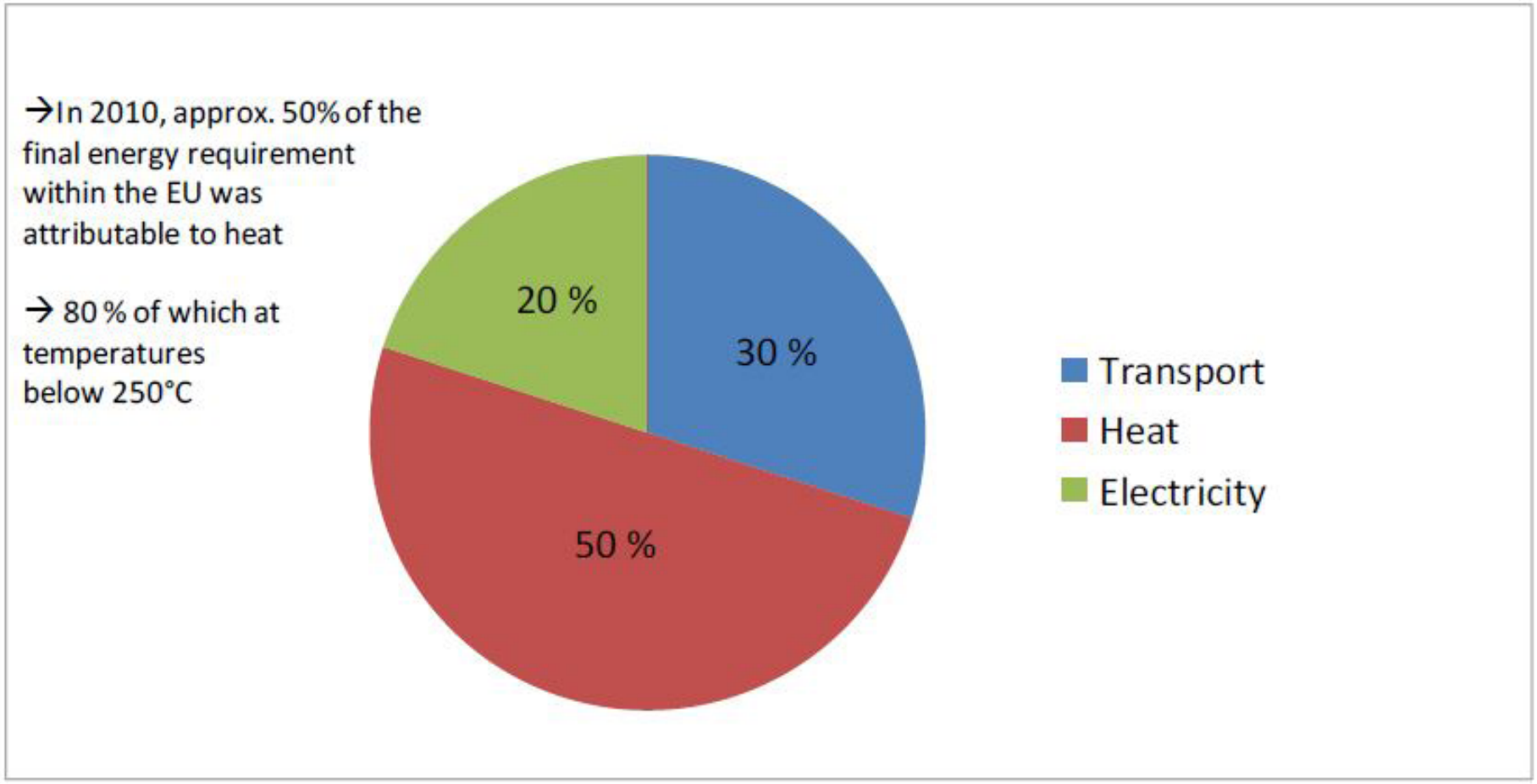
The heat loss, which in Bulgaria is about 50-60% is unacceptable.

Pyramid for conventional heating systems



The plants are permanent heat-guided, that means the plants are so dimensioned, that heat has priority 1 and electricity has priority 2.

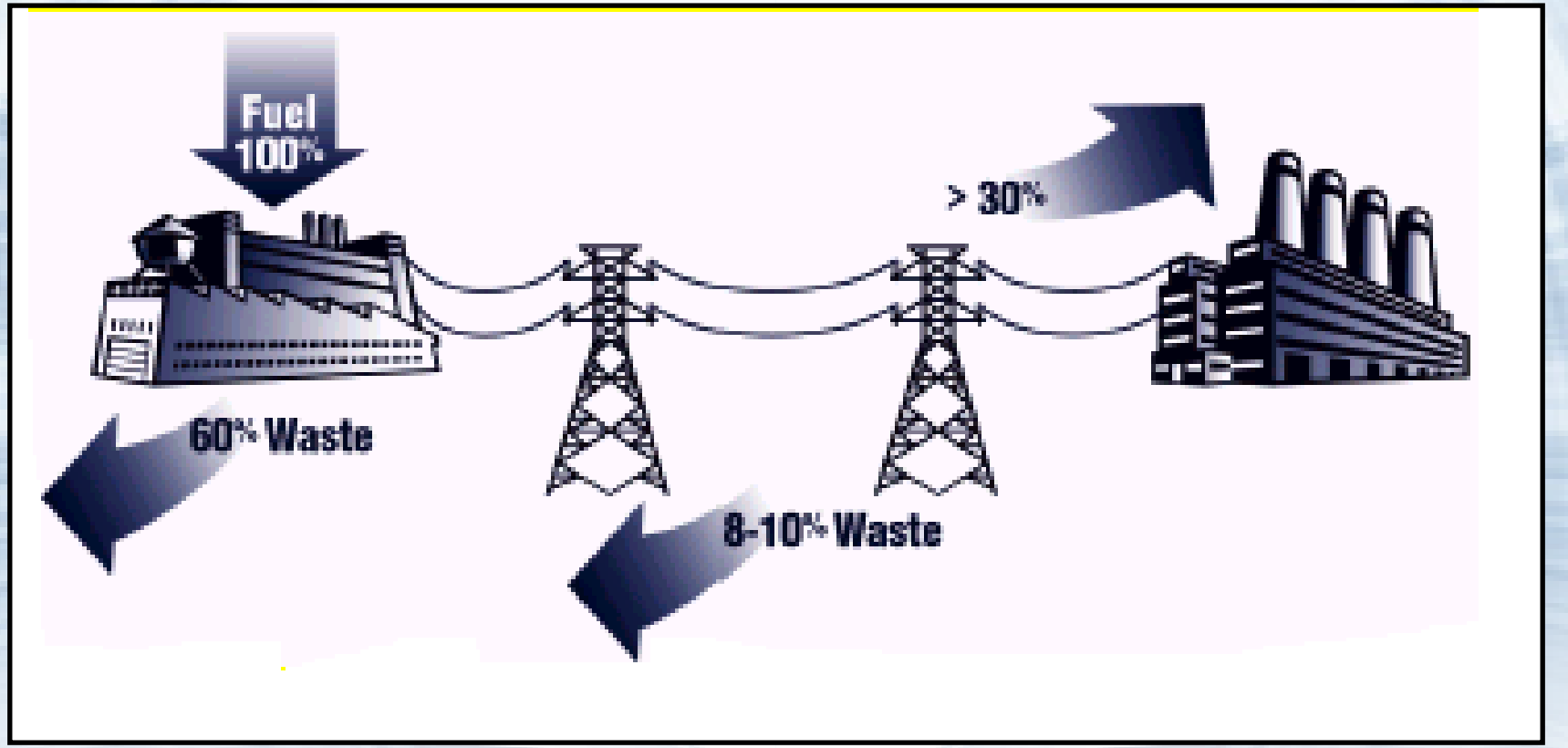
Energy requirements in the European Union



Critical opinion : We use oil-and gas burners to produce temperatures of nearly 1000 °C, but in our buildings we need only temperatures up to max. 75°C ☹
Therefore the future things are low based energy systems and energy saving in every step/phase ☺

40% loss of fuel in the generation and transmission of energy produced

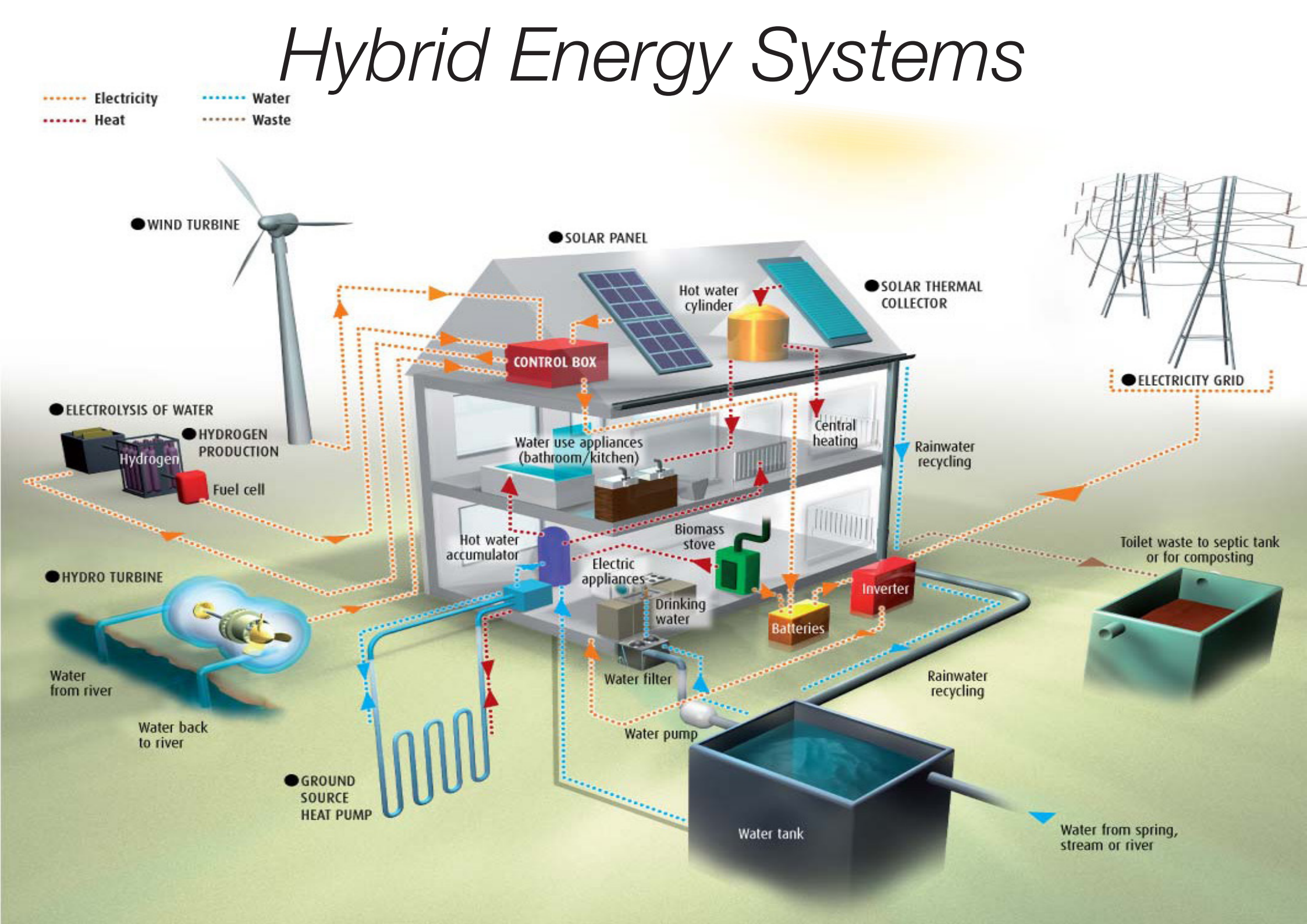
for the end user



About 40% of energy costs are actually charges to transport and access to the transmission and distribution network (including the losses). Almost the same amount of the bill is formed of the actually consumed energy, which includes, however, the profit of enterprises and the waste, due to mismanagement. Thus we come to the point, namely:

How to reduce our energy bills?

Hybrid Energy Systems



Reasons for heat and cold storage Energy Efficiency

We strive to find solutions to our customers, leading to a maximum optimization of the investment and energy resources, while at the same time being friendly to nature. Our solution is in cost reduction, by decentralizing and transforming systems with one energy source to:

Hybrid Energy Systems

The decision we offer to fulfill this goal is the integration of systems for energy storage. It allows us to transform each energy system using gas, diesel, etc.., As a primary energy source, to a system of the so-called hybrid type. It allows us the use of energy sources in their maximum volume and the use of other expensive energy source, only when necessary.

The higher efficiency of our systems is due to our new product.

powerbox

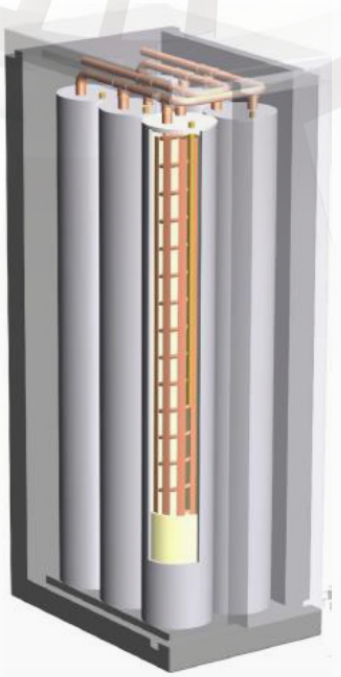
What is PowerBox ? ? ?

PowerBox is a new technology developed in Bulgaria in a team with foreign specialists in the heating sector. It is a system for energy storage, ideal for domestic, commercial and industrial installations. Combined with thermal solar panels, heat pumps, central heating and / or CHP units it can reduce your bills by at least 25% to reach, where possible to 50%.

It gives us security, reliability and independence of the supplied heat.

PowerBox stores excess heat generated in your heating system, while reducing the cycles of the boiler with 80%, i.e. the number of times which the boiler fires up.

Innovation is based on the change of the physical behavior of specific materials. When they change their physical state from solid to liquid, the intermediate phase is the melting point at which the system stores up to four times more energy than conventional water-based systems.



The latent heat storage is the core of the entire system.

Main functions

- Balancing peak demand;
- Minimising Primary energy costs with:
  - Solar Thermal use also for Heating and cooling
  - Possibility for Waste heat implementation
  - Reduction of peak-Loads
  - Reduction of Transmission losses
  - Reduction of supply losses
  - Raising of system stability
  - Constant operation and constant temperatures in the boiler flow
  - 4-times higher thermal capacity
- The efficiency of the usable energy of thermal solar heating can almost double;
- The dependence of the gas supplier can be reduced significantly;
- Optimization of energy distribution;

PowerBox will provide you with:

- Improved use of energy fuel;
- Increasing the energy gains higher return on investment, high efficiency;
- Reduces the temperature of the in-coming flow and reduces the basic cost;
- Long service life;
- Flexible solutions for installation;
- Reduce the loss of energy transfer with a minimum of 12%;

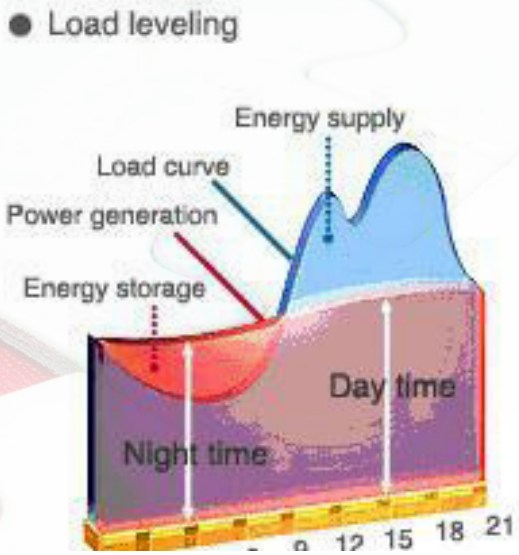
Balancing peak demand

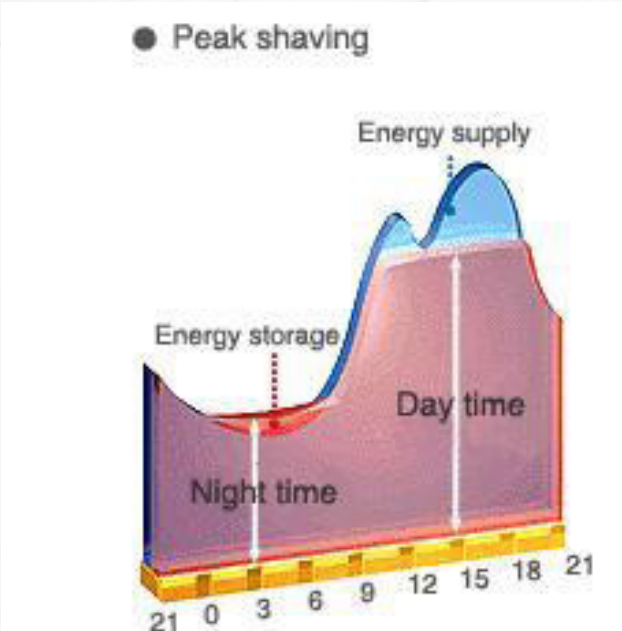
Balancing peak demand e extremely cost-effective method to reduce energy costs.
The reason for this is the ability to use night electricity, which is much cheaper (across Europe about 50%) of the day and peak.

Fully Storage

A full-storage strategy, also called load shifting, shifts the entire on-peak heating or cooling load to off-peak hours.

The system is typically designed to operate at full capacity during all non-peak hours to charge storage on design days. This strategy is most attractive where on-peak demand charges are high or the on-peak period is short.





Partial storage

In the partial-storage approach, the mechanical equipment runs to meet part of the peak period cooling load, and the remainder is met by drawing from storage.

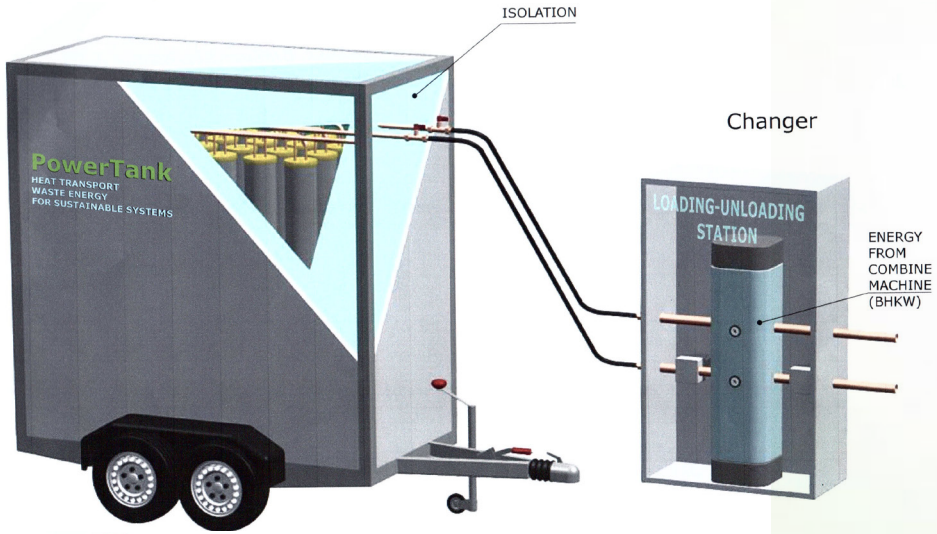
The equipment is sized at a smaller capacity than the design load. Partial storage systems may be run as load-leveling or demand-limiting operations.

Use and customer focus of latent heat storage cells

- **Blocks of flats and social residential construction**
- **Hotel trade,tourism and wellness sector**
- **Local/district heating systems**
- **Solar cooling**
- **Major commercial customers**
- **Small customers in the gas and oil segment**
- **Boiler exchange general -single-family homes/blocks of flats**
- **Process heat for industry**
- **Homes for the elderly**
- **Sports venues**
- **Wood drying**
- **Hospitals, private clinics**
- **Special applications -examples**
  - **Bakeries**
  - **All SMEs**
  - **Mobile applications**
  - **De-icing systems on bridges**
  - **Re-cooling in absorption refrigerating machines**

Mobile PowerBOX

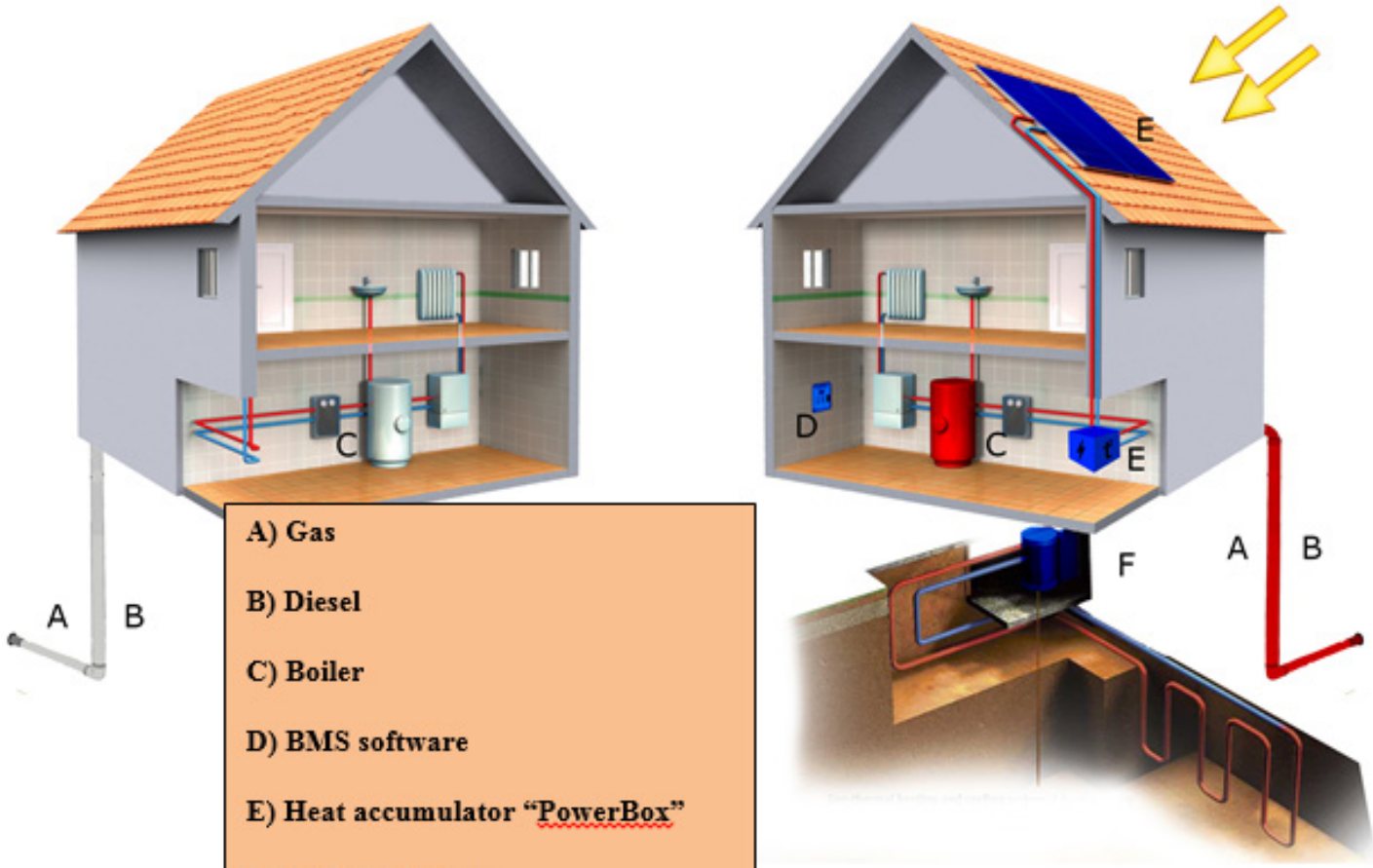
PowerTank



With the mobile version of PowerBox we offer a solution for multiple plants nearby that are able to be supplied with heat or to have the option to sell it, depending on its current needs.

PowerTank is our solutional development, which allows us to store heat from facilities that dont use it and throw it away and subsequently deliver it to a customer that could use it as intended.

Thus reducing heat loss from an entity / object , empowering our clients to benefit from PowerBox in its maximum capability.



A) Gas

B) Diesel

C) Boiler

D) BMS software

E) Heat accumulator “PowerBox”

E2) Thermo-panels

F) Heat-pump

From the show example it can be observed the operation of a conventional energy system, compared with the hybrid. In the first house the price of heat exceeds 100BGN / MWh, while the second case has lower than 40BGN / MWh. This results due to the collaboration between thermal sources: thermo-solar panels, heat pump and the latent storage energy system “Power Box”.

Usually 20% of the electricity bill of a site is hot water, 50% for heating and cooling and 30% are from energy consumers. The hybrid energy system can save between 20% and 50% of the total amount spent on electricity / gas / diesel.

Let us that you are a house conected to:

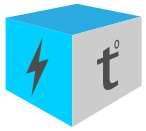
• **Sofia central heating**	78 lv/MWth
• **Gas utility**	130 lv/MWth
• **Pellets**	110 lv/MWth
• **Electricity**	150 lv/MWth

Hybrid System:

Heat Pump

+

Thermo-solar panels



PowerBox
Latent heat storage

1MW electricity converts 4MW heat

Electricity Liberalization night tariff 40 Lv/MW converts 10 Lv/MWt

Example I - Hotel - Energy Results

Project Proposal for improvisation of thermo-solar system

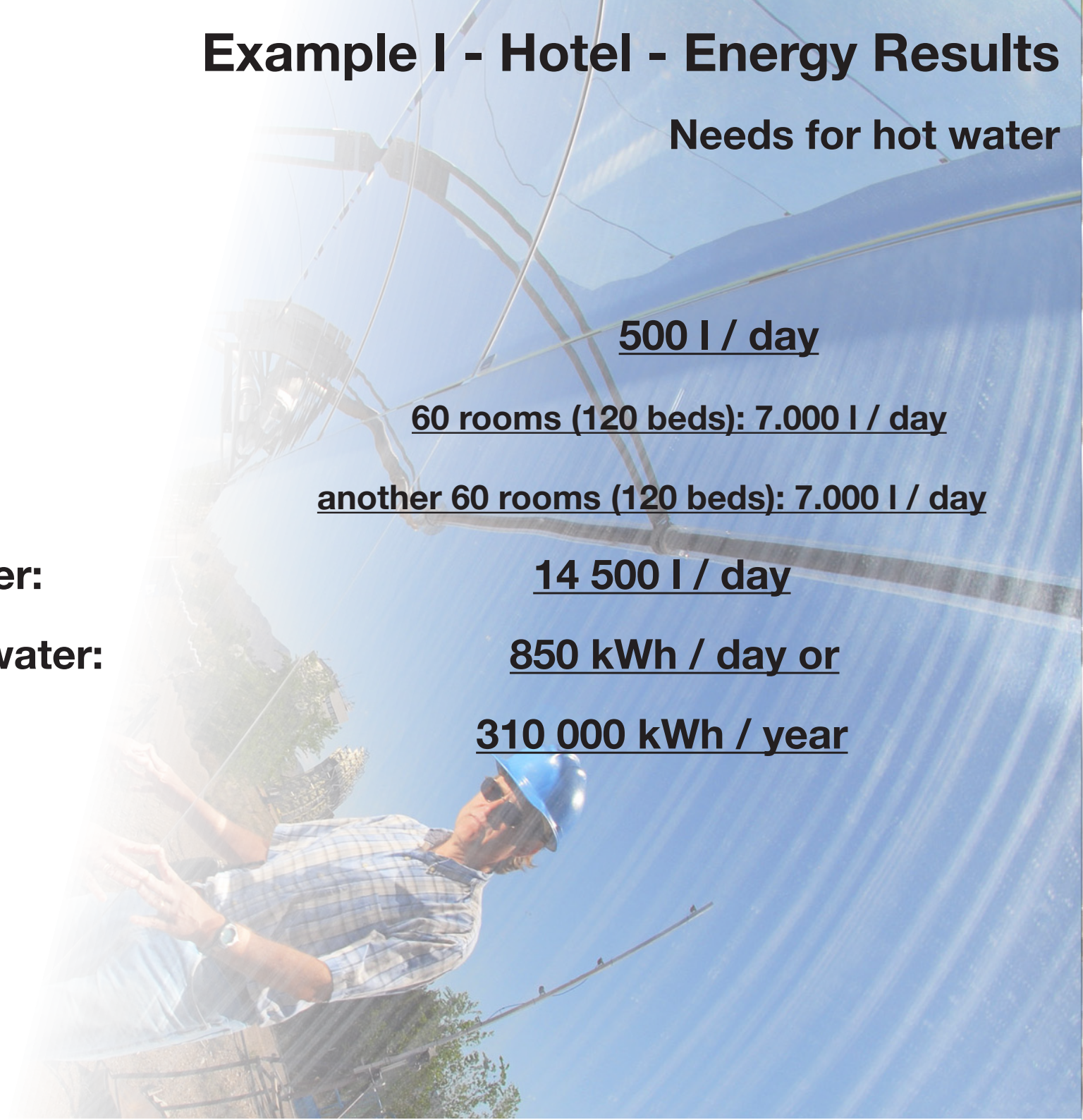
Data of building:

Phase 1:	60 rooms (120 beds), to be opened in 2014, equipped with individual electric powered AC Drives
Phase 2:	another 60 rooms (120 beds) to be opened in 2015
Current:	*10 000 Leva / month for gas*
Current gas needs:	*12,500 m ^{3} / month*
Price of gas	*800 Leva / 1.000 m ^{3}*

Example I - Hotel - Energy Results

Needs for hot water

Kitchen:	**500 l / day**
Phase 1:	**60 rooms (120 beds): 7.000 l / day**
Phase 2:	**another 60 rooms (120 beds): 7.000 l / day**
Total required hot water:	**14 500 l / day**
Heat demand for hot water:	**850 kWh / day or**
	310 000 kWh / year



Example I - Hotel - Energy Results

Production of water for other purposes

Step 1

- **Installation of 201 m ² Thermal solar collectors**

with a heat output of 140 kW

- **Installation of 22 cells PowerBox**
- **SEP-energy manager / UVR 1611**

Step 2

- **Installation of more 500 m ² thermal solar panels**
- **Installation of absorption chiller**

cooling capacity of 250 kW

- **Increase the system storage PowerBox 44 cells**

- **1,500 cooling hours per year - at full load**

Example I - Hotel - Energy Results

Photovoltaic panels

Step 3

Installation of photovoltaic panels

depending on the power required for the maintenance of the pumps, valves, and lighting system

- **Support of the ACM / Pumps / Valves / Lighting**

Details of the project:

- **Size of tank: 2 x 2000 liters.**
- **System size for storing latent heat:**

64 cells (approximately 12.000 liters buffer.)

Savings: 70 000 Euro per year

Total Investment: 140 000 Euro

ROI: 2 years

Example II - Hospital - Financial Results

Data of building:

Installed capacity -	1MW
Total area -	5000 m2
Ongoing -	25.000 Leva / month central heating (heating and cooling)
Annual consumption -	300.000 Leva / year central heating

Example II - Hospital - Financial Results

Solution

- Installation of 250 kW solar thermal collectors
- Installation of 250 kW heat output of the heat pump
- Installation of 150 cells PowerBox

Solution:

- **Monthly bills before - 25,000 lev / month**
- **Monthly savings - 7500 lev / month**
- **Annual consumption before - 300 000 lev / year**

Annual savings - 90 000 lev / year

Total utilization factor of the hospital 30%

Reconstruction of heating system

Details of the project:

House - for 2 families
Living area - 230 square meters
Fuel - diesel for heating
Burner - 34 kW
Consumption - 4500 l.

Reconstruction:

20.8 m2 solar collectors
16 cells PowerBox
400 l. Boiler for domestic use
SEP - monitoring system

Energy savings:

Improvement of the system by 46%
which leads to a saving of 2500. diesel fuel for heating

Waste heat from the bakery

Utilize me toplinatat steam through a heat ex-changer mounted on the stove.

Energy used is stored in the PowerBox and use of a residential building in the area.

Temperature storage cell:
60-67 C

Details of the project:

PowerBox 12 cells
14 m2 solar collectors
20 kW - steam

Consumption before reconstruction:
5700 l. Diesel fuel for heating.

Consumption following:
2750 l. Diesel fuel for heating

How does it work?

powerbox

ESCO ENERGY

Invesment for energy efficiency and upgrade the custom energy system

ESCO Contract for electricity/heat LED

20% Guaranty price reduction from energy expenditures

“PowerBox” - Security, reliability, independence!

Thank You!

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