МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ

Київський національний університет будівництва і архітектури

С.В. РУБЦОВА

ENGLISH FOR SPECIFIC PURPOSES: ENGLISH FOR CIVIL ENGINEERING

Рекомендовано вченою радою Київського національного університету будівництва і архітектури як навчальний посібник для студентів галузі знань 19 «Архітектура та будівництво» спеціальності 192 «Будівництво та цивільна інженерія»

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Навчальний посібник «English for Specific Purposes: English for Civil Engineering» призначений для студентів першого (бакалаврського) рівня спеціальності «Будівництво та цивільна інженерія», які вивчають фахову англійську мову, а також усіх, хто прагне вдосконалити англійську мову в межах цивільного будівництва.

Мета посібника – формувати англомовну лексичну компетентність студентів у професійно орієнтованому читанні (ПОЧ) з використанням автентичних матеріалів та візуалізіції навчальної інформації (ВНІ), вміння розширювати їхні технічні знання і формувати індивідуальну лексичну усвідомленість, формувати реальний словниковий запас (активний і пасивний) для рецептивних і репродуктивних видів мовленнєвої діяльності, розвивати інтелектуальні та компенсаторні вміння при читанні з подальшим формуванням англомовної комунікативної компетентності.

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ПЕРЕДМОВА

Навчальний посібник «English for Specific Purposes: English for Civil Engineering» призначений для студентів першого (бакалаврського) рівня спеціальності «Будівництво та цивільна інженерія», які вивчають фахову англійську мову; для фахівців галузі цивільного будівництва, які мають потребу використовувати англійську мову в практичній діяльності та бажають самостійно розвивати англомовні компетентності; а також усіх, хто прагне вдосконалити англійську мову в межах цивільного будівництва.

Мета посібника – формувати англомовну лексичну компетентність студентів у професійно орієнтованому читанні (ПОЧ) з використанням автентичних матеріалів та автентичної візуалізації навчальної інформації (ВНІ), поглиблювати їхні технічні знання і формувати індивідуальну лексичну усвідомленість, формувати реальний словниковий запас (активний і пасивний) для рецептивних і репродуктивних видів мовленнєвої діяльності, розвивати інтелектуальні та компенсаторні вміння при читанні з подальшим формуванням англомовної комунікативної компетентності.

Навчально–методичний посібник складається з чотирьох тематичних блоків: Heat balance of buildings; Passive building strategy; Heating, Ventilation and Air Conditioning (HVAC) systems; Top tips for an effective presentation і включає такі теми: Heat balance of buildings, The energy balance envelope, Heat losses and heat gains, Passive building strategy for commercial building, Passive house simply illustrated, Advanced building envelope, HVAC systems, Switch to energy–efficient technologies, Heat recovery ventilation, How can you make a good presentation even more effective.

У посібнику втілена методика формування англомовної лексичної компетентності у професійно орієнтованому активному читанні (ПОАЧ) в майбутніх інженерів галузі будівництва та цивільної інженерії з використанням автентичних матеріалів для читання і автентичної ВНІ.

PRE-TEXT EXERCISES:

UNIT 1. HEAT BALANCE OF BUILDINGS: 1.1.

Ex. 1. *Match English terms 1) – 6) with Ukrainian equivalents a) – f). Use Figure 1 and Table 1 below to find out the meanings of English equivalents graphically. Take into account that the colour of the font and the colour of the figure correspond to each other.*

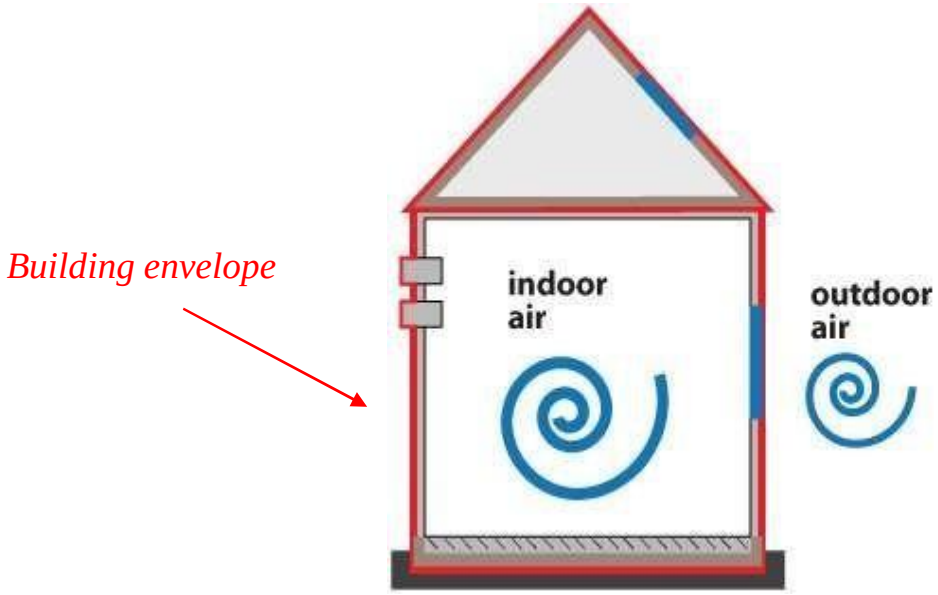


Figure 1. Heat transfer

Table 1

English terms and Ukrainian equivalents

English terms		*Ukrainian equivalents*	
1)	outdoor air	a)	внутрішнє повітря
2)	indoor air	b)	зовнішнє повітря
3)	building envelope	c)	теплопередача
4)	heat transfer/ht	d)	об’єм
5)	air exchange/air exchange rate	e)	огороджувальна конструкція
6)	volume	f)	повітрообмін

Ex.2 *Match English terms 1) – 5) with Ukrainian equivalents a) –* e). *Use Figure 2 and Table 2 below to find out the meanings of English equivalents graphically. Take into account that the colour of the font and the colour of the figure correspond to each other.*

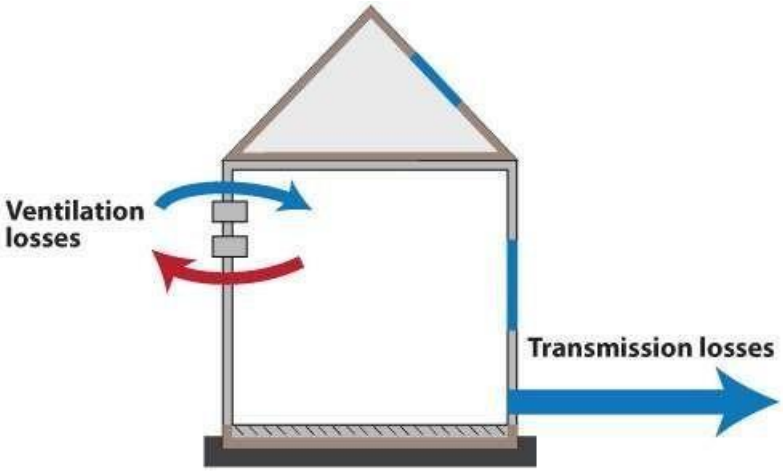


Figure 2. Heat losses

Table 2

English terms and Ukrainian equivalents

English terms	*Ukrainian equivalents*
1) Transmission losses LT	a) Тепловий баланс будівлі
2) Ventilation losses LV	b) Втрати тепла через вентиляцію
3) Heat balance of buildings	c) Втрати тепла через конструкції будівлі
4) Heat losses	d) Механічна вентиляція
5) Mechanical ventilation system	e) Втрати тепла

Ex.3 *Match English word combinations 1) – 6) with Ukrainian equivalents a) –* f). *Use Figure 3 and Table 3 below to find out the meanings of English equivalents graphically. Take into account that the colour of the font and the colour of the figure correspond to each other.*

Table 3

English terms and Ukrainian equivalents

English terms	*Ukrainian equivalents*
1) heat flows	a) об’єм
2) infiltration	b) теплова енергія/енергія, що йде на підігрів
3) exfiltration	c) опалювальний об’єм

4)	heated space	d)	теплові потоки
5)	heating energy	e)	інфільтрація/проникнення
6)	volume	f)	ексфільтрація/непроникнення

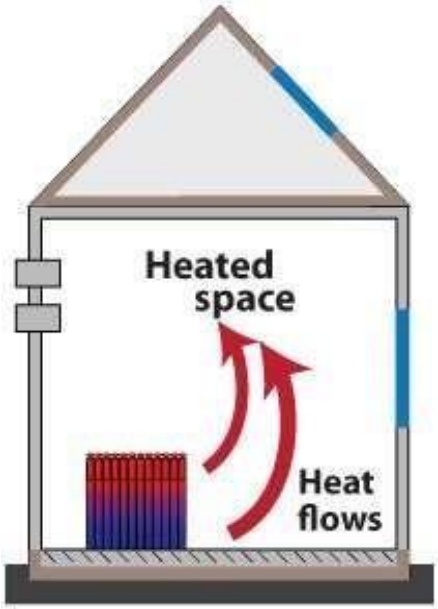


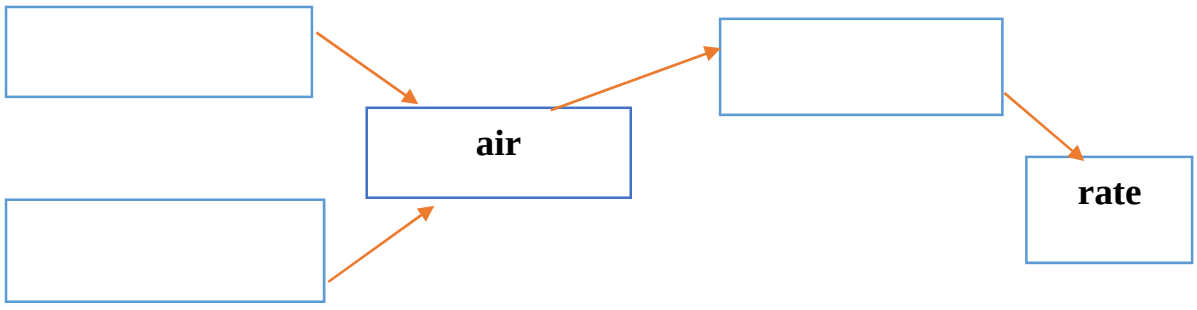
Figure 3. Heating

Ex.4 Choose the words in the box and match them with the word(s) in scheme structures (1 – 4) to make technical terms.

transfer, losses, balance, flows, outdoor, indoor, exchange, envelope, system, space, energy, ventilation, transmission, heat

1.

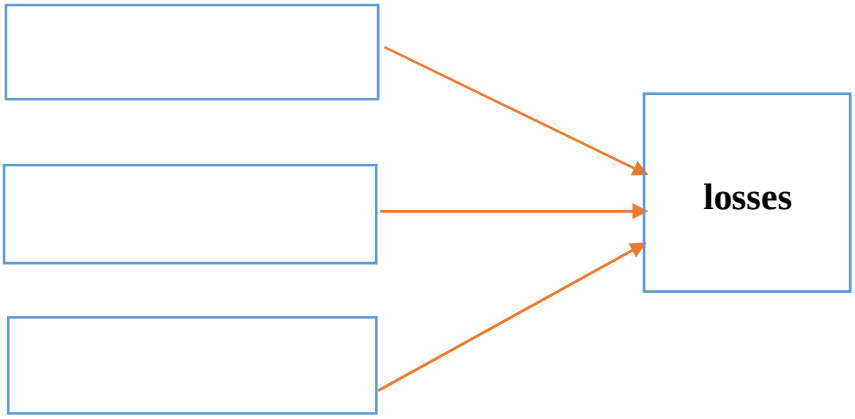
2.



3.

1.	building	
2.	ventilation	
3.	heated	
4.	heating	

4.



Ex.5 *Complete the following sentences using the word combinations from ex.4 The first and the last letters of each words are given.*

1. Room air can be exchanged through open windows or by a *m_ _ _ _ _ _ _ _ _ _ l v_ _ _ _ _ _ _ _ _ n s_____m*.

2. B_ _ _ _ _ _g e_ _ _ _ _ _e is the exterior shell of the building, including the external walls, windows, floor and roof.

3. Ventilation losses LV are caused by exchange of warm *i_ _ _ _ r a_r* with colder outdoor air.

4. T_ _ _ _ _ _ _ _ _ _n l_____s LT are those amounts of heat, which flow through the building envelope from inside to outside.

Ex.6 *Use Photo 1, 2 and Table 4 below to find out two meanings of the word "generation".*

generation

Photo 1, 2 Generation

Ex.7 *Use Photo 1, 2 and Table 3 below to find out two meanings of the word "generation".*

Table 4

Two meanings of the word "generation"

Word	*Definition*	*Ukrainian equivalents*	*Example*
generation	all of the people born and living at about the same time, regarded collectively	всі люди що народжені і живуть приблизно в один час	one of his generation's finest songwriters
	the production or creation of something	виробництво або створення чогось (особливо енергії)	methods of electricity generation

Ex.5 *Use Table 5 below to find out two Ukrainian equivalents of the word "generation".*

Table 5

	а) виробництво

Generation	*b)* продукція *c)* покоління *d)* сусіди

PRE-TEXT EXERCISES: UNIT 1. HEAT BALANCE OF BUILDINGS: 1.2.

Ex 1. *Match English word combinations 1) – 8) with Ukrainian equivalents a) – h). Use Figure 1 and Table 1 below to find out the meanings of English equivalents graphically. Take into account that the colour of the font and the colour of the figure correspond to each other.*

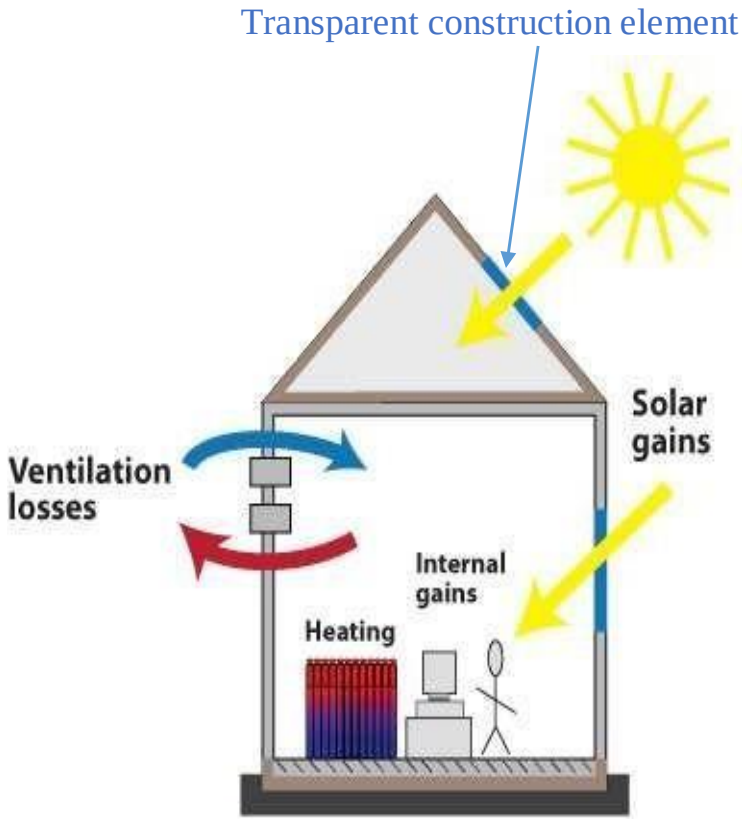


Figure 1. Gains

Table 1

English terms and Ukrainian equivalents

English terms	*Ukrainian equivalents*
1) solar gains	a) обігрів від сонця
2) gains/heat outputs	b) сонячні теплові надходження
3) heating	c) теплові надходження
4) internal gains	d) прозорий елемент конструкції
5) transparent construction element	e) внутрішні теплові надходження

6) translucent construction element	f) непрозорі конструкції
7) solar heating	g) опалення
8) opaque building envelope	h) напівпрозорий елемент конструкції

Ex 2. *Match English word combinations 1) – 6) with Ukrainian equivalents a) – f). Use Figure 2 and Table 2 below to find out the meanings of English equivalents graphically. Take into account that the colour of the font and the colour of the figure correspond to each other.*

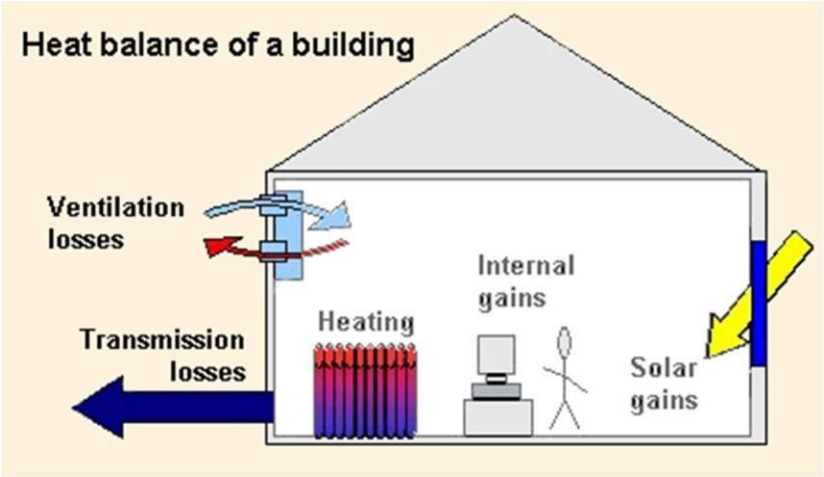


Figure2. The 5 elements of the heat balance of a building

$$H = L_T + L_V - F_U \cdot (G_S + G_I)$$

Table 2

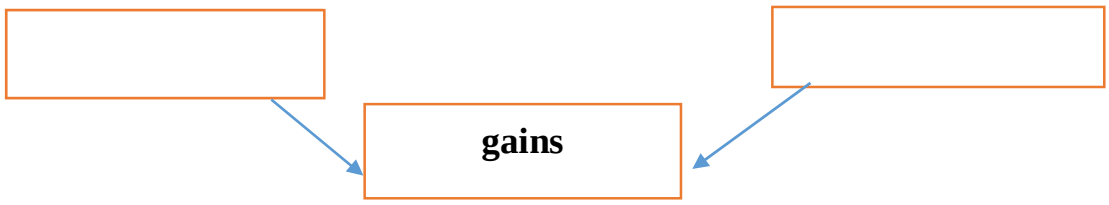
English terms and Ukrainian equivalents

1) Heating demand H	a) коефіцієнт одночасності
2) an utilisation factor FU	b) потреба на опалення
3) Ventilation losses LV	c) втрати тепла через конструкції будівлі
4) Transmission losses LT	d) внутрішні теплові надходження
5) Solar gains GS	e) втрати тепла через вентиляцію
6) Internal gains GI	f) сонячні теплові надходження

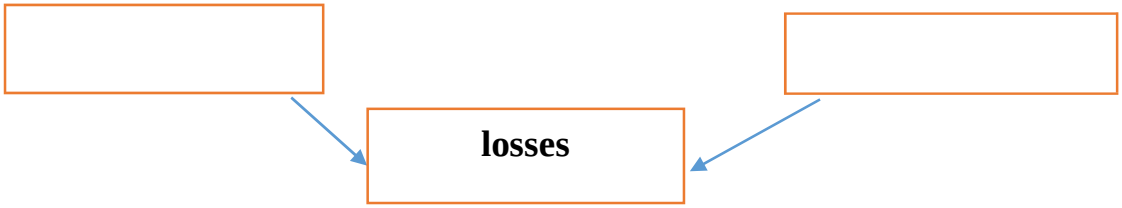
Ex 3. *Choose the words in the box and match them with the words or word combination in scheme structures (1 – 3) to make technical terms.*

translucent, ventilation, internal, transmission, solar, transparent, opaque

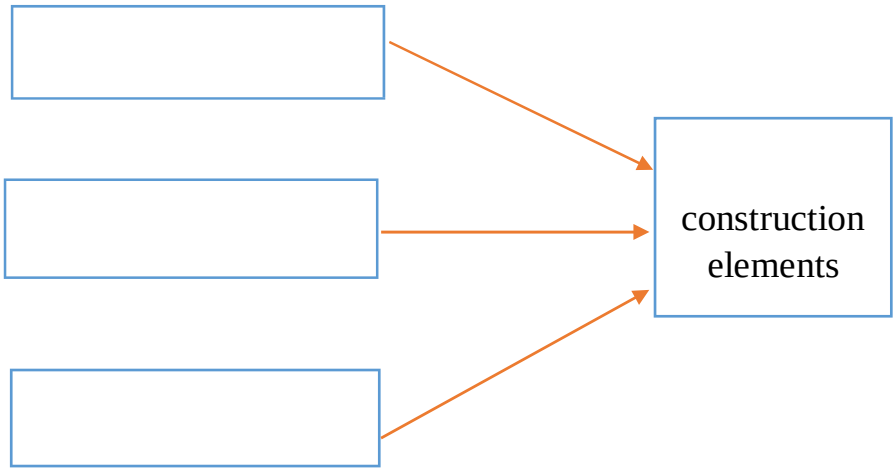
1.



2.



3.



Ex 4. *Complete the following sentences using the word combinations from Ex.3. The first and the last letters of each words are given.*

1. S_ _ _r g_ _ _s GS are irradiations of solar energy through windows and other transparent or translucent constructional elements.

2. I_ _ _ _ _ _l g_ _ _s GI are heat outputs from persons, appliances, computers and other electric devices, as well as from illumination.

3. V_ _ _ _ _ _ _ _ _n l_ _ _ _s LV are caused by exchange of warm indoor air with colder outdoor air.

4. T_ _ _ _ _ _ _ _ _ _n l____s LT are those amounts of heat, which flow through the building envelope from inside to outside by conduction or heat transfer, respectively.

5. To say that a material is t_ _ _ _ _ _ _ _ _t is to say that light may pass through that material, but images on the other side of that material are not clearly visible.

6. To say that a material is t_____t is to say that light passes through a material, and images on the other side of that material can be seen clearly as they truly appear.

Ex.5 *Use Photo 1, 2 and Table 3 below to find out two meanings of the word "*seal*".*

seal

Table3

Two meanings of the word “seal”

Word	*Definition*	*Ukrainian equivalents*	*Example*
seal	a device or substance that is used to join two things together so as to prevent them from coming apart or to prevent anything from passing between them	пристрій або речовина, яка використовується для з'єднання двох речей, щоб запобігти їх роз’єднанню або проникненню між ними чогось	the improvement in weather seals around doors and windows prevented fresh air from entering the building
	a fish-eating aquatic mammal with a streamlined body and feet developed as flippers, returning to land to breed or rest	водяний ссавець, що їсть рибу, з обтічним тілом і стопами, розвиненими як ласти, який повертається на сушу для розмноження чи відпочинку	we could see seals on the rocks, basking in the sun

Ex.6 *Use Table 4 below to find out two Ukrainian equivalents of the word “*seal*”.*

Table 4

seal	a) тюлень b) алігатор c) рідина d) ущільнювач

Ex.7 *Use Table 4 below to find out two Ukrainian equivalents of the words “generation” and “*seal*”.*

Table 5

seal	a) тюлень b) алігатор c) рідина d) ущільнювач

generation	e) виробництво f) продукція g) покоління h) сусіди

TEXTS: UNIT 1. HEAT BALANCE OF BUILDINGS

Text 1. **Heat balance of buildings**

Task 1. *Before you begin to read the text "Heat balance of buildings", list details in the first two columns.*

1	2
What I Know about the topic "**Heat balance of buildings**"? *Write all information you know in the form of words, word combinations, sentences.*	**What I expect to know** after reading the text. *Write all information in the form of questions.*

Task 2. *Skim the text "Heat balance of buildings". Add the important terms and terms combination words in the first column. Write additional questions in the second column.*

Tips for skimming:

Read the first sentence of every paragraph

Read any headings and sub-headings

Notice any figures, charts, or graphs

Notice any italicized or boldface words or phrases

Text **Heat balance of buildings**

The heat balance of a building includes all sources and sinks of energy inside a building, as well as all energy flows through its *envelope*. This envelope encloses the *volume* which is kept above a set temperature (in general 20 ºC) for all weather conditions by the use of *heating energy*. The extend of all *heat flows*, which do hereby occur, is either dependent on external or internal influence factors (weather, user). These *heat flows* can be arranged into five categories:

(1) **Transmission losses LT** are those amounts of heat, which flow through the *building envelope* from inside to outside by conduction or *heat transfer*, respectively.

(2) **Ventilation losses LV** are caused by *exchange of warm indoor air with colder outdoor air*. The user independent *air exchange* is through joints by *infiltration* or *exfiltration*, respectively. In addition, room air can be exchanged through open windows or by a *mechanical ventilation system*. Ventilation is

indispensable, up to a certain extend, to assure the hygienically necessary *air exchange rate*.

(3) **Solar gains GS** are irradiations of *solar energy* through windows and other *transparent or translucent constructional elements*. Also added to the solar gains, is that part of the *solar heating* of the *opaque building envelope*, from which the indoor area benefits.

(4) **Internal gains GI** are *heat outputs* from persons, appliances, computers and other electric devices, as well as from illumination.

(5) **Heating demand H** is exactly that amount of energy, which is necessary to maintain the desired room temperature by compensating the *excess of losses* (1 and 2) compared to the gains (3 and 4).

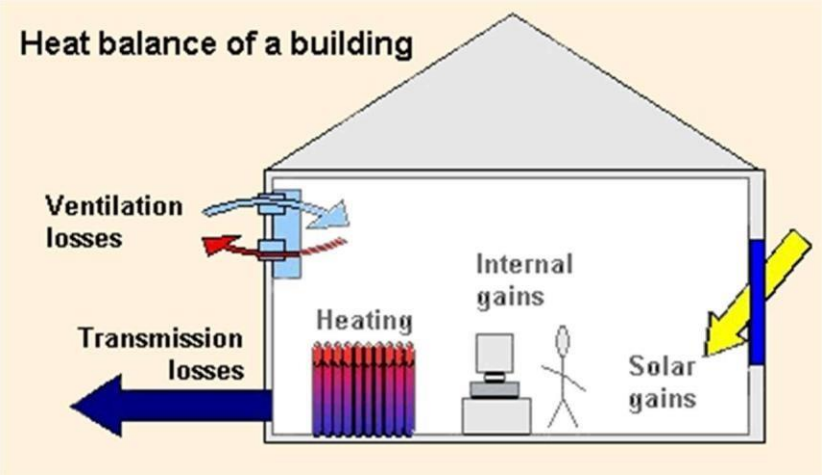


Figure 1. The 5 elements of the heat balance of a building.

Figure 1 shows a diagram of these elements of the *heat balance*. The gains and losses are specified for a certain period of time (e.g. one year). Division of this value by the corresponding area of *heated space* in m2, gives all *heat flows* (1 to 5) in the usual unit for the (floor space) specific *energy demand for heating*: kWh/(m²·a). The allocation of the transmission and ventilation to *gains or losses* depends, strictly speaking, on whether the outdoor temperature is higher or lower than the *room temperature*. If the gains exceed the losses for a longer period of time, the desired indoor temperature would be overstepped. Instead of *heating*, *cooling* would be necessary for the balance. This case occurs in summer and is treated separately. In northern and middle European climates, in general, the winter case is considered. However, it can happen in winter, but especially in the *intermediate times* (autumn, spring), that the set temperature is sporadically exceeded by high solar or internal gains. The total monthly internal and solar gains are, however, not to 100% effective for heating. Therefore, they are rated with *an*

utilisation factor FU < 1. Typical values for the yearly mean value are in the range FU ≈ 0.5 to FU ≈ 0.9, depending on the *heating energy demand* and the kind of construction. For an extended period of time (several months, heating period) the changes of the stored energy in the building mass, indicated by the mean building temperature, are negligible, and the energy balance is:

$$H = L_T + L_V - F_U \cdot (G_S + G_I)$$

This means, the *heating energy* corresponds to the sum of the losses, reduced by the utilised part of the gains. Figure 2 shows 1 examples for a heat balance. The example for the building stock (20s to 80s of the last century) has an energy demand for heating of 284 kWh/(m²·a). The example of a *low energy house* (see below) with *high insulation standard* and *ventilation system with heat recovery* has the *heating energy demand* of only 66 kWh/(m²·a).

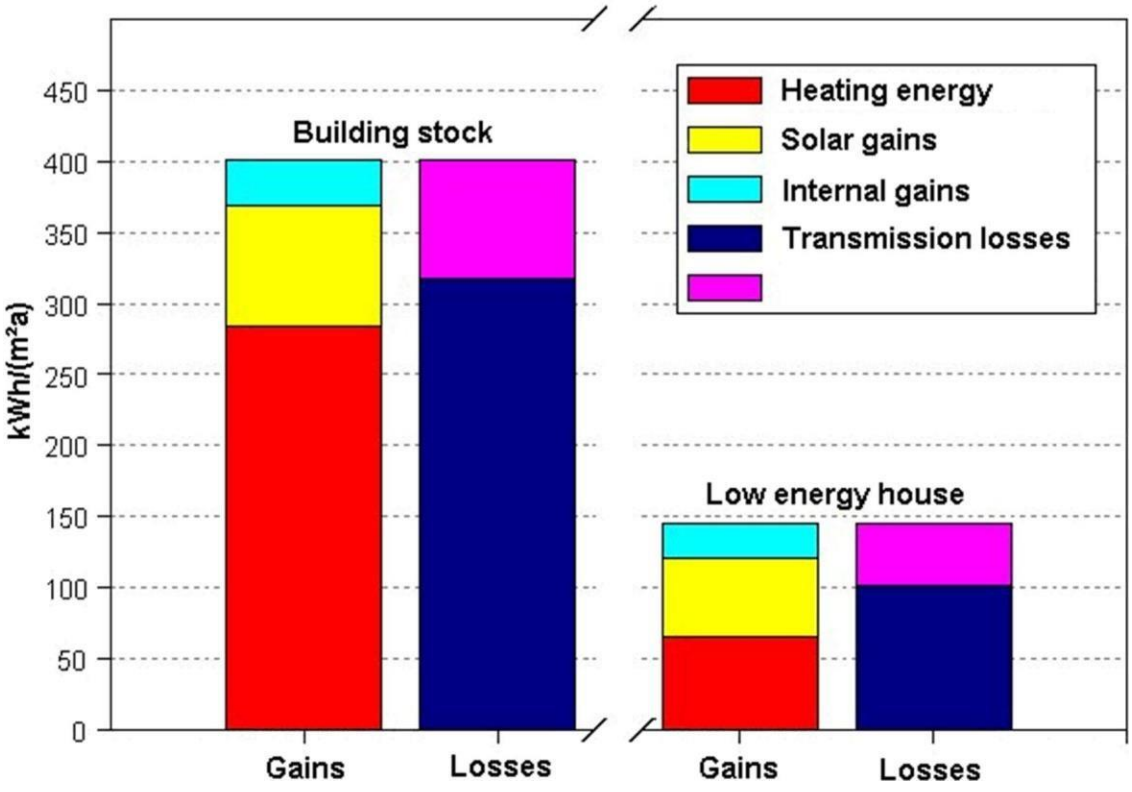


Figure 2. Two examples of a heat balance (for Germany). On the left, a typical balance for the average building stock. On the right, the balance of a low energy building.

Task 3. *Read the text "Heat balance of buildings". Find the answers to the questions from the second column and write them in the third column in the*

form of sentences. Write all the questions you have not answered in the fourth column.

3	4
What I Learned. *Write the answers to the questions from the second column. Write all information that you can find in the text "Heat balance of buildings" in the form of sentences.*	**Met expectations** *Write all the questions you have not answered.*

Task 4. *Find the answers to the questions from the fourth column and use this information for the individual work. Use additional information resources.*

Text 2. **The energy balance envelope**

Task 1. *Before you begin to read the text "*The energy balance envelope*", list details in the first two columns.*

1	2
What I Know about the topic "**The energy balance envelope**"? *Write all information you know in the form of words, word combinations, sentences.*	**What I expect to know** after reading the text. *Write all information in the form of questions.*

Task 2. *Skim the text "*The energy balance envelope*". Add the important terms and terms combination words in the first column. Write additional questions in the second column.*

Tips for skimming:

Read the first sentence of every paragraph

Read any headings and sub-headings

Notice any figures, charts, or graphs

Notice any italicized or boldface words or phrases

Text. **The energy balance envelope**

Energy is always conserved - it is never lost. However, energy can leave a certain area, resulting in **"energy losses"** for this specific area.

Consequently, energy balances can only be prepared for restricted spatial areas with clearly defined boundaries. These boundaries are called the **envelope**.

In the case of heating or cooling, the area of interest is the "heated or cooled space" or more precisely: it includes all areas in a building in which comfortable thermal conditions should prevail. It is usually convenient to include all "passively heated" areas in the balance, if the balance envelope is simplified in this way. Generally, the choice of the balance envelope is seen primarily in pragmatic terms: for a building it is particularly convenient to opt for the balance limit on the outside of the thermally insulated external building components (Figure 3).

The purpose of heating or cooling is to keep the temperature comfortable, i.e. constant, inside the building being considered (see Discussion about the purpose of heating).

Figure 3. It is convenient, to define the envelope for energy balances of a building at the external surface of the insulation.

Discussion about the purpose of heating. Does the purpose of heating really consist of keeping the temperature of a building constant? Although that is a simplification, it does describe the function of heating quite well, especially for a high quality building envelope.

This question is discussed under various aspects:

1. Why should some areas inside the building envelope be passively heated along with the rest of the building, although heating is not required there?

The fact is that if "unheated areas" inside a building are included in the thermal envelope, this saves construction costs as well as energy costs – whenever the envelope thus formed has a reduced surface area.

2. Isn't it better for health, if the temperatures change during the course of the day and vary between different rooms?

We cite Ole Fanger (taken from "Thermal Comfort"): *"It is a well known fact that the internal body temperature has a daily rhythm with a maximum occuring some time before sleeping and a minimum occuring some time before awaking (...)However, Nevins found no difference in optimal temperatures between experiments performed in the afternoon and those performed in the evening, an observation which has been confirmed in the present study <Fanger>... If any influence of daily rhythm on comfort conditions exists it is probably so small as to be of no practical significance."*

3. Doesn't a night (or weekend) set-back save energy?

Of course it does. But the savings in well-insulated buildings are not very high.

The issue of temperature differentiation is dealt with in Protocol Volume No. 25 of the Working Group Cost-efficient Passive Houses (in German only).

There are often critical remarks about the the calculation method too:

4.Can (stationary) U-values be used in calculations at all? Isn't the heat storage more important than the thermal insulation, and isn't the whole U-value calculation method incorrect?

No, the U-value calculation method is the correct approach as has been shown by many systematic analyses (see Insulation vs. thermal mass). The comparison of the energy balance after the calculation and after the measurement additionally proves this.

Task 3. *Read the text "The energy balance envelope". Find the answers to the questions from the second column and write them in the third column in the form of sentences. Write all the questions you have not answered in the fourth column.*

3	4

What I Learned. *Write the answers to the questions from the second column. Write all information that you can find in the text "*The energy balance envelope*" in the form of sentences.*	**Met expectations** *Write all the questions you have not answered.*

Task 4. *Find the answers to the questions from the fourth column and use this information for the individual work. Use additional information resources.*

Text 3. **Heat losses and heat gains**

Task 1. *Before you begin to read the text "*Heat losses and heat gains*", list details in the first two columns.*

1	2
What I Know about the topic "**Heat losses and heat gains**"? *Write all information you know in the form of words, word combinations, sentences.*	**What I expect to know** after reading the text. *Write all information in the form of questions.*

Task 2. *Skim the text "Heat losses and heat gains". Add the important terms and terms combination words in the first column. Write additional questions in the second column.*

Tips for skimming:

Read the first sentence of every paragraph

Read any headings and sub-headings

Notice any figures, charts, or graphs

Notice any italicized or boldface words or phrases

Text. **Heat losses and heat gains**

Let us look at a heat flow which travels out of the balance area through the envelope, e.g. warm air which escapes through a window. At first such a heat loss would reduce the energy in the balance area; this would mean that the temperature

in the building is sinking. However, this is exactly what should be prevented in order to maintain living comfort. Therefore, the energy flowing out has to be replaced: another heat flow must travel from the outside towards the inside in order to keep the temperature constant (Figure 4).

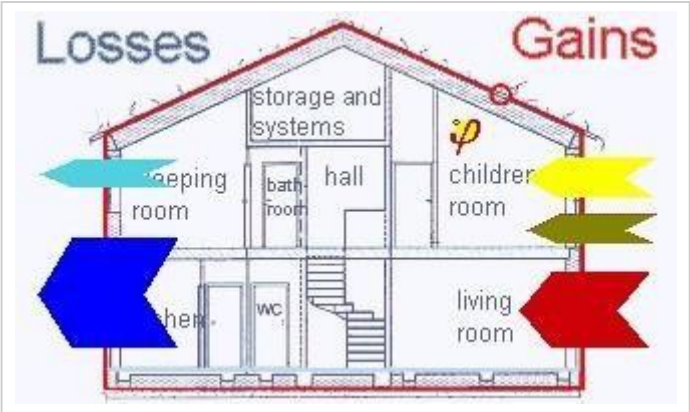


Figure 4. Heat losses (transmisson and ventilation losses) exit the building through the envelope. Heat gains enter the building through the same envelope. Using the law of energy conservation, the sum of the gains equals the sum of the losses as long as the internal energy does not change.

An important note at this point: **The necessity for supplying heat arises only due to heat losses**. Because of the conservation of energy, the house itself remains warm - as long as it doesn't lose any heat. Unfortunately, the mechanisms by which systems having a higher temperature transfer heat to a cooler environment, are various and very effective. If the warmer system is not deliberately isolated ("thermally insulated"), much heat is automatically lost through conduction, convection and heat radiation to the colder surroundings.

"Heating" therefore, is only a replacement of this heat loss and can therefore be reduced as required by more effective prevention of losses.

Fortunately, there are also **flows of free "heat gains"**: e.g. solar radiation entering through windows (so called **passive solar energy**) and the energy which enters the house through the electricity supply and is converted to the so-called **"internal heat sources"**. These also include the body heat of the persons present in the house. This energy is also transferred through the envelope into the house – when people enter the building or when food is brought into the house.

It is easy to prepare the energy balance based on the simplified conditions described here:

The sum of the heat losses is equal to the sum of the heat gains.

As the heat losses can be easily and relatively acurately calculated (they depend to a considerable extent on the insulation), and the internal heat sources as well as the passively utilised solar energy can be estimated well enough, it is possible to calculate the remaining heat supply required (the heating demand) using the energy balance.

There's just a little problem: **the amount of excessive solar gains**: this is the portion of the free heat which cannot be utilised and needs to be ascertained accurately. With a little effort, this problem can be solved by using **simulation programmes** (see Dynamic simulation of a building's thermal performance), which can determine energy balances at short time intervals. Fortunately, there are some well-validated **simplified formulas** available for this today which can be found, for example, in the European Norm EN 832 (now classified internationally as ISO13790). For practical purposes, we have integrated these in the **"Passive House Planning Package"** (see PHPP – Passive House Planning Package).

Task 3. *Read the text "Heat losses and heat gains". Find the answers to the questions from the second column and write them in the third column in the form of sentences. Write all the questions you have not answered in the fourth column.*

3	4
What I Learned. *Write the answers to the questions from the second column. Write all information that you can find in the text "*Heat losses and heat gains*" in the form of sentences.*	**Met expectations** *Write all the questions you have not answered.*

Task 4. *Find the answers to the questions from the fourth column and use this information for the individual work. Use additional information resources.*

AFTER-READING ACTIVITIES:
UNIT 1. HEAT BALANCE OF BUILDINGS

I. Listen and watch the video on the topic "Heat balance of buildings". Write down all terms and terms combination words you have heard.

II. Compare the following data, make the necessary calculations, and find out the reasonable decisions for the assigned tasks. Use Figure 1 and Figure 2 below to find out the meanings of English equivalents and data graphically:

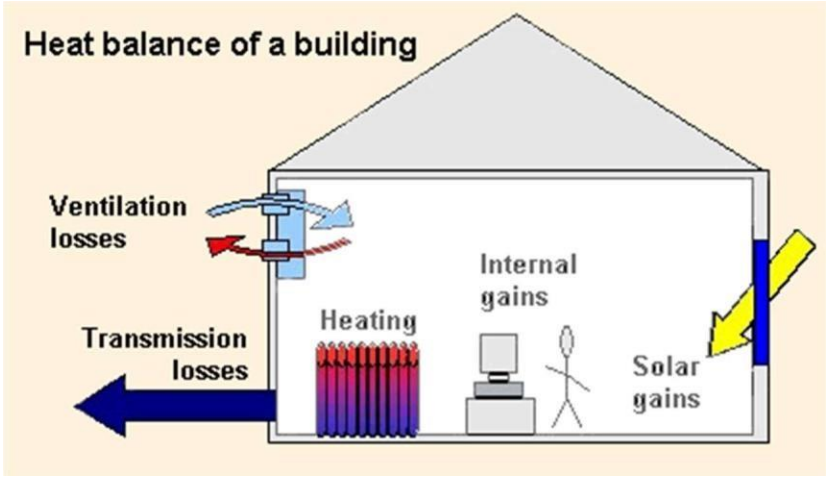


Figure 1: The 5 elements of the heat balance of a building

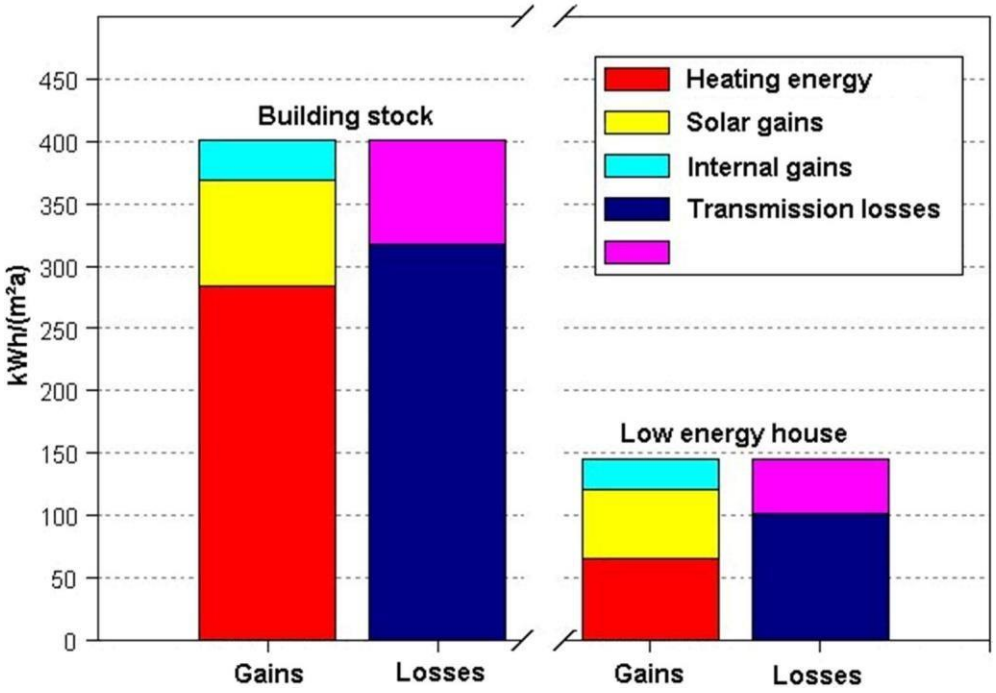


Figure 2: Two examples of a heat balance (for Germany). On the left, a typical balance for the average building stock. On the right, the balance of a low energy building.

1. The amount of these kinds of losses for a low energy house are 100 kWh/(m²·a). Choose the appropriate kinds of losses a), b) or c). Use Figure2: Two examples of a heat balance (for Germany).

a) Ventilation losses LV
b) Transmission losses LT
c) Solar gains + Internal gains

2. Count the sum of the losses for a low energy house. Choose an appropriate formula for the calculation a), b) or c). Use Figure 2: Two examples of a heat balance (for Germany).

a) LT+LV =
b) GS+GI =
c) LT+LV- FU(*GS+GI) =*

3 . Write the amounts of all possible gains for the average building stock. Use Figure 2: Two examples of a heat balance (for Germany).

_____

_____

_____

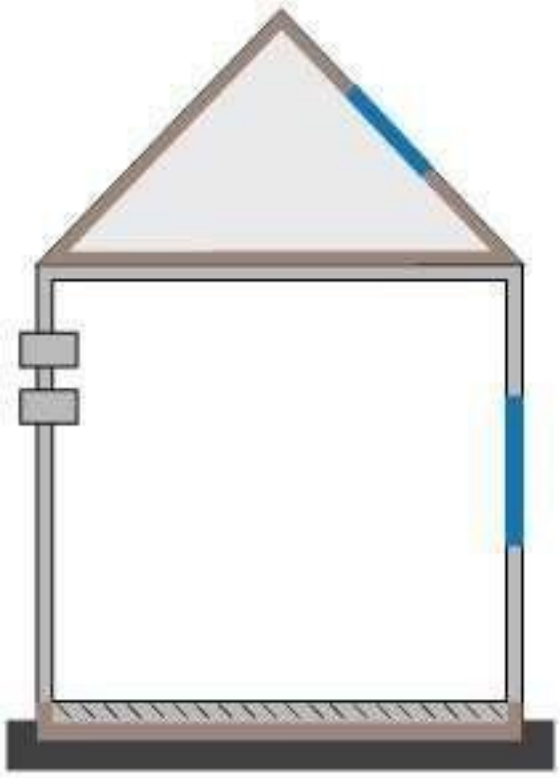
_____

_____

4. Draw at the figure below:

a) the losses caused by exchange of warm indoor air with colder outdoor air;

b) gains through windows and other transparent or translucent constructional elements.



5. Find in the text five categories of heat flows. Use Figure 1: The 5 elements of the heat balance of a building

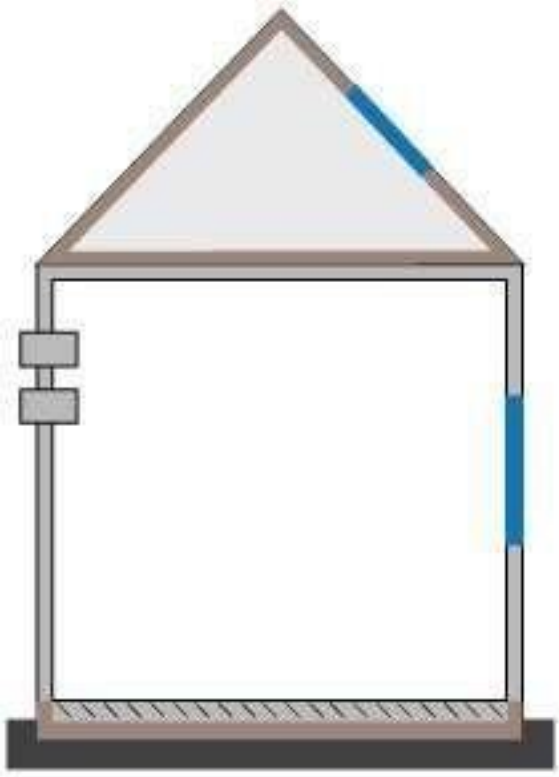
1. _____
2. _____
3. _____

4. _____
5. _____

6. Draw at the figure below:

a) losses are caused by the amounts of heat, which flow through the building envelope from inside to outside;

b) gains from people, appliances, computers and other electric devices.



7. Compare the following data of a typical balance for the average building stock and the balance of a low energy building. Then make notes and express your opinion. Use Figure 2 above and Table1 below.

Table1

Model of expressing opinion in a discussion	*Useful phrases for discussion*
Main idea: What is your opinion on that? /What do you think?	In my opinion, …/ I think…
Why do you think so? Support 1	Next, … For example, …

Support 2 Support 3	Last of all, … After all, …

TESTS: UNIT 1. HEAT BALANCE OF BUILDINGS

I. *Match the Ukrainian words and phrases with their English equivalents:*

1. heating(*n)* 2. building envelope (*n)* 3. heat transfer/ht (*n)* 4. air exchange/air exchange rate (*n)* 5. cooling (*n)* 6. heat losses (*n)* 7. mechanical ventilation system (*n)* 8. heat flows (*n)* 9. infiltration (*n)* 10.exfiltration (*n)* 11. heated space (*n)* 12. heating energy (*n)* 13.volume (n*)* 14. building (n*)* 15. gains (*n)* 16. ventilation (n*)* 17. construction element (*n)* 18.losses(*n)* 19. ventilation system (n*)* 20. air flows (n*)*	a) елемент конструкції b) втрати c) повітрообмін d) огороджувальна конструкція e) теплопередача f) охолодження g) втрати тепла h) опалювальний об'єм i) опалення j) механічна вентиляція k) теплові потоки l) інфільтрація/проникнення m) ексфільтрація/непроникнення n) теплова енергія/енергія, що йде на підігрів o) об'єм p) будівля q) надходження r) повітряні потоки s) вентиляція t) вентиляційна система

v – verb (дієслово)
n – noun (іменник)
adv –adverb (прислівник)

II. *Match the Ukrainian words and phrases with their English equivalents:*

1. heat balance of building	a) потреба на опалення
2. heat gains/heat outputs	b) охолоджуваний об’єм

3. cooled space 4. transparent construction element 5. translucent construction element 6. solar heating 7. opaque building envelope 8. heating demand H 9. utilisation factor FU 10. ventilation losses LV 11. transmission losses LT 12. solar gains GS 13. internal gains GI 14. outdoor air 15. indoor air	c) тепловий баланс будівлі d) теплові надходження e) коефіцієнт одночасності f) прозорий елемент конструкції g) напівпрозорий елемент конструкції h) обігрів від сонця i) непрозорі конструкції j) втрати тепла через конструкції будівлі k) сонячні теплові надходження l) зовнішнє повітря m) внутрішні теплові надходження n) втрати тепла через вентиляцію o) внутрішнє повітря

III. *Complete the following sentences using the correct answer: a,b or c.*

1. _____is the exterior shell of the building, including the external walls, windows, floor and roof.

a. Building envelope
b. Heat recovery
c. Cooling

2. _____are those amounts of heat, which flow through the building envelope from inside to outside.

a. Solar gains GS
b. Transmission losses LT
c. Internal gains GI

3. Room air can be exchanged through open windows or by a (an) _____.

a. utilisation factor FU
b. mechanical ventilation system
c. set temperature

IV. *Read the paragraphs below. Choose the most appropriate variant: a,b or c to complete the following sentences.*

1. Instead of heating, cooling would be necessary for the balance. This case occurs in summer and is treated separately. In northern and middle European climates, in general, the winter case is considered.

We need_____during summertime then the outdoor temperature is higher than the room temperature.

a. cooling
b. heating
c. activity of people

2. Cooling is needed to lower temperature in a space where heat gains are caused by the sun, activity of people and the function of equipment.

Heat gains are caused by _____

a. cooling
b. the solar energy, heat outputs from persons, appliances, computers and other electric devices, as well as from illumination.
c. colour of walls in a room, building, etc.

3. Solar gains GS are irradiations of solar energy through windows and other transparent or translucent constructional elements. Also added to the solar gains, is that part of the solar heating of the opaque building envelope, from which the indoor area benefits.

Solar gains are caused by_____

a. energy from renewable energy systems

b. solar energy through the transparent or translucent constructional elements and the opaque building envelope

c. energy balance caused by the sun, activity of people and function of equipment

V. *Which list of the words belongs to the description of «Heat balance of buildings»?*

a. Mechanical ventilation system, heat losses, volume, internal gains, solar gains, heat flows, transmission losses.

b. Civil engineering, theoretical knowledge, empirical information, environmental engineering, water supply, purification, sewer system.

c. Scientific evidence, solid background, construction, architecture, civil engineering establishment, rewarding discipline.

VI. *Read the text below and find out two paragraphs that describe different kinds of losses for a building during wintertime. Find out all appropriate variants (a, b, c, d, e).*

These heat flows can be arranged into five categories:

a. **LT** are those amounts of heat, which flow through the building envelope from inside to outside by conduction or heat transfer, respectively.

b. **LV** are caused by exchange of warm indoor air with colder outdoor air. The user independent air exchange is through joints by infiltration or exfiltration, respectively. In addition, room air can be exchanged through open windows or by a mechanical ventilation system. Ventilation is indispensable, up to a certain extend, to assure the hygienically necessary air exchange rate.

c. **GS** are irradiations of solar energy through windows and other transparent or translucent constructional elements. Also added to the solar gains, is that part of the solar heating of the opaque building envelope, from which the indoor area benefits.

d. **GI** are heat outputs from persons, appliances, computers and other electric devices, as well as from illumination.

e. **Heating demand H** is exactly that amount of energy, which is necessary to maintain the desired room temperature by compensating the excess of losses compared to the gains.

VII. *Read the text below. Match choices (a-h) to (1-5). There are three choices you do not need to use.*

The heat balance of a building includes all sources and sinks of energy inside a building, as well as all energy flows through its envelope. This envelope encloses the volume which is kept above a set temperature (in general 20 ºC) for all weather conditions by the use of heating energy. The extend of all heat flows, which do hereby occur, is either dependent on external or internal influence factors (weather, user). These heat flows can be arranged into five categories:

1. Transmission losses are those amounts of heat, which flow through the building envelope from inside to outside by conduction or heat transfer, respectively. Such a heat loss as warm air which escapes through a window would reduce the energy in the balance area; this would mean that the temperature in the building is sinking. However, this is exactly what should be prevented in order to maintain living comfort.

2. Ventilation losses are caused by exchange of warm indoor air with colder outdoor air. The user independent air exchange is through joints by infiltration or exfiltration, respectively. Room air can be exchanged not only through open windows but by a mechanical ventilation system. Ventilation is indispensable, up to a certain extend, to assure the hygienically necessary air exchange rate. Therefore, the energy flowing out has to be replaced: another heat flow must travel from the outside towards the inside in order to keep the temperature constant.

3. Fortunately, there are also flows of free “heat gains”: e.g. solar radiation entering through windows (so called passive solar energy). Solar gains are irradiations of solar energy through windows and other transparent or translucent constructional elements. Also added to the solar gains, is that part of the solar heating of the opaque building envelope, from which the indoor area benefits.

4. Internal gains are heat outputs from persons, appliances, computers and other electric devices, as well as from illumination. It is easy to prepare the energy balance based on the simplified conditions described here: the sum of the heat losses is equal to the sum of the heat gains. Nevertheless, the internal heat sources as well as the passively utilised solar energy can be estimated well enough, it is possible to calculate the remaining heat supply required (the heating demand) using the energy balance.

5. Heating demand is exactly that amount of energy, which is necessary to maintain the desired room temperature by compensating the excess of losses compared to the gains. If the warmer system is not deliberately isolated ("thermally insulated"), much heat is automatically lost through conduction, convection and heat radiation to the colder surroundings. Heating therefore, is only a replacement of this heat loss and can therefore be reduced as required by more effective prevention of losses.

Which of these heat flows can_____?

a.	travel out of the balance area through the envelope
b.	enter the building through the same envelope
c.	be the most effective design approach to reducing building energy
d.	travel out of the balance area through the ventilation
e.	be caused not by the sun but the activity of people and the function of equipment
f.	purify the outdoor and indoor air
g.	be reduced as required by more effective prevention of losses
h.	be combined with elements of modern architecture

PRE-TEXT EXERCISES: UNIT 2. PASSIVE BUILDING STRATEGY: 2.1.

Ex 1. *Match English word combinations 1) – 6) with Ukrainian equivalents a) – f). Use Figure 1 and Table 1 below to find out the meanings of the technical terms graphically. Take into account that the colour of the font and the colour of the figure correspond to each other.*

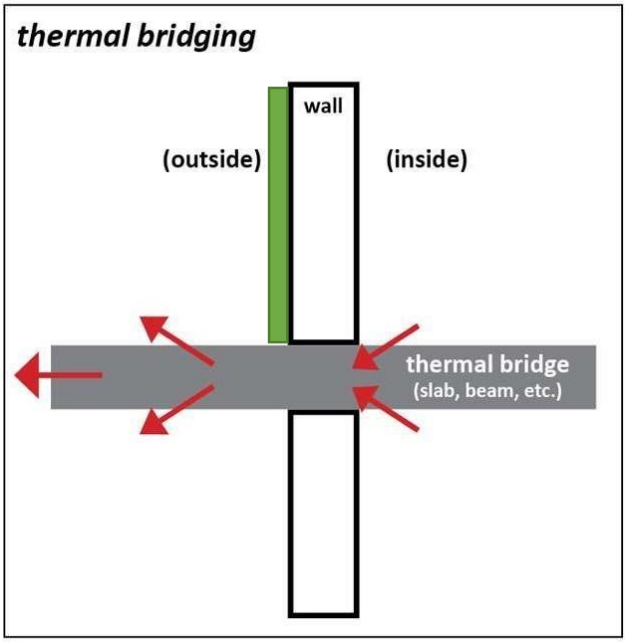


Figure 1. Thermal bridging

Table 1

English terms and Ukrainian equivalents

English terms	*Ukrainian equivalents*
1. thermal bridge	a) плита
2. the adjacent areas	b) стіна
3. insulation	c) балка
4. slab	d) місток холоду
5. beam	e) ізоляція
6. wall	f) прилеглі частини

Ex 2. *Read the definition of a Thermal Bridge and find out the technical terms in sentences. Take into account that the colour of the font of Exercise 1 and the colour of the font of Exercise 2 correspond to each other.*

What is a Thermal Bridge?

A thermal bridge is an element or location with less insulation, or reduced insulation performance, relative to of the thermal envelope. This means the element or location provides a path of least resistance (a "bridge") for heat to move through the building envelope. In cold climates, this means additional heat will be lost through these specific locations. In hot climates, a thermal bridge will allow unwanted additional heat to pass through the thermal envelope into the building.

The Passive House Standard requires thermal bridge free construction to ensure a robust high-quality building envelope that delivers radical energy efficiency and exceptional comfort.

Ex 3. *Complete the following sentences using the word combinations from Exercise 1 and Exercise 2. The first and the last letters of each word are given.*

1. A t_ _ _ _ _l b_ _ _ _e is formed when there is a low thermal i_ _ _ _ _ _ _ _n between the external and internal faces of a wall.
2. The CCTV and communications control make it possible to monitor all premises and engineering equipment in the building and a_ _ _ _ _ _t a_ _ _s.
3. The building has been completely reconstructed having preserved its historical values – wooden b_ _m(s), stone, wall – which, combined with elements of modern architecture.

Ex 4. *Match English word combinations 1) – 4) with Ukrainian equivalents a) –d). Use Photo 1 and Table 2 below to find out the meanings of the technical terms graphically. Take into account that the colour of the font.*

Photo 1. Continuous insulation

Table 2

English terms and Ukrainian equivalents

English terms	*Ukrainian equivalents*
1.to install	a) зовнішня частина
2.the interior	b) безперервна цілісна ізоляція
3.the exterior	c) встановлювати, інсталювати
4. continuous insulation	d) внутрішня частина

Ex 5. *Read the definition of a Continuous Insulation and find out the technical terms in sentences. Take into account that the colour of the font of Exercise 4 and the colour of the font of Exercise 5 correspond to each other.*

What is continuous insulation?

Continuous insulation, also known as CI, is defined by ASHRAE 90.1as *"insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior, exterior, or is integral to any opaque surface of the building envelope."*

Ex 6. *Complete the following sentences using the word combinations from Exercise 4 and Exercise 5. The first and the last letters of each word are given.*

1. When we i_____l the central heating, we put a radiator in every room.
2. This company exports its wooden windows and i_ _ _ _ _ _r doors to Denmark, Germany, Norway and Ireland.
3. On e_____r doors high demands are made.

Ex 7. *Match English word combinations 1) – 4) with Ukrainian equivalents a) –d). Use Figure 2 and Table 3 below to find out the meanings of the technical terms graphically.*

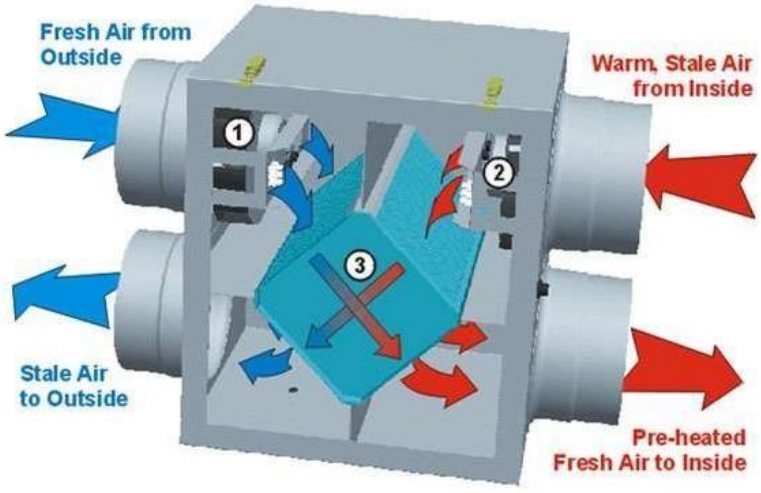


Figure 3. Energy Recovery Ventilation (ERV)

Table 3

English terms and Ukrainian equivalents

English terms	*Ukrainian equivalents*
1.the benefits	a) витрати на охолодження
2.airstreams / flow	b) несвіже повітря
3.cooling costs	c) переваги
4.stale air	d) повітряні маси
5.Energy Recovery Ventilation	e) вентиляція з рекуперацією

Ex 8. *Read about benefits of Energy Recovery Ventilation (ERV) and find out the technical terms in sentences. Take into account that the colour of the font of Exercise 7 and the colour of the font of Exercise 8 correspond to each other.*

How Energy Recovery Ventilation (ERV) Works

One of the benefits of using an ERV is that it transfers heat and moisture between incoming and outgoing airstreams. This means it takes much less energy to heat/cool the air you bring into your home, ultimately saving you money on heating and cooling costs.

Ex 9. *Complete the following sentences using the word combinations from Exercise 7 and Exercise 8. The first and the last letters of each word are given.*

1. S_ _ _e a_r or a stale smells is unpleasant because it is no longer fresh.
2. C_____g is needed to lower temperature in a space where heat gains are caused by the sun, activity of people and the function of equipment.
3. In the current economic conditions, construction companies are increasingly taking into consideration long term b_____t(s) of the products they are using.

PRE-TEXT EXERCISES: UNIT 2. PASSIVE BUILDING STRATEGY: 2.2.

Ex 1. *Match English word combinations 1) – 4) with Ukrainian equivalents a) – d). Use Figure 1, Photos 1, 2 and Table 1 below to find out the meanings of the technical terms graphically. Take into account that the colour of the font and the colour of the parts of the figure and photos correspond to each other.*

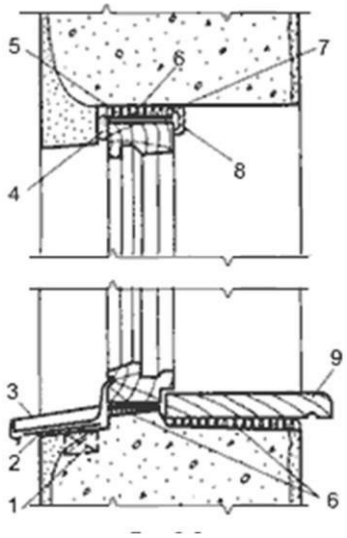


Figure 1. Installing windows in concrete wall

Photos 1,2. Triple pane windows

Table 1

English terms and Ukrainian equivalents

English terms	*Ukrainian equivalents*
1.concrete	a) залізобетон aa
2.triple pane windows/ triple-glazed windows	b) бетон
3.reinforced concrete	c) потрійне вікно/потрійне скління
4.durability	d) довговічність, зносостійкість

Ex 2. *Read about high - performance components and find out the technical terms in sentences. Take into account that the colour of the font of Exercise 1 and the colour of the font of Exercise 2 correspond to each other.*

High - performance components

High – performance windows typically triple paned for cold climates and doors provide thermal comfort and building *durability*. If you want to upgrade your old windows, be sure to check out the benefits of triple pane windows as well as double-pane. In cold regions, such as New England, triple-glazed windowscan save 2 to 3 percent of your heating bill, compared with double-glazed windows. From a cost standpoint, it'll take a few decades to recoup the 10 to 15 percent upcharge to go from low-e double-glazed windows to triple-glazed.

Ex 3. *Complete the following sentences using the word combinations from Exercise1 and Exercise 2. The first and the last letters of each word are given.*

1. *D_ _ _ _ _ _ _ _ y* of c_ _ _ _ _ _e made this material the leader among building materials, that`s why regular and r _____d c_____e made the bulk of the most construction projects.
2. The penthouse has a balcony stemming from each of its bedrooms, bamboo flooring throughout, fully equipped kitchen and laundry, modern bathroom fixtures, d_ _ _ _e-p_ _e w_ _ _ _ _s, central air conditioning, high ceilings and your own private elevator.
3. Wood can also be a substitude for non-renewable construction materials such as plastics, steel or c_____e.

Ex 4. *Match English word combinations 1) – 4) with Ukrainian equivalents a) – d). Use Figure 2 and Table 2 below to find out the meanings of the technical terms graphically. Take into account that the colour of the font and the colour of the parts of the figure correspond to each other.*

Airtightness

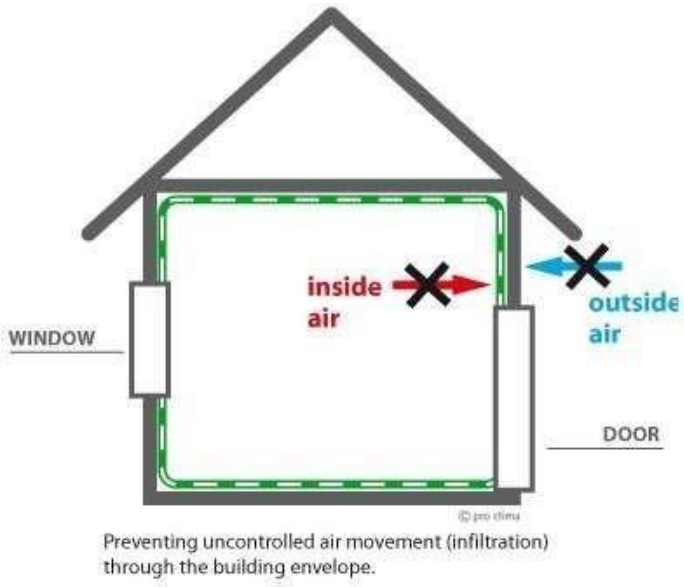


Figure 2. Airtightness – *Герметичність*

Table 2

English terms and Ukrainian equivalents

English terms	Ukrainian equivalents
1. airtight envelope	a) герметичні огороджувальні конструкції
2.air leakage	b) протяги
3. airtightness	d) повітронепроникненість, герметичність
4.incoming draughts	c) виток повітря

Ex 5. *Read about an air tight construction and find out the technical terms in sentences. Take into account that the colour of the font of Exercise 4 and the colour of the font of Exercise 5 correspond to each other*

What is Air Tight Construction?

The basic principle of airtight building is in the formation of a continuous airtight envelope to minimize air leakage.

Why is it important? An airtight building doesn't lose heat through gaps or allow incoming draughts. This means that your heating system will work more efficiently and you'll be more comfortable in your home. You'll also save money on your fuel bills.

Ex 6. *Complete the following sentences using the word combinations from Exercise 4 and Exercise 5. The first and the last letters of each word are given.*

1. The building envelope is extremely a_ _ _ _ _ _t, preventing infiltration of outside air and loss of conditioned air as well as ensuring moisture free assemblies.
2. A_r l_ _ _ _ _e, or infiltration, is outside air that enters a house uncontrollably through cracks and openings. It is unwise to rely on a_r l_____e for ventilation.
3. They possess good health, but it would be better to keep them away from i_ _ _ _ _ _g d_____s.

Ex 7. *Read the sentence about solar gain and shading elements. Match English word combinations 1) – 4) with Ukrainian equivalents a) – d). Use Figure 3 and Table 3 below to find out the meanings of the technical terms graphically.*

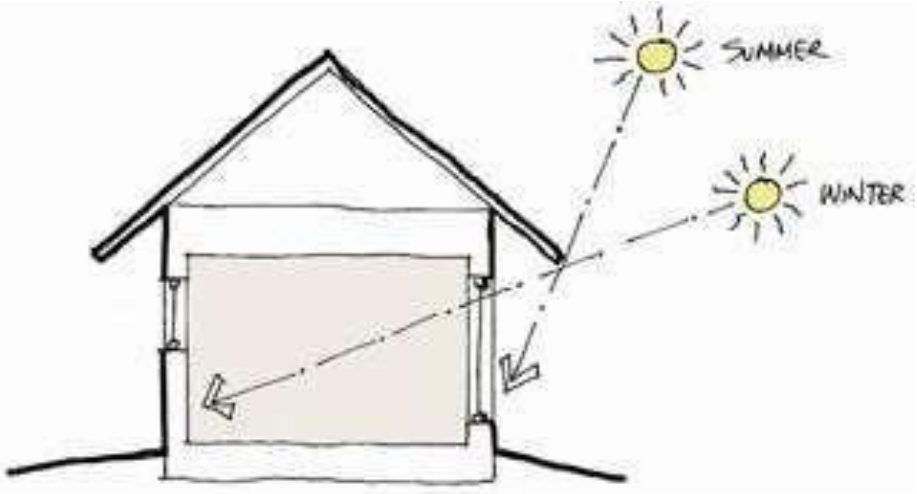


Figure 3. Controlling Gains: Windows and Siting

Solar gain is managed to exploit the sun`s energy for heating while shading elements work to minimize overheating in cooling seasons.

Table 3

English terms and Ukrainian equivalents

English terms	Ukrainian equivalents
1. solar gain	a) розташування
2. shading elements	b) сонячні теплові надходження
3. controlling gains	c) елементи для затінення

4. siting	d) контрольовані теплові надходження

TEXTS: UNIT 2. PASSIVE BUILDING STRATEGY

Text 1. **Passive building strategy for commercial building**

Task 1. *Before you begin to read the text "Passive building strategy for commercial building", list details in the first two columns.*

1	2
What I Know about the topic "**Passive building strategy for commercial building**" *Write all information you know in the form of words, word combinations, sentences.*	**What I expect to know** after reading the text. *Write all information in the form of questions.*

Task 2. *Skim the text "Passive building strategy for commercial building". Add the important terms and terms combination words in the first column. Write additional questions in the second column.*

Tips for skimming:

Read the first sentence of every paragraph

Read any headings and sub-headings

Notice any figures, charts, or graphs

Notice any italicized or boldface words or phrases

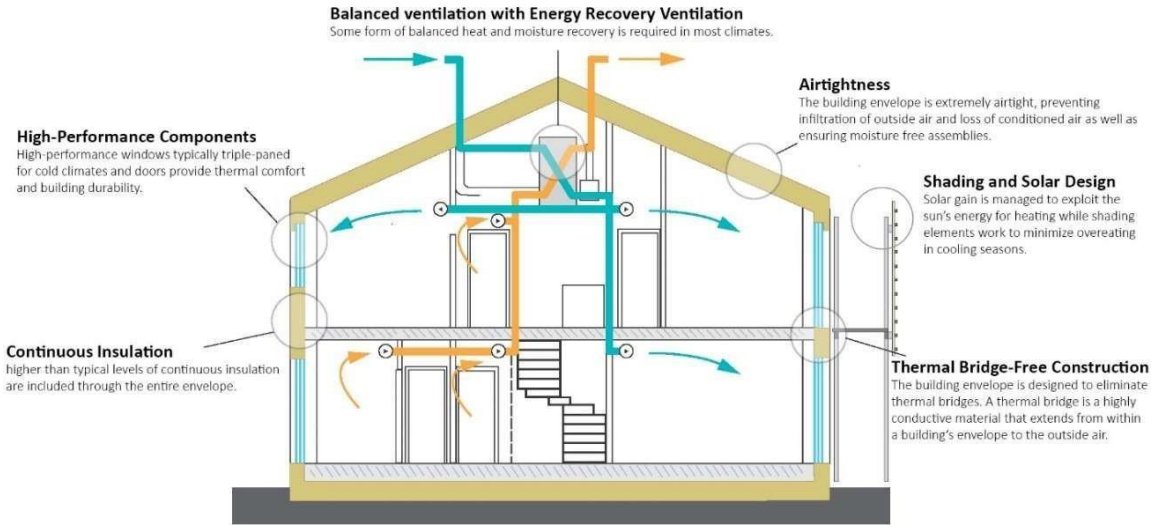
Text **Passive building strategy for commercial building**

The Passive House design movement has been the most effective design approach to reducing building energy use for over 25 years around the globe. Although Passive House design began in *residential buildings*, it is now widely used in many other building types including offices, hotels, libraries, museums, and schools. The passive building strategies developed by the Passive House Institute include a *quantifiable performance standard* that can be implemented in most building types. Buildings that meet this high *performance building standard* use dramatically (up to 80%) less energy and provide better *indoor air quality* and *thermal comfort* than those designed to conventional codes. This design approach also provides greater *resiliency* and *survivability* during extreme weather events.

Passive building strategies lower the amount of *operating energy* in *a cost effective manner* by applying *conservation measures* first. In this way it is

practical *to supply* all of a building's energy needs with relatively low levels of renewable sources. As a result, passive building strategies are the ideal foundation for *net zero energy buildings.*

A Passive House design relies on a few foundational principles to achieve extreme *energy efficiency*, *comfort*, and *resiliency*.



Passive building strategies are low-tech, with few moving parts, so buildings are *durable* and have minimal *maintenance* needs. Passive House design carefully models and balances a comprehensive set of factors—including *heat emissions* from appliances and occupants—to keep the building at comfortable and consistent indoor temperatures throughout the heating and cooling seasons, using as little active energy input as possible.

Passive building strategies do not radically differ from conventional building, but *require* special balancing and care through both the design and construction stages. The passive building designer uses software and design methods to adjust multiple variables—insulation R-values, wall construction parameters, etc.—until the design model meets the energy performance targets. Construction crews must learn and apply approaches to *air sealing* and *thermal bridges*. As a result, to assure performance, a project will undergo stringent third-party quality assurance and quality control inspections, including final testing and commissioning of the mechanical systems.

Passive building strategies do not dictate an aesthetic—they have been successfully applied in traditional as well as *contemporary* and minimalist designs.

Larger buildings are economical candidates for passive building for a variety of technical reasons, including economy of scale and a more favorable volume-to-surface-area ratio. Passive House multifamily projects have cost

approximately 0% – 3% more than conventional multifamily buildings. A recently completed passive apartment building in Brooklyn, referred to in the "One City, Built to last" report that the New York City Mayor's Office published in 2014, did not have a cost premium compared to a conventional building.

(June 25, 2015/in Sustainability /by Craig E. Stevenson)

Task 3. *Read the text "Passive building strategy for commercial building". Find the answers to the questions from the second column and write them in the third column in the form of sentences. Write all the questions you have not answered in the fourth column.*

3	4
What I Learned. *Write the answers to the questions from the second column. Write all information that you can find in the text "Passive building strategy for commercial building" in the form of sentences.*	**Met expectations** *Write all the questions you have not answered.*

Task 4. *Find the answers to the questions from the fourth column and use this information for the individual work. Use additional information resources.*

Text 2. **Passive house simply illustrated**

Task 1. *Before you begin to read the text "Passive house simply illustrated", list details in the first two columns.*

1	2
What I Know about the topic "**Passive house simply illustrated**"? *Write all information you know in the form of words, word combinations, sentences.*	**What I expect to know** after reading the text. *Write all information in the form of questions.*

Task 2. *Skim the text "Passive house simply illustrated". Add the important terms and terms combination words in the first column. Write additional questions in the second column.*

Tips for skimming:

Read the first sentence of every paragraph

Read any headings and sub-headings

Notice any figures, charts, or graphs

Notice any italicized or boldface words or phrases

Text. **Passive house simply illustrated**

We came across these wonderfully simple illustrations of the principles of Passive House design (Passive Haus) and thought they were well worth sharing. They are by a U.S. firm, Albert, Righter and Tittman Architects.

The illustrations help make the case that green building in the new millennium should be about simplicity: weaving together and maximizing simple technologies rather than relying on fancy gizmos and complex systems.

The first image shows the evolution in building technology over the centuries, from *wood-heated homes* in the 19th century, to *a complex jumble of building systems* in 20th century homes, to the promise of simplicity presented by today's Passive House standard:

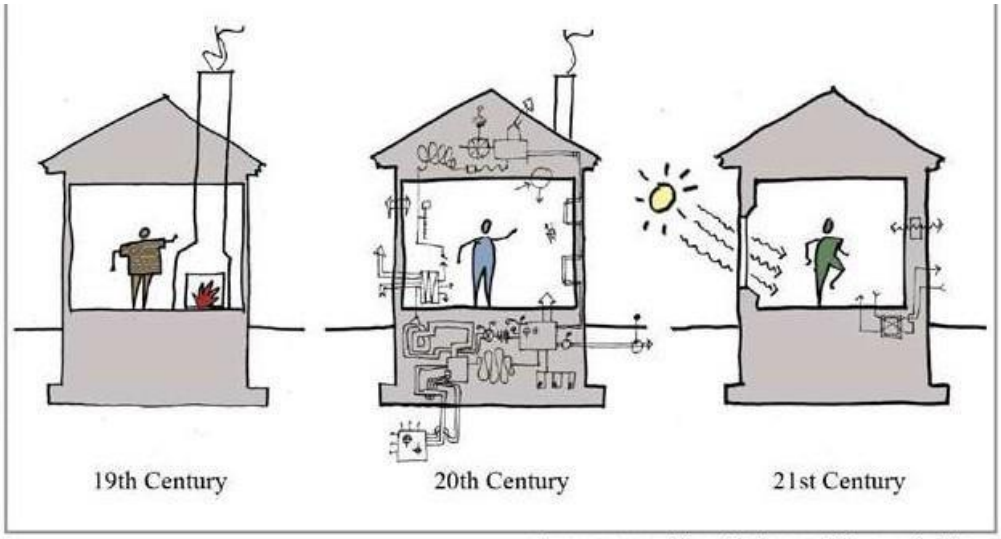


image source: Albert, Righter and Tittmann Architects

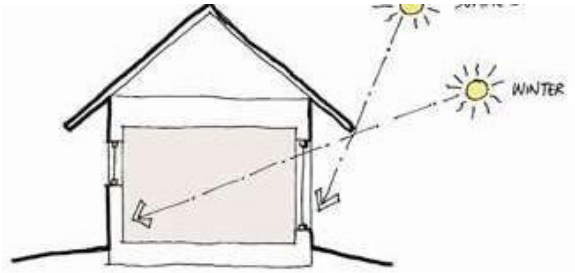
It's all about the envelope. A central principle of Passive House design is to reduce heat loss by *superinsulating homes*, creating *airtight building envelopes*, and *eliminating thermal bridges* (elements or penetrations that allow heat or cold to leak through the *fabric*):

image source: Albert, Righter and Tittmann Architects

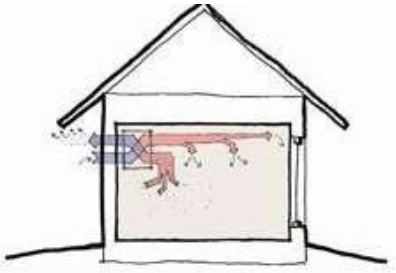
With a carefully-designed and executed building envelope in place, almost all the heating needs of a Passive House can be met by body heat, heat from lights and appliances, and solar gain:

image source: Albert, Righter and Tittmann Architects

The control of these solar gains can be easily regulated though a combination of *well considered siting* (along the east-west axis), *shade-providing overhangs* for the highest sun of the summer months, and the careful placement of *high-performance windows*. All that's left is to include *heat-recovering mechanical ventilation*, a simple system that exhausts spent air and brings in fresh air, all the while capturing and retaining the thermal energy of that *exhausted air*:



Controlling Gains:
Windows and Siting



Providing Fresh Air:
Heat Recovering Ventilation

image source: Albert, Righter and Tittmann Architects

The end result is a comfortable, normal-looking home that saves 75-90% of the energy consumed by a conventional home.

(Hofler Architects - Monkstown, Dun Laoghaire, Co. Dublin May 13, 2015)

Task 3. *Read the text "Passive house simply illustrated". Find the answers to the questions from the second column and write them in the third column in the form of sentences. Write all the questions you have not answered in the fourth column.*

3	4
What I Learned. *Write the answers to the questions from the second column. Write all information that you can find in the text "Passive house simply illustrated" in the form of sentences.*	**Met expectations** *Write all the questions you have not answered.*

Task 4. *Find the answers to the questions from the fourth column and use this information for the individual work. Use additional information resources.*

Text 3. **Advanced building envelope**

Task 1. *Before you begin to read the text "Advanced building envelope", list details in the first two columns.*

1	2
What I Know about the topic "**Advanced building envelope**"? *Write all information you know in the form of words, word combinations, sentences.*	**What I expect to know** after reading the text. *Write all information in the form of questions.*

Task 2. *Skim the text "Advanced building envelope". Add the important terms and terms combination words in the first column. Write additional questionsin the second column.*

Tips for skimming:

Read the first sentence of every paragraph

Read any headings and sub-headings

Notice any figures, charts, or graphs

Notice any italicized or boldface words or phrases

Text. **Advanced building envelope**

The conservation-first approach to high performance building starts with the advanced building envelope. Guided by physics and building science, advanced building envelopes combine a simple suite of components to manage heat, air, and moisture and deliver superior efficiency, durability, comfort, and occupant health.

The first step is airtight construction. By controlling the movement of air across building assemblies we also control the movement of heat and moisture.

To this end, we wrap a continuous, unbroken air barrier around our high performance buildings.

Next we super-insulate, combining a thick layer of interior insulation in wall cavities with a continuous, "monolithic," layer of exterior insulation to thermally isolate the envelope and to keep sheathing warm and free of condensation.

We also detail carefully to "break" the thermal bridges that can compromise a building's thermal layer and rob it of efficiency and comfort. These insulation-bypassing flaws in building design can also undermine durability by introducing condensation-causing cold penetrations into otherwise warm layers of an assembly.

To protect the envelope from bulk water intrusion we install a water-resistant barrier, or WRB. Often, though not always, this WRB also serves as the building's air barrier. The WRB should not be confused with a vapor barrier. In our maritime Pacific NW climate we tend to avoid vapor barriers in our wall assemblies and therefore employ vapor-open WRBs in our assemblies. Because vapor drive can oscillate between inside-to-outside and outside-to-inside numerous times in a single day in our climate, we like to detail our walls to be vapor open in both directions to facilitate drying.

To further promote this drying capacity, high performance buildings employ a ventilated rain screen, a gap between cladding and wall assembly that not only provides a channel for bulk water to drain away, but also generates air movement across the face of the assembly to dramatically increase drying. All things equal, a highly thermally resistant wall will have less drying capacity than a conventional wall, so the air movement provided by the ventilated rain screen helps ensure the resilience and durability of high performance wall assemblies.

As a holistic system, the advance building envelope transforms building energy efficiency with its airtight and thermally resistant layers, promotes occupant comfort by creating even, warm interior surface temperatures, and ensures building durability and occupant health by minimizing the risk of the moisture accumulations that lead to rot and mold. (Hammer & Hand Construction Woodcraft).

Example of Passive House Wall Assembly
(Hammer & Hand Construction Woodcraft).

Task 3. *Read the text "Advanced building envelope". Find the answers to the questions from the second column and write them in the third column in the form of sentences. Write all the questions you have not answered in the fourth column.*

3	4
What I Learned. *Write the answers to the questions from the second column. Write all information that you can find in the text "Advanced building envelope" in the form of sentences.*	**Met expectations** *Write all the questions you have not answered.*

Task 4. *Find the answers to the questions from the fourth column and use this information for the individual work. Use additional information resources.*

AFTER-READING ACTIVITIES:
UNIT 2. PASSIVE BUILDING STRATEGY

I. Listen and watch the video on the topic "Energy efficient homes". Write down all terms and terms combination words you have heard.

II. In pairs, look at Figure 1, Table 1 and Table 2 below and find out the reasonable decision for reducing of the heat losses during wintertime. Discussthe possible costs, beauty of the design and comfort for each decision.

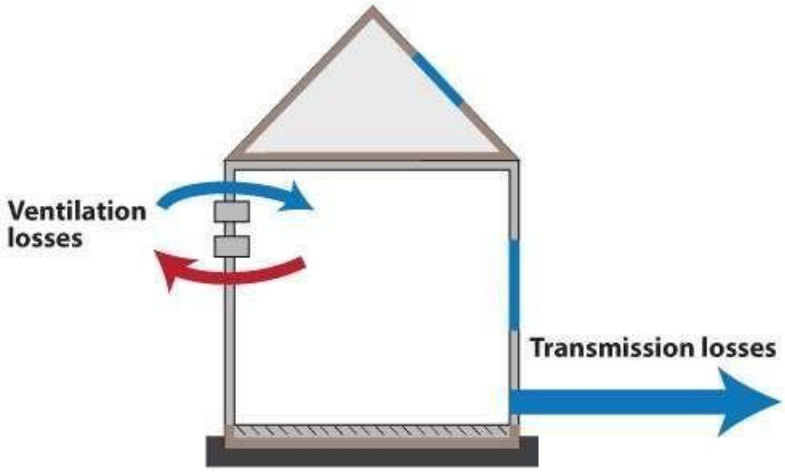


Figure 1. Heat losses

Table 1

Kind of losses	*decision for reducingof the heat losses during wintertime*	*Costs*	*Beauty of interior or exterior) design*	*Comfort*
Ventilation losses LV	*a.* Energy Recovery Ventilation *b.* Natural Ventilation			

Transmission losses LT	*a.* Insulation (interior or exterior) *b.* Building location (walls without windows in the north, small windows, etc.) c. High - performance components (triple paned windows, building materials with high airtightness)			

Table 2

Model of expressing opinion in a discussion	*Useful phrases for discussion*
My opinion	I think… I think it is more important to… I believe that… In my opinion… Personally, I don`t think/think… To be honest, I don`t think/I think…
What I know	There are/aren't… There is/isn't…
My predictions	Also, (not) everyone will be able to… I believe, it will be (un)popular with people… It could/would be very (in)expensive to…, so…

TESTS: UNIT 2. PASSIVE BUILDING STRATEGY

I. *Match the Ukrainian words and phrases with their English equivalents:*

1. wall (*n)*	a) місток холоду
2. thermal bridge (*n)*	b) міцний, довговічний
3. beam (*n)*	c) стіна
4. robust **(***adj)*	d) балка
5. slab (*n)*	e) зовнішня частина
6. insulation (*n)*	f) плита
7. to install *(v)*	g) ізоляція
8. interior (*n)*	h) встановлювати, інсталювати
9. exterior (*n)*	i) внутрішня частина
10.benefit (*n)*	j) несвіже повітря
11.airstreams / flow (*n)*	k) перевага
12. stale air/ exhausted air/ exhaust air (*n)*	l) повітряні маси
	m) залізобетон
13. concrete (*n)*	n) бетон
14.reinforced concrete (*n)*	o) довговічність, зносостійкість
15.durability (*n)*	p) опір
16.leakage (*n)*	q) протяги
17.resistance (*n)*	r) повітронепроникненість, герметичність
18.airtightness (*n)*	s) виток
19.incoming draughts (*n)*	t) витрати на охолодження
20.cooling costs (*n)*	

v – verb (дієслово)
n – noun (іменник)
adj – adjective (прикметник)

II. *Match the Ukrainian words and phrases with their English equivalents:*

1. external and internal surfaces of a wall	a) потрійне вікно/потрійне скління
2. opaque surface of the building envelope	b) зовнішні та внутрішні поверхні стіни

3. triple pane window / triple-glazed window 4. air leakage 5. airtight envelope 6. adjacent areas 7. a path of least resistance 8. thermal bridge free construction 9. to ensure a robust high-quality building envelope 10. to deliver energy efficiency 11.exceptional comfort 12.unwanted additional heat 13. a low thermal insulation 14.Energy Recovery Ventilation 15.continuous insulation	c) непрозора поверхня огороджувальної конструкції d) будівля без містків холоду e) шлях найменшого опору f) виток повітря g) герметична огороджувальна конструкція h) прилеглі частини i) забезпечити надійну якісну огороджувальну конструкцію j) забезпечити енергоефективність k) особливий комфорт l) небажане додаткове тепло m) низька теплоізоляція n) вентиляція з рекуперацією o) безперервна цілісна ізоляція

III. *Complete the following sentences using the correct answer: a,b or c.*

1. A thermal bridge is formed when there is a low thermal_____ between the external and internal faces of a wall.

a. Energy Recovery Ventilation
b. insulation
c. install

2. The Passive House Standard requires_____free construction.

a. thermal bridge
b. insulation
c. robust

3. Energy Recovery Ventilation takes much less energy to heat the air you bring into your home saving you money on_____.

a. cooling costs
b. heating costs
c. mechanical ventilation system

IV. *Read the paragraphs below. Choose the most appropriate variant: a,b or c to complete the following sentences.*

1. A thermal bridge is an element or location with less insulation, or reduced insulation performance, relative to of the thermal envelope. This means the element or location provides a path of least resistance (a "bridge") for heat to move through the building envelope. In cold climates, this means additional heat will be lost through these specific locations. In hot climates, a thermal bridge will allow unwanted additional heat to pass through the thermal envelope into the building.

_____are elements or penetrations that allow heat or cold to leak through the fabric.

a. Means
b. Thermal bridges
c. Unwanted additional heat

2. Continuous insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior, exterior, or is integral to any opaque surface of the building envelope.

We super-insulate, combining a thick layer of interior_____in wall cavities with a continuous, "monolithic," layer of exterior_____to thermally isolate the envelope and to keep sheathing warm and free of condensation.

a. insulation
b. solar energy
c. service openings

3. One of the benefits of using an Energy Recovery Ventilation (ERV) is that it transfers heat and moisture between incoming and outgoing airstreams. This means it takes much less energy to heat/cool the air you bring into your home, ultimately saving you money on heating and cooling costs.

_____is drawn from kitchen and bathrooms where odors, moisture, and pollutants collect, passes through the heat exchanger where it shares its thermal energy with intake air.

a. Exhaust air
b. Incoming air
c. Incoming flows

V. *Which list of the words belongs to the description of «Passive building strategy»?*

a. Mechanical ventilation system, heat losses, volume, internal gains, solar gains, heat flows, transmission losses.
b. Civil engineering, theoretical knowledge, empirical information, environmental engineering, water supply, purification, sewer system.
c. Thermal bridge, continuous insulation, Energy Recovery Ventilation, airtight envelope, airtight building, exceptional comfort.

VI. *Read the text below and find two paragraphs that describe the basic principles of passive house design. Find out all appropriate variants (a, b, c, d, e).*

A Passive House design relies on a few foundational principles to achieve extreme energy efficiency, comfort, and resiliency.

a. As a holistic system, the advance building envelope transforms building energy efficiency with its airtight and thermally resistant layers, promotes occupant comfort by creating even, warm interior surface temperatures, and ensures building durability and occupant health by minimizing the risk of the moisture accumulations that lead to rot and mold.
b. The heat balance of a building includes all sources and sinks of energy inside a building, as well as all energy flows through its envelope. This envelope encloses the volume which is kept above a set temperature (in general 20 ºC) for all weather conditions by the use of heating energy. The extend of all heat flows, which do hereby occur, is either dependent on external or internal influence factors (weather, user).
c. Ventilation losses are caused by exchange of warm indoor air with colder outdoor air. The user independent air exchange is through joints by infiltration or exfiltration, respectively. In addition, room air can be exchanged through open windows or by a mechanical ventilation system.

Ventilation is indispensable, up to a certain extend, to assure the hygienically necessary air exchange rate.

d. Buildings that meet this high performance building standard use dramatically less energy and provide better indoor air quality and thermal comfort than those designed to conventional codes. This design approach also provides greater resiliency and survivability during extreme weather events. Passive building strategies lower the amount of operating energy in a cost effective manner by applying conservation measures first.

e. Consequently, energy balances can only be prepared for restricted spatial areas with clearly defined boundaries. These boundaries are called the envelope. In the case of heating or cooling, the area of interest is the "heated or cooled space" or more precisely: it includes all areas in a building in which comfortable thermal conditions should prevail. It is usually convenient to include all "passively heated" areas in the balance, if the balance envelope is simplified in this way.

VII. *Read the text below. Match choices (a-h) to (1-5). There are three choices you do not need to use.*

The first image shows the evolution in building technology over the centuries, from wood-heated homes in the 19th century, to a complex jumble of building systems in 20th century homes, to the promise of simplicity presented by today's Passive House standard:

1. It's all about the envelope. A central principle of Passive House design is to reduce heat loss by superinsulating homes.

Continuous insulation, also known as insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior, exterior, or is integral to any opaque surface of the building envelope.

2. A thermal bridge is an element or location with less insulation, or reduced insulation performance, relative to of the thermal envelope. This means the element or location provides a path of least resistance (a "bridge") for heat to move through the building envelope. In cold climates, this means additional heat will be lost through these specific locations. In hot climates, a thermal bridge will allow unwanted additional heat to pass through the thermal envelope into the building.

The Passive House Standard requires thermal bridge free construction to ensure a robust high-quality building envelope that delivers radical energy efficiency and exceptional comfort.

3. A heat recovery ventilation, or HRV, is a fresh air system that preserves indoor warmth (or cool) inside a building while providing a 24/7 supply of fresh, filtered air to building occupants. ERV, or energy recovery ventilation, is closely related to HRV, but in addition to recovering heat it can also transfer water vapor between incoming and outgoing air, which is useful in avoiding over-drying of indoor air during winter in our climate.

4. By controlling the movement of air across building assemblies we also control the movement of heat and moisture. The basic principle of airtight building is in the formation of a continuous airtight envelope. An airtight building doesn't lose heat through gaps or allow incoming draughts. This means that you will minimize air leakage, your heating system will work more efficiently and you'll be more comfortable in your home. You'll also save money on your fuel bills.

5. With a carefully-designed and executed building envelope in place, almost all the heating needs of a Passive House can be met by body heat, heat from lights and appliances, and solar gain: The control of these solar gains can be easily regulated though a combination of well considered siting (along the east-west axis), shade-providing overhangs for the highest sun of the summer months, and the careful placement of high-performance windows.

Which of these software and design methods allow_____?

a.	to transfer heat and moisture between incoming and outgoing airstreams
b.	to lose the outdoor and indoor air
c.	heat or cold to enter through the fabric
d.	travel out of the balance area through the ventilation
e.	to thermally isolate the envelope and to keep sheathing warm and free of condensation
f.	to build a continuous airtight envelope and minimize air leakage
g.	to prevent reducing building energy use
h.	to minimize overheating in cooling seasons

PRE-TEXT EXERCISES:
UNIT 3. HEATING, VENTILATION AND AIR CONDITIONING (HVAC) SYSTEMS: 3.1.

Ex. 1. *Match English word combinations 1) – 5) with Ukrainian equivalents a) – e). Use Photo 1 and Table 1 below to find out the meanings of the technical terms graphically. Take into account that the colour of the font and the colour of the figures on the photo correspond to each other.*

Photo 1. Air Conditioning

Table 1

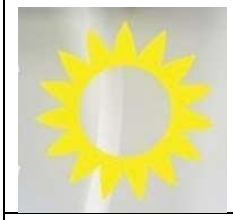
Technical terms

Technical terms	*Ukrainian equivalents*
1. air conditioning	a) вологість
2. humidity	b) вентиляція
3. ventilation	c) опалення
4. heating	d) кондиціонування повітря
5. cooling	e) охолодження
6. equipment	f) обладнання

Ex 2. *Read the list of definitions of the following technical terms 1) – 6) and find outUkrainian equivalents a) – f). Take into account that the colour of the font of Exercise 1 and the colour of the font of Exercise 2 correspond to each other.Use Table 2 below.*

Table 2

List of definitions of the technical terms

Technical terms	*Definitions*	*Ukrainian equivalents*
1.heating 	1. equipment or devices used to provide heat	a) відведення тепла, яке зазвичай призводить до зниження температури
2.humidity 	2. a measure of the actual amount of water vapor in the air	b) обладнання або пристрій що використовується для подачі тепла
3 cooling	3. removal of heat, usually resulting in a lower temperature	c) система для контролю вологості, вентиляції і температури в будинку
4.air conditioning 	4.a system for controlling the humidity, ventilation, and temperature in a building	d) міра фактичної кількості водяної пари в повітрі
5.ventilation 	5.the provision of fresh air to a room, building, etc.	e) ряд умов, що дозволяють оперувати системою або процесом
6.operating conditions	6. a set of conditions for operating a particular system or process	f) постачання свіжого повітря в кімнату, будинок, тощо

Ex.3 Match the terms *1) – 6)* with the definitions *a) – f). Use Table 3 below.*

Table 3

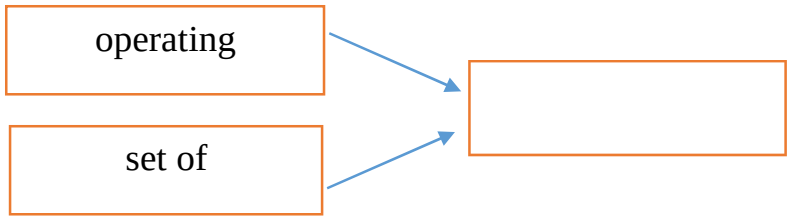
Technical terms and their definitions

Technical terms	*Definitions*
1. humidity	a) equipment or devices used to provide heat, especially to a building
2. operating conditions	b) provision of fresh air to a room or a building
3. equipment	c) a system for controlling the humidity, ventilation, and temperature
4. cooling	d) a set of conditions for operating a particular system or process
5. ventilation	e) the necessary items for a particular purpose
6. air conditioning	f) a measure of the actual amount of water vapor in the air
7. heating	g) removal of heat, usually resulting in a lower temperature

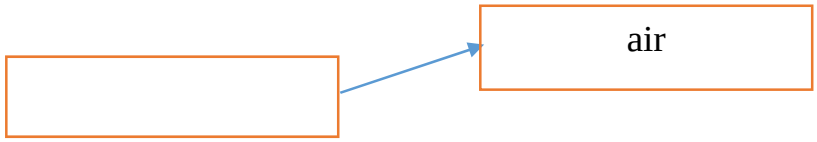
Ex.4 Choose the words in the box and match them with the word(s) in scheme structures (1 – 4) to make technical terms.

vapor, fresh, conditioning, conditions, quality

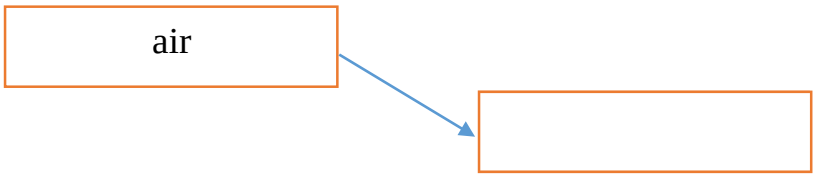
1.



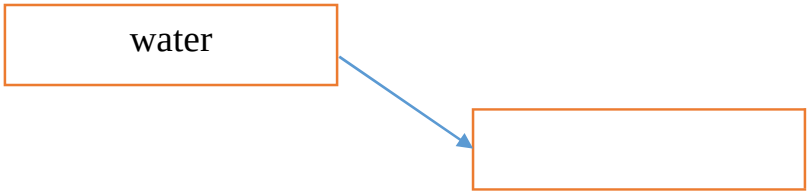
2.



3.



4.



Ex.5 *Complete the following sentences using the word combinations from Ex.4 The first and the last letters of each word are given.*

1. Heating,Ventilation and Air Conditioning (HVAC) systems are equipment or devices used to provide thermal comfort, acceptable indoor a_r q_____y and ideal o g c_____s.
2. HVAC systems will use more energy when the required indoor temperature and a_r q_____y - in extreme temperatures or in the case of operations where greater precision or more refined a_r q_____yis required
3. A_r c _ _ _ _ _ _ _ _ _ _ g process refers to the process of conditioning the interior air according to the human comfort.
4. Three central functions of HVAC systems are interrelated to providing the set of chosen or preferred internal c_____s such as temperature, humidity and q_____y of a_r.
5. *W_ _ _r v_ _ _r* is also the most important greenhouse gas in the atmosphere.

PRE-TEXT EXERCISES:
UNIT 3. HEATING, VENTILATION AND AIR CONDITIONING (HVAC) SYSTEMS: 3.2.

Ex. 1. *Look at the work of Heat Recovery Ventilation. Match English word combinations 1) – 4) with Ukrainian equivalents a) – d). Use Figure 1 and Table 1 below to find out the meanings of the technical terms graphically. Take into account that the colour of the font in the table and the colour of the figure correspond to each other.*

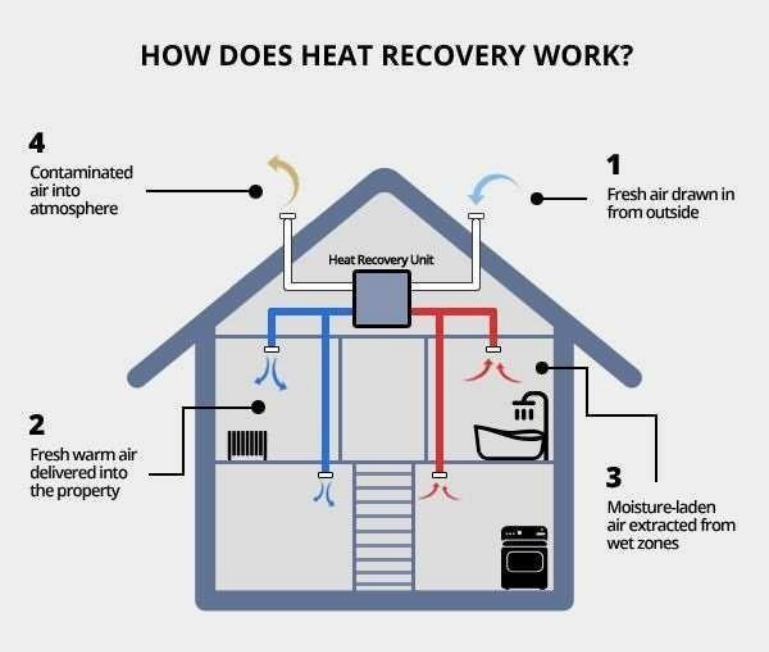


Figure 1. Heat Recovery Ventilation

Table 1

English terms and Ukrainian equivalents

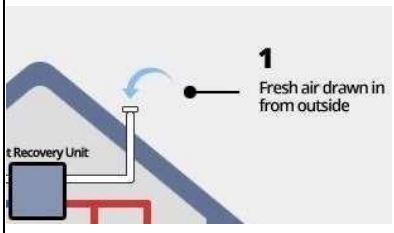
English terms	*Ukrainian equivalents*
1. fresh intake air	a) забруднене повітря/ витяжне повітря назовні
2. incoming air / fresh warm air	b) свіже повітря, що надходить ззовні
3. exhaust air / moisture-laden air	c) повітря, що подається до

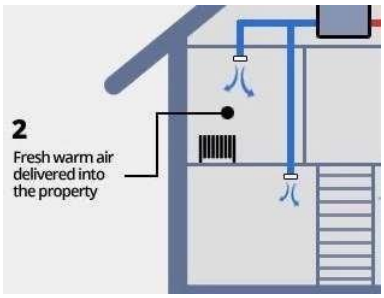
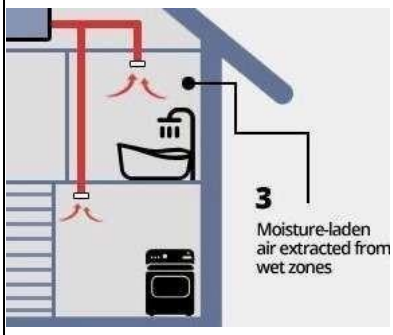
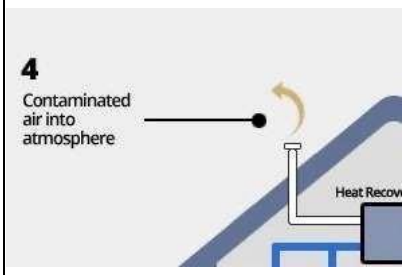
	оселі / свіже тепле повітря
4. contaminated air	d) задушливе (відпрацьоване) повітря / вологе повітря

Ex. 2. *Look at the work of Heat Recovery Ventilation. Follow the two air streams – fresh intake air and stale exhaust air. Find the Ukrainian equivalents of processes shown in Figure 1 and described in Table 2. Match English word combinations 1) – 4) with Ukrainian equivalents a) – d). Use Figure 1 and Table 2 below to find out the meanings of the technical terms and the processes graphically. Take into account that the colour of the font and the colour of the figures correspond to each other.*

Table 2

Description of the English terms and processes of Heat Recovery Ventilation

English terms	*Description of the processes*	*Ukrainian equivalents (English terms+ Description of the processes)*
1. fresh intake air 	is drawn in from outside	a) свіже тепле повітря, що подається у спальні та житлові зони

2. incoming air / fresh warm air  	is delivered to bedrooms and living areas	b) свіже повітря, що надходить ззовні
b) exhaust air  	is drawn from kitchen and bathrooms where odors, moisture, and pollutants collect	c) забруднене повітря, що витягується назовні
4. contaminated air  	is exhausted to the outside	d) задушливе повітря, що витягується з кухні та ванних кімнат, де збираються запахи, волога та забруднювачі

Ex 3. *Look at the Figure 2. below "Types of heat exchangers" and find the most efficient one.*

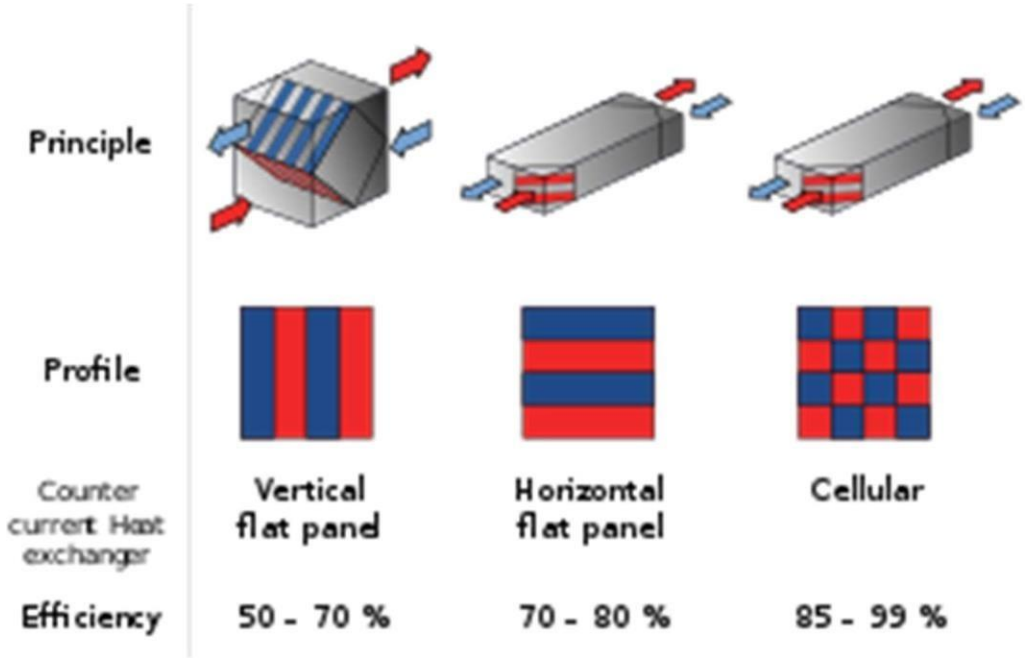
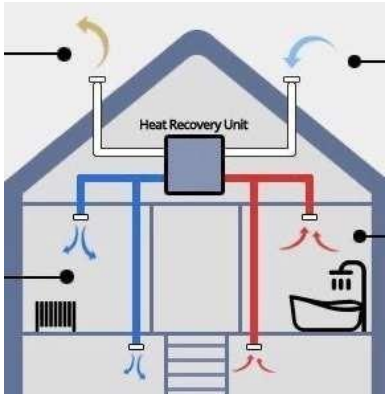
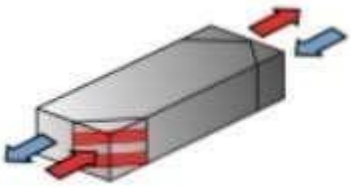


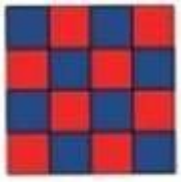
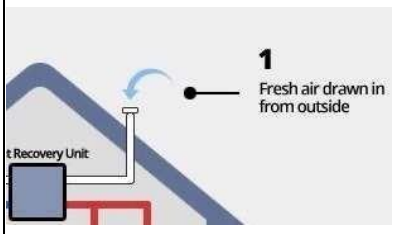
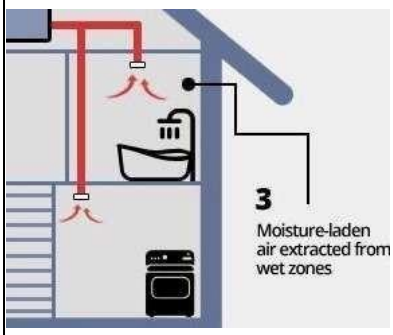
Figure 2. Types of heat exchangers

Ex. 4. *Match English word combinations 1) – 5) with Ukrainian equivalents a) – e). Use Figure 1 and Table 3 below to find out the meanings of the technical terms and processes graphically. Take into account that the colour of the font and the colour of the figures on the photo correspond to each other.*

Table 3

Description of English terms and processes of two air streams that passes through the heat exchanger

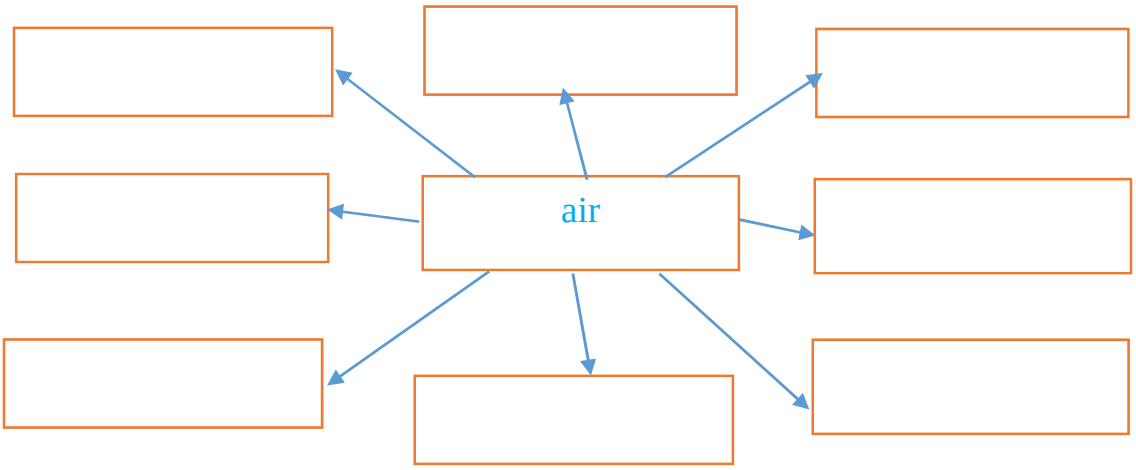
English terms	*Description of the processes*	*Ukrainian equivalents*
1. Heat Recovery Unit 	The two air streams – fresh intake air and stale exhaust air – never mix. 	a) вентиляційний пристрій рекуперації тепла (HRV)

2. honeycomb-like structure / cellular  Cellular		b) припливно-витяжна вентиляція
3. Heat Recovery Ventilation (HRV)		c) сотоподібна структура
4. fresh intake air 	fresh intake air, passes through the heat exchanger where up to 90% of thermal energy from exhaust air is transferred into the incoming air	d) відпрацьоване повітря, проходить через теплообмінник, де теплова енергія переходить до повітря, що надходить ззовні
5. exhaust air 	exhaust air, passes through the heat exchanger where it shares its thermal energy with intake air	e) свіже повітря, що надходить ззовні, проходить через теплообмінник, де до 90% теплової енергії з відпрацьованого повітря переходить у повітря, що надходить до оселі

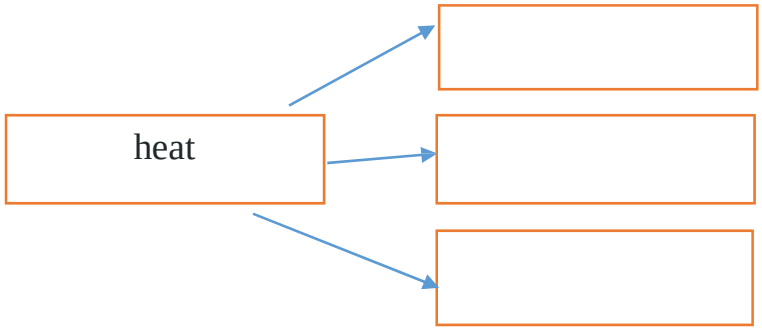
Ex.4 Choose the words or word combinations in the box and match them with the word(s) in scheme structures (1 – 4) to make technical terms.

fresh, intake, exchanger, exhaust, contaminated, incoming, stream, warm, moisture-laden, stale, recovery unit, structure, recovery ventilation

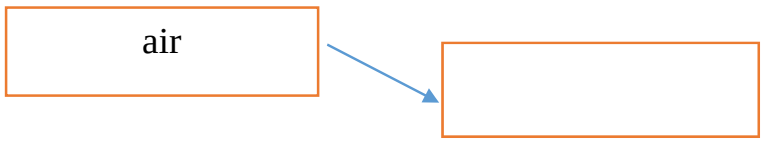
1.



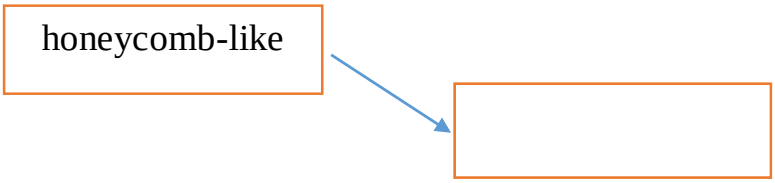
2.



3.



4.



Ex.5 *Complete the following sentences using the word combinations from Ex.4 The first and the last letters of each word are given.*

1. There are now many stoves on the market which can be connected directly to a ducted f_ _ _h a_r supply to allow efficient combustion and do not introduce cold f_ _ _h a_r into the room.

2. As a way of overcoming all these problems, h_ _t r_ _ _ _ _ _y u_ _t(s) are now being fitted to new and existing homes.

3. W_ _m moist a_r is extracted from the wet areas of a building, e.g. utility, kitchen. bathroom and particularly shower rooms.

4. This a_r passes into the unit across a very efficient h_ _t e_ _ _ _ _ _ _r where up to 92% of the heat is extracted and transferred to f h a_r being drawn in from the outside.

5. This w_ _m dry a_r is then returned to the living areas of the building.

TEXTS: UNIT 3. HEATING, VENTILATION AND AIR CONDITIONING (HVAC) SYSTEMS

Text 1. **Heating, Ventilation and Air Conditioning (HVAC) systems**

Task 1. *Before you begin to read the text "Heating, Ventilation and Air Conditioning (HVAC) systems", list details in the first two columns.*

1	2
What I Know about the topic "**Heating, Ventilation and Air Conditioning (HVAC) systems**"? *Write all information you know in the form of words, word combinations, sentences.*	**What I expect to know** after reading the text. *Write all information in the form of questions.*

Task 2. *Skim the text "Heating, Ventilation and Air Conditioning (HVAC) systems". Add the important terms and terms combination words in the first column. Write additional questions in the second column.*

Tips for skimming:

Read the first sentence of every paragraph

Read any headings and sub-headings

Notice any figures, charts, or graphs

Notice any italicized or boldface words or phrases

Text **Heating, Ventilation and Air Conditioning (HVAC) systems**

Heating, Ventilation and Air Conditioning (HVAC) systems control temperature, humidity and quality of air in a building to a set of chosen or preferred conditions. To achieve this, systems need to transfer heat and moisture intoandoutof the air and control the level of air pollutants, either bydirectlyremoving it orbydiluting it to acceptable levels.

- Heating is needed to increase the temperature in a space to compensate for heat loss.
- Ventilation is needed to supply air to a space and extract polluted air from it.
- Cooling is needed to lower temperature in a space where heat gains are caused by the sun, activity of people and the function of equipment.

Three central functions of Heating, Ventilation and Air Conditioning are interrelated to optimally provide thermal comfort, acceptable indoor air quality and ideal operating conditions within the boundaries of acceptable or reasonable costs.

HVAC systems vary widely in terms of size, functions they perform and the amount of energy they consume.

Factors that influence energy usage include:

- The design, layout and operation of a building, affects how the external environment impacts on internal temperature and humidity levels
- HVAC systems will use more energy when the required indoor temperature and air quality - in extreme temperatures or in the case of operations where greater precision or more refined air quality is required
- The heat generated internally by lighting, equipment and people - all have an impact on how warm your building is, and the load on the HVAC system
- The design and efficiency of your HVAC system - older systems tend to be less energy-efficient
- How, when and for how long your HVAC system is operated every day
- How well the HVAC system is monitored and maintained.

(Heating, Ventilation and Air Conditioning (HVAC) system: energy-efficient usage and technologies. Eskom Integrated Demand Management, July 2015. Eskom Holdings SOC Ltd Reg № 2002/015527/30)

Task 3. *Read the text "Heating, Ventilation and Air Conditioning (HVAC) systems". Find the answers to the questions from the second column and write them in the third column in the form of sentences. Write all the questions you have not answered in the fourth column.*

3	4
What I Learned. *Write the answers to the questions from the second column. Write all information that you can find in the text "Heating, Ventilation and Air Conditioning (HVAC) systems" in the form of sentences.*	**Met expectations** *Write all the questions you have not answered.*

Task 4. *Find the answers to the questions from the fourth column and use this information for the individual work. Use additional information resources.*

Text 2. **Switch to energy–efficient technologies**

Task 1. *Before you begin to read the text "Switch to energy–efficient technologies", list details in the first two columns.*

1	2
What I Know about the topic "**Switch to energy–efficient technologies**"? *Write all information you know in the form of words, word combinations, sentences.*	**What I expect to know** after reading the text. *Write all information in the form of questions.*

Task 2. *Skim the text "Switch to energy–efficient technologies". Add the important terms and terms combination words in the first column. Write additional questions in the second column.*

Tips for skimming:

Read the first sentence of every paragraph

Read any headings and sub-headings

Notice any figures, charts, or graphs

Notice any italicized or boldface words or phrases

Text **Switch to energy–efficient technologies**

Consider replacing old HVAC systems – new systems offer enhanced control functionality and can use up to 50% less electricity than energy-intensive systems. Savings on the day-to-day running costs of electricity saving systems can quickly recoup the investment in energy-efficient HVAC technology solutions.

Upgrading and refurbishing

When putting in a new HVAC system, always choose the most energy-efficient technology solution you can afford and one that fits your building's requirements - avoid simply exchanging like with like, in the belief that it will minimise disruptions to your business. When replacing inefficient components also avoid simply exchanging like with like - ensure that the replacement is of the highest possible efficiency.

Consider:

- Replacing conventional boilers with condensing boilers
- Replacing standard motors with high efficiency motors
- Investing in Variable Speed Drives (VSDs) for motors to match speed with output demand
- Investing in direct drive pumps and fans, which are more efficient than those that are belt driven
- Opportunities for heat recovery and recirculation in your building
- Installing a Building Energy Management System (BMS or BEMS), which offers close control and monitoring of building services performance, including Heating, Ventilation and Air Conditioning. Displayed on a computer screen in real time and allowing system performance to be monitored and settings to be changed quickly and easily, BEMS can reduce energy costs by up to 10%.

Seek advice

Always seek advice from HVAC system specialists before you upgrade or refurbish.

HVAC system action checklist: Start reducing your energy costs today

	Action
	Reduce the need - switch off unnecessary equipment during the day and, especially, after hours to reduce heat build-up in your building (unless your building is 'night-cooling').
	Consider installing automatic controls to ensure equipment stays off.
	Set higher switch-on temperatures for cooling and lower switch-on temperatures for heating - a temperature control gap or "dead band" between heating and air conditioning of about 5ºC will improve occupants' comfort, cut operating costs and reduce wear and tear on both systems.
	Look into areas that appear too hot or too cold and consider localised thermostatic controls.
	Check for draughts, especially around poor fitting windows and doors - install draught-proofing to reduce heat loss and increase staff comfort.
	Check insulation levels and increase it wherever practical to reduce the need for heating.
	Walk around your building at different times of the day and during different seasons to see how and when systems are on - check time

	and temperature settings.
	Take advantage of free-cooling - where outside temperatures are colder than the required internal temperature you can ventilate the building with fresh air. ("Night cooling" is especially efficient in summer).

(Heating, Ventilation and Air Conditioning (HVAC) system: energy-efficient usage and technologies. Eskom Integrated Demand Management, July 2015. Eskom Holdings SOC Ltd Reg № 2002/015527/30)

Task 3. *Read the text "Switch to energy–efficient technologies". Find the answers to the questions from the second column and write them in the third column in the form of sentences. Write all the questions you have not answered in the fourth column.*

3	4
What I Learned. *Write the answers to the questions from the second column. Write all information that you can find in the text "Switch to energy–efficient technologies" in the form of sentences.*	**Met expectations** *Write all the questions you have not answered.*

Task 4. *Find the answers to the questions from the fourth column and use this information for the individual work. Use additional information resources.*

Text 3. **Heat recovery ventilation**

Task 1. *Before you begin to read the text "Heat recovery ventilation", list details in the first two columns.*

1	2
What I Know about the topic "**Heat recovery ventilation**"? *Write all information you know in the form of words, word combinations, sentences.*	**What I expect to know** after reading the text. *Write all information in the form of questions.*

Task 2. *Skim the text "Heat recovery ventilation". Add the important terms and terms combination words in the first column. Write additional questions in the second column.*

Tips for skimming:

Read the first sentence of every paragraph

Read any headings and sub-headings

Notice any figures, charts, or graphs

Notice any italicized or boldface words or phrases

Text. **Heat recovery ventilation**

A heat recovery ventilation, or HRV, is a fresh air system that preserves indoor warmth (or cool) inside a building while providing a 24/7 supply of fresh, filtered air to building occupants. ERV, or energy recovery ventilation, is closely related to HRV, but in addition to recovering heat it can also transfer water vapor between incoming and outgoing air, which is useful in avoiding over-drying of indoor air during winter in our climate.

The old way of "ventilating" our buildings through random air leaks is not only inefficient and drafty, but also unhealthy. Poor indoor air quality is a chronic problem in conventionally-built structures. Buildings with no ventilation system depend on weather to exchange air through leaks and flaws in the building enclosure. If there's no wind or inadequate difference between indoor and outdoor temperatures then there's no force to refresh air in the building. The result is stale air.

Even on those days that the weather does cooperate, the source quality of incoming air is poor when we rely on the old way of ventilating. A recent Washington State University study showed that forty percent of all interior air in existing homes originates in crawlspaces and unconditioned basements – not good sources of healthy fresh air. Diluting indoor air pollutants with dirty air is counterproductive.

While virtually every building built today would benefit from a balanced, mechanical, fresh air HRV or ERV system, the more airtight the building, the better that system will perform. With this modern fresh air system we know where incoming air is coming from: a clean, filtered intake leading directly through the HRV or ERV, delivering healthy fresh air, comfortable interior temperatures, and a smaller carbon footprint.

HOW DO HRVs WORK?

Fresh intake air is (1) drawn in from outside, (2) passes through the HRV's (or ERV's) heat exchanger where up to 90% of thermal energy from exhaust air is transferred into the incoming air, and (3) is delivered to bedrooms and living areas. Exhaust air is (1) drawn from kitchen and bathrooms where odors, moisture, and pollutants collect, (2) passes through the heat exchanger where it shares its thermal energy with intake air, and (3) is exhausted to the outside.

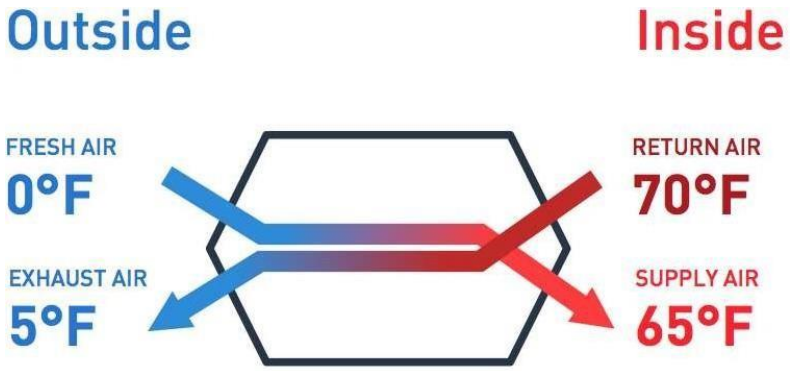


Diagram courtesy of Skylar Swinford (діаграма надана Skylar Swinford)

The two air streams – fresh intake air and stale exhaust air – never mix. In the highly efficient units we use, the two streams pass through a honeycomb-like structure of thin-walled passages inside the heat exchanger that provides a very large surface area for the transfer of energy between adjacent intake and exhaust air streams.

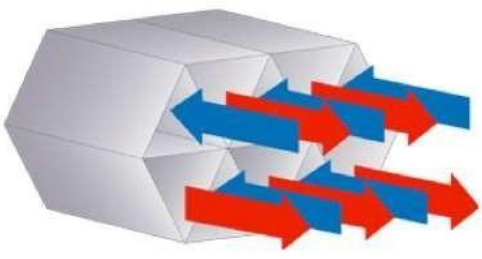


Image courtesy of Paul Wärmerückgewinnung GmbH (Зображення надано Paul Wärmerückgewinnung GmbH)

BUT WHAT IF THE POWER GOES OUT?

It is not a big deal if the HRV cuts out during a power outage, as even the most "airtight" buildings are far from hermetically sealed. If it gets a little stuffy the solution is simply to crack a window or two until power is restored. The passive qualities of high performance buildings extend the "open window season" anyway, so even with a couple windows open the high performance building will be more comfortable during that power outage than a conventional building.

(Hammer & Hand Construction Woodcraft).

Task 3. *Read the text "Heat recovery ventilation". Find the answers to the questions from the second column and write them in the third column in the form of sentences. Write all the questions you have not answered in the fourth column.*

3	4
What I Learned. *Write the answers to the questions from the second column. Write all information that you can find in the text "Heat recovery ventilation" in the form of sentences.*	**Met expectations** *Write all the questions you have not answered.*

Task 4. *Find the answers to the questions from the fourth column and use this information for the individual work. Use additional information resources.*

AFTER-READING ACTIVITIES:
UNIT 3. HEATING, VENTILATION AND AIR CONDITIONING (HVAC) SYSTEMS

I. Listen and watch the video on the topic "Passive house ventilation system". Write down all terms and terms combination words you have heard.

II. In pairs, look at Figure 1,Table 1 and Table 2 below and find out the reasonable decision for reducing of the heat gains during summertime. Discuss the possible costs, beauty of the design and comfort for each decision.

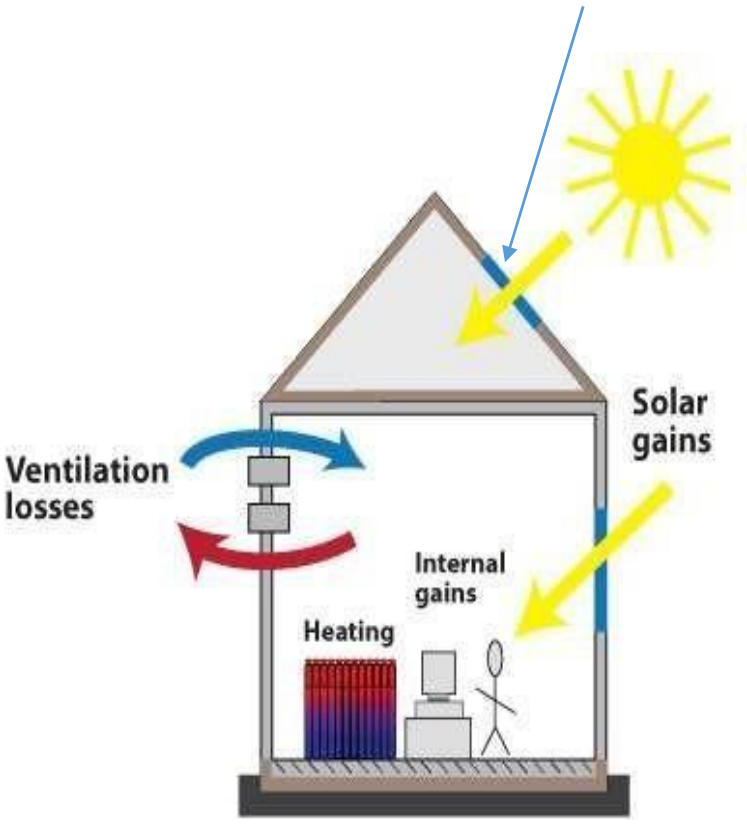


Figure 1. Gains

Table 1

Kind of gains	*decision for reducing of the heat gains during summertime*	*Costs*	*Beauty of interior or exterior) design*	*Comfort*
Solar gains	Shading (blinds and shutters, construction elements)			
Internal gains	*a.* Energy Recovery Ventilation *b.* Natural Ventilation			
Heating energy	Do not use heating during summertime			

Table 2

Model of expressing opinion in a discussion	*Useful phrases for discussion*
Position	In my opinion/ From my point of view, …/ The main point is…/ On balance I think… I disagree with… I have to disagree with… Of course/Obviously… However/Though, …/ but… More importantly, …
Argument 1 Argument 2 Argument 3	First, … whereas… Second, … Third, … On the other hand, … so…/ whereas… Also, … Moreover, … Another advantage is …
Conclusion/Summary	In conclusion, … In summary, … In short, … To sum up, …

TESTS: UNIT 3. HEATING, VENTILATION AND AIR CONDITIONING (HVAC) SYSTEMS

I. *Match the Ukrainian words and phrases to their English equivalents:*

1. to consume (*v)* *2.* to maintain (*v)* *3.* to extract (*v)* *4.* to increase (*v)* *5.* to decrease (*v)* *6.* to refine (*v)* *7.* to provide (*v)* *8.* to heat (*v)* *9.* ventilation (*n)* *10.*equipment (*n)* *11.* qualityof air (*n)* 12.humidity (*n)* 13.air (*n)* 14.building (*n)* 15.heat balance (*n)* 16.resistance (*n)* *17.* heat loss (*n)* *18.* heat gains (*n)* 19.quantity (*n)* 20.heat transfer (*n)*	a. теплові втрати b. теплові надходження c. збільшувати d. обслуговувати, підтримувати робочий стан (обладнання) e. видаляти f. зменшувати g. очищати (від домішок) h. якість повітря i. споживати j. забезпечувати k. нагрівати l. вентиляція m. обладнання n. вологість o. повітря p. будівля q. тепловий баланс r. теплопередача s. опір t. кількість

v – verb (дієслово)
n – noun (іменник)
adv –adverb (прислівник)

II. *Match the Ukrainian words and phrases to their English equivalents:*

1. qualityofair 2. indoor air quality	a. видалення забрудненого повітря з

3. refined air quality 4. the level of air pollutants 5. preferredconditions 6. dilute to acceptable levels 7. to increase the temperature 8. to extract polluted air from 9. to lower temperature 10. the external environment impacts 11. to provide thermal comfort 12. ideal operating conditions 13. reasonable costs 14. layout of a building 15. to be less energy-efficient	b. якість очищеного повітря c. якість повітря d. якість повітря в приміщенні e. знижувати температуру f. рівень забруднення повітря g. кращі умови h. знижувати до необхідного рівня (забруднення) i. підвищувати температуру j. забезпечувати тепловий комфорт k. оптимальні умови при роботі (обладнання) l. план будови m. помірні витрати n. вплив зовні навколишнього середовища o. бути менш енергоефективним

III. *Choose the correct answer: a,b,c.*

1. _____is needed to increase the temperature in a space to compensate for heat loss.
   a. Heating
   b. Cooling
   c. Pollution

2. _____is needed to supply air to a space and extract polluted air from it.
   a. Humidity
   b. Ventilation

c. Heating

3. _____is needed to lower temperature in a space where heat gains are caused by the sun, activity of people and the function of equipment.

a. Heat gains
b. Cooling
c. Heating

IV. *Read the paragraphs below. Choose the most appropriate variant: a,b or c to complete the following sentences.*

1. HVAC system will use more energy when the required indoor temperature and air quality – in extreme temperatures or in the case of operations where greater precision or more refined air quality is required.

HVAC system will use more energy _____

a. in hospitals and during summer/ winter time at high/low temperatures
b. during winter/summer time
c. during spring months

2. Cooling is needed to lower temperature in a space where heat gains are caused by the sun, people activity, appliances, computers and other electric devices, as well as from illumination.

Internal heat gains are caused by_____

a. cooling
b. colour of walls in a room, building, etc
c. activity of people and the function of equipment

3.Three central function of Heating, Ventilation and Air Conditioning are interrelated to optimally provide thermal comfort, acceptable indoor air quality and ideal operating conditions within the boundaries of acceptable or reasonable costs.

Three central functions of HVAC are interrelated to_____

a. providing set of chosen or preferred internal conditions such as temperature, humidity and quality of air
b. energy from renewable energy systems
c. energy balance caused by the sun, activity of people and function of equipment

V. *Which list of the words belongs to the description of "Heating, Ventilation and Air Conditioning"?*

a. Indoor air quality, level of air pollutants, extreme temperatures, provide thermal comfort, energy recovery ventilation, ideal operating conditions, heat balance.

b. Civil engineering, theoretical knowledge, empirical information, environmental engineering, water supply, purification, sewer system.

c. Scientific evidence, solid background, construction, architecture, civil engineering establishment, rewarding discipline.

VI. *Read the text below and find two paragraphs that* ***don't*** *describe the factors that influence HVAC systems energy usage. Find out all appropriate variants (a, b, c, d, e).*

a. Heating, Ventilation and Air Conditioning (HVAC) systems control temperature, humidity and quality of air in a building to a set of chosen or preferred conditions.To achieve this, systems need to transfer heat and moisture into and out of the air and control the level of air pollutants, either bydirectlyremoving it orbydiluting it to acceptable levels.

b. HVAC systems will use more energy when the required indoor temperature and air quality - in extreme temperatures or in the case of operations where greater precision or more refined air quality is required.

c. The heat generated internally by lighting, equipment and people – all have an impact on how warm your building is, and the load on the HVAC system.

d. The design and efficiency of your HVAC system – older systems tend to be less energy-efficient.

e. A heat recovery ventilation, or HRV, is a fresh air system that preserves indoor warmth (or cool) inside a building while providing a 24/7 supply of fresh, filtered air to building occupants. ERV, or energy recovery ventilation,

is closely related to HRV, but in addition to recovering heat it can also transfer water vapor between incoming and outgoing air.

VII. *Read the text below. Match choices (a-h) to (1-5). There are three choices you do not need to use.*

1. A heat recovery ventilation, or HRV, is a fresh air system that preserves indoor warmth (or cool) inside a building while providing a 24/7 supply of fresh, filtered air to building occupants.

2. ERV, or energy recovery ventilation, is closely related to HRV, but in addition to recovering heat it can also transfer water vapor between incoming and outgoing air, which is useful in avoiding over-drying of indoor air during winter in our climate.

3. The old way of "ventilating" our buildings through random air leaks is not only inefficient and drafty, but also unhealthy. Poor indoor air quality is a chronic problem in conventionally-built structures. Buildings with no ventilation system depend on weather to exchange air through leaks and flaws in the building enclosure. If there's no wind or inadequate difference between indoor and outdoor temperatures then there's no force to refresh air in the building. The result is stale air.

4. Heating, Ventilation and Air Conditioning (HVAC) systems control temperature, humidity and quality of air in a building to a set of chosen or preferred conditions.To achieve this, systems need to transfer heat and moisture into and out of the air and control the level of air pollutants, either bydirectlyremoving it orbydiluting it to acceptable levels.

5. Factors that influence energy usage include:

HVAC systems will use more energy when the required indoor temperature and air quality - in extreme temperatures or in the case of operations where greater precisionor morerefinedairquality is required.

Which of these systems can_____?

a.	transfer heat and moisture between incoming and outgoing airstreams
b.	transfer heat between incoming and outgoing airstreams and provide tempered purified air
c.	be transformed by the sun and the activity of people

d.	use more energy in hospitals and during winter or summer time at low/high temperatures
e.	thermally isolate the envelope and to keep sheathing warm and free of condensation
f.	build a continuous airtight envelope and minimize air leakage
g.	control the level of air pollutants
h.	lead to the problem of providing purified indoor air

TEXTS: UNIT 4. TOP TIPS FOR AN EFFECTIVE PRESENTATION

Text 1. **How can you make a good presentation even more effective?**

Task 1. *Before you begin to read the text "How can you make a good presentation even more effective?", list details in the first two columns.*

1	2
What I Know about the topic "**How can you make a good presentation even more effective?**"? *Write all information you know in the form of words, word combinations, sentences.*	**What I expect to know** after reading the text. *Write all information in the form of questions.*

Task 2. *Skim the text "How can you make a good presentation even more effective?". Add the important information in the first column. Write additional questions in the second column.*

Tips for skimming:

Read the first sentence of every paragraph

Read any headings and sub-headings

Notice any figures, charts, or graphs

Notice any italicized or boldface words or phrases

Text **How can you make a good presentation even more effective?**

Task 3. *Read the text "How can you make a good presentation even more effective?". Find the answers to the questions from the second column and write them in the third column in the form of sentences. Write all the questions you have not answered in the fourth column.*

3	4
What I Learned. *Write the answers to the questions from the second column. Write all information that you can find in the text "How can you make a good presentation even more effective?" in the form of sentences.*	**Met expectations** *Write all the questions you have not answered.*

Task 4. *Find the answers to the questions from the fourth column and use this information for the individual work. Use additional information resources.*

AFTER-READING ACTIVITIES:
UNIT 4. TOP TIPS FOR AN EFFECTIVE PRESENTATION

I. Choose three tips from the article "How can you make a good presentation even more effective?". Write the speech for the presentation "Three main tips." Use the Sample speech form below.

Sample speech

Slide 1

My name is_____. I am the first year student of Engineering systems and Ecology department in the Kyiv National University of Construction and Architecture.

I`m here to present the results of the research "Three main tips."

I hope you will find my presentation helpful.

Thank you for the opportunity to work with you.

To do this I've divided my presentation into three parts.

Firstly, I will talk about how to "Show your Passion and Connect with your Audience".

Then we will look at "Smile and Make Eye Contact with your Audience".

Finally, I will tell you about positive impact of "the 10-20-30 Rule for Slideshows".

Slide 2

Let's start with non-verbal contact with the audience.

Show your Passion, Keep it Simple, Make Eye Contact with your Audience.

It's hard to be relaxed and be yourself when you're nervous. The great presenters say that the most important thing is to connect with your audience, and the best way to do that is to let your passion for the subject shine through.

Be honest with the audience about what is important to you and why it matters.

Slide 3

I'd like to turn now to the importance of smiling and making eye contact with the audience. This sounds very easy, but a surprisingly large number of presenters fail to do it. If you smile and make eye contact, you are building rapport, which helps the audience to connect with you and your subject. It also

helps you to feel less nervous, because you are talking to individuals, not to a great mass of unknown people. Your audience needs to see you as well as your slides.

Now you understand the advantages of some rules of presentation.

Slide 4

Let's continue our topic and look at the positive impact of "the 10-20-30 Rule for Slideshows"

Remember "the 10-20-30 Rule for Slideshows"

This is a tip from Guy Kawasaki of Apple. He suggests that slideshows should:

- Contain no more than 10 slides;
- Last no more than 20 minutes;
- Use a font size of no less than 30 points.

As a general rule, slides should be the sideshow to you, the presenter. A good set of slides should be no use without the presenter, and they should definitely contain less, rather than more, information, expressed simply.

If you need to provide more information, create a bespoke handout and give it out after your presentation.

Slide 5

So, we can draw the following conclusions:

- Be enthusiastic and honest, and the audience will respond
- Your audience needs to see you as well as your slides
- Remember the "10-20-30 Rule for Slideshows"

Now I've come to the end of my presentation "Three main tips."

Slide 6

It should be mentioned that these tips for a good presentation have been studied and presented to you to reflect on them.

Thank you and if you have any more questions, I ' m very happy to answer them.

II. Choose the necessary slides for the chosen tips and present your speech for the class (slides are added).

GLOSSARY

A

to add – додати
additional heat – додаткове тепло
adjacent – прилеглий, суміжний
adjacent areas – прилеглі частини
air – повітря
air duct – повітропровід
air exchange – повітрообмін
air exchange rate – кратність повітрообміну
air flows – повітряні потоки, повітряні маси
air infiltration – проникнення повітря
air leakage – виток повітря
air leaks – витоки повітря
air stream – повітряні потоки, повітряні маси
airtight envelope – герметичні огороджувальні конструкції
airtightness / air tightness – повітронепроникненість, герметичність
to allow – дозволяти
amount – кількість
amount of heat – кількість тепла
to appear – з'явитися
appliance – прилад, пристрій
to assemble – монтувати, збирати
average building stock – звичайні будинки

B

to be less energy-efficient – бути менш енергоефективним
beam – балка
benefit – перевага
blinds – гардини
bill – рахунок
to build – будувати
building – будівля
building enclosure – огороджувальна конструкція
building envelope – огороджувальна конструкція
building occupants – мешканці будівель

building stock – будівельний фонд

C

carbon footprint – вуглецевий слід
central air conditioning system – центральна система кондиціонування
central heating – центральне опалення
clearly visible – добре видно
cold – холодний
cold climate – холодний клімат
combustion – горіння
concrete – бетон
conduction – провідність
conditioned space – кондиціонований об’єм
conditioned area – кондиціонована площа
to connect – підключити, поєднувати
construction element – конструктивний елемент (напр. вікно)
to consume – споживати
consumption – споживання
to contaminate – забруднювати
contaminated air – забруднене повітря
continuous insulation – безперервна цілісна ізоляція
cooled space – охолоджуваний об’єм
cooling – охолодження
cooling costs – витрати на охолодження
costs – витрати
to crack – ламати
to crack a window – зламати вікно
crawlspace – важкодоступне місце для прибирання
current economic conditions – сучасні економічні умови

D

decade – десятиліття
to decrease – зменшувати
to deliver – доставляти
to deliver energy efficiency – забезпечити енергоефективність
delivered energy – поставлена енергія
device – прилад, пристрій

to dilute – розбавляти, розводити
dilute to acceptable levels – знижувати до необхідного рівня (забруднення)
diluting indoor air – змішане (розведене) внутрішнє повітря
to draw – подавати, постачати
dry air – сухе повітря
durability (*n)* – довговічність, зносостійкість

E

east-west axis – вісь схід-захід
efficient combustion – ефективне горіння
electric device – електричний прилад
to eliminate – усунути, ліквідувати
emission – викиди
energy carrier – енергоносій
energy consumption – споживання енергії
energy efficiency – енергоефективність
energy need for heating and cooling – енергопотреба для опалення чи охолодження
energy performance of building – енергетична ефективність будівлі
Energy Recovery Ventilation (ERV) – вентиляція з рекуперацією тепла, припливно-витяжна вентиляція
engineering equipment – інженерне обладнання
to ensure – забезпечувати
to ensure a robust high-quality building envelope – забезпечити надійну якісну огороджувальну конструкцію
environment – навколишнє середовище
equipment – обладнання
exceptional comfort – особливий комфорт
exchange – обмін
exfiltration – непроникнення, ексфільтрація
exhaust air – задушливе (відпрацьоване) повітря
exterior – зовнішня частина
external – зовнішній
external dimension – зовнішні розміри
external environment impacts – вплив зовні навколишнього середовища
to extract – видаляти
to extract polluted air from – видалення забрудненого повітря з

F

fabric – будова, структура
fasteners – кріплення
floor – підлога
to flow through – протікати крізь
to flow through the building envelope – проникати через огороджувальні конструкції
fresh air – свіже повітря
fresh intake air – свіже повітря, що надходить ззовні
fuel bill – рахунок за пальне

G

gains – надходження
generation – покоління, виробництво (особливо енергії)

H

healthy fresh air – корисне свіже повітря
to heat – нагрівати
heat balance – тепловий баланс
heat balance of building – тепловий баланс будівлі
heat emissions – виділення тепла
heat exchanger – теплообмінник
heat flows – теплові потоки
heat gains – теплові надходження
heat gains– теплові надходження
heat losses – теплові втрати
heat outputs – теплові надходження
heat recovery – рекуперація тепла
Heat Recovery Unit – вентиляційний пристрій рекуперації тепла (HRV)
Heat Recovery Ventilation (HRV) – вентиляція з рекуперацією тепла, припливно-витяжна вентиляція
heat recovery ventilator – вентилятор рекуперації тепла
heat transfer (ht) – теплопередача
heated space – опалювальний об’єм
heating – опалення
heating bill – рахунок за опалення
heating demand (H) – потреба на опалення

heating energy – теплова енергія
heating installation – опалювальне обладнання
hermetically sealed – герметично закритий
high-quality – високоякісний
honeycomb-like structure – сотоподібна структура
humidity – вологість

I

ideal operating conditions – оптимальні умови при роботі (обладнання)
illumination – освітлення
image – зображення
impact – вплив
incoming air – повітря, що подається до оселі
incoming draughts – протяги
to increase – збільшувати
to increase the temperature – підвищувати температуру
increasingly – все більше
indoor air – внутрішнє повітря
indoor air quality – якість повітря в приміщенні
infiltration – інфільтрація, проникнення
to install – встановлювати, інсталювати
installation – обладнання
insulation – ізоляція
intake – споживання
intake air – повітря, що надходить ззовні
interior – внутрішня частина
internal – внутрішній
internal dimension –внутрішні розміри
internal gains GI – внутрішні теплові надходження
irradiation – випромінювання

L

layout of a building – план будови
to leak– проникати
leakage – виток
level of air pollutants – рівень забруднення повітря
light – світло

light may pass through that material – світло може проходити через цей матеріал
location – розташування, місцеположення
location with less insulation – місце з меншою ізоляцією
losses – втрати
low energy house – енергозберігаючий будинок
low thermal insulation – низька теплоізоляція
to lower – знизити
to lower temperature – знижувати температуру

M

to maintain – обслуговувати, підтримувати робочий стан (обладнання)
mechanical ventilation system – система механічної вентиляції
moisture – вологість
moisture-laden air – вологе повітря

O

odor – запах
opaque building envelope – непрозорі конструкції
opaque surface of the building envelope – непрозора поверхня огороджувальної конструкції
operating conditions – умови при роботі (обладнання)
outdoor air – зовнішнє повітря

P

to pass through – проходити крізь
passive building – пасивний будинок
passive building strategy – пасивна стратегія будівництва
path of least resistance – шлях найменшого опору
to penetrate – проникати
pollutant – забруднювач
pollution – забруднення
power outage – відключення електроенергії
precision – точність
preferredconditions – кращі умови
to provide – забезпечувати
to provide thermal comfort – забезпечувати тепловий комфорт

Q

qualityofair – якість повітря
quantity – кількість

R

random air leaks – випадкові витоки повітря
reasonable costs – помірні витрати
to recoup – компенсувати, повернути
to reduce – знизити
to refine – очищати (від домішок)
refined air quality – якість очищеного повітря
to refurbish – переобладнати
reinforced concrete – залізобетон
to require – вимагати
resiliency – стійкість, надійність
resistance – опір
respectively – відповідно
robust – міцний, довговічний
roof – дах

S

seal – ущільнювач, тюлень
sealing – герметизація
service openings – службові (технічні) отвори
shell – каркас, оболонка
shell of the building – оболонка будівлі
shutters – жалюзі
slab – плита
solar gains GS – сонячні теплові надходження
solar heating – обігрів від сонця
stale air – несвіже повітря
standpoint – точка зору
stove –пальник (газовий), прилад для підігріву холодного повітря
to supply – постачати
surfaces of a wall – поверхні стіни

T

to take into consideration – брати до уваги
thermal bridge – місток холоду
thermal bridge free construction – будівля без містків холоду
thermal envelope area – площа теплоізоляційної оболонки
translucent construction element – напівпрозорий елемент конструкції
transmission losses LT – втрати тепла через конструкції будівлі
transparent construction element – прозорий елемент конструкції
triple pane window – потрійне вікно, потрійне скління
triple-glazed window – потрійне вікно, потрійне скління
truly – по-справжньому

U

ultimately – зрештою
unwanted additional heat – небажане додаткове тепло
upcharge – доплата
utilisation factor FU – коефіцієнт одночасності

V

ventilation – вентиляція
ventilation losses LV – втрати тепла через вентиляцію
ventilation rate – кратність повітрообміну
ventilation system – вентиляційна система
volume – об’єм

W

wall – стіна
warm air – тепле повітря
water vapor – водяна пара
well considered siting – продумане розміщення
window – вікно

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Відеофонограми та ілюстрований матеріал надано з відкритих інформаційних джерел:

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