ENERGY SOURCES

USED

IN SLOVAKIA

GREEN OR NOT?

OBJECTIVES:

- to compare different ways of obtaining energy
- to form students‘ opinions on efficient use of energy sources taking into account better environment



Energy consumption on our planet - exponential rising character
Fossil fuel supplies – inadequate to rising number of people

Disadvantages of fossil fuels:

- unevenness of their distribution
- their necessity to be transported from long distances

Conclusion:

- it is better and more convenient to use energy sources directly in the place of their origin
- the only way to ensure better diversification and distribution of energy sources is to use renewable sources of energy which are limitless – biomass, water, solar and wind energy

Strategic targets in Slovakia

- to lower harmful substances in power engineering
- efficient transformation of coal power stations
- to increase the share of gas and nuclear energy in heating and electricity production
- wider use of renewable sources of energy

$$1\ TJ = 1.10^{12}\ J = 1\ 000\ 000\ 000\ 000\ J$$

Potential of use of renewable sources of energy in Slovakia

Kind of energy	Technically efficient potential	
	GWh/year	TJ/year
Geothermal energy	6300	22680
Wind energy	605	2178
Solar energy	5200	18720
Small water power stations	1034	3722
Large water pawer stations > MWe	5573	20063
Biofuels	2500	9000
Altogether	**32499**	**116816**

Coal power station

- based on burning coal, gas and mazut
- a turbine connected with a generator is driven by steam
- heat energy changes into electricity through a steam cycle steam jednotkou.

In Slovakia we have 2 coal power stations

Na Slovensku vyrábajú elektrickú energiu 2 tepelné elektrárne :

- Power station in NOVÁKY
- Power station in VOJANY

Power Station

Nováky

Power Station Nováky

It provides our region with production and transmission of electricity as well as transmission of hot water and heating into our houses and into other industrial companies.

It uses coal from the mines in our region and now wood chips are being mixed with coal to produse energy.
Biomass accounts for 10% .
Later it should be 15%.
In this way the production of greenhouse gases will be reduced up to 35 000 tonnes a year.

Water power station

Kinetic energy of water falling down in a turbine changes into electric power in generator of current.

In Slovakia there are 203 small water power stations which produce 260 000 MWh / year and 24 large power plants - 4 340 000 MWh a year.

Water power stations

They work as regulating and uninterruptible power supplies and their importance also consists in:

- protection of the territory from floods
- suply industries and farms with water
- keeping a balance of uneven water flows in rivers during a year
- protection of environment
- recreational sports

Nuclear power station

It is based on uranium nuclear fission. Nuclear fuel is highly efficient.From 1g ^{235}U we can get 75600 MJ heat energy .

Thermonuclear fission reactor is the source of heat which is transmited into steam generator. The steam produced here is transmited into turbogenerator and from there electricity is transmited into electricity network.

Disadvantage:

- by-product – radioactive particles dangerous for all living beings
- problems with radioactive waste
- building costs too high

Nuclear power station

Advantages:

- operating expenses are lower
- it is safer and doesn‘t pollute environment so much as coal power stations

In Slovakia we have 2 nuclear power stations in Jaslovske Bohunice and Mochovce.

Nuclear power station

Threats in the history:

Huge disasters

- in Harrisburg (USA) in 1979
- in Tchernobyl (Ukraina) in 1986
- in Fukushima (Japan) in 2011 after a huge earthquake and tsunami

Wind power station

It is based on airflow which changes into electricity.

Slovakia as an inland country with lower wind-energic potential because of our natural conditions (a mountainous country, turbulences, glaze ice)

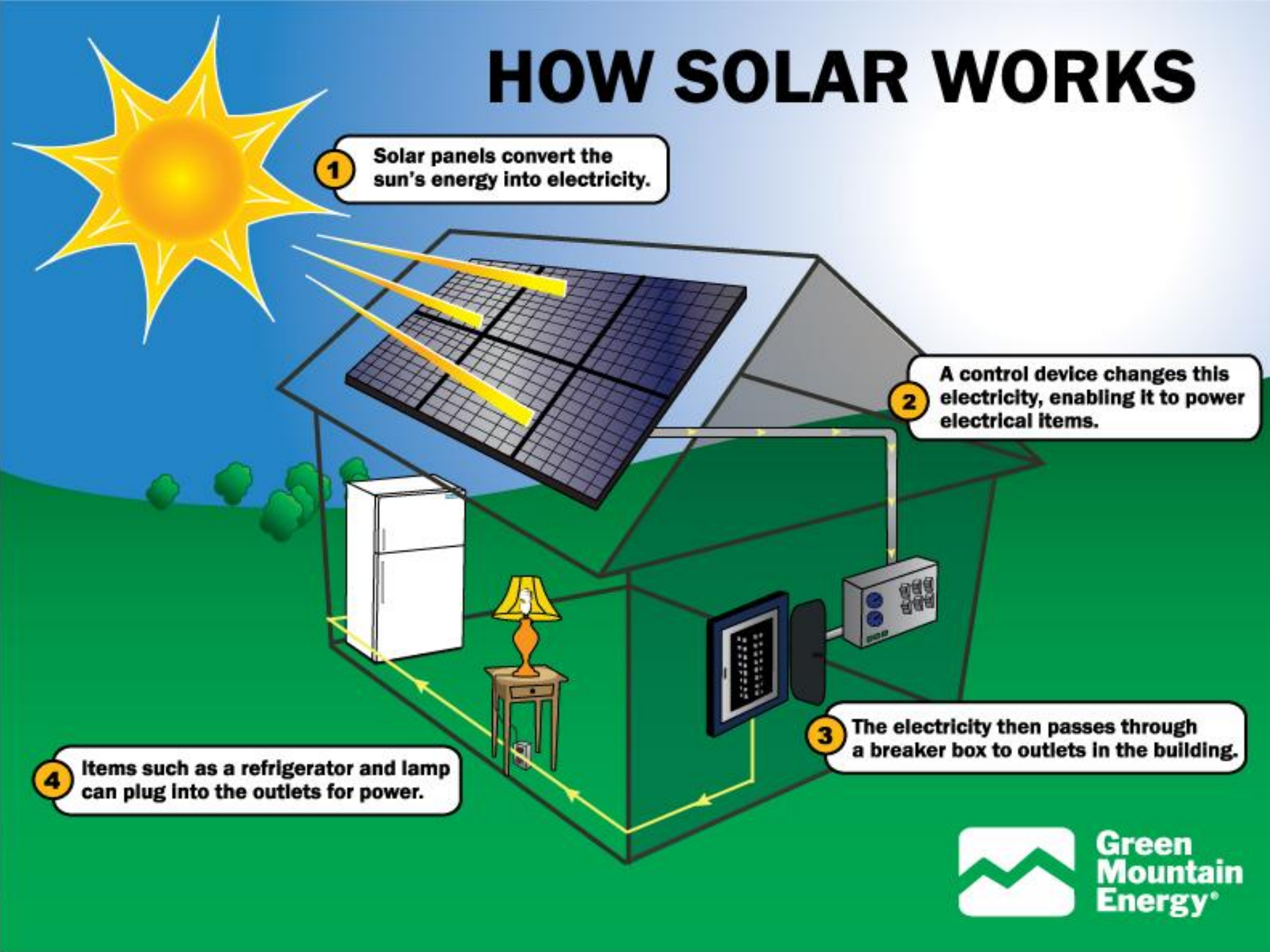
Our potential is 600 GWh/year due to low number of suitable locations.

Solar energy

It is unlimited source of energy available all the year round and contributes to sustainable way of life.
It doesn‘t have any negative influence on environment during long-life technology device. (20 – 30 years)

Using solar collectors and photovoltaic panels everyone can prepare hot water and electricity and in this way we can become independent from energy suppliers.

HOW SOLAR WORKS



Green Mountain Energy®

Energy situation in Slovakia

According to surveys in 2011 there were 144 750 m^2 collector areas.
Assumption: growth more than 15 000 m^2 a year in the future

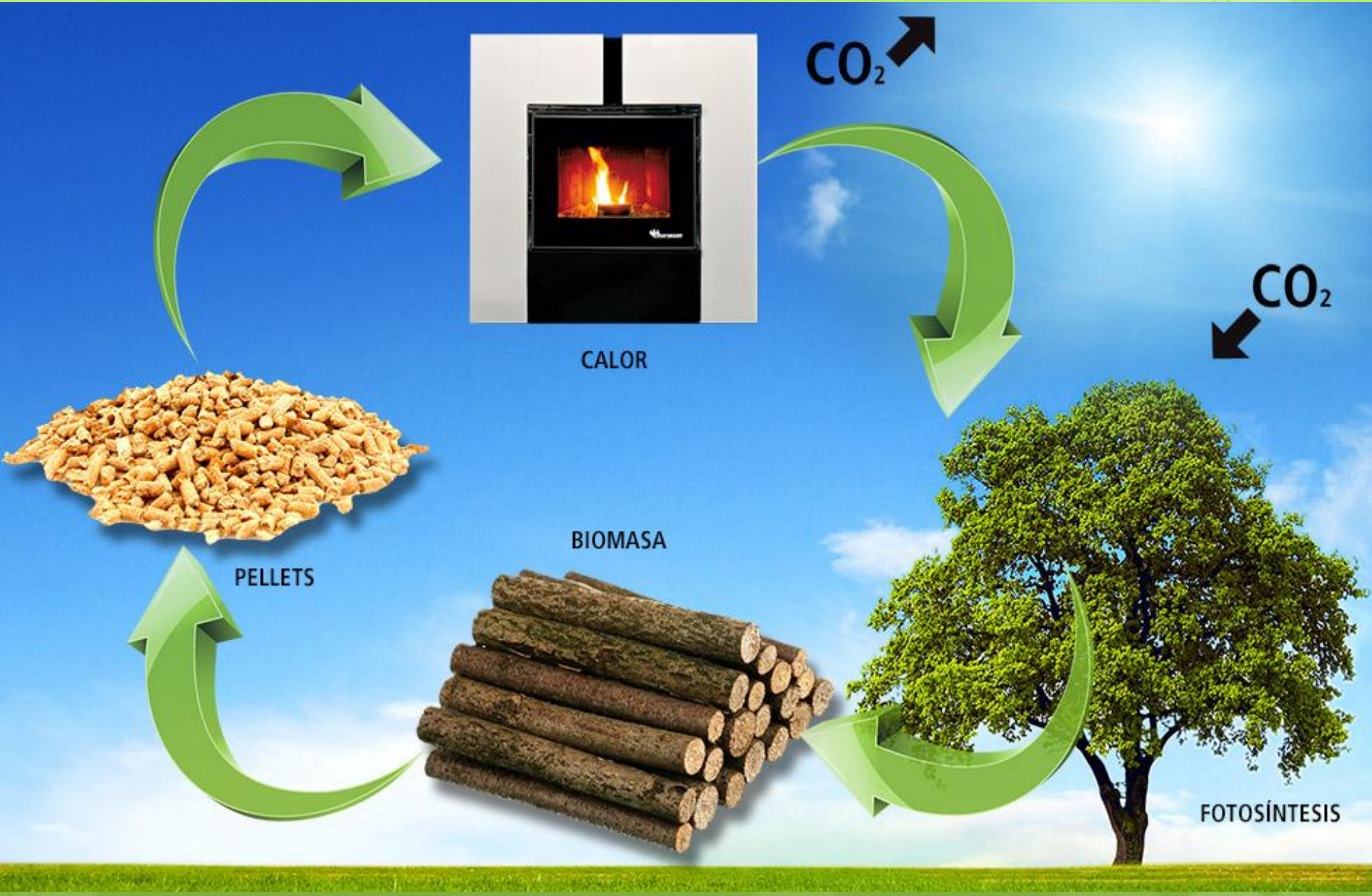
	2003	2004	2005	2006	2007	2008	2009	2010	2011
Collector growth (m^2/year)	5500	5500	7420	8500	9060	13580	12600	13900	23000
year-on-year growth (%)	0	0	35	15	7	50	-7	10	65
Total collector areas	51250	56750	64170	72610	81670	95250	107850	121750	144750

Energy from biomass

It is the biggest potential of energy in Slovakia. Taking into consideration CO_2 emissions biomass is a neutral fuel because during its burning so much CO_2 is released into the atmosphere as a plant during its growth absorbed.

4 kinds of biomass:

- forest biomass – firewood, branches, tree stumps, roots, rind, sawdust,
- agricultural biomass – cereal and oilseed rape straw, industrial hemp, animal excreta, biological waste,
- waste from wood-working industry - cuttings, shavings, sawdust,
- municipal waste- solid incinerable waste, disposal site gas, sludge gas.


CO_2
CALOR
CO_2
PELLETS
BIOMASA
FOTOSÍNTESIS

Geothermal energy

In our conditions we use it to heating.

How it works:

- water from a deep drill hole (up to 4 km) reaches Earth's surface,
- in heat exchangers water is heated in secondary circuit,
- heated water is transmited straight into radiators

The water which turned cold is drained back into the drill hole or is discharged into rivers.

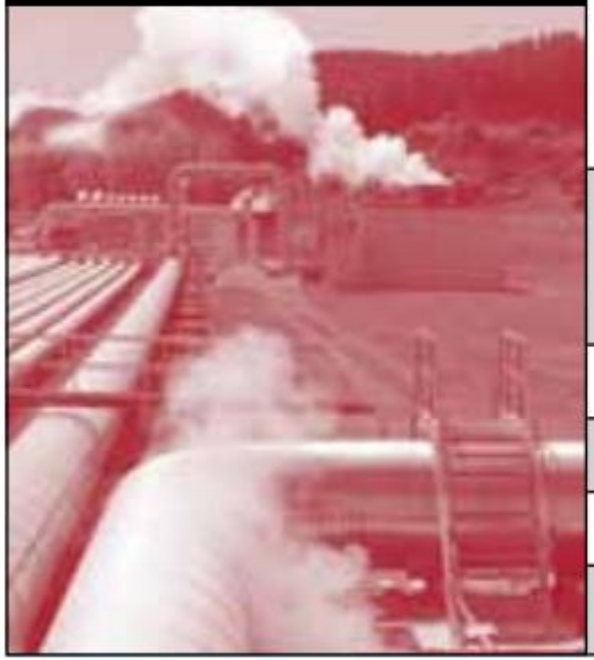
Geothermal energy in Slovakia

- rich in number of thermal springs
- geathermal water is in wider meaning the water with temperature more than 20 C on Earth‘s surface
- nowadays just 5,4 % of all the potential is used in the field of heating
- more of them are used for thermal baths purposes

Termálne kúpalisko Bojnice: Čajka

Lokalita	Bojnice, kúpalisko
Technológia	Geotermálny vrt + tepelné čerpadlo, teplota vody 38 °C
Využitie energie	Geotermálna voda sa využíva na prevádzku termálneh kúpaliska a kúpeľných zariadení.
Prístup verejnosti	áno
Prevádzkovateľ	Zámok a okolie 8, Bojnice 972 01

Termálne kúpalisko Bystričany: Chalmová



Lokalita	Chalmová
Technológia	Geotermálny vrt, ponorné čerpadlo, tri vrty s hĺbkou od 150 do 217 m a teplotami vody od 31°C do 42°C.
Využitie energie	Geotermálna voda sa využíva na prevádzku termálneho kúpaliska.
V prevádzke od roku	1925
Inštaloval	INGEO
Prístup verejnosti	Áno – počas leta
Prevádzkovateľ	Obec Bystričany

Problem solving

During nuclear decay of Uranium ^{235}U 200MeV energy is released. Calculate how many kilograms of coal would we have to burn instead of 1kg uranium to get approximately the same amount of energy. Look up all necessary figures to the calculation on the Internet.

Solving:

Najskôr zistíme počet jadier uránu v 1 kilograme izotopu ^{235}U

Potom zistíme energiu, ktorá sa uvoľní pri rozpade 1 kg ^{235}U

Zistíme si výhrevnosť uhlia

Nakoniec zistíme množstvo uhlia

We have to find out the number of uranium nucleuses:

Ar = 235, mu = 1,66 · 10-27 kg, m = 1 kg, N = ?

$= \quad . \quad \cdot \quad = 1.235 \cdot 1{,}66 \cdot 10^{-27} =$ **$2{,}56 \cdot 10^{24}$**

How to calculate energy released during nuclear decay of 1 kg ^{235}U

$N = 2{,}56 \cdot 10^{24}$, $E_0 = 200\ MeV = 2 \cdot 10^8\ eV = 3{,}2 \cdot 10^{-11}\ J$, $E = ?\ J$

$= \quad \cdot \quad _0 = 2{,}56 \cdot 10^{24} \cdot 3{,}2 \cdot 10^{-11} =$ **$8{,}19 \cdot 10^{13}$**

We have found out a coal heating value and now we can calculate the amount of coal:

$E = 8{,}19 \cdot 10^{13}\ J$

$H_1 = 15 \cdot 10^6\ J/kg$ ... *heating value for brown coal (mine Novaky)*

$H_2 = 28 \cdot 10^6\ J/kg$ ... *heating value for hard coal (Poland)*

$m = ?\ kg$

$= \ .$

$= \ :$

$_1 = 8{,}19 \cdot 10^{13} : 15 \cdot 10^6 = 5{,}467.10^6$ = **5 467 ton**

$_2 = 8{,}19 \cdot 10^{13} : 28 \cdot 10^6 = 3{,}154.10^6$ = **3154 ton**

Result of problem solving

During nuclear decay of 1 kg Uranium such an amount of energy is released as during burning process of **5 467 tons brown coal or 3154 tons hard coal.**

Thanks for your attention

Rudolf Badan
Physics teacher
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