FIFTY/FIFTY
ENERGIESPAREN
AN SCHULEN

November 26th 2018

Introduction & **pedagogical content**

fifty/fifty

energy saving in schools

UfU
Independent Institute for
Environmental Issues

Content

1. Getting to know each other
2. Why save energy?
3. What are the energy saving projects à la fifty/fifty?
4. Pedagogical content: methods and measurements

Personal details - Hoai Nguyen



- BA Communication and Media Management
- **in the past:** energy saving projects at another company in Berlin district Pankow
- **today:** project manager at UfU



projects: energy saving projects in

- Berlin district Reinickendorf
- Hannover
- Bulgaria

+ training of school counselors



public relations

juror in school contest „energy saving champion“

UfU

Personal details – Tilman Abresch

- B.Sc. Physics and M.Sc. Renewable Energies and Energy Efficiency
- **in the past:** educational projects at the Academy for Nature and the Environment of the German state of North Rhine-Westphalia
- **today:** project manager and project member at UfU
- projects: symposium „climate protection at schools“, BEACON, energy saving projects in Jerichower Land, Havelland, Luckenwalde





UfU Unabhängiges Institut für Umweltfragen

- **founded 1990** by East German scientists
- around **30 employees** in **4 departments** at **2 locations**

main activity fields:

- energy efficiency & energy revolution
- climate protection & transformativ education
- environmental law & participation
- conservation and environmental communication



UfU

Participant‘s details – Who are YOU?



What role does

energy saving

play in your everyday working life?

It does not matter.

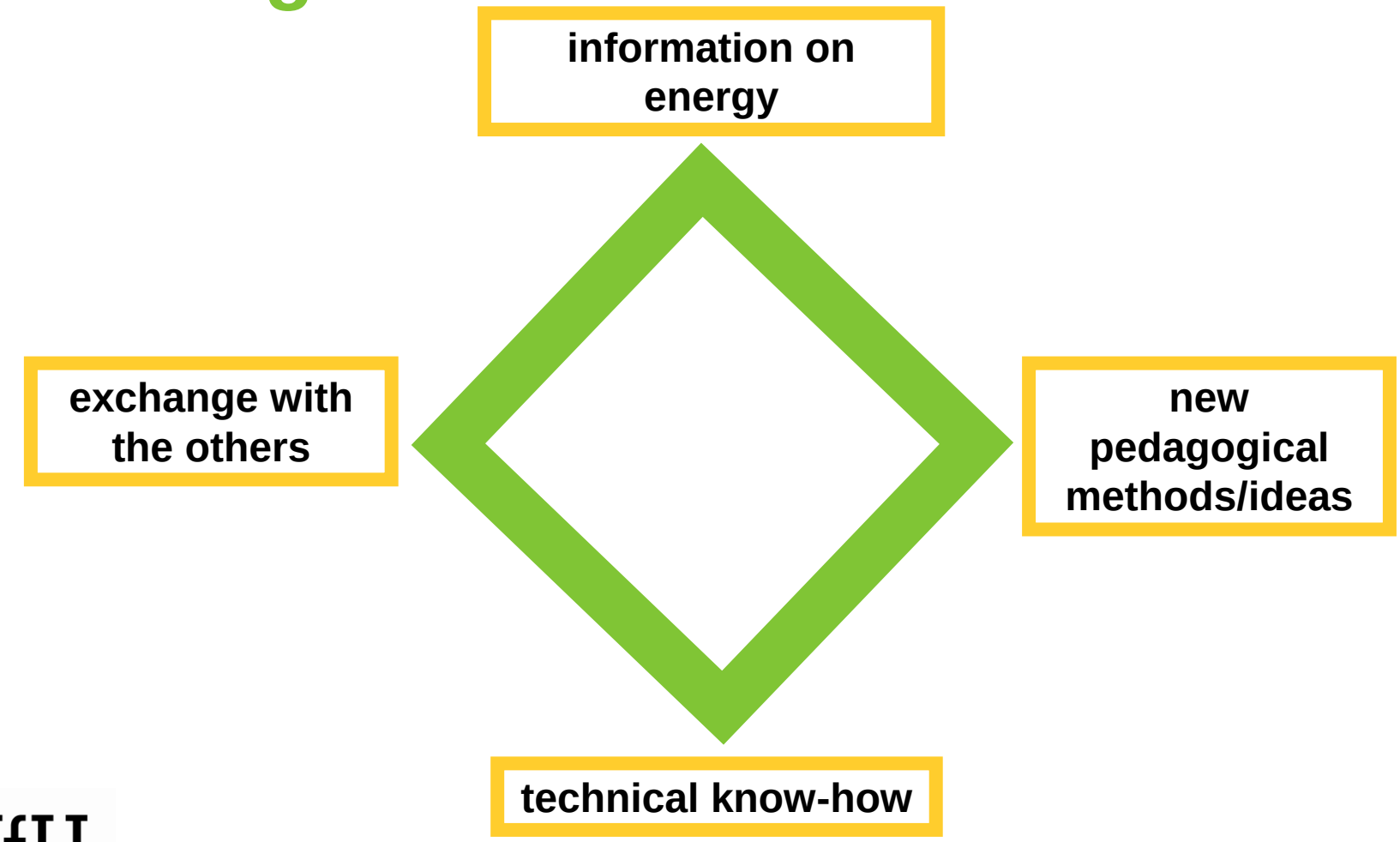
It matters a lot.



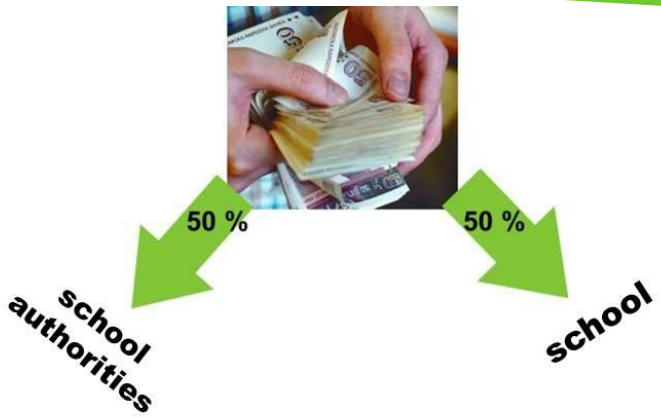
UfU

4 corner

What are you expecting from the training?



fifty/fifty in Germany



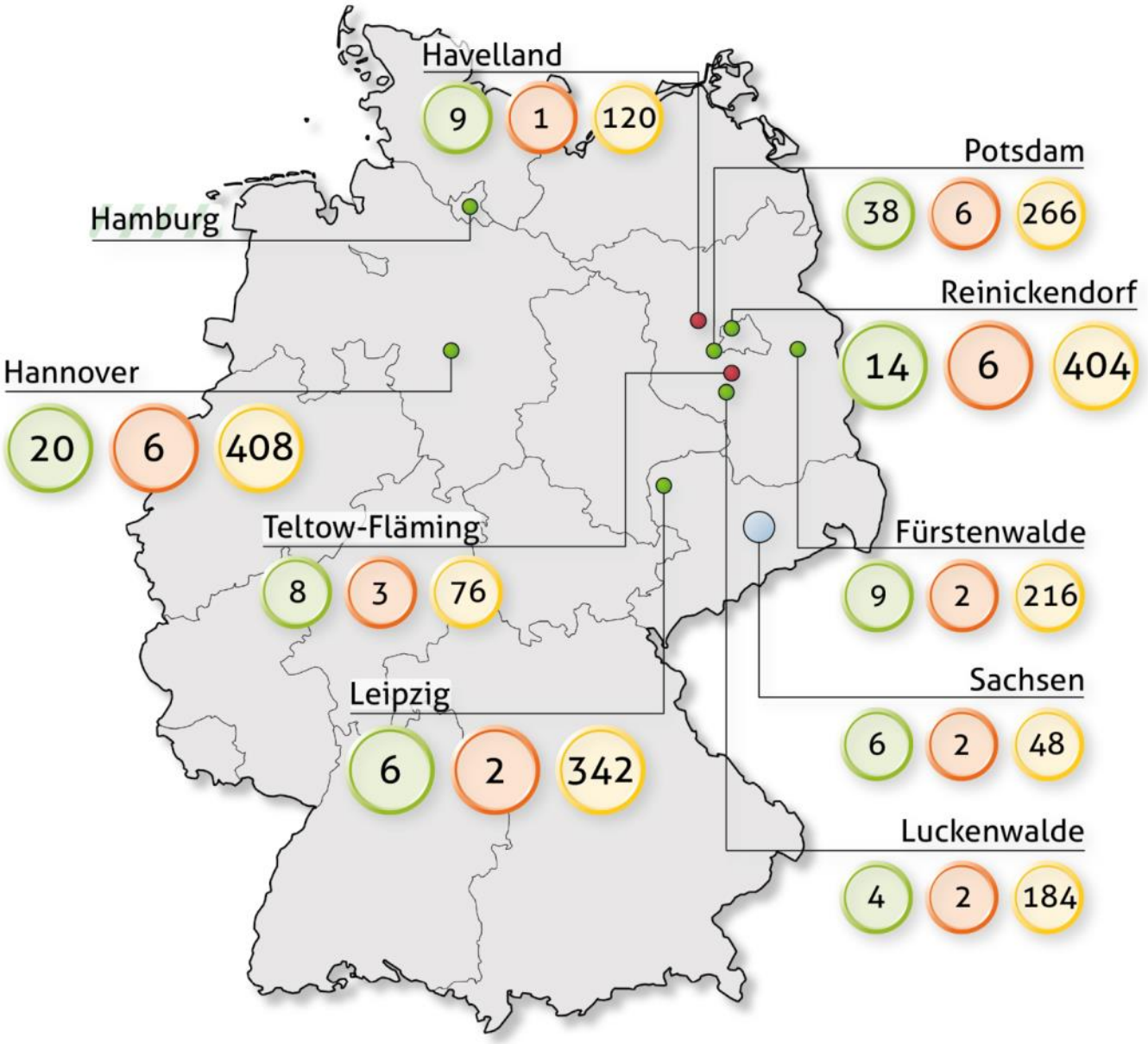
- idea from a teacher from Berlin but no interest in Berlin, first ran in Hamburg
- about saving energy mainly through optimization of user behavior instead of big investments in construction
- schools get part of saved money
- around 3.500 German schools take part (10% of all schools)
- saving potential (with 90 % of all schools):

~ 750.000 t CO_2

150 Mio. € every year

UfU

work locations
October 2017 – April 2018



legend

- number of facilities
- number of deployed employees
- number of working hours
- city
- region
- state
- consultation, no ped. work

UfU
Independent Institute for Environmental Issues

Romania, Bulgaria, Athens

















Why

…save energy?

…do these projects?

UfU

Energy costs **a lot**

of money.

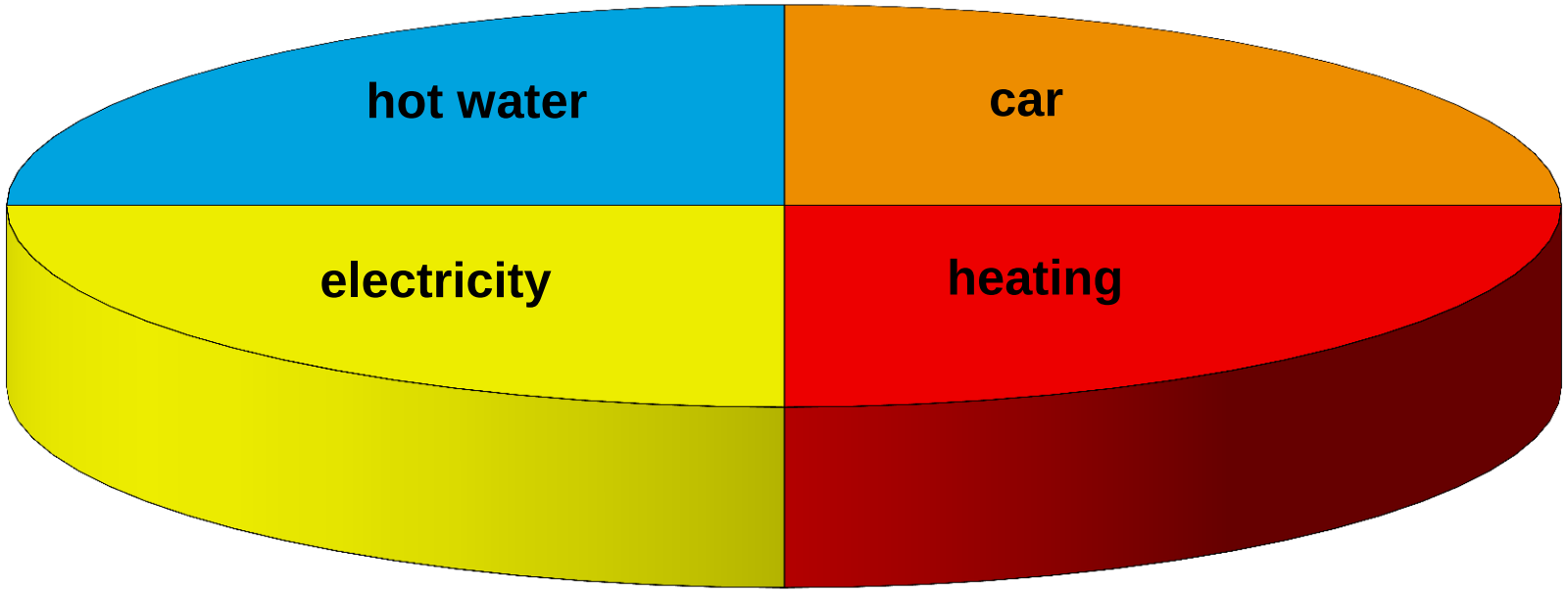




UfU

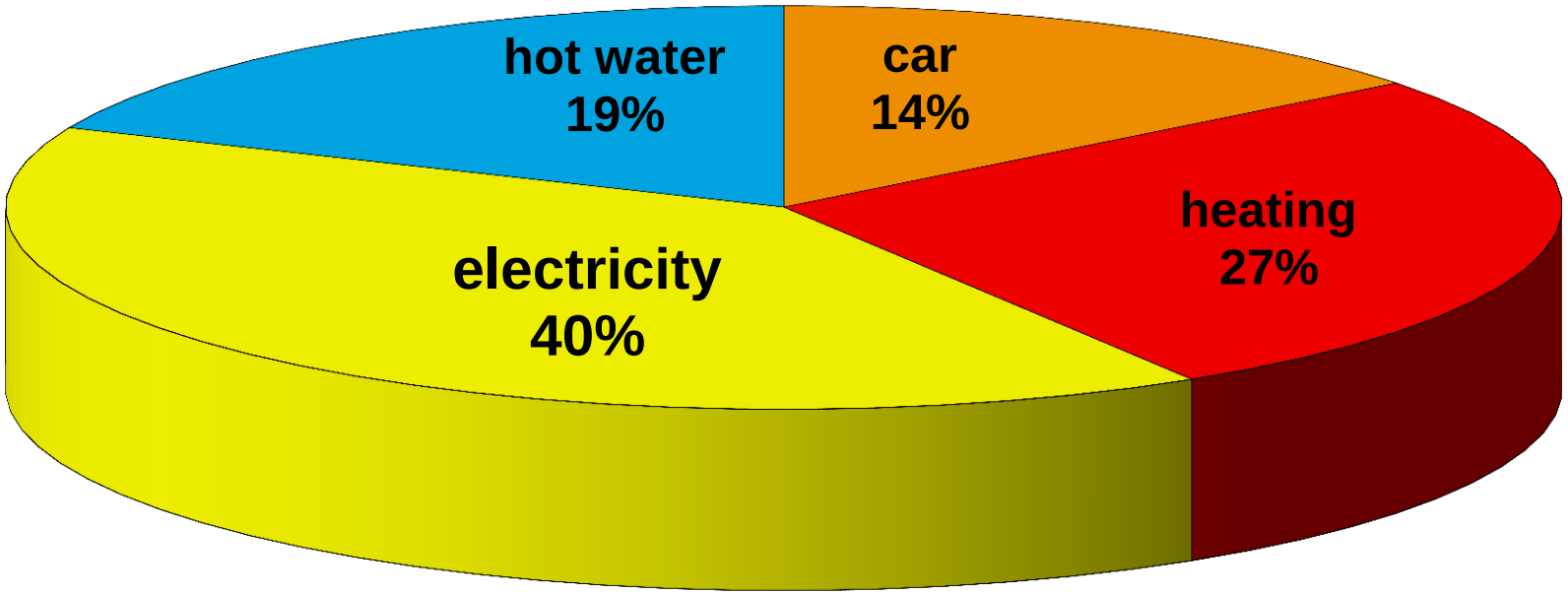
How?

Where does the average household use the most energy?



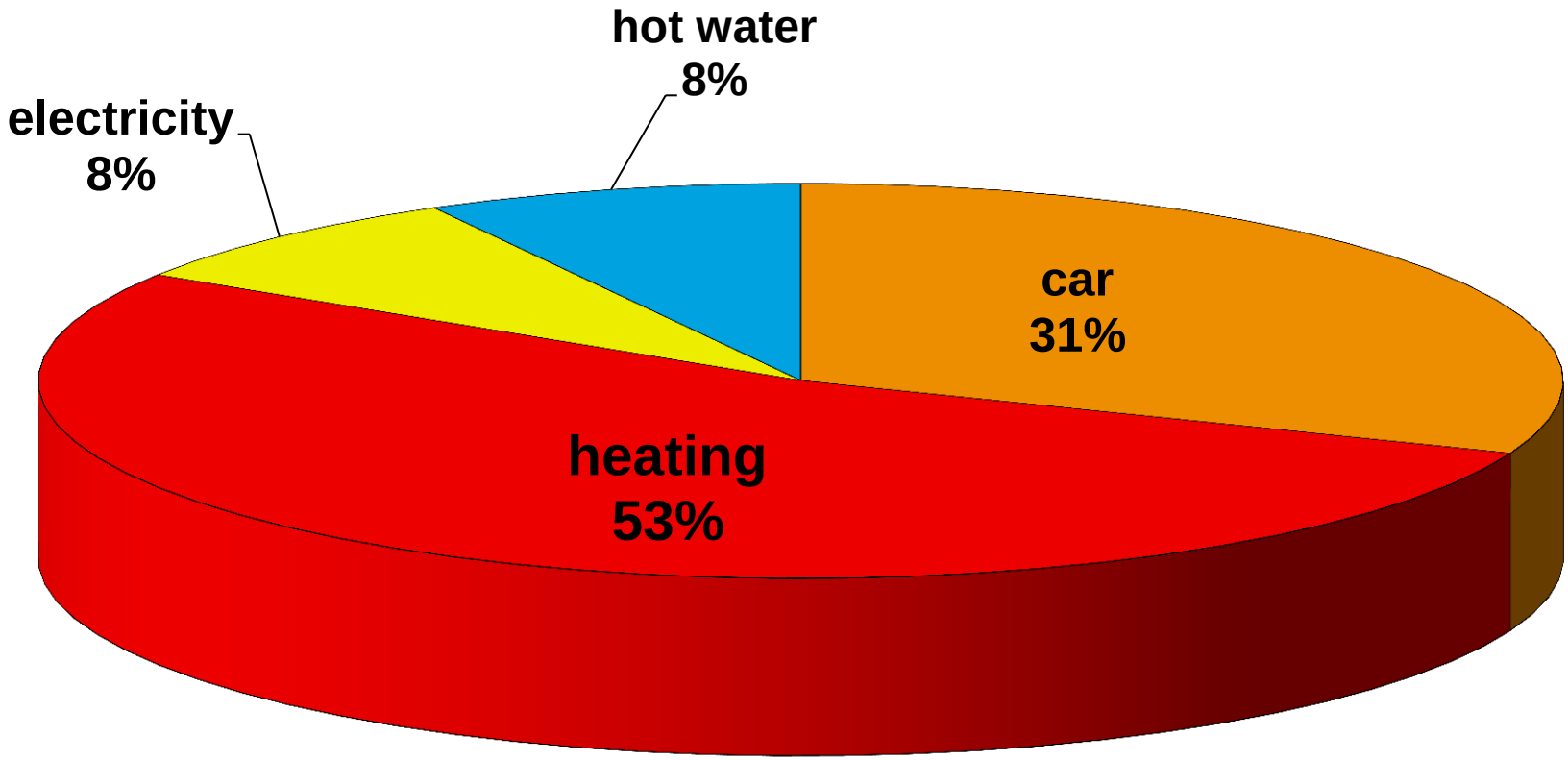
UfU

Most people‘s assumptions



UfU

The reality



UfU

Energy consumption

of a medium size school:



	Consumption (kWh/a)	**CO_2 emission** (kg/a)	**costs** (€/a)
electricity	100.000	60.000	22.000 €
heating	1.000.000	240.000	75.000 €
sum		**300.000** (150.000 m^3)	**97.000** €

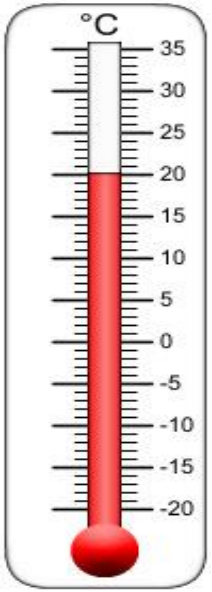
The **biggest** energy saving potential
lies with the **heating**!

UfU

Energy saving potential in schools

No. 1:

Heating



No. 2:

Electricity





UfU

Fossil fuel sources soon will be



exhausted.

→ Leading to less to higher energy prizes & supply shortages.



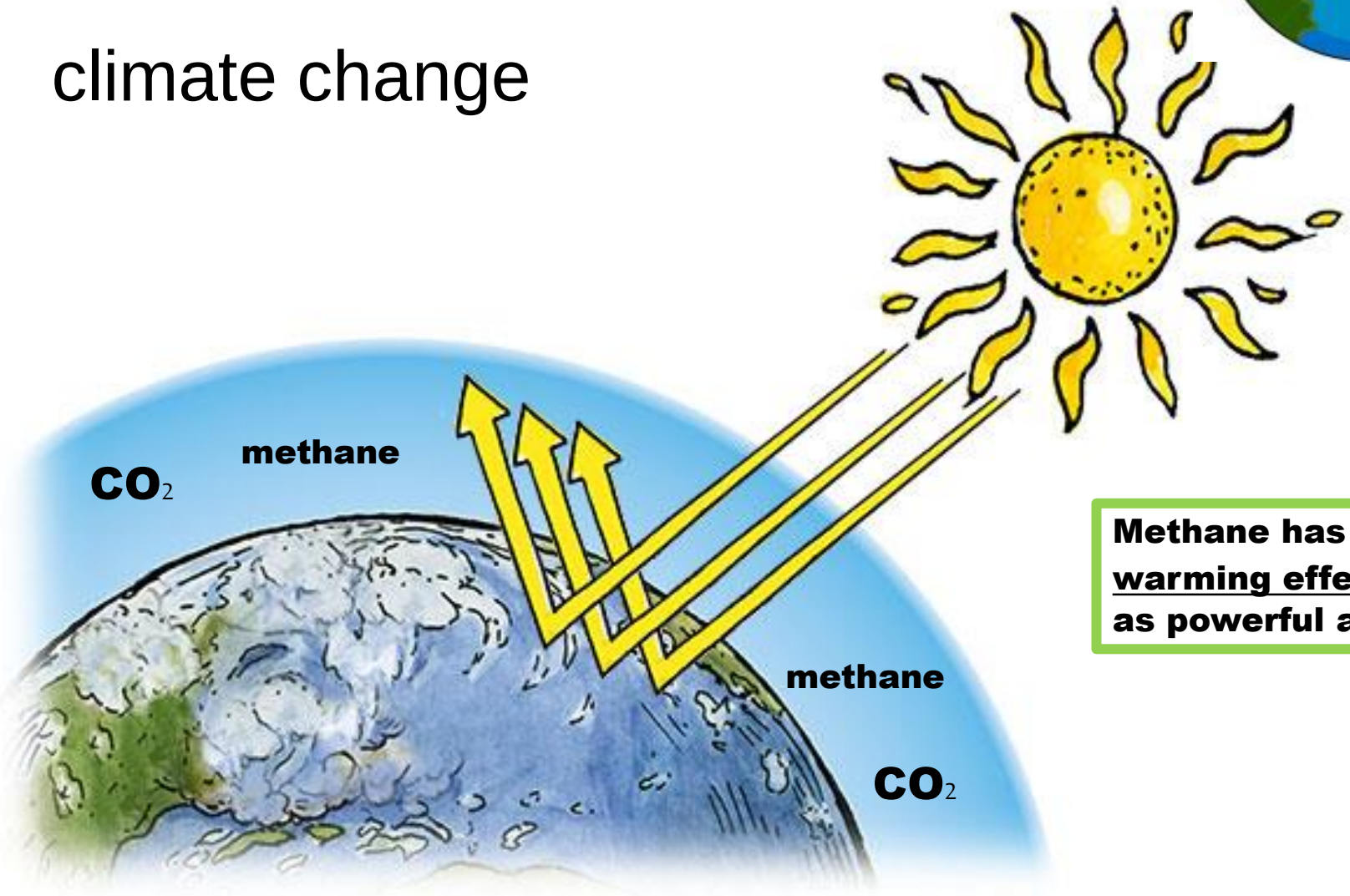


UfU

Slow down

climate change





Methane has a warming effect 20 x as powerful as CO_2 !


forest fires


melting
ice caps


floods


droughts


hurricanes


crop
failures


heat waves


monsoons

Goals of fifty/fifty projects

1. actually **saving**

   energy



2. involvement and

   activation of **whole**

   school



UfU

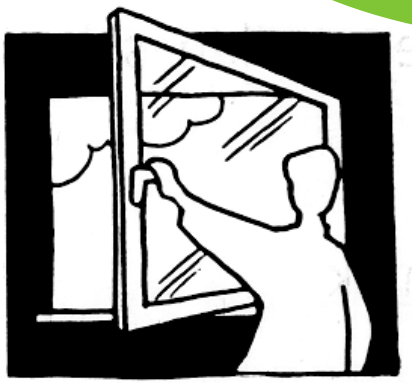
What is energy saving in schools?

technical optimizations



+

optimized user behavior







No one has to freeze or sit in the dark!

9 steps to success in Germany

1. **Kick off** meeting & **form energy team**

2. **energy tour** (energetic-technical analysis) of the whole school, & producing a **report** with list of energy saving measures

3. **teaching students**

   a) energy sources

   b) climate change

   c) necessity of saving energy

4. **energy tour** <u>with students</u>







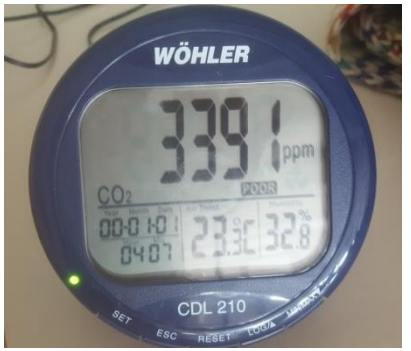


UfU

9 steps to success in Germany







5. measurements

a) temperature distribution

b) temperature profile / curve

c) illuminance

d) CO_2 concentration

e) electricity consumption





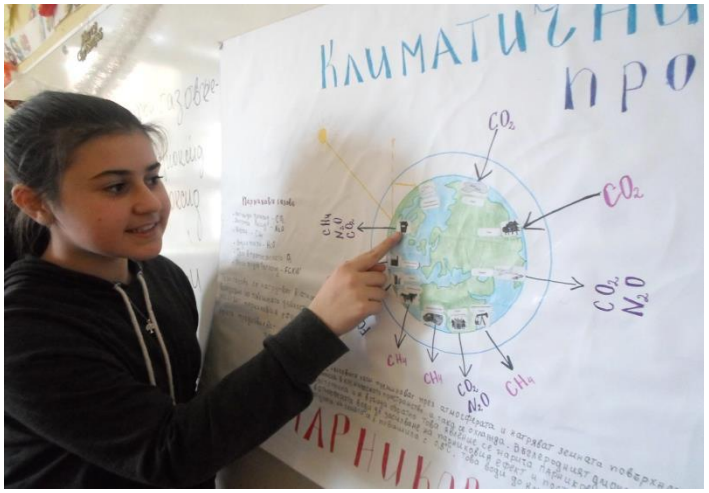
6. nudge technical energy saving measures

wherever possible

UfU

9 steps to success in Germany

7. guide public relations within school



8. forward investment suggestions to school authorities



9. decision about use of saved money

UfU

How does it work in Germany?

school counselor
goes to schools



technical & pedagocial support/guidance
in approx. 5 appointments

charges

UfU

school authority

documentation & invoice



UfU

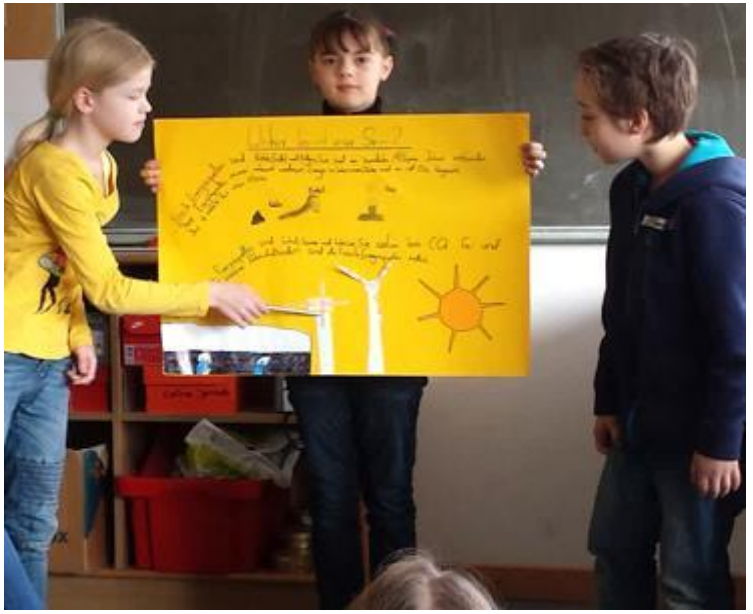
How achieve savings through user behavior?

External school counselor
and / or a teacher
train a group of students



…and additionally work with technical responsible on technical optimizations

… who then get the rest of the school on board by the right use of PR.



… so that the whole school follows the energy saving tips and therefore real savings are achieved.

UfU

The project…



…helps schools to find energy saving potentials

and to **improve their climate footprint**





…does not only generate a **financial benefit for the municipality** but it also brings a **high pedagogical value** to the participating school and helps it **enhance / build its school profile**



UfU

Conscious everyday behavior saves approx. 4 – 15 %



everyday school life

1. using thermostats correctly
2. correct ventilation
3. use of light only when necessary

technology

1. appropriate light switching
2. lowering the heating temperature
   a) during the day
   b) during the night
   c) on weekends
   d) during the holidays

school authorities

1. necessary repairs
2. renovations
3. optimization of heating management possibilities

UfU

What

do students learn?

UfU

1. They are made aware of **real problems of life**

(climate change, climate justice).







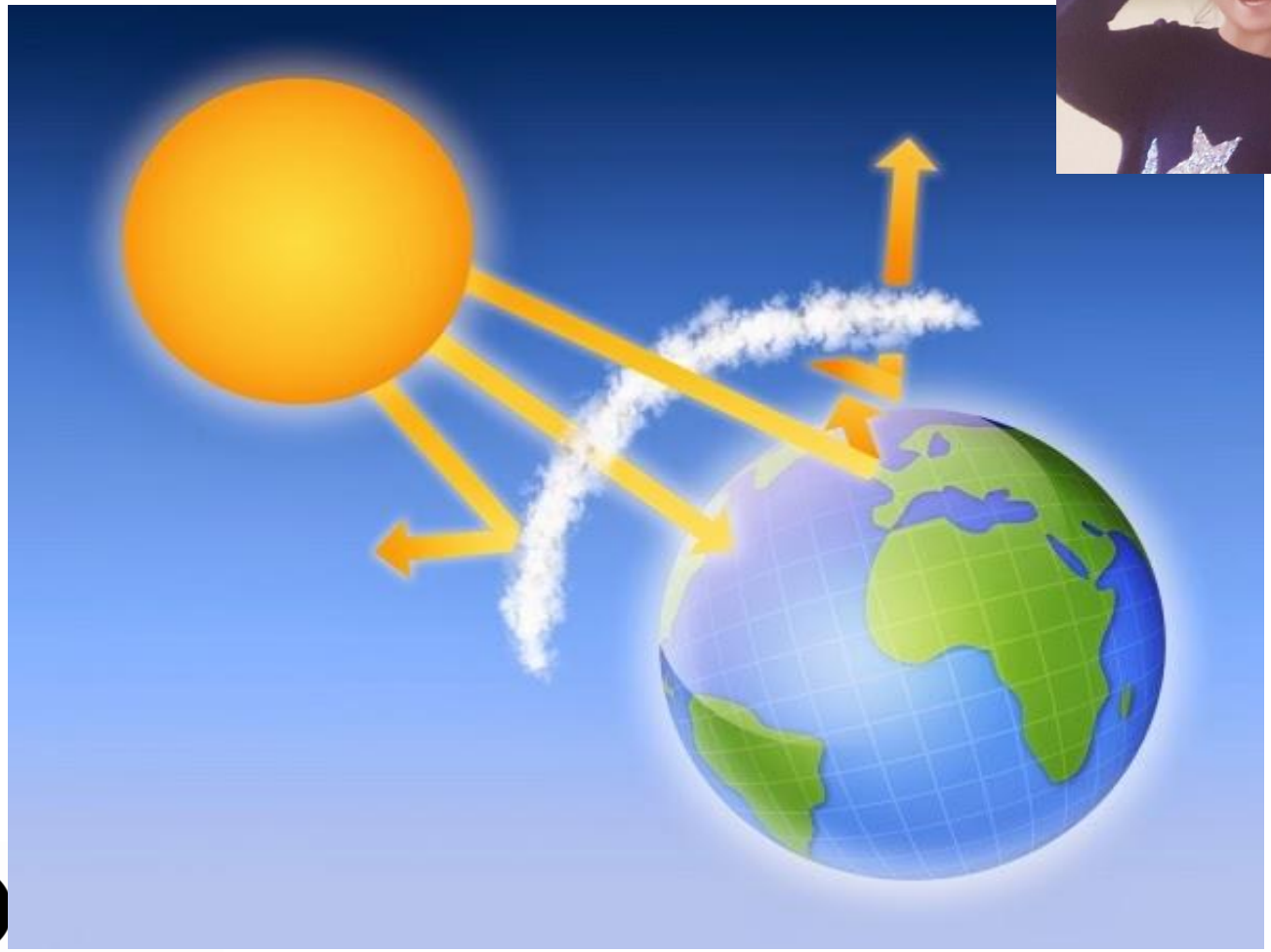
UfU

2. Interdisciplinary learning:

geography: they learn

how the climate works













3. measurements: They learn to approach problems analytically **& work scientifically**.

4. technical understanding





5. They learn to pay attention to a **healthy indoor climate** and good learning conditions in the classroom.



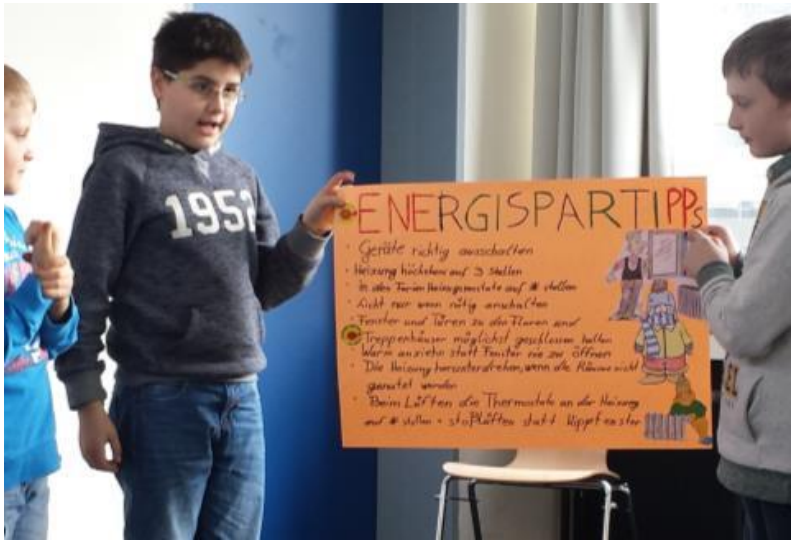
UfU

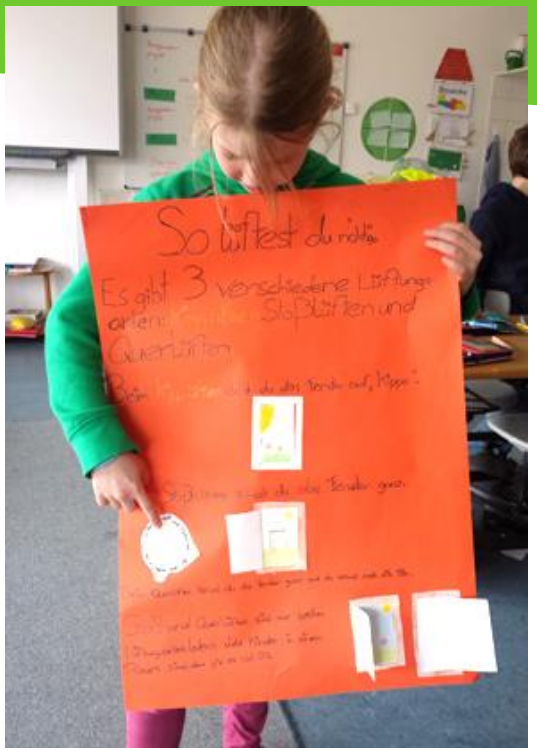
6. …as future adults: **energy and climate conscious** way of life and knowledge about impacts of one's own actions to the environment

7. …**think about the community:** change bad habits for the public good



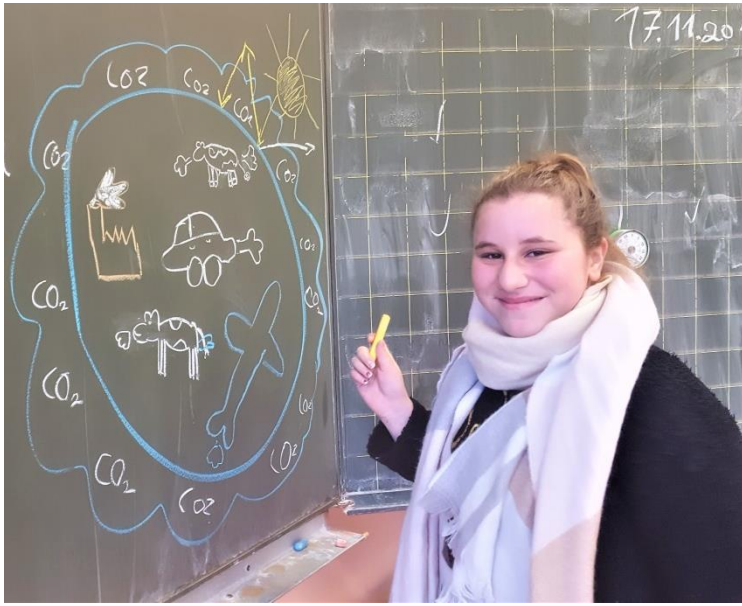






8. …**become active** for a good cause

9. …**effective** outreach activities / public relations



UfU

… an of course:
to have

fun at school!









UfU

achieved savings in Germany

school / nursery	savings		
	heat	electricity	water
Fünfeichener GS	5 %	- 6 %	14 %
Fontane GS	11 %	13 %	3%
GS an der Stadtmauer	14 %	5 %	4%
Europaschule Storkow	17 %	- 10 %	3 %
Hort Würfelkids	16 %	- 9 %	6 %
Grundschule Friedland	8 %	6 %	6 %

This was in the municipality of Beeskow, Brandenburg, near Berlin.



UfU

an example:

German **municipality of Teltow Fläming** (Brandenburg)



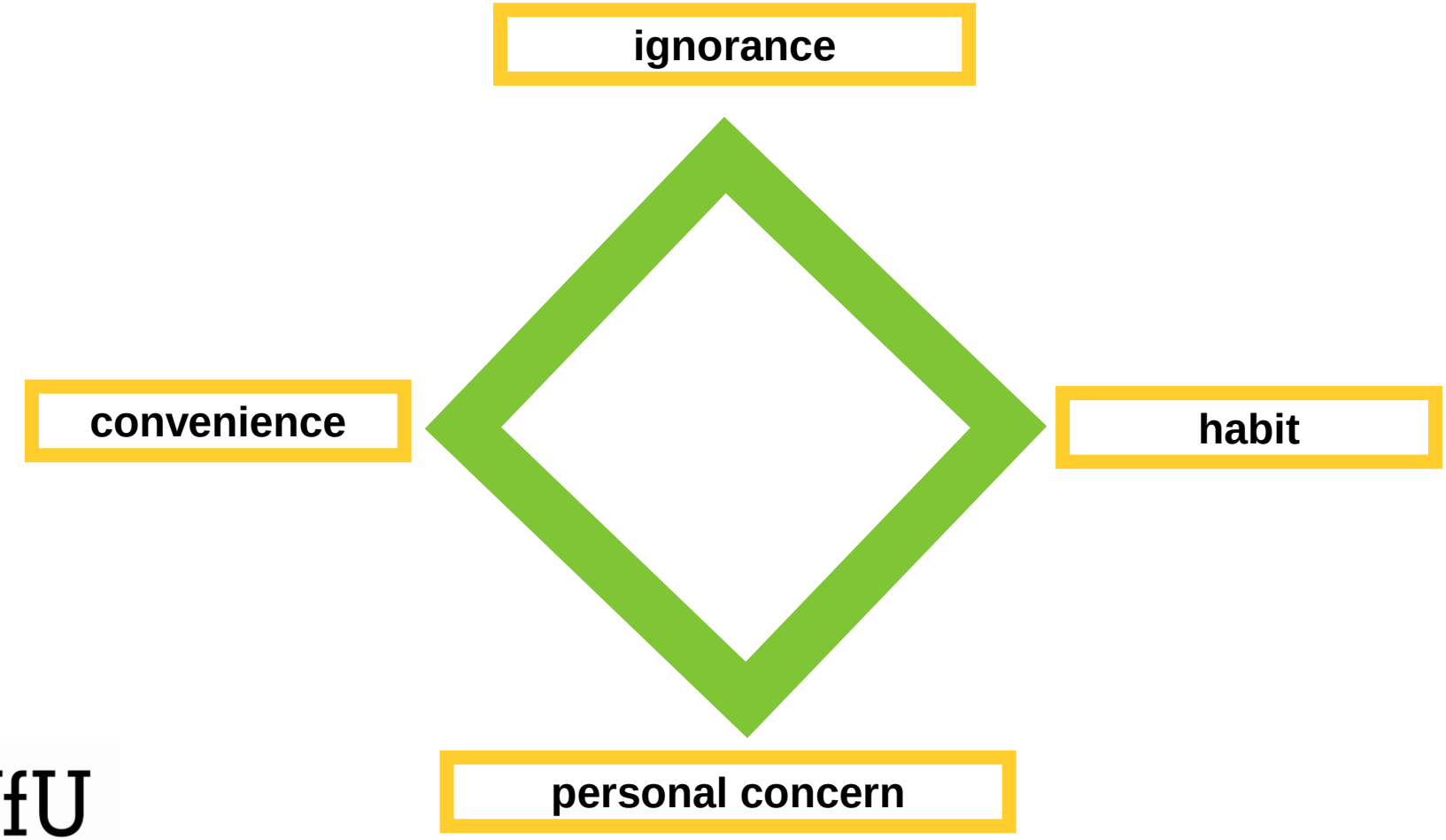
- 11 high schools and special schools
- energy costs at beginning of project in 2010: 1,02 Mio. €
- 250.000 € saved in 3 years, external consultation through UfU cost only less than one eighth

220.000 € saved!

UfU

4 corner – What do you think?

Why do people find it difficult to save energy?



Pedagogical content

Kick off meeting with…

…headmaster

… everything should be coordinated with him/her!

1. Which group of students?
2. How shall the project be embedded in the students' timetable?





...and the technical responsible

- contributes substantially to achieving savings
- knows the processes and problems of energy supply
- teachers doing energy saving projects should talk and coordinate with the technical responsible









Technical responsible

…his/her inclusion is essentially important!

- knows about the technical functioning
- contact person in case of problems, for technical support **and** realization of technical energy saving measures
- can help you find out about heating settings & administrative responsibilities



UfU

Form energy team

students + teacher + headmaster/ technical responsible





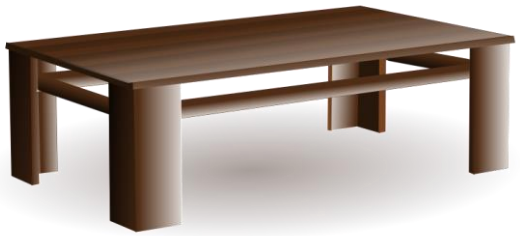


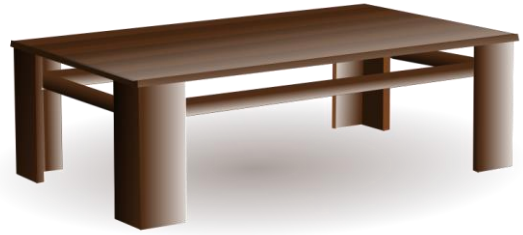
positive interplay of these project actors is essentially important for achievement of savings!

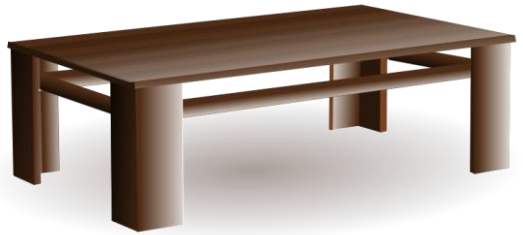
UfU

Methods and measurements

three tables, three groups
→ explanations, discussions, hands on



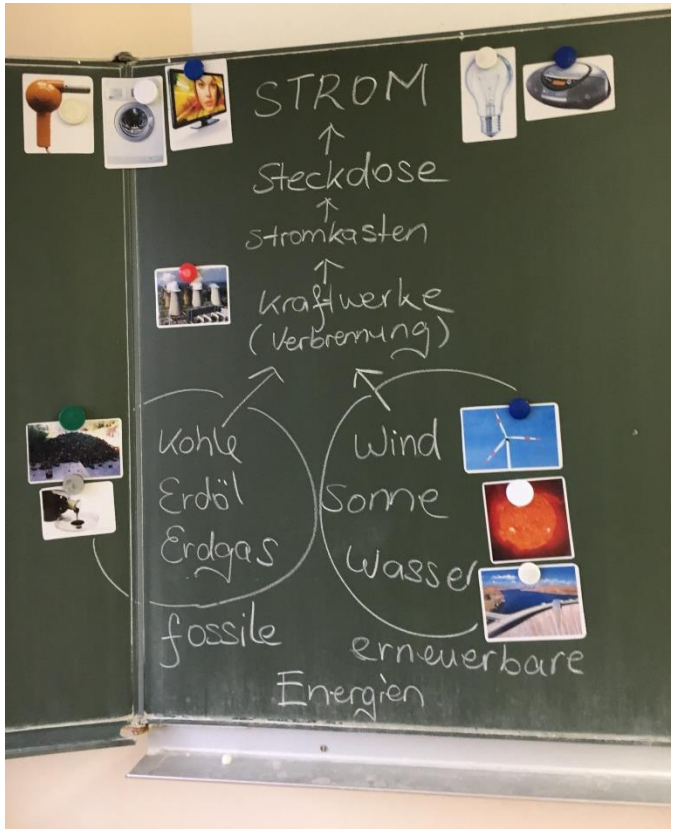




UfU

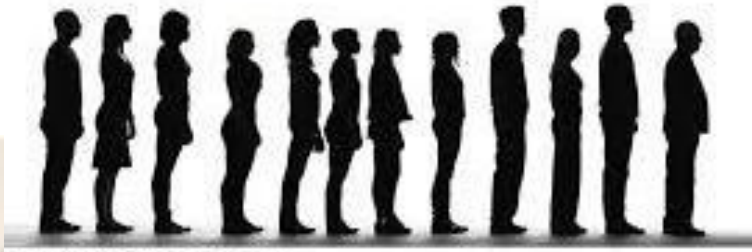
Methods

1. Standard: Chalk & talk (classic lecture format)





2. Positioning alongside a stream



wenig

viel

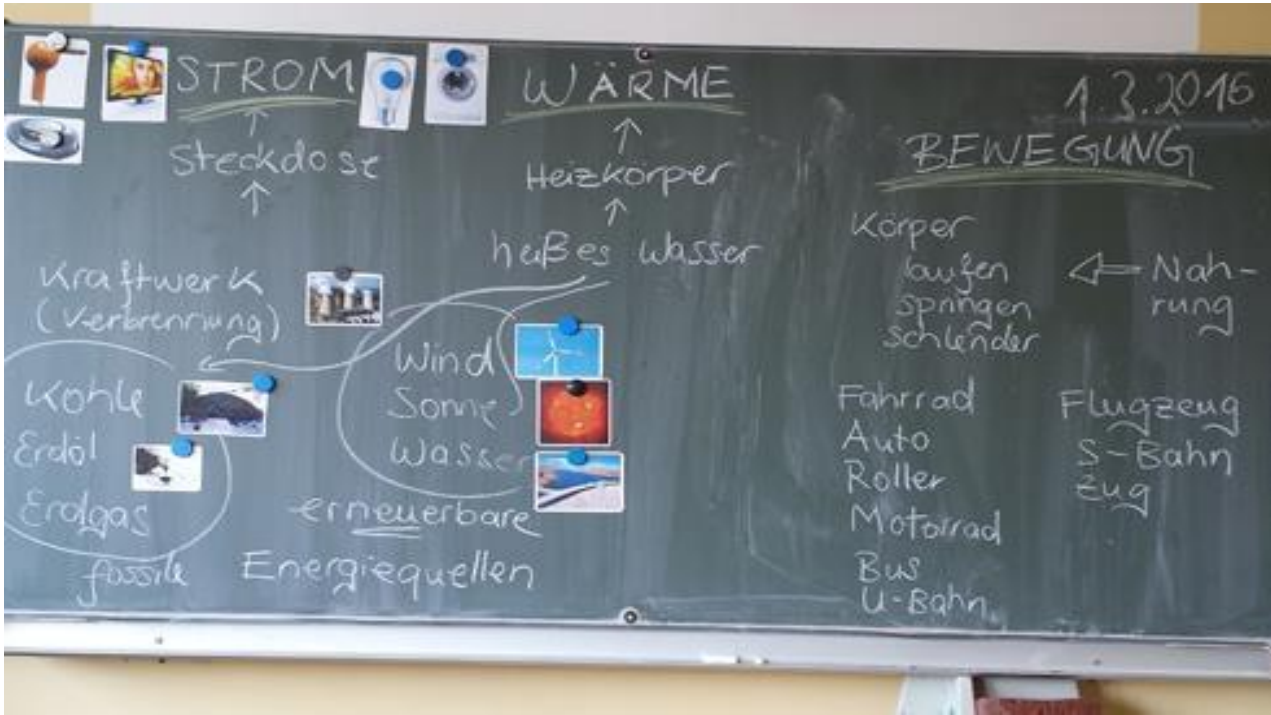
3. Energy pictures

Hand out picture cards to let them be categorised.

- What is energy?
- Where does it come from?
- differentiation of fossil & renewable energy sources
- Which energy consumers exist?
- difference between power & energy
- Why save energy?
- What are primary and secondary energy?

Or give them pictures and let them read out texts of **witnesses to climate change** and ask them to find the matches





4. Group work

creating mind maps

- What is energy?
- Where does energy come from?
- Why save energy?
- Where/when have you used energy today already?





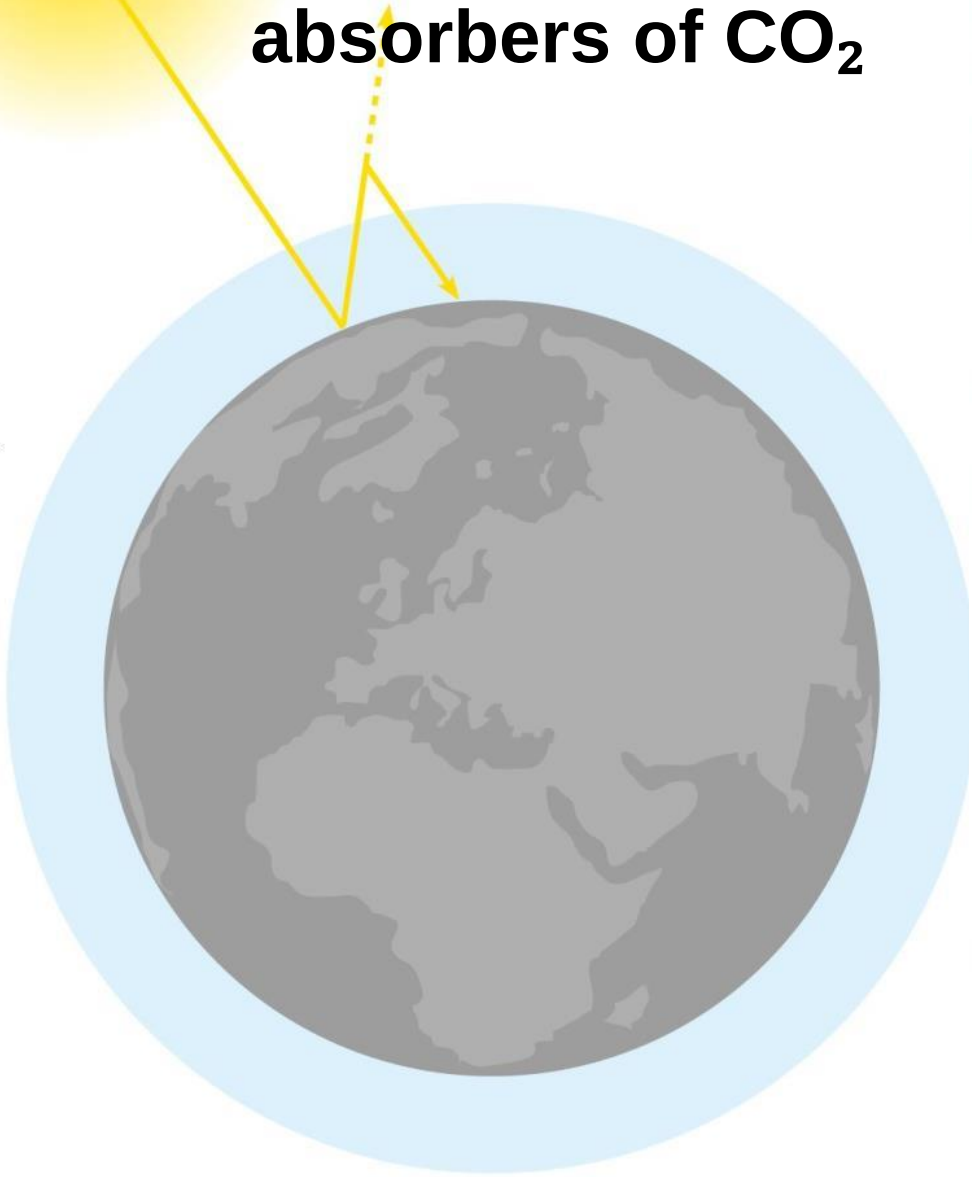
In between:

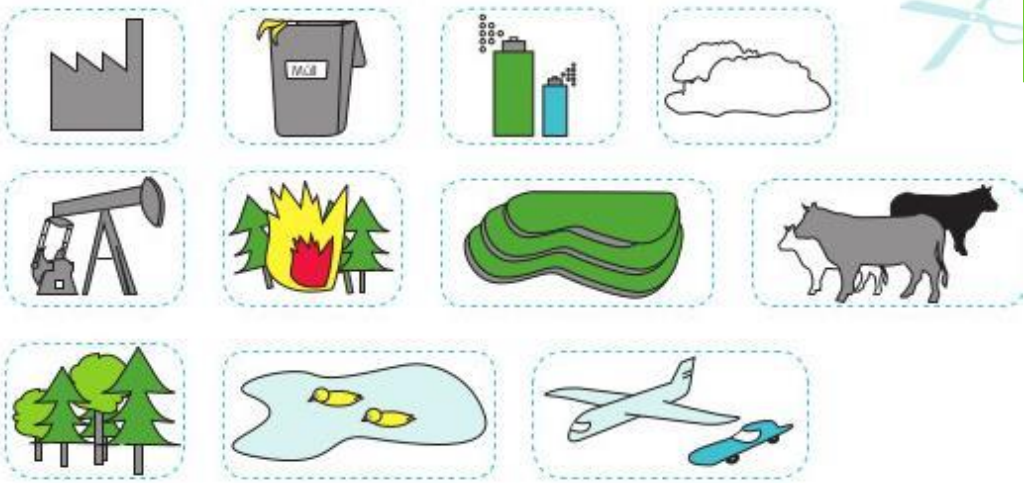
Energizer

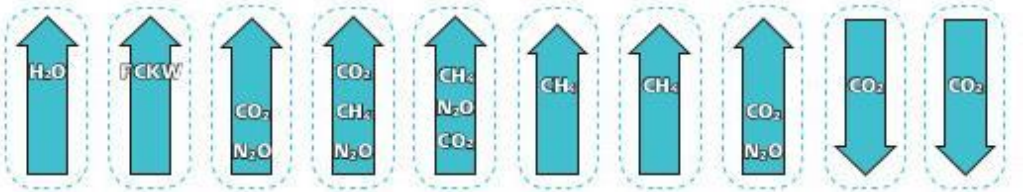




5. Worksheet to Polluters and absorbers of CO_2







Forest

Livestock Farming

Slash and Burn Farming

Increasing Water Vaporization

Energy and Industry

Trash

Waters

Chemicals

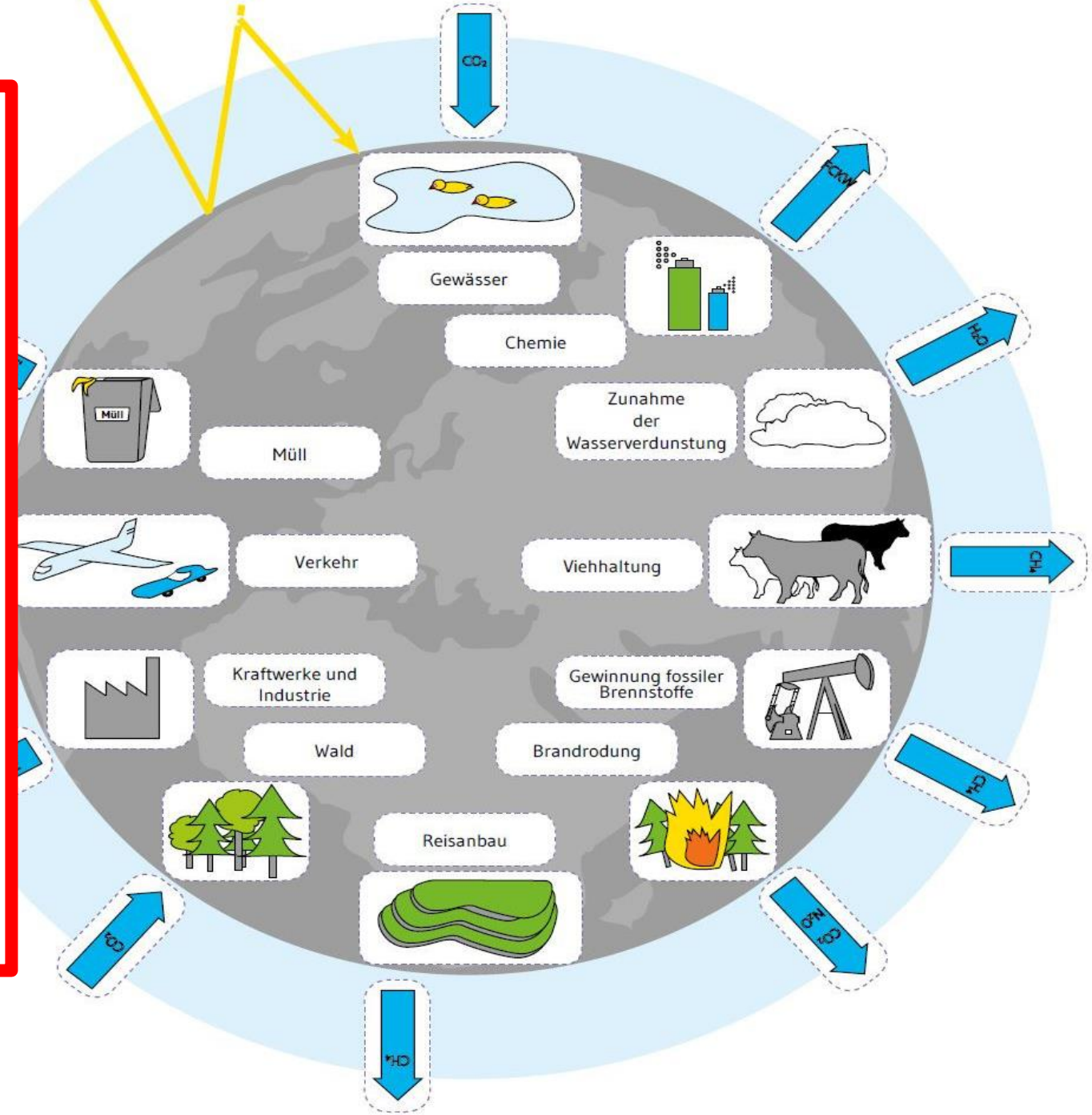
Rice Production

Traffic

Production of Fossile Fuels

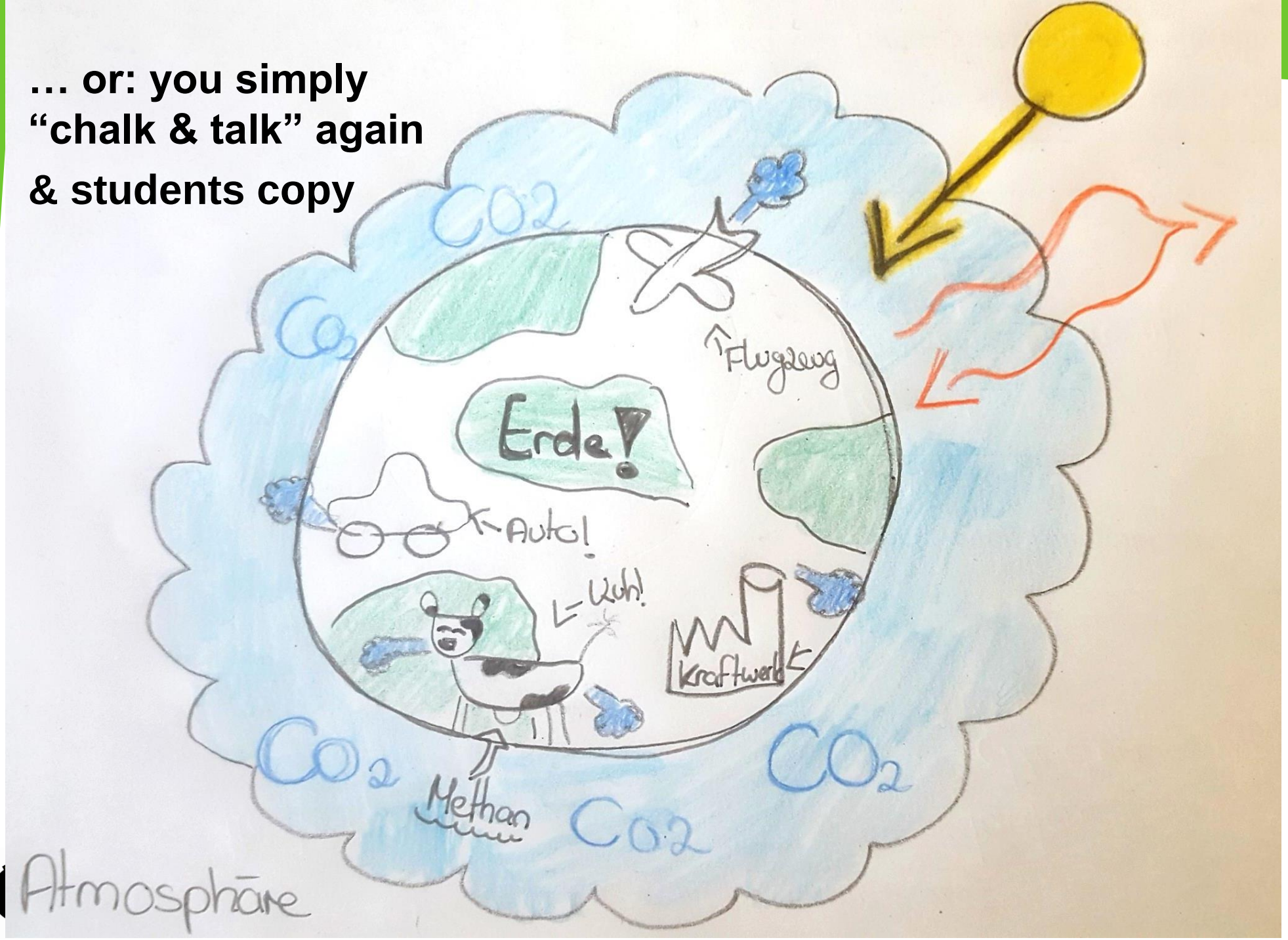

It helps to understand
…how the greenhouse effect works.
ATHL DEPT
NEW CITY

Teddy, please paste here a scan/picture of this worksheet from the translated the Bulgarian workbook. In the German version it is on page 27. Should be the same in the Bulgarian workbook.

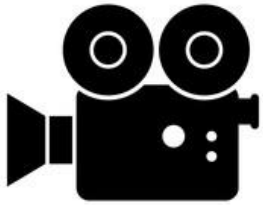


… or: you simply “chalk & talk” again

& students copy



6. explanatory videos







idea:

before seeing the video students draw a card with a question on it, during the video their task is to concentrate on answering their question, summary afterwards

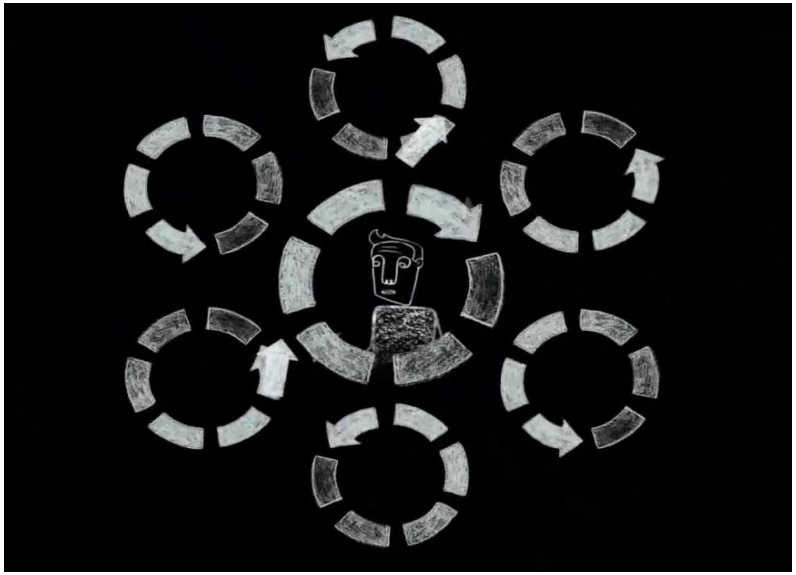
To connect with subject English

“Wake up - Freak Out Get a Grip”

about the self amplifying mechanisms of climate change that add up and worsen global warming



1. **albedo effect** (white surfaces reflect more solar radiation than dark surfaces)
2. as the planed warms, **evaporation rates increase** → **H_2O** = greenhouse gas
3. previously absorbed **CO_2 is released when cold oceans warm up**
4. **forest fires** → more absorbed CO_2 is released
5. Siberia: **permafrost is melting** → methane is released



UfU

7. Cloze

Fill in the blanks from the word list.

her	my	win	know
sad	think	get	once

1. We will _____ the football game.
2. I was _____ when he left.
3. Do you _____ my sister?
4. Can you _____ me some water?
5. I will call _____ tomorrow.
6. Play the game only _____.

8. Energy knowledge competition running back & forth (speed)



9. „1, 2 or 3“ (answer choice game)









10. Experiments







11. Hand wind turbine



12. Keeping warmth

- students get bottle with warm water and try to keep it warm as long as possible
- aluminum foil, paper bag, wool, wodden box, glass container, backpack, paper towels, cotton (socks), newspaper, cork, thermal container, down clothes, felt, polystyrene
  - ➢ discussion about appropriate clothing in winter
  - ➢ discussion von insulation of buildings







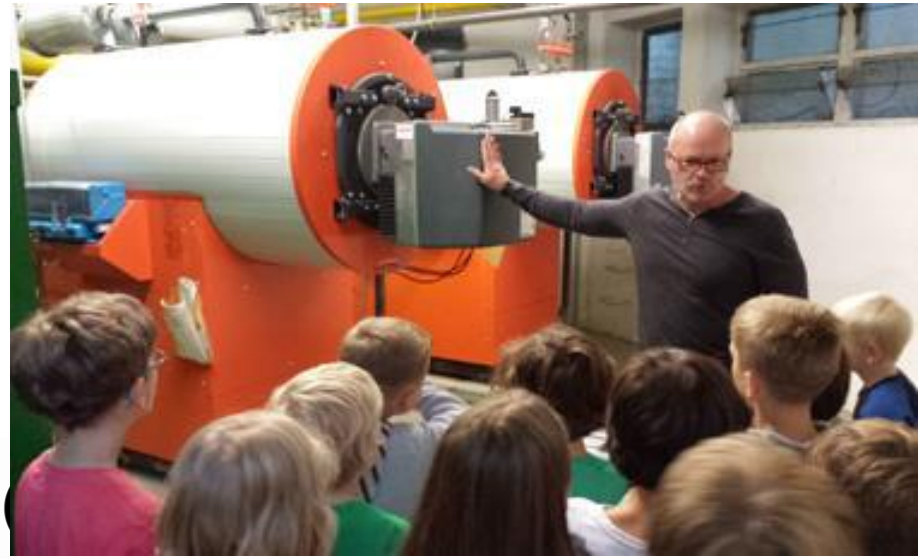
13. Energy tour with students



Show highlights from 1st energy tour:

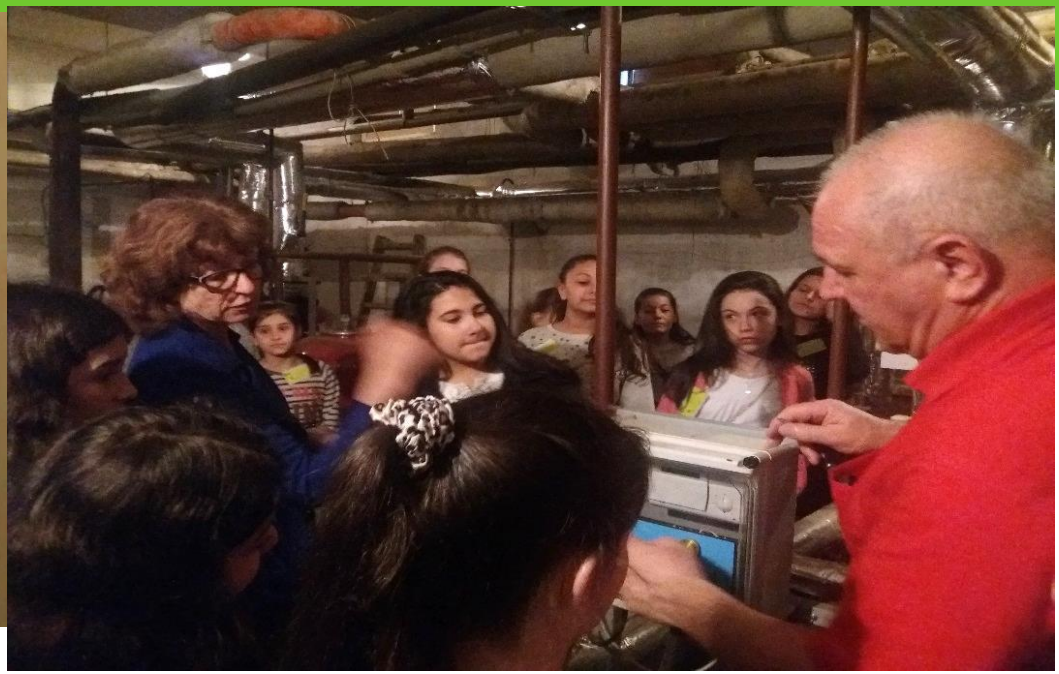
1. How the heating system works
2. Energetic weak points of building
3. Which bigger energy consumers are there (in kitchen, offices etc.)?
4. User behavior - interviews














ERATO - VIADRUS






NIKE

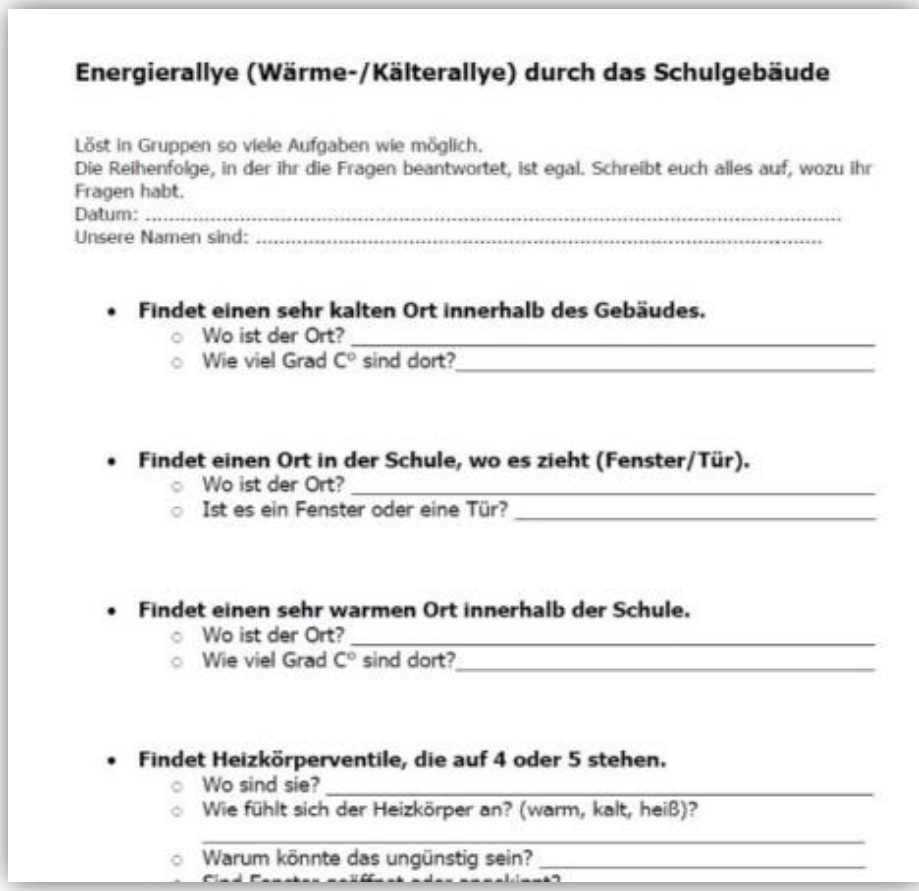


14. Energy-Rally



Ask students to find …

1. …a very cold place.
2. …a place with a draught (windows, doors).
3. …a very warm place.
4. …thermostats that are set on level 4 or 5.
5. …access to hot water from the tap.
6. …whether the school building has an energy pass.
7. …the electricity meter.



Energierallye (Wärme-/Kälterallye) durch das Schulgebäude

Löst in Gruppen so viele Aufgaben wie möglich.
Die Reihenfolge, in der ihr die Fragen beantwortet, ist egal. Schreibt euch alles auf, wozu ihr Fragen habt.
Datum: .....
Unsere Namen sind: .....

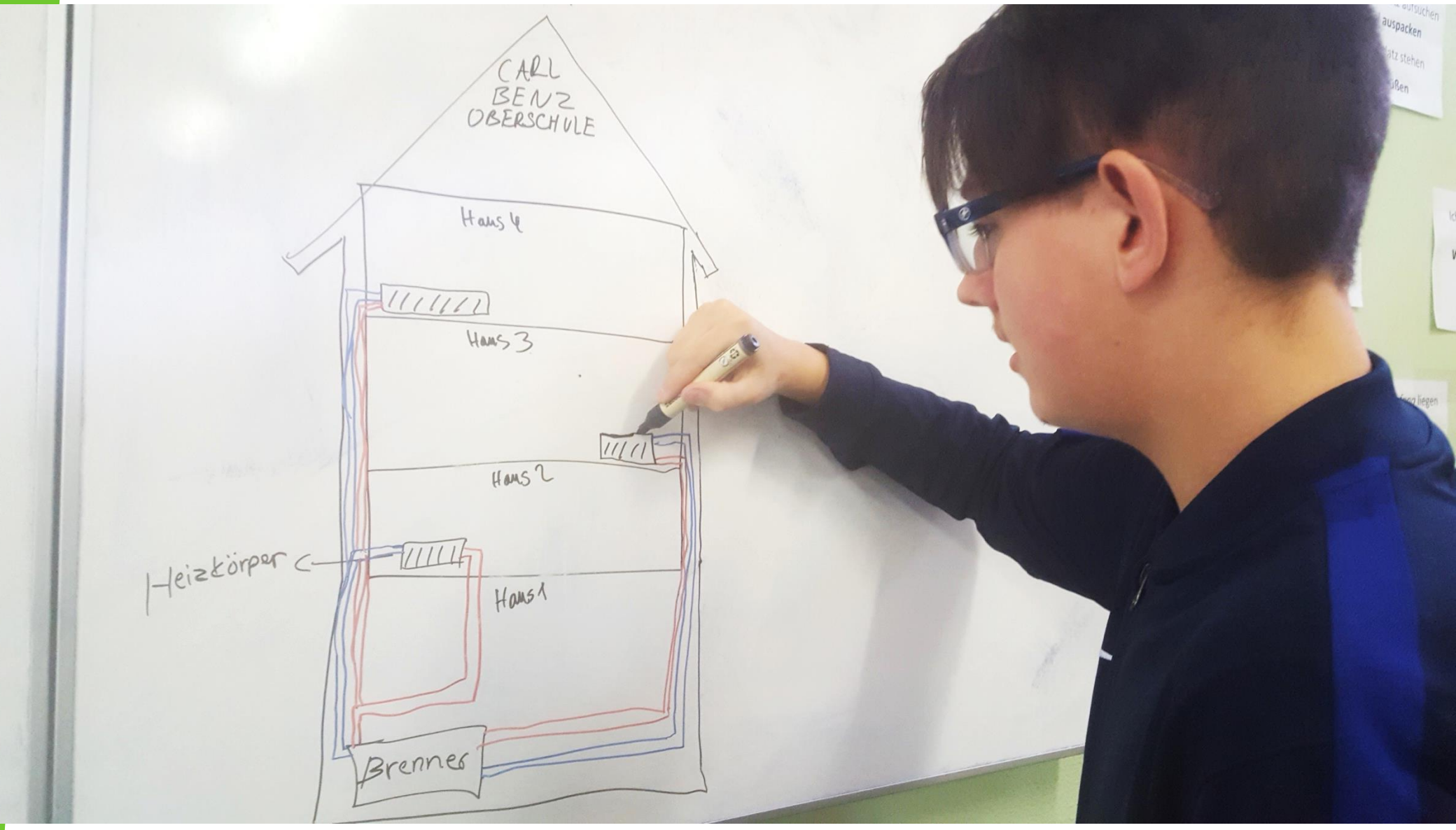
- **Findet einen sehr kalten Ort innerhalb des Gebäudes.**
  - Wo ist der Ort? _____
  - Wie viel Grad C° sind dort? _____
- **Findet einen Ort in der Schule, wo es zieht (Fenster/Tür).**
  - Wo ist der Ort? _____
  - Ist es ein Fenster oder eine Tür? _____
- **Findet einen sehr warmen Ort innerhalb der Schule.**
  - Wo ist der Ort? _____
  - Wie viel Grad C° sind dort? _____
- **Findet Heizkörperventile, die auf 4 oder 5 stehen.**
  - Wo sind sie? _____
  - Wie fühlt sich der Heizkörper an? (warm, kalt, heiß)? _____
  - Warum könnte das ungünstig sein? _____
  - Sind Fenster geöffnet oder angekippt?

15. Making memory cards

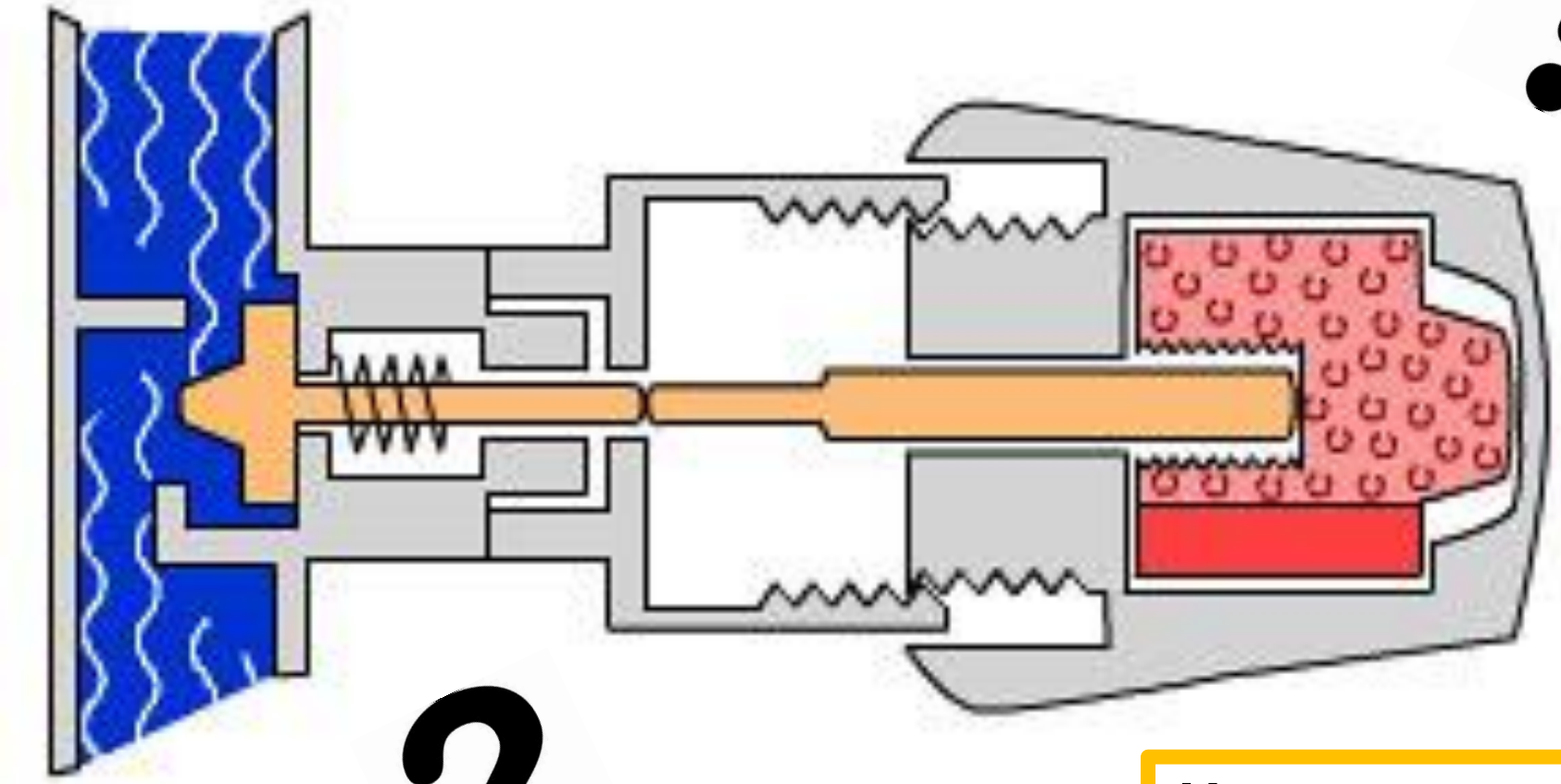




16. Explaining the general heating system using a simple drawing



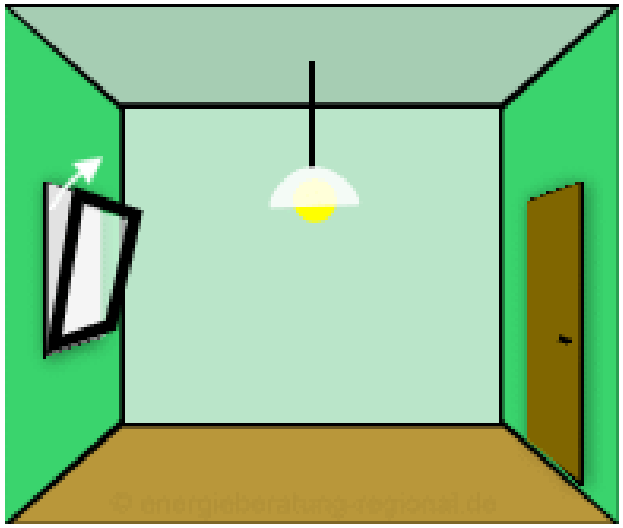
17. Explanation of thermostatic valve using cross sectional image & a „riddle“



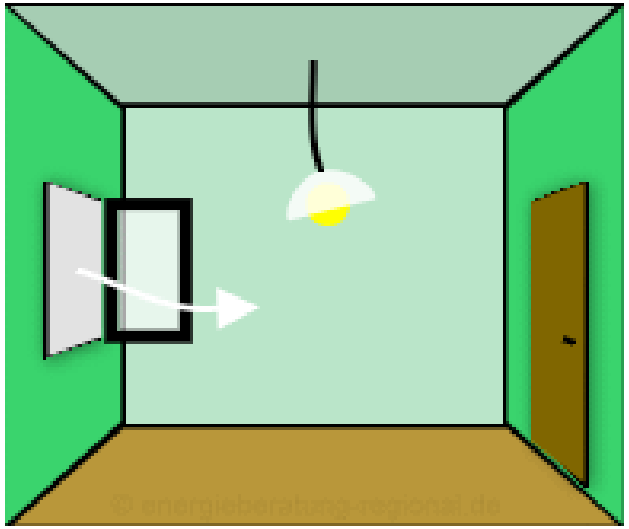
How does the thermostatic valve know when it has heated the room enough to stop?

UfU

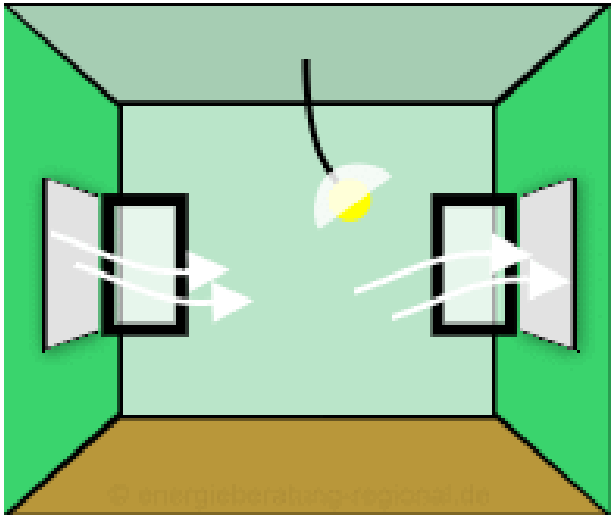
18. Testing different ways of airing



tilt ventilation



shock ventilation



cross ventilation





UfU

19. Adjusting the setting of thermostatic valves







20. World game







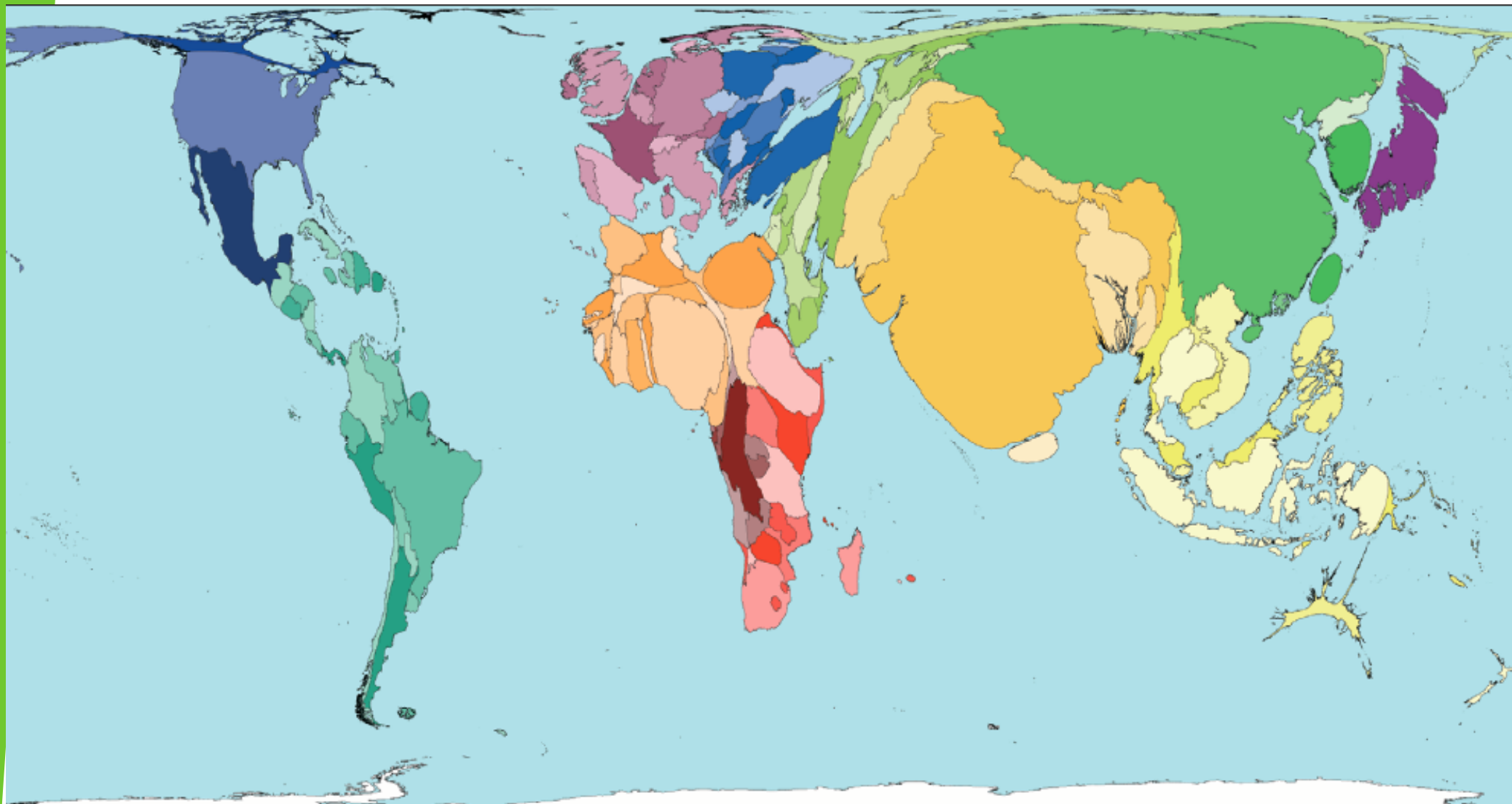
It helps the understanding of the
greenhouse effect and climate change

- consequences of climate change
- climatic injustice
- secondary school: political situation





If the size of the countries would correspond to its numbers of inhabitants…

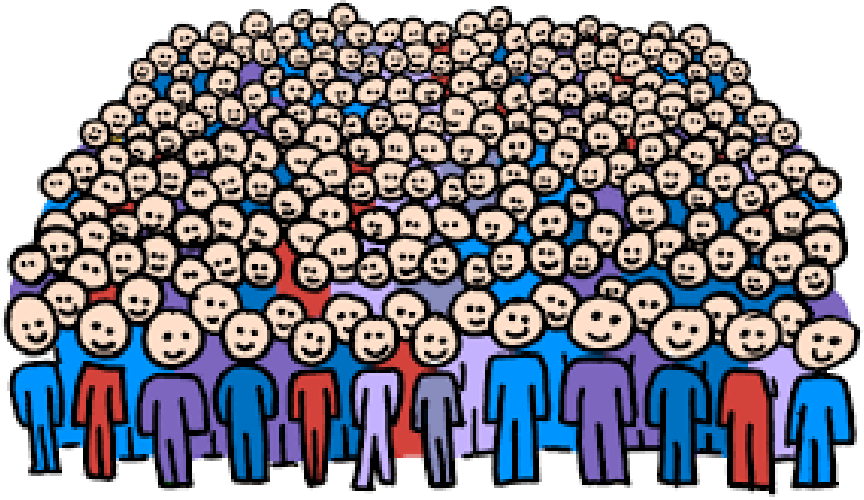


Did you notice anything?

Who had how much?







UfU

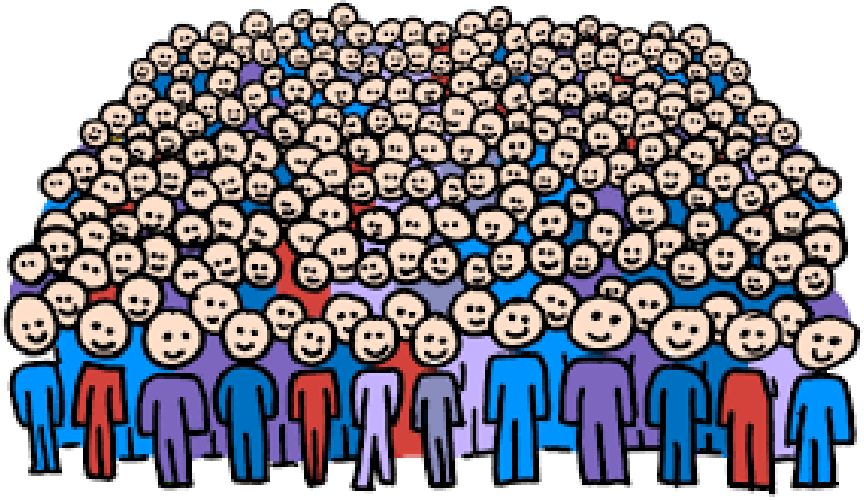
Who are the causer of climate change & who is the most affected by it?

Is the distribution of energy use and the correlating CO2- emission fair?



How did you feel?

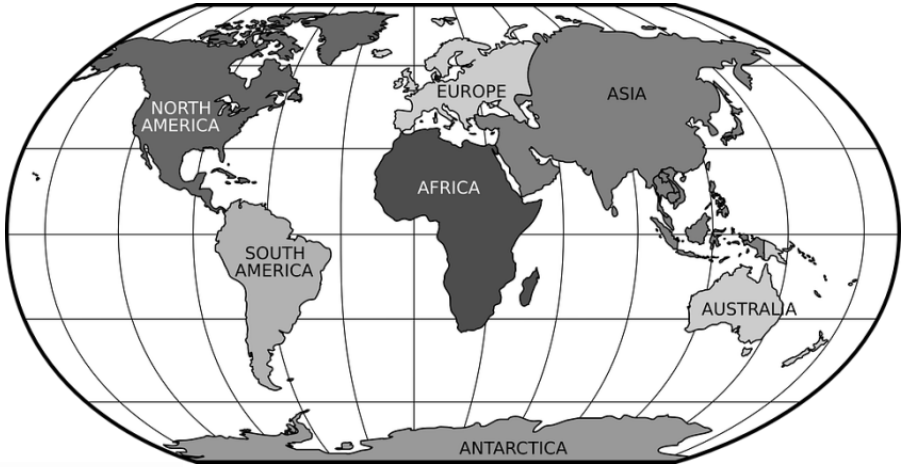




UfU



How did you like it?

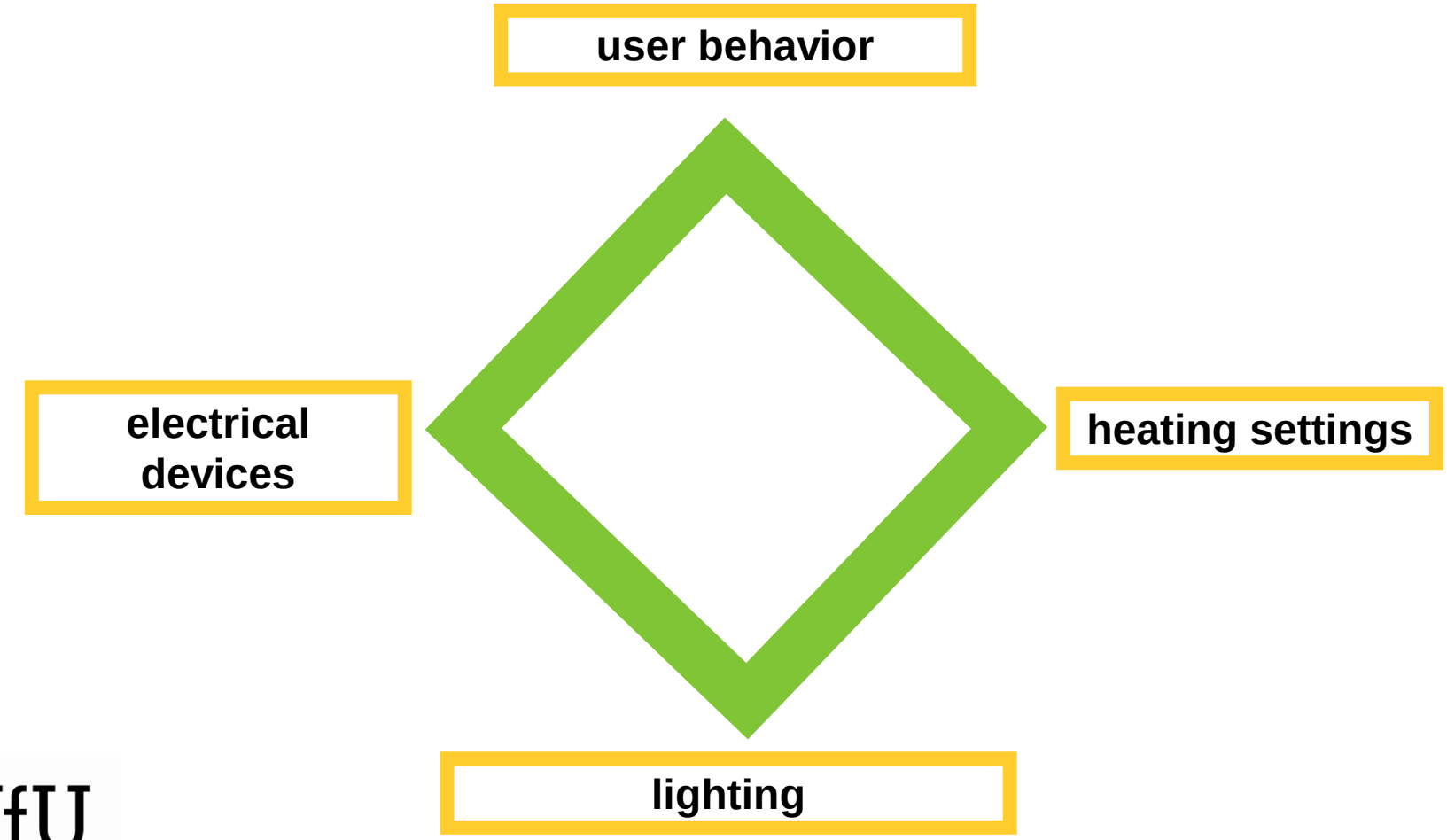




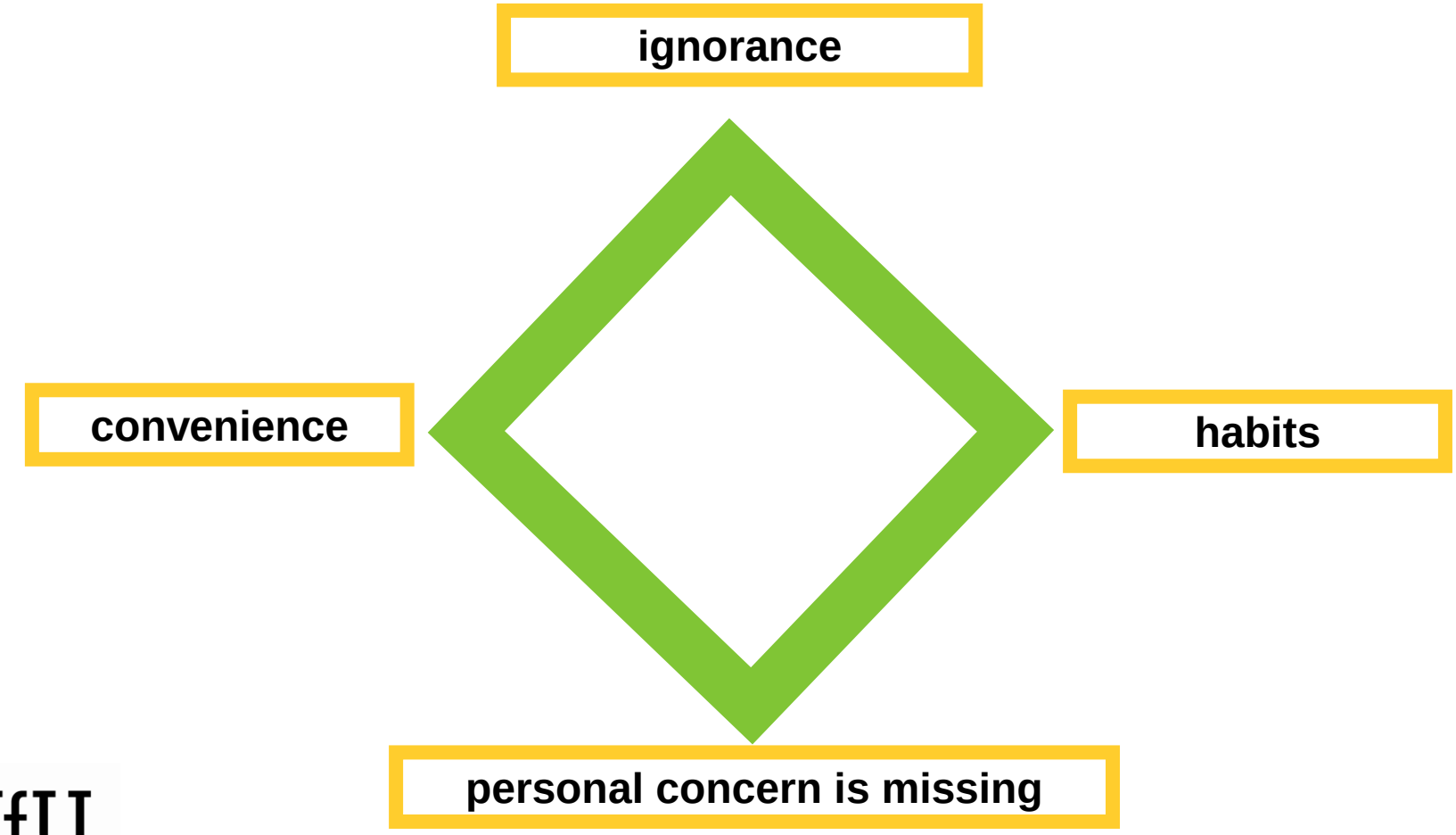
UfU

21. „4 corner method“

Where do you see the most energy saving potential in this school?



Why do people have such difficulties to save energy?



UfU

4 corners

Why do people have such difficulties to save energy?







UfU

4 corners

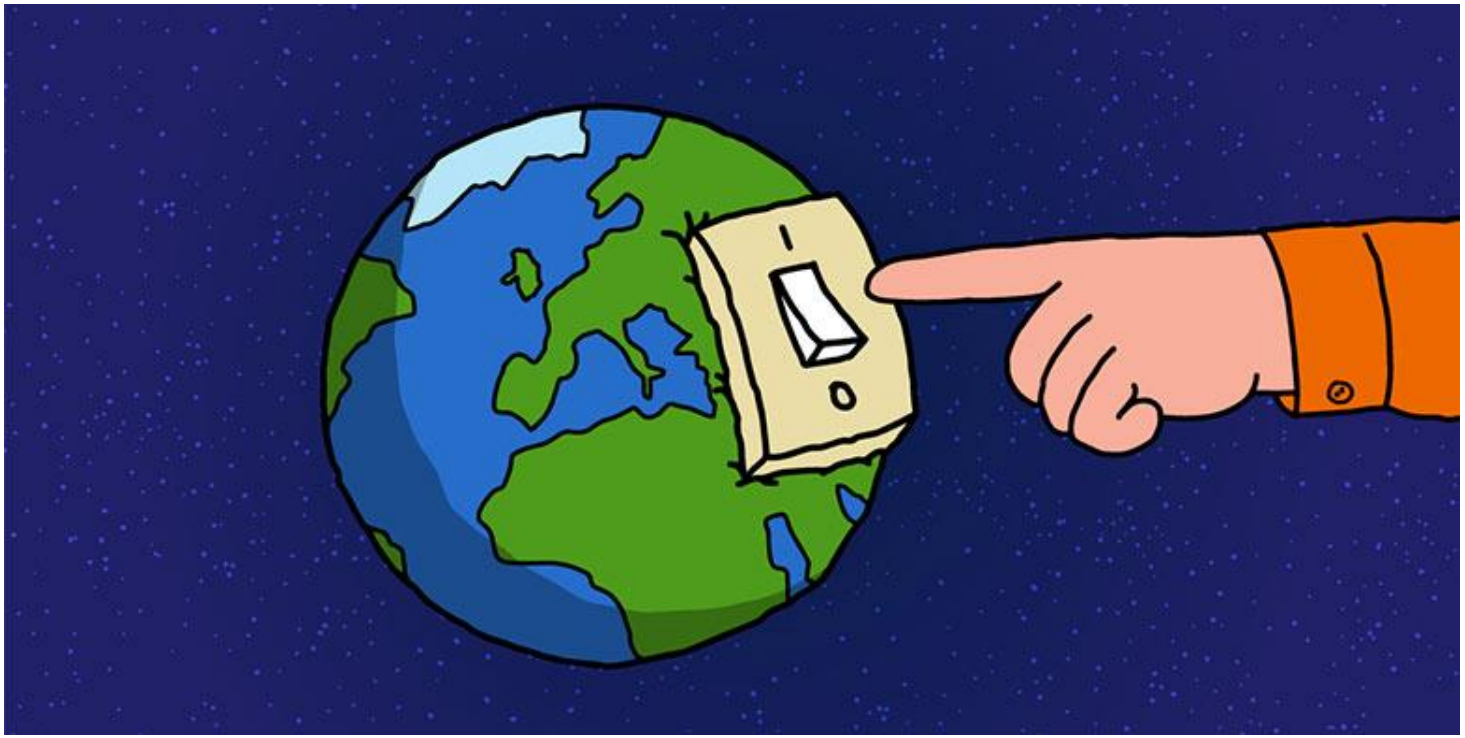
Why do people have such difficulties to save energy?



UfU

22. Make Earth Hour a topic of discussion

- worldwide climate and environmental action l protection
- public lighting is turned off
- Was initiated in 2007 by WWF Australia and has since taken place every year in March



23. Collecting at home energy saving tips as a contest:



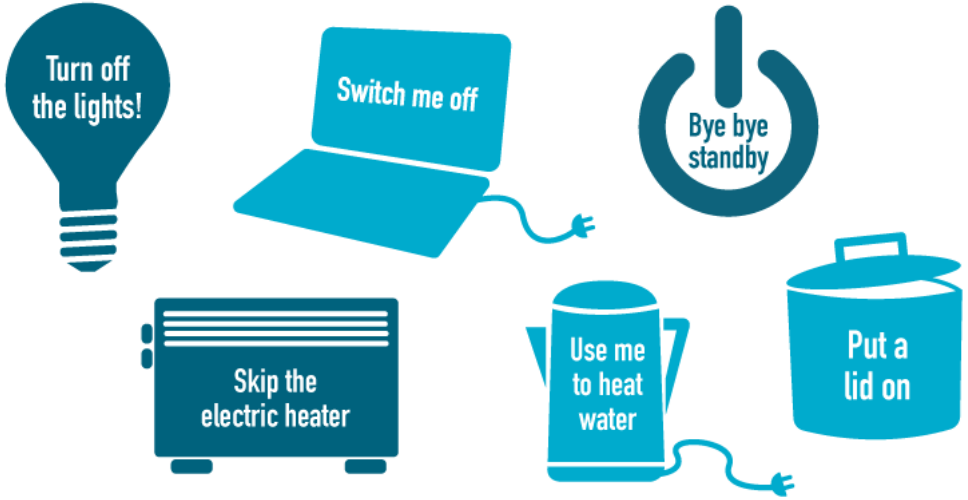
- use public transport, take the bike or walk instead of taking the car
- if it’s chilly, put on a sweater instead turning up the radiator, every degree less saves a lot of energy
- check if windows and doors are airtight and well-sealed so that heat doesn’t get lost
- don‘t wash your laundry hotter than necessary
- put the lit on the pot when cooking
- Buy environmentally friendly paper instead of white paper, it doesn’t only save energy but protects trees which help protect our climate
- use lunch boxes instead of aluminum foil and use water bottle for your drinks

UfU

More energy saving tips at home:

- Eat less meat. For livestock breeding a lot of energy is needed and produces a lot of waste.
- Buy more local products. It saves energy intensive transport.
- The less waste the better for the environment and the climate. Take a basket or a or fabric bag for your shopping. Separate your garbage for recycling purposes and avoid disposable plastic packaging.

(When burning plastic CO2 is emitted, also energy has gone into its production.)



- Save water: the treatment of wastewarter ist energy intensive. Use rainwater for watering plants, if possible.
- Take a shower instead of a bath. It saves water and energy.

UfU

Measurements

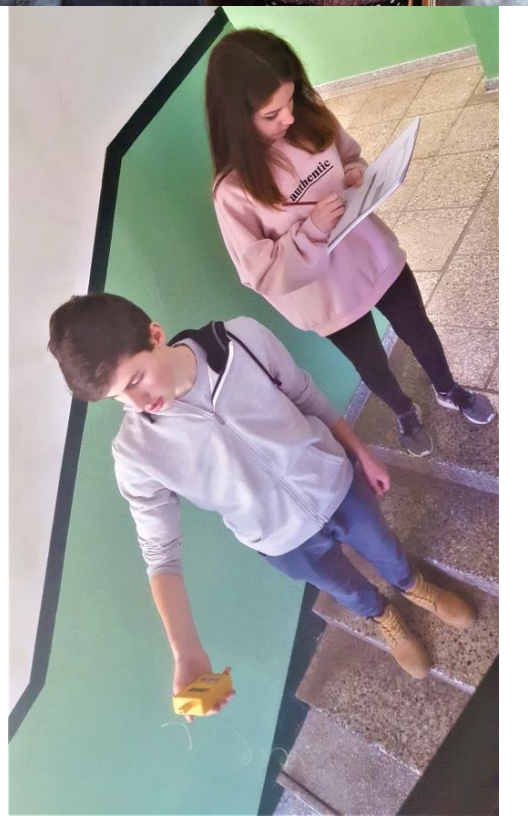
UfU

Temperature distribution measurement



Quick response thermometer

- measures temperature quickly
- sensor is at end of wire
- sensor is delicate → if students are not careful with it they can break it
- the two tiny wires there need to touch
- when turned on it measures immediately
- hold it away from your body so that your body temperature does not influence the measured value
- to get the average room temperature you should measure standing in the middle of the room, possibly not standing close to other people



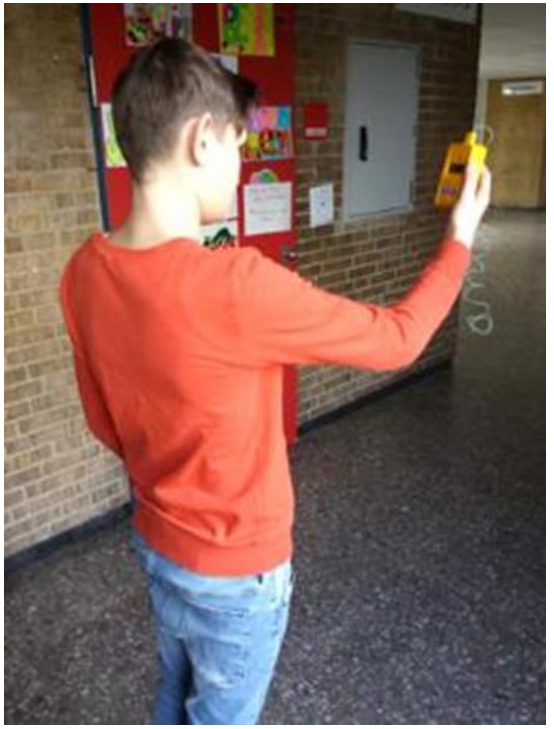
UfU

Temperature distribution measurement



Quick response thermometer

- you shouldn't hold it too close to the ground since measuring at the average room height gives you the most precise/exact value, 1m height is ideal
- 20 - 22°C is the appropriate room temperature for classrooms and offices
- for detecting conspicuous temperature distribution within school & can be first sign of overheated building / increased temperature level



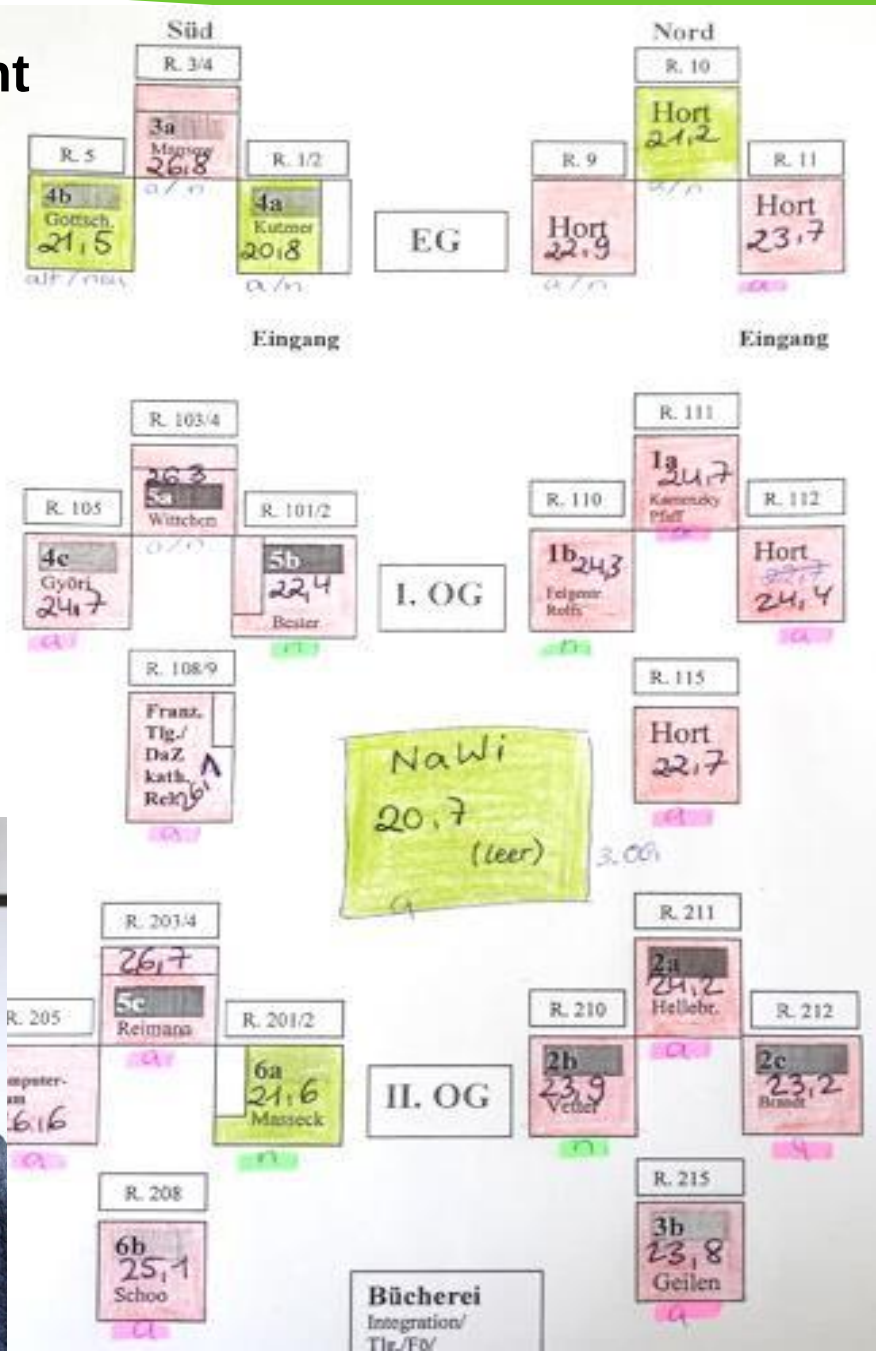
UfU

Temperature distribution measurement









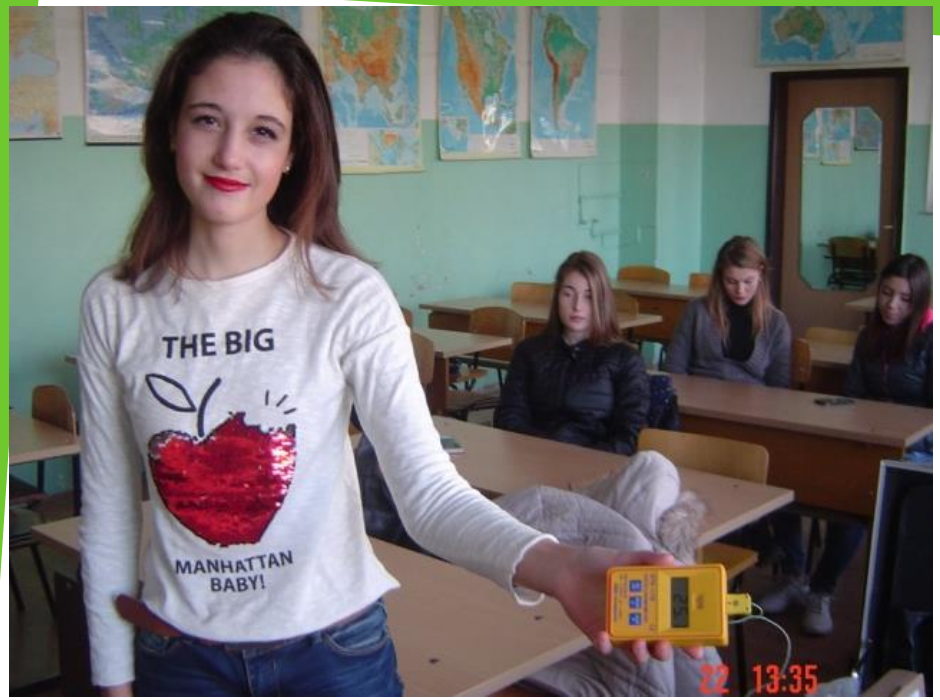
classrooms: 20°C

hallways/corridors: 16 – 18°C

stairwell: 14 – 17°C

gym 15 – 18°C

UfU







UfU

Temperature development

Сграда		02.2017 г. при външна температура 2°C	12.2017 г. при външна температура 1°C	Тенденция
Приземен етаж		24.40°C	20.80°C	**- 3.60°C**
1 етаж		22.70°C	21.06°C	**- 1.64°C**
2 етаж		23.62°C	22.76°C	**- 0.86°C**
3 етаж		23.20°C	22.28°C	**- 0.95°C**
4 етаж		21.31°C	22.10°C	**+ 0.79°C**
Административен корпус		22.64°C	21.04°C	**- 1.60°C**
Физкултурни салони	**Голям**	22.60°C	21.06°C	**- 1.54°C**
	Малък	20.70°C	17.60°C	**- 3.10°C**
Средна стойност		22.64°C	21.09°C	**1.55°C**

UfU

Colorful Evaluation

e. g. classrooms:

too cold

until 19,9 °C

okay

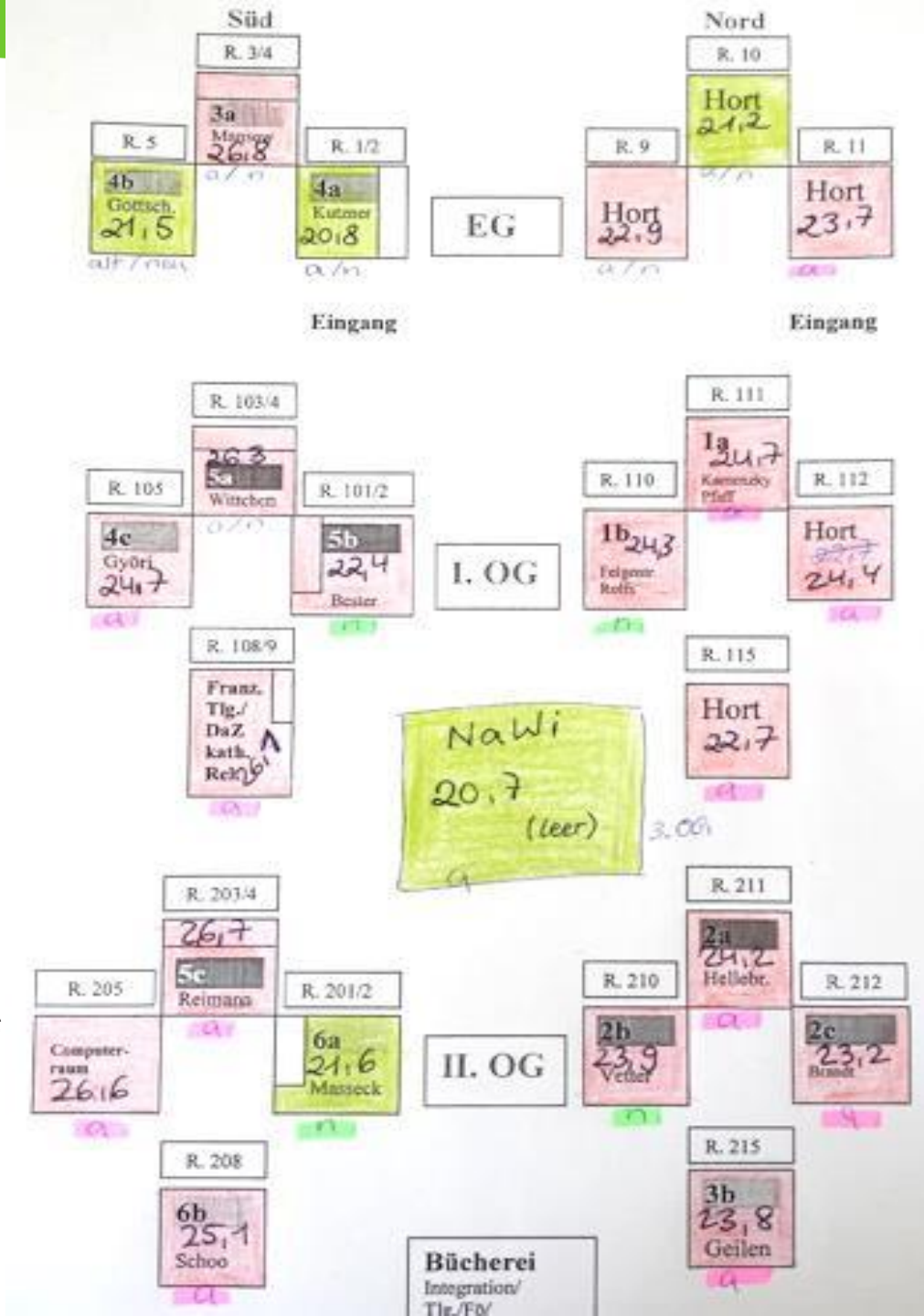
20 – 22°C

too warm

from 22,1°C

evaluation sentence in report:

- *„18 out of 23 measured areas/ rooms were too hot with over 22°C, 0 areas were too cold with under 19°C and 5 areas were appropriately heated.“*



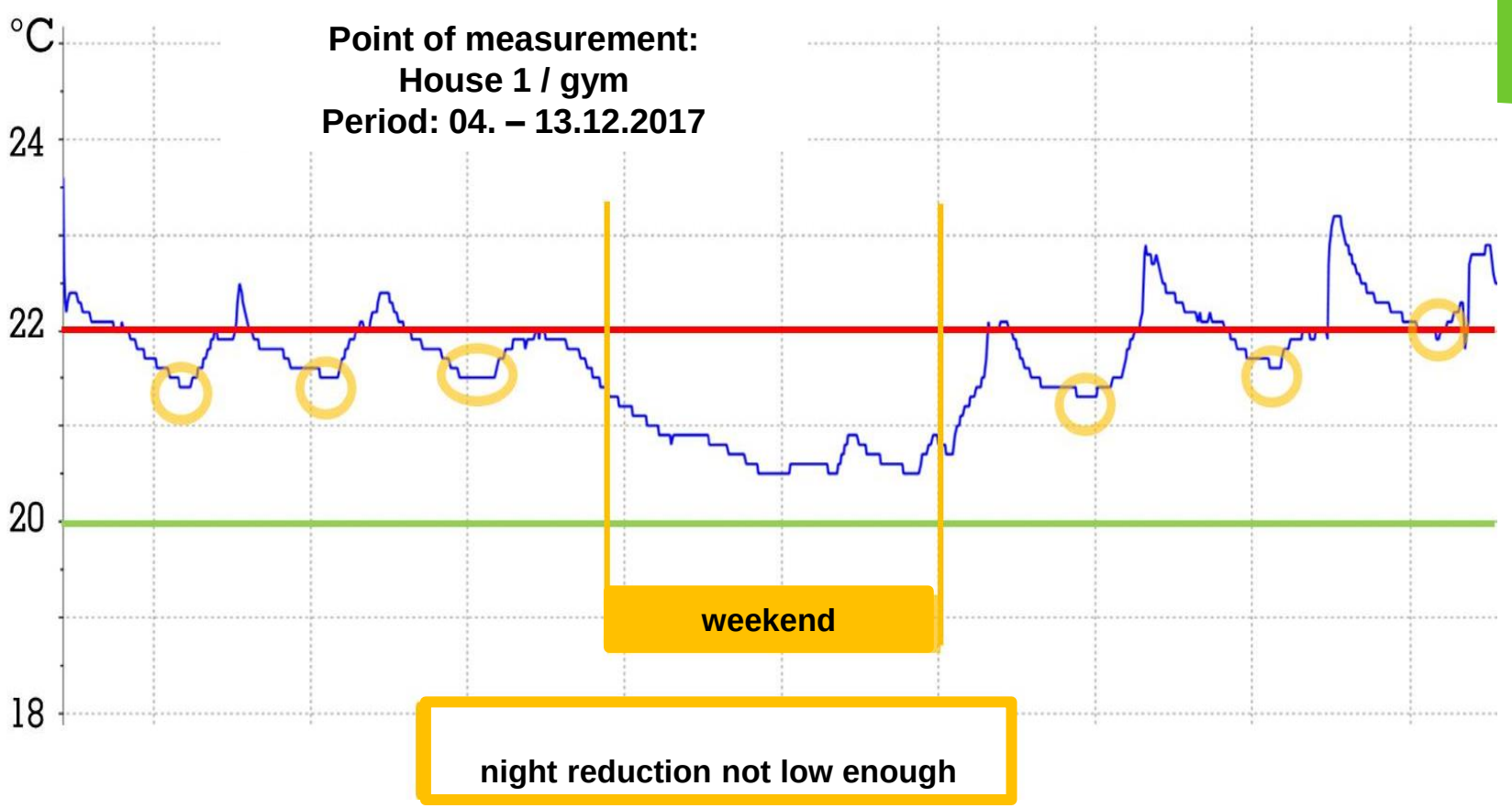
Temperature course measurement

Data logger

- measures temperature over long period and saves the measured values
- used to check the general temperature level and whether temperature is lowered during nights, weekends and holidays
- basically to discover energy saving potential in the heating control
- needs to be programmed before use & afterwards data can be evaluated with a free software on the computer
- <u>duration of measurement:</u> at least 1 week incl. a weekend should be recorded, if it includes the holidays even better
- <u>measuring point:</u> no direct sunshine, not too close to ground (cold), if possible in middle of the room, in a regular used room
- shows general temperature level as well valuable energy saving potentials during nights, weekends and holidays → thus detecting need for adjustments in heating settings



UfU



Written evaluation in report

The maximum temperature during the day was 23°C (which occurred only twice). Therefore all in all the general temperature level was appropriate.

But the minimal temperature during the nights were 21,3°C. There is a lot of energy saving potential in the heating system here. The night time heating temperature for classrooms should be lowered to at least 17°C or lower.

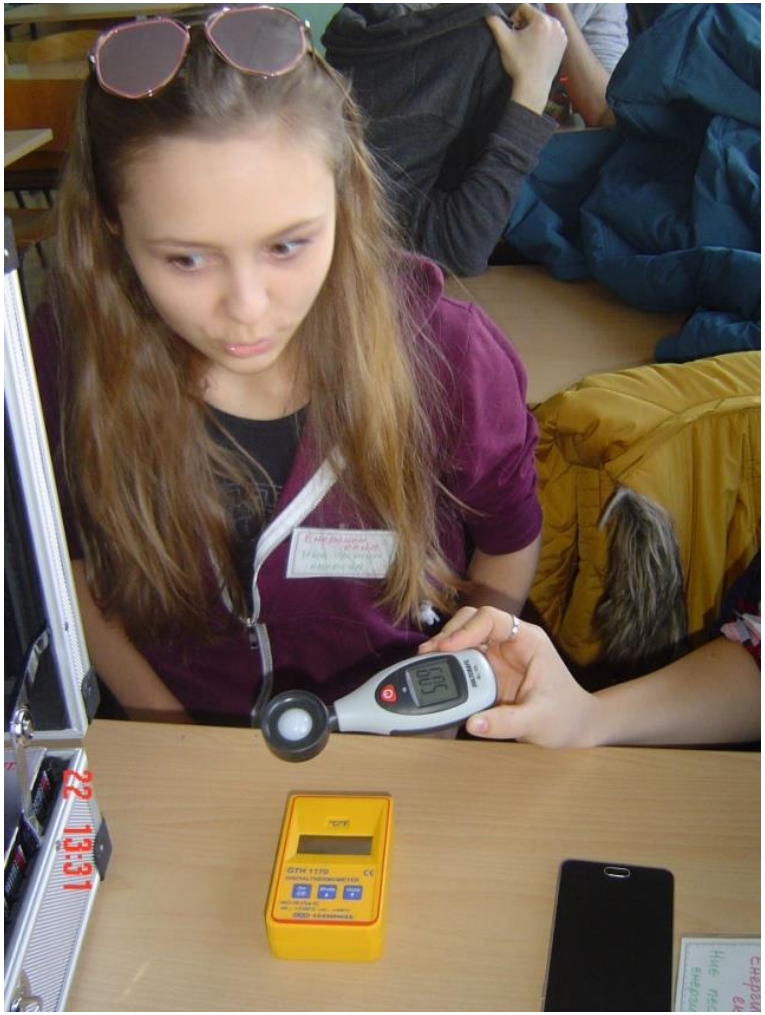
Also during the weekend, there is a lot of energy saving potential since the maximum temperature was 20,5°C. The lowered heating temperature should be reduced in small steps.

UfU

Illumination measurement







UfU

Illumination measurement



Luxmeter

- measures the illumination (how much light there is) in “lux”
- there are different scales on the luxmeter; when turning it on you have to choose one
- when you’re in a not so bright room or far away from the window, the first level (200 lux) should suffice
- when you’re close to the window you’ll need a wider range (2000 lux)
- and if you are in an even brighter place you, you raise the level even higher
- in the energy saving project we are usually interested in the illumination on the students’ desk to teach them to only switch on the light when necessary
- 300 lux is needed at a student’s desk







Illumination measurement

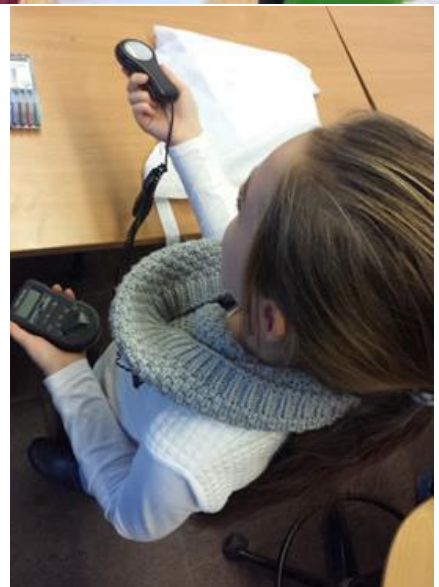




Type of room	illumination standards
normal classrooms, teacher‘s lounge, administrative rooms, multi-purpose rooms	300 lux
specific rooms (art, physics, chemistry, biology, handicrafts…)	500 lux
hallways, staircases	100 lux
auditorium, canteens	200 lux
storage rooms	200 lux

Standard values according to DIN 5035





UfU

CO_2 concentration measurement

- health: indoor climate is becoming more and more important
- too high CO_2 concentration in rooms leads to decrease of performance among the students
- increase of noise level
- cold hands can be a sign of that

CO_2 concentration [ppm]	Hygienic assessment	Recommendation
< 1000	harmless	none
1000 - 2000	conspicuous	room should be aired
> 2000	unacceptable	room has to be aired



Correct airing
is vital!

CO_2 concentration measurement



- measures the CO_2 value in the air in “ppm” (parts per million)
- also to not distort the measured value no one should stand too close to the device or breath in it directly
- when the measured value in a classroom reaches 2000 ppm, it is necessary to open the window
- this measuring device is used to
  1. show how fast the air in a classroom can become bad and
  2. which kind of ventilation is the most effective and therefore wastes the least energy





UfU

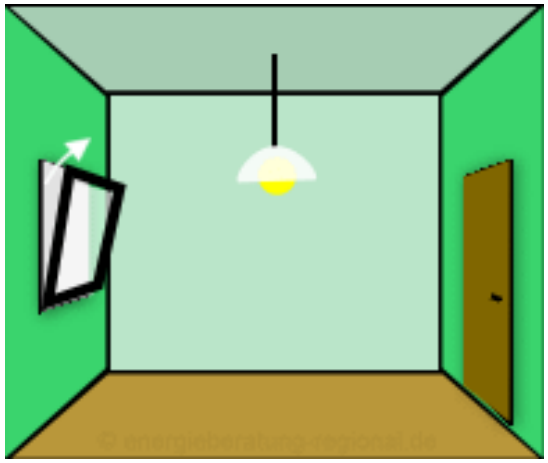
CO_2 concentration measurement

- shock ventilation or cross ventilation exchange the air quickly

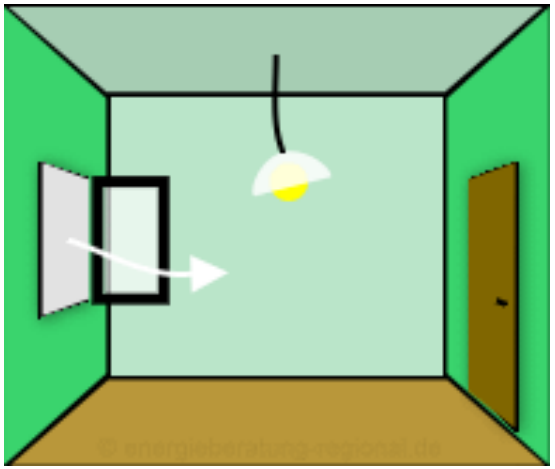
→ therefore very little heat of the room is lost

→ especially important if thermostat can't be regulated!

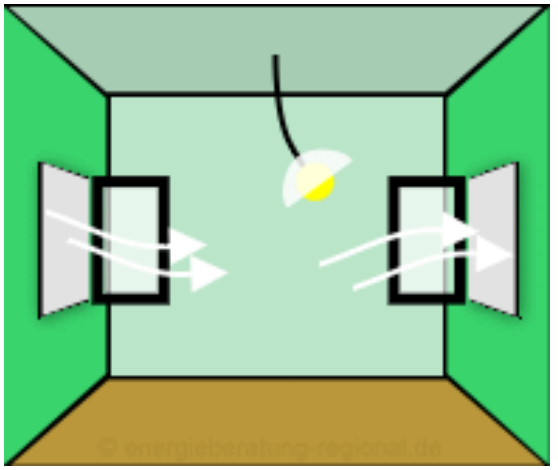
- tilt ventilation doesn't get the CO2 out, s often forgotten to be closed and lets a lot of heat escape outside



tilt ventilation

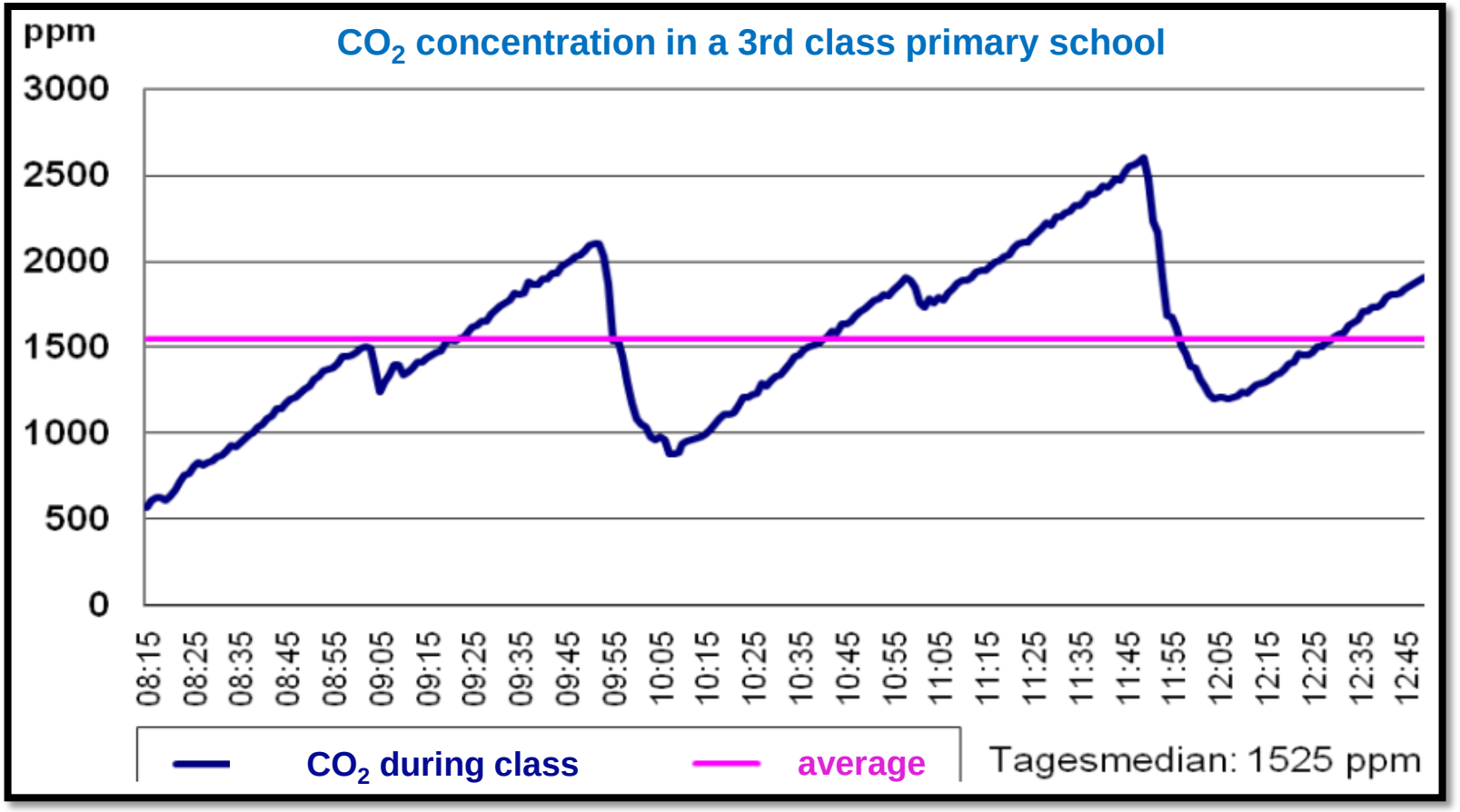


shock ventilation



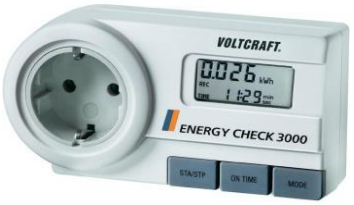
cross ventilation

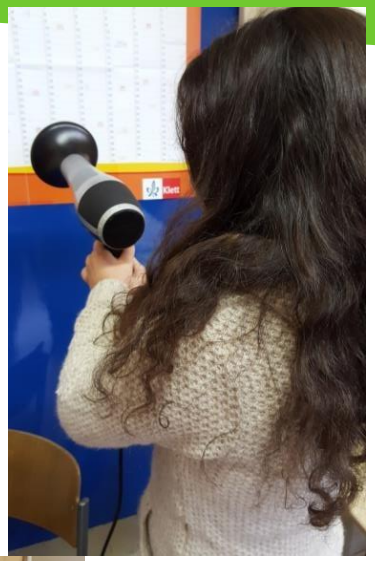
CO_2 concentration easily rises above 1500 ppm



Electricity consumption

measurement

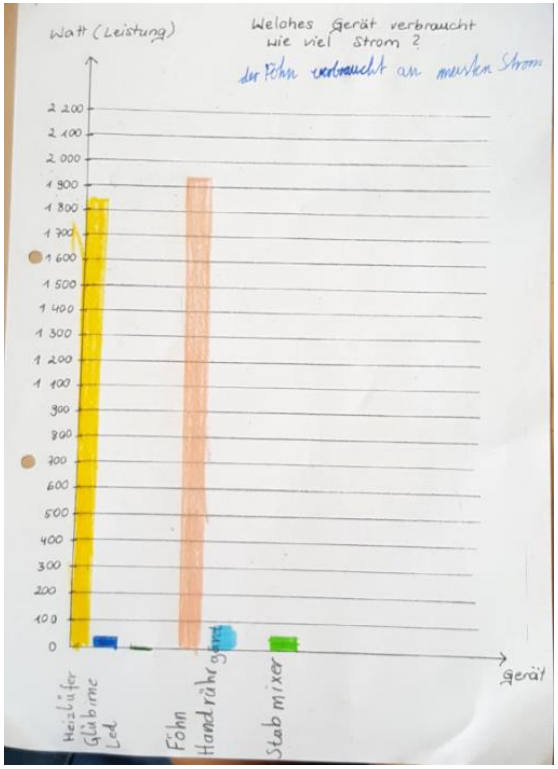






- Measures the power of electrical devices
- Students often don’t know electricity consumption of devices
- Measurement gives them an impression of the power consumption of different devices





Changing batteries of measuring devices

A screwdriver is often useful.



UfU

Power consumption

measurement



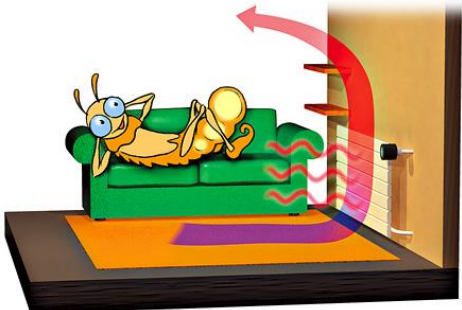
Energy saving tips - **heating**



1. don‘t turn the thermostat higher than on level 3
2. shock ventilation for a short while instead of tilt ventilation for long time
3. turn off thermostat during ventilation, turn back on afterwards
4. warm clothing instead of wasting heat energy **AND** instead of neglecting ventilation
5. close windows and doors in order to avoid heat leakages to the outside or corridors
6. in rarely used rooms: lower thermostat level
7. don’t block radiators with furniture



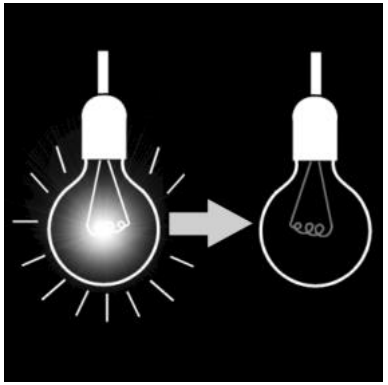




Energy saving tips - **electricity**

1. switch light of during breaks
2. first turn on lamps on wall side, window side is seldom needed
3. don’t play with the light switches
4. turn off electrical devices which are not in use instead of stand-by mode





UfU

Благодарим Ви!

UfU