

# Solar Panels

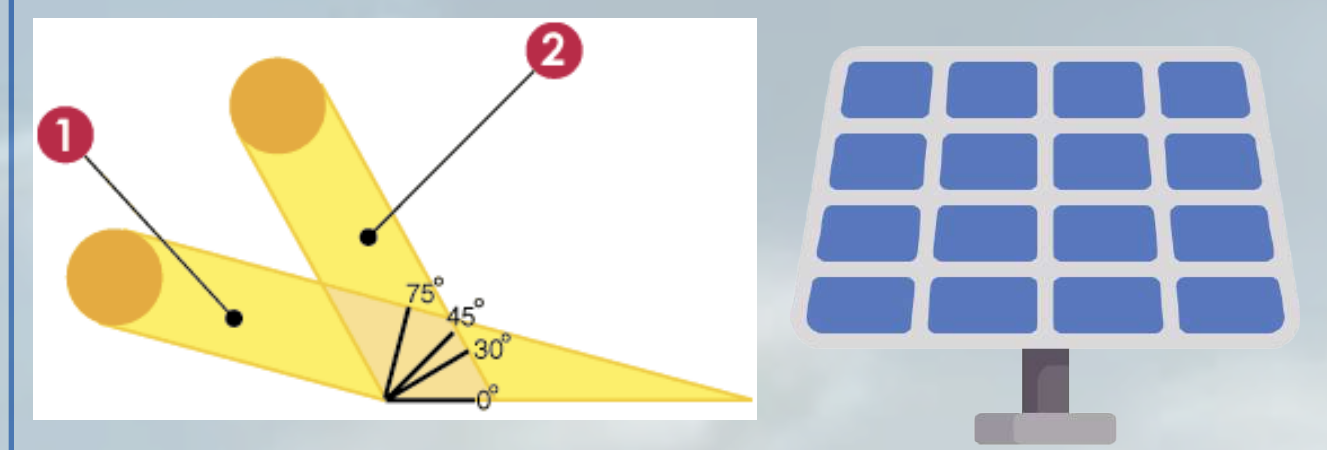
Cătărig Horațiu, Crișan Bianca, Dobra Sofia, Jucan Codruța, Vasiliu Mara  
 Colegiul Național Emil Racoviță Cluj-Napoca

## RESEARCH TOPIC

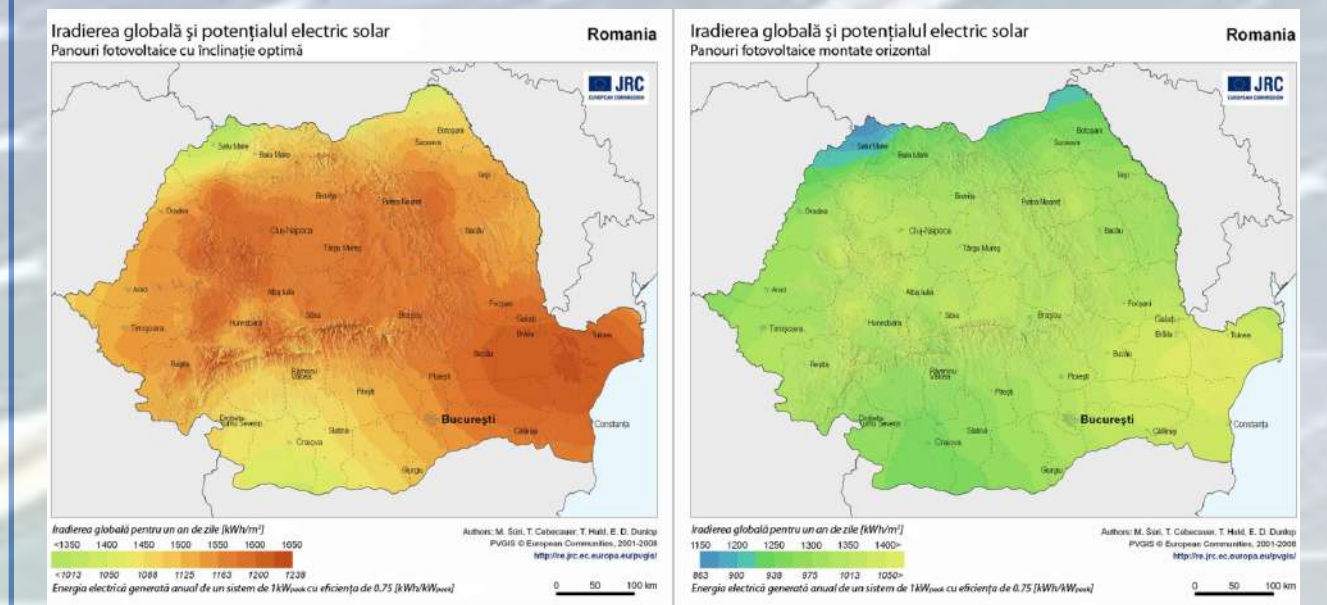
Your school wants to equip most of its roof with solar panels to reduce its use of energy.  
 Estimate the possible number of solar panels and the expected yield in a year.

## INFORMATION ABOUT SOLAR PANELS

The best type of solar panel for schools is *thin film* because although they don't have a high efficiency, they are less expensive and in a large number can generate the same amount of energy as other solar panels.

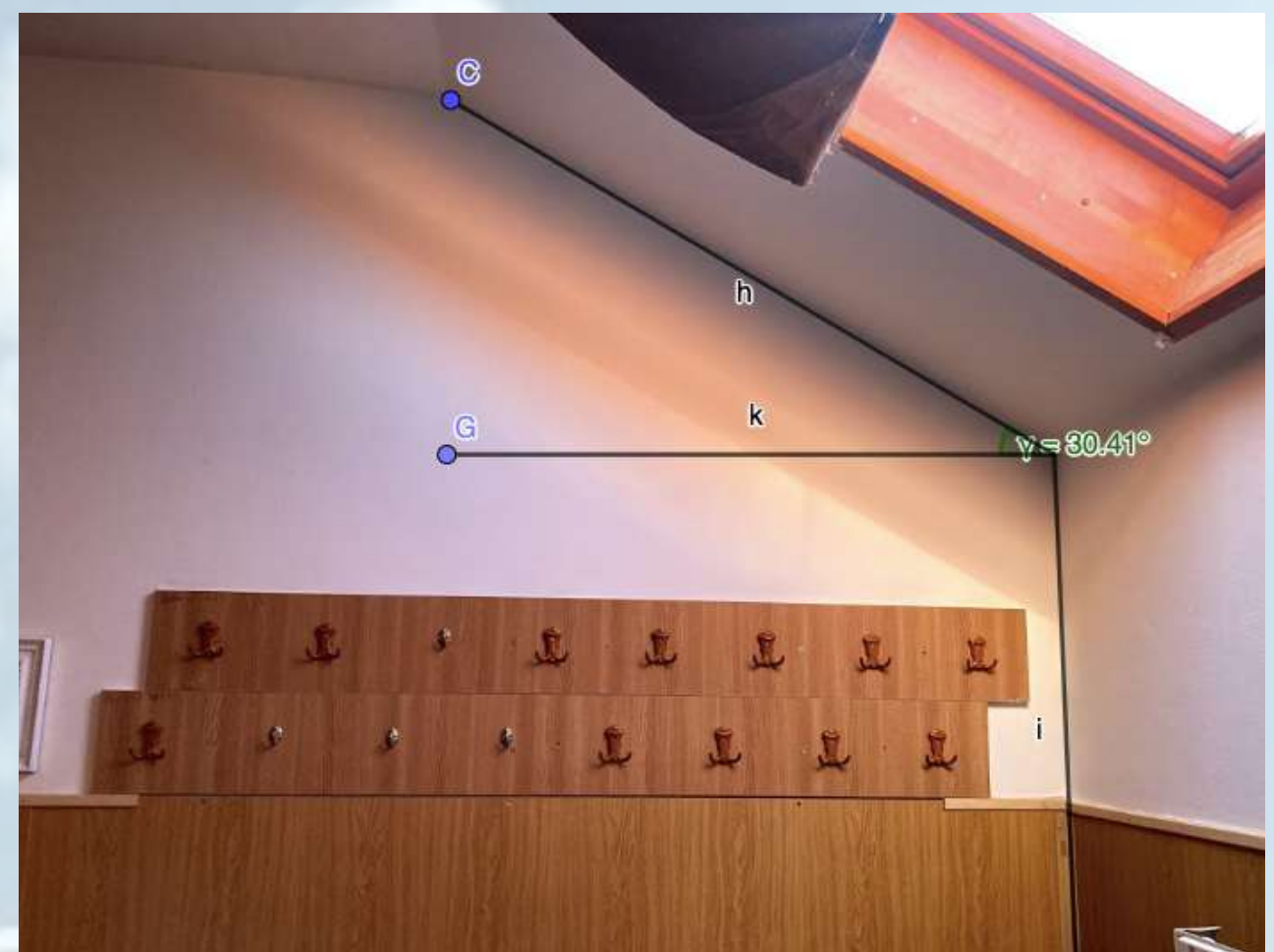


The optimum inclination angle of solar panels is around **45°** in Cluj-Napoca and the energy flux is **1500 kWh**.  
 Panels must face South in order to be more efficient. The efficiency of one panel is approximately **20%**. The surface of a panel is **1x1.7 m<sup>2</sup>**



## METHOD & RESULTS

There are three roofs facing south on which we can put solar panels to have the best efficiency. The slope of the roof is **30.41°**. The surface of the roof : **782.8 m<sup>2</sup>**. Without the surface of the windows and the space between them, the surface becomes **735.2 m<sup>2</sup>**.  
 The maximum number of solar panels that can be put on our roof is **432** panels which occupy a surface of **734.4 m<sup>2</sup>**.



The total energy consumption of our school in 2017 was **74810 kWh**.  
 The total electrical energy generated by a photovoltaic system can be calculated using the formula:

$$E = S * R * H * PR$$

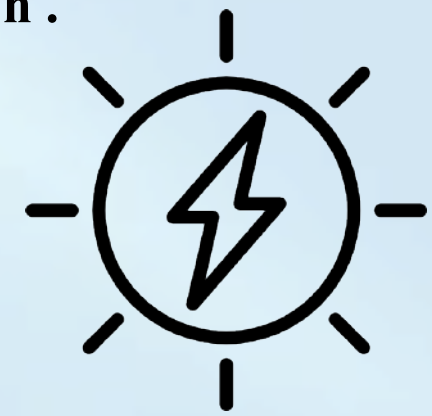
Where:  
 S - the total surface of the solar panels  
 R - the efficiency  
 H - the annual energy flux  
 PR - the loss coefficient = 0.75

This would mean that 432 panels can generate **165 240 kWh** in a year.

Year	Month	Energy consumption(kWh)	Total energy (Kwh)
2017	1	9954	74810
	2	8748	
	3	9725	
	4	6040	
	5	0	
	6	7273	
	7	4346	
	8	2592	
	9	2860	
	10	5787	
	11	8600	
	12	8921	

## CONCLUSIONS

The maximum number of solar panels produces much more energy than our school needs. We can store the remaining energy produced in summer and use it in winter, or we can sell it.  
 We can also put fewer solar panels that produce just the right amount of energy. The minimum number would be **200** solar panels producing **76 500 kWh**.



## PRICES

The price of a solar panel is **100 €**, so the minimum number of solar panels costs **20 000 €** and the maximum number costs **43 200 €**, this without other needed equipment.

