

# Introduction





Heriburg for future

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Green Heriburg

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# Challenges in our school building



No good insulation



Big Foyer



Budget

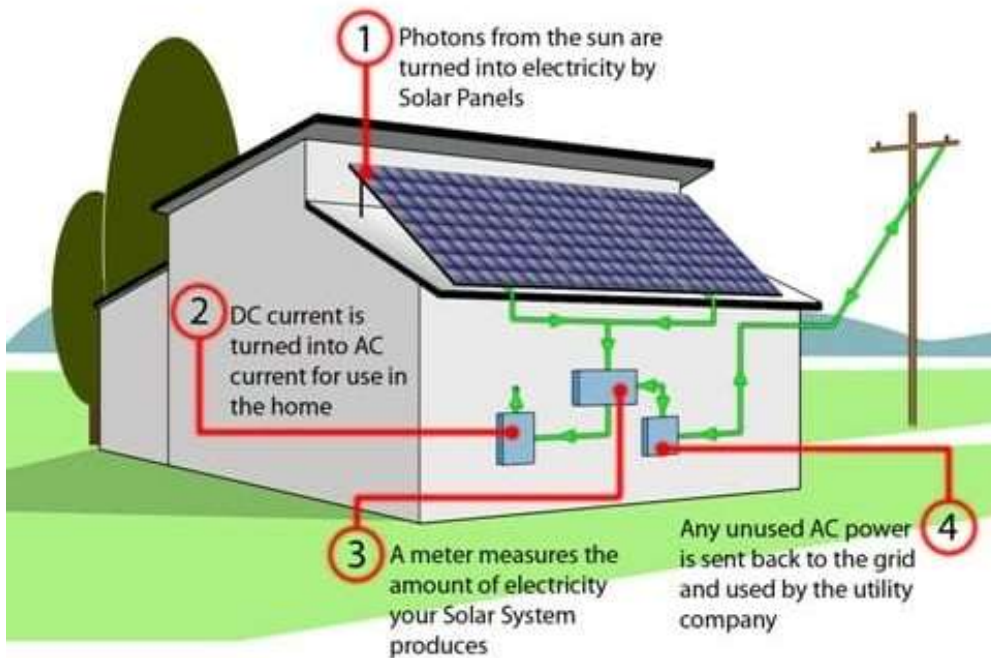
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## What are Photovoltaics?

- ▶ renewable method
- ▶ Use the sun energy
- ▶ Produce electricity
- ▶ 7,2 percent of the German electricity



## How does it work



- ▶ panel collects the sun energy
- ▶ a chemical reaction produce direct current
- ▶ Direct current into alternating current
- ▶ sell the electricity or charge a battery

# What do you need for it



a roof or a shiny  
spot



Some money



connection to the  
grid or a battery



Panels and an  
inverter



Why we can benefit so much

Flat roof

Much sun shine

a high consumption

be independent



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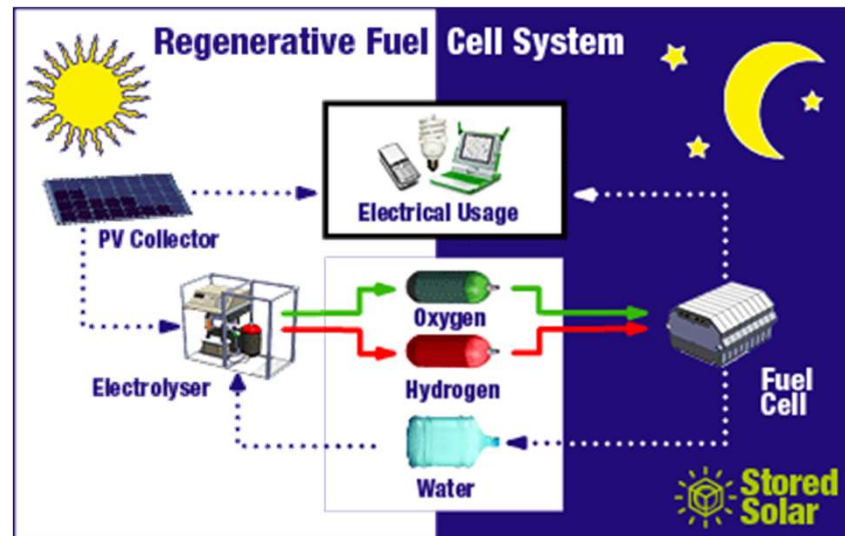
Video



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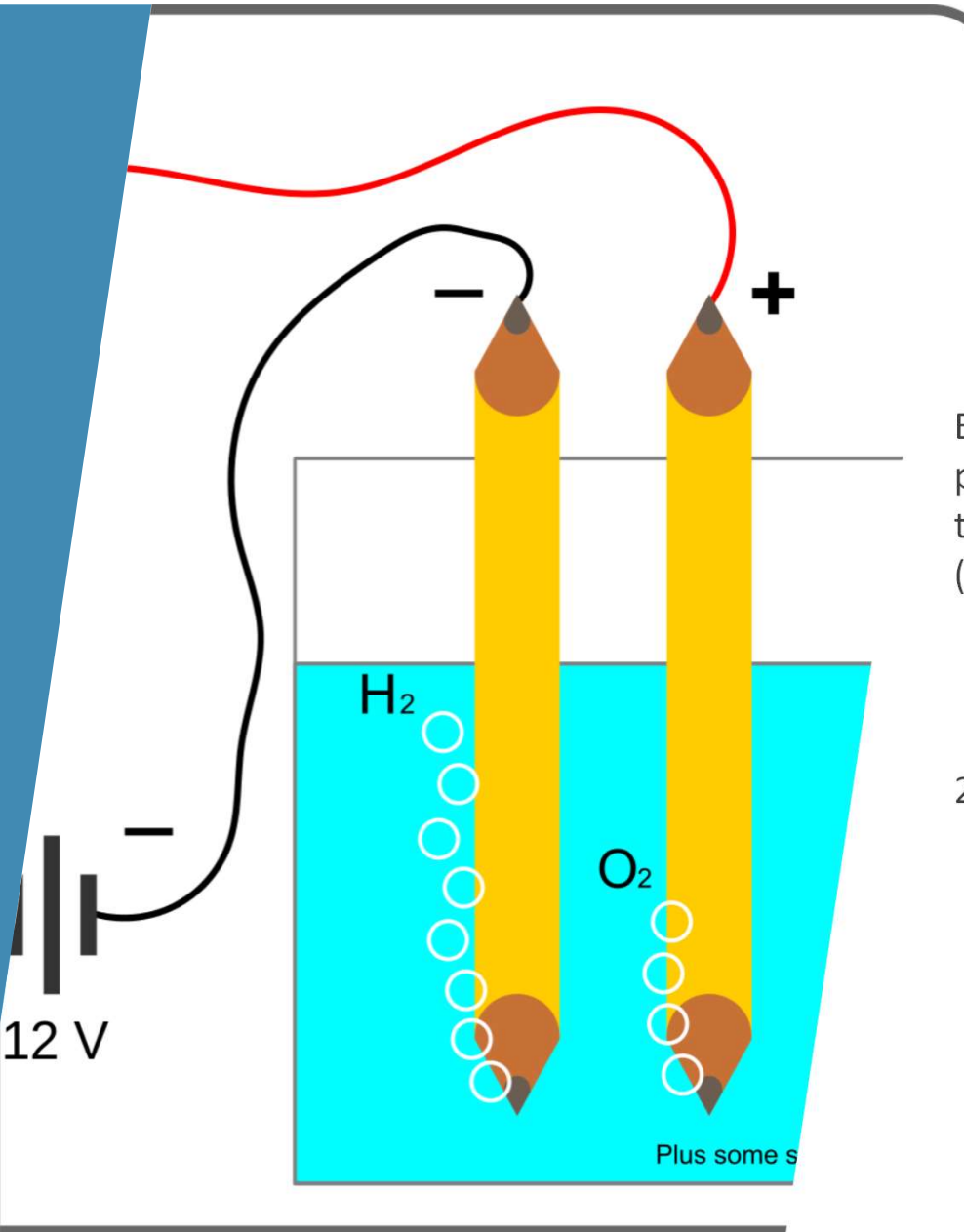
# The function of our photovoltaics

- ▶ Use the electricity
- ▶ power the PEM-cells in the electrolyzer



Next step:  
the  
electrolyzer

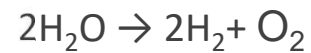




## What is Electrolysis and how does it work ?

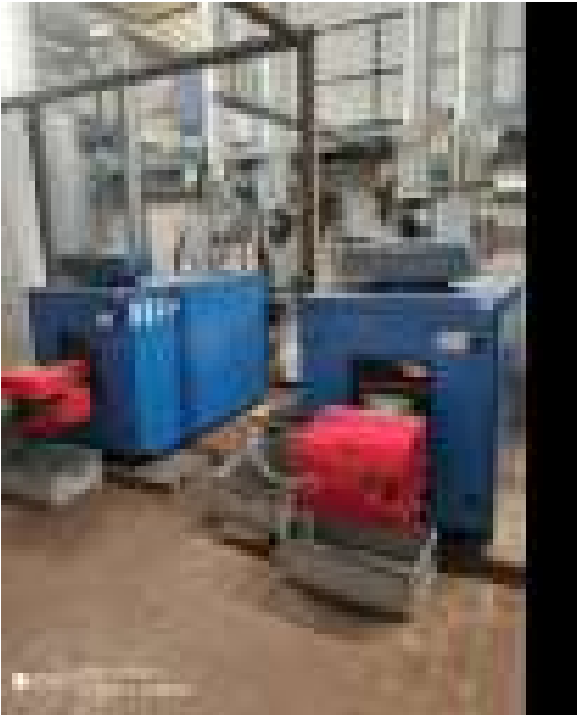
Electrolysis is a chemical decomposition produced by passing an electric current through a liquid or solution containing ions (in our case: water).

electricity



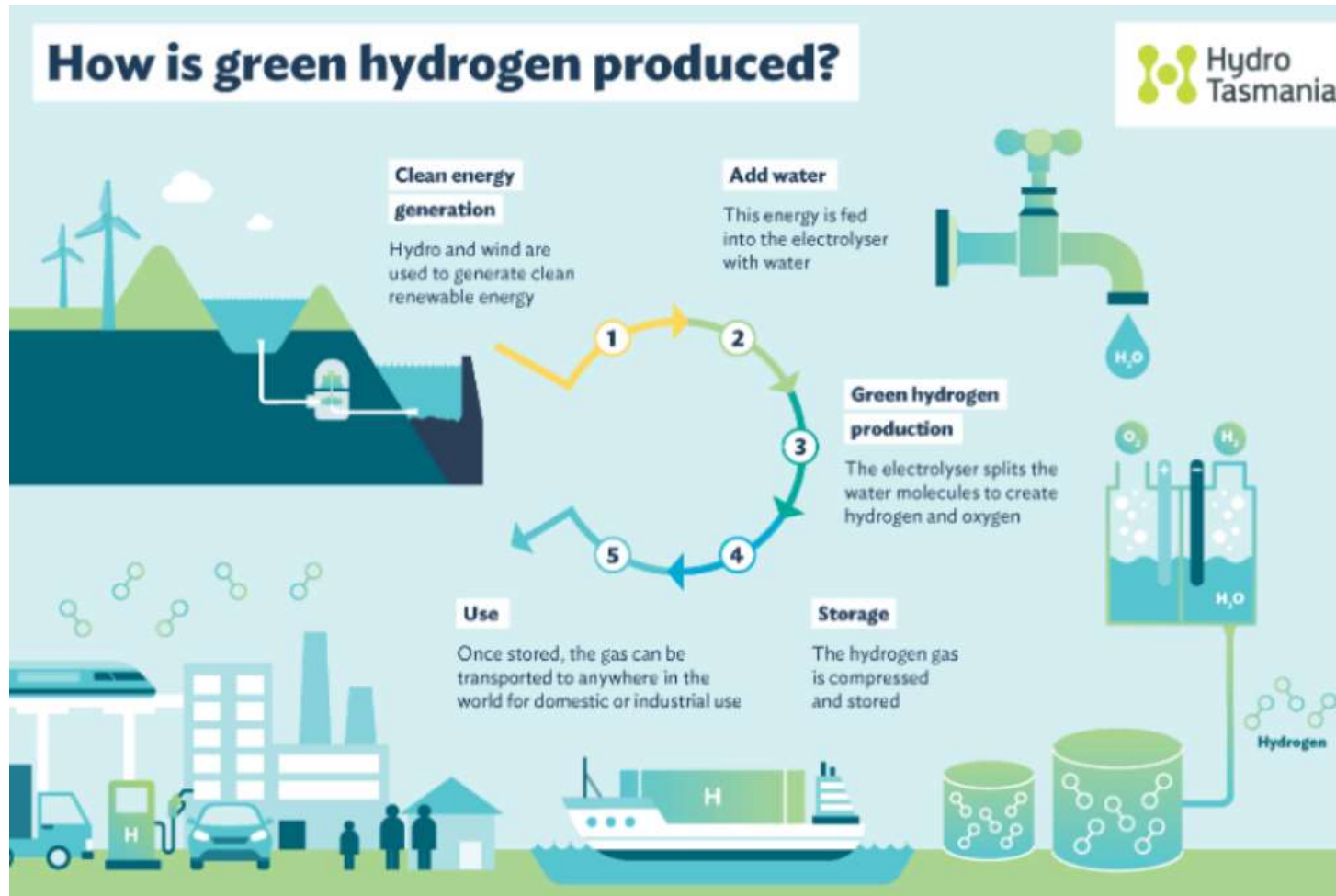


# Where do we put the electrolyzer and the metal hydrides tanks?



► In our basement is enough space to fit a big electrolyzer and metal hydride storage if we remove the oil-fired heating.

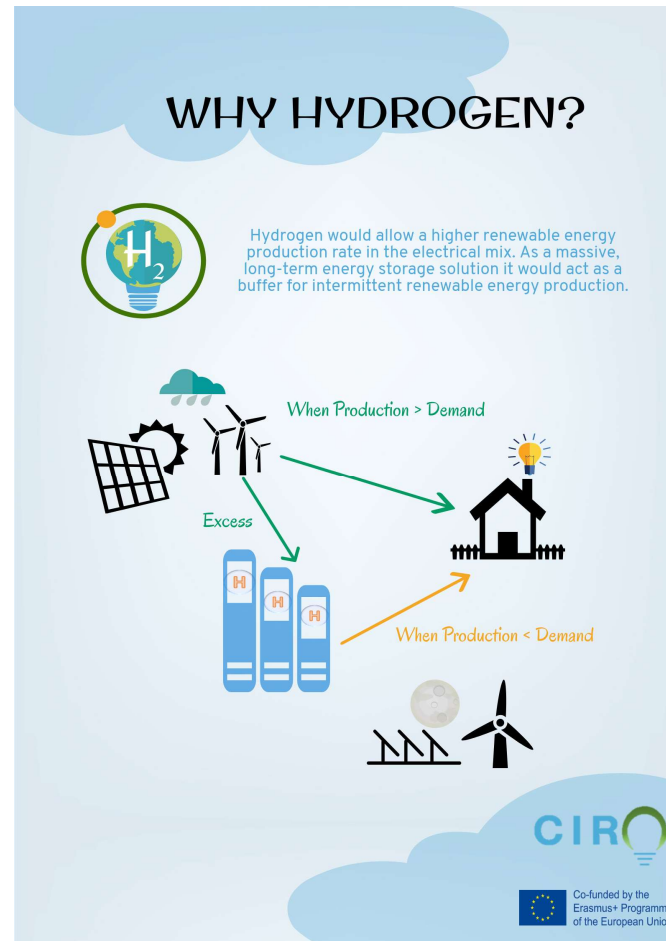
# Green hydrogen



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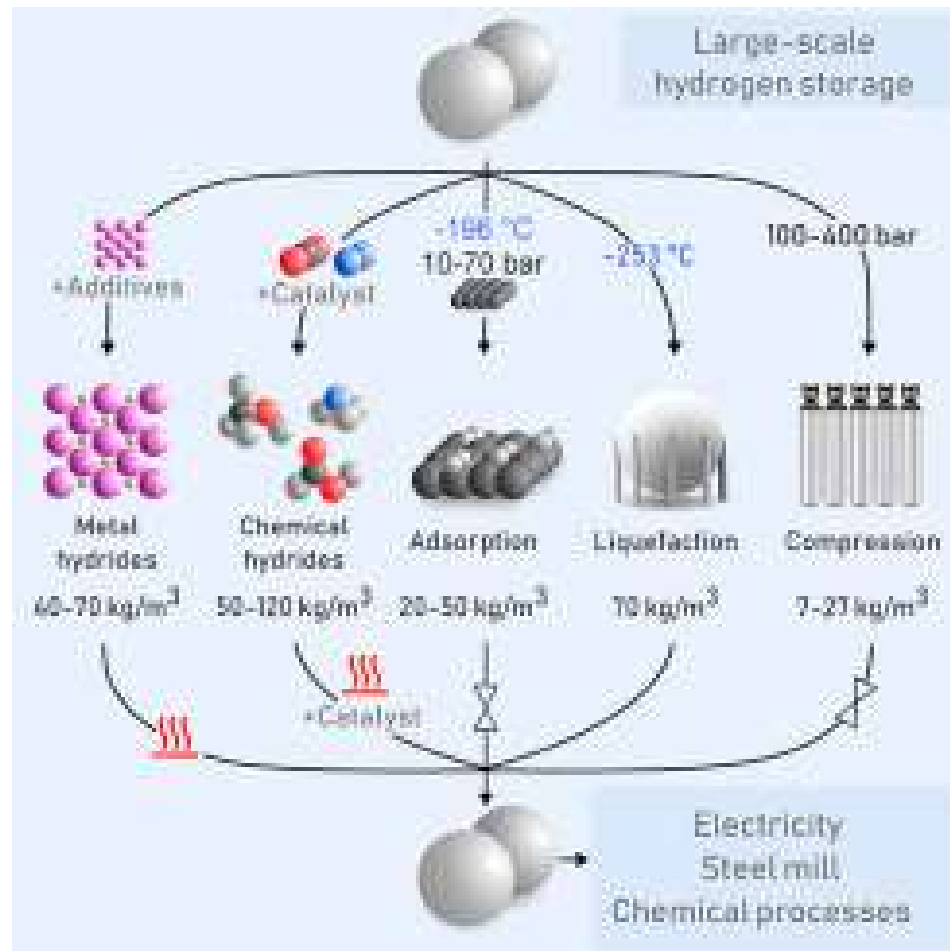
# More electricity than consumption

- ▶ Production of energy > demand → create hydrogen
- ▶ Production of energy < demand → hydrogen is used to create energy



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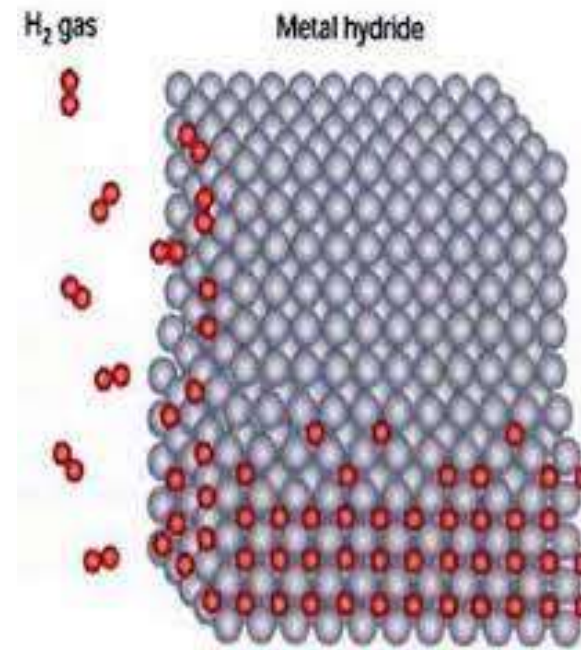
# Ways to store hydrogen





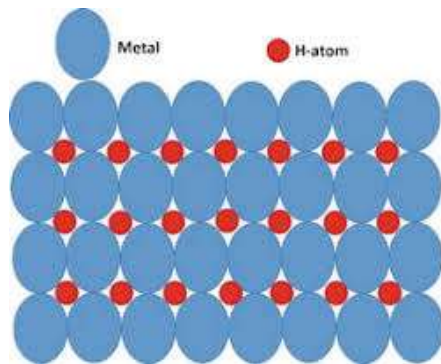
# Metal hydrid

- ▶ We have chosen metal hydrids (ammonia borane)
- ▶ Hydrogen is expelled from the hydrid by lowering the pressure and applying heat



# Advantage of metal hydrides

- ▶ High density
- ▶ The space is available in the basement
- ▶ Do not have to build up pressure or low temperatures

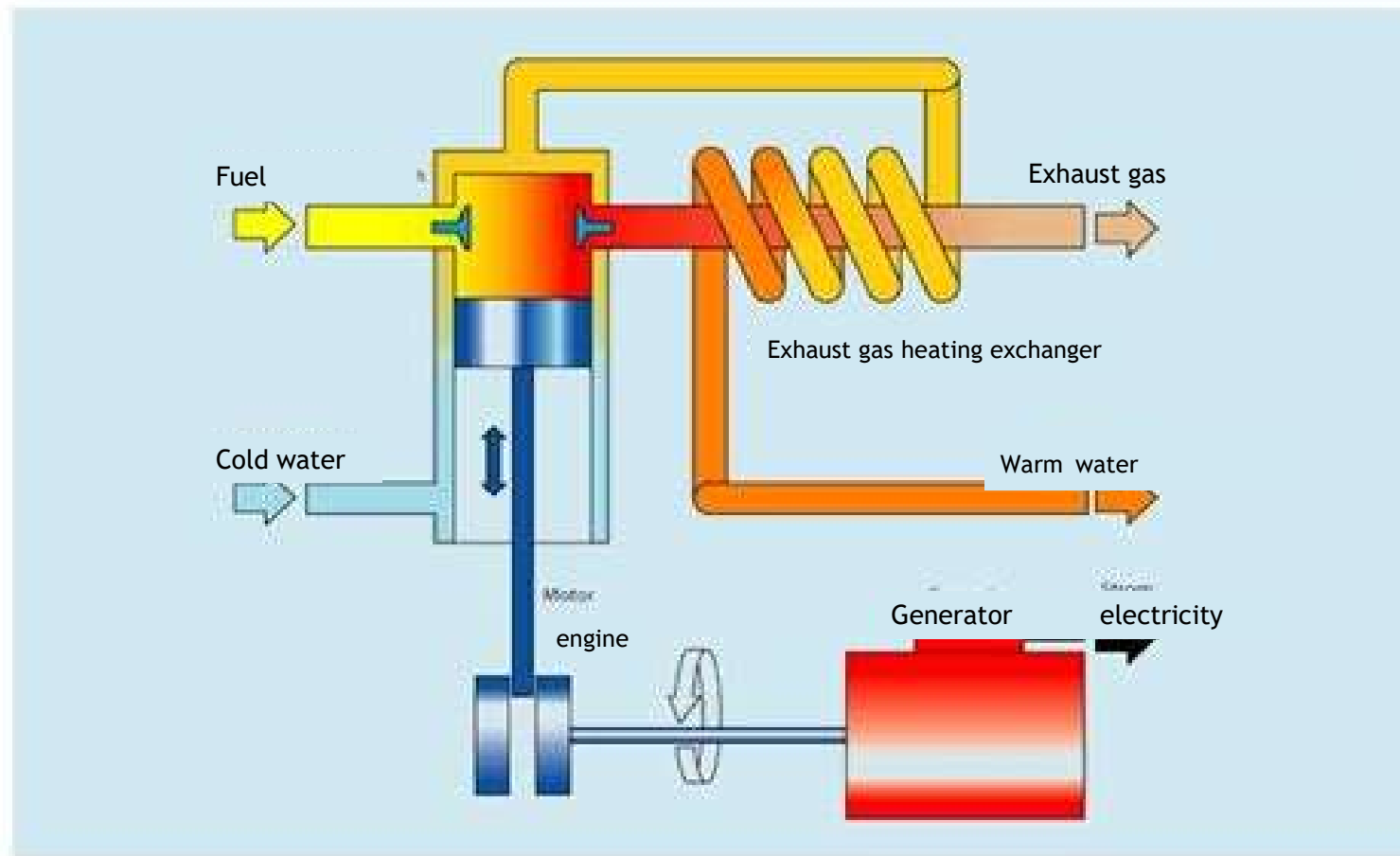


# What is a block-heating and generating plant?



WOLF block heating and generating plant

# How does a block heating and generating plant work ?



LT1

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## Diapositiva 20

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**LT1**

Lena Tenkamp; 29/04/2021

# Why a block heating and generating plant for our project?



- ▶ Price
- ▶ Climate friendly- no carbon dioxide
- ▶ Several functions- heating and electricity
- ▶ No oil- heating

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# When would we use the block heating and generating plant?

- ▶ No sun- photovoltaic system
- ▶ Not enough electricity
- ▶ As heating



# How would we use the block heating and generating plant ?



Own hydrogen



Do not buy anything



# How much would a block heating and generating plant cost?

- ▶ WOLF-block heating and generating plant- 50 kw
- ▶ 80 000€
- ▶ Promotion of 10 000€ from state



## Why do we need insulation?

- ▶ Warmth always go where it is cold
- ▶ U-value → heat transfer trough a bulding



## The U-value of the school building

- ▶ Our school has a high U-value
- ▶ We lose approx. 20% through our bad U-value

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# Insulation of our school building

- ▶ We have chosen fiberboards with hemp
- ▶ Good for the environment

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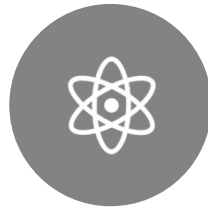
# Costs for the project



PHOTOVOLTAIC  
SYSTEM



BLOCK HEATING  
AND GENERATING  
PLANT



PEM-CELL



THERMAL  
INSULATION



## In Conclusion

Photovoltaics

Electrolysis

Metal hydrid

Block heating and generating plant

Insulation

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# Links

- ▶ Source: [https://www.bing.com/images/search?view=detailV2&ccid=u2YNicTP&id=192B94384C0E284CEF3ED877C7A8A6F2FF5DF08B&thid=OIP.u2YNicTPVX6i5w0g3UXR6QHaF4&mediaurl=https%3a%2f%2fwww.wolf-ps.de%2ffileadmin%2fWPS%2fBilder\\_Neue\\_Struktur\\_\\_ab\\_10-2020%2fWasserstoff%2fWolf\\_Motor\\_offen\\_web.jpg&cdnurl=https%3a%2f%2fth.bing.com%2fth%2fid%2fRbb660d89c4cf557ea2e70d20dd45d1e9%3frik%3di%252fBd%252f%252fKmqMd32A%26pid%3dImgRaw&exph=423&expw=533&q=bhkw+wolf+wasserstoff&simid=608017230027701885&ck=34C7450ECA27A40D3CD4A9AC99C0BBF8&selectedIndex=2&FORM=IRPRST&ajaxhist=0](https://www.bing.com/images/search?view=detailV2&ccid=u2YNicTP&id=192B94384C0E284CEF3ED877C7A8A6F2FF5DF08B&thid=OIP.u2YNicTPVX6i5w0g3UXR6QHaF4&mediaurl=https%3a%2f%2fwww.wolf-ps.de%2ffileadmin%2fWPS%2fBilder_Neue_Struktur__ab_10-2020%2fWasserstoff%2fWolf_Motor_offen_web.jpg&cdnurl=https%3a%2f%2fth.bing.com%2fth%2fid%2fRbb660d89c4cf557ea2e70d20dd45d1e9%3frik%3di%252fBd%252f%252fKmqMd32A%26pid%3dImgRaw&exph=423&expw=533&q=bhkw+wolf+wasserstoff&simid=608017230027701885&ck=34C7450ECA27A40D3CD4A9AC99C0BBF8&selectedIndex=2&FORM=IRPRST&ajaxhist=0)
- ▶ Source: [https://www.bing.com/images/search?view=detailV2&ccid=MA4jWT4j&id=0DDA956038854AD6D5070DD1357D7649B1939723&thid=OIP.MA4jWT4jt07eZlOoDcruRQAAAA&mediaurl=https%3a%2f%2fth.bing.com%2fth%2fid%2fR300e23593e23b74ede6653a80dcaee45%3frik%3di%252fTsxUl2fTXRDQ%26riu%3dhttp%253a%252f%252fbrechenwagen.fun%252fliu%252fZtICbK8qOCDSf6sZa9ydgHaE0.jpg%26ehk%3dsc57X5U3%252bhUDO%252bC3EzTsXV7yHChvyAB13TRIM2wuL9o%253d%26risl%3d%26pid%3dImgRaw&exph=308&expw=474&q=Bhkw+Skizze&simid=608045293341455057&ck=955F8F9AA632FB635916A8CF0D367208&selectedIndex=3&form=IRPRST&ajaxhist=0&pivotparams=insightsToken%3Dccid\\_rhsjO9Qj\\*cp\\_FDE62C59C974630EF08543F269482F00\\*mid\\_4814022B25D771D164178F1E0B9C53BF49C8C499\\*simid\\_608001819689827894\\*thid\\_OIP\\_rhsjO9QjXcSDk8kZ0p3KSAHaGi&vt=0&sim=11&iss=VSI&ajaxhist=0](https://www.bing.com/images/search?view=detailV2&ccid=MA4jWT4j&id=0DDA956038854AD6D5070DD1357D7649B1939723&thid=OIP.MA4jWT4jt07eZlOoDcruRQAAAA&mediaurl=https%3a%2f%2fth.bing.com%2fth%2fid%2fR300e23593e23b74ede6653a80dcaee45%3frik%3di%252fTsxUl2fTXRDQ%26riu%3dhttp%253a%252f%252fbrechenwagen.fun%252fliu%252fZtICbK8qOCDSf6sZa9ydgHaE0.jpg%26ehk%3dsc57X5U3%252bhUDO%252bC3EzTsXV7yHChvyAB13TRIM2wuL9o%253d%26risl%3d%26pid%3dImgRaw&exph=308&expw=474&q=Bhkw+Skizze&simid=608045293341455057&ck=955F8F9AA632FB635916A8CF0D367208&selectedIndex=3&form=IRPRST&ajaxhist=0&pivotparams=insightsToken%3Dccid_rhsjO9Qj*cp_FDE62C59C974630EF08543F269482F00*mid_4814022B25D771D164178F1E0B9C53BF49C8C499*simid_608001819689827894*thid_OIP_rhsjO9QjXcSDk8kZ0p3KSAHaGi&vt=0&sim=11&iss=VSI&ajaxhist=0)

# Links

- ▶ [https://www.bing.com/images/search?view=detailV2&ccid=CAmXwl9H&id=D1FAC69558284E5E121484FE2D19C8120A82C3FD&thid=OIP.CAmXwl9H6KGcBVf0Dt vWbAHaHF&mediaurl=https%3a%2f%2faspennvalleyvapes.com%2fwp-content%2fuploads%2f2017%2f02%2fno\\_sun.png&cdnurl=https%3a%2f%2fth.bing.com%2fth%2fid%2fR080997c08f47e8a19c0557f40edbd66c%3frik%3d%252fcOCC hLIGS3%252bhA%26pid%3dlmgRaw&exph=478&expw=500&q=keine+sonne&simid=607991563320431338&ck=B4513C60A3B95779BD69A95AFCE6956C&selectedIndex=5&FORM=IRPRST&ajaxhist=0](https://www.bing.com/images/search?view=detailV2&ccid=CAmXwl9H&id=D1FAC69558284E5E121484FE2D19C8120A82C3FD&thid=OIP.CAmXwl9H6KGcBVf0Dt vWbAHaHF&mediaurl=https%3a%2f%2faspennvalleyvapes.com%2fwp-content%2fuploads%2f2017%2f02%2fno_sun.png&cdnurl=https%3a%2f%2fth.bing.com%2fth%2fid%2fR080997c08f47e8a19c0557f40edbd66c%3frik%3d%252fcOCC hLIGS3%252bhA%26pid%3dlmgRaw&exph=478&expw=500&q=keine+sonne&simid=607991563320431338&ck=B4513C60A3B95779BD69A95AFCE6956C&selectedIndex=5&FORM=IRPRST&ajaxhist=0)
- ▶ Picture: <https://www.solarthermalworld.org/news/green-hydrogen-and-associations-point-view>
- ▶ <https://www.solarthermalworld.org/news/green-hydrogen-and-associations-point-view>

# Links

- ▶ Picture :  
[https://www.google.de/search?q=metal+hydrid&tbm=isch&ved=2ahUKEwi36ImgvKHwAhWEtqQKHV-HDwUQ2-cCegQIABAA&oq=metal+hydrid&gs\\_lcp=CgNpbWcQAzIECCMQJzICCAAyBAGAEb4yBAGAEb4yBAGAEb4yBAGAEb4yBAGAEb4yBAGAEb4yBAGAEb4yBAGAEb46BwgjEOoCECc6BQgAELEDOgQIABBDogcIABCxAXBDUPn8IliA4CNguMjaAJwAHgAgAHJAYgBvAuSAQU2LjUuMZgBAKABAaoBC2d3cy13aXotaW1nsAEKwAEB&sclient=img&ei=OJyJYLfsM4TtkgXfjr4o&bih=535&biw=1184#imgsrc=HZRQhx66HWRPz](https://www.google.de/search?q=metal+hydrid&tbm=isch&ved=2ahUKEwi36ImgvKHwAhWEtqQKHV-HDwUQ2-cCegQIABAA&oq=metal+hydrid&gs_lcp=CgNpbWcQAzIECCMQJzICCAAyBAGAEb4yBAGAEb4yBAGAEb4yBAGAEb4yBAGAEb4yBAGAEb4yBAGAEb4yBAGAEb46BwgjEOoCECc6BQgAELEDOgQIABBDogcIABCxAXBDUPn8IliA4CNguMjaAJwAHgAgAHJAYgBvAuSAQU2LjUuMZgBAKABAaoBC2d3cy13aXotaW1nsAEKwAEB&sclient=img&ei=OJyJYLfsM4TtkgXfjr4o&bih=535&biw=1184#imgsrc=HZRQhx66HWRPz)
- ▶ <https://www.caplor.co.uk/wp-content/uploads/2017/09/how-solar-pv-works.jpg>
- ▶ <https://www.pv-magazine.de/2017/08/21/photovoltaik-dachanlagen-auch-ohne-ballast-moeglich/>

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- ▶ <https://www.storedsolar.com/electrolysers.html>