Contribution to sustainable energy solutions for the eco park Thanh Tam (Viet Nam)

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TRƯỜNG ĐẠI HỌC XÂY DỰNG
National University of Civil Engineering
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Solar energy is very promising

- **Solar constant: 21.10^{20} kJ /year**

  0,01 % of this solar constant can provide worlds demand for energy (in about 90 minutes !!!)

  Technique:

  Sun boiler : harvesting solar heat

  Photovoltaic cell (PV-cell) turns light energy directly into electricity.

- **Germany is solar champion in in Europa.**

In Germany PV-generated power amounted to 38.3 TWh and covered approximately 7.4 percent of Germany's net electricity consumption in 2016. Renewable energy (RE) as a whole accounted for **ca. 37 percent** (!!) of net electricity consumption. On sunny weekdays, PV power can cover 35 percent of the momentary electricity demand. On weekends and holidays the coverage rate of PV can reach 50 percent. At the end of 2016, the total nominal PV power installed in Germany was ca. 41 GW, distributed over 1.5 million power plants,

In 2015, the PV industry employed 30,000 people in Germany

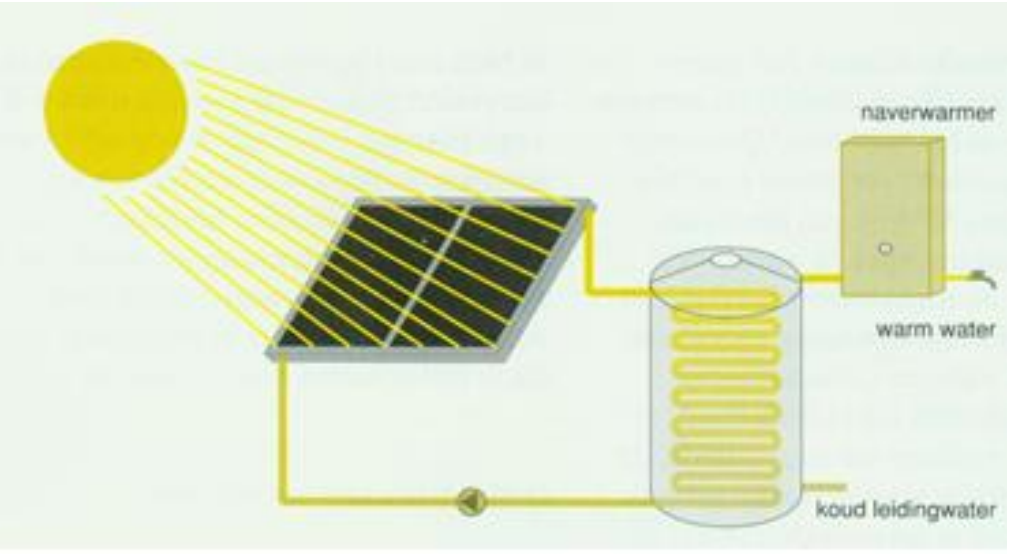
https://www.ise.fraunhofer.de/content/dam/ise/en/documents/publications/studies/recent-facts-about-photovoltaics-in-germany.pdf

Sun boilers deserve to be better integrated…

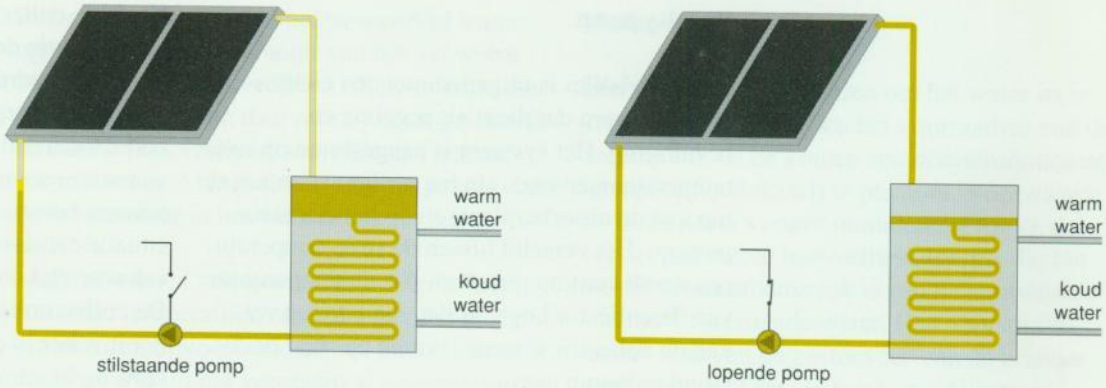
…in the design

Swimming pool heated by solar heat (Saint-Nicolas de la grave (F).

Principle of a sun boiler



Afbeelding 13
Waterniveau in collectorcircuit bij stilstaande pomp en bij lopende pomp.
Bovenop het opslagvat bevindt zich het terugloopvat.

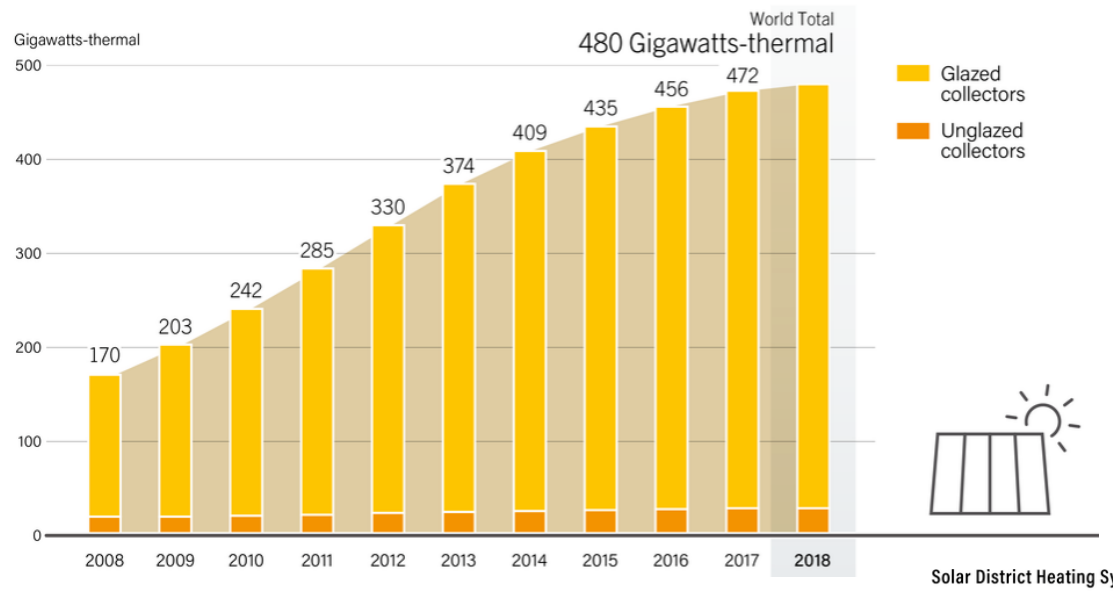


Some types of sun boilers

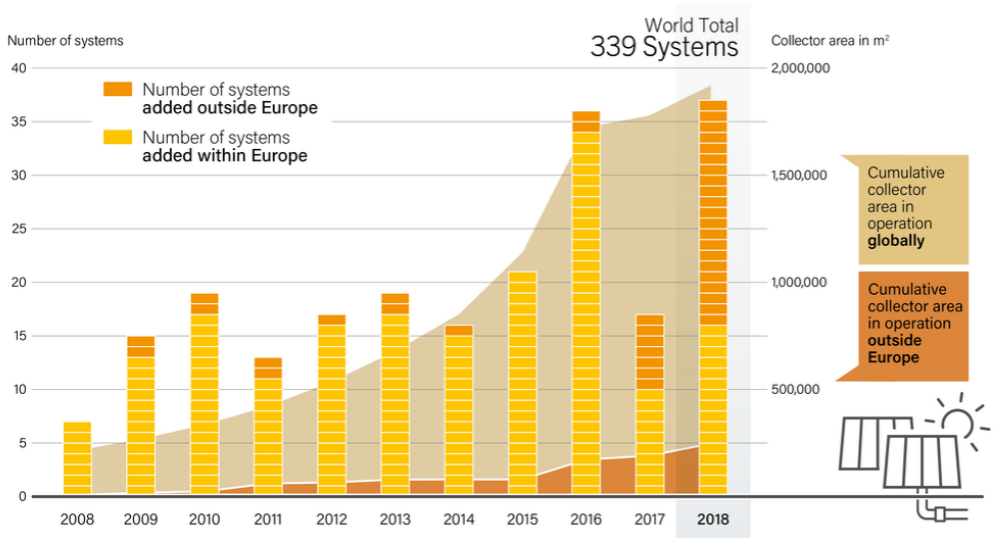
Globe, parabolic mirror, flat plate collector types.

Thermal solar heat use grows rapidly, worldwide

Solar Water Heating Collectors Global Capacity, 2008-2018



Solar District Heating Systems, Global Annual Additions and Total Area in Operation, 2008-2018



Note: Includes large-scale solar thermal installations for residential, commercial and public buildings. Data are for solar water collectors and concentrating collectors.

Source: IEA SHC.

https://www.ren21.net/gsr-2019/chapters/chapter_03/chapter_03/

Fischbach bei Dahn (Germany). Visitor centre
Surplus solar heat in summer is stored in underground tanks

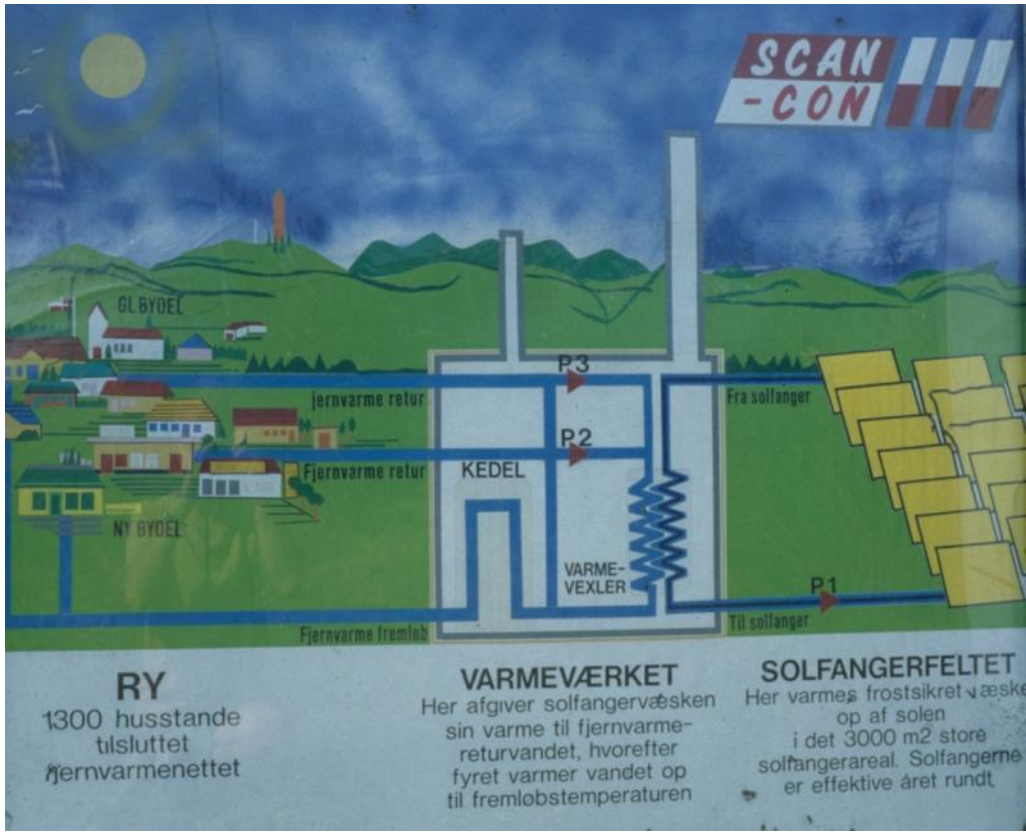
http://www.biosphaerenhaus.de

Heat collectors are connected…

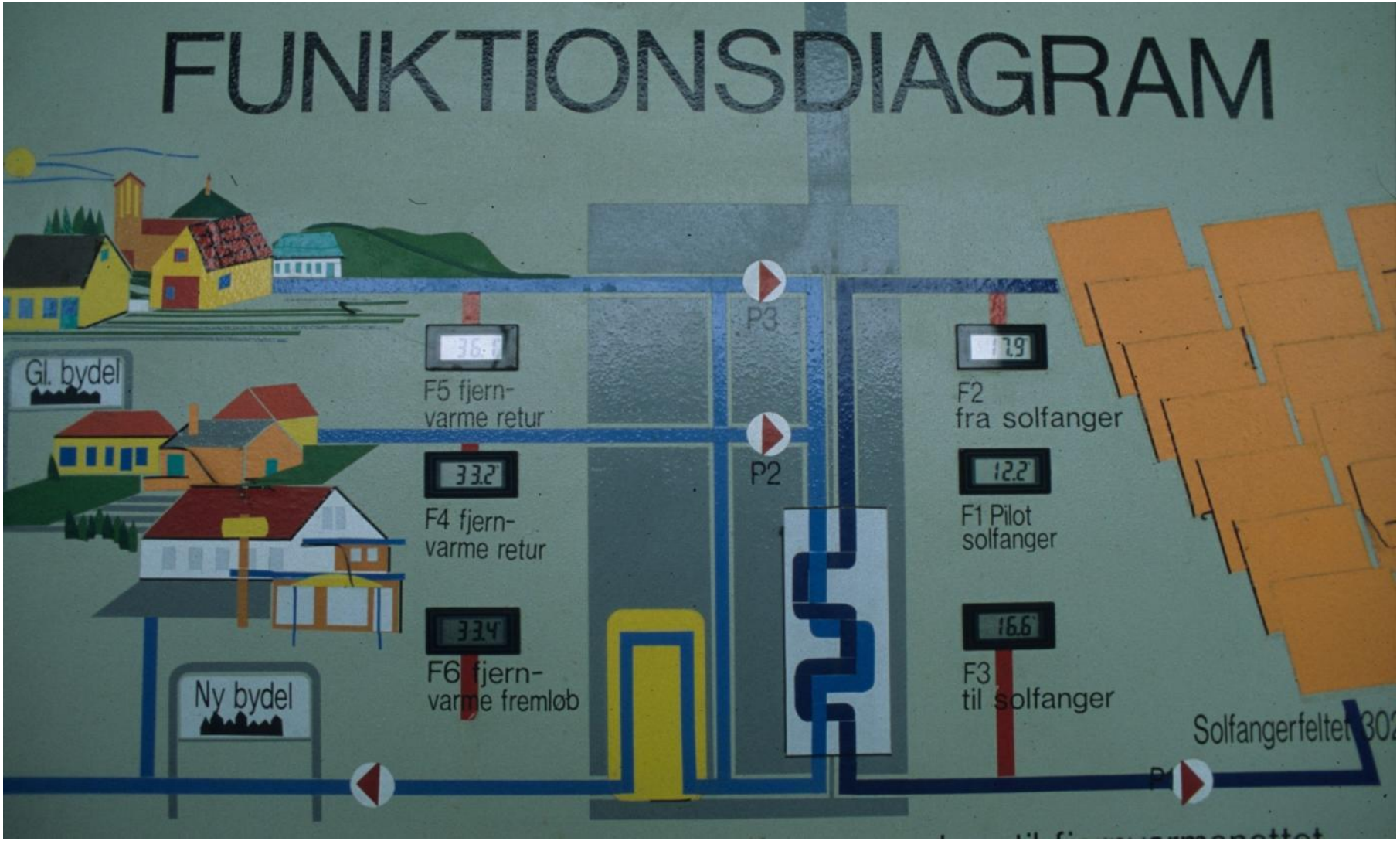
Odder (DK): social housing

Malmö (S). Augustenborg

… into a solar heat energy plant in Denmark (Ry, DK)



District heating network (township Ry , DK)



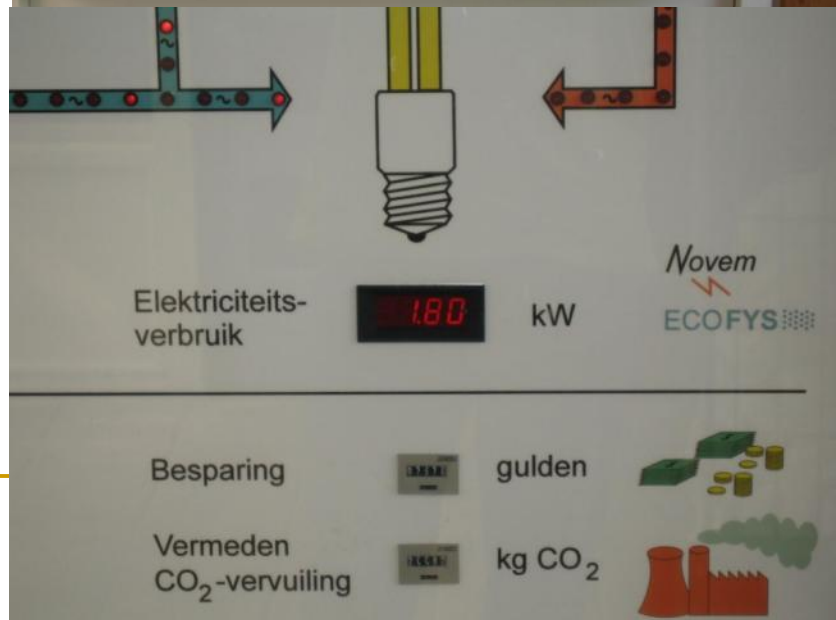
Photovoltaic electricity enables autonomy …

…when batteries are used to store surplus…

Bamboo house with 2,475 watt off-grid system. Nine 275-watt panels are mounted on the south-facing roof and an Outback Inverter system and six Aquion 48-volt batteries manage the electrical storage and conversion to the usual AC (alternating) current of our 1,180 square foot home.

https://heartfeltassociates.wordpress.com/2015/11/18/off-grid-lessons-learned/

… but is often applied on-grid, so surplus is injected on the grid.



Visitor centre De Kleine Aarde (Boxtel, NL)

Niederzier (D). EUT Haustechnik
www.enus.de

Schönau (D, Schwarzwald) PV on the church

Solar factory Gelsenkirchen (Germany), built by Shell.

Some producents of PV in Viet Nam,

Giới Thiệu Dự án Điện Năng Lượng Mặt...

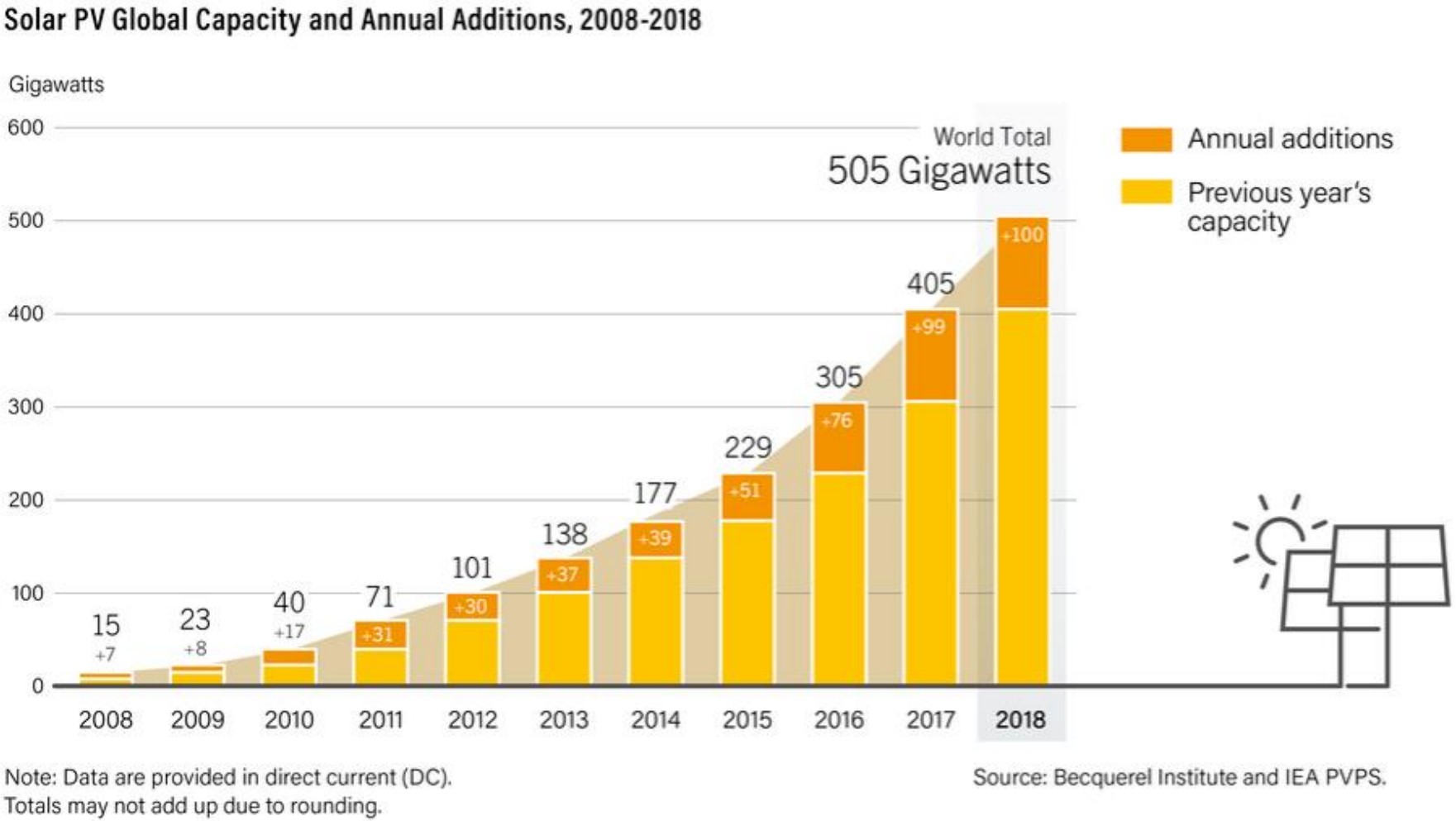
https://solarbk.vn/vi/

http://www.boviet.com/html/enIntro1_.html

https://irex.vn

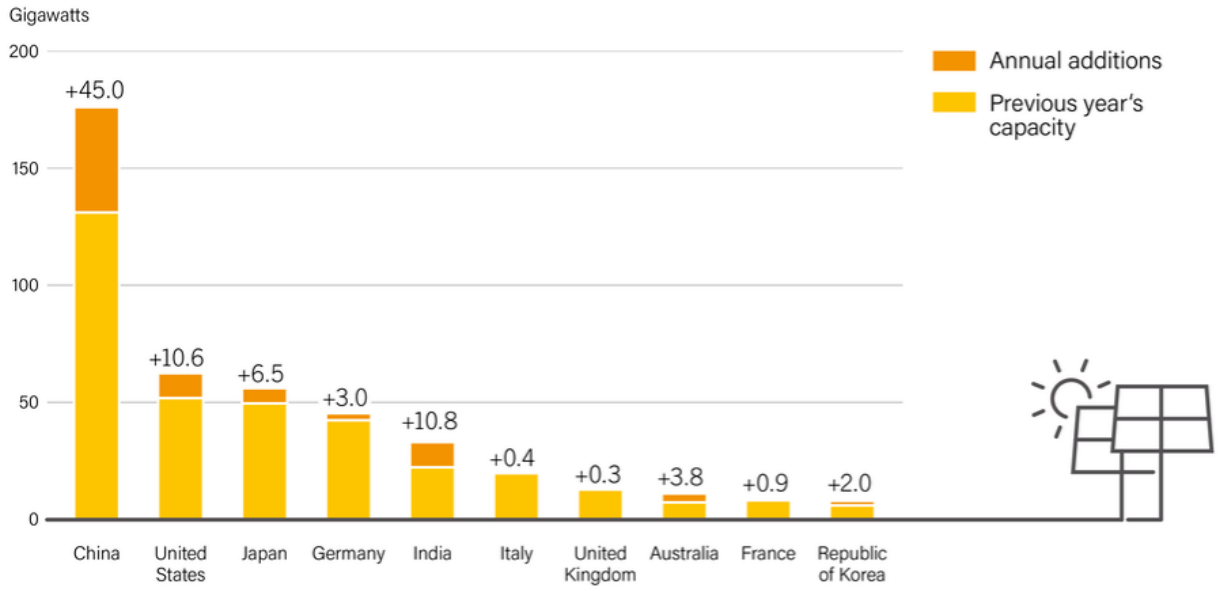
Photovoltaic solar energy grows fastly, worldwide.

End 2018 was the cumulated capacity installed **worldwide** circa **505 GW**.



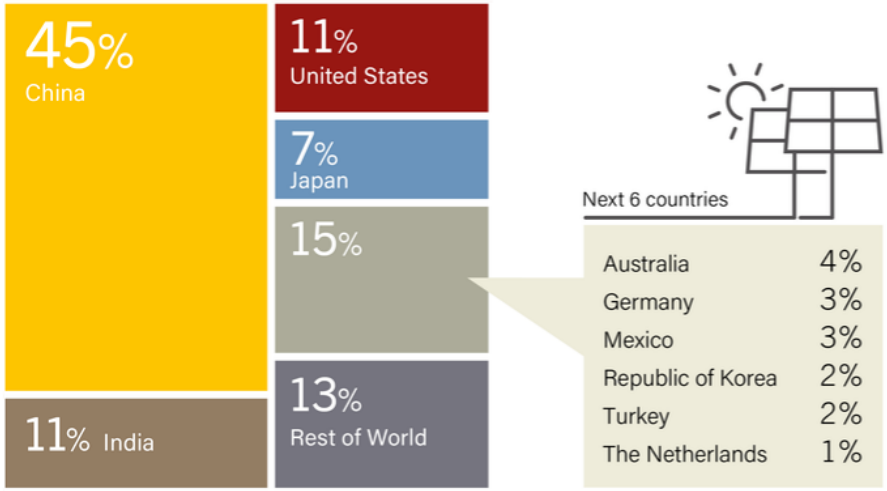
PV-installations, worldwide

Solar PV Capacity and Additions, Top 10 Countries, 2018



Note: Data are provided in direct current (DC).
Data for India are highly uncertain.

Solar PV Global Capacity Additions, Shares of Top 10 Countries and Rest of World, 2018



De fastest growth is in
China

https://www.ren21.net/gsr-2019/chapters/chapter_03/chap

Evolution of the investment cost PV-cells (€/kWp)

https://www.ise.fraunhofer.de/content/dam/ise/en/documents/publications/studies/recent-facts-about-photovoltaics-in-germany.pdf

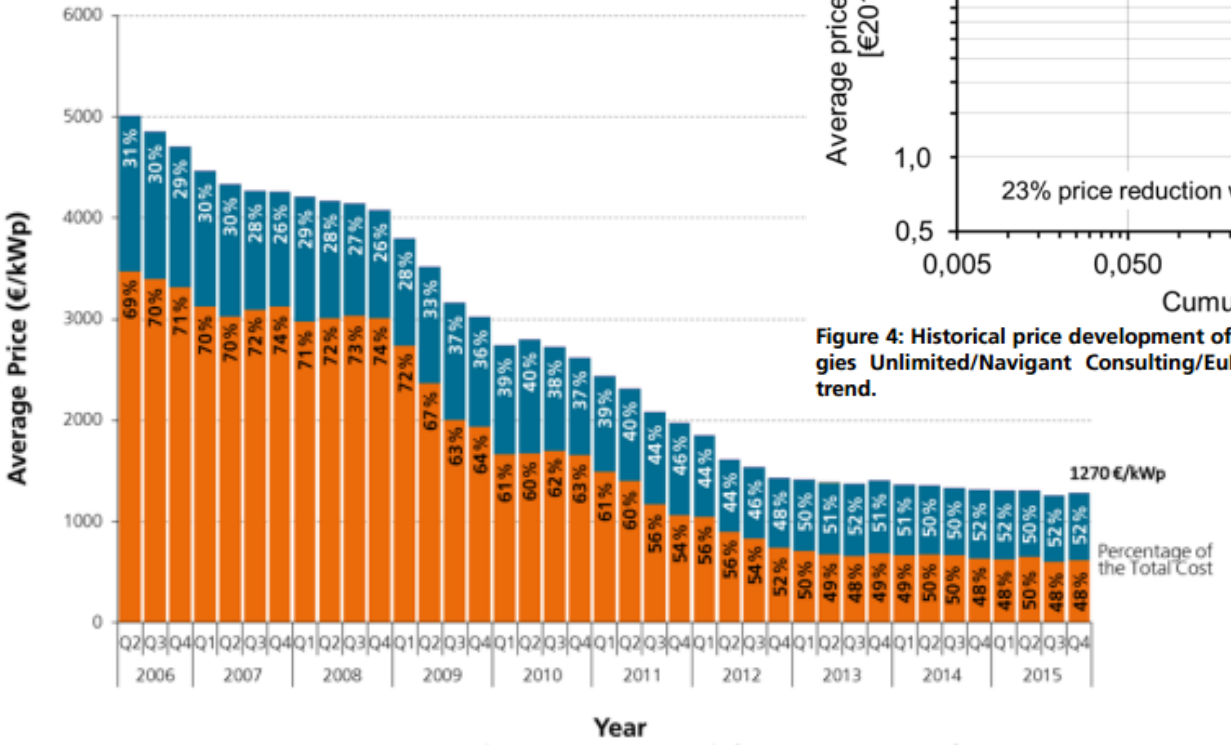


Figure 3: Average end customer price (net system price) for installed rooftop systems with rated nominal power from 10 - 100 kWp, data from BSW, plotted by PSE AG.

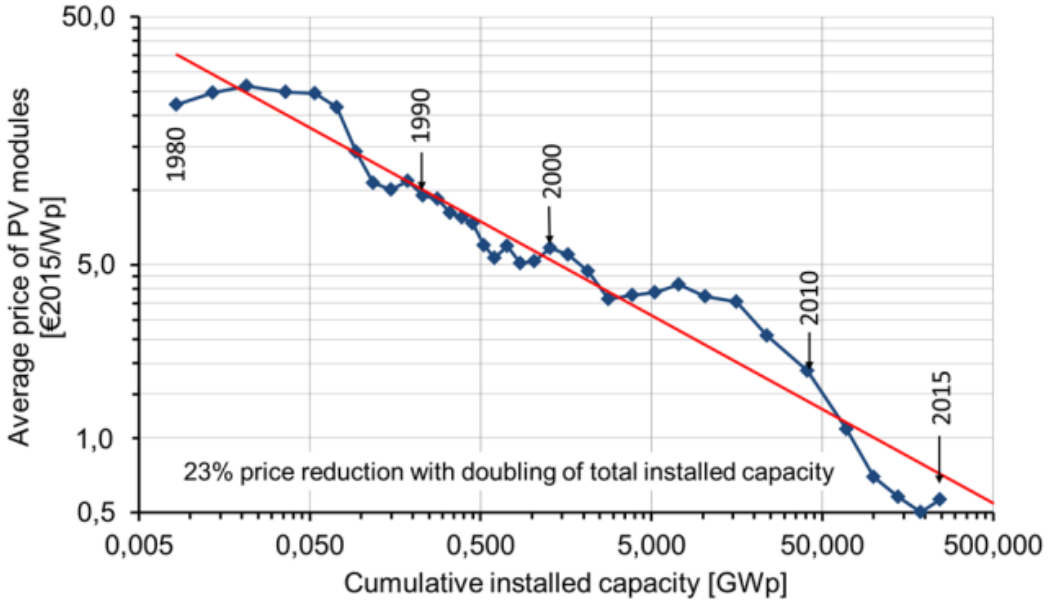
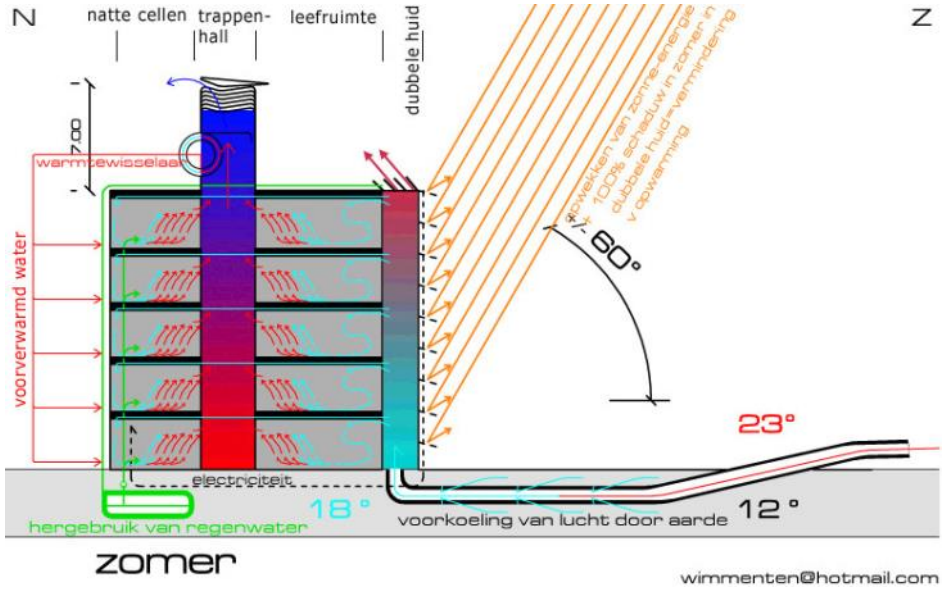


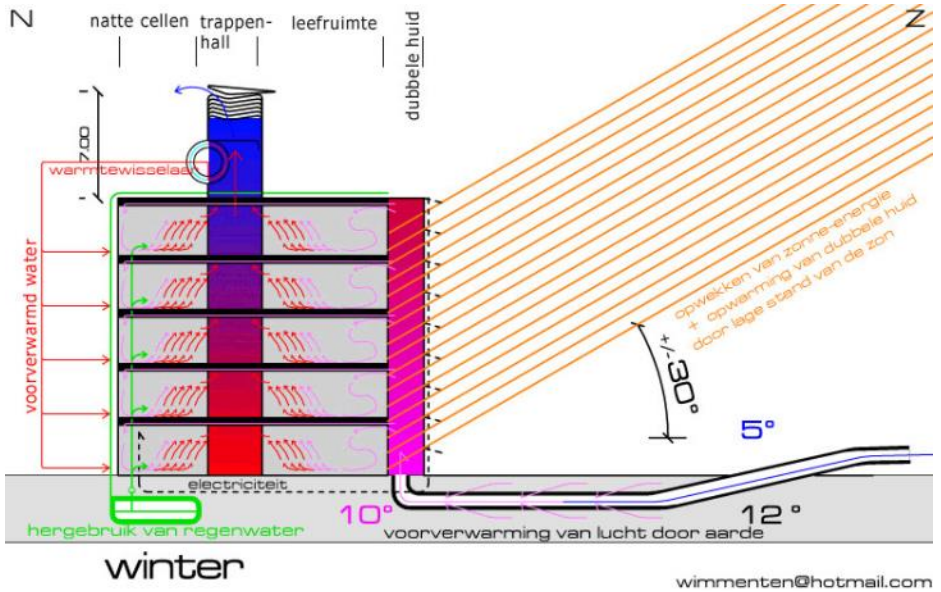
Figure 4: Historical price development of PV modules (PSE AG/Fraunhofer ISE, data from: Strategies Unlimited/Navigant Consulting/EuPD). The straight line shows the price development trend.

Dankzij technologische innovate, leercurve en grootte-schaalvoordelen is de investeringskost voor PV sedert 2006 met gemiddeld 13% per jaar afgenomen, in totaal nu al met meer dan 75% (2016).

The carbon neutral Solar factory (Freiburg, Germany)

http://www.solar-fabrik.de/unternehmen/firmenprofil/nullemissionsfabrik





Principle of cooling with ground tubes and of shading the building in summer

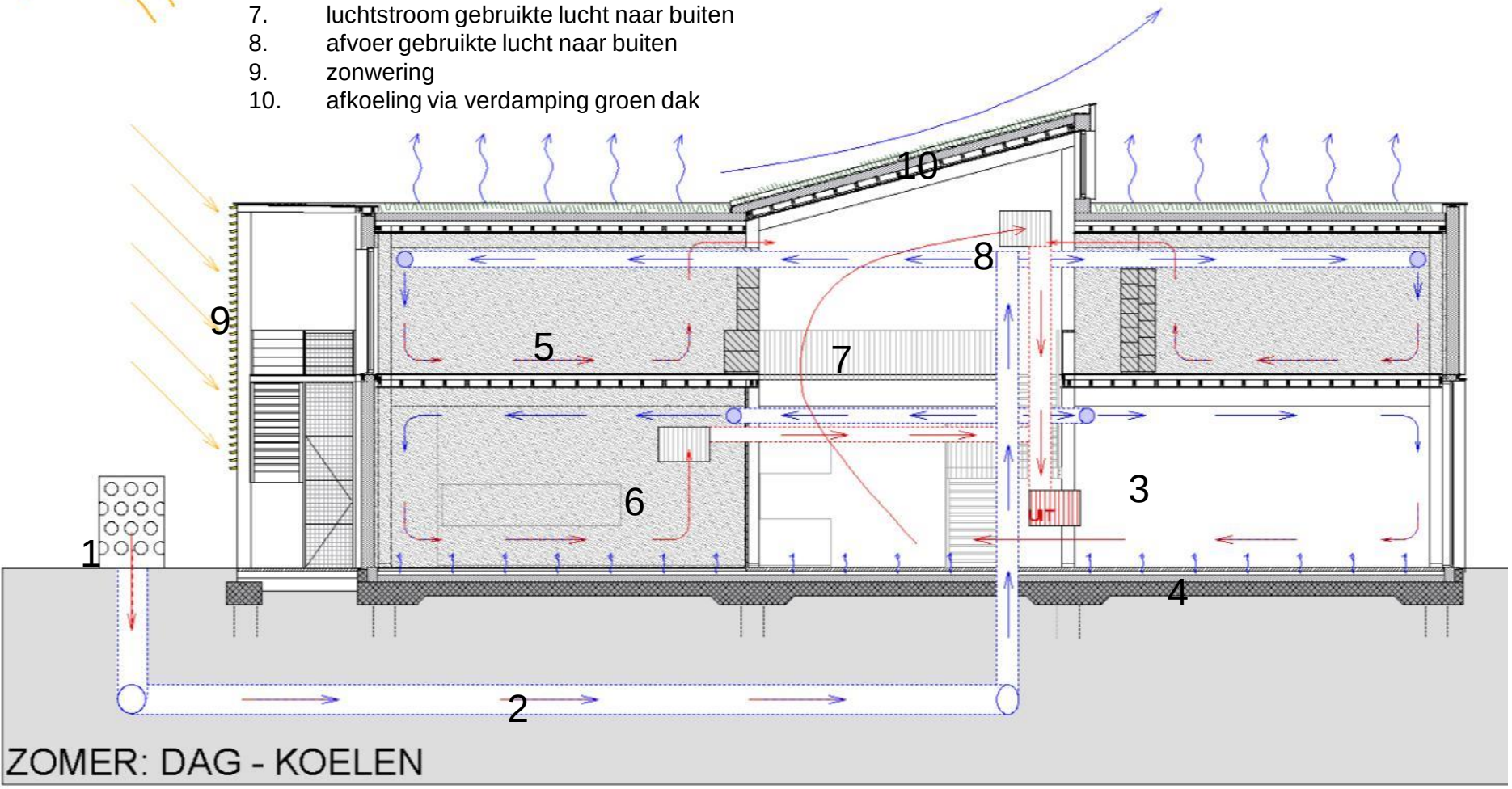

luchtinlaat grondbuis

Construction phase cooling ground tubes (B)

evr-Architecten

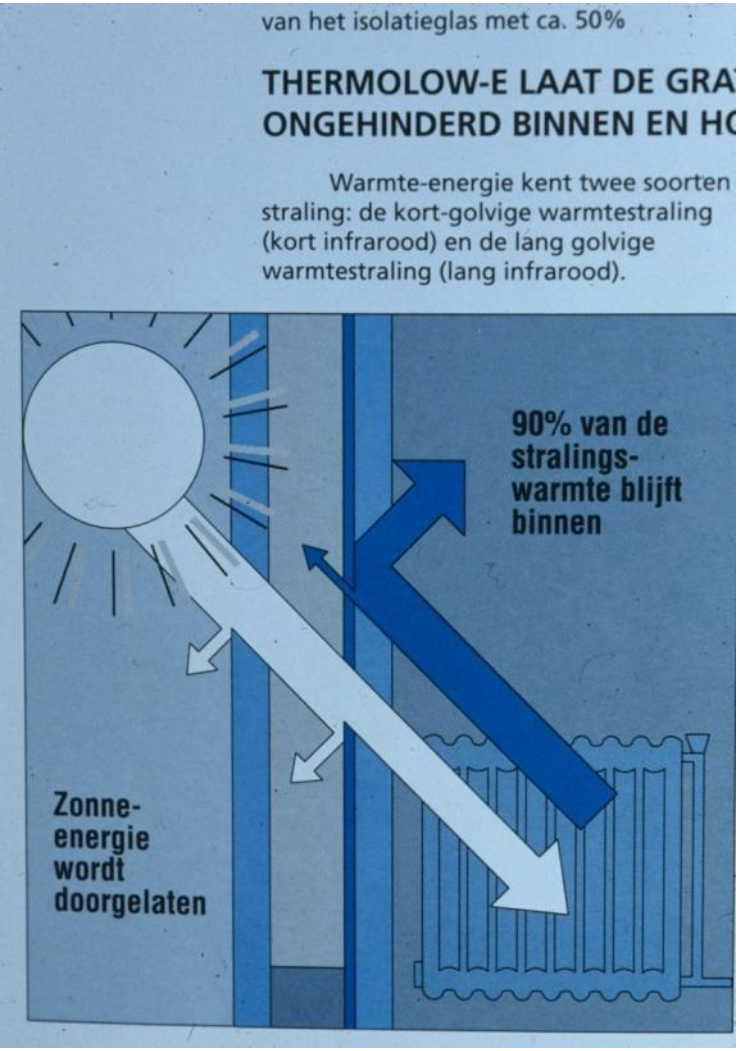
Cooling without airco

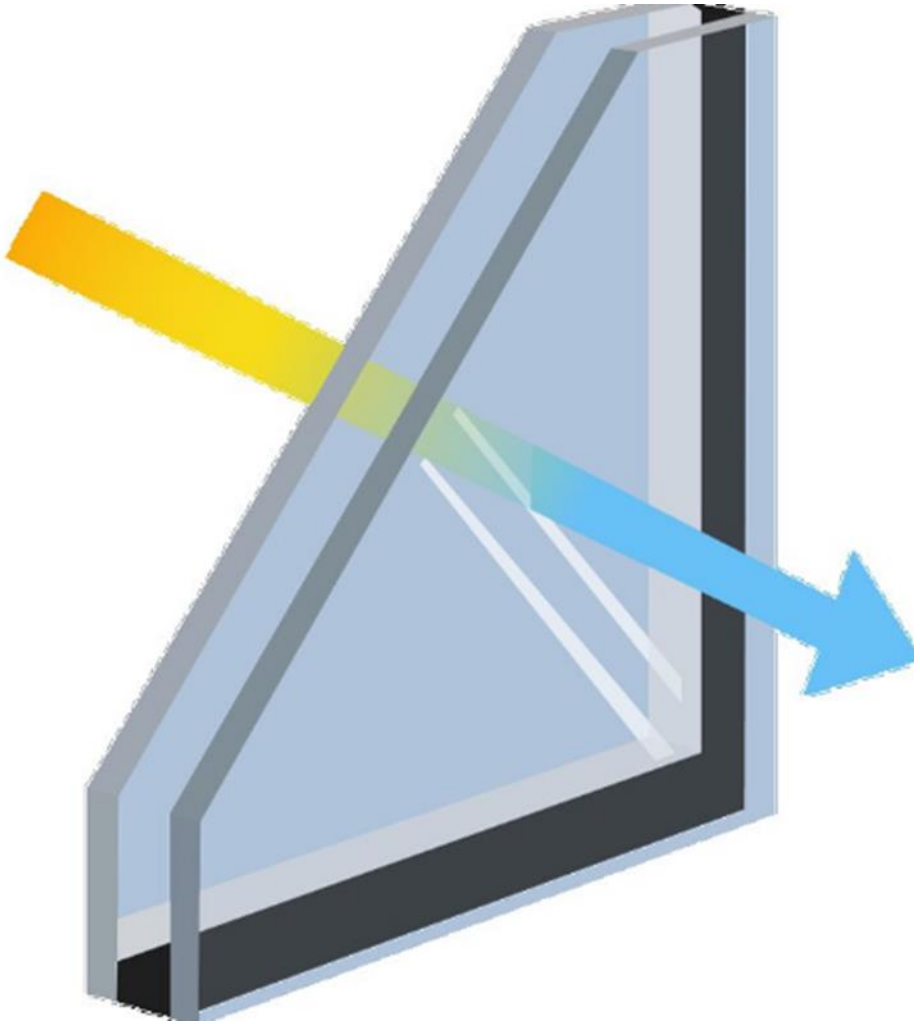
1. aanvoer verse buitenlucht
2. afkoeling lucht via grondbuis
3. inblazen koele lucht via ventilatiekanalen
4. koele vloer door nachtventilatie
5. vraaggestuurde ventilatie (CO2)
6. gescheiden afvoer keuken en cafetaria
7. luchtstroom gebruikte lucht naar buiten
8. afvoer gebruikte lucht naar buiten
9. zonwering
10. afkoeling via verdamping groen dak



Need for: double glazing, green roofs, shading, cooling ground tubes, ventilation with automatic night cooling

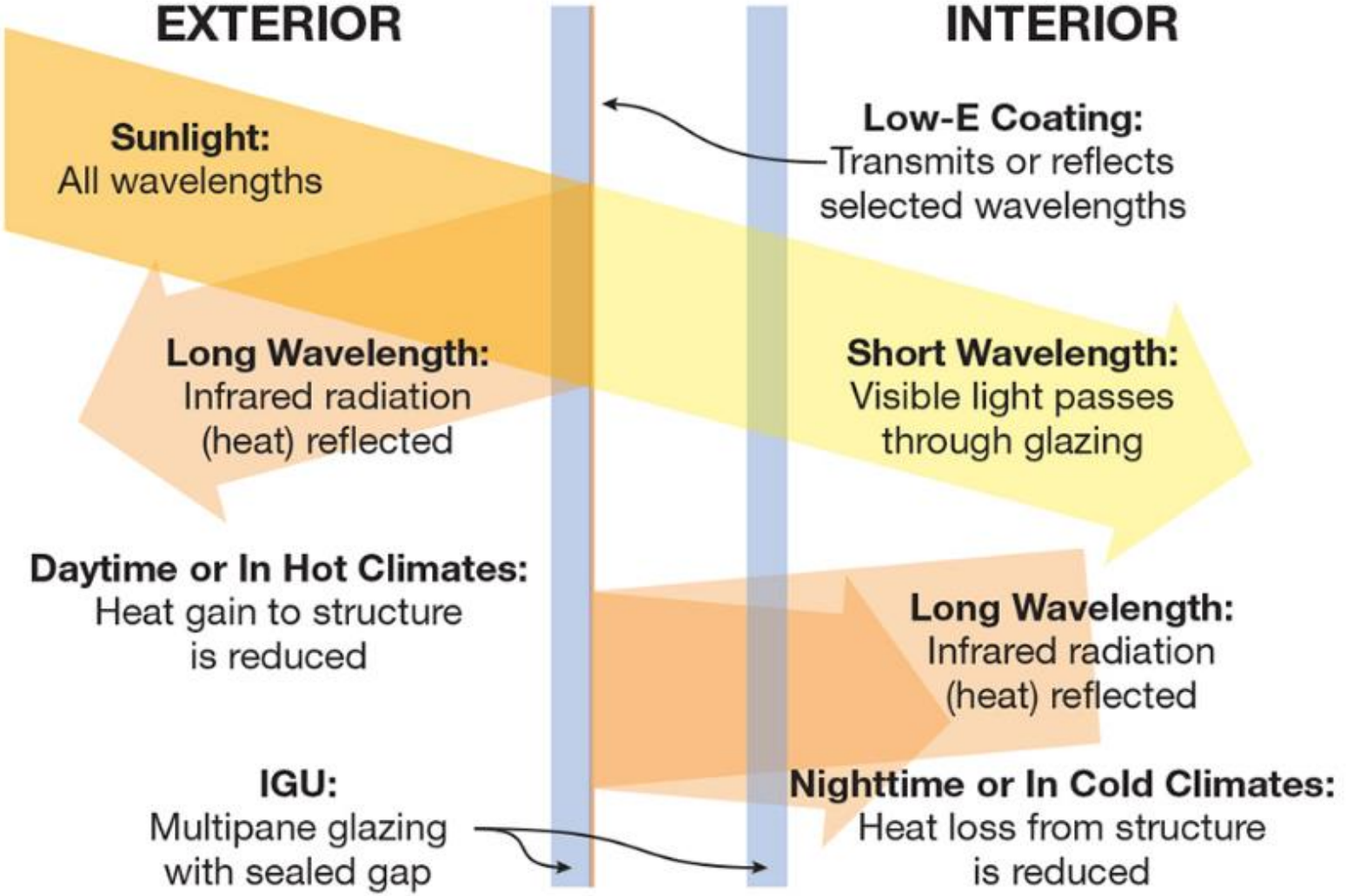
Low Tech : Double glazing is always required in hot and in cool climates





https://www.vidrogroup.co.uk/secondary-glazing/secondary-glazing-vs-double-glazing/

Low-E Coating Performance



https://www.casver.com.au/benefit-of-double-glazing/

KẾT HỢP PHỤ KIỆN

VẬT LIỆU CẤU THÀNH

- Thanh profile nhôm định hình loại 6063-T5.
- Kính (Laminated Glass, Temper Glass, Double Glazing). độ dày tối đa 22mm.
- Hệ gioăng cao su EPDM đảm bảo độ bền, kín nước, kín khí.
- Hệ phụ kiện kim khí: bản lề chữ A, bản lề 2D, 3D (điều chỉnh được theo 2 hoặc 3 chiều), sử dụng được khóa đơn điểm và đa điểm.

MÀU SẮC THÔNG DỤNG

ĐẶC ĐIỂM

- Là hệ thống đang được ưa chuộng tại thị trường Việt Nam.
- Có tính cách âm, cách nhiệt và độ kín khít cao.
- Được làm từ profile nhôm định hình có độ dày từ 1,4mm-2mm.
- Hệ thống được thiết kế linh hoạt cho phép lắp ghép thành nhiều phương án kiến trúc khác nhau. Sử dụng được nhiều chủng loại phụ kiện hiện có trên thị trường.

http://gigigigi.com.vn/san-pham/5416/he-cua-viet-phap-shal-xf55

Another ecosystem service

of vegetation
decreasing stormwater RUN-OFF

Increasing urbanisation, increases storm water run-off and is raising flooding risks in rural areas downstream of cities

Conclusion: Design not only carbon-neutral but also water-neutral: restore urban small water cycles

Boxtel (NL). De Kleine Aarde

Use succulent plants (such as *Sedum sp*.) for green roofs.
Green roofs are interesting for biodiversity, summer cooling and water management, …

Westerlo (B). Kamp C

Green roofs are good to combine with solar panels, because temperature of the panels is lowered [1]

https://www.pinterest.co.uk/pin/141089400804430143/?lp=true

https://www.greenem.nl/een-groen-dak-en-zonnepanelen/

https://www.optigroen.nl

[1] For most solar panels the efficiency is lowered with 0,4 percent per degree above 25° Celsius, with loses up to more then 6 % on extreme hot days.
https://www.ilumen.be/nl/renderen-zonnepanelen-minder-goed-als-het-warm-is/

Green facades and green roofs to support urban biodiversity and small urban water cycles.

Paris (F): Quai Branly

Paris (F) is planning minimum 100 ha green roofs and facades by 2020: http://www.paris.fr/duvertpresdechezmoi

Bosco Verticale, Milano (It.)

Bron: http://thelandscape.org/2014/09/01/bosco-verticale-milan-the-next-step
The landscape architects Emanuela Borio and Laura Gatti working with Stefano Boeri.
https://cleantechnica.com/2017/12/04/berlin-reusing/ SPONGE CITIES

https://www.youtube.com/watch?v=4w7lsydq8ks

Green walls for cooling
All green learning centre (Thailand)

9 Moo 4 Baan Nonkradon, Payayen, Pak Chong, Nakornratchasima 30320 ; Tel. 081-8757172 , 086-4686362
info@allgreenlearningcenter.org

Green walls are interesting to combine (for example in an eco-hotel) to lower temperature, to minimise run-off and to support biodiversity

https://www.travelandleisure.com/slideshows/naman-retreat-vietnam-living-wall

https://www.dezeen.com/2016/12/20/mia-design-studio-drawers-house-vietnam-planting-courtyards/

Green walls, photovoltaic energy, renewable materials: green city Hotel Vauban (Germany)

Green city Hotel Vauban / Freiburg-im-Breisgau (D.)

Solar powered cooling

- Just as efficient and more so than an HVAC system
- Reduce carbon footprint – eco-friendly!
- More versatility in cooling requirements
- Reduction in utility bills

https://climatecontrolhickory.com/heating-air-conditioning-blog/solar-powered-cooling-an-eco-friendly-way-to-stay-cool/

Eco-friendly ho(s)tels require solar energy installations

https://www.motherearthliving.com/wiser-living/green-traveler-eco-friendly-hotels

Plus energy solutions

The solar project *'Am Schlierberg'* in Freiburg (Germ.) is a plus energy neighbourhood.

Plusenergie neighbourhood *Am Schlierberg* (Freiburg, Germany.)

Plusenergie concept:

De huizen in de wijk Am Schlierberg in Freiburg produceren 36 kWh/m².jaar sinds 2005. (bron www.AKBW.de)

Every house produces more energy than needed itself

Am Schlierberg (Freiburg, D.)
www.rolfdisch.de

50 demonstration solar projects in Nordrhein-Westfalen (D.)

w.oekosiedlungen.de

Wijk *Bismarck* in gemeente Gelsenkirchen (D), laagenergie sociale huisvesting.