Energy Efficiency and Sustainability - the context of the 2030 Agenda

jOiNEd For sUsTainability - bUilding climate REsilient communities in WB and EU

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Place: Ohrid

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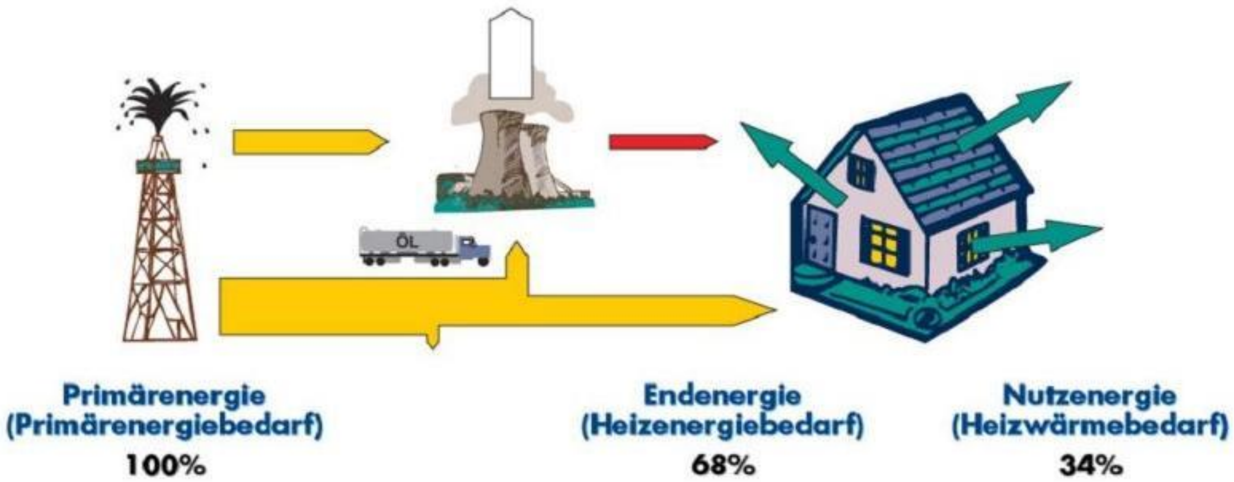
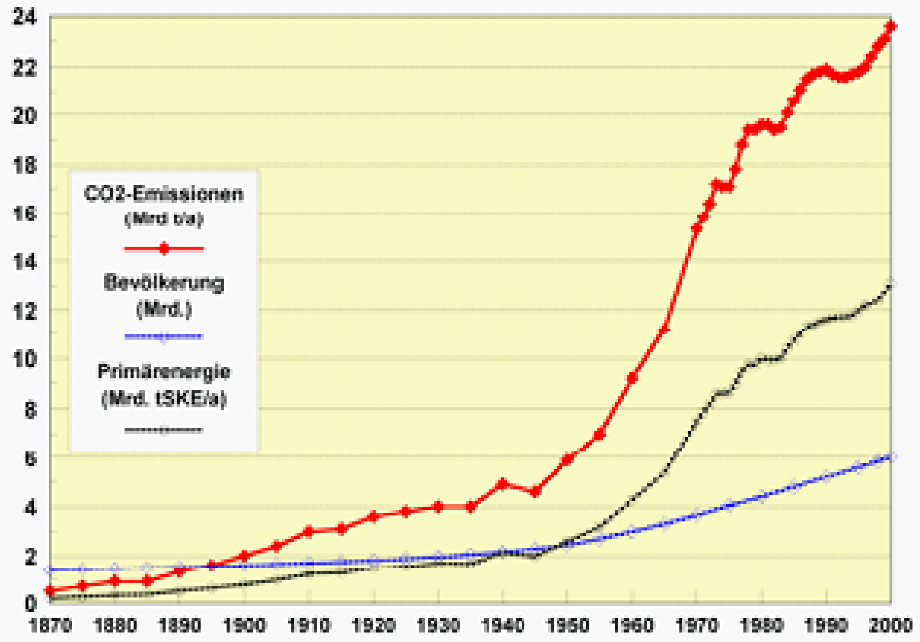
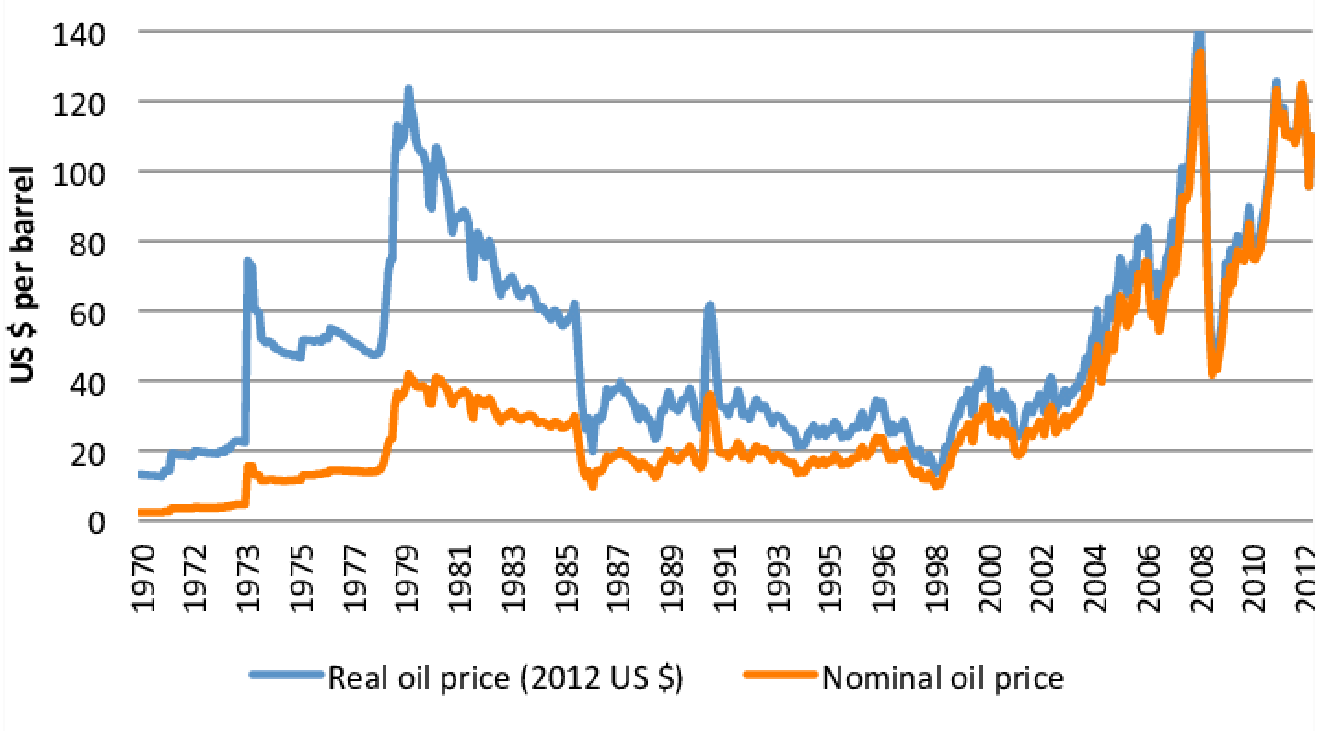


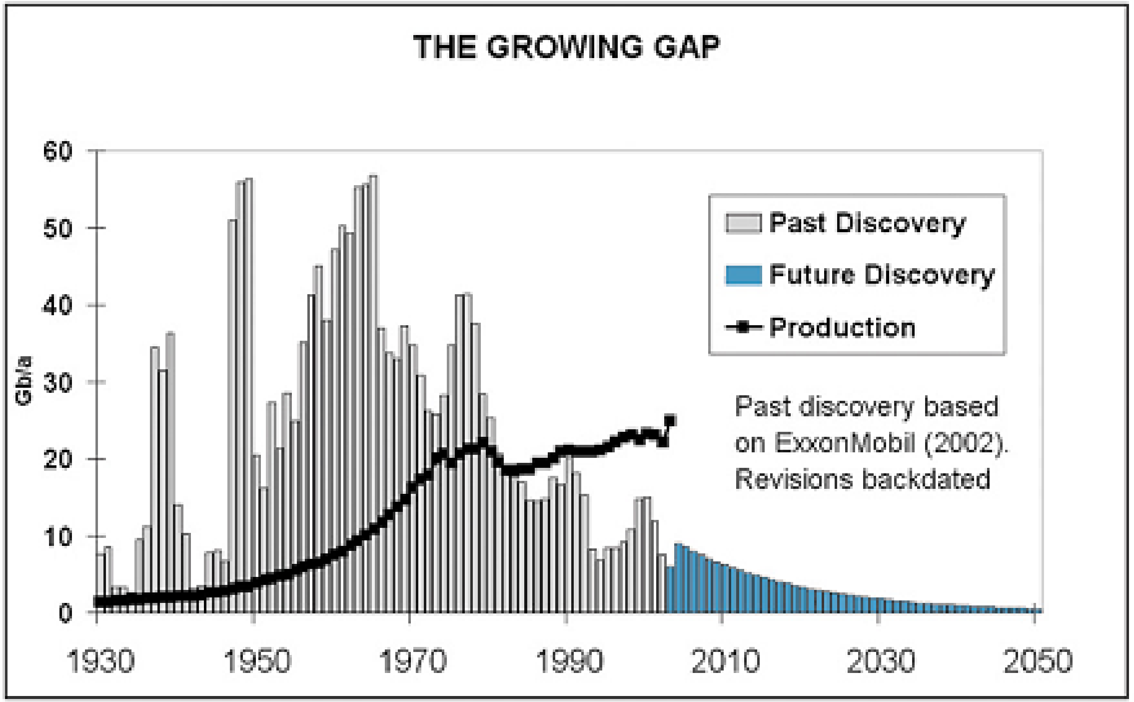
Primary energy → Energy carrier

Final energy → Efficiency of heating system

Net (usable) energy → Quality of building envelope







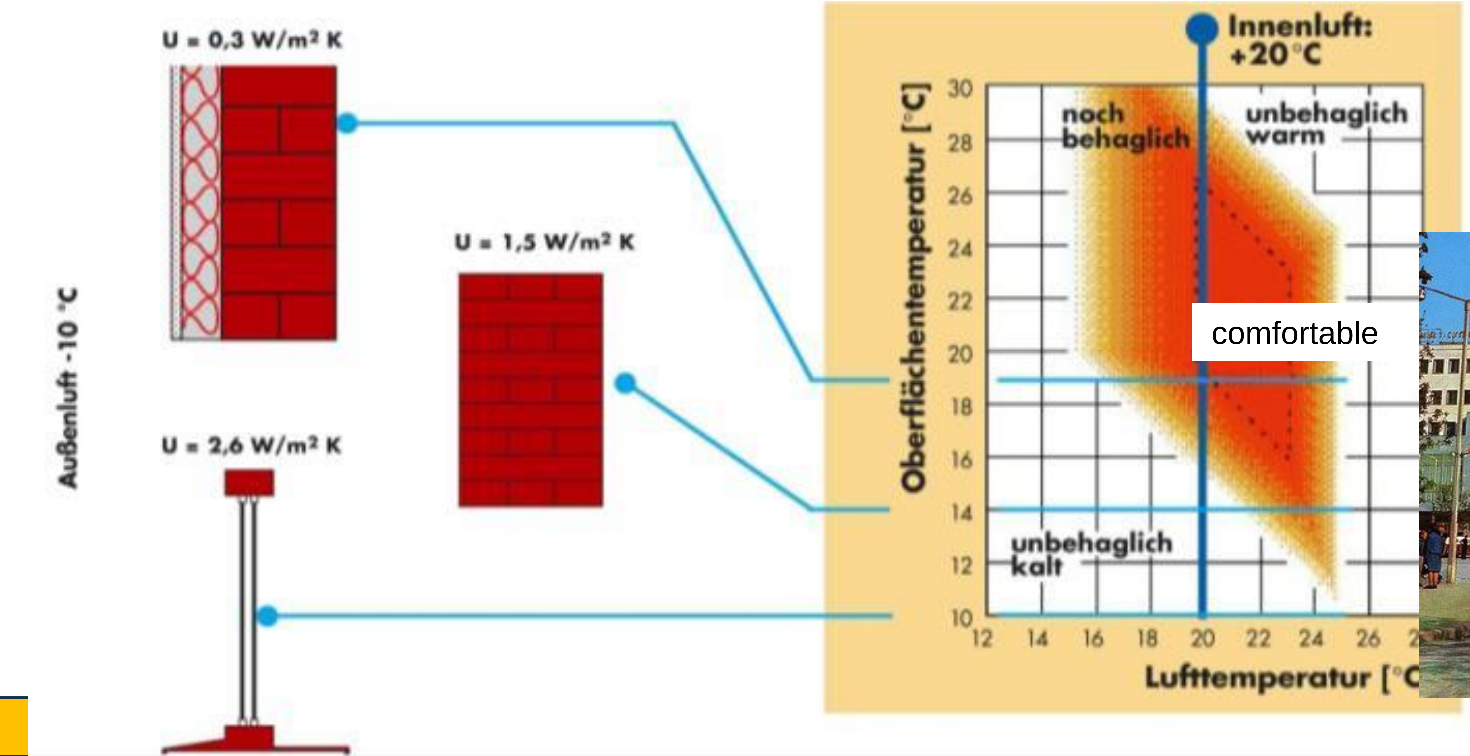
Thermal Comfort – indoor air quality

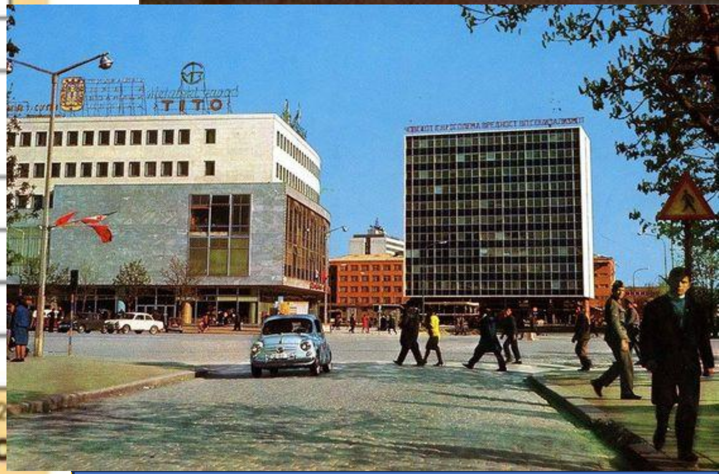
Forming of black marks in inhabited rooms

On walls, ceilings and in cold corners

Mainly during winter times

Caused by Coanda-Effect and Convection





Overview on the housing stock in NMK

According to the 2002 Census there are 697.529 dwelling units in Macedonia totaling 49,671,709 m^2. Distributed within the stock of 446.235 single buildings of different type

Up to 1900year.	6.773 dwelling unites
- 1901-1918 year.	6.282
- 1919-1930year.	11.614
- 1931-1945year	16.282
- 1946-1960 year	68.787
- 1961-1970year.	124.959
- 1971-1975year.	72.019
- 1976-1980year.	77.076
- 1981-1985year.	62.723
- 1986-1990year.	51.933
- after 1990 year	118.740

-annual new construction and reconstruction represents less than 1% of existing housing stock,

Regulations and Standard 80's

Requirements for design and manufacturing of buildings - MKS U.J5.600,

external walls: First climate zone /heat transfer coefficient Umax=1,20 W/m2K
Second climate zone /heat transfer coefficient Umax=0,90 W/m2K
Third climate zone /heat transfer coefficient Umax=0,80 W/m2K

-slab above basement :First climate zone /heat transfer coefficient Umax=0,75 W/m2K
Second climate zone /heat transfer coefficient Umax=0,60 W/m2K
Third climate zone /heat transfer coefficient Umax=0,50 W/m2K

-under roof slab:First climate zone /heat transfer coefficient Umax=0,95 W/m2K
Second climate zone /heat transfer coefficient Umax=0,80 W/m2K
Third climate zone /heat transfer coefficient Umax=0,70 W/m2K

-Double glazed windows(8-10mm air space) with wooden frame Umax=2,60 W/m2K

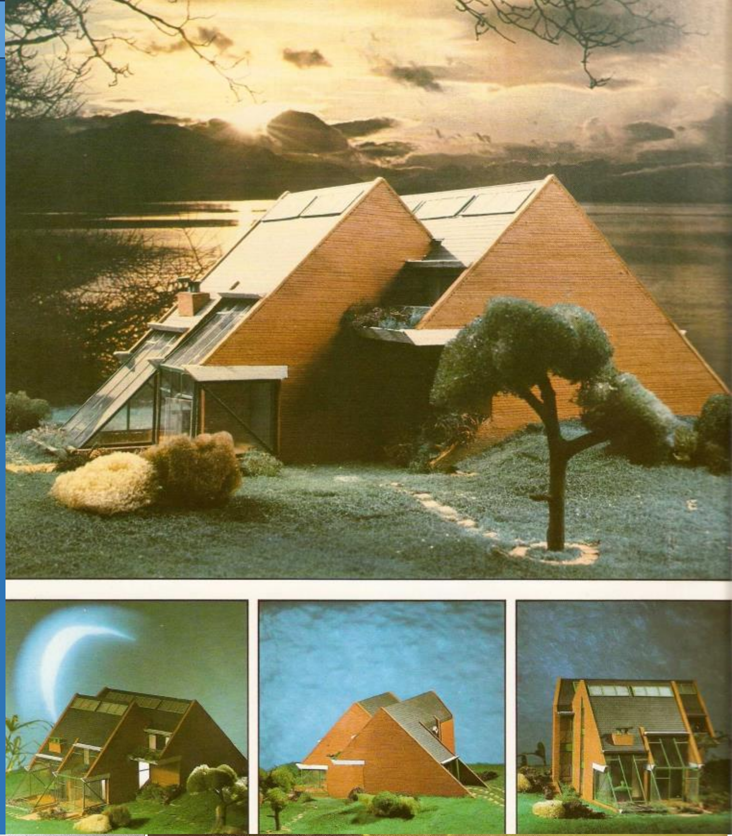
Chronology of acceptance of the Law , Regulations and Standards

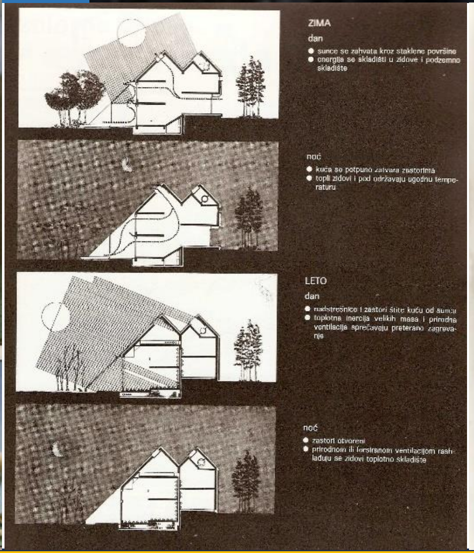
-In 1970, "Book of rules for technical measures and conditions for building thermal protection"

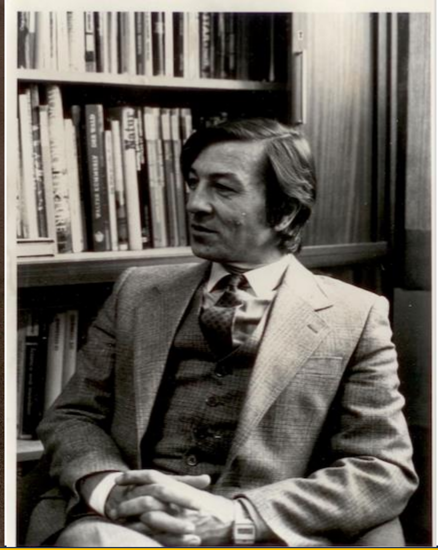
-from the 1980's there is setting thermal insulation standards for buildings :

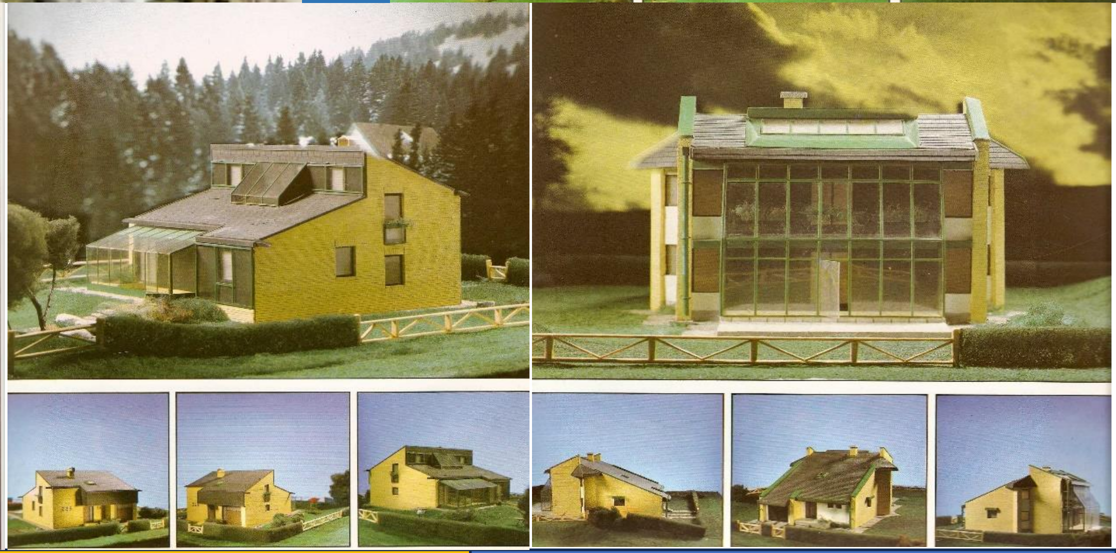
- Requirements for design and manufacturing of buildings - U.J5.600,
-Coefficient of heat transfer in buildings - U.J5.510,
-Calculation of water vapor diffusion in buildings - U.J5.520
-and Characteristics of thermal stability of buildings - U.J5.530. ,
- corrected by innovating the standards U.J5.600 and MKS U.J5.510 in 1987

1982 – solar house



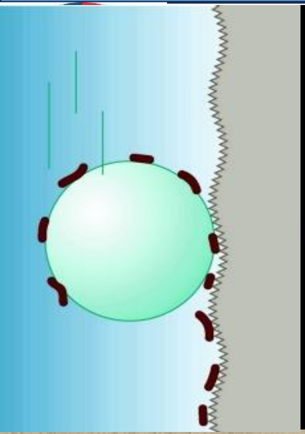


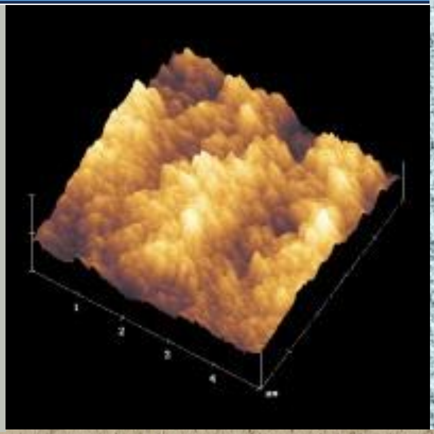


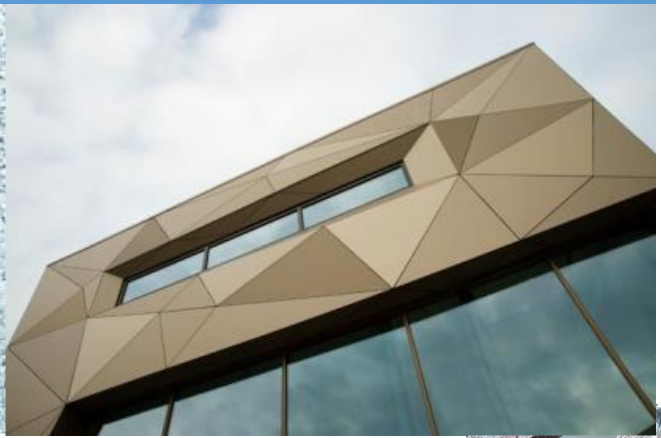


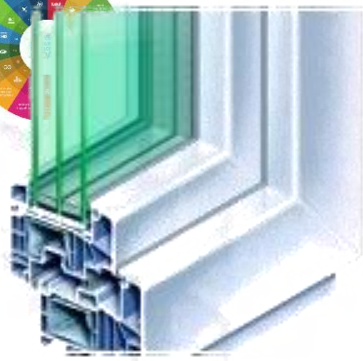
1976/1983 Solar amorphous cells costing $2 per W with an efficiency of 4 % -today 1 watt of solar energy in the range of $0.50 to $0.70 –China $0.30 -0,4 eff of18 %

ETICS

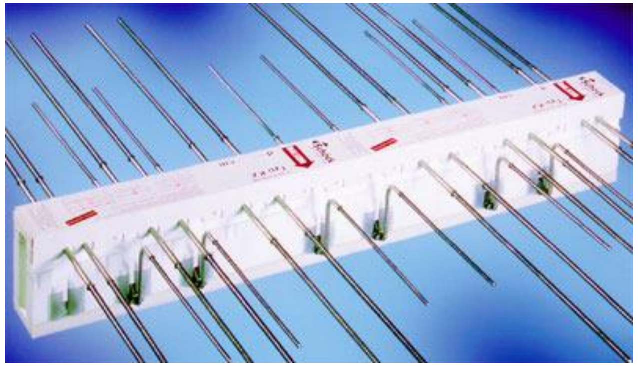


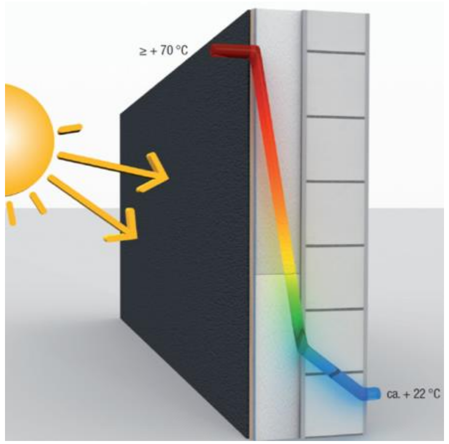
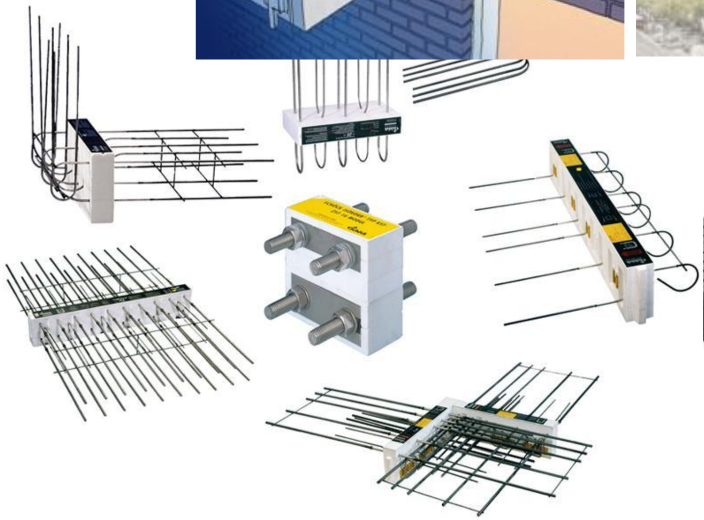
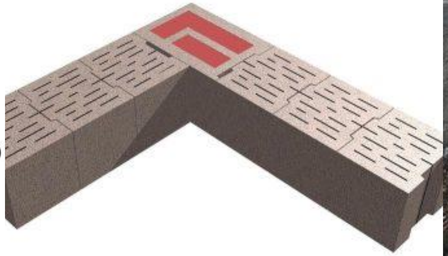




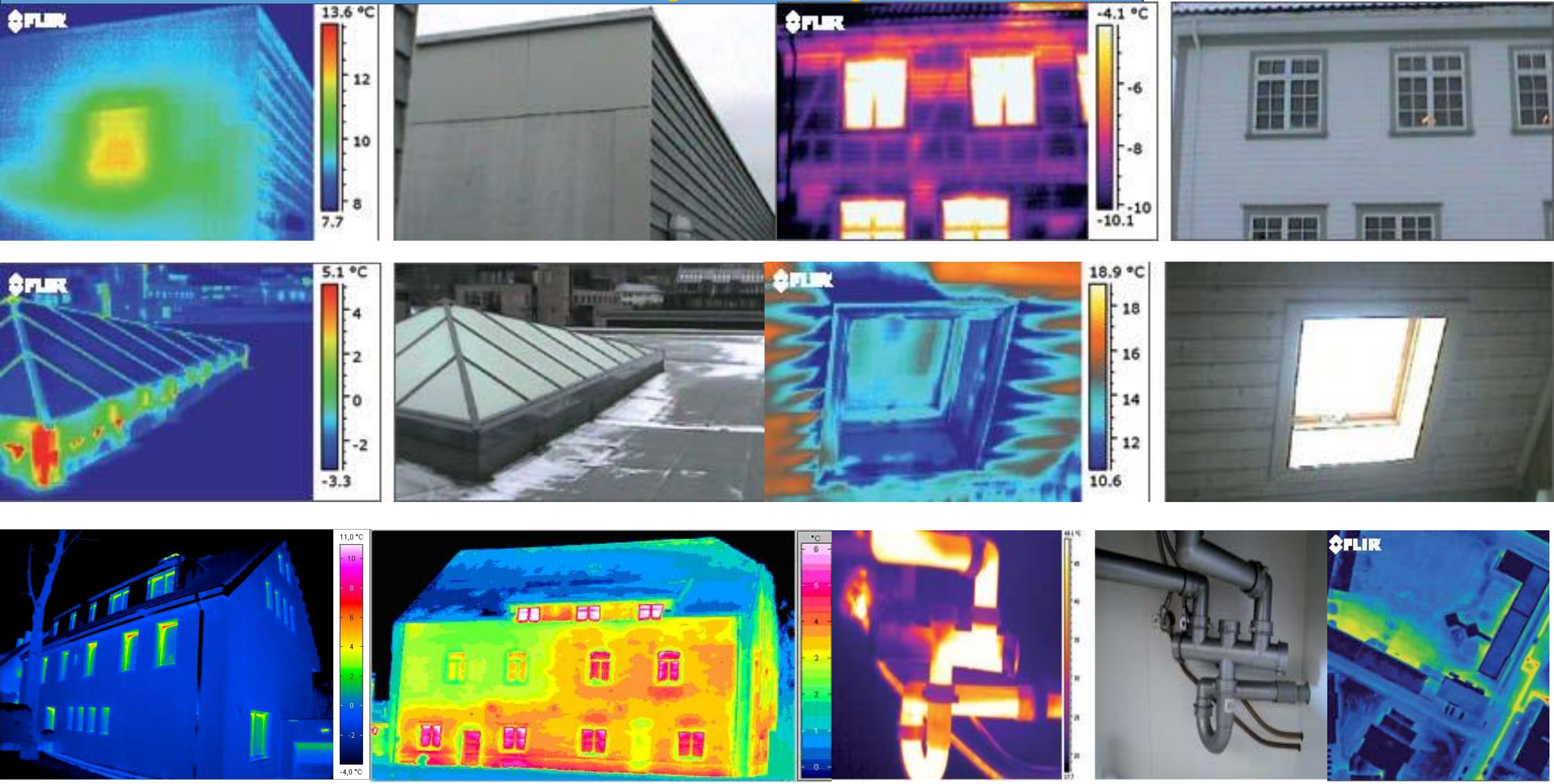






≥ + 70 °C
ca. + 22 °C




Thermo-vision camera for testing of the buildings



SB conference timeline

CIB TG8, Watford, 1994

CIB TG8 Paris 1997

Green Building Challenge GBC 98, Vancouver, 1998

Sustainable Building (SB) conferencies

SB00 Maastricht 2000

SB02 Oslo 2002

SB05 Tokyo 2005

SB08 Melbourne 2008

SB11 Helsinki 2011

5 national events in 2004

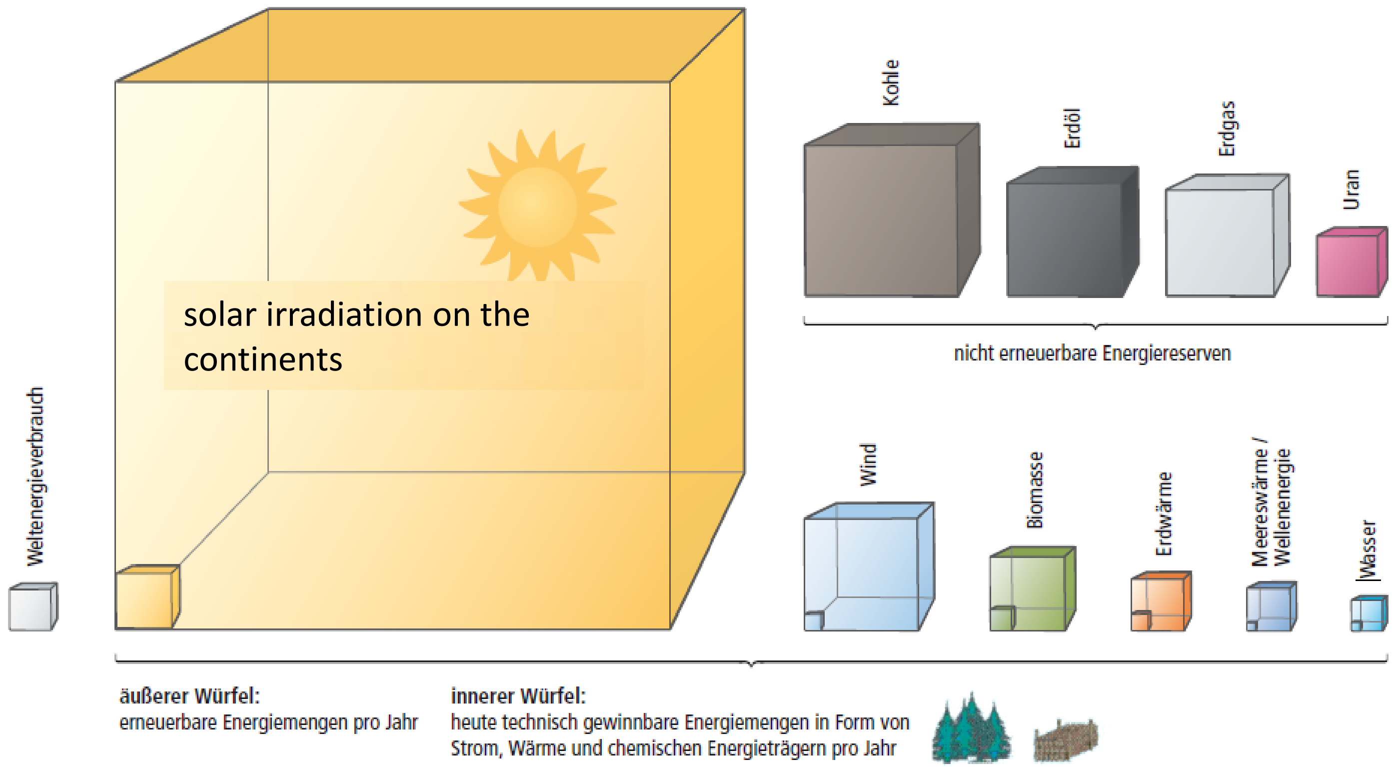
11 national events in 2007

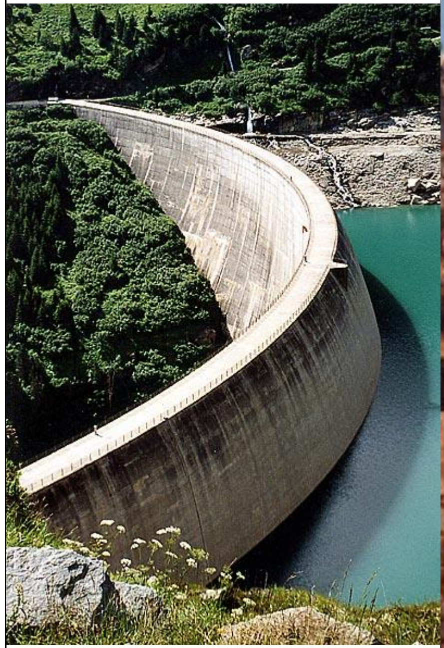
10 national events in 2010

1994 1998 2000 2002 2004 2005 2007 2008 2010 2011

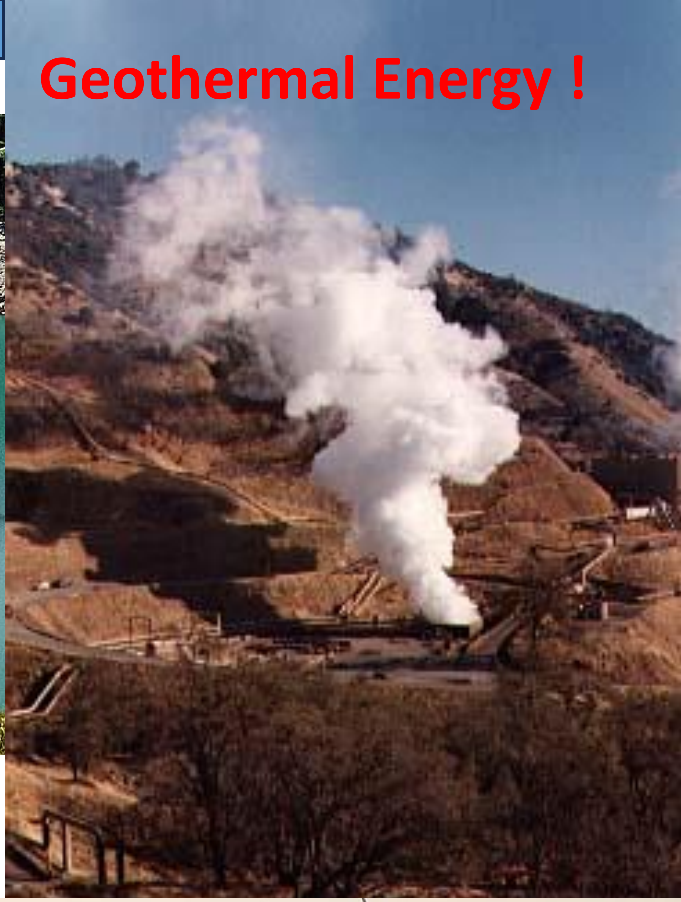
Support with subsidies feed-in tariffs

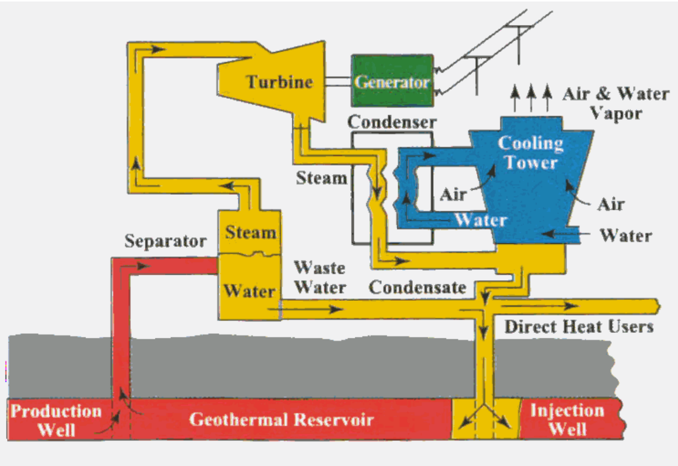
Renewable Energy

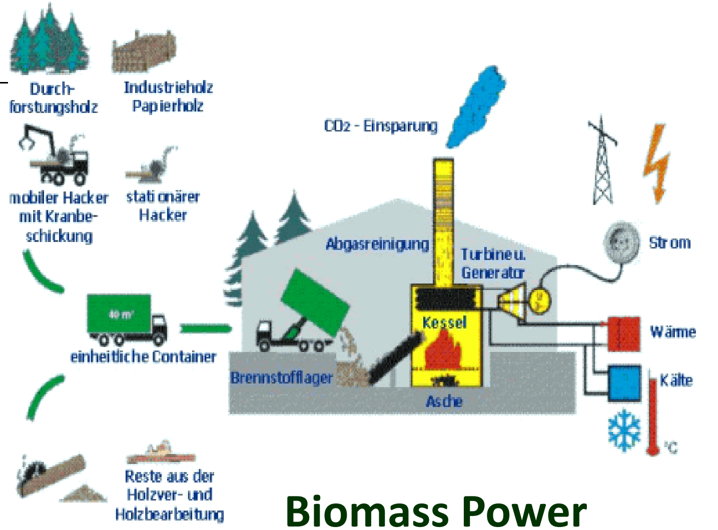




Geothermal Energy !

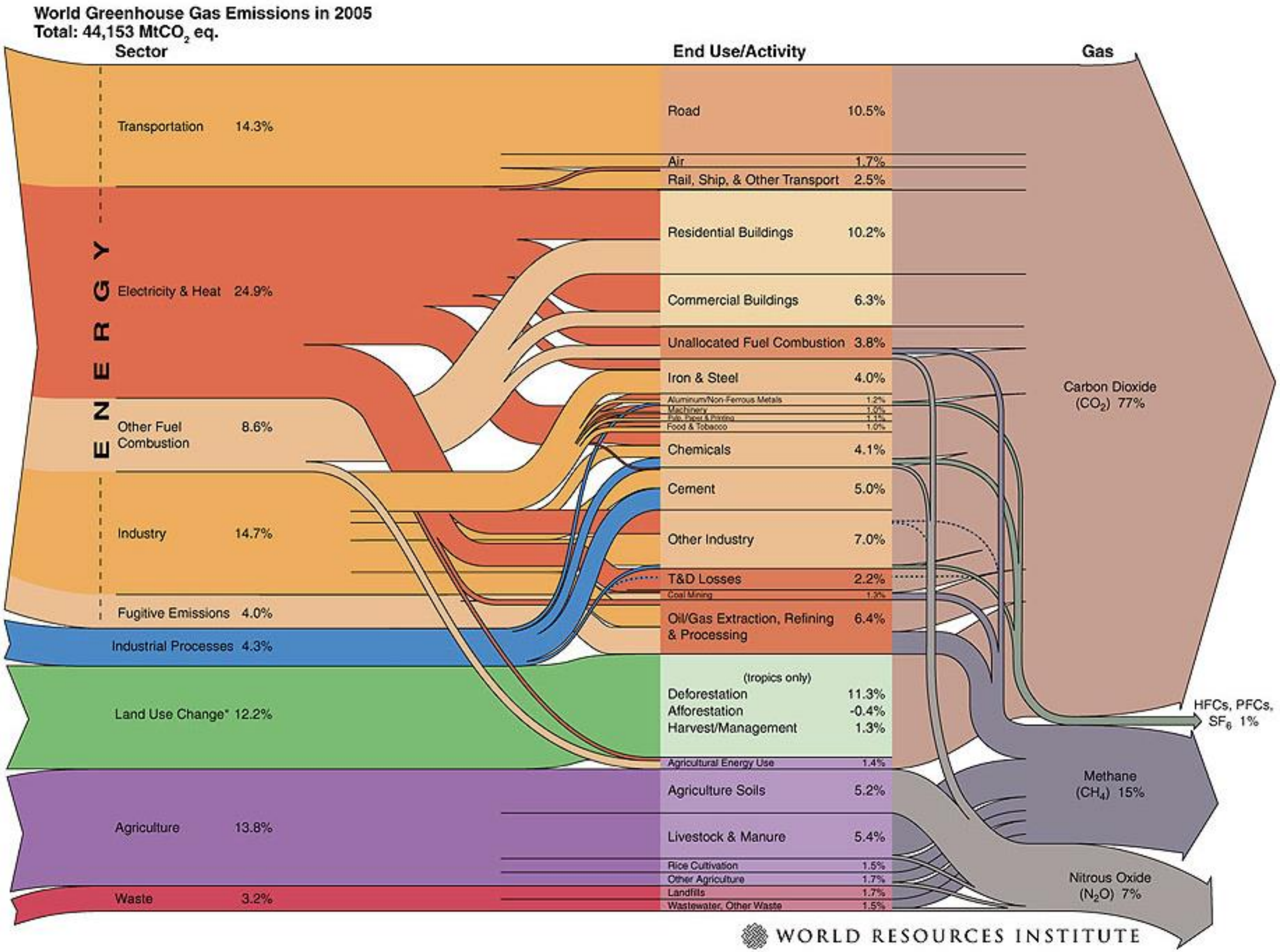






Biomass Power Plant

The cause of the problem



Passive House (Passivhaus) standard

Energy Efficiency

Passive buildings consume up to 90% less energy for heating and cooling compared to conventional buildings.

Comfort

Enhanced thermal comfort and indoor air quality due to better insulation, airtightness, and ventilation.

Sustainability

Lower greenhouse gas emissions and reduced environmental footprint.

Cost Savings

Reduced energy bills and long-term savings on maintenance and operational costs.

Resilience

Improved building resilience against extreme weather conditions and energy price fluctuations.

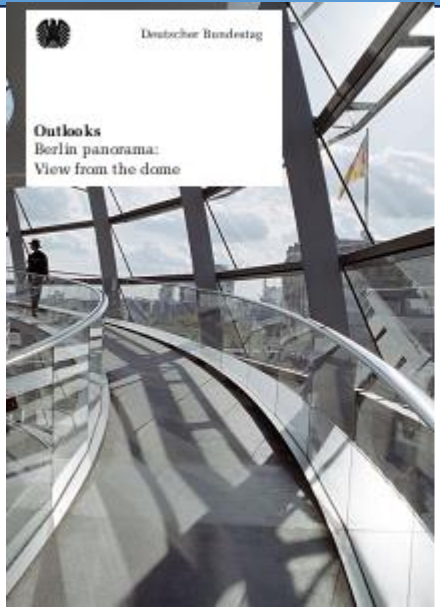
Passive House (Passivhaus) standard

Dr. Wolfgang Feist and Bo Adamson

Passive buildings are designed to be highly energy-efficient through the use of improved insulation, airtight construction, high-performance windows, and heat recovery ventilation systems

This approach minimizes the reliance on active heating and cooling systems, thereby reducing both energy costs and the environmental impact of buildings

The first Passive House building was completed in 1991 in Darmstadt, Germany

According to the climat with appropriate technology
(1995-1999).



Examples of solar assisted district heating systems

a

Friedrichshafen-Wiggenhausen (1996)
380 Wohnungen, 4.050 m^2 Flachkollektor,
12.000 m^3 Heißwasser-Wärmespeicher

b

Steinfurt-Borghorst (1999)
23 Reihenhäuser, 510 m^2 Flachkollektor,
1.500 m^3 Kies/Wasser-Wärmespeicher

c

Hamburg-Bramfeld (1996)
124 Reihenhäuser, 3.000 m^2 Flachkollekto
4.500 m^3 Heißwasser-Wärmespeicher

d

Rostock-Brinkmannshöhe (1996)
108 Wohnungen, 1.000 m^2 Flachkollektor,
20.000 m^3 Aquifer-Wärmespeicher

e

Neckarsulm-Amorbach (1998)
5.263 m^2 Flachkollektor,
63.360 m^3 Erdsonden-Wärmespeicher

f

Hannover-Kronsberg (2000)
106 Wohnungen, 1.350 m^2 Flachkollektor
2.750 m^3 Heißwasser-Wärmespeicher

- Ref: FVEE
- Pictures: a, b, d, e
- Uni Stuttgart, ITW
- Pictures: c, f
- Prof. Em. Gockell,
- IGS, Uni Braunschweig

the application of minimum requirements to the energy performance of:

- **existing buildings, building units or elements subject to major renovation;**
- buildings elements that form part of the building envelope and that have a significant impact on the energy performance of the building envelope when they are retrofitted or replaced; and
- **technical building systems whenever installed, replaced or upgraded**;

-**national plans** for increasing the number of **nearly zero-energy buildings**;

-energy performance certification of buildings and building units;

-**regular inspection of heating and air-conditioning** systems in buildings; and

-**independent control systems for energy performance certificates** and inspection reports.

EU Directive on the Energy Performance of Buildings- (EPBD) 2002/91/EC

The general **objectives of the EPBD** are **to reduce final energy consumption, CO2 emissions and creation of jobs**.

-improvement of the energy performance of buildings, **taking into account various climatic and local conditions**

-a common general **framework for a methodology for calculating**

2004

2002

Dirctive 2006/32/EC on energy end-use efficiency and energy services

The EU Directive on the promotion of cogeneration based on useful heat demand in the internal energy market 2004/8/EC

Directive 2004/101/EC establishing a system for greenhouse gas emission allowance trading under the Kyoto Protoco

Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the EU

Directive 2001/77/EC on promotion of electricity produced from renewable energy sources in the internal electricity market

EU Directive on mandatory energy efficiency labeling of household appliances 92/75/EEC and others.

Long-Term Renovation Strategies (LTRS) for pubic and private building transformation into nearly zero-energy ones

- The **core elements included the introduction of nearly zero-energy buildings**, measures **to stimulate renovation through** appropriate financing and rules on penalties.
- **Strengthened measures on inspections** of heating and cooling, energy performance certificates and high-efficiency alternative systems.
- The principle that the **public sector should set a good examples** as regards the energy efficiency of buildings

Climate and energy framework 2030
- Reduce greenhouse gases by 40 % compared to 1990 levels
- Reach at least 32 % share of renewable energy consumption
- Achieve energy savings of at least 32.5 %

2015

EPBD recast 2010/31/EU
- Kept main provisions of the 2002 Directive
- Simplified legal framework and facilitated implementation
- General aims specified: reduction of energy consumption, reduce CO2 emissions and create new jobs.
- Widened the scope to cover a larger part of EU buildings stock, but at a cost-effective way

2010

Climate and energy package for 2020
- Reduce GHG emission by 20 % compared to 1990 levels
- Increase share of renewable energy to 20 %
- Increase energy efficiency by 20 %

Visions of the solar thermal industry for the year 2030

The active solar house (heat demand covered 100% with solar systems) is the building standard

Multifamilybuilding with 100% solar heating built in Switzerland in 2007

International Solar Energy Society, German Section

Visions of the solar thermal industry for the year 2030

50% of the low temperature heat demand will be covered by solar thermal systems

Solar Thermal Systems in Europe

Falkenberg/Sweden, 5.500 m² collectors, 6% of the local heat delivered

Marstal/ Denmark, 18.300 m³ collectors, 10.000m³ buffer storage, 30% of the local heat delivered, **Energy woods need > 10 times larger land area!**

Energetikhaus100 – 95% solar fraction

Partners:

Technical University Freiberg

FASA AG Chemnitz

Eder Ziegelwerk Freital GmbH

Soli fer Solardach GmbH

www.energetikhaus100.de

Storage: 28.000 liters

Collector area: 69 m2

Vision 2030

New residential buildings: 100% solar thermal heating

Existing residential buildings: 50 % solar thermal heating

Industrial solar thermal systems for temperatures > 100° Celsius

Solar cooling systems

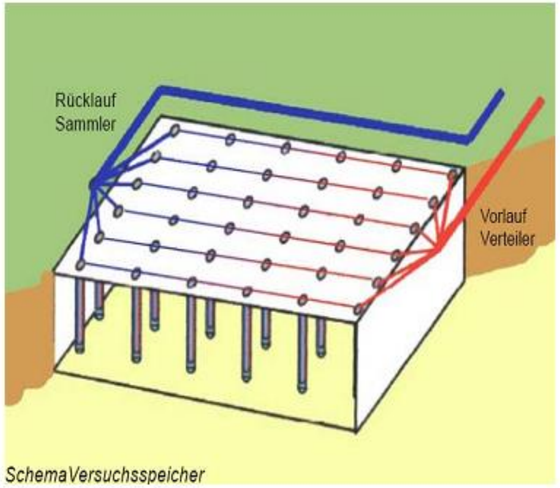
Solar District Heating Systems

Overall Goal: Heating Demand up to 250°C will be covered by Solar Thermal systems

Solarthermal District Heating

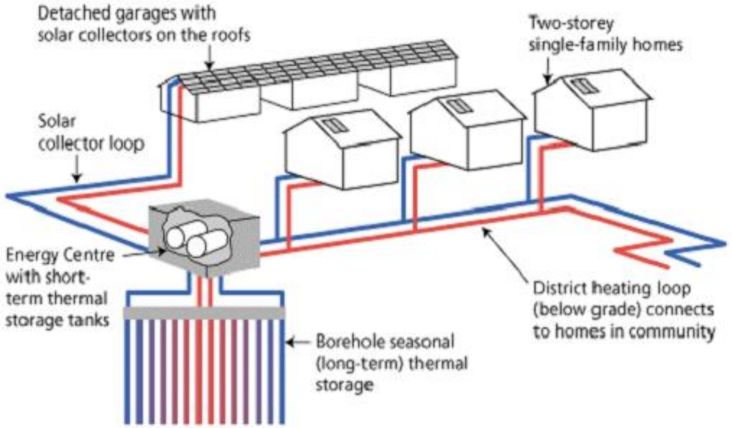
Neckarsulm II / Germany

- Storage: 20.000 m³
- Total Heat requirement: 1663 MWh/a
- Solar Heat: 832 MWh/a
- Costs: 1,45 Mio €
- Solar fraction: 50 %
- Used simulation program: TRNSYS



Neckarsulm II / Germany

- Supply Area: 6 Multifamilybuildings, School, Hostel, Shoppingcenter
- Heated Area: 20.000 m²
- Collector Area: 2.700 m²
- Typ of Storage: Borehole seasonal long term storage

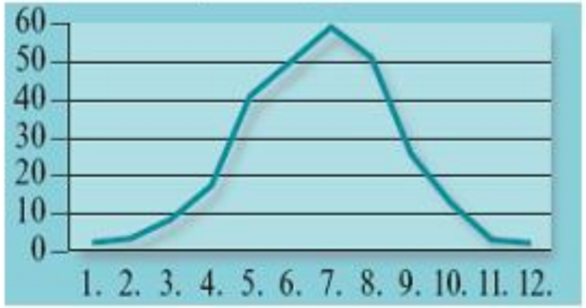


Solarthermal Systems in Agriculture – Piglet Breed

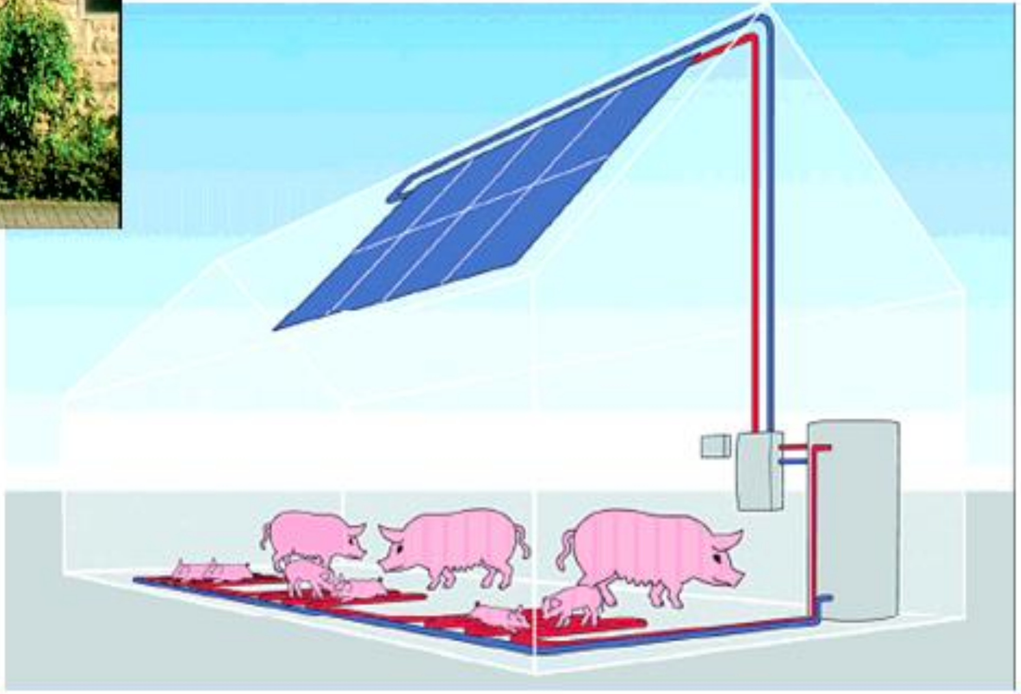
- System Tested in Münsterland Germany
- 65m² Collector Area
- Natural Gas Reheating
- System Saves 3.200m³ Natural Gas per Year

- Other Farms Use the Heat Behind PV-Collectors to Dry Their Straw

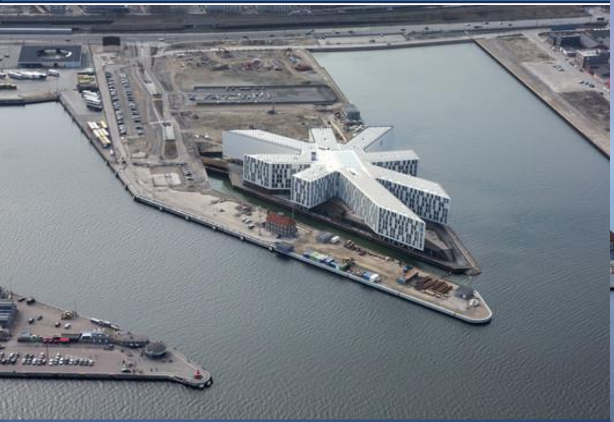
Solar coverage rate(%):



(20% annual average)

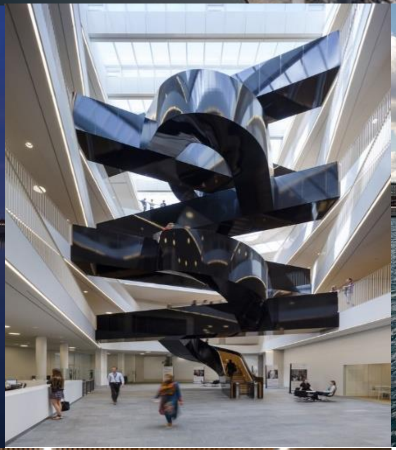


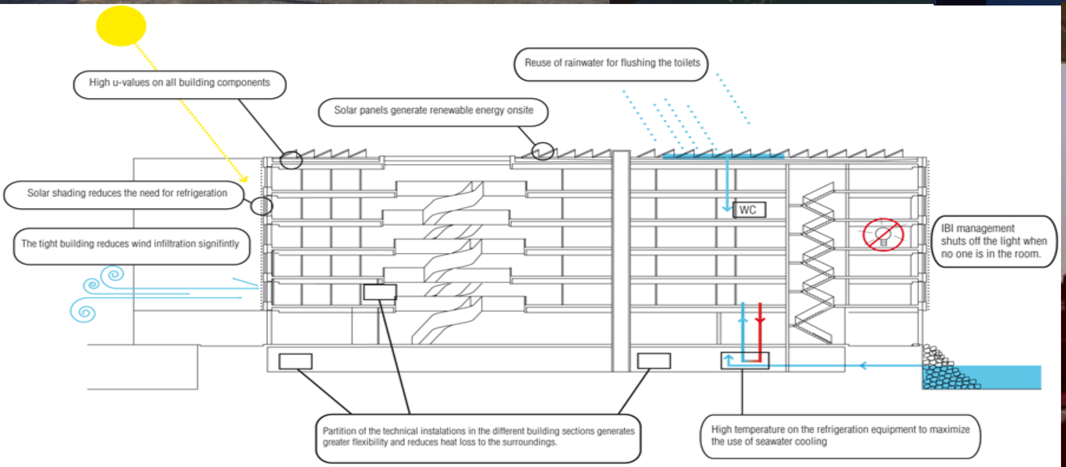
UN City - COPENHAGEN - 2013

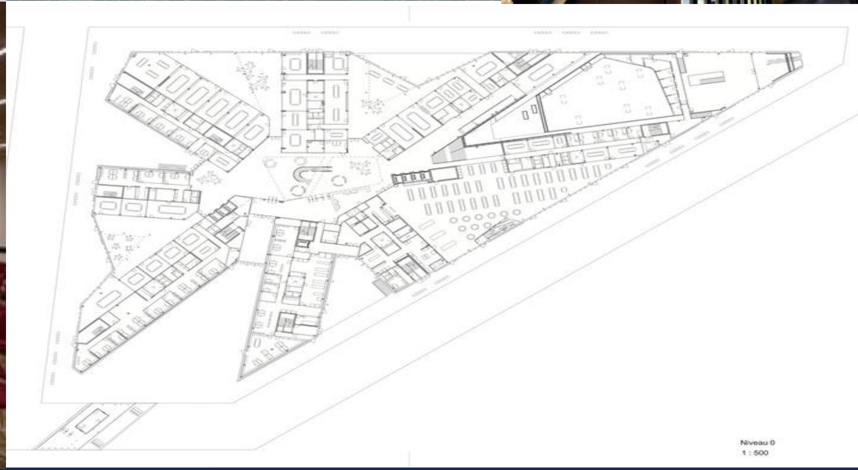






Sustainability matrix

Issues

Operational Energy Consumption and CO^2 Emissions

	1. GOOD PRACTICE	2. BEST PRACTICE	3. INNOVATIVE	4. PIONEERING	NOTES
1. CO^2 Emission Target	40kgCO^2/m²/yr	30kgCO^2/m²/yr	15kgCO^2/m²/yr	"Carbon neutral" 0kgCO^2/m	Industry standard EEO targets
2. Heating Load Target	79kWhr/m²/yr	47kWhr/m²/yr	30kWhr/m²/yr	20kWhr/m²/yr	Industry standard EEO targets
3. Electrical Load Target	54kWhr/m²/yr	43kWhr/m²/yr	35kWhr/m²/yr	25kWhr/m²/yr	Industry standard EEO targets
4. U Values: Wall Average Windo Roo Ground Floo	0.35 2.2 0.2 0.25	0.2 1. 0.1 0.2	0.2 1.4 0.15 0.2	0.1 0.9 0.1 0.1	good practice=current building regulations pioneering=Bedzed values
5. Airtightness	<10m³/hr/m²	<8m³/hr/m²	<5m³/hr/m²	<3m³/hr/m²	All measures require careful attention to details and monitoring construction.
6. Ventilation	Natural ventilation where possible. Mechanical ventilation where not.	BMS controlled natural ventilatio with automatic openers, mechanical ventilation to WCs etc.	Mechanical ventilation with heat reclaim in winter and BMS controlled natural ventilation in summer		BMS with manual overrides preferable on all windows.
7. On Site Energy Generation		Solar domestic water heating to WCs.	Solar domestic water heating to WC cores. Cost effective PV installation using PVs to shade rooflights. Gas fired CHP installation.	Solar water heating to kitchens. Maximum PV installation using most efficient PVs. Wood/waste fired CHP.	Potential 50% grant available from DTI for wolar water heating, up to 65% for PV installation.
8. Daylighting	"Reasonable" to BS8206 part 2. A 2% daylight factor.	80% office space daylit to meet criteria of BS8206: part 2.	100% of office space daylit to BS8206 part 2		Ensure prevention of solar heat gain/glare by building form/shading systems
9. Artificial Lighting Controls	PIR detectors in WCs etc. Low energy fittings throughout.	Luminance and presence detectors throughout building. N dimming.	Luminance and presence detection on all fittings with dimming to zero and BMS override.		Personalised controls strongly recommended by Rob Jarman
10. Cooling Systems/Source	Zero ozone depletion refrigerants in high efficiency comfort cooling/air conditioning systems.	Night time structural cooling with automatic window vents.	Evaporative cooling to rooms with high internal heat gains.	Borehole/ground water cooling to rooms with high internal heat gains.	Need to provide for areas where cooling is required and provide upgrade path for entire building.
11. Embodied Energy in Structural Materials	Steel and concrete frame engineered to minimise mass of materials.	Use of cement replacements eg GGBFS in concrete. Use recycle steel.	Timber structure in lieu of steel or concrete but retaining concrete floors. Use of recycled aggregates in structural concrete.	All timber structure with thermal mass provided using minimum amount of concrete.	NB. Rob Jarman particularly keen on use of timber for low embodied energy

Successful low-carbon building renovation combining energy efficiency measures with renewable energy integration

Source: AEE INTEC, in IEA EBC Annex 56 – Evaluation of the Impact and Relevance of Different Energy-Related Renovation Measures on Selected Case Studies (Kapfenberg, Austria, 2012-2014).

History

- Early 1990's: the ***Building Research Establishment Environmental Assessment Method*** **(BREEAM)** was developed by BRE and a private-sector architect, John Doggart;
- Mid 1990's: **the *Leadership in Energy and Environmental Design*** **(LEED)** was developed by the **U.S. Green Building Council (USGBC)**;
- **Both of these initiatives began essentially as checklists of what to do and what not to do in the design** of commercial buildings;
- **These systems provided guidelines for good design and management** suited to the region of origin;
- As the field developed, more emphasis was **placed on the assessment of performance**, but some of the guideline aspects remained, so we **might call them hybrid systems**;
- Many other systems have been developed, e.g. CASBEE, Greenstar, etc., with most following the similar pattern.
- **20 Certification Schemes for Buildings Used Throughout Europe, Including LEED, Minergie, and PassivHaus**

Sustainability Performance Assessment and Benchmarking of Buildings

The overall objective of OPEN HOUSE is to develop and to implement a **common European transparent building assessment methodology**, complementing the existing ones, for planning and constructing sustainable buildings by means of an **open approach and technical platform.**

OPEN HOUSE baseline are existing standards (both CEN/TC 350 and ISO TC59/ SC17), the EPBD Directive and its national transpositions and methodologies for assessing building sustainability at international, European and national level.

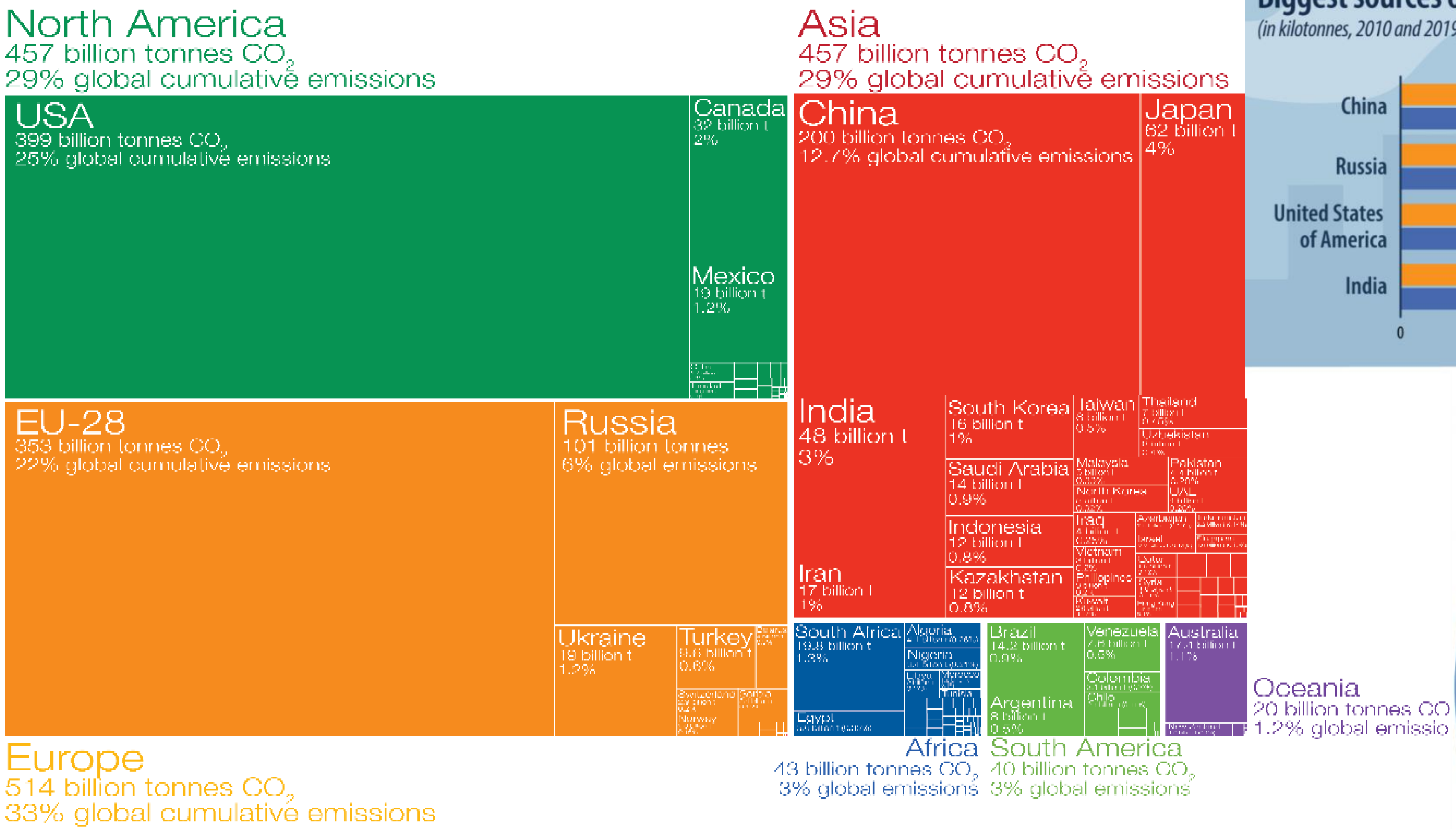
Sustainability Performance Assessment and Benchmarking of Buildings

Evaluation framework

- The evaluation framework defines the hierarchical structure of the assessment methodology.
- It is composed of 6 main **categories**:
- Each **category** is composed of several **indicators** assessing different key issues for the sustainability performance of the project.
- Each **indicator** consists in one or several **sub-indicators** that evaluate a precise issue covered by the indicator topic.

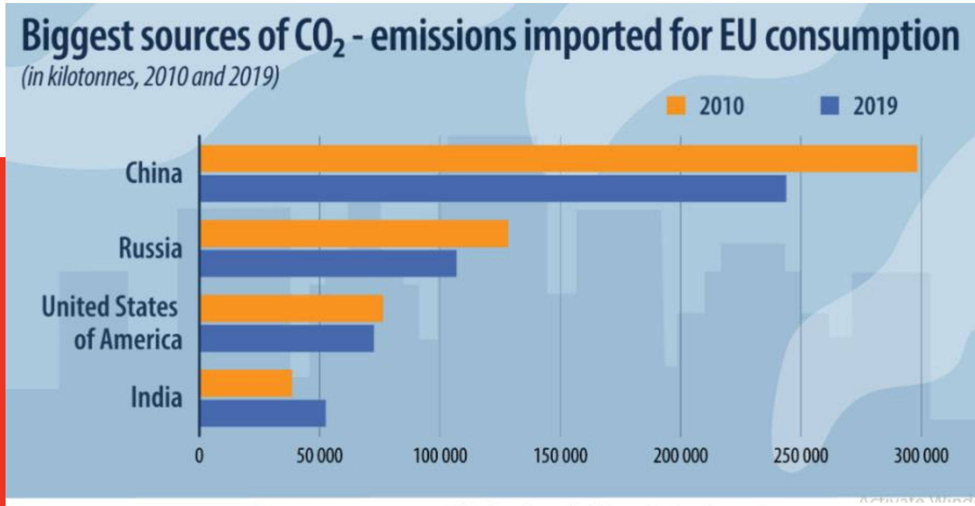
Who has contributed most to global CO_2 emissions?

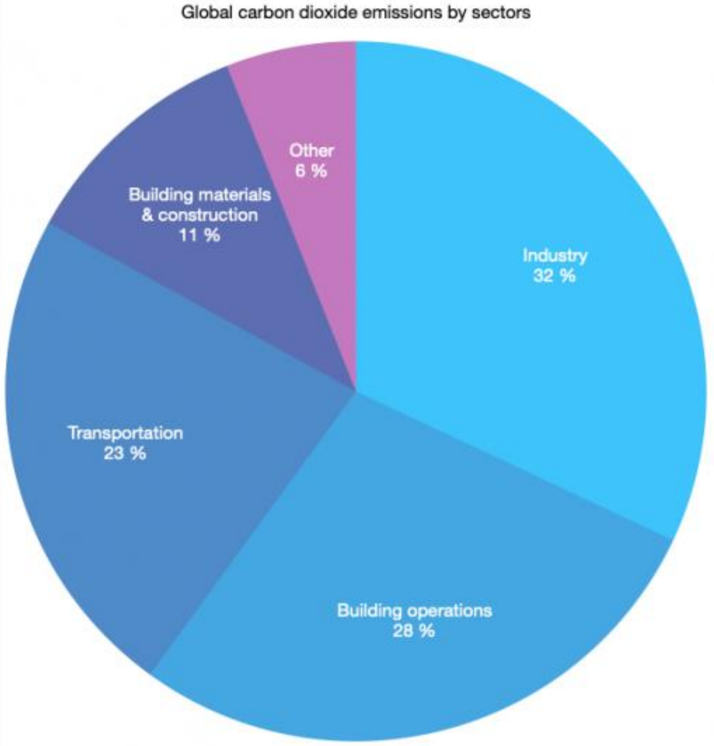
Cumulative carbon dioxide (CO_2) emissions over the period from 1751 to 2017. Figures are based on production-based emissions which measure CO_2 produced domestically from fossil fuel combustion and cement, and do not correct for emissions embedded in trade (i.e. consumption-based). Emissions from international travel are not included.

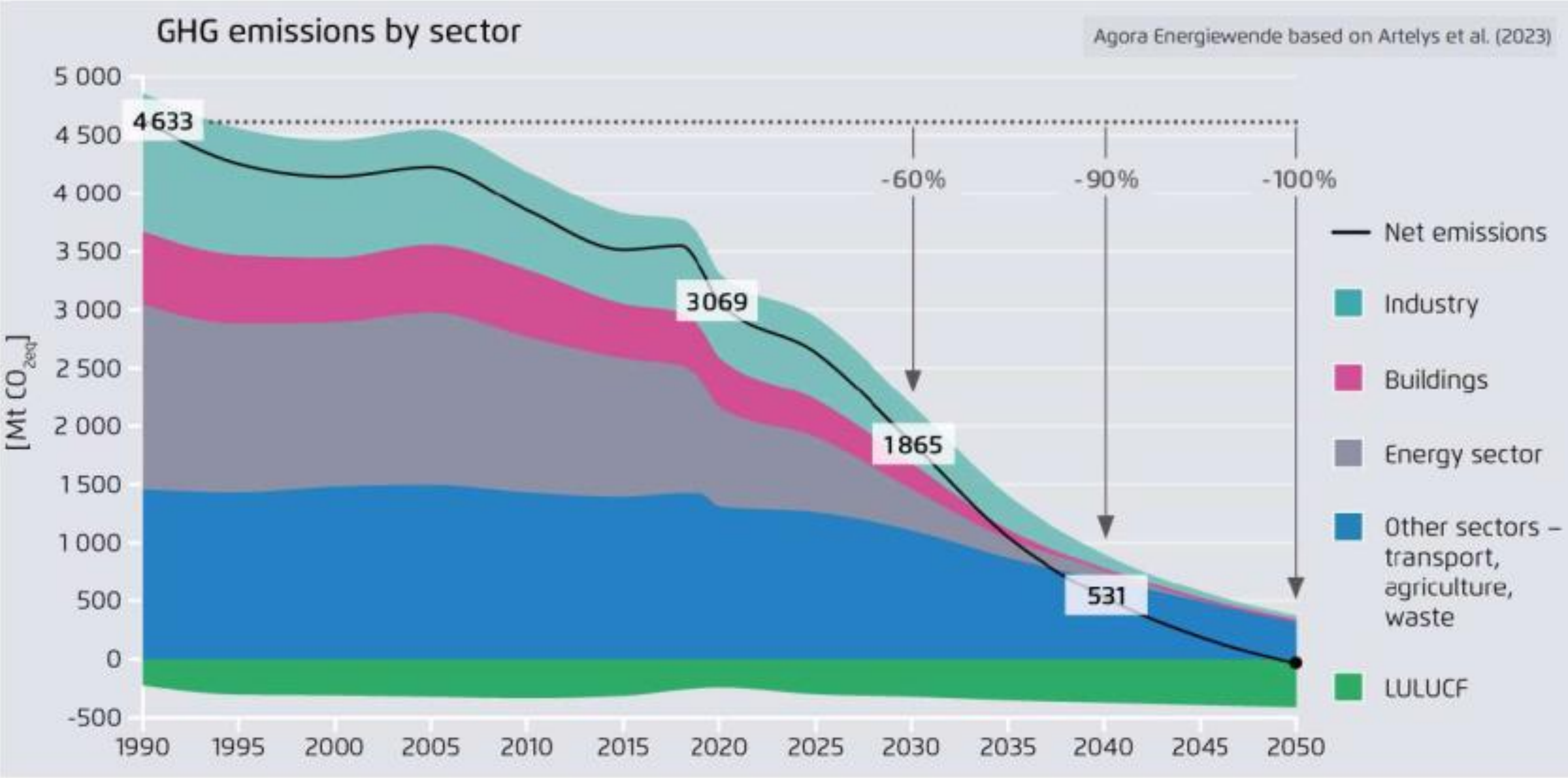


Figures for the 28 countries in the European Union have been grouped as the 'EU-28' since international targets and negotiations are typically set as a collaborative target between EU countries. Values may not sum to 100% due to rounding.

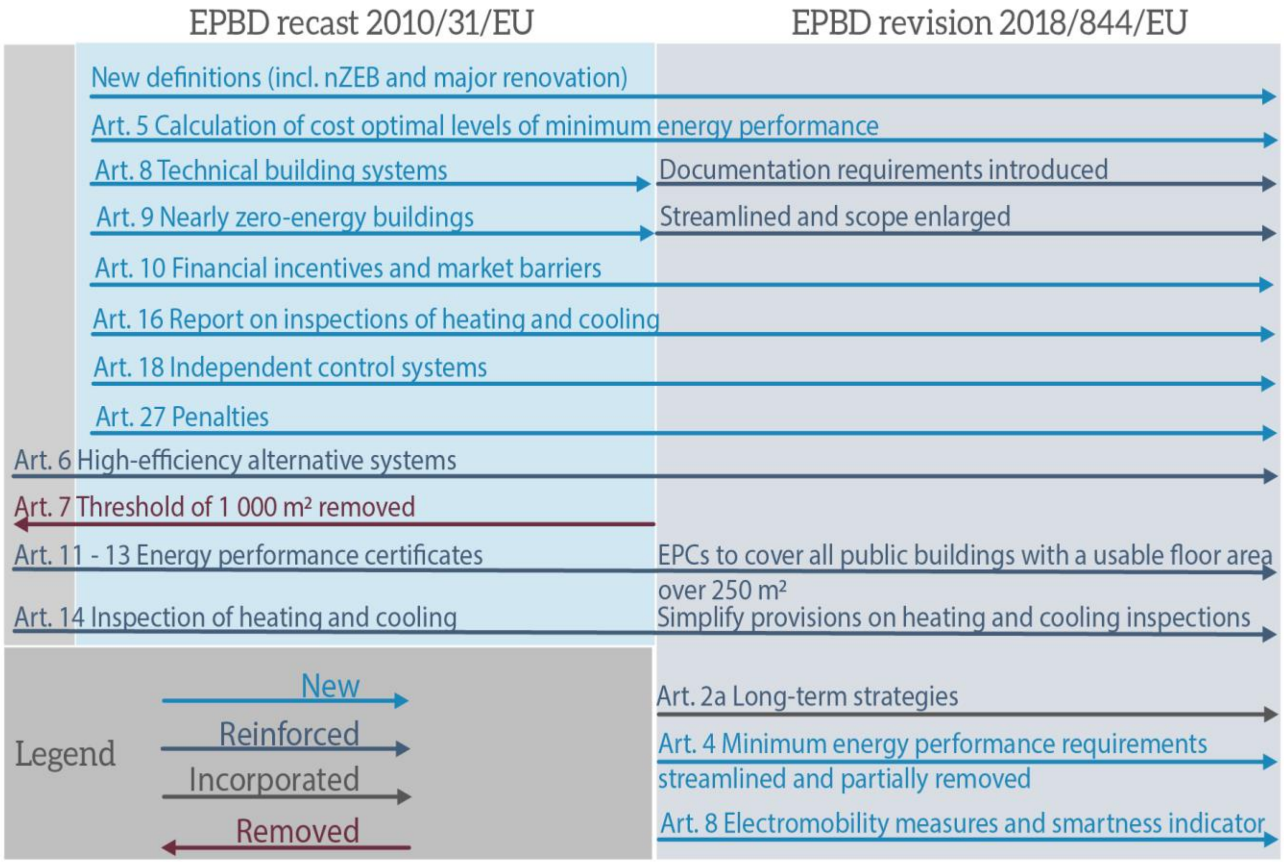
Data source: Calculated by Our World in Data based on data from the Global Carbon Project (GCP) and Carbon Dioxide Analysis Center (CDIAC).
This is a visualization from OurWorldinData.org, where you find data and research on how the world is changing.



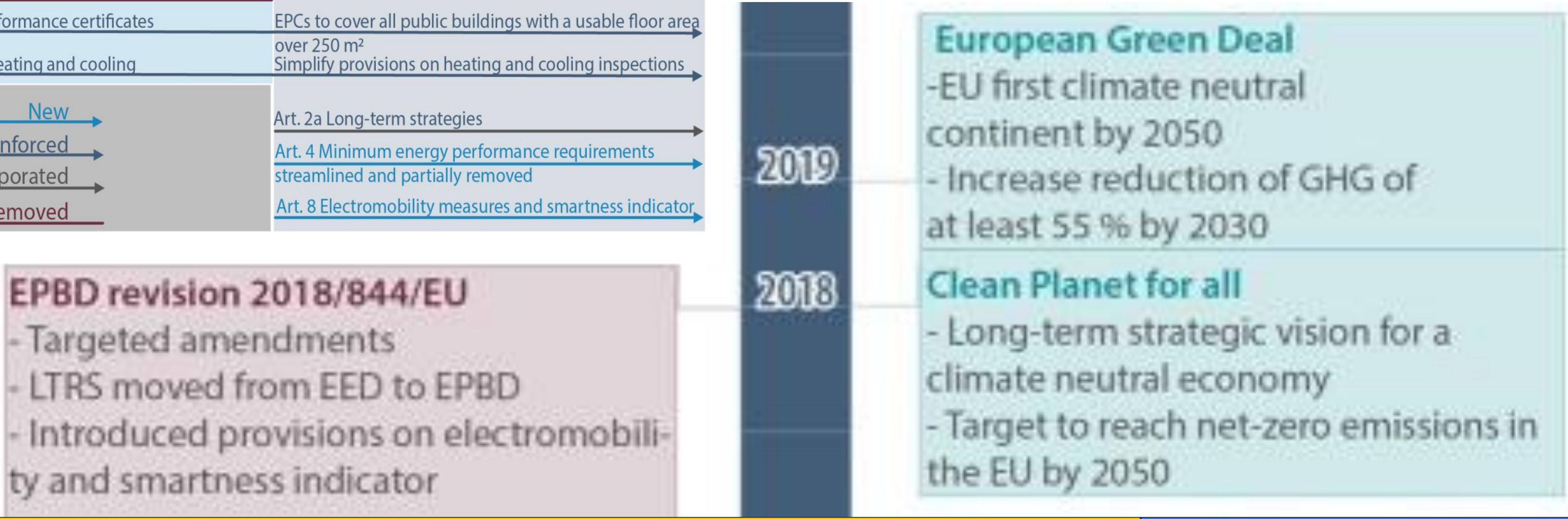




«All global modelled pathways that limit warming to 2°C involve "**rapid and deep**" [...] greenhouse gas emissions
reductions in all sectors this decade.» (IPPC Summary for Policymakers Report, 2023)



Guidelines for the promotion of nearly zero-energy buildings (NZEB) for best practices, by the end of 2020,



Long-Term Renovation Strategies

Evolution of an idea

1600 - 1800s

1800s
Church influence & **"Sin" stocks**

1950 - 2000

1960s
Rise of ethical investing due to **civil rights** and **anti-war** movements

1980s
Divestment campaigns **against Apartheid** in South Africa

1990
The Domini 400 **Social Index** was created (MSCI KLD 400)

1992
The Earth Summit and launch of **UNFCCC** in Rio de Janeiro

1997
Kyoto Protocol -
192 countries pledging to decrease GHG emissions
+
Global Reporting Initiative (**GRI**) launches

2000 - 2020

2004
Global Compact published report "Who Cares Wins"

2011
The Sustainability Accounting Standards Board (**SASB**) launched

2015
The UN Sustainable Development Goals
+
Paris Agreement
+
TCFD

The 2030 Agenda for Sustainable Development

was launched by a UN Summit in New York on 25-27 September 2015

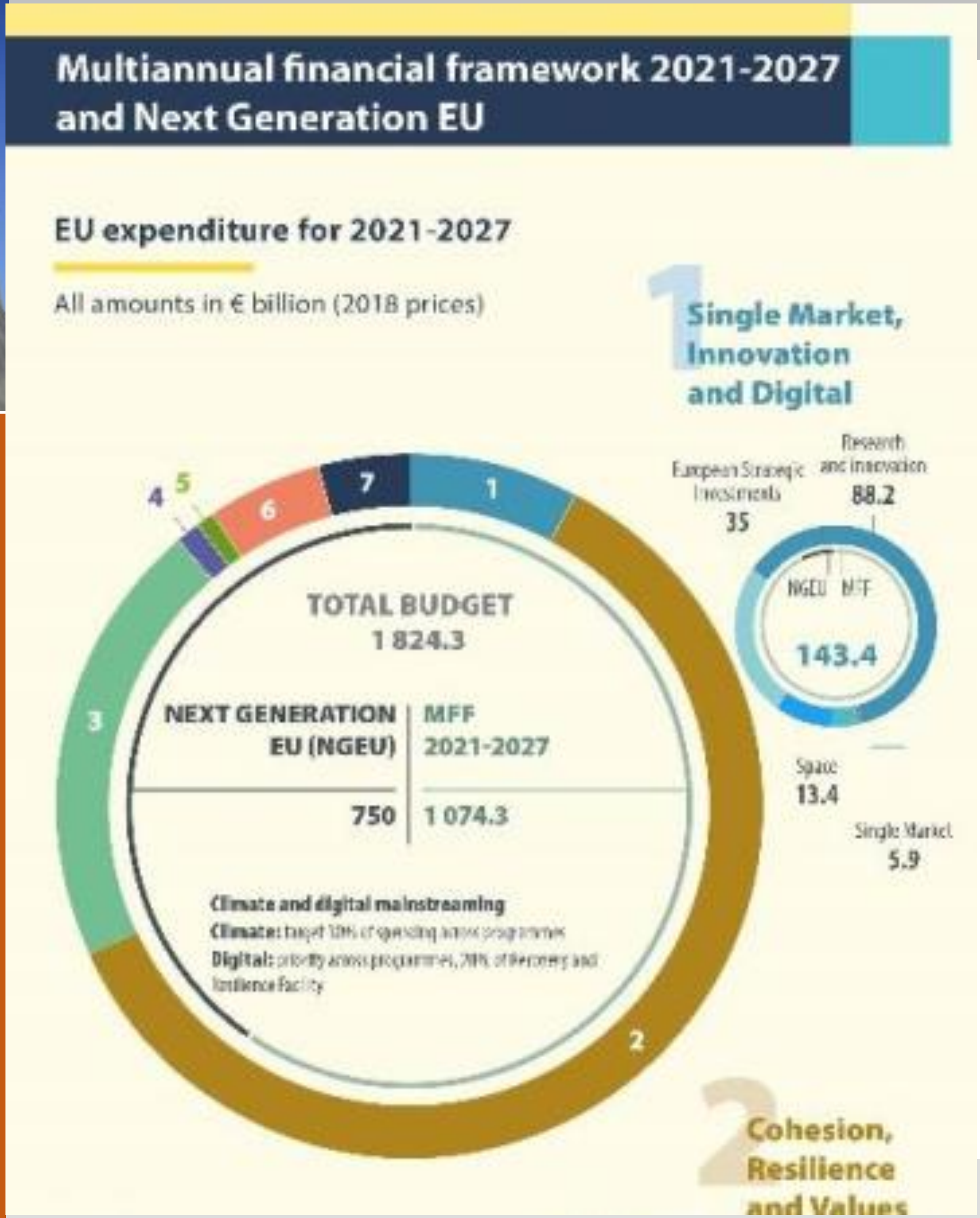
NEXT GEN EU

„"We need to give our own unique aesthetics to our systemic change - **to harmonize style with sustainability**," said Ursula von der Leyen, President of the European Commission, during her address to the plenary session of the European Parliament on September 16/2020. This is why we will establish a new European Bauhaus - a space for co-creation where architects, artists, students, engineers, and designers work together to make it happen."

'What a Second Bauhaus Movement Means for Europe' (Bloomberg)

The European Union's Green Deal will spark a wave of building renovations - and a chance to find a new shared architectural aesthetic.

A new common aesthetic born from the need to renovate and construct more energy efficient buildings



- One schedule calls for the renovation of as much as 2% of the continent's building stock each year. That type of "renovation wave" would advance the goal of Europe becoming the world's first climate-neutral continent by 2050 and could represent an opportunity for symbolic transformation.

The 2015 Paris Agreement on Climate Change (COP 21) reinforces the Union's efforts to decarbonize its building stock. T aking into account that almost 50% of final energy consumption in the Union is used for heating and cooling, of which 80% in buildings, achieving the Union's energy and climate goals, According to the Commission's performance assessment, the average renewal rate should be 3% per year.

The directives promote policies that will help:
-achieve a **highly energy efficient and decarbonized** building stock by 2050
-create a **stable environment for investment decisions**
-**helps increase the rate of renovation** in the EU, particularly for the worst-performing buildings
-supports **better air quality,**
-the **digitalization of energy systems** for buildings and the **roll-out of infrastructure for sustainable mobility.**
-**renovation measures best-suited to their specific national context**.
-more targeted financing to investments in the building sector, complementing other EU instruments
-fighting energy poverty by **supporting vulnerable consumers**
-one-stop-shops for the energy renovations of buildings for home-owners, small and medium-sized enterprises and other stakeholders
-further roll-out of recharging points for electric vehicles in buildings

Revised EPBD 2024

2028

All new residential and non-residential buildings must have zero on-site emissions from fossil fuels, as of 1 January 2028 for publicly-owned buildings and as of 1 January 2030

revised Energy Efficiency Directive (EU/2023/1791).

REPowerEU Plan, reducing our use of imported fossil fuels.

European Green Deal, the EPBD aims to reduce building sector emissions by at least 60% by 2030

2024

long-term renovation strategies, to be renamed national Building Renovation Plans (BRP)

EPBD revision proposal
to be put forward by the end of 2021 as part of *Fit for 55* package

2021

European Climate Law
- Climate neutrality by 2050
- Binding target GHG reduction of at least 55 % by 2030

Other measures in the revised Energy Performance of Buildings Directive (EPBD) include
- the **gradual introduction of minimum energy performance standards for non-residential buildings** based on national thresholds to trigger the renovation of buildings **with the lowest energy performance**
- **decrease the average energy performance of the national residential building stock by 16% by 2030 in comparison to 2020, and by 20-22% by 2035, based on national trajectories**
- an **enhanced standard for new buildings to be zero-emission** and the calculation of whole life-cycle carbon for new buildings
- **enhanced long-term renovation strategies,(LTRS) to be renamed national Building Renovation Plans (BRP)**
- increased reliability, quality and digitalization of Energy Performance Certificates with energy performance classes to be based on common criteria
- **the introduction of building renovation passports** to guide building owners in their staged and **deep energy renovations**
- increased deployment of solar technologies on all new buildings and certain existing non-residential buildings where technically and economically feasible, and ensuring that new buildings are solar-ready (fit to host solar installations)
- **a gradual phase-out of boilers powered by fossil fuels**, starting with the end of subsidies to stand-alone boilers powered by fossil fuels from 1 January 2025
- **one-stop-shops for the energy renovations of buildings** for home-owners, small and medium-sized enterprises and other stakeholders
- further **roll-out of recharging points for electric vehicles in buildings, removing barriers to their installation,** enabling smart charging and introducing measures for bike parking in buildings
- data collection and sharing, to improve knowledge on the building stock and awareness on energy consumption in buildings

Revised EPBD 2024

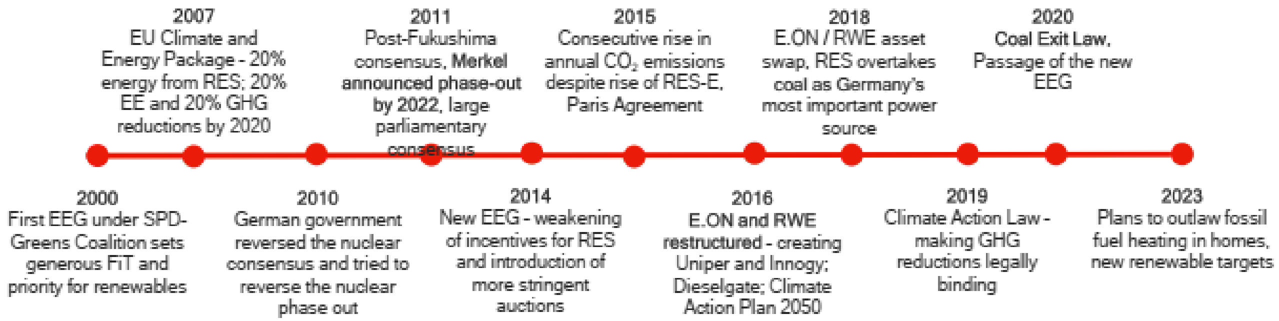
2024

Milestones for 2030 that The International Energy Agency (IEA) describes a route to net zero emissions with steep reductions in carbon emissions by 2030

- All countries targeting zero-carbon-ready buildings in building codes
- Renovation of nearly 20 per cent of existing buildings to be zero-carbon-ready
- Installation of approximately 600 million heat pumps, meeting 20 per cent of global demand for heating
- Approximately 100 million households relying on rooftop solar PV
- Solar PV and wind generation providing approximately 40 per cent of electricity used in buildings
- 350 million building units connected to district energy networks, meeting approximately 20 per cent of space heating need

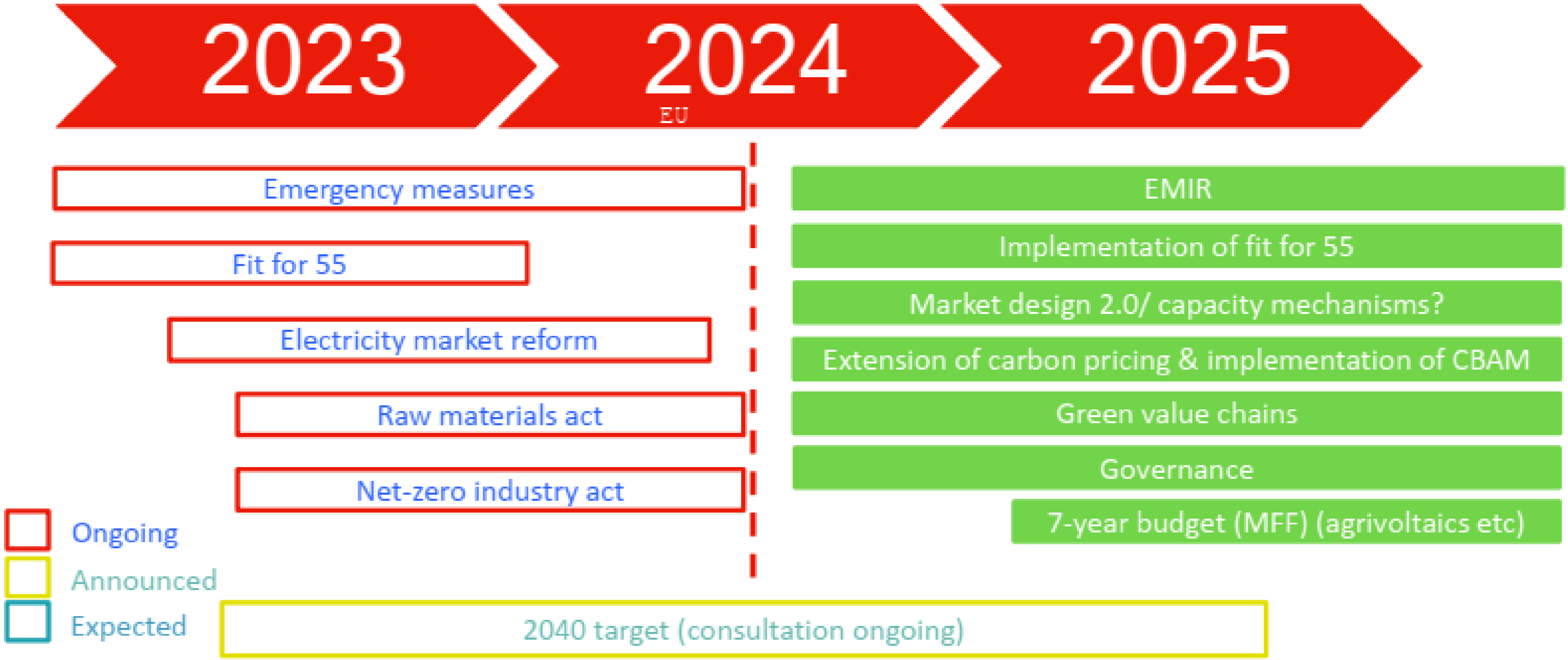
transformative change in everything

- from the design,
- material manufacture,
-construction,
- operation and end of life of structures,
- to the form and organization of urban and rural built environments,
- allowing denser living with increased social and economic opportunities
- reduced reliance on transport and energy-intensive living patterns.



The legislative landscape 2023-2025

What next for European climate policy?



The EU Sustainable Finance policy

Key EU regulation focused on green transition

Sustainable Finance Disclosure Regulation (SFDR)

- Improve investor disclosure
- Ensure standard and comparable information,
- Enable informed decisions on the sustainability of the financial product.

EU Taxonomy

- Framework for the classification of environmentally sustainable economic activities
- Sets out the conditions for the establishment of a uniform classification system and
- Establishes criteria and factors for a product or activity to be considered "environmentally sustainable".

Corporate Sustainability Reporting Directive (CSRD)

- Ensure that companies disclose sufficient information on the risks, opportunities and impacts of their activities on the population and the environment.
- Large companies must disclose information about how they cause and manage social and environmental problems.

SOFIA DECLARATION ON THE GREEN AGENDA FOR THE WESTERN BALKANS

Up to 9 billion with IPA III

Table 1: Western Balkans' Strategic and Legislative Frameworks on Energy and Climate

	Energy Strategy	Low-carbon Development Strategy	Climate-change Law	Energy Efficiency Strategy	Renewables Development Strategy
Albania	National Energy Strategy 2018-2030	National Climate Change Strategy (endorsed in 2019)	Law on Climate Change (adopted in December 2020)	National Energy Efficiency Action Plan expired in 2020	National Action Plan for Renewable Energy Resources in Albania 2019-2021
Bosnia and Herzegovina	Framework Energy Strategy 2035	Climate Change Adaptation and Low Emissions Growth Strategy 2025	–	Action Plan for Energy Efficiency of Bosnia and Herzegovina 2019-2021 (NEEAP BiH) (final draft)	National Renewable Energy Action Plan 2020
Kosovo	Energy Strategy 2017-2028	Climate Change Strategy 2019-2028 and Action Plan on Climate Change 2019-2021 (approved)	–	National Energy Efficiency Action Plan (NEEAP) 2019-2021 (draft)	National Renewable Energy Action Plan (NREAP 2011-2020)
North Macedonia	Energy Development Strategy 2030	Long-term Strategy on Climate Action and National Action Plan on Climate Change (drafts)	Law on Climate Action (draft)	Fourth National Energy Efficiency Action Plan (NEEAP) (adopted)	Renewable Energy Action Plan Until 2025
Serbia	Energy Sector Development Strategy for the Period until 2025; Energy Development Strategy 2040 (draft ongoing)	Draft low-carbon development strategy	Law on Climate Change (adopted in 2021)	Fourth National Energy Efficiency Action Plan (NEEAP) (until 2021) (adopted)	National Renewable Energy Action Plan 2020 (adopted in 2013)

Source: Adapted from OECD, Multi-dimensional Review of the Western Balkans. From Analysis to Action, April 2021, section 14.2.

Note: Green: document approved and valid. Black: document still valid but requires revision. Blue: draft document exists, but has not yet been approved. Red: document expired.

EU buildings by construction date

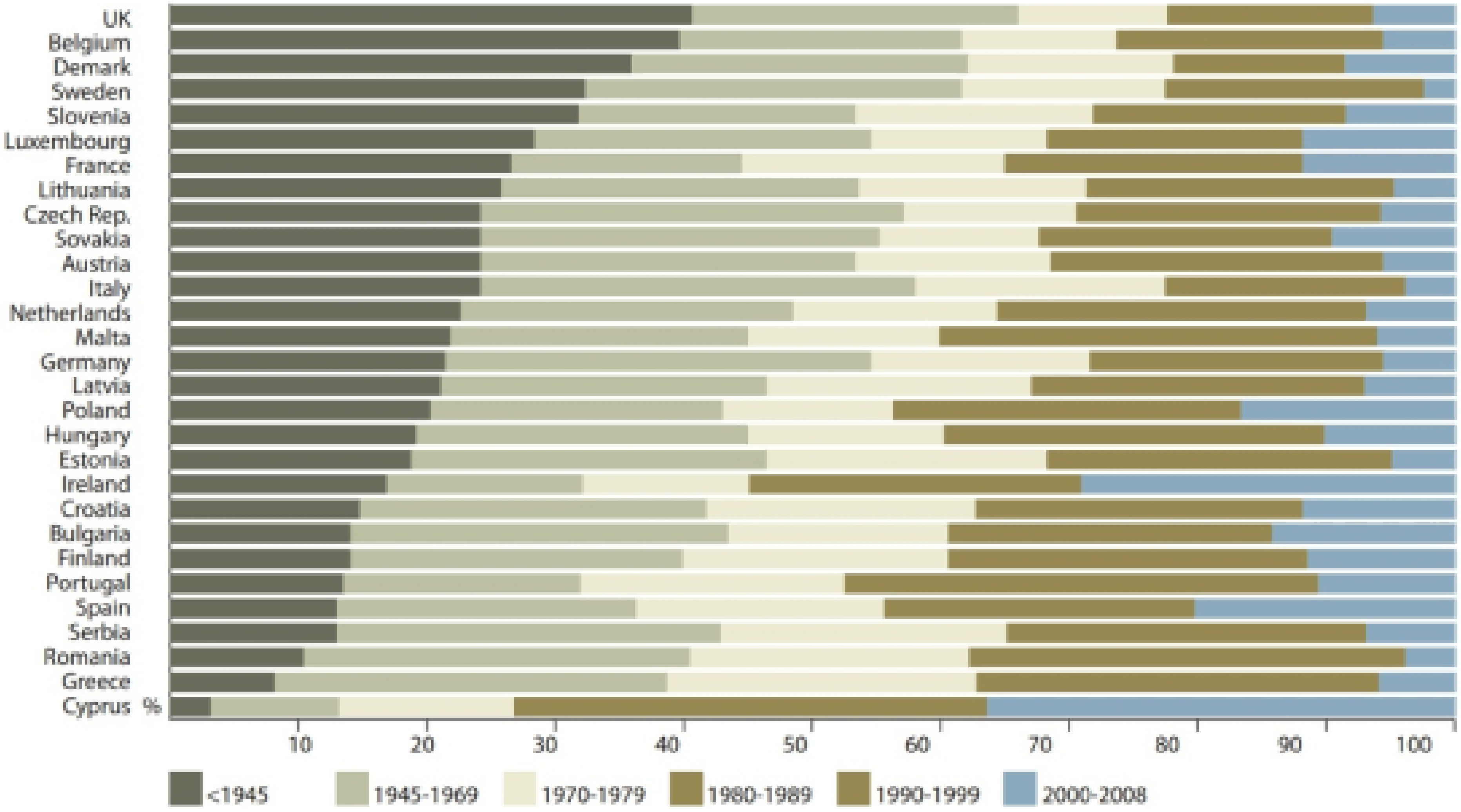
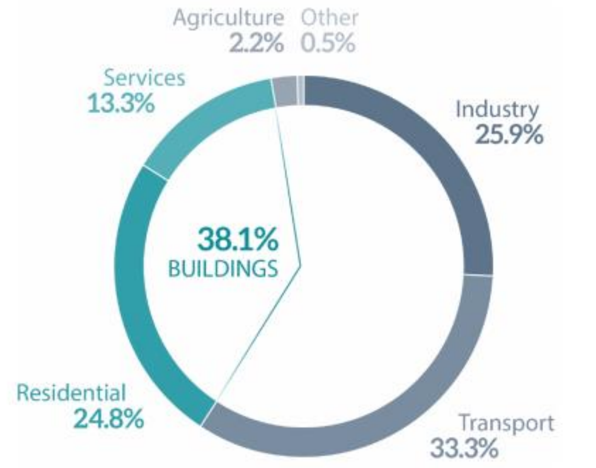


Figure 1 – 2014 energy consumption by sector in the EU-28



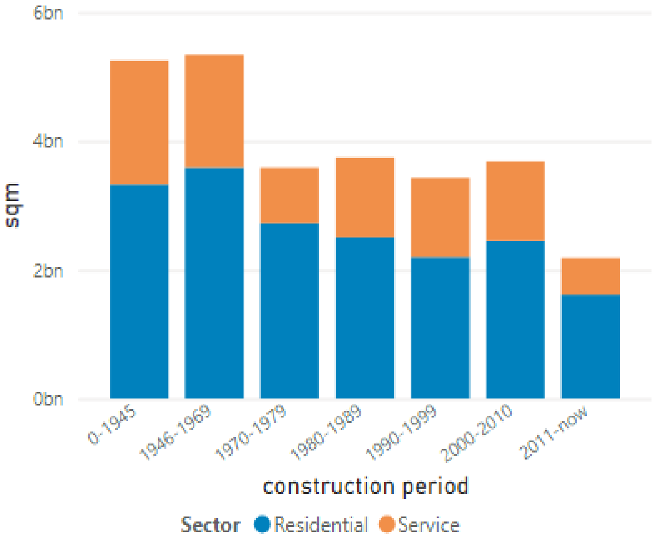
Data source: Eurostat, 2014.

Eurostat EU27

1. Building Stock

	Buildings 2020	Floor area (sqm) 2020
total	111.58M	27,229M
residential	101.47M	18,408M
services	10.11M	8,821M

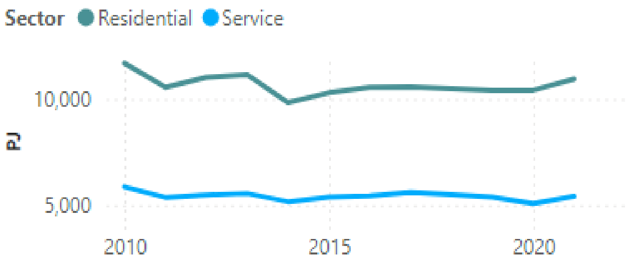
**Occupied stock (primary and secondary residencies)*
Source: MODERATE project



Useful floor area by sector and construction period in the year 2020 (for residential occupied building stock only)
Source: MODERATE project

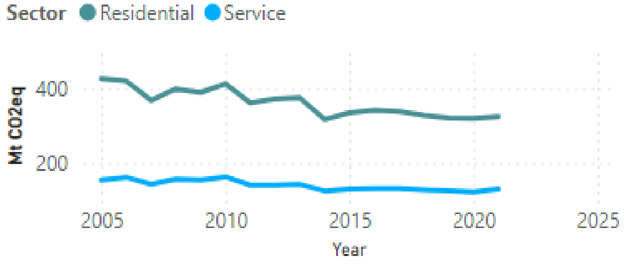
2. Energy Consumption and GHG Emission

In 2021, final energy consumption was at 10941.66 PJ in residential sector and 5420.89 PJ in services sector.



Final energy consumption in residential and services sectors
Source: Eurostat

In 2021, direct emissions due to fossil fuel use were at 324.74 Mt CO2eq in residential sector and 129.90 Mt CO2eq in services sector.



Direct GHG emissions in residential and services sectors
Source: EEA

3. Social Aspects

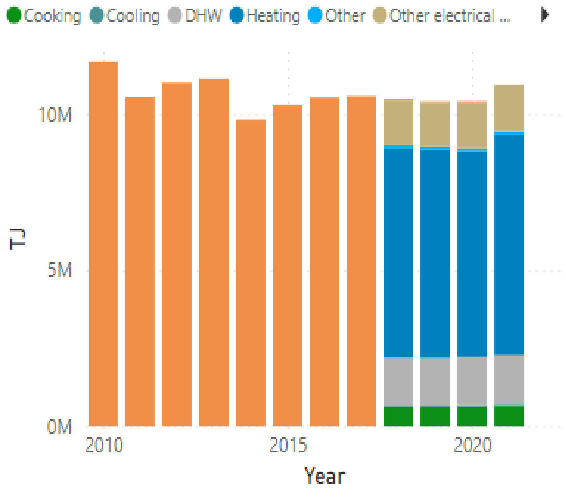
In 2022, 6.9 % of the total population was having arrears on their utility bills while 9.3 % was not able to keep their home adequately warm over the cold periods of the year. In 2020, about 14.8 % of total population was living in a dwelling with leaking roof, damp walls or rotten windows, frames or floor.

Arrears on utility bills	Inability to keep house adequately warm	Dwelling with leaking roof, damp walls or rotten frames
6.9 %	9.3 %	14.8 %

Source: Eurostat SILC

4. Energy use in households

In 2021, households consumed 64.4% for space heating, 14.5% for domestic hot water, 0.5% for space cooling, 13.6% for lighting and electric appliances and 5.9% for cooking.

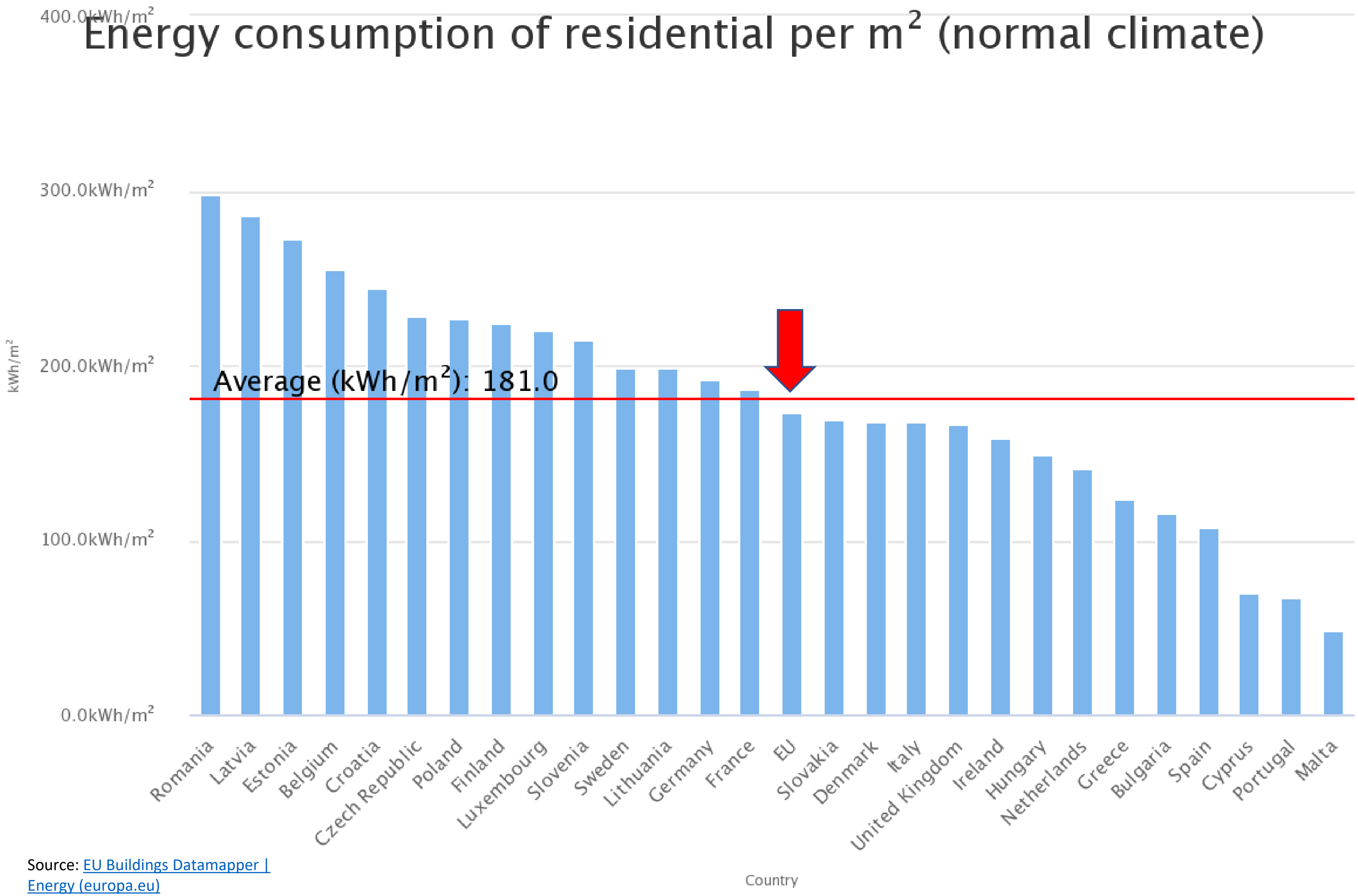


Final energy consumption in households by end-use
Source: Eurostat

the Renewable Energy Directive which is part of legislation, passed in June ,2024 meaning all European Union (EU) member states must contribute to the EU's common goal of 45% renewable energy use by the end of the decade.

The new rules for buildings, heating and cooling stipulate there is an "indicative target" of at least 49% target of renewable energy use in buildings by the end of the decade. Targets for heating and cooling would "gradually increase."

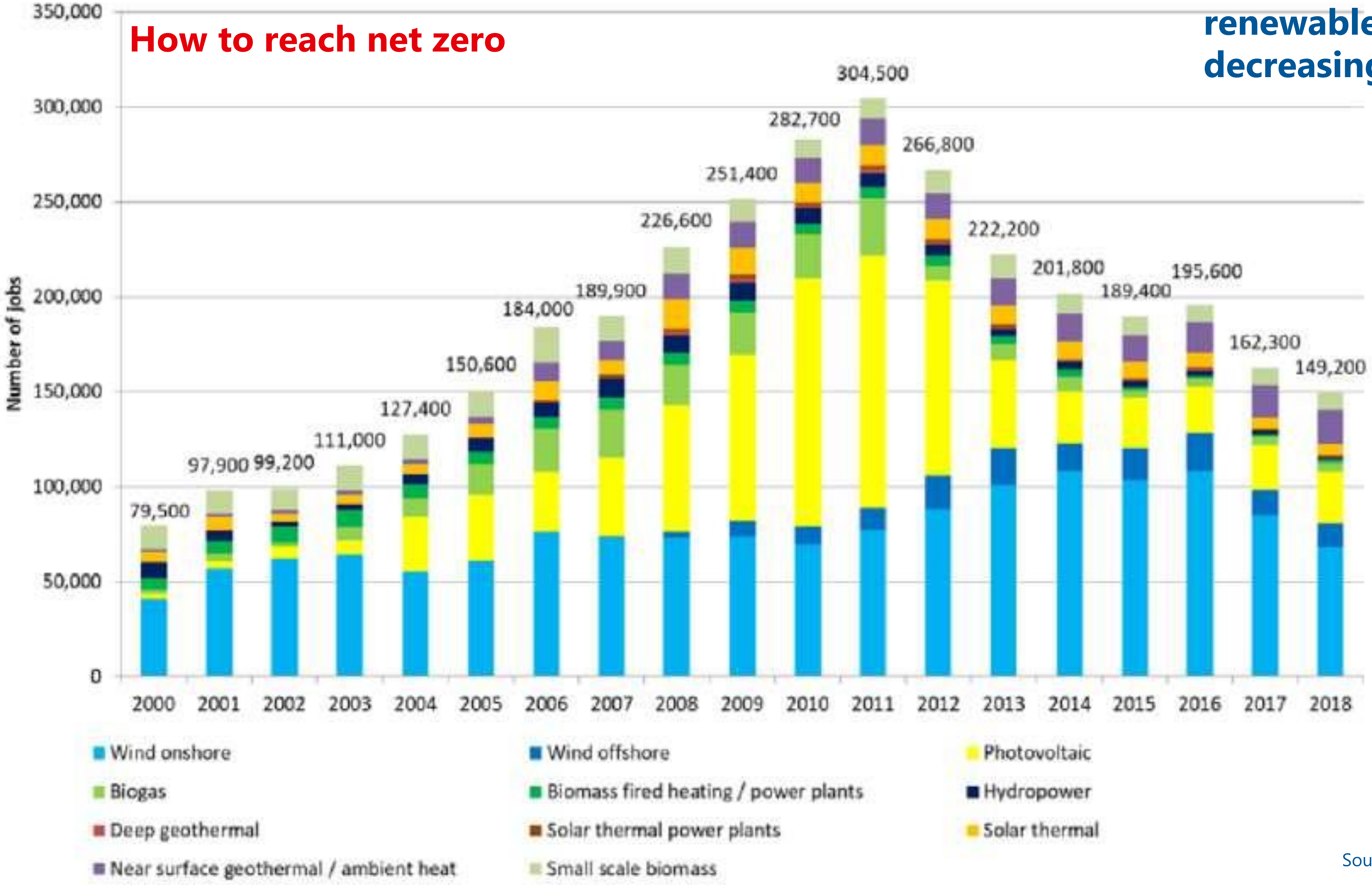
Member states will identify areas worthy of acceleration and renewable energy projects will undergo a "simplified" and "fast permit-granting" process.



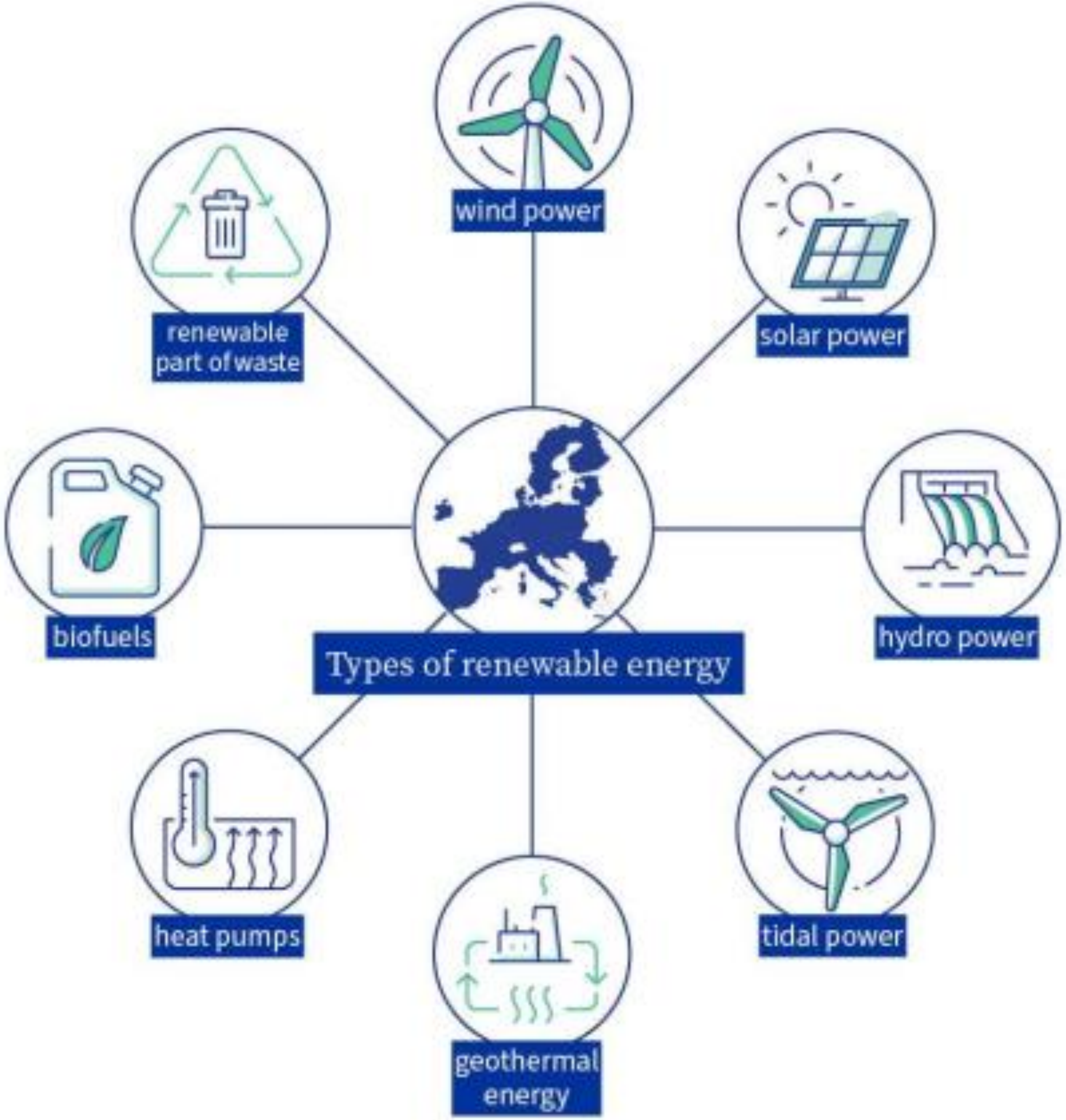
Source: EU Buildings Datamapper | Energy (europa.eu)

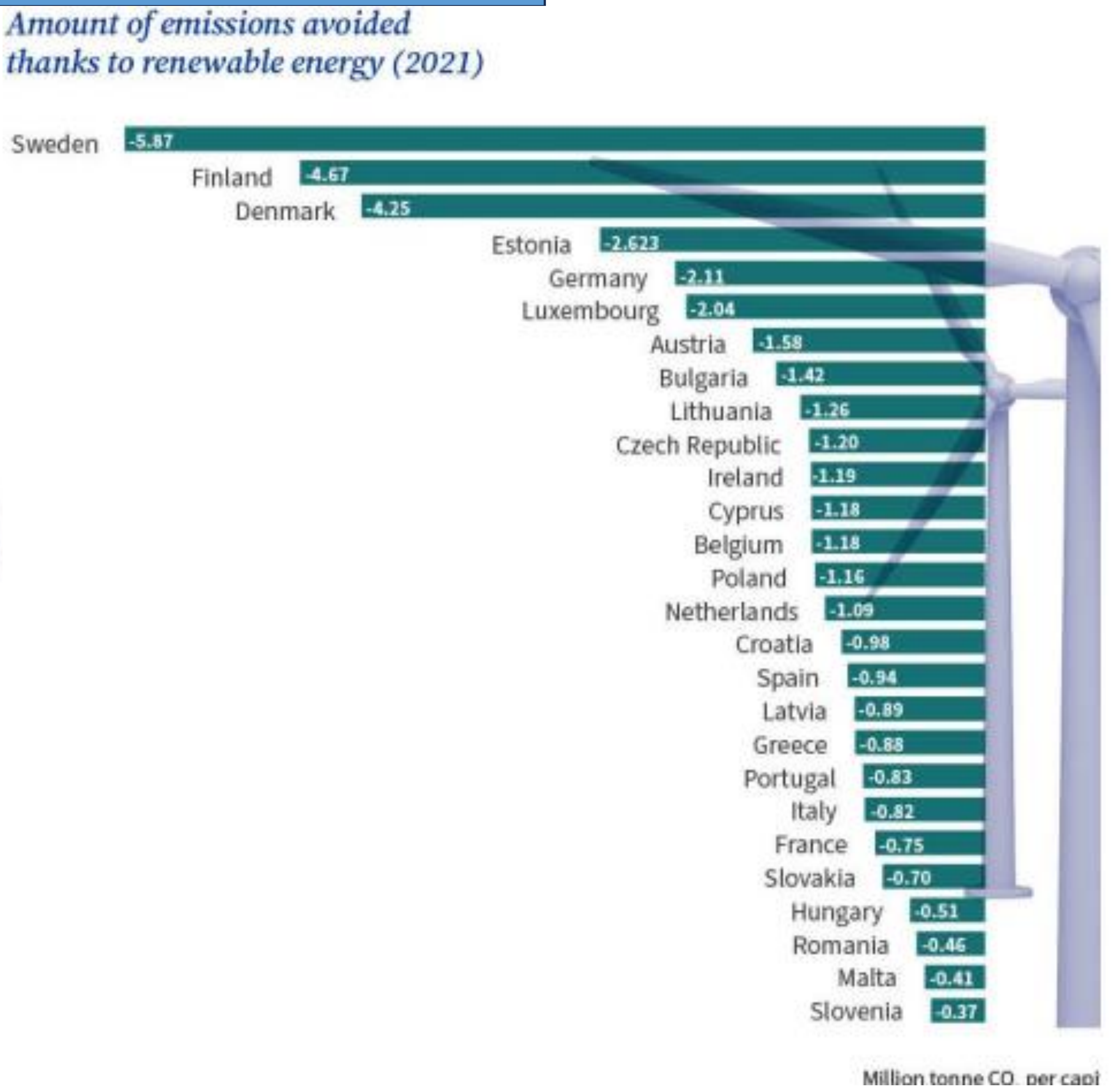
Employment in renewable energy: decreasing since 2011

How to reach net zero



Source: O'Sullivan et al.


Types of renewable energy
wind power
solar power
hydro power
tidal power
geothermal energy
heat pumps
biofuels
renewable part of waste


Amount of emissions avoided thanks to renewable energy (2021)
Sweden -5.87
Finland -4.67
Denmark -4.25
Estonia -2.623
Germany -2.11
Luxembourg -2.04
Austria -1.58
Bulgaria -1.42
Lithuania -1.26
Czech Republic -1.20
Ireland -1.19
Cyprus -1.18
Belgium -1.18
Poland -1.16
Netherlands -1.09
Croatia -0.98
Spain -0.94
Latvia -0.89
Greece -0.88
Portugal -0.83
Italy -0.82
France -0.75
Slovakia -0.70
Hungary -0.51
Romania -0.46
Malta -0.41
Slovenia -0.37
Million tonne CO per capi

Energy Efficiency as a Foundation of Sustainability:

-Reduction of Energy Consumption: Energy-efficient buildings consume less energy for heating, cooling, lighting, and other needs. This directly reduces greenhouse gas emissions and contributes to combating climate change.

-Financial Savings: In the long run, energy-efficient buildings bring significant savings on energy bills. This can motivate investors and property owners to invest in energy-efficient technologies and materials.

-Improvement of Quality of Life: Energy-efficient buildings often have better insulation and ventilation, which improves indoor air quality and the comfort of the occupants.

Other Key Aspects of Building Sustainability:

-Use of Sustainable Materials: Using materials that are recycled, renewable, or locally produced reduces the ecological footprint and supports the local economy.

-Efficient Water Management: Systems for rainwater harvesting, efficient sanitary devices, and wastewater treatment contribute to the conservation of water resources.

-Waste Management: Recycling and responsible management of construction waste reduce the negative environmental impact.

-Local Ecology and Biodiversity: Designing buildings that minimize disruption to local ecosystems and promote biodiversity is crucial for sustainability.

-Location and Transportation: Choosing locations that allow easy access to public transportation, bike lanes, and pedestrian zones reduces car dependency and helps lower transportation emissions.

-Social Sustainability: Involving the community in planning processes, respecting cultural values, and promoting social inclusion are also important aspects of sustainability.

Although energy efficiency represents the foundation of building sustainability due to its significant contribution to reducing energy consumption and emissions, comprehensive building sustainability requires the integration of a wide range of ecological, social, and economic aspects. Only by combining all these factors we can achieve truly sustainable buildings that are environmentally friendly, economically viable, and socially beneficial

Thank you for your attention

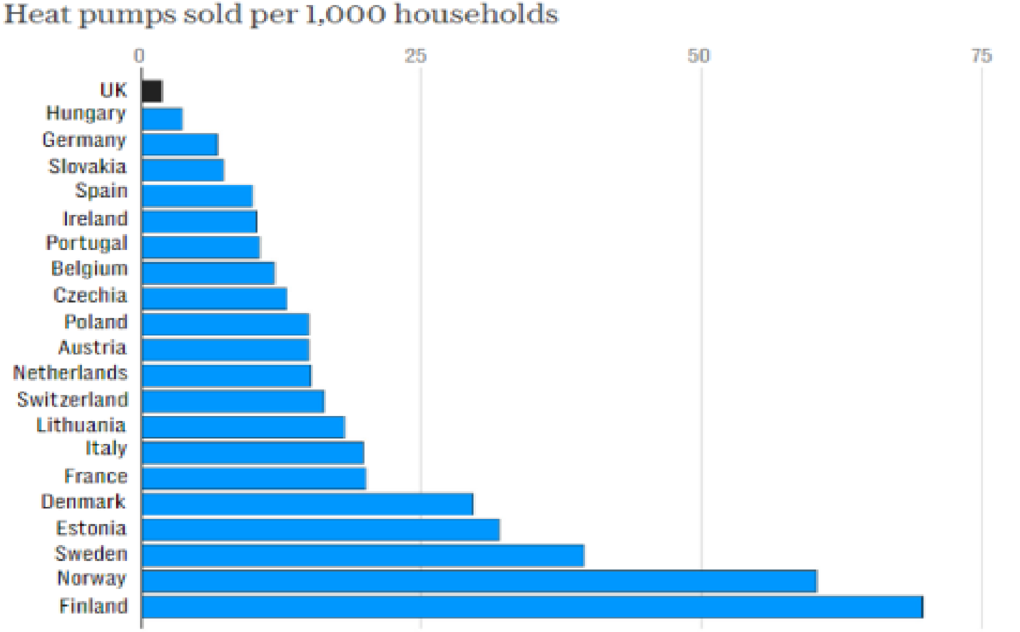
trpevski.strahinja@arh.ukim.edu.mk

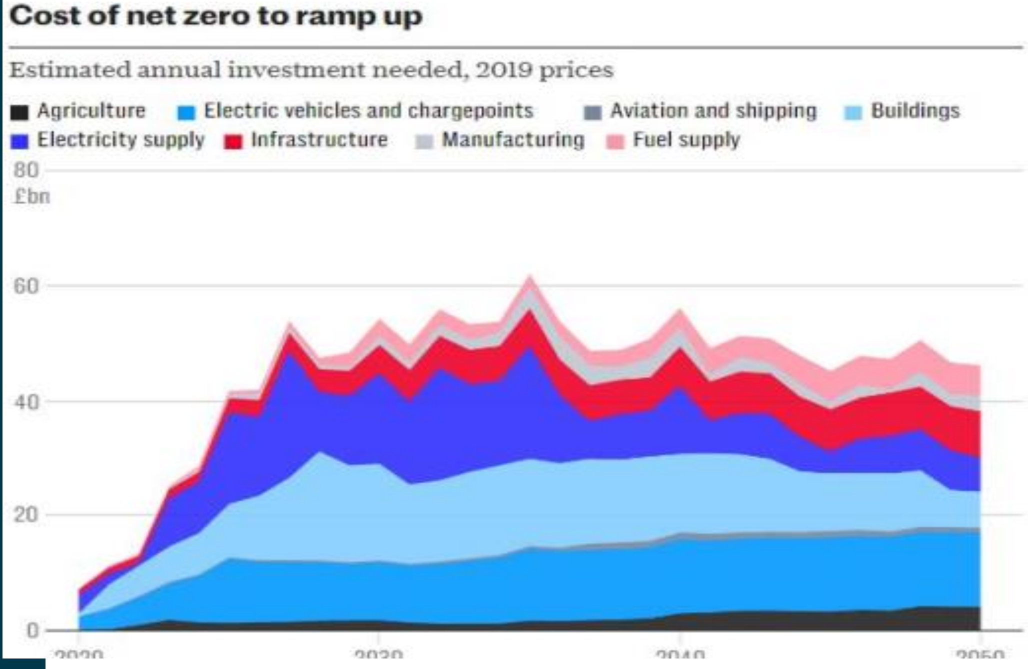
Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or EACEA. Neither the European Union nor the granting authority can be held responsible for them.”

A GLOBAL TREND

How thermally driven heat pumps can help decarbonize heating

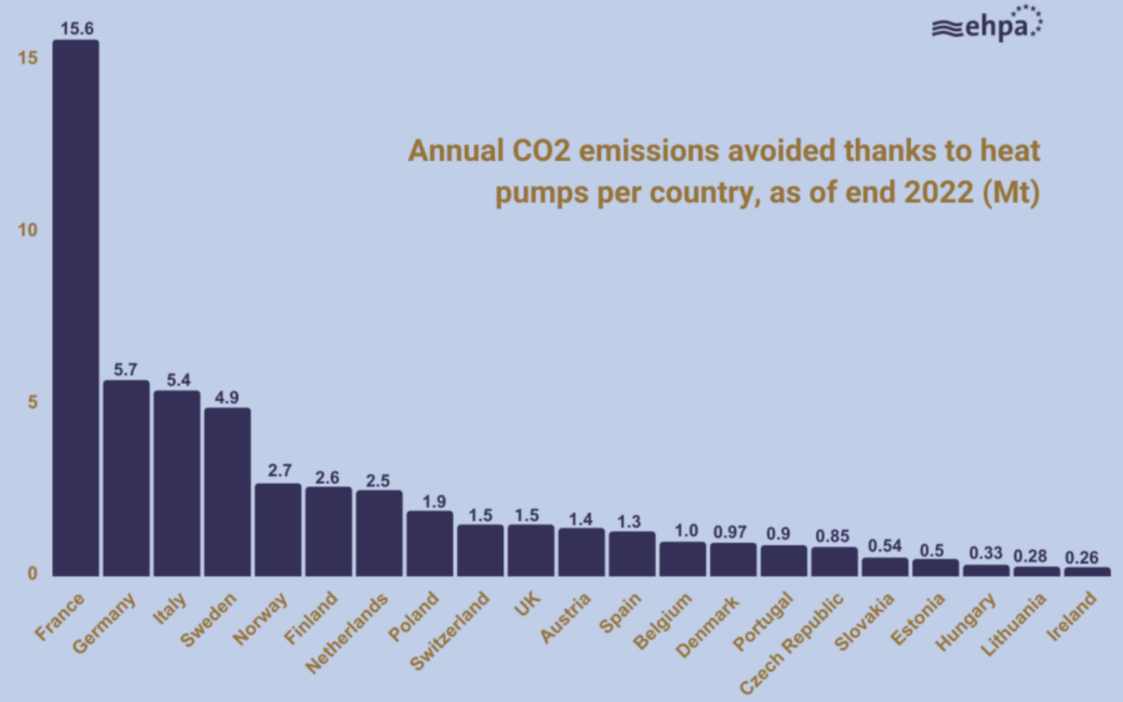
The International Energy Agency estimates that achieving net zero emissions by 2050 will require additional investment in mitigation of $2 trillion to $2.5 trillion globally over the next decade alone.

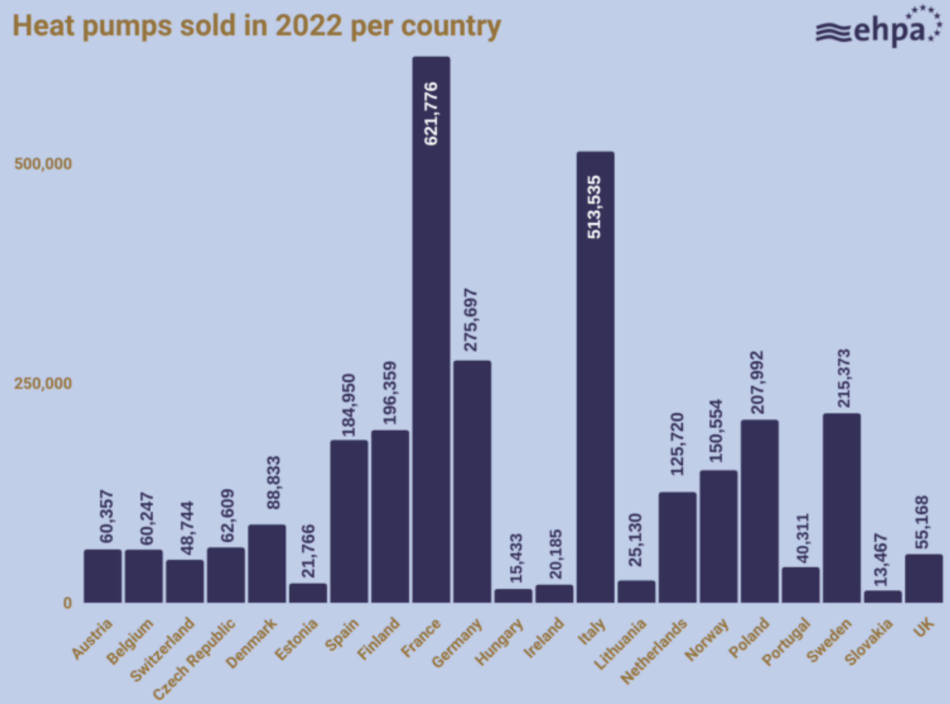


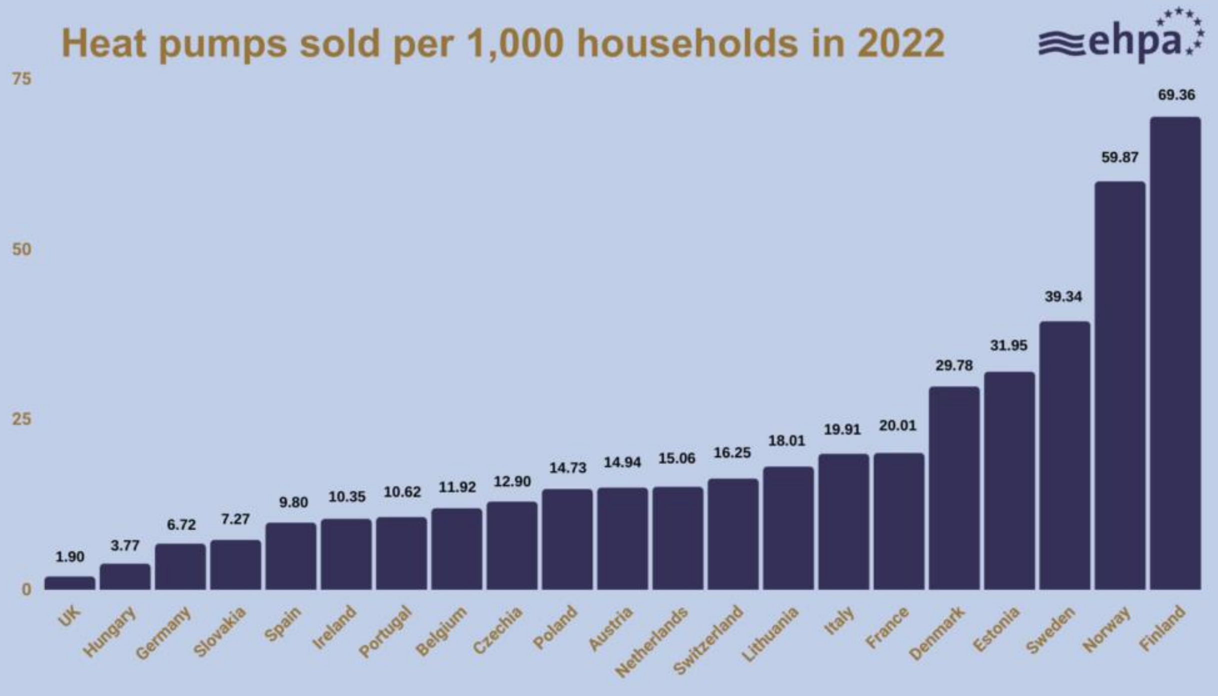


-The 3 million heat pumps added last year bring the total stock of heat pumps to 20 million. These avoid 52.5 Megatons of greenhouse gas emissions per year

-According The ‘Heat Pump Accelerator’- 60 million additional heat pumps need to be installed in Europe by 2030







LARGE HEAT PUMPS IN DISTRICT HEATING

- Mannheim, Germany.

Massive river heat pump launched to warm thousands of homes

- The German project utilises the Rhine's heat to **provide warmth to 3,500 households.**
- **One of Europe's largest river heat pumps** has been officially commissioned in Mannheim, Germany.
- The river heat pump operates by **harnessing heat from the Rhine River, capable of generating water temperatures as high as 99°C.**
- The scale of this river heat pump is considerable, resembling the size of a house.
- The new river heat pump **boasts a substantial thermal capacity of 20MW** and **an electrical capacity of 7MW.**
- It is anticipated to deliver **annual savings of 10,000 tons of carbon dioxide emissions** and is equipped to provide heat to approximately 3,500 households.
- Mr Specht highlighted that expanding and decarbonizing district heating is a crucial component of Mannheim's ambitious plan to achieve climate neutrality.

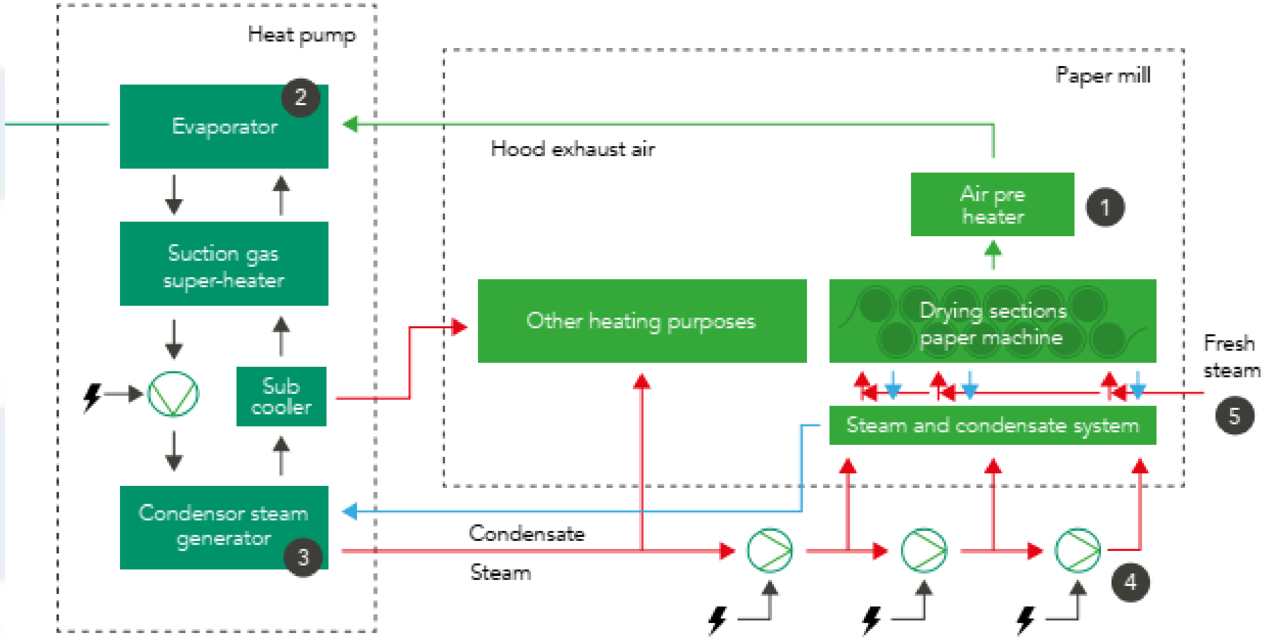
INDUSTRIAL

HEAT PUMPS

Temperature range		Technology readiness level (TRL)	Example process
<80 °C	🟢	TRL 11: Proof of market stability	Paper: De-inking Food: Concentration Chemical: Bio-reactions
80 °C to 100 °C	🟢	TRL 10: Commercial and competitive, but large-scale deployment not yet achieved	Paper: Bleaching Food: Pasteurisation Chemical: Boiling
100 °C to 140 °C	🟢	TRL 8-9: First-of-a-kind commercial applications in relevant environment	Paper: Drying Food: Evaporation Chemical: Concentration
140 °C to 160 °C	🟡	TRL 6-7: Pre-commercial demonstration	Paper: Pulp boiling Food: Drying Chemical: Distillation Various industries: Steam production
160 °C to 200 °C	🟢 🔴	TRL 8-9: First-of-a-kind commercial applications for small-scale MVR systems and heat transformers TRL 4-5: Early to large prototype	Various industries: High-temperature steam production
>200 °C	🔴	TRL 4: Early prototype	Various industries: High-temperature processes

Readiness level: 🔴 TRL 1 to 5 🟡 TRL 6 to 7 🟢 TRL 8 to 11

How a heat pump can be integrated into the paper production process



ABsorption


Source: Robur

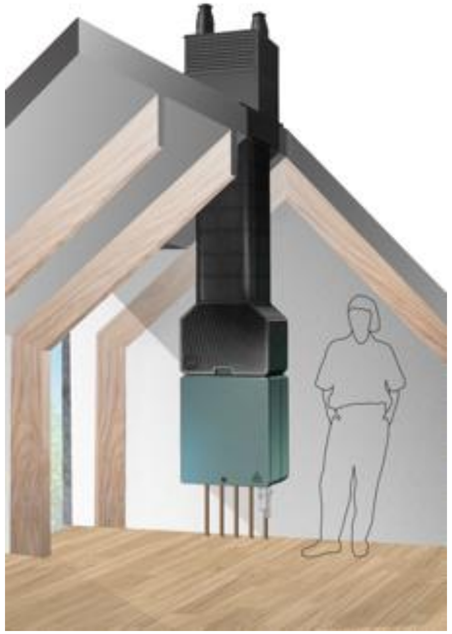

Source: Ariston

- **Liquid solution** is continually circulated
- Natural refrigerant (ammonia-water solution), GWP 0
- Usually **directly fired generator**
- **Most commercially-mature** TDHP option


Source: Elco

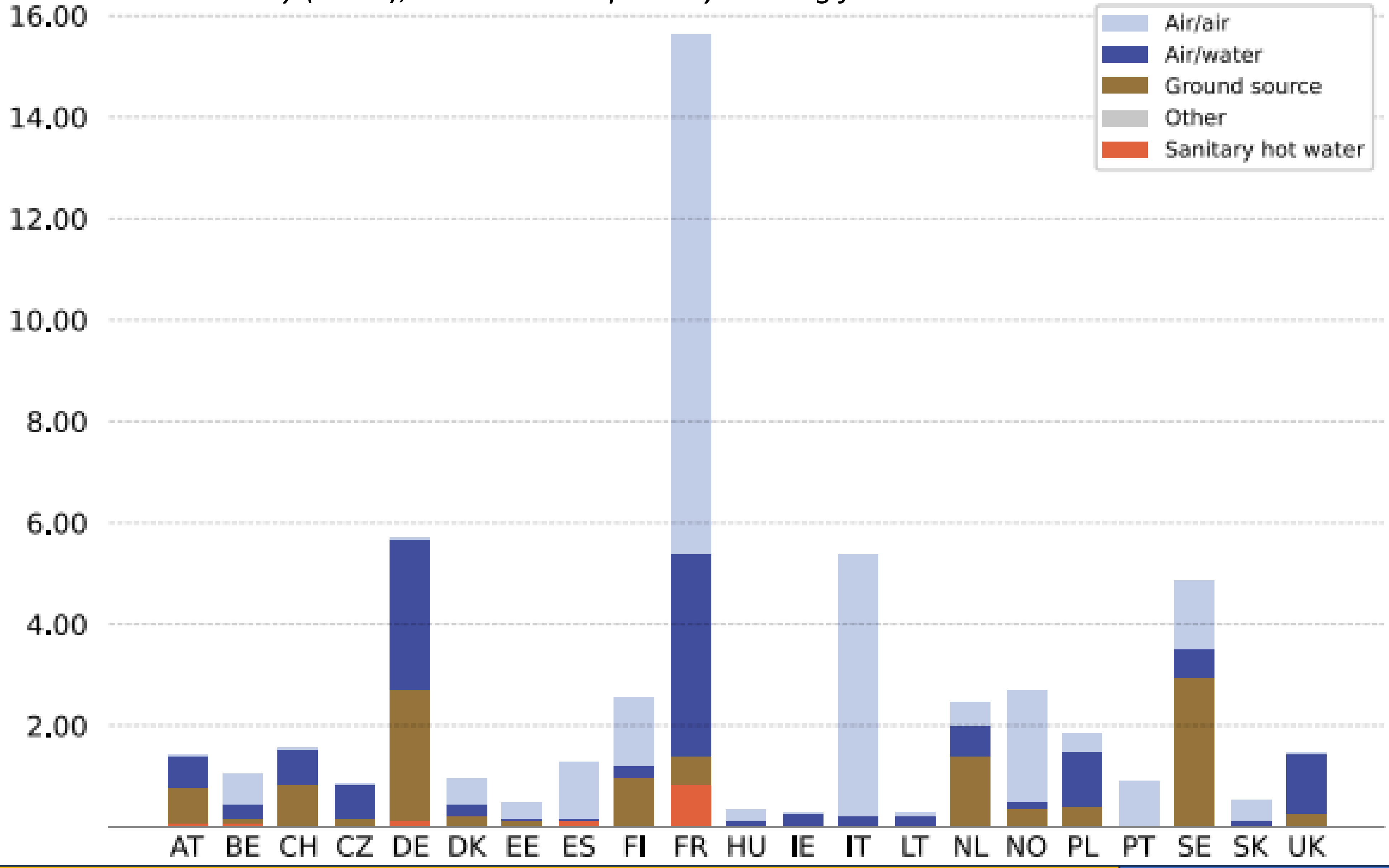
Source: Remeha

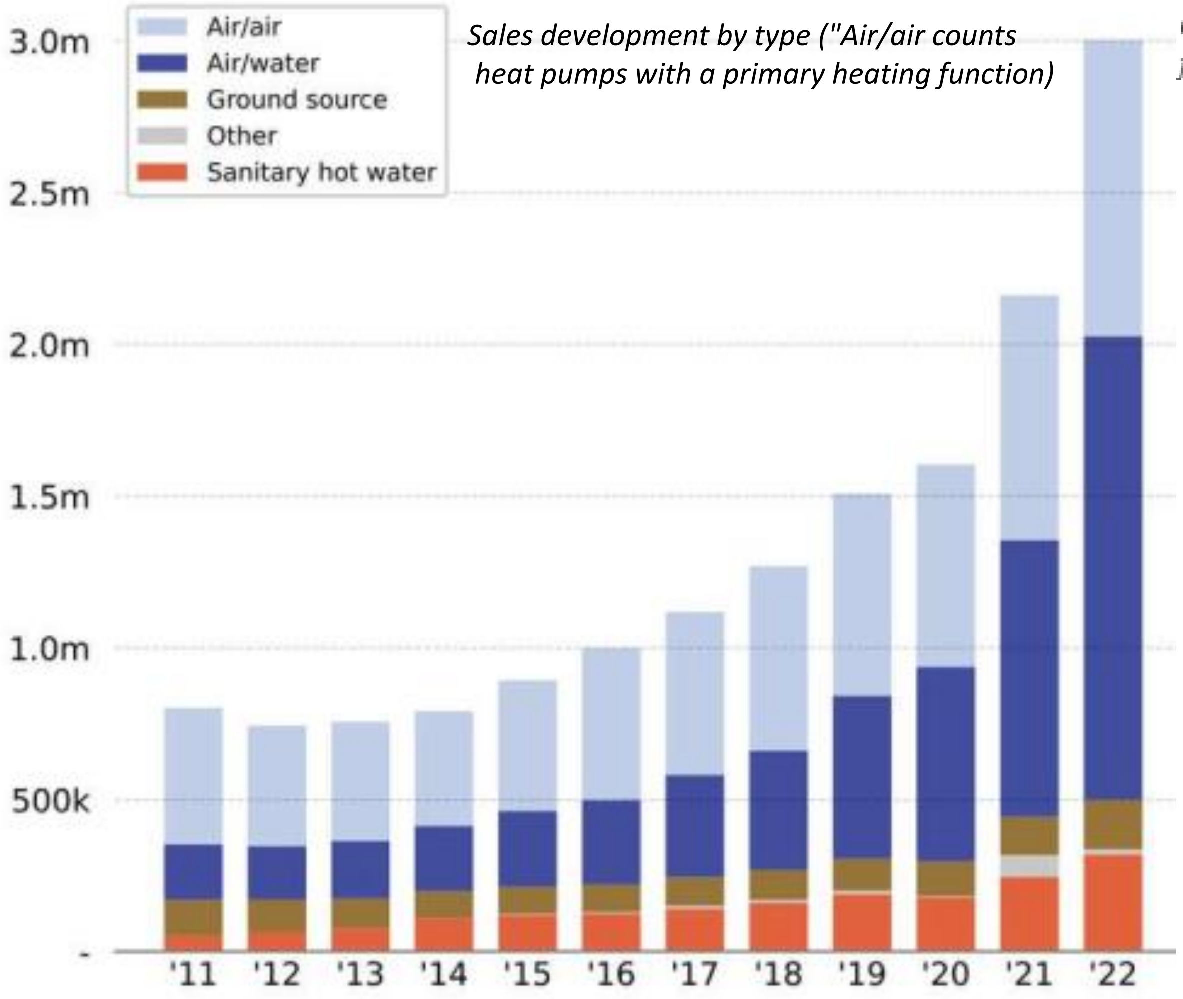
ADsorption



- Batch process **switching between adsorption and desorption**.
- Natural refrigerant (ammonia-active carbon), GWP 0
- More **easily configured as hybrid** solution (heat pumping only in part load, high loads directly by gas condensing boiler)
- Currently **in field tests**

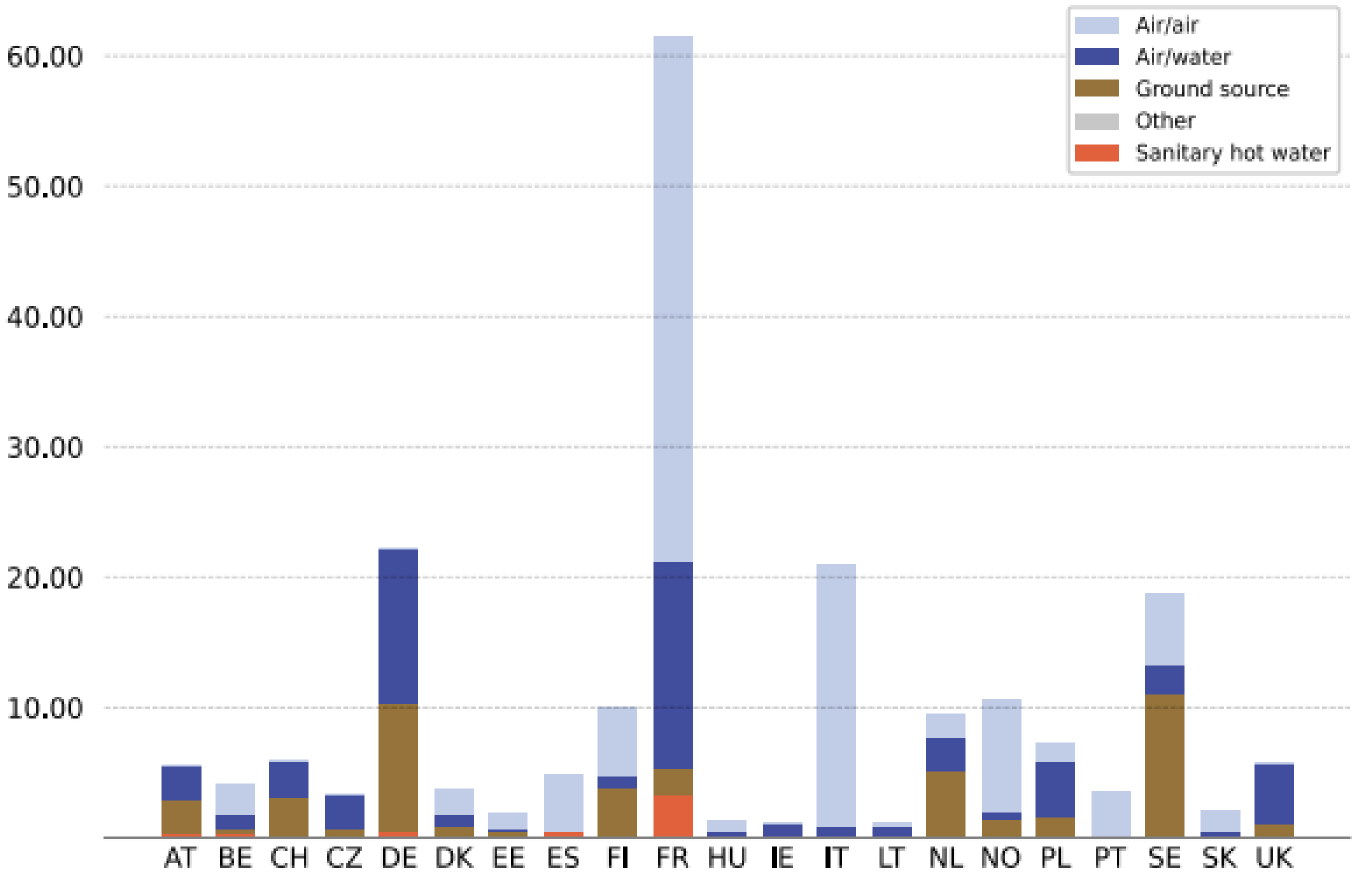
Greenhouse-gas emission savings based on stock 2022, per country (in Mt);"H-" indicates primary heating function





Sales development by type ("Air/air counts heat pumps with a primary heating function)

Chart 1.0-2: Renewable thermal energy provided per country, by type, 2022 (in TWh); "H-" indicates primary heating function



A cosy atmosphere at 40 degrees below zero

Two Supraeco T 480-2 geothermal heat pumps from Bosch cover the complete hot water and heat requirements of a unique holiday resort north of the Arctic Circle.

Picture 1: Two brine heat pumps from Bosch cover the complete hot water and heat requirements of the Arctic River Lodge in Sweden, north of the Arctic Circle, where outside temperatures can be 40 degrees below zero.

Picture 2: A Bosch heating system serves as the new energy source of the Arctic River Lodge. Characterised by a simple, futuristic design, it comprises two cascaded Supraeco T 480-2 geothermal heat pumps.

Picture 3: Two Bosch hot water storage tanks with a capacity of 750 litres each supply all rooms and facilities of the Lodge with sufficient hot water.

Source: Bosch

Facts & Figures

Kind of object: Extended multi-generational house

Heating System: Hybrid system consisting of existing Buderus GB135 oil condensing boiler and new Logatherm WLW 196i-8 AR air/water heat pump.

Heating area: 230 square metres (2 residential units)

Heating capacity: 10.7 kW

Sound power level, outdoors: 53 dB(A)

Year of installation: 2020

COP: 4.29

Refrigerant: 410A

Heating source: Ambient air

Supplied temperature: Max. 62 °C

By Buderus

Picture 1: The Nitschke family lives on a plot of about 1400 square metres with a terrace and garden in the German city of Krefeld.

Picture 2: Well planned and even better equipped: The boiler room with (from left) hot water tank, oil condensing boiler, buffer storage tank, system controller and air/water heat pump from Buderus

Picture 3: The outdoor unit of the WLW 196i-8 in Dirk Nitschke's garden

Source: Buderus

Heating system

3 ELFOEnergy Ground Medium² WSH XEE2 40.2 geothermal heat pumps with water-circuit change over.

Capacity: 420 kW

Temperature: 35°C

No. apartments: 58

COP: 4.5

Refrigerant: R410A

More info: https://www.clivet.com/en/bari-lo-project

Heat batteries & heat pump system removes gas in high-rise tower blocks

An integrated system design allows the removal of gas combi boilers from 364 space-constrained homes – increasing tenant safety and reducing CO_2-emissions

Technical details of the application

- Carbon savings: Approx. 420t/yr (-70%)
- Heating capacity: 308 x 3 kW + 56 x 6 kW (1,26 MW)
- Storage capacity: 364 x 9 kWh (3,28 MWh)
- Heating source: Individual heat pumps (Kensa Shoebox) and heat batteries (Sunamp UniQ) connected to a shared open-loop ground-source system.
- Supplied temperature: Space Heating up to 55°C and Water Heating up to 65°C.

By Sunamp

Picture 1: The towers in Sunderland

Picture 2: The Sunamp UniQ heat battery in place

Picture 3: The Kensa Shoebox HP with the UniQ heat battery in the background

Source: Sunamp

Waterside holiday home is transformed by air-to-water upgrade

Re-thinking the heating in a sixteen-year-old German holiday cottage made it as thermally efficient as the most up-to-date new residential property

"The ecological benefit of this heat source is priceless," according to Heiner Wockel. "We obtain 75 percent of our energy from the ambient air, and only need to supply a quarter in the form of electricity as drive energy. And for this we will later install a photovoltaic system on the roof."

Facts & Figures

Kind of object:	One-family house
Heating System:	1 aroTHERM Split 7 kW Wall-hung module MEH
Heating & cooling area:	140 m²

By Vaillant

23

Picture 1: Sinne Technyk installed Panasonic solar panels and heat pump in a house in Oudemirdum in Friesland, the Netherlands.

Picture 2: The Aquarea T-CAP indoor unit. (Picture at the bottom)

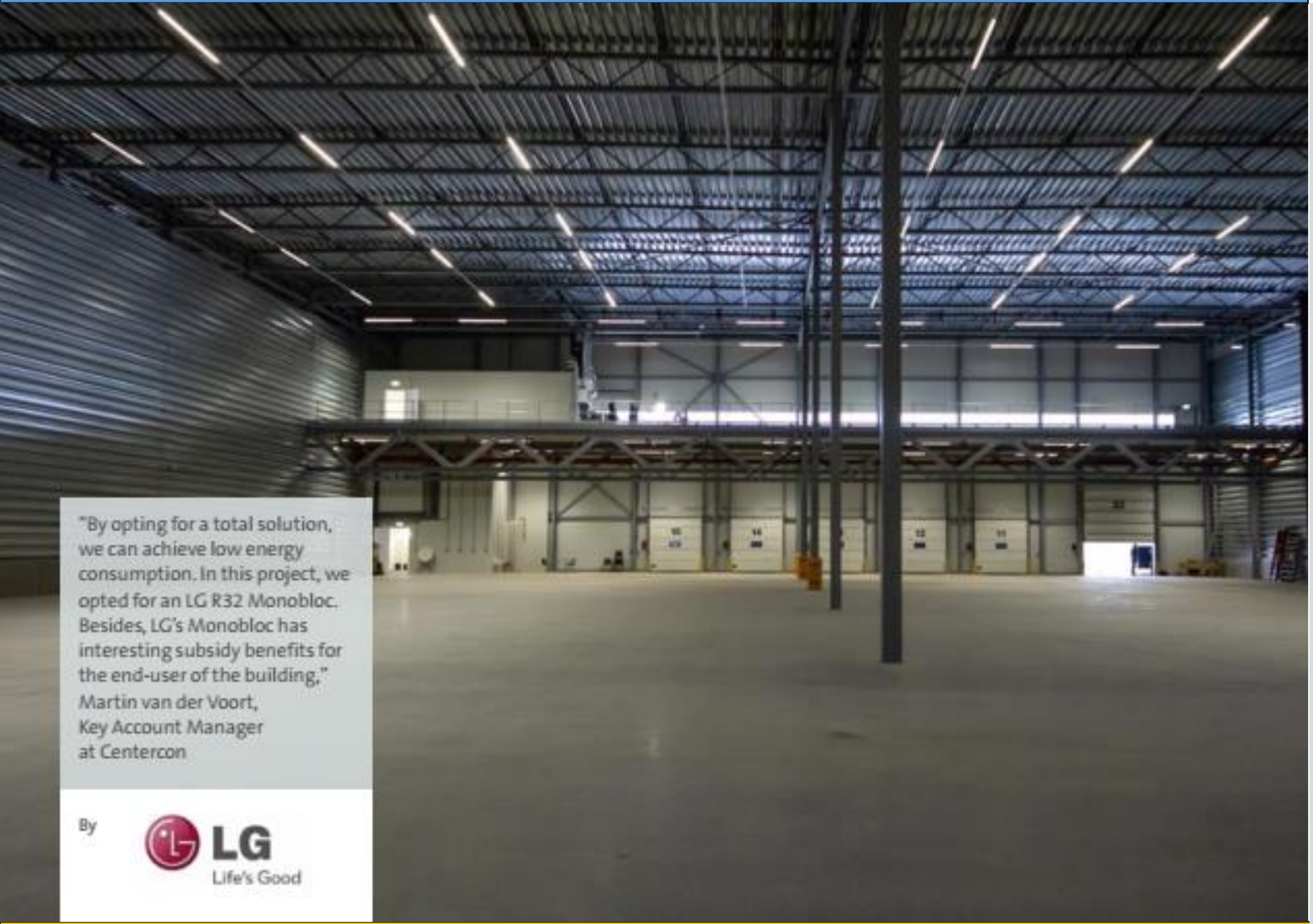
Picture 3: The Aquarea T-CAP outdoor unit (Picture on the top)

Source: Panasonic, Sinne Technyk

"The aim was to realize an energy-neutral home and reduce the usage of gas to zero."

Leo van der Molen, Sinne Technyk

"All-in-one" solution for heating, cooling and hot water in BREEAM certified new office buildings in the port of Amsterdam



Picture 1 (left): Charging area in the warehouse, subject to temperature control

Picture 2 (above): Roof of the office space equipped with the LG air to water heat pump and LG PV panels

Source: LG

Renovation of the historical palace in Chorzów with heat pumps – Heat4Cool project

Picture 1 (above):
Historical façade of the Polish demo site

Picture 2 (below):
DC heat pump installed in Chorzow

Picture 3 (right): PV modules installed on the roof

Source: Heat4Cool project

Technical details of the application

- Heating capacity: 30 kW
- COP: 4,34 at A7 W35
- Refrigerant: R134a
- Heating source: air to water
- Supplied temperature: 55 °C

By HEAT4COOL

Single house refurbishment with heat pumps and solar thermal – Sunhorizon project

Sun coupled innovative heat pumps, efficient solutions for residential and tertiary buildings

Picture 1: Façade of demo site.

Picture 2: BoostHeat thermal compression heat pump

Picture 3: TVP Solar vacuum solar thermal panels

Source: SunHorizon project

CASE STUDY
THE WAVES - BELGIUM

Vaillant

Yannick De Mol and Leandro Depaepe, Vaillant

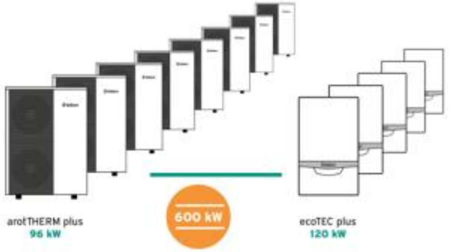
The challenge

New build holiday accommodation with 118 apartments at the Belgian seaside with fluctuating occupancy of the building

- Holiday periods: high occupancy
- During working days: low occupancy
- Ready to connect to district heating
- Complex system due to high rise building

The process

Chosen system: Hybrid installation: 5 ecoTEC pl condensing boilers combined with 8 aroTHERM p monobloc air/water heat pumps



A sustainable system with the aroTHERM plus air/water heat pumps during low occupancy

Ability to absorb peaks with the 5 ecoTEC plus gas condensing boilers

Collective boiler room: building will eventually be connected to district heating

The outcome

Consumption:

- 90 %/year = heat pump
- 10 %/year = gas condensing boilers
- Only 30 € energy costs/month for the residents

R290 NATURAL PERFORMANCE

- Use of **Natural refrigerant R290**
  In line with the future fgas regulations
- **COP**: maximum 5,4 (A7/W35)
- Capacity: 600 kW with gas condensing boiler and 96 kW with air/water monobloc heat pumps
- Reduced Energy costs of 60% compared to the old gas fired systems

#WHY WAIT

Leandro Depaepe, Sales Manager North West Flanders
Yannick De Mol, Sales Engineer Projects

CASE STUDY

DAISYFIELD,
TOGETHER HOUSING

DAVID BROOM, KENSA CONTRACTING

The challenge

The aim was to move away from fossil fuels, maintain residents' comfort and safety, and save money on their heating bills.

- Replacing redundant gas boiler system
- De-gas building
- Safeguarding residents
- Reduce compliance costs
- Reduce carbon emissions
- Tackling fuel poverty

The process

- Part of £4.6m retrofit upgrade scheme
- 183 flats across 3 high-rise tower blocks – residents in-situ
- Kensa's Shoebox ground source heat pumps
- Shared Ground Loop Array system architecture
- Heating system upgrade & additional measures

The outcome

- Kensa's GSHP system was the lowest carbon and also lowest lifetime ownership cost solution, plus a path to net zero
- Non combustion GSHPs ensured tenant safety and improve air quality
- Estimated lifetime CO_2 savings of 6,556t
- Reduced lifetime ownership cost to landlord
- NDRHI income

H&V news AWARDS 2022 FINALIST

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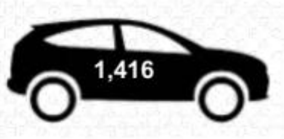

Boosting Energy Performance

Touron de Gloire Lourdes France

Hervé Pierret
Section Manager, Marketing & Business Intelligence
Daikin Europe

The challenge

- Social housing renovation project
- Reduce the building's energy consumption and tenants' energy bills.
- Complex :
  - 197 apartments in total, situated on a hill side
  - Current heating system : Electric heaters and hot water tanks
  - Energy rating : F
- Renovation target :
  - obtain energy rating = C
  - drastically reduce greenhouse gas emissions

The process

- Choice for air-to-water heat pumps.
  - Currently off-grid location
  - Gas connection installation = too expensive
  - Gas = not reducing CO2 emissions
- Daikin Altherma 3
  - Meeting energy performance requirement of the project
  - Provide heating
  - Hot water provide by separate domestic hot water tank.
  - Running on R-32, low GWP refrigerant
  - Allows to have a phased implementation: renovation work divided into 3 phases
- Installation
  - Outdoor unit : on apartment balconies
  - Indoor unit : kitchen
  - + new low temperature radiators
  - Replacement of electric heating with hydronic heating/piping

The outcome

- 85% completed (167 apartements)
  - Project work initiated October '19
  - Phase 1 finalized October '21 (60 apts)
  - Final completion by end '23
- Energy level improvement (F -> C):
  - Awaiting confirmation from the Social Housing authorities
- Air-to-water heat pumps are a viable solution
  - Apartments in individual set up
  - Financially affordable
  - Tenants of social housing to have reducing heating bills