

Innovative Energy Technologies in Austria, Market Development 2022

Presentation of Results

Vienna, 26 June 2023

Project Team



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Commissioned by BMK

Contents of the Presentation

- Project targets
- Framework conditions of the market development 2022
- Results of the investigated technologies
- Summary
- Conclusions

Investigated Technologies

- Photovoltaics
- Battery storages in photovoltaic systems
- Solid biomass – fuels
- Solid biomass – boilers and stoves
- Innovative energy storage systems
- Solar thermal systems
- Large scale heat storages in heat grids
- Wind power
- Heat pumps
- Thermal activated building parts

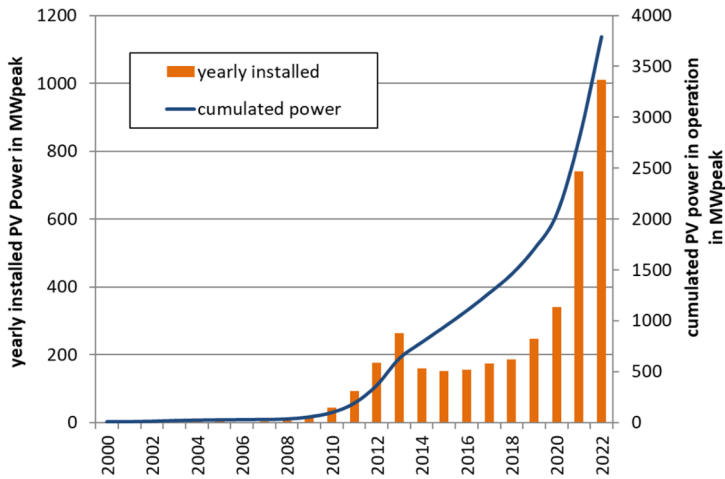
Project Targets

- Empirical survey and documentation of the market development
- Information processing and analysis
 - Energy output
 - GHG-emission savings
 - Economic effects
 - Innovations and trends
 - Market diffusion compared to roadmaps
- Deriving of conclusions
- Target groups: Energy-, research- and environmental policy, industry, R&D institutes

Framework Conditions Market Development 2022

- Compulsory climate and energy targets 2030/2040 for AT, EU and globally
- Strong investment incentives through federal government and federal states
- Massive and general increase of energy prices
- Uncertainties in regard to security of supply with natural gas
- Highest inflation since 1974 with 8.6 % in 2022
- GDP increase AT: 5.0 %, euro area: 3.5 %
- Unemployment rate AT: 4.8 %, euro area: 6.7 % (Def. Eurostat)

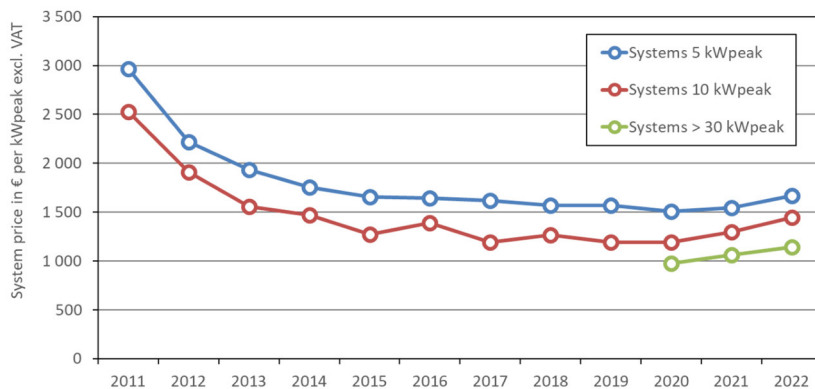
Photovoltaics: Market Development 2022



Source: Technikum Wien

- New installations: 1.009 MW_{peak}
- 2021→2022: +36,4 %
- Stock: 3.8 GW_{peak}
- 2021→2022: +36,3 %

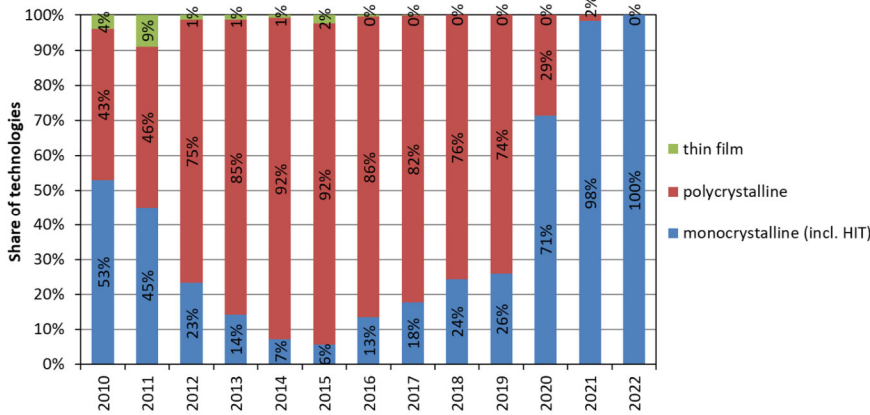
Photovoltaics: System Prices



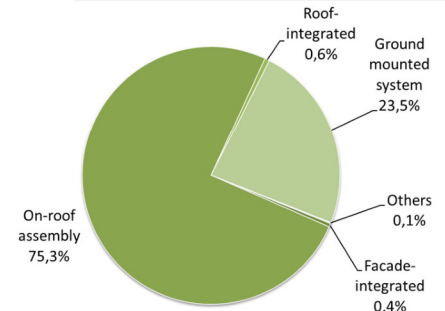
Source: Technikum Wien

- System prices of 5 kW_{peak} systems increased by 8.2 %
- System prices of 10 kW_{peak} systems increased by 11.6 %
- System prices of >30 kW_{peak} systems increased by 7.1 %
- Rising personnel costs as a price driver

Photovoltaics: Technology and Type of Assembly



New installations 2022

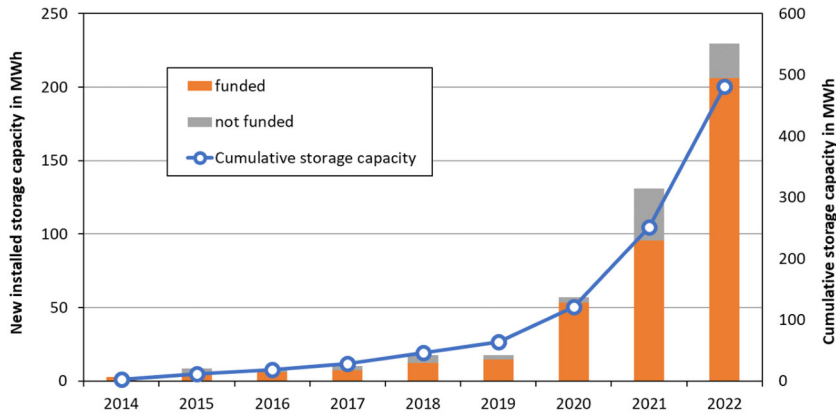


Source: Technikum Wien

Photovoltaics: Conclusions

- Positive development, however, 2030 targets cannot be taken for granted
- Grid access and a lack of qualified professionals are serious risk factors for 2030 and 2040
- The end of the story in regard to the annual installation figures has not been reached
- Increasing dependency on Asia

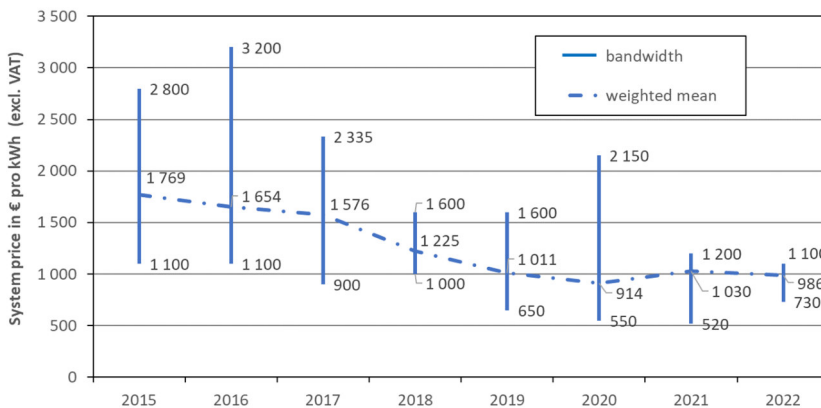
PV Battery Storages: Market Development 2022



- New installations: 230 MWh
- 2021→2022: +75.2 %
- Stock: 481 MWh
- 2021→2022: +91.3 %

Source: Technikum Wien

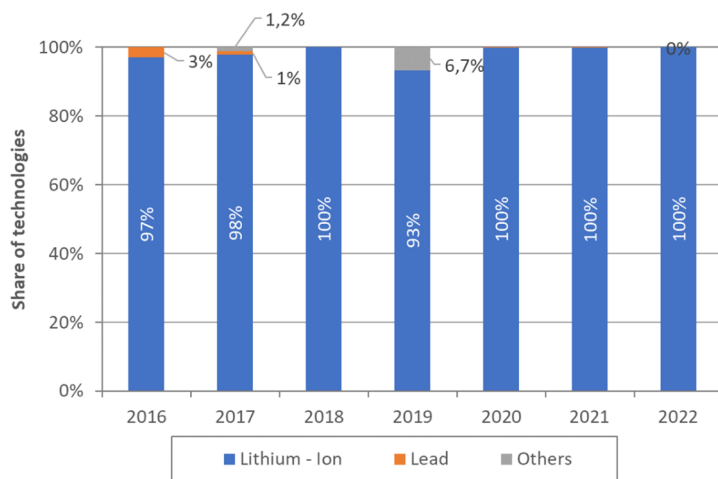
PV Battery Storages: System Prices



- End customer system price 2022: 986 €/MWh
- 2021→2022: -4.3 %

Source: Technikum Wien

PV Battery Storages: Share of Technologies



Source: Technikum Wien

- Lithium-ion dominant technology
- High percentage of DC-coupled systems
- Continued high proportion of new installations

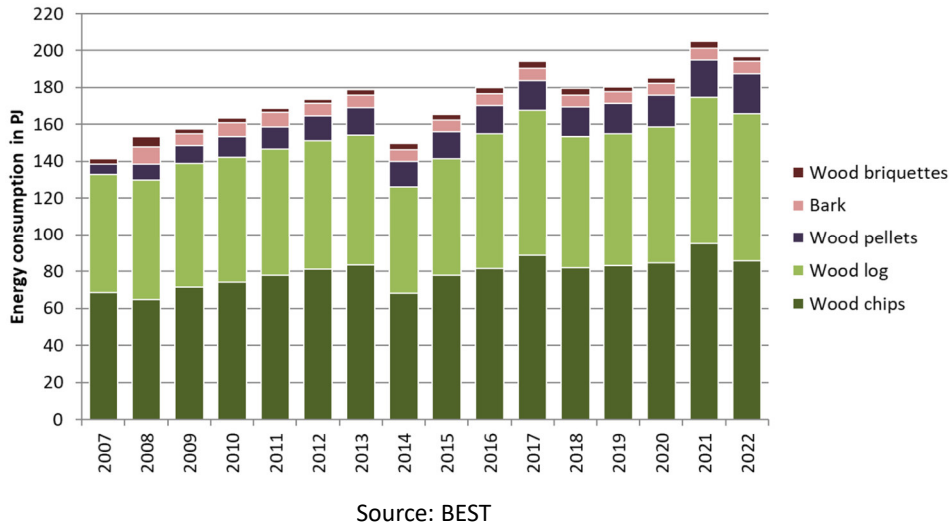
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PV Battery Storages: Conclusions

- Further missing grid and/or system usefulness
- Need for target oriented subsidy mechanisms
- Clear strategies for the expansion of energy storage devices as well as further flexibility are missing

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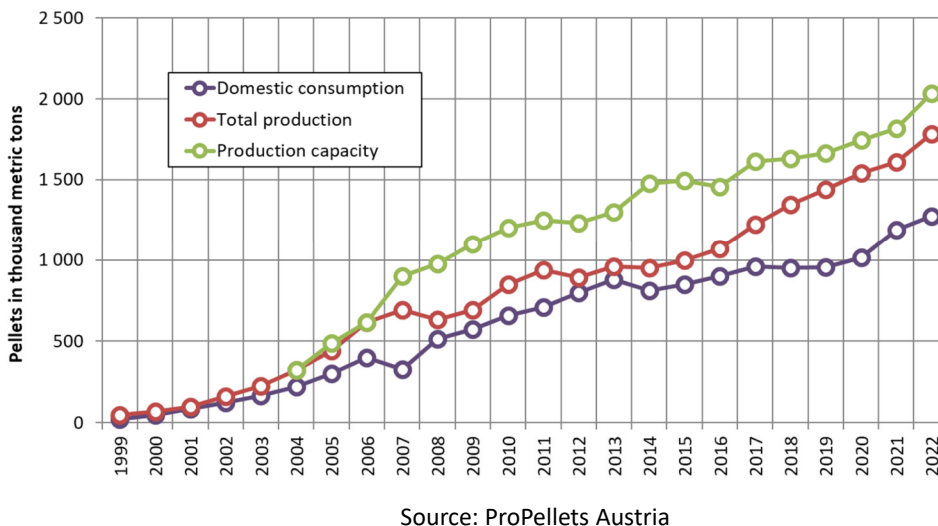
Solid Biomass – Fuels: Market Development 2022



2021 → 2022:

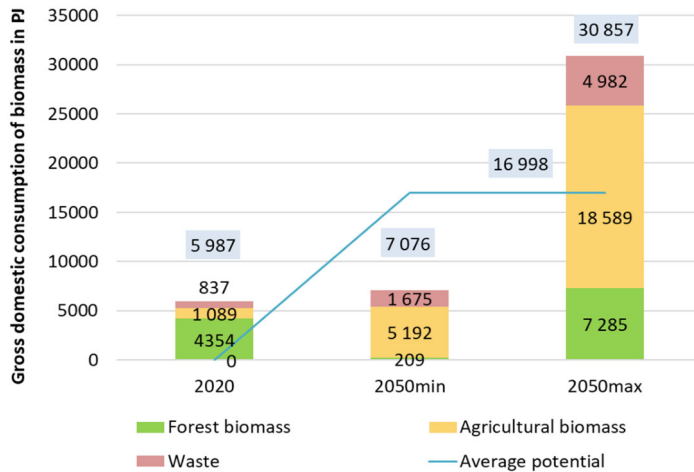
Briquettes:	-24 %
Pellets:	+7 %
Bark:	+7 %
Wood chips:	-10 %
Logs:	+0 %
Total:	-4 %

Solid Biomass – Fuels: Production of Pellets



- Constant expansion of production capacities
- Proposal for anchoring the obligation to stockpile pellets in the Raw Materials Stockpiling Act
- High pellet prices = image damage

Solid Biomass – Fuels: Biomass Potentials



Source: Bioenergy Europe (2022), Faaij (2018)

- EU: Shift from forest to agricultural biomass
- AT: forest biomass still dominant
- Waste use in terms of a sustainable bioeconomy

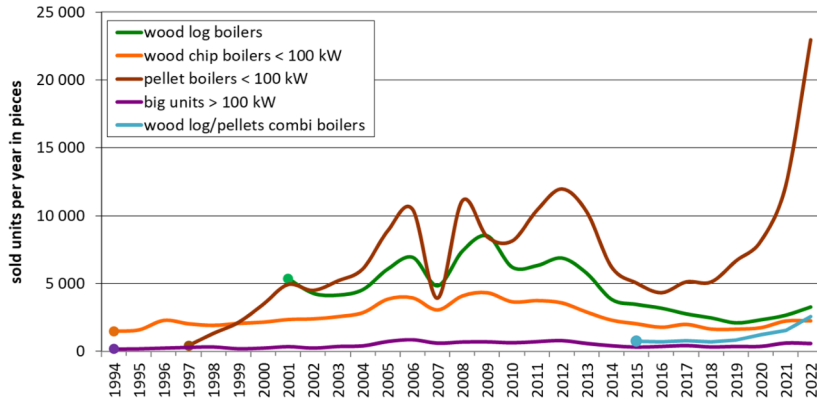
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Solid Biomass – Fuels: Conclusions

- Biomass fuels = energy suppliers and energy storage regardless of weather
- The thermal transformation of biomass is part of the circular economy (production of bio-based raw material as e.g. carbon black or pyrolysis oil)
- High prices for biomass in 2022 = obstacle for further market diffusion (competitive drawback in comparison with other renewable technologies)

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Solid Biomass – Boilers: Market development 2022



Source: BEST

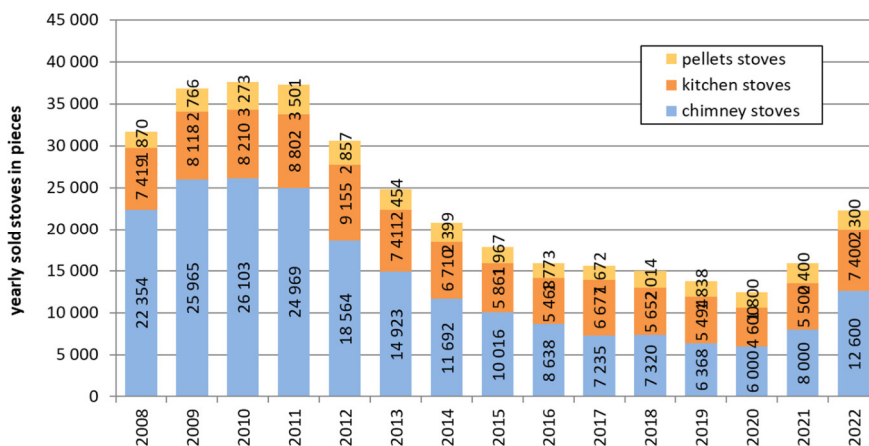
2021 → 2022:

in total 31,645 pieces

Pellet boilers:	+88 %
Combined pellet boilers:	+69 %
Log boilers:	+23 %
Wood chips to 100 kW:	+1 %
Wood chips >100 kW:	+0 %
Total:	+64 %

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Solid Biomass – Stoves: Market Development 2022



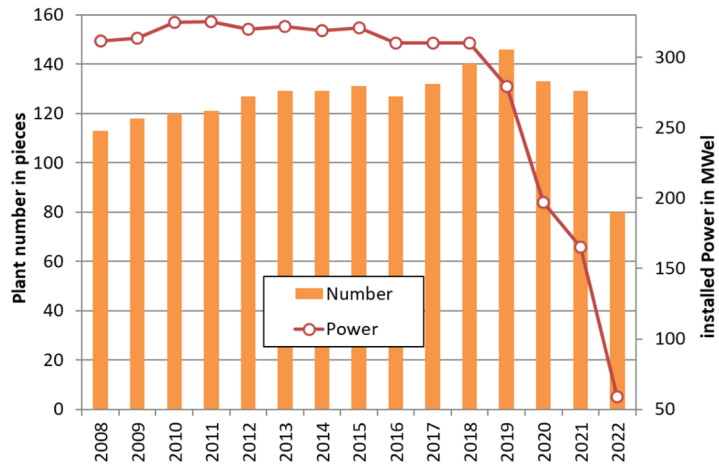
Source: BEST

2021 → 2022:

Pellet stoves:	-4 %
Kitchen stoves:	+35 %
Chimney stoves:	+58 %
Total:	+40 %

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Solid Biomass – Development of Green Power Plants



Source: OeMAG

- 2021 → 2022: -38 %
- Main reason for the decline: expiry of the green electricity tariff
- Strong contradiction to the expansion target anchored in the EAG (+3.6 PJ)

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Solid Biomass – Boilers: Conclusions

- Austrian biomass producers are well prepared for an increased demand (limiting factor: skilled personnel, heating engineer)
- Up to 2050 the supply of space heating through solid biomass will be less important (exception: comfort & back-up system)
- Process heat has a great potential of contributing to the decarbonisation of the energy system (e.g. green gas, synthetic fuels)

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Innovative Energy Storage: Definition

- Hydrogen storage & Power-to-gas (fuel cell, electrolysis)
- Innovative stationary electric storages (brine battery, Redox-flow battery)
- Latent heat storage (Phase Change Material – PCM, ice storage)
- Thermochemical storage (absorption- and adsorption storage)

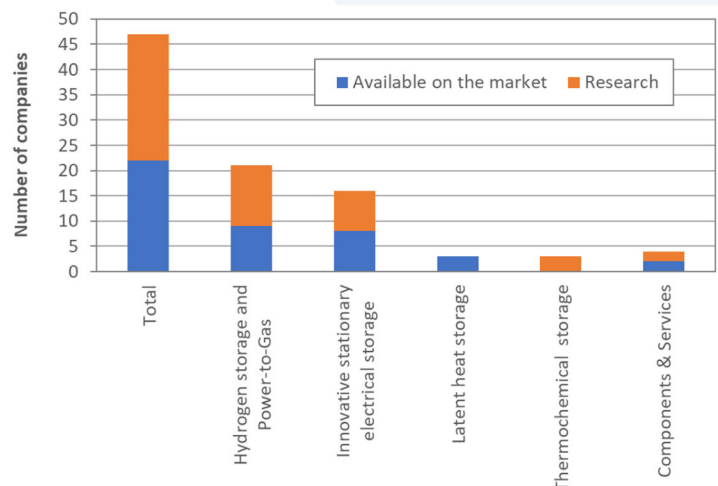
Local limitation

- Austrian producers respectively Austrian market
- Austrian research activities
- Sold units or realised pilot- and demonstration projects

Innovative Energy Storage: Market Participants

Company and research institutions innovative storage technologies in Austria

Number of companies and research institutions that research innovative storage technologies or offer those on the Austrian market.



Source: BEST

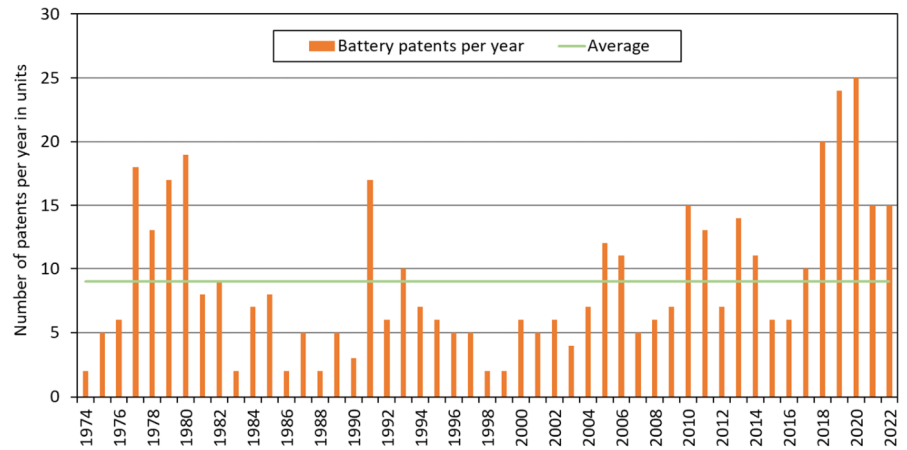
Innovative Energy Storage: Patents

The number of patent applications gives insight into the research activities

Amount of annually submitted battery patents in Austria:

Ø 1974 to 2022: 9,0

Ø 2018 to 2022: 19,8

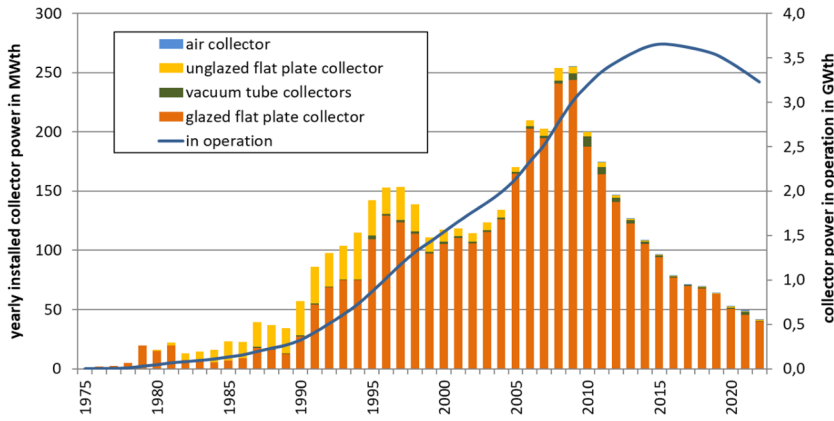


Source: Austrian patent database, evaluation BEST

Innovative Energy Storage: Conclusions

- The number of identified companies and research institutions has increased from 36 to 47 in 2022 in comparison to 2020
- The number of patent applications in the area batteries, hydrogen and fuel cells has clearly increased over the last 5 years
- The field is still rather limited
- An expansion of research and development will be necessary in order to persist in the international competition

Solarthermics: Market Development 2022



Source: AEE INTEC

Standard collectors

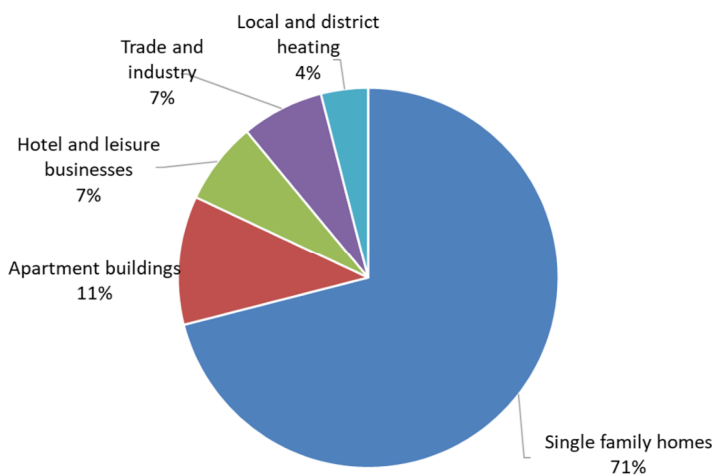
- New installations: 41.4 MW_{th}
- 2021→2022: **-16 %**
- Stock: 3.2 GW_{th}
- 2021→2022: **-6.3 %**
- Export: 375 MW_{th}.
- 2021→2022: **+16 %**

Solar hybrid collectors (PVT)

- New installations: 1,003 m²
- 2021→2022: **±0 %**

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Solarthermics: Areas of Application

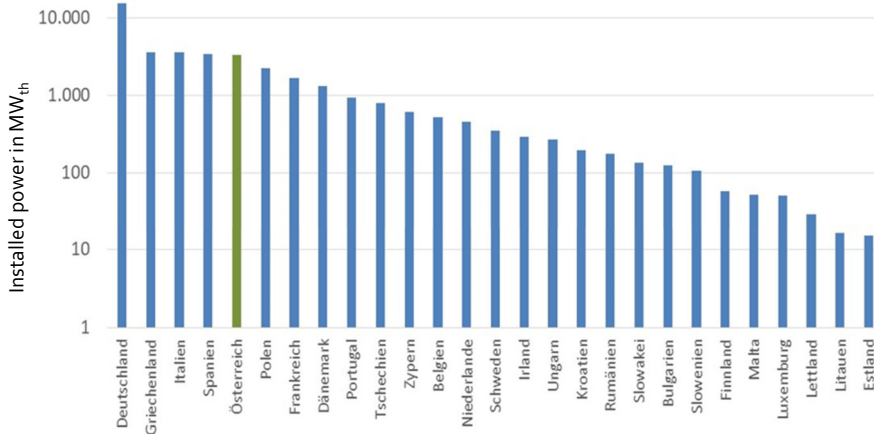


Source: AEE INTEC

- Implementation in the area single-family houses dominate the market 2022
- The technology could not profit from the booming exchange of heating boilers in the area single-family houses
- Large-scale plants could not compensate the decrease in the housing sector in 2022

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Solarthermics: Total Performance in Comparison with the EU



Source: AEE INTEC

- With 3,2 GW_{th} of implemented performance Austria is in 5th place, in the 1st place per inhabitant
- The density of solarthermics is twice as high than e.g. in Germany
- Austria lost a place in 2022
- Strong market growth in IT (43 %), FR (29 %), GR (17 %), DE and PL (11 %)

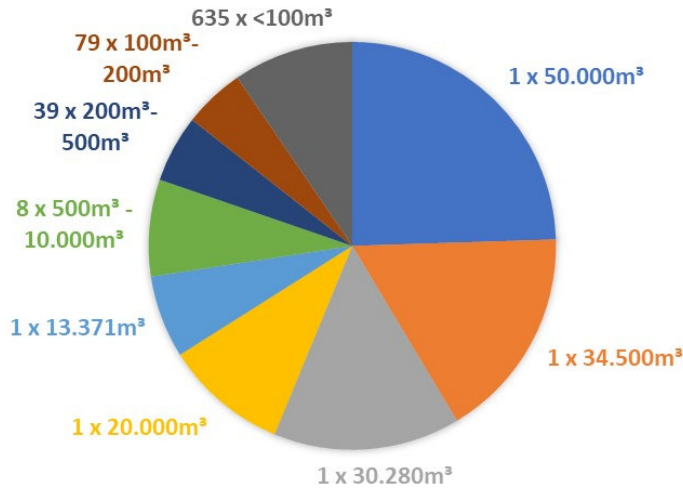
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Solarthermics: Total Performance in Comparison with the EU

- New impulses in the subsidies policy (housing sector) are needed – two-digit growth figures in countries as e.g. DE, IT, FR, GR, PL show how to do it!
- Presently projects exceeding 640 Mw_{th} are being developed in the sector of large-scale plants. The large-scale plants sector needs continuity especially regarding the subsidies policy!
- With 95 % export ratio the branch is an important supplier on the world market and has with 70 % a very high value-added share
- Long-term technology leadership caused a high sovereignty of technology that has to be upheld with specific RTI activities (e.g. hybrid collectors, multivalent systems, seasonal heat storages, solar reactors etc.)

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Large Heat Storages: Usage in Heat Grids 2022

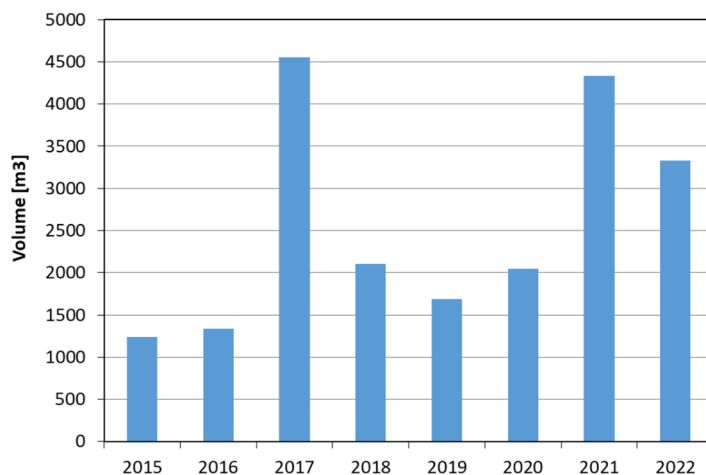


Source: AEE INTEC

- **1.073 Heat grids** with a total sales of heat of 20,8 TWh provide the database (>90 % of in AT consumed district heating)
- Multiple creation plants and sources → **high demand for flexibility**
- **End 2022:** 1,015 container storages with 204.099 m³ (8.3 GWh) in 766 installed heat grids; 2021→2022: +1.6 %
- **New installations** in 2022 in the segment between 100 m³ and 10.000 m³

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Large Heat Storage: Market Development 2015 to 2022



Source: AEE INTEC

- Illustration with time series with current data base possible since 2015
- Installed in 2022: 3,326 m³ (0.14 GWh storage capacity)
- 35 container water storages
- The largest container water storage in 2022 had 1.400 m³

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Large Heat Storage: Largest Storage Installed in 2022



Source: © www.kremsmueller.com

- District heat Hall, Tirol
- 1.400 m³
- Spot weld
- Storage usage:
 - - P2H (20 MW)
 - - load management (18 MW)
 - - industrial waste heat
- Costs: ~1.300 €/m³

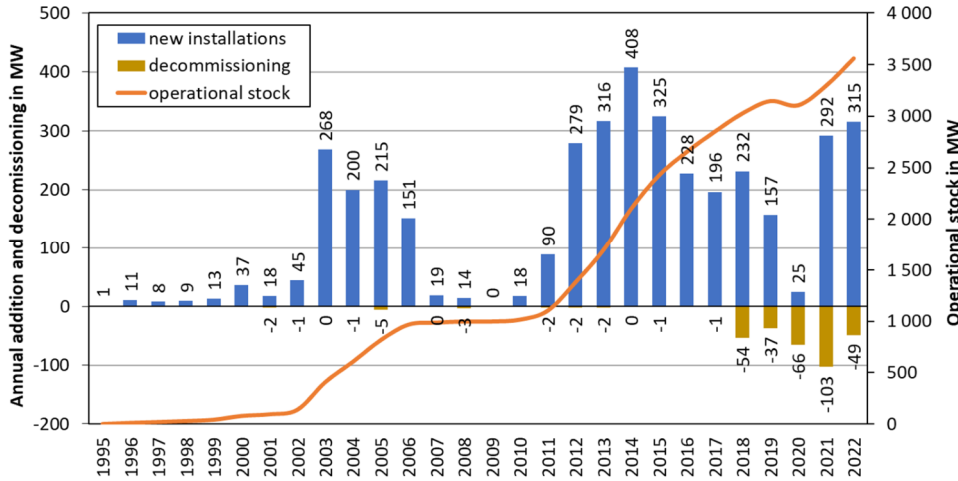
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Large Heat Storage: Conclusions

- The need for large heat storages increases drastically in the course of the transformation. However, the profitability of large heat storages with the present framework conditions is marginal that is why purposeful models of subsidies are necessary.
- Technologies: up to approximately <1 GWh large heat storage above ground made of steel and above 1 GWh underground containers resp. basin storages, aquifers and geothermal probes
- The first underground container storage (approx. 40,000 m³ resp. 1,6 GWh) for the district heating grid Vienna is being prepared to be realised
- Purposeful research activities in the area of GWh storages are needed (development, realisation and support) as well as scaling (up to 1 m. m³)

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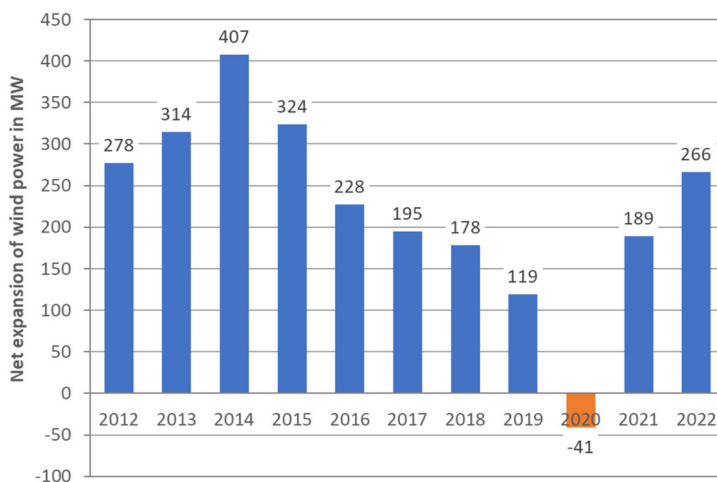
Wind Power: Market Development 2022



Source: IG Windkraft

- New installations: 315 MW
- Stock: 3,560 MW
- 2021→2022: +8.1 %
- Wind power 2022: ca. 8.2 TWh

Wind Power: Net Expansion on the Level of 2012



Source: IG Windkraft

- **Expansion of 50 % too low** (to reach the target of the Renewable Energy Expansion Act)
- All plants installed in 2022 are still supported by the old green electricity act
- REEA: Only half of the amount were assigned
- **Increase of expansion is therefore not sustainable!**

Wind Power: Current Usage in the Federal States

Austria in total

1.365 plants
3.560 MW
8,2 TWh

Lower Austria

757 plants
1,851 MW

Upper Austria

31 plants
50 MW

Vienna

9 plants
7 MW

Burgenland

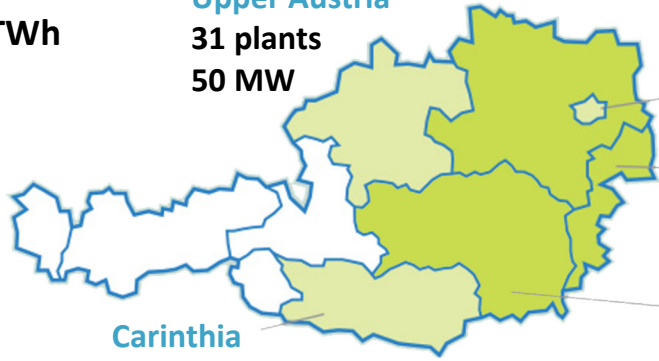
445 plants
1,333 MW

Carinthia

10 plants
28 MW

Styria

113 plants
290 MW



Source: IG Windkraft

- Wind power production concentrated in eastern Austria
- Wind also blows in western Austria
- **Framework conditions for wind power expansion are missing!**

Wind Power: Subcontractor Branch with World Market Leaders



Copyright: Pletterbauer

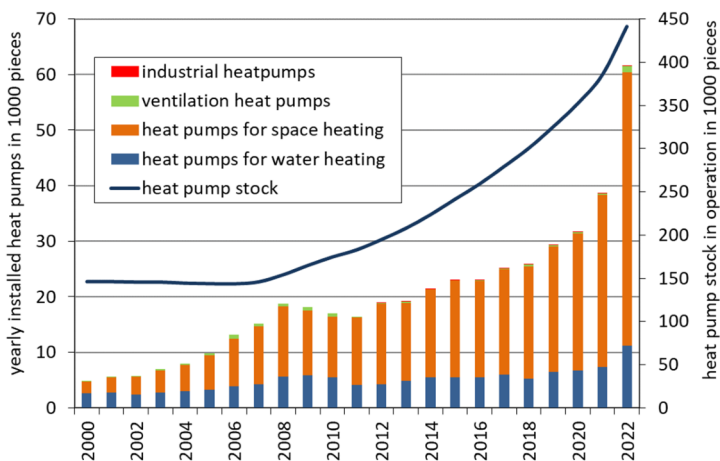
- No wind power producer in Austria
BUT:
- More than **180 companies in subcontractor and service areas** of the wind branch in Austria
- Several **world market leaders in various sectors**

Wind Power: Conclusions

- **Expansion of wind power installations not sustainable** due to missing framework conditions
- **Important laws on a federal level** still need to be realised: the Renewable Energy Expansion Act, the Energy Industry Act, Climate Protection Act, changes of the Renewable Energy Expansion Act
- The **greatest constraint** are missing framework conditions on a **federal state level** (in almost all federal states!)

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Heat Pumps: Market Development 2022

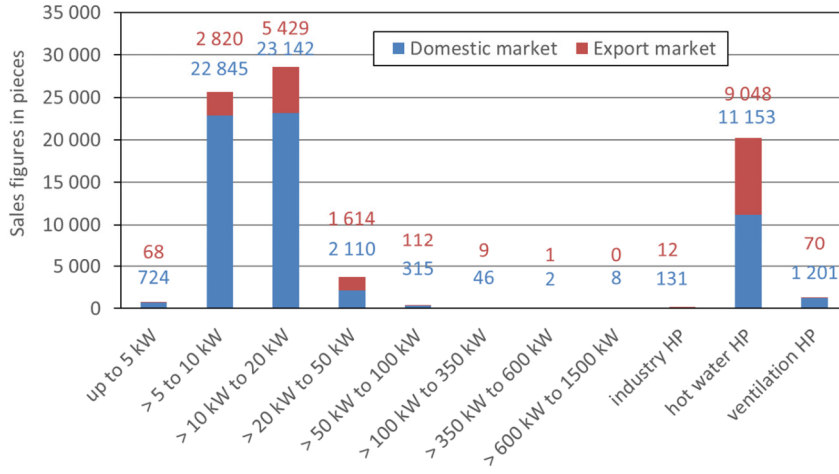


Source: ENFOS

- New installations: 61,677 pieces
- 2021→2022: +59.9 %
- Stock: 441,068 pieces
- 2021→2022: +14.5 %

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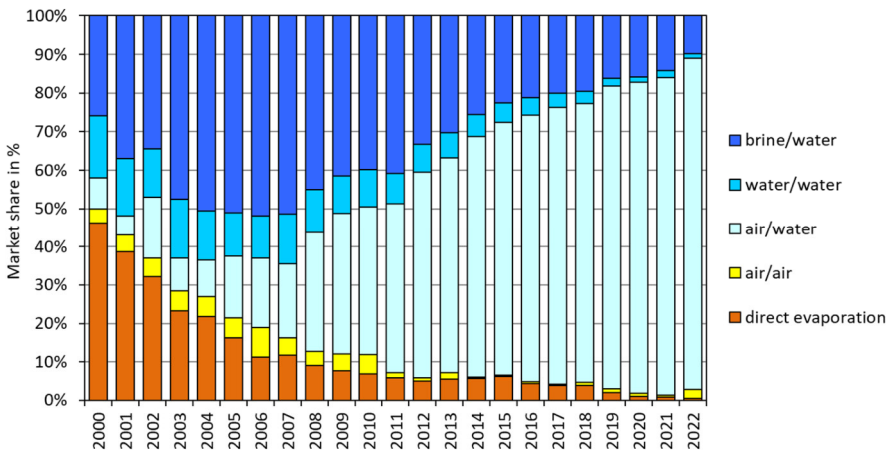
Heat Pumps: Sales by Type and Market 2022



Source: ENFOS

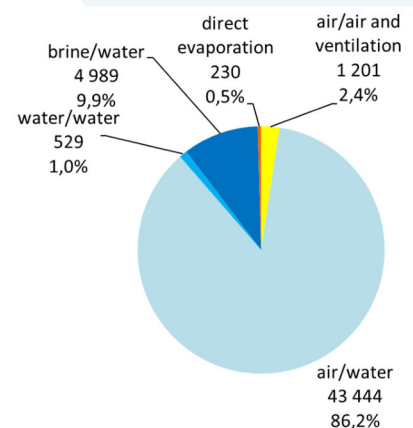
- Export quota heat pumps for space heating : 17.0 %
- Export quota domestic water heat pumps: 44.8 %
- Export quota total: 23.7 %

Heat Pumps: Sales by Type and Market 2022



Source: ENFOS

2022:

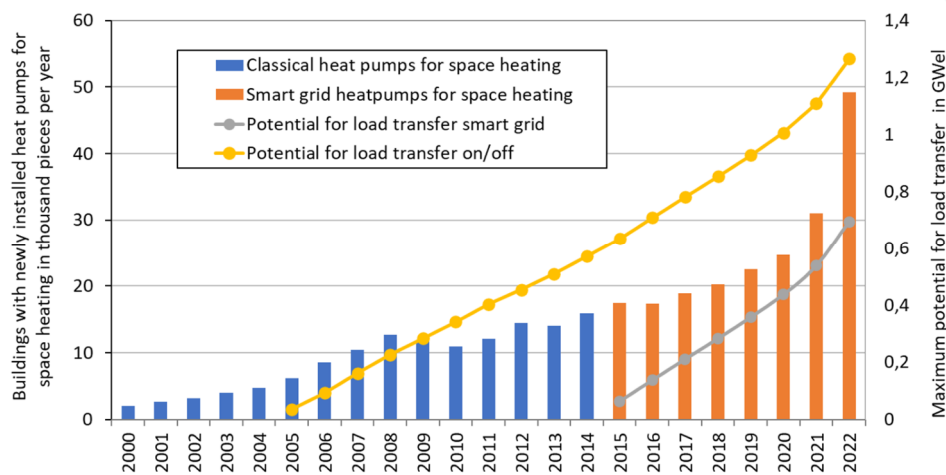


Heat Pumps: Conclusions

- The productivity of the market growth of the sector had difficult conditions in 2022 (supply chain problems, shortage of skilled workers)
- The heat pump has a key role in the heat transition
- Long-term developments of building energy efficiency and cooling demand promote the further market diffusion
- Energy political challenge: Maintaining of the diffusion rates with once more sinking prices for fossil energy

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Activation of Buildings: Market Development 2022



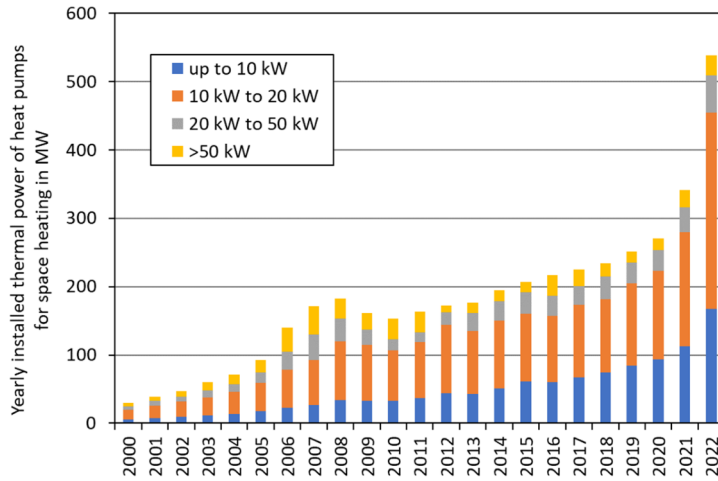
Source: ENFOS

Grid-friendly load shifting potential:

- Ripple control:
max. 1.3 GW_{el}
2021→2022: +14.1 %
- Smart Grid HP:
max. 0.7 GW_{el}
2021→2022: +29.1 %

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Activation of Buildings: Distribution of Power Classes



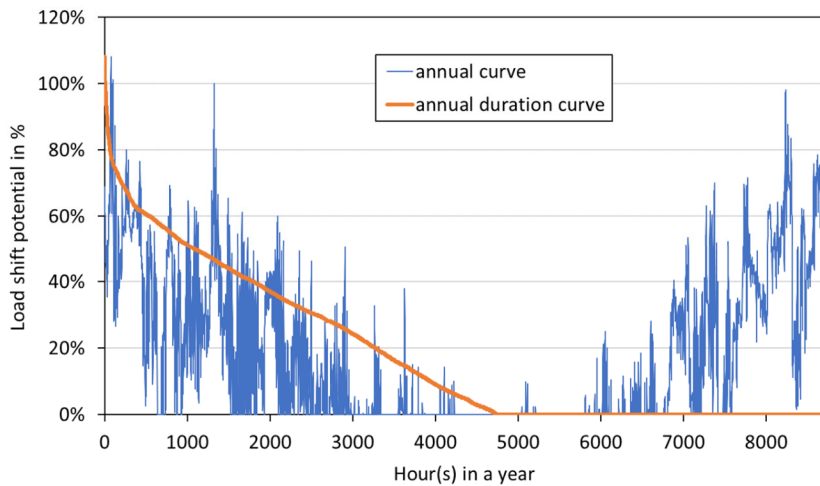
Source: ENFOS

Power classes:

- bis 10 kW: +48.5 %
- >10 kW – 20 kW: +72.0 %
- >20 kW – 50 kW: +50.5 %
- >50 kW: +19.9 %

→ **Swarm solution necessary**

Activation of Buildings: Success Factors



Source: ENFOS

Success factors:

- Critical mass of smart grid heat pumps
- Comprehensive availability of smart meters
- High control energy prices
- Business models for network operators

Activation of Buildings: Conclusions

- In the upcoming years a rapid growth of the grid beneficial load transfer potential through the component activation is to be expected
- The spreading of the Smart Meter makes the use of the potential possible for the grid operators
- The future price development in the energy balancing markets is essential
- The development of corresponding business models builds upon the named aspects

Summary: Key figures 2022

(Sums of biomass, photovoltaics, solarthermics, heat pumps and wind power)

- **Renewable energy:** 270 PJ (\cong 74.9 TWh)
- **CO₂_{equ}-savings:** 15.6 million tons
- **Turnover** (primary, gross): 11.3 billion €
- **Employees:** 44,600 full-time equivalents

Summary: Trends

Trend	20/21	21/22
Biomass boilers and stoves	↗	↗
Photovoltaics	↗	↗
Solar thermal	↘	↘
Heat pumps	↗	↗
Wind power	↗	↗
PV battery storage	↗	↗
Large heat storage	↗	↗
Activation of buildings	↗	↗
Innovative energy storage	↗	↗

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General Conclusions (1)

- **A mix of exogenous and endogenous factors** caused up to now unknown market dynamics in 2022
- In 2022 growth rates could be reached for the first time in several sectors which may make the attainment of climate and energy targets 2030/2040 possible
- However, to achieve the targets a **massive increase of the energy efficiency** has to take place synchronously to the diffusion of supply and storage technologies
- The **central energy political challenge** is the continuation of the development of 2022 in times of once again sinking prices for fossil energy

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General Conclusions (2)

- To achieve the targets 2030/2040 **established technologies for the use of renewables have to be implemented** without delay and problematic fields need to be treated with **strained R&D**
- The **present framework conditions** as “out of oil and gas” as well as greatly increasing prices for fossil energy accelerate the energy transition
- **Shortage of skilled workers, inflation and increasing investment costs** become new diffusion constraints

General Conclusions (3)

- **Electricity:** - Targets 2030 can only be reached with a well-performing Renewable Energy Expansion Act - Grid development plan and grid expansion have to be compatible with the target path
- **An agreement of targets and measures** between federation and federal states is essential
- The implementation of a **serviceable legal frame** for the energy transition should have highest priority

The final report is on the Internet:
<https://nachhaltigwirtschaften.at/de/iea/publikationen/>



Acknowledgement

We are thankful for the productive cooperation of:

- The Austrian companies
- The associations
- The places of support of the federal states and federal government
- The energy departments of the federal states
- The employees of the R&D-institutions

Thank you for your attention!