Wissen schafft Perspektiven

Growing fastest ...

... in Austria: Smart grid technologies, that is, technologies for intelligent power grids, digital technologies for more efficient and flexible control of energy production, distribution, and consumption.

Austria shows ...

... strong innovative power in clean and sustainable technologies: ranked 1st in the building sector and 3rd in the waste/waste-water sector.

Green Patent Applications ...

... have tripled in Austria over the past two decades. They are increasing globally at a higher rate than all other patent applications.

Worldwide perspective ...

... in absolute numbers: large economies like Japan, the USA, and China are leading. When adjusted for population, a dominance of European countries becomes evident.

Austria's Universities ...

... make a significant contribution, with 10% of their patent applications belonging to clean and sustainable technologies.

Clean and Sustainable Innovations from Austria: An Intellectual Property Perspective

österreichisches patentamt

Volume 3, 2024

„Failure is simply the opportunity to begin again, this time more intelligently"

(Henry Ford, American inventor and entrepreneur, 1863-1947)

„Hope and curiosity about the future seemed better than guarantees."

(Hedy Lamarr, American actress and inventor, born in Austria, 1914-2000)

Wissen schafft Perspektiven is a series of publications by the Austrian Patent Office that attempts to present topics relating to intellectual property in such a way that they can be of use to an interested public without claiming to be exhaustive. Various data and studies from renowned IP organizations are analyzed and processed and underpinned with our own data analyses. Wherever possible, the focus is on the Austrian IP landscape and its stakeholders.

The statements and considerations contained therein do not necessarily reflect the opinions and views of the Austrian Patent Office. The data presented has been carefully and conscientiously compiled to the best of our knowledge, but errors cannot be completely ruled out.

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österreichisches patentamt

Table of Content

List of Figures

österreichisches patentamt

List of Abbreviations

APO – Austrian Patent Office
CAGR – Compound Annual Growth Rate
CCMT – Climate Change Mitigation Technologies
CPC – Cooperative Patent Classification
EGSS - Environmental Goods and Services Sector
EIB – European Investment Bank
EIS – European Innovation Scoreboard
EPO – European Patent Office
EP – European Patent
EST – Environmental Sound Technologies
EUIPO – European Union Intellectual Property Office
EUTM – European Union Trademark
FTE – Full-time equivalent
GDP – Gross Domestic Product
GII – Global Innovation Index
GVA – Gross Value Added
ICT – Information and Communication Technologies
IP – Intellectual Property
IPC – International Patent Classification
IPF – International Patent Family
OECD – Organisation for Economic Co-operation and Development
PCT – Patent Cooperation Treaty
RTA – Revealed Technology Advantage
SME – Small and Medium-sized Enterprises
UNFCCC - United Nations Framework Convention on Climate Change
USPTO – United States Patent and Trademark Office
UWG – Unfair Competition Act (Gesetz gegen unlauteren Wettbewerb)
VKI – Austrian Consumer Information Association (Verein für Konsumenteninformation)
WIPO – World Intellectual Property Organization

1. Background

The global shift towards sustainability has placed green transition at the forefront of the European agenda. In an era where the pursuit of environmentally friendly and resource-efficient solutions is becoming increasingly urgent, green technologies play a crucial role in sustainable economic growth. Promoting sustainable innovations is not only a key factor in the global race for clean technologies but also a significant driver of long-term economic stability and competitiveness. Economies that invest in green technologies secure crucial advantages in the global innovation competition, laying the foundation for sustainable growth. This is further confirmed in the recently published Draghi Report on European Competitiveness, which highlights the importance of clean and sustainable technologies for decarbonization in closing the European innovation gap.[1]

This paper starts by examining the **significance of the environmental economy** for Austria using various indicators and rankings. It reveals not only a steadily growing trend in key macroeconomic factors such as value creation, employment, and exports, but also that the environmental economy appears to be less susceptible to economic fluctuations. Austria's performance in international rankings related to innovation and intellectual property is rather mixed when it comes to indicators of ecological sustainability: while there are specialization advantages in some areas, there is a need for improvement in others.

Ecologically sustainable products and services are also relevant to **brands and trademarks**. Chapter 3 discusses the development of so-called 'green trademarks' as well as recent trends, counter-trends, and new EU regulations affecting trademark areas.

The main part of this analysis paper focuses on green, i.e., **clean and sustainable, patent applications**, examining them from various perspectives. The focus here is particularly on Austria's innovation capacity in a global context and on technology sectors that are currently experiencing the most growth, where Austria demonstrates considerable potential in the international competition. Additionally, recently published data from the European Patent Office is used to highlight the role of universities and their invention activities in the field of clean and sustainable technologies.

Finally, the paper addresses the **initiatives and projects of the Austrian Patent Office**, which has set its focus on green and digital transformation for the year 2024.

[1] Draghi, Mario. (September 2024).

2. Economic Assessment of the Importance of Clean and Sustainable Technologies

2.1. How Green is the Austrian Economy?

To assess the economic significance of clean and sustainable technologies for Austria's economy, a range of indicators and metrics can be utilized. One approach is to examine the environmental goods and services sector (EGSS). This sector, also referred to as the environmental economy, eco-economy, or eco-industry, consists, according to the Eurostat framework, of a diverse group of producers of goods and services focused on environmental protection and resource management.[2] A total of 16 categories are assigned to these two areas.

The following analysis examines this sector in terms of its gross value added, its employment potential, and its external economic performance (export development) from an Austrian perspective and compared to the EU.

Gross Value Added of the Environmental Economy

Gross value added (GVA) indicates the economic added value generated by the various production processes of a country's economic sectors, including the environmental sector (EGSS).[3] In 2021, the overall contribution of the environmental economy to Austria's GDP was 4.81% (latest available data), amounting to €19.5 billion. With this figure, **Austria ranks second in the EU**, just behind Finland with nearly 6%. This value has steadily increased in recent years: in 2016, Austria ranked third in the EU (after Finland and Estonia).[4]

Naturally, gross value added, being measured against GDP, is highly dependent on economic cycles, and so is the GVA of the environmental economy. However, in absolute terms (in billions of euros), there have been continuous increases in Austria, with the exception of the 2009 economic and financial crisis and the pandemic year of 2020. For instance, the GVA of the environmental economy in Austria was €13.2 billion in 2010 and had risen to €19.5 billion by 2021. While the total GVA in Austria grew by 38.6% during this period[5], the GVA of the environmental economy increased by 47.4%. Due to the pandemic, Austria's GVA fell by 3.5% from 2019 to 2020, while the

[2] Environmental goods and services are, according to the Eurostat definition, products or services with the primary purpose of: (1) preventing or minimizing pollution, environmental degradation, or the depletion of natural resources; (2) addressing damage to air, water, waste, noise, biodiversity, and landscapes; (3) reducing, eliminating, treating, or managing environmental pollution, environmental degradation, and the depletion of natural resources; (4) conducting other activities such as measurement and monitoring, control, research and development, education, training, information, and communication related to environmental protection or resource management. Eurostat. (August 2023).

[3] Gross value added (GVA) is calculated by subtracting intermediate consumption from the production value; it thus includes the added value created in the production process. In other words, GVA represents the difference between production value and intermediate consumption. GVA is measured at basic prices, meaning it excludes taxes on products but includes product subsidies. For comparison: GDP is the sum of the GVA of all resident producers, plus taxes on products minus subsidies on products. (Product subsidies include import subsidies and other product subsidies such as economic transfers to ÖBB, EU subsidies, regional subsidies to hospitals, etc. Currently, there are no import subsidies in Austria). Statistics Austria. (2024).

[4] Eurostat. (August 2024a).

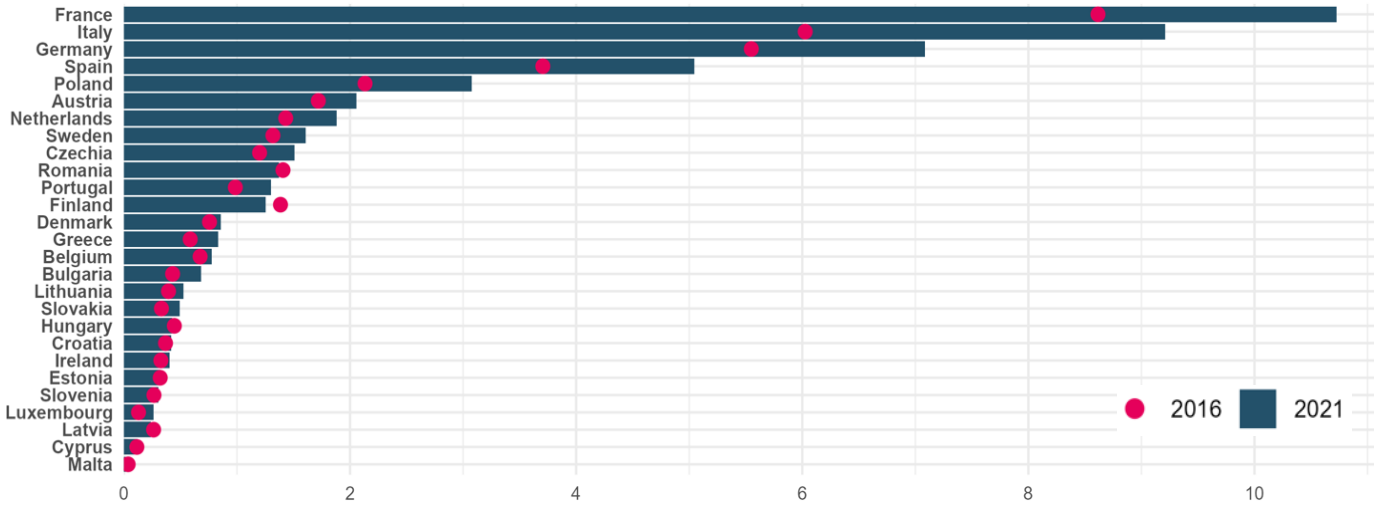
[5] Eurostat. (October 2024).

GVA of the environmental economy only declined by 1.4%. From this analysis of value creation, the following can be concluded:

- On the one hand, the contribution of the environmental sector to GDP is particularly high in Austria compared to the EU average.
- On the other hand, the environmental sector has shown higher growth rates over time and is less affected by economic downturns than the overall economy.

Figure 1: Gross Value Added of the Environmental Sector - EU countries, 2016 & 2021.

Source: Eurostat, Figure: Anna Cailotto (APO).



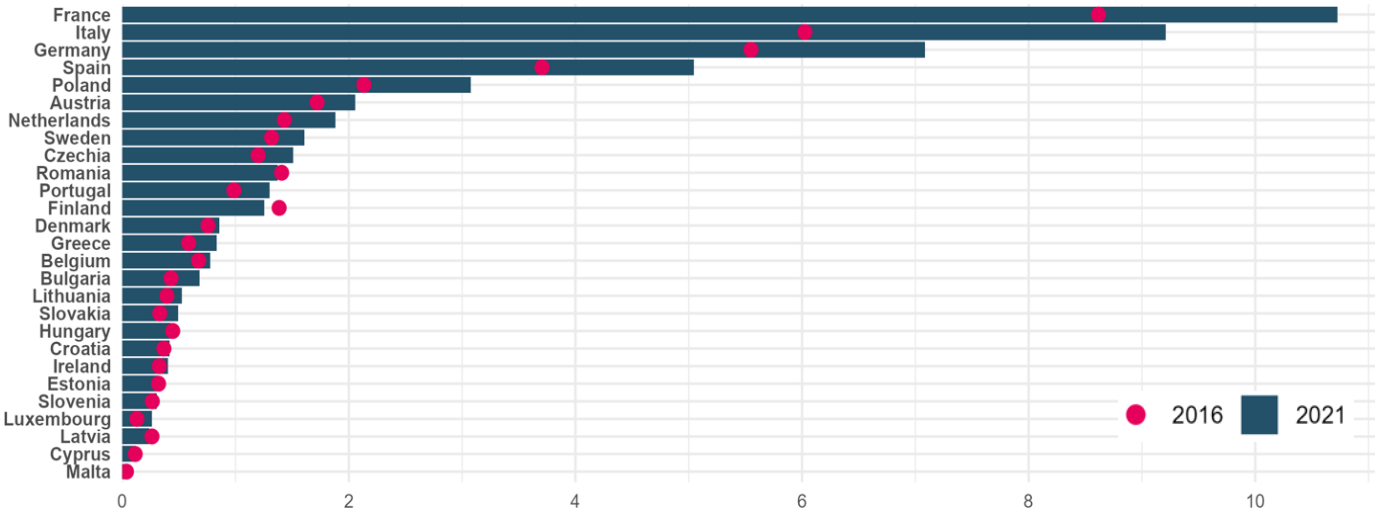
Employment in the Environmental Economy

According to the latest data (2021), around 5.2 million people (measured in full-time equivalents) are employed in the environmental economy across the EU.

Austria ranks 6th in the EU, with approximately 206,000 employees (full-time equivalents), following the large economies of France (1 million), Italy (921,000), Germany (709,000), Spain (505,000), and Poland (308,000).[6, 7]

Figure 2: Employment in the Environmental Sector - EU countries, FTE/100.000 inhabitants, 2016 & 2021.

Note: FTE = Full-time equivalent. Source: Eurostat, Figure: Anna Cailotto (APO).



[6] Eurostat. (September 2024).

[7] Eurostat. (September 2024a).

A stronger growth trend in the environmental sector compared to the overall economic development can also be observed here: in Austria, employment in the green industry has increased by nearly 20% since 2016 (full-time equivalents), whereas total employment (in persons) has only grown by 2.6%. Even during the years affected by the COVID-19 crisis (2020/2021), there were employment gains in this sector.[8]

Exports from the Environmental Economy

Austria is a highly export-oriented economy that relies on foreign trade to achieve economic success due to its relatively small domestic market. In fact, every second job in Austria depends on the export sector. Moreover, exports drive innovation and competitiveness among companies, as products and services in international markets are subject to constant competition, leading to ongoing improvements in export goods and production processes.

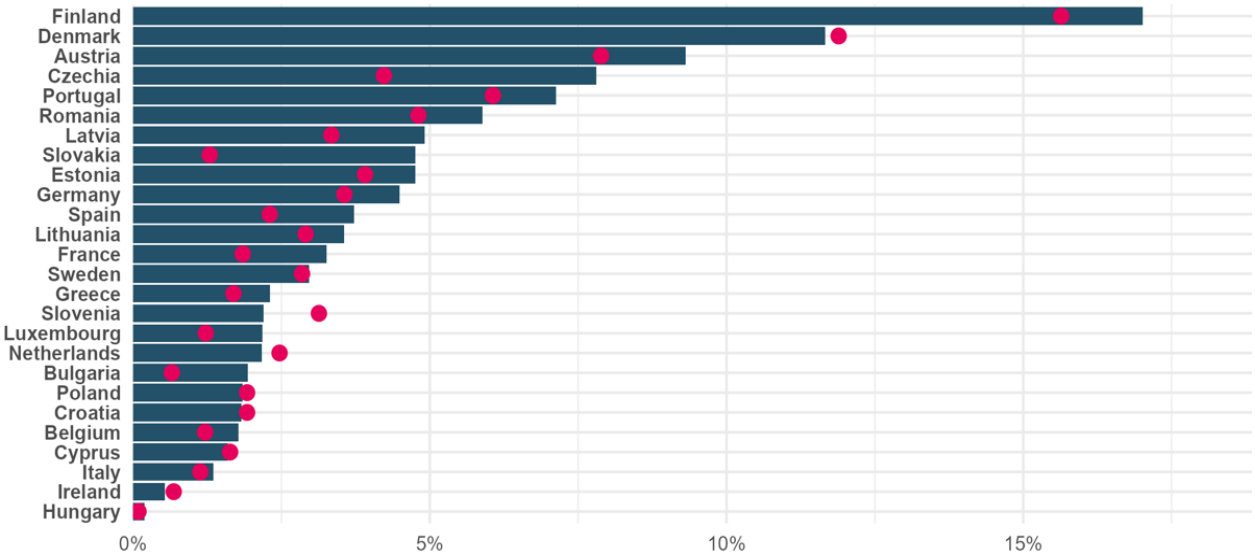
The environmental sector is particularly important for Austria in this regard: after Germany (around €55 billion), **Austria ranks second in absolute export figures**, despite its relatively smaller size, with €15 billion in 2021 (followed by France with €13.3 billion and Denmark with €11.6 billion). Since 2016, Austria's export activities in this sector have increased by 50%.

Currently, exports of goods and services from the environmental sector account for 9% of Austria's total exports. Only Finland (17%) and Denmark (12%) are ahead of Austria in this regard.[9, 10]

There was a slight COVID-19-related decline in environmental sector exports from €14.6 billion in 2019 to €13.9 billion in 2020 (-5%), followed by a strong recovery to €15 billion in 2021 (+7.9%).

Figure 3: Share of Exports of Environmental Goods and Services - EU countries, 2016 & 2021.

Source: Eurostat, Figure: Anna Cailotto (APO).



[8] Eurostat. (August 2024b).
[9] Eurostat. (August 2024c).
[10] Eurostat. (August 2024d).

2.2. Environmental Sustainability in the EIS

In the European Innovation Scoreboard (EIS) of the European Commission, Austria is again classified as a 'Strong Innovator' in 2024. For the critical **Intellectual Assets** dimension, **Austria ranks second** among the 40 countries surveyed, following Switzerland, and therefore holds the top position within the 27 countries of the European Union. However, as regards the dimension of **Environmental Sustainability**, Austria scores only slightly above the EU average (with a score of 104.7, where the EU average is set to 100), placing it 11th overall and 9th within the EU.[11]

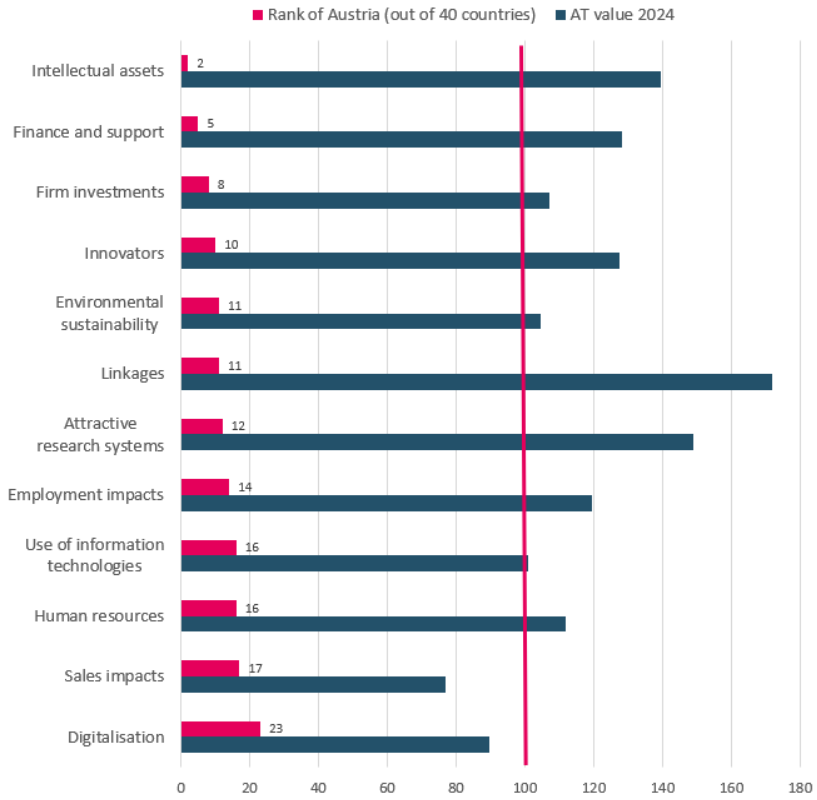


Figure 4: Austria's Ranking Position in the 12 EIS Dimensions (2024).

Note : 100 = EU average; Source: EC. (2024). Own illustration.

The **Environmental Sustainability** dimension comprises three indicators:

(1) Resource Productivity: Austria scores below average here with a value of 94.2, ranking 13th in Europe and 10th within the EU.

(2) Air Emissions from Particulates: for 2024, Austria achieves a score of 116.1, which places it 5th in Europe and 4th within the EU.

(3) Environmental Technologies: this indicator measures the share of patented inventions in environmental technologies relative to all patent filings. Austria ranks 6th among the 40 countries studied and 3rd within the EU. Only Denmark and Germany outperform Austria among EU countries.

A closer look at the underlying OECD data reveals that Austria performs quite well in comparison with other countries:

- Nearly 14% of all patent filings in Austria are in the field of environmental technologies. Germany is just slightly ahead with 14.12%, while Denmark

[11] The European Innovation Scoreboard (EIS) is a comparative assessment of the research and innovation performance of EU countries and selected non-EU countries to measure their innovation performance. There are a total of 4 categories (framework conditions, investments, innovation activities and impact). Each of these categories is divided into 3 dimensions, and each dimension consists of 2-3 indicators. The EIS comprises a total of 32 indicators that measure a country's innovation performance. Member States are categorised into four innovation groups based on their scores: Innovation Leaders (performance above 125% of the EU average), Strong Innovators (between 100% and 125%), Moderate Innovators (between 70% and 100%) and Emerging Innovators (below 70%). Austria ranks 8th out of 40 European countries in the overall 2024 ranking with an overall score of 116.3% (6th place within the EU). European Commission. (2024).

leads significantly, with nearly a quarter (23.12%) of all inventions falling into this category. For comparison, the OECD average is 11%, the USA 9.5%, and China 8.8%.[12]

- In Austria, there are 40 patent applications in environmental technologies per 1 million inhabitants, which is twice the EU average. In Germany, this figure is 52, and in Denmark, it is nearly 72. By comparison, the OECD and the USA figures are around 24, while China has about 4.[13]
- Regarding the Relative Technology Advantage (RTA) - an index measuring a country's specialization in environmental innovations compared to the global average - Austria scores 1.34, just behind Germany at 1.35. Denmark leads with a score of 2.22. The USA has an index value of 0.91, only slightly ahead of China at 0.85.[14]

In the **Eco-Innovation Index 2024** of the European Commission, Austria ranks 3rd (behind Finland and Denmark), placing it among the group of Eco-Innovation Leaders. Austria performs better than the EU average in 9 out of a total of 12 indicators.[15]

2.3. Ecological Sustainability in the Global Innovation Index

The Global Innovation Index (GII), published by the WIPO, ranks Austria 17th out of 133 countries. The GII includes a total of 80 indicators, three of which specifically assess a country's ecological sustainability:[16]

- Energy Productivity[17]: it measures how efficiently a country uses energy to create economic value. A higher value indicates that more economic value is generated per unit of energy, suggesting greater energy efficiency. Austria ranks 27th in this category (Ireland is in 1st place).
- Use of Low-Carbon Energy Sources: this indicator measures the share of total primary energy consumption[18] derived from low-carbon sources. Austria is ranked 24th here (Iceland takes the top spot).
- Number of Issued ISO 14001 Environmental Management System Certificates: Austria ranks 40th in this category (Bulgaria is 1st).

Combining these three indicators, Austria ranks 37th in the aggregated indicator for ecological sustainability.

[12] OECD. (2024a). Patstat-data average of the last two available years, 2018 and 2019.
[13] OECD. (2024b). Patstat-data average of the last two available years, 2018 and 2019.
[14] OECD. (2024c). Patstat-data average of the last two available years, 2018 and 2019. The specialisation advantage is calculated as the ratio of 1) the share of environmentally related inventions in all inventions (in all technologies) in the country and 2) the share of environmentally related inventions in all inventions (in all technologies) in the world. An index of 1 therefore means that a country is just as innovative in 'green' technologies as the world average; an index of over 1 indicates a relative technological advantage (RTA - Revealed Technology Advantage) or a specialisation in environmentally related technologies compared to the world average.
[15] The index includes the majority of the indicators mentioned above and in 2.1 and 2.3. EC. (2024a).
[16] WIPO. (September 2024).
[17] Measured by GDP per unit of total energy supply. The energy supply is measured using the TES (total energy supply) - data: IEA energy balances.
[18] Primary energy is the untreated energy available in raw materials that serves as input into the energy system. It measures the total energy consumed before efficiency losses occur through conversion to secondary energy (a transportable form) or final energy (delivered to the consumer).

3. Green Trademarks

Trade mark applications are an indication that a new product or service has been launched on the market. The EUIPO, the EU's intellectual property office, has started surveys on 'green trademarks' for the first time in 2021. Green EU trademarks (EUTM - European Union trademarks) are understood to be trademark applications that contain at least one 'green' term. Green terms are in turn expressions in the description of goods and services in the applications that relate to the protection of the environment and sustainable development. A list of around 900 terms has been defined, which are divided into 35 categories and nine groups.[19]

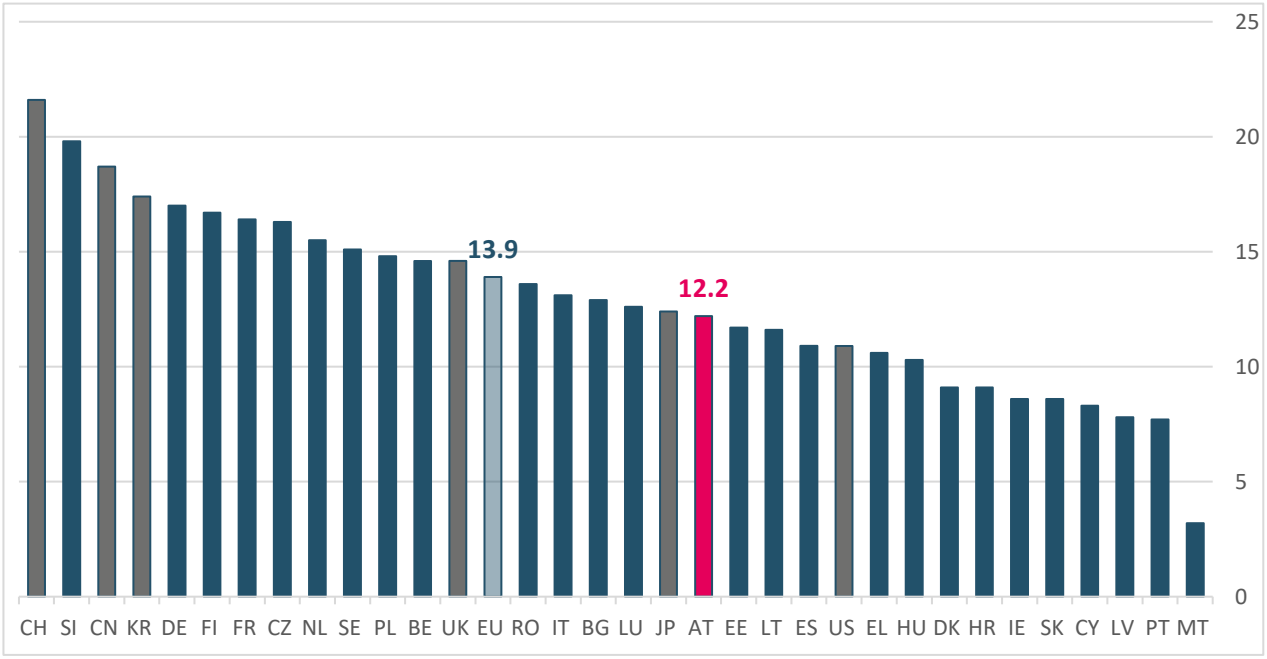
3.1. Development of Green Trademarks

The most recent update to this study contains data from 1996 to the end of 2022, according to which the peak of green trademarks was reached in 2021 with 21,281 green EU trademark applications. In 2022, in line with the sharp decline in EU trademark applications overall (-15%), there was also a decline in green trademarks (to 19,659), but this was only half as high. As a result, the share of green EU trademarks in all applications increased in 2022, from 13.3% (2021) to 14.5% (2022).[20]

This share of green trademarks in total trademarks is highest in Switzerland, followed by Slovenia, China and South Korea. Although Germany is in second place worldwide after China in absolute terms with around 3,300 registrations, it is only in fifth place in relative terms. The share of green trademarks from Austria is 12.2% (+1.4% compared to the previous year). This puts Austria in 19th place (14th place in the EU).

Figure 5: Share of Green Trademarks (in total EUTM-registrations 2022 in %).

Note: Blue: EU27 countries, Grey: non-EU countries.
Source: EUIPO (2024). Own illustration.



[19] The classification is based on the lists of goods and services in the trade mark applications. EUIPO. (2024).

[20] EUIPO. (2024a).

A quarter of all green terms belong to the energy saving category, 18% to the energy production category, 15% to the transport category and 14% to the pollution control category.

The EUIPO has developed special correction mechanisms to ensure that products and services are not wrongly assigned to green trademarks. It also checks whether the product or service behind the trade mark is actually green. If, for example, the terms 'carbon' and 'monitor' appear in the application, which may indicate a green product/service, it will not be counted as a green trade mark if the application was filed in Nice Class 10, medical instruments, as it is obviously a medical and not an ecological product.

Furthermore, trademarks registered by applicants must not mislead or deceive the public. For example, a trade mark that falsely suggests environmental friendliness can be excluded from registration or even revoked later.[21, 22]

3.2. Green Hushing versus Greenwashing

Green Hushing, a fairly new term that has only emerged since the 2020s, refers to the deliberate silence of companies about their sustainability initiatives in order to avoid criticism or accusations of greenwashing. Greenwashing, on the other hand, is a term that has been around since the 1980s - it is attributed to the American ecologist Jay Westerveld, who suspected self-serving cost-cutting strategies behind the initiative launched by hotels at the time to encourage guests to reuse hotel towels for environmental reasons.[23]

In contrast to greenwashing, where companies exaggerate or misrepresent their environmental credentials, green hushing involves companies avoiding communication about their actual sustainability efforts in order to avoid negative publicity. Green hushing can therefore be understood as a reaction by companies that are aware of the intense scrutiny and criticism from organisations and the media and decide it is better not to publicise their sustainability initiatives in order to avoid becoming a target.

Greenwashing is a well-known problem in Austria, which numerous initiatives and organisations are working to counteract. Greenpeace Austria, for example, has carried out several market checks to examine the credibility of quality seals and the sustainability of products in Austrian supermarkets. This revealed that around a third of the more than 200 quality seals used in Austria are not trustworthy or only partially trustworthy and are often used in a misleading manner.[24] The Austrian Consumer Information Association (VKI) is also involved in projects on sustainability and against greenwashing. For example, a reporting form has been set up for consumers to report suspicious cases of greenwashing.[25] Greenwashing is also an issue for financial supervision and financial

[21] EUIPO. (2024b).

[22] For example, the trade mark 'Bio-insect shocker' for biocidal products was considered misleading. Reasoning: The prefix 'bio' suggests environmental protection, the use of natural materials or even ecological manufacturing processes; it conveys the impression that the products are natural, environmentally friendly and not harmful to health. This is a quality that biocidal products cannot have by definition. EUIPO. (2020).

[23] Sun, Ziyouan & Zhang, Weiwei. (10.09.2019).

[24] Beskow, Edward. (2024).

[25] VKI. (2019).

market regulation. Various surveys have shown that greenwashing, just like the lack of sustainability-related financial knowledge, can have an impact on the financial market and jeopardise its stability.[26, 27]

In 2020, consumer protection authorities concluded from an EU-wide review of 344 advertising claims that more than half of the environmental claims were vague, misleading or unsubstantiated and 40% of the claims were not justified. The abundance of labelling schemes and labels, which vary in transparency and are often not verified by a third party, also create an uneven playing field and mislead consumers.[28, 29]

This was taken as an opportunity to launch **two new directives at EU level**:

- Firstly, the Directive on empowering consumers for the green transition through better protection against unfair practices and better information – **'Empowering Consumers Directive'**. It must be transposed into national law by the EU member states by 27 March 2026. The measures contained therein aim to provide consumers with more reliable information and prevent misleading environmental claims. The main objectives include: a ban on general environmental claims such as 'environmentally friendly' or 'climate neutral' without proof, the introduction of stricter requirements for advertising with future environmental impacts, the regulation of sustainability labels (only official or officially established certification systems are permitted), as well as a focus on product durability, better visibility of warranty information, a new harmonised label for extended warranty periods and a ban on unsubstantiated claims regarding the durability and reparability of products. For Austria, this means that it will be necessary to adapt the provisions of the Unfair Competition Act (UWG).[30]
- Secondly, the **'Green Claims Directive'** - a directive on environmental claims - which updates EU consumer law to ensure consumer protection. The main aspects of the draft Directive include: an obligation for companies to provide evidence of environmental claims with life cycle assessments and scientific evidence, but also sanctions for violations with fines of up to 4% of annual turnover, revenue confiscation and exclusion from public contracts. This evidence (life cycle analysis or eco-labelling) must be verified by independent external experts before publication.[31, 32, 33]

Even though the two directives are primarily aimed at consumer protection and environmental aspects and do not appear to have a direct impact on intellectual property rights, they could also indirectly affect the use of trademarks, especially in connection with environmental and sustain-

[26] OeNB. (2024).
[27] Organisations and authorities that, in addition to private competitors, can bring claims for injunctive relief in court in cases of suspected unfair or misleading business practices (such as greenwashing) are regulated in Section 14 UWG. These are: the Federal Competition Authority, the Chamber of Labour, the Chamber of Commerce, the Federation of Trade Unions and possibly VKI.
[28] European Commission. (22.03.2024).
[29] European Commission. (12.04.2023).
[30] Federal Ministry of Social Affairs, Health, Care and Consumer Protection. (March 2024).
[31] European Commission. (22.03.2024).
[32] Council of the European Union. (17.06.2024).
[33] As it is still unclear when the legislative process for this directive will be finalised, the entry into force of the regulations is also still open at this stage.

ability claims. This could particularly apply to certification marks if they are intended to guarantee a certain environmental/sustainability aspect. The Trademark Protection Act stipulates that the owner of a trademark is responsible for ensuring that it is used exclusively in accordance with the specified standards. This is accompanied by continuous monitoring and control of use (see also §63 MSchG).

On the other hand, the certification marks, which were only introduced in 2017, are not used very often:

- In 2022, there were eleven upright certification marks in Austria, with three additional ones being applied for.[34]
- In 2023, there were 97 registrations for certification marks (EUTMs) - that is 0.06% of all trademarks. Since certification marks came into existence, there have been 741 applications and 481 registrations to date (2017 - June 2024).[35] Eleven certification marks are currently registered with the EUIPO by Austrian applicants.

[34] ELVIS query (APO internal database - evaluation of the trade mark register). (June 2024).

[35] EUIPO. (2024).

4. Analysis of 'Green Patents'

Various sources attest to the same trend: 'green' patent applications have been rising continuously for around 20 years and more strongly than applications from other fields:

- For example, in a publication published in September 2024, the **OECD** analyses PCT applications[36] and concludes that the proportion of green patents in the OECD rose from 9.6% of all PCT patents in 2000 to 15.8% in 2021. While an average of 4.6 green patents per million inhabitants were filed in the OECD in 2000, this figure was three times higher in 2021, at around 13.7 patents per million inhabitants.[37]

- The **EPO** and the **EIB** analysed international patent families (IPF)[38] in clean and sustainable technologies in their study published in April 2024. While cleantech IPF accounted for 8% of all global inventions in 1997, this figure rose to 15% in 2021. Since 2017, these have grown at an average annual growth rate of 6.2% - twice as fast as the overall growth rate of IPF across all technologies.[39]

Although different measurement methods are used here, the findings of a rising trend in patents from green and sustainable innovations are the same. An observation that emphasises the increasing importance of these technologies. The different methodologies and definitions as well as the methodological approach of our own data analysis are discussed below.

4.1. What are 'Green Patents'?

The number of patent applications - like other indicators (e.g. R&D expenditure, utilisation rates of new technologies and products, degree of digitalisation, innovation rankings, etc.) - can be used as a measure of the innovation potential of an economy. A patent grants an exclusive right to an invention that comprises either a product or a process that provides a new technical solution to a problem. The features of novelty and technicality that characterise a patent are therefore directly related to innovation. As patents are divided into technical fields in order to systematically categorise them and facilitate access to technological information, analysing these categories can allow conclusions to be drawn about trends in certain technologies, such as 'green', i.e. clean and sustainable technologies.

'Green patents' generally refer to inventions or technologies that focus on environmental and climate protection and, for example, reduce environmental pollution, promote the sustainable use of resources or increase energy efficiency. They can be used to illustrate a country's innovative strength in these areas, as they reflect the technological potential for overcoming environmental problems.

However, technologies and innovations in the field of clean and sustainable technologies were not categorised accordingly in existing classification systems, such as the CPC

[36] PCT (Patent Cooperation Treaty): international patent procedure that makes it possible to apply for protection for an invention in over 150 contracting states with a single application. A PCT application does not lead directly to a granted patent, but simplifies the procedure so that patents can later be granted in individual countries.
[37] Peñalosa, Patricia/Kleine-Rueschkamp, Lukas. (2024).
[38] Details: see 4.2.
[39] EPO/EIB. (April 2024).

or IPC classification system.[40] They were therefore initially categorised under various existing technological areas. This made the search for patent information complex and incomplete.[41] Over time, **three main established methods** were developed to identify green patents on the basis of code classification:

- WIPO and the UNFCCC introduced the **IPC Green Inventory** in 2010, which covers 'environmentally sound technologies' (ESTs). The IPC Green Inventory is updated annually and is only applicable to patents with IPC codes.
- In 2016, the OECD developed patent search strategies to identify selected environmentally sound technologies (**ENV-TECH** for short) based on both IPC and CPC codes. An update took place in 2020 and 2022.
- And finally, the EPO's **Y02/Y04S tagging scheme** - the methodology used in this paper. This methodology is therefore also explained in more detail below.[42]

Green patents in the CPC-system

More than ten years ago, the EPO, together with the USPTO, developed its own classification system for climate change mitigation technologies (CCMT), the 'Y02-Y04S Tagging Scheme', which is now part of the CPC patent classifications. It aims to tag patents relating to technologies that are important for climate protection and sustainable energy and to make it easier to identify such patents. This means that users can now also search for and research cleantech patents themselves.

In Espacenet, the EPO's freely accessible online database, which provides access to millions of patent documents from all over the world and is therefore a valuable tool for innovation research - both for experts (inventors, companies, researchers, patent attorneys) and laypersons - you can now also find Section Y in addition to Sections A (Human Necessities) to H (Electricity), in which new technological developments are now subsumed, namely in classes Y02 and Y04:[43]

- **Y02** refers to technologies that help to mitigate climate change and
- **Y04** to smart grid technologies, i.e. intelligent electricity grids that support sustainable energy distribution and use.

Y02 – Technologies or Applications for Mitigation Against Climate Change

The Y02 class 'technologies or applications to mitigate climate change' currently comprises **eight subclasses**, characterised by letters, each of which relates to specific technologies and solutions for environmental and climate protection measures: [44]

1. **Y02A: climate change adaptation** technologies, such as protective measures

[40] CPC (Cooperative Patent Classification) and IPC (International Patent Classification) are both classification systems for patents that are used to categorise patent applications according to fields of technology. However, they differ in their structure, scope of application and purpose. IPC: introduced by WIPO in 1971 as an international system that is used in over 100 countries and serves as a basis for patent offices to classify patents uniformly. CPC: introduced in 2013 as a joint classification system by the EPO and the USPTO. Primarily used by the EPO, USPTO and other international patent offices and is more specific and somewhat more detailed.

[41] Angelucci, Stefano et al. (September 2018).

[42] For a discussion of the three concepts, their differences and similarities, see: Favot, Marinelle et al (October 2023).

[43] EPO. (2024a).

[44] These eight subclasses are in turn subdivided into 40 groups, which are in turn split into various technological subgroups.

against drought, heat, flooding or other extreme weather conditions through to invasive species monitoring.

2. **Y02B:** climate change mitigation technologies in **buildings**: energy-efficient building technologies, including insulation, heating, lighting, ventilation and air conditioning, and the use of renewable energy.
3. **Y02C:** technologies for the capture, storage, reuse or sequestration of **greenhouse gases**.
4. **Y02D: energy-efficient information and communication technologies** (ICT) that reduce energy consumption in areas such as data processing and storage.
5. **Y02E:** greenhouse gas reduction technologies related to the generation, transmission and distribution of **energy** from renewable and non-renewable sources, e.g. solar, wind, hydropower, fossil fuels.
6. **Y02P:** climate protection technologies in the field of **production**, including energy-efficient processes and environmentally friendly technologies to reduce emissions in industry and agriculture.
7. **Y02T:** climate protection technologies in the **transport** sector that aim to reduce CO_2 emissions, such as electric vehicles, hybrid drives and efficient fuel utilisation.
8. **Y02W:** climate protection technologies in the field of **wastewater** treatment and **waste** management, including recycling methods and processes for the reuse of materials.

Y04 – ICT Having an Impact on Other Technology Areas

There is currently a single subclass in this class: **Y04S** - systems for the integration of technologies related to the operation of electricity grids, information or communication technologies (ICT) to improve the generation, transmission, distribution, management or utilisation of electricity, i.e. **smart grids**.

There are currently five sub-groups focussing on the technologies required for a sustainable, intelligent and resilient electricity grid that meets the demands of modern energy supply. These include energy management systems, smart grids, integration of renewable energy into the electricity grid, storage systems and load control systems. The figure below provides an overview of the classification system.

4.2. Methodology of the Analysis

The most important elements of the analysis are briefly described below to make it easier to understand how the analysis was carried out.[45]

The analysis of patents for clean and sustainable technologies is based on data from PATSTAT (Spring 2024 Edition). **International Patent Families (IPF)** are used to measure patent activity instead of individual patent applications. An IPF combines applications for the same invention that seek protection in several countries - this ensures greater informative value and international relevance of the invention.

The IPF assigned to the Y classification in PATSTAT for sustainable technologies form

[45] Details on the methodology – see Appendix.

the basis of the analysis. The earliest publication date serves as the reference year, with the first known country code indicating the origin of the applicant. An IPF can be assigned to more than one environmental category, whereby the assignment to several categories is possible in order to consider their versatile applicability.

Therefore, in these cases, an equal weighting is applied across the Y-classes concerned.

In the analysis, the term patent applications from the Y section is also used synonymously with applications from cleantech areas or 'green patents'.

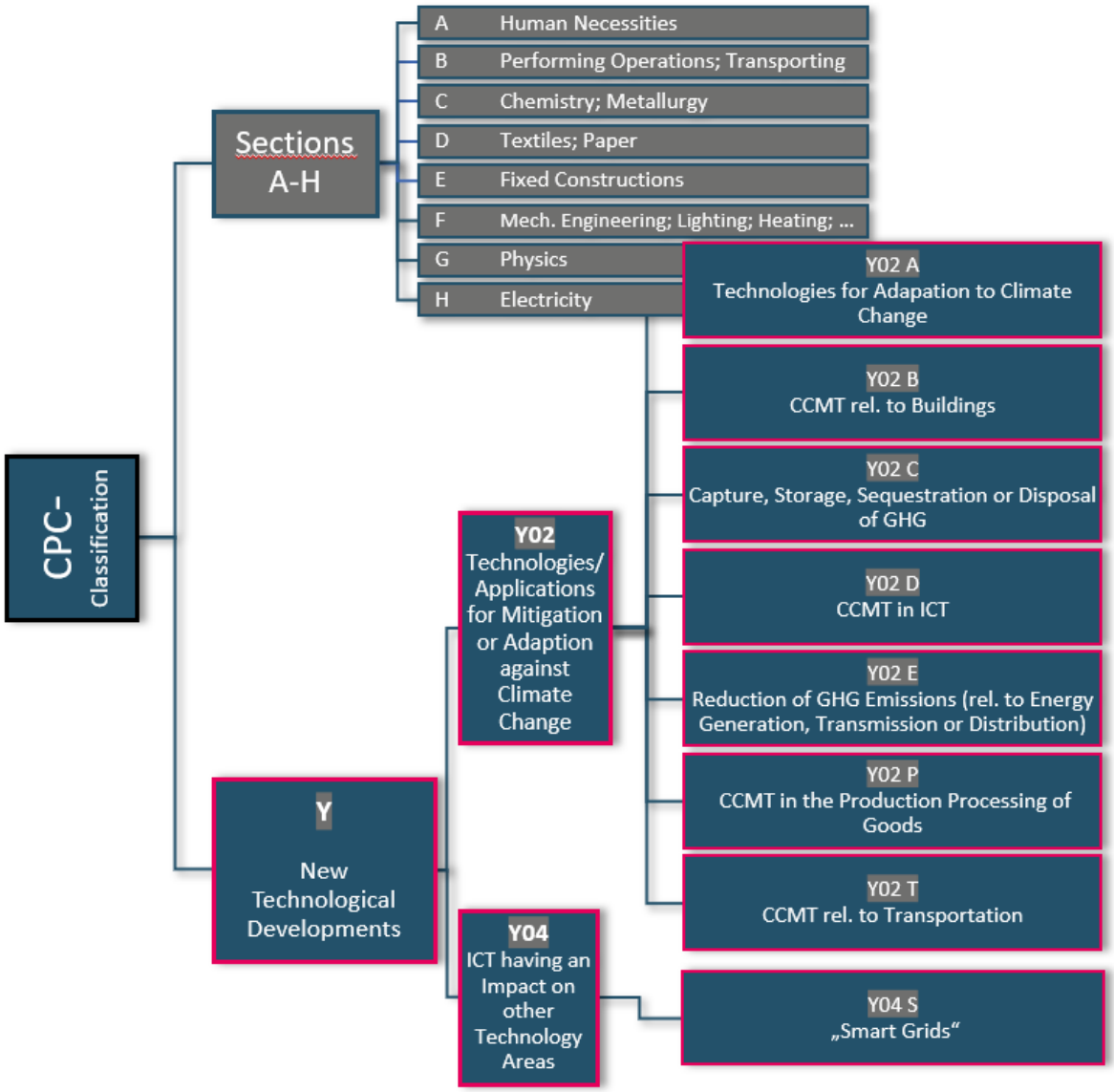


Figure 6: Illustration of the CPC classification system including the Y-section and (sub)classes
Note: Own illustration.

4.3. Data on Austria

Development Over the Last 20 Years

Austrian IPF from cleantech sectors have almost tripled in the last 20 years: in 2003, just under 100 IPF were published in the new Y-section.

In 2022, there were already 267. Before 2000, the number was generally less than 100 IPF per year.

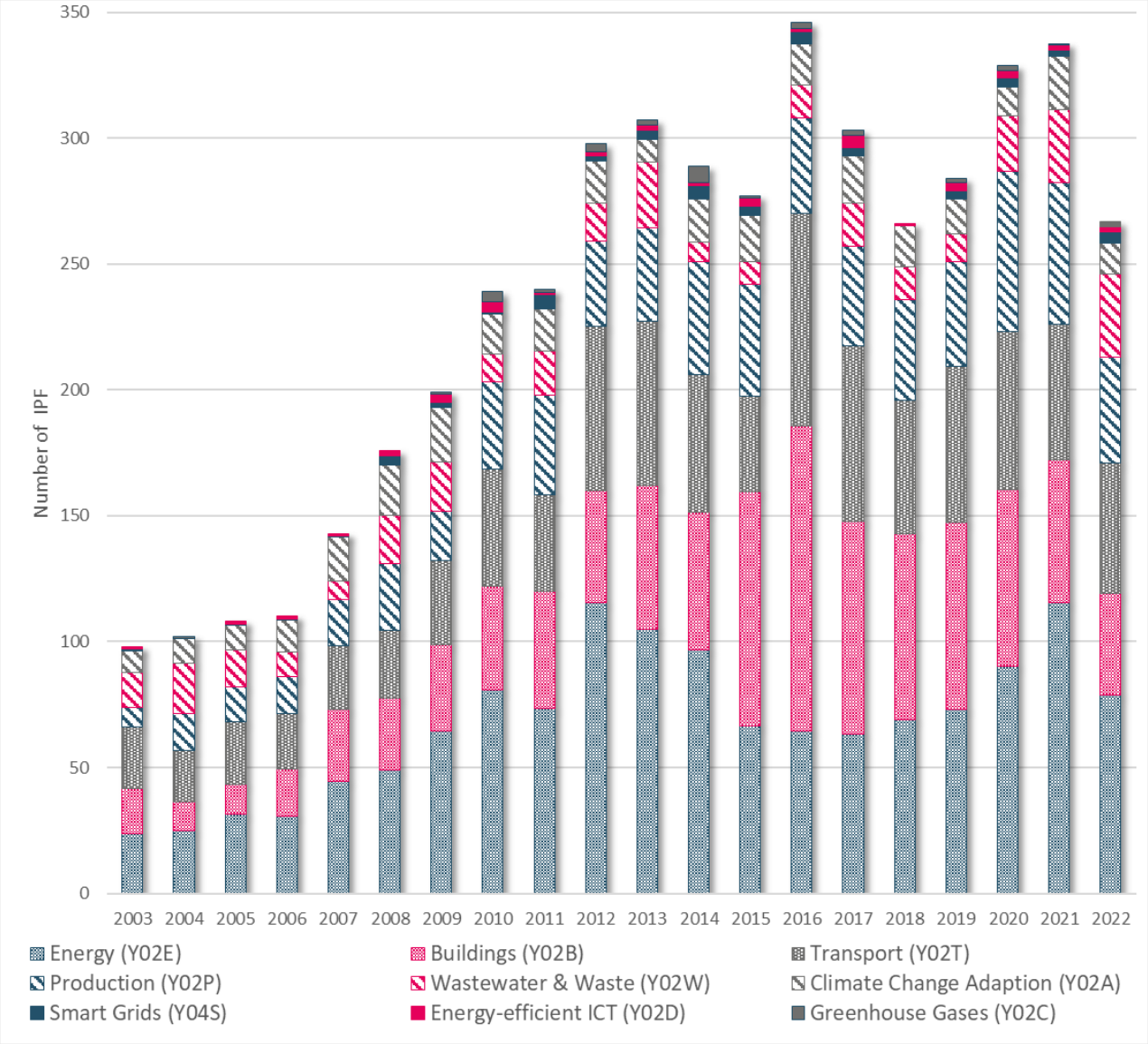
There was a slight increase between 2001 and 2006, but the total number still remained below 150.

The number of IPF rose noticeably from 2008 and exceeded the 300 IPF per year mark for the first time in 2013. This indicates a clear wave of innovation.

After 2014, the number of patent applications remained high (all-time high in 2016 with 346 IPF), but has fluctuated since then.

Figure 7: Austrian IPF in the 9 cleantech sectors over the last 20 years.

Note: Own calculation and illustration.



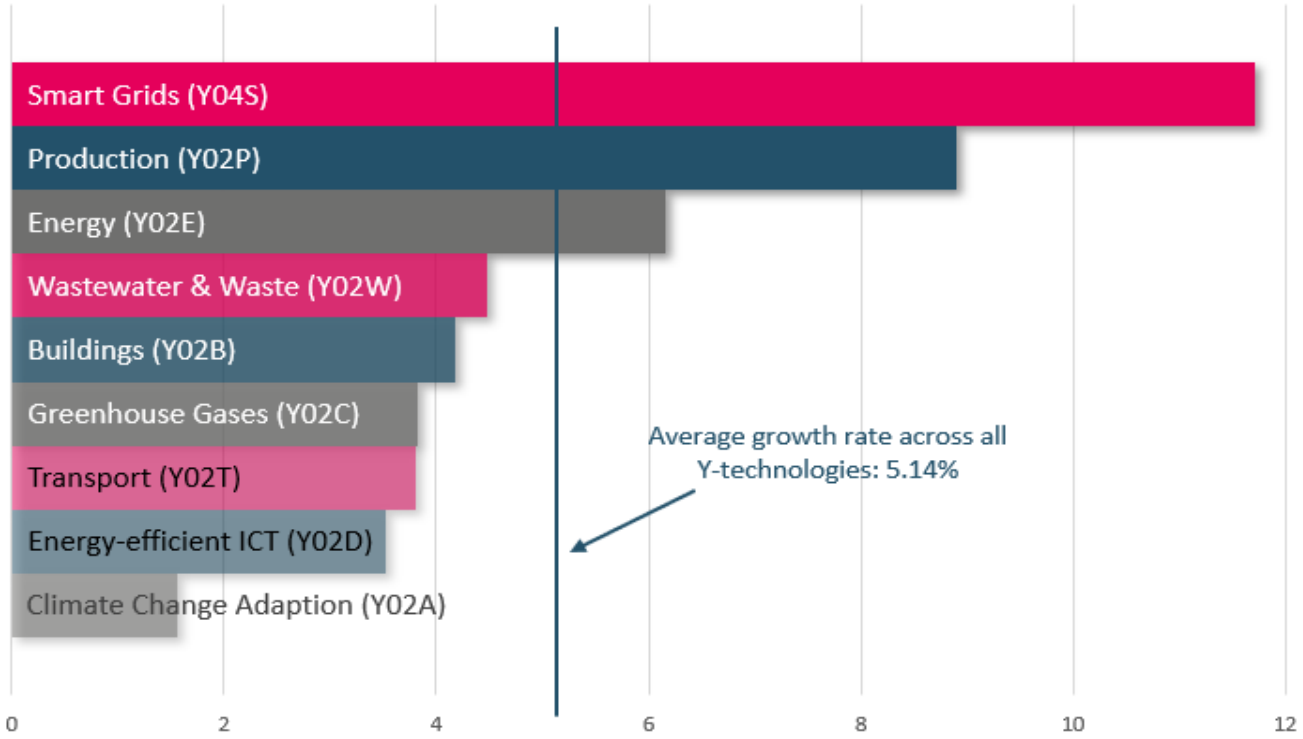


Figure 8: Average annual growth rate across all 9 cleantech areas - Austria, 2003-2022.

Note: Own calculation and illustration.

Technology Sectors in Which Austria Excels?

A closer look at the nine cleantech sectors reveals a number of special features. Not only are the shares of the individual technology areas in the total volume of all cleantech IPF (2003-2022) analysed, but also their average annual growth rates. The average annual growth rate (CAGR[46]) in Austria across all nine technology areas is 5.1% from 2003 to 2022. (Fig. 8).

Above-average growth rates can be seen in the following three technology areas, although their **share** of the total volume **varies greatly**:

- The strongest growth over the observation period was in **Y04S** - **smart grids** with an annual growth rate of almost 12% - albeit from a low level (see also Fig. 7). They account for just 1% of Austrian cleantech IPF over the period 2003-2022.
- The area of clean and sustainable **production technologies (Y02P)** grew at an above-average annual rate of around 9%. In terms of share, this is the fourth strongest technology area: clean and sustainable technologies for production in industry and agriculture account for just under 14% of all cleantech IPF in Austria.
- Cleantech IPF from the **energy** sector **(Y02E)** is the area that performs

[46] CARG: Compound Annual Growth Rate. The CAGR is well suited to analysing long-term trends and is not influenced by short-term fluctuations.

conspicuously in terms of both growth and share: energy technologies account for the largest share with just under a third of all cleantech IPF (see Fig. 7) and show above-average annual growth of over 6%. Of the total of 4,718 cleantech IPF identified in the period 2003-2022, around 1,360 are in the field of energy production, transmission and distribution.

The following areas show **good growth rates and high shares of the total volume:**

- Technologies for **wastewater and waste management (Y02W)**: they have a share of 7% (5th strongest area) and have grown by 4.5% annually over the last 20 years.
- Clean and sustainable technologies from the **building sector (Y02B)**: they account for a good fifth of the total volume of Austrian cleantech IPF and are therefore the second strongest technology area. They are growing comparatively strongly at just over 4% per year (2003-2022). Of the total of 4,718 cleantech IPF identified in the period 2003-2022, just under 1,000 are in the buildings sector.
- The same applies to the technology area of **transport (Y02T)**: with a 20% share of the total, it is the third strongest area in Austria and shows an annual growth rate of 3.8%. Of the total of 4,718 cleantech IPF identified in the period 2003-2022, 920 can be assigned to this technology area.

These areas have **moderate growth rates but a low share:**

- Technologies related to **greenhouse gases (Y02C)** - capture, storage, reuse or sequestration - are growing at an average annual rate of just over 3.8%, but account for the smallest share of the total volume in Austria. In global terms, this is also currently the area with the lowest share (see Fig. 9).
- **Energy-efficient ICT technologies (Y02D)** are growing at over 3.5% annually in Austria, but account for less than one per cent of the total volume of all cleantech IPF in Austria.

The following area has the **lowest growth rate**, but with some notable aspects:

- **Climate change adaptation technologies (Y02A)** account for 6% of all cleantech IPF in Austria - making it the sixth strongest area in terms of share. With average annual growth of just 1.6% (2003-2022), this area ranks last. It is interesting to note that the latter in particular has grown faster than all other categories over the last 10 years.

A brief look at how the nine technology sectors are performing in terms of share **worldwide**:

According to these calculations, technologies for the production, transmission and distribution of energy are also the largest area **worldwide** - as in Austria - accounting for a third of all Y-IPF. This is followed by transport technologies and technologies from industry and agriculture and, in fourth place, the building sector, on a par with energy-efficient ICT.

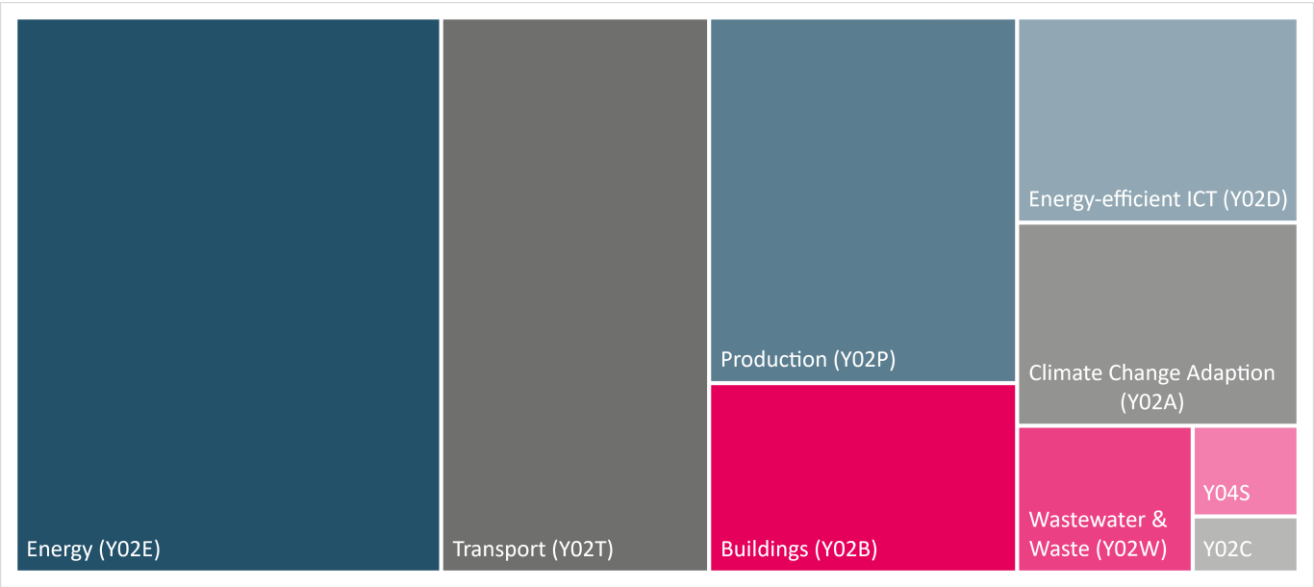


Figure 9: Cleantech IPF shares worldwide, 2003-2022.

Note: Own calculation and illustration.

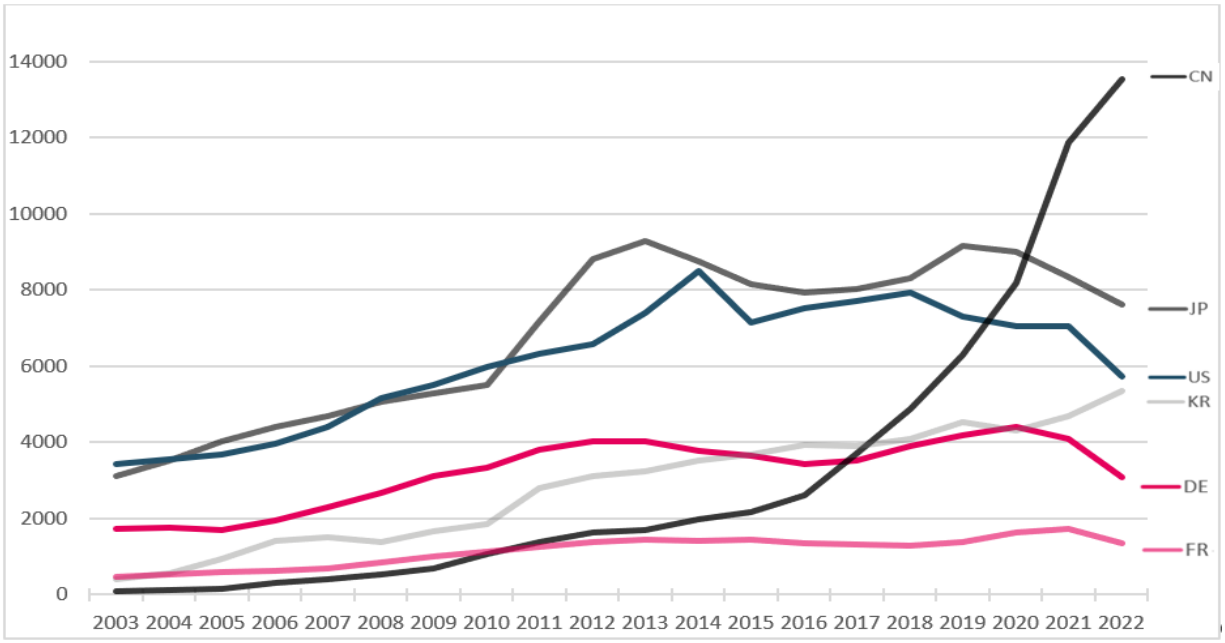
In **Austria** (as mentioned above), the **building sector** is the second strongest sector in terms of share, while energy-efficient ICT come in far behind. **Asian countries** are particularly strong in the latter area, contributing around 60% of all global IPF.

4.4. Austria in a Global Context

From a global perspective, **China** has seen a significant increase in patent applications in general in recent years (especially since 2016), but also in clean and sustainable technologies in particular, clearly overtaking other top performing countries such as **Japan, USA and South Korea**. Leading European countries such as **Germany** and **France** remain at a comparatively lower level.

Figure 10: Top performing countries worldwide - Total cleantech-IPF, 2003-2022

Note: Own calculation and illustration.



While a time trend provides information about the dynamics of technology development, the sum of all cleantech IPF over time can provide information about a country's current potential and its market position. If we therefore look at the **shares** of countries in the total volume of IPF in the Y-section (2003-2022), **Japan** has the highest volume in terms of share at almost a quarter, closely followed by the **USA** with just over a fifth of all Y IPF.

It is followed by **Germany**, **China** (11% each) and **South Korea** (10%). Austria has a global share of 0.8%. This puts **Austria** in **15th place** worldwide out of the 178 countries for which data is available (2003-2022).

It is striking that smaller economies such as Switzerland, the Netherlands, Sweden, Denmark and Austria are among the top 15 worldwide in terms of share, right after the large economies. This points to their innovative strength and focus on clean and sustainable technologies.

It therefore makes sense to look at these figures **in relation to the country's population** (standardisation of the Y-IPF per 100,000 inhabitants of the respective country).

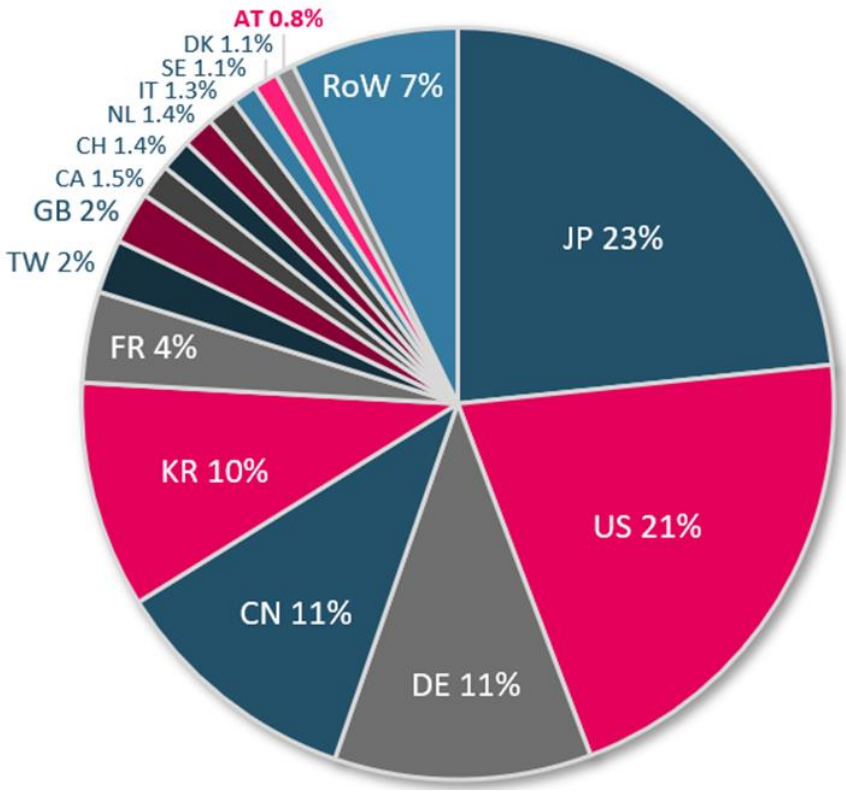
As can be seen in the following chart (Fig. 12), the ranking is changing in favour of smaller countries: South Korea and Japan are followed by five European countries.

Austria is now ranked **9th worldwide** in terms of population, while the USA (12th) and China (24th) have slipped down the rankings. This means that **Austria ranks 5th in the EU** and **6th in Europe** (with Switzerland in second place).

The USA and China are also not among the top 3 countries in any of the areas when looking at the global ranking **weighted by population according to technology areas**.

Figure 11: Top-15 countries with highest shares of cleantech-IPF, 2003-2022.

Note: Rest of World (RoW): other 163 countries. Own calculation and illustration.



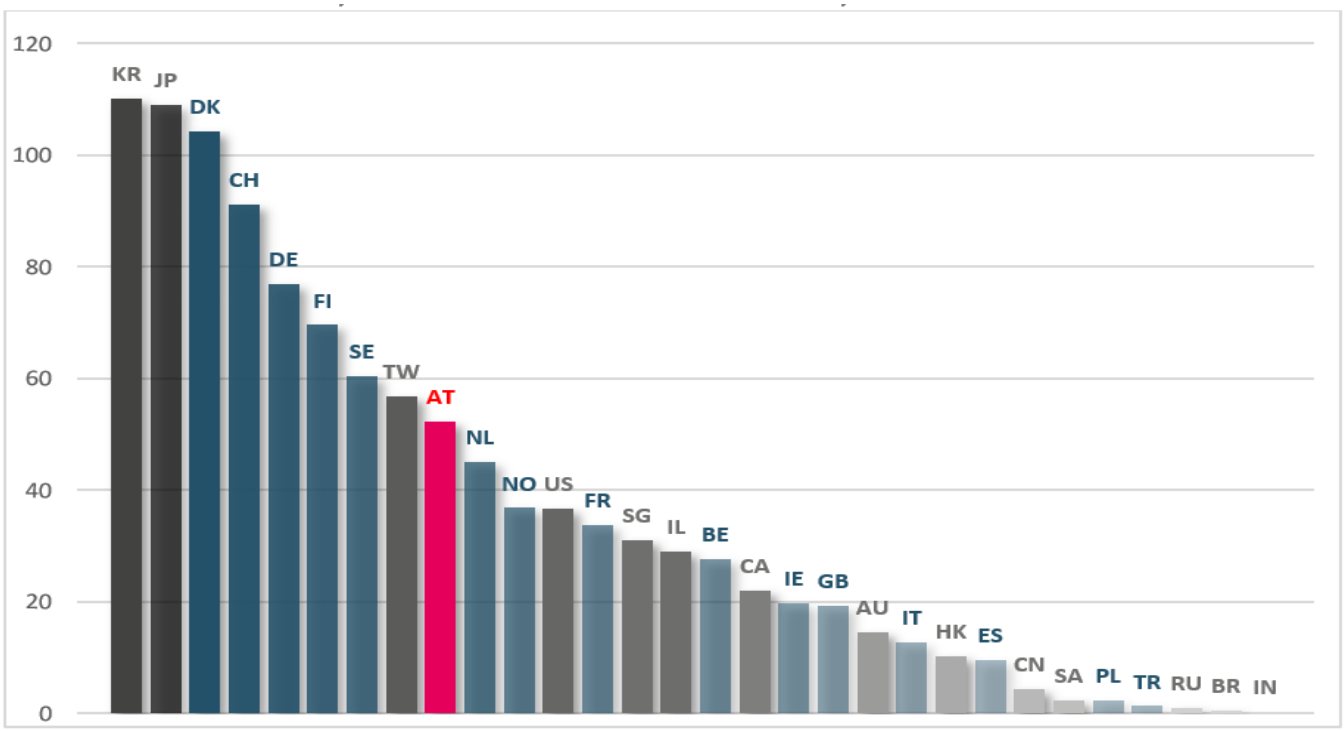


Figure 12: Total cleantech-IPF, normalised to the country's population.

Note: per 100,000 inhabitants, 2003-2022. TOP 30; EPO countries: blue, AT: pink, others: Grey. Only countries with more than 100 IPF were considered (= 56).

As the table below shows, there is still a **clear dominance of European countries** (at least at present): 19 times (12 times) a European (EU) country ranks among the top 3 and only 8 times a non-European country. Korea and Japan are clearly the leading non-European countries. They also lead the field overall, as can be seen from the chart.

If we look at **Austria's performance** in the individual cleantech sectors, standardised by population, the following picture emerges:

- Austria **ranks first** worldwide in clean and sustainable technologies in the **building sector** (measured by population).
- Austria is also in the **top 3** worldwide for **wastewater and waste management technologies** (2nd place in the EU).
- Austria is also **among the top 10 worldwide** in the areas of transport (7th place, 4th place in the EU), energy (8th place, 4th place in the EU) and production (9th place, 5th place in the EU).

This finding is also in line with the results of the EPA study (2024)[47] on cleantech innovations, according to which Austria ranks first in Europe in the field of buildings. The aforementioned study also shows that **Austria is one of the six European countries** with the **highest specialisation advantages** in clean and sustainable technologies (in relation to overall innovative strength).

[47] EPO/EIB. (April 2024).

Ranking / Technology	1	2	3	AT Ranking	
				worldwide	EU
Y02B (Buildings)	AT	TW	NL	1	1
Y02W (Wastewater & Waste)	FI	CH	AT	3	2
Y02T (Transport)	JP	DE	SE	7	4
Y02E (Energy)	DK	KR	JP	8	4
Y02P (Production)	CH	JP	DK	9	5
Y02C (Greenhouse Gases)	NO	CH	NL	12	5
Y04S (Smart Grids)	CH	KR	JP	12	6
Y02A (Climate Change Adaption)	CH	NO	DK	15	8
Y02D (Energy-efficient ICT)	FI	SE	KR	20	8
Total	**KR**	**JP**	**DK**	**9**	**5**

Figure 13: Global ranking of Austria in the cleantech sectors (population standardised).
Note: Categories were ranked according to Austria's performance. Countries with more than 100 IPF (56) were included in the ranking by technology area. Data basis for the ranking: Y0-IPF per 100,000 inhabitants (2003-2020).

4.5. Austria's Universities and Green Technologies

Finally, as one of many different groups of applicants, the group of universities as patent applicants will be discussed. The reason for this is the EPO's latest study, which analyses the **patent activity of universities** and attests to the growing role of universities in the patenting and commercialisation of inventions. More than 10% of all academic patents filed with the EPO by European applicants in 2020 originated at universities.

This EPO study analyses academic patents, which are both direct applications from universities and indirect applications (where university-affiliated researchers are among the listed inventors - they are usually filed by companies and are the result of knowledge transfer through research collaborations, entrepreneurship or informal contacts).[48]

In terms of the number of these academic patents (2000-2020), **Austria** ranks **10th** among the 27 EU countries (12th place EPO-wide). The total number of Austrian academic patents amounts to 3,125, which corresponds to 3% of European academic patents.

When measuring the number of academic patents **per capita** in each country, a strong performance of small countries, including Austria, is evident. With 363.4 academic patents per million inhabitants, **Austria ranks 6th in Europe**.

The APO got access to the original data of all **direct applications** from universities in Austria[49], making it possible to analyse whether these direct applications fall within the domain of clean and sustainable

[48] EPO. (October 2024).
[49] A total of 969 inventions originated directly from Austrian universities (2000-2020). These inventions were registered by one or more Austrian universities. If these joint applications are considered, a total of 1044 applications were filed directly by Austrian universities at the EPO in the period 2000-2020. No detailed data is available for indirect applications.

technologies. The analysis reveals that **10% of all direct EP applications from Austrian universities are related to green technology sectors**. Technical and natural science-oriented universities, in particular, stand out with high proportions and are seen as pioneers in this field.

- Most of these green applications, in absolute terms, come from the **Vienna University of Technology** (TU Wien), which is also the university with the highest number of direct patent applications overall (across all technical fields). It is followed by **Graz University of Technology** (TU Graz) and **University of Mining Leoben** in second and third place, respectively.

- When looking at relative proportions, the ranking changes: **University of Mining Leoben** leads with over 21%, followed by **TU Graz** with around 18%, and the **University of Vienna** with 13% of Cleantech patents as a share of their total EP applications.

Ranking by absolute numbers: Direct applications from cleantech-sectors	**Ranking by Cleantech Share in %:** Share of direct cleantech applications as a percentage of the university's total direct applications	
1. Vienna University of Technology	1. University of Mining Leoben	21,1%
2. Graz University of Technology	2. Graz University of Technology	17,7%
3. University of Mining Leoben	3. University of Vienna	12,9%
4. University of Innsbruck	4. Vienna University of Technology	11,2%
5. University of Vienna	5. University of Innsbruck	10,8%

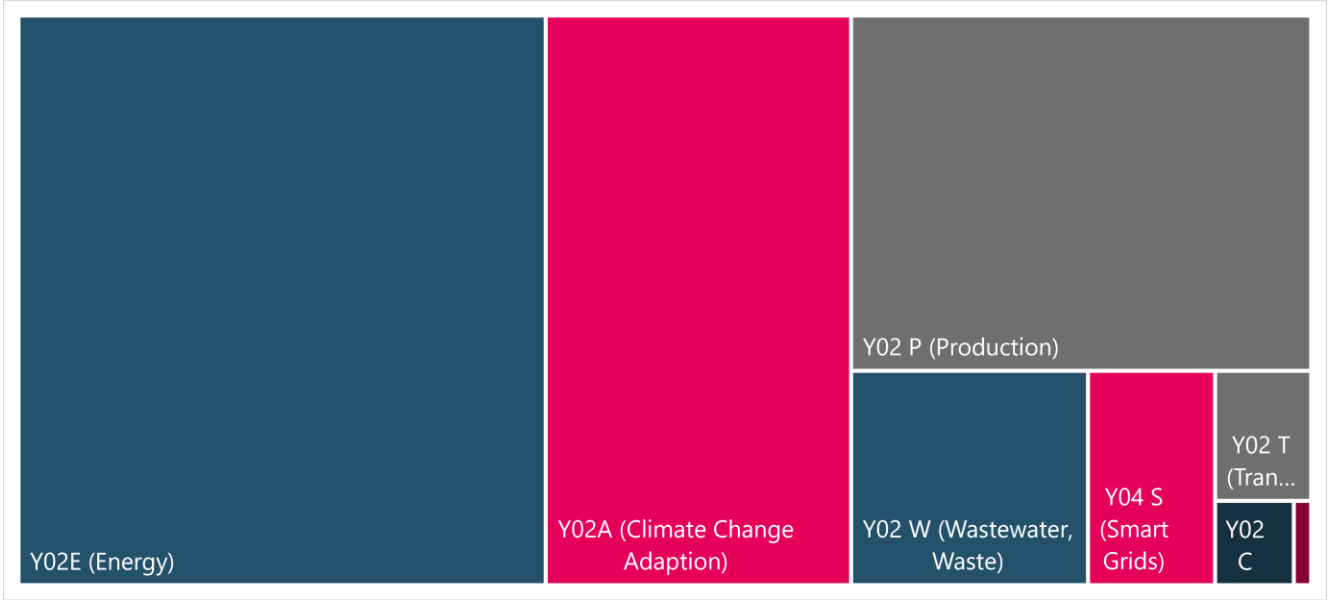
Figure 14: Cleantech EP applications from Austrian universities (2000-2020).

Note: TOP 5 (measured by absolute numbers); Source: EPO. (2024). Own calculations and illustration.

The cleantech technology fields with the highest number of direct EP applications from Austrian universities are energy production, generation, and distribution (Y02E), climate change adaptation (Y02A), and production technologies in industry and agriculture (Y02P). Over 85% of all direct university cleantech applications fall within these three areas.

Figure 15: Cleantech EP applications from Austrian Universities - technology areas.

Note: Own calculations and illustration.



5. Green Initiatives of the APO

In addition to fulfilling its administrative responsibilities, the Austrian Patent Office focuses strongly on knowledge dissemination and raising awareness about intellectual property. In 2024, the APO launched several initiatives and projects focused on green innovations to provide targeted education, enhance awareness, and showcase pioneers and best practices. These efforts aim not only to set thematic impulses but also to strengthen Austria's position as an innovative hub in the long term. Below is an overview of the key initiatives.

Fee Deferrals for 'Green' Patents

The APO grants fee deferrals for green patents if the invention supports environmentally sustainable goals, such as energy generation or conservation or the reduction of greenhouse gas emissions. This policy is based on Section 7 of the Patent Office Fees Act.

Masters of IP - Green Edition

Masters of IP is a free event series organized by the APO's IP Academy, targeting SMEs, startups, and anyone interested in gaining insights into the innovation process. The series addresses opportunities and challenges related to implementing inventions and offers a platform for networking and exchange. Special emphasis is placed on exploring funding opportunities. In 2024, two editions of this series were dedicated to clean and sustainable technologies:

- First event – July 2024: This event focused on the 'Twin Transition' - the digital and ecological transformation in the context of inventions and patents. A highlight was the State Prize-winning patent from the *Vienna University of Technology*, enabling clean hydrogen recovery from existing natural gas infrastructure and its compression for use. This innovation demonstrated how environmentally friendly patents and advanced technologies can form the foundation for a sustainable future society.

- Second event – November 2024: The focus was on sustainable innovations in construction. Featured was the Tyrolean startup *Parastruct*, which developed 3D printing technology to efficiently recycle construction waste. Panellists included an expert in sustainable construction and representatives from funding agencies AWS and FFG, along with the APO.

Podcast

The APO's podcast *'IP Frequency'* introduces listeners to the world of intellectual property by highlighting the people behind the innovations. Through conversations with inventors, role models, IP experts, and creatives, the podcast combines personal stories with professional insights. In 2024, a special edition focused on clean and sustainable technologies:

- *'Green Patents - Sebastian Vogler'* Sebastian Vogler, co-founder of *Beetle ForTech*, shared insights about his patented innovation for tracking roundwood globally. This invention promotes sustainable forestry by ensuring resource traceability.

Additional episodes on this topic are planned.

Expert Conference

The Austrian Patent Office is celebrating its 125th anniversary this year - a good occasion to reflect on its own history, but above all to look to the future: the international conference, taking place on November 28, 2024 at the Vienna Museum, will address the question of what role intellectual property can play in the green and digital transition.

Under the title '*IP for the green and digital transition*', high-profile representatives of international organizations will examine this topic from various perspectives - including the Director General of WIPO Daren Tang, the Executive Director of the EUIPO João Negrão and the President of the EPO António Campinos. Kamil Kiljanski, Vice Director for Intellectual Property at the European Commission, will also give a keynote speech. In addition, a whole series of Austrian pioneers of transformation provide insight into their experiences and best practices.

Data Deep Dives

The Austrian Patent Office uses national and international data sources to analyse IP developments on a topic-specific basis and to communicate trends and developments to a broad public. The cooperation with the EPO Observatory is particularly noteworthy here. In 2024, two of the main areas of analysis focused on the topic of green and sustainable technologies. Firstly, the analysis on cleantech innovations published in April[50] and the publication on 'Energy Transition' published in December. The Austria-specific data obtained in the course of such studies help to create one's own analyses of the situation in Austria and to disseminate knowledge about it. These analyses help to give the topic media presence. Examples on this area:

- Ö1 interview with Federal Minister Leonore Gewessler and Patent Office President Stefan Harasek on cleantech patents and Austria's performance, broadcast in the morning journal on April 27, 2024.
- '*Austria particularly strong in green-tech patent*s', interview with Patent Office President Stefan Harasek, October 2024, Börsianer Magazin (No. 59).
- '*Austria is a pioneer in green patents*', interview with Patent Office President Stefan Harasek, October 2024, Trend Magazine (39-2024).
- 'Patent Ideas for the Environment', article from October 25, 2024 in 'Heute', Austria's largest free daily newspaper.

Contribution of the APO to climate protection

Sustainability and environmental awareness in the patent office: the topic of sustainability and environmental protection affects everyone in order to ensure a planet worth living on for future generations. As an authority committed to promoting innovations for a better future, the patent office assumes a special responsibility. Some of the APO's concrete measures for climate protection are listed below:

[50] EPO/EIB. (April 2024).

Mobility/transportation area

- 70% of the workforce uses public transport to get to work; many have a 'climate'[51] or job ticket.
- The regulation on the possibility of using teleworking reduces commuting, which reduces CO_2 emissions and energy consumption.
- Public transport is used almost exclusively for business purposes; company cars were abolished years ago.
- 8% of employees cycle to work. Instead of previously discounted car parking spaces, secure bicycle parking spaces are now provided. In addition, a free bicycle service (for repairs) was also offered on site at the APO for the first time in 2024.

Office/Resource conservation area

- The APO relies on a completely digital offering in the sense of a paperless office.

  For instance, apart from the fact that all applications can be submitted digitally, the annual report is not printed, but published on the APO website and the link to the annual report is sent with a work of art. For this purpose, a competition is held annually among students of the University of Applied Arts in Vienna to deal with the topic of IP and the respective annual theme (2023: IP gender gap, 2024: clean and sustainable technologies) and implement this in works of art.
- The electricity requirement is 100% covered by renewable energies.
- To conserve resources, the office space was reduced by around 12.5%.
- All lighting systems were converted to LED technology.
- When purchasing furniture, office materials and technical equipment, attention is also paid to resource conservation, regionality and social responsibility in accordance with the requirements of the National Action Plan for Sustainable Procurement.

Consumption/Events area

- Larger events are held as 'Green Events'.
- At many events, the food bank box is offered so that leftover food can be taken away; 20 cents per box goes to 'Tafel Österreich', a non-profit organization dedicated to reducing food waste and redistributing it to people in need.
- Disposable tableware is largely avoided in the canteen and at coffee machines.

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[51] Climate ticket (Klimaticket): a nationwide public transport pass that allows unlimited travel on most trains, buses, and trams across the country for a flat annual fee.

österreichisches patentamt

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Appendix:

Patent Metrics - Infobox

- **Data source: PATSTAT** (Spring 2024 Edition) is used as the primary data source.
- **IPF**: The analysis uses patent families (more precisely: international patent families, IPF) rather than individual patent applications as a key figure to measure patent activity in the various categories of clean and sustainable technologies.

An IPF is a collection of applications for **the same invention** that includes a published international patent application, a published patent application at a regional patent office or published patent applications at two or more national patent offices.[52] Thus, not only applications at individual offices but also EP, international patent applications and applications at OAPI, ARIPO, etc. are considered, since the latter in particular meet the claim of international relevance.

Each IPF thus covers one invention and includes patent applications that relate to at least two countries. This gives the invention a certain relevance in terms of its international market value and ensures that it is only counted once (and not in every country for which protection was sought). It is therefore a reliable indicator of inventive activity, as it offers a certain degree of control over patent quality by only representing inventions for which the applicant considers the value to be sufficient to apply for international protection.

- **Y0 classification:** The analysis is based on all IPF that have been assigned to one or more areas of clean and sustainable technologies in PATSTAT, which is done by the EPO patent examiners depending on the technical features of the invention.[53]
- **Date of first publication:** The date of first publication is the date of the first publication of a patent application from the patent family in question. From this point onwards at the earliest, assignment to the Y technology areas (classes, subclasses, etc.) is also possible.
- **Reference year** is the year of the first publication.
- The **country of origin** of an IPF is determined based on the first patent application in this family. Therefore, all patent applications in the family are first sorted by filing date and then by the order of the applicants. The first non-empty country code in this sorted list is set as the country of origin. Background: the origin of the applicant is not always available in the database. For example, the coverage of indications of origin of Chinese intellectual property rights is very low. The procedure outlined here takes this into account.
- **Weighting:** A claimed invention can be assigned to several technical fields, each of which is described by different patent classification symbols. The approach here was to divide the invention pro rata among the assigned patent classification symbols. However, only those classification symbols that are assigned to the various Y classes and subclasses are considered. The allocation is therefore based exclusively on this limited set of classification symbols, whereby the relevance of the environmental categories is specifically considered in the weighting of the application.

[52] See i.e. EPO/EIB. (April 2024).
[53] The CPC classification system is discussed in detail in Chapter 4.