

'22

graanul
invest
Sustainability
Report

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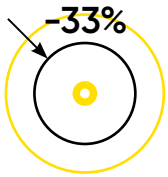
Sustainability highlights in 2022

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• The addition of a new vessel, **Helme**, improves our logistics efficiency and delivery accuracy in the Baltic Sea



• We reduced our group's raw material **procurement radius by 33%**, achieving an average sourcing distance of only 37 km



• Implementing an innovative solution at our **US plant** significantly reduced its environmental footprint



• We successfully raised our production of green energy amidst **the energy crisis**



• Overcoming the challenges posed by the energy and raw materials crisis caused by the war, we displayed remarkable adaptability, ensuring a sustained supply of raw materials and **fulfilling all supply contracts** without compromising sustainability





Nicholas B. Dottino

CEO

2022 was a difficult year for many! For us it was defined by the war in Ukraine and how it affected the global economy with volatile and elevated commodity prices, energy costs and spiking inflation. Questions about energy security have become more prominent than ever. The world understands that we need viable renewable energy solutions, and that speed of those efforts/ results needs to increase.

The turbulence of the last 12 months was excellent confirmation that our company is strong, mature, and resilient to successfully pass through globally difficult times. Despite the difficulties, we ended the year with good results without making any sacrifices to our sustainability principles. It has been an incredible effort; our employees and supply partners are core contributors to those achievements.

We kept our promises

As we are part of the wood and forestry industry's circular economy and depend on wood and forestry residues for our raw materials, it raised the difficulty level. After Russia started the war on the 24th of February, we substituted all feedstock imports from Belarus immediately. It was challenging, as many of the Baltic sawmills also had a shortage of timber they had formerly imported from Russia, which used to be a natural part of the local neighbouring procurement radius. Despite all the challenges, our procurement and logistic teams did outstanding work to secure a stable flow of raw materials.

One of the year's most outstanding achievements was that we fulfilled all our contracted deliveries to our customers despite the storm in global energy markets. The role of woody biomass in ensuring regional energy security and substituting fossil fuels is inevitable. As one of the most prominent bioenergy producers, we believe that our leadership in the effective use of biomass as part of the circular economy has a key role in meeting global climate targets.

Our customers view us as being one of the most regular, reliable, and predictable suppliers in their supply chain, which is the exact position we want to retain and build upon further. Our global ambitions will increase as a central part of our strategy as we advance. Expanding our reach and role in transitioning to a cleaner and more resilient energy sector across the globe is important.

It has been a joint effort

Our factories have tremendous operational efficiency, delivering high productivity and a low ecological footprint. Despite all challenges in 2022, the year-end results prove that our long-term focus on efficiency and sustainability, with refined standardised processes and technology throughout our production units, is the key to success through the global economy's fluctuations. We ended the year by improving our key sustainability figures.

There is much to learn from our challenges last year, and we are still digesting some of those lessons. For more than 19 years, our team has built Graanul Invest into what it is today, and 2022 demonstrated that experience is a valuable currency.

I want to express my greatest gratitude to our employees, customers and cooperation partners for the joint effort and great empathy that helped us stabilise our situation and make us successful.



At Graanul Invest, I am constantly amazed by our ability to rise above challenges and continuously improve. We have proven to be highly efficient, adaptable and committed to enhancing our data processing. While the pandemic years tested our IT solutions and teamwork, 2022 came to present serious challenges for our raw material supply chains and sustainability compliance. Reflecting on the year, we were once again amazed by our production team's remarkable efficiency and diligence in meeting the value chain's dynamic demands, even amidst the ever-changing backdrop.

Today, we can confidently say that our European Union value chain has achieved an optimal level, with the difference in key indicators between stable and volatile years settling within the range of 5% to 7%. Despite two consecutive "crisis" years, we have managed to maintain consistent results. Despite the broader range of impacts of the efforts and risks undertaken in 2022, the overall stability of our value chain footprint serves as a clear testament to our resilience.

We have made significant strides in our reporting practices

The occupational safety indicators for 2022 remained consistent with historical levels, but we recognise that maintaining the status quo is not enough. The engagement and ideas put forth by our workers to enhance safety demonstrate their enthusiasm and awareness. However, a systematic action plan is crucial to translating these initiatives into positive trends in key safety parameters. During 2023, we are focused on developing engineering, procedural, and structural projects that will bring about clear improvements in the 2024 safety indicators.

In response to the growing interest of global stakeholders and investor reporting, we introduced several new reporting practices in 2022, including the GHG Protocol and the TRIR operational safety metric. These tools will enable us to benchmark our performance against global sectors and leading energy and industrial companies. Moreover, they give stakeholders a meaningful understanding of our environmental footprint and occupational safety on a comparable scale.

Measuring and reporting on the various impact areas specified in the GHG Protocol presents an exciting challenge. Although calculating the full life-cycle footprint of our products is mandatory in the energy sector, it often remains unfamiliar or overlooked for many service providers and products we regularly engage with. Obtaining auditable and accurate data from third parties adds to the excitement and complexity of this task.

We sustain international collaboration for sector advancement

2022 was certainly also an active year in the corridors of the EU institutions. The various versions of European directives, regulations and documents from the European Parliament, while also sparking healthy debate, set ambitious targets in sustainable bioenergy, thereby underscoring its pivotal role in achieving the EU's climate objectives. These developments provide valuable insights into best practices within the biomass and bioenergy sectors.

Throughout the year, we maintained our commitment to promoting and monitoring global sustainability principles in collaboration with like-minded partners in the renewable energy sector. The Glasgow Declaration aims to harmonise global rules for the sustainable use of biomass, ensuring that emerging industries utilising biomass (e.g. lime, steel, biochemistry, biofuels and hydrogen) can benefit from established best practices without the need to start from scratch or compromise on current standards.

Sustainability is part of all of us

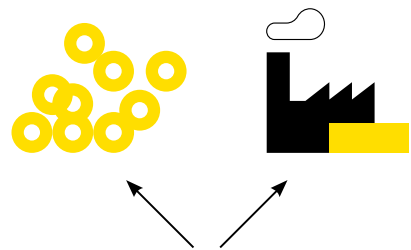
Sustainability is deeply ingrained within the entire team at Graanul Invest, reflecting our identity as a forward-thinking renewable energy company. As the green energy sector has grown into a global industry, it has given rise to the best practices and requirements that drive us to constantly improve. All biomass is no longer automatically classified as renewable energy, just as every windmill or solar panel is not recognised as green technology. The key indicators that effectively determine the climate-friendliness of the generated megawatt are efficiency and life-cycle cost-effectiveness.

We take great pride in the fact that sustainability holds equal importance to finance and production within Graanul Invest's board, and that we have a dedicated team committed to making tangible and measurable positive impacts in this field. As the world sets higher climate targets and establishes more stringent requirements, Graanul Invest has a unique opportunity to demonstrate its exceptional value chain footprint and commitment to sustainability.



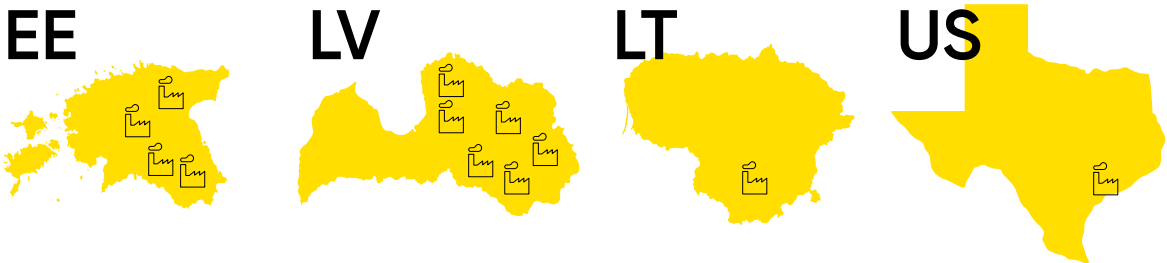
**Mihkel
Jugaste**
Chief Sustainability
Officer

Graanul Invest – an international bioenergy producer



The company has **two** main business areas: producing wood pellets and creating environmentally friendly, carbon-neutral electricity and heat from forestry and wood industry waste. We produce premium-grade and industrial wood pellets.

Our cogeneration plants provide sustainable electricity and heat for our pellet plants and support the local power grid with green energy. Both our pellet and cogeneration plants are fuelled by residues and waste from the sawmill and forestry, following the principles of a circular economy, specifically the concept of cascading use: we only use wood biomass that cannot be recycled or processed by higher value-added industries.



Graanul Invest Group is the world’s leading producer of sustainable biomass and bioenergy. We have dedicated over 19 years to the development of the bioenergy sector. With our cutting-edge processes and technologies, we are an industry leader.

Established in Estonia in 2003, the company has grown into an international entity, recognised as a global leader in the highly efficient and environmentally friendly production of wood pellets.

Mission

Our mission is to accelerate the advancement of biomass science and the uptake of biomass opportunities.

Tackling climate change has become more important than ever, and more than ever, we need to take action to reduce carbon emissions. What the world needs most are solutions that work here and now. We are dedicated to discovering improved methodologies and finding new answers to existing questions.

Wood pellets are one of the most flexible and efficient renewable energy sources as a solid biofuel, replacing gas, oil and oil shale. Preserving any fossil material below ground brings us one step closer to solving climate challenges.

Our values

We believe solutions must be sought right now, every single day.

We believe in our people and value their expertise highly.

We believe in the relentless pursuit of efficiency and learning.

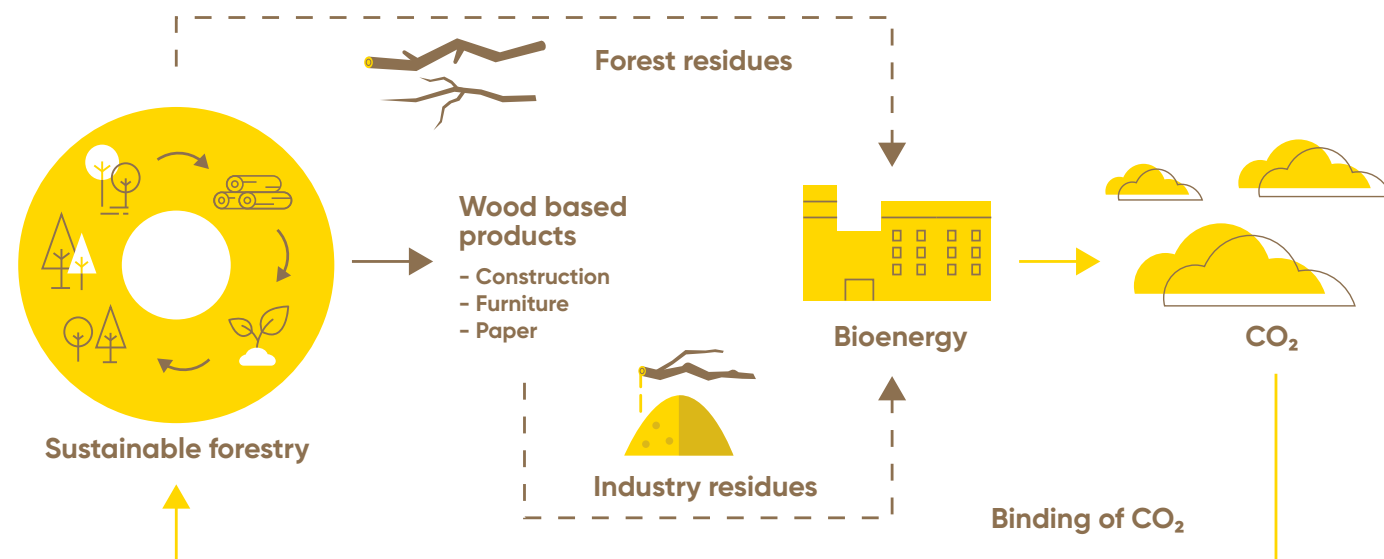
We value trust and transparency.

We guarantee high quality and strive for innovation.





The group includes 12 modern pellet plants in the Baltics and the US, as well as six cogeneration plants in Estonia and Latvia. It employs more than 500 people.



Wood pellets are an environmentally friendly fuel that replaces fossil fuels

Wood pellets are a solid biofuel that is one of the most flexible and efficient renewable energy sources. Using wood residues in energy will help us move towards our climate targets by burning less oil, shale and natural gas.

Sustainably produced wood-based biomass is an environmentally friendly energy source provided that the raw material comes from natural waste streams, does not compete in price or value with other industries, and is produced with the lowest possible environmental impact.

The energy produced from biomass that meets these criteria can reduce emissions by up to 98% over its life cycle compared with coal and is indispensable in meeting climate targets.

Our operating principles Principles

Our operating policy is focused on the quality of our products and services, ensuring this is achieved with minimal environmental impact. We are fully committed to developing a sustainable renewable energy system that replaces fossil fuels in our business and day-to-day operations.

We regularly monitor our environmental emissions as well as energy and resource efficiency to improve our ecological footprint. We constantly improve performance and ensure sufficient information and resources to reach our goals. When making decisions, we carefully assess their immediate and long-term implications for our workforce, customers, stakeholders, the environment, operational efficiency and overall business operations.



Our goals are built around the following key indicators:

- Highest-quality products
- Minimum environmental impact
- Highest energy efficiency in production and the best energy performance of individual installations
- A safer working environment
- Greatest greenhouse gas savings potential

Safety first!

Safety is a top priority within our group. Our ultimate goal is to ensure that every employee and partner who sets foot on our premises can return home to their loved ones in good health every day.

We have implemented stringent and carefully thought-out safety measures that prioritise prevention to safeguard our employees and enable them to perform their duties without safety issues.

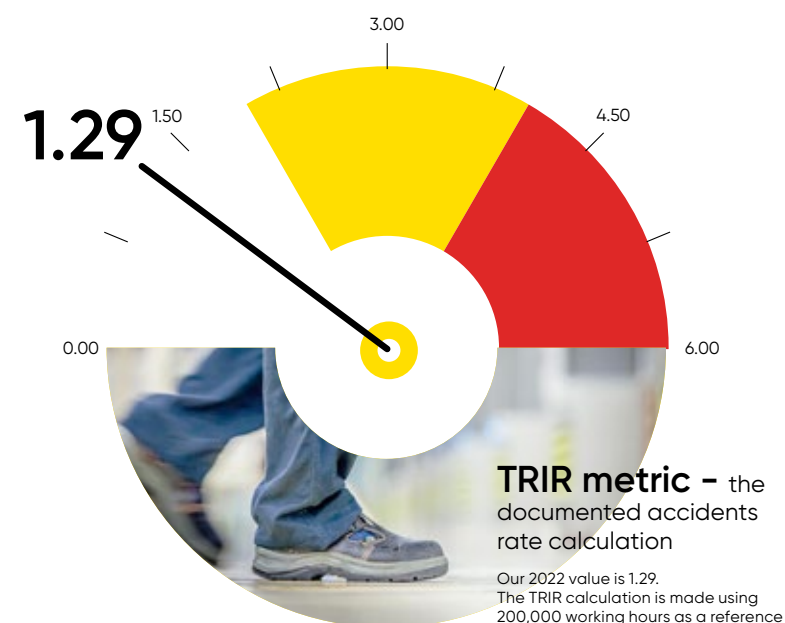
We made significant progress in 2022 by implementing a system to identify “near misses”, incidents that could have resulted in accidents, across our group. By closely monitoring hazardous situations, we can discuss and learn from mistakes that could have had severe consequences.

Despite a notable increase in our workforce, with a growth rate of up to 10% per year, we are proud that the number of **work-related accidents have not risen** across the group.

While we have always prioritised safety and maintained various safety and well-being metrics and targets, we recognised the need to benchmark ourselves against leading global companies and provide transparent safety performance reports to international stakeholders.

Consequently, starting in 2022, we incorporated the TRIR (total recordable incident rate) metric, a fixed method for accident rate calculation, into our official external reporting. We treat each incident seriously, and our daily efforts are dedicated to preventing accidents. As we progress on this journey, it is crucial to establish a dependable method to ensure that our practices align with the highest global standards. While incident severity is an essential parameter for decision-making and improvement, the inclusion of TRIR, which considers the number of incidents relative to the total working hours, adds another dimension to our understanding of safety performance.

By sharpening our focus on identifying and analysing near misses, we can gain valuable insights and engage in open discussions about mistakes that could have had adverse outcomes.



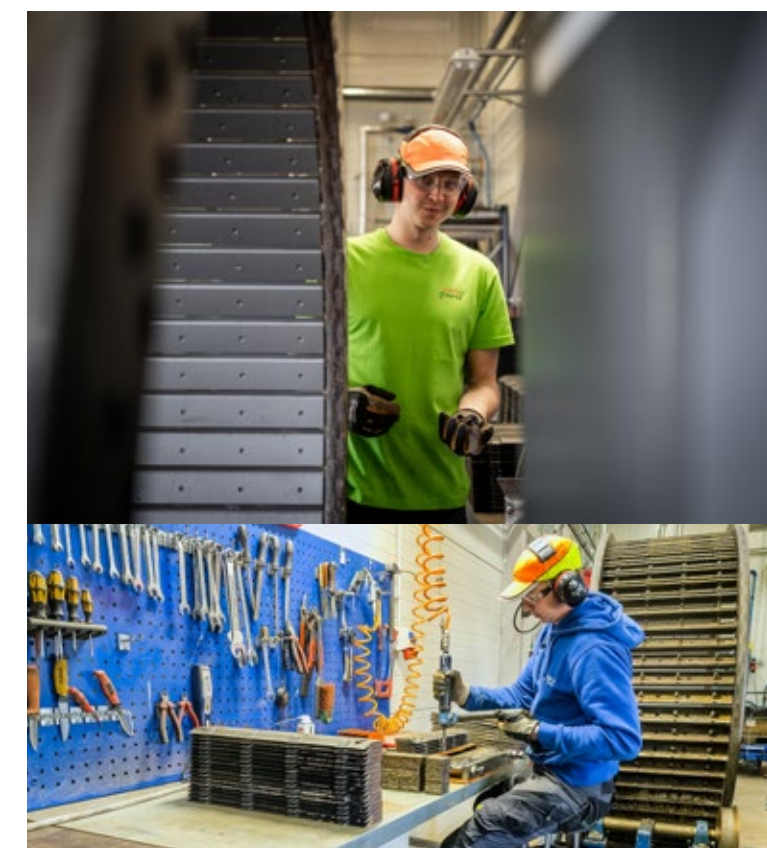
Our comprehensive safety policy at Graanul Invest encompasses various aspects, including equipment maintenance, employee training, and emergency procedures, ensuring that the same rules apply to our guests and partners visiting our facilities.

Principles for a safe working environment

- **Promoting health.** Our employees have regular health check-ups, and we also promote healthy lifestyles outside work.
- **Encouraging individual ownership.** We encourage individuals to take ownership of their safety by maintaining personal protective equipment and tools in excellent condition.
- **Training.** We regularly organise safety training and update our guidelines.
- **Modernisation.** We implement new tools and safer solutions as they become available.
- **Regular safety checks.** Appropriate personal safety equipment is always mandatory. We encourage our staff to report any shortcomings or breaches.
- **Regular inspection and maintenance.** We regularly check and maintain equipment and machinery to ensure it works properly and safely.
- **Communication.** We talk about incidents and share our experiences. It is always safer to learn from past mistakes than to repeat them.
- **Culture.** We believe in a safety culture that encourages employees to prioritise safety and immediately report any safety issues or hazards to management.
- **Partners.** At Graanul Invest, we regularly welcome a diverse range of partners to our premises, including truck drivers, maintenance partners, and subcontractors. We actively share our safety practices, policies, and knowledge during their visits. We do our best to keep everyone safe in our workplace.

Proper use of personal protective equipment

Ensuring the proper use of personal protective equipment is vital for maintaining a safe work environment. Our company requires all our employees to wear the appropriate equipment based on the nature of their work. This includes helmets, safety goggles, earplugs, respirators, safety footwear, gloves and other protective equipment, significantly reducing the risk of injuries and safeguarding workers' health. We regularly train our staff to ensure they are well informed about the correct usage of protective equipment.



We support mental well-being

In addition to prioritising physical health, we recognise the **importance of nurturing mental well-being**. We ensure that all team members have an adequate number of days off for training and personal time, as needed, and that everyone can participate in team events.

Safety training is an essential component of our onboarding process for new employees. Regular occupational health checks are provided to all employees within our group, fully covered by the company, to prevent occupational diseases. The results and recommendations from these checks inform the organisation of individual work arrangements.

Safety always comes first. Ensuring our workplaces are safe is our shared responsibility.

Our people

Our 500 employees are the backbone of our operation. It is essential that every member of our team experiences a workplace that fosters safety, freedom, and mutual respect. We are delighted to have a team of dedicated individuals who work with passion and accountability. We are fully committed to supporting their growth and well-being.

Continuing education and training are integral to our daily work

We actively encourage our people to raise their awareness about quality, the environment, energy efficiency and occupational health. We strive for continuous improvement and support our people through training and education to ensure that processes run smoothly.

Given the nature of our business, a significant portion of our staff training focuses on continuously enhancing professional skills. Our staff, with an average tenure of over six years, are seasoned specialists in their respective fields, continuously updating their skills to stay at the forefront of their expertise.

Although the COVID-19 pandemic posed challenges to training, in 2022, there was a notable surge in our staff's interest in self-development, particularly in productivity, leadership and communication skills. Due to changes in our company structure, our middle managers underwent a series of training sessions, and we took the necessary steps to prepare specific individuals for new roles.

Sports have always been a significant part of the culture at Graanul Invest. Throughout the years, we have actively supported our employees' training and participation in various sporting activities to foster mental and physical health.



Our 500 employees are the backbone of our operation.



More than ever, we need to take action to meet climate challenges. As one of the world's largest bioenergy producers, our vision is the sustainable advancement of renewable energy and biomass science.

In order to pioneer and develop sustainable technological and industrial solutions, Graanul Invest has grown its sustainability team and competencies over the years.

Our sustainability team consists of top experts, each specialising in different areas of sustainability development.

Our ESG specialist oversees integrated quality management systems throughout our value chain. Their role is to ensure that we understand our operations accurately and make significant strides in key performance indicators related to the natural environment, operational environment, employee well-being and stakeholder engagement.

Our environmental specialists monitor our plants' environmental impact, coordinate with regulators and supervising authorities, and work with technology experts to minimise our ecological footprint consistently.

Our work environment specialist coordinates health and safety across the group and coordinates with national inspection bodies.

Our sustainable supply chain specialists maintain regular communication with suppliers and partners daily and conduct ongoing due diligence to ensure that raw materials for our plants are sustainably sourced and well-documented. This approach gives us transparency and a comprehensive understanding of our supply chain down to the "stump level". Our health and safety specialists work in local sub-divisions to ensure a safe and health-conscious work culture.

Managing natural and social environmental impacts and sustainability is an integral part of Graanul Invest's operating principles, guiding both our day-to-day activities and the decisions of our management board. Since its establishment, Graanul Invest has been a pioneer in the efficient production and sustainable use of bioenergy. The company views environmental best practices as a baseline requirement but goes above and beyond, setting its sights even higher to advance and promote a global bioenergy framework proactively.

Today, Graanul Invest has a dedicated sustainability unit that focuses on developing a robust and sustainable renewable energy system. The sustainability team collaborates closely with the production teams to ensure product and service quality while minimising environmental impact.

Sustainability was elevated as a key priority area in 2022, overseen by a board member serving as our Chief Sustainability Officer (CSO).

Mihkel Jugaste joins the management board as CSO.

In late 2022, we welcomed Mihkel Jugaste as Chief Sustainability Officer to Graanul Invest's management board, further elevating the priority of sustainability within the company's management framework.

As a company, our vision is to reduce emissions throughout our value chain while simultaneously positively impacting local communities and pursuing growth. We must achieve all this in an ever-tightening regulatory environment and translate our ESG commitments into tangible achievements. Sustainability has always been at the core of our identity as a renewable energy company, and by elevating this role to the board level, we are taking a practical and transparent step to align ourselves with even higher ambitions and meet the growing expectations for a sustainable future.

We are one of the few industrial concerns with a background in the Baltics that has linked its financing in the global bond market to the success and achievement of the group's environmental goals. Investors funding the group's future growth will assess the company's risks, success and competitiveness based on environmental factors, also considering forthcoming regulations.

Mihkel Jugaste worked as Head of Quality and Certification at Graanul Invest Group for the past six years, leading his team to elevate the entire value chain process and enhance quality procedures to new heights.

Our sustainability team and sustainability position



Sustainability team

Our sustainability team consists of top experts, each specialising in different areas of sustainability development.

As one of the largest wood valorisation companies in the region, we maintain an ongoing dialogue with state and local government policy groups, local communities and forestry-related civil society organisations.

Most of our plants are located away from bigger cities, providing stable and positively challenging job opportunities in rural areas. Recognising our role as a significant employer, we stay closely connected with local communities and help improve local life when needed.

Internationally, as one of the world's leading bioenergy producers, we embrace our responsibility to promote the bioenergy sector more widely and actively engage in dialogue with international professional associations, stakeholders and policymakers.

On the one hand, this engagement means providing the necessary input to key policy-making processes and representing the industry's perspectives. On the other hand, it involves sharing our experiences and knowledge at industry conferences and events.



Shaping policies

The forestry and wood industries play an essential role in the well-being of Estonian people

Graanul Invest is a member of the Estonian Forest and Wood Industries Association (EMPL), with Raul Kirjanen, one of the owners of Graanul Invest, serving as a board member. Through our involvement with EMPL, we raise public awareness of the forestry and wood industry while shaping relevant public policy and communication.

In 2022, EMPL's activities focused on a number of key areas. Under the leadership of EMPL, 11 Estonian organisations joined forces to deliver a strong message to the public and policymakers: meeting Estonia's LULUCF (land use, land use change and forestry) commitments will lead to job losses in rural areas.

Promoting understanding of wood use

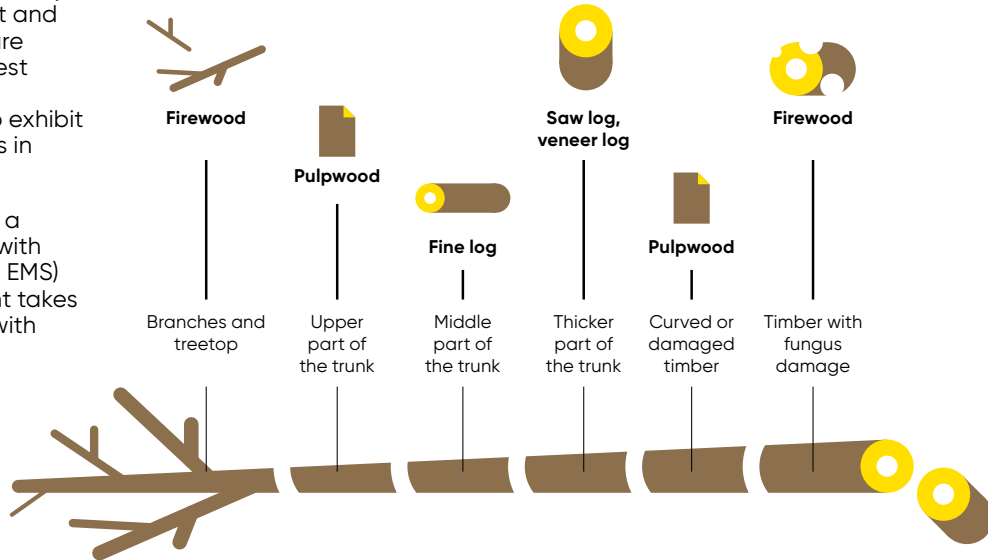
We are committed to enhancing public and decision-makers' comprehension of the vital role played by the wood and forestry industry in the well-being of Estonian people and addressing environmental challenges. We aim to foster an understanding that through sustainable forest management, we ensure the preservation of healthy and robust forests for future generations. To spread this message, we organise events and media coverage highlighting the utilisation of wood as a domestically available renewable and environmentally friendly resource. These include the annual Forest and Wood Conference, along with a wood architecture competition and an exhibition showcasing the best examples of wood architecture. Additionally, we collaborate with the Estonian Academy of Arts to exhibit the works of talented wood architecture students in urban spaces.

To engage the public further, we have organised a family event, Forest People's Day, in partnership with the Estonian Forest Association (Eesti Metsaselts, EMS) for three consecutive years. The nationwide event takes place every year in September. In collaboration with EMS, we also conduct Forest Schools for Decision-Makers throughout the year. These immersive programmes invite state and local politicians and officials to join us in small groups, visiting forests and industrial sites to gain firsthand insights on the ground.

Standing up for rural interests

In the run-up to the 2023 Estonian parliamentary election, we focused on raising public awareness about the potential impact of political candidates' promises on rural communities. We developed a rural electoral compass to help citizens understand the implications.

Following the election, we successfully provided input to the new government's coalition agreement. We compiled and presented sector-specific proposals to key individuals from the governing parties through formal and informal meetings. We also joined forces with other stakeholders to send a joint appeal to the new government, urging their support for the needs of our sector.



New target for renewable energy production – at least 100% of final consumption

As a member of the Estonian Renewable Energy Association, with our COO Jaano Haidla also serving as one of the Chamber's commissioners, Graanul Invest has helped advocate for the transition to renewable energy.

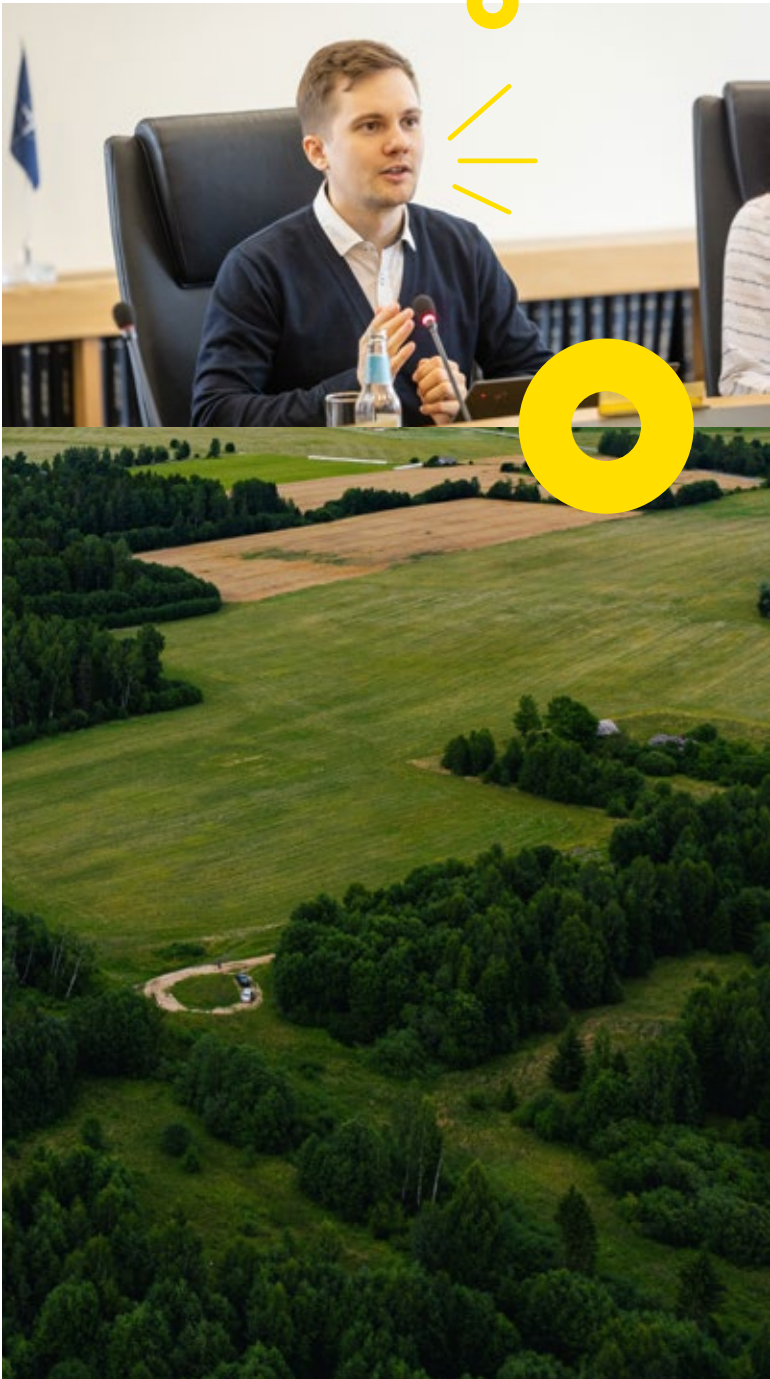
In October 2022, the Estonian Parliament amended the Energy Sector Organisation Act, updating the national renewable energy target for 2030. Under this government-initiated amendment, the revised target is to produce at least as much renewable electricity in Estonia as the total electricity consumed by the end of this decade. In other words, renewable energy produced in Estonia must exceed 100% of the total final electricity consumption. Previously, the target aimed for renewable electricity to constitute at least 40% of total electricity consumption by 2030, further specifying that renewable energy should comprise at least 65% of the total final national energy consumption by 2030, with specific targets of at least 63% in the heating sector and at least 14% in the transport sector.

Developing a new PEFC standard

Since the beginning of 2020, Graanul Invest has participated in an Estonian Forest Certification Council working group to update the PEFC National Forest Management Standard for Estonia, ensuring its alignment with national and international sustainability criteria. Bringing together 29 stakeholders, the working group made significant progress throughout 2021 and 2022 to develop a comprehensive and practical standard, striking a balance between meeting the expectations of forest owners, the forest industry, and consumers while avoiding excessive bureaucracy.

Graanul Invest played a crucial role in the working group, leveraging its practical forest management experience and knowledge of the existing standard. Our aim was to provide input to ensure the new standard adhered to sustainability principles while remaining accessible to forest owners and avoiding unnecessary restrictions.

The Forest Management Standard was officially adopted in 2023 and embodies the finest sustainability criteria. It takes into account natural processes and respects the needs of forest owners.



International promotion of the bioenergy sector

Working together to expand the Glasgow Declaration network

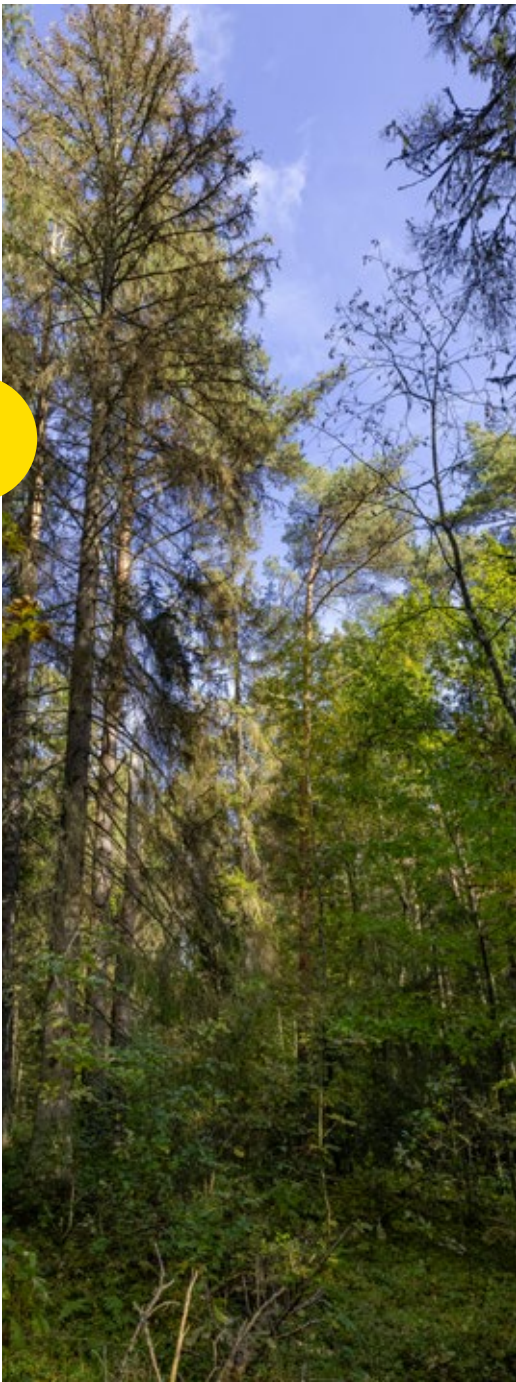
Since 2021, Graanul Invest has actively collaborated with other leaders in the sustainable bioenergy industry to advance the principles and practices outlined in the Glasgow Declaration on Sustainable Bioenergy. As a member of the steering group, we have engaged in cross-sectoral discussions, sharing best practices and collectively seeking innovative solutions.

At the heart of the Glasgow Declaration is the global standard of sustainability for the bioenergy industry, which sets out principles for sustainable bioenergy. Based on these principles, wood-based bioenergy can help fight climate change by supporting countries and communities in reaching their zero emissions targets.

The Glasgow Declaration's framework of sustainability principles include accurate carbon accounting and transparency in the supply chain, responsible resource management, biodiversity conservation, and community support.

In 2022, the main objective of the Glasgow Declaration movement was to expand the network and invite all organisations involved in the bioenergy sector, including industry, civil society and academia, to join the signatories and together achieve the full potential of sustainable bioenergy. This year, the Declaration Steering Group focused on launching a cross-sectoral dialogue to help raise awareness of the Glasgow Declaration on Sustainable Bioenergy principles among the sector and the public.

Glasgow Declaration's principles of sustainable bioenergy



Managing natural resources responsibly

We promote healthy lands and forests. We support forests to store more carbon. We only use sustainably sourced feedstocks. We avoid and disincentivise negative land use change.

Transparency and science-based carbon accounting

We adhere to internationally accepted carbon accounting rules. We comply with robust and independent certification systems. We provide transparent and independently audited sourcing data. We account for full lifecycle emissions.

Protecting biodiversity

We contribute to healthy forest ecosystems. We respect nature conservation restrictions. We support the protection of unique habitats.

Supporting and protecting communities

We protect and invest in our communities. We support land managers in delivering sustainability. We ensure safe operations. We demand employment best practices throughout the supply chain. We respect the rights of indigenous peoples.

Standing up for bioenergy perspectives in Brussels

Graanul Invest actively supports and advocates for the bioenergy sector in Brussels through its membership in Bioenergy Europe. This non-profit organisation strives to voice the needs of the bioenergy industry within European Union institutions by shaping policies and regulations.

By engaging with policymakers, stakeholders, and industry representatives, Bioenergy Europe plays a vital role in influencing the bioenergy sector's future at the EU level.

The organisation also facilitates knowledge exchange and networking within the bioenergy community by organising conferences, workshops and events where experiences, best practices and technological advances are shared. It plays an important role in promoting bioenergy and shaping public opinion. As one of the world's largest bioenergy producers, Graanul Invest holds a pivotal position within Bioenergy Europe, actively contributing to its initiatives and helping to shape a sustainable bioenergy landscape.



International cooperation to promote the bioenergy sector

Graanul Invest actively engages in international efforts to advance the bioenergy sector, particularly through its membership in the US Industrial Pellet Association (USIPA), a significant advocate for sustainable bioenergy as an environmentally friendly fuel source on a global scale. As an active member of USIPA, Graanul Invest contributes to developing industry standards, sustainability criteria and best practices for producing and using biomass pellets. USIPA provides a platform for collaboration, knowledge sharing and representation of the sector, facilitating dialogue between industry stakeholders, policymakers and regulators. Through its membership, Graanul Invest can amplify its voice and raise awareness about the immediate applicability of using wood residues in energy as a solution to meet international climate targets.

Contribution to society

Graanul Invest's production plants are located in rural areas with a strong sense of community. As one of the primary employers within each municipality, we offer a range of job opportunities. Our workforce comprises not only engineers and top specialists but also individuals without specialist education who receive valuable on-the-job training. We are committed to empowering the local community through collaborative projects and charitable funding initiatives. We have actively engaged in projects that benefit our factory communities and neighbourhoods for years.



Determining the focus of sponsorship activities is always a challenge. We are always driven to assist and guide the communities where our production facilities are located. Regarding substantial projects, we prefer fostering enduring partnerships rather than supporting isolated initiatives, as we believe in creating sustainable and tangible change in specific regions.

Support for communities and sustainable projects
Karit Kaasik, Communication and Brand Manager.

We supported more than 40 initiatives

Our support extended to over 40 diverse projects in 2022, with a significant focus on empowering local communities in Estonia and Latvia.

Almost two-thirds of the activities were dedicated to fostering sports education for young people in rural areas and smaller settlements. Throughout the years, we have assisted sports clubs in Imavere and Väike-Maarja in Estonia and Jēkabpils and Gulbene in Latvia, among others. Beyond sports, our support has also encompassed various community-driven initiatives, such as the Inčukalns orphanage in Latvia, a blood donation campaign in Texas, USA, and a folk dance club in Jaunjelgava, Latvia. Additionally, we have extended our aid to animal welfare by consistently assisting a cat shelter with our supply of wood pellets, which serve as an ideal filling for cat litter boxes.



We support science education

We have a longstanding partnership with the University of Tartu Youth Academy, which we have supported since 2019. Through this collaboration, we aim to nurture students' talents and facilitate the long-term advancement of in-depth learning in natural science, particularly in the wood science field.

Our grants are used to support integrated science teaching within a dedicated research lab as well as initiatives such as the Estonian Primary School Biology Olympiad and Science Olympiad. By supporting the development of experimental tasks in wood technology and facilitating interactions with industry experts, we empower young people in their scientific pursuits. Furthermore, we proudly acknowledge students who have achieved medals in international competitions by awarding them with Graanul Invest scholarships. We firmly believe that our investment in science education catalyses future success. The impact of our support will manifest in the years to come when today's students make critical career decisions in higher education.



Volleyball is our passion

We are passionate about supporting top-level and youth sports in Estonia and Latvia, two of our largest operating locations. Our primary focus lies in volleyball, which we support in both countries. We seek to back more and more local clubs and young volleyball enthusiasts to pave their path to the finest sports schools, enabling them to develop their skills and capabilities to their fullest potential. At the national team level, our support extends beyond volleyball to include biathlon and junior cycling in Estonia.

We open our doors to the public

We have participated in an annual one-day event called Forest People's Day in recent years, where we showcase the fascinating aspects of wood pellet production to all those who are interested. Once again, in September 2022, we welcomed visitors to explore the hidden world of forestry in numerous locations across the country. Following its successful debut in 2021, this year's event attracted enthusiasts of forests and the forest industry in more than 50 locations throughout Estonia.

The event aims to foster knowledge sharing and provide unique experiences related to forests, forestry and its products. It brings together scientists, forest managers, hikers, nature experts, and representatives from the forest industry, all with a shared passion for the natural world.

In 2022, Graanul Invest welcomed visitors to three of our production plants: Imavere, Osula and Helme. In Imavere, an exciting addition this year was the opportunity for visitors to join us on a tour of our former subsidiary, Fibenol, located on the same site. The Fibenol pilot plant, poised to launch production, also opened its doors to offer captivating tours.



"The presence of families from the community and visitors to the area infuse our plants with positive energy. Our factories have become well-known landmarks within the local community, sparking a desire to explore their inner workings. People are naturally eager to learn more about the intricate process of transforming wood residues into valuable resources," said Kristo Vahar, who works at our Helme pellet plant. "This year, everybody's focus revolves around energy, energy independence, and local energy production."



We took part in the Latvian Forest Day

Our Latgran team in Latvia showcased our pellet production and overall activities at the Latvian Forest Day. Organised annually by the Latvian national forest administrator, this prominent event serves as a platform for forest growers and companies involved in adding value to forest materials to share their endeavours with the public. The event attracts numerous entrepreneurs and draws thousands of visitors nationwide. It places a special emphasis on engaging young people and families, providing information and interactive experiences. For our Latgran team, participating in Forest Days has become a cherished tradition. In our spacious tent, visitors were treated to an immersive display of the wood pellet production process, from our diverse range of raw materials to observing our state-of-the-art equipment.



Forestry and wood industries are the backbones of rural life

The forestry and timber sector plays a pivotal role in the national economy. The sector employs 58,000 people, mainly in rural areas, where well-paid and valued jobs are scarce. Notably, the industry generates direct tax revenues of €787 million annually for the country and has an export turnover of €3 billion per year, as shown by a 2021 Ernst & Young survey. Beyond its economic contributions, the sector also plays a crucial role in meeting climate targets by preventing 9.8 million tonnes of carbon emissions each year, as highlighted by an AFRY study.

The Estonian forest and timber sector also holds great importance in rural livelihoods, accounting for a substantial portion of the value added in central and southern Estonia, at 24.4% and 27.5%, respectively, according to Ernst & Young's 2023 report. Graanul Invest, alongside its production and cooperation partners, contributes significantly to this. Our group employs more than 500 people, most residing in rural areas. We are the largest taxpayer in multiple municipalities, substantially contributing to local life.



Our raw materials

Wood pellets are a versatile and highly efficient form of renewable energy, serving as a solid biofuel. In our wood pellet production, we only use raw materials derived from other industries that have no other application and would otherwise go to waste. All the raw material we use has undergone a cascading effect in price, value and priority, meaning that we use only wood with the lowest quality (energy or firewood) and price available on the market. Our wood pellets are made from various types of waste from the forestry and timber industry and low-quality stemwood. We use wood chips and bark to generate electricity and heat.

Raw materials for wood pellets

Wood shavings and dry sawdust are sourced from companies that add value to sawn timber as their raw material. These post-processing by-products have a low moisture content and fine fraction, making them highly suitable for our processing operations. We exclusively use chemical-free raw materials because chemically processed by-products, which may contain varnishes and glues, are incompatible with our production process.

Wet sawdust, a major by-product of the sawmilling process, has been traditionally utilised in pellet production due to its minimal processing requirements, fine fraction and consistent quality.

Wood chips derived from the sawmill and timber industries are produced when processing logs that have already been barked, resulting in uniform fractions and high purity.

Low-quality stemwood reaches us as residue from forestry operations when it cannot be used for industrial purposes. Additionally, we incorporate scrap wood from sawmills, which may contain warped, damaged or foreign materials, such as pieces of metal, that could pose risks to equipment and workers. Forest management activities such as clear-cutting and thinning also produce lower-quality wood when felling smaller, inferior trees to make space for the growth of higher-quality ones.

Raw materials for electricity and heat generation

Forest chips primarily consist of fine branches, brush, and other logging residues, often containing soil and sand that make mechanical processing impractical. These chips, distinct in composition and appearance from sawing residue chips, play a crucial role in our cogeneration plants and dryers, where they are utilised to generate carbon-neutral electricity and heat.

Tree bark is obtained from peeling lines in our factories and sawmills. Mechanically stripped from logs, the bark is directed towards on-site green energy production rather than waste incineration, ensuring optimal use of every gram of wood.



Wood shavings and dry sawdust

Wet sawdust

Wood chips derived from the sawmill and timber industries

Low-quality stemwood



Tree bark

Forest chips



Shape
Ø

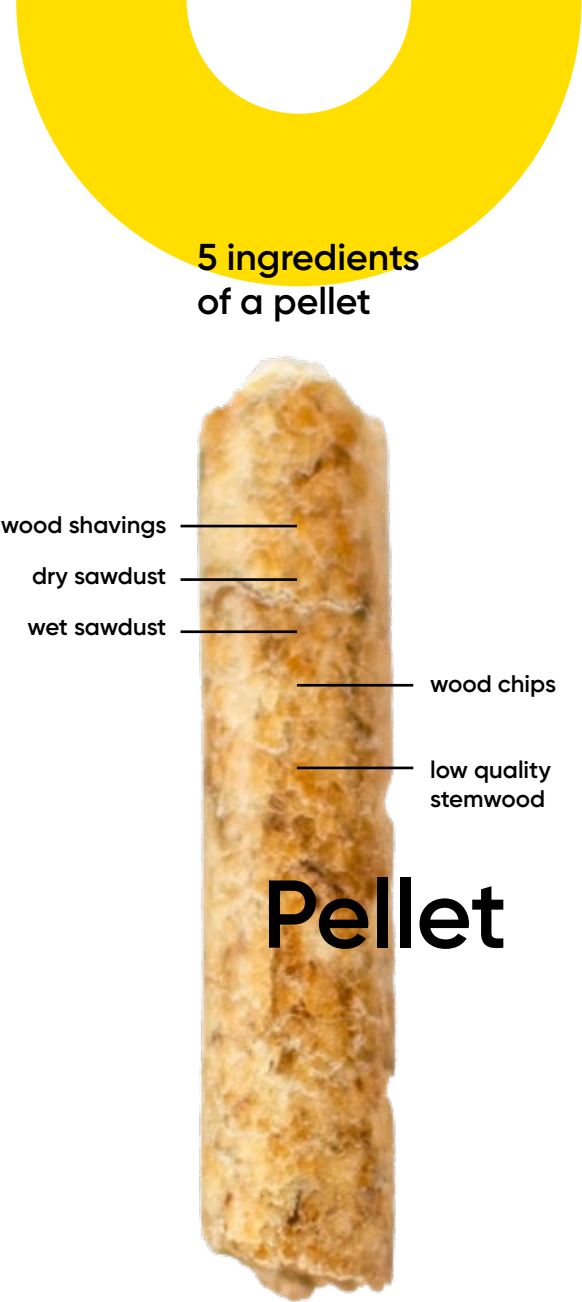
Cracks

Sharp curvature

Rotting

Raw materials used for pellet production

In 2022, the raw materials used in our factories were divided as follows:



Like other industry participants, Graanul Invest faced significant challenges and volatility regarding raw materials in 2022. The outbreak of hostilities in Ukraine and subsequent sanctions and transformations reverberated throughout Europe and directly impacted our company throughout the year. The Russian attack on Ukraine triggered an international energy crisis, resulting in a swift surge in energy prices across all carriers and widespread shortages. This altered economic landscape led to decreased activity within the construction sector, reducing the workload in sawmills. Consequently, there was a noticeable decline in the volume of raw materials reaching our facilities.



A carefully combined recipe for superior pellets

To ensure consistent quality, our industrial wood pellets are created by blending all five essential raw material groups: wood shavings, dry and wet sawdust, sawmill chips, and low-grade stemwood. Adhering to resource efficiency and waste hierarchy principles, we use all these raw material categories for all common tree species to optimise resource utilisation.

Benefiting from the extensive expertise of our production managers, we achieve the highest quality wood pellets that meet stringent standards for length, hardness, particle size and calorific value despite the ever-changing nature of materials and weather conditions. The laboratories at each of our factories conduct frequent analyses of production quality multiple times a day. In addition, independent laboratories regularly verify the quality of our pellets in our warehouses and at our customers' premises.

Alternative sources of raw materials

Given the critical geopolitical situation, we made the strategic decision to discontinue the use of raw materials sourced from Belarus and Russia. Instead, we sought alternative options in the Nordic countries to meet the needs of our Baltic factories. Scandinavia, specifically Finland, Sweden and Norway, emerged as viable sources of suitable raw materials. Still, the shift led to a significant increase of 2-3 times in the price of our primary raw material assortment. We partially replaced sawdust and wood chips with locally sourced and imported firewood to compensate for the changes. As a result, the proportion of stemwood in our feedstock rose from 44% to 57%.

The rapid price hike and limited availability of raw materials significantly impacted the stock levels at our Baltic factories, depleting their reserves and constraining production capacities. However, as the year progressed, the situation began to stabilise. Prices gradually settled, and our raw material stocks gradually replenished, allowing our factories to resume production as





Premium and industrial pellets use different raw materials

On the face of it, premium and industrial pellets only seem to differ in colouration – fuel intended for large energy industries appears noticeably darker. This variation in colour stems from differences in the ingredient composition. Industrial pellets are crafted using substantial amounts of low-value stemwood, which includes a significant proportion of dead and damaged wood.

A more varied recipe for industrial pellets

The composition of industrial pellets encompasses a greater variety of species, taking advantage of the abundant Baltic forests that host over 50 different types of trees. Many of the softer hardwoods are not extensively utilised in higher-value timber industries. Among these species, the grey alder, thriving in unmanaged wet forests and farmland within a relatively short period of 20–30 years, stands out as the most prevalent in the energy sector, as the soft curved trunks of the fast-growing alder are often naturally damaged and unsuitable for the sawmill, paper and board industries.

The lower mechanical strength and higher friability of industrial-grade pellets due to their diverse range of raw materials pose no issues for large energy producers handling fuel quantities thousands of times greater than small domestic boilers.

Mechanically stronger premium pellets

In contrast to industrial pellets, premium pellets must possess significantly enhanced mechanical strength. These premium pellets are compressed from the finest quality sawdust and shavings to prevent blockages in small boilers that use them. Sawmills exclusively utilise spruce, pine and birch as their primary raw materials, ensuring a supply of residue with consistent and uniform properties for producing premium pellets. The manufacturing process of premium pellets involves higher compressive strength and a slower procedure. Consequently, producing the best-quality assortment carries a slightly higher energy footprint.

Where do our raw materials come from?

At Graanul Invest, we strive to produce bioenergy with the smallest possible carbon footprint, recognising that raw material transport currently represents one of the few fossil energy-dependent activities within our value chain. Each additional kilometre that raw materials travel contributes to excess carbon emissions. Our raw materials are sourced from the geographically closest locations to our mills, leveraging existing wood industry residue within those areas to mitigate those emissions. We diligently monitor and maintain an accurate overview of our raw material flows to ensure a local supply base that does not disrupt material movements within Estonia or compete with other industries or regions.

In 2022, the weighted average raw material procurement radius for the entire Graanul Invest Group stood at **37.07 km**. For our Baltic factories, the average radius was **34.26 km**, while for our **US factory**, it reached **55.68 km**.

Although our onshore procurement radius has traditionally remained stable around 55 km, the significant reduction in radius during the previous year can be attributed primarily to the cessation of rail transport from Belarus. Previously, we relied on trains for material transportation from Belarus, covering distances of 400–600 km. However, due to the changed geopolitical situation and the outbreak of the war in Ukraine, we discontinued the use of materials from Belarus and Russia.

Our raw materials by country of origin during 2022



Estonia
46.56%

Latvia
46.03%

Lithuania
4.93%

Sweden
1.49%

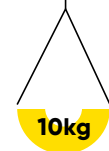
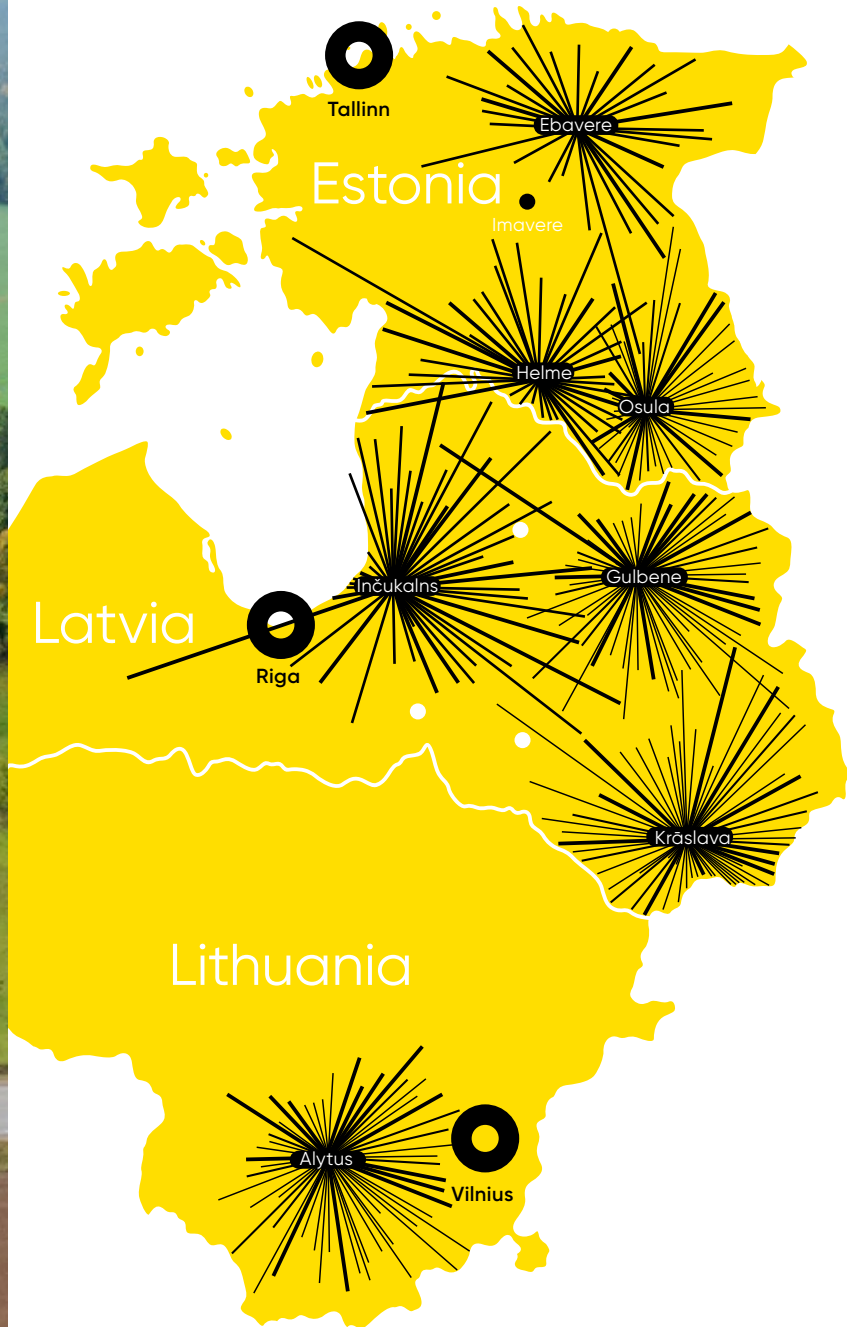
Belarus 0.59%
Norway 0.30%
Poland 0.07%
Russia 0.04%

In 2022, the weighted average raw material procurement radius stood at **37.07 km**

10kg

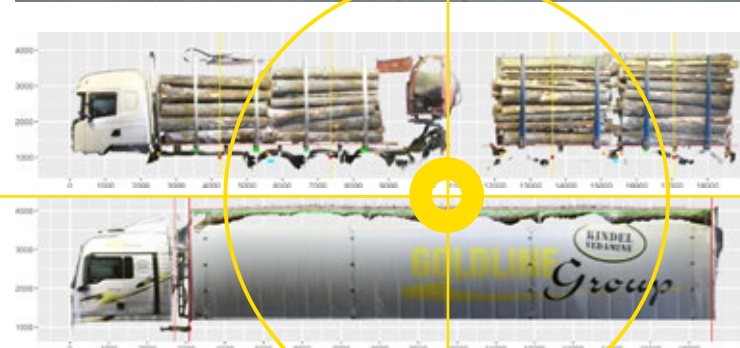
At our factory gates and the group's port facilities, LoadMon's automated timber measurement system accurately records incoming and outgoing loads with a remarkable accuracy of 10 kg.





Loadmon measures wood with 10 kg accuracy

Loadmon



Pellet production

In 2022, we produced a total of 2,319,840 tonnes of wood pellets, which is approximately 185,304 tonnes (7.4%) less than in 2021. The decrease in production volume resulted from the limited availability of raw materials at our plants in the Baltic states.

Our production volumes:

Estonia – 912,994

(Imavere 305,420; Ebavere 104,118; Helme 191,141; Osula 312,312)

Latvia – 1,013,329

(Inčukalns 260,879; Launkalne 236,312; Jaunjelgava 84,120; Jēkabpils 147,230; Krāslava 132,039; Gulbene 152,751)

Lithuania – Alytus 88,371

USA – Woodville 305,146

Graanul Invest's plants produced 2,319,840 tonnes of wood pellets in 2022: 39% in Estonia, 44% in Latvia, 13% in the US and 4% in Lithuania. In 2022, our total production declined by 7.4% (185,304 tonnes), primarily due to reduced volumes at our Estonian and Latvian plants.

Our Latvian plants experienced the largest decline, with production dropping by nearly 14% due to a shortage of raw materials. However, the decline was somewhat mitigated thanks to our efforts in sourcing alternative raw material supplies from Scandinavia.

The Woodville production site in the US has shown more positive developments, with stable production and a 13% growth rate.



Focusing on stability at Woodville

Jason Ansley, Head of US Operations at Graanul Invest:

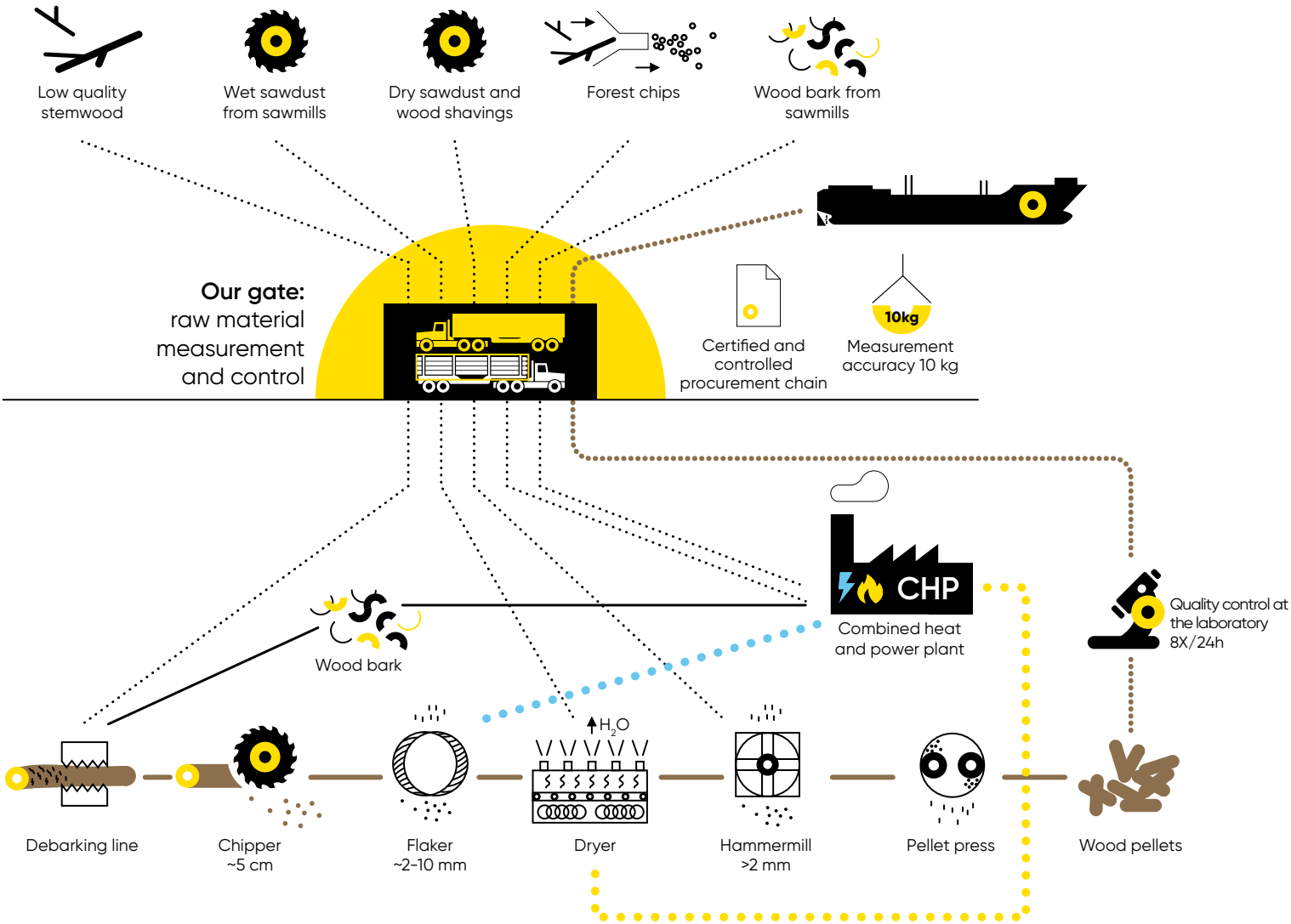
"Our Woodville plant achieved a 13% growth in production in 2022 compared to the previous year. This outcome was reached thanks to our strong emphasis on reliability, which has significantly enhanced the stability of our production processes. We are actively strengthening our reliability programme and projecting production growth throughout 2023."

Interdependencies in raw material flows

In 2022, production was significantly impacted by multiple factors, such as the notable increase in raw material prices, the overall scarcity of biomass, and the volatility of commodity markets. These factors disrupted the historically established stable flows of raw materials as we embarked on the time-consuming process of finding suitable alternatives.

Graanul Invest produces wood pellets using residues from other industries. Our production represents the final stage in the circular economy of the wood supply and processing chain. As a result, we experience the direct impact of both positive and negative developments throughout the value chain, despite not being directly involved in its initial stages.

Graanul Invest has established stable and optimised supplier networks and physical supply chains developed over an extended period. While abrupt and volatile market changes can pose short-term challenges, our dedicated team is adept at finding prompt solutions to stabilise the situation. The forest and wood supply chain begins in the forest, and effective planning and efficient management of forestry operations set the key parameters for the timber industry, construction sector and, ultimately, bioenergy production. This applies to economic performance as well as energy efficiency.



Impact of springtime felling restrictions on the raw material supply for the timber industry

Forestry operations are planned well in advance, and since in the Baltic countries, small volumes of timber are harvested at a time, the sector is highly susceptible to the painful impact of sudden restrictions and obstacles. The implementation of springtime felling restrictions, known as "bird peace", and the subsequent suspension of forest operations undoubtedly affected the sector's performance and the efficiency of the supply chain, further exacerbating the energy crisis that began earlier in 2022.

Forest owners and managers play a crucial role in implementing conservation measures and act as the true guardians of biodiversity within forests. Forest managers and the timber sector demonstrate a strong commitment to nature conservation restrictions. However, the desired long-term outcomes can only be achieved if temporary and permanent restrictions are implemented consistently and systematically.

Due to the springtime felling restrictions, several wood industries depleted their raw material supply in the second quarter, leading to workers being placed on forced leave. These gaps also extended to the wood sector's waste streams, contributing as the second primary factor for the decrease in our production volumes.



Digital tools to minimise electricity costs

Haralds Vigants, Board Member at Latgran

In 2022, everyone came to recognise the importance of using sustainable biomass for energy production – even the sceptics. The primary catalyst for this was Russia's invasion of Ukraine, leading to a sudden surge in electricity prices.

The challenging situation emerged due to the limited availability of raw materials, which were increasingly utilised in biomass boilers to generate energy and reduce electricity and heating costs across Europe. All production processes were subject to fluctuations in electricity prices and rapid increases in raw material prices. In synergy with our cogeneration plants and electricity suppliers, we developed digital tools to minimise electricity costs and ensure the efficiency of our pellet production process.



A volatile year for premium-grade pellets

Maida Insler, Small Package Sales Manager

Graanul Invest offers ENPlus premium-grade wood pellets in convenient 15 kg packages as well as bulk quantities. Our commitment is consistently delivering the highest quality standard and ensuring reliable supply to our valued partners.

In 2022, the European pellet market experienced an unprecedented price increase due to the energy crisis sparked by the war in Ukraine. There was a significant surge in demand for and interest in pellets. The disappearance of Russian and Belarusian pellet production from the market due to war-related sanctions further fuelled the demand. Both raw material suppliers and pellet producers responded to the shift, resulting in a spike in prices. Amidst the escalating energy crisis, there was a notable surge in interest among household consumers, who sought to proactively purchase pellets during the summer to prepare themselves for the upcoming heating season. The daily rise in wood pellet prices, coupled with the up to fivefold increases in the price of natural gas, led to panic buying in the markets, heightening concerns of even more severe shortages awaiting in the winter season.

Pellet prices rose to unprecedented heights. Mild weather conditions across Europe at the end of 2022 resulted in a significant decrease in heat consumption, with some countries experiencing a reduction of up to 35%. In conjunction with falling gas and fuel oil prices throughout Europe, this contributed to a sharp decline in pellet demand towards the end of the year. Consumers across Europe had also been building up reserves. The market is predicted to stabilise in 2023.



Online pellet store launched in Latvia

In the summer of 2022, we launched an online store in Latvia. With a sudden surge in demand within the local market, it became crucial for us to introduce the packaging and sale of high-quality pellets to cater to the needs of the Latvian market. The new online store at graanul.lv opened in the autumn of 2022.

graanul.lv

Production footprint

Since 2017, we have diligently audited and calculated the environmental footprint of our value chain using the methodology outlined in the Renewable Energy Directive (RED II). We measure this impact as "grams of CO₂ equivalent per MJ of energy contained in a pellet". This continues to be one of the most important and objective metrics in the field of energy carriers, particularly in the context of renewable energy. Ensuring transparency and avoiding deceptive greenwashing practices is paramount when it comes to products entering the EU market. Having a standardised metric that accurately reflects the environmental impact is crucial. Within the energy sector, accurate calculations of emitted and/or saved emissions are of utmost importance due to the sector's substantial influence on overall emissions. For the past five years, we have been at the forefront of our industry in this regard, setting an example for others. With our pellets derived from Baltic raw materials and produced using renewable energy, we are poised to maintain our prominent position on the global stage.

While assessing the overall footprint of a sustainably sourced, efficiently manufactured and delivered product is pivotal in determining its sustainability and value, equal consideration must be given to manufacturing and processing companies' day-to-day or momentary physical footprint. Both the product and the producing company must align with high-quality standards and demonstrate commitment to all aspects of ESG.

In line with this commitment, we have integrated direct emissions reporting based on the GHG Protocol standard into our lifecycle footprint, following the methodology outlined in RED II. Incorporating this addition ensures transparency, enables global comparability, and holds us accountable in our reporting process. As we continue to advance, it is essential to establish a clear baseline and scope for third-party reporting (Impact Area 3). Until these parameters are solidified, aggregate CO₂ figures are currently excluded from our reporting. Our 2023 Sustainability report will feature audited results of the 2022 performance indicators.

Our monitoring and reporting of greenhouse gas emissions adhere to the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard.

Thanks to introducing the standard, we now have an accurate overview of the emissions in Impact Areas 1 and 2 and a partial overview of the emissions in Impact Area 3. Detailed monitoring data enables us to set targets for greenhouse gas emission reductions and work towards achieving zero net emissions in the future.

Impact Area 1 encompasses direct emissions from fuel combustion, vehicle use and cooling equipment leaks.
Impact Area 2 encompasses indirect emissions from the procurement of electricity and heat.
Impact Area 3 currently encompasses transporting raw materials and finished products, including road, rail and sea transport. It also includes transmission and distribution costs related to electricity procurement.

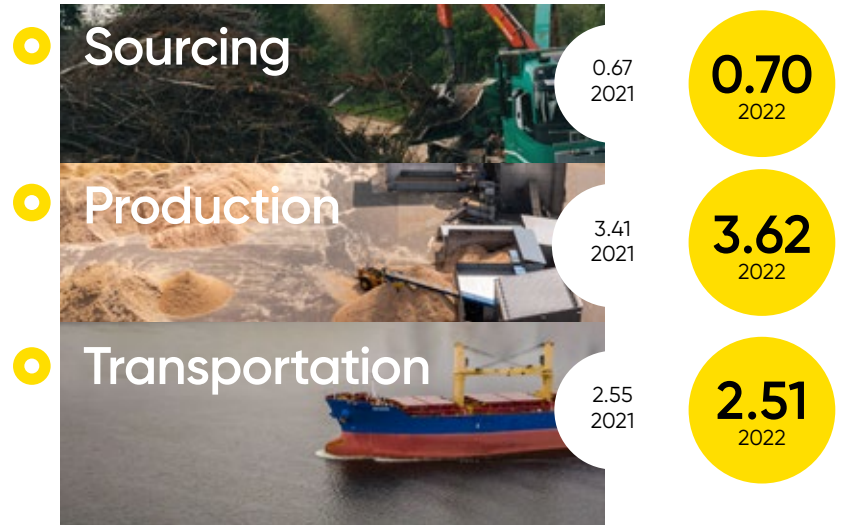
There are plans to expand the monitoring and reporting of Impact Area 3 to include various aspects, such as employee commuting, business travel, the production and transport of packaging, chemicals and fuels, waste transportation and treatment, and the utilisation of the final product.

In 2022, Impact Area 1 accounted for 20% of total emissions, while Impact Areas 2 and 3 each accounted for 40% of the total emissions. Compared to the base year 2022 (2021), the emissions of Impact Area 1 increased by 29% due to the introduction of new ships, while the emissions of Impact Area 2 remained relatively stable. In contrast, the emissions of Impact Area 3 saw a reduction of approximately 80% due to the ceased raw material supply from Belarus due to the Russian war in Ukraine.

The lifecycle footprint of our product in 2022, based on the RED II methodology, was as follows.

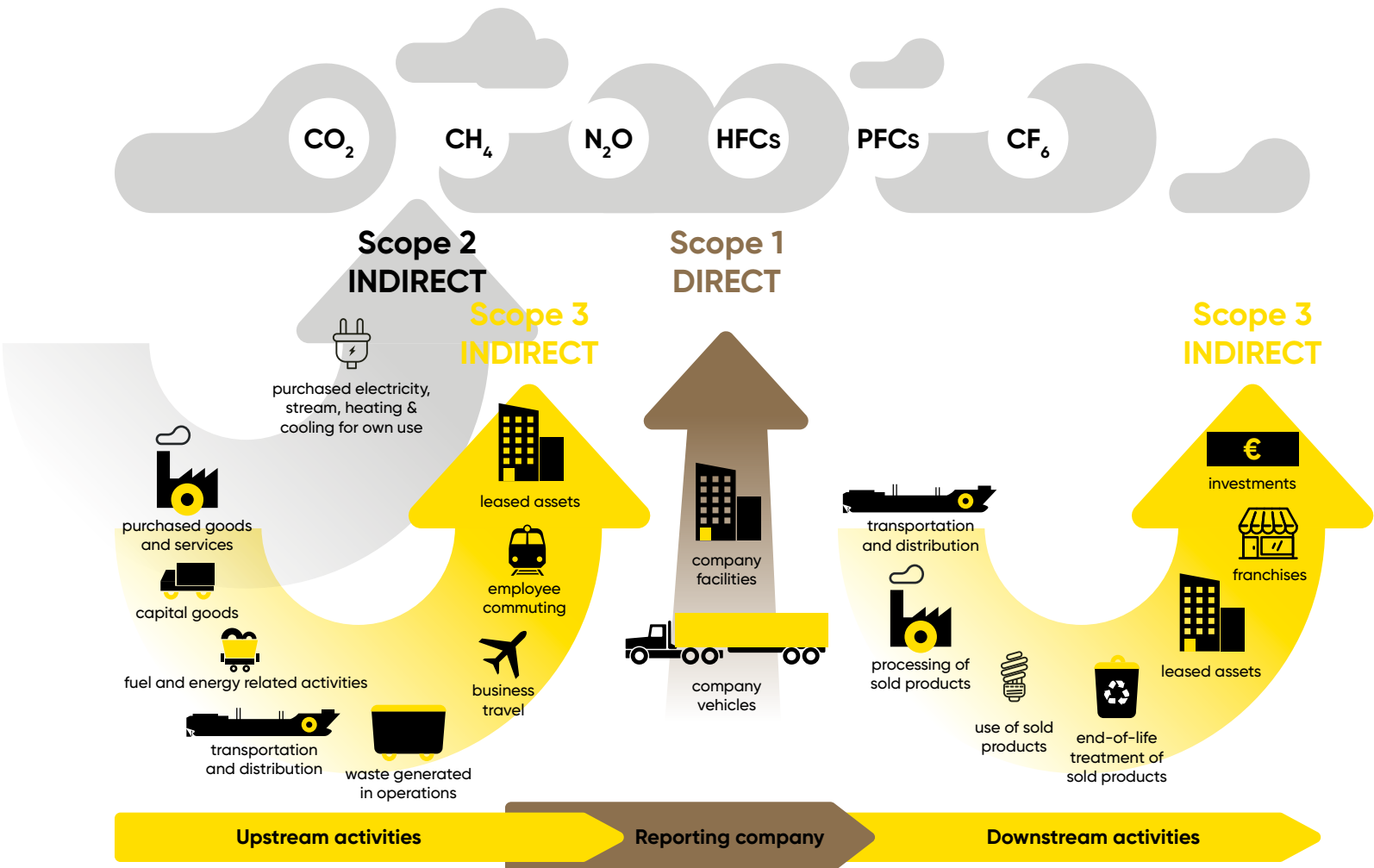
Group weighted average: 6.83 g CO₂eq/MJ.
 This is almost 3% more than in 2021.

Pellet production CO₂ footprint g/MJ



This change was expected, given the close correlation between production parameters, volume and the production footprint. As production decreased compared to 2021, we anticipated that the share of the production footprint would proportionally increase.

However, by steadfastly adhering to effective and localised solutions in other areas, we have successfully kept our overall footprint close to the target level. We aim to achieve a level below 6.73 g CO₂eq/MJ by the end of 2023, or a 5% reduction compared to our 2020 levels.



Key developments

With the growing importance of tackling climate change, Graanul Invest is committed to seeking continuous improvements and innovative solutions to minimise our environmental footprint and enhance the efficiency of our operations, even though our production environmental footprint already stands 3 to 4 times lower than the sector average.

Smart innovations at our plants



A novel solution at our US plant eliminates air emissions

During the mechanical processing of large volumes of wood residues, raw materials are heated, causing organic compounds to evaporate, and resulting in distinctive odours and emissions. For years, the technology team at Graanul Invest has been seeking an efficient and innovative solution to reduce air emissions in a cost-effective and environmentally friendly way. In 2022, they found a suitable solution.

The most common technology used to reduce emissions of this kind are regenerative thermal oxidisers (RTOs), devices designed to combust the exhaust air from production processes. Equipped with ultra-high temperature ceramic beds, RTOs effectively incinerate organic compounds present in the gases flowing from the unit, transforming them into neutral odourless carbon dioxide and water vapour. While RTOs have proven to be an efficient and reliable industrial solution for eliminating odorous organic air emissions, they come with significant investment and operating costs. As a solution, Graanul Invest's technology and engineering team successfully developed a unique system that achieves a remarkable 99% reduction in air emissions while requiring only one-eighth of the capital cost. The team designed a novel system to reduce the emissions of our wet milling process that is both cost-effective and climate efficient.

Urmo Ariva, Technical Manager at Graanul Invest: "With nearly one-eighth of the capital costs, this innovative solution has proven to be highly successful. It serves as a great example of our collaborative efforts in developing the world's leading pellet production technology."

Closed press rollers save the Woodville plant 60 tonnes of lubricants each year

The Woodville plant implemented a major technological innovation in the summer of 2022 by replacing their pellet mill rollers with components featuring maintenance-free bearings. This modification results in an annual saving of 60 tonnes of petroleum-based lubricant. The investment not only significantly reduces the risk of mill failures but also represents a crucial technological advancement towards achieving optimal capacity and stable operation at the Woodville plant.

Compared to previous generation components, the new rollers enable a significant simplification of the mill by eliminating the need for a separate lubrication system. A simpler mill that does not need lubrication, in turn, makes operation cheaper and more reliable.



A belt dryer pilot project at our Imavere plant reduces the production footprint

The drying of the raw material is the most energy-intensive stage in wood pellet production. Raw or wet wood material has a moisture content of up to 50%. The belt dryer reduces the water content of wood up to five times. In cooperation with Stela, the company that constructed the belt dryer used at the Imavere plant, engineers from Graanul Invest and the German company designed a new system to recirculate the drying air and accurately measure its moisture content. By maximising air recycling within the dryer, we can effectively harness environmentally friendly heat energy during the drying process. The lower the energy consumption of producing a tonne of pellets, the smaller its ecological footprint. The reconstruction of the belt dryer at Imavere resulted in a 26% increase in drying capacity during the winter months while maintaining normal heat consumption.





Digitalising port cargoes enhances accuracy in logistics

Graanul Invest is currently conducting pilot projects to automatically detect road and rail transport at Tallinn's Bekker Port and Riga's Universālais Termināls. These projects aim to leverage digital innovation to achieve the highest level of accuracy in tracking goods and monitoring movements.

The pilot project began with the objective of developing a solution that could accurately determine the destination warehouse for each plant's production, track the stock levels of each plant's output, and trace the shipment's movement on the loaded ship.

The system operates based on automatic detection, tracking the specific warehouse that the loaded truck enters upon arrival at the port. Both the warehouse number and the precise entry and exit times of the vehicle are recorded in the registry. This technology is also used to monitor the loading of ships. The system provides a real-time overview of the specific warehouses that are emptied during the loading process. Registry entries are fully automated, eliminating the need for human intervention. Once the vessel is fully loaded, the registry will provide an accurate overview of the material quantities and the number of operations performed.

In Riga, we also use this technology to detect freight wagons. In addition to detecting the freight's arrival at the territory, the system determines the precise time when the wagon was unloaded and sent back to the plant, resulting in reduced waiting times. At our Estonian production sites, we have implemented a system based on the same principle to detect trucks entering and leaving the site automatically.



Digital developments in our Latvian units

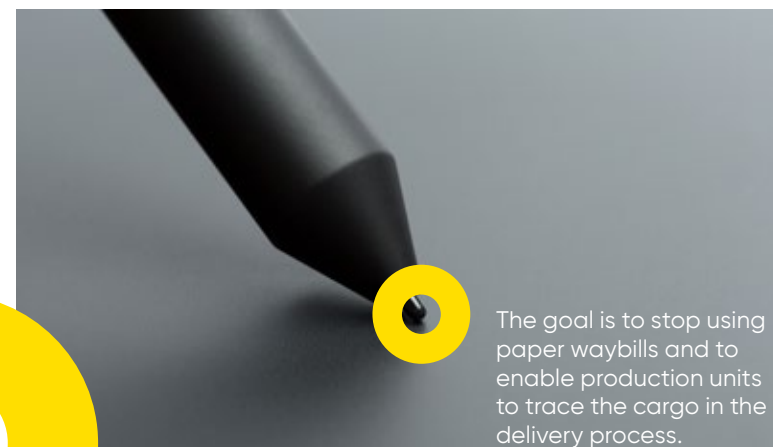
Digital waybills in Latvia

In 2022, we started a project to digitalise the waybills for raw materials shipped to our plants in Latvia. The aim is to eliminate paper waybills and enable production units to track shipments. Waybills are generated using pre-filled forms. The driver's task is to identify the correct order and confirm the shipment. Once the shipment is confirmed, the information is automatically sent to the gate system as a pre-filled message.

The described solution reduces reception time by up to five minutes, providing a clear time advantage for both the driver and the receiver. To date, five suppliers have joined the system, and we anticipate a substantial increase in that number soon. In addition, we have already integrated the Latvian Timber Flow Data Centre (KPDC) waybill system.

Enhanced checks for habitats with great biodiversity

Ensuring the preservation of habitats with great biodiversity and validating felling permits is integral to our raw material harvesting and reception process as a producer. Until 2022, the convenience of conducting these tasks with a single click and machine interfaces was unavailable in Latvia. The innovative EEWay Biotops Control solution allows quick queries to verify the origin of raw materials. EEWay offers both visual and textual overviews by cadastral parcel. In addition to biodiverse habitats, the system also allows us to check felling permits.



The goal is to stop using paper waybills and to enable production units to trace the cargo in the delivery process.

Quality control and certification

We guarantee that our wood pellets are manufactured using raw materials sourced from sustainably managed forests. All the companies within our group hold third-party certificates that undergo regular verification by independent auditors and the certifying body, providing complete assurance to our customers.

By implementing the highest standards in production and transportation, our pellets are produced and transported using the most stringent practices available, ensuring the smallest possible environmental footprint.

We adhere to the highest standards in raw material procurement, production and transportation to supply our customers with pellets with the smallest possible environmental footprint.

We are fully prepared to meet the European Union's RED III climate targets for 2030 by meeting the highest standards and implementing forward-looking practices.

Certification systems ensure transparency

Internationally recognised certification systems make our work transparent and reliable for our partners. Nowadays, certificates extend beyond forestry purposes to encompass other important factors, such as the ecological footprint of production, supply chain efficiency, and the share of green energy in production processes.

Certificates enable us to trace the raw material and its footprint right down to the specific forest plot where it was harvested. We take great care to source all our woody biomass from sustainably managed forests and companies that uphold high standards for both their work practices and occupational safety.

For example, in February 2022, in response to Russia's aggression against Ukraine, we immediately stopped using raw materials sourced from Russia and Belarus in all of our group's factories. This decision was made independently of the import restrictions that came into effect several months later. Our PEFC chain of custody certification ensures that no raw materials sourced from conflict areas are used in our processes.

Our certifications

ENplus® certification guarantees the physical quality of our products and enforces standardised laboratory procedures for precise verification and measurement. Seven of our European factories have obtained this certification.

ISO 9001 certification validates our quality management system, encompassing the physical quality of the product, company procedures, operating environment and customer satisfaction. All our European factories have obtained this certification.

ISO 14001 certification demonstrates that our environmental management system ensures we map and manage our environmental impacts and engage in monitoring that exceeds the requirements. All our European factories have obtained this certification.

ISO 45001 certification for occupational health and safety management systems is held by all of our European factories.

FSC® (FSC-C103815) chain of custody certification helps identify and mitigate potential risks in supply chains and ensures that the supply chain complies with international FSC standards.

PEFC certification ensures that our supply chain is sustainable and transparent. It defines requirements for the transparent and traceable movement of certified raw materials and helps to identify and mitigate potential risks in the movement of raw materials. All our factories have obtained this certification.

ISO 50001 energy management and performance certification ensures systematic and effective energy consumption in our ten factories in Estonia and Latvia.

SBP is widely recognised as our sector's most important and impactful certification. What sets SBP apart is its comprehensive coverage of the entire value chain, ensuring rigorous requirements and supervision from raw material sourcing to goods transportation, and from forestry carbon cycle to energy sources used in production. All our factories have obtained this certification.

Criticism and independent inquiry

The forest industry affects stakeholders in big cities as well as rural areas, where the vast majority of raw materials originate, and production is located. We take public criticism seriously and, if necessary, investigate all claims with the help of independent experts. If inquiry shows the production of pellets can be made more transparent or its environmental impact can be further reduced, we will take action.

Throughout 2022, no violations related to the group's products or raw materials were detected.



Graanul Invest operates six modern environmentally friendly combined heat and power (CHP) plants in Estonia and Latvia, producing green thermal energy and electricity for the pellet factories by using sustainably sourced forest and wood industry waste. The electricity generated in our plants exceeds the needs of our group's factories, and a significant portion is sold on the local power exchange.

Built between 2012 and 2017, all our CHP plants are new to the energy sector. All production units are highly efficient and equipped with effective air pollution control filters.

Forest and wood industry waste is all the fuel we use

Our CHP plants are powered by forest and wood industry waste: sustainably sourced wood chips from well-managed forests and bark from our pellet production and sawmill peeling lines. Our energy production in CHP successfully closes the loop of the forest and wood industry's circular economy and cascading use. With nearly 100% efficiency, we ensure that all the valuable timber harvested from the forest is utilised to its fullest extent.

The CHP plants operate with minimal waste generation. The ash produced in the boilers, including fly ash captured by the filters, is repurposed as a valuable mineral fertiliser and returned to the surrounding farmland as part of the natural cycle.

Our CHP boilers are green, both figuratively and literally.



High heat demand in pellet production ensures high efficiency

Our CHP plants excel in meeting the substantial thermal energy demands of the pellet mills' raw material drying processes. The plants are custom designed to match the heat load of our pellet mills, ensuring optimal efficiency in generating electricity and heat from biomass throughout the year. During summer, we redirect surplus steam generated from electricity production to fuel our dryers. Whenever possible, we sell any excess green thermal energy to nearby sawmills. We also plan to use this surplus energy to supply the Fibenol wood fractionation plant in Imavere.

The wood usage efficiency is almost 100%

We produced 1.8% more green electricity

We produced 1.8% more green electricity

In 2022, Graanul Invest produced around one-seventh of Estonia's wood-based renewable electricity.

Our six plants generated 331 GWh of electricity, which is 1.8% more than the previous year. With minimal technological downtimes, our CHP plants consistently operate at near maximum load, resulting in a consistent level of energy production year after year.

"The Osula cogeneration plant deserves special mention for delivering its best-ever production performance in 2022. Because our plants are new and modern, any stable and normal year is a good year, and 2022 was no exception. Despite experiencing a three-week downtime at Imavere, we managed to exceed the group's 2021 productivity rates," says **Vaiko Kikkatalo**, Technical Manager of Cogeneration Plants.

One of our key sustainability indicators is the specific consumption of electricity. The amount of electricity our European factories consume to produce a tonne of pellets has remained stable for years, averaging just above 140 kWh/t. Our technical teams are consistently working to reduce the specific electricity consumption of the Woodville factory in the US, aiming to bring it below the 150 kWh/t threshold. We have closely monitored the factory's electricity consumption for several years and set specific targets to reduce costs continually.

CHP plants play a vital role in regional security

Despite our stable and well-optimised generation process, electricity consumption in the Baltic countries came under increased scrutiny during the second half of 2022. The electricity market in the region faced a deficit, leading to a significant price surge during the last quarter. The situation was compounded by an unusually cold start to December, causing hourly electricity prices on the exchange to surpass €1,000/MW on a few occasions. In light of these substantial price increases and heightened volatility in hourly electricity prices, we are exploring strategies to manage the production process of our Baltic CHP plants more flexibly based on the hourly electricity price on the exchange.

"Amidst the energy crisis sparked by the war, the significance of our cogeneration plants in safeguarding local energy security has further amplified," says energy engineer **Imre Drovta**. "Given the limited inertia of the generating sets used in the local power grid of the Baltic countries, the role of our relatively small CHP plants in stabilising the grid frequency becomes increasingly crucial, especially considering the impending desynchronisation from the

frequency area of the extensive Russian grid. The 2022 energy crisis in Europe served as living proof that we made the right move by investing in our own cogeneration plants in the past."

The thermal energy output from our biomass boilers reached 949 GWh, marking a 3.7% increase from 2021. This rise can be attributed to the exceptional surge in market demand for wood pellets during the summer of 2022 and the increased need for thermal energy in our factories' drying processes.



Our power and heat production are 100% circular

At Graanul Invest, we implement a circular economy model, where 100% of the thermal energy used in our processes is generated on-site. This energy is derived from carbon-neutral and sustainably sourced wood processing waste obtained through sustainable forest management practices. By contrast, the average share of renewable heat in the European industrial sector is significantly lower, standing at just 22%.



949
GWh
3.7%



Water use

The consumption of primary water within the entire group has decreased by 5%.



All four of our vessels were equipped with ballast water treatment systems by the end of 2022.

Within our factories, daily water usage is limited to equipment washing and providing water for our workers. All our production facilities are equipped with modern amenities, including dual-flush toilets and water-saving shower heads, to promote water conservation.

It is important to note that no water is used in the pellet production process, meaning that daily water usage in our factories is not directly linked to production volumes. Nevertheless, monitoring the group's consumption of primary water remains essential, and we observed a 5% decrease over the year.

In 2022, a significant investment was made at the Woodville factory in the US, where we applied a waterproof concrete coating to the area beneath the production equipment. This modification improves surface water treatment, prevents the contamination of rainwater with oil and lubricants, and minimises soil absorption and accumulation.

Earl Herndon, Manager of the Woodville factory, emphasises that the factory's environmental investment in 2022 was the largest in the group. "Covering large production areas with easy-to-clean and waterproof concrete was the most substantial water-related investment across all our factories in 2022. This measure reduces the risk of contamination and leads to future cost savings in vehicle washing, as there will be significantly less soil dust present on-site," Herndon said.

All of our ships use efficient ballast water treatment systems to safeguard the Baltic Sea ecosystem

In 2022, the most significant and impactful investment related to water management was made by our marine unit. The Imavere, our first vessel acquisition, received a robust ballast water sterilisation system, joining the other three ships in our fleet that were already equipped with this technology.

Olari Tiide, Logistics Manager, emphasises the importance of the investment: "As of 2022, all four of our vessels are equipped with powerful and modern ballast water treatment systems. As our ships primarily operate in the Baltic, this investment is vital for preserving and protecting our local ecosystem."

Sterilising ballast water is crucial in preserving the unique Baltic Sea ecosystem, characterised by low salinity and isolation from oceans. By UV-sterilising ballast water, we effectively prevent the artificial and rapid spread of alien species and microorganisms between different natural areas via ships.

Due to its enclosed position and small size, the brackish ecosystem of the Baltic Sea is particularly vulnerable to invasive species introduced by human activity.



Woodville, Texas, USA

Reduced production led to an increase in specific water consumption

Graanul Invest's specific water consumption in 2022 was 0.098 m³/t, representing a 2.6% increase compared to 2021. This increase can be attributed to a roughly 7% reduction in our pellet production compared to 2021.

In 2022, we made a notable investment in optimising the usage of process water at the Helme CHP plant to reduce local water consumption in the future. At the Imavere factory, we also implemented the practice of recycling cooling water from the process water analysis system, resulting in daily savings of 15–20m³.

Our Woodville factory in the US achieved the most significant improvement in specific water consumption, with a notable decline of 13%, directly correlated with a 13% increase in production volume.



2.6%
2022
0.098 m³/t
2021 0.096 m³/t



The footprint of CHP plants



We use tree bark and forest chips left over from wood processing.

Our six CHP plants in Estonia and Latvia are fuelled by waste wood sourced from sustainably managed forests, specifically tree bark and forest chips.

These plants recycle wood waste deemed unsuitable for industries other than energy production. This includes forest chips, logging residues and bark, which often contain high levels of dust, sand and soil. However, the pellet industry, as well as the board and paper industry, cannot mechanically process biomass contaminated with hard mineral impurities.

Fuel transport is the main factor contributing to our CHP plants' minimal fossil carbon footprint. Most of the bark we use is sourced from our own peeling lines, located in close proximity to the plants, or from nearby sawmills within the same industrial park. Logging residues and forest chips are typically transported from within a 30 km radius.



Our pellet factories are powered by green electricity generated by our own CHP plants.



Five principles guide our efforts to minimise the use of fossil diesel in fuel transport:

- 1 We prioritise sourcing CHP fuel from nearby locations.
- 2 We closely monitor the moisture content of forest chips to avoid unnecessary water extraction.
- 3 We ensure trucks are loaded close to 100% of the permitted mass.
- 4 We collaborate with transport partners who have modern and fuel-efficient fleets.
- 5 We regularly upgrade the loader fleet in our factories to maximise efficiency.

Fuel wood collection for CHP plants is constrained by spring-summer felling restrictions, resulting in insufficient drying time for wood harvested in the latter part of the summer before it is chipped and transported. Transporting wetter wood chips directly increases the CO₂ footprint of the forestry and energy sector.

Modern precipitators ensure superior air emissions.

All our CHP plants are equipped with cutting-edge electrostatic precipitators, effectively capturing 99% of solid particles in flue gases. The combination of modern biomass boilers and advanced purification systems is unrivalled in providing energy for industrial processes.

Reusing wood ash as mineral fertiliser.

The ash produced from biomass combustion in our CHP plant boilers is far from being a waste. Instead, it is a valuable resource that is repurposed as agricultural fertiliser. With the termination of European imports of mineral fertilisers from Russia and Belarus in early 2022, the demand and value of our ash have soared.

Moreover, the bottom ash generated by our boilers is perfectly suited for organic farming practices.

Collectively, our factories generate approximately 1,000 tonnes of ash per year. Located in rural areas with vibrant agricultural activities, we have the organic and cyclical capability to recycle all the minerals present in the wood combustion residues back to the neighbouring fields and the natural environment.

The common transport radius of chipped logging residues and forest chips is approx. 30 km.

Reusing wood ash as mineral fertiliser



Logistics footprint

- We expanded our fleet by acquiring the Helme, a new vessel measuring 133 meters and boasting a capacity of 8,600 tonnes.
- We reduced our procurement radius to 37.07 kilometres
- We invested in upgrading the Port Arthur terminal in the US to accommodate larger Supramax cargo vessels. This expansion enabled us to successfully load our first pellet cargo weighing over 50,000 tonnes in Texas.

Focusing on optimising logistics

Logistics plays a vital role in the environmental impact of wood pellets, as using fossil fuels for transporting both raw materials and the final product is the main contributor to the overall fossil CO₂ footprint. Therefore, our focus is always on optimising logistics, striving for the smallest possible environmental footprint and ensuring optimised supply chains.

There were many adjustments and rapid changes in our logistics operations in 2022. The Russian invasion in February significantly disrupted stable and well-established supply chains. The Baltic wood and biofuel commodity markets were particularly impacted by the sudden halt in imports from Russia, and especially Belarus. Before the war, Graanul Invest mainly imported sawmill waste from

Belarus for the Alytus factory in Lithuania. Import restrictions also reduced the volume of our primary raw material, sawdust and wood shavings from local sawmills, which no longer processed logs sourced from aggressor states. These market fluctuations led to a 50% decrease in the potential sourcing radius for the Baltic countries, creating an unprecedented shortage of wood-based raw materials in the first half of 2022.

The surge in energy input costs resulting from the war drastically increased the demand for pellets in the first six months of 2022. Industrial energy producers, along with households and small-scale producers seeking quality pellets, scrambled to secure large quantities, driven by concerns over price hikes and potential shortages. This surge in demand, combined with a rapid decline in raw material availability, compelled us to explore alternative supply chains quickly.

Reducing the supply radius of raw materials

In 2022, we further decreased our supply radius, which had remained around 53 km for many years. This reduction was driven by the suspension of sawmill residue imports from Belarus and the substitution of raw materials with biomass from local markets. Our average supply radius in 2022 was 37.07 km.

The fossil CO₂ footprint per MJ of energy for wood pellets delivered to our customers was 2.51 grams, marking a 1.6% decrease compared to 2021.

Average
supply radius
37.07 km

Expanding our fleet with a fourth vessel

The growth of our fleet in 2022 has significantly enhanced our logistics efficiency. After acquiring the Launkalne in December 2021, we expanded our fleet by procuring her 8,600-tonne sister ship at the beginning of summer. Following the tradition of honouring the chronology of our factories, we named her the **Helme**.

“Adding a second smaller ship allows us to serve all our customers in the Baltic Sea region with greater optimisation, flexibility and cost-efficiency. Its shallower draught enables us to transport goods more efficiently from the relatively shallow Port of Pärnu to shallow-draught ports in Denmark and other parts of the Baltic Sea region. Moreover, operating two pairs of identical sister vessels provides a logistical advantage, significantly accelerating and streamlining port operators’ loading and unloading processes,” explains Logistics Manager **Olari Tiide**.

The role of maritime transport continues to grow, contributing to the reduction of the transport footprint for premium pellets. “The surging demand for premium pellets in the first half of 2022, coupled with industries’ increasing inclination to replace fossil-fuelled heat with environmentally friendly biomass energy, is set to significantly increase the importance of our smaller vessels in transporting quality pellets. By using a single ship instead of 350 trucks, we can reduce our pellet transport footprint several times over. We are witnessing rapid growth in the share of large batches and maritime transport within the premium range,” remarked **Maida Insler**, Sales Manager for premium pellets.



Regarding air emissions, it is worth noting that all of Graanul Invest’s vessels exclusively transport pellets within the Baltic Sea and the European part of the British Isles – areas with the strictest emission standards. Only low-sulfur diesel is allowed onboard to minimise NOx and SOx emissions, underscoring our commitment to reducing environmental impact.

Using larger vessels significantly reduces the transport footprint of US pellets to Europe

The Atlantic route from Texas to the British Isles is our longest primary transportation route for industrial pellets. At the end of 2022, we achieved a significant milestone by loading more than 50,000 tonnes of cargo at our Port Arthur terminal in Texas.

“This represents a new level of logistical efficiency for us. With larger individual shipments, the amount of fuel consumed per tonne in maritime transport will decrease dramatically. I want to extend our gratitude to our partner Drax, who also invested in efficiency enhancements to facilitate the unloading of larger vessels at our ports of destination in the UK,” states **Jason Ansley**, Vice President of our US Operations.

In 2022, in collaboration with our British partners, we completed our investments to accommodate Supramax vessels, which have twice the carrying capacity of Handymax vessels, surpassing 60,000 tonnes. These larger vessels will play a significant role in further reducing our logistics footprint in the coming years.



Helme

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