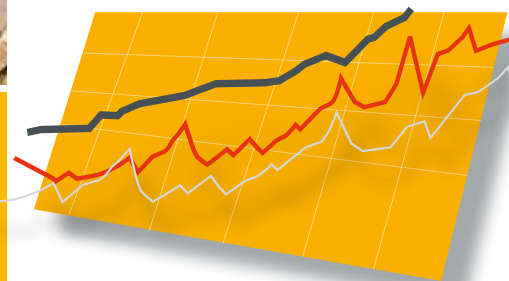


Fuel data
Firewood, Wood Chips, Pellets, Miscanthus



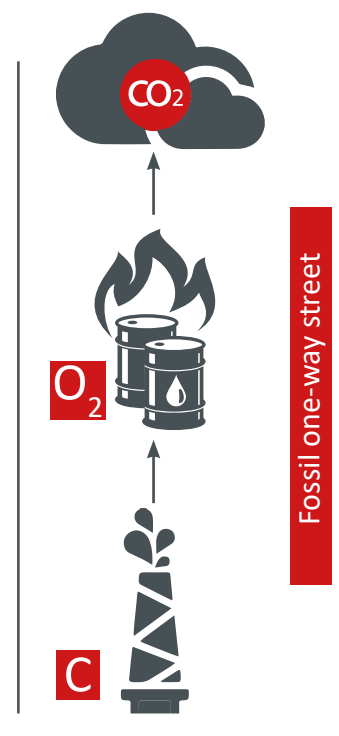
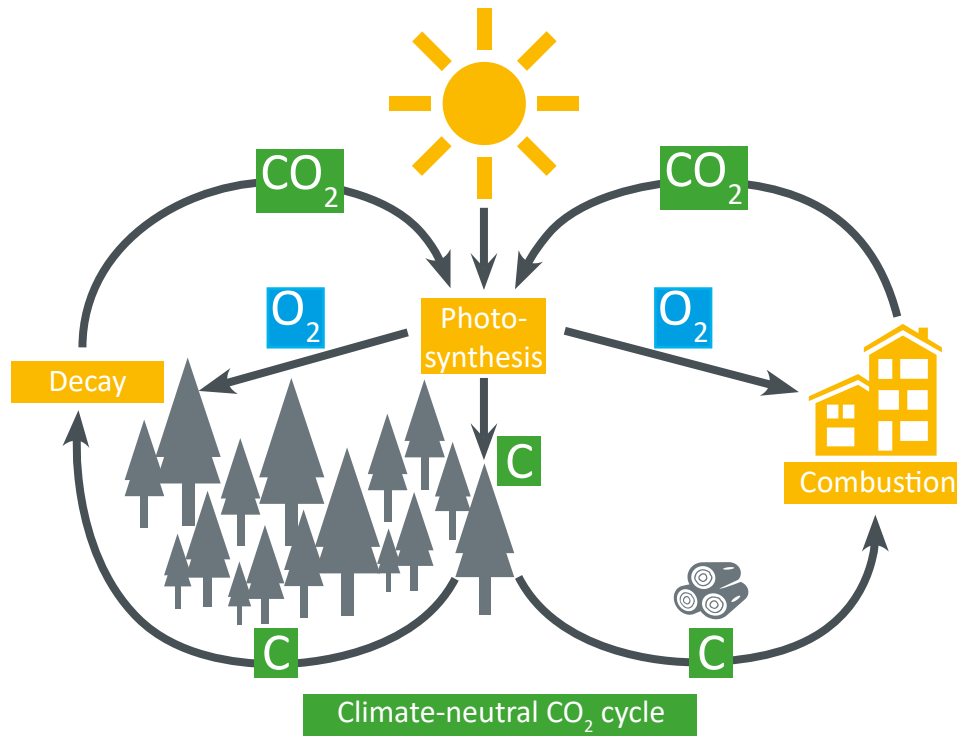
Heat from Biomass



A passion for perfection.

www.eta.co.at

HEAT FROM THE FOREST



Source: Austrian Biomass Association

Heat from the forest

Why heating with wood is so advantageous

What is biomass?

Everyone has heard the term biomass by now. But what does it really mean? Biomass refers to all organic substances which are biogenic and non-fossil. Examples of biomass include waste wood, shrub cuttings, biowaste, animal manure and many more organic substances. Energy can be derived from all of these raw materials. For heating, wood in its various forms is the standard and most frequently used energy source.

Heating with wood

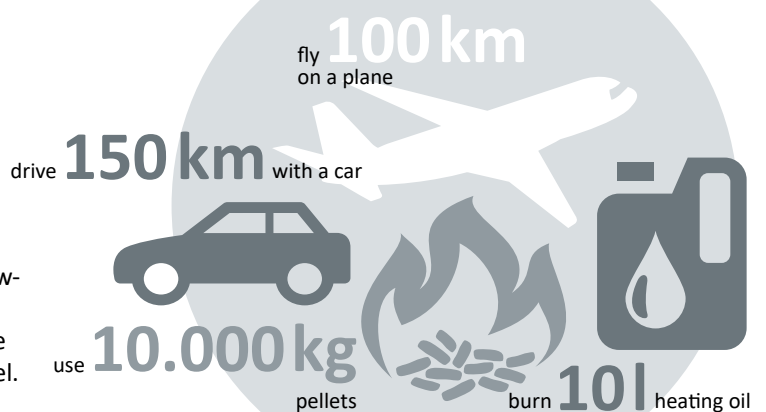
Wood as fuel has proved its worth in the heating sector against other biomass raw materials for various reasons. On the one hand, the energy requirement and the effort for the further processing and transport of the wood are very low, even with pellets. Another reason why wood is an established fuel is its chemical composition with low-emission combustion. Compared to other biomass raw materials, availability and climate neutrality are important factors in the popularity of wood as a fuel.

Environmentally friendly and CO₂-neutral

Everyone knows by now why burning fossil fuels, such as oil and gas, is not preferable. The procurement of crude oil and gas is very energy- and cost-intensive, as is the further processing of the final heating medium. Moreover, fossil fuels are not climate-neutral. This means they intensify the greenhouse effect and contribute to climate warming.

The natural raw material wood is CO₂-neutral, which means that during its combustion no more CO₂ will be released than the tree took in during its growth. The same amount will also be released if the wood rots in the forest. So heating with wood doesn't burden our climate.

about 30 kg **CO₂** are emitted when you



Strengthen the local economy

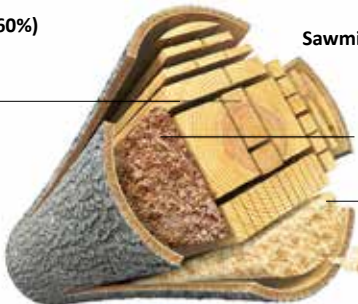
Wood not only keeps our homes warm, but also creates jobs and added value in the region. From forestry to transportation to the production of firewood, wood chips or pellets - people along the entire value chain are working on refining wood into valuable fuel. And not only the production, but also the distribution of heat to multiple households from biomass district heating plants create jobs in the region. Oil by comparison also creates employment, but for the most part in distant parts of the world.

Wood continuously regrows in our domestic forests, thus it is crisis-proof and impervious to the stark fluctuations of international markets. Currently, forested areas are increasing across the whole of Europe, for more solid cubic metres of wood are being produced each year than consumed. This means that the potential is not sufficiently exhausted and there is still room to improve our economy and the climate.

Wood cutting in the sawmill

100% softwood* (without bark) consisting of:

| | |
|---------------------------------|--|
| <p>Sawn timber (60%)</p> | <p>Sawmill by-products (40%)</p> <ul style="list-style-type: none"> Woodchips (26%) Sawdust (12%) Other (2%) |
|---------------------------------|--|



*More than 95% of sawmill products in German sawmills are made of softwood.
 Source: Döring, P., Mantau, U.: Standorte der Holzwirtschaft - Sägeindustrie - Einschnitt und Sägebrenprodukte 2010. Hamburg, 2012.
 Conversion: DEPI, German Pellet Institute, using images from mipan / 123RF.com and Can Stock Photo / dusan694

No extra trees have to be felled to produce pellets, because the wooden briquettes consist mainly of sawdust, a waste product of the wood industry.

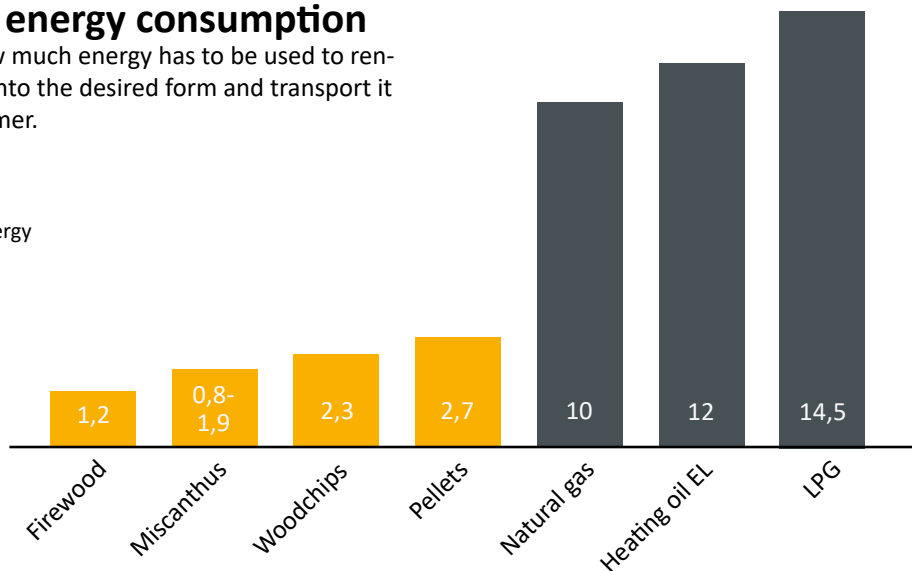
!

By the way: Did you know that trees are not felled to produce firewood, but mainly for sawmill and industrial wood production (e.g. furniture and paper production)? The fear that heating with wood means diminishing forests is, therefore, unfounded, since the production of firewood mainly uses wood from the forest, such as branches and timber, as well as leftovers from the sawmill industry.

Primary energy consumption

Indicates how much energy has to be used to render the fuel into the desired form and transport it to the consumer.

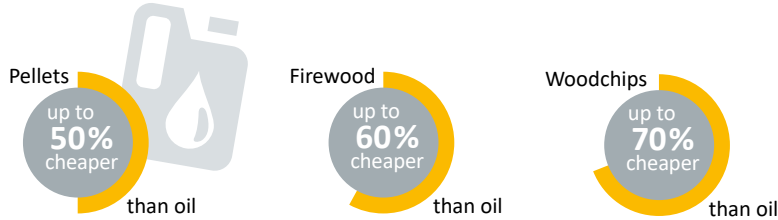
In % of final energy



Switching over is worthwhile

While the price of fossil fuels such as oil and gas is subject to heavy fluctuations in the international markets and will certainly rise long-term, the price of wood and pellets is reliable.

Calculation period: 5 years



Looking back 15 years

I heated with oil and that was really expensive...



3,200 litres of oil per year

€ 2,200 per year

... if I would have heated with pellets...



5,800 kg pellets per year

€ 1,200 per year

... me and my family would still have available...



after 1 year ~€ 1,000
 after 7 years ~€ 7,000
 after 10 years ~€ 10,000
 after 15 years ~€ 15,000

This fuel comparison takes into account the following efficiencies: old oil boiler 80%, pellet boiler 90%

Average price of heating oil 6.8 cent/kWh

Average price for pellets 4.19 cent/kWh

Average prices of the last 15 years

Source: IWO, BMWFW, Treibstoffpreismonitor, Genol, proPellets Austria



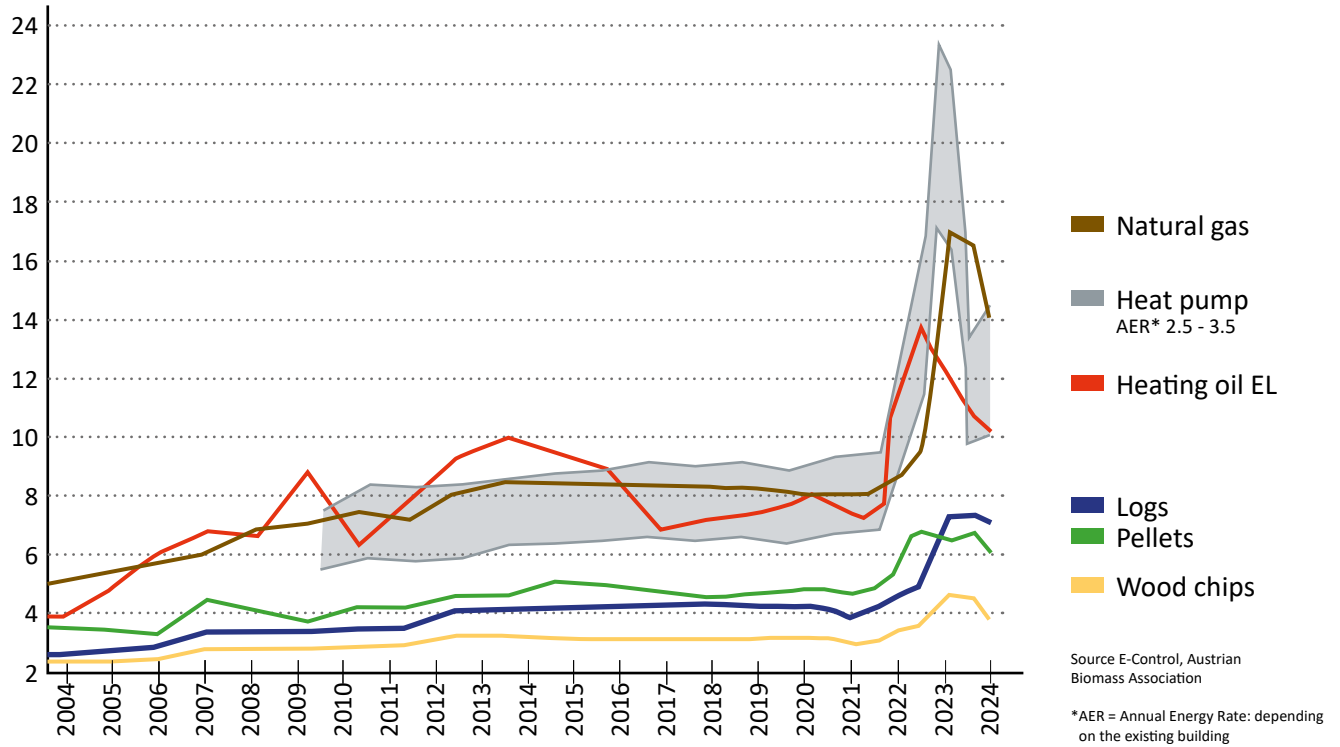
Calculate your savings: <https://www.eta.co.at/en/products/heating-costs-in-comparison/a-change-is-worthwhile/>



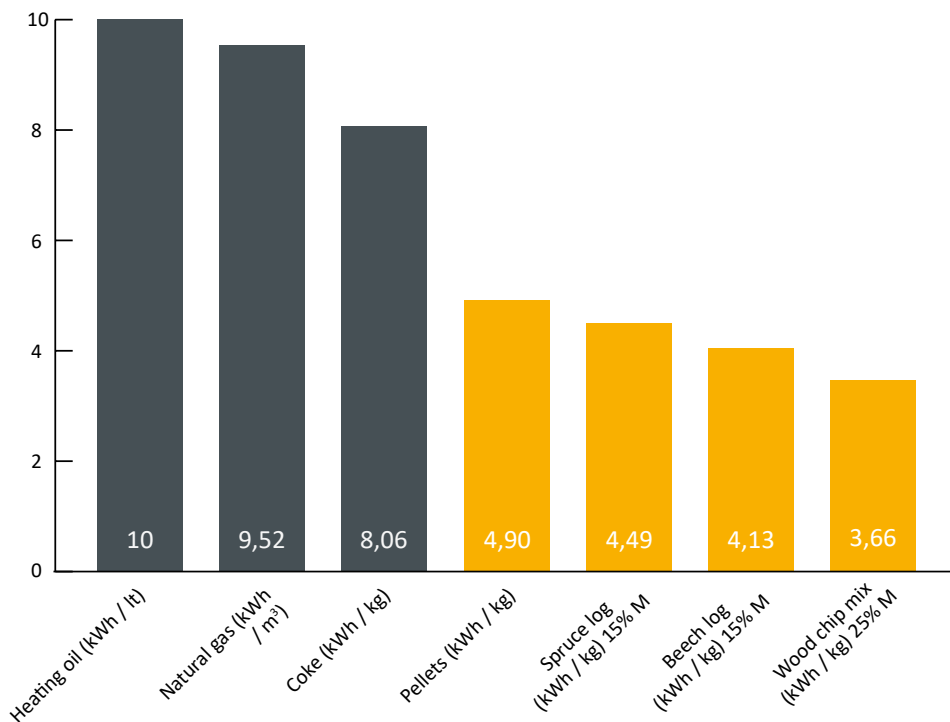
Price development of energy sources

for households 2004 - 2024

Cent/kWh



Calorific values of different fuels



WARNING danger of confusion!
Moisture is not the same as water content

Water content (M) in relation to the total mass



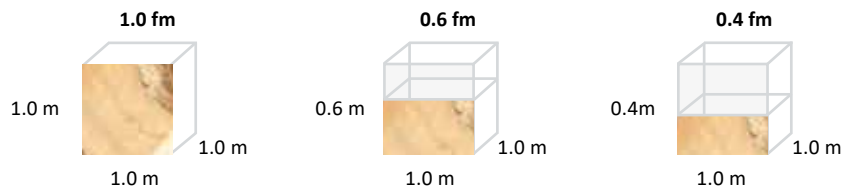
Moisture (u) in relation to the dry mass (pure wood mass without water)



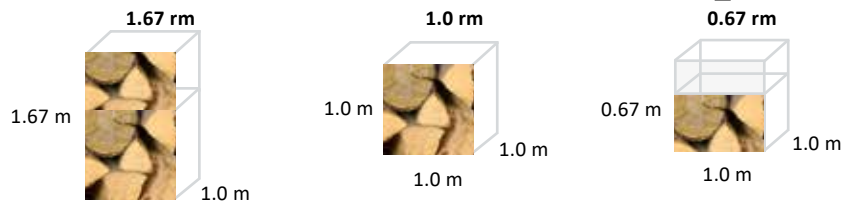
| Comparison | |
|------------|---------------|
| Moisture | Water content |
| 15% | 13% |
| 17.6% | 15% |
| 20% | 16.7% |
| 25% | 20% |
| 30% | 23.1% |
| 33.3% | 25% |
| 40% | 28.6% |
| 42.9% | 30% |
| 50% | 33.3% |
| 53.8% | 35% |
| 60% | 37.5% |
| 66.7% | 40% |
| 70% | 41.2% |
| 80% | 44.4% |
| 81.8% | 45% |
| 90% | 47.4% |
| 100% | 50% |

Ratios of the room dimensions

Solid cubic metre (fm)



Cubic metre (rm) or stacked cubic metre stacked split logs

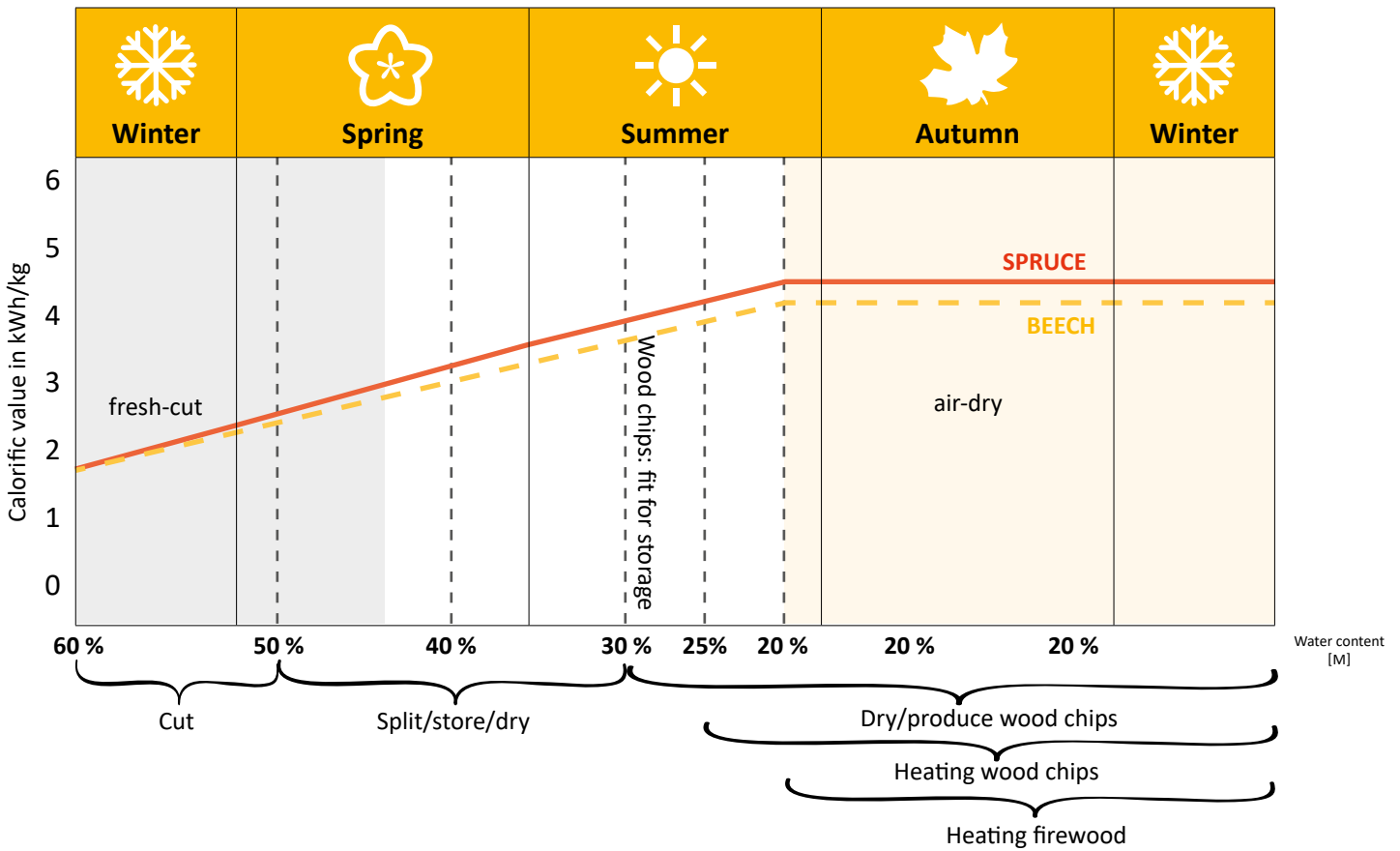


Loose cubic metre (srm) Poured wood chips



For more detailed conversion factors for the dimensions of round and split logs, see: www.tfz.bayern.de > Festbrennstoffe > Publikationen > Umrechnungsfaktoren verschiedener Raummaße für Scheitholz

Optimal wood drying and recycling process in Central Europe



Calorific values depending on water content and size

| | Calorific value based on weight | | Cubic metre half-metre log | | | | Loose cubic metres P16S wood chips | | | | Loose cubic metres P31S wood chips | | | |
|-------------|---------------------------------|----------|----------------------------|---------|----------|----------|------------------------------------|----------|-----------|-----------|------------------------------------|----------|-----------|-----------|
| | M = 15% | M = 30% | M = 15% | M = 30% | M = 15% | M = 30% | M = 15% | M = 30% | M = 15% | M = 30% | M = 15% | M = 30% | M = 15% | M = 30% |
| Unit | kWh / kg | kWh / kg | kg / rm | kg / rm | kWh / rm | kWh / rm | kg / srm | kg / srm | kWh / srm | kWh / srm | kg / srm | kg / srm | kWh / srm | kWh / srm |
| Softwood | | | | | | | | | | | | | | |
| Fir | 4.40 | 3.51 | 276 | 317 | 1,210 | 1,110 | 178 | 205 | 780 | 720 | 148 | 171 | 650 | 600 |
| Spruce | 4.49 | 3.58 | 293 | 337 | 1,310 | 1,210 | 189 | 218 | 850 | 780 | 157 | 181 | 710 | 650 |
| Douglas fir | 4.43 | 3.53 | 319 | 368 | 1,410 | 1,300 | 206 | 237 | 910 | 840 | 172 | 198 | 760 | 700 |
| Pine | 4.32 | 3.44 | 360 | 414 | 1,550 | 1,420 | 232 | 267 | 1,000 | 920 | 193 | 223 | 830 | 770 |
| Larch | 4.27 | 3.39 | 370 | 426 | 1,580 | 1,450 | 239 | 275 | 1,020 | 930 | 199 | 229 | 850 | 780 |
| Hardwood | | | | | | | | | | | | | | |
| Poplar | 3.99 | 3.16 | 256 | 295 | 1,020 | 930 | 174 | 200 | 690 | 630 | 145 | 167 | 580 | 530 |
| Willow | 3.76 | 2.97 | 320 | 369 | 1,200 | 1,100 | 217 | 250 | 810 | 740 | 181 | 208 | 680 | 620 |
| Alder | 4.06 | 3.23 | 313 | 361 | 1,270 | 1,160 | 212 | 245 | 860 | 790 | 177 | 204 | 720 | 660 |
| Maple | 4.04 | 3.21 | 384 | 443 | 1,550 | 1,420 | 260 | 300 | 1,050 | 960 | 217 | 250 | 880 | 800 |
| Birch | 4.01 | 3.18 | 391 | 450 | 1,570 | 1,430 | 265 | 305 | 1,060 | 970 | 221 | 254 | 890 | 810 |
| Ash | 4.10 | 3.25 | 429 | 494 | 1,760 | 1,610 | 291 | 335 | 1,190 | 1,090 | 242 | 279 | 990 | 910 |
| Oak | 4.10 | 3.25 | 429 | 494 | 1,760 | 1,610 | 291 | 335 | 1,190 | 1,090 | 242 | 279 | 990 | 910 |
| Beech | 4.13 | 3.28 | 435 | 502 | 1,800 | 1,640 | 302 | 347 | 1,220 | 1,110 | 251 | 289 | 1,010 | 930 |
| Robinia | 4.11 | 3.27 | 467 | 538 | 1,920 | 1,760 | 317 | 365 | 1,300 | 1,190 | 264 | 304 | 1,090 | 990 |

Pellets – locally sourced energy bricks

This natural raw material is predominantly made from saw-cutting by-products. Producible from any type of wood, the cost of pellets is currently about half the price of oil. Unlike oil, however, this fuel comes from the region and creates domestic jobs. Heating with pellets not only protects the environment affordably, but also strengthens the local economy.

Always space for pellets

Pellets are delivered – like oil – with tank trucks. Every common oil tank can be converted without any problems and holds enough pellets for an entire winter. In new buildings, because of the small amount of energy required, only 2 m² are needed to accommodate a year's supply of pellets.



Fact sheet about wood pellets ISO 17225-2 Class A1

| | |
|--|--|
| manufactured from trunk wood without bark (forest wood), planing or saw dusts chips (chemically untreated) | |
| Calorific value (Q) | from 4.9 kWh/kg softwood from 4.6 kWh/kg hardwood |
| Bulk density (BD) | ≥ 650 kg/m ³ (spruce) |
| Diameter (D) | 6.0 mm ± 1.0 mm |
| Length (L) | 3.15 < L ≤ 40 mm |
| Water content (M) | ≤ 10% |
| Mechanical strength (DU) | ≥ 97.5 % |
| Fine material portion from plant (F) | max. 1.0% smaller than 3.15 mm |
| Ash content (A) | ≤ 0.7% |
| natural pressing aids (e.g. maize starch) max. 2% of the mass | |
| Energy required for manufacture approx. 2 - 2.5% of the energy content | |

When moving from another energy source to pellets, the pellet requirement can also be determined based on the previous consumption. 1 ton of pellets roughly corresponds to:

- 500 l heating oil
- 520 m³ natural gas
- 750 l LPG
- 600 kg Coke
- 1,400 kWh current for geothermal heat pumps (practical coefficient of performance 3.4)
- 2,700 kWh current for air heat pumps (practical coefficient of performance 1.8)

Before buying the pellets, please note: **the quality is crucial, not the price.**

Preferably pellets according to ISO 17225-2 Class A1, EN plus A1.

! How big does the store room have to be? Rule of thumb for the pellets required

Heating value of the pellets = 4.9 kWh/kg 9 kW heating load / 3 = 3 tonnes pellets annually

Weight of the pellets = 650 kg/m³ 9 kW heating load / 2 = 4.5 cubic metres annually

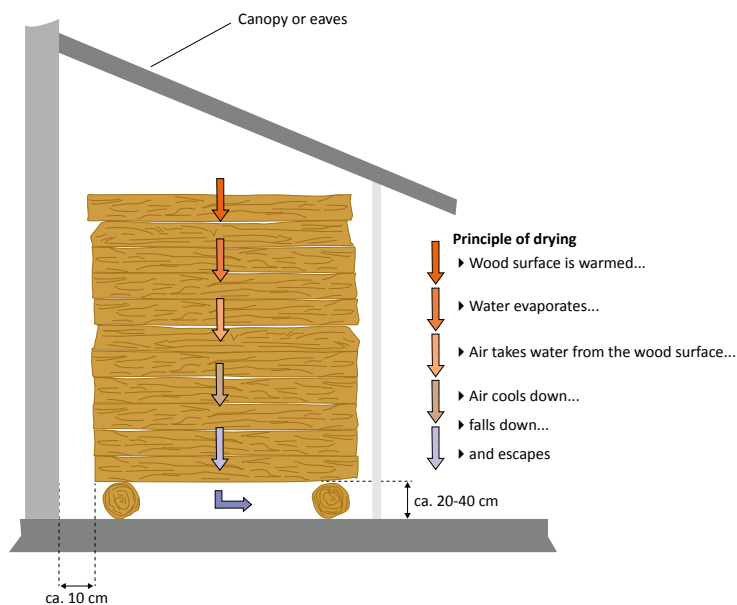
Firewood – the world's oldest fuel

From camp fires in the Stone Age cave to modern wood gasification boilers, firewood has always provided heat in our homes. Especially when wood is available from our own forests, firewood is the most favourable form of energy for heating. Even if wood has to be purchased, it can be up to 60% less expensive than oil.

Firewood can be stored outdoors, but it must be protected from the elements. Temporary storage in the house near the boiler is nevertheless an advantage when it comes to convenience.

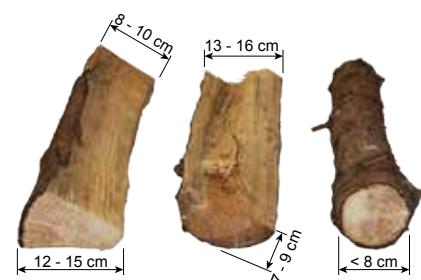


Drying principle



Suitable fuel

The firewood must be air-dry, i.e. it must have dried for at least one year and have a water content under 20%. We recommend using half-metre split logs with an average diameter of 10 cm.



Estimating your wood requirements

Each kilowatt of heat output requires 0.9 cubic metres of half-metre split beech logs or 1.3 cubic metres of split spruce per year.

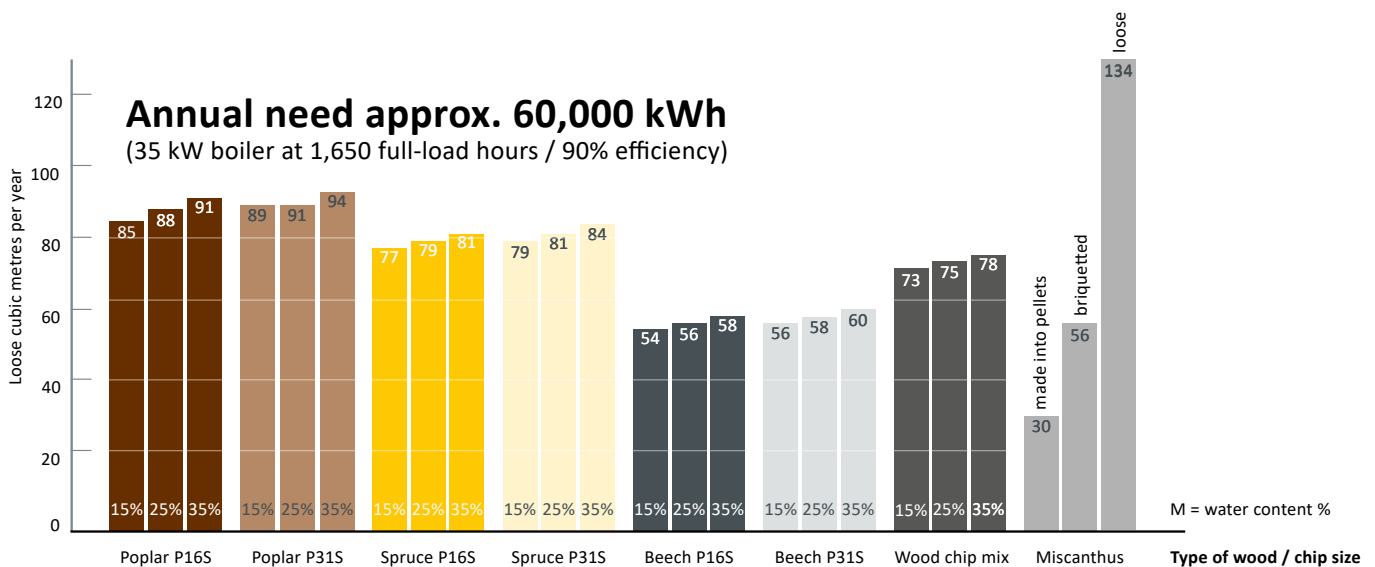
Wood chips – versatile and affordable

Cost-effective wood chips are available from the thinnings of forests and from sawmills. This versatile fuel is excellently suited for automatic burning in boilers of all sizes. Although a larger storage space is required than for pellets, for example, this is compensated by the more favourable price. The standardisation of this fuel type makes the purchase easier for you as a customer. You receive exactly the quality you order.






Shredded material

Unlike wood chips, the wood is torn apart with a blunt tool. This method is mainly used for waste wood. Wood prepared in this way is also suitable in most cases as fuel in wood chip plants. It is important to ensure that no long fibres are produced which could hinder the flow of the fuel. Since, however, nails and other metal parts can often be present, the use of a magnetic separator during shredding is recommended.






P16S wood chips according to ISO 17225-4

largely correspond to G30 wood chips according to ÖNORM M 7133

| Ø | 0 | 3,15 | 16 | 45 |
|-------------------|--|------|----|----|
| 2 cm ² | Coarse content < 6% | | | |
| |  <ul style="list-style-type: none"> - maximum 6% of the total mass - maximum length 45 mm - maximum cross-section 2 cm² | | | |
| | Main content > 60% | | | |
| |  <ul style="list-style-type: none"> - at least 60% of the total mass - particle size between 3.15 and 16 mm | | | |
| | Fine content max. 15% | | | |
| |  <ul style="list-style-type: none"> - maximum 15% of the total mass - particle size ≤ 3.15 mm | | | |

P31S wood chips according to ISO 17225-4

largely correspond to G50 wood chips according to ÖNORM M 7133

| Ø | 0 | 3,15 | 31,5 | 150 |
|------------------------|---|------|------|-----|
| max. 4 cm ² | Coarse content < 6% | | | |
| |  <ul style="list-style-type: none"> - maximum 6% of the total mass - maximum cross-section 4 cm² - maximum length 150 mm | | | |
| | Main content > 60% | | | |
| |  <ul style="list-style-type: none"> - at least 60% of the total mass - particle size between 3.15 and 31.5 mm | | | |
| | Fine content max. 10% | | | |
| |  <ul style="list-style-type: none"> - maximum 10% of the total mass - particle size ≤ 3.15 mm | | | |

Water content class M according to ISO 17225-4

The % portion relative to the total mass is called M. Up to M35 (water content less than 35%) is acceptable. M25 is preferable for storage and maximum heat output.

Ash content class A according to ISO 17225-4 the % portion in relation to the dry mass is called A. Up to A1 (ash content less than 1%) is acceptable.

Bulk density BD

The bulk density S was formerly given in ÖNORM M 7133 in water-free state (dry mass without water). In the new ISO 17225-4 the bulk density BD in delivered state (total mass including water) is given. The standardised classes with BD150 and BD200 are too vague and have no relevance for wood chips as a fuel. Bulk densities for different woods in wet state M15 and M30 are provided in a table on page 7.

Miscanthus (Chinese reed, elephant grass) – efficient yield

We have weighed the possibilities of different energy plants against one another - with the highest demands on yield and environmental compatibility. Miscanthus replaces 6,000 to 8,000 litres of fuel oil per hectare without fertilizer or spray. A further advantage is the low-maintenance cultivation of Miscanthus. From planting to harvest, no effort is required.

In order to make ideal use possible, it is necessary to pay attention to the chlorine content in the first few years. It should not exceed 0.07%.

Since Miscanthus has an increased ash content and a lower ash melting point, flue gas recirculation is necessary during combustion to reliably prevent slag formation.



Chopped material

With a maximum length of 2 cm, Miscanthus, in chopped form, is generally very free-flowing and can, therefore, be fed with fuel conveying devices from wood chip plants to the location of combustion.

However, since the density of Miscanthus is relatively low, roughly two to three times the storage volume is needed for the same heat output compared to wood chips. Therefore, Miscanthus pellets or briquettes are also often used in confined spaces.



From Hausruckviertel to the world

ETA specialises in the manufacture of biomass heating, i.e. log, pellet and wood chip boilers. The most modern technologies combined with naturally growing resources.

ETA is efficient

Technicians designate the efficiency of a heating system with the Greek letter η , pronounced „eta“. ETA boilers stand for more heat with less fuel consumption, environmental soundness and sustainability.

Wood: old but excellent

Wood is our oldest fuel - and our most modern: There is a lot of history - from open fires in front of caves to modern biomass boilers. In the middle of the 20th century, the number of wood heating systems briefly fell. Oil heating became the new, hyped option. A brief interlude in comparison to the consistency of wood. Today, we know that heating with fossil fuel has no future. It contributes to global warming and harms the environment. Supply security is also not guaranteed in the long term, as fossil fuels are being depleted, aren't renewable and often come from unstable regions. While wood by contrast is a cheaper, locally grown, renewable raw material that does not pollute the climate when burnt. No wonder wood heating is booming!

Comfort with many components

Since December 1998, the Upper Austrian company ETA has been designing and building a new generation of wood-fired boilers. They are full of patented technologies and the most modern control technology – making them easy to use. Convenience and efficiency make ETA products so popular around the world. With a production capacity of up to 35,000 boilers per year and a global export proportion of around 80%, ETA is one of the leading biomass boiler producers.

You get more than just a boiler

Anyone who decides on a wood or pellet boiler from ETA is choosing sustainability. This is not just in terms of fuel, but encompasses responsibility across the board, with sustainable workplaces in the region. More than 400 employees in Hofkirchen an der Trattnach have the best working conditions – including an in-house restaurant, bright assembly and storage halls, a fitness room and a sauna. There is even a free electric charging station for electric cars, which is supplied by the in-house photovoltaic system. This also covers all the power needed of a production hall and thus saves around 230 tonnes of CO₂ per year.



ETA PRODUCT RANGE

Efficiency for households, commerce and industry



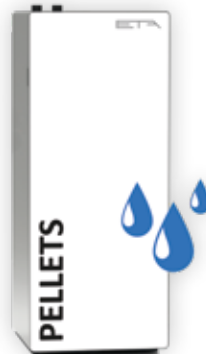
Renewable energy:
environment, save



ETA PU PelletsUnit
7 to 15 kW



ETA ePE pellet boiler
7 to 56 kW



ETA ePE BW condensing
pellets boiler
8 to 62 kW



ETA PC PelletsCompact
20 to 105 kW



ETA ePE-K pellet boiler
100 to 240 kW



ETA eHACK wood chip boiler
20 to 240 kW

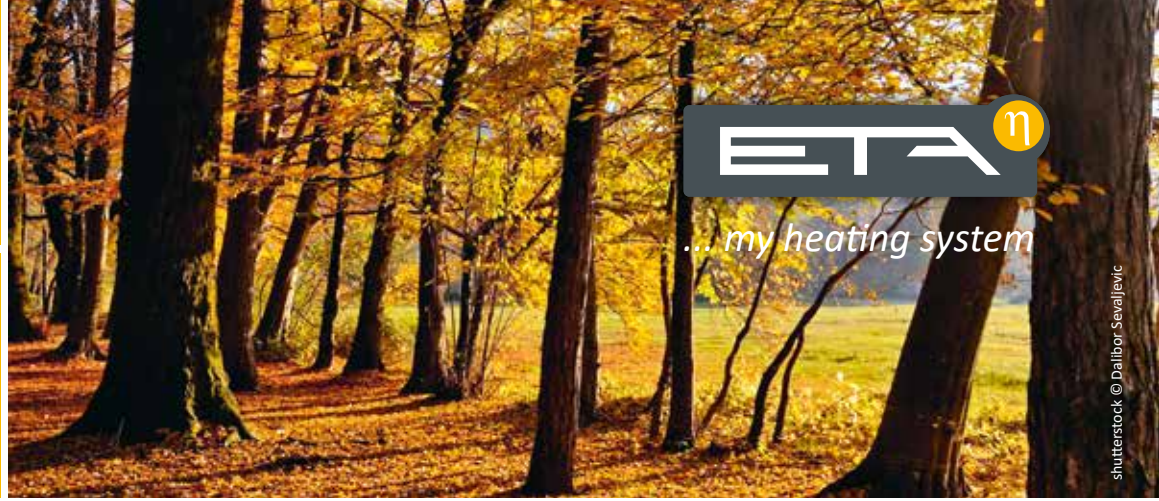


ETA HACK VR wood chip boiler with moving grate
250 to 500 kW



*Miscanthus: Compliance with country-specific regulations is mandatory.

protect the
operating costs



ETA η
... my heating system

shutterstock © Dallbor Sevaljevic



ETA eSH wood gasification boiler 16-40 kW with
ETA eTWIN wood gasification boiler 16-32 kW



ETA eSH wood gasification boiler 16 to 32 kW



ETA SH-P wood gasification boiler 20 to 60 kW with
Pellet burner ETA TWIN 20 to 50 kW



ETA SH wood gasification boiler 20 to 60 kW



ETA stratified buffer 500 to 5,000 l



ETA hydraulic modules for perfect heating systems



A passion for perfection.

www.eta.co.at





ETA Pellets boiler

| | |
|--------------------------|--------------|
| ETA PU PelletsUnit | 7 - 15 kW |
| ETA ePE Pellets boiler | 7 - 56 kW |
| ETA PC PelletsCompact | 20 - 105 kW |
| ETA ePE-K Pellets boiler | 100 - 240 kW |



ETA Condensing heat technology

| | |
|-------------------------------------|-------------|
| ETA ePE BW Pellets boiler | 8 - 62 kW |
| ETA BW Condensing heat exchanger PU | 7 - 15 kW |
| ETA BW condensing heat exchanger PC | 20 - 105 kW |



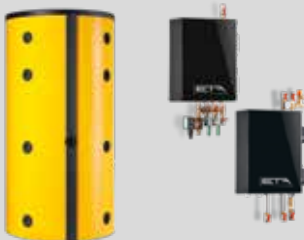
ETA SH Log wood boiler and TWIN Pellets boiler

| | |
|---|------------|
| ETA eSH Log wood boiler | 16 - 40 kW |
| ETA eSH-TWIN Combination boiler with ETA eTWIN Pellets boiler | 16 - 40 kW |
| ETA SH Log wood boiler | 16 - 32 kW |
| ETA SH Log wood boiler | 20 - 60 kW |
| ETA SH-P Log wood boiler with ETA TWIN Pellets boiler | 20 - 60 kW |
| | 20 - 50 kW |



ETA Wood chip boiler

| | |
|------------------------------|--------------|
| ETA eHACK Wood chip boiler | 20 - 240 kW |
| ETA HACK VR Wood chip boiler | 250 - 500 kW |



ETA Buffer tank

| | |
|----------------|---------------|
| ETA Buffer | 500 l |
| ETA Buffer SP | 600 - 5.000 l |
| ETA Buffer SPS | 600 - 1.100 l |

ETA Hydraulic modules

| |
|--------------------------------------|
| ETA Fresh water module |
| ETA Stratified charging module |
| ETA System separation module |
| ETA Mixing circuit module |
| ETA Heat transfer module and station |

Your heating specialist will be happy to advise you:



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 www.eta.co.at

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