D3.3 - Topten HACKS Criteria Paper
Local Space Heaters
Pellet and Logwood

Picture 1: Logwood stove with a water tank add-on
Source: https://www.klimaworld.com/edilkamin-wasserfuehrender-holzofen-cubira-cubira-cs-12-2-kw.html

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Project partners and websites

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Germany, co2online www.co2online.de	Italy, Eliante www.topten.it	Lithuania, LNCF www.ecotopten.lt	Luxembourg, Oeko-Zenter www.oekotopten.lu
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About HACKS

The objective of the Heating and Cooling Knowhow and Solutions (HACKS) project is to achieve market transformation for heating and cooling (HAC) appliances and improve comfort and health of European citizens.
Across the EU almost half of all buildings have individual boilers that were installed before 1992 with efficiency of 60% or less. The expected energy savings from a speedy replacement are immense.
To achieve this goal, 17 HACKS partners in 15 countries are working together, thanks to the financial support of the European Horizon 2020 programme.
After scanning market actors, current policies and most commonly used products in each country, starting from April 2020 the HACKS partners will implement involvement campaigns to raise awareness of the economic and environmental benefits brought by good HAC products and solutions:

- HACKS will motivate households equipped with old and inefficient devices – boilers, water heaters, air conditioners, certain types of boilers and stoves, etc. – to replace them with new super efficient equipment.
- In each country, partners will set-up dedicated on-line platforms to assist consumers in their purchasing process. The platforms will propose: tools to assess households' needs and provide customised information; best product lists with technical specifications; direct links to suppliers of most efficient products; and advice on how to use and maintain equipment.
- For those households who need to improve their situation because they feel too hot, too cold, or too humid but who cannot invest in new equipment or can avoid getting equipped, HACKS will propose simple and low costs solutions. It is possible to reduce energy consumption and energy bills while improving winter and summer comfort, air quality and health conditions through the installation of shading devices, thermostats, water saving taps and showerheads, etc.

Beyond households, HACKS will target all relevant stakeholders ("multipliers") that participate in the decision-making process of consumers by setting up strategic partnerships to facilitate the purchase of energy efficient appliances. HACKS places a strong emphasis on installers but also retailers and consumer organisations because of their proximity to consumers, their capacity to involve them and bring them guidance on energy efficient equipment.
More information on the HACKS project can be found at www.topten.eu/hacks

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Executive summary

With the Criteria Papers the intention is to be able to identify and select the most energy efficient models available on the market. The primary objective is to help project partners on their territory for their Topten and HACKS website, but the technical content may also support anyone willing to find good products from an environmental point of view.

This document gives an overview on local space heaters burning wood (logwood and pellets). It does not include central heat boilers located in the basement of the building. The selection criteria and the products selected according to them for the website topten.eu are presented and explained. They are based on the European energy label and the requirements for air quality, mandatory as of 2022 as defined in the Ecodesign regulation for this appliance group.

A brief technical overview is given on local space heaters burning wood, while a more conclusive view is given in the annex with many different types of stoves and technologies used. Important to note is the influence of the consumer when it comes to air pollution. It is crucial that the lighting and refuelling of logwood is properly taught to consumers.

Furthermore, the current EU regulations such as the Energy labelling regulation and the Ecodesign requirements are presented in detail. They include criteria on energy efficiency as well as on air quality, the major environmental issue when burning wood. The label, which is mandatory since 2018, is explained and the impact of the new Ecodesign requirements presented. As of 2022, a product fiche with all information has to be provided.

The presented products are characterized with a number of attributes which can be used as filters for easier grouping, for example by stove-type, size, fuel used, etc. These attributes are presented and discussed with regards to their relevance. In addition, recommendations are given on how to find the data for each product.

Finally, useful information is collected, such as various links, terms and a glossary. Inputs for consumers are given with a FAQ-section on important topics.

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1 Topten.eu: Local space heaters - current selection criteria and products selected

1.1 Scope

Within the HACKS project, the scope is single-family-houses. There, the focus lies on logwood and pellet stoves which are one typology of local space heaters. Other types of stoves are presented in the appendix.
The term "local space heaters" summarizes all heating devices not located in the basement, (those, on contrary, have to be connected to a central heat distribution system), meaning all the stoves you find in your living room, that are designed to look good and provide a cozy atmosphere. Further explanations of specific terms can be found in the Terminology on page 13.
They can use liquid fuel (oil, petrol, etc.), burn natural gas, or solid fuels such as coal or, the only renewable source and with that, the focus of this paper, wood.
The energy labelling regulation (EU 2015/1186) applies to all local space heaters, however the product group is regulated by two ecodesign regulations

- 2015/1188: Space heaters that use electricity, gaseous or liquid fuels, such as electric radiators and electric underfloor heating
- 2015/1185: Space heaters which use solid fuels such as stoves and fireplaces

As the scope of this papers is wood as fuel the relevant ecodesign regulation is the latter one.
Keep in mind that for some local space heating products, it is still possible to connect them to a central heating system.

1.2 Current selection criteria on Topten.eu

The criteria for Topten.eu[1] were developed as part of the HACKS project. They were defined based on selection criteria from Austria, Germany and Switzerland, which already presented this category on their national Topten-websites. In order to provide early insight into the market for installers and dealers, the Topten air quality criteria match the Ecodesign requirements which have become mandatory as of 2022 (as defined in regulation EU 2015/1185).

Table 1: Selection criteria for local space heaters (Topten.eu) – February 2022

	Pellet stoves	Logwood stoves
Energy label	A+	A+
Dust [mg/m^3]	20	40
CO nominal load [mg/m^3]	300	1500
C org nominal load [mg/m^3]	60	120
NO_x [mg/m^3]	200	200

1.3 Best available products

Here you can find the stoves presented on topten.eu
https://www.topten.eu/private/products/local_space_heaters

Furthermore, you can check out other stoves as presented on national Topten-websites in Appendix 7.2 below. With these selection criteria, in February 2022, 16 manufacturers are able to produce and distribute compliant models. Currently, no logwood models reach the highest efficiency class A++ on the European energy label.

[1] www.topten.eu is the European portal where all the HACKS websites can be found

Table 2: Number of models per efficiency class and fuel type as of February 2022

Efficiency Class	Logwood	Pellets	Total
A+	13	20	33
A++		10	10
Total	**13**	**30**	**43**

Source: https://www.topten.eu/private/products/local_space_heaters

1.4 Comparison of national selection criteria

In addition to energy efficiency, one of the most relevant issues for solid fuel heaters is the associated emissions. Particulate matter emissions and air quality are critical topics all over the EU. However, emission declarations have only recently become mandatory as of 2022; as such the products on Topten.eu will need to declare their emissions accordingly and comply with the European requirements set for 2022. In accordance with those requirements, the air quality criteria differ between local space heaters using pellets and logwood.

Some countries already have stricter air quality requirements on a national level than the 2022 kicked-off EU requirements. In this case, national Topten criteria will be adjusted to national minimum requirements or higher.

Because emission declarations were not mandatory in the Ecodesign until 2022 and the energy label is scarcely and sometimes difficult to find in product catalogues, many national local space heater associations use their own test methods and sometimes own endorsement label as is the case in e.g. Austria, Switzerland, France and Italy. While some national Topten websites have so far relied on such associations' labels, an adjustment of their selection criteria to include the European label is expected in the course for 2022.

1.5 Expected Topten selection criteria by end of project

With the Ecodesign requirements from EU 2015/1185 being enforced since January 2022, the European-wide criteria on air quality have become stricter. As declaration of emission values is now officially mandatory, a clearer overview of the market situation is to be expected. While as of February 2022 the availability of such product declarations is still very limited, we expect a better adoption of the regulation in the coming months and the decision on updated Topten selection criteria in the second half of the year.

At the moment, given the market evolution, possible air quality criteria could be the next tier of Ecodesign and where applicable, the even stricter criteria from Austria. A tightening of the minimum energy class from A+ to A++ could also be possible (cf. Table 3).

Table 3: Topten Selection criteria for local space heaters (Topten.eu) proposed for the second half 2022[2]

	Pellet stoves	Logwood stoves
Energy label	A+	A+
Dust [mg/m^3]	15	35
CO nominal load [mg/m^3]	250	1000
C org nominal load [mg/m^3]	20	65
NO_x [mg/m^3]	180	180

1.6 Technical background

Important technical considerations for stoves are the amount of fuel they require to maintain heat levels in the building home and how the burning process can be regulated.

The better the heat can be stored for a longer period of time, the less fuel is required.

[2] A glossary is available in Chapter 5.

Buyers should consider effective heat storage features in order to optimize fuel efficiency. Most common are storage masses surrounding the stove or a liquid heat storage that can also distribute the heat throughout the house.
An optional feature is a sensor for the heat demand that regulates the refueling and can further increase the efficiency of the stove.

2 Policy measures, standards and labels (Local Space Heaters)

The revision of the regulation on local space heaters started in 2015. The revision for all heating products is taking longer than expected because there is the intention from the European Commission to list all heating products on the same label using the same metric. This is very contested by many stakeholders because it will show inefficient technologies in a very bad light. A lost opportunity for good technologies is that the label will lose its granularity. It will be more difficult for good products to differentiate themselves from one another. However, Topten supports the use of one label for all heating technologies because it is important for the consumer to distinguish the efficient ones from the inefficient ones. Having one label per technology would give an advantage to the less efficient technolgies and products would not not be on the same playing field. The review study was published in May 2019. The completion of the revision of the label with regards to the rescaling is expected to be finalised in 2023. The revision of the ecodesign requirements by 2024.

2.1 List of existing regulations

2.1.1 Energy Labelling Regulation EU 2015/1186

For local space heaters, energy labels indicating their energy efficiency on a scale from A++ (most efficient) to G (least efficient) are mandatory since January 1st, 2018. The label provides information such as brand, model, energy efficiency class, direct and - if applicable - indirect heat output in kW, which measures the heat transferred to a liquid (for hot water circulating in radiators or for a central heating system). The energy label is mandatory for appliances with rated output up to 50 kW.

Picture 2: Energy efficiency index according to regulation EU 2015/1186

$$EEI = \left(\eta_{S,on} \cdot BLF\right) - 10\,\% + F(2) + F(3) - F(4) - F(5)$$

- $\eta_{S,on}$ is the **seasonal space heating energy efficiency** in active mode, expressed in %, calculated as set out in point 4(b),
- *BLF* is the **biomass label factor**, which is 1,45 for biomass local space heaters and 1 for fossil fuel local space heaters,
- *F*(2) is a correction factor accounting for a **positive contribution** to the energy efficiency index due to **adjusted contributions of controls of indoor heating comfort**, the values of which are **mutually exclusive**, cannot be added on top of each other, expressed in %, → *temperature controls*
- *F*(3) is a correction factor accounting for a **positive contribution** to the energy efficiency index due to **adjusted contributions of controls for indoor heating comfort** the values of which can be **added** on top of each other, expressed in %; → *detectors*
- *F*(4) is a correction factor accounting for a **negative contribution** to the energy efficiency index by **auxiliary electricity consumption**, expressed in %;
- *F*(5) is a correction factor accounting for a **negative contribution** to the energy efficiency index by energy consumption of a **permanent pilot flame**, expressed in %.

2.1.2 Ecodesign requirements EU 2015/1185

The Ecodesign regulation is valid for appliances with a rated output up to 50 kW. The requirements are legally binding as of January 1st, 2022. Requirements are specified for the following criteria (cf. Table 4):

- energy efficiency (criteria is the seasonal space heating energy efficiency)
- emission of particulate matter
- organic gaseous compounds
- carbon monoxide
- nitrogen oxides

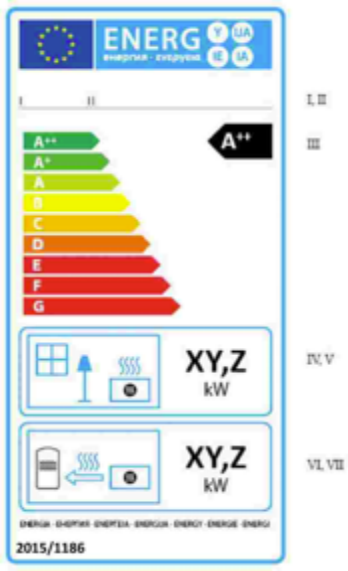
In addition, a product fiche with additional information is mandatory since January 1st, 2022.
Existing air quality minimal requirements in various European countries are already considerably stricter.
Especially strict requirements can be found on a local level in some cities and urban areas, where air pollution is a traditonally high given car traffic, for instance in Milan.

Table 4: Requirements as specified in the Ecodesign 2015/1185

	Pellet (closed)	Logwood (closed)	Logwood (open)
Efficiency at rated load (%)	>79%	>65%	>30%
Dust [mg/m^3]	<20	<40	<50
CO nominal load [mg/m^3]	<300	<1500	<2000
C org nominal load [mg/m^3]	<60	<120	<120
NO_x [mg/m^3]	<200	<200	<200

2.2 Explanation of energy label

Picture 3: Energy label for local space heaters



Source: Energy label as described in 32015R1186 - OJ L 193, 21.7.2015, p. 27

The following information is presented on the label:

I. supplier's name or trademark
II. supplier's model identifier
III. the energy efficiency class, the head of the arrow containing the energy efficiency class of the local space heater is placed at the same height as the head of the relevant energy efficiency class
IV. the symbol for direct heat output
V. the direct heat output in kW, rounded to the nearest one decimal place
VI. for local space heaters with heat transfer to a fluid, the symbol for indirect heat output

VII. for local space heaters with heat transfer to a fluid, the indirect heat output in kW, rounded to the nearest one decimal place

2.3 Table with efficiency class thresholds

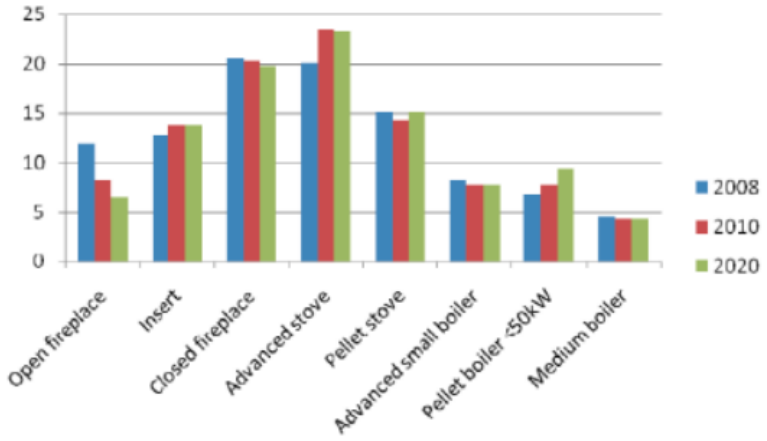
Table 5: Energy efficiency classes for local space heaters according to the EU energy label

Energy efficiency class	Energy efficiency index (*EEI*)
A++	EEI ≥ 130
A+	107 ≤ EEI < 130
A	88 ≤ EEI < 107
B	82 ≤ EEI < 88
C	77 ≤ EEI < 82
D	72 ≤ EEI < 77
E	62 ≤ EEI < 72
F	42 ≤ EEI < 62
G	EEI < 42

2.4 Market analysis

European sales of solid fuel-fired local space heaters (fuels such as biomass or coal) accounted for 13% of total local space heaters with around 3'150'000 units purchased in 2010.[3]

Picture 4: Market shares of all solid fuel appliances (2010 and 2020 are estimates).

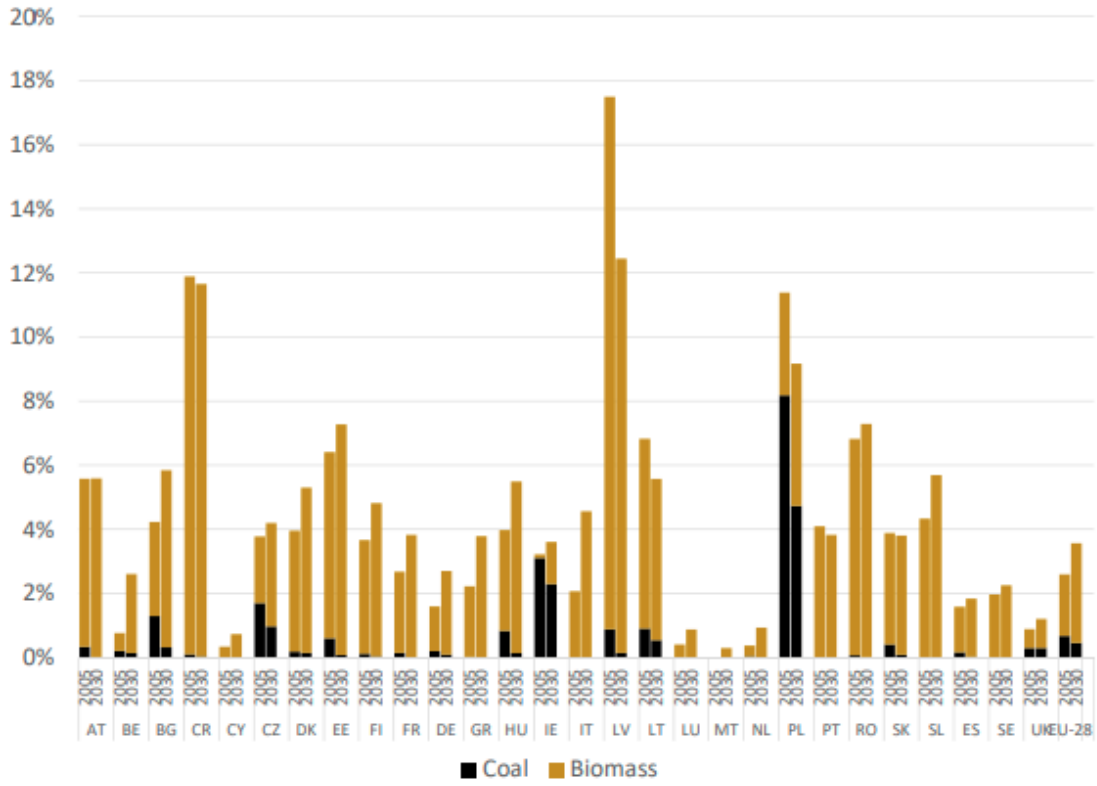


Source: https://ec.europa.eu/transparency/regdoc/rep/other/SWD-2015-92-F1-EN-0-3.PDF, p.71.

Overall, biomass combustion in the residential sector accounted for 1.9% of total primary energy use in the EU-28 in 2005, while coal combustion accounted for 0.7% (cf. Picture 5).[4]

[3] https://ec.europa.eu/transparency/regdoc/rep/3/2015/EN/3-2015-2638-EN-F1-1.PDF, p.2
[4] https://ec.europa.eu/environment/air/pdf/clean_air_outlook_combustion_sources_report.pdf, p 9

Picture 5: Coal and biomass use in the household sector as shares of total energy use by country for 2005 and 2030.



Source: https://ec.europa.eu/environment/air/pdf/clean_air_outlook_combustion_sources_report.pdf, page 9

Solid fuel local space heaters have used 174'000 million kWh in the EU in 2010. This corresponds to 9.5 million t of CO_2-emissions.
The annual saving potential until 2030 with successful implementation of the EU Regulations (Ecodesign, Labelling) is 11'400 million kWh and 400'000 t CO_2, as per Ecodesign 1185, Article 18 of Directive 2009/125/EC, page 2:

7) «Annual energy consumption related to solid fuel local space heaters was estimated to have been 627 PJ (15,0 Mtoe) in the Union in 2010 corresponding to 9,5 Mt of carbon dioxide (CO_2) emissions. Unless specific measures are taken, annual energy consumption related to solid fuel local space heaters is expected to be 812 PJ (19,4 Mtoe) in 2030 corresponding to 8,8 Mt of CO_2. »
(…)
11) «Together, the ecodesign requirements set out in this Regulation and in Commission Delegated Regulation (EU) 2015/1186 (1) are expected to result by 2030 in estimated annual energy savings of approximately 41 PJ (0,9 Mtoe) corresponding to 0,4 Mt of CO_2. »

3 How to gather data

Topten.eu serves as a reference and starting point for national Topten product lists.
National product lists should reflect market availability of most efficient products for each country. The following procedure is recommended for data gathering:

- Check what products are listed on topten.eu
- Check which of those products are available in your country

- Check national products which are only available in your country to see if they comply with the selection criteria. Inform Topten.eu about them so they can be added to the topten.eu list.

Determining appropriate attributes for the new products: as of January 1st, 2018, manufacturers are required to display the energy label on product catalogues and manufacturer's websites where other product details are also available. As of January 1st, 2022, manufacturers are also required to provide an (electronic) product fiche. The energy label and product fiche are not yet as broadly published as they should be, which is why it can be time-consuming to find the label with the product documentation. If the label is not present at all, contact the manufacturer and - if necessary - notify your authorities to enforce the regulation concerning the publishing of the energy label and product fiche.

3.1 Attributes

3.1.1 Attributes on Topten.eu

The following attributes are the information shown on the Topten.eu website for each product, because they are important to buyers and / or relate to the Topten selection criteria.

Table 6: Attributes for Topten.eu

Product Data	Example
Brand	CS Thermos
Model	Sirmione 10
Similar models	
Energy Label class	A++
Fuel type	Pellet, Logwood, Pellet+Logwood
Weight (kg)	230
Height (cm)	212
Width (cm)	56
Depth (cm)	55
Max. heat output (kW)	10
Connected load boiler (Electricity) [kW]	n/a
Energy Efficiency Index (%)	131
Refuelling system	Manual, Screw conveyer, Pneumatic conveyer
Auxiliary energy demand at nominal load (%)	0.7
Dust nominal load [[mg/Nm^3]	8
CO nominal load [mg/Nm^3]	80
C org nominal load [mg/Nm^3]	5
NO_x [mg/Nm^3]	99

4 Input for Consumer Recommendations

4.1 Recommendation page

On Topten.eu, policy recommendations are displayed on the recommendation page, as this platform is not specifically designed for consumers.

One of the main concerns is the emission of pollutants when wood is burnt. Many regions have forbidden certain biomass stoves as a result. This may be reversed once the Ecodesign minimum requirements come into action and stoves emit less pollutants. Ecodesign measures for stoves and boilers need to push for increasingly strict air-pollutant regulations.

Another important aspect is the proper maintenance of the chimney and stove, not only for a clean burning process but also for fire safety reasons. Some countries have national regulations on this (e.g. in Switzerland, control and cleaning are mandatory on a regular basis (depending

on the oven once to twice a year). It would be advisable to include adequate requirements in the Ecodesign regulation.
Furthermore, the question of how the wood is burnt (for manual stoves) is important for a low-emission-burning. For details on this, see FAQ below and Picture 6: How does efficient, clean burning work?
For national Topten recommendation pages, detailing some topics of special relevance for consumers such as what types of stoves exist, what the important aspects to consider are, and links to pre-filtered product lists on Topten is suggested.
Check the Appendix for an example of a complete national recommendation page, "7.6 Example of a national recommendation page (in detail)".

4.2 FAQ

- **Which stove is the best?**

If you can, use a stove with an integrated water pocket or a connection to a central water system. This increases energy efficiency substantially because you can use the latent heat in the water as well.

- **I heard burning wood is not good for the environment, is that true?**

That depends on your alternatives. If you heat your house with district heat from a renewable source or a heat pump that runs on electricity from a renewable source, that could be better than burning wood. But if you choose a good product that complies with the high air quality standards, the negative impact of burning wood can be minimized. Always burn the proper fuel. Don't burn wood waste (even worse, with paint or varnish residues), don't burn cardboard or paper, and of course don't burn any household trash.

- **What do I need to consider when I use a manual stove?**

If you are manually starting and refuelling your stove, make sure to use the proper fire starting technique. With this, the fire is lit on the top of the stack, not from the bottom (like it used to be lit). This method uses a special starter module (e.g. a ball of wood wool drenched in wax) on top of the stack of logs. They burn downwards and fuel is only added when there are no more flames, just strong ember. This way there is no cold wood in the flames, meaning a lot less smoke is produced and with that, less dust and toxins. If you don't refuel, the airflow is reduced and only when there is no more ember visible, shut off completely. With this system logs burn slower and more steadily, thus also increasing efficiency.

Picture 6: How does efficient, clean burning work?

Source and more information: https://www.holzenergie.ch/ueber-holzenergie/richtig-anfeuern.html

5 Terminology

Attribute glossary:

- Brand: specifies the brand of the presented stove
- Model: specifies the name/number of the presented stove
- Similar models: specifies names/numbers of similar stoves (different colours, material, but essentially the same model)
- Energy Label Class: specifies the current European Energy label as specified in EN 2015/1186. The label ranges from A++ to G.
- Fuel type: Specifies the fuel that can be used in the stove. The attribute value can be Pellet, Logwood or both.
- Heat distribution: Specifies the type of heat distribution this stove provides. The attribute values can be one or several of the following: None, ventilation, automatic storage mass, water pocket, central distribution system
- Weight (kg): Specifies the weight in kg. For example, 181.
- Height (cm): Specifies the height in cm. For example, 104.
- Width (cm): Specifies the width in cm. For example, 68.
- Depth (cm): Specifies the depth in cm. For example, 38.
- Max. heat output (kW): specifies the maximum heat output in kW.
- Connected load boiler [W]: specifies the electricity load for which the boiler is connected. For example, 2000.
- Energy Efficiency Index (%): specifies the efficiency in % at the rated load, e.g. 107. The higher the EEI, the more efficient the stove.
- Refuelling system: specifies how the stove is refuelled. The attribute value can be one or several of the following: Manual, Screw conveyer, Pneumatic conveyer.
- Auxiliary electric energy demand at nominal load (%): Specifies the additional energy demand in % for additional processes (such as refuelling, ventilation, controlling airflow, etc.).
- Dust nominal load [[mg/Nm^3]: specifies the particulate matter in the exhaust air at nominal load of the stove.
- CO nominal load [mg/Nm^3]: specifies Carbon monoxide in the exhaust air at nominal load of the stove.
- C org nominal load [mg/Nm^3]: specifies the organic Carbon in the exhaust air at nominal load of the stove.
- NOx [mg/Nm^3]: specifies Nitrogen dioxide in the exhaust air at nominal load of the stove.

Additional terms used:

- Boiler: is a device in the basement that connects to a central heat distribution system and is refuelled mostly automatically from a fuel storage/tank.
- Fireplace: a place to burn a fire, usually open or only closed with glass doors, some heat storage in the mass, but not necessarily.
- Logwood: pieces of wood, uniform in size (20, 25, 33 or 50 cm, incl. bark). Humidity is 20-60 %, depending on storage duration.
- Stove: a freestanding or built-in device usually located in the living room, where a fuel is burnt and heats up either just the surrounding air, a storage mass or even a liquid which feeds into a central heat distribution system.
- Wood chips: 3 - 6 cm pieces of wood, incl. bark, humidity of 20-30 %, easier handling than logs, mostly used in multiple family houses.
- Wood pellets: 3 x 0.6 cm pieces of pressed sawdust (no bark), very uniform, humidity of less than 10 %. Best conditions to ensure equal, clean, efficient burning

6 References and links

6.1 Useful links

- Topten.eu Product list: https://www.topten.eu/private/products/local_space_heaters
- Topten.eu Selection criteria https://www.topten.eu/private/selection-criteria/selection-criteria-local-space-heaters
- Topten.eu Policy recommendations https://www.topten.eu/private/adviser/policy-recommendations-for-local-space-heaters

6.2 References

- EU regulations
  - Regulation: EU ecodesign regulation for **solid fuel local space heaters** (EU) 2015/1185 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2015.193.01.0001.01.ENG
  - Regulation: Labelling regulation for **local space heaters** (EU) 2015/1186 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32015R1186
  - Regulation: EU energy labelling regulation for **solid fuel boilers** (EU) 2015/1187 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2015.193.01.0043.01.ENG
  - Regulation: EU ecodesign regulation for **local space heaters** (EU) 2015/1188 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2015.193.01.0076.01.ENG
  - Regulation: Ecodesign regulation for **solid fuel boilers** (EU) 2015/1189 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2015.193.01.0100.01.ENG
  - Commission guidelines: Energy labelling and ecodesign requirements for **local space heaters** (2017) https://ec.europa.eu/energy/sites/ener/files/documents/2017guidelineslocalspaceheaters20171113.pdf
  - Commission guidelines: Ecodesign requirements for **heaters**, and **solid fuel boilers** (2018) https://ec.europa.eu/energy/sites/ener/files/documents/guidelinesspacewaterheaters_final.pdf

- Prep. Studies
  - Review study of ecodesign for **local space heaters**, 2019 https://www.applia-europe.eu/images/Library/Preparatory_study_for_local_space_heaters_-_2019.pdf

- Other papers and presentations
  - Holzenergie Schweiz (Swiss Label):

https://www.holzenergie.ch
https://www.holzenergie.ch/fileadmin/user_resources/01_Holzenergie/Qualitaetssicherung/D_QS_Reglement.pdf

- Bundesamt für Energie: Biomasse
  https://www.bfe.admin.ch/bfe/de/home/versorgung/erneuerbare-energien/biomasse.html
- Bundesamt für Umwelt BAFU: Emission limits Switzerland
  https://www.bafu.admin.ch/dam/bafu/de/dokumente/luft/fachinfo-daten/Information_Inverkehrbringen_Feuerungen.pdf
- Energie Schweiz: Holzenergie
  https://www.energieschweiz.ch/page/de-ch/holzenergie
- Topten Advisor Holzöfen:
  https://www.topten.ch/private/adviser/ratgeber-holzofen
- Topten Advisor Pelletheizungen:
  https://www.topten.ch/private/adviser/ratgeber-pellet-heizung
- Umweltzeichen (Austrian label)
  https://www.umweltzeichen.at
  https://www.umweltzeichen.at/file/Richtlinie/UZ%2037/Long/Uz37_R6.1a_Richtlinie_Holzheizungen_2017.pdf
- Blauer Engel (German label)
  https://www.blauer-engel.de
  https://www.blauer-engel.de/de/produktwelt/bauen-heizen/holzpelletoefen
- Flamme Verte (French label)
  https://www.flammeverte.org/
- DECRETO 7 novembre 2017, n. 186 (Mandatory Italian label for stoves)
  https://www.gazzettaufficiale.it/eli/id/2017/12/18/17G00200/sg

7 Appendix

7.1 Criteria for local space heaters in different countries and labels (Feb 2022)

Table 7: Selection criteria for local space heaters (Topten Germany, https://www.ecotopten.de/)

	Pellet stoves
Efficiency at rated load (%)	Min. 90%
Auxiliary energy demand nominal load (%)	≤ 0.9%
Auxiliary energy demand partial load (%)	≤ 0.7%
Dust nominal load [[mg/Nm^3]	20
Dust partial load [mg/Nm^3]	45
CO nominal load [mg/Nm^3]	160
CO partial load [[mg/Nm^3]	350
C org nominal load [mg/Nm^3]	8
C org partial load [mg/Nm^3]	13
NO_x [mg/Nm^3]	150

Table 8: Swiss energy regulation (EnEV) adopts emission values from EU regulations as of Jan 1st 2022

	Pellet stoves	Logwood stoves
Dust nominal load [mg/m^3]	20	40
CO nominal load [mg/m^3]	300	1500
C org nominal load [mg/m^3]	60	120
NO_x [mg/m^3]	250	250

Table 9: Requirements for Flamme Verte (French Label) as of March 1st, 2022

	Pellet stoves	Logwood stoves
Seasonal space heating energy efficiency (ηs)	79%	65%
Dust [mg/ Nm^3]	20	40
C org nominal load [mg/ Nm^3]	60	120
CO nominal load [mg/ Nm^3]	300	1500
NO_x [mg/ Nm^3]	200	200

7.2 National product lists

Logwood stoves
Switzerland
https://www.topten.ch/private/products/stoves_living_quarters?filters%5Btype_of_stove%5D%5B%5D=wood_stove&filters%5Bheating_power_max%5D=6%3B27&sort_attribute=heating_power_max&sort_direction=4

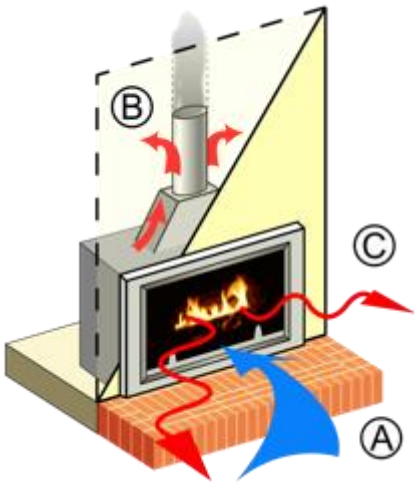
Pellet stoves
Germany
https://www.ecotopten.de/waerme/holzpelletoefen
Switzerland
https://www.topten.ch/private/products/stoves_living_quarters?filters%5Btype_of_stove%5D%5B%5D=pellet_stove&filters%5Bheating_power_max%5D=6%3B27&sort_attribute=heating_power_max&sort_direction=4

7.3 Heat dissipation systems

7.3.1 Radiant heat

A regular fireplace provides radiant heating and draws in cold air from the room.

Picture 7: How does radiant heat work



A: Air for the combustion, in drafty rooms pulled from the outdoors.

B: Hot exhaust gas heats building by convection as it leaves by chimney.

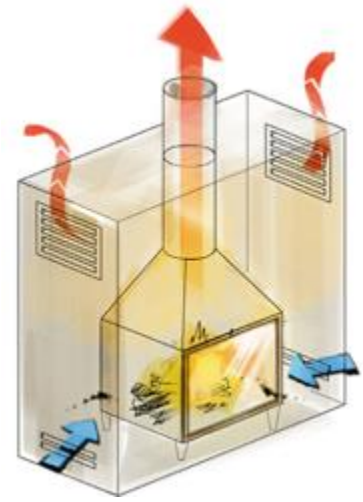
C: Radiant heat, mostly from the high temperature flame, heats as it is absorbed.

Source: https://en.wikipedia.org/wiki/File:FireplaceRad.svg

7.3.2 Ventilation heat

Pure radiant heaters and devices with gravity air heat exchangers (without fan) do not require a power supply, but the heat is emitted only at close range.

Picture 8: How does ventilation heat work



Source: https://www.haus-und-wohnen.ch/de-wAssets/img/bauen_umbauen/architektur_trends/cheminee_oefen/biofire-cheminee/cheminee_biofire_haus-bauen_10.jpg

Hot air units with fan allow faster heat dissipation with somewhat more extensive distribution through the air circulation. However, the downside are the audible noise and connection to electricity is required.

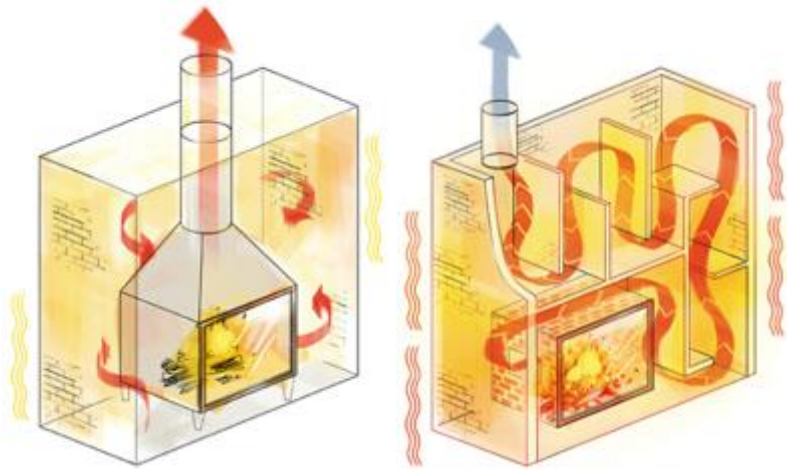
Picture 9: How does automatic ventilation heat work

Source: https://www.qlima.com/assortment/heating/pellet-heaters/lindara-100s-line/

7.3.3 Storage heat

Pure storage heaters (no electricity connection) release heat slowly and up to several hours after the "end of fire". It is critical that the storage mass is sufficient. Another way to heat up the mass is to move the hot air through the rock for longer.

Picture 10: How does storage heat work

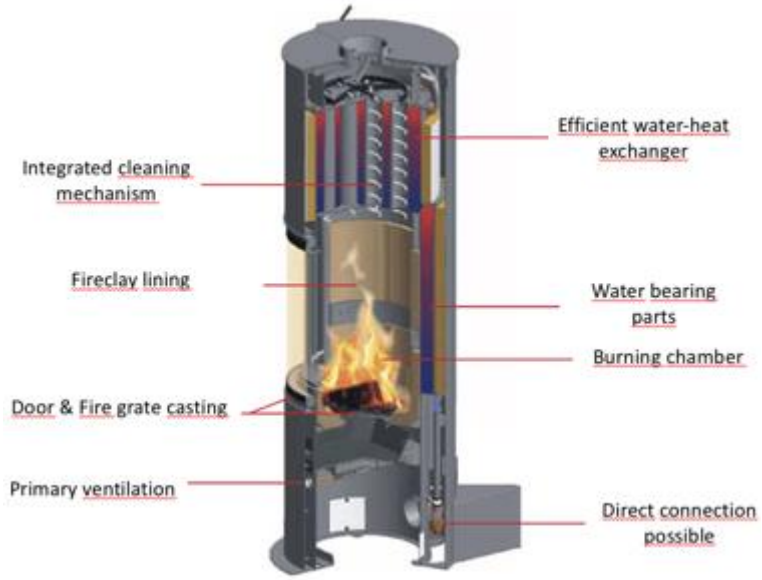


Source: https://www.haus-und-wohnen.ch/de-wAssets/img/bauen_umbauen/architektur_trends/cheminee_oefen/biofire-cheminee/cheminee_biofire_haus-bauen_10.jpg

7.3.4 Central distribution system

If the heater is connected to a central distribution system, often also combined with a water storage tank and other sources (solar-thermal), the heat can be stored and distributed through the whole house. In addition, this increases efficiency, because the heat contained in the exhaust air is recuperated and also used for heating the building. As an additional bonus, these stoves achieve much better emission values because most of the critical compounds in the exhaust air are washed out during the condensation process. Filters are regularly cleaned and washed out into the wastewater.

Picture 11: How does a water tank connection work



Source: https://www.ofen.de/blog/wp-content/uploads/2014/09/kamin-innerer-aufbau.png

Picture 12: Integration of several systems to a central distribution system

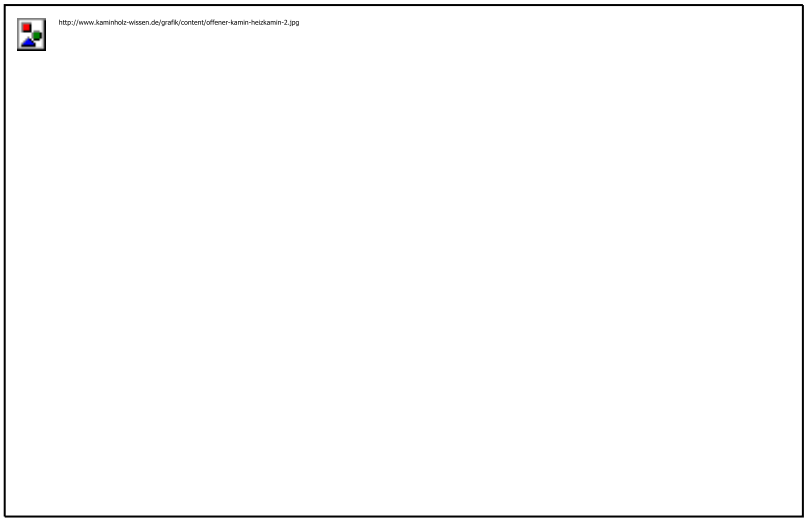
Source: https://www.kamdi24.de/images/content/effektives-und-umweltschonendes-Heizen-des-Hauses-mit-einem-wasserfuehrenden-Kaminofen.jpg
Blue line: cold water is heated by the wood stove, the wood boiler as well as the solarthermal panels. Red line: hot water is being circulated into the various demand areas of the house.
1. Pellet stove with a water element, 2. Buffer tank, 3. Solarthermal installation, 4. Pellet boiler, 5. Pellet storage, 6. heating elements, 7. floor heating elements, 8. Pool heating, 9. sanitary installations (shower, bath, sinks, etc)

7.4 Types of stoves

7.4.1 Open fireplaces

An open fireplace is open towards the room, thus there is no regulation of any kind possible. Airflow cannot be regulated. Burning temperatures are quite low thus resulting in an unclean burning process. Efficiency is also low, only 20-30% of the heat are used in the room, the rest is lost through the chimney. Another factor is a larger fire hazard as well as toxic exhaust into the room from the unclean burning.

Picture 13: Open fireplace

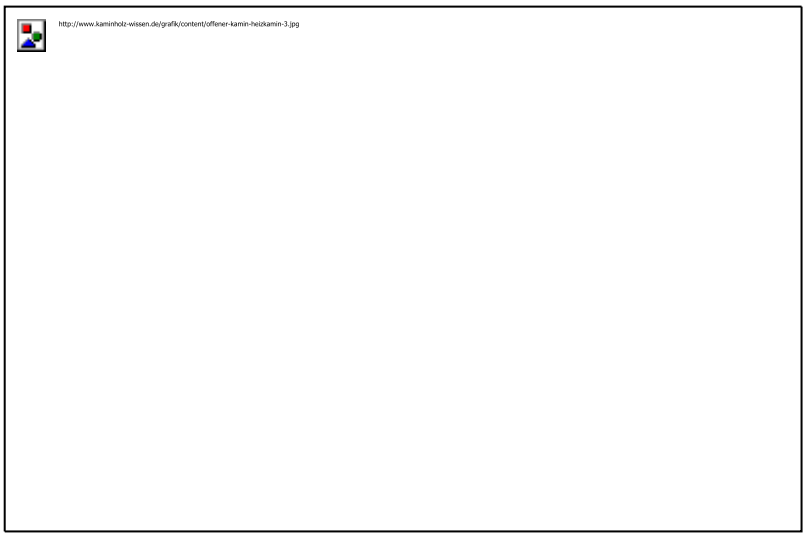


Source: http://www.kaminholz-wissen.de/grafik/content/offener-kamin-heizkamin-2.jpg

7.4.2 Closed fireplaces

A variation is a closed fireplace which has a glass-door. That way airflow can be somewhat regulated, and efficiency increases to 70-80%. At the same time fire hazard is avoided.

Picture 14: Closed fireplace



Source: http://www.kaminholz-wissen.de/grafik/content/offener-kamin-heizkamin-3.jpg

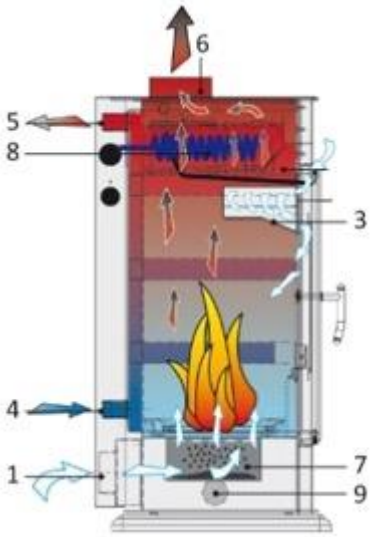
7.4.3 Closed fireplace with water system

There are also fireplaces which use a water pocket, which is then hooked up to the hot water system or a central heat distribution system. Thus a bigger part of the heat can be used.

Picture 15: Closed fireplace with water system

Source: https://www.klimaworld.com/edilkamin-wasserfuehrender-holzofen-cubira-cubira-cs-12-2-kw.html

Picture 16: Closed fireplace with water system, functionality



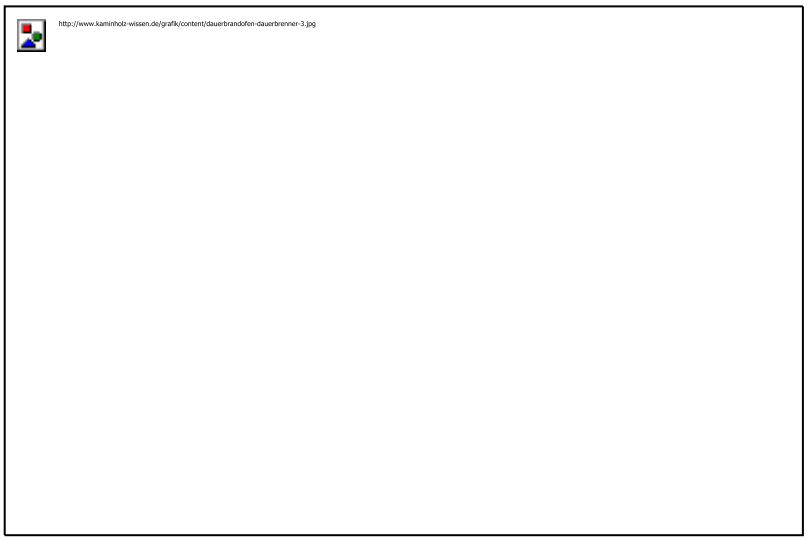
1: primary air supply
2: secondary air supply
3: lever to regulate air supply
4: water return
5: Water supply
6: Smoke outlet
7: ash drawer
8: heat release
9: fresh air supply

Source: https://www.klimaworld.com/edilkamin-wasserfuehrender-holzofen-cubira-cubira-cs-12-2-kw.html

7.4.4 Closed stoves and chimney stoves

They are freestanding stoves with a door, refuelling is manual and regulation is limited (airflow can be regulated sometimes by adjusting the ash drawer or specific airflow flaps). Maintaining a fire is time consuming, thus these stoves are usually only used during the mid-seasons to bridge cooler nights without having to turn on the main heating system yet.

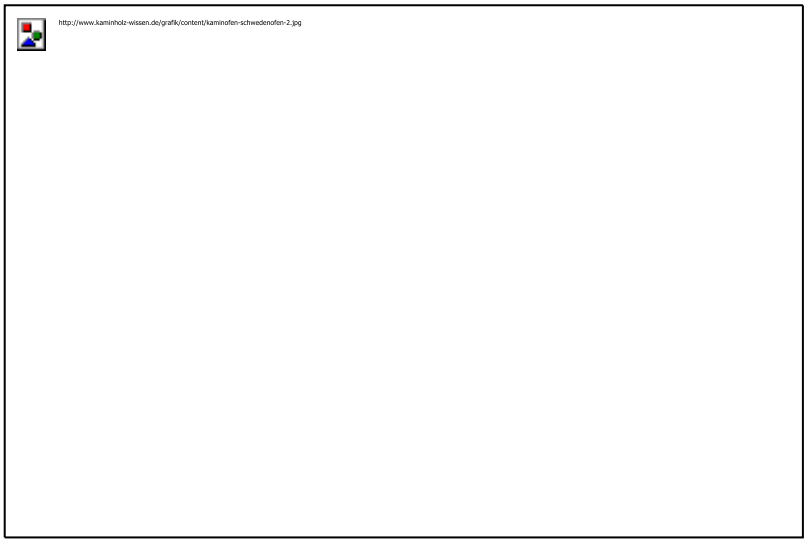
Picture 17: Closed stove



Source: http://www.kaminholz-wissen.de/grafik/content/kaminofen-anschliessen-4.jpg

A variety is the chimney stove, which instead has a glass door and sometimes some minor heat storage elements, but otherwise no additional regulation is present.

Picture 18: Chimney stove

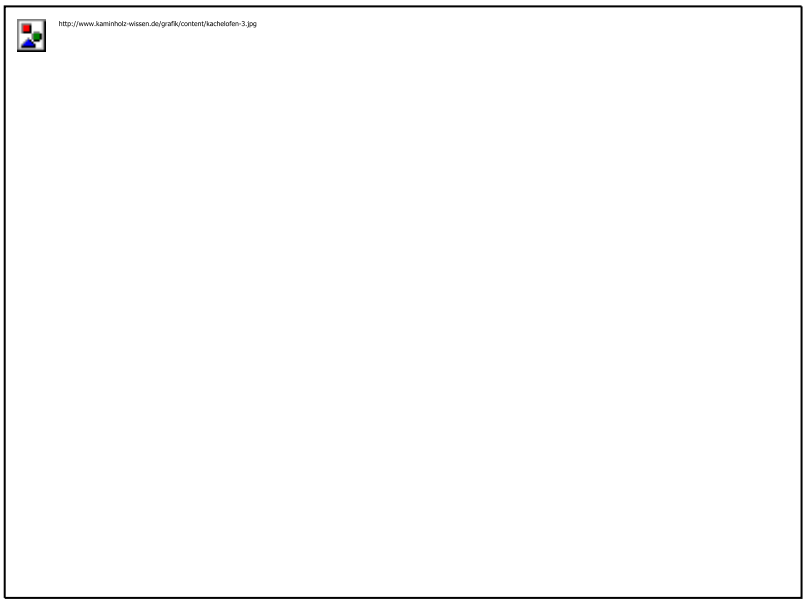


Source: http://www.kaminholz-wissen.de/grafik/content/kaminofen-schwedenofen-2.jpg

7.4.5 Storage stoves (Cockle stoves, Soapstone stoves)

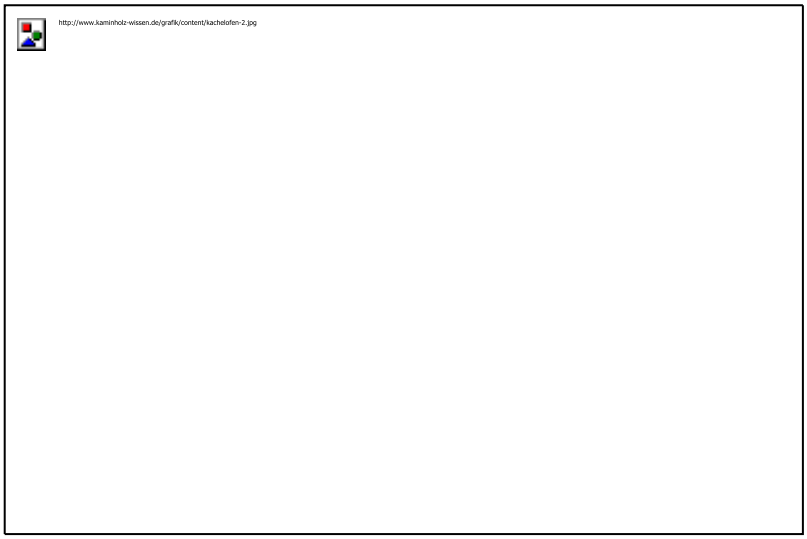
Storage stoves use a big storage mass which is heated at full load for a short period and afterwards slowly releases the heat over a long period. There are different materials such as tiles, cement plaster, clay, fireclay or soapstone that are used for storing the heat. A characteristic of these stoves is a bigger surface over which the heat is given off to the room.

Picture 19: Cockle stove



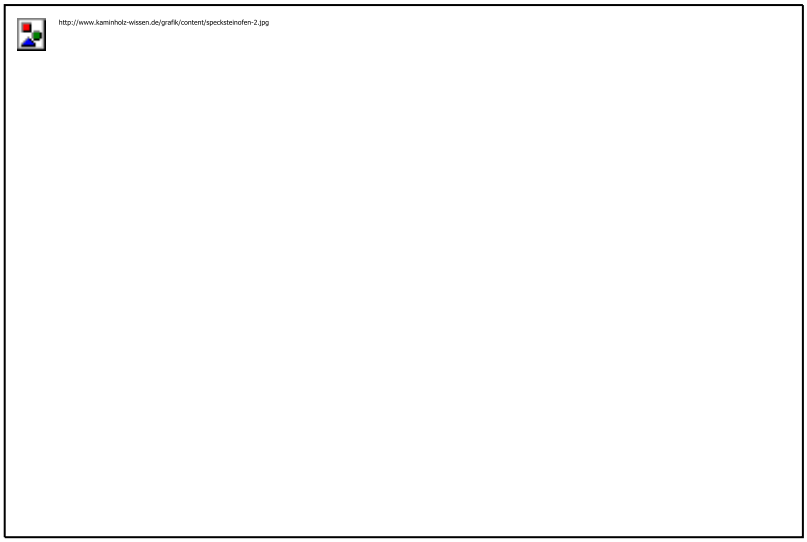
Source: http://www.kaminholz-wissen.de/grafik/content/kachelofen-3.jpg

Picture 20: Cockle stove



Source: http://www.kaminholz-wissen.de/grafik/content/kachelofen-2.jpg

Picture 21: Soap stone stoves



Source: http://www.kaminholz-wissen.de/grafik/content/specksteinofen-2.jpg

7.4.6 Automatic pellet stoves

Pellets are transported into the burning chamber with an automatic screw conveyer from the integrated depot (usually between 10-40 kg of pellets). The big advantage of pellet stoves is the automatic regulation which is regulating the amount of pellets depending on the heat demand by managing the motor of the conveyer.

The pellets are being automatically ignited with a built-in heating element. The heat is dissipated to the room by a heat exchanger and through the glass window (if present), sometimes in combination with an automatic ventilation or connection to a central distribution system, thus up to 80-90% of the heat is being used in the heating system (directly and indirectly).

For a fully automatic system, a pellet stove can be connected to a pellet storage for automatic refuelling, but this is normally done for a central space heater only, located in the basement.

Picture 22: Pellet stove with pellet depot

Source: https://www.hornbach.ch/hornbach/media/de/bilder/projekte/wohnen/kaminofen/chke1-53d756fad5667dec1591bcd5bbdf328e/funktionsweise-pelletofen-1200x800.jpg.webp

7.5 Types of fuels

7.5.1 Logwood

Logwood is usually standardized to 30 – 50 cm logs (depending on the size of the oven) and needs to be refuelled manually. The humidity range is around 30-40%, much more than in e.g. wood pellets (see below). Logwood also still contains the bark, which means emissions are less clean compared to wood pellets. Logwood is usually cut in the region or even same community where it is burnt. There are no long transport distances or energy intense production processes.

7.5.2 Pellets

Pellets are pressed from sawdust and wood shavings which are pressed into shape by heat. The energy required to do this is usually less than 3%. They are very dry (less than 10% humidity) and thus possess the best conditions to ensure equal, clean, efficient burning. They are also easy to handle in that they can be transported over larger distances, stored in a bunker and transported automatically into to the oven almost like a liquid. Depending on the type of oven, there is a steady refuelling installed with a screw conveyer or the oven has a depot that can be filled manually.
The refuelling occurs depending on the power requirements, so these heaters ensure the same comfort than regular gas or fuel heaters.

7.5.3 Combination of fuels

There are more and more stoves which can use both types of fuels. This can make sense if the owner is absent for a longer time and wants to keep the heating going. For these occasions, pellets can be used in combination with a regulated refuelling. For the other times, the homeowner can refuel manually with logwood.

7.6 Example of a national recommendation page (in detail)

As an example, you can find the translation of Topten Switzerland here. (Also available online in:

German https://www.topten.ch/private/adviser/ratgeber-holzofen
French https://www.topten.ch/private/adviser/recommandation-fourneaux-a-bois
Italian https://www.topten.ch/private/adviser/consigli-stufe-caminetto

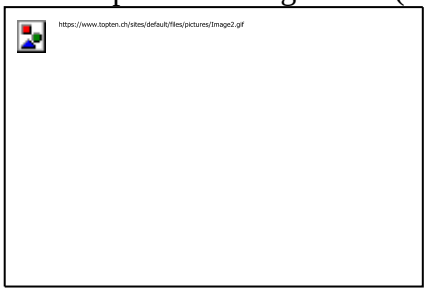
English translation:
Fireplaces, fireplace stoves, tiled stoves are cosy and in the transition period practical for tempering a room. Low-energy houses (e.g. a Minergie house) can heat them completely under favourable conditions. If you expect more than a few cosy evenings, you will have to account for wood consumption, storage facilities and the amount of work needed for firing. Example: firing twice in 30 days and once in another 60 days per 5 kg of wood means "processing" 600 kg of wood, i.e. 1 ½ to 2 m^3. With hardwood logs - sawn to 33 cm - this gives a pile of about 3 m length and 1.5 to 2 m height. The wood must be stored in a dry place and usually three to four times in the hand: Unload it, bring it to the house, put it in the oven. Of course, no waste or dirty wood (paint, wood preservative etc.) must be burnt within the stove. Pellet furnaces are a user-friendly and very good alternative in terms of combustion technology. Pellets can be filled into containers like a liquid and burned automatically (see the Pellet Firing Guide).

Heating with wood is more economical today than with heating oil or gas. In addition, wood firing does not release any additional CO_2 (greenhouse gas) into the atmosphere because the CO_2 was taken from the air when the trees grew. When the certified stoves are carefully fired, there is hardly any air pollution.

Fireplace stove, Swedish stove
The classic wood stove for the living area, equipped with approx. 30cm long pieces of wood.
Pellet stove
As the name suggests, these models generate the heat with the help of pellets. Models available with and without water supply.
Pellet stove / fireplace stove
These models can burn logs or pellets.

Checklist
Do you primarily want to sit comfortably in front of the fire, but still use the energy of wood? A fireplace stove or fireplace insert, i.e. a fireplace with a large glass pane, offers you this. Fireplaces without panes do not meet the requirements of the quality seal and are therefore not included in the list. In the case of fireplaces that can also be fired with the glass pane open, the seal of quality only applies to closed operation.
Fireplace stoves can usually be installed in a room without any structural measures and connected to an existing fireplace. They must be reported to the fire police. If the floor or wall is combustible, the fire police require documentation or screening.
If you are planning a fully-fledged wood heating system (without water circulation) for a low-energy house, heat-storing, i.e. heavy stoves or automatic pellet firing are advantageous. The corresponding lists include certified stoves, stove inserts and pellet firing systems. Usually a stove builder will carry out the project. Some fireplace stoves and heating inserts are also available with central heating heat exchangers, which requires appropriate installations.

Tech Guide
If an indoor stove is to give off a pleasant constant heat, it must have a large storage mass - if possible, several hundred kilos! - be able to heat up. A fire output of more than 5 kilowatts (kW, see selection criteria) is not at all pleasant without a storage effect: it gets (much too) hot quickly, and quickly cold again! The weight is therefore definitely a quality feature and is therefore included in the lists. In order to be able to store effectively, the storage mass must actually be heated by the fire; i.e. large areas of the weighty components must be covered by the fire gases. Stone stove linings are often hardly effective for storage because they are not integrated into the flue gas ducts. Unfortunately, the storage efficiency cannot be assessed without a thorough examination of the construction. Let us explain the storage efficiency to you before you buy! With heating elements, the storage mass is mainly contained in the oven built around it.

Heat output of a storage stove (source: Tonwerk Lausen)


Heating chimney inserts are often offered with different heat dissipation systems:
Pure radiant heaters and units with gravity air heat exchangers (without fan) do not require a power connection, the heat is emitted at close range.

Warm air units with fan (noise audible, power supply required) allow a faster heat dissipation with a slightly more extended distribution by air circulation; they usually have little storage effect.
Pure storage heaters (no electrical connection) release the heat slowly and up to several hours after "end of fire".
Fireplaces without or with an open glass pane have poor combustion because the fire is cooled down too much. In addition, on balance, hardly any heat can be emitted, because much previously heated room air escapes through the open fireplace and this loss exceeds the radiant heat generated.