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Passive houses for active students – Providing knowledge about eco-efficient buildings

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Passive houses for active students – Providing knowledge about eco-efficient buildings

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Abstract. The OeAD-Housing Office is a non-profit organisation in the area of international cooperation in education, science and research in Austria. We cooperate with our parent company OeAD-GmbH as well as various Austrian student residences and partner universities worldwide. The main responsibility is accommodating international and national students in Austria's university towns. Our success story started with the construction of the first halls of residence built according to the passive house standards world-wide in Vienna in 2005. Since its completion, the OeAD-Guesthouse Molkereistraße has accommodated 280 international students and guest professors per semester. We are successful in managing a total of 8 student guesthouses in the passive house design constructed in Vienna, Graz and Leoben. This paper describes the benefits of passive houses and raising awareness for eco-efficient buildings. We focus on two OeAD-Guesthouses in Austria and highlight their design, architecture and what it is like to live in both of them. Upon request we are also able to propose the OeAD-Guesthouse PopUp dorms. As we want to share our knowledge with the rest of the world we initiated 2 summer universities which pay attention to ecological buildings and the financial and economic system. We also draw attention to several awards we have won during the past years.

1. More than 20 years of applied sustainability

The OeAD-Housing Office (=OeAD-WohnraumverwaltungsGmbH) is a non-profit organisation in the area of international cooperation in education, science and research in Austria [1]. It cooperates with its parent company OeAD-GmbH as well as various Austrian student residences and partner universities worldwide. Our main responsibility is the annual accommodation of over 12,000 international students and guest professors in Austria's university towns and since 2016 we also accommodate national students.

Mr. Günther Jedliczka became the CEO of the OeAD-Housing Office in 1998. He studied business and economics at the University of Economics and Business in Vienna. While pursuing his studies he spent two months in London and one month in Paris which helped improving his language skills and his personal growth. Back in 1999 Ernst Ulrich von Weizsäcker's book "factor4" served as inspiration to construct a passive house.

The starting point of this initiative was the construction of the first halls of residence built according to the passive house standards world-wide in Vienna in 2005. Since its completion, the OeAD-Guesthouse Molkereistraße, 1020 Vienna, has accommodated 280 international students and guest professors per semester. Since then we are successful in managing a total of 8 student

IOP Conf. Series: Earth and Environmental Science **323** (2019) 012160 doi:10.1088/1755-1315/323/1/012160

guesthouses in the passive house design constructed in Vienna, Graz and Leoben. We have also expedited the construction of student dorms in the passive house design in Austria, as well as the retrofitting of existing dorms with photovoltaics systems, with the goal of reducing ecological impact both during construction and during the subsequent supply of energy.

The concept of a passive house is economically profitable in terms of energy expenses and benefits are evident within the company. By means of a regulated ventilation system a passive house creates a comfortable atmosphere and prevents stuffy air mold formation due to insufficient ventilation which helps reducing the operating costs.

Many students come into contact with the topic of eco-efficient building for the first time when they move to any of the OeAD-Guesthouses, while others chose one of our guesthouses because of the passive house standard. When moving in, each student receives information about the concept of the house and a basic manual with general instructions like airing or water saving. Suffice to say, staying in one of our passive houses is cozy, energy-saving and environmentally-friendly. According to today's state of the art technology it is the best and least expensive method to produce a comfortable room climate.

In each OeAD-Guesthouse the residents receive the information about the quality of the tap water and the importance of waste separation. In order to avoid the consumption of paper, the residence contracts are sent out only digitally (by email). The OeAD-Guesthouses as well as the OeAD-Housing Offices are centrally located in each university town and can easily be reached by public means of transportation. We also encourage students to use bicycles and provide storage places/rooms and even rent bicycles to them.

In the Housing-Offices fair trade coffee and fruits are provided. On a regular basis movie nights and panels are hosted to educate about the sustainable use of our planet (concerning fair fashion, climate change etc). The facility management also hosts training sessions about the ecological use of detergents.

In the OeAD-Guesthouses we provide fully furnished accommodations so the students do not have to purchase new bedding, dishes or kitchen ware during their (short term) stay. We also provide energy saving lamps in the residences.

There is a very high acceptance of the passive house concept by the residents. Due to the short dwell time of the students in the residence, between a few months (international students) up to some years, and the following change to other forms of living, most residents move out with the wish to continue living in a building with a passive house standard which helps to raise awareness for eco-efficient buildings. Especially students of technical studies, like constructional engineering or architecture, find a great interest in the concept of passive houses. International students popularize the building concept and a direct multiplier effect arises.

2. Highlighting two OeAD-Guesthouses

2.1. OeAD-Guesthouse GreenHouse in Lakeside Aspern [2]

IOP Conf. Series: Earth and Environmental Science **323** (2019) 012160 doi:10.1088/1755-1315/323/1/012160

Figure 1: Main facade - Sonnenallee

Back in the year 2005, there were first discussions with Mr. Christoph Chorherr (spokesman of the Green Party in Vienna), DI Josef Lueger (Federal Real Estate Company) and Mag. Günther Jedliczka (CEO of the OeAD-Housing Office) concerning the construction of a student residence in the seaside town of Aspern. An important prerequisite for the location of a new home in this largest urban development area of Vienna was the proximity to the subway and thus a connection to the universities within 30 minutes. After it had been ensured that there was a subway connection to Aspern during the construction phase, the OeAD-Housing Office was looking for partners for this pioneering project. In July 2010, 6 architecture firms were invited on the basis of a competition to present ideas for a student residence with the minimum standard passive house. The project was chosen by aap.architekten ZT-GmbH, which had developed a convincing concept with the goal of zero energy standards and were experienced in participatory processes and their knowledge in the field of ecological and energy-sufficient construction.

The OeAD-Housing Office, the Austrian Youth Movement (ÖJAB) and the Housing Association for Private Employees (WBV-GPA) jointly realized a forward-looking project in a new district – a highly efficient passive house for 313 international and Austrian students and the architecture should visualize this ambitious project.

Due to the three different home operators, an interesting mix of the residents and thus also an important impulse for the new district was developed. The WBV-GPA has also taken on the role of developer and installer.

At the time of its opening, GreenHouse was the world's first certified Passive House Plus (PHI) student residence, accompanied by a research project on electricity storage and monitoring energy consumption. In 15 reference rooms, 5 in each component, an extended monitoring with various measurements takes place. For precise control of the energy balance of the building, calibrated heat meters, energy meters, electricity meters and water meters, temperature sensors, window contacts, humidity sensors, etc. are used distributed throughout the building. The meters are equipped with bus modules and communicate directly with the building management system (BMS). The research project is being carried out by ASCR (Aspern Smart City Research) and Siemens.

The energy sources of the future for the urban development area are at the time of the design of solar energy, the energy from the air, which is recovered by the comfort ventilation with heat recovery in passive house construction and geothermal heat from the earth.

For economic reasons, the building had to be implemented in concrete construction with a full thermal protection facade. By an alternative development proposal, deviating from the original requirements of the master plan, a more compact structure could be implemented, which reduces the built-up area, at the same time ensures better tanning of the occupant rooms on the courtyard side and offers more living space and less development areas for the same area.

The compactness of the structures and the clear structural design grid across all floors, the use of semi-finished parts, prefabricated elements and floor slabs in the shell construction as well as the space-optimized development system allow for moderate construction costs despite high equipment quality and excellent energy values. Professional quality assurance and process support in the execution planning as well as in the construction work by the project management contributed significantly to the sustainability.

The rainwater is seeped through infiltration baskets in a core of the earth at the site. The water consumption is significantly reduced by flow restrictors and by fittings with extended cold water range, as the requirement for hot water in dormitories is above average. .
To achieve the zero energy standards, a centralized ventilation unit with 2 parallel rotary heat exchangers with heat and moisture recovery and special filters has been developed to reduce energy consumption. In the course of the research project, the ventilation could be carried out on demand and the energy consumption could be reduced. The residual heat requirement is covered by Fernwärme Wien.

SUMMARY

In dormitories, energy consumption is much greater than in classical residential buildings because of the large number of small apartments, each with its own kitchen. As a result, all components that consume electricity within the building must be optimized and extremely reduced. Reaching the Passive House Plus Standard under the given financial conditions (residential funding from the Community of Vienna, Passive House funding and research investments) required intensive collaboration among the building owners, the users and a team of architects, building physicists and building service technicians, who focused on this goal. The project received Gold ÖGNB (Österreichische Gesellschaft für Nachhaltiges Bauen, Austrian Sustainable Building Council) certification; a level of this certificate was required for all buildings in the district. In addition, the building owners and users chose to have the Passive House Institute certify GreenHouse.

From Passive House to Passive House Plus

The building was constructed as reinforced concrete with insulation in the façade upstairs and a curtain wall of boards as the façade on the ground floor and in parts of the floors upstairs. The U-value of the external walls is 0.10 W/(m²K), while the U-value of the flat roofs with sloped insulation is 0.07 W/(m²K). The wood-aluminium windows with triple glazing have a Uw-value of 0.80 W/(m²K).

In 15 reference rooms (three in each building section), energy consumption, temperature, humidity, water consumption and window ventilation were extensively monitored. ASCR (Aspern Smart City Research) and Siemens conducted the research project.

Reducing energy demand

The following steps were taken to reduce the building's energy demand (Figure 2):

Central comfort ventilation (Figure 3) with parallel rotation heat exchangers (operation is based on CO2 levels) (Figure 4) and special bag and mini-pleat filters (F9) to reduce the ventilation system's flow resistance. A volume flow of 6,000 m³/h per rotation exchanger. Heat recovery (EN308) 90.58 %, moisture recovery 73.14 %.

Daylighting in the first-storey common room and in the circulation areas.

LED lights throughout the building.

Motion detectors and light-dependent resistors in all common areas.

Optimisation components that consume power and avoidance of standby functions.

Elevator with energy recovery from the brakes.

Excellent insulation of distribution lines.

IOP Conf. Series: Earth and Environmental Science **323** (2019) 012160 doi:10.1088/1755-1315/323/1/012160

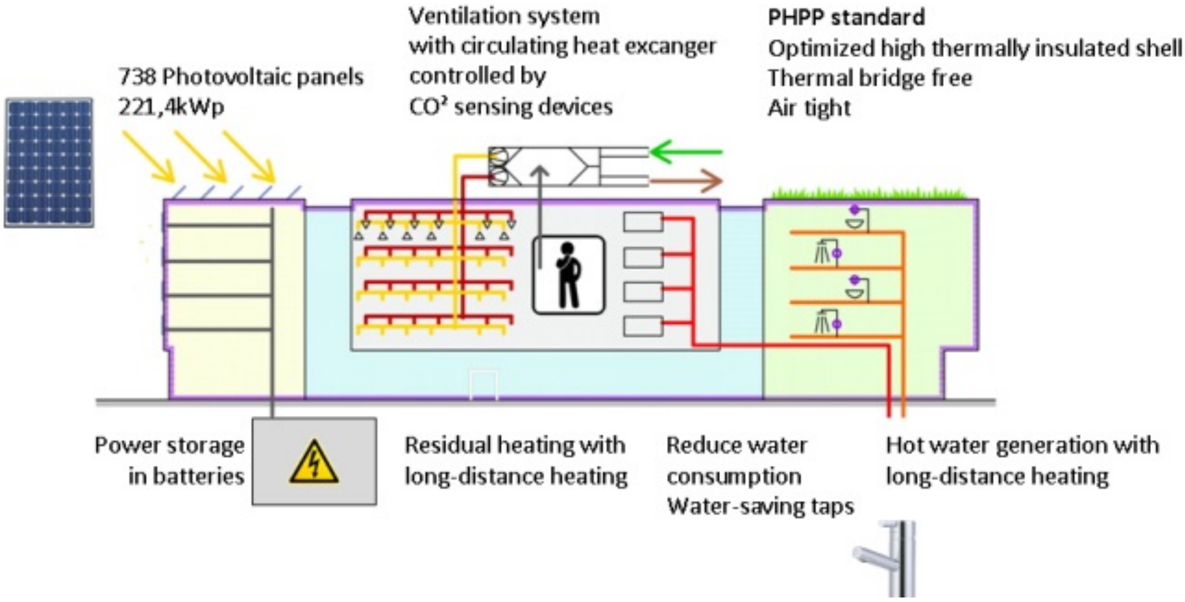


Figure 2: Building services

Figure 3: TROX X-CUBE ventilation system

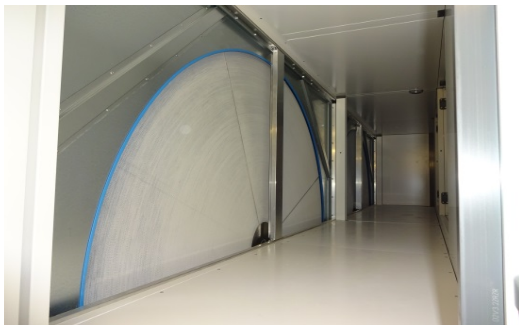


Figure 4: Rotation heat exchanger

Photovoltaic array

An essential component towards the Passive House Plus Standard is the photovoltaic array. 738 solar panels 300 Wp monocrystalline facing east and west were installed on the roof.

Total nominal output: 221.4 kW
Total production annually: 215,865 kWh
Total CO2 savings annually: 25,903.8 kg

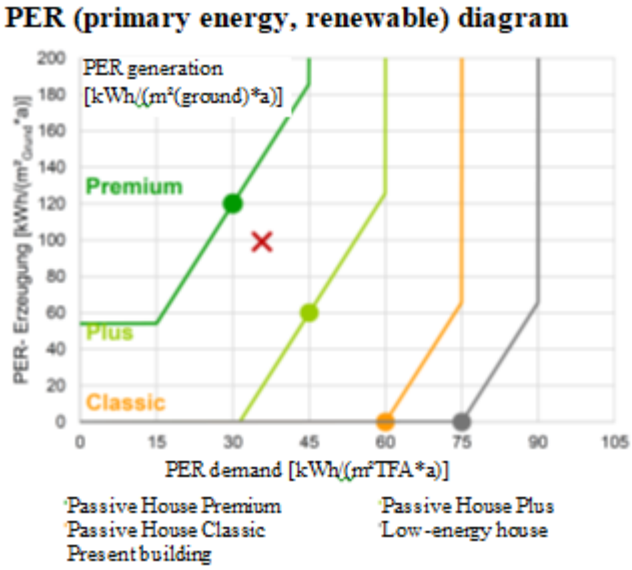
As part of a research project, excess electricity from the solar array is stored in batteries (Figure 4) for later consumption in the dorm:

Battery system, AC
Lithium-iron phosphate cells
Maximum constant output: 150 kW
Storage capacity: 170 kWh

IOP Conf. Series: Earth and Environmental Science **323** (2019) 012160 doi:10.1088/1755-1315/323/1/012160

Table 1. Building data OeAD-Guesthouse GreenHouse

Key data	
Plot area	3,820 m²
PHPP treated floor area	2,000 m²
Mean heating demand based on PHPP	11 kWh/(m²a)
Heating load based on PHPP	9 W/m²
Primary energy (PE) demand	101 kWh/(m²a)
Airtightness n_{50}	0.24/h



Graph 1: PER generation and demand
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2.2. OeAD-Guesthouse mineroom in Leoben [3]

Figure 6: Street façade – main entrance ©J.Konstantinov

The OeAD-Guesthouse mineroom was opened on October 1, 2016 after only 11 months of construction. This student residence is a contemporary home for 201 international students during their time in Leoben. The close connection of the region and the university to nature and its resources

IOP Conf. Series: Earth and Environmental Science **323** (2019) 012160 doi:10.1088/1755-1315/323/1/012160

should be reflected in the building. Therefore, e.g. quotes from the mining sector, with which the city and the university have been connected for generations, can be found in the building.

This first global high-volume passive house was constructed as timber framed structure and is klima: aktiv GOLD certified. The certification by the Passive House Institute Darmstadt has also been carried out and the Passive House Plus Standard was achieved.

The building is located on Josef Heißl-Straße at a height of ground floor up to the 5th floor and set off to the north by one floor. Smooth facades form a clearly defined counterpoint to the subsequent demolished development structure. The facades are accentuated by colored frames around the large windows of the common rooms and by loggia-like recesses in front of the living areas of the residential communities in which plant troughs with kitchen herbs are arranged.

The structure was developed from a perimeter block development, which opens to the lower development in the west. Thus, courtyard and garden are protected from street noise. The components are staggered at the height of the ground floor up to the 5th floor and from the ground floor up to the 3rd floor and thus adapted to the smaller-scale development of the neighboring plots. By lowering the southern connecting tract, the tanning of the inner courtyard is optimized. On the southern facades, "green walls" of plant troughs were provided, which positively influenced the microclimate in the street and courtyard. The recessed and transparent ground floor zone provides an insight into student life as well as views into the courtyard and creates a weather-protected meeting zone in front of the building.

Inspired by the liveliness and the play of colors of the ore stone, the formally clear structures were covered with a plastic, multi-colored wooden formwork. The pre-grayed shuttered formwork, which repeatedly bursts out of the smooth, untreated larch wood formwork, runs vein-like over the building and will gradually discolor irregularly in various grays, browns and reds.

With the exception of the entrance area - the basement and the two staircases - the entire building was built in timber construction. The outer walls consist of a prefabricated, with mineral wool-finished timber frame construction, mostly having no supporting function. Horizontal bracing is provided by partition walls made of cross laminated timber wall elements in conjunction with glue laminated timber ceiling panels. About 1,900 m^3 of wood were used in the building for the supporting structure and the facade, thereby binding approx. 2,000 tons of CO2. Partition walls and ceilings are fitted with plasterboard liners to meet the fire and sound insulation requirements. Beams and columns were over-dimensioned to burnup and could therefore be left visible.

The door cut-outs of the cross-laminated timber interior walls were turned into mobile furniture. Tables, benches, stools and sideboards bring the wood character back into the living and common areas. The house offers a wide range of residential and common areas. Single apartments, double rooms as well as shared apartments for 2-5 residents enable the students a differentiated housing offer. On each floor, so-called parlors offer individual retreat areas. There are common areas such as the extended living room, a launderette, music practice room, meeting and study rooms, gym and a multi-purpose room for chilling out and celebrating on the ground floor. In the courtyard, there is seating and table tennis, and in the garden wooden decks for lounging can be found.

Table 3 gives an indication of the key building data and building physics, with Figure 9 highlighting the measures taken with regards to the building equipment.

Additional to the building envelope, also power-consuming components have been optimized, whilst standby functions were avoided. The entire object was equipped with LED lighting, and the general areas are supplied with motion detectors and twilight switches. A space or empty piping for possible battery storage has already been provided and there is also the possibility to charge e-bikes and electric cars. The elevators are equipped with braking energy recovery.

By means of water saving, valves with an extended cold water range (cold water in the middle position), the hot water consumption, which is above average in the houses of the OeAD-Housing Office from experience, should be reduced. In line with that, the residual heat demand and hot water generation are covered by district heating (process waste heat from VOEST Alpine Stahl).

The ventilation system plays a big part in reduction of the overall energy demand. Here, the TROX X-Cube ventilation system (Figure 7) with 2 parallel rotary heat exchangers was used, which has an air volume flow of 4,500 m³/h per exchanger. Additionally, special pocket and pleated filters are used to reduce the flow resistance of the ventilation system. Further details to be highlighted are the re-heat number (EN308) of 90.58% and the moisture content of 73.14%.

Table 2. Performance indicators (PHPP)

OeAD-Guesthouse mineroom

Airtightness	n_{50} = 0.27/h
Heating demand	17.6 kWh/(m²a)
Building heating load	10 W/m²
Primary energy need	76 kWh/(m²a)
PER-demand	37 kWh/[m²a)
Producing renewable energy	87 kWh/(m²a)

Figure 7: TROX X-CUBE ventilation unit

Photovoltaic system:
Modules monocrystalline á 300 Wp with 3 inverters, 388 PV modules in east-west orientation
Total rated power 116 kWp
Total production per year: 105,000 kWh
Total savings CO2 per year: 12,600 kg


Figure 8: Photovoltaic panels – guesthouse mineroom

Table 3. Building data OeAD-Guesthouse mineroom

Building data		Building physics	
Plot area	3,214 m²	Exterior wall	0.104 kW/m²K
Built area	1,449 m²	Roof	0.067 W/m²K
Gross floor area	7,196 m²	Ceiling against unheated	0.091 W/m²K
Usable area home	5,900 m²	Windows/U_w	
Total number of homes	201		
Total accommodation	139		

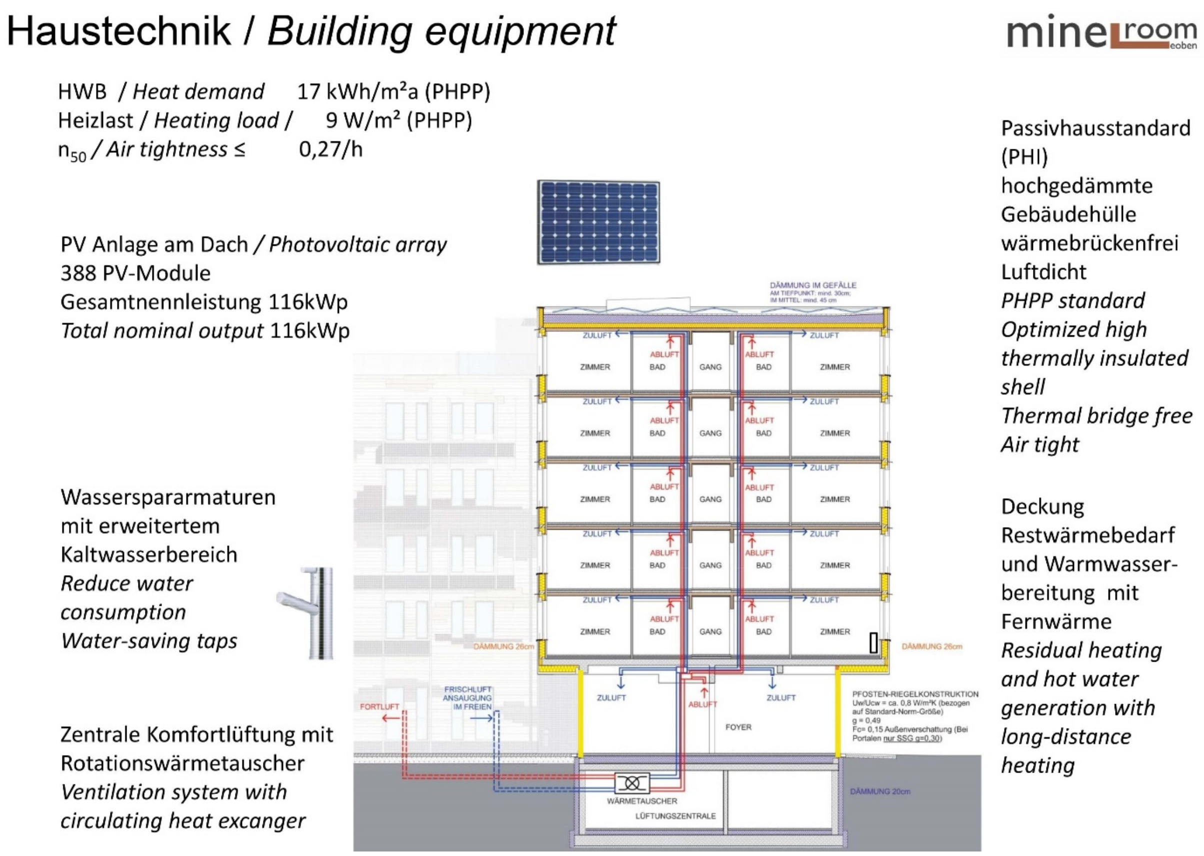

Figure 9: Overview building equipment guesthouse mineroom

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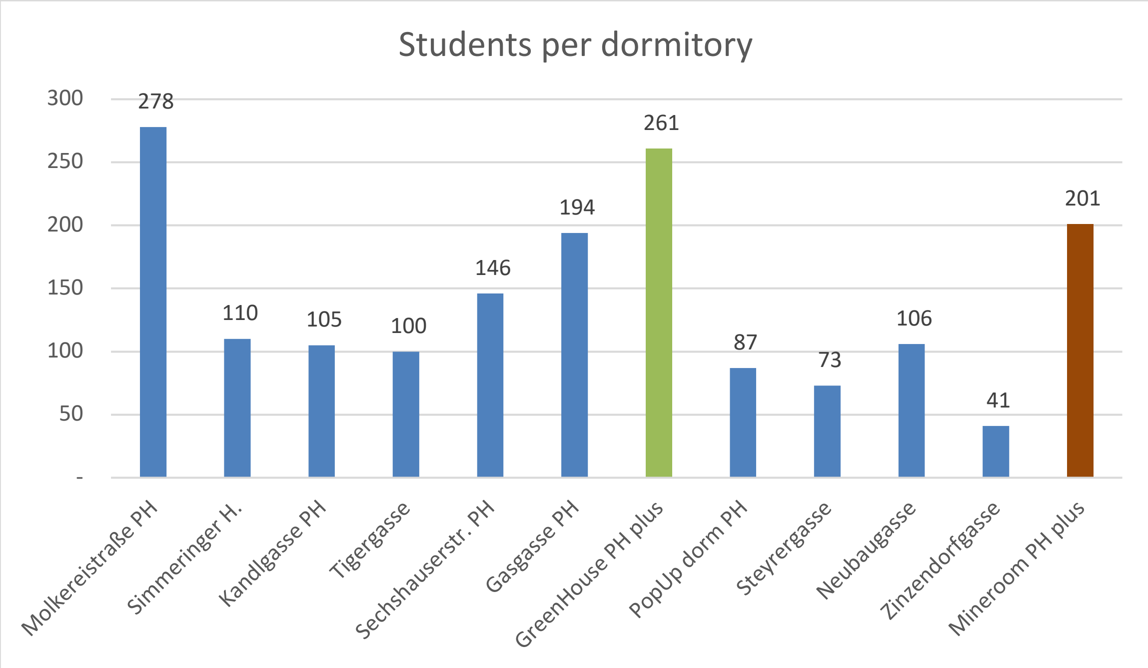
3. Comparison of guesthouses of the OeAD-Housing Office

As visible from Table 4, most buildings use district heating for heating and hot water generation purposes. Out of the following 12 houses, 3 are situated in Styria (Steyrergasse and Zinzendorfgasse in Graz and Mineroom in Leoben), also, the passive house buildings Molkereistraße, GreenHouse and Mineroom accommodate the highest number of students (graph 2).

Table 4. Comparison of OeAD-Guesthouses

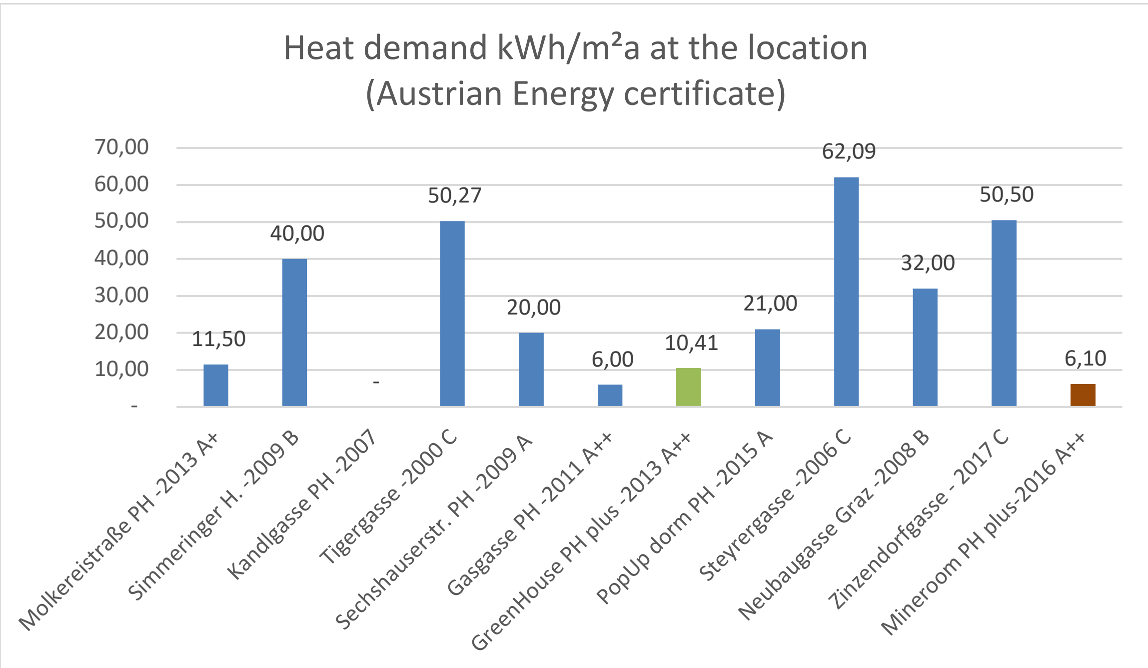
Object	Year of construction	Students	m²	Construction	Heating	Hot water generation	Ventilation system with heat recovery	PV [kWP]
Molkerei-straße	2013	278	6,338	Solid building	District heating	District heating	yes	n.d.
Simmer-inger H.	2009	110	2,778	Solid building	District heating	Local electric boiler	no	12.42
Kandl-gasse	2007	105	2,723	Solid building	District heating	District heating	yes	19.9
Tiger-gasse	2000	100	2,013	Solid building	District heating	District heating	no	16.7
Sechshaus-erstraße	2009	146	3,372	Solid building	Central heating	Central heating	yes	15.39
Gasgasse	2011	194	4,683	Solid building	District heating	District heating	yes	60.0
Green-House	2013	261	8,488	Solid building	District heating	District heating	yes	221.4
PopUp dorm	2015	87	2,028	Timber construction	Heat pump	Heat pump	yes	12.0
Steyrer-gasse	2006	73	1,337	Solid building	District heating	District heating	no	n.d.
Neubau-gasse	2008	106	2,009	Solid building	District heating	District heating	no	n.d.
Zinzendorf-gasse	2017	41	1,247	Retrofit	District heating	District heating	no	n.d.
Mineroom	2016	201	6,000	Timber construction	District heating	District heating	yes	116.4



Graph 2: Overview students per dormitory

Compared with the other guesthouses, the passive house buildings have a significantly lower heat demand – depending on the heating system in use. Graph 3 displays the heat demand for each of the 12 buildings for the year 2018, while also taking into account the energy category.

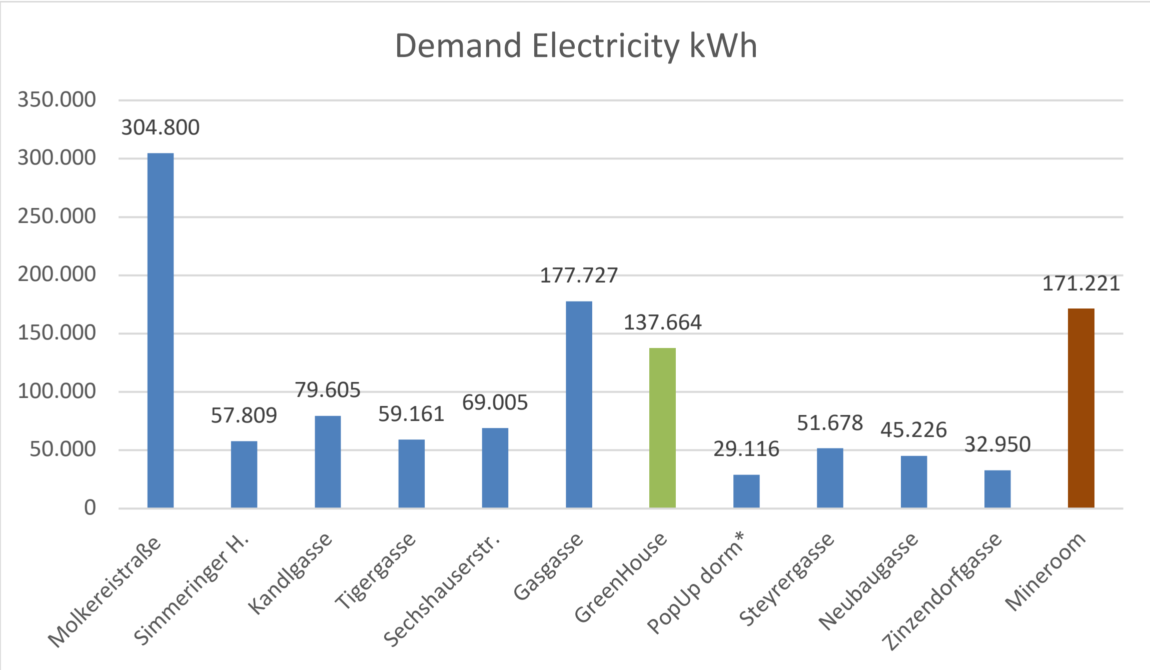
There was no data available for the guesthouse in Kandlgasse.



Graph 3: Heat demand per guesthouse [kWh/m²] – building names also indicate the resp. year of construction and energy category. Data are for the year 2018.

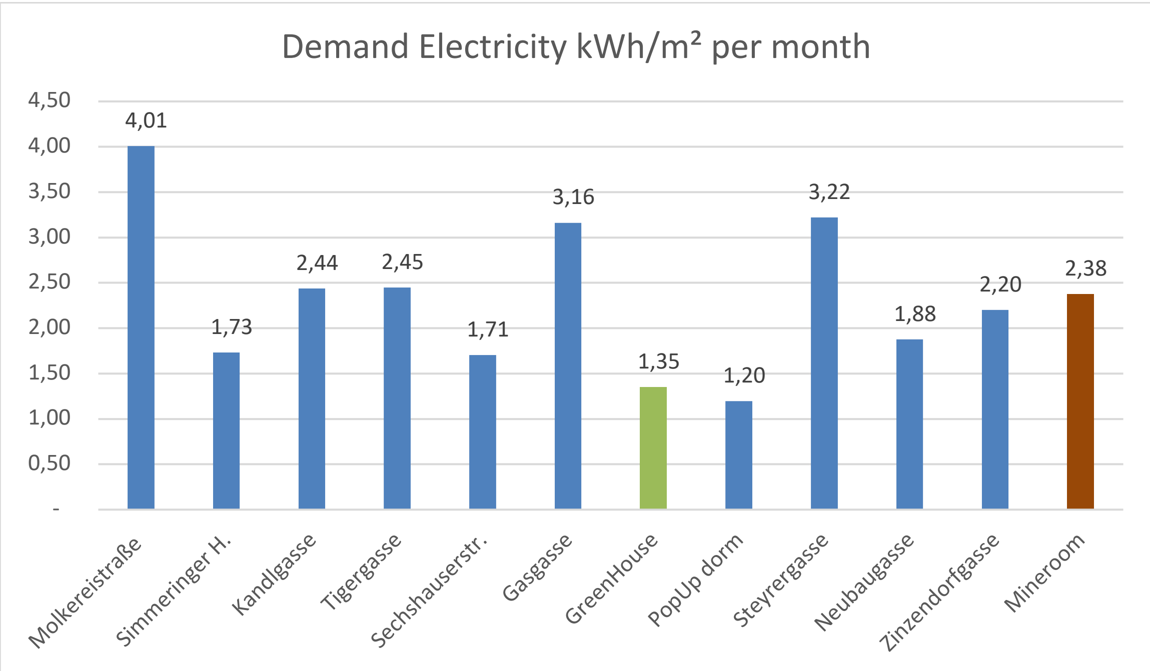
Surprisingly, for 2018, the electricity demand was higher in some of the passive houses than the other buildings (graph 4). This is in part due to some technical issue in the photovoltaic system of the guesthouse mineroom in 2018 – in line with that, the data shows a significantly lower electricity demand for 2017 (92.367 kWh). A further explanation probably lies in the behavior of the residents.

The electricity demand per m² and month (2018) was lowest in the passive houses, as is shown in graph 5.



Graph 4: Demand of electricity per guesthouse [kWh] – data for the year 2018

*PopUp dorms: Removable construction, size optimized for transportation. 250 m² common room as atrium – not conditioned, kitchen and laundrette in an oversea container.



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Graph 5: Demand of electricity per guesthouse [kWh/m^2 per month] – data for the year 2018

4. Passive houses – active satisfaction

Striving towards reaching the highest possible standard of living with the lowest environmental impact, the contentment of OeAD-guesthouse residents is assessed once in a year via feedback questionnaires, which evaluate the overall satisfaction by looking at the different factors of room size, room quality and equipment. Residents rank the different buildings using grades ranging from 1 (very satisfying) to 4 (very unsatisfying). A system of 4 grades is used in order to put special emphasis on positive as well as negative critique.

The evaluation for 2018 shows an overall good ranking of OeAD-guesthouses within a range of 1.48 to 2.03, with the passive house-buildings GreenHouse (1.48) and Mineroom (1.52) providing the most satisfaction for residents. Also in 2017, GreenHouse and Mineroom were ranked best in contentment.

5. Sharing the knowledge with the world

Population growth, overuse of resources and environmental degradation are just a few of the big global challenges that we already face today. Too often, these developments are reigned by view that there is no alternative. However, there are many alternatives with some being already successfully implemented on a local scale. With the goal in mind to raise awareness, the OeAD-Housing Office initiated 2 summer universities: "Alternative Economic and Monetary Systems" (AEMS) in 2013 and "Green. Building. Solutions." (GBS) in 2011.

Both programmes attract highly qualified students and professionals from all around the globe and diverse backgrounds. In order to further foster diversity, there is also a system of scholarship support for those, who otherwise would not be able to cover the participation fee by themselves. This way 103 people from 50 nations and 5 continents could participate in AEMS and GBS in 2018.

5.1. The beginning of AEMS

11 years after the stock market crash, the world has not seen any substantial systemic changes. Neither economic textbooks nor incentives for financial actors to make one-sided bets have changed. The design of the financial and economic system basically remains the same, as does its inherent instability. There is overwhelming evidence that the current economic model based on everlasting economic growth is destroying the ecosystem of our planet, and thus the basis for the existence of humanity. However, dominant recipes for overcoming the current economic crisis still focus on restoring economic growth. AEMS sheds light on approaches and reforms that can make a difference.

The main intention behind the creation of the AEMS was to use a positive approach applied to the field of economic alternatives, asking if this apparently inherent economic instability might be reduced or avoided, and to show students chances for reforms. A great variety of possible approaches to economic reform has been proposed over the years proving that high demand for a new economic system exists.

A number of successful and promising concepts are presented to the students ranging from individual actions all the way up to fundamental reforms of global structures and institutions. This enables them to have a level-headed discussion of economic reform. The monetary system has its own intricate feedback loop with the economy; further emphasis on monetary reform is a natural choice.

AEMS offers room for critical thinking and the possibility to openly discuss and deconstruct ideas and concepts with distinguished experts from various scientific fields. The participants are able to move beyond the widespread limitations of higher education that lacks extensive exchange between scientific disciplines.

2018 saw the 5th installment of the summer school with 61 participants from 34 different countries.

5.2. Take care of your future

It is the aim of the OeAD-Housing Office to convey knowledge about eco-friendly building to future generations on the one hand, and to offer the highest possible standard of living with the lowest environmental impact on the other hand. To our minds, working sustainably does not only mean realizing eco-friendly projects, it also means creating awareness and knowledge, because nothing in this world is more sustainable than knowledge.

The GBS graduate-level summer program took place from July 21 to August 12, 2018 for the 8th time and 42 international students and professionals successfully completed the course. The GBS students primarily study architecture, urban planning, and engineering sciences; however, they worked alongside professionals and students from all faculties relating to the built environment.

The GBS takes up the central ecological, economic, technical, and social themes of sustainable design and construction to offer students the unique opportunity to study content focused on sustainable construction within an interdisciplinary framework, and also to experience the practical applications of sustainable concepts. The GBS provides knowledge that sharpens and deepens the students' competencies and understanding of sustainable planning, design, and construction. The participants belong to the generation that bears the brunt of the change from a postmodern industrial society to a circular-economy-oriented society. The participants therefore form a central target group that are sensitized to the environmentally conscious and responsible use of natural resources and need to be equipped with the appropriate knowledge to take action. The importance of the GBS Summer University is reinforced by ever-present evidence of more extreme climate change. The associated urgency to quickly reduce greenhouse gas emissions and resource consumption shows that the construction and building sectors are responsible for an enormous share of greenhouse gas emissions worldwide. The circular economy, urban mining, and the reduction of energy consumption in urban metropolises are indispensable measures which must be considered for sustainability in future urban planning, architecture, and construction sectors. Renewable energy production by new technologies and innovative ecological and sustainable building concepts and materials should therefore contribute to natural resource conservation and reducing greenhouse gas emissions.

Since 2018, both summer universities are supported by the Club of Rome.

6. Hard work pays off

All our efforts for an active ecologic contribution were honored with numerous awards (Table 3).

In November 2013 the OeAD-Housing Office was awarded with the Climate Protection Prize at the ORF climate protection awards in the category “Climate Protection in Companies”. With more than 30,000 votes from the audience, the OeAD-Housing Office was chosen among 230 submissions.

The OeAD-Guesthouse mineroom in Leoben won the 2018 Blue & Green Award and the Styrian wood construction prize in the category large residential buildings in the year 2017.

In October 2018 the OeAD-Guesthouse PopUp dorms were awarded with the FIABCI Prix d' Excellence. It is an unique award given to real estate projects that embody innovation and economic sustainability. The OeAD-Guesthouse mineroom appeared as runner-up.

The OeAD-Guesthouse PopUp dorms was nominated for the climate protection award in 2016 and it was also awarded with the Green & Blue Building Award in 2015. Moreover the PopUp dorms were nominated for the 2018 City of Vienna Environmental Prize.

The OeAD-Guesthouse GreenHouse is the first award-winning Net-Positive Energy student residence in the world, winning the 2015 City of Vienna Environment Prize, with 1000 of 1000 points certified as a klima:aktiv gold building.

AEMS has won the “Bildung für nachhaltige Entwicklung - Best of Austria”-Award (Education for sustainable development – Best of Austria) in the category "political support" in 2016, while GBS was chosen by UNESCO Commission as UN Decade Project for Sustainable Education in 2013 and received the Green & Blue Building Award 2014 in the category Products / Services.

The OeAD-Housing Office and the University of Natural Resources and Life Sciences Vienna were runners-up for the Austrian TRIGOS Award 2015 in the category best partnership - for GBS and AEMS.

Table 3. List of awards and nominations

Nominee	Award	Year
OeAD-Guesthouse Gasgasse	state prize for architecture and sustainability	2012
OeAD-Guesthouse GreenHouse	winner klima:aktiv	2016
OeAD-Guesthouse mineroom	Green & Blue Building Award	2018
OeAD-Guesthouse mineroom	timber frame construction prize Styria	2017
OeAD-Guesthouse PopUp dorms	Green & Blue Building Award	2015
OeAD-Guesthouse PopUp dorms	winner FIABCI Prix d'Excellence	2018
OeAD-Housing Office	award Sustainable Development Goals	2018
OeAD-Housing Office	winner climate protection award	2013
OeAD-Housing Office	winner Austria's Leading Companies	2014
OeAD-Housing Office	winner innovative buildings	2016

In conclusion, the OeAD-Housing Office emphasizes Austria's leading role in relation to eco-friendly building and seeks to share knowledge with their international students and thus wants to carry the basic ideas of eco-friendly building out into the world. Moreover, our residents will always associate the comfort of their experience with eco-friendly building with Austria and will gladly return to the country - be it as tourists, university graduates or future business partners. Even if only a handful of our residents will be inspired by their positive experience with passive houses to build their own homes according to eco-friendly standards, or even launch an initiative similar to this one in their home countries, our goal of educating and inspiring people will have been reached and we will have contributed to a more responsible and intelligent use of resources.

Regarding the overall efficiency of the passive house buildings, it can be seen that the heat demand is significantly lower than in other guesthouses, while the picture for the electricity demand is not always as clear, since it is probably also influenced by other factors.

References

[1] https://oead.at/en/
[2] https://housing.oead.at/en/accommodation/details-en?&view=application&object_id=325
[3] https://housing.oead.at/en/accommodation/details-en?&view=application&object_id=350