

Annex B) Scenario pursuant to EED:2012, Art. 4(a)-(e)

April 2017

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0 Motivation

"Pursuant to Art. 4(e) of the Energy Efficiency Directive EED:2012/4/, the Member States shall establish a long-term strategy for mobilising investment in the renovation of the national stock of residential and commercial buildings, both public and private. This strategy shall encompass:

- (a) an overview of the national building stock based, as appropriate, on statistical sampling;*
- (b) identification of cost-effective approaches to renovations relevant to the building type and climatic zone;*
- (c) policies and measures to stimulate cost-effective deep renovations of buildings, including staged deep renovations;*
- (d) a forward-looking perspective to guide investment decisions of individuals, the construction industry and financial institutions;*
- (e) an evidence-based estimate of expected energy savings and wider benefits.*

A first version of the strategy shall be published by 30 April 2014 and updated every three years thereafter and submitted to the Commission as part of the National Energy Efficiency Action Plans".

This paper seeks expressly to give **no** forecast of energy savings that are to be expected, but rather merely develops scenarios for the estimation thereof. In any event, any increases in energy requirements or consumption owing to demographic developments are not taken into account here.

1 Overview of the national building and housing stock 2011 (a)

The data on the building stock and housing stock that is published by Statistik Austria serve as the basis for the development scenarios. The building stock can be taken from the Statistical Yearbook 2014 /1/:

Table 1 Building stock 1869 to 2011 (Table 12.01 from /1/)

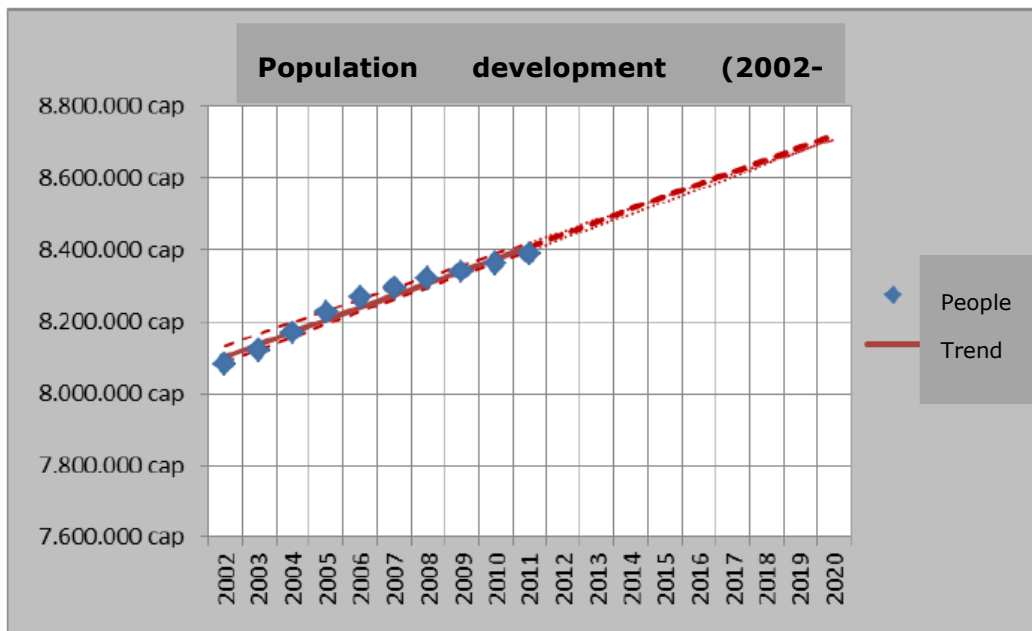
[Bldg.]	1869	1880	1890	1900	1910	1923	1934	1951	1961	1971	1981	1991	2001	2011
Austria	562 045	590 029	614 694	648 116	690 731	717 004	805 849	896 030	1 049 953	1 259 533	1 586 841	1 809 060	2 046 712	2 191 280

The housing stock can be taken from the Statistical Yearbook 2014 /1/:

Table 2 Housing stock 1869 to 2011 (Table 12.02 from /1/)

[Hsg.]	1869	1880	1890	1900	1910	1923	1934	1951	1961	1971	1981	1991	2001	2011
Austria	908 600	1 027 900	1 134 300	1 295 700	1 466 200	1 583 359	1 784 434	2 138 001	2 249 678	2 665 942	3 052 037	3 393 271	3 863 262	4 441 408

The population development can be taken from the Statistical Yearbook 2017 /6/:



[full stops in numbers should be read as commas or spaces]

Figure 1 Population development (2002-2014)**2 Overview of cost-effective approaches to renovations (b)**

A number of possibilities for obtaining cost-effective approaches to renovations for a building exist in Austria:

1. The procedure pursuant to point 4.2 of OIB Guideline 6 "Energy saving and heat insulation" /5/, which lays down coordinated requirements as regards the heating energy needs or the overall energy efficiency factor for major renovations.
2. The procedure pursuant to point 4.5.b of OIB Guideline 6 "Energy saving and heat insulation" /5/, which provides coordinated HTC value requirements, on the basis of the principle "any individual renovation may be performed so long as it does not preclude a deep renovation/major renovation". This procedure makes it possible, without any financial outlay, to lay down requirements for measures which correspond to one of the options of a renovation approach developed in accordance with the second option in this list.
3. The procedure pursuant to point 4.5.a of OIB Guideline 6 "Energy saving and heat insulation" /5/, in which a tailored approach to renovation is created, the objective of which is to reach the cost-optimal level following a deep renovation/major renovation. The basis for this is constituted by the OIB document on establishing the cost-optimality of the requirements of OIB-GL6 or of the National Plan /3/.

The achievable savings, based on the average energy consumption of a building constructed prior to the first Building Regulations in relation to the thermal building envelope are, on average:

Renovation of the top-floor ceiling	-10%
Renovation of the external wall	-20%
Renovation of the windows	-10%
Renewal of the heating system	-10%

It should be highlighted at this point that for individual buildings the concrete savings may differ considerably from the values given, in

particular since these savings [lacuna] on the difference between the average energy consumptions of buildings with a building envelope which correspond to those of the average default HTC values from the OIB Guideline and corresponds to the average energy requirement after the measures have been carried out. This means that, in particular in the event that all measures are carried out, a reduction in energy consumption by 50%, in the case of standardised use, can be achieved.

4. The procedure pursuant to Point 3.1 of this document in the context of the residential building subsidies from the provinces (see that item).
5. The procedure pursuant to Point 3.2 of this document in the context of the federal renovation cheque (see that item).

It should be noted at this point that in Austria only deep/major renovations are sought; however, in view of the amount of financing required, this is to be facilitated on an open timescale. In this regard, the approach pursuant to 4.5 of the OIB Guideline 6 "Energy saving and heat insulation" /5/ provides the corresponding legal foundations.

Primarily for reasons of the financial impact, it is a precondition for renovations that they are, as far as possible, conducted at the same time as necessary measures. This permits the best possible result upon an analysis of economic efficiency, especially since the savings gained in respect of the reduced energy costs can only be compared against the low additional costs based on the minimum requirements.

3 Overview of the policies and measures to stimulate cost-effective deep renovations of buildings (c) and a forward-looking perspective to guide investment decisions of individuals, the construction industry and financial institutions (d)

It should be assumed for these purposes that these two measures can be regarded as being inseparable from one another.

3.1 Residential building subsidies of the provinces

- Burgenland

The Burgenland Residential Building Subsidies Act 2005 in the currently applicable version provide subsidies for the construction and renovation of residential properties, the creation of living space, the purchase of non-subsidised houses and apartments, the installation of alternative energy systems, and measures for improving the thermal quality of the building envelope of a subsidised property, and additionally provides for the granting of homebuilding loans and housing benefits.

The amount of the subsidies is dependent to a large degree on energy efficiency. For instance, in the case of loans for new-build properties, the amount of the subsidy increases in each case by a maximum of €25 000 according to the percentage by which the minimum necessary energy indicator (36 kWh/m²a with a surface to volume ratio > 0.8) is undershot, depending on the eco-points that have been achieved. Likewise, there is a corresponding sliding scale of eco-points in relation to renovation methods, and minimum energy standards have to be complied with.

When heating and hot water supply systems are installed for the first time in the case of a new build, the use of innovative, climate-friendly systems is a prerequisite for the granting of a subsidy. Renovation measures which relate to the heat supply systems or the heating systems are, as a matter of principle, subsidised only if innovative, climate-friendly systems are used and these or additional renovation measures also lead to a reduction in the energy indicator in comparison with the starting value.

The use of ecological building materials constitutes a further precondition for subsidies. The subsidy principles are published on the province's homepage <http://www.burgenland.at/wohnen-energie/wohnen/wohnbauforderung/>.

For the installation or expansion of alternative energy systems and systems for saving energy and elementary resources as well as systems for recovering heat energy, a non-repayable grant can be awarded as part of the subsidisation of residential building. The current guidelines can be seen at <http://www.burgenland.at/wohnen-energie/energie/downloads/foerderung-alternativenergieanlagen-2016/ersichtlich>. Anyone who has decided to build a house or to renovate an existing house should engage in advance with the issues surrounding energy technology, because energy-related measures that have already been put in place can be corrected subsequently only with great difficulty and at considerable expense. In this regard, the province of Burgenland offers assistance in the form of energy consultations. These energy consultations are conducted by Department 3 – Finance, main department residential building subsidies.

The thermal/energy-related standards in respect of subsidies for new builds and for the renovation of houses and apartments are also to be increased or developed further in future.

- Carinthia

The residential building subsidies of the province of Carinthia provide support for new-build properties and renovations of residential properties. The amount of the subsidy depends to a large extent on the energy efficiency achieved. This includes both the quality of the building envelope and the nature of the energy supply. For instance, for new-build properties, the subsidy increases by €275 per m² in the case of a passive house in comparison with the minimum standard. There is likewise a corresponding sliding scale of incentives for renovations. However, when an energy supply based on renewable energy sources is newly installed, the province's renovation support scheme also awards investment grants which are paid out in 20 half-yearly instalments. These have strict quality criteria attached to them. The guidelines are publicly available on the province's homepage at <https://www.ktn.gv.at/Themen-AZ/Details?thema=1&detail=2>.

- Lower Austria

In 2002, a residential building subsidy system was established in Lower Austria which takes account of minimum standards in terms of heat energy demand and the use of heating and hot-water systems with renewable energy sources and ecological building materials. The higher the quality in terms of energy, the higher the subsidy. Since 2010, the use of innovative, climate-friendly heating systems has been a prerequisite for the payment of a subsidy. The subsidy consists in the issuance of loans by the province or of annuity subsidies relating to bank loans. The subsidies are provided both for new-build properties and for renovation (of the whole of the heating system). In the five-year period from 2012 to 2016, the renovation of approximately 30 000 houses and apartments and the building of around 29 000 houses and apartments was subsidised. The Lower Austrian subsidy principles are standardised in the Lower Austrian housing subsidy guidelines 2011 and are published on the homepage of the province of Lower Austria at <http://www.noel.gv.at/Foerderungen/Foerderungen.html>.

A special financial initiative by the province: the subject of the subsidy is, in particular, infrastructural construction measures by Lower Austrian municipalities or their companies. The subsidy consists of the granting of an interest subsidy in relation to loan or leasing financing. Compliance with specific standards in respect of heat energy demand in new builds and in renovated properties is a precondition for a subsidy, the supply of heat must be based on renewable energy sources and energy-efficient appliances and equipment must be used for heating, ventilation and lighting.

Subsidies for advisory work: the province of Lower Austria organises and finances advice programmes – the following can be cited in this context: Energieberatung Niederösterreich [Energy Consultancy Lower Austria] was created as a consultancy initiative for the private sector. The project comprises a hotline and a pool of advisers which currently has 80 advisers. Any citizen of Lower Austria can take advantage of a free-of-charge consultation. The advice primarily relates to measures for increasing energy efficiency (insulation of buildings) and the use of efficient heating systems. For industry, the consultancy initiative Ökomanagement [Eco-management] was created. Enterprises are given a comprehensive subsidised consultation; efficiency increases in buildings and building technology are important themes

in the advice given. A comprehensive service for municipalities was created by way of the EnergieGemeindePaket [Energy municipality package]. Municipalities can take advantage of free-of-charge advice in relation to their own buildings. By virtue of the provision of support for energy strategies and energy guidelines, the municipalities have become hubs and information points for questions relating to energy. Since last month, e5 municipalities have also existed in Lower Austria. This programme is intended for engaged municipalities and has the objective of benchmarking municipalities in relation to energy.

- Upper Austria

The province of Upper Austria offers, inter alia, the following subsidies in support of the implementation of Directive 2010/31/EU:

- Subsidies for the construction of energy-efficient buildings (Upper Austrian Private Housing Ordinance, Upper Austrian Ordinance on Subsidies for New-Build Properties, Upper Austrian Young Living Ordinance, Upper Austrian Private Apartments Ordinance),
- Subsidies for the energy-efficient renovation of existing buildings (Upper Austrian Residential Building Renovation Ordinance, provincial environmental subsidies for thermal building renovation),
- Requirements in terms of energy for new-build properties and renovation of schools, kindergartens, nurseries and official buildings of the municipalities in the context of need-based allocations,
- Subsidies for energy-efficient building-technology systems (Upper Austrian Energy Saving Ordinance, provincial environmental subsidies, biomass subsidy guidelines),
- Comprehensive and product-independent energy advice in relation to the construction and renovation of buildings for private individuals, companies and public bodies.

A detailed description of these subsidies is set out at <https://www.land-oberoesterreich.gv.at/103309.htm> or <http://www.energiesparverband.at/foerderungen/liste-aller-energiefoerderungen.html>. The energy advice and further advice is provided by the Upper Austrian Energy Agency: <http://www.energiesparverband.at/>.

- Salzburg

Residential building subsidies: as part of the province of Salzburg's support for residential building, an incentive system for energy-ecological and ecological measures which go beyond the respective minimum requirements was established as long ago as 1993. The amount of the subsidy depends inter alia on the energy efficiency achieved. This includes both the quality of the building envelope and the nature of the energy supply. In the field of residential building subsidies, these measures have been constantly adjusted for the purpose of reducing emissions of greenhouse gases, and minimum energy requirements in new-build housing and for subsidies for renovations of residential buildings have been laid down. The minimum values introduced were implemented in close coordination with construction law. Financial incentives are offered by way of an increase in the primary energy indicator (PI value). This primary energy indicator (PI value) takes into account, in addition to the primary energy requirements and the carbon dioxide emissions, also the ecological quality of the building materials used for the building envelope.

For higher PI values which go beyond the minimum requirements, financial incentives have been created in all subsidy areas in order to promote further innovative, climate-friendly systems as well as the use of building materials that are particularly beneficial from an ecological point of view.

With the exception of the subsidy for the building of rental apartments, the subsidies are provided in the form of a non-repayable contribution for each m² of floor space depending on the supplementary points achieved for increased overall energy efficiency and selection of ecological building materials, location qualities and other measures. The building of rental apartments is subsidised in the form of a basic loan amount of, currently, €600 per m² of floor space, plus outright grants depending on the supplementary points achieved.

As renovations of residential buildings, unlike the building of new housing, lead to "actual" savings, for major renovations, where the standard for energy-efficient building stock is satisfied, the basic amount of the renovation costs eligible for subsidy is currently increased to 20% (instead of 15%). Innovative, climate-friendly systems for the supply of heating and hot water are subsidised as a priority, and in this way fossil fuel sources can in large part be supplanted.

The minimum requirements stipulated in the agreement pursuant to Art. 15a of the Federal Constitutional Act were implemented in the field of residential building subsidies in March 2010 and were constantly developed further up until 2016. All legal foundations are available on the province's homepage under the following link:

<https://www.salzburg.gv.at/themen/bauen-wohnen/wohnen/wohnbauforderung>.

As renovations of residential buildings, unlike the building of new housing, lead to "actual" savings, for deep, energy-based renovations of residential buildings, a particular financial incentive by way of interest-free loans is currently offered. Innovative, climate-friendly systems for the supply of heating and hot water are subsidised as a priority, and in this way fossil fuel sources are being gradually supplanted.

The minimum requirements stipulated in the agreement pursuant to Art. 15a of the Federal Constitutional Act were implemented in the field of residential building subsidies in March 2010. These provide for a gradual implementation and adaptation by 01.01.2012 at the latest. The implementing ordinance is available on the province's homepage: http://www.salzburg.gv.at/wfvo_2010_mit_db-2.pdf

Subsidies for renewable energy sources in residential buildings: when an energy supply based on renewable energy sources is newly installed, investment grants are paid out. These have strict quality criteria attached to them. The guidelines are publicly available at <https://www.energieaktiv.at/information-und-beratung/downloads/>.

Central energy performance certificate database (ZEUS): in Salzburg, all energy protection certificates must mandatorily (Building Control Act, Section 17a(4)) be forwarded by the issuer to the province's energy protection certificate database "Zeus". They are then examined for compliance with the energy-related provisions of construction law and of subsidy law. They are accessible to the public via the website <https://www.energieausweise.net>. The subsidies are approved on the basis of the data in the energy protection certificate, which is collected in a central energy protection certificate database (ZEUS), and the data from the assurances of residential building subsidies.

Provision of advice in respect of energy-efficient building and renovation: the energy advisory body "Energieberatung Salzburg" [Energy Advice Salzburg] offers relevant advice to owner-builders, tenants, municipalities, property developers and tradespeople. See under: <http://www.salzburg.gv.at/energieberatung>.

Energy-active management platform: the energy-active management platform serves to interconnect all players involved with the processing of an energy subsidy or with an energy project. The result is an energy project that is coordinated between customer and tradespeople. In the filing process, the planning declaration submitted by the planner is checked fully automatically for compliance with subsidy guidelines and other legal minimum requirements. The quality assurance of the workmanship is undertaken by way of a random-sample check.

- Styria

In Styria, residential building guidelines in accordance with the agreement pursuant to Art. 15a of the Federal Constitutional Act have applied since 1.4.2009. Inter alia, the subsidy variant of "Deep energy renovation" has been newly introduced. New insulation standards were stipulated for the years 2010/2012 in respect of multi-storey buildings: from 1.1.2010, multi-storey buildings are not permitted to exceed 45 kWh/m²,a for a ratio of surface to volume of at least 0.8 and 25 kWh/m²,a for a ratio of surface to volume of at most 0.2, and, from 1.1.2012, to exceed 36 kWh/m²,a for a ratio of surface to volume of at least 0.8 and 20 kWh/m²,a for a ratio of surface to volume of at most 0.2. For the improved heat insulation and ecological manner of construction, owing to the additional costs and the bank financing in multi-storey construction, a non-repayable supplement is required as a compensatory payment for the ecological manner of construction in order that no further increases in housing costs are produced in Styria. The compulsory use of solar energy for the supply of hot water was introduced a number of years ago, as was a ban on fossil fuels for heating purposes (with exceptions for the supply of natural gas under certain conditions). The use of direct electrical heating has been prohibited for over 20 years.

Deep energy renovation: by this is meant temporally synchronised renovation works on the building envelope and/or the technical systems of a building if at least three of the following aspects are covered and the heat energy demand

does not exceed 75 kWh/m²,a for a ratio of surface to volume of at least 0.8 and 35 kWh/m²,a for a ratio of surface to volume of at most 0.2:

- Window surfaces
- Roof insulation or top-floor ceiling
- Façade surface
- Cellar ceiling
- Energy-related technical systems of the building

The subsidy awarded is either a non-repayable 30% annuity subsidy for a bank loan with a term of 14 years or a one-off, non-repayable subsidy contribution of 15% of the recognised subsidised overall construction costs up to a maximum of 30,000 per residence.

Deep renovation: the values (heat energy demand) for the deep energy renovation also apply to deep renovations (e.g. loft conversion). The subsidy rates are set at €910.00/m² or €1 130.00/m² of recognised subsidised overall construction costs. Supplements for optimised thermal insulation of €40.00 for new-build values in 2010 and of €70.00 for passive houses were newly introduces as incentives. A non-repayable 45% annuity subsidy, with a term of 15 years, or, for social housing, a loan from the province over 25 years is granted. Comprehensive information about this is available on the homepage of the province of Styria: <http://www.wohnbau.steiermark.at>

Provincial environmental fund: systems for the use of renewable energies for non-commercial applicants are subsidised from the resources of the provincial environmental fund; these are primarily low-power biomass furnaces, solar systems (thermal and photovoltaic), district heating resulting from biomass, etc., in order not only to make buildings more efficient, but also, overall, within the meaning of the 20-20-20 targets of the European Union, to supply them with energy in an optimal manner. Detailed information can be found at <http://www.technik.steiermark.at/cms/ziel/59689784/DE/>.

- Tyrol

Residential building subsidies

As far as residential building subsidies are concerned, comprehensive measures and instruments for pursuing the objectives of Directive 2010/31/EU exist in Tyrol. As financial instruments, both loans and grants are provided in the context of the residential building subsidies. In principle, subsidies are awarded both for the construction of new buildings and for the renovation of existing buildings. With regard to the corresponding subsidy criteria, the requirements in relation to energy efficiency have been taken into account in each case. For example, when new buildings are constructed, the use of innovative, climate-friendly heating and hot-water systems is a precondition for the granting of residential building subsidies. Furthermore, a heat energy demand calculation in which a maximum permissible, annual heat energy demand (HWB) per m² of conditioned gross floor space must be submitted in respect of the property that is to be subsidised. In the case of subsidies in the context of renovations of existing buildings, inter alia compliance with corresponding HTC values for the relevant building parts (walls, roof, windows, etc.) is demanded as a subsidy criterion. In relation to the renovation of the heating system or of the heat supply system, the use of innovative, climate-friendly systems is likewise a precondition for subsidies. With regard to the corresponding detailed subsidy types, subsidy criteria and the existing subsidy guidelines, reference is made to the homepage of the province of Tyrol – Department of Residential Building Subsidies: www.tirol.gv.at/wohnbau

Provision of advice for energy-efficient building and renovation: in 1992, the “Energie Tirol” [Energy Tyrol] association was established by the province of Tyrol as an independent advisory body for promoting environmentally friendly energy technologies and the economical use of energy. The main focus of its advisory work is on energy-saving construction and building technology, and environmentally friendly heating. By making financial contributions to “Energie Tirol”, the province of Tyrol is thus supporting wide-ranging advice in respect of energy-efficient building and renovation: <http://www.energie-tirol.at>

e5 provincial programme for energy-efficient municipalities: finally, it can additionally be noted that a number of e5 municipalities have existed in Tyrol for several years now (currently 43 municipalities in Tyrol). Further information about this, inter alia, at <http://www.energie-tirol.at>.

- Vorarlberg

Residential building subsidies: the residential building subsidies of the province of Vorarlberg provide support for new-build properties and renovations of residential properties. The amount of the subsidy depends to a large extent on the energy efficiency achieved. This includes both the quality of the building envelope and the nature of the energy supply. For instance, for new-build properties, the subsidy (low-interest loan) increases by €300/m² in the case of a passive house in comparison with the minimum standard. There is likewise a corresponding sliding scale of incentives for renovations. The guidelines are published on the home page of the province:

https://www.vorarlberg.at/vorarlberg/bauen_wohnen/wohnen/wohnbauforderung/weitereinformationen/foederungsrichtlinien/saemtlicherichtliniendera.htm

Subsidies for renewable energy sources in residential buildings: when an energy supply based on renewable energy sources is installed, investment grants are paid out. These have strict quality criteria attached to them. The overview of this can be found on the province's homepage at <http://www.vorarlberg.at>. The following systems fall within the scope of the subsidies:

- Solar thermal systems

http://www.vorarlberg.at/vorarlberg/wasser_energie/energie/energie/foerdern/sub/foederungvonthermischens.htm

- Wood-based heating systems and connection of buildings to local district heating systems

http://www.vorarlberg.at/vorarlberg/wasser_energie/energie/energie/foerdern/sub/foederungvonholzheizung.htm

- Electrically powered brine-to-water and water-to-water heating pumps

http://www.vorarlberg.at/vorarlberg/wasser_energie/energie/energie/foerdern/sub/foederungvonelektrischbe.htm

- Ventilation systems with heat recovery (WRG)

http://www.vorarlberg.at/vorarlberg/wasser_energie/energie/energie/foerdern/sub/foederungvonlueftungsanl.htm

Additional subsidies from municipalities: many municipalities grant subsidies in addition to those from the province. Information can be obtained from the municipality offices or from the Vorarlberg energy institute (<http://www.energieinstitut.at/>).

Energy protection certificate platform:

in Vorarlberg, all energy protection certificates must mandatorily be collected in a comprehensive database. This means that the development of building activity can be evaluated in a simple manner and random quality samples can be carried out. This database is associated with a comprehensive information and advice segment. The public has access via the website <https://www.eawz.at/>.

Building products database: around 3 500 building products, with information relating to the physics and ecology of buildings and technical information, are stored in a comprehensive database. Use is free of charge for all users and is intended to support energy-efficient and ecological construction (www.baubook.at).

Provision of advice regarding energy-efficient building and renovation: for example, the province supports the comprehensive provision of advice in relation to renovation projects. The provincial energy agency (<https://www.energieinstitut.at/>) likewise offers relevant advice to owner-builders, tenants, property developers and tradespeople. All of the information is listed, for example, via the homepage of the province of Vorarlberg under the heading of Energy, and is thus easy to find: http://www.vorarlberg.at/vorarlberg/wasser_energie/energie/energie/start.htm

- Vienna

Residential building subsidies: the resources of the residential building subsidies are intended to facilitate affordable housing when new-build projects are constructed. The subsidies are awarded on a sliding scale depending on income and family situation. The primary recipients of subsidies are tenants of apartments or residential buildings. In addition, there are specific eco-requirements for environmentally friendly building and renovation measures.

You can find information about residential building subsidies and associated topics such as heating, new buildings and renovation at www.wien.gv.at/wohnen/wohnbauforderung/foerderungen/.

Example: thermal-energy renovation (THEWOSAN): a wide variety of subsidy opportunities exist in the area of housing improvement and renovation. In the context of thermal-energy renovation (THEWOSAN), construction-related measures for the thermal renovation of the entire building envelope such as the insulation of all exterior components, the elimination of thermal bridges or the increasing of passive-solar energy gains are subsidised. In addition, measures relating to systems technology such as the conversion or installation of the heating and hot water system with primary-energy-efficient and/or CO₂-reduced or renewable energy sources are subsidised. The objective is to reduce significantly both the heat energy demand – and thus the CO₂ emissions of the building – and the consumption of fossil fuels. The subsidies are provided in the form of a non-repayable contribution in the amount of €25 to €160 per m² of floor area depending on the energy indicators achieved, and of an additional €60 per m² of floor area if the passive house standard is achieved. The maximum amount of the non-repayable contribution is limited at up to 30% of the total building costs eligible for subsidies, depending on the subsidy level. Taking account of renewable energy sources in residential building subsidies: one of the preconditions for subsidies is also an appropriate choice of energy source for the future energy supply. The central guidelines in this regard are the protection of the environment and resources and dealing with energy in a rational and economical manner.

(www.wien.gv.at/stadtentwicklung/energieplanung/foerderungen/wbf.html)

3.2 Federal renovation cheque

The Austrian federal government's renovation drive was launched in 2009 and has become established as an important and successful incentivising instrument for companies and private individuals for the purposes of reducing energy consumption. The subsidies are provided in the form of one-off, non-repayable grants.

In 2016, around 10 400 renovation projects were supported, and sustainable investments of €370 million were thus initiated. Up to €8 000 was able to be claimed for the renovation of buildings and dwellings. The average subsidy amount per renovation project was €3 450.

Thermal renovation, renovation cheque for private individuals 2016:

Subsidies are paid in respect of thermal renovations in private housing for buildings which are more than 20 years old (date of the building consent). The insulation of external walls and top-floor ceilings and the renewal of windows are eligible for subsidies. The renovation cheque is aimed at (joint) owners, leaseholders or tenants of detached or semi-detached houses or at owners/tenants of apartments in multi-storey residential buildings. The subsidy amounts to up to 30% of the costs eligible for subsidy, or at most €8 000 for the thermal renovation in the sphere of detached houses and up to €3 000 per apartment in multi-storey residential buildings. If insulation products made of renewable raw materials are used, a supplement of €1 000 can be claimed. One innovation in the 2016 renovation cheque in comparison with the federal support initiatives for thermal renovation over the last few years is that the model renovation in the sphere of detached houses has been added as a new type of renovation, i.e. more support is provided for renovation projects which are particularly ambitious from a thermal/energy perspective.

Thermal building renovation for enterprises 2016:

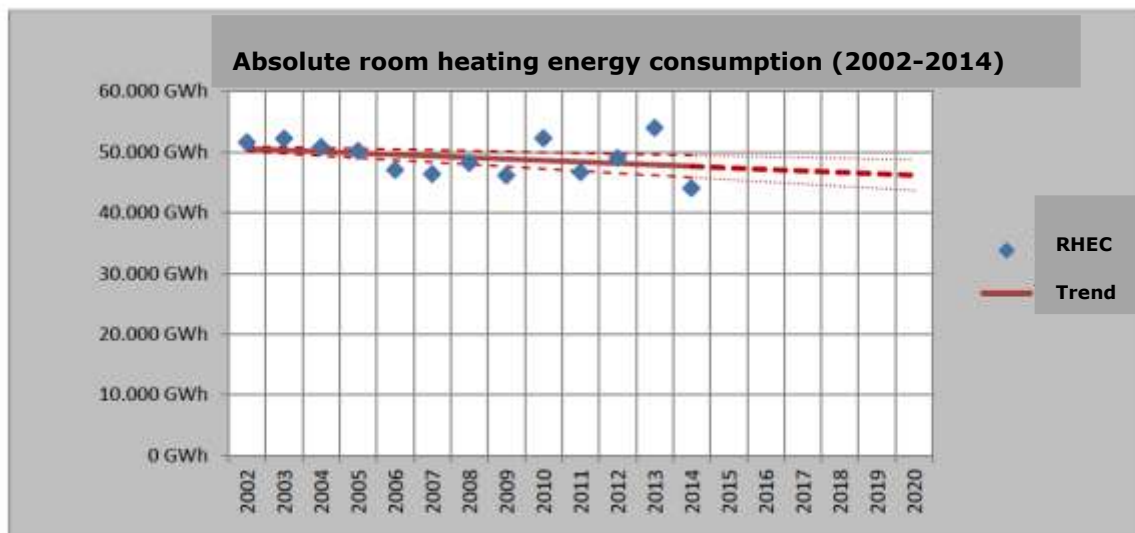
Measures for improving the thermal protection of buildings used for business purposes which are more than 20 years old are supported. The level of the payments is based on the quality of the renovation and the decrease in heat energy demand and amounts to up to 30% of the costs eligible for subsidy.

There is a supplement for the use of insulation products made of renewable raw materials and for EMAS-certified companies.

Further information can be accessed at www.sanierungsoffensive16.at.

4. Overview of final energy consumption

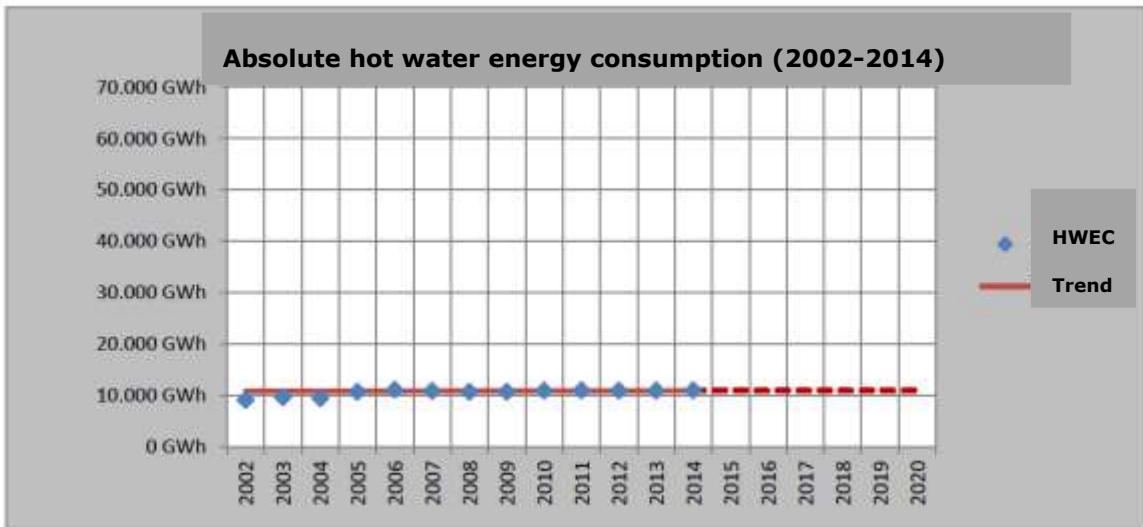
For private households, the following absolute energy consumption values can be gathered from Statistik Austria's energy balance sheet in respect of room heating...



[full stops in numbers should be read as commas or spaces]

Figure 2 Absolute room heating energy consumption (2002-2014)

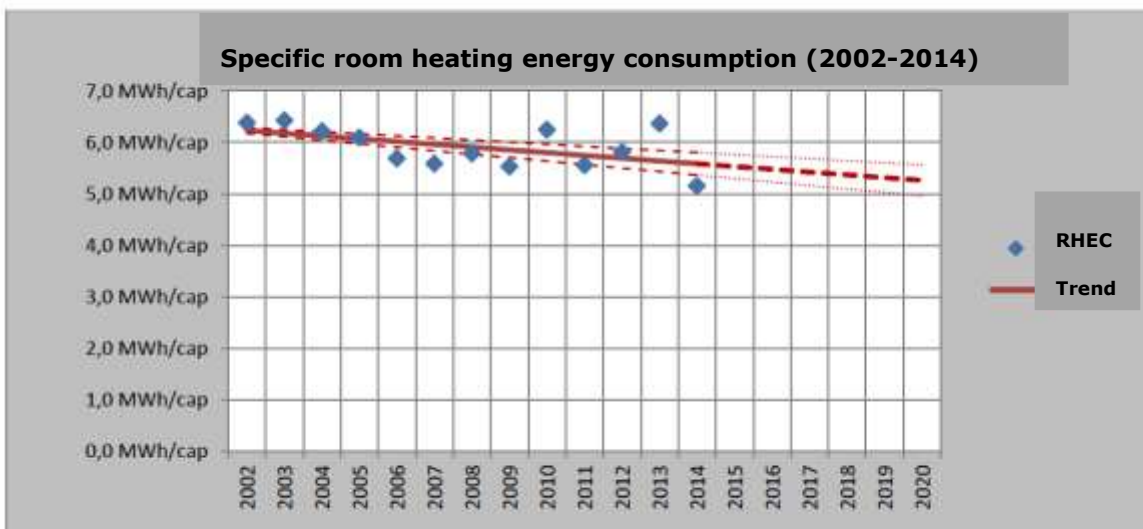
... and in respect of hot water:



[full stops in numbers should be read as commas or spaces]

Figure 3 Absolute hot water energy consumption (2002-2014)

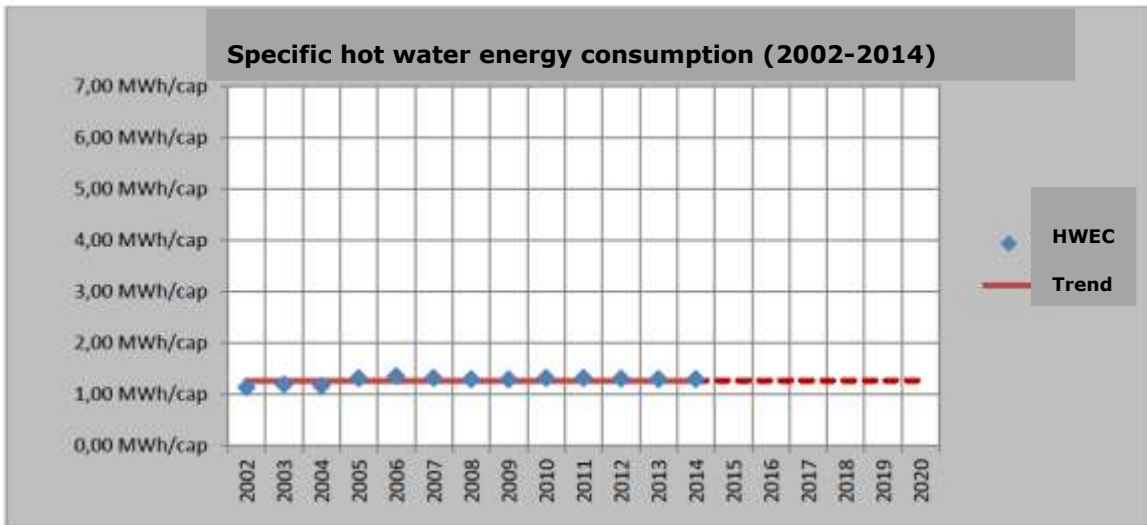
Likewise, for private households the following specific energy consumption values can be gathered in respect of room heating...



[full stops in numbers should be read as commas or spaces]

Figure 4 Specific room heating energy consumption (2002-2014)

... and in respect of hot water:



[full stops in numbers should be read as commas or spaces]

Figure 5 Specific hot water energy consumption (2002-2014)

5 Evidence-based estimate of expected energy savings and wider benefits (e)

5.1 Determination of the saving from the statistical data

If this data is analysed in its chronological sequence, then it will be seen that firstly it has been possible to reduce the room heating energy consumption by -14.6% despite an increase in population of 5.7%. This can be attributed to both climate change and the renovation activity. In this regard, it is also important to bear in mind that the average floor area has risen by 11.5% over the same period. In parallel to this, however, the specific hot water consumption has increased by 14.3%, this presumably being attributable to higher expectations in terms of comfort and hygiene, especially since the efficiency of hot water provision has certainly not decreased in this period.

Population:	2002: 8 082 000 cap ->	2014: 8 544 000 cap ...	+0.41% p.a.
RHEC:	2002: 51 539 GWh ->	2014: 44 008 GWh ...	-1.04% p.a.
HWEC:	2002: 9 96 GWh ->	2014: 10 995 GWh ...	+1.50% p.a.
HEC:	2002: 60 635 GWh >	2014: 55 003 GWh ...	-0.66% p.a.

If it is now assumed that the additional residential units now only account for a third of the room heating energy consumption on account of the significantly increased requirements arising from the building regulations, then the saving increases to -16.3%, or in the combination of room heating energy consumption and hot water energy consumption, i.e. heat energy consumption, to -9.3% or -0.66% per annum, or, in absolute figures, approx. -400 GWh/a.

5.2 Determination of the saving from the Building Regulations

If the initial data is analysed in an analogous manner, the result for the building stock is on average the 61 line in relation to the heat energy demand and a heat energy consumption which would correspond to being equipped

with reference equipment. However, this already indirectly contains a usage profile and should be regarded as a weighted average value over all construction periods up to 2002. This usage profile means, in its actual effect, that there is generally no full usage during the heating period.

If, on this basis, an equivalent renovation rate of 1% is assumed, then this would give a saving of approximately -0.4% per annum. The effect of climate change is not taken into account in this context. If this effect is taken into account over the course of many years, then the saving increases to approximately -0.5%, with full usage – i.e. no sufficiency measures on account of “non-affordability of the energy costs” – being assumed after the renovation.

If this trend were continued, then this would result in an expected saving by 2020 of a further -1.6 TWh/a for the building stock. It should be noted at this point that the long-term continuation of this trend would make it possible for residential buildings to be supplied with electricity without fossil energy sources as far as the total final energy consumption is concerned.

6 Summary

The development of heat energy consumption over recent years shows a clear development. Despite significantly increasing population figures and a significantly increasing stock of buildings and housing, it has been possible to reduce consumption continuously. The key factors responsible for this were the developments in building legislation and the individual subsidy programmes of the provinces and of the federal government, as well as the intensive advice programmes, which led to a high level of awareness of energy saving measures among the public and consequently led to many investments.

Building on the experience of recent years, the legal provisions are being adapted to comply with the stipulations of the EPBD and the subsidy programmes are being further developed as regards efficiency, the renewables proportion and climate protection.

7 Literature and abbreviations

7.1 Literature

- /1/ Statistical Yearbook 2014 from Statistik Austria
- /2/ Statistical Yearbook 2012 from Statistik Austria
- /3/ OIB document establishing the cost optimality of the requirements of OIB Guideline 6 and of the National Plan pursuant to Article 4(2) in relation to 2010/31/EU of 17 March 2013
- /4/ Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC
- /5/ OIB Guideline 6 "*Energieeinsparung und Wärmeschutz*" [Energy saving and heat insulation], April 2015 edition
- /6/ Statistical Yearbook 2017 from Statistik Austria

7.2 Abbreviations

HWB.....Heat demand
WWWB....Hot-water heat demand
HEB.....Heat energy demand
HEV.....Heat energy consumption
I_c.....Characteristic length
BGF.....Gross surface area
EFH.....Detached house
MFH.....Semi-detached house
GWB.....Multi-storey residential building
WG.....Residential building
NWG.....Non-residential building
THG.....Greenhouse gas
GT.....Building type
OIB.....OIB Guideline 6:2015