

Case Study on System Innovation: Sustainable Building in Austria

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1. Main objectives

This country case study was compiled within the OECD TIP project on 'System innovation' as part of the TIP's contribution to the CSTP Intermediate Outputs 1.3 and 1.4. [See DSTI/STP (2012)1/REV1 and DSTI/STP/TIP (2012)3]. Aims of the TIP project are the clarification of the concept of system innovation and the identification of common good governance approaches. The main objectives of the country case study is the identification of key self-reinforcing mechanisms that can act as drivers / bottlenecks and of a suited 'policy-mix', as well as potential 'policy gaps/bottlenecks'.

2. System innovation

System innovation is a rather new topic in innovation policy that can be understood as an addition to tradition innovation policy (Gassler et al. 2008). Interest in system innovation stems mainly from the grand challenges (ageing society, climate change, energy and resource scarcity etc.), as system innovation is seen as a promising strategy to cope with these challenges.

System innovation is a broad concept about changes in the way societal functions are met, often related to societal challenges that cannot be achieved with incremental technological change alone but require transitions in the socio-technical systems (that is in production and consumption patterns). It can be understood as a change from one socio-technical system to another where the direction of change matters. It is generally characterised by long-term processes.

Geels (2004) differentiates three relevant aspects in system transition:

- technological substitution comprising the emergence of new technologies, the diffusion of new technologies and the replacement of old technologies,
- coevolution of changes not only in technologies but also in elements such as user practices, regulation, industrial networks, infrastructure, and cultural meaning and
- the emergence of new functionalities related to radical innovations.

This makes clear technological developments alone are not sufficient when system innovations are concerned. System innovation requires the interplay of different actors at different levels and is about the linking of multiple technologies reinforcing each other. In addition to technology it involves changes in things like regulation, infrastructure etc. (Geels 2004). This implies an important role for policy. However, system innovation is a political challenge itself as it has to cope with different – often vested - interests of firms, departments etc. in a framework of uncertainty.

Typical barriers that hinder system innovation towards less carbon intensive socio-technical systems (like e-mobility) are that

- new technologies are in general more expensive than established technologies that profit from scale effects,
- uncertainties for producers are particularly high (often hype cycles) and
- a mismatch with established usage pattern exists (Unruh 2000).

To overcome lock-in that hinders system innovation, generally a double strategy is required: the stimulation of innovation in niches (that means the creation of variety) and simultaneously the adaptation of the selection environment by specific incentives (Geels 2014).

3. Sustainable buildings / retrofitting in Austria

This case study was compiled within the OECD Systems Innovation Project and describes and analyzes the development concerning sustainable buildings in Austria. The focus of this case study is on the retrofitting of existing buildings of different categories in Austria. In order to study the innovation and transition activities concerning the retrofitting of buildings this case study consists of a general analysis and three specific local experiments.

Sustainable retrofitting encompasses different kinds of measures to improve the energy efficiency of existing buildings ideally similar to those of newly build high energy efficient passive houses¹. Sustainable retrofitting does not rely on a single technology or a set of specific technology, but on a broad array of technologies and non-technological measures. Innovation in the field is merely based on the integration of several innovations to achieve a high efficiency during the construction works and in particular the operation of the building. Restoration projects aiming for such high energy efficiency standards frequently draw on a number of innovations and new knowledge such as insulation materials, controlled ventilation and heat recovery) and on novel holistic approaches how to retrofit and operate a building.

The analysis and conclusions drawn in this document draw upon an analysis of the development and situation concerning sustainable retrofitting in Austria and three local experiments. These three local experiments cover a wide range of building types and ownership structures. The first of the three projects, 'Graz Dieselweg', encompasses the refurbishment of a housing complex from the 1960ies to passive house standard, the second project 'Wissgrillgasse – Gründerzeit with future' aims to improve the energetic performance of a typical historical building in Vienna from the late 19th century. The third local experiment covers the reconstruction of a public office building ('Amtshaus Bruck').

¹ Although discussion concerning a common standard for passive houses are continuing, generally a house with requiring less than 15 kWh/m² for heating purposes. In comparison, old buildings before retrofitting demand 150 and more kWh/m² for heating.

The case of sustainable retrofitting is relevant to study as a case of an envisioned system innovation. First, the challenges ahead to achieve the transition towards a more sustainable building stock require the transformation of the socio-techno-economic system with all its facets increasing the complexities involved. Thus a new approach going beyond traditional technology and innovation policy appears necessary. In the following a number of criterions why sustainable retrofitting appears to be a relevant example of a system innovation will be described.

As our case study will show the numerous facets and related governance challenges make clear the necessity of a policy approach going beyond conventional technology and innovation policy, a system innovation approach.

Criteria for selecting socio-techno-economic system case studies

Buildings are of key importance to the society and the economy. More than one third of the total energy consumption in Austria is related to the heating, cooling and the provision of warm water (Lutsey, 2010). On a global scale almost half of the energy (46%) is related to this tasks, whereas the need of energy for cooling is expected to further increase (BMVIT, 2014). Furthermore the building sector is growing, e.g. the stock of buildings in Austria has doubled since the 1960s (Kemp et al., 2007). The construction sector accounts for appr. 14 billion EUR added value and annually approximately 40.000 apartments are built. In 2011 more than 85.000 people were employed in the construction sector (total number of employees in Austria 4.1 m people)². Furthermore 1% of the existing building stock (appr. 3 m buildings) are retrofitted every year (Berti and Levidow, 2014; Kemp and Loorbach, 2006).

However, with regard to research and development the construction sector has a traditionally low R&D quota of 0.2% in comparison with the total quota of 2.3% (2009) in Austria. In terms of public research funding the construction sector was able to double its share from 3.2 in 2006 to 5% in 2008 (ERAWATCH Network ASBL, 2013).

Thus the case of sustainable retrofitting qualifies as a system innovation according to the criteria discussed by the OECD³.

a) Addresses highly desirable societal benefits

The reduction of greenhouse gas emissions caused by the heating and/or cooling of buildings represents a major share (approximately a third) of the overall emissions in Austria, as in most other industrialized countries. Thus sustainable retrofitting of the existing building stock represents a major opportunity to reduce the CO₂ emissions.

b) Links to major global business opportunities

Although the building industry currently operates on a rather local or national level, there are already attempts to internationalize and to export Austrian know how regarding highly energy

² other sources report about 250.000 employees (FFG 2009)

³ System innovation: Concepts, dynamics and governance, DSTI/STP/TIP(2013)³

efficient buildings to other markets. Therefore sustainable retrofitting could be a major emerging business opportunity on a European or even global scale. There are already ongoing activities aiming to facilitate the export of Austrian innovations and know how in the field, for instance the “Österreichhaus” (Austria house, the place where medal winners usually celebrate after the competition with high representatives from politics, industry from different countries) at the Winter Olympic Games in Vancouver (Whistler) was built as a passive house.

c) Of importance to the country in question in terms of capabilities and competences

High competences and capabilities in the construction sector are of major importance for the erection of new buildings and the retrofitting of the existing building stock. Whereas the construction sector has traditionally a relatively low share of R&D activities, an intensification of innovation activities is necessary to achieve the societal benefits such as emissions reductions. In order to realize highly energy efficient buildings enhanced capabilities and training is necessary in all parts of the value chain.

d) Requiring considerable system transition to reach desirable performance

The current energy efficiency of the existing building stock is by far below newly erected buildings. To reach desirable (and technologically achievable) performance a system transition including technological and non-technological dimensions including regulatory framework conditions is necessary.

e) Involving substantial policy involvement

The building sector is a highly regulated sector with a number of policy fields, for instance innovation policy, social policy/social housing policy, economic policy, labor policy, involved. Thus, the policy can be considered a key factor for the development of the building sector in general and concerning retrofitting in particular.

f) Involves public-private partnerships

There are a number of public-private partnerships and cooperation in the building sector in general and concerning the reconstruction of buildings. Such public private partnerships can have different legal status, depending on the purpose. One example are the networks for the exchange of knowledge concerning highly energy efficient buildings which are (to a different degree) financed by public sources and aim to facilitate the transfer of knowledge and learning between private and public actors.

g) Covering different layers of systems - Social, Technological, Industrial, Economic, Policy

As mentioned above a system transition requires changes and re-configurations in all of these layers of the system. As our case study will show, the coordination and interaction of policy intervention originating in different policy fields can be considered as key factor for a successful system transition towards more energy efficient buildings.

h) Covering different layers of policy governance Local, Regional, National, International

The level of provinces is highly important for governance of the building sector in Austria. However, there are important governance processes on all levels, starting from the community level to the regional, national and European level. Thus, the governance of the system has to take into account the interactions between these different levels, even though the governance of the building sector is rather on the local and regional level. Nevertheless innovation policy has a stronger embedding on the national and European level.

i) Political backing and stakeholder support

There is a principal political backing to improve the energy efficiency of the existing building stock, even though there are controversial discussions concerning the priority of different goals in the building sector, e.g. energy efficiency vs. affordability, in particular with regard to (social) housing. The Austria Climate Strategy envisages a refurbishment rate of 3% already between 2008 and 2012 in order to reach Austrian climate targets. One the medium term a refurbishment rate of 5% per year is formulated as a target. Furthermore public buildings should contribute considerably to reach this target and to (Lebensministerium, 2007). Beyond the refurbishment rate as such, the quality of the refurbishments is an important factor.

j) Critical level of change agents and accumulated experience in transition approaches

Highly energy efficient houses are being developed and diffused in Austria since the 1990s. Currently Austria has the highest density of highly energy efficient houses ('passive houses') worldwide (BMVIT, 2009). Thus, there is already an established network of change agents with experiences regarding highly energy efficient houses. Sustainable retrofitting as such is a more recent topic, however many of the actors involved can draw on capabilities and competences from these early transition experiences.

The three local experiments:

Wißgrillgasse, Wien

This project is a sub project of the flagship project "Gründerzeit with future: Innovative Modernisation of Wilhelminian style "Gründerzeit Buildings"⁴

Starting point / motivation: Wilhelminian style or "Gründerzeit" buildings with typically decorated façades represent a considerable part of the total building and housing stock in Austria. These buildings were constructed between 1850 and 1918 and are in poor thermo-technical conditions. Hence, possible savings are huge with regard to a CO₂-neutral building stock. However, with application of usual refurbishment measures (replacement of windows)

⁴ The aim of this project is to modernise these historical buildings in a systematic and holistic way using innovative technical and organisational solutions. This should lead to the substantial improvement of the thermal-energetic quality of future renovation projects and thus make a contribution to attaining a CO₂ neutral building sector.

the energetic performance may be improved slightly. This demonstration project Wißgrillgasse shows how innovative refurbishment of Wilhelminian style buildings can overcome technical, economical, social and legal barriers and achieve a great performance. The demonstration project is part of the flagship project "Gründerzeit mit Zukunft".

Contents and Objectives: An integral modernization of the building was put forward by applying innovative technical and organizational solutions, which assure a modern living standard with high comfort. The building was refurbished energetically and a high efficient attic was developed. Goal of the project was a comprehensive and sustainable system solution, which allows a broad reproduction to further Wilhelminian style buildings.

Methods of treatment: Optimization of thermal quality of the building shell was keen. Therefore, insulation of all exterior building elements were risen up to a very high level in order to reduce energy demand for thermal heat. Due to usage of high efficient insulation materials losses of surface area could be reduced. Special attention was given to insulation of the fire-proof wall, because this wall accounts for 32% of all exterior walls. In order to secure interests of the neighborhood special neighborhood arrangements were made. This was especially important to enable insulation beyond property lines. Exclusively heat insulation triple glazing was used. Thus, transmission heat losses could be kept little. Additionally a central comfort ventilation system and a local incoming and outgoing ventilation system with thermal heat recovery was installed in the top floor. Thus heat losses due to ventilation could be reduced significantly. High noise pollution due to the railway junction was a further reason to install such ventilation systems. Given that Wißgrillgasse is not covered by the supply of district heating the developer decided in favor of a central biomass heating system, which ensures a resource efficient allocation of energy for thermal heat and hot water. Drainage of the cellar was important to maintain the building substance, which proved to be very extensive, but was keen in order to guarantee a dry storage of wood pellets. Additionally 30 m² solar thermal collectors were integrated into the façade and cover a part of the required energy demand for thermal heat and hot water. It has to be highlighted that the development of an attractive living space in the top floor is keen to realize such projects. This project accomplished a development of additional 800 m² useable surface by restructuring the existing building and development of a two-storied top floor in nearly zero energy standard.

Results: Initially the heating demand was 186 kWh/m²a. Due to the application of above mentioned measures the heating demand could be reduced to 28 kWh/m²a, what corresponds to a refurbishment with factor 7 and hence a nearly zero energy building. This demonstrates far better performance compared with conventional new buildings. The building convinces with its high thermal quality and usage of renewable energies but also with its high comfort of living and pleasant architecture. Furthermore success may be proven by the residents, who are highly satisfied with the building and and experts show strong interests in viewings. The high thermal-energetical quality of this demonstration project with innovative technical and organizational solutions shows fair possibilities how the refurbishment of Wilhelminian style buildings could make an important contribution to a CO₂-neutral building sector.

Prospects / Suggestions for future research: In order to draw serious conclusions about the factual performance of the building the project will be subject to a technical energy demand and comfort monitoring within the framework of the flagship project “Gründerzeit mit Zukunft” for a period of two years. Beside energy demands satisfaction of users and economical efficiency will be evaluated. The experiences gained during the construction and accompanying monitoring phase will be incorporated immediately in further development projects of the builder Ulreich Bauträger GmbH and the Gassner & Partner Baumanagement GmbH. In addition, to the in-house usage of gained experiences and use for further demonstration projects within the knowledge about refurbishment of Wilhelminian style buildings will be disseminated by excursions, publications in journals and presentations.

Refurbishment of a housing complex to passive-house standard, Graz - Dieselweg

Starting Point / Motivation: Built in the period from 1950 to 1970, the 204 flats within 4 storey buildings without elevators, were provided with a roomheating based on electricity, oil and coal. At this time the CO₂ emission was 700t/a, and the energy key data was between 142 and 255 kWhh/m²a. GIWOG bought the settlement in the year 2007 with the aim to reduce the energy consumption in big scale and to eliminate the domestic fuel and respirable dust emission.

Contents and Objectives: The solution from GIWOG was a combination from thermal insulation and solar energy production, groundwater heat pump, supported by a pressure less storage technology and heat regaining fresh air supply. The result was the elimination of the harmful substances and a much better air quality to release the inhabitants.

Methods of Treatment: The loss of heat was minimized by a solar façade, covering the houses by glass, wood and a cardboard comb with integrated passive house windows and ventilation canals. Large scale solar collectors and a groundwater heat pump with a pressure less storage tank were installed. The heating line and the hot water feeding were built into the former outside wall (“climate wall”). Also the cellar ceiling and the attic ceiling were insulated. Every living room was supplied with a heat regaining fresh air appliance. Monitoring the heat consumption operating the heat production can be done by the internet. Other important points in the project were the annex for the elevators, the integration of the former balconies in the living room area and first of all the participation of the inhabitants.

Expected Results / Conclusions: GIWOG comes up to a reduction of the thermal energy consumption (old energy key data 142 to 255 kWhh/m²a, new energy key data: from 9,6 to 13,6 kWh/m²a). and the costs for heat- and warm water for more than 90% and reached a high acceptance of the inhabitants.

BIGMODERN - Subproject 8: Demonstration building Amtshaus Bruck

This project is a sub project of the flagship project "BIGMODERN - Sustainable modernization standards for buildings owned by the Federal Republic of Austria from the 1950s to the 1980s"

Starting Point / Motivation: This subproject, as being part of the flagship project BIGMODERN, documents the realized measures of one of the demoprojects (office building Bruck an der Mur). To reach sustainable refurbish-standards in practice, there have to be greater changes in different technologies. Innovative technologies in the context of modernization mean additional efforts in planning and coordination, which is hardly possible in the standard planning process. Changes to the standard planning process and to the technologies used imply risks for the building owner like exploding costs, less savings than planned in operation and susceptibility to failure. To get innovations to reach modernization-standards, these risks have to be minimized. The core element of the flagship project is the implementation of two demonstration projects, which should be modernized especially for the Bundesimmobiliengesellschaft m.b.H. (BIG) according to above-average quality standards concerning energy efficiency and sustainability while complying with an industrial management point of view. This is supposed to raise awareness of the BIG breaking new ground in order to maintain innovative and yet cost-effective renovations. The aim is to set new standards in conventional renovation and to tap into the BIG's full potential with regard to implementation.

Contents and Objectives: The aim of this sub-project is to gather information/experience from pilot projects, to be directly used in the planning and decision-making process of the building owner Bundesimmobiliengesellschaft (BIG) and other building owners. Against this background, the sub-project documents the measures implemented in the demonstration project:

- Demonstration of how far the modernization of a federal office building in high thermal-energetic quality is feasible;
- Starting from the BIG's basic commitment to build the demonstration building to high quality standards, a specification of the quality requirements for energy efficiency and sustainability for the specific modernization projects should be carried out (shown in the outline of BIGMODERN subproject 1);
- Design and monitoring of planning processes in such a way that the required quality standards are not "lost" during the planning process (edited in detail in BIGMODERN subproject 2);
- Based on the "lessons learned" in the demonstration project, a basis for generalizable conclusions and recommendations for further project planning is created as a result of the core BIGMODERN subproject 4

Results: This project represents a first step in the implementation of outstanding energy projects. In upcoming renovations from the ARE/BIG the objectives of BIGMODERN will be further supported and optimized on the basis of experience from the demonstration project. Despite difficulties and challenges the converted project represents a shining example of energetic standards in modernisations. It is not only important to implement the overall control of the integrated planning process, but also to control the commissioning and operation of the plant in the first phase after implementation. It showed that despite very good and integrated planning, weaknesses and errors can occur during the operation of the plants, which remain undetected in the absence of operation-management and therefore the savings targets can be missed. According to BIG's existing leases the type of operation-management is not regulated in

detail. The tenants are generally responsible for the operational management. With new buildings and building control, the tenants are faced with a new challenge. In the future operational management should already be regulated for energy efficient retrofit projects before starting the planning process. When handing over the building to the tenants, the operator should be trained (EVM), so that he can respond to faults in the control and optimize the building from the information provided by energy consumption monitoring.

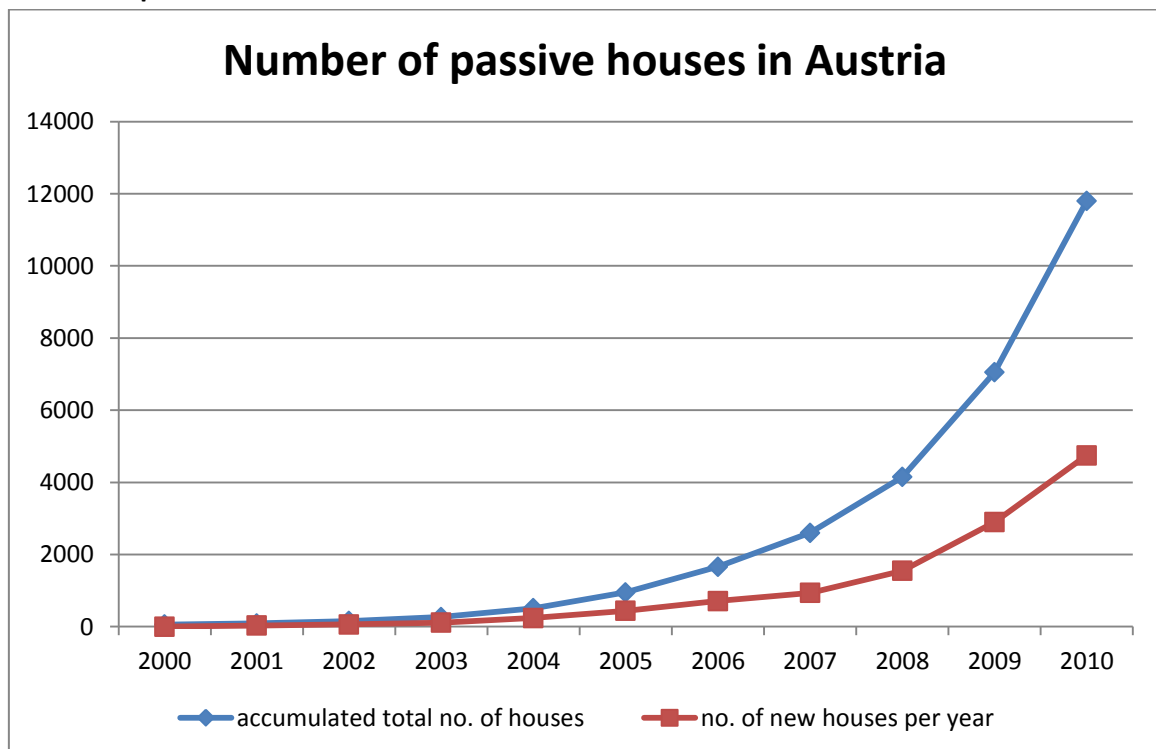
Energy efficient buildings in Austria – a brief success story

Austria plays a leading role in the field of sustainable building. For many years now, with support from the Ministry of Transport, Innovation and Technology (BMVIT) and the Climate and Energy Fund, and as part of focused research programmes (e.g. Building of Tomorrow, New Energy 2020), innovative building designs and technologies have been developed and tested in practical demonstration projects. Several technologies and products have already reached the industrial production stage and been marketed internationally.

This success story has started almost two decades ago: The first passive house in Austria was built in 1996, in 2000 there were already almost 12.000 passive houses, in 2012 every 4th passive house worldwide has been located in Austria (Statistics Austria 2013, BMVIT 2012,). Because of this impressive dynamics Austria accounts for the highest density of passive houses worldwide (BMVIT 2009) (see figure 2).

Figure 1

Growth of passive houses in Austria



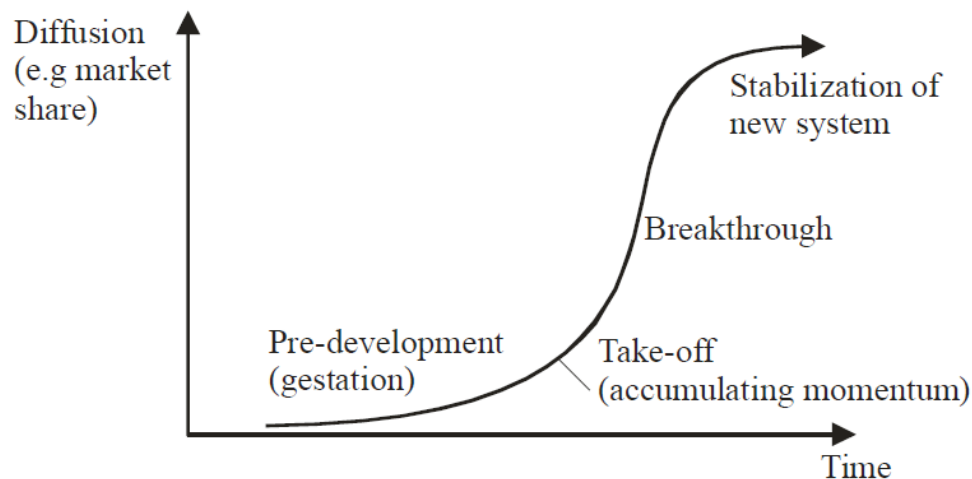
Building on the development of this new local market and its associated technological competences initiatives have been taken up to use knowledge and competences beyond Austria (e.g. “Austrian house” in Whistler, during Olympic Winter Games in Vancouver 2010). Furthermore knowledge and experiences gained in Austria has a significant influence on the European building standards regulation.

4. Characterization of System Transition Stages

System Transitions ideally follow an s-curve type diffusion curve. Even though most of the actual transitions exhibit quite complex dynamics and follow different pathways including setbacks, five stylized phases of a transition can be identified.

Figure 2

Stylized phases in systems innovation and transitions



Source: Rotmans et. al., 2001, from *System innovation: Concepts, dynamics and governance*, DSTI/STP/TIP(2013)3, p.14

What is the actual stage of transition?

- a) Embryonic
- b) Early
- c) Middle
- d) Advanced
- e) Front-runners

Following the ideal type s-curve, we argue that the transition is merely in an early stage. The number of projects in different regions of Austria and concerning buildings of different use types

(housing, office buildings) and the re-construction of buildings originally built from the late 19th century to the 1970ies indicates that the transition has left the embryonic stage already.

However, it remains difficult to classify the actual stage of transition regarding sustainable retrofitting as such, since there are considerable differences between specific projects. However, sustainable retrofitting has not reached middle or advanced stage yet in any field (building type, year of construction, etc.). There are still many barriers with regard to technological, social and the policy dimension existing, which hamper the development towards these more advanced stages.

One major reason for is, that the building sector as such is in a mature phase with established routines, practices, structures and institutions (a regime according to the multi-level perspective of transition studies (Geels, 2002)). Although the energy efficiency of newly erected buildings has already improved considerably over the last decades, nevertheless refurbishment rates in Austria still remain below the target of 3 % respectively 5% (Lebensministerium, 2007). Current refurbishment rates are around 1%, with relatively large variations depending on type of buildings (IIBW, 2013). Whereas the refurbishment rates are generally higher in the field of buildings which were supported by public housing subsidies and are operated by non-profit associations ('Genossenschaften') and apartments built and operated by communities. Among the buildings owned by non-profit associations the refurbishment rates are considerably higher (approximately 3% on the long term) (IIBW, 2013).

Moreover, it is important to consider that these data takes into account all kind of retrofitting activities, whereas sustainable retrofitting as defined in this case study represents only a share of these activities.

More generally, in the field of newly built houses, passives houses are already in a more advanced stage in Austria. Whereas the first passive house was built in 1996, the number of passive houses exceeded 12.000 in 2013 (Statistics Austria 2013, BMVIT 2012,). The transition activities in the field of sustainable retrofitting build upon these experiences to a large extend. However, retrofitting activities are even more challenging as this case study will show.

Nevertheless, retrofitting projects with a high degree of innovation, e.g. including the installation of ventilation system, the use of pre-fabricated facing modules or an intensive use of renewable energies is still relatively low and in almost all cases dependent on specific support by the state (through the programs discussed below).

Policy-makers' perceptions of development and transition

- a) Role of policy-maker perceptions of system development in generating policy rationales
- b) Source of such policy-makers' system analysis in generating policy design

Policy plays a key role for sustainable retrofitting and building. Nevertheless policies from very different policy fields with their specific policy goals are influencing transition activities in the field.

Part of this case study was to analyze to what extent systemic approaches are applied to develop and generate policies in the field. We can conclude that the term „system innovation“ is not a widely understood term. However, underlying characteristics of system innovations are widely shared among policy makers. Generally, it is well understood, that sustainable retrofitting is

- not only an incremental innovation
- not only related to technological challenges
- requires involvement of different stakeholders and policy fields
- requires policy changes beyond innovation/technology policy

However in particular the last point leads to challenges in the policy process, since every policy field usually generates its specific policy rationales. Whereas the policy rationale of innovation policy may be guided by market/system failure logic, the rationale in housing policy may be completely different. Moreover each policy field, frequently represented by a specific ministry or different departments within a ministry follows specific primary policy goals. Thus, the primary policy goal of housing policy is to provide affordable housing space to all groups of the populations. Even though this should be done in the most energy efficient and environmentally friendly way, policy actors in the field will eventually be evaluated against their primary policy goals. A ministry responsible for the environment has to develop its policy interventions with the primary goal to reduce the environment in mind, which is the primary task of the ministry. Another important case is the tenancy law, which primary aim is to provide a legal framework to provide legal certainty and to protect tenants from unfair conditions or agreements. Thus, it was not an explicit aim of the law to support or facilitate (sustainable) retrofitting activities. There are numerous examples beyond these, why the coordination and cooperation of different policy fields, respectively ministries is often a lengthy and challenging process.

System innovations, such as sustainable retrofitting are faced with these coordination challenges, since they require the coordination and cooperation of policy interventions from numerous policy fields. However, as our case study shows, there can be enormous potential to facilitate or trigger system innovations through an intensive cooperation of actors from different policy fields and policy levels (local, regional, national, European).

In addition it is important to take into account national, regional and local differences, since buildings and related policies are usually quite specifically adapted to local circumstances.

The source of policy maker's system analysis is depending on specific policy field and policy rationale of the policy field. Thus, the system as such may be defined differently according to the specific policy field.

5. Identifying Transition Mechanisms and Bottlenecks

What have been key mechanisms in initiating and driving the transitions?

Key drivers (i.e. positive incentives) of the transitions towards sustainable housing are in particular:

- **Climate change and related CO2 emission reduction targets**
CO2 emission reduction targets ("Kyoto" process, EU targets) are a driver of the transition for policy and policy makers as retrofitting offers a very high leverage towards aspired CO2 reduction targets.
- **Local air pollution**
Besides CO2 emissions, the reduction of local air pollutants produced by domestic fuel remains a major issue. In particular the reduction of particles (i.e. particulate matter) to fulfill EU regulations towards air quality is an important driver for retrofitting and sustainable buildings.
- **Urbanisation**
A major driver for innovation and transition activities in the field of sustainable building in Austria is the continuing process of urbanisation. In particular cities with old building stock (i.e. Vienna, Graz, and Linz-Wels) are expected to grow in the upcoming decade dramatically. This process of urbanization leads to an increasing need to create living space while keeping up quality of life in urban areas. Along with this trend goes also a growing need for affordable social housing – here subsidies that are tied to retrofitting and sustainable building requirements are a positive incentive for projects meeting these requirements.
- **Changes in consumer preferences**
Among real estate owners there is a growing awareness of the higher quality of living that retrofitting and sustainable buildings imply (i.e. higher building quality / better ventilation etc.). Accordingly such qualities are increasingly asked for in refurbishing and building projects.

Main barriers (or bottlenecks) of the transitions towards sustainable housing are in particular:

- **Legal barriers**
Tenancy law leads in Austria to split incentive problems, as according to the current law tenants living in the building stock (with long term contracts) would benefit from retrofitting projects but are not obliged to share the costs of such measures. Accordingly landlords often restrain from retrofitting of their real estate as they would need to bear the incurring costs alone.
- **Economic barriers**
Along with legal barriers go economic bottlenecks. First to mention is here a trend towards affordable housing that leads to changes in the legal framework for housing; implying the weakening of needs for sustainable building. Another economic barrier stems from the long

periods for the pay-off of investments while in the mean-time cost savings from retrofitting are for many buildings so marginal that they do not pay-off.

- **Capacity and transparency problems on the supply side**

Due to the growing demand for retrofitting services there is currently a lack of architects, planners and developers beyond an established community that does stem from the early pioneers in the 1990ies. In addition interested house developers and private clients do complain about a lack of transparent information on the supply side. There is a lack a clear of signals for quality and experience that does prevent potential project owners from choosing a sustainable building solution.

- **Lack of necessary changes in the values, beliefs and norms of developers and private clients**

Albeit sustainable buildings have gained popularity in the last decade (also due to publicly funded demonstration projects) there ist still a need of change in the values, beliefs and norms in order to bring fourth new patters of planned behavior in favor of retrofitting and new sustainable houses.

In Austria there are several key actors and key actor constellations driving the process of transition. These are in particular:

- **Strong bottom up initiatives both for outer shells and building equipment and appliances**

Since the beginning of the early 1990ies pioneers in Austria's regions played a key role in kicking-off research and development and pilot activities for sustainable buildings. In particular in the provinces of Styria, Vorarlberg and Tirol there have been forming strong bottom-up initiatives that brought fourth innovative technological solutions that were then tested and applied of regional markets. These pioneers do also form the core of a community that is active in HdZ programmes.

- **National Level Policy**

At national level incentives have been set for the development of local experiments through joint actions of different ministries. Key actors are here: Ministry of Transport, Innovation and Technology, Ministry of Agriculture, Forestry, Environment and Water Management ("Ministerium für ein lebenswertes Österreich"), and the Austrian Climate and Energy Fund (KliEn) (as actor with coordination function). The administration of grants and subsidies is mainly coordinated and managed by the Austrian Research Promotion Fund (FFG).

- **Regional and local Level Policy**

Key actors at regional level are the Provincial governments of Vorarlberg, Tirol, Kärnten, Salzburg, Steiermark, Oberösterreich, Niederösterreich, Burgenland, and Wien. Here several governmental departments deal with retrofitting and sustainable building. Comptences are here often fragmented accordingly. Provincial governments do also coordinate their actions to some extent actively with the national level (this holds particularly true for policy measures in the domain of climate and environmental policy). Local level policy is designed and implemented by urban administrations of the large and medium sized Austrian cities.

6. Describing related Policy Agendas and Measures

The basic motive for the OECD Systems Innovation project and the compilation of this case study is to understand how innovation policy can influence Systems innovation. Therefore this section includes influential policies for the development of sustainable retrofitting activities in different sectors in Austria.

Referring to the analytical framework suggested by the expert group working on System Innovation (see the figure below) three levels of policy agenda and measures can be distinguished. Typically policy makers located in ministries are responsible for the general development of policy portfolios, the definition of programme rationales and the monitoring. Programme management frequently takes place in agencies, which are responsible for the management and administration of policy programmes.

Figure 3
Policy, program and project management



Source: Arnold and Boekholt, 2003:11, from *System innovation: Concepts, dynamics and governance*, DSTI/STP/TIP(2013)3, p.30

With regard to sustainable retrofitting in Austria, this principal division of labor holds true with the Ministry for Transport, Innovation and Technology (BMVIT) being responsible for the most relevant innovation policy programme ('Building of the future') supporting innovation activities with regard to sustainable retrofitting. The Austrian Research Promotion Agency (FFG) is responsible for the administration of the programmes. In addition to this innovation policy oriented initiatives, another programme (klima:aktiv) owned by the Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) represents a more diffusion

oriented policy action. Similar to 'Building of the future', the programme's administration is under the responsibility of actors outside the ministry (Austrian Society for Environment and Technology – ÖGUT and the Austrian Energy Agency).

Another actor, reported in the interviews, as being important is the Austrian Climate and Energy Funds ('Klima- und Energiefonds – KliEn'). On the one hand it provides funding for innovation and transition activities and on the other hand it contributes to the coordination of the two ministries involved (BMVIT & BMLFUW).

In addition to these two influential policy programmes a series of other policies and legal framework conditions do influence the innovation and transition activities in the field. These are discussed where appropriate (drivers, barriers, policy and future policy perspectives below , etc.).

Which policy agendas and measures have been important?

In the following the two influential policy programmes aiming to support sustainable retrofitting activities in Austria will be discussed: 'House of the future' and 'klima:aktiv'. Both programmes cover innovation and transition activities to improve the energy efficient and sustainability of buildings, either newly built or through refurbishment. Since the policy initiatives regarding refurbishment cannot be understood without analyzing the emergence and development of this programmes as such, a short discussion about the origins and rationales of the two policies will follow.

Against the background of the emerging topic of sustainability (Rio conference, Brundtland report) on the global level, discussions between different Austrian ministries emerged if and how new technologies could contribute to a more sustainable development. Thus a process called Austrian Program on Technologies for Sustainable Development (at:sd) was set up. Within this process several focus groups were formed to create visions of a sustainable future for Austria. In these discussion the idea, that something should be done to promote research and development with regard to innovative technologies potentially contributing to a more sustainable society. From the at:sd process different focus groups were set up with relevance for the built environment (Solar energy, bio energy, building & living, regional development). Additionally to these focus groups several studies (surveys, Delphi, studies, etc.) were drafted to come up with recommendations.

Eventually an initiative called "Nachhaltig Wirtschaften" (which can be translated roughly with sustainability and economy) was set up by the Ministry for Transport, Innovation and Technology (BMVIT). This initiative started in the year 1999 with the program "Building of the Future" ("Haus der Zukunft").

However activities and initiatives already starting a decade earlier played an important role for the setup of the "Building of the Future" program.

Already in the late 1980s/early 1990s different concepts of low energy houses, solar houses and passive houses were developed and discussed, in particular in Southern Germany. In 1996 the

first Austrian passive house was built in the province of Vorarlberg (the most western province of Austria bordering Germany and Switzerland). In the following years numerous activities concerning passive houses took place in Vorarlberg, facilitated by the Energy Institute Vorarlberg (Energieinstitut Vorarlberg, EIV). The EIV played a key role for the knowledge transfer from Germany and served as a platform for communication, cooperation and learning (BMVIT, 2007).

In 1997 the Upper Austrian Energy Utility company Energie AG OÖ presented a so called Building/house of the future at a trade fair. This project caught the attention of the responsible persons in the ministry of transport, innovation and technology, since it demonstrated the technological feasibility of passive houses. The house was described as being very futuristic, including many smart home applications and automated functions. Since it was designed as a technology demonstrator many components and systems of the house were overdesigned. Moreover many technologies were used in parallel (heat pumps, photovoltaics, etc), where probably one technology would have met the needs of the potential users of such a house. Altogether the construction of such a house, slightly larger than a single family house was estimated to cost around 8 mio ATS (appr. 580.000 EUR) without the land it was built on, which was considered far too high at the time. Thus, the house demonstrated that passive house were technically feasible, however costs were far too high. In addition to this influential technology demonstrator, the EIV in Vorarlberg was involved in an EU project CEPHEUS (Cost Efficient Passive Houses as European Standards) which stimulated the erection of several demonstration projects across Austria.

At the time these activities (Vorarlberg, CEPHEUS project, and the technology demonstrator in Upper Austria) coincided and it was decided to setup a research, technology and innovation program in the area of the “building of the future”⁵.

The topic of passive houses and the building of the future in a broader sense was chosen as one focus in the Nachhaltig Wirtschaften initiative, on the one hand due to the need to improve the energy efficiency in the housing sector against the background of the sustainability challenge. On the other hand the field was considered since there were already some activities going on and some kind of community established in Austria. Furthermore the field was considered to be suitable to set up a program since a house consists of many components. Thus it was possible to start activities here and bring actors together in cooperative research projects, without the issue of competition between them.

The “Building of the Future” program shared its general aims with the other two programs of the “Nachhaltig Wirtschaften” initiative, factory of the future and energy systems of the future. These programs followed the principle of a “double dividend” (Doppeldividende), which means that they should generate an economic and a societal benefit at the same time. On the one hand the program should support innovation activities which would lead to new competences which eventually contribute to the competitiveness of the Austrian economy (economic benefit). On

⁵ The name of the program „Haus der Zukunft“ in German was inspired by the name of the house presented at the gardening fair in Upper Austria. Nevertheless the official English translation is “building of the future”, however in German almost every building is referred to as a house.

the other hand the program should stimulate research and development activities which would enable the long term quality of life for the current and future generations (sustainability benefit).

On a more concrete level the program's aim was primarily to support the development of energy efficient and sustainable buildings. The main issue identified was the high costs, which had to be reduced in order to be able to diffuse innovations like passive houses. The key concepts, technologies and innovations integrated in the design of the "Building of the Future" program are shown by Figure 4. When the program was developed, already existing activities and concepts like solar low energy houses, passive houses and ecological building materials were integrated in the program. Thus it provided an additional incentive for the actors to integrate their findings and concepts.

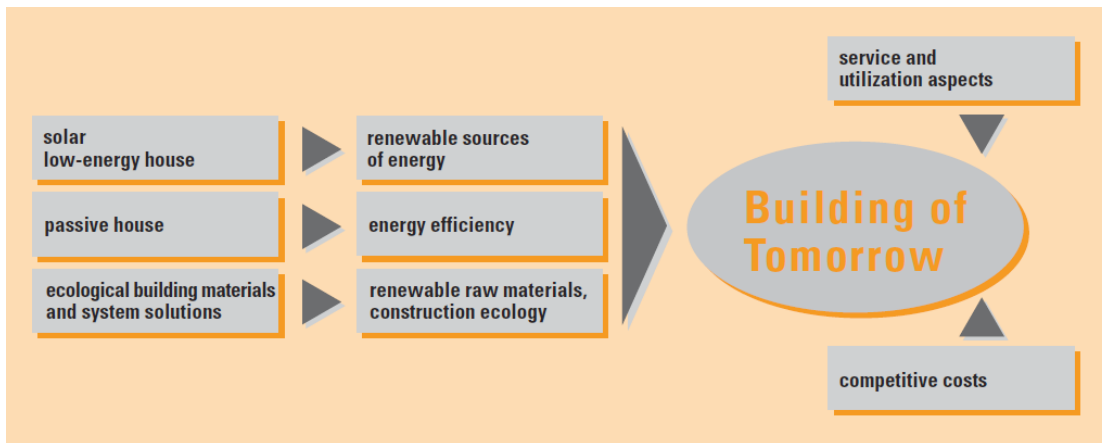


Figure 4: Overview, Building of tomorrow program, source: BMVIT (2009)

Key aims of the programs were to take into account service and utilization aspects (usability and comfort) and in particular the reduction of the costs to the same level or slightly above the level of conventional buildings.

Concerning the design of the instruments of the program it followed a rather linear model, as presented in Figure .

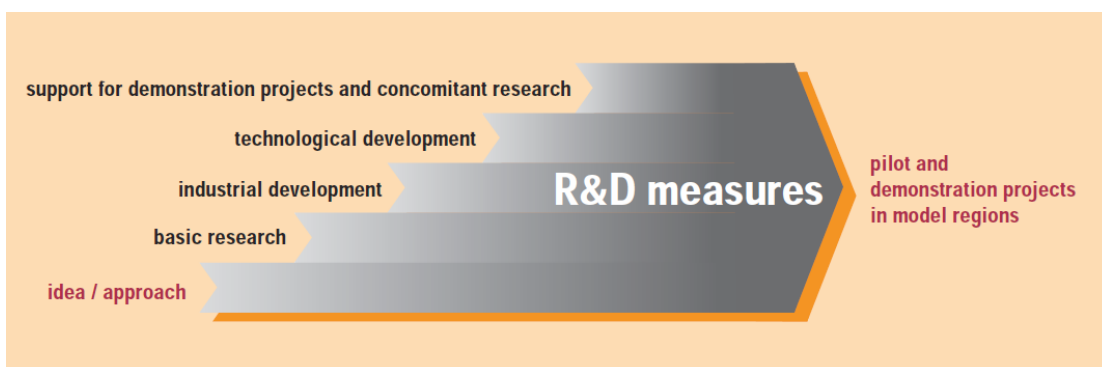


Figure 5: Policy design, Building of tomorrow program, source: BMVIT (2009)

In the first years the calls of the program focused on basic research, including social sciences followed by more applied research, usually technology development and the development of components. Subsequently pilot projects should be realized, pathing the way for real life demonstration projects. To facilitate the diffusion of the technology, other activities like education and training were planned. Although this conceptual background follows a linear model, it was handled more flexible, for instance in the case of ventilation systems. As soon it became clear that these systems would be ready for a broader market introduction, education and training programs for technical experts and plumbers were initiated and supported.

Whereas the first calls in the “Building of the Future” program were aimed at new buildings, from 2002 calls started to focus stronger on the retrofitting of existing buildings to passive house standards. During the third call launches in 2002, project proposals aiming for the development of retrofitting existing buildings represented already 22% of the overall project proposals (Hdz Homepage <http://www.hausderzukunft.at/statistik/statistik3.htm>).

The follow up programme ‘Building of the Future plus’ builds upon the experiences of the first program and has the long term vision of a ‘building of the future’ which does not produce any greenhouse gas emissions of its life cycle.

In order to realize this vision the program aims to create the technological prerequisites to construct and operate buildings, which do not consume but produce energy. Besides this ‘plus energy house’ the two other foci of the program are office buildings and refurbishment of existing buildings. Besides the support for research and development activities, networking activities, increasing international cooperation and technology transfer are aims of the program. Furthermore the program supports the development of training and education activities and the integration of existing state of the art know how in the curricula of these education and training activities (<http://www.hausderzukunft.at/about/index.htm>).

In addition to the “Building of the Future” initiative which was led by the BMVIT, another influential program “klima:aktiv” (climate:active) was launched in 2004 by the Federal Ministry of Agriculture, Forestry, Environment and Water Management (Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, BMLFUW)”. This initiative aims at the “market introduction and rapid diffusion of climate friendly technologies and services” (AEA/BMLFUW 2011). klima:aktiv is a broad initiative covering the areas of energy savings, renewable energies, mobility and building and renovation with specific subprograms. In the following this case study will focus on the building and retrofitting aspects within this initiative.



Figure 6: Policy design, klima:aktiv program: AEA/BMLFUW (2011), simplified by the authors

Figure provides an overview of the program goals, the thematic fields and even more interestingly the design of the program. Every subprogram was supposed to address all five “leverages for change” or dimensions of change as they are labeled in the figure. These are “Activating Partners & Networking”, “Vocational and further education”, “Orientation and Quality Assurance”, “Information & Raising Awareness” and “Consultation & Support for Implementation”. Although there have been different foci in the different subprograms and changes over time, the principal idea was that all of these dimensions should be addressed simultaneously. Thus, the subprogramme building & renovation was following this logic as well.

When klima:aktiv was set up it was designed to supplement the “Building of the Future” program by the BMVIT. Although there have been some tensions concerning the ownership and the task sharing over time, this was greatly enabled by an intensive cooperation at the personal level between the policy actors responsible in the both ministries involved (BMVIT and BMLFUW).

One of the key aspects of the klima:aktiv buildings and retrofitting subprogram was the development and establishment of a passive house standards. Thus in doing so the klima:aktiv program was developing a dedicated building standard which was based on previous research and development activities financed by the “Building of the Future” program.

Which governance structures and mechanisms have characterized the development?

The governance structures in the case of sustainable retrofitting are complex located at different geographical levels. There are differences in the governance of the innovation policy programs, the more diffusion and climate policy oriented programs and the general building regulations and housing subsidies at the provincial level. Governance with regard to the more general tenancy law are again a different logic, than innovation or climate policy.

However, referring to the distinction by De Bruijn et. al. (1993), see the table below, the governance structures fit relatively well with the ideal type of policy networks. Due to the complex interactions of several policy fields at the different regional levels the governance structures are characterized best by the ideal type of policy networks.

Figure 7

Different Policy Paradigms

	Classic steering paradigm (top-down, command-and-control)	Market model (bottom up)	Policy networks (processes and networks)
Level of analysis	Relationship is between principal and agent	Relationship is between principal and local actors	Network of actors
Perspective	Centralized, hierarchical organization	Local actors	Interactions between actors
Characterization of relationships	Hierarchical	Autonomous	Mutually dependent
Characterization of interaction processes	Neutral implementation of formulated goals	Self-organization on the basis of autonomous decisions	Interaction processes in which information and resources are exchanged
Foundation scientific disciplines	Classic political science	Neo-classical economy	Sociology, innovation studies, neo-institutional political science
Governance instruments	Formal rules, regulations and laws	Financial incentives (subsidies, taxes)	Learning processes, network management through seminars and strategic conferences, experiments, vision building at scenario workshops, public debates

Source: De Bruijn et. al., 1993:22, from *System innovation: Concepts, dynamics and governance*, DSTI/STP/TIP(2013)3, p.24

Even though there are elements of a classic steering paradigm and the market model, most policy processes explicitly take into account learning processes or network management, rather than direct steering. The classical steering paradigms appears to be insufficient for the case of sustainable retrofitting since no policy actor or ministry as such has the legitimation and power to intervene in all relevant policy fields. Moreover some policy instruments in the governance of

the transition follow a market model, in particular the financial incentives provided to facilitate or enable sustainable retrofitting activities.

a) Policy organization – Horizontal and Vertical organization?

On a horizontal level, there are various policy fields involved, from RTI policy, climate policy to energy policy or social policy. Of particular relevance are the two national policy programs 'Building of the future' and 'klima:aktiv' presented above. Even though the programs are managed by two different ministries (BMVIT & BMLFUW) their coordination works relatively well on the operational level. Although the boundaries between the responsibility and legitimation of the two programs at the national level are sometimes blurry, coordination was reported to work quite well on the operational level.

The coordination with social policy, respectively housing subsidy policy works relatively well, however depending on the specific province. Whereas some provinces are rather fast in taking up new technological opportunities in their housing policies, other are less ambitious or put more emphasis on other issues in housing policy (initial costs, accessibility – barrier-free buildings). Thus the coordination of innovation policy and the influential policies at the provincial level require (housing subsidies and building standards) requires horizontal and vertical organization at the same time.

Although the coordination of policies works relatively well between innovation, climate and social housing policy on the operational level, there are a number of barriers hampering the development. As mentioned in our discussion on barriers, current tenancy law acts as a barrier in certain segments of the housing sector, however coordination remains weak. A major reason for coordination problems are the different logics of policy fields. Every policy actor, respectively ministry has its specific policy goals, legitimation and logic.

Within the BMVIT, policy actors involved in RTI policy usually have a mid-term to long-term innovation perspective supporting primarily research and innovation activities whereas widespread diffusion support is not a policy goal. The BMFLUW, responsible for environmental and climate policy on the other hand gains its primary legitimation from the expected environmental benefits of its interventions. Thus policy actors are primarily interested to achieve an actual impact in terms of environmental benefit. The ministry for the economy again follows the rationality to stimulate the economy to create added value and jobs. The primary aim of policy actors from the field of social housing is to make sure affordable housing is available to as many societal groups as possible.

Due to these different rationalities in the ministries coordination activities are inherently challenging. From the perspective of our case study it is important to understand, that coordination efforts are often very demanding since so many policy fields with different rationalities are necessary to stimulate and enable a system innovation.

The important task is to achieve such policy coordination, even though there are inherent challenges in the horizontal coordination of policies. Despite these differences very broad approaches, offering space for the formation of networks for policy actors and stakeholders promise to help to overcome these coordination challenges. Our case study shows that the coordination of policies (for instance between RTI, climate policy and social housing policy) bears great potential to stimulate a transition towards more sustainability in the building sector.

To summarize, the interaction of a RTI policy program, a more diffusion oriented program and in particular the coordination with the housing subsidy policies at the province level can be considered as success factors. Although diffusion rates (see stage of transition above) are still relatively low, these policy programs enabled the emergence of a community around sustainable retrofitting, respectively energy efficient buildings in general. Even though the organization of the housing subsidies at the province level has raised a lot of critique in recent years, this situation facilitated the diffusion of innovations from the RTI policy programs in the housing subsidy schemes at the province level. Experts involved in the interviews hypothesized frequently that it would have been more challenging to introduce findings and energy efficiency norms from RTI policy programs into national law rather than at the province level, since the province level provided space for experimentation. Thus, the introduction of new regulations in one province frequently led to the diffusion of this or an even more ambitious policy change in another province. Some experts were speaking of a positive competition between the provinces.

7. Analyzing the role of Policy and Policy Measures

Policy Analysis

How have policy agendas, governance and measures impacted transitions and structures?

The process of transition in Austria has been driven by a complex interplay of top-down and bottom-up initiatives. For the case of sustainable buildings / retrofitting of building stock there exists a multitude of geographical levels for governance with a complex policy mix in place at different governance levels that has brought forth a very favorable environment for innovation acceleration in a bottom-up and top-down mode:

- **EU-Level:** Here in particular the Energy Performance of Buildings Directive (Directive 2010/31/EU) is providing a strong motivation for transitions: This EU directive adopted in 2010 on the energy performance of buildings prescribes nearly zero-energy buildings as the standard across the EU. The new directive stipulates that from 2020 onward only nearly zero-energy buildings may be erected, with very high overall energy efficiency and needing very little energy for heating, hot water, ventilation and cooling. In the case of new administration buildings the rules apply even earlier, from 2019 onward. Minimum standards for calculating overall energy efficiency are to apply throughout the EU. These buildings' extremely low energy consumption is to be covered by renewable sources of

energy, if possible from the region in question. In future the same requirements will also apply to major renovations (involving more than 25 % of the building envelope).

- National Level is providing a technology push approach with specifically targeted programmes such as “Haus der Zukunft” (for details see section above). This funding has led to a substantial number of successful local experiments and demonstrator projects. In addition recent programmes such as Smart City Demo and “Stadt der Zukunft” (i.e. City of the Future) are offering incentives for upscaling and roll-out of successful local solutions. These approaches are complemented by specific soft measures being mainly implemented in the framework of the klima:aktiv Initiative in cooperation with the nine Austrian Provinces. These soft measures comprise awareness raising, training of professionals and voluntary standards for sustainable building.
- Regions (i.e. provinces) have set on the one hand framework conditions for the uptake of national funding opportunities (i.e. local experiments) On the other hand the wider use of new technological solutions has been fostered by establishing regulations and providing subsidies and accompanying soft measures (i.e. training). Incentives for private investors have been set by the integration of retrofitting and sustainable building in general housing subsidy programmes (“Wohnbauförderung”). Thus at regional level specifically tailored policy mixes comprising building regulations, residential building subsidies and soft measures but to some extent also funding for innovation and research and development projects have been in place to support bottom-up initiatives. To a large extent regional policy coordination is done by provincial climate change strategies and corresponding action plans.
- City Level: Here on the one hand municipal building regulations (regulating building density and allowed height of rooftops) and land use planning do form relevant regulatory frameworks for sustainable buildings and retrofitting of existing building stock; on the other hand smart city strategies and development of whole quarters in large urban agglomerations / regions in urban hinterland do offer space for local experiments and bottom-up initiatives such as
 - Seestadt Aspern in Vienna
 - Smart Future Graz
 - I energy Region Weiz-Gleisdorf

These initiatives are mainly funded by means of national programmes (in particular Smart city Demo and “Stadt der Zukunft”).

Thus it may be concluded that the role of national innovation policy has to be understood in close top-down and bottom-up interaction with regulations and residential building subsidies at regional level. Regional policies are thereby developed in the framework of close interaction of various departments of the provincial government. Interaction and coordination takes mainly place in the domain of environmental/climate policy.

National policies are developed from different ministries according to their rationality; while Environmental/climate policy: focused on CO₂ reduction, innovation policy focusses on different technologies; it is in a sense “technology-neutral”, aiming at improvement of competitiveness of

relevant industries. Regional policies are developed in the framework of close interaction of various departments. Regional innovation policy is focused in most Austrian regions at the development of clusters and innovation networks.

Impact Analysis

Policy impacts are currently mainly captured by interim- and ex-post evaluations at national level. This holds mainly true for those policy measures that do aim at research & development and innovation but also initiatives in the domain of environmental policy such as klima:aktiv have been subject to external evaluation studies.

Currently national and regional environmental policy but also and urban policy is informed by indicators that are focused on physical stocks. Key indicator for the impact of existing measures for sustainable buildings is here the retrofitting rate among existing building stock. As this indicator does provide for the time being only unsatisfactory results (i.e. low adoption rates of private clients are seen as major obstacle), a demand for further indicators reflecting the road to transition is uttered by relevant policy actors and stakeholders. In particular indicators are missing that do address the change in attitudes of developers and private clients.

Innovation policy is relying on generic indicators systems aiming at economic effects. Here the medium to long term improvement of competitiveness of Austrian enterprises is in focus. Here in addition to regular programme evaluations also a monitoring of funded projects is being performed by the responsible funding agencies.

Thus it can be concluded that different “rationalities” of indicators in the policy mix for sustainable building make guidance for policy a complex task. This task is made even more complicated by the fact that in addition to relevant policy domains such as innovation policy, environmental / climate policy and urban policy also different geographical levels of policy implementation do also lead different levels for indicator collection with complex interaction between different levels and associated attribution problems.

In addition to impact related indicators in Austria also a second forum for discussions could be spotted among stakeholders. In particular architects, developers, planners, bottom up platforms and initiatives are expressing a growing demand for more quality control and monitoring. Here a need for indicators that do measure real life performance, user satisfaction, etc. is being formulated. Such indicators could according to stakeholders also provide opportunities for learning and knowledge sharing and give legitimation for up-scaling of local experiments.

Future policy perspectives

Which policy agendas and measures would be important in the future?

Removing legal barriers for change

As described above tenancy law leads in Austria to split incentive problems, as according to the current law tenants living in the building stock (with long term contracts) would benefit from

retrofitting projects but are not obliged to share the costs of such measures. Accordingly landlords often restrain from retrofitting of their real estate as they would need to bear the incurring costs alone. Thus efforts should be undertaken at national policy level to overcome this major obstacle for large scale roll-out of retrofitting among the existing building stock.

Reforming the complex system for residential building subsidies

The system of residential building subsidies is in Austria currently spreading across two geographical governance levels (i.e. the national and the provincial level). Accordingly there exist plenty of overlaps and inconsistency in the regulations between the different levels. Private clients are often so confused by the existing complexity that they restrain from a initially planned retrofitting project. Thus a streamlining of the existing framework concentrating the administration of building subsidies at provincial level could reduce this complexity significantly.

Provision of transparent information on the supply side for developers and private clients

Currently there is in Austria a lack of information on the supply side for solutions and services; interested house developers and private clients do complain about a lack of transparent information on the supply side. Beyond a small community of pioneers that is overbooked with requests for services there is no information available about further actors on the supply side. On the one hand there is no such thing as certification process for professionals offering products and services in the domain of sustainable houses, on the other hand potential clients do have problems to find relevant partners for their project as there is no registry of enterprises in place to inform about relevant offers for private clients and developers.

Need for knowledge exchange and training

In order to spread existing knowledge beyond the community of pioneers public support to measures are needed that do foster the exchange of knowledge between practitioners and training for professionals that do want to offer in the future products and services related to retrofitting and sustainable buildings. For the time being such measures are to some degree organized in shape of local bottom-up initiatives but do lack coordination and necessary size in order to bring forth significant impact.

Further Development of standards and their implementation

Especially related to the retrofitting of existing building stock there is a need for further development of standards. Although there do exist already initiatives for shared standards (e.g. klima:aktiv) there is a strong necessity to adopt those standards to the heterogeneity of the building stock and to set steps for the implementation and further diffusion of already developed standards.

Quality management and control

There is a clear of signals for quality and experience that does prevent potential project owners from choosing a sustainable building solution. In general there is currently an indicator system missing that is able to measure real life performance and user satisfaction. The design and

implementation of measures for quality management and control could thus contribute strongly to a faster uptake of retrofitting solutions by private clients and developers.

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