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Sustainable reading
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50 MILLION BY 2030

The heat transition: making it work

Transforming social norms Interview with Daniel Fuhrhop

Room wanted, for a while



Jan Peter Schemmel
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I wish our apartment had a spare room. Just one. Now that the children are a bit older, it would be nice for them to have a space of their own. We would only need it for a few years, just until they leave home. After that, I would happily hand it back – my wife and I wouldn't use it.

That's not how it works, I hear you say. But that's how it should work, don't you think? We have very fixed ideas about our living arrangements, and that limits our scope. So you need a bigger apartment? Then you'll have to move! But once the children fly the nest, it will be time to move again, or you'll find yourself occupying a space that is far too big and costs far too much to heat. So why not make smarter use of our living space? One option is to divide off some areas of our overly large apartments and houses and create self-contained housing units that are suitable for renting out. An alternative is to design new housing that is flexible from the outset and can be adapted to different stages of life and space requirements.

The heat transition has been on hold for far too long. We need to take urgent action if we are to close the ever-widening emissions gap in the building sector. When it comes to identifying effective mechanisms, there is no shortage of suggestions: a substantial increase in the refurbishment rate, use of heat pumps, the phase-out of fossil fuels, and more efficient use of existing living space, to mention just a few.

But that's not all: ambitious efficiency standards for new buildings are also required, because how we build today will determine whether we reach our goal of climate neutrality in 2050. We already have the technology to build houses that produce more energy than they consume. In fact, smart building is not a recent innovation: when it comes to cooling, there is a lot we can learn from traditional architecture in the world's warmest countries. It offers plenty of helpful hints for cool living – from the choice of building material and the colour of the exterior to the careful configuration of space, installation of air vents and optimum positioning of windows.

There is no shortage of ideas, in other words. And if you do happen to have a spare room or two, maybe you'll find someone who is the perfect match for the space.

Yours,
Jan Peter Schemmel

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LIVING SPACE IS A RESOURCE

Ban construction! The title says it all: in 2015, Daniel Fuhrhop published an impassioned polemic against new builds. Presenting his case from an economist's perspective, he argues that the demand for housing can be met through smart use of the existing building stock. Daniel Fuhrhop is now based at the Carl von Ossietzky University of Oldenburg, where he is working on a research project on optimised use of living space and new housing models. In this interview with *eco@work*, the former publisher talks about living space trends and strategies for space-saving living. And, of course, he explains why he is convinced that new construction, in most cases, is no longer needed.

Daniel Fuhrhop, what is the general living space trend in Germany?

Living space is expanding overall because the number of new housing units being built is consistently higher than is necessary to cover population growth. Between 1993 and 2018, Germany's total dwelling stock increased from 35 to 42 million units, while the population grew by just two million over the same period. Of course, there are various factors at play, such as smaller households and increased demand in booming cities. But that does not justify this kind of growth. In many regions, we are seeing more construction than is rational.

Why should we reduce the number of new builds?

Because living space is an important resource and from both a climate and an energy perspective, we should not use it wastefully. The construction and operation of buildings account for around 40 per cent of greenhouse gas emissions. Energy efficiency alone will not be enough to bring about the heat

transition. A trend that we can observe in Germany is that many senior citizens live in apartments and houses which have grown too large for them, perhaps because their children have moved out. With our ageing society, the problem is getting worse. However, some senior citizens do not want to live alone.

Where is there scope to make better use of living space?

It is important to produce an inventory of vacant properties – we think there are around two million at present – and regenerate them. But as I see it, one of the main priorities for space-saving living is to consider and facilitate the diversity of housing preferences and lifestyles. This must include providing support for people who would like to live in a smaller space and offering them a range of options. This can include moving into a smaller apartment, or converting existing housing into self-contained units, but it could also include sub-letting or communal living arrangements. There are many excellent models that have been tried and tested.

You are currently working intensively on a model at the University of Oldenburg.

Yes, that's correct. It's called "Living for Help". For example, a student could move in with a widowed pensioner on the basis of an agreement that instead of paying rent, he will assist with household chores – doing laundry, mowing the lawn, repainting the garden fence, and so on. We need agencies that can connect people.

How much potential does the model offer?

If we look at the organisations that are performing best, we see that the number of matches is very high. For ex-

ample, there is a small Wallonian organisation that matches homeshare pairs in and around Brussels. In 2019, there were 330 new homeshares like this in Brussels and a further 120 in smaller towns in the region. If this success rate could be replicated in Germany in proportion to its population size, we would achieve more than 7,000 new homeshare pairs annually. Unfortunately, we are a long way off unlocking the available potential here.

Who should be responsible for promoting these models?

Basically, it is a matter for government and administration at the federal, state and municipal levels. Thus far, the public authorities have tended to view housing purely as a social issue. It is time to raise awareness and focus attention on the massive climate impact of living space. But that will require coherent and strategic action – an integrated programme, in other words.

Thank you for talking to *eco@work*.

The interviewer was Christiane Weihe.



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Policy instruments for the heat transition

The present situation cannot continue: the building sector is heading for a substantial emissions gap. Under the Federal Climate Change Act (Bundes-Klimaschutzgesetz), this sector is required to cut its annual greenhouse gas emissions to 70 million tonnes of CO₂ equivalent (CO₂e) by 2030 – a 67 per cent reduction compared with the 1990 level. With the current package of measures, however, this target will be missed: a study led by the Oeko-Institut predicts a gap of almost 17 million tonnes of CO₂e unless remedial action is taken. Experts from the Oeko-Institut's Energy and Climate Division have already produced a number of studies showing where we stand with the heat transition and which instruments would still enable an almost climate-neutral building stock to be achieved.



A LARGE AND CUMBERSOME

SHIP

“The heat sector is like a very large, cumbersome ship,” says Dr Veit Bürger, Deputy Head of the Oeko-Institut’s Energy and Climate Division in Freiburg. “To stop it running aground, you have to pull the rudder around early enough to give the ship time to change course.” For this Oeko-Institut scientist, that means taking action as soon as possible and certainly no later than the next legislative term, which starts in autumn 2021. “The gap, in terms of the climate target, is simply too wide.” Then there are the very long investment cycles in the building sector, with major refurbishments such as re-roofing or renovation of exteriors only carried out every few decades. “Added to that, there is a shortage of qualified craftspeople,” says Dr Bürger. “It’s another problem for which there is no quick fix: it takes several years of training to acquire these skills.”



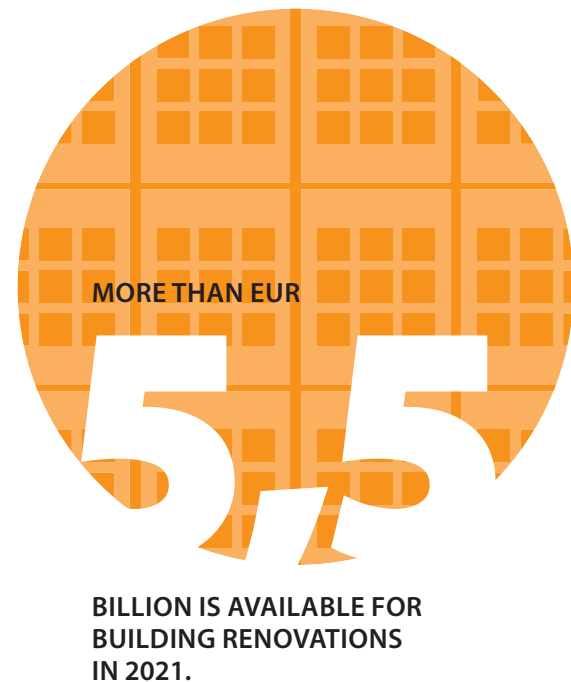
But why has not enough been done in the building sector, given that heating and hot water account for more than 80 per cent of private households’ energy demand? Installing thermal insulation could reduce the heat demand of unrenovated properties by as much as 80 per cent. And the need for refurbishment is substantial: around 50 per cent of all detached and semi-detached houses have uninsulated exterior walls, and where insulation has been fitted, it often does not meet the required standard.

There are many reasons why progress on upgrading is slow, as Veit Bürger explains. “The energy transition has mainly focused on the electricity sector; this has been the case for some time, partly because transforming this sector is more straightforward and fewer decision-makers are involved. But in the building sector, we have more than 15 million property owners who have to be persuaded and motivated.” However, the coal phase-out, among other things, has increased the pressure to take action in the heat production sector. “When coal-fired power stations go offline, many heat and power cogeneration plants will be shut down as well. A substitute will have to be found for the heat that they currently produce, which is supplied to customers via district heating networks.”

IMPERATIVES, INCENTIVES, INFORMATION

An array of instruments, large- and small-scale, broad-based and specialised, can be used to progress the heat transition. “In essence, three elements come into play – incentives, imperatives and information,” says Veit Bürger. “We now have some good funding programmes and information campaigns, for example.” This year, the German government is providing more than 5.5 billion euros for renovation of buildings. The funding will go towards external wall insulation, window upgrading and the installation of new heating systems. “But even more financial support will be required in future.” The funding criteria will need to be adapted at the same time in order to create better incentives for more ambitious efficiency standards. For example, the government is still promoting the Efficiency House 100 model, the reference property which broadly corresponds to the current standard for new builds under the Buildings Energy Act (Gebäudeenergiegesetz). “But if we want to achieve the climate targets in the building sector, we will need to adopt the more efficient 40, 55 or 70 standards, meaning that a building will then utilise only 40, 55 or 70 per cent of the primary energy required by a similar reference property,” the Oeko-Institut expert explains. “The point is that most

of the buildings that we live and work in today will still be standing in 2050. So we will only achieve the building sector’s climate targets if we build to rigorous standards and renovate our existing building stock with a high level of ambition today.”



Funding programmes can also play an important role if more stringent regulations are introduced, ensuring that all property owners who are obliged to carry out renovations have access to the required finance. “Far more action needs to be taken in the context of regulatory law, with triggers that get owners to start upgrading. For example, one option is to prohibit highly inefficient buildings from being rented out to new tenants after a certain cutoff point. Another is to require new owners who have purchased or inherited a property to upgrade it to a prescribed efficiency standard within a specific timeframe,” says Veit Bürger. “And an important point: in order to achieve an increasingly ambitious level of efficiency, the regulations must become more stringent over time.” A requirement to install solar panels on new builds and when re-roofing existing properties, already introduced in Hamburg and Baden-Württemberg, would also be beneficial, he says. “We urgently need these spaces for energy generation.”

Furthermore, since the start of 2021, greenhouse gas emissions from heating have been subject to carbon pricing; the starting price is 25 euros per tonne, rising to 55 euros in 2025. In the Oeko-Institut's view, this mechanism needs to be developed further: "It is important to have a progressive increase in the price of CO₂ and a simultaneous reduction in the price of electricity," says Veit Bürger. The latter is necessary, he says, in order to increase the incentives for homeowners to install heat pumps – one of the key technologies in the heat transition. "The Heating Cost Ordinance (Heizkostenverordnung) should also state that in rental properties, the carbon price should not be borne solely by the tenants; landlords should also pay their share, as they are the ones making the renovation decisions."

Prohibiting the use of fossil fuels for heating is also a sensible approach in the long term. "A ban on the installation of new 100 per cent oil-fired heating systems will come into effect in 2026; a similar decision is now needed for gas-fired heating as well." Oil- and gas-fired boilers can also be combined with renewable energies, perhaps in the form of a hybrid heat pump. However, in Veit Bürger's view, it is essential to ensure that the operating period for fossil fuel boilers is restricted to the coldest days of the year.

But a combination of imperatives and incentives is not the only viable option: blending information and incentivising elements may also be worthwhile in order to create synergies. In a building renovation passport, for example, energy advisers assess an individual property's deep renovation needs and map

each step in the refurbishment process. "If someone applies for a subsidy for just one element, such as re-roofing or replacement of the heating system, they should only be granted the funding if a building renovation passport is available," the Oeko-Institut's expert explains. "This avoids a situation in which individual elements of the refurbishment are carried out but may not be compatible with other upgrading measures further down the line."

ROADMAP FOR THE HEAT TRANSITION

In the Systemic Challenge of Heating Sector Transformation project, commissioned by the German Environment Agency (UBA), the Oeko-Institut and its project partners – the Fraunhofer Institute for Solar Energy Systems (ISE) and HIC Hamburg Institut Consulting GmbH – focused in detail on the heat transition. "We developed a roadmap showing how refurbishment rates need to rise, at which point a ban on oil- and gas-fired heating should come into effect, and when district heating should be decarbonised," says Veit Bürger. "Our starting point for developing the roadmap was the goal of a climate-neutral building stock." The partners also looked at heating market stakeholders and considered the role of heating networks in the heat transition. In addition, the project team devised a package of instruments, consisting of legislation and funding schemes, that would facilitate implementation of the roadmap. As well as most of the policy instruments described above, its elements include consistent training and reskilling

programmes in the crafts and trades, support for regional advice networks, minimum renewable energy quotas for heat network operators, adaptation of the regulatory framework for district heating, and obligatory heat planning for municipalities (*for more information on this latter topic, see: Individual heating here, district heating there on p. 8*).

EXIT WITH IMPACTS

A key question which has not yet been resolved, from this scientist's perspective, concerns the future of the natural gas grid. "If gas-fired heating systems are banned, the gas distribution network, as an infrastructure, will gradually become redundant. Much too little attention has been paid to this issue so far, and that needs to change as a matter of urgency. The exit from this infrastructure must be approached strategically, so we need some ideas on how it can be regulated." Many gas suppliers argue that in the long term, the network could be used for hydrogen. "But its availability is limited and hydrogen is far too expensive to use as heating energy. For that reason, the gas distribution network is likely to lose much of its significance over time."

Christiane Weihe



Sustainable transformation of the heating sector is a key area of Dr Veit Bürger's work. A physicist and energy management specialist, he develops, assesses and evaluates appropriate policy instruments, with a focus on the energy renovation of the existing building stock and decarbonisation of the heat supply. In his projects, he also analyses the heat transition at European, national and regional level.
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THE INSTALLATION OF NEW 100 PER CENT
OIL-FIRED HEATING SYSTEMS
IS BANNED FROM 2026.

INDIVIDUAL HEATING HERE, DISTRICT HEATING THERE



Municipal heat planning

Gas or oil? For a long time, these seemed to be almost the only heating options available. Today, there is much more choice. Depending on the locality and region, geothermal, solar thermal or even industrial waste heat may be worth considering. What is still lacking, however, is a broad overview of which type of heat supply is most appropriate and sustainable for different municipalities and neighbourhoods. But in Baden-Württemberg, that is about to change: here, under the amended Climate Protection Act adopted in 2020, larger towns and urban districts must carry out municipal heat planning – a major step towards a climate-neutral heating sector.

Municipal heat planning is a long-term strategy for conversion of the heat supply as an element of sustainable urban development. It requires each municipality to look at the development of its heat sector, taking account of local conditions, and consider how it can become climate-neutral. "This should start with an inventory of current heat demand and existing infrastructure, as well as scenarios on possible future trends," explains Benjamin Köhler, a Senior Researcher at the Oeko-Institut. A considerable amount of detailed information is required: on the refurbishment status of buildings, the type of heating systems installed, and the specific supply structures. The analysis looks at neighbourhoods, streets and sometimes even individual buildings and also identifies open space that may be suitable for solar thermal, for example. "In addition, the municipality considers where there is potential for

heat generation or recovery, focusing on renewables such as geothermal and solar thermal or biomass, but also on waste heat from industry or incineration plants." A municipal heat plan is then developed as a roadmap for the long-term heat supply. It is important that the various planning processes are well-coordinated and that all stakeholders are involved, from the municipal utility companies and urban planners to the environmental and civil engineering departments. "This enables an integrated, efficient and sustainable heat supply to be designed for the long term."

DENMARK IN THE LEAD

In Denmark, communal heat planning began several decades ago. After the oil crises in 1973 and 1979, the country

was keen to become less dependent on energy imports. "Heating networks offered a great opportunity here, so they were expanded on the basis of heat plans, mainly in urban centres at first. At the same time, the price of oil-fired heating was pushed up using taxes and levies, for example," says Benjamin Köhler. To avoid the formation of monopolistic structures, almost all the district heating suppliers are owned by the municipalities or cooperatives. Profits have to be ploughed back, and strict transparency criteria apply. But heat planning has not only contributed to the expansion of district heating. It has also led to buildings being refurbished and low- or zero-emission heating systems being installed in neighbourhoods in which developing or expanding district heating was not, or is not, the most efficient and favourable option. Today, almost every municipality has a heat plan, and Denmark shares its experience with Germany in their inter-country dialogue. This includes addressing ongoing challenges: "Of course, more district heating does not necessarily mean more sustainability. At present, Denmark still burns a lot of waste and wood, as well as coal. Work is being done to find ways to increase the number of heat pumps and boost the share of geothermal and solar thermal energy."

In Benjamin Köhler's view, energy-related spatial planning, which is carried out in Salzburg, Vienna and the federal state of Styria in Austria, is another good approach. It deals with the structural dimension of energy supply and demand, with a focus on how space can be secured and utilised for renewable energy production. "Space is a critical factor for the heat transition," says the senior researcher. "We need it for solar thermal and heat storage facilities, as well as for geothermal drilling and installations that convert surplus renewables-generated electricity into heat."

HEAT: A MATTER FOR THE LÄNDER

Baden-Württemberg is now the first German state (Land) to introduce municipal heat planning on a mandatory basis. Towns with a population of more

than 20,000 have until the end of 2023 to produce a heat plan; other municipalities may do so voluntarily and can apply for funding for this purpose. "Unfortunately, the Climate Protection Act is vague on matters relating to implementation, and that's a risk," says Benjamin Köhler. As he explains, the law simply states that five actions must be initiated within five years of the plan's publication. "It is important that the heat plan leads to real policy-making at the local level, for example by forming the basis for decisions on the heat production infrastructure in districts where new-build or regeneration projects are under way. And it is essential to ensure overall coherence across the heat plans so that not every municipality prioritises biomass, for instance, which offers insufficient potential."

Hamburg has already produced a heat map, or "heat cadastre", which compiles information on heat demand and supply. But other German states are trailing behind. "In Schleswig-Holstein, the climate protection legislation states that municipal heat planning is voluntary. And it's regrettable that when Bavaria updated its Climate Protection Act, it couldn't bring itself to make municipal heat planning compulsory." Municipal heat planning is still in its infancy, says Benjamin Köhler. Integrated and strategic approaches are in short supply, and most of the German states do not carry out heat planning as mandatory. "There is still a heavy reliance on voluntary approaches and incentives via funding schemes, as was previously the case with building refurbishment as well," says Benjamin Köhler. "However, it is difficult to adopt rules that apply on a nationwide basis when heat planning is a municipal, local or regional responsibility."

How to move forward on this issue is one of the questions currently being explored by the Oeko-Institut and its project partners in a study on the energy transition in the heating sector, commissioned by the Federal Ministry for Economic Affairs and Energy (BMWi) and the Federal Energy Efficiency Center (BfEE). A key aspect of the project involves gaining an overview of the status quo and identifying which Land laws already include provisions on municipal heat planning, what kind of plans

are being developed, and what we can learn from other countries. "Another key question is how the German government can take action by introducing legal requirements, for example. Rules cannot generally be imposed on the municipalities in this instance, so we are looking at whether municipal heat planning can be introduced nonetheless, and how this can be done." One possibility is to devolve statutory obligations from the Land to the municipal level. Baden-Württemberg can act as a role model here, with other German states following its lead.

DIVERSE AND MULTI-FACETED

Looking to the future of the heat supply, Benjamin Köhler not only expects a growing commitment to heat planning. He also predicts that the question of which energy to use for heating and hot water will be answered in increasingly diverse ways in the coming decades, depending on local conditions, with positive impacts on local and regional value-added. "Cities such as Karlsruhe and Hamburg will be using waste heat from industry, while in Munich, exploitation of deep geothermal energy will have a key role to play," he says. By then, the days when natural gas and oil were the only heating options will be a distant memory.

Christiane Weihe



Benjamin Köhler's work at the Oeko-Institut deals with various aspects of the heat transition, including energy-efficient buildings, climate-adapted construction and the techno-economic evaluation of buildings and building energy systems. He also develops policy instruments for sustainable transformation of the building sector. Benjamin Köhler has a Master's degree in Energy and Environmental Management.
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