Local Co-Benefits and Adverse Side-Effects
The Perspective of Actors in German Small-Sized Cities

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Abstract

The non-energy co-benefits and adverse side effects (together, the effects) of energy retrofits are widely discussed in the energy evaluation literature, and by major research bodies and international agencies such as the Intergovernmental Panel of Climate Change (IPCC) and the International Energy Agency (IEA). However, little evidence on the relevance of those effects for local decision makers (as e.g. mayors or heads of local energy and building companies) is available. Since it can be argued that local efforts are central to making a transition to a low carbon energy system, quantifying and specifying these associated local side effects is valuable.

This paper takes a look at small-sized German cities and evaluates, based on 30 interviews, which effects are relevant for key local actors. These interviews incorporate the perspectives of building companies, municipal staff, energy companies and the local energy business in the selected locations. The key findings are that local actors perceive the effects of energy refurbishment very differently and might therefore be addressed with an actor specific communication that takes their concerns into account. Further the interviewees focused, compared to the academic discussion, more on the local adverse side effects than on co-benefits. Still, many of the locally relevant effects are already discussed in literature (such as the landlord-tenant dilemma and the re- and pre-bound effect) but others may deserve further research (such as the value of increased attractiveness of the building stock).

Introduction[1]

To successfully address the challenges of meeting the goals of serious climate change mitigation as well as the implied need to reduce CO_2 emissions, the building sector must undergo a comprehensive transformation process. This process requires the involvement of all relevant actors at all levels. Given the tedious on-going negotiations at the international level, actions on local levels are of increased importance. Many of the decisions taken at higher levels must be implemented locally.

Most research on local climate mitigation focus on bigger and growing cities (e.g. Heinelt & Lamping 2015). The conditions in smaller and shrinking municipalities are less researched, but still important: in Germany 45% of the population lives in small and middle sized cities of 5,000-50,000 inhabitants (Destatis, 2015). Recent results from the COST-Action 'Cities Regrowing Smaller' project revealed that within Europe many rural regions, including middle-sized cities as their regional centres, have entered a pathway of urban shrinkage (Wiechmann & Wolff, 2013). Studies on urban shrinkage show that 42% of European cities (with a population of 200,000 or more) are shrinking; in Eastern Europe, the majority of cities are shrinking (Turok & Mykhnenko, 2007). Taking the relevance of small

[1]The introduction and the chapter "co-benefits and adverse side effects" are based partly on a previous published paper: T. Weinsziehr, M. Gröger, M. Verhoog and Bruckner T. 2015. "Multiple benefits as incentive for municipal climate mitigation efforts? The case of a German shrinking and aging middle size city", in: *eceee proceedings 2015 Summer Study.* (pp. 487-497). eceee.

and shrinking cities into account this paper focuses on German small-sized cities with shrinking and stable populations.

While meeting sustainable energy use and CO_2 emission reduction goals continues to grow in importance, the efficiency goals in the building sector appear hard to achieve. To overcome barriers in this sector, the academic debate discusses issues related to the techno-economic feasibility of renovations, calculating costs of measures and expected energy bill reductions. In addition, a vast literature refers to the decision paths of single actors such as homeowners (Gröger et al. 2011) or social landlords (Reeves 2010). Although actors from the building sector are the usual focus of energy renovation benefits, there are other local actors that can facilitate and increase local energy renovation activities. Those include local businesses providing refurbishment services (as energy consultants), tenants, the local energy provider, the municipal administration and the local civil society.

While those local actors may have great potential to influence change, the perceived co-benefits they might gain or the adverse side effects they might face due to building refurbishment are not fully researched.[2] Weiß et al. (2014) examined in this context the municipal perspective to quantify the municipal welfare and employment effects for energy renovations in Germany. From a more general perspective the IPCC report summarizes: "*Taken together, the monetizable co-benefits of many [building] energy efficiency measures alone often substantially exceed the energy cost savings and possibly the climate benefits (medium agreement, medium evidence), with the non-monetizable benefits often also being significant (high agreement, robust evidence).* It concludes: *"These benefits offer attractive entry points for action into policy-making, even in countries or jurisdictions where financial resources for mitigation are limited (high agreement, robust evidence).*" (Lucon et al. 2014, p.5).

This wider, multi-faceted approach may suggest ways to overcome the inactivity in building renovation. Thus, this research focuses on gathering the perspectives of representatives from the building and the energy sector and from municipal administrations in small German cities. To better understand different local perspectives on refurbishment activities, we asked the following questions:

- Which specific co-benefits and adverse side-effects (together, the effects) that may be linked to refurbishment activities in municipalities are perceived by the selected local actors in small-sized German cities?
- What are the actor specific effects? Which are most important?

Our analysis identifies which effects are relevant for representatives of the municipal government, small and big building companies, local energy providers and local businesses providing refurbishment services (such as energy consultants). It also explores the stakeholder-specific perceived relevance of effects and "*attractive entry points for action into policy making*." Finally, the paper discusses which effects of refurbishment projects need further evaluation and which effects can be disregarded.[3]

Following a short overview on the issues, this paper analyzes the results and implications of our interviews with representatives from small-sized shrinking and non-shrinking German cities and with several representatives of national and regional building and energy sector associations.

[2] This paper uses the terms "co-benefits" and "adverse side effects," (together, the effects) as the IPCC report does (e.g. Lucon et al. 2014). Many other terms have been used such as "multiple benefits" (e.g. OECD/IEA 2014) and "non-energy impacts (NEI)."

[3] Although of major importance, this research excludes home owners from the analysis due to limited resources.

Local Effects of Building Refurbishment

Much research addresses how and why local actors engage in climate change mitigation. The relevant literature can be divided into two categories. One strand focuses on the motivation and barriers for local climate change mitigation (see Azevedo et al. 2013, Kousky and Schneider 2003, Betsill and Bulkeley 2007, Sippel and Jenssen 2009), and on specific stakeholder points of view, such as building owners, building companies or energy companies. The second strand focuses on co-benefits, adverse side effects and externalities, and usually employs an economic perspective without being actor specific (see Lucon et al. 2014, OECD/IEA 2014). Most publications focus on quantifying core local economic effects such as cost savings, local job effects and investment costs. Other harder to measure effects receive less attention, such as local welfare, ecologic, and social effects.

We have summarized the main effects for different local actors in Table 1. The table lists additional effects of energy efficiency measures in residential buildings, but does not list climate change mitigation effects such as reducing heat waves and natural catastrophes. Most of the effects are discussed positively in the literature (light grey shading), while those in dark grey indicate a negative effect and those in white have both positive and negative connotations.

Table 1. Co-benefits, adverse side effects, and two-way effects on local actors

Involved stakeholder		**Municipal government**	**Building Company**	**Energy Company**	**Local Business**
Direct specific effects	**Economic effects**	local job effect	cost savings/ better rentability	customer retention	local job effect
		more local income	building resilience	new business opportunities	innovation/ local expertise
		tax revenues	increased building value	innovation/ local expertise	
		energy independence	innovation/ local expertise	less energy demand	
		more local expertise/ industrial location	high investment costs		
			more maintenance		
			higher rents		
	Ecologic effects	air quality improvement			
	Social effects	better design and urban quality	increased heat comfort		
		attractiveness of location	higher visual comfort		
		increased energy awareness	increased indoor air quality		
		more gentrification/ segregation	better acoustic insulation		
		little acceptance	better health		
		Less or more energy poverty	less acceptance		
	Other effects	higher reputation/image/ role model	higher reputation/image	higher reputation/image	
		networking with other municipalities			

Source: Author's elaboration, based on Lucon et al. 2014, Sippel and Jenssen 2009. Note: light grey = positive, dark grey = negative, white = positive or negative.

According to Ostrom (2010), who considers the numerous positive side effects of energy renovation, local actors should recognize they have many reasons to choose a low carbon urban building future. By guiding building companies and homeowners through the renovation process, municipal government can reach an optimal municipal net-efficiency. Moreover, through integrated urban development, the municipality can effectively address such problems as gentrification and energy poverty. The energy company, usually active in energy production and delivery, can create a new

business strategy or "protect" their local district heating grid from inefficiency by actively fostering building efficiency activities. Research indicates that co-benefits are important motivators for local climate change activities (Sippel and Jenssen, 2009; Oliviera Fernandes et al. 2011; Betsill and Bulkeley 2007; Wang, 2012). Kousky and Schneider (2003) stress that "in the majority of cities, policy is not driven primarily by widespread public pressure, nor wholly for climate protection, but instead, justified by cost savings and other perceived co-benefits."

Method and Data Collection

This research is based on 30 semi-structured interviews with 26 actors from small-sized cities in Germany with 16,000-28,000 inhabitants; 4 tenant, energy and building company associations served as an additional information source. Among the six cities under research, four were shrinking and two were stable. Half of the cities had already engaged in local climate change mitigation, such as preparing municipal climate mitigation plans, employing a manager for the process or being active within energy efficiency competitions.

The 28 in-person interviews and 2 telephone interviews followed an interview guide that was prepared for a broader research project. In one section of the interview actors were asked to specify positive and negative local effects of building refurbishment on their professional environment. The answers were open; besides giving examples in the case respondents did not understand the question, interviewers provided no further suggestions for possible effects. The interviews were conducted within the following actor groups:

- Building Owners (4 interviews), Buildings Owners Association (2 interview)
- Municipal Government (9 interviews, of which 4 with mayors and 5 with municipal staff)
- Municipal Energy Company (5 interviews), Regional Association of Municipal Energy Companies (1 interview)
- Local Business (as energy advisors) (8 interviews)
- Tenant Association (1 interview)

The interviews were recorded, transcribed and coded with the coding software MAXQDA. The codes emanated from the material and were grouped within the named effects (e.g. "air quality improvement", "job effects"). Since terms used in the interviews varied greatly, we grouped the answers by their primary meaning.

Most interviews were carried between October and December 2015 and one was completed within the context of a 2013 pre-study. The following analysis describes qualitative insights from these interviews.

Analysis

Actors perceive the local effects of building retrofits in different ways. While members of the municipal government have a highly positive perspective on refurbishment, building companies perceive more negative effects. This is especially important as these are the two groups which have to implement efficiency measures. Municipalities can solely refurbish their own building stock, which, while only a small contribution to energy reduction on a city level, sets a positive example. To implement city-wide efficiency measures, building companies and home owners must also cooperate. For energy companies, which can act as contractor and facilitator, and local businesses the positive effects slightly outweigh the negative.

Table 2 compares the effects mentioned in the interviews with those compiled from two reviews

(Lucon et al. 2014, Sippel and Jenssen 2009). A light grey background indicates co-benefits; a dark grey background adverse side effects; and white boxes are either positive or negative. Effects not mentioned in literature are written in italic letters and are underscored. Crossed-out effects are mentioned in literature but not in the interviews. All interviewed actors observed more negative effects than mentioned in Table 1. But additional positive effects are also named.

Table 2. Co-benefits, adverse side effects and two-way effects from interviews

Involved stakeholder		**Municipal government**	**Building Company**	**Energy Company**	**Local Business**
Direct specific effects	**Economic effects**	local job effect more local income tax revenues energy independence/ *self-sufficiency* innovation/more local expertise industrial location *more funds available*	cost savings ~~building resilience~~ increased building value/*attractiveness* innovation/ local expertise *new business models* high investment costs more maintenance *lobbyism* higher rents/*not possible to pass to tenant uneconomic legal requirements* *(no)* energy reduction	innovation/local expertise less energy/heat demand *devaluation of heating grids* *new actors constellation (building company)* *(no)* "customer retention *(no)* „new business opportunities"	~~local job effect~~ innovation/local expertise *(no)* better order situation
	Ecologic effects	increased energy awareness ~~air quality improvement~~ *waste disposal*			
	Social effects	~~better design and urban quality~~ attractiveness of the location more gentrification/ segregation ~~little acceptance~~ ~~less/more energy poverty~~	increased heat comfort ~~higher visual comfort~~ increased indoor air quality better acoustic comfort ~~better health~~ less acceptance *mold*		
	Other effects	higher reputation/image/ role model networking with other municipalities *awareness in municipal staff* *bureaucracy/complexity* *higher workload, complicated networks* *displacement of other more important issues*	higher reputation/image *displacement of other more important issues* *no planning security* *bureaucracy/complexity* *no new investments/status quo*	higher reputation/image	*bureaucracy/complexity* *high craftsman expertise needed*

Note: light grey = positive, dark grey = negative, white = positive or negative. Italic and underscored = effect not mentioned in table 1. Crossed-out = effect not mentioned in interviews.

As the tenants were not in the centre of interest only one interview was conducted with a tenant association representative who said he had mostly negative views of energy renovations. He stated that energy renovations always imply higher rents which in turn leads to a displacement process where low-income households are forced to move to other areas, resulting in segregation and gentrification. Aside

from energy retrofits having broad positive impacts such as resource conservation and improved air quality, and improving tenant awareness of energy efficiency, he perceived no positive effects.

Table 3 summarizes the most mentioned co-benefits (light grey) and adverse side effects (dark grey) by actor. The numbers in brackets indicate the number of actors that were mentioning the effect. In the next section, the effects are discussed on an actor specific level.

Table 3. Most mentioned co-benefits (light grey) and adverse side effects (dark grey) by actor (number of actors mentioning effect).

Municipal Government (9)	Building Company (6)	Energy Company (6)	Local Business (8)
energy cost savings (5)	energy cost savings (5)	new business models for energy companies (3)	better order situation of local business (3)
increased energy awareness of municipal staff (3)	attractiveness of building stock (4)	better image for energy companies (2)	more local expertise (1)
attractiveness of the location and its buildings (5)	better image for building companies (4)	customer retention (2)	more local value added (1)
more coordination/ higher workload for municipal staff (3)	higher rents/not possible to pass to tenant/no cost-effective energy reduction (6)	no customer retention (2)	Lobbyism (1)
complexity/bureaucracy/wrong legal framework (3)	complexity/bureaucracy/wrong legal framework (4)	complexity/bureaucracy/wrong legal framework (2)	worse order situation of local business (1)
displacement of other more important issues (3)	more maintenance for heating and ventilation systems (3)	devaluation of heating grids (2)	no customer retention (1)

Municipal Government

As the municipal government is closest to the people, local politicians play a vital role in educating, mobilizing and responding to the issues that promote energy renovations (Barrutia and Echebarria 2013). From the municipal perspective, the most important effect of energy efficiency measures is that they lower energy costs for their own building stock and this reduces the burden on municipal budgets. As one mayor pointed out, "the most important issue [when doing efficiency measures] is the municipal budget, every kWh saved frees money."[4] Respondents mentioned the increased energy awareness of the municipal staff as a positive energy efficiency effect, and observed that municipal staff increasingly take efficiency into account when doing their everyday work and planning new projects. The attractiveness of the location[5] and its buildings[6] were also mentioned as important effects of efficiency.

Other perceived positive effects of energy efficiency measures relate to energy independence and energy self-sufficiency.[7] In addition, the availability of new funds has a positive effect on the municipality because renovation projects can be implemented with more ambitious energy efficiency

[4] „(…) aber an allererster Stelle [steht] die Verbesserung der kommunalen Haushaltslage, denn jede nicht verbrauchte Kilowattstunde macht Geld frei." Mayor, city 1, 2015.

[5] „Und wir wollen ja auch (…) als attraktive Stadt wahrgenommen werden, wo solche Themen behandelt und kritisch hinterfragt werden." Mayor, city 1, 2015

[6] "We have many one-family houses and to keep them attractive in the future, we need to take care that those buildings have a reasonable energy demand"; „Wir haben viele Einfamilienhäuser und um die weiterhin attraktiv zu halten, müssen wir gucken, dass die Gebäude vernünftig energetisch aufgestellt sind." Municipal administration, city 2, 2015.

[7] „The big opportunity of the energy transition is the energy indepen, to be independet from crisis". „Die große Chance der Energiewende ist die Energieunabhängigkeit, das Wegkommen von den Krisen" Mayor, city 3, 2013.

measures. Further, respondents note positive effects upon the local economic environment including job effects, more local income, more tax revenues and local expertise, and positive impacts on industrial location and innovation. The interviewees also observed the networking opportunity with other actors (as other municipalities, academia, etc.) was a positive effect.

Interviewees said key negative effect of implementing efficiency measure related to increased workloads of municipal staff and to the high complexity and bureaucracy that accompany efficiency activities, especially funding and legal requirements. Additionally, they said coordination among the diverse actors is time consuming. As one interviewee puts it: "We have no personnel capacity (…) nobody is doing it [the coordination of energy efficiency and other climate mitigation measures] within the municipal administration."[8] Many representatives think that efficiency displaces other more pressing issues in the municipality such as the need for street repairs and issues regarding demographic changes. Respondents said the federal government should improve the coordination of the process since the current process leads to complexity and insecurity of investments. The interviewees did not mention gentrification and segregation issues due to energy renovations, which might be due to the fact that four out of six municipalities interviewed are shrinking and displacement of low-income tenants is not a central issue.

Building Companies

The local building companies interviewed ranged from smaller to larger organizations. These very central actors for building refurbishment measures proved to be somewhat skeptical regarding the positive effect of energy refurbishments, even though they have free access to all governmental support schemes. Companies commonly acknowledge the possible cost and energy savings and highlight the increased building value and attractiveness (which includes increased heat comfort, better indoor air quality and lower heating expenses).[9] With energy efficiency measures they also see a chance for innovation and new business models, which can positively influence their image and attractiveness as potential landlords.

Nevertheless, many representatives indicate that the high investment costs do not pay off through energy savings. Additionally, they say the resulting higher rents cannot, in many cases, be passed along to the tenants[10] because tenants are often not in a financial position to pay more.[11] From a building owner's perspective, as soon as refurbishment measures are realized it is the tenant who profits from the lower heating expenses (landlord-tenant dilemma).

The complex and constantly changing legal requirements also result in an unstable planning perspective. Further, complex and overly ambitious governmental targets (referring to legal

[8] „Es gibt keine personellen Kapazitäten, keinen der das [Energieeffizienz- und weitere Klimaschutzmaßnahmen] macht in der Verwaltung". Municipal administration, city 4, 2015.

[9] "If I can lower the heating expenses, it is obviously making my building stock more attractive for tenants", "(…) wenn man dies zweite Miete dann senken kann ist das natürlich ein Vermietargument" Building company 1, city 4, 2015.

[10] „The next problem is that rents must stay socially compatible. If I am doing now e.g. an energy renovation, rents cannot be payed by households that depend on social aid." „Das nächste Problem ist ja, ich muss die Mieten irgendwie sozialverträglich halten. Wenn ich jetzt z.B.: eine energetische Modernisierung mache, sind die Mieten für die Transfereinkommensempfänger nicht mehr bezahlbar." Building company, city 1.

[11] "And another possibility would be to finance the refurbishment measures with the rent. This is legally possible. But this is difficult to communicate to our tenants. Consequently, we did not pass the costs of refurbishment measures to our tenants." „Und die andere Möglichkeit wäre, ich refinanziere es [die Sanierungsmaßnahme] als Wohnungsunternehmen über die Miete. Diese gesetzliche Möglichkeit habe ich. Aber das ist (…) unseren Mietern sehr schwer vermittelbar. So dass man dann wenn man etwas macht, wir haben nicht so viel gemacht, dann haben wir die Gebäudedämmung an sich dann nicht auf die Miete umgelegt." Building company 2, city 4, 2015.

requirements and funding programs) can sometimes lead to inactivity from the building company.[12] Building companies also can see legal requirements as uneconomical because energy savings never repay the high investment costs. Some representatives from building companies assume that legal requirements have fallen victim to lobbyism by the insulation industry and are therefore ill-designed. From their point of view, the federal government is displacing other, more important issues (for instance issues surrounding affordable living space for barrier-free, elderly and low-income households). In addition, some believe new heating and ventilation technologies lead to higher maintenance costs[13] and often have a reduced service life.[14] They also mentioned mold and fire hazards can result from energy refurbishment, or there may be problems related to disposing insulation materials[15] and the chemicals applied to them.[16] A further negative effect related to the refurbishment of buildings protected as historic monuments, since those buildings may not be insulated with outside wall insulation.

Energy Companies

Energy companies are commonly perceived as a new actor in the refurbishment market – for instance, as providers of contracting packages. The companies we interviewed see new business opportunities for themselves such as contracting[17], micro-CHP and district solutions as well as increased customer retention. They also think being involved with efficiency can enhance their reputation and image in terms of innovation and expertise.[18] Finally, they see the increased focus on regional energy companies, rather than bigger companies, as managers of the energy transition as positive.

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[12] „And the other negative impacts refer to the strict legal requirements; they are getting always stricter and reduce the willingness to invest. We keep everything as it is"; „Und die andere Sache als negative Auswirkung ist ganz einfach diese stringenten gesetzlichen Vorgaben, die werden immer schärfer und die mindern natürlich die Investitionsfreude. (…) wir belassen alles so wie es ist" Building company 2, city 4, 2015.
„Sometimes it is the case that investments become uneconomic [because of the change in legal taxation framework]."
„Manchmal passiert es dadurch [durch die Änderung steuerlicher Rahmenbedingungen] auch, dass eine Investition durch zusätzliche Auflagen, im Nachhinein die Rechnung kaputt gemacht wird." Federal association building companies, 2015.

[13] „The [new heating system] needs far more maintenance. There is no financial benefit, because the energy savings are removed by the additional maintenance costs"; "Die [neue Heizungsanlage] ist viel wartungsaufwändiger. Finanziell ist die kein Gewinn, weil sie das, was sie einspart, auch an Wartung wieder verbrauchen." Small building company, city 2, 2015.

[14] „A wear out before lifetime of heating systems happens unexpectedly, which thwarts economic feasibility calculations, as a new investments have to made." „Ein vorfristiger Verschleiß von Anlagen tritt immer wieder unterwartet auf und macht natürlich im Nachgang die Wirtschaftlichkeitsberechnungen zu Nichte, wenn man dann noch mal investieren muss." Federal association of building companies, 2015.

[15] „This is not sustainable, only heat expenses are relevant. But when [insulation material] needs to be disposed, it will be an ecological catastrophe." „Nachhaltig ist das gar nicht, das Einzige worauf geguckt wird ist die Heizkosteneinsparung. Aber wenn das Zeug [das Dämmmaterial] mal weg muss, ist das ökologisch eine Katastrophe" Building company, city 1, 2015.

[16] „And chemicals are needed as plant protection [for the insulation material]. These chemicals are washed out into the soil. This [technology] does not seem mature enough to make me apply it to my house." „Und dass da auch Chemikalien dran sein müssen, damit es nicht gleich grün wird. Diese Chemikalien waschen sich dann aber in den Boden. Das ist mir alles noch nicht wirklich ausgereift genug, als dass ich sagen würde, das kleben wir jetzt an unser Haus." Small building company, city 2, 2015.

[17] „We will now focus now on the cooperation with the actors from the energy transition, as building companies and local business and industry to enhance the contracting business model". „Damit in Verbindung steht eine Sache, die wir verstärkt angehen, mit den Partnern aus der Energiewende, also Wohnungswirtschaft und Gewerbe aber auch Industrie, wird das Geschäftsfeld Contracting ausgebaut" Energy company, city 5, 2015.

[18] "And the issues around energy efficiency and sustainability – to create a value added for the customer and to create in this way a better image for the energy company, that is our primary challenge." „Und wie gesagt, die Problematik Energieeffizienz, Nachhaltigkeit und damit den Kunden einen Mehrwert und damit ein besseres Image für die Stadtwerke zu erzeugen, das ist die primäre Herausforderung." Energy company, city 5, 2015.

Direct negative effects relate to the reduced energy demand caused by efficiency measures, which in turn devalues the heating grid infrastructure.[19] Also, they perceive the entry of new actors into the energy market, such as building companies acting as pro-sumers of energy negatively. Some companies claim to not see any customer retention and business opportunities from efficiency measures.[20] Some also think, as building companies do, that the legal framework is influenced by lobbyism from the construction materials industry, which negatively impacts the energy companies as more wall insulation reduces energy demand and district heating solutions are disregarded.

Local Business

Representatives from local businesses are a major source of information for home owners when initiating and planning an energy renovation process. Energy consultants, installers of heating systems and chimney sweepers can actively influence the renovation decisions of local owners, making their perspective on energy refurbishment of central importance.

Local businesses perceive the new expertise and the more orders as positive effects.[21] Only certain actors, such as chimney sweepers, suffer from reduced orders. The better order situation also results in a higher local value added. Representatives of local business, especially energy consultants, highlight many other positive effects resulting from energy efficiency measures, including energy and cost savings, energy independence and self-sufficiency, as well as better building quality.

Businesses see the new bureaucracy and complexity as negatives, as well as the need for highly trained staff. One actor had the impression that that the construction materials industry is responsible for legal requirements and several interviewees doubted the economic effectiveness of some measures.

Summary and Conclusion

The analysis shows that many of the relevant positive effects of energy refurbishment are already discussed in existing literature. However, many of the adverse side effects are overlooked. The interviewed local actors worry about technical issues such as the waste disposal of refurbishment material and the devaluation of heating grids and about the overall negative effects of the transition of the energy system with its potential for increased bureaucracy, work load and complexity. The effects of improved air quality and the reduction or increase of energy poverty, although highly discussed in literature, were not an issue for the interviewees (see table 2). Table 4 summarizes the ten most mentioned effects – both adverse and beneficial – from the 29 interviews.

[19] „If 80% of heating energy [in the buildings sector] will be reduced, we will need to think about how to operate our gas distribution system.“ „Wenn 80% eingespart werden, müssen wir uns überlegen, wie wir unser Gasnetz betrieben (…)“. Energy company, city 2, 2015.

[20] „There is no business model [in the contracting market].“ Es gibt kein Geschäftsfeld [im Contracting Markt]“. Energy company, city 2, 2015.

[21] „Positive is that there is an increase in my business, that I can live as energy consultant from my work.“ „Positiv ist einfach, dass der Umfang meiner Tätigkeit insgesamt zugekommen hat. Also für mich persönlich ist es so, dass ich als Energieberater von meiner Arbeit jetzt auch leben kann.“ Energy consultant, city 6, 2015.

Table 4. Ten most mentioned effects across 29 interviews (number of actors mentioning effect)

10 most mentioned adverse side effects	10 most mentioned co-benefits
higher rents/not possible to pass to tenant (7)	energy cost savings (17)
no energy reduction from measures (6)	attractiveness of building stock (8)
complexity/bureaucracy/wrong legal framework (6)	more local expertise (8)
less energy/heat demand (energy companies) (5)	independence/autarky (7)
complicated networks/ higher workload for municipal staff (4)	better order situation of local business (3)
lobbyism influencing legal requirements (4)	new business models for energy companies (3)
mold, negative impact on indoor air quality (4)	better image for building companies (3)
high investment costs (3)	increased energy awareness of municipal staff (2)
displacement of other more important issues (3)	better image for energy companies (2)
more maintenance for heating systems (3)	attractiveness of the location (1)

Many of the most mentioned effects are already discussed and analyzed in literature (such as the landlord-tenant-dilemma, the pre- and rebound effect and other cost related issues). However, other effects local actors care about may deserve further discussion and analysis, such as the value of the increased attractiveness of the building stock, building local expertise and gaining greater energy independence.

If evidence exists to mitigate adverse effects, more could be done to communicate this evidence to local actors. For instance, good examples of successful case studies that dealt with the challenges of energy refurbishment might change local perspectives if better disseminated. For some adverse effects, only a better organization of the national energy efficiency process may be a solution. The analysis also shows that local actors value effects differently (see table 3). To engage all local actors for energy refurbishments the actor specific concerns need to be addressed.

This research was a first step to capture the different local perspectives on energy refurbishment activities in small German cities. Due to the qualitative nature of this research, it is not definitive. Still, it can indicate the need for more quantifiable research to capture the views of local actors on the effects of refurbishment measures. More research may also be needed that includes the perspective of urban development within the analysis, as shrinking cities show special conditions for energy refurbishment. By this the "*attractive entry points for action into policy making*" can be identified and applied to successfully manage the comprehensive transformation process of the building sector, involving all relevant local actors.

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