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Scalable Strategy for Heat Pump Adoption: Community-Based Events with Behavioural Design

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Abstract

This paper demonstrates how behaviourally designed community events activate heat pump adoption at scale by closing the intention-action gap.
It examines two complementary interventions designed to accelerate heat pump adoption in Germany through behavioural communication strategies. The "Week of the Heat Pump" (WdWp) campaign reached 50,000+ citizens across 550 events, generating 23,720 additional funding applications (€687.9–€901.4 million private investment from €4 million public budget). The "Heat Pump Info Days" format across 10 municipal events (5,750 participants, 2,542 survey responses) achieved +28% average knowledge gain (n=2,542), 91.2% average post-event conviction rate, and 92.5% action readiness in single 2-hour sessions. With 75.6% pre-event conviction, the primary barrier is not persuasion but activation: participants lack actionable knowledge (especially on subsidies) and a clear path to action. Systematic communication combining municipal anchoring, manufacturer neutrality, and behavioural science principles closes this intention-action gap at scale.

Keywords: heat pump adoption, behavioural economics, community engagement, heating transition, technology diffusion

1. 1. Introduction

Germany's heating sector accounts for 40% of final energy consumption and must achieve climate neutrality by 2045. The heating transition is legally mandated through constitutional law (German Constitution Art. 20a), the Paris Agreement, and EU directives including the EU Climate Law and Energy Efficiency Directive [1,2]. Despite established technology and comprehensive subsidies (up to 70%) [3], adoption rates remain below targets [25] among risk-averse homeowners aged 45 and above. The federal WdWp campaign (autumn 2024) trained 150 communicators and applied behavioural heuristics across 550 events. Following government changes, funding was discontinued, creating a communication gap [15] addressed by industry-financed "Heat Pump Info Days" combining municipal credibility with behavioural science design.

2. Method and conceptual framework

Event Structure: Municipal welcome (5 min), expert presentation (75 min), manufacturer exhibition. Program replicated across 10 municipal events reaching 5,750 participants with 2,542 survey responses.

Communication Design: Risk framing (LNG dependency, legal mandates, cost projections), autonomy preservation (three "free choice" statements), complexity reduction ("95% air-source systems"), concrete action pathways, interactive group dynamics.

Behavioural Principles: Loss aversion, social proof (Nordic adoption rates), risk reduction, friction reduction, herd behaviour, autonomy preservation.

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2.1. Diffusion of innovations and the Late Majority

According to Rogers [4], the "late majority" (34% of the market) is characterized by high risk aversion and a reliance on established social norms [10,23]. In the German heating market, this segment comprises homeowners aged 45 and above who were most affected by the "Heizhammer" debate. For this group, technical novelty is a source of uncertainty rather than an incentive. To bridge the adoption gap, communication must shift from technical efficiency to risk mitigation and social proof. The federal "Woche der Wärmepumpe" (WdWp) showed that decentralized, low-threshold information can reach this segment at scale [11]. Our model refines this by creating a permanent, community-based "Choice Architecture" [8,22] that addresses these specific psychological barriers.
Our event design integrates six behavioural mechanisms [19]:

1. **Loss aversion**: Fossil heating costs will rise due to various effects, including, for example, the CO_2 pricing (EU ETS2), while heat pump operating costs remain stable [5]
2. **Social proof**: Colder nordic countries show mass adoption (Norway 65%, Denmark 68% of heat pumps in single-family homes) [6]
3. **Risk reduction**: Heat pumps presented as mature, reliable technology with widespread deployment
4. **Herd behaviour**: Visible community adoption reduces perceived risk
5. **Friction reduction**: Technical complexity minimized; first action step provided
6. **Autonomy preservation**: Decision framed as voluntary, economically rational choice [14]

2.2. Organizational model

The format uses a hybrid funding model:

- Organizer: Municipality/local energy agency (credibility)
- Financing: 9 manufacturers + Federal Heat Pump Association (neutrality maintained)
- Content: Two independent experts without manufacturer affiliation
- Structure: 5-hour event combining exhibition (manufacturer booths with local installers) and 75-minute expert presentation
- Evaluation: Pre/post questionnaire on 4-point scale

3. Method

3.1. Event structure (Bonn, February 26, 2026)

The Bonn event followed a standardized format consisting of a municipal welcome and local heat planning context (5 minutes), a 100-minute main presentation by independent experts, and a manufacturer exhibition with nine companies and local installation partners; the event lasted five hours and attracted 863 registered participants. Events were initially planned for approximately 300 participants each; actual attendance averaged 575 across all 10 events, reflecting both the strength of the municipal communication strategy and the high latent demand for independent heat pump information.

3.2. Communication design

The presentation architecture systematically integrated behavioural triggers [12] through risk framing in the opening slides, addressing LNG dependency (43% USA, 21% Russia, 12% Qatar), the legal framework defining climate neutrality as a constitutional mandate rather than a political option [16,17], and cost projections showing rising fossil fuel costs versus stable heat pump operating costs. Reactance was reduced through three explicit statements affirming freedom of choice [14], while complexity was lowered [13,21] by highlighting that 95% of installed heat pumps are air-source systems. Clear action pathways were provided, including guidance on calculating annual energy consumption, low-cost optimisation measures below €5,000, subsidy composition and application procedures, realistic cost scenarios with financing options, and contact information for national and local advisory services. Group dynamics were activated through interactive elements such as show-of-hands questions on building type, social exposure to heat pumps, and cost expectations, which normalised uncertainty, reduced individual hesitation, and created visible social validation; participants were encouraged to photograph slides, reinforcing collective interest and perceived relevance [18].

3.3. Evaluation methodology

Of the 863 attendees in Bonn, 418 evaluation forms were submitted (48.4% response rate). Across all 10 events, 2,542 of 5,750 attendees returned questionnaires (44.2% average response rate). A pre/post assessment using a four-point scale (1 = not at all, 4 = very well) measured perceived knowledge of energy costs, building suitability, subsidies, municipal heat planning, and heat pump functionality, as well as cost expectations, perceived helpfulness, and planned follow-up actions.

4. Results

4.1. Participant Profile

Bonn: Target group precision: 66.1% aged 60-74 or 75+ (57.7% aged 60-74, 8.4% aged 75+), 21.3% aged 45-59, 78.9% single/two-family homeowners, 9.1% multi-family buildings. Across all 10 events, the average participant profile shows: 50.6% aged 60-74, 24.4% aged 45-59, 71.9% single-family homeowners.

4.2. Knowledge development

Participants rated their knowledge on five core topics using a 4-point scale (1=not at all, 2=rather little, 3=rather well, 4=very well) before and after the event. The questionnaire asked: "Before the event, I feel... informed about the following topics" (pre-assessment) and "I now feel... informed about the following topics" (post-assessment). The five assessed topics were: 1. Development of energy costs 2. Suitability of my building for a heat pump 3. Subsidies, financing, rough cost calculation 4. Municipal heat planning: relevance for my building 5. I think that a heat pump could work for my building.
Results show substantial knowledge gains across all dimensions:

Table 1. Pre-/post-event knowledge gains across five topics (Bonn event, n=418). Scale: 1=not at all informed, 4=very well informed.

Topic	Pre	Post	Delta	%Change
Energy costs	2.59	3.24	+0.65	+25.1%
Building suitability	2.48	3.25	+0.77	+31.0%
Subsidies	2.19	3.28	+1.09	+49.8%
Heat planning	1.72	2.53	+0.81	+47.1%
HP functionality	2.93	3.41	+0.48	+16.4%
Average	2.38	3.14	+0.76	+32%

Interpretation:

- Three-quarter competence level gained in 2 hours (+0.76 on a 4-point scale)
- Subsidies showed largest knowledge gap (pre=2.19) and largest gain (+49.8%)
- All topics reached "rather well informed" (3+) post-event

4.3. Conviction shift: "Heat pump will work for my house"

Table 2. Pre-/post-event conviction shift distribution (Bonn event, n=418).

	Pre	Post
Sceptical (1-2)	24.4%	4.5%
Convinced (3-4)	75.6%	95.5%
Highly convinced (4)	21.4%	46.6%

Result: In Bonn, 95.5% of participants reached conviction level 3-4 after the event. Across all 10 events, the average conviction rate was 91.2%, with 39.2% highly convinced (level 4).

This shift suggests that the barrier is primarily psychological (perceived feasibility), not technical (objective suitability). The pre-post shift is consistent with knowledge building changing subjective perception, though the quasi-experimental design limits causal attribution.

4.4. Urgency perception

84% expect rising fossil heating costs

4.5. Action readiness

Participants were asked: "Which concrete steps have you planned after today's participation?" 91.9% (Bonn), 92.5% (all events average) plan at least one action step. In Bonn: 3.05 planned steps, across all events: 3.29 planned steps average.
Top actions: Check energy consumption (53.2%), Contact installer (52.1%), Watch videos/info (46.6%), Apply for subsidy (44.6%), Use advisory services (40.0%).
Age differentiation (Bonn): aged ≤44: 48.6%, aged 45–59: 58.4%, aged 60–74: 57.7%, aged 75+: 68.6% plan installer contact
Building type differentiation (Bonn): Single-family homeowners (n = 330) achieve a larger knowledge gain (Δ +0.77 vs. multi-family Δ +0.64 on a 4-point scale) and prioritise subsidy applications (49.4%) as their second action step after installer contact (60.0%). Multi-family residents (n = 38) instead favour information-seeking steps (videos/information 44.7%, advisory services 42.1%), suggesting that collective ownership structures create different activation pathways requiring tailored communication formats.
Gender differentiation reveals a notable pattern across all metrics. Women report substantially larger knowledge gains than men (Bonn: women Δ +0.99 vs. men Δ +0.69 on a 4-point scale; meta-average: women Δ +0.84 vs. men Δ +0.66), with the gap widest for subsidies (Bonn: women +67.3% vs. men +45.3%) and energy costs (women +36.3% vs. men +20.7%). Yet women remain slightly less convinced after the event (meta-average conviction: men 91.1% vs. women 88.2%; “very convinced”: men 40.4% vs. women 37.6%) – a conviction paradox suggesting that greater knowledge acquisition may correlate with more differentiated rather than more enthusiastic assessment. Despite this, overall action readiness is virtually identical (meta-average installer contact: men 52.0% vs. women 51.9%), though women set different priorities: women prioritise “check energy consumption” (63.1% vs. men 54.5%) and “apply for subsidies” (52.7%), while men proceed directly to installer contact (55.8%) as their top step.

4.6. Information helpfulness

"Today I found these topics particularly helpful:" (meta-average across all 10 events) Subsidies (59.1%), Building suitability (51.8%), Heat pump functioning (47.4%), Energy costs (41.3%), Municipal heat planning (14.8%)
Interpretation: Cost and financing are the most relevant topics; technical aspects less interesting. Heat planning, though presented by municipality, received moderate helpfulness rating despite large knowledge gap.

4.7. WdWp Campaign Results

The WdWp campaign provided complementary macro-level evidence of behavioural communication effectiveness. Administrative data from December 2024 to February 2025 showed 47,440 additional funding applications, with approximately 50% (23,720 cases) attributed to the campaign based on statistical modelling and time-series comparison (detailed methodology available upon request; causal attribution subject to confounding from concurrent media coverage and policy announcements). This represents €687.9–€901.4 million in private investment coinciding with a €4 million public budget, yielding an ROI of 171.97 to 225.34. The campaign reached over 50,000 citizens across 550 decentralised events, coordinated by 35 trained partner organisations using standardised behavioural messaging modules. These results are consistent with the scalability of psychologically informed communication approaches and suggest that adoption barriers are primarily communicative rather than technical.

5. Discussion

5.1. Key findings

Participants arrive already half-convinced: with a pre-event conviction rate of 75.6% (rating 3–4), the self-selected audience does not primarily lack persuasion – it lacks actionable knowledge and a clear path from intention to action. The following findings combine Bonn-specific data (75.6% conviction, 84% cost

expectation) with meta-averages across all 10 events (knowledge gains, helpfulness, action readiness). Municipal anchoring creates trust, as local institutions acting as neutral messengers reach conservative segments (75.0% aged 45–74), with municipal hosting, manufacturer financing and on-stage neutrality establishing credibility. Risk framing combined with explicit autonomy enables activation without reactance: after framing, 84% expected rising costs, while positioning within the climate protection pathway and emphasis on free choice prevented resistance [14], supported by social proof [10,23]. Subsidies represent the critical knowledge gap, showing the lowest pre-event knowledge (2.20), the largest gain (+46.0%) and the highest helpfulness rating (59.1%), indicating that many perceive heat pumps as too expensive not because of actual cost but because of missing information on subsidies, real operating costs and individual eligibility. The event's primary achievement is activation, not persuasion: 92.5% of participants plan at least one concrete action step, with an average of 3.29 planned steps resulting from asking "which steps" instead of "whether," closing the intention-action gap [9,22]. For participants aged 76+, the event serves a different function: rather than direct installer contact, it connects them to 1:1 counselling services (energy agencies, consumer advice centres, municipal advisory points) as the appropriate next step for this age group. This supports the interpretation that the main bottleneck of the heating transition is communication, not technology.

5.2. Theoretical implications

Results validate the intention-action gap as the central barrier in heat pump adoption [24]. Participants arrive with high conviction (75.6% pre-event) but without the specific knowledge and concrete steps needed to act. The format functions as an activation mechanism [9,22]: systematic friction reduction (Sunstein, 2021) closes the gap between "I think it could work" and "I know what to do next," while loss framing [7] and social proof [10,23] reinforce motivation.

The "late majority" responds to different triggers than early adopters: it is less motivated by innovation and more by risk mitigation, is responsive to peer adoption and institutional endorsement [20], and requires simplified decision pathways and clearly defined default options.

5.3. Practical implications for scaling

The format is modular and replicable. It is based on a standardized event architecture, a documented evaluation methodology, and can be transferred across municipalities. Between October 2025 and February 2026, the format was replicated across 10 municipal events: Heidelberg (334), Hannover (1,000), Ahlen (120), Lübeck (800), Erfurt (383), Stuttgart (750), Moosburg (500), Neumünster (500), Osnabrück (500), and Bonn (863), reaching a total of 5,750 participants.

For 2026, events are already planned in Stuttgart, Moosburg/Landshut, Osnabrück, Bonn/Rhein-Sieg-Kreis, Gütersloh and Freiburg, with expected attendance of 300–800 participants per event. In addition, new municipal inquiries are received on a weekly basis, with more than 50 municipalities currently on a waiting list for a WP-I event.

Scaling requirements:

Scaling the format requires an expanded speaker pool with additional trained presenters, professionalisation of backend structures including municipal coordination and installer partnerships, and an improved website with automated evaluation processes. In addition, local public relations and advertising campaigns are necessary, although these cannot be funded at scale by municipalities. The diffusion potential has already been demonstrated by the "Week of the Heat Pump" (2024), which successfully rolled out 550 events within one week, showing that effective local organisation and diffusion are achievable in cooperation with energy agencies.

5.4. Transferability to other technologies

The model is transferable to other domains of the energy transition, including electric mobility, rooftop solar, district heating concepts, and other technologies in the built environment. These share comparable adoption barriers: persistent uncertainty, perceived complexity, lack of trust in new solutions. **The event architecture, behavioural communication design, and evaluation instrument can be adapted to activate conservative target groups in other transformation areas.**

6. Limitations

The intervention is subject to self-selection bias, as participation was voluntary. Nonetheless, the high share of older, risk-averse homeowners (51% aged 60–74) suggests successful reach into typically hard-to-engage segments.

The evaluation captures intentions and self-assessed knowledge, not actual installations. A follow-up after 12–24 months is planned to assess real-world adoption. A control group was not feasible due to the event format. Instead, a pre/post survey among the same participants was used to measure change. While this limits causal attribution, it enables insight into short-term effects under realistic conditions. Generalisability remains to be tested across varying municipal, political, and infrastructural contexts.

7. Conclusion

Both interventions demonstrate that the central barrier to heat pump adoption is not conviction but activation: participants arrive half-convinced yet lack the actionable knowledge and concrete steps to move forward. The WP-I format closes this intention-action gap, achieving +28.2% average knowledge gain, 91.2% average conviction rate, 92.5% action readiness, and 3.29 planned steps per household within two hours. The WdWp campaign generated 23,720 additional funding applications, representing € 687.9 – € 901.4 million in private investment from a € 4 million public budget. The combination of detailed behavioural measurement (WP-I) and macro-economic validation (WdWp) provides comprehensive evidence for scaling communication-based interventions. This paper documents what appears to be the first field-tested, large-format communication model for the heating transition delivered through real municipal settings, at scale and at low cost. Results suggest that the heating transition bottleneck is communication, not technology — systematic communication design can overcome this barrier at scale and low cost. For policymakers and practitioners aiming to accelerate technology adoption in conservative markets, the documented approaches offer tested, cost-efficient frameworks that strengthen understanding, reduce uncertainty and support informed decisions at scale.

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Appendix A: Evaluation Instrument (WP-I Heidelberg)

The paper-based questionnaire used in the Heidelberg evaluation included five knowledge items (pre/post), three intention items, and one final open-ended prompt for specifying intended next steps.

Appendix A: Evaluation Instrument (WP-I Heidelberg)

Heat Pump Information Day • LOCATION, DATE • anonymous survey

Age: ☐ up to 44 years ☐ 45–59 years ☐ 60–74 years ☐ 75+ years

Gender: m☐ w☐ d☐

Building type: ☐ Single-/two-family house ☐ Multi-family building (multiple answers possible)

A1 Before the event, I feel … informed about the following topics (please tick):

Topic	Not at all	Rather little	Rather well	Very well
Development of energy costs	☐	☐	☐	☐
Suitability of my building for a heat pump	☐	☐	☐	☐
Subsidies, financing, rough cost calculation	☐	☐	☐	☐
Municipal heat planning: relevance for my building	☐	☐	☐	☐
I think that a heat pump could work for my building	☐	☐	☐	☐

I expect heating costs for oil and gas (next 5 years) to:

☐ decrease ☐ remain the same ☐ increase

— Please complete the following section only after the event —

B1 I now feel … informed about the following topics:

Topic	Not at all	Rather little	Rather well	Very well
Development of energy costs	☐	☐	☐	☐
Suitability of my building for a heat pump	☐	☐	☐	☐
Subsidies, financing, rough cost calculation	☐	☐	☐	☐
Municipal heat planning: relevance for my building	☐	☐	☐	☐
I think that a heat pump could work for my building	☐	☐	☐	☐

B2 Today, I found the following information particularly helpful:

☐ Energy costs ☐ Building characteristics

☐ Subsidies / financing ☐ Municipal heat planning ☐ Diffusion / functioning of heat pumps

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B3 Which concrete steps have you planned after today's participation?

(Please select all that apply.)

☐ Check energy consumption / heating costs

☐ Check / reduce flow temperature of the heating system (☐ already < 55 °C)

☐ Talk to heat pump operators / installers (e.g. here today)

☐ Use support services (e.g. municipality / energy agency / consumer advice centre)

☐ Watch videos / read information (e.g. *Energiesparkommissar*, waermepumpe.de, schlau-energiesparen.de)

☐ Secure / apply for subsidies

☐ Talk to neighbours / acquaintances about heat pumps

Please simply leave the questionnaire on your row of chairs. Thank you very much!

See Figures 1–3 within the main text for graphical representations of LNG dependency, legal climate targets, and projected heating costs (2025–2045). All figures were presented at the start of each WP-I event to increase risk salience and contextualise the need for action.

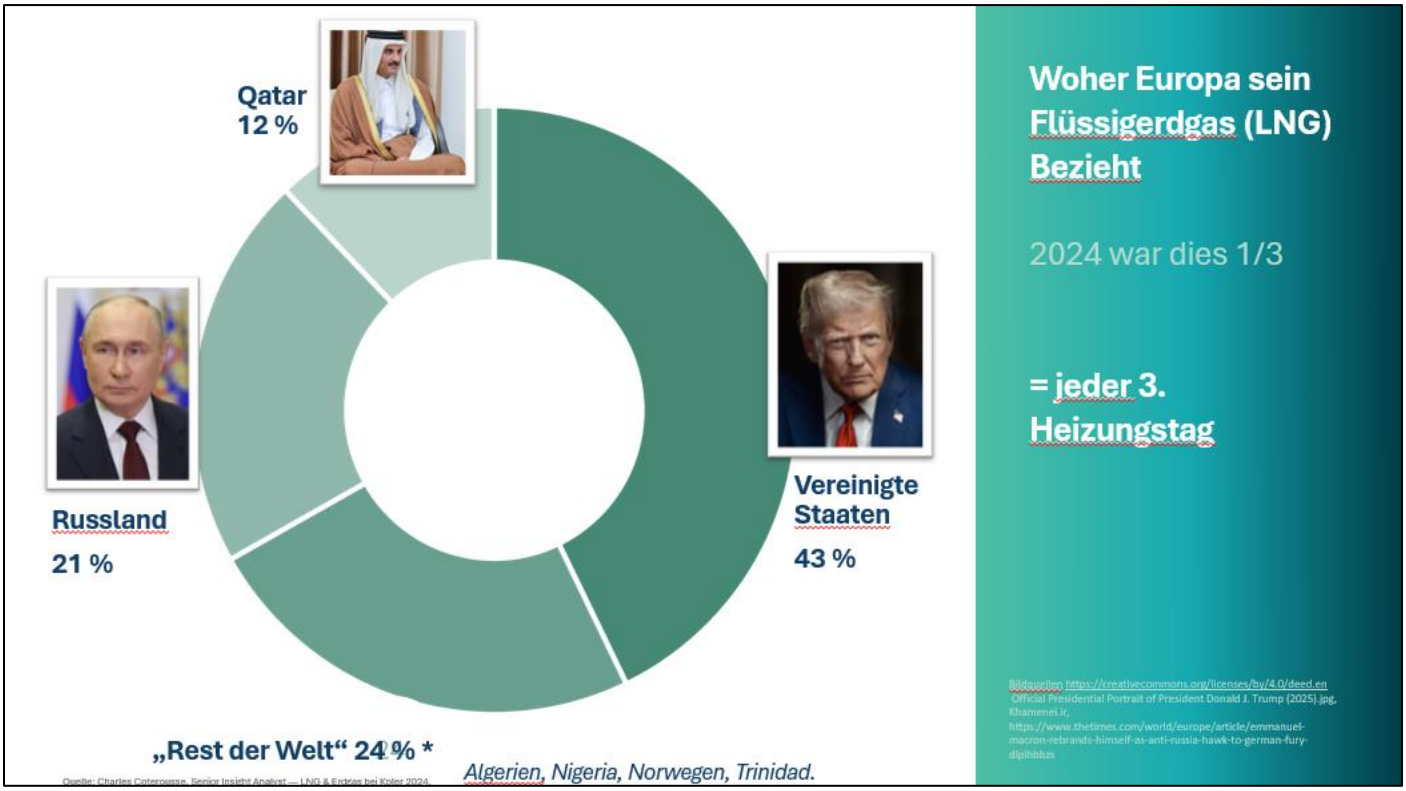

Figure 1: In 2024, approximately one third of Europe’s heating energy came from liquefied natural gas (LNG) imports. The primary supplier was the United States, accounting for 43% of LNG imports, followed by Russia (21%) and Qatar (12%). The remaining 24% originated from a group of countries summarized as "Rest of the World", including Algeria, Nigeria, Norway, and Trinidad.
This dependency translates into roughly “every third heating day” in Europe being powered by LNG. The geopolitical implications of this supply structure are significant, especially in light of EU decarbonisation targets and energy security considerations.
Data source: Charles Coterousse, Senior Insight Analyst – LNG & Exports, ICIS, cited in 2024.
Image sources: official portraits and press materials under Creative Commons licenses (see original presentation for full attribution).
This slide establishes geopolitical volatility as a latent fossil fuel heating risk.

Figure 2: Germany aims to become climate-neutral by 2045, as mandated by Article 20a of the Basic Law. Interim targets include a 65% reduction in greenhouse gas emissions by 2030. Achieving these goals requires full sector coupling: heating, mobility, production, and transport must all shift to clean electricity—under the principle that more renewable electricity means more prosperity.

By 2045, all heating systems, vehicles, and industrial installations are to run entirely on renewable energy. At the international level, the Paris Agreement sets binding targets for climate neutrality by 2050 across the EU. Milestones and intermediate goals are codified in various European directives, including the EU Climate Law and Energy Efficiency Directive.

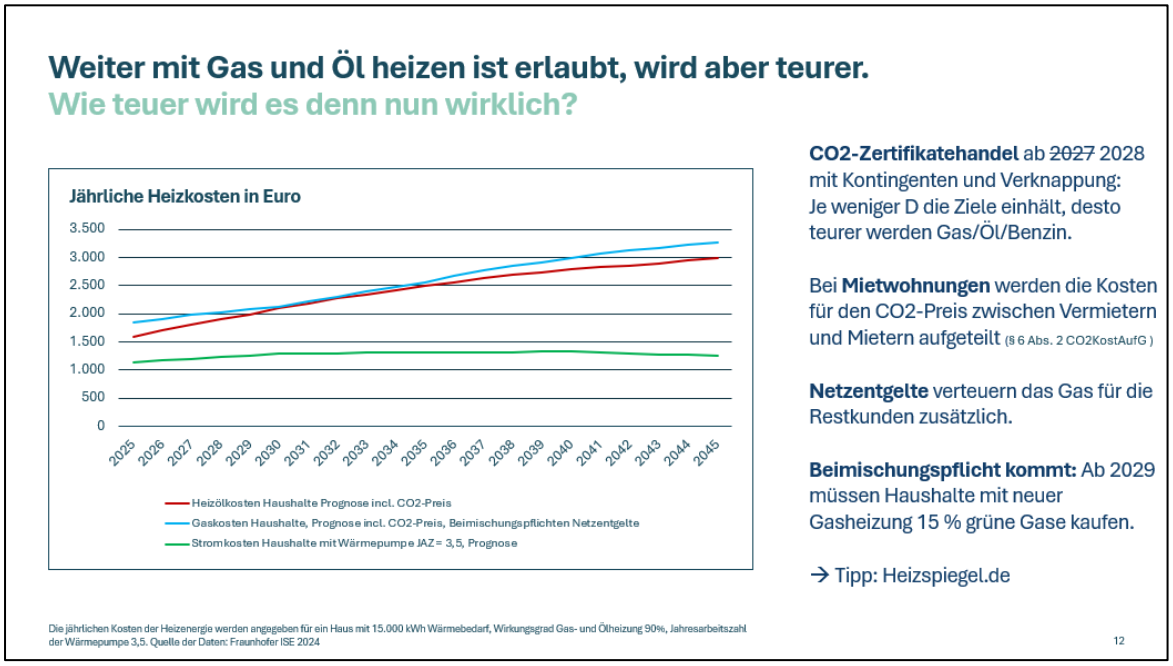

Figure 3: Continuing to heat with gas and oil remains legally permitted but will become increasingly expensive. The graph shows projected annual heating costs for a standard household with 15,000 kWh heat demand.
Three scenarios are compared:
(red) total heating costs including CO_2 pricing with oil
(blue) gas-based heating including CO_2 pricing, blending obligations, and rising network charges, and
(green) electricity costs for heat pump operation (COP = 3.5)

The CO_2 emissions trading system (EU ETS2) will be tightened from 2028 onwards, leading to further increases in fossil fuel costs if national targets are missed. In rental housing, CO_2 costs are shared between landlords and tenants (§ 6 para. 2 CO_2 Cost Allocation Act). Additionally, gas network charges will rise for the remaining user base. From 2029, a mandatory 15% share of renewable gases will apply to new gas heating systems.

Data basis: Fraunhofer ISE (2024), based on standard assumptions for heating systems and price projections.
For orientation on current heating costs, see: heizspiegel.de