Aligning Behavior & Policy: Strategies to Advance Aalborg University's Climate Goals

AALBORG UNIVERSITY

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Executive Summary

This project, *Aligning Behavior and Policy: Strategies to Advance Aalborg University's Climate Goals*, supports the implementation of Aalborg University's 2030 Climate Action Plan (CAP) with a targeted focus on reducing Scope 3 emissions; those associated with mobility, procurement, and campus space use. Although AAU has made meaningful progress toward its emissions goals, reducing greenhouse gas emissions by 32% from 1990 levels as of 2022, further action is required to meet the 2030 target of a 50% reduction. Through stakeholder interviews, literature-informed analysis, and cross-institutional benchmarking, our team developed a suite of actionable interventions aimed at shifting campus behavior and enhancing policy alignment. Key deliverables include a prototype thermal comfort app, a Climate Ambassador training outline to build peer-led engagement capacity, and targeted strategies to encourage low-carbon commuting and sustainable purchasing practices. These recommendations are designed to be practical, scalable, and closely aligned with AAU's existing goals and governance structure, helping to close the implementation gap and strengthen campus-wide climate action.

Section 1: Introduction & Background

Aalborg University (AAU) has made a strong institutional commitment to climate action through its 2030 Climate Action Plan (CAP), which outlines the university's path toward carbon neutrality by 2045. The CAP establishes interim goals for 2030, including a 50% reduction in total greenhouse gas (GHG) emissions compared to 1990 levels. However, as illustrated in **Diagram 1**, AAU had only achieved a 32% reduction in emissions by 2022, signaling a need for accelerated and expanded action to meet the 2030 target. This gap underscores the urgency of addressing areas that have proven most difficult to influence—particularly Scope 3 emissions, which remain a major contributor to the university's carbon footprint.

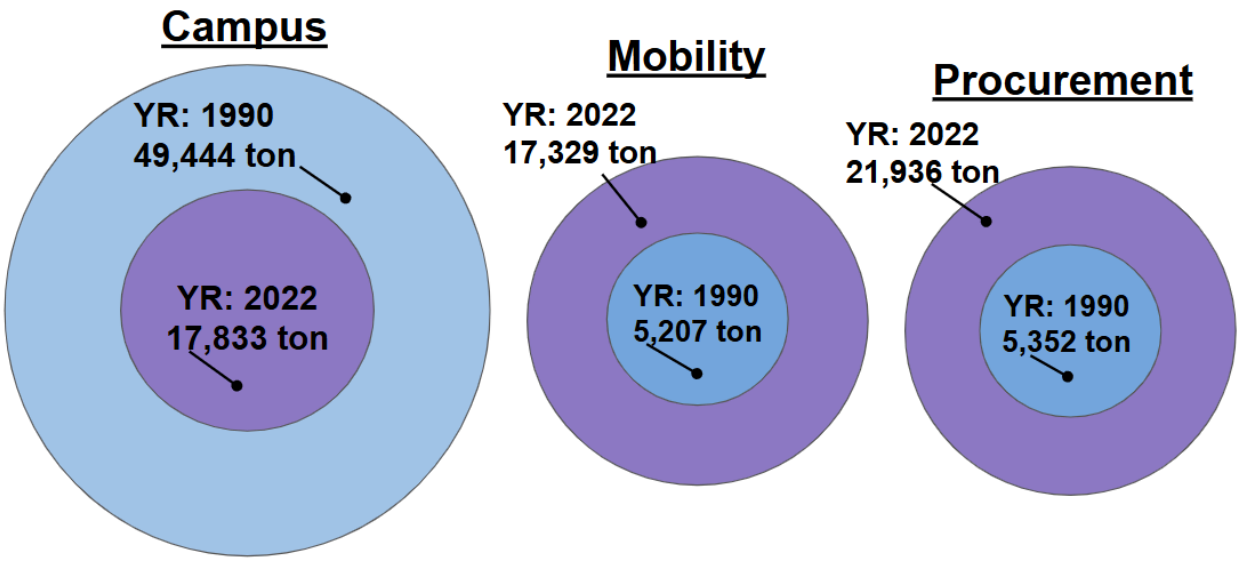


Diagram 1: Aalborg University's Greenhouse Gas Emissions (1990–2022) Compared to 2030 Target

This report was developed to directly support AAU's existing CAP. Rather than proposing a new plan, our objective is to strengthen implementation of the current CAP by generating actionable recommendations that target Scope 3 emissions. These include emissions generated through university-related activities such as commuting, business travel, procurement, and the use of campus facilities—areas where behavioral change is both crucial and complex.

Our project focuses on three key domains within Scope 3: mobility use (e.g., travel patterns among students and staff), procurement practices (e.g., departmental purchasing decisions and supply chain impacts), and campus space use (e.g., energy consumption linked to space allocation and user behavior). These domains are interconnected with institutional culture and decision-making processes, and therefore require strategies that align behavioral incentives with sustainability policies. Through consultation with AAU's sustainability leadership team, stakeholder interviews, and a review of institutional best practices—including case studies from peer institutions like UC Davis—we developed a set of tailored recommendations designed to complement the CAP's existing goals and action items. By foregrounding the perspectives of students, faculty, and staff, the project aims to enhance campus-wide engagement and support a shift toward more sustainable daily practices.

Evidence from the academic literature shows that Climate Action Plans are most effective when paired with targeted behavior change interventions and ongoing stakeholder involvement. Particularly in higher education settings, where decentralized structures and diverse user groups present implementation challenges, aligning

personal actions with institutional goals has proven essential to achieving meaningful emissions reductions [Leal Filho et al., 2019; Sharp, 2002]. By building on the CAP's existing framework and identifying high-impact opportunities for action, this project supports AAU's efforts to close the gap between current progress and its 2030 emissions goals, while fostering a campus culture that actively contributes to long-term climate leadership.

Section 2: Methodologies

This research project employed a structured, multi-step methodology to evaluate the implementation potential of Aalborg University's Climate Action Plan (CAP), with a specific focus on Scope 3 emissions and behavior change strategies that support the CAP's objectives. The approach combined a thorough review of institutional context, stakeholder engagement through formal interviews, and the application of best practices drawn from comparable programs, including tools and frameworks developed at UC Davis.

1. Background Review
   The project began with a detailed review of Aalborg University's Climate Action Plan (2030), which provided the foundational framework for understanding the institution's climate goals, emissions profile, and proposed mitigation strategies. This analysis identified key focus areas for intervention, particularly the challenge of addressing Scope 3 emissions, which arise from activities such as commuting, purchasing, and supply chain operations.

2. Client Interview and Project Scoping
   An initial project scoping meeting was conducted with the client—representatives from Aalborg University's sustainability leadership team—who articulated the primary objectives of the study. They requested a focus on Scope 3 emissions and emphasized the need for actionable recommendations that would facilitate behavior change across the campus community in support of the CAP.

3. Stakeholder Engagement through Formal Interviews
   To incorporate the perspectives of those directly impacted by the Climate Action Plan, the team conducted formal interviews with a diverse range of stakeholders, including students, staff, and faculty. These semi-structured interviews were designed to elicit insights on the barriers and challenges faced in aligning personal and departmental practices with the CAP's goals. Topics included commuting behaviors, purchasing decisions, and levels of awareness regarding Scope 3 emissions. Interview data were systematically coded and analyzed to

identify common themes and inform the development of targeted recommendations.

4. Application of Tools, Case Studies, and Literature-Informed Best Practices
   In developing actionable recommendations for Aalborg University, the project team utilized a combination of tools, case studies, and academic research. UC Davis served as a key reference point, with resources from the UC Davis Sustainability Office and UC Davis Facilities Management providing practical models for embedding climate action into daily operations. These examples illustrated how higher education institutions can foster a culture of sustainability by integrating climate goals into purchasing decisions, facilities management, and campus-wide engagement among students, staff, and faculty.

   In addition, the team integrated evidence from the academic literature and case studies cited in the project bibliography. This included research on the effectiveness of behavior change interventions in higher education settings, methodologies for Scope 3 emissions accounting, and strategies for engaging stakeholders in climate action initiatives.

5. Analysis, Synthesis and Recommendations Development
   Insights from the background review, client consultation, stakeholder interviews, and best practice case studies were synthesized to identify barriers to implementation and opportunities for enhancing behavior change. The team then developed a set of tailored recommendations for Aalborg University, focusing on strategies that address Scope 3 emissions while aligning with the CAP's broader goals of climate mitigation and community engagement.

   Throughout this process, the project maintained a user-centered and equity-focused outlook by prioritizing interventions that are accessible, inclusive, and responsive to the diverse needs and constraints of different campus populations. We emphasized solutions that empower individuals, regardless of their role or resources, to take part in climate action, while ensuring that our recommendations do not disproportionately burden any single group.

Section 3: Results & Findings

3.1 Mobility emissions

Mobility emissions at Aalborg University are shaped by the commuting behaviors of students, staff, and faculty, as well as by academic travel. Although Aalborg benefits from cycling-friendly infrastructure and relatively short travel distances, car use remains prevalent among staff, especially those commuting from surrounding municipalities.

Interviews indicated that many individuals default to private vehicles due to limited flexibility in public transport routes or scheduling constraints.

A secondary challenge involves the tension between climate goals and the university's international academic culture. Academic staff and students often rely on air travel for conferences, research collaboration, and exchange programs. While these activities are integral to Aalborg's institutional mission, they contribute disproportionately to Scope 3 emissions and are difficult to offset meaningfully without affecting core academic operations. This challenge echoes broader findings across European universities where academic mobility remains a blind spot in emissions planning [Buehler & Pucher, 2021; Eltis, 2021].

3.1.1 Major Sources of Mobility-Related Emissions

Mobility emissions at Aalborg University stem from two primary sources: daily commuting by students, faculty, and staff, and academic-related travel, particularly by air. Among these, staff commuting by private vehicle is a significant contributor. While Aalborg benefits from a dense urban core and cycling-friendly infrastructure, many staff members commute from peri-urban or rural municipalities where public transportation is less frequent or lacks direct routes. This reliance on cars is exacerbated by inconsistent schedules for regional buses and trains, as well as limited university-level support for multimodal commuting solutions [Buehler & Pucher, 2021].

The second major source is air travel associated with academic missions, including conferences, research collaboration, and fieldwork. Internationalization is central to AAU's academic identity, but it comes at a high environmental cost. Long-haul and short-haul flights disproportionately inflate the university's Scope 3 emissions, as air travel has significantly higher emissions per kilometer than other modes of transportation. This trend is particularly pronounced in research-intensive departments, where faculty are encouraged to maintain strong global networks, contributing to a high travel frequency [Eltis, 2021]. Moreover, postdoctoral researchers and visiting scholars also contribute to institutional travel emissions, with limited mechanisms currently in place to track or mitigate their travel footprints.

While less emphasized in formal emissions reporting, logistics and transportation related to university operations—including deliveries and service travel—also play a role. These operational trips, often taken using small vans or personal vehicles for administrative tasks and events, contribute marginal but avoidable emissions. Few centralized policies or guidelines currently exist to optimize or consolidate these transport needs, representing a potential area for low-cost intervention [Pojani & Stead, 2015].

3.1.2 Sources of Uncertainty in Mobility Emissions

Quantifying mobility-related emissions at AAU involves several data and methodological uncertainties that affect the reliability of emission inventories and the development of mitigation strategies. First, there is limited availability of mode-specific commuting data across the entire university population. While general trends are known—such as the dominance of cycling among students and car use among staff—the lack of systematic surveys or transportation logs hampers accurate estimates of distance traveled, vehicle types, and commuting frequency [Eltis, 2021]. Without such detail, current models rely on generic assumptions or regional averages, which may obscure departmental or demographic variability.

Second, emissions from academic and professional travel are typically underreported or poorly tracked. While some departments maintain travel logs for reimbursement purposes, these are not standardized or integrated into emissions reporting systems. Moreover, emissions calculators used in travel booking systems often exclude key variables such as travel class, layovers, or ground transport to and from airports. These gaps introduce significant uncertainty, particularly as air travel is a high-impact emissions source with wide variation depending on flight length and seating class [Bows-Larkin, 2015].

Third, hybrid and remote work arrangements since the COVID-19 pandemic have introduced further complexity. While some reductions in commuting-related emissions have occurred due to flexible work policies, there is no consistent data on how these behavioral shifts have changed travel patterns at AAU. Hybrid teaching models and digital collaboration tools may have reduced the need for on-campus presence, but without longitudinal data, it is difficult to quantify these impacts or determine if they are sustained long-term [UNEP, 2020].

Finally, international student travel—including one-time arrivals and holiday return trips—remains largely invisible in current emissions accounting. These journeys often involve long-haul flights and represent a unique emissions category not easily addressed through institutional policy, yet they form a substantial share of total mobility emissions in globalized academic settings [Gössling et al., 2020]. Future iterations of the CAP will need to address this gap by incorporating estimated emissions from international mobility flows into university-wide emissions reporting.

3.2 Campus emissions

Understanding the physical campus's contribution to greenhouse gas (GHG) emissions is essential to implementing Aalborg University's 2030 Climate Action Plan. University campuses are complex systems where energy use, infrastructure, and user behavior

interact to influence emissions outcomes. The Aalborg plan emphasizes the importance of addressing Scope 1 and 2 emissions from buildings, heating, and electricity, while acknowledging the rising impact of Scope 3 categories like procurement and mobility [Aalborg University, 2024]. To support evidence-based action, it is necessary to assess both the structural sources of emissions and the uncertainties that affect reporting and mitigation planning [UNEP, 2020; Offermann, 2021].

3.2.1 Major Sources of Campus Emissions

Buildings represent a major source of Aalborg University's GHG emissions, primarily through heating and electricity use. According to the university's Climate Action Plan, district heating—which supplies most of the thermal energy for buildings—is a key emissions contributor, although efforts are underway to transition municipal utilities toward lower-carbon sources [Aalborg University, 2024]. Emissions are also generated by ventilation systems, laboratory equipment, lighting, and IT infrastructure. Older, energy-inefficient buildings and high-demand research facilities present challenges for energy reduction, as noted in broader studies of university infrastructure [Offermann, 2021].

The plan outlines a pathway for reducing building-related emissions through retrofitting, digital energy monitoring, and user-informed behavioral strategies, such as encouraging energy conservation and deploying smart thermostat systems—approaches which are supported by energy reduction planning frameworks [Offermann, 2021].

There are also systemic gaps in data collection and user engagement. Facilities staff expressed uncertainty about how building use patterns relate to actual energy demand, while students and faculty reported little transparency around energy-saving initiatives. Without clear feedback loops or participatory mechanisms, it remains difficult to identify priority areas for intervention or to build user buy-in for energy-saving behaviors. These issues reflect broader challenges in operationalizing sustainability at decentralized institutions [Nielsen & Skov-Petersen, 2018].

3.2.2 Sources of Uncertainty of Campus-related Emissions

Estimating campus GHG emissions involves several uncertainties that can influence reporting accuracy and future planning. Key uncertainties include:

- Emission Factor Variability: District heating and electricity grids in Denmark have emission factors that fluctuate annually due to changes in fuel mix and renewable energy share. This makes long-term projections difficult without updated datasets.

- Data Gaps in Scope 3: Emissions from procurement, travel, and construction materials (Scope 3) are harder to quantify due to limited or inconsistent departmental reporting, making these values subject to underestimation.
- User Behavior Impacts: Variability in building use patterns, influenced by hybrid work and teaching models, can affect real-time energy use and make forecasting less reliable.
- Infrastructure Changes: Renovation and expansion projects may not yet be reflected in baseline emissions data, especially when future energy performance is uncertain.

The AAU plan acknowledges the need for transparent data collection and improved digital infrastructure for real-time monitoring to address these uncertainties and support evidence-based climate actions.

3.3 Procurement emissions

AAU's Climate Plan 2030 specifies clear targets across emission scopes: achieving climate neutrality for Scope 1 and 2 by 2030, and reducing Scope 3 emissions by 70% per FTE compared to 1990 levels—while reaching full climate neutrality across all scopes by 2045. Within the Scope 3 target, procurement holds particular importance; AAU aims to cut procurement-related emissions per FTE by 50% from 1990 levels by 2030 . Procurement currently accounts for approximately 38% of the university's total emissions (~1.1 t CO_2e per FTE in 2022), up from around 6,000 t CO_2e in 1990 [Aalborg University, 2024].

Despite ambitious targets, strategic documents—the Climate Plan and Sustainability Report—outline few binding policies, tools, or metrics to support procurement reform. Global best practices suggest that sustainable purchasing can be advanced through carbon-weighted tenders, lifecycle-based decision criteria, strengthened supplier transparency, and data-driven accountability. To align goals with outcomes, AAU must now supplement its targets with concrete implementation mechanisms, including baseline tracking, sector-focused tender adjustments, and procurement system integration.

3.3.1 Major Sources of Procurement-related Emissions

While the report does not provide a detailed category-level breakdown, insights from comparable higher education institutions and sustainability procurement literature point to several well-documented emission hotspots:

- IT and Lab Equipment: The production and transportation of high-tech equipment—including servers, computers, and specialized lab instruments—are

associated with high embodied emissions. These items also have relatively short replacement cycles in academic environments, further increasing their carbon footprint [Axelsson et al., 2024].

- Food and Catering Services: Though not as capital-intensive as construction, food procurement—especially meat and dairy—can be a significant source of emissions. Modeling studies suggest that shifting institutional food purchases toward more plant-based alternatives can yield substantial emissions reductions [Cerutti et al., 2018].
- Professional and outsourced services—such as security, IT support, and janitorial work—can contribute indirectly through facility lifecycle and supply chain emissions. Research shows that outsourcing does not reduce local GHG emissions and may even exacerbate supply chain emissions, underscoring how such emissions pathways are often overlooked in procurement analysis [Fu & Su, 2020].

These categories provide a useful starting point for prioritization. Developing procurement-specific emissions baselines would allow the university to identify high-impact categories and establish targeted reduction strategies, such as low-carbon vendor selection, product substitution, or service-level decarbonization commitments.

3.3.2 Sources of Uncertainty in Procurement Emissions

Efforts to decarbonize procurement are hindered by several technical and systemic uncertainties. First, data availability is a persistent issue. Like many higher education institutions, AAU relies on environmentally extended input-output analysis (EEIOA) to estimate procurement-related emissions. While efficient for generating broad estimates, EEIOA lacks granularity and is ill-suited for tracking changes at the product or supplier level [Lo, 2023].

Third, AAU's current procurement approach lacks formal guidelines for supplier emissions reporting. This gap is notable, as modern sustainable procurement research—such as Kannan's (2021) study on the Danish supply chain—shows that emissions transparency improves substantially when formal criteria, multi-tier reporting requirements, and stakeholder coordination are embedded in procurement systems [Kannan, 2021].

Third, AAU's current procurement approach lacks formal guidelines for supplier emissions reporting—a critical gap given that standardized climate provisions in public tenders (as seen in Germany) significantly improve data completeness and enforceability of emissions criteria [Chiappinelli et al., 2019].

3.4 Challenges for Equity Implementation

AAU embeds equity and climate justice into its overarching sustainability narrative, particularly through its alignment with the United Nations Sustainable Development Goals (SDGs). The university has made explicit its commitment to responsible consumption and inclusive development [Aalborg University, 2024]. This orientation provides a strong ethical foundation for pursuing climate-aligned procurement.

However, operationalizing equity within procurement processes remains a challenge. Emerging literature warns that well-intentioned sustainable procurement policies may disproportionately disadvantage small, under-resourced, or Global South suppliers. These entities often lack the capacity to meet advanced sustainability standards or participate in complex tendering processes [Leire & Mont, 2010]. At present, AAU does not appear to employ specific equity indicators to assess who benefits from procurement spending, nor does it address the risk of supplier exclusion based on sustainability thresholds.

In addition, case studies on green supply chains reveal that shifting to low-carbon products or in-house green manufacturing can entail longer delivery timelines and higher costs, especially if suppliers are inexperienced with sustainable practices [Niu et al., 2023].

Challenges related to campus emissions primarily stem from the mismatch between infrastructure capabilities and actual user behavior. Stakeholders frequently noted that many buildings are heated or cooled based on static schedules rather than real-time occupancy, leading to significant inefficiencies. Large lecture halls and administrative spaces are often conditioned regardless of whether they are in use, resulting in unnecessary energy consumption.

Another issue is the uneven distribution of energy upgrades across campus. Interviews revealed that while some newly renovated buildings are equipped with smart HVAC systems and automated controls, older facilities still rely on manual systems with limited adjustability. This creates discrepancies not only in energy efficiency but also in user comfort and satisfaction, particularly for students and staff working in legacy buildings. As a result, campus users often resort to personal fans or heaters, which further undermine energy-saving efforts.

Challenges related to mobility emissions at AAU reflect a complex interplay between cultural norms, logistical constraints, and institutional priorities. Despite a growing awareness of climate impacts, academic and professional travel remains deeply ingrained in university operations, with frequent flights seen as necessary for research collaboration, conference participation, and international visibility. Stakeholders noted that while virtual alternatives have become more common since the COVID-19

pandemic, there is still a strong preference—particularly among senior staff—for in-person engagement, which reinforces high-carbon travel behaviors. This culture of travel is further reinforced by performance metrics that reward international networking and publishing, indirectly encouraging frequent mobility even when low-carbon alternatives exist.

Equity concerns also shape the mobility landscape in important ways. Students and staff with limited financial resources or those living in areas poorly served by public transportation face greater difficulty accessing campus sustainably. Interviewees highlighted the cost and time burden of commuting by train or bus compared to driving, particularly for those residing in rural areas or juggling caregiving responsibilities. Additionally, international students and researchers often experience pressure to travel home or attend international events for visa-related reasons, exacerbating their travel footprint. AAU currently lacks mechanisms to assess or mitigate these disparities, and without inclusive mobility planning, efforts to reduce emissions risk placing disproportionate burdens on already disadvantaged groups. Addressing mobility-related emissions will therefore require strategies that are not only technically effective but also sensitive to the varied constraints faced by campus users.

Section 4: Recommendations & Solutions

4.1 Recommendations for Procurement based on Successful Case Studies

A practical, low-cost recommendation for reinforcing sustainable procurement at AAU is to implement tiered sustainability criteria in tenders—a strategy that accommodates varying supplier capacity and promotes inclusivity without additional expenditure. This approach is informed by Danish municipal case studies [Kristensen et al., 2020], which found that municipalities with diverse departmental strengths in green procurement benefit from flexible, scalable sustainability tools. By aligning requirements—offering basic expectations for SMEs and advanced criteria for larger contracts—AAU can ensure that smaller, under-resourced suppliers remain competitive while still advancing the university's climate goals.

Another highly applicable Danish model is the use of strategic procurement partnerships, particularly in building renovation contexts. In Denmark's strategic partnership framework, public agencies cooperate closely with a single, long-term contracted partner using relational contracting, shared risk management, and structured knowledge exchange [Berg et al., 2023]. This approach—adopted in dozens of major renovation projects—produced cost efficiencies, accelerated project delivery, and fostered sustainability innovation, all without requiring large upfront investment. AAU can replicate this by designing framework agreements or multi-project contracts within

specific procurement categories (e.g., lab equipment), promoting deeper supplier engagement, shared sustainability objectives, and continuous improvement over time

4.2 Campus Recommendations - Integrating Participatory Thermal Sensing to Advance Energy Efficiency and Equity at Aalborg University

Aalborg University's Climate Action Plan outlines an ambitious path toward carbon neutrality and climate resilience by 2030. One scalable, cost-effective, and human-centered strategy that could support these goals is implementing a Participatory Thermal Sensing (PTS) program, modeled after the TherMOOstat initiative at the University of California, Davis. TherMOOstat is a feedback-based tool where building occupants report their thermal comfort through a simple interface indicating whether they are "hot," "cold," or "comfy." This data is crowdsourced and integrated with Building Automation Systems (BAS) to identify areas of discomfort, HVAC inefficiencies, and energy-saving opportunities. The tool has helped UC Davis reduce unnecessary heating and cooling loads while increasing occupant satisfaction, comfort, and engagement. Our group has developed a prototype app for Aalborg University to use as a starting point for surveying and gathering feedback on thermal comfort around campus. The app prototype contains a basic outline of the questions used for data collection, alongside some of the current buildings located on campus as a reference. See Appendix 1 for application layout, which can also be found here: https://ucdavis.co1.qualtrics.com/jfe/form/SV_0855FAbToer7XXo

4.2.1 Climate Mitigation and Operational Benefits of Thermal Comfort App

Implementing a similar system at Aalborg University could:

- Optimize HVAC system performance by reducing overheating or overcooling in underutilized or misconfigured zones, leading to measurable energy savings and GHG emission reductions.
- Enhance energy efficiency of legacy buildings without requiring costly retrofits, helping address Scope 1 and 2 emissions in a resource-efficient manner.
- Inform long-term capital planning by identifying problematic spaces and prioritizing building upgrades based on real occupant needs, rather than assumptions or isolated complaints.

The TherMOOstat Resources site outlines key operational considerations that Aalborg can tailor to its context. Under the *Questions to Consider* section, campuses are encouraged to ask:

- Do we have a team familiar with HVAC systems and BAS who can assess and act on feedback?
- How will we triage feedback and communicate outcomes to participants?
- Do we have individuals or units to champion the program (e.g., student interns, facilities staff)?
- How do we embed this process into existing sustainability or energy data efforts?

These operational questions directly align with Aalborg's goal of mainstreaming sustainability into campus governance and operations.

4.3 Mobility Recommendations – Advancing Low-Carbon Travel Through Cultural and Structural Incentives

While Aalborg University's Climate Action Plan emphasizes reductions in Scope 3 emissions, mobility remains one of the most culturally embedded and structurally challenging domains to reform. Addressing emissions from staff and student travel requires not only the provision of low-carbon alternatives but also a deliberate shift in institutional culture and travel norms. Based on stakeholder interviews and comparative analysis of sustainability strategies in higher education, this section outlines several mobility interventions that complement AAU's CAP while centering user agency, recognition, and departmental accountability.

A foundational step is the introduction of a department-level carbon budgeting system for travel-related emissions. Rather than mandating top-down restrictions, this model assigns annual emissions targets for travel to each academic and administrative unit, calibrated based on historical data and functional necessity. Departments can then make their own decisions on travel priorities—whether to attend fewer conferences, use train travel within Europe, or favor hybrid meeting formats. This decentralized approach promotes autonomy and transparency while making emissions data more salient to decision-makers. Notably, case studies from the University of Edinburgh and ETH Zurich demonstrate that internal carbon pricing and departmental carbon caps significantly reduce air travel without compromising academic output.

To complement structural measures, AAU should implement a recognition-based behavioral initiative that celebrates low-carbon travel behaviors across campus. This may include an annual "Sustainable Travel Challenge" with awards or public acknowledgment for departments or individuals who exemplify climate-conscious commuting and business travel practices. Social recognition has proven particularly effective among faculty and students who are motivated by visibility and peer influence, as observed in campaigns like Stanford's "My Last Flight" initiative. This soft incentive

aligns with research showing that social norms and public accountability are powerful drivers of long-term behavior change, particularly when paired with supportive infrastructure.

Finally, a critical enabler of equitable emissions reduction is the institutionalization of hybrid and virtual collaboration tools beyond the pandemic period. Rather than reverting to high-frequency academic travel, AAU can establish policies and technical support that normalize remote participation in conferences, inter-campus meetings, and guest lectures. This not only reduces emissions but also levels the playing field for students, junior scholars, and international collaborators who face financial or visa-related travel barriers. Pilot efforts at Uppsala University and the University of British Columbia show that maintaining flexible digital formats sustains international academic exchange while cutting air travel by over 40%.

Together, these recommendations form a mobility strategy grounded in fairness, autonomy, and cultural change. By embedding emissions awareness into everyday departmental decisions and celebrating individual contributions to climate goals, AAU can reduce travel-related emissions without compromising its core academic values.

4.4 Equity and Inclusion: Gathering Diverse Input for Climate Action

A unique strength of this approach is its ability to incorporate a diversity and equity lens into sustainability. Traditional facilities planning often lacks input from those who are most affected by environmental discomfort—such as students, international staff, or employees working in under-resourced spaces. A PTS program provides an open, accessible, and inclusive channel for feedback from all campus users, regardless of their role or location on campus.

Benefits include:

- Equitable comfort: Ensures that thermal comfort is not just optimized for faculty offices or research labs, but also for lecture halls, study areas, and communal spaces that serve a broader, more diverse student population.
- Inclusive engagement: By encouraging feedback from everyone, including international students, students with disabilities, and those from underrepresented backgrounds, the university can better address systemic inequities in comfort and building quality.
- Educational opportunity: Student interns from diverse disciplines (engineering, social science, communication) can contribute to data analysis, system design, and outreach, enhancing academic and professional development while diversifying participation in campus sustainability leadership.

4.5 Conclusion and Recommendation

Adopting a Participatory Thermal Sensing (PTS) system, inspired by UC Davis's TherMOOstat, presents Aalborg University with a practical and innovative strategy to meet its climate and sustainability goals. This approach improves building energy performance through targeted HVAC adjustments, resulting in measurable reductions in energy use and greenhouse gas emissions. At the same time, it enhances occupant satisfaction by responding to real-time comfort feedback from students, staff, and faculty.

By placing users at the center of climate adaptation efforts, Aalborg can foster a more inclusive and responsive approach to campus sustainability. The program also supports the university's educational mission by engaging students in data analysis, outreach, and climate research. Furthermore, it creates space for diverse voices to contribute to planning and operations, advancing equity and participation in environmental decision-making. With strategic implementation and community involvement, this initiative is well-suited for pilot testing in 2025 and has the potential to position Aalborg as a leader in creating climate-smart, people-focused universities.

Section 5: Bibliography & Appendices

Aalborg University. (2024). *AAU Climate Plan 2030* [PDF]. Aalborg University. https://www.aaudxp-cms.aau.dk/media/wvrdaooh/aau_climate_plan_2030_final.pdf

Axelsson, K., Gong, J., Dugast, C., Lambe, F., Maquet, P., & Suljada, T. (2024). *Consumption-based emissions: A new frontier for EU climate policy*. Stockholm Environment Institute. https://doi.org/10.51414/sei2024.025

Berg, J. B., Thuesen, C., & Jensen, P. A. (2023). Procurement innovation as a vehicle for sustainable change: A case study of the Danish model of strategic partnerships. *Construction Innovation, 23*(3), 665–682. https://doi.org/10.1108/CI-04-2021-0067

Bows-Larkin, A. (2015). *Carbon emissions from international air travel: Trends and mitigation potential*. *Transport Policy, 34*, 4–13. https://doi.org/10.1016/j.tranpol.2014.12.010

Buehler, R., & Pucher, J. (2021). Sustainable transport in European cities. *International Journal of Sustainable Transportation, 15*(1), 1–20. https://doi.org/10.1080/15568318.2020.1851383

Cerutti, A. K., Ardente, F., Contu, S., Donno, D., & Beccaro, G. L. (2018). Modelling, assessing, and ranking public procurement options for a climate-friendly catering service. *The International Journal of Life Cycle Assessment, 23*(1), 95–115. https://doi.org/10.1007/s11367-017-1306-y

Chiappinelli, O., Gruner, F., & Weber, G. (2019). Green public procurement: Climate provisions in public tenders can help reduce German carbon emissions. *DIW Weekly Report, 9*, 433–441. https://doi.org/10.18723/DIW_DWR:2019-51-1

Eltis. (2021). *National policies supporting urban mobility transition in Europe*. European Commission. https://urban-mobility-observatory.transport.ec.europa.eu/sustainable-urban-mobility-plans_en

Fu, W., & Su, H.-C. (2020). Take actions or outsource? An empirical examination of strategic environmental options on greenhouse gas emissions. *International Journal of Operations & Production Management.* https://doi.org/10.1108/IJOPM-02-2020-0088

Gössling, S., Hanna, P., Higham, J., Cohen, S., & Hopkins, D. (2020). Can we fly less? Evaluating the ‘necessity’ of air travel. *Journal of Air Transport Management, 81*, 101722. https://doi.org/10.1016/j.jairtraman.2019.101722

Kannan, D. (2021). Sustainable procurement drivers for extended multi-tier context: A multi-theoretical perspective in the Danish supply chain. *Transportation Research Part*

E: Logistics and Transportation Review, 146, 102092. https://doi.org/10.1016/j.tre.2020.102092

Kristensen, H. S., Mosgaard, M. A., & Remmen, A. (2020). Circular public procurement practices in Danish municipalities. *Journal of Cleaner Production.* https://doi.org/10.1016/j.jclepro.2020.124962

Leire, C., & Mont, O. (2010). The implementation of socially responsible purchasing. *Corporate Social Responsibility and Environmental Management, 17*(1), 27–39. https://doi.org/10.1002/csr.198

Lo, S. Y. (2023). Decoding the accuracy of input-output models in carbon accounting for institutional procurement. *Environmental Impact Assessment Review, 98*, 106916. https://doi.org/10.1016/j.eiar.2022.106916

Nielsen, T. A. S., & Skov-Petersen, H. (2018). Bikeability—Urban structures supporting cycling in Denmark. *Cities, 72*, 1–9. https://doi.org/10.1016/j.cities.2017.07.029

Niu, B., Zeng, F., Shen, Z., & Jin, J. Y. (2023). In-house purchasing for green design products when the manufacturer's promised-delivery-time matters. *Annals of Operations Research.* https://doi.org/10.1007/s10479-023-05535-8

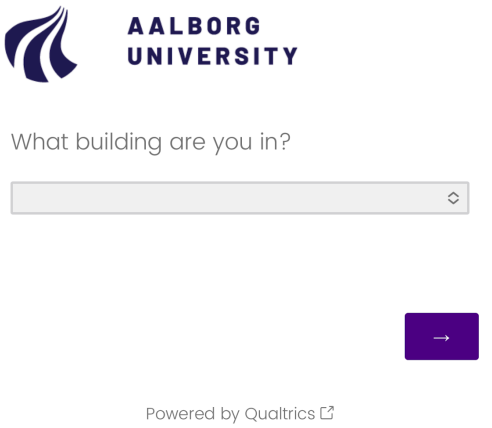
Offermann, S. (2021). *Creating a strategic energy reduction plan*. https://doi.org/10.1201/9781003207283

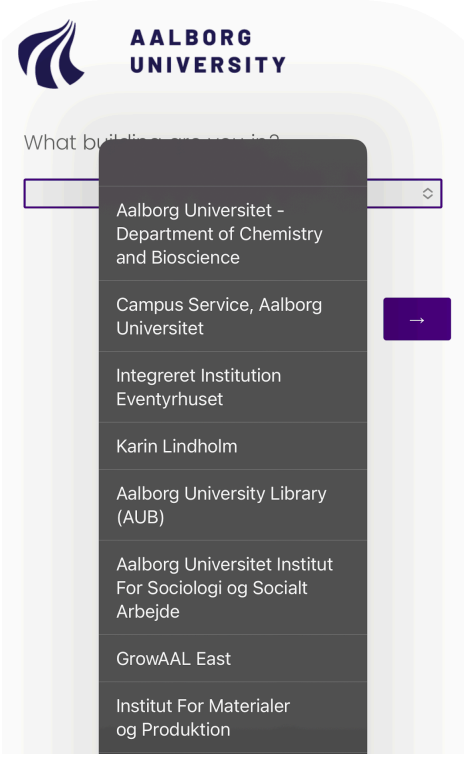
Pojani, D., & Stead, D. (2015). Sustainable urban transport in the developing world: Beyond megacities. *Sustainability, 7*(6), 7784–7805. https://doi.org/10.3390/su7067784

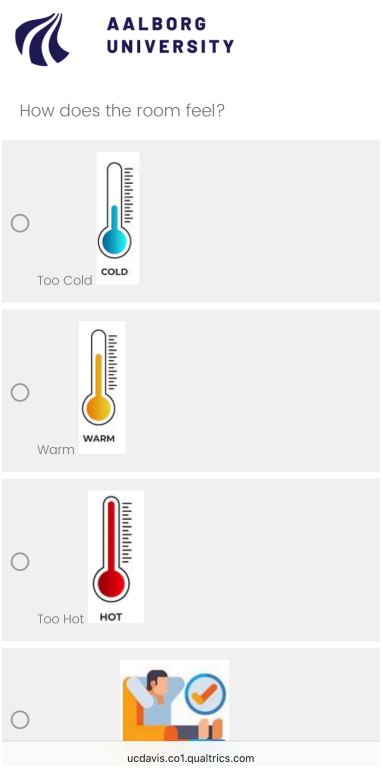
United Nations Environment Programme. (2020). *University greenhouse gas protocol guidance: Reducing emissions and improving transparency in the higher education sector*. https://www.unep.org/resources/report/university-greenhouse-gas-protocol-guidance

Appendix 1 - Building Thermal Comfort Survey Application

The following building thermal comfort survey was developed for Aalborg University as a starting point to implement and encourage student, staff, and faculty participation and input regarding energy use for building heating and cooling. Currently the application list a few buildings at Aalborg University, and can be expanded to include more buildings and specific rooms for a more robust survey. This layout is simplistic and easy to navigate to make it user friendly, and facilitate inclusion from various community members. Access: https://ucdavis.co1.qualtrics.com/jfe/form/SV_0855FAbToer7XXo







How are you willing to adapt to changing indoor temperatures to save energy? "I am willing to be.....

- ◯ Cooler (have thermostat settings heat room less)
- ◯ Cooler & Warmer (have a wider temperature range in both heating & cooling)
- ◯ Warmer (have thermostat settings cool the room less)

→

Any comments to add? (Notes about drafts, recurring comfort or recent changes, to help us understand what may be happening in the building)

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Appendix 2 - Climate Ambassador Training

Training Curriculum and Core Modules

Each module combines scientific facts, case-based learning, and behavioral insights to empower ambassadors as change agents. Training will reference Aalborg's Climate Action Plan and build on best practices from UC Davis' "Adopting Green Lifestyle" program.

Module 1: Climate Science and the Global Emergency

Goal: Provide a solid foundation in climate science, linking global trends to local responsibility.

Key Facts Covered:

- The Earth has warmed by ~1.2°C since pre-industrial levels (IPCC, 2023).
- Human activity is responsible for nearly all observed warming.
- Climate change increases risks of extreme weather, flooding, drought, and heatwaves—seen increasingly in Northern Europe.
- Denmark's emissions must drop by 70% by 2030 (compared to 1990) to meet national targets.

Ambassador Learning Outcomes:

- Understand causes and consequences of climate change.
- Be able to communicate urgency using data-driven narratives.
- Recognize local climate risks and the role of Aalborg University in mitigation and adaptation.

Module 2: Campus Footprint and Scope 1–3 Emissions

Goal: Understand institutional emissions and areas of influence.

Key Facts Covered:

- Scope 1: Direct emissions from campus operations (e.g., heating systems).
- Scope 2: Indirect emissions from purchased energy.
  Scope 3: Emissions from travel, food, procurement—typically 60–80% of total university emissions.

Ambassador Learning Outcomes:

- Learn to interpret university GHG reports.

- Identify opportunities for student-led reduction strategies (e.g., low-carbon commuting, zero-waste events).
- Use emissions data to advocate for sustainable policy and behavioral shifts.

Module 3: Sustainable Behavior and Behavior Change Theory

Goal: Apply social and psychological insights to shift habits.

Key Facts Covered:

- Behavioral change can reduce emissions by 5–10% without infrastructure changes (IEA).
- Visual cues, feedback loops, and peer norms are proven to influence action. Over 70% of students say sustainability influences their lifestyle choices—but many face barriers.

Ambassador Learning Outcomes:

- Apply nudge theory, framing, and incentives in campaigns.
- Design outreach that removes barriers to action (e.g., ease of recycling, visible transportation options).
- Facilitate student-driven climate pledges and workshops.

Module 4: Communication and Climate Narratives

Goal: Build confident, inclusive communicators.

Key Facts Covered:

- People respond more to stories and peer examples than data alone.
- Emphasizing hope and local impact is more effective than fear-based messaging.

Ambassador Learning Outcomes:

- Practice crafting persuasive messages and storytelling techniques.
- Host effective climate dialogues and peer-to-peer outreach.
- Use branding elements like mascots, color palettes, and visuals to support campaigns (e.g., UC Davis' “TherMOOstat” cow and building thermal comfort tool – Aalborg can co-create its own mascot for engagement and implement building thermal comfort survey tool).

Module 5: Climate Justice and Equity

Goal: Integrate inclusion and justice into climate action.

Key Facts Covered:

- Climate change disproportionately affects marginalized communities.
- Climate policies can unintentionally widen inequality if equity isn't addressed.
- Student involvement in planning enhances representation and effectiveness.

Ambassador Learning Outcomes:

- Recognize how to include diverse perspectives in campaign design.
- Use climate action as a tool for environmental and social justice.
- Co-develop inclusive surveys and participatory design practices.

Module 6: Campaign Planning and Campus Engagement

Goal: Equip ambassadors to lead successful sustainability efforts.

Core Topics:

- Event planning for sustainability fairs, climate weeks, and Green Action Days.
- Digital engagement through social media, QR-coded posters, and email campaigns.
- How to track, measure, and report campaign outcomes.

Ambassador Learning Outcomes:

- Draft and pitch a climate campaign.
- Engage stakeholders in housing, dining, and transportation.
- Monitor impact using simple metrics (participation rates, energy/waste changes).