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How does air conditioning become ‘needed’? A case study of routes, rationales and dynamics

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ABSTRACT

In the UK, air conditioning is becoming increasingly common in non-domestic buildings. From an energy and carbon perspective this is problematic. Identifying methods of preventing further reliance on air conditioning depends on understanding where and why it is being used. We draw on an analysis of the introduction of cooling in one complex case study site – a hospital in the north of the UK – to explore the processes of change involved. We find that the spread of air conditioning is an outcome of repeated moments at which multiple, situated forms of need become established. We argue that the various entry points in processes of building design, refurbishment, reuse and thermal system ‘repair’ are caught up in wider changes in the institutional context and working practices of the hospital. The use and reuse of internal space, increased reliance on heat emitting and heat sensitive technology and intense pressure to meet operational targets come together to create specific conjunctions in which air conditioning is seen to be necessary. These findings have implications beyond the case study setting. Limiting the spread of air conditioning requires multiple, customised strategies which differentiate between various forms of ‘need’, and a policy willingness to engage with the making of cooling demand.

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1. Introduction

In the UK the heating, cooling and ventilation of indoor spaces is responsible for a significant proportion of aggregate energy demand. Of these heating comprises by far the major part, but the energy used for cooling in non-domestic buildings has increased, with the number of installed conditioning systems and units growing markedly since the 1970s¹ [1]. In some specific settings the energy demand for cooling already exceeds that used for heating and further upward trends are expected [2,3]. The Carbon Trust suggests that “increased use of air conditioning” is likely to affect UK future energy demand [4] and the ‘high carbon’ scenario outlined in the 2050 Pathways analysis by the Department of Energy and Climate Change [5] includes the assumption that by 2050

“all non-domestic floorspace would be air conditioned” ([5], p. 104). Any development of this order would be hugely problematic given national targets of achieving an 80% reduction in net carbon emissions by 2050 and a 34% reduction by 2020 [6]. Identifying methods of reducing and preventing further reliance on air conditioning depends on understanding the dynamic processes that are involved. So why is it that more and more of the UK’s non-domestic building stock is air-conditioned?

Explanations for the diffusion of technologies are many and varied [7], but often seek to model processes of change using a limited set of macro level variables. For air conditioning, such analyses have generally centred on the interrelation between climate and affordability [8–10]. For example, Isaac and van Vuuren’s modelling of future domestic energy demand [11] supposes that in ‘hot’ climates, cooling technologies will be adopted as soon as they can be afforded. Such modelling typically makes assumptions about an inherent desire for thermal comfort, or, to be more accurate, for an indoor climate that remains at around 22 °C, whatever the weather outside. This approach sustains the view that in hot climates further air conditioning is simply inevitable, disregarding potentially important differences of history, culture and context. However, whilst it is true that the cost of installing mechanical cooling has

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¹ Department of Energy and Climate Change modelled data for example estimates an increase in installed ‘central’ air conditioning units from 108 in 1970 to 1859 in 2012. These figures have to be treated with caution but the relative scale of change is apparent.

fallen, in the UK outdoor temperatures have not risen dramatically to somehow move it beyond a temperate climatic regime.² External temperature alone is clearly not what is driving the 'need' for cooling.

What is missing in modelling approaches but is evident in more historical discussions of air-conditioning's development and subsequent adoption, is an appreciation of the cultural, scientific and technical work through which the apparent demand and need for new technologies is made and established [12]. Technologies in this sense are embedded in dynamic sociotechnical arrangements which are produced and sustained rather than given [12]. Cooper's [13] *Air Conditioning America*, remains the most perceptive study of this form, explaining how the air-conditioning industry was formed, and of the specific circumstances in which cooling took hold in industrial processes, cinemas, theatres, schools, offices and homes across the USA. Cooper's work demonstrates that far from being an obvious or inevitable trajectory, establishing both the possibility and the normality of air conditioning depended on a series of contingent material and historical conjunctions – a house building boom, an emerging field of physiological research, a set of commercial interests and a socio-cultural concern about health, well-being and air. Other commentators, including Arsenault [14] and Ackermann [15] provide further detail, explaining how in the US air conditioning came to signify status and respectability, and how various conventions and practices of daily life were re-arranged as a result. These largely historical works concentrate on the early days of air-conditioning and on the period in which it was not yet established as a viable or useful technology.

Research beyond the US context has also demonstrated that the need for cooling is best understood not as a natural or inevitable requirement but as an outcome of specific situated processes. Studies of the arrival, uptake and use of air conditioning, for example, in India [16]; Singapore [17]; Australia [18], Asia [19], the Philippines and Japan [8,20], have documented transition processes away from traditions and practices of cooling (e.g. vernacular building styles, outdoor living, etc.) identifying the particular discursive forms, material reconfigurations and cultural shifts through which more standardised regimes of air conditioning took hold. In drawing on this work as part of a wide ranging international review, Hitchings [21] stresses the cultural differences and contextual dynamics shaping the manner in which urban people across different world regions have come to manage their daily relations with outdoor temperature. In this sense a universal global air conditioning 'regime' has not become established, although as various authors note [22,23] there are globalising circulations of standards, norms and conventions that are pushing in that direction. Hitchings also observes that little research on the movement of air conditioning into temperate climates (such as the UK) has been undertaken, situations in which prior histories have been more about heating than cooling. His own work [24] has demonstrated how codes of office dress in corporate office settings in London have come to require air conditioned environments, while Parkhurst and Parnaby [25] identify a set of interweaving sociological, psychological and commercial explanations for why air conditioning has so rapidly moved into mobile transport settings across Europe. There has also been more technical work applied to a UK context focused on building design and ways of achieving passive ventilation and cooling in face of climate change trends [26,27]. To a large extent though, the ongoing movement of air conditioning into the UK building stock remains undocumented and unexplained in any detail.

² Between 1970 and 2000 the average number of cooling degree days ranged from 42 in the South to 0–5 in Scotland. <http://ukclimateprojections.defra.gov.uk/media/image/4/e/T.Fig2.Large.jpg>.

Bringing these threads together, we can observe that the growing demand for air conditioning in the UK is not related to the emergence of new air cooling innovations, to a sudden increase in outdoor temperature, or to a uniform transition away from traditional methods of keeping cool. Instead, the research reviewed above would suggest that trends in the growth of non-domestic cooling in the UK are likely to be the outcomes of multiple more specific pathways through which the need for and dependency on cooling is becoming established not in general, but for particular contingent and situated reasons [23].

In order to build on this foundation we report here on a detailed investigation of the introduction and use of air conditioning within just one organisation and physical setting – a hospital based in the north of England.³ We focus on this hospital not because it is especially unusual, or because it is in any sense representative of hospitals in general, but because it allows us to understand, in microcosm and within a diverse and multifunctional organisation, the routes, circumstances and rationales through which air conditioning has over-time become progressively embedded in its functioning as a healthcare provider. We use the detailed accounts of empirical material in this paper to provide a foundation for wider reflections on the contemporary diffusion of air conditioning (given that the hospital case study is part of a wider study of other non-domestic settings [23,28]) and the challenges involved in limiting further growth in the future.

Before moving into empirical detail some further conceptual and methodological grounding is needed. Whilst isolating air conditioning as a technology provides a focus for our research and empirical design, both the literature outlined above, and our own approach to understanding air conditioning as a sociotechnical phenomenon, means that in theoretical and methodological terms its connections and interrelations (rather than its isolation) have to be centre stage. In this respect we can make three related observations.

First, technologies, including air conditioners, do not exist or function alone. As is always the case, to some degree they are connected to and interdependent with other technologies and infrastructures. Air conditioning needs an electricity infrastructure, but also crucially some form of material structure (buildings, but also cars, train carriages and similar) which can separate internal from external air, making a 'sharp distinction' [13] between inside and outside and limiting movement between the two. Air conditioning mediates this separation, actively bringing conditioning into thermal exchanges and balances such that the temperature (and humidity) of indoor air is regulated to some degree. In necessarily being attached (for this focus of this paper) to buildings, air conditioning is then bound up and interconnected with other thermally relevant building-related technologies, but also with much else that makes up the materiality, meaning and purpose of any one building setting.

Second, although buildings can appear to be rather static and obdurate, they are from other perspectives full of change and instability [29]. As Latour and Yanava [30] argue '*a building is not a static object but a moving project, ... once it is has been built, it ages, it is transformed by its users, modified by all of what happens inside and outside, ... it will pass or be renovated, adulterated and transformed beyond recognition*'. Air conditioning may then variously figure in the 'moving project' or 'biography' [31] of a building over time, included or excluded as part of its evolving material form and function.

³ The name of the hospital and its location are not given for reasons of confidentiality.

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