To what extent has COVID-19 impacted hard-to-reach energy audiences?

Rotmann, Sea; Ambrose, Aimee; Chambers, Joseph; Mundaca, L.; O'Sullivan, Kimberley ; Viggers, Helen ; Harris Clark, Isobel ; Karlin, Beth ; Foster, Hale

Published in:
eceee Summer Study Proceedings

2021

Document Version:
Peer reviewed version (aka post-print)

To What Extent Has COVID-19 Impacted Hard-to-reach Energy Audiences?

Dr. Sea Rotmann
Hard-to-Reach Energy Users Task by Users TCP by IEA
43 Moa Point Road, 6022 WELLINGTON, New Zealand
Email: drsearotmann@gmail.com

Prof. Aimee Ambrose and Dr. Joseph Chambers
Centre for Regional Economic and Social Research (CRESR)
City Campus, Howard Street, SHEFFIELD, S1 1WB, UK
Email: A.Ambrose@shu.ac.uk

Prof. Luis Mundaca
International Institute for Industrial Environmental Economics
Lund University, Tegnérsplatsen 4, 22100 LUND, Sweden
Email: luis.mundaca@iiiee.lu.se

Dr. Kimberley O'Sullivan, Ms. Helen Viggers and Ms. Isobel Harris Clark
He Kāinga Oranga / Housing and Health Research Programme, University of Otago (Wellington)
23a Mein St, 6021 WELLINGTON, New Zealand
Email: kimberley.osullivan@otago.ac.nz

Drs. Beth Karlin and Hale Forster
See Change Institute
414 Rose Avenue, CAL-90291 VENICE BEACH, United States
Email: bkarlin@seechangeinstitute.com

Abstract

Energy users who don't participate in efficiency and conservation programmes despite ongoing outreach are often referred to as 'Hard-to-Reach' (HTR). These individuals or organisations can include, e.g., low income or vulnerable households; renters; and small businesses. More effectively engaging HTR audiences is key to ensuring everyone benefits equitably from low-carbon energy transitions and related (policy) interventions. This is even more so the case in light of the COVID-19 pandemic, and the ongoing implications for energy use and affordability for the most vulnerable (and newly-vulnerable) members of our society.

Within this context, the main purpose of this paper is to explore the extent to which HTR energy audiences have been impacted by COVID-19. Our primary method for this work was a comprehensive, critical literature review and a compilation of official statistics. We also collected survey, interview and focus group data during 2020 COVID-19 pandemic responses in the U.S., UK, NZ and Sweden. The geographical scope is determined by a 3-year project focusing on HTR energy users and implemented in partnership with the *User-Centred Energy Systems Technology Collaboration Programme* (Users TCP) by the International Energy Agency (IEA). Key findings we highlight and discuss in this paper:

- In the UK, energy debt is growing due to higher domestic consumption arising from lockdown measures and the reduced income of many households. Most households (72%) have increased their

energy (monthly gas and electricity bills are up £32) use. In response, 36% are turning thermostats down and 27% limiting lighting.
- In the U.S., a survey of 1,000 energy customers found that more than 50% are using more energy, and monitoring their energy use less; 15% reported postponing a utility bill.
- NZ's model COVID-19 "elimination" response has included housing, financial support, and specific energy payments to date, though unhealthy and unaffordable housing remains a major issue.
- Sweden has taken a different approach to manage COVID-19, yet when it comes to mobility, declines in demand (~25%) have shown relatively similar patterns to countries with stricter measures.

Whereas the pandemic has exacerbated several elements of the HTR policy discourse (e.g. impacts on vulnerable and/or low-income households), our findings also reveal several opportunities and critical aspects for policy makers, researchers and utilities to identify and engage HTR energy users and segments.

Introduction

Energy efficiency (EE) programme administrators and policy makers have long encouraged the adoption of energy-efficient technologies and conservation practices (Ashby et al, 2020a). Energy users who haven't yet participated in efficiency, demand response, and conservation programmes despite ongoing outreach, are often referred to as 'Hard-to-Reach' (HTR), 'underserved' (e.g. CPUC, 2018), or hard-to-motivate. These individuals, or sometimes even entire energy use segments (e.g. mobility) or organisations can include, for instance, low income (e.g. Cluett & Amann, 2015), other vulnerable groups (e.g. Cappers et al, 2018), or private cars users (Oswald et al, 2020) on the residential side; and small businesses (e.g. Trianni & Cagno, 2012), or building operators (e.g. Cowen et al, 2018) on the non-residential side. More effectively engaging both HTR audiences or HTR energy users is key to foster the transition towards low-carbon and sustainable energy systems, as well as ensuring everyone benefits equitably from EE policies and programmes (VEIC, 2019). This is even more the case in light of the ongoing COVID-19 pandemic, as we witness alterations in energy use (direct and indirect), demand for energy services (e.g. heating, mobility), resulting environmental emissions and/or affordability within HTR audiences and users.

Background to the HTR Task

In June 2019, EE and HTR researchers, practitioners, and policy makers from New Zealand, Sweden, the United States, the United Kingdom, and Canada embarked on a 3-year project in partnership with the Users TCP by IEA[1]. This international research collaboration between multi-disciplinary academics, behaviour change consultants, policy makers and practitioners seeks to characterise, in detail, the various audience segments that are commonly, but also vaguely, referred to as HTR in both the residential and non-residential (primarily commercial) sectors, and to uncover the barriers, needs and opportunities for more effectively engaging them.

Well-designed behavioural EE interventions, and a 'human focus' on energy use (rather than a technological one), have usually been regarded as an afterthought, if at all, and they receive significantly less funding (Overland & Sovacool, 2020), research and policy attention (aside from various 'Nudge Units') than technological solutions to the energy and climate crises (e.g. Mundaca et al, 2019). This oversight of a key area of robust research has contributed to continued increases in our energy consumption and related greenhouse gas emissions, in addition to energy injustice, social inequity and energy poverty (see Rotmann et al, 2021). The need to focus on the human impacts, behavioural responses and resulting energy use patterns and environmental emissions has been made clearer than ever by the COVID-19 pandemic (e.g. Bavel et al, 2020).

The HTR Task and COVID-19 impacts on hard-to-reach energy users and segments

The focus and shared goal of this international research collaboration was "*to identify, define, and prioritise HTR audiences[2]; and design, measure and share effective strategies to engage those audiences to achieve energy, demand response and climate targets while meeting access, equity, and energy service needs*."

The COVID-19 pandemic, and the immense, global response focusing largely on behavioural changes highlighted the great importance of utilising behavioural science to inform engagement strategies (ibid). It is argued that many of the short-term behavioural responses, if embedded long-term, can also help improve EE, public health, social inequalities, and the quality of our natural environment - even supporting the 'just transition' of our energy system (Henry et al, 2020). However, what the pandemic has also made clear is that any improvements at the micro-level will not be visible or maintained long-term at the macro-level unless wider system change is supported alongside - and that behavioural science concepts need to be carefully examined

[1] https://userstcp.org/annex/hard-to-reach-energy-users/

[2] "In this Task, a hard-to-reach energy user is any energy user from the residential and non-residential sectors, who uses any type of energy or fuel, and who is typically either hard-to-reach physically, underserved, or hard to engage or motivate in behaviour change, energy efficiency and demand response interventions that are intended to serve our mutual needs."

before using them to inform policy decision-making. “Behavioural fatigue”, for example, was a factor used by some countries like the UK to delay lockdown measures, leading to significant loss of life (Harvey, 2020). Another crucial impact of the COVID-19 pandemic is that many more energy users have now fallen into audience groups often regarded as HTR (e.g. low income, unemployed, vulnerable households, and small businesses; Mastropietro et al, 2020).

Although the COVID-19 pandemic may eventually (and hopefully) abate, its significant economic (e.g. unemployment, whole job sectors disappearing), health (e.g. chronic illness and mental & physical disabilities), and social consequences (e.g. high level of evictions and homelessness, compounded by structural inequalities) will likely persist (Kanda & Kivimaa, 2020). For example, vulnerable households and businesses will likely suffer disproportionately from additional global challenges, such as the climate crisis, economic recession / depression, racial protests etc. (Chen et al, 2020). The transport sector, an emblematic hard-to-engage or motivate segment, has also experienced demotorisation and decarbonisation opportunities. COVID-19 did also lead to reductions in energy demand and (at least in the short-term) improved environmental outcomes (e.g. reduction in greenhouse gases and air pollution; Bauwens et al, 2020), ongoing embedded behaviour changes (e.g. more work from home, less use or private car, less non-essential flying; Kanda & Kivimaa, 2020), and could lead to systemic governance changes (e.g. improved social welfare, just energy and labour transitions; Henry et al, 2020). This pandemic has certainly helped to highlight deep, structural inequalities in our societies, and foster research on segments or energy users who are in dire need of support or change, and who are often also hard-to-reach or hard-to-motivate for energy “Behaviour Changers” (see Rotmann, 2016).

In this paper, we present findings of an in-depth literature review on HTR audiences (Rotmann et al, 2021) and empirical research undertaken in four countries participating in the HTR Task. Our overarching research question was: *How has COVID-19 impacted on HTR energy users or HTR segments in our participating countries?* With due limitations, our study also aims to highlight the variety of HTR users and segments that need to be considered in the current HTR policy and academic discourse.

Methodology

The introduction of this paper was synthesised from a full, integrative, narrative literature review of 1000+ primary and secondary publications (Rotmann et al, 2021). The review focused on characterising, in-depth, HTR audience segments which were pre-selected based on input we obtained from surveys (N=135) and interviews (N=50) with HTR and EE researchers and practitioners and based on our participating countries’ priorities (Ashby et al, 2020b).

The empirical data on COVID-19 impacts on HTR energy users in each of our participating countries was collected using official data, quantitative (e.g. surveys) and qualitative (e.g. interviews and focus groups) methods. We would like to note that in our qualitative samples, sample sizes were either sufficient to generate data saturation, or we would also argue that this need not be the primary goal for this type of research where a small sample can generate rich storied accounts that in its own right, or when mixed and triangulated with other methods, provide a more detailed picture of experience and outcomes. The following methods were used:

- In the U.S., a census-representative survey of 1,000 electric utility customers (47% were classified as low-income < U.S.$50,000 p.a.) and 8 focus groups (N=38) with a subset of survey respondents (split into high/low income and high/low engagement) was undertaken (Forster et al, 2021).
- In the UK, a review of COVID-19 policy measures was undertaken (Ambrose et al*,* 2021). A qualitative 2017 study on the lived experiences of fuel-poor households (based on interviews, N=50) was updated by re-interviewing some of the same households (N=5) in April 2020.
- Data on energy impacts of COVID-19 on New Zealand households were collected through three online surveys (N=1452 in the first online panel), and phone interviews with a subset of respondents from the second survey (N=75 of 299 were identified as HTR, 7/17 interviewed were HTR). The third online survey (N=750) targeted students that were enrolled at a tertiary education provider during 2020.
- In Sweden, official data from transport authorities was reviewed. This was also complemented with another recent study (Mundaca, 2021) surveying transport modal shifts among users (N=1,210).

Results

United States

Background

A significant focus of EE programme administrators among U.S. utilities is on low-income customers, as they are relatively easily identified and targeted with e.g. *Weatherization Assistance Programs* (WAPs; see Bednar &

Reames, 2020). Other target HTR audiences are renters, and a few programmes target the geographically-remote or non-native language speakers as well as small businesses (VEIC, 2019). COVID-19 and its reverberations has caused the greatest levels of economic (and social) distress since the 1930s in the U.S. (Kalil et al, 2020). Its impacts were particularly hard on low-income, less-educated families with preschool age children (ibid) and people of colour, due to school closures, lockdowns, furloughs and increased rates of unemployment and evictions (see Rotmann et al, 2021 for detailed statistics).

HTR Annex Project Partners *See Change Institute*[3] undertook a survey and subsequent focus groups of utility customers across the U.S. to better understand customer satisfaction, use of programmes, interactions with the utility, and how COVID-19 has impacted their energy use and relationship to their utility (see Forster et al, 2021). This research took a customer-centred approach to understanding the customer-utility experience. Specifically, the links between the overall utility customer experience and the customer energy-saving journey was examined. Among the research questions in the survey, two were related to COVID-19, the third one was probed in more depth during focus groups:

1. How has COVID-19 changed customers' utility relationship and energy use?
2. How has COVID-19 influenced customers' investment in energy technologies?
3. How has utility communication changed since COVID-19?

Findings

When utility customers were asked to report any changes related to the COVID-19 pandemic, the most frequent response was that energy use increased (50%), followed by family members working from home (36%), postponing paying a bill (15%), purchasing smart home equipment (14%), contacting their utility more than usual (12%), and using a new channel (e.g., social media, online portal) to contact their utility (11%). When prompted during focus groups on communication from their utilities around COVID-19 support, 63% of respondents offered positive assessments regarding the support their utility was offering particularly to vulnerable customers (although some of the high-income respondents mentioned "unnecessary COVID-19 email overload" from their utilities).

Additional COVID-19 related concerns

Participants were also asked to report on whether they had concerns about letting technicians into their home to perform work, and whether they have paid less attention to their energy usage due to changes in their lifestyle brought on by the pandemic. We found that 48% of households spent less time monitoring their household energy use and (49%) expressed increased safety concerns with letting technicians into their homes.

Demographics predicting bill postponement due to COVID-19

Overall, 15% of the total sample indicated they had postponed their bill due to COVID-19. These participants were demographically diverse, but tended to be somewhat lower income than the general sample and included a somewhat greater proportion of renters and a lower proportion of white respondents.

Home purchases postponement by demographics

We also examined whether a set of demographic predictor variables (income, age, white vs. non-white, gender) could meaningfully explain variance in participants' reported decision to postpone home purchases during the pandemic. While the demographic model incorporating these variables accounted for just 2% of the variance, we did find significant demographic differences. Specifically, non-whites, those of lower incomes, and younger participants were more likely to postpone purchases. Finally, there was a positive association between participants postponing purchases due to COVID-19 and monitoring energy usage less since COVID-19 began. Those postponing their purchases were 4% more likely to report paying less attention to their energy usage, suggesting that utility use may not have been a priority in the context of COVID-19-related changes.

COVID-19 related utility communications

Low-income focus group participants were more likely to notice energy-saving tips on their bills, and they mentioned COVID-19 relief more commonly, and more positively. Higher-income groups often pointed out that they didn't need the support provided by COVID-19 communications, whereas lower-income participants were more appreciative of them, even if they didn't apply for the support. The exception was where support provided only prolonged the pain - e.g. by offering a short-term moratorium but expecting pay back of the whole bill (sometimes, plus interest) within 3 months. More personalised communication to utility customers during crises based on such demographic and psychographic information could thus help utilities provide more targeted support for those customers most in need.

[3] www.seechangeinstitute.com

United Kingdom

Background

The impacts of COVID-19 for UK fuel poor households – those who struggle to afford to heat their homes to a comfortable temperature – have received inadequate coverage or consideration due to the scale of fuel poverty in the UK and because of the crisis, many more households fell into this category for weeks and look likely to remain in it for months to come. Discussion to date has focussed on the amount households are spending on energy during lockdown. This is a valid focus, not least because recent research has revealed the average UK household was set for a 37% rise in their annual energy bill due to increased consumption as a result of remote working. Furthermore, 72% of households increased their energy use since the onset of the pandemic, spending an average of £32 extra a month on energy[4] (Partridge, 2020) and, because the lowest income and most vulnerable households are concentrated in the least energy-efficient housing (Burlison et al, 2018) they are likely to experience a higher than average increase on top of already strained household incomes.

Research on pandemic impact on fuel poor households suggests that lockdown and ongoing restrictions on daily lives have raised challenges beyond utility bill increases. Most significantly, it has confined such households to cold and uncomfortable homes that provide little in the way of sanctuary and has closed off the alternative spaces that they relied on to find warmth, comfort and social contact. Furthermore, falling housing quality in the UK has worsened fuel poverty rates due to many EE programmes being paused (Kotak & Chappell 2021).

Findings

The impact of COVID-19 on UK's fuel poor

Fuel debt is growing due to higher domestic consumption arising from lockdown measures and the reduced income of many households due to unemployment, shielding and furlough. By September 2020, 2.1 million energy consumers had fallen behind on their energy bills, 600,000 more since February 2020, with average household arrears of £760 for electricity and £605 for gas (Citizens Advice, 2020a). Furthermore, 700,000 households on prepay meters (16% of total) had been unable to top-up since March 2020 (ibid). Colder winter months and ongoing waves of redundancies are thought to have increased these numbers further (Ofgem, 2021).

Since the start of pandemic, the UK Government/Ofgem[5]/industry put agreements in place to protect vulnerable consumers) through payment holidays, credit loans and emergency top-ups for prepayment meter consumers (BEIS, 2020). In February 2021 however, Ofgem announced the cap will be lifted on energy bills, resulting in a predicted increase of household costs by an average of £96. There is also evidence of higher levels of self-disconnection after not topping up a prepayment meter due to insufficient income due to COVID-19 (Citizens Advice, 2020b). This is of particular concern seeing that self-disconnection can exacerbate physical and mental health problems (Citizens Advice, 2018). Again, private rental tenants are more likely to be affected, given that many pay for their fuel via prepayment meters (Ofgem, 2019). Further evidence of the energy challenges people are facing is provided by market research which found that 26% of families were struggling to pay their energy bills and 23% were worried about their ability to meet upcoming financial obligations[6].

The Government also introduced temporary protection against eviction for tenants as part of its emergency measures in response to the COVID-19 pandemic (MHCLG, 2020). Yet, Citizens Advice (2021) reported half a million people were behind in their rent payments, with an average of £360 owned per person and one in four renters being threatened with eviction. The problems also illustrate the lack of security, alongside problems of affordability, that many private tenants face and which has been exacerbated by the pandemic. Rates of fuel poverty, debt and self-disconnection are very likely to get worse, given the growing rate of unemployment (Oct-Dec 2020) which stands at 5.1%, 1.3% higher than a year ago and 0.3% higher than the previous quarter (ONS, 2021). With 600,000 additional households falling into fuel poverty since the start of lockdown (Citizens Advice 2021), this is an urgent problem to address for policymakers and utilities alike.

Understanding the lived experience

In this section, we draw on data from a previous study which provided deep qualitative insights into the lived experiences of highly vulnerable fuel poor households, undertaken between 2016 and 2019 (Ambrose et al, 2017). This data supports an understanding of the rhythms and routines of life in fuel poverty and provides some indications of the specific ways in which COVID-19 and the associated lockdown may have impacted upon the

[4] Findings based on a survey conducted in January 2020 of 2,437 UK adults aged 65 and over, commissioned by Compare the Market and conducted by Populus

[5] The government regulator for gas and electricity markets in Great Britain

[6] Research undertaken by Yonder Consulting on behalf of comparethemarket.com, surveying 2,082 UK adults between 15-17 January 2021

lives of fuel poor households. The study involved 50 interviews, aimed to understand the experiences of fuel poor households living in private rented housing. These insights have renewed significance in the face of COVID-19 - a time when it is more important than ever that the home offers a safe and comfortable sanctuary.

In April 2020 (about six weeks into the first UK lockdown), we re-contacted a number of participants in the 2017 study to find out how they were coping with life under the lockdown. Specifically, we sought an update on their circumstances, establishing what sort of accommodation they were now living in and whether they still struggled to afford to heat their homes to a comfortable temperature. We asked them how they were coping with lockdown (financially and otherwise) and how it was impacting their ability to stay warm and comfortable.

One respondent, Mo (53) told us in 2017 that he relied on local libraries, cafes and riding buses around London to keep warm and to reduce time spent in his bedsit. We discovered that the loss of his job (for health reasons) and the lockdown had effectively removed all of Mo's usual coping strategies:

"*The main things that I miss are being in work - it was always warm in there. I sat by a gas fire in the winter and that was bliss really. I miss being able to go to the library and read the paper in a warm place before maybe going to a café and nursing a tea for a bit. It was a social thing but also about saving electricity - a pound on a mug of tea was much cheaper than a couple of hours in the flat and nicer, too. I miss that and riding the buses.*"

Our interview with Sasha, a single mother of a primary school-age child, revealed how school had formed a key coping mechanism for her and her son, alleviating some of the pressure on her to provide warmth and nutrition. The alternative strategies she has employed since school closed are ingenious (notably the use of passive solar gain and distraction techniques) but require a lot of effort to maintain and placed a strain on their relationship:

"Now he's not at school, I have to feed him all his meals here. He never stops eating and he does complain that the house is cold. So I have to keep him distracted or he asks for food all the time. He would prefer to sit and watch tele but if he does that then I need to put the heating on….we walk a lot but in quiet places because I don't want him exposed. I get him to run fast when we get near the house so he's warm when we get inside. The sun starts off on the back of the house and by mid-morning, his room is pretty warm on a sunny day, so we play in there until it moves round and then we play in my bedroom later in the day. We're both so much more relaxed when we're warm and the sun is shining and we argue less then."

Both Sasha and Mo's accounts bring the well-established 'heat or eat' maxim into sharp relief (Lambie-Mumford & Snell, 2015). This maxim could be criticised for oversimplifying the complexities of life in fuel poverty but it seems to resonate for these two respondents as they describe the daily trade-offs necessary to survive lockdown. It is clear that lockdown is a challenging time for many. These accounts reveal the extent to which it is adding to existing stresses in homes and affecting health and wellbeing. The fuel poor live in the most poorly-performing homes which are challenging to live in under normal circumstances. Spending more of their budget on energy than more affluent householders means that even seemingly small increases have a profound effect.

A narrow focus risks obscuring the bigger picture. It is not solely about the home, nor is it only about energy. By considering only the home we risk forgetting that the spaces of coping are varied and dispersed. With access to libraries and cafes restricted, and safe public transport services limited, those opportunities to seek out warmth in a public space are lost, and those opportunities for social warmth and companionship with family and friends are restricted. Even public areas and front yards become spaces of anxiety and coping strategies must be adapted or reinvented. With more time spent at home with the whole family, grocery costs must be added to the balance sheet as must the energy used for cooking, entertainment and home working and schooling.

New Zealand

Background

New Zealand has implemented a highly-successful (Robert, 2020) COVID-19 elimination strategy (Baker et al, 2020), which has seen the virus eradicated in the community and allowed the country to operate largely as usual following a strict Level 4 'lockdown' from 25 March to 27 April 2020. NZ remained in a lighter Level 3 'lockdown' until 13 May 2020 when businesses, education, and public facilities reopened under Level 2 restrictions. This has remained the case with the exception of two minor localised outbreaks of COVID-19, which have been swiftly eliminated through less strict regional Level 3 'lockdown' measures in Auckland while the rest of the country returned to Level 2. A recent survey (Jenkins et al, 2021) showed that ⅔ of New Zealanders have experienced significant 'silver linings' (i.e. positive aspects such as post-traumatic growth, increased resilience, more meaningful relationships, less environmental pollution) following the country's world-class COVID-19 response (Jefferies et al, 2020).

Findings

A panel survey undertaken by Horizon Research Limited NZ (see https://www.horizonpoll.co.nz/) (n=1,452) included three questions to enable comparison to a more in-depth online survey focussing solely on the impacts

of COVID-19 on home energy use in 2020. Of those 2% of respondents in the panel survey who had been disconnected from electricity in the past year to September, all had a maximum gross annual household income of NZ$70,000. Disconnection was also more prevalent where household income was less than NZ$30,000 per year. Indicating poor thermal comfort, 37% of respondents reported being able to see their breath indoors. Of the 12% who reported that this occurred four or more times during the winter, they were more likely to be younger, working, to have less personal and household income, and to have children at home compared to the average. Just under 5% of all respondents (an estimated 165,000 adults extrapolating to the NZ population) said they always had to juggle other bills or spend less on food to afford electricity or gas and just over 5% (an estimated 190,100 adults) said they often had to do so, while 32% (an estimated 1,147,900 adults) said they sometimes did. A further 1% reported that they did have to juggle bills or spend less on food to afford household energy since COVID-19 – but where a respondent reported losing their job as a direct result of the pandemic, this rose to 9%, and 3% where work hours had been reduced. Among those who had lost their jobs as a direct result of COVID-19, 14% said they always had to juggle bills or spend less on food to be able to afford their energy.

The second online survey investigated how participants' (n=299) use of energy had changed during COVID-19 Level 4 restrictions (O'Sullivan et al, forthcoming). A HTR-subset (n=75/299) was constructed using five indicators (>85yo; <$40,000p.a.; non-NZ immigrants; poor housing; prepayment meters). Similar proportions of the HTR and other households reported a decrease in income during Level 4 lockdown (22% vs 25%), however a greater proportion of HTR households reported that their income had remained constrained post-lockdown (26% vs 17%). The HTR sample were much more likely to report having received the *Winter Energy Payment* (40% vs 19%) and to at least sometimes having to juggle between other bills or food to afford electricity (31% vs 15%), and also having to do this juggling just since COVID-19 (6% vs 1%).

Seven of the HTR subset respondents also participated in follow-up phone interviews undertaken with 17 of the 299 survey respondents. This data confirmed that the HTR subset were more conscious of energy use and were particularly at risk of energy poverty during and after the initial strict lockdown period, illustrated by P5 who commented: "*I tried very hard, like I was very aware of it and tried very hard not to have the heater going like I'd just have it on for five minutes and then turn it off, and then turn it back on.*"

Tertiary students in New Zealand would normally be classified as HTR energy users, in that they are typically either renting a single room in multiple-occupancy housing ('flatting' or living with 'roommates'); in formal student accommodation, usually with electricity included in the cost of rent and therefore with cost and usage 'hidden' from students as they do not have a direct relationship with their energy retailer; or living at home (with their parents or their family). Most (60.4%) of the 750 respondents were in shared (multiple-occupancy) housing in the private rental sector, and 29% reported that their energy costs were fully or partially included in their rent (Harris Clark & O'Sullivan, forthcoming).

Although progress is being made, New Zealand has a long history of poor quality, cold, damp, and mouldy housing, especially among the private rental sector (Telfer-Barnard et al, 2019). Students reported poor thermal comfort across a range of indicators, with results more severe in comparison with surveys of the general population. Health and wellbeing of students was negatively affected by cold and poor housing conditions, and the results demonstrate that students are at increased risk of energy poverty than the general population. In open-text responses, the effects of energy poverty on mental health was a recurrent theme, illustrated by the following quote: "*The cold has a major impact on my mental health, midwinter this year I started taking anti-anxiety medication, and one of the main stressors at that time was how cold I was*." (Respondent 101).

When asked if COVID-19 made it more difficult to pay for bills like electricity 15.4% of student respondents said yes, while 40% said yes, but that their energy use and costs went back to normal after 'lockdown' measures ended. Students in New Zealand are able to borrow 'course-related costs' as part of a Student Loan from the government, which has a 0% interest rate while they are living in New Zealand and is paid back at a rate of 12% of gross income over a threshold when working. The maximum annual course-related cost amount was doubled from NZ$1000 to NZ$2000 in 2020 as part of the government response to COVID-19. Of the 307 who responded to the question of whether they used the course-related costs payment to help with energy costs, 53.8% said yes, at least somewhat.

Taken together, these data from New Zealand confirm that the COVID-19 pandemic presents an even greater challenge for those residential energy consumers who are HTR – especially compared with the majority positive impacts reported by Jenkins et al (2021). However, indications are that the initial extension of the Winter Energy Payment was successful in basic targeting towards HTR households. The combination of greater need for energy use at home due to restrictions as well as reductions in income during and after restrictions will require ongoing policy targeted to support HTR households to improve energy efficiency, as well as financial support to improve energy access – even when the country has largely been operating "as before" since the first national lockdown period ended in May 2020 in one of the most successful COVID-19 responses globally.

Sweden

Background

Mobility and transport (private car users and international travellers) were identified as a specific HTR segment in Sweden (for details see Ashby et al, 2020b). There are multiple (and growing) reasons behind this, particularly from a user perspective and how hard-to-engage or hard-to-motivate this audience is. For example, the transport sector accounts for half of energy-related CO_2 emissions (IEA, 2019) and there are growing calls for stronger policy actions to achieve the goal of a fossil-fuel independent vehicle fleet in 2030 (Klimatpolitiska Rådet, 2020). As the nation has become wealthier and its purchasing power has increased, travel frequency and travelled distances have also grown (including resulting carbon emissions; Norden & IEA, 2016), and private car ownership remains high (>500 road motor vehicles per 1,000 people) and continues to grow (SCB, 2018). Mobility also relates to high-income households (another identified HTR segment in Sweden) that exhibit increasing demand for both direct and indirect energy use in relation to, such as private car use (e.g. vehicle fuel), and international air travel (e.g. package holidays). In fact, emissions from Swedish residents' air travel increased by 61% between 1990 and 2014 and had equalised emissions from private car use (Larsson et al, 2018) before the pandemic. From a policy perspective, the *Climate Act and Climate Policy Framework* adopted in 2017, which established a net-zero GHG emission target by 2045, also includes a milestone goal for domestic transport (excluding domestic flights): a reduction of emissions by 70% in 2030 compared with 2010 levels (Ministry of Environment and Energy, 2018).

Findings

Like in many countries, mobility and transport patterns in Sweden have been significantly affected by the pandemic (see Figure 1). Overall, an average reduction of nearly 25% in the use of all transport modes during 2020 is estimated. Consistent with international trends, major reductions in demand for aviation have taken place (up to 80–90% in March-April 2020). In large cities, like Stockholm and Göteborg, the use of passenger cars reached reductions in the proximity of 15% in 2020 (Trafik Analys, 2021). In fact, road traffic as a whole exhibited a reduction of 25% during the first wave of the pandemic, and 16% during the second one. Passenger trains experienced even lower demand (e.g. 30% in May 2020). When it comes to modal shifts and sustainable transport, a recent study (N=1,210) showed that people used walking (18%) and cycling (11%) in 2020 more often than in 2019 for non-recreational activities (Mundaca, 2021). However, significant reductions in the use of public transport (42%) were also identified. Consequently, GHG emissions from the Swedish transport sector have dropped significantly (e.g. 38% in the 3rd quarter of 2020 compared to 2019; SCB, 2021).

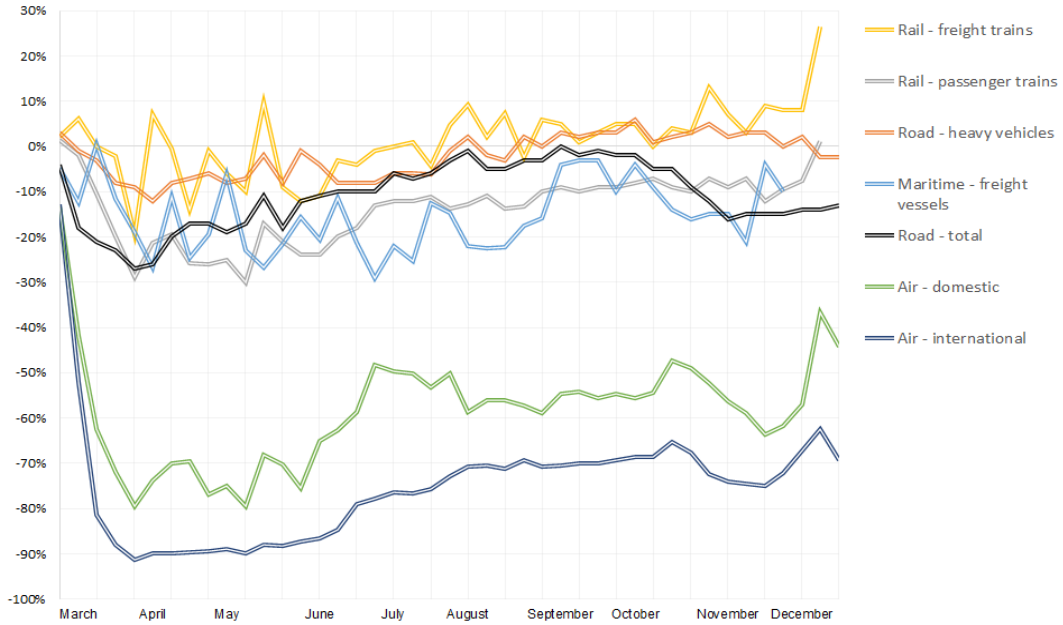

Figure 1: Use of transport modes in Sweden for the March-December 2020 period. Numbers show relative changes by comparing weekly traffic volumes between 2020 and equivalent periods in 2019. Data source: Trafikanalys (2021).

As a whole, the pandemic has shown (or confirmed) various policy opportunities to address HTR energy users (e.g. private car commuters) in this HTR sector. Firstly, it has revealed that reductions in mobility needs are feasible and that possibilities for non-essential travel need to be further explored or materialised (e.g. via the digitalisation of work). Second, it has also stressed the role and significance of active travel (i.e. walking and cycling) and related health and environmental benefits. In turn, this highlights the need to maintain or improve active travel infrastructure, which can also be targeted via economic recovery stimulus packages (IEA, 2020). This also calls for a better integration of economic benefits of active travel in policy assessments, which appear to be lacking in transport decarbonisation studies (Woodward and Wild, 2020; Smith et al, 2017). Third, this also reveals that improvements in the public transportation system will very likely play a role once the pandemic is over and there is a need to revamp / resuscitate the demand for it —particularly if preferences for private car use bounce back (e.g. Kanda & Kivimaa, 2020). At the same time, increased demand for active travel also indicates that a better integration with public transportation and other forms of mobility services (e.g. car sharing, although mobility-as-a-service products have suffered setbacks due to social distancing, ibid) will need further assessments. Fourth, the pandemic has also disrupted the global supply and demand for biofuels (Elleby et al, 2020), and Sweden is not the exception. Studies indicate that a secure supply of biofuels, which can improve the environmental credentials of this HTR sector, is a critical element to achieve the goal of a fossil-fuel independent vehicle fleet in the country (Mundaca et al, 2015). The situation can serve as basis to (re-)assess the extent to which this transition will rely on imported biofuels or establish a domestic production of sustainable biofuels (c.f. Klimatpolitiska Rådet, 2020). Finally, the pandemic also highlights the role of local authorities in the design and implementation of behavioural-oriented policy interventions (e.g. addressing decision information, support and/or assistance). For instance, as the Swedish approach to combat COVID-19 has entailed far fewer restrictions compared to other countries (e.g. Kanda & Kivimaa, 2020), guidelines to the public stressing social responsibility have played an important part. In the case of mobility, local transport organisations and agencies have launched several campaigns calling for users to, e.g. work from home whenever possible and re-assess the need for travel to stop the spreading of the virus. While the trends shown above seem to suggest some degree of effectiveness, the situation underlines that behaviour interventions (e.g. social norms) implemented during the pandemic need to be properly evaluated. For example, this can improve their design, implementation, accountability and transparency. Evaluation is also critical to assert the degree of complementarity, and potential extension and re-orientation once the pandemic is over, between behavioural-oriented interventions and existing transport policy portfolios, which appear to be heavily dominated by economic instruments (e.g. fuel and road taxes).

Conclusions

From a conceptual and project perspective, these short case studies from four different countries, spread among large geographical areas, provide some initial insights:

1. *Who researches HTR energy users* - the so-called “Behaviour Changers” in charge of collecting data and funding, designing, implementing and evaluating pilots and programmes targeting the HTR differ between countries: In the U.S., it is largely utilities and third party EE implementers and evaluators who collect data and design targeted programmes. In Sweden and New Zealand, this work is shared between dedicated government agencies and academia, with a lesser onus on utilities. In the UK, dedicated government agencies and utility regulators (Ofgem) work with charities (Citizens Advice) and academics (Fuel Poverty Research Network) to provide cross-sector collaboration.
2. *Which HTR energy users are regarded as high-priority*: In the UK, U.S. and NZ, “vulnerable” households are regarded as high-priority targets by different Behaviour Changers, and they are usually defined primarily by low income. In NZ, however, research and policy has been focussed towards very specific HTR groups in order to establish risk groups for effective EE and energy poverty policy targeting (low-income households, poor quality housing, elderly, non-European immigrants, prepayment meter consumers, and tertiary students). In Sweden, with its lowest rate of energy poverty, the priorities are geared towards mobility and transport, and resulting emissions, particularly among private car users and international travelers. Overall, the cases underscore the variety of HTR energy users and audiences. Country-specific issues and contextual aspects frame their definition, characterisation and potential (policy) interventions.
3. *How to collect data on HTR energy users* - to gain valuable insights into those energy users widely regarded as “hard-to-reach”, a mixture of high-level government statistics, utility data, in-depth reviews of policies and publications, and quantitative and qualitative insights (demographic and psychographic), such as surveys, interviews and focus groups of targeted audiences are recommended.

From a policy perspective, the pandemic is also revealing various opportunities and critical issues for stakeholders. At the risk of generalisation, it is showing that policy makers, utilities, researchers and local

authorities have numerous avenues to make HTR energy users more 'reachable' in the future. At the same time, the situation is also underscoring significant elements for the design and implementation of future initiatives.

First, our findings suggest that HTR energy users have become more aware about their energy use, patterns and demand of energy services (e.g. mobility, heating), overall. To some extent, one can argue that the pandemic has created a sort of a massive 'awareness raising campaign' in this area; something that has lasted for a significant time period in most countries. While the effectiveness and persistence of this unplanned policy intervention remains to be seen, we would expect that barriers related to engaging or motivating HTR energy users in future interventions or programmes should be less pronounced in the analysed countries - particularly as the link between health and housing (and related energy use / costs) has been more pronounced.

Second, our findings strongly suggest that there is an abundance of policy interventions and programmes to address HTR energy users. They include, for example, the use of social norms, (comparative) feedback, "nudges", and also more traditional interventions such as direct subsidies and credit loans / guarantees. A key issue relates to the level of ambition, integration and coverage of these (potential) interventions; including their performance. The latter inevitably highlights the importance of rigorous assessments, particularly when interventions address simultaneous objectives (e.g. energy efficiency, climate mitigation, poverty alleviation, health, and social inclusiveness).

Third, our findings also underline the strong linkages between HTR energy users and their wellbeing; especially when it comes to vulnerable or low-income households and mobility. This means that wellbeing should be at the core of any programme or intervention addressing HTR energy users in the future (e.g. what are the links between independence, mobility and wellbeing?). The provision of (long-term) certainty also appears to be significant from a HTR energy user perspective. While poverty or the lack of basic energy services (e.g. heating) may still be too abstract for decision-makers, there is a need of ensuring that the wellbeing of HTR energy users is properly understood and improved. The inclusion of hedonic welfare or subjective wellbeing in the design, implementation and evaluation of HTR-oriented interventions appears to be a doable avenue in the short term.

Finally, the pandemic has also highlighted that trust remains a core aspect to effectively reach HTR audiences. This means that despite the sophistication or complexity of interventions addressing HTR segments, it seems that gaining and managing trust among HTR energy users remains a critical factor of success. The literature shows that honesty, competence, cooperation, and norms are significant determinants in this process (e.g. Dunning et al, 2019).

References

Ambrose, A., McCarthy, L. and Pinder, J. (2017) Energy (in)efficiency: what tenants expect and endure in private rented housing. Sheffield: CRESR, Sheffield Hallam University.

Ambrose, A., Baker, W., Chambers, J. & Sherriff, G. (2021). Covid-19 & Hard-to-Reach Households. Manuscript in preparation.

Ashby, K., Rotmann, S., Smith, J., Mundaca, L., Reyes, J., Ambrose, A., Borelli, S. and M. Talwar (2020a). Who are Hard-to-Reach energy users? Segments, barriers and approaches to engage them. In Proceeding of *ACEEE Summer Study for Energy Efficiency in Buildings*. Monterey.

Ashby, K., Smith, J., Rotmann, S., Mundaca, L. and A. Ambrose (2020b). *HTR Characterisation*. Users TCP HTR Annex: Wellington.

Baker, M., Kvalsvig, A., Verrall, A.J., Telfar-Barnard, L., Wilson, N., 2020. New Zealand's elimination strategy for the COVID-19 pandemic and what is required to make it work. *The New Zealand Medical Journal* 133: 10-14.

Bauwens, M., Compernolle, S., Stavrakou, T., Müller, J.‐F., van Gent, J., Eskes, H., et al. (2020). Impact of coronavirus outbreak on NO2 pollution assessed using TROPOMI and OMI observations. *Geophysical Research Letters* 47: e2020GL087978.

Bavel, J.J.V., Baicker, K., Boggio, P.S. et al (2020). Using social and behavioural science to support COVID-19 pandemic response. *Nat Hum Behav* 4: 460–471.

Bednar, D.J. and T.G. Reames (2020). Recognition of and response to energy poverty in the United States. *Nature Energy* 5: 432–439.

BEIS (2020). *Government agrees measures with energy industry to support vulnerable consumers during COVID-19*. Press release 19/3/20.

Burlinson, A., Giulietti, M. and Battisti, G., (2018). The elephant in the energy room: Establishing the nexus between housing poverty and fuel poverty. Energy Economics, 72: 135-144.

Cappers, P., Spurlock, C.A., Todd, A. and L. Jin (2018). Are vulnerable customers any different than their peers

when exposed to critical peak pricing: Evidence from the U.S. *Energy Policy* 123(C): 421-432.
Chen C.F., Zarazua de Rubens G., Xu X., and J. Li (2020). Coronavirus comes home? Energy use, home energy management, and the social-psychological factors of COVID-19. *Energy Res Soc Sci*. 68:101688.
Cluett, R. and J. Amann (2015). Multiple Benefits of Multifamily Energy Efficiency for Cost-Effectiveness Screening. ACEEE: Washington DC. 31pp.
Citizens Advice (2018). *Improving support for prepay consumers self-disconnecting*.
Citizens Advice (2020a) *Recovering or Ruin? The role of accessible support in helping energy consumers through the crisis*.
Citizens Advice (2020b). *The end of the beginning. How the retail energy market needs to support people in the next phase of COVID-19*.
Citizens Advice (2021). *Half a million renters in arrears as evictions set to resume*
Cowan, K., Sussman, R., Rotmann, S. and E. Mazzi (2018). It's Not my Job: Changing Behavior and Culture in a Healthcare Setting to Save Energy. *ACEEE Summer Study for Energy Efficiency in Buildings*.
CPUC (2018). Decision addressing energy efficiency business plans. CPUC: California. 214pp.
Dunning D, Fetchenhauer D, Schlösser T. (2019). Why People Trust: Solved Puzzles and Open Mysteries. *Current Directions in Psychological Science* 28(4): 366-371.
Elleby, C., Pérez Domínguez, I., Adenauer, M. & Genovese, G. (2020). Impacts of the COVID-19 Pandemic on the Global Agricultural Markets. *Environmental and Resource Economics* 76: 1067-1079.
Forster, H.A., Rotmann, S., & Karlin, B. (2021). *Exploring energy engagement: results of a multi-method study of U.S. energy consumers.* Available on request.
Harris Clark., I., and O'Sullivan, K.C. (forthcoming). Energy poverty among tertiary students in New Zealand.
Harvey, N. (2020). Behavioral Fatigue: Real Phenomenon, Naïve Construct, or Policy Contrivance? *Frontiers in Psychology* 11: 2960.
Henry, M.S., Bazilian, M.D. and C. Markuson (2020). Just transitions: Histories and futures in a post-COVID world. *Energy Research and Social Science* 68: 101668.
IEA. (2019). Energy *Policies of IEA Countries: Sweden 2019 Review*. OECD/IEA. Available at https://webstore.iea.org/energy-policies-of-iea-countries-sweden-2019-review
IEA. (2020). Sustainable Recovery. A World Energy Outlook Special Report. International Energy Agency. IEA: Paris. Available at https://www.iea.org/reports/sustainable-recovery
Jefferies, S. et al (2020). COVID-19 in New Zealand and the impact of the national response: a descriptive epidemiological study. *The Lancet* 5(11): E612-E623.
Jenkins M, Hoek J, Jenkin G, Gendall P, Stanley J, Beaglehole B, et al. (2021). Silver linings of the COVID-19 lockdown in New Zealand. *PLoS ONE* 16(4): e0249678.
Kalil, A., Mayer, S. and R. Shah (2020). *Impact of the COVID-19 crisis on family dynamics in economically vulnerable households.* Harris School of Public Policy Studies: University of Chicago. 31pp.
Kanda, W. and P. Kivimaa (2020). What opportunities could the COVID-19 outbreak offer for sustainability transitions research on electricity and mobility? *Energy Research & Social Science* 68: 101666.
Klimatpolitiska Rådet (2020). Report of the Swedish Climate Policy Council. Stockholm. Available at https://www.klimatpolitiskaradet.se/rapport-2020/
Kotak, M & Chappell, V. (2021). *How COVID-19 has exacerbated fuel poverty in the UK*. Charles River Associates. March 2021.
Lambie-Mumford, H. and Snell, C. (2015). *Heat or Eat: Food and Austerity in Rural England*. Final Report. Working Papers of the Communities & Culture Network+, 6. ISSN 2052-7268
Larsson, J., Kamb, A., Nässén, J. & Åkerman, J. (2018). Measuring greenhouse gas emissions from international air travel of a country's residents methodological development and application for Sweden. *Environmental Impact Assessment Review* 72: 137-144.
Mastropietro, P., Rodilla, P. and C. Batlle (2020). Emergency measures to protect energy consumers during the COVID-19 pandemic: A global review and critical analysis. *Energy Research & Social Science* 68.
MHCLG (2020). Complete ban on evictions and additional protection for renters. Press release, 18/3/20. Ministry for Housing, Communities and Local Government. www.gov.uk/government/news/complete-ban-on-evictions-and-additional-protection-for-renters
Ministry of Environment and Energy (2018). *The Swedish Climate Policy Framework*. Government Offices of Sweden. Available at: https://www.government.se/information-material/2018/03/the-swedish-climate-policy-framework/

Mundaca, L., Román R. & Cansino, J.M. (2015). Towards a Green Energy Economy? A macroeconomic-climate evaluation of Sweden's CO_2 emissions. *Applied Energy* 148: 196-209.

Mundaca, L. et al (2019). The global expansion of climate mitigation policy interventions, the Talanoa Dialogue and the role of behavioural insights. *Environmental Research Communications* 1(6):061001.

Mundaca, L. (2021). *On the role of social norms on sustainable transport and car sharing in Sweden.* Working Paper. International Institute for Industrial Environmental Economics, Sweden.

Norden & International Energy Agency I. (2016). *Nordic Energy Technology Perspectives 2016* . OECD/IEA. Available at https://www.nordicenergy.org/project/nordic-energy-technology-perspectives/

Ofgem (2019). *Consumer Survey data tables*.

Ofgem (2021). *Ofgem raises price cap on UK energy bills to cover COVID-19 costs*. Accessed 22/3/21: https://www.power-technology.com/news/ofgem-raises-price-cap-on-uk-energy-bills-to-cover-COVID-19-costs/

ONS (2021). *Labour Market Overview, UK*: February 2021.

O'Sullivan, K.C., Viggers, H., and Howden-Chapman, P. (forthcoming) Home energy use during and after COVID-19 restrictions: evidence from New Zealand.

Oswald, Y., Owen, A. and Steinberger, J. K. (2020) 'Large inequality in international and intranational energy footprints between income groups and across consumption categories', *Nature Energy* 5(3), pp. 231–239. doi: 10.1038/s41560-020-0579-8.

Overland, I. and B.K. Sovacool (2020). The misallocation of climate research funding. *ERSS* 62: 101349.

Partridge, J. (2020). *UK household energy bills to soar by £32 per month*. The Guardian. Accessed 20/07/20: https://www.theguardian.com/money/2020/may/04/uk-household-energy-bills-to-soar-by-32-per-mont

Robert, A. (2020). Lessons from New Zealand's COVID-19 outbreak response. *The Lancet* 5(11): E569-E570.

Rotmann, S. (2016). How to create a "magic carpet for Behaviour Changers". *BEHAVE conference*: Coimbra.

Rotmann, S., Mundaca, L., Castaño-Rosa, R., O'Sullivan, K., Ambrose, A., Marchand, R., Chester, M., Karlin, B., Butler, D. and K. Ashby (2021). *Hard-to-Reach Energy Users: A critical review of audience characteristics and target behaviours*. User-Centred Energy Systems TCP - HTR Annex: Wellington

SCB (2018). More than 5 million passenger cars on the road. Statistics Sweden. Available at https://www.scb.se/en/finding-statistics/statistics-by-subject-area/transport-and-communications/road-traffic/registered-vehicles/pong/statistical-news/new-registrations-of-passenger-cars-and-lorries-in-sweden-june-2018/

SCB (2021). *Greenhouse gas emissions decrease continued in the third quarter of 2020*. Statistics Sweden. Available at https://www.scb.se/en/finding-statistics/statistics-by-subject-area/environment/environmental-accounts-and-sustainable-development/system-of-environmental-and-economic-accounts/pong/statistical-news/environmental-accounts--emissions-to-air-third-quarter-2020/

Smith, M., Hosking, J., Woodward, A., Witten, K., MacMillan, A., Field, A., & Mackie, H. (2017). Systematic literature review of built environment effects on physical activity and active transport - an update and new findings on health equity. *Int J Behav Nutr Phys Activity*: *14*(158).

Telfar-Barnard, L., Bennett, J., Robinson, A., Hailes, A., Ombler, J., & Howden-Chapman, P. (2019). Evidence base for a housing warrant of fitness. *SAGE open medicine*, 7, 2050312119843028.

Trafikanalys (2021). Transport Indicators. Updated January 2021. Available at https://www.trafa.se/en/commissions/coronapandemin/transport-indicators/

Trianni, A. and E. Cagno (2012). Dealing with barriers to energy efficiency and SMEs: Some empirical evidences. *Energy* 3: 494-504.

VEIC (2019). *The State of Equity Measurement: A Review of Practices in the Clean Energy Industry*. Vermont Energy Investment Corporation: U.S.A. Pp. 33

Woodward, A., & Wild, K. (2020). Active transportation, physical activity, and health. In *Advances in transportation and health* (pp. 133-148). Elsevier.

Acknowledgements

We sincerely thank the Users TCP by IEA, and our participating country sponsors, as well as William Baker and Graeme Sherriff (UK), Uplight (U.S.), and Prof. Philippa Howden-Chapman (NZ) for country contributions.