RESEARCH INSIGHT

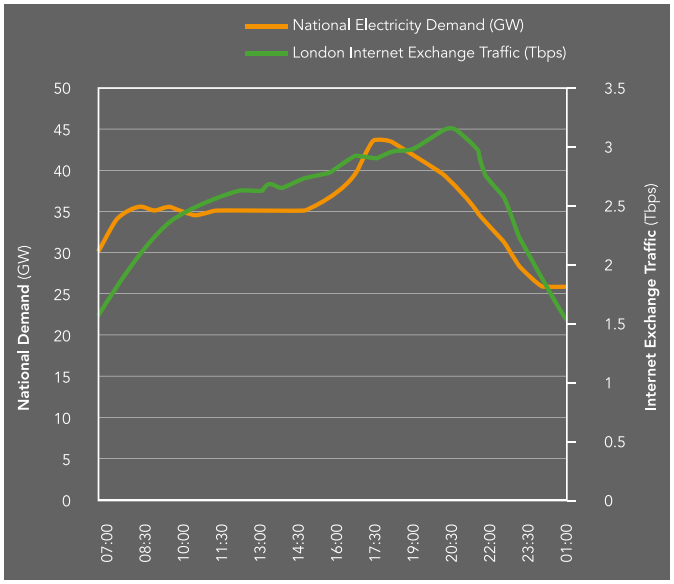
HOW DOES ON-DEMAND TV VIEWING AFFECT PEAK ELECTRICITY CONSUMPTION?

DYNAMICS OF ENERGY, MOBILITY AND DEMAND

Key points

- The shift towards on-demand viewing of TV programmes and films increases the energy used in Internet infrastructures.
- Despite the apparent flexibility offered by on-demand viewing, most of it still happens in the evening in the living room.
- The established 'peak' in TV-viewing occurs after the early evening peak in national electricity demand.
- On-demand viewing during the early evening does add to peak electricity loads. Trends in this direction include streaming programmes whilst commuting and running video content 'in the background'.
- There may be opportunities to manage these developments, as they emerge, and before new energy-intensive expectations are established.

Figure 1 The timing of national electricity demand for England and Wales (source: National Grid) and Internet traffic at the London Internet Exchange (source: LINX) on 01/11/2017



Introduction

Information technologies account for roughly 10% of global electricity use, with the Internet and telephone networks using more (1.7%) than data centres (1.4%) and computers (1.6%), according to estimates for 2012.[1] This consumption is growing, especially for networks, as volumes of Internet traffic increase. For UK households, the growth in data traffic is rapid[2] and largely due to increased streaming and downloading of video content. The energy use associated with this adds to that of broadcast infrastructures and TV sets, which are still in use. Traditionally, most TV viewing takes place in the evening between about 8 and 10pm.[3] National peaks in Internet traffic occur at around the same time; with video content accounting for a significant and growing portion of these peaks.[4]

Could growth in on-demand viewing add to peak electricity load, exacerbating associated problems with cost and carbon emissions? As Figure 1 shows, peaks in energy and data demand do not currently coincide, but this might change. If more on-demand viewing happens earlier in the evening it will add to electricity use during peak hours (5-8pm on winter weekdays). To investigate how and when on-demand viewing is taking place in the UK we interviewed 38 adults, aged between 26 and 80, from 28 households. 16 of these also completed time diaries.

Questions

- How do households watch on-demand TV and films: when, where and with what devices?
- How does this relate to, or differ from, other and previous forms of watching TV?
- In what ways does on-demand viewing fit into everyday life?

Findings

In the majority of households we interviewed, on-demand viewing supplemented pre-existing ways of watching TV and films: only one household had completely switched to on-demand services. In general, on-demand viewing appeared to take two forms: one more flexible, the other similar to patterns of watching live, broadcast TV.

The flexible form involved watching streamed or downloaded audio-visual content on mobile devices like tablets or smart-phones. This (mostly individual) way of watching TV filtered into new spaces and times: for example, watching catch-up TV on the tablet whilst making dinner, watching on a train, or watching films in bed.

> *I watched a film the other night in bed because I couldn't sleep. And that's amazing isn't it to be able to do that? …Yes, it opens up a whole new world of watching television.* (Carol, aged 61-65)

In contrast to this flexible mode, most on-demand viewing reported in our research took place on a TV-set in the living room and at a similar time as for watching live TV[5]. It formed part of evening routines, after eating and before bed, and often involved multiple members of the household.

Significance

This research indicates that the shift towards on-demand provision and consumption of TV and films has not, so far, involved a radical departure from established patterns, times and places of watching live TV. Some forms of on-demand viewing do extend into new times and spaces,[6] but this is often additional to rather than instead of established evening routines, into which on-demand viewing also fits, replacing live TV.

This suggests that peak hours for watching TV may not change if on-demand viewing continues to grow. If so, peaks in electricity use associated with TV viewing, including on-demand traffic, will continue to occur *after* the overall peak in electricity demand. But some on-demand viewing does take place earlier in the evening. This does add to peak electricity loads and could do so more in the future. Some relevant trends in this direction include:

- On-demand viewing by those, such as younger children, who watch TV in the early evening.
- Streaming programmes over mobile networks during commuting hours[7].
- Playing on-demand TV 'in the background' when doing other things, such as making dinner.

DEMAND research insight #15 ON-DEMAND TV VIEWING
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Implications

Containing the growth in electricity used by the Internet depends on curbing massive increases in data traffic, a large portion of which relate to on-demand viewing. This goes against government policies in many countries which are to invest in higher capacity broadband infrastructures. By encouraging extra data traffic, such policies have implications for global energy demand and carbon emissions, but rarely take this into account.

Our research shows that the timing of Internet-related energy consumption is also key. Trends in on-demand viewing are still unfolding as part of household routines. Whilst the sequence of activities and well-established meanings of TV-watching suggest a large degree of continuity, new arrangements, such as streaming programmes whilst commuting or for background noise, are emerging and may increasingly contribute to energy demand during peak times. The introduction of ultra-high-definition streamed media will also add to Internet-related electricity use, making the timing of on-demand viewing an even more important question.

In the context of radical carbon reduction targets, there must be more effective strategies for dealing with Internet-related energy demand as it develops, rather than allowing it to become a 'problem' that is harder to tackle once the emerging expectations and services it enables are embedded in normal, everyday life.

[1] Van Heddeghem, W., Lambert, S., Lannoo, B., Colle, D., Pickavet, M., & Demeester, P. (2014). Trends in worldwide ICT electricity consumption from 2007 to 2012. *Computer Communications*, 50, 64-76.

[2] Household data consumption rose from an average of 17 GB per month in 2011 to 132 GB per month in 2016 (Ofcom. (2016). Connected Nations Report)

[3] Torriti, J. (2017). Understanding the timing of energy demand through time use data: Time of the day dependence of social practices. *Energy Research & Social Science*, 25, 37-47.

[4] In Europe real-time entertainment accounted for 40% of peak time traffic in 2015, the largest single share. In the US, this was much higher at 65% in the same year. In both cases, this share of traffic has been steadily growing (Sandvine. (2015). Global Internet Phenomenon Report)

[5] This was most evident from the time diaries in which periods spent on 'online' activities and watching TV were recorded over the course of one week by 16 people (4 retired, 11 female, average age 56, age range 35-79).

[6] And may be more common amongst younger adults who were not represented in this sample.

[7] Studies of data traffic on mobile phones show that video traffic is highest in the later evening (11pm-midnight) but with a secondary peak earlier in the evening (6-7pm) which is more likely to be during commuting hours (Widdicks, K., Bates, O., Hazas, M., Friday, A., & Beresford, A. R. (2017). *Demand Around the Clock: Time Use and Data Demand of Mobile Devices in Everyday Life.* Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems, Denver, Colorado, USA). Streaming over a mobile network is also more energy intensive than over wi-fi or ethernet connections (Schien, D., Shabajee, P., Yearworth, M., & Preist, C. (2013). Modeling and assessing variability in energy consumption during the use stage of online multimedia services. Journal of Industrial Ecology, 17(6), 800-813).

DEMAND is one of six Centres funded by the Research Councils UK to address 'End Use Energy Demand Reduction'. DEMAND also has funding from ECLEER (EDF R&D), Transport for London and the International Energy Agency.

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