

Case study: *Energy Efficiency First Principle: Societal trend of working from home*

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Introduction

The development during the past decades of price and speed of the internet for the private households, the digitalisation of communication and the almost paperless office have made working from home possible but – until recently - not very common. In this article, we discuss a flexible workspace referring to office work with possibility of being carried out from the employee's home. This societal trend became particularly relevant in 2020 and 2021 due to the pandemic of COVID-19. The pandemic led Governments in several countries, and Denmark as one of the first ones to reduce human physical interaction in the public sphere to contain the virus. One measure taken to reduce human physical interaction was to ask office workers in the public sector to work from home (unless physical presence was critical) and private companies to ask their employees to work from home if possible. This is why many people have been (and still are) working fully or partly from home around Europe today.

This extensive lockdown of society has opened up the discussion for companies and public employers on one hand of meeting a possible new request by employees for more flexibility in where to work from, and on the other hand employers wishing to save costs by asking some employees to partly work from home.

One possible consequence of this societal trend is reducing office areas. An obvious benefit for the employers is lower office costs. Other possible benefits like productivity increase and well-being are still under discussion.

The focus of this article is to discuss if reducing energy consumption from Energy Efficiency First perspective is realistic. For this discussion, this article uses Denmark as a case.

Energy Efficiency First

Energy Efficiency First principle is a principle described in the Energy Efficiency Directive and it regards a principle where energy efficiency is taken into account when making policy, planning and investment in the energy sector. This principle also includes energy consumption in buildings.



Flexible workspaces resulting in a reduction of office space could be a tempting future national policy in accordance with Energy Efficiency First principle. Before this policy is implemented at national level, some analyses should be performed in order to ensure balance in relevant aspects regarding flexible offices. The authors have identified at least two aspects relevant to be analyzed to avoid unintentional increase in energy consumption. The aspects are the balance between energy consumption in offices/home offices and energy consumption for transport. More precisely to ensure that flexible workspaces do not result in overall higher energy consumption on national level. On one hand, an increase in heating and electricity as they will be necessary for both the company office and the home office. On the other hand, a decrease in energy consumption for transport in private cars.

Statistics and articles about the effect of flexible offices' energy consumption during the COVID-19 pandemic are limited. The aim of this article is therefore to provide input for further analyses.

Denmark

In this case study, the focus is the energy consumption of Denmark in 2020 compared to previous years. Denmark was one of the first countries to introduce lockdown measures. This happened on a press conference 11 March 2020 where staff working with non-essential functions in the public sector were asked to work from home.

In the following, the findings of the sectors expected to be mostly affected by the lockdown is presented. These sectors are the Households sector, selected branches in the Commercial and Public sector and the Transport sector.

Results

Households

In 2020, preliminary figures state that for households, the total energy consumption was reduced by 4.7 pct. in 2020 compared to 2019 as shown in figure 1. Looking at fuels traditionally used for water and space heating, we see a reduction. Parts of the reduction in these fuels finds the explanation in warmer temperatures in 2020 compared to 2019 hence leading to a smaller need for heating in general. This finding reveals the complexity of the analysis.



Gross energy consumption - households

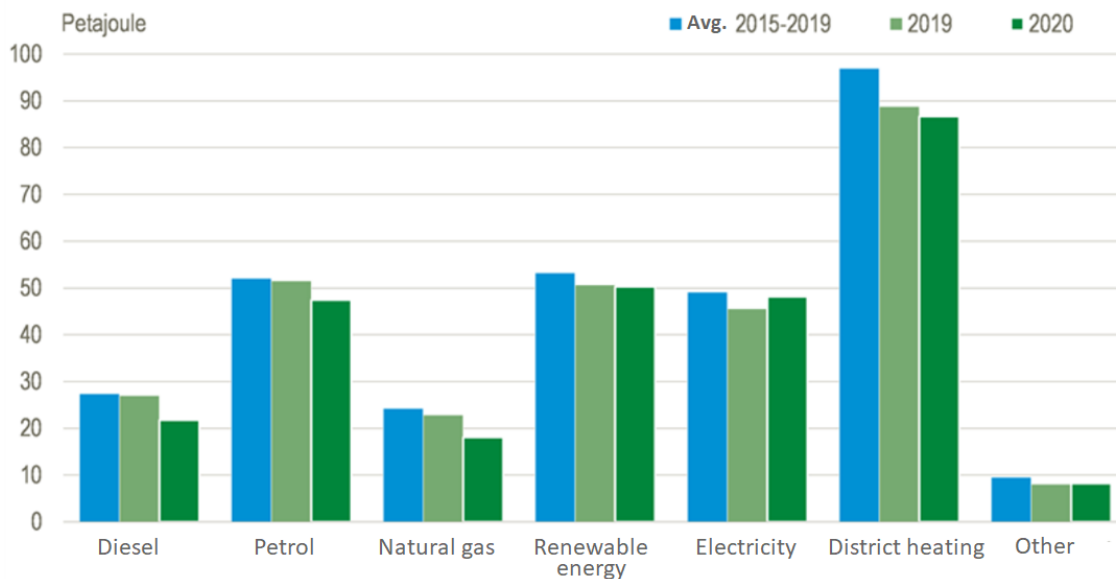


Figure 1 – Energy consumption of households in Denmark. Renewable energy includes a.o. heat pumps and wood pellets. Source: Statistics Denmark, preliminary figures.

Electricity consumption in households increased by 5.7 pct. from 2019 to 2020. This increase may find its explanation in the lockdown of Denmark. Figure 2 shows the median of the daily electricity consumption for households in 2019 and 2020. Having a look at electricity consumption, week by week, it is clear to see the point of the press conference where the Danish Prime Minister encouraged the Danes to stay home had a significant impact. Until that week, the electricity consumption has approximately the same pattern as in 2019. Later in spring, week 15 in 2020 it is Easter and the drop in electricity consumption for households is less significant compared to Easter in week 16 in 2019. This change in holiday pattern should be noted.

A closer look at figure 2 shows that the daily electricity consumption is significantly higher for households in 2020 – especially during the weekdays where many people worked from home. When working from home, electricity is required for the computer, lighting, cooking for lunch, coffee or tea etc. To these figures, it should be noted that some employees were asked to stay home from jobs which would require their presence, e.g. staff working in retail, staff in the tourist business etc. The figure also shows that the electricity consumption gap between 2019 and 2020 is generally smaller during the weekends (grey vertical area) compared to weekdays as most people did not work during weekends. However, the electricity consumption is generally higher during weekends in 2020



compared to 2019. This could be due to the lockdown in Denmark, which meant many closed shops, restaurants, cinemas, museums, sport facilities etc. Households would therefore typically spend more time at home as other places were closed. The pattern is particularly significant in the months where lighting is necessary due to fewer hours of natural daylight.

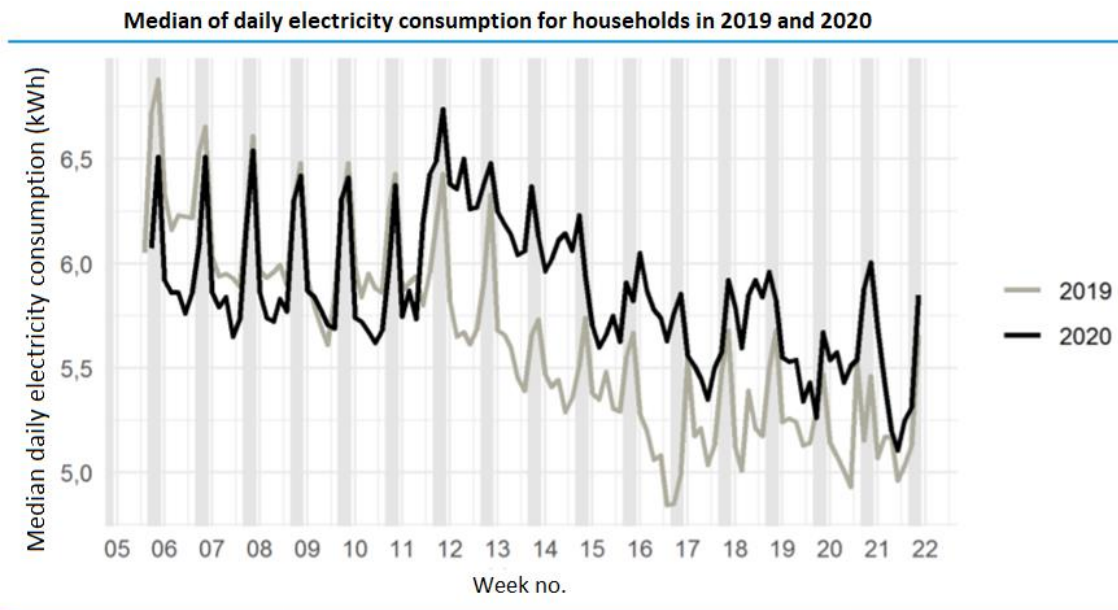


Figure 2 - Median of daily electricity consumption for households in 2019 and 2020. The white vertical areas are weekdays, and the grey ones are weekends. Source: Statistics Denmark, experimental statistics.

Transport

The decrease in diesel and gasoline consumption by households are due to the COVID-19 restrictions where many people worked from home and hence did not consume fuel for transportation in private cars to go to work.

When comparing total sales figures for gasoline month by month in 2020 and the years before, there is a significant drop in March 2020. This drop equals during the year. Before drawing hasty conclusions, it is important to keep in mind that gasoline is also used for other purposes than private cars.

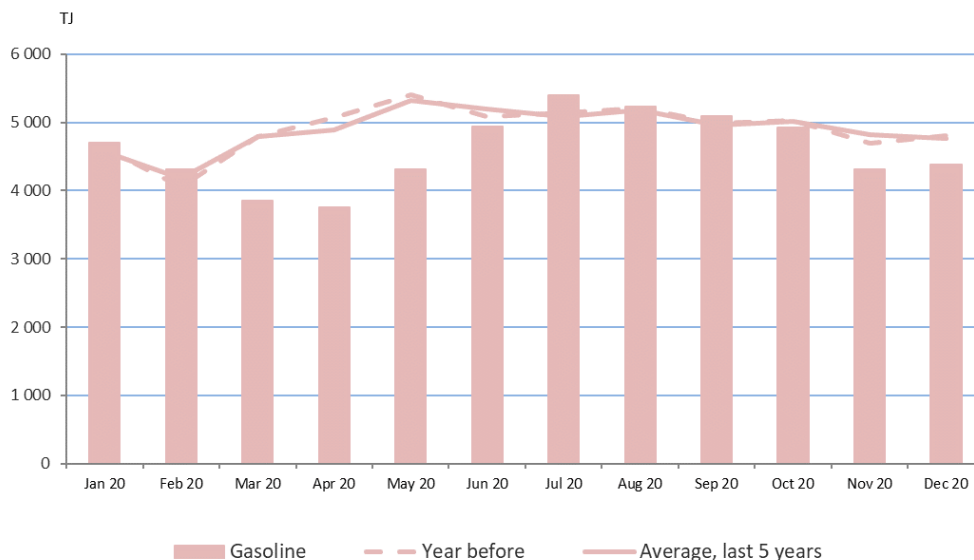


Figure 3 – Sales figures of gasoline in Denmark, for the months of 2019, 2020 and average of the last 5 years. Source: Danish Energy Agency, Monthly energy statistics

As diesel is used for other purposes like heating, the fuel has not been included in this description.

Services – selected branches

The service sectors were also highly affected during 2020. Restaurants, hotels, sport activities, museums etc. were asked to close down temporarily. Shops, except for food stores, were closed only allowing internet sales. The closing was extensive. Figure 4 shows that the energy consumption for selected branches in the services sector is lower in 2020 compared to the average of the previous 2-3 years. Besides less activity, this could also be due to higher outdoor temperatures in 2020. Another explanation for decreasing energy consumption in these branches could be that a downward trend in the last few years has continued due to e.g. energy efficiency. Furthermore, energy were still consumed for building operations during lockdown, so the decrease is less significant in these branches. It is not possible to draw conclusions regarding energy consumption this early.



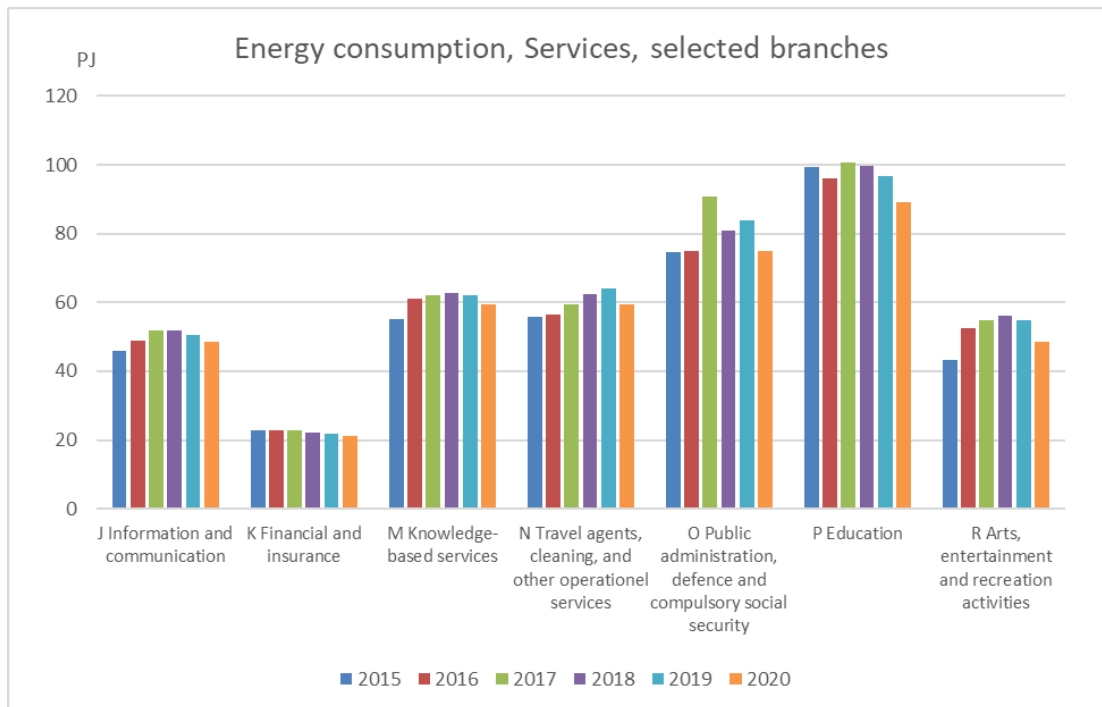


Figure 4 - Energy consumption for service sectors, 2015 – 2020 in Denmark. Source: Statistics Denmark, preliminary statistics

Conclusion and Recommendation

The Danish data indicates that the households’ electricity consumption will increase if employees work from home. However, if most or all of the employees at an office works from home, the office building would still have to provide the required indoor climate in accordance with the Building Code. Therefore, office buildings were still heated and ventilated during COVID-19 lockdown. Thus, a significant drop in energy consumption in branches with office buildings related to employees working from home was not detected in the present preliminary statistics.

Sales of fuel for transport decreased as Denmark was closed. Fuel consumption rose again through the year to the same level as previous years.

The energy consumption in the services sector, which was highly affected by the closing has not dropped significantly according to preliminary statistics.

Recommendation for future analyses

The findings of this article indicates that some data is already available and easy accessible. Much data and statistics are not yet available and is difficult to analyze. Based on our findings we recommend case studies or deeper analyses of final statistics on energy consumption, focusing on private transportation (e.g. change of mode) and heating/electricity consumption at workplace offices/home offices. An analysis performed by IEA could be taken into consideration. IEA analyzed international data showing that for people who commute by car, working from home is likely to reduce their carbon dioxide (CO₂) footprint if their journey to work is greater than about 6 kilometers. However, for short car commutes or those done by public transport, working from home could increase CO₂ emissions due to extra residential energy consumption.

Disclaimer

The opinions expressed in this publication are those of the authors. They do not necessarily reflect the opinions or views of the Danish Energy Agency or the Danish Ministry of Climate, Energy and Utilities



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[Danmark lukker ned: Regeringen sender elever, studerende og offentligt ansatte hjem - Altinget - Alt om politik: \[altinget.dk\]\(http://altinget.dk\)](#) - This article regards the press conference 11 March 2020 where the Prime Minister of Denmark asks the Danes to stay home.

[Vi vil fortsætte med hjemmearbejde | Djøfbladet \(\[djoefbladet.dk\]\(http://djoefbladet.dk\)\)](#) - This article regards a survey about working from home made by a trade union for professionals in social sciences, business and law.

