UNIVERSITY OF PIRAEUS

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COURSE: ENERGY SYSTEMS AND POLICIES

WHY TELECOMMUTING CAN RESULT IN LOWER GLOBAL ENERGY CONSUMPTION

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PIRAEUS, 2020

ABSTRACT

One of the biggest contributors to the pollution of the environment is the constant increase of global energy consumption. In 2018 27% of the global energy consumed came from coal, 24% from natural gas and 34% from oil while only a minor 11% came from renewable sources [1]. A big part of this is due to the transportation needs of the workforce to and from their workplace but also due to the power demands of office buildings. Telecommuting might be a solution to this problem. If applied, workers will not need to commute to and from work everyday and the energy consumption of office buildings will stop being an issue. It is something that is already applied due to COVID-19 and companies have already invested a significant amount of money into it. Workers have gotten familiar with it and there is a possibility that it might be here to stay.

CHAPTER 1: THE PROBLEM

CLIMATE CRISIS

40 years ago (1979), scientists from 50 nations met at the first world climate conference in Geneva and agreed that climate change was in fact an issue and that it was necessary to act. Since then, similar calls to action have been made through the 1992 Rio summit, the 1997 Kyoto Protocol, and the 2015 Paris agreement. Yet GHG (greenhouse gas) emissions are still rising with increasingly damaging effects on the earth's climate. Despite 40 years of global climate negotiations we have generally conducted business as usual and have, for the most part, failed to address the issue, as a result the climate crisis has arrived and is accelerating faster than most scientists expected, threatening natural ecosystems. Especially worrisome are potential irreversible climate tipping points that could lead to a "hothouse Earth," well beyond our control. This could cause significant disruptions to ecosystems, potentially making parts of Earth uninhabitable. [12]

It is critical to implement energy efficiency and replace fossil fuels with low-carbon renewables and other cleaner sources of energy. Fossil fuels should stop being extracted and wealthier countries need to support poorer nations in transitioning away from fossil fuels. [12]

ENERGY COST OF OFFICE BUILDINGS

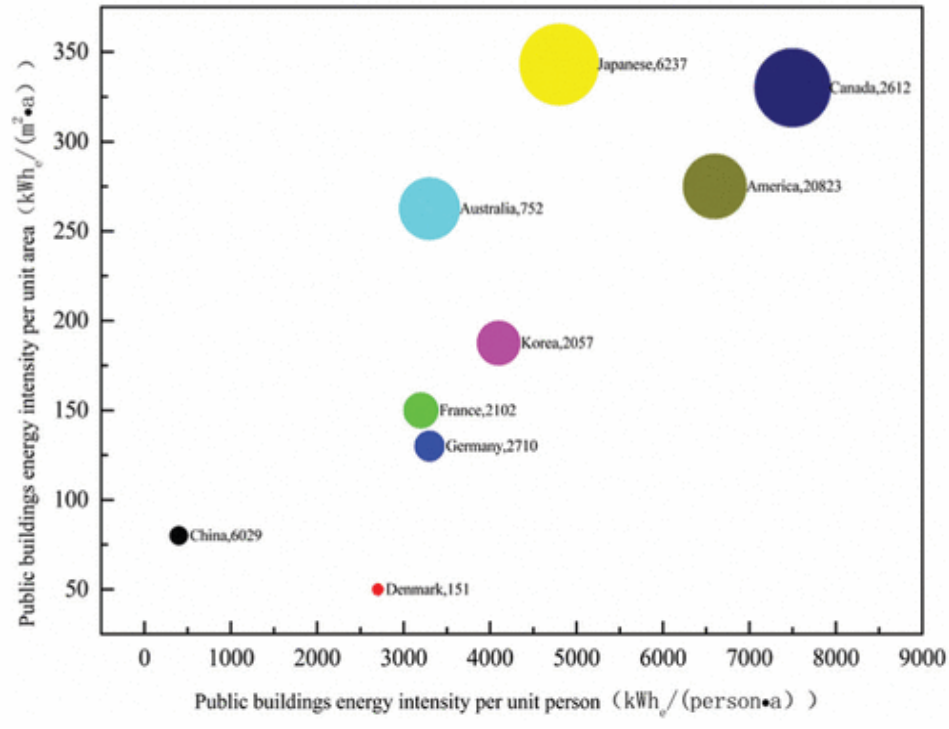

Figure 1.1[3]

From figure 1.1 we can see that the average consumption per unit area in a Chinese building is far lower than those of developed countries. In a study conducted in colder areas of China, where the heating needs are far higher, it was found that the average Chinese government building electricity consumption is at 76.56 kW h/(m^2 a) while the non-government buildings' electricity consumption is at 68.14 kW h/(m^2 a) [3],while countries like Germany and France are above 100 kW h/(m^2 a) and countries like Canada and Japan are way above 300 kW h/(m^2 a). [4]. From that we can assume that office buildings in developed countries are not nearly as efficient as they need to be and while improving energy efficiency could be beneficial it might be time for a completely different approach.

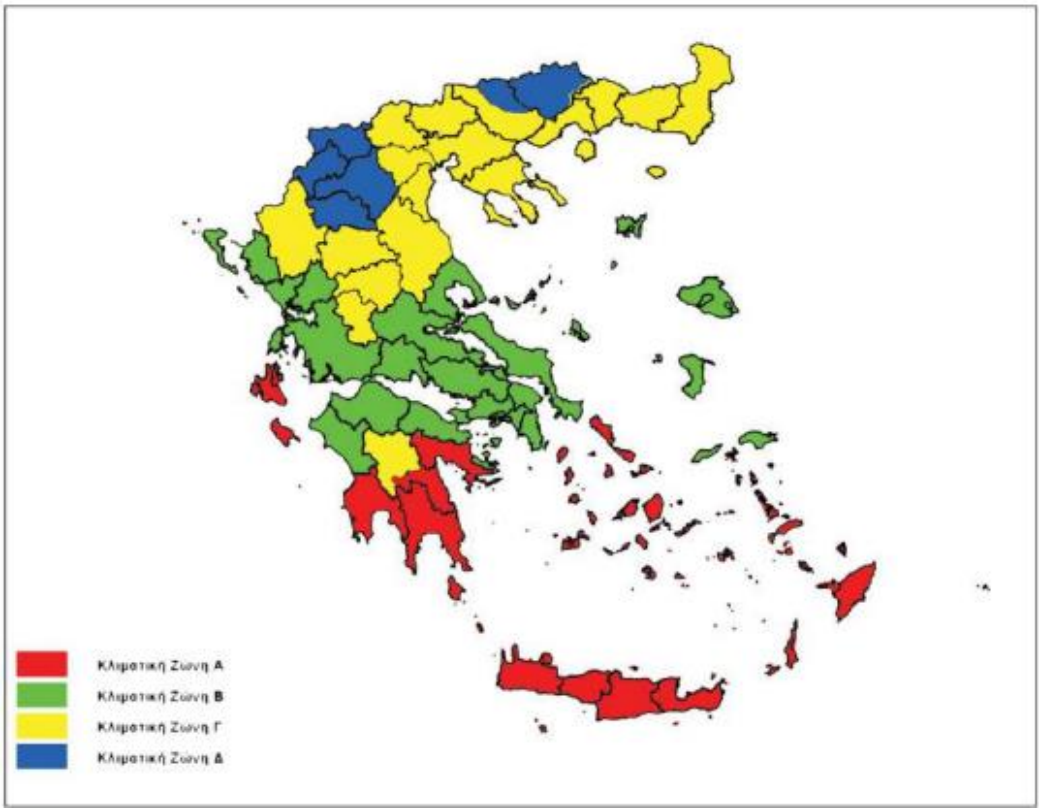

Figure 1.2 [6]

Now let us take Greece as an example. A study conducted in 2012 in Thessaloniki-Greece [2] states that the mean annual energy consumption for heating in 30,000 national office buildings, built from 1960 to 2009, is 38.70 kWh/m2 for climatic zone A, 49.96 kWh/m2 for climatic zone B, and 76.09 kWh/m2 for climatic zone C. The mean annual energy consumption for cooling is 108.80 kWh/m2 for climatic zone A, 110.54 kWh/m2 for climatic zone B, and 97.91 kWh/m2 for climatic zone C.

Another research that took place in Greece proved that office buildings, that represent 2.74% of the building stock, have energy consumption equal to 339 kWh/m2 and can even reach 345 kWh/m2 when talking about office buildings used as bank

branches, in comparison to other European countries, this number is extremely high. [2]

ENERGY COST OF INDIVIDUAL TRANSPORTATION

As of April 29, 2020, the number of operational SUVs throughout the world was at 200 million units while the annual sales were 27 million units. SUVs account for 48% of new personal vehicle sales in the US, 33% in Europe and 42% in china [7] [11]. We know that SUVs consume 25% more fuel than an average personal vehicle, because of the greater engine displacement and weight [11], and the constant SUV sales increase in the last decade shows us that there will be a further

New passenger cars by type of engine fuel, 2017

	Total	Petrol	Diesel	Alternative energy
Belgium	553 692	288 484	259 790	5 418
Bulgaria	240 121	:	:	:
Czechia	269 622	:	:	:
Denmark	221 476	142 607	77 495	:
Germany	3 441 262	1 986 488	1 336 776	143 474
Estonia	25 621	19 177	6 409	35
Ireland	133 579	40 798	87 640	5 444
Greece	130 227	:	:	
Spain	1 342 011	648 790	680 575	12 646
France	2 079 515	1 073 148	979 495	26 872
Croatia	93 802	20 875	71 385	1 542
Italy	1 993 826	:	:	163 320
Cyprus	36 067	20 532	15 478	57
Latvia	17 064	9 488	7 446	130
Lithuania	161 115	47 486	110 328	3 301
Luxembourg	52 775	:		:
Hungary	271 720	148 139	113 161	10 420
Malta	18 729	11 766	6 865	98
Netherlands	414 309	331 609	72 267	10 433
Austria	353 320	171 862	175 590	5 868
Poland	1 336 787	719 727	500 112	116 948
Portugal	224 029	78 675	139 106	6 248
Romania	627 743	199 463	422 731	5 549
Slovenia	72 477	38 229	32 410	1 838
Slovakia	165 652	:	:	:
Finland	118 587	81 435	36 216	936
Sweden	392 717	191 048	192 191	9 477
United Kingdom (²)	2 509 330	1 446 500	1 049 086	13 744
Liechtenstein (¹)	1 984	951	985	48
Norway	183 728	95 077	46 970	41 681
Switzerland	315 000	195 200	114 100	5 700
North Macedonia	26 609	:	:	:
Turkey	741 902	259 325	457 069	25 508

Note: (:) not available.

(¹) 2016 data instead of 2017

(²) Great Britain only.

Source: Eurostat (online data codes: road_eqr_carmot and road_eqr_carpda)

eurostat

Figure 1.3 [9]

increase in the number of operational units, this means that the energy usage for individual transportation will also increase.

SUVs however are not the only problem when it comes to individual transportation, in 2017 a significant percentage of new cars that were sold in the European union were powered by diesel engines, in Germany for example 38.84% of units sold were diesel cars [9]. The greater fuel economy that accompanies diesel engines is, for most people, an important factor when purchasing a vehicle, that comes with a significant increase in emissions but also lesser intention to conserve fuel, this essentially means that people will drive more if it costs less and will be less likely to use public transport, bicycles or even walk.

The number of vehicles in the European union is also growing every year. In 2013 there was a 5.98% increase in the number of passenger cars in Germany and a 6.7% increase in Spain and while this is a significant increase, the highest growth over this period was recorded in Slovakia where the number of passenger cars increased by 18%, followed by Czechia and Portugal with a 17 % increase for both. It is also important to mention that only 3 member states recorded a decline in the number of registered passenger cars over the period observed. France experienced a fall of 2.6 % and Bulgaria 4.8 % from 2013 to 2017, in Lithuania, the number of registered passenger cars slumped by 25 % over this period, mainly due to a change in register procedures in 2014, where cars that do not have compulsory technical inspection or where vehicle owner's compulsory civil liability insurance had expired by 1 July 2014 were removed from the register. Consequently, Lithuanian data from 2014 onwards cannot be directly compared to data for earlier years [9].

Passenger cars
(number)

	2013	2014	2015	2016	2017
Belgium	5 493 472	5 555 499	5 623 579	5 712 061	5 785 447
Bulgaria	2 910 235	3 013 863	3 162 037	3 143 568	2 770 615
Czechia	4 729 185	4 833 386	5 115 316	5 307 808	5 538 222
Denmark	2 278 121	2 329 578	2 390 823	2 465 538	2 530 047
Germany	43 851 000	44 403 000	45 071 000	45 803 560	46 474 594
Estonia	628 565	652 950	676 596	703 151	725 944
Ireland	1 984 550	2 018 310	2 060 170	2 102 720	2 142 390
Greece	5 124 208	5 110 873	5 107 620	5 160 056	5 235 928
Spain	22 025 000	22 029 512	22 355 549	22 876 830	23 500 401
France	32 858 000	32 531 000	32 326 000	32 076 000	32 005 986
Croatia	1 448 000	1 474 000	1 499 802	1 552 904	1 596 087
Italy	36 963 000	37 080 753	37 351 233	37 876 138	:
Cyprus	474 561	478 492	487 692	508 284	526 617
Latvia	634 600	657 799	679 048	664 177	689 536
Lithuania	1 808 982	1 205 668	1 244 063	1 298 737	1 356 987
Luxembourg	363 247	372 827	381 103	390 935	403 282
Hungary	3 040 732	3 107 695	3 196 856	3 313 206	3 471 997
Malta	256 096	265 950	275 380	282 921	291 664
Netherlands	7 932 290	7 979 083	8 100 864	8 222 974	8 373 244
Austria	4 641 308	4 694 921	4 748 048	4 821 557	4 898 578
Poland	19 389 446	20 003 863	20 723 423	21 675 388	22 503 579
Portugal	4 327 478	4 699 645	4 722 963	4 850 229	5 059 472
Romania	4 696 000	4 908 000	5 155 000	:	:
Slovenia	1 063 800	1 068 360	1 078 740	1 096 523	1 117 935
Slovakia	1 879 800	1 949 100	2 034 574	2 121 774	2 223 117
Finland	3 105 834	3 172 735	3 234 860	3 322 672	3 398 937
Sweden	4 494 661	4 584 711	4 668 262	4 767 262	4 844 823
United Kingdom (')	:	:	30 250 294	30 850 440	31 200 182
Liechtenstein	28 100	28 470	28 802	29 241	:
Norway	2 500 000	2 555 000	2 610 000	2 662 910	2 719 396
Switzerland	4 321 000	4 384 000	4 458 000	4 524 000	4 570 800
North Macedonia	346 798	371 449	383 833	394 934	403 316
Turkey	9 283 923	9 857 915	10 589 337	11 317 998	12 035 978

Note: (:) not available.
(') Great Britain only.
Source: Eurostat (online data code: road_eqs_carmot)

eurostat

Figure 1.4[9]

In the EU 70% of the CO_2 emissions in urban transport come from passenger cars, however this number is expected to decrease by about 22% by 2050, due to the Regulation setting emission performance
standards for new passenger vehicles. [16]

TRAFFIC CONGESTION

Congestion has been an issue in big cities for decades, traffic congestion is a term used to describe increased vehicular queuing in urban areas. Traffic flow slows down when the number of vehicles on the road increases or the roadway capacity decreases. This results in a series of issues, including increased travel times for anyone that is part of the traffic jam, increased fuel consumption and GHG emissions, higher vehicular crash rates and so on. [15]

According to CIVITAS [14] in 2010, 73% of European citizens lived in urban areas and it is expected that this percentage surpass 80% by 2050 while in some countries like the Netherlands, Denmark and Luxembourg the urbanization rate will rise to a percentage greater than 90%.

Around 85% of the EU's GDP is generated in European cities and due to the extensive economic activity in urban areas, most European cities face several issues caused by traffic, since expansion of public transport networks has not developed at the same rate as the private car use increase.

According to the European Commission [16], the cost of congestion in Europe is estimated to approximately 1% of the EU's GDP every year. This cost is expected to increase by about

50% in 2050, to nearly € 200 billion annually, although estimating this is not straightforward since it must consider peak hour congestion and unexpected bottlenecks in the road network.

In 2013, in a sample of 58 European cities, the average percentage delay compared to the “free flow” (non-congestion) situation ranges from 14% in Malmö (Sweden) to 39% in Palermo (Italy). Non-European cities like Rio de Janeiro at 55% and Mexico City at 54% were significantly higher compared to most European ones. Based on that we can assume that European action on reducing congestion is in fact successful. [14]

Figure 1.5

ENVIRONMENTAL IMPACT OF CONGESTION

In the European Union, in 2011, transport accounted for 30% of final energy consumption and about a quarter of CO_2 emissions. The final energy demand is expected to increase by 5% by 2030 and 1% more by 2050. [16]

The trend in emissions generated by transport is determined by 3 components. The first component is transport activity levels, the second is energy intensity of transport and the third is the carbon intensity of the energy used, by taking into consideration those 3 components, it has been evaluated how much the projected transport emissions will vary between 2005 and 2050. [16]

The growth in transport activity is expected to result in a 47% increase in passenger transport emissions but overall CO_2 emissions from passenger transport are expected to decrease by 8% by 2050. This is because the improvements in energy intensity are expected to prompt a 46% decrease CO_2 emissions and improvements in carbon intensity are expected to prompt a 9% decrease in CO_2 emissions. [16]

Contributors to the acidification and eutrophication of ecosystems as well as to the formation of ground level ozone, are also emissions of nitrogen oxides (NO_x). According to numerous articles, by tackling air pollutants like ground level ozone and particulate matter (including “black carbon”), we can achieve short term climate change mitigation, since there is a correlation between air pollutants and climate change. [16]

Air quality standards and targets, for a range of pollutants, exist in the EU. Still the limits and targets for PM_{10} (particulate

matter), NO_2 (nitrogen dioxide) O_3 (Ozone) are already exceeded or are expected to be exceeded. A big part of this is due to road transport, since 40% of total NO_x emissions in EU-27 come from it, and although overall emissions have decreased since 1990, the rate of decrement has not met the original expectations. [16]

HEALTH IMPACT OF AIR POLLUTION

It is known that emissions of air pollutants cause risks to human health and nature. Exposure to particulate matter (PM_{10}, $PM_{2.5}$) can cause impaired lung development, lower lung function in children, acute and chronic cardiovascular effects, asthma, reduced birth weight and even premature death. [16]

According to EDF [17], air pollution is responsible for 5 million premature deaths every year, by causing heart attacks, strokes, diabetes and respiratory diseases, making it the biggest environmental risk for premature deaths and surpassing the number of deaths by AIDS, tuberculosis and malaria combined. Additional research [18] suggests extended exposure to some pollutants increases the risk of emphysema more than smoking a pack of cigarettes daily, while recent studies show it can impact mental health and worker productivity.

Air pollution in general is a mixture of particles including but not limited to particulate matter, nitrogen oxides and ozone, which are often produced by road transport. It is important to better understand what those are if we are aiming to create solutions to minimize the threat. [17]

Particulate matter consists of small airborne particles like dust, soot and drops of liquid and is mostly formed from burning of fossil fuels (petroleum, natural gas, coal) by automobiles,

industrial facilities, and power plants. Secondary particle formation from gases and vapors, dust, diesel emissions are also sources although minor compared to the former. PM_{10} (coarse particulate matter, less than 10 microns in diameter) is known to cause nasal and upper respiratory track health problems while $PM_{2.5}$ (fine particles, less than 2.5 microns in diameter) can impair brain development in children and cause several health conditions like heart attacks, strokes and premature death from lung disease and cancer, to name a few. [17]

Nitrogen oxides can result development or, if it already exists, exacerbation of asthma and bronchitis. It is mostly produced by the transportation sector; therefore, they are formed in high concentrations around roadways. [17]

Ozone is essentially what the ozone layer, a region of Earth's stratosphere, consists of, but ground level ozone (smog) is known to be a respiratory irritant. Ozone is formed through reactions of volatile organic compounds and nitrogen oxides produced by the combustion of fossil fuels. Exposure to ozone, even if it is short-term, can cause chest pain, coughing and throat irritation, while, if exposed for an extended period of time, it can result in decreased lung function and cause chronic obstructive pulmonary disease. It is also important to add that exposure to ozone can intensify existing lung diseases. [17]

CHAPTER 2: COVID-19

EVENT BACKGROUND

Figure 2.1

On 31st of December 2019 a cluster of 29 pneumonia cases were reported in Wuhan City, Hubei province, China, by the Wuhan Municipal Health Commission. The cause is still unknown, but the cases seem to be linked to Wuhan's Huanan Seafood Wholesale Market. The market was closed down on January 1st, 2020. [19]

On January 9th, 2020, a coronavirus that was later named SARS-CoV-2 was reported by the China CDC as a causative agent for 15 of 59 cases of pneumonia. [19]

On January 10th, 2020, the first novel coronavirus genome sequence was deposited in the GenBank database with the accession number of MN908947 and uploaded to the Global Initiative on Sharing All Influenza Data (GISAID). [19]

By January 20th, 2020, the virus had reached Thailand, Japan, and South Korea. The origin of those cases was mainland China. [19]

On January 23rd, 2020, Wuhan was locked down. The number of cases at the time is unknown. [19]

On January 24th, 2020, France reported the first European case with a travel history to China. [19]

On January 28th, 2020, cases were also reported in Germany. [19]

On January 30th, 2020, Coronavirus was first declared an emergency by the world health organization. Consequently, several countries implemented entry screening measures for anyone arriving from china. Eventually, most major airlines suspended their flights from and to china. [19]

On February 22nd, 2020, a cluster of cases was reported, by the Italian authorities, in Lombardy, Piedmont and Veneto. COVID-19 cases were identified among healthcare workers and patients. Consequently, Cases of COVID-19 were reported by several European countries. [19]

On March 11th, 2020, strict healthcare measures were implemented in Italy. Spain, France, and others followed soon after. On the same day COVID-19 was declared a global pandemic by the World Health Organization. [19]

As of March 25th, 2020, more than 150 countries were affected. [19]

LARGE SCALE IMPLEMENTATION OF TELECOMMUTING

Figure 2.2

After strict healthcare measures were implemented in most first world countries and people were quarantined, several

companies started enabling remote work to keep business running while helping employees follow social distancing guidelines.

According to CNBC [20] a typical company saves about $11,000 per half time telecommuter per year. “The coronavirus is going to be a tipping point. We plodded along at about 10% growth a year for the last 10 years, but I foresee that this is going to really accelerate the trend,” Kate Lister, president of Global Workplace Analytics, told CNBC [20].

Gallup’s state of the American workplace 2017 study found that working from home is something 43% of employees are already doing although not daily.

Twitter, one of the first companies to implement telecommuting has told staff that they can keep working remotely if they wish to. Twitter said: "The past few months have proven we can make that work. So, if our employees are in a role and situation that enables them to work from home and they want to continue to do so forever, we will make that happen." Google and Facebook followed soon after by enabling their employees to work remotely until the end of the year. [21] Sree Sreenivasan, a Loeb Visiting Professor of Digital Innovation at the Stony Brook University School of Journalism, said it was "era-defining news".

"Some people may not take this seriously as its Twitter, but we can learn a lot from Silicon Valley about workplace flexibility. There has been a mentality that working from home was stealing from the boss and facetime in the office was more important.”

"But people are proving they can be far more productive and get tasks done working from home. A lot of people tell me

they are working harder at home and are exhausted," he added. [21]

COVID-19'S IMPACT ON WORKER'S RIGHTS

Several incidents of labor rights violations have been reported since the start of this pandemic.

According to UNI Global Union [23], in the 17th of April 2020, a complaint was filled with the French government, where a coalition of labor unions called for an intervention to stop violations of workers' rights to a safe workplace at Teleperformance. The complaint documents unsanitary conditions such as hundreds of workers having to sleep on crowded call center floors and multiple employees sharing equipment such as headsets during the coronavirus crisis.

CNN [24] reported that three amazon workers filed a complained claiming the company has erected "a façade of compliance" to meet public health guidelines while simultaneously putting pressure on employees to work under unsafe conditions.

"We are saddened by the tragic impact COVID-19 has had on communities across the globe, including on some Amazon team members and their family and friends," Rachael Lighty, an Amazon spokesperson, said in a statement to CNN Business.

In June 4th, 2020, A new lawsuit targeting the company (Amazon) claims that a lack of COVID-19 protection in Staten Island facility has put both the workers and their families at risk.

The lawsuit is only one of the accusations it has received that it has not done enough to protect its workforce during the pandemic. Amazon has declined requests for information on the number of confirmed cases, arguing the data would not be useful. As a result of this, 9 workers have died across its us facilities.

Since the last death amazon has claimed that $4 billion have been invested from April to June on COVID-related initiatives but amazon employees have complained of rationed hand sanitizer, insufficient quarantine leave policies and work expectations that do not allow for social distancing. [24]

Western countries workers are not the only ones affected by the lack of labor protection, According to DW [25], in a bid to boost industry and draw investment in the aftermath of the pandemic, several Indian stated have suspended most labor laws. They have increased working hours from 8 to 12 and have abandoned minimum wage and working conditions laws. This essentially means that millions of Indians will be facing longer workdays and lower wages.

The above essentially means that to implement telecommuting in a larger scale, governments should also implement strong labor laws to make sure that companies will not take advantage of workers and that work will not become a 24/7 activity.

CHAPTER 3: TELECOMMUTING

DEFINITION

Telecommuting is a work arrangement in which employees do not commute or travel to a central place of work. Essentially telecommuting is the activity of working for a company but staying at home and communicating with an office by computer and telephone.

BENEFITS OF TELECOMMUTING

Telecommuting can have a lot of benefits for both the employers and the employees. For one, it would save a significant amount of money and office space and reduce the time employees spend commuting, the latter could be a significant factor in lowering energy consumption while saving time and money for employees. [26]

According to an experiment at a large Chinese travel agency, productivity may also be increased. The experiment found that in a call center randomly selected employees, who worked from home for 9 months, saw a 13% performance improvement. [26]

It is estimated that employers in the US lose 1.8 trillion a year in productivity which is of course a significant amount of money. There are multiple factors involved in that and of course excessive commuting is one of them. According to the state of work productivity report, 65% of full-time employees think telecommuting would increase productivity. By eliminating the distractions of a traditional office setting, telecommuting increases efficiency since it allows workers to retain more of their time in the day and adjust to their personal wellbeing needs that optimize productivity. Essentially telecommuting allows you to work when you feel like it instead of when you must, making you more productive. [27]

The average U.K. worker spends more than an hour commuting to and from work every day, consuming a significant amount of energy in the process. According to a report published by the Royal Society for Public Health in the UK, 55% of workers felt more stressed as a result of their commute.

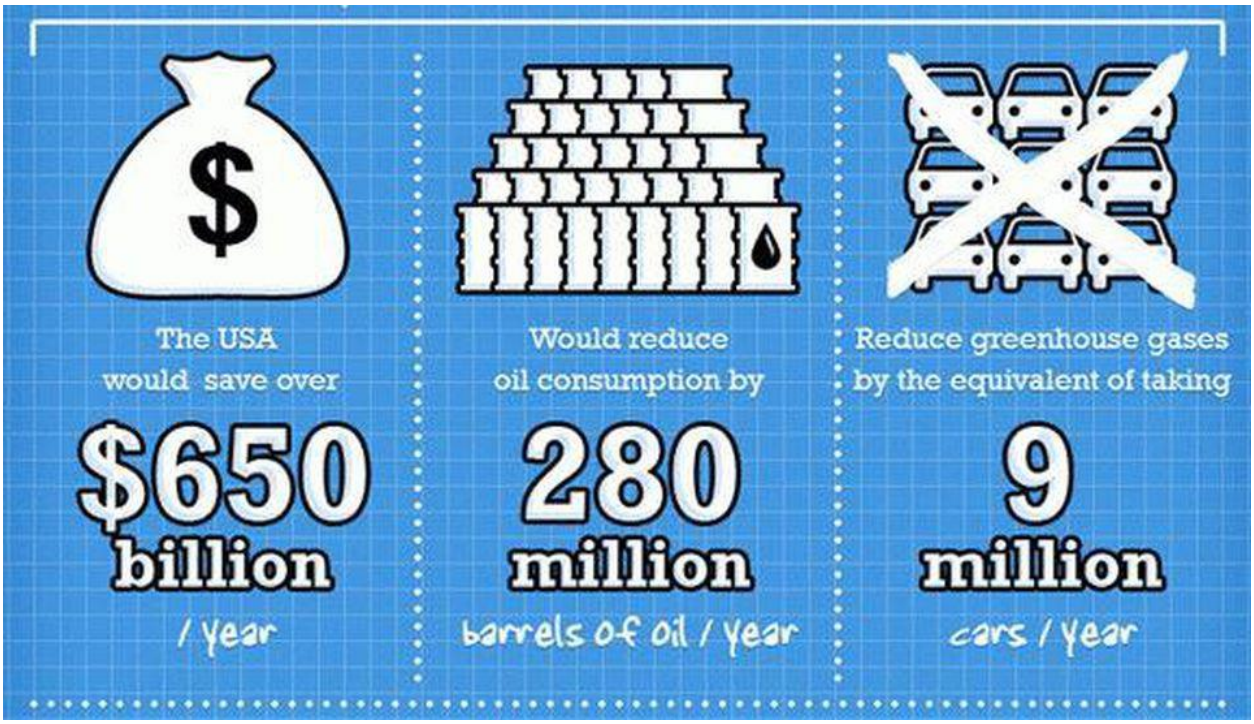

Figure 3.1

Another significant benefit of telecommuting is cost saving for both the employer and the employee. Successful examples of this are Aetna, an insurance giant in America, that saved $78 million dollars by getting rid of 2.7 million square feet of office space, but also American express that saved $10-15 million annually. When it comes to workers, Global Workplace Analytics reports that the average employee could save on average $11.000 per year just by telecommuting half of the time. It is also important to note that jobs not requiring physical presence are attractive to younger workers and could reduce employee turnover. [27]

NEGATIVES OF TELECOMMUTING

Although in theory telecommuting is a good idea, it can lead to serious worker rights violations. As mentioned above, multiple businesses have been accused of this since most countries are not prepared for it. Working hours have been extended and workers seem to have no free time since they are expected to always be available.

Professional isolation could be another downside of telecommuting since it can have a negative impact on worker's mental well-being. A solution for this could be alternating telework with face-to-face contact. [26]

Working remotely can also have a negative impact on career development. In the experiment at the Chinese travel agency that was mentioned above, teleworkers were less likely to be promoted since managers do not have an equally as good perception of remote workers as they do with workers that are present. Another study of employees at a U.S. technology services company found that extensive telecommuting is associated with fewer promotions and lower salary growth. This isn't the case when employees work outside of normal hours by performing supplemental work since signals dedication, but it also blurs the boundary between work and personal life. [26]

Finally, working remotely can increase the risk of network privacy and security loss, since employees need to access documents located on a company's internal network. A security breach could lead to losses of consumer personal, medical or income data. This can lead to significant legal costs if not prevented by providing employees with company-issued equipment [28]

IS IT A LONG TERM OR A TEMPORARY SOLUTION?

Figure 3.1

The pandemic is forcing employers to invest in the technology and management practices necessary to operate a tele-workforce, while at the same time more people are learning how to use this technology. As a result, there is a chance we will see a permanent shift toward telecommuting. [26]

Susan Athey recently told the Washington Post, “People will change their habits, and some of these habits will stick. There’s a lot of things where people are just slowly shifting, and this will accelerate that.” [26]

Experts say that telecommuting will stay even after covid-19 is gone since companies have been forced to function with a

remote staff. They have already made the necessary investments and are aware that they can save money on office and real estate costs. [29]

Chris Bedi, chief information officer of IT automation software provider ServiceNow, said that the talent war will change since employers will start hiring people from anywhere. “The concept of getting on a plane for six hours for a two-hour meeting and being jet lagged, people are going to go — why?” Bedi said. [29]

According to Julia Pollak[30], Before the crisis companies have been reluctant to allow employees to work from home because of entrenched norms. The pandemic is what forced 2/3 of Americans to work remotely, making it clear how much work can be done from home, and since workers got a taste of it they might resist returning to their offices. “Many companies would have switched to telework with just a small push, and now they’re getting a great big shove,” Pollak says. According to Pollak, the percentage of job postings increased from 1.3% to 11.3%. [30]

CHAPTER 4: BENEFITING FROM NEW TECHNOLOGIES

USEFUL TOOLS

- **Telecommunications:**

Figure 4.1

In the past months, many online tools used like skype, slack and zoom have seen a big increase in traffic. One of the most successful platforms was zoom, in the company's quarterly earnings release, zoom delivered a beat that represented 169% year-over-year revenue growth. The company reported that they now have 265.400 customers with more than 10 users on their

account, a number which according to zoom represents a 354% surge. Zoom also saw a growth in the number of customers who had spent more than $100k on the platform the past year, a growth amounting to 90% since Q1 last year. [31]

Skype is another platform that has gained a significant amount of traffic, Microsoft says 40 million people are using skype daily now, 70% more than a month ago. The platform has also seen a 220% increase in Skype-to-Skype call too. [32]

Slack is also a platform that saw a surge in usage because of the pandemic. Slack users went from 10 million to 12.5 million in a matter of days.

It is obvious that this growth has forced the companies to further develop their apps to handle the traffic by investing millions of dollars into them. This essentially means that previously ignored tools that would not be able to handle a permanent shift towards telecommuting are now more than capable and it is also safe to assume that even more tools will be developed in the future.

- **Cloud storage:**

Figure 4.2

Cloud storage is a service model in which data is transmitted and stored on remote storage systems, where it is maintained, managed, backed up and made available to users over a network.

With the right cloud storage implementation, employees can sync files and data from wherever they are working from. Collaboration is easy. Once information is stored, workers can share it simply by sharing a link. Businesses do not have to rely on emailing files that are too large, worry about version control between static files, or share removable storage devices that are easily lost or damaged.

A big advantage of cloud storage is also that when you are working with a trusted cloud provider, like Amazon or Microsoft, the storage of your data is in the hands of professionals who specialize in the hardware and software the vendor runs. [33]

- **High speed internet:**

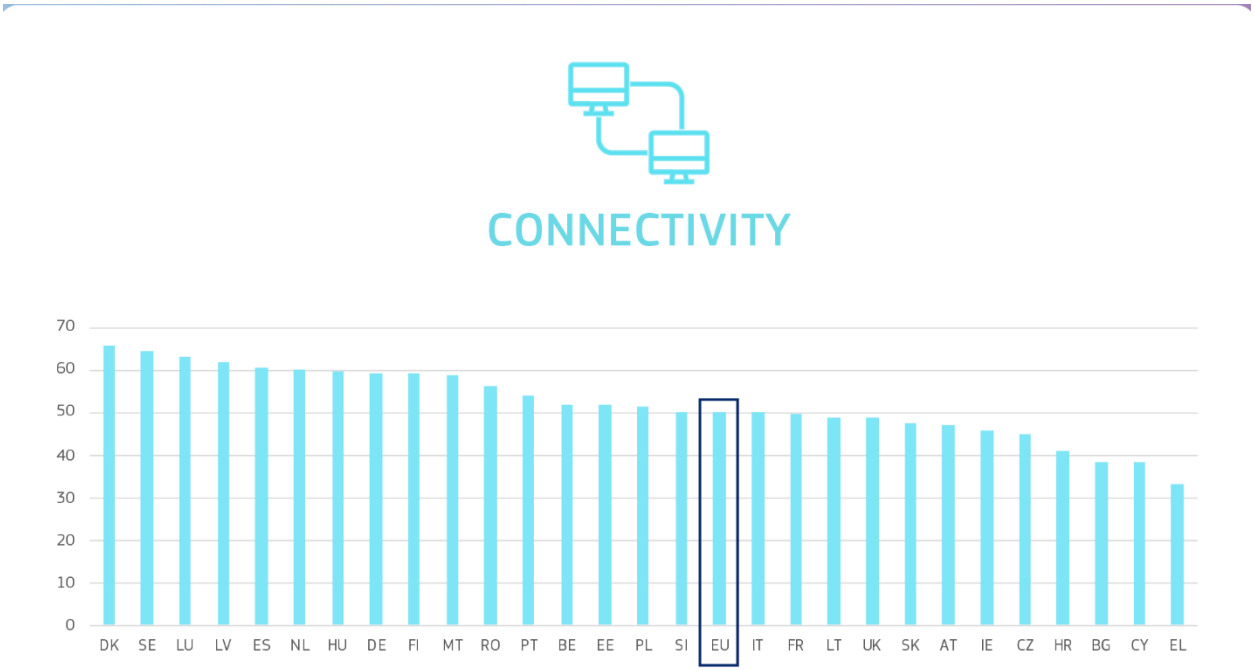

Figure 4.3

In the European union next generation access coverage increased from 83% to 86% in 2019, while fixed very high capacity networks are available to 44% of households. VHCN coverage is approximated as the combined footprint of FTTP (Fiber to the Premises) and DOCSIS 3.1 (Data Over Cable Service Interface Specification 3.1) cable networks.

Over a period of 5 years there have been a significant increase in the number of people that are taking up broadband services of at least 100 mbps, with a current percentage of 26%, five times higher than five years ago. [34]

4G covers almost the entire population of Europe but the 5G usage increase has not been as significant with only 17 Member States having already assigned spectrum in the 5G pioneer bands. [34]

CHAPTER 5: THE CONCLUSION

Telecommuting can be beneficial for the environment and the economy while also improving the life of the average worker if implemented correctly. It can decrease the overall energy consumption of businesses and workers commuting to and from work while simultaneously reducing our carbon footprint. Telecommuting can also save a up to $11.000 annually for the average worker since there would not be a need for transportation and other costs (lunch, formal attires, etc.). In addition, companies can see a significant decrease in operating costs since they would be able to decrease their office space. Workers will also have more free time to spend on themselves and their family while also being less stressed, significantly improving their living standards. But there are also drawbacks. Companies are unlikely to respect worker's rights if governments do not intervene and the boundaries between work and personal life can be blurred since workers will be expected to always be available. In third world countries and in some cases even in western countries, since the coronavirus outbreak, workers have been expected to work from home for more than 8 hours with no overtime, so we can assume that this will also happen if teleworking becomes the standard.

In conclusion the benefits of teleworking outweigh the negatives since the negatives can be combated with stronger labor laws and worker's unions.

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