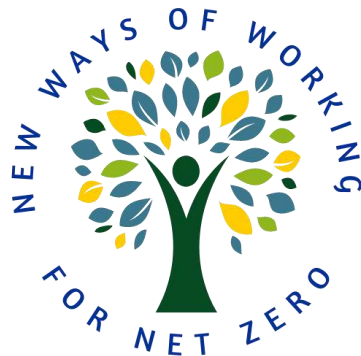# NEW WAYS OF WORKING FOR NET ZERO EMISSION

DEVELOPED BY

CONSEIL & RECHERCHE (France)

CENTER FOR KNOWLEDGE MANAGEMENT (North Macedonia)

POUR LA SOLIDARITE ASBL (Belgium)

HTAG BY RÉFÉRENCES (Belgium)

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Introduction

The profession of human resources (HR) manager is increasingly involved in the management of corporate social responsibility issues and sustainable development of their company. HR practitioners are in a unique position, due to their connections across their organizations and the requirement to engage with all levels, disciplines, and sectors, to improve communication and training, social innovation, mentoring, and intrapreneurship on these issues.

Performance indicators for companies used to be only economical, focusing on their capacity to generate profit. It is no longer the case: companies must now demonstrate economic, social, and environmental performance.[1] The requirement specifications are now both broader and more demanding. Following this dynamic, traditional strategic approaches to human resources management (HRM), which focus mainly on economic, and short-term efficiency objectives, are now considered insufficient for companies. In parallel with the growing consideration of well-being at work and corporate social responsibility issues, the concept of "Sustainable HRM" has also recently emerged[2]. Although the definitions of this concept are very diverse within the literature on the subject, some main characteristics can be noted. At a macro level, **"sustainable HRM"** implies that the integration of sustainable development issues in human resources management can also contribute to the well-being of employees and improve the company's impact on society[3]. However, at the micro level of the company, **"sustainable HRM"** focuses mainly on the internal processes of HRM to promote **"***long term socially and economically efficient recruitment, development, retainment, and dis-employment of employees***"**[4]. Sustainable HRM is often based on a conception of sustainability as a utilitarian or instrumental means to enhance the social and economic rationality of the company. Most published guides and research articles on the link between human resources and sustainable development highlight the following benefits for HR: employer branding, the attraction of talent to the organization, the creation of a feeling of greater identification with the organization, and an increase of the **employee's** well-being. The objective of reducing the carbon footprint is still not associated with the HR function.

More recently, a new concept has also emerged in the literature, which is the notion of **"Green HRM"** (GHRM). GHRM emphasizes individual behavior within the organization. It aims to influence and improve **employees'** ecological awareness and behavior, and ultimately to both reduce an **organization's** carbon footprint and improve its environmental records. GHRM focuses on **"greener human resource activities"** such as environmental performance management, environmental engagement, environmental education training, the promotion of **employees'** eco-friendly behaviors, and rewarding green behavior (linking bonuses with the achievement of environmental

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[1] Lo Giudice, C., Puel, F., & d'Iribarne, A. (2022, July 31). Interview with Alain d'Iribarne. personal.

[2] Quairel, F., & Capron, M. (2013). Le couplage « responsabilité sociale des Entreprises » ET « développement durable » : Mise en perspective, enjeux et limites. *Revue Française De Socio-Économie*, *n° 11*(1), 125–144. https://doi.org/10.3917/rfse.011.0125; Beaupré, D., Cloutier, J., Gendron, C., Jiménez, A., & Morin, D. (2008). Gestion des ressources humaines, développement durable et responsabilité sociale. *Revue internationale de psychosociologie*, XIV, 77-140. https://doi.org/10.3917/rips.033.0077 ; Aust, I., Matthews, B., & Muller-Camen, M. (2020). Common good HRM: A paradigm shift in sustainable hrm? *Human Resource Management Review*, *30*(3), 100705. https://doi.org/10.1016/j.hrmr.2019.100705.

[3] Beaupré, D., Cloutier, J., Gendron, C., Jiménez, A., & Morin, D. (2008). Gestion des Ressources Humaines, Développement durable et responsabilité sociale. *Revue Internationale De Psychosociologie*, *Vol. XIV*(33), 77–140. https://doi.org/10.3917/rips.033.0077.

[4] De Vos, A., & Van der Heijden, B. I. J. M. (2017). Current thinking on contemporary careers: The key roles of sustainable HRM and sustainability of Careers. *Current Opinion in Environmental Sustainability*, *28*, 41–50. https://doi.org/10.1016/j.cosust.2017.07.003.

goals)[5]. GHRM also incorporates environmental factors into employee performance evaluation and compensation management[6]. Through its influence on environmentally responsible worker attitudes, GHRM is considered to be critical in the development of a sustainable culture in organizations.

Nevertheless, sustainable and green forms of HRM have remained in the margin[7]. Moreover, there is still little data and analysis on the mechanisms by which green HRM practices have an impact on reducing companies' carbon emissions and the sustainability of their activities[8]. Therefore, despite a limited movement within the HR discipline toward promoting environmentally friendly practices in the workplace, not all HR stakeholders are convinced that addressing green challenges should be a core function of HRM. Thus, a paradigm shift to broaden the focus of HRM is proving to be a challenge. It will become increasingly indispensable for human resource managers to understand how the implementation of green practices can affect the **organizations'** environmental performance, and to recognize that these practices can stimulate progress towards environmental sustainability in the workplace.

As the IPCC reports on the state of the world sound more and more alarming, it becomes imperative for organisations, both private and public, to become actors of change in order to respect the Paris Accords, and keep temperature rise below 1.5°C. This implies a deep behavioural change to attain the Net Zero goal, also called carbon neutrality[9]. Unfortunately, the framework within which companies must navigate to reach this goal is still blurry[10].The possibility of **"offsetting"** (through carbon credits for instance) induces psychological bias hindering the needed immediate, concrete action. Sustainable and green HRM approaches must become the transformation heralds in such a context. It is precisely here, at the corner of influences, that the NWoW4NetZero projects finds its importance. It identifies three main sectors where HR managers can influence their organisations and lead them in a carbon-neutral dynamic: hybrid working habits, green digital habits, and sustainable workplace mobility.

To best create anchored and efficient toolkits for professionals, this report first reviews the academic and professional literature in these tree fields.

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[5] Ribeiro, N., Gomes, D. R., Ortega, E., Gomes, G. P., & Semedo, A. S. (2022). The impact of Green HRM on **employees'** eco-friendly behavior: The mediator role of organizational identification. *Sustainability*, *14*(5), 2897. https://doi.org/10.3390/su14052897.

[6] Ercantan, O., & Eyupoglu, S. (2022). How do green human resource management practices encourage employees to engage in green behavior? Perceptions of university students as prospective employees. *Sustainability*, *14*(3), 1718. https://doi.org/10.3390/su14031718; Ribeiro, N., Gomes, D. R., Ortega, E., Gomes, G. P., & Semedo, A. S. (2022). The impact of Green HRM on **employees'** eco-friendly behavior: The mediator role of organizational identification. *Sustainability*, *14*(5), 2897. https://doi.org/10.3390/su14052897.

[7] Bal, M., & Brookes, A. (2022). How sustainable is human resource management really? an argument for radical sustainability. *Sustainability*, *14*(7), 4219. https://doi.org/10.3390/su14074219.

[8] Aust, I., Matthews, B., & Muller-Camen, M. (2020). Common good HRM: A paradigm shift in sustainable hrm? *Human Resource Management Review*, *30*(3), 100705. https://doi.org/10.1016/j.hrmr.2019.100705.

[9] "*Net zero carbon dioxide (CO_2) emissions are achieved when anthropogenic CO_2 emissions are balanced globally by anthropogenic CO_2 removals over a specified period. Net zero CO_2 emissions are also referred to as carbon **neutrality.**"* IPCC. (June 2018) *Global Warming of 1.5°C – Special Report*. IPCC, Geneva. Retrieved 5 August, 2022, from https://www.ipcc.ch/sr15/.

[10] Net Zero Initiative. (April 2020). *A Framework for Collective Carbon Neutrality* [White paper]. Carbone 4, Paris. Retreived 6 July, 2022, from https://www.carbone4.com/en/publication-referentiel-nzi.

Work outside of work: definition and key trends in hybrid work approaches

Organizations worldwide have created new working standards that have facilitated the development of hybrid forms of work. Hybrid work is a flexible approach that enables employees to split their time between working in the office and working from home. There is a wide variety of hybrid work models, and hybrid work policies can be declined in different forms, such as[11]:

- hybrid at-will: employees can choose which day(s) to come into the office;
- hybrid split-week: the company assigns specific days for on-site and remote work by team or function;
- hybrid manager-scheduling: managers choose which day(s) their team comes into the office.

In Western countries, flexible work arrangements have increased significantly during and after the COVID-19 pandemic. In the EU, only 3.2% of employees worked remotely regularly before the pandemic, a group mainly consisting of higher-paid and higher-skilled workers with overrepresentation in northern Europe[12]. This number increased to 39% during the pandemic. In Belgium this amounts respectively to 22% and 48% [13]. Nearly two-and-a-half years on, organizations worldwide have acknowledged that flexible work is no longer a temporary pandemic response but an enduring feature of the modern working world, creating a massive rupture to past office work habits. In the US, a survey conducted in April 2022 by the company Envoy among 800 workplace leaders showed that 77% of companies had adopted a hybrid working model, while they were 6% before the pandemic[14]. Only 15% of workplace leaders stated that they have returned to a 100% in-office requirement for their employees. Another survey conducted by McKinsey and Ipsos among 25,000 Americans in spring 2022[15] across many kinds of jobs and sectors demonstrated that 58% of respondents reported having the opportunity to work from home at least one day a week. However, this evolution only concerns a certain category of population, living in the most developed countries. The International Labour Organization (ILO) estimated in 2021 that nearly 18% of workers have occupations suitable for home-based work and live in countries that have the infrastructure to enable home-based work[16]. In France, according to the French national statistical office, INSEE, 58%

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[11] Fowell, T. (2022, May 11). *What is hybrid work and why do employees want it?* Envoy. Retrieved August 1, 2022, from https://envoy.com/blog/what-is-a-hybrid-work-model/.

Migliore, A., & Tagliaro, C. (2020). Collaborative Spaces: Organizational, spatial and relational crossover for new ways of working. *International Multidisciplinary Research Journal*, 1–5. https://doi.org/10.25081/imrj.2020.v10.6473.

[12] Babapour Chafi, M., Hultberg, A., & Bozic Yams, N. (2021). Post-pandemic office work: Perceived challenges and opportunities for a sustainable work environment. *Sustainability*, *14*(1), 294. https://doi.org/10.3390/su14010294.

[13] Wrzesinski, D. Vander Elst D. & Kluppels, L. (2021) Télétravail en Belgique - avis de la population sur les conditions de télétravail après la crise du COVID19. Bruxelles, Belgique : institut Vias – KCC, Cette étude a été rendue possible grâce au soutien financier du Service Public Fédéral Mobilité et Transports, Télétravail en Belgique 2021 (teletravailler.be)

[14] Envoy. (2022, April 26). *New survey reveals how to get employees back to the Office*. Envoy, San Francisco, US. Retrieved August 1, 2022, from https://envoy.com/blog/getting-employees-back-to-the-office/.

[15] McKinsey & Company. (2022, June 27). *Americans are embracing flexible work--and they want more of it*. McKinsey & Company, Los Angeles, US. Retrieved August 1, 2022, from https://www.mckinsey.com/industries/real-estate/our-insights/americans-are-embracing-flexible-work-and-they-want-more-of-it.

[16] Sokovic, D. (2022). 78th International Scientific Conference on Economic and Social Development. In *Remote Work and Hybrid Organizations*. Aveiro. Retrieved August 2, 2022, from https://www.researchgate.net/publication/359056200.

of executives and middle-ranking positions worked from home during the first lockdown compared to 20% of those in non-managerial roles and 2% of manual workers[17].

Several studies conducted in Western countries in 2022 have shown that most employees see the value in hybrid work and that flexibility is one of the most important factors in deciding whether to accept a job offer. The 2022 McKinsey survey mentioned previously showed that when people have the chance to work flexibly, 87% of them take it[18]. Another study on future work arrangement preferences, conducted by Reisinger and Fetterer in 2021[19] reported that knowledge workers find flexibility more important to them than wage or other benefits (59% of respondents) and would prefer to work for a company that gives them the flexibility to work from anywhere rather than exclusively on the employer's premises (77%). Similarly, in Belgium, a survey indicated that since 2021, 58% of workers applying for new jobs take into account the possibility of teleworking in their application (Acerta and Stepstone, 2021) [20].

Recent attempts by some companies, most notably Apple, Tesla and Google, to get their employees to return to 100% office work have resulted in resignations[21]. The norm that is gradually emerging in large companies is 3 days in the office per week[22]. Therefore, the challenge that managers are facing today is how to make the workplace a place where people want to be[23]. However, flexibility does not exclude occasional working from the office. The OECD reported in 2021 that while both employers and employees expected greater use of telework after the pandemic, relatively few employees will work fully remotely in the future.

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[17] Dardanne, F. (2021, September 13). *Is remote working shaping the future of work?* La Fabrique de l'industrie, Paris. Retrieved May 27, 2022, from https://www.la-fabrique.fr/fr/publication/is-remote-working-shaping-the-future-of-work-2/amp/

[18] McKinsey & Company. (2022, June 27). *Americans are embracing flexible work--and they want more of it.* McKinsey & Company, Los Angeles, US. Retrieved August 1, 2022, from https://www.mckinsey.com/industries/real-estate/our-insights/americans-are-embracing-flexible-work-and-they-want-more-of-it.

[19] Reisinger, H., & Fetterer, D. (2021, November 5). *Forget flexibility. your employees want autonomy.* Harvard Business Review. Retrieved August 1, 2022, from https://hbr.org/2021/10/forget-flexibility-your-employees-want-autonomy.

[20] Analyse et impact du télétravail en Région de Bruxelles Capitale, Institut bruxellois de statistiques et d'analyse (ibsa). Rapport d'étude, ULB (DULBEA et IGEAT), Octobre 2021, p 22. Perspective - Analyse et impact du télétravail en RBC (ibsa.brussels).

[21] Lawler, R., & Schiffer, Z. (2022, May 17). *Apple slows return to office, will let employees stay remote and require masks in common spaces.* The Verge. Retrieved August 1, 2022, from https://www.theverge.com/2022/5/17/23100696/apple-delay-hybrid-office-return-work-from-home-covid-19-masks.

[22] Dardanne, F. (2021, September 13). *Is remote working shaping the future of work?* La Fabrique de l'industrie, Paris. Retrieved May 27, 2022, from https://www.la-fabrique.fr/fr/publication/is-remote-working-shaping-the-future-of-work-2/amp/

[23] Velsey, K. (2022, June 15). *The 3-day return to office is, so far, a dud.* Curbed. Retrieved August 1, 2022, from https://www.curbed.com/2022/06/hybrid-3-day-return-office-apple-google-remote-work.html.

A brief overview of the academic literature

The literature on new work/hybrid work is scattered across multiple disciplines. It includes conceptual and empirical studies mainly within social sciences, architecture, real estate management, human resource management, and facility management[24]. These studies mainly focus on how the development of hybrid work affects all dimensions of organization. The key concepts that are usually discussed are the following[25]: workstyle, multiple workplaces, remote working, collaborative spaces, the evolution of office cultures, and work-private balances. Many of the most recent articles discuss the benefits and risks of hybrid work, focusing mostly on the productivity and attractivity impact of hybrid work on employees[26].

According to these studies, hybrid work practices have a positive impact on work-life balance, flexibilization, agility, value orientation, meaningfulness of work, and the attractiveness of the employer brand[27]. The development of new spatial work models like coworking, collaborative or team-focused spaces enable self-development of employees and meaningful work[28], thanks to the flexibility of their forms and functions, **users'** inclusion, and to their spatial and managerial fragmentation. A recent Harvard Business School working paper even characterized hybrid work as "*the best of both worlds*[29]".

Nevertheless, several studies also highlight the risks associated with the rise of hybrid work. A 2021 study by Microsoft showed that remote work represents obstacles to collaboration and innovation, as **workers'** networks become more static and siloed, with fewer bridges between disparate parts of an organization[30]. Employees can also be more affected by overtime, high pressure, intense work schedule, lack of boundaries between work and home, and overall higher stress levels[31]. Other issues can arise from inefficient work communication, lack of motivation, weak leadership, and the deterioration of labour rights[32]. In addition, the weaker relationship between employer and employee is expected to lead to higher turnover in the workforce.

[24] Leede, J. de. (2017). *New ways of working practices: Antecedents and outcomes*. Emerald, Bingley, UK.; Babapour Chafi, M., Hultberg, A., & Bozic Yams, N. (2021). Post-pandemic office work: Perceived challenges and opportunities for a sustainable work environment. *Sustainability, 14*(1), 294. https://doi.org/10.3390/su14010294.

[25] Harrison, A., Wheeler, P., & Whitehead, C. (2004). *The distributed workplace: Sustainable work environments*. Routledge, London, UK.

[26] Gratton, L. (2021). Four principles to ensure hybrid work is productive work. *MIT Sloan Management Review, 62*(2), 11A-16A. Retrieved from https://sloanreview.mit.edu/article/four-principles-to-ensure-hybrid-work-is-productive-work/.

[27] Del Río Castro, G., González Fernández, M. C., & Uruburu Colsa, Á. (2021). Unleashing the convergence amid digitalization and sustainability towards pursuing the sustainable development goals (SDGs): A holistic review. *Journal of Cleaner Production, 280*, 122204. https://doi.org/10.1016/j.jclepro.2020.122204.

[28] Migliore, A., & Tagliaro, C. (2020). Collaborative Spaces: Organizational, spatial and relational crossover for new ways of working. *International Multidisciplinary Research Journal*, 1–5. https://doi.org/10.25081/imrj.2020.v10.6473.

[29] Choudhury, P., Khanna, T., Makridis, C. A., & Schirmann, K. (2022, March 24). *Is Hybrid Work the Best of Both Worlds? Evidence from a Field Experiment*. Harvard Business School. Retrieved August 1, 2022, from https://www.hbs.edu.

[30] Yang, L., Holtz, D., Jaffe, S., Suri, S., Sinha, S., Weston, J., Joyce, C., Shah, N. P., Sherman, K., Hecht, B., & Teevan, J. (2021, September 9). *The effects of remote work on collaboration among information workers*. Microsoft Research. Retrieved August 1, 2022, from https://www.microsoft.com/en-us/research/publication/the-effects-of-remote-work-on-collaboration-among-information-workers/.

[31] BBC. (2022, January 21). *Why hybrid work is emotionally exhausting*. BBC Worklife. Retrieved August 1, 2022, from https://www.bbc.com/worklife/article/20220120-why-hybrid-work-is-emotionally-exhausting.

[32] Sokovic, D. (2022). 78th International Scientific Conference on Economic and Social Development. In *Remote Work and Hybrid Organizations*. Aveiro. Retrieved August 2, 2022, from https://www.researchgate.net/publication/359056200.

The impact of hybrid work on carbon emissions reduction

Among the benefits of hybrid work, most studies mention its positive effects on the environment, particularly by reducing employees' mobility. For example, a survey conducted by the Boston Consulting Group in 2020 showed that 61% of HR director think that remote working contributes to reducing their company's carbon footprint[33]. However, the question of the direct link between hybrid work and sustainability has rarely been explored in depth. It is only very recently that academic research has turned its attention to this issue, as shown in the graph below[34]:
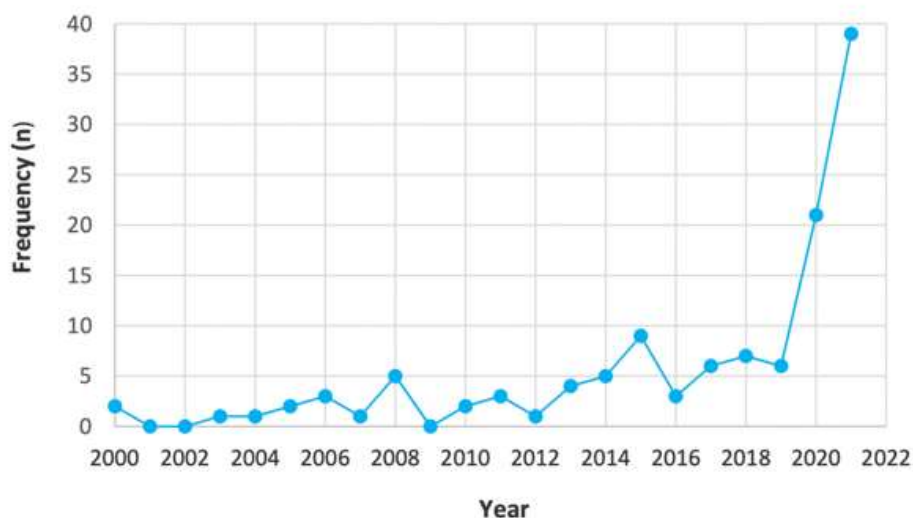

Figure 1. Articles linking telework and sustainability over time (2000–2021). Note that the number of papers for 2021 has been extrapolated based on current papers published at an equal rate for the remainder of the year, i.e., this does not adequately consider exponential growth and does not fully consider early or delayed publication of papers.

The first studies and initiatives developed in the 1990s and in the 2000s focused mainly on the link between office building and sustainability, dealing with the issues of energy consumption reduction, building and construction materials, and preserving biodiversity. The assumption was that the inclusion of environmental sustainability should result in higher quality workplaces and therefore contribute to increased productivity of the employees[35]. In 2004, the research conducted by Harrison, Wheeler, and Whitehead significantly contributed to broadening the approach to sustainable development, combining it with the evolution of workplaces. They developed an interesting guide to including sustainability into the workplace strategy. This guide starts from the evaluation of the organizational and business context of companies, of their processes and existing work styles, to define an adapted work organization strategy that includes sustainable development objectives.

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[33] ANDRH, Boston Consulting Group. (2020). *Le télétravail, post covid, vu par les DRH*. Retrieved May 23, 2022, from https://www.andrh.fr/article/Le-teletravail-post-covid-vu-par-les-DRH-Resultats-enquete-ANDRH-BCG.

[34] Moglia, M., Hopkins, J., & Bardoel, A. (2021). Telework, hybrid work and the United Nation's Sustainable Development Goals: Towards Policy Coherence. *Sustainability*, *13*(16), 9222. https://doi.org/10.3390/su13169222.

[35] Harrison, A., Wheeler, P., & Whitehead, C. (2004). *The distributed workplace: Sustainable work environments*. Routledge, London, UK.

However, only the most recent studies attempt to evaluate the real impact of new ways of working on sustainable development. The authors of two very exhaustive literature reviews published in 2020[36] and 2021[37] argue that the effects of hybrid work on the reduction of **companies'** carbon footprint are non-linear and more complex than expected. These findings concur with a report published by ADEME, the French agency for the environment and energy management in 2020[38].

On the one hand, the development of telework can have a positive impact on the environment. The most cited benefit of teleworking is its 'substitution' effect, whereby commuter travel is substituted (or displaced) by less energy-intensive activities or behaviours. This can lead to a net reduction in energy use and/or emissions:

- it may reduce congestion on roads, help improve air quality and reduce associated ill health and death. In France, ADEME also estimates that remote working reduces the environmental impacts associated with home office commuting and travel by about 30%. This gain is estimated to result in a 58% reduction in fine-particle emissions, bringing about a notable improvement in air quality[39].

- the other hypothesized change in greenhouse gas emissions arises because the reduction in energy use in the office might be greater than the increased energy use at home.

On the other hand, the ecological benefits of hybrid work are likely to be more nuanced, because of the risks of rebound effects that derive from several reasons:

- People who work from home are more likely to live in larger, single-family dwellings that are associated with urban sprawl and higher car dependence. Therefore, workers who telecommute tend to be more car-dependent and, on average, travel more than their office-based counterparts. This effect increases the longer they have worked from home.

- The rise of teleworking could encourage changes in behaviour that increase work and/or non-work travels. In the case of work travel, the ability of employees to live further away from their place of work could mean that the longer trips they make on non-teleworking days outweigh the travel and energy savings they make on days that they work from home. In the case of non-work travel, telecommuters may have to make additional trips for non-work activities that were normally carried out while commuting, generally leading to an increase in non-commuting travel. To fight against isolation, employees may also be willing to set up compensatory trips to social places that may partly offset the travel and energy savings achieved by avoiding commuting.

- Energy consumption in the residential sector could increase significantly, without being compensated by a significant decrease in the professional sector (e.g. offices may continue to be heated and lit as much as before). There could be an 'additive' impact of teleworking if businesses neither move to smaller offices (which have a smaller energy footprint) nor close their offices in response to increased teleworking. Research indicates that unless there is widespread adoption of telecommuting—beyond "just a day or two a **week**"—the reduction

[36] Hook, A., Court, V., Sovacool, B. K., & Sorrell, S. (2020). A systematic review of the energy and climate impacts of Teleworking. *Environmental Research Letters*, *15*(9), 093003. https://doi.org/10.1088/1748-9326/ab8a84.

[37] Moglia, M., Hopkins, J., & Bardoel, A. (2021). Telework, hybrid work and the United **Nation's** Sustainable Development Goals: Towards Policy Coherence. *Sustainability*, *13*(16), 9222. https://doi.org/10.3390/su13169222.

[38] Almosnie, J., & Carballes, S., (2020) Étude sur la caractérisation des effets rebond induits par le télétravail. ADEME, Dir. Mobilité et transport. Retrieved May 27, 2022, from https://librairie.ademe.fr/mobilite-et-transport/3776-caracterisation-des-effets-rebond-induits-par-le-teletravail.html.

[39] Quoted in Dardanne, F. (2021, September 13). *Is remote working shaping the future of work?* La Fabrique de l'industrie, Paris. Retrieved May 27, 2022, from https://www.la-fabrique.fr/fr/publication/is-remote-working-shaping-the-future-of-work-2/amp/.

in office energy use may be only marginal. This is in part because even unoccupied office buildings tend to use nearly half of the energy of fully occupied buildings.

- Remote working also leads to an increase in digital pollution (responsible for 4% of global greenhouse gas emissions), especially with bandwidth-consuming video conferencing, and the increased production of digital devices, which leads to increased energy and resource consumption, as well as electronic waste production.

Many of these risks can be managed, and the benefits and weaknesses of hybrid work on the environment depend strongly on the **company's** context. For example, the net positive effect of telework is greater in cities with less sprawl and car dependence. This indicates an important nexus between the availability of appropriate housing, urban mobility, and telework, with critical implications for greenhouse gas emissions. Therefore, policies that promote hybrid work should be combined with other policies, especially regarding mobility, energy consumption, and digital technology.

Green IT and digital sobriety: definitions and key trends

Over the last 5 years, the environmental impacts of digital technology have been increasingly documented[40]. At the intersection of the digital and sustainable development domains, "Green IT" relates to "*the study and practice of designing, manufacturing and using computers, servers, monitors, printers, storage devices, and networking and communications systems efficiently and effectively, with zero or minimal impact on the environment*"[41]. Green IT is also closely tied to the notion of digital sobriety, which consists of "*developing a strategy for designing and using our digital system in a way that is compatible with natural physical constraints.*"[42] The digital system includes, on the one hand, physical components made of user equipment and terminals, network infrastructures and cables, and data centres; and on the other hand, individual or collective personal and professional practices.

> Digital technology plays an increasingly important role in the problem of reducing emissions of greenhouse gases originating from human activity. The global digital industry now consumes 10% of the world's electricity and emits nearly 4% of global CO_2 emissions, which is nearly as much as the world's civil aviation sector[43]. In 2020, the environmental impacts of the French digital sector represented 3.2% of the French global emissions, the equivalent of the yearly emissions of 2.2 million Parisians[44]. To aim for digital sobriety, ADEME recommends adopting a holistic approach, which integrates the impacts generated during all stages of the equipment life cycle and the physical components of the digital system[45]. Indeed, the impact of moderating data consumption is limited if it is considered separately from the issue of equipment renewal.

Except for primary energy, which is mainly related to the production of electricity, the most important negative environmental impacts of digital technology are related to the manufacture of devices, as well as the end of life of the equipment. For example, the production of a desktop computer requires two tons of natural resources, many of which are rare and difficult to extract and transform. Several studies have predicted an increase in the number of devices per capita in the

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[40] See for example: The Shift Project. (2021, June 28). "*Pour une sobriété numérique* ": *Le Nouveau Rapport du shift publié*. The Shift Project. Retrieved July 29, 2022, from https://theshiftproject.org/article/pour-une-sobriete-numerique-rapport-shift/.

[41] Murugesan, S., & Gangadharan, G. R. (2012). *Harnessing green it: Principles and practices*. John Wiley & Sons, Inc., Hoboken, US.

[42] ADEME, Arcep. (2022, January 19). *Évaluation de l'impact environnemental du numérique en France … - arcep*. Retrieved July 29, 2022, from https://www.arcep.fr/uploads/tx_gspublication/etude-numerique-environnement-ademe-arcep-note-synthese_janv2022.pdf.

[43] Pitron, G. (2021). *L'enfer Numérique : Voyage au bout d'un like*. Éditions Les liens qui libèrent, Paris.

[44] Bordage, F., de Montenay, L., Vergeynst, O. (2020, June). *Étude « iNum » :Impacts environnementaux du Numérique en France*. GreenIT, Paris. Retrieved July 29, 2022, from https://www.greenit.fr/wp-content/uploads/2020/06/2020-06-iNum-etude-impacts-numerique-France-rapport.pdf.

[45] ADEME, Arcep. (2022, January). *Évaluation de l'impact environnemental du numérique en France et analyse prospective*. ADEME & arcep, Paris. Retrieved July 29, 2022, from https://www.arcep.fr/uploads/tx_gspublication/etude-numerique-environnement-ademe-arcep-note-synthese_janv2022.pdf.

coming years, mainly related to the massive use of smartphones[46]. Collecting electronic waste will be a huge challenge, as less than 20% of equipment is currently recovered and recycled[47]. Daily digital uses and data consumption are also growing very rapidly. This is linked to two main phenomena: the increase of the time allocated daily to the use of digital online services; and the parallelization of tasks associated with digital uses, which multiplies the number of equipment and applications used during the same time slot. In addition, watching videos represents 60% of data flows and it is the practice that generates the most carbon impact[48].

A key role for the private sector

Today, many experts warn that the economic context is still not very favourable to the deployment of responsible digital technology and that consumers are still too reluctant to turn to alternative offers[49]. Private and public organizations have a key role to play in moving their operations and employee practices toward digital sobriety. In Europe, the private sector will be subject to increasing regulation in favour of digital responsibility. The digital field is set to become increasingly standardized, as evidenced by the European Parliament's July 2017 vote on a resolution for longer product lifetimes. In addition, there is now a growing consensus that the environmental challenges of digital technology must be integrated into business strategies and other KPIs.

Many methodological guides and tools exist to help companies develop a holistic, comprehensive Green IT strategy[50]. Green IT focuses first on making the **company's** own IT greener by improving end-user working practices, creating an energy-efficient office environment, and reducing energy consumption. In addition to this priority issue, the Belgian Institute for Sustainable IT includes two other aspects: the creation of an inclusive digital environment and the challenges of well-being at work (teleworking, right to disconnect)[51]. Because of the cross-sectoral nature of digital activities, IT departments should not be the only ones concerned by the issues of digital sobriety. The corporate management and the overall environmental strategy of an enterprise are seen as major drivers of a Green IT strategy. Among the various recommendations that are given for implementing a digital sobriety policy, the most common are:

- increasing the lifespan of equipment: for example, promoting the repair and reuse of the device. According to ADEME, if French companies were to favour the reuse of their computers, this could create 1,500 jobs and save 810,000 tons of greenhouse gases and 6 billion litres of water, the equivalent of the annual footprint of 100,000 French people.
- reducing the number of used digital resources. This aspect can be put into practice through simple plans of actions, such as mutualizing the equipment, favouring eco-design digital services, and reducing the number of connected devices. Their number skyrocketed from a global average of 1.83 devices per person in 2010 to an estimated 9.27 items in 2025.[52]

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[46] In France in 2020, there were approximately 631 million devices; 58 million users; and 11 devices per user. Bordage, F., de Montenay, L., Vergeynst, O. (2020, June). *Étude « iNum » :Impacts environnementaux du Numérique en France*. GreenIT, Paris. Retrieved July 29, 2022, from https://www.greenit.fr/wp-content/uploads/2020/06/2020-06-iNum-etude-impacts-numerique-France-rapport.pdf.

[47] Pitron, G. (2021). *L'enfer Numérique : Voyage au bout d'un like*. Éditions Les liens qui libèrent, Paris.

[48] Pitron, G. (2021). *L'enfer Numérique : Voyage au bout d'un like*. Éditions Les liens qui libèrent, Paris.

[49] Pitron, G. (2021). *L'enfer Numérique : Voyage au bout d'un like*. Éditions Les liens qui libèrent, Paris.

[50] Murugesan, S., & Gangadharan, G. R. (2012). *Harnessing green it: Principles and practices*. John Wiley & Sons, Inc., Hoboken, US.

[51] Lo Guidice, C., Levaillant, M., & Vergeynst, O. (2022, June 20). Interview with Olivier Vergeynst. personal.

[52] Safaei, B., Monazzah, A. M., Bafroei, M. B., & Ejlali, A. (2017). Reliability side-effects in internet of things application layer protocols. *2017 2nd International Conference on System Reliability and Safety (ICSRS)*. https://doi.org/10.1109/icsrs.2017.8272822

- shifting to a responsible design of digital services: creating value by designing digital products and services that are more efficient from an environmental, social, and economic point of view. This falls in line with the new performance indicators that companies must now face: more than just economic performance, organisations must also provide evidence of their social, and environmental performances[53]
- optimizing data storage and try to have the smallest data footprint possible so as not to overload the datacentres;
- making better use of digital data: reduce the size of emails by avoiding attachments, for example, go as fast as possible when searching the web, and limit the use of videos;
- limiting energy consumption when equipment is not in use, which has the double benefit of prolonging the life of the device as well as limiting its carbon footprint.

Traditionally, HR teams do not take part in the development of Green IT strategies, nor in their implementation. As it is the case for most **"greening"** initiatives, top management tends to create trends, and rely on middle management to implement them. In the case of Green IT, companies generally seek the help of technological departments instead of HR. However, because of their implication in staff hiring and their impact on corporate culture, HR members can become instrumental in carrying out Green IT measures. This implies that HR managers and collaborators must train in the field to best operate. Although they are never mentioned directly in the methodological guides relating to Green IT, human resource managers can play a key role in developing and implementing responsible digital strategies and supporting cultural and behavioural changes[54]. They can particularly contribute by:

- training and raising awareness of the environmental challenges of digital technology among employees at all management levels;
- harmonising methodologies for quantifying the environmental impact of digital technology and better disseminating them[55];
- implementing a policy of coupling personal and professional digital tools;
- developing Green IT standards across the enterprise and better defining tasks, roles, and responsibilities, especially through the inclusion of the IT department[56];
- better integrating work between corporate social responsibility projects and IT departments[57];
- creating inter-company synergies to encourage innovation

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[53] Lo Giudice, C., Puel, F., & d'Iribarne, A. (2022, July 31). Interview with Alain d'Iribarne. personal.

[54] Schmidt, N.-H. (2011, January). (thesis). *Environmentally Sustainable Information Management Theories and concepts for sustainability, Green IS, and green IT*. Retrieved August 2, 2022, from https://www.researchgate.net/publication/254862190.

[55] Lo Guidice, C., Levaillant, M., & Courboulay, V. (2022, July 21). Interview with Vincent Courboulay. personal.

[56] Molla, A. (2009, January). *The reach and richness of green it: A principal component analysis*. Retrieved July 29, 2022, from https://www.researchgate.net/publication/228807869_The_Reach_And_Richness_Of_Green_IT_A_Principal_Component_Analysis.

[57] The implications of sustainability and corporate social responsibility has been researched in the general management literature: Esty, D. C., & Winston, A. S. (2009). *Green to gold: How smart companies use environmental strategy to innovate, create value, and build competitive advantage*. John Wiley & Sons, Hoboken, US.; van Marrewijk, M. (2012). Concepts and definitions of CSR and corporate sustainability: Between agency and Communion. *Citation Classics from the Journal of Business Ethics*, 641–655. https://doi.org/10.1007/978-94-007-4126-3_32.

The long drive towards neutrality: the current impact of mobility on the environment

Aiming at a carbon neutrality in the mobility sector is a way to fulfil one of the UN Sustainable Development Goals. Indeed, the SDG 11, *Sustainable Cities and Communities*, seeks among other aspects to provide access to safe, affordable, accessible, and sustainable transport systems for all and to improve road safety.

The ecological impact of transport makes it one of the world priorities in terms of change. In 2019, according to the statistics aggregator Climate WatchData, 24.7% of GHG (Green House Gas) emissions in the European Union came from transport. Some European countries such as France even revealed an impact of the transport sector as high as 31%[58]. Within the transportation sector, road traffic counts for 75% of GHG emissions[59].

The predominant reliance on road networks makes the mobility sector one that is very slow, and hard to change. However, to adhere to Net Zero dynamics, policy effort should strive to take advantage of any disruption and global event to promote long-lasting behavioural changes. In this regard, the Covid-19 crisis manifested as a true opportunity. According to the World Economic Forum, sharp transformation of global mobility habits due to the ongoing pandemic (various waves of lockdowns, implementation of remote work and subsequent economic recession), CO_2 emissions sank by 8% compared to April 2019[60]. This is due to a major shift in mobility practices: global use of public transport fell by 50 to 90%[61], and long-distance rail traffic went down 80%[62]. On the contrary, other mobility modes showed a stark increase. Active modes of transportation, such as cycling and walking were at an all-time high, as well as micro-mobility (e-bikes, electric scooters, shared bicycles, pedelecs).[63] To accommodate the growing demand, various cities in Europe (Paris, London, Barcelona, among others)[64] have reallocated road space to create micro-mobility lanes. As much of air traffic was going down to a stall, European cities have collectively decided to increase the offer on night trains across borders.[65]

All these new trends have an unclear longevity. However, to fulfil the requirements of a dynamic towards carbon neutrality, permanent modal shifts from individual cars to active mobility and public transportation must happen. In the Net-Zero Scenario, 20 to 50% of car trips are shifted to buses (depending on the city), with additional trips replaced by cycling, walking and other public transport.

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[58] Ministère de la transition écologique, Conseil Général au Développement Durable. (2021, February 25). *Les émissions de gaz à effet de serre du secteur des transports*. Retrieved July 12, 2022, from https://www.notre-environnement.gouv.fr/.

[59] Ritchie, H. (2020, October 6). *Cars, planes, trains: where do CO2 emissions from transport come from?* Our World in Data. Retrieved July 12, 2022, from https://ourworldindata.org/.

[60] Caballero, S., & Tanzilli, M. (2021, April 30). *Why the future of sustainability starts with mobility*. World Economic Forum. Retrieved July 12, 2022, from https://www.weforum.org/.

[61] IEA. (2020). *The Covid-19 Crisis and Clean Energy Progress*, IEA, Paris. Retrieved July 1, 2022, from https://www.iea.org/reports/the-covid-19-crisis-and-clean-energy-progress.

[62] IEA. (2020). *Sustainable Recovery*, IEA, Paris. Retrieved July 1, 2022, on https://www.iea.org/reports/sustainable-recovery.

[63] IEA. (2022), *Global EV Outlook 2022*, IEA, Paris. Retrieved July 4, 2022, on https://www.iea.org/reports/global-ev-outlook-2022.

[64] Reid, C. (2020, April 22). Paris To Create 650 Kilometers of Post-Lockdown Cycleways. *Forbes*. Retrieved July 4, 2022, from https://www.forbes.com.

[65] Pleschberger, J. (2020, December 16). Europe expands night train network as rail becomes more popular. *Euronews*. Retrieved July 4, 2022, from https://www.euronews.com/.

By the mid-2030s, this leads to a reduction in emissions from cars of more than 320 Mt CO_2 from a current 3.2 Bt CO_2[4].

If road traffic is at the heart of discussions in Net-Zero scenario, it is not only because of the importance it has within the mobility sector. Its chemical composition is also important. Indeed, more than 97% of GHG coming from transportation is CO_2 only, which makes it the least diversified emission source. This is an issue, as CO_2 has a long lifespan (hundreds to thousands of years) compared to other greenhouse gases, such as methane (about 20-30 years)[66].

As the world is eager to go back to a **"new normal",** all the virtuous behaviour trends are waning, and so are their positive impacts. Borders reopening and the frantic race to economic growth have led global CO_2 emissions post-Covid to exceed those prior to the crisis: in December 2020, they were 2% higher than in December 2019[67].

To successfully create an environment fostering sustainable behaviour, the European Union unveiled on 14 December 2020 its *Sustainability and Smart Mobility Strategy*, strengthened by the European Green Deal, signed on 14 July 2021. The European plans are ambitious, ranging from a 90% reduction of GHG emissions from the transportation sector by 2050 to showing support for carbon-neutral city planning.

The following part focuses on two different aspects of mobility planning: Sustainable Urban Mobility Plans (SUMPs), and workplace mobility plans.

Sustainable Urban Mobility Plans

A clear engagement from territories and official institutions is an essential parameter to consider when drafting a successful carbon-neutral mobility plan. Policies are the main motor for change: 60% of corporate shifts in mobility planning are motivated by the wish to align (or to comply) with national, regional, or local policies[9].

> Even though national policing might seem like an adequate scale to start with, local planning in the mobility sector is crucial, as local mobility accounts for 70% of global emissions in the transport sector[68]. There is also a real economic impact in defining better mobility management, as traffic congestions represent heavy costs to urban areas: they cost the Madrid metropolitan area about €800 millions per year. On a greater scale it is estimated that the cost of traffic jams amounts to the equivalent of 1.3 to 2% of the European GDP[69]. Conversely, implementing a virtuous mobility plan can have very real return on investment. The city of Arad, Romania, estimated that its mobility plan would give back €2.2 million for every €1 million invested[70].

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[66] Autonomy & Capgemini Invent. (2021). *Getting to Net Zero: The Way Forward for the Mobility Ecosystem* [White paper].

[67] After a steep drop in early 2020, global carbon dioxide emissions have rebounded strongly. (2021, March 2). *IEA*. Retrieved June 12, 2022, from https://www.iea.org/.

[68] Infiniti Research Ltd. (June 2021). *Global Business Travel Market 2021-2025*. Retrieved June 26, 2022, on https://www.reportlinker.com/p05166388/Global-Business-Travel-Market.html

[69] CE Delft, INFRAS, Fraunhofer ISI. (September 2011). *External Costs of Transport in Europe. Update Study for 2008*. Delft. Retrieved 23 June, 2022, from https://www.cedelft.eu/.

[70] City of Arad. (2017). *Planul de Mobilitate Urbană Durabilă al Municipiului Arad.* Retrieved June 29, 2022 from https://portal1.primariaarad.ro.

The easily quantified positive outcomes of mobility planning has sparked growing interests from territories and metropolitan areas in Europe. The most complete version to date of these documents is the Sustainable Urban Mobility Plan, or SUMP. A SUMP takes various indicators such as passenger and freight transport demands, but also **citizens'** quality of life[71]. The German consulting firm Rupprecht has defined such a plan in the following terms: "*A Sustainable Urban Mobility Plan is a strategic plan designed to satisfy the mobility needs of people and businesses in cities and their surroundings for a better quality of life. It builds on existing planning practices and takes due consideration of integration, participation, and evaluation principles.*"[72]

As evaluation criteria evolve, several versions of SUMPs have been created, showing the importance of adapting a plan to the aspects of each territory. However, it has been noted in a review comparing 15 major SUMPs across Europe by Kiba-Janiak and Witkowski (2019)[73] that local authorities tended to focus their mobility planning on passenger transport, leaving freight to the side. Such an attitude tends to shift responsibility for freight solely on the private sector[74]. However, with an impact on 20 to 30% of all road mileage and 16 to 50% of GHG emissions[75], freight must be considered to build an all-encompassing plan. The review extracts three main categories of indicators: SUMP formulation, implementation of measures (such as infrastructure, land management, access condition, etc.) and, following the Rupprecht definition, evaluation principles. Altogether, the authors of the review stated that a solid SUMP should be composed of no less than 45 indicators.

Most plans prioritise introducing vehicle-free zones and time slots. The Kiba-Janiak and Witkowski review also notes that a key indicator of a successful SUMP is the collaboration with a network of stakeholders, may they be public or private, and announces it as inherent to reducing GHG emissions. SUMPs are also available for smaller cities and territories, through projects such as EU-funded '**Urban** Transport **Roadmaps'**. The platform enables authorities to enter the key defining criteria of their territory, thus generating adequate guidelines.

Workplace action

Private organisations should consider mobility as much as their public counterparts in their internal strategies. Commuting to work has a real impact on the environment, and the disruptions brought about by the Covid-19 crisis do not hinder much the expansion of employee mobility. Indeed, local mobility accounts for 70% of global transportation GHG emissions, much of which is business-related[76]. This sheds light on organisations as major actors of the carbon-neutral dynamic, as they have the opportunity to influence their **employees'** behavioural habits regarding mobility. The impact of hybrid work on mobility habits is currently being studied by numerous scholars, in an effort

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[71] Louro, A.; da Costa, N.M.; da Costa, E.M. Sustainable urban mobility policies as a path to healthy cities—The case study of LMA, Portugal. *Sustainability* 2019, 11, 2929.

[72] Rupprecht Consult (editor). (2019). *Guidelines for Developing and Implementing a Sustainable Urban Mobility Plan, Second Edition*, 2019. Retrieved May 25, 2022, from www.rupprecht-consult.eu.

[73] Kiba-Janiak, M., & Witkowski, J. (2019). Sustainable urban mobility plans: How do they work? *Sustainability*, *11*(17), 4605. https://doi.org/10.3390/su11174605.

[74] Lindholm, M. (2012). How Local Authority decision makers address freight transport in the Urban Area. *Procedia - Social and Behavioral Sciences*, *39*, 134–145. https://doi.org/10.1016/j.sbspro.2012.03.096.

[75] Dablanc, L. (2007). Goods transport in large European cities: Difficult to organize, difficult to modernize. *Transportation Research Part A: Policy and Practice*, *41*(3), 280–285. https://doi.org/10.1016/j.tra.2006.05.005.

[76] Infiniti Research Ltd. (June 2021). *Global Business Travel Market 2021-2025*. Retrieved June 26, 2022, on https://www.reportlinker.com/p05166388/Global-Business-Travel-Market.html.

to best address the ramifications of the new work paradigm[77]. It is imperative that companies recognise that status quo is not an option.

> According to the French National Institute of Statistics and Economic Studies, 74% of French workers use their individual car to commute to work, among which 52.9% (which accounts for roughly 2 million people) drive a distance shorter than 2 kilometres[78]. Active mobility (walking and biking) only represents 8.5%, revealing there is a real opportunity for action.

According to the French National Institute of Statistics and Economic Studies, 74% of French workers use their individual car to commute to work, among which 52.9% (which accounts for roughly 2 million people) drive a distance shorter than 2 kilometers. Active mobility (walking and biking) only represents 8.5%, revealing there is a real opportunity for action.

Tapping into the mobility sector to foster sustainable behaviours can prove a crucial asset for companies. Indeed, companies that demonstrate green HR practices have demonstrated better employee engagement and retention[79]. It should also be noted that employee mobility is a market projected to reach a value of US$791.9 billions by 2026[80]: mobility is a flourishing sector craving for innovation and good practices, and every strategy can become a strength for recruiters. According to a Stanford University School of Business study, 90% of MBA graduates consider sustainable practices when they apply for a job[81].

The correlation between commuting and compensation is one delicate matter. Indeed, there is little to no regulation over the decision to commute (or not) to work: employees are considered free to find a place to live next to, or far from their workplace. Organisations cannot influence where employees choose to live, as it would be an obvious breach of their privacy[82]. The works of Stutzer and Frey (2008)[83,] reveal that it is hard to counterweigh commuting to work, even when parameters such as cheaper housing or better personal life quality are considered. Indeed, to feel fully rewarded for a 23-minute commute one way (the German average) instead of no commuting, an employee would need a 19% salary increase. Therefore, while companies might try to enforce going back to the office as the norm to exploit existing resources (office rent for instance, or specific amenities), some employees might prefer the "new" status quo of less mobility with hybrid work, especially employees who travel often and/or over long distances. Demanding that employees come back to work on their worksite instead of remotely has become a breach of privacy in itself[84]. Besides,

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[77] In reference to Pr. E. **Pigalle's** postdoc research, and the works of Pr. B. Motte-Baumvol on the impact of remote work on mobility habits. Lo Guidice, C., Levaillant, M., & Belton Chevallier, L. (2022, July 20). Interview with Leslie Belton Chevallier. personal.

[78] Brutel, C., & Pages, J. (January 2021). La voiture reste majoritaire pour les déplacements domicile-travail, même pour les courtes distances, Insee Première, N°1835, Retrieved June 27, 2022, on https://www.insee.fr/fr/statistiques/5013868.

[79] Al-Hajri, S. A. (2020). Employee retention in light of green HRM practices through the intervening role of work engagement. *Annals of Contemporary Developments in Management & HR, 2*(4), 10–19. https://doi.org/10.33166/acdmhr.2020.04.002.

[80]Infiniti Research Ltd. (June 2021). *Global Business Travel Market 2021-2025*. Retrieved June 26, 2022, on https://www.reportlinker.com/p05166388/Global-Business-Travel-Market.html.

[81] Montgomery, D. B., & Ramus, C. A. (2003). Corporate Social Responsibility Reputation Effects on MBA job choice. *Research Paper Series (Stanford Graduate School of Business)*, 1–15. https://doi.org/10.2139/ssrn.412124.

[82] Lo Giudice, C., Puel, F., & d'Iribarne, A. (2022, July 31). Interview with Alain d'Iribarne. personal.; Lo Giudice, C., Levaillant, M., & Ravalet, E. (2022, June 15). Interview with Emmanuel Ravalet. personal.

[83] Stutzer, A., & Frey, B. S. (2008). Stress that doesn't pay: The commuting paradox. *Scandinavian Journal of Economics, 110*(2), 339–366. https://doi.org/10.1111/j.1467-9442.2008.00542.x.

[84] Tsipursky, G. (2022, July 11). Why remote work will win this fall. *Fortune*. Retrieved 5 August, 2022, from https://www.fortune.com.

research preceding the current debate whether teleworking really reduces overall car use tends to gear towards a positive answer[85].

Becoming actors of change means companies must invest the resources – financial, human and time – to conduct a thorough examination of their current mobility practices and how individual variables (age, gender, employment position, commuting route, etc.) affect their preferred mode of transportation86. Gathering information through surveys, employee, supplier and customer interviews and other tools is crucial in crafting an appropriate response. Combined with a plethora of solutions available to enhance and improve the alternative mobility experience (using public transport, bicycle, EPAC/e-bikes…) lies the possibility of creating all-encompassing workplace mobility plan. This plan is the corporate pendant of the aforementioned SUMP. It considers employee mobility across all modes, how to develop alternative and sustainable modes while lowering the use of individual cars, and curate an optimum employee experience. Workplace travel plans may also address other travel affecting the worksite, including business, visitor, customer, or patient travel, etc. A good plan considers and seeks to influence where people choose to reside, and how they choose to commute, to encourage modal shifts87.

> The notion of workplace mobility plans is not new. American and Dutch researchers considered the matter in the 1990s, mainly focusing on the return on investment generated by adequate planning of what was then called TDM (Transport Demand Management)[88]. Since then, the interest has not waned. In the early 2000s, the city of London invested millions of pounds to develop workplace mobility, and in 2022 alone, the investment reached £40 millions.

To ensure that mobility plans last, it is of fundamental importance to raise awareness about the need to change. Acknowledging that commuting and access to goods and products shapes our life and ultimately determines a large part of its quality, companies must identify achievable goals to get the conversation started and engage individuals effectively.

In 2010, Cairns et al. offered a review of twenty workplace mobility plans in Great Britain[89]. As previously seen in this paper, their findings stated that the success of mobility plans relies heavily on policy context. They also mention that addressing car parking is a central issue: companies developed measures ranging from incentives (a financial reward for not bringing one's car on site for instance) to penalties (introducing on-site parking charges). The research showed that organisations that altered parking conditions in some way had achieved more than double the reduction in car use of those that had not, and had car driver levels which were, on average, 25% lower. However, such measures, especially retributive ones, sparked some conflicts within the companies.

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85 Cairns, S., Sloman, L., Newson, C., Anable, J., Kirkbride, A., Goodwin, P. (2004). Smarter choices - changing the way we travel. The Influence of Soft Factor Interventions on Travel Demand. Department for Transport. London. Retrieved July 2, 2022, on www.researchgate.com.

86 Lo Guidice, C., Levaillant, M., & Belton Chevallier, L. (2022, July 20). Interview with Leslie Belton Chevallier. personal.

87 Cairns, S., Newson, C., & Davis, A. (2010). Understanding successful workplace travel initiatives in the UK. *Transportation Research Part A: Policy and Practice, 44*(7), 473–494. https://doi.org/10.1016/j.tra.2010.03.010.

88 Knaap, R. V. D., & Schreffler, E. (1996). Effective TDM at Worksites in the Netherlands and the U.S. https://doi.org/10.13140/2.1.1405.3121.

89 Cairns, S., Newson, C., & Davis, A. (2010). Understanding successful workplace travel initiatives in the UK. *Transportation Research Part A: Policy and Practice, 44*(7), 473–494. https://doi.org/10.1016/j.tra.2010.03.010.

They also stated that HR policies were inherent, central even, to the success of the mobility plan, starting from employee recruitment. Some companies had developed hiring policies that favoured short commute[90]. Some set up recruitment drives in postcodes close to bus routes serving the site. Another organisation allocated shifts according to postcodes, in order to facilitate the provision of more sustainable travel arrangements for the staff. The definition of a planning champion is also crucial. Most of the plans in the study relied on management leading by example[91], and some companies also had an in-house travel plan coordinator. Some organisations delegated the role of travel plan management to line managers, to create some in-group emulation. What should the message be? According to Belgian mobility expert Xavier Tackoen, focusing on the environmental positive outcomes of active/shared mobility is not the way to go. Instead, HR should focus on diffusing images of mental and physical well-being, of commuting time control (cf. *super*) and corporate cohesion. These campaigns produced the best results in Danish companies who pushed alternative mobilities[92].

A recent report from mobility-dedicated community Autonomy and consulting firm Capgemini expanded the view with a benchmark of good practices around the world[93]. Notable examples for them were linked to the electrification of transports for the Bank of America employees, with measures ranging from financial incentives for EV purchases as well as the development of charging stations on site. A Brazilian energy company devised an application to facilitate shared mobility in its São Paulo location: users would enter their commuting route, and the app would cross the data with all other inputs and introduce employees following similar itineraries. Shared mobility increased by 18% of transportation and saved the company US$300,000 per year[94].

According to Tackoen[95], a good mobility plan is threefold:

- Plan: evaluate the current situation and develop an ad hoc strategy

- Operate: implement mobility services, offer parking and mobility solutions.

- Activate: educate and train management and staff, disseminate information, and experiment. This part is often forgotten, yet it is inherent to the success of a workplace mobility plan. It sometimes implies the development of a mobility manager position, who needs to be trained and train in turn. On a larger scale, the mobility manager position suggests the development of a mobility managers network, already in the making in Belgium.

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[90] A preference backed by Swiss mobility engineer and elected official Emmanuel Ravalet. Lo Guidice, C., Levaillant, M., & Ravalet, E. (2022, June 15). Interview with Emmanuel Ravalet. personal.

[91] This statement was corroborated by Beligian mobility expert Xavier Tackoen, who explained that middle and top management alike should be the leaders of the change, as heralds of corporate culture. Lo Guidice, C., Levaillant, M., & Tackoen, X. (2022, July 29). Interview with Xavier Tackoen. personal.

[92] Lo Guidice, C., Levaillant, M., & Tackoen, X. (2022, July 29). Interview with Xavier Tackoen. personal.

[93] Autonomy & Capgemini Invent. (2021). *Getting to Net Zero: The Way Forward for the Mobility Ecosystem* [White paper].

[94] World Economic Forum. (December 2019). *Corporate Mobility Transport Challenge*. Global Future Council on Mobility. Retrieved July 25, 2022, on https://www3.weforum.org.

[95] Lo Guidice, C., Levaillant, M., & Tackoen, X. (2022, July 29). Interview with Xavier Tackoen. personal.

In their research, Autonomy & Capgemini defined a framework for net-zero mobility on the acronym SIMED, which stands for:

- Shared: developing and enhancing shared mobility solutions instead of individual vehicles. This can be developed through carpooling schemes, or the promotion of shared corporate vehicles (cars, active vehicles…). We are coming to the end of an age where work vehicles were considered as a sign of prestige.[96]

- Intelligent: improving flows through technology. HR departments can harness this aspect through employee education: how to calculate one's footprint, or through workforce mapping.

- Multimodal: advocating for multimodal transportation through incentives, financial or otherwise[97]. Multimodal mobility can be enshrined in travel policies, as well as in the development of corporate mobility aggregators, presenting MaaS (Mobility as a Service) or CMaaS (Corporate Mobility as a Service) solutions.

- Eco-Powered: supporting the adoption of zero-emission vehicles, through infrastructural changes and incentives. Following the American example seen earlier, infrastructural changes reside in electrifying the corporate mobility fleet, or implementing charging stations on site.

- Circular: promoting a circular approach to mobility, offering solutions to recycle vehicles for instance.

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[96] Lo Guidice, C., Levaillant, M., & Belton Chevallier, L. (2022, July 20). Interview with Leslie Belton Chevallier. personal. Some countries will have a hard time phasing out of this paradigm: for instance, in Belgium 40% of individual cars are work vehicles. Lo Guidice, C., Vergeynst, O., Levaillant, M., Puel, F., & Devis, P. (2022, August 2). Interview with Patrick Devis. personal.

[97] Multimodality has been advocated as a solution to individual car transportation for many years, especially in peri-urban areas. Huyghe, M. (2017). Développer Une approche Complexe de la mobilité pour faire évoluer l'usage de la voiture dans les territoires ruraux et périurbains. *Transports Urbains*, *130*(1), 18–21. https://doi.org/10.3917/turb.130.0018.

Existing Guides

Implementing the Net Zero dynamics in one's company through the scope and prerogatives of Human Resources is a field of growing interest. As such, some general guides already exist, aiming at providing recommendations to HR professionals. Below is a list of such guides. Added to the literature review, they contribute to creating a framework of reference for the creation of the NWoW4NetZero toolkits.

Maskell, J. (July 2021). *Embedding Environmental Sustainability in your organisation***. Chartered Institute of Personnel and Development, London. Retrieved May 27, 2022, from https://www.cipd.co.uk/Images/sustainability-guide_tcm18-98576.pdf.**
This guide "*looks at the practical steps an HR professional can take to apply environmental sustainability in their organization*". It focuses on traditional HR practices, i.e., recruitment and selection, performance management and reward, learning and development, leadership and engagement.
This raises question about the coercive dimension of this approach towards the employees.

World Business Council for Sustainable Development. (November 2005). *Driving Success. Human resources and sustainable development.* **World Business Council for Sustainable Development, University of Cambridge, London. Retrieved May 27, 2022, from http://docs.wbcsd.org/2005/11/Driving_Success_HumanResources_SD.pdf.**
Focuses on traditional HR practices (Employee Recruitment, Motivation, Competencies, training, and development).
Provides insight through interesting case studies.

Asselin, E. (2021, September 22). 3 Steps to Building a Net Zero Workforce with a Sustainability Academy. Retrieved July 13, 2022, from https://www.capgemini.com/insights/expert-perspectives/3-steps-to-building-a-net-zero-workforce-with-a-sustainability-academy/.
Step 1: Awareness — Develop an environmentally conscious corporate mindset through a common path = Training on key concepts
Step 2: Education — Develop new competencies through a custom path = develop or extend the competencies (knowledge, skills and attitudes) required to reach their net zero ambitions
Step 3: Anchoring behavioural Change

Maymo, V., & Murat, G. (2021). *La Boîte à outils du développement durable et de la Rse: 82 outils clés en main***. Dunod, Paris.**
(In French only)
Developed in an easily accessible, practical, toolbox format. Parts of the book address which tools Human Resources can use to harness a sustainable development dynamic. However, the focus is more on sustainable development than carbon neutrality.

Rupprecht Consult (Ed.). (2019). *Guidelines for developing and implementing a sustainable urban mobility plan* **(2nd ed.). European Platform on Sustainable Urban Mobility Plans.**
A comprehensive guide for Mobility Planning, from preparation and planning to implementation and monitoring. Each step of the SUMP is explained in a detailed manner, so every organisation can properly adapt and implement it.
A solid framework of reference, commissioned by the EU
Several examples of good practices in public and private organisations

Net Zero Initiative. (April 2020). *A Framework for Collective Carbon Neutrality* **[White paper]. Carbone 4, Paris. Retreived 6 July, 2022, from https://www.carbone4.com/en/publication-referentiel-nzi.**
The net Zero Initiative is a project gathering companies, academics, and carbon footprint specialist Carbone 4.
Together, they try to define exactly what is Carbon Neutrality, and how to aim for it. It provides a framework of reference for organisations, and how they can contribute to meeting the 1,5°C target.
It also acts as a reminder that an organisation's emission supersede direct emissions (scopes 1 and 2), and that scope 3 emissions must be considered.

AXA Climate School, Le Lab RH, PageGroup. (2022). *La Transition Écologique au Cœur des Enjeux RH* **[White paper]. Michael Page, Paris. Retrieved 29 June, 2022 from https://www.michaelpage.fr/advice/tendances-de-march%C3%A9/livre-blanc-la-transition-%C3%A9cologique-au-coeur-des-enjeux-rh.**
(In French only). A short guide offering concrete plans of action for HR professionals to influence collaborators' behaviour and take part in the Net Zero dynamic.

Bolton, P., Lacy, P., Spence, M., Xu, M., Chen, L., Choi, S., Liu, W., Sun, Q., & Tang, B. (2022). Digital Circular economy for net zero. *SSRN Electronic Journal.* **https://doi.org/10.2139/ssrn.4092608.**
A good overview on how to align the latest advancements of the digital industry with the circular economy paradigm.
Digitalization increases energy efficiency through virtualization, data monitoring, collection, and optimization, and by connecting people and firms that otherwise would not have been connected. Enhanced efficiency allows the same activity to be completed with less energy, which can be translated into fewer carbon emissions.
The key to achieving Net Zero is in promoting both digitalization and Circular Economy (CE) under a new economic system (Chapter 2.3) that is aligned with Net Zero goals, and that is changing our consumption patterns to attain sustainability.