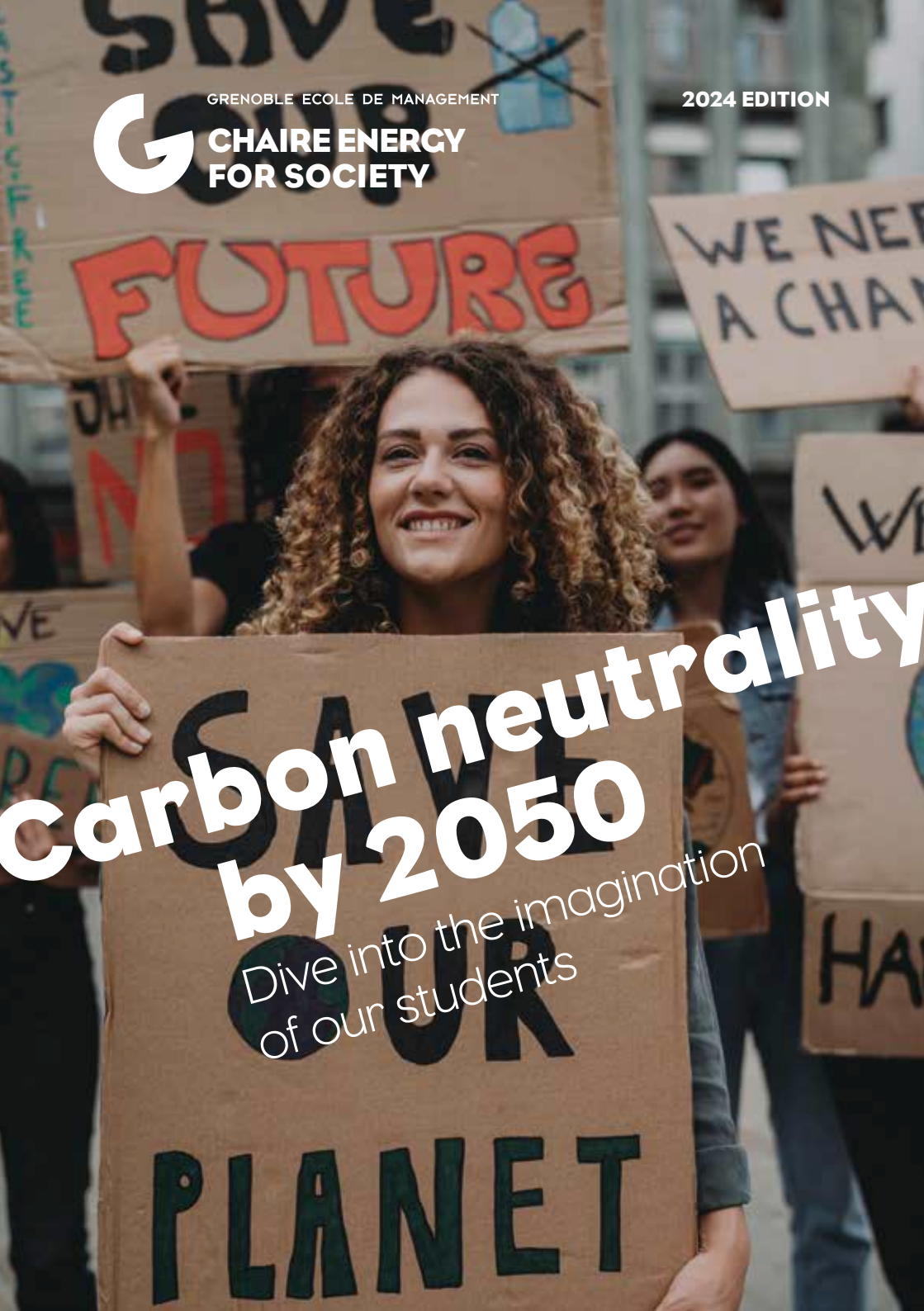

GRENOBLE ECOLE DE MANAGEMENT

CHAIRE ENERGY FOR SOCIETY

2024 EDITION

Carbon neutrality by 2050

Dive into the imagination of our students

Contents

Editorial

About this report:
Describing the day of a character of their choice in a carbon-neutral society in 2050. This was the task given to the second-year students of the «Programme Grande Ecole» (PGE) at Grenoble Ecole de Management (GEM) as part of the course «Technological and Social Innovation to Transform the Energy Sector» and to third-year international students of the «Global Management- Bachelor in International Business» (BIB) as part of the course "international Contemporary Issues", from which we present a selection here.

But why ask students to undertake such an unusual exercise? Because transitioning to a carbon-neutral society requires renewing our collective imagination and reshaping our relationship with energy and nature. As part of the «Fabrique des Récits» co-founded by Ademe, this exercise encourages students to unleash their imaginations. Utopia or dystopia, individual or collective sobriety, unconstrained or frugal technological innovation – each story reflects the anger, hope, and expectations of students facing a challenge that will undoubtedly have a significant impact on their lives. ●

Anne-Lorène Vernay, Associate Professor and Member of the Energy for Society Chair.

Grenoble Ecole de Management and the Energy for Society Chair do not endorse or reject the opinions expressed in this report. They stem from the work of our students and should be considered as their own.

About the Energy for Society Chair:
Research conducted within the Energy for Society Chair examines the impact of new low carbon energy services that reconcile business attractiveness and citizen adherence. Through this publication, the Energy for Society Chair at GEM is delighted to support this initiative launched by the professors of GEM's «Technological and Social Innovation to Transform the Energy Sector» course in PGE, and the «International Contemporary Issues» course in the Global Management track of the Bachelor in International Business. What better exercise than to ask our students, tomorrow's decision-makers, to imagine the future in order to truly understand 1) the mindset they have towards climate challenges, 2) how they integrate and appropriate the fundamentals presented in class, and 3) envision the solutions of tomorrow.

These essays were written in the spring of 2024, on the eve of important elections, while the world is going through the hottest months on record, and climate change and the necessary energy transition are gradually fading from political debates... Let's hope that their narratives serve as an awakening for some and a source of hope for others, or even both at the same time. Enjoy the read! ●

Carine Sebi, Associate Professor and Coordinator of the Energy for Society Chair

To you in 30 years

A medical student wakes up in 2050 in a world shaped by the «Zero Carbon Law». Between resource shortages, omnipresent surveillance and severe restrictions, life has become a struggle to maintain a semblance of normalcy. She discovers a diary from 2020, and is confronted with a disturbing truth about the sacrifices made for an ecological future.

Paris, April 22, 2050

The sound of the birds, the cool breeze caressing my face, and the sumptuous glow of the sunset gently led me to great serenity as I flew through the sky tinted an unparalleled scarlet red. My azure wings were large and long, taking me swiftly from cloud to cloud. Suddenly, a shrill cry pulled me abruptly out of my state of calm. The sky I loved so much vanished, leaving the blackness of my bedroom in its place. I reach out to turn off my alarm clock, wishing I could fly longer.

6 a.m., throat dry, right arm numb, probably from the dream I've just had. I turn on the light and look around. It's true, I'm not a bird, my name is Julie, I'm 23 and I'm a medical student. I live in a student residence in the middle of an eco-neighborhood in Paris, with plant-covered buildings built exclusively with eco-responsible materials. When you put it like that, you can imagine pretty plants running down the walls, adding greenery to these cold walls. However, these previously cold walls are now in a state of disrepair, due to lack of maintenance, the quality of the building materials used and, above all, the overcrowding of the buildings. Today, finding suitable accommodation is no easy task.

Author

Sarah Ledan holds a DUT Tech de Co from the IUT de Troyes, during which she spent a semester in Montreal. She then took a preparatory course at ENC Bessières and completed a Licence in Economic and Social Administration at Université Paris Nanterre. She is currently doing a Master 1 in Responsible Business Management at GEM (Pantin), as part of a work-study program at Koesio.

Progamme : Technological and social entrepreneurship to transform the energy sector

It's true that at first, I greatly appreciated living in an environmentally-friendly building, but we've recently learned that these are not always durable and robust in the long term. Will I have to move soon? Perhaps, ... But where?

I get out of bed and stand in front of the mirror. Before I even notice the state of my skin, the electricity goes off. Electricity and water cuts are common. In fact, we have consumption restrictions. We are given a limit per building, so if one resident consumes much more than is allowed, the whole building is affected. If only my upstairs neighbor didn't take 20-minute showers... I might have enough water to make myself a cup of coffee this morning! Well, you still have to have something to heat it with. It's the same with heating. Everyone has to be responsible, otherwise it's the others who pay.

I leave my room and head for the building's communal kitchen to prepare my breakfast. On the menu, vegetarian food and state-issued synthetics. Forget eggs and English bacon. These days, the government decides what we eat. Weekly portions are handed out. In this residence, sharing is obligatory and waste is forbidden. I haven't eaten meat for 5 years now. Meat is in short supply these days, causing a number of demonstrations across the country. Intensive vertical farming has become commonplace in France, providing us with a food that offers very little variety. Feeding myself is no longer a pleasure, just a necessity.

After eating my lentil salad, I go back upstairs to get dressed and leave the residence so as not to miss my bus. All public transport is now hydrogen-powered, which has considerably reduced the number of vehicles. So I have one bus in the morning and one in the evening. You can imagine the number of people on the bus. On sunny days, I like to avoid this daily chore by taking an electric bike. I dream of a car, which is much more practical for getting around. However, we're constantly under surveillance by drones, monitoring everyone's movements to check personal carbon quotas.

After more than an hour's journey in appalling conditions, I finally reach the entrance to my faculty, dilapidated by moss and humidity. The classrooms are becoming increasingly crowded, severely limiting our access to medical technologies and laboratories. The lack of resources and maintenance is not the thing that has impressed me the most. Our teachers are under constant surveillance, heavily influenced by government directives to promote renewable energy and reduce carbon footprints. In addition to our long days filled with medical courses, we have been given a common core curriculum covering these themes. Compulsory exams are then required to pass the following year. What a pain in the ass... As if we didn't have enough courses as it is. Regardless of our field of study, this core curriculum is compulsory. We are all forced to

learn these notions, which reminds me strongly of propaganda at times.

I take out my notebook to start the energy course. At the same time, I receive a message from my tutor at the hospital. Due to a lack of materials, I will have to get my own equipment. The situation in the hospital is becoming increasingly critical: exhausting working hours, severe restrictions on the use of energy-guzzling equipment and extreme tensions between overworked medical staff and desperate patients. The end of overproduction has had an adverse effect on the supply of medical equipment. We are short of gowns, hospital beds and equipment in general. This is making it increasingly difficult to practice the medical professions. The government wants to produce less, yes, but the population can't keep up. Energy-efficient and durable raw materials are very expensive, which considerably reduces production. The number of thefts from hospitals and many other facilities is rising sharply. As far as energy is concerned, solar panels have been installed on most buildings, but this is not a sufficient source of energy to run an entire hospital. Water and electricity shortages are also frequent in the various public structures. In a carbon-free world, technology develops much more slowly. Medical devices are environmentally friendly, but often faulty due to programmed obsolescence, centralized IT systems and frequent breakdowns. In today's working world, communications are closely monitored, and access to the Internet and international medical information is limited to prevent the leakage of sensitive information.

When my class finishes, I head for the exit to catch my bus. No drinks at the bar, no movies, just straight to my residence. Recreation is controlled by the government and few green spaces are accessible, despite reforestation efforts. I was forced to give up field hockey, my lifelong passion. Between Internet restrictions, reduced choice of extra-curricular activities and omnipresent surveillance, stress and anxiety became widespread. Some students have even had a nervous breakdown. Personally, I dream of going back to my parents' time, when they said anything was possible. They could take up any hobby they liked, they could eat meat, they were simply free. I dream of a world where I could travel, discover new cultures, get on a plane and fly like a bird. I know that such practices are bad for the environment, we're reminded of that often enough. Nevertheless, my parents' time seemed so perfect. Could there be a place where environmental issues do not affect so much of our everyday life?

In my daydreaming, I forget my bus stop. Too late, I have to finish my journey on foot. Along the way, I pass many homeless people. The number of people in difficulty has tripled because of the housing crisis, and those lucky enough to have one are having trouble keeping it. Increasingly frequent problems such as mold on the walls, leaking windows and even the collapse of certain buildings darken our daily lives.

Finally arriving at my residence, I'm greeted by the smell of dampness and reminded of the stark contrast with the promise of comfort and modernity when these buildings were first erected. I head for my room, nauseous, fearing an illness is coming. Stomach upsets are very common these days, caused by the food we're fed. The population is even more worried because quality medical care is now reserved for an elite, while the rest of society has to do with makeshift treatments. The lack of equipment, means and above all money is becoming a real obstacle to decent healthcare. What outraged me most was when the government was forced to drastically cut social security benefits.

It's now 8pm and the sun has set. I don't feel like preparing a snack for what promises to be another long evening. Plunging into my homework, I find the motivation to study. Suddenly, the light disappears. I let out a despairing sigh, reached for my phone to guide me to my emergency light. I then decide to finish my work in the dark, since I have no choice. It's now 11 p.m., I close my anatomy book and head for my bed. I stumble on one of the uneven floorboards. As I put my hand on it to put it back in its place, I realize that it is concealing a book. Being an avid reader of mystery-infused novels, I pick up the book and sit down on my bed. The notebook is old, yellowed and dusty. I shine my light over the pages. The book begins with «dear Diary». I discover that this diary belonged to a student living here in 2020, 30 years ago. Absorbed in a most interesting reading, I relive her life. A student life filled with parties, events and, above all, freedom. A freedom that, according to her, ended overnight when that pesky «Zero Carbon Law» was passed. This student has recorded her opinion on the matter: articles on the hidden truths of politics, ecological transition, manipulations, censored scientific testimonies on the effects of new green technologies, forgotten issues such as resource shortages, growing inequalities or natural disasters intentionally provoked to reinforce state control. I realize the power of the manipulation we are undergoing. What should we do, how do we get out of it? Should we continue to live like this, at the expense of our own comfort? I don't know any more. That's why today, dear Diary of an unknown woman, I'm sharing my story in order to record the truth of our daily lives. I hope this book finds its way into the hands of the next tenant of this apartment. Your turn in 30 years, how will our world change?

Julie

Top 0.1%

In 2050, Paris faces extreme climate change. Charles, a wealthy investor, grapples with his role in a world of high-tech green projects and stark inequalities. His journey exposes the moral and environmental costs of delayed climate action and privilege.

The year is 2050, and the global community has failed to keep the average temperature rise below 3°C above pre-industrial levels. Charles works in Paris, a city profoundly altered by climate change. Once known for its mild summers, the city now faces extreme heatwaves, with temperatures frequently exceeding 40°C. The River Seine's water levels are unpredictably low due to decreased rainfall and increased evaporation, severely affecting water supply and biodiversity.

Charles starts his day on the 123rd floor (penthouse) of one of Paris's biggest high-rise projects to date. A superstructure that, marketed as a green project, is covered with vines and other flora as natural forms of carbon capture. He walks to his window, which overlooks the old centre of Paris, protected by cultural laws which prevented these megastructures to be built within the specified arrondissements. He opens the door to his overhanging greenhouse, hearing the whirrs of the carbon capture fans that are placed throughout the building. Every 10 floors to be exact. He pictures the blueprint of the building in his mind, bringing him back 25 years to when he was first pitched the idea. He remembers himself signing the papers to a 500-million-dollar investment towards the project, making his

Author

Alexander Shepherd has been influenced throughout his life by his family to be aware of climate issues and their impacts across the globe. He is a Junior Partner at Potrero Capital a Family Office which has inspired this essay through his exposure to the reality of the ultra-rich and the contradictory essence of the green investments industry.

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company one of the lead curators of its construction. How he wishes he had thought harder about it before signing.

He picks up some of his home-grown tomatoes and puts them in a basket. As he stands up, he looks into the distance and asks the home AI assistant what the AQI is today. The response comes in an uncannily realistic voice: “It is relatively average, currently the air quality index number sits around 70”. That is rather good, he thinks to himself. The direct pollution from the city is low, as petrol vehicles have been banned for years. He stares at the glint of a solar tower. The horizon was no longer a continuous line here; it was dotted with these glints, as if 10s of strong flashlights were pointed towards him in the distance. These drowned out the wind turbines that were surely visible from here. He tries to look for the solar farm that he had signed off on, 15 solar towers powered by 100s of heliostats each. He remembers when it was just fields, but this was no longer the best use of land in France.

After a decade-long war, Ukraine, with very little of its eastern parts annexed by Russia, eventually joined the European Union in 2035. The integration of Ukraine’s vast agricultural capabilities severely disrupted the rest of European agriculture. French farmers could not compete, as they shared European subsidies with their eastern counterparts, and lost productivity. This was especially the case in the south where summers were too long and too hot to maintain the tiny margins they already had. Slowly the number of farmers fell, a time when Charles saw one of the biggest opportunities in French land ownership. The only valuable thing that these farmers still had was their land, which Charles’s green industry investments firm bought up at massively low prices, both building and selling off the rights to build solar fields, with the previous owners receiving royalties from the industrial super-giants that built on their properties. Most of these fields that once blossomed with crops and vineyards across France were now blanketed by extensive networks of solar panels. The only viable form of farming in France remains the highly sought after luxury goods such as true champagne, cheeses and wines. Charles thinks about the 50,000 bottle of Bordeaux sitting in his wine cellar. He has many acquaintances that have spent much more to keep production going and buy these goods. His good friend and fellow billionaire (now largest Nvidio shareholder) bought multiple farms, spending millions to force the French government to exclude him from usual water restrictions for his “culturally relevant” farming. How many people could he have saved with that money and that water, Charles thought to himself. Still, even the northern parts of France that maintained some level of productivity are now interspersed with towering wind turbines. This has created a dual landscape of renewable energy production and specialized agriculture.

As he continues to scan the horizon, he sees the CDG airport, a grey spot, lifeless compared to the rest of the city. Commercial airlines have been banned for years. But there are still aeroplanes at the terminal, smaller, private ones that still run. “We live in a world of exceptions, where laws built to protect the collective from carbon giants end up impacting the majority. The most fortunate don’t need to give up anything”, Charles thinks to himself. With an economy now built around carbon quotas, those that build the infrastructure that “reverses” the damage get to offset the damage they continue to cause. When you build projects and businesses that contribute to millions of tonnes of carbon removed from the atmosphere or prevented from being emitted, you may think you are having a positiveimpact. And yet, the government rewards you with the ability to emit more carbon, a privilege reserved to richest of the rich,

Charles finds himself in the elevator going down to have his in-person meeting with a close friend and business partner at the Ritz hotel. Something one doesn’t need to do anymore, with virtual reality meetings usually taking precedence over anything in person. But business deals at this level will always require fine dining, even if Charles thinks that they are a waste of the precious direct carbon caps that the luckiest hold. He walks to his car that is waiting outside. His driver stays in as the car detects his presence and opens the door for him. As usual, he always wonders why he has a driver as cars have been self-driving for a decade, but he always prefers the conversation of a human driver, rather than the silence of an AI assistant listening for the summoning words. He also prefers the older electric cars, this being the third iteration of the electric Moyboch gifted to him by his mentor 20 years ago.

They begin the drive, the streets outside are far less congested than decades past due to strict regulations that limit the number of vehicles on the road, and those that are permitted are fully electric. This reminds him of the initial switch to electric vehicles. While reducing direct emissions, this initially just deferred the emissions’ problem from the exhaust pipe to the energy source. For years, the electricity powering these vehicles came from non-renewable sources, effectively shifting the pollution upstream to power plants rather than eliminating it. It’s only recently that the grid has transitioned to predominantly green energy sources. But this change came too late—the environmental damage accelerated before these corrective measures could have a broader impact, illustrating an example of delayed environmental policy and its lasting repercussions.

The streets are empty, as most people use underground passages built in cases of heatwaves or air quality emergencies. There are still buses but very few cars, as you must have a permit for the use of a personal or company vehicle. Charles is a close friend of the Minister of Climate Protection, who has let him to keep his car, even if it is still much less efficient than the ones that he sees today. Due to his vast green projects, he has aggregated a large amount of carbon credits, which he refrains from overusing as he always has a sense that it is undeserved and would reverse all the progress he, through his companies, tries to stimulate.

On the journey, Charles uses a VR headset to scroll through the news. The immersive experience brings him face-to-face with the harsh realities of a failing third-world country. The news segment details a recent statistic: a significant increase in climate-related deaths due to hunger and lack of clean water. This virtual encounter with global suffering starkly contrasts with his comfortable surroundings. He lowers the volume as his driver is a first-generation immigrant. He had sponsored his immigration years ago. There is an awkward silence as he knows his driver lost his mother and father to severe drought.

He then joins a meeting; Charles participates in discussions that highlight distinct carbon inequalities. Wealthy nations and high net worth individuals continue to emit disproportionately high levels of greenhouse gases, a topic Charles often discusses in debate sessions. These inequalities exacerbate the climate crisis and hinder global cooperation, as poorer nations bear the brunt of climate impacts without the resources to adapt.

He finally arrives at the Ritz. He is a recurring customer at their restaurant and is graciously welcomed in. He is shown to his private table, where the head of Climate Protection Indonesia is sitting. Charles shakes his hand and asks if his flight was enjoyable. He feels a sense of disgust as he shakes the hand, feeling the weight of the carbon emissions behind the meeting. They then move on to talk about how Indonesia is falling behind in its development, failing to reach international regulation, now suffering major tariffs on development. They agree on the unfairness behind being unable to reach goals set by states that were already heavily progressing in green technologies. Charles has invested in many of Indonesia's technologies and advocated for more investment into their company but has seen a lot of pushback with the current tariffs in place. At this point, Charles was making donations, not investments. But this was of no concern to him, unlike most in his income bracket. He agrees to continue his support and semester-based revaluations and payments.

He returns to his vehicle, on the drive home he sees graffiti saying "Blame the rich" and sympathises with it, knowing that he is on the right side of history. He contemplates the real impacts of his work throughout the years and wonders whether he ever did enough. Or was he blinded by the lack of connection to real world issues and financial returns from his projects? He knows that while he is "successful", he has failed society and therefore betrayed his values and duty.

Letter to my late father

In 2050, Margaret writes to her late father about Ghana's journey to carbon neutrality. She shares her thoughts on her career, global challenges, and the importance of collaboration and innovation for a sustainable future.

Wednesday 15th of June 2050
Dear Dad,
As I sit down, watching the vibrant colours of the sun setting over the ocean in Accra, I can't help thinking about your dream to permanently move back from Belgium to our homeland Ghana. I have followed your footsteps as you have inspired me to do the same.
Since you have left, many things have changed, and my perspective on the world has evolved as well. Between the year you have left, 2023, and now, the climate has never stopped being a topic of concern. Even though many countries did not believe that global warming was a real threat to humanity, more and more states believed in it and joined in on making efforts to save the planet. I thought that most people did not care enough about this cause to do anything about it. So, I thought that carbon neutrality would be impossible to reach. I am glad to tell you that we finally made it, Dad! We have reached carbon neutrality! Before I tell you how the world and more specifically Ghana became sustainable, I will tell you about my professional career. After graduating from university in 2025, I worked for the European Union as a Climate Policy Analyst for a few years. Following this, I held a similar position at the United Nations. Finally, I moved to Ghana where I started working at the Ministry of Trade & Industry. In 2030, the Ministry of Energy expanded to the Ministry of Energy and Environment, where I am currently working. Dad, I will first talk about the amelioration of the food and agriculture industry and how it impacted Ghanaians. Then, I will cover how countries worldwide found a way to mitigate wealth inequalities. Finally, I will write about the significant lifestyle changes that contributed to reaching carbon neutrality this year.
Before you left, you were stunned by the negative impact globalisation had on the Ghanaian tomato industry and its derivatives, along with the Ghanaian citizens. The industry did not rely on local production anymore but was importing tomato paste from China. This had forced too many of our compatriots out of their harvesting jobs and pushed them to migrate to what they perceived as the "better world", in the hopes of providing a better life for themselves and their families. For most of them, their migration journey led them to Italy where they were forced to harvest tomatoes by hand for salaries that were below the minimum wage rate. There, they were treated as "modern-day slaves" because of their illegal immigration situation. Troubled by the conditions of a segment of the Ghanaian agriculture and food industry, the national government decided to include changes in this area in their updated National Determined Contribution (NDC) plan that was established during the Paris Agreement. Hence, to reach carbon neutrality, the Ghanaian government imposed adjacent transformations on companies from different industries. This policy changed the vision, mission, and supply chain of businesses, fostering innovation and promoting environmentally friendly practices through the local economy rather than relying on the global market. This shift towards sustainability not only aligns with global efforts to combat climate change but also positions Ghana as a leader in environmentally conscious business practices in Africa.
As you know, Ghana, as well as most developing countries, is vulnerable to the changes caused by global warming. Despite this, the carbon emissions in Ghana are lower than wealthier nations that are not exposed to similar risks. It is the carbon inequality phenomenon. This disparity is explained by a correlation between the GDP and carbon footprint. This raises the question of how to share the blame and resources in the context of climate change and inequality. I remember discussing this matter in class more than 20 years ago, my classmates and I mainly agreed that against what most activists of our age suggested, further taxing the "rich" did not sufficiently incentivise companies to lower their carbon emissions. Conversely, it led to them finding ways to avoid this liability. Over time, NGOs tried to find solutions with third-world countries to counter carbon inequality. During the United Nations Climate Change Conference (UNCCC) and multiple Conferences of the Parties (COPs), third-world countries acknowledged their responsibility and pointed out their vulnerability to global warming. They also advocated for more equitable solutions. One of the regulations issued was to ban Article 6 of the Paris Agreement. This article sets out the criteria and processes

Author

Margaret Akumfi Ameyaw
an exchange student from Maastricht University, spent the first semester of 2024 at GEM. She is passionate about music and politics. She is Belgian but originally comes from Ghana. In this essay, Margaret intended to highlight the journey of a victim of climate change.

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for developing carbon credit projects and trading carbon credits. In other words, it allowed foreign companies to purchase carbon credits to offset their carbon tax liabilities. Developing countries argued that Article 6 perpetuated carbon inequality by allowing wealthy nations to produce high levels of carbon while outsourcing their emissions reduction responsibilities to poorer nations. This loophole left developing countries like Ghana at a disadvantage adding to their climate vulnerability. The banned article from the Paris Agreement called for more robust tools to confront climate inequality and ensure a fair distribution of responsibilities worldwide. The proposals issued include more transparency and accountability regarding GHG emissions. In the longer run, it led to reducing the carbon inequality gap between developed and developing countries. Additionally, emerging economies recognised that the scarcity of resources and technology hinders their capacity to rapidly mitigate and adapt to climate change in order to reach carbon neutrality. Even though this is a significant obstacle in the efforts to battle climate change, it has stressed the importance of innovation and collaboration among countries. Despite this inequality, the Ghanaian government still imposed a large range of policies, initiatives, and regulations with the goal of reducing carbon emissions, promoting renewable energy resources, and enhancing environment conservation efforts by enlarging wildlife parks for instance. During a meeting with the Ministries of Trade & Industry, the Ministries of Energy and Environment from the different governments of the Economic Community of West African States (ECOWAS), the Ghanaian ministers convinced other leaders that the most appropriate way for fellow members of ECOWAS was based on regional cooperation. This implied a shift in routine to embrace sustainable lifestyles for environmental and social well-being. It seemed like a bold stance when official statements were released but it reflected Ghana's commitment to increase collaboration and solidarity among ECOWAS to address common challenges to overcome in hopes of reaching carbon neutrality. By advocating for regional cooperation, Ghana, similarly to the other West African countries, benefited from collective strength and resources to implement solutions that encouraged sustainable development and enhanced the well-being of Ghanaians across all industries. Dad, I remember how you always told me that local consumption was preferred to imported products in Ghana because citizens want to purchase high-quality products, maintain cultural connections with local food and crafts and support the circular local market. This societal choice led to a global degrowth that was anticipated and controlled. I remember that most of my classmates 20 years ago were skeptical about this approach and thought it was completely unfeasible. They were proven wrong because this route led to a higher degree of collaboration among countries worldwide. Green technological innovation did not belong to a niche market anymore. Instead, it worked as a direct financial and technological support mechanism helping all nations to move towards environmental sustainability and human development. These changes were well-received in Ghana. The government adapted its priorities and massively invested in renewable energy sources and their complementary infrastructures. As Ghana has abundant natural resources, solar and wind power provide enough energy to shift from fossil energies to sustainable alternatives. Moreover, this transition led to a greener economy creating new job opportunities. Also, agricultural innovations helped the national Ghanaian agriculture industry.

In spite of all our efforts, we were not able to limit the global warming level to below 1,5°C. Instead, the global temperature increased by 2,5°C. Now, the world is experiencing more and more severe climatical negative impacts. These include intense and frequent heatwaves, droughts, floods, and storms. It also has disastrous consequences on ecosystems and communities around the world. Looking to the future, it is clear that reaching carbon neutrality is not the end goal but just a step toward the preservation of our planet Earth. All nations and the entire population must continue their efforts of collaborating and innovating on a global scale. It is true that alone we cannot make an impact but if everyone takes some initiative individually, the impact will be more significant. I noticed this over these past decades. The efforts made by the government of our homeland Ghana demonstrated remarkable flexibility and determination on this path to carbon neutrality. Similarly, Ghanaians were an example to follow to all African countries on this extraordinary journey. Dad, I wish you could be here to witness the progress that the Black Stars have made during your absence. As the sun sets over the ocean in Accra, I feel hopeful for future generations, knowing that together we overcome numerous challenges to reach carbon neutrality, I am confident about our ability to continue our efforts in a more sustainable and resilient world.

With love,
Margaret

Reinventing vineyards

In a world transformed by climate change, a passionate winegrower reinvents himself by combining winegrowing tradition and technological innovation. Between climate challenges and sustainable solutions, he adapts his practices, modernizes his estate and adopts green technologies to safeguard the future of his business.

5:30 AM, already! The alarm wakes me up with a startle; it feels like I only slept for a few minutes. I struggle to open my eyes, but the grape harvest won't wait—it's the most important time of the year. My vineyards are swarming with seasonal workers like dozens of ants, each perfectly aware of its role, working to keep the operation running. Ants? Maybe. But highly evolved ants, like those described in Bernard Werber's book. My workers operate in perfect symbiosis with the equipment I provide each year. Over the years, I've watched my profession evolve and the workers adapt: my estate is a model of sustainability. Located in Pierrefeu-du-Var, a small town in southern France, it is equipped with solar panels and a geothermal system for heating and cooling. France has been carbon-neutral since 2050, and every house, every farm, every process contributes to this national goal.

I have to admit, at first, I wasn't very inclined to all these changes. My estate is a family business; the old model worked very well for my parents and grandparents, so why change everything? A few hundredths of a degree more—was it really worth the scandal? But the years passed, the hundredths of a degree turned into tenths, and then into whole degrees. "Greenhouse gas emissions from human activities have warmed the climate at an unprecedented rate: the Earth's surface temperature has risen by 1.1°C compared to the pre-industrial period", an alarming IPCC report stated in 2023. Regardless of the emission scenarios, the report estimated that global warming would reach 1.5°C as early as the 2030s. These declarations delivered the final blow to the governments in place. A collective awareness occurred; we were all in the same boat, and it was definitely sinking.

Just numbers, you might say. That's what I thought too. Far from the capital and the urban hustle, I was forced to look into these new data. Heatwaves were multiplying. I was losing up to 50% of my grape production every year. The grapes were literally burning under extreme heat, reaching up to 45°C in some places. My vines had always been very resistant to drought, but the heatwaves started too early in the year. My vines, in June, were simply not prepared to endure such temperatures. Professionals spoke of a "hairdryer effect," high temperatures combined with a Mistral wind reaching up to 50 km/h. If you ask me, a ridiculous term for a major economic and ecological disaster.

And if only it was just the drought… But now it's coupled with devastating floods and frosts in winter. So, I decided to invest massively. My old plots of Cinsault and Merlot gave way to new, more resistant grape varieties from southern Portugal: Touriga Nacional and Alvarinho. That was the first major change, and the heartbreak of my career. And then the process began.

This morning, like every day, I take a few minutes to check the vineyard data on my tablet. Thanks to sensors scattered throughout my plots, I can monitor in real time the condition of my soils, humidity levels, vine growth, and any disease presence. These technologies, combined with artificial intelligence, minimize the use of water and pesticides. My job, once based on instinct and contact with the vine, is gradually turning into a desk job.

No! I need to meet my vines. I finish getting ready and hop on my electric bike. Internal combustion vehicles have almost disappeared from the French countryside, replaced by electric or hydrogen alternatives. I pass fields where farmers work with autonomous machines. What was I saying earlier about intelligent ants? Work has become easier, I must admit. No more back pain, splinters in the fingers, or the smell of sulfur on clothes. And the most positive point of all: environmentally-friendly machines. Not everything is solved. As predicted by the IPCC, we reached the 1.5°C increase in 2033. A year everyone remembers. But since then, we can say that efforts have paid off; we are already seeing improvements in experts' forecasts. This process does not have unanimous support, of course. Some talk about degrowth, and I keep wondering: what's wrong with degrowth if it allows us to leave a sustainable planet for future generations? Is the pursuit of performance and over-scaling really the key?

Author

Marie Caillol began her post-bac studies with an ECS preparatory class at Massena High School in Nice. She is now a student at Grenoble Ecole de Management in the CSR program, which she completed on a work-study basis with Le Guide MICHELIN. A native of Pierrefeu-du-Var, she was inspired by her seasonal work in the vineyards to imagine the life of a winegrower in a few years' time.

Programme: Technological and social entrepreneurship to transform the energy sector

Lost in my thoughts, I've already arrived at my plots without noticing the journey. Jean, my team leader, is already there. I check in with this year's team, composed of local workers and agricultural robots. The robots are used for the most repetitive and physical tasks, such as weeding and harvesting. I remember the period before agricultural robots arrived, when seasonal workers broke their backs in the vine rows, pruning shears in hand or baskets on their shoulders. Usually, I hired students during their summer vacations; they earned pocket money, and I saved costs. But new e-tech solutions, with their growing appeal, quickly replaced them. I do a final check of the robotic parameters and programs before lunch. These robots are a revolution, combining the quality of manual labor with the speed of our old interline tractors. Before, we had to choose: well-done and environmentally friendly work, or quick and polluting work. Today, not only do we no longer choose, but these robots also make our lives easier by picking the grapes at the optimal ripeness, determined by instant biochemical analyses.

I spent the morning in the vineyards with my teams. They did good work; at noon, I charge my harvesting robots and join my employees for a communal meal. Technology has certainly modernized the winemaker's job, but the spirit of community and traditions must remain alive. They discuss the weather conditions, particularly hot and dry this year, a consequence of ongoing climate changes affecting viticulture. Through regenerative viticulture practices, I have managed to maintain the health of my soils and the quality of the grapes. Sometimes extreme weather conditions have forced me to install rotating solar panels above my vineyards. It's a technological marvel! While I took a long time to accept changing grape varieties and workers, as soon as these panels were marketed, I was one of the first to invest. This system allows me to control shading to prevent overexposure of my plots to the sun.

After lunch, everyone goes home. They will return in the evening when the temperatures are cooler. Meanwhile, only the robots work in the rows. I connect to a virtual conference organized by the National Research Institute for Agronomic and Environment (INRAE). Today's topic is biodiversity and vineyard resilience in the face of climate change. A few years ago, humanity hit a wall. Diseases proliferated, harvests were almost nonexistent. I managed to make ends meet thanks to state aid to invest in more sustainable solutions. Laws were passed, studies were conducted on my plots, and research led to the development of grape varieties more resistant to drought and disease, reducing dependence on chemical treatments.

Back in the cellar, I oversee the morning's harvested grapes being brought in. Soon, only grape juice will remain to ferment. The tanks are equipped with sensors that continuously measure temperature and pH, optimizing the winemaking process. They are set to parameters I've determined. Over the years, I've deduced from my experience that alcoholic fermentation finishes when the grape must reaches about 995 density. The energy I use in my cellar comes exclusively from renewable sources, primarily solar and wind, a commitment I made to reduce my carbon footprint. I spend the late afternoon managing the estate's administration, now almost entirely digital. Contracts, orders, organic certification reports, everything is accessible via secure online platforms. Blockchain is used to guarantee the traceability of each bottle, from vine to consumer, strengthening customers' trust in the quality and authenticity of my wine.

My workday ends around 7 PM. I enjoy the sunset, admiring my vineyards, a glass of my best vintage in hand. I take a few minutes to reflect on the challenges and successes I face. Thanks to a local and sustainable distribution network, my wines are sold mainly in the region. I have no plans to go abroad, and anyway, exported products are so heavily taxed that it wouldn't be profitable to venture there. In 2050, France has managed to transform its agricultural practices to address environmental challenges while preserving the quality of products and, most importantly, traditions. In my view, being a winemaker means being both a guardian of tradition and a pioneer of innovation. I am proud to contribute to more environmentally friendly agriculture and to see that my work positively impacts the community and the environment.

US Societal Shift

Regional Collaboration vs. Green Tech

In a podcast, host Paul Richards and Dr. Charles Walker discuss the US split into «Regional Collab» and «Green Tech» states. «Regional Collab» embraces frugality and sustainability, while «Green Tech» maintains consumerism, both aiming to enhance lifestyles and reduce environmental impact.

Host: To shed light on intersections of psychology, sustainability, and societal change, I'm Paul Richards joined today by Dr Charles Walker: a leading expert in psychology and the current director of the Second-Generation Grant Study. [Background music fades in, setting a contemplative tone]

Host: Thank you for joining our podcast today, Charles. 27 years ago, I sat here with your predecessor Dr Robert Waldinger, who shared the lessons learned from the world's longest study on human happiness: the Grant study. I look forward to hearing your new discoveries from the 2nd Generation.

Charles: Thank you for having me, Paul. I hope I do Dr. Waldinger proud.

Host: I've read a paper recently about a significant decline in happiness in the past decade. Our generation has been raised to think having more access to more comfort should make us happier. Why is that?

Charles: There's a myth that more comfort equals more happiness. Unfortunately, despite life becoming more comfortable, average rates of happiness have fallen in

Author

Margarita Markus, born in 2002 in Berlin, has lived across 6 countries thus far and hopes to transfer her open-mindedness into future endeavours. She has studied Economics and Finance in Catolica Lisbon SBE and expanded her academic background with Global Management within her Double Degree at GEM.

Programme: Bachelor in International Business - Global Management- 3rd year

the US. Though I must admit, the radical shift in 2027 towards the Regional Collab and Green Tech States' movements has transformed our citizen's lifestyles, for the better. Looking at the first 20 years of our century: statistics show that U.S. homes were 1000 square feet larger than in the 70's; living spaces doubled; and even with increased inequality the lowest income bracket increased their consumer spending… Access to internet doubled, access to social media multiplied by 15%, and despite all the luxuries citizens could afford 50 years after, the US General Social Survey emphasises happiness decreasing since the 1970's.

And why is that? We are looking for happiness in all the wrong places… From a global Ipsos study, the largest sources of happiness stem from personal relationships, well-being and health, and personal safety. You might wonder, but where are the materialistic possessions, that the capitalist past so strongly encouraged? They're among the worst-ranked factors for happiness…

Host: Interesting. Do you think people consciously realise that buying the newest car or items is not the key to happiness? Because I suspect a need for validation, that people feel that being perceived as well-off will feed their ego towards contentment. When I talked to Dr. Waldinger in 2023, he mentioned that the 3 main factors people get wrong about happiness according to the 1st Grant Study is fame, wealth, and badges of achievement. He said it is culture that dictates our perceived keys to happiness. Does this still hold true today? Have we since evolved to be more aware of sources of happiness? Or does external culture still direct us?

Charles: Yes and No…. As we are social beings within our society, of course we will listen and adapt to what is normalised in our community. The Green Tech States are still gambling on new sustainability technologies and recycling so as to hold on to old lifestyles of comfort. In their case, the over-consumption remains habitual. But I do have hope that they will be inspired by the progress made by the Regional Collab States. These recognise the intrinsic problem of society's misaligned priorities. I must admit the global crisis events of the 20's really helped push for a more self-reliant interest. When I just started collaborating with local governments, we noticed an underlying core problem in our system. The financial crises and wars we faced were symptomatic of deeper structural problems in our country. Change had to be made: systems of lifestyles and norms had to face radical evolution. We realised collaborating within the regional community provided more stability, as dependence remains within confined local bounds. The shift inwards inspired RC's movement of Unite America Again. Ever since 2027, the mentality of the two Unions has drifted, and so have their citizens' attitudes, and their work ethic, and consequently their economies.

Paul, have you heard of satisficers and maximisers?

Host: It sounds familiar, but please refresh the audience's and my memory.

Charles: In 2004 Schwartz published a research study on the psychology of choice. He categorised people into two types: satisficers and maximisers. Satisficers are content with a good enough option that meets their predetermined need. Maximisers always seek for optimisation via more choices, without ever being fully content with the final option. Schwarz's findings show that maximisers are evidently more pessimistic and less happy than satisficers. This is still relevant 50 years later.

Only 23 years since the US divided into the two state unions, the effects are evident. Through our 2nd Generation of the Study of Adult Development, we see that our participants living in the RC States tend towards being satisficers. Whilst Green Tech participants show signs of perfectionist mentalities as early as in high-school, underlining their maximisers approach. This ties back to your question on how are we to realise our source of happiness? Sometimes the shape of society around us will shape our beliefs and habits.

There's finally a glimmer of hope for humanity's wellbeing, but even more hope for the planet. Even if one has a more radical shift to sustainability, both the RC and GT states have begun to exploit natural sources less and dispose less waste. From an early age our RC State participants have engrained priority for community interest and frugality. Whilst GT State citizens have an eye for technological opportunity (to be "Tomorrow's Promise" as they call it). Already now the Carbon Footprint of the RC citizens is significantly lower than of GT's, as their GHG emissions are down 68%, relative to a mere 18.7% for the GT States. This indicates willingness to adapt as proven among Grant's 2nd Generation.

Host: Speaking of rising significance of the carbon footprint, do you think the ambitious theory of degrowth is feasible for our society? Especially regarding the readiness of the 2nd generation to adjust their lifestyles and attitudes?

Charles: I'd like to believe anything is feasible, if the conditions allow for it. I'm inclined to imagine the RC States communities are likely to support degrowth. They have already been raised to value mutual support among their community. Some participants we recently interviewed highlighted that since the new RC regime, they noticed production and consumption downscaled a lot, in comparison to their parents' past. Carbon Accounting in these states has evolved to be much more feasible to follow through, ever since the trend for deglobalisation since the 20's.

Host: So you suppose degrowth has been facilitated by deglobalisation? Is degrowth our future?

Charles: Absolutely. Ever since the switch to regionalisation and deglobalisation, governments, companies, and

citizens have recognised the move to resourcefulness. Many resources spent on global transactions have been recognised redundant. The evolution of off-shore to near-shore to regional cooperation is a big indicator on how industries change when the demands of citizens changed. Look at demand prior to industrialisation contrary to the overconsuming early 2000's. Historically, when the supply of goods was dependent on the weather, demand wasn't the issue. Then, in a capitalist environment, people started to dictate supply chains according to their own demands. Now with a refocus on local sufficiency, the younger generations begin recognising wastefulness. Though weather is no longer a control factor, and technologies make nearly any production possible, the demands of supply are evolving in favour of our planet to care for our limited resources. We might have infinite wants in a world of limited resources, but the new generations are helping shape our disciplinary resilience to consider the needs of supra-human stakeholders.

Host: Speaking of stakeholders, I'm fascinated by your circular take on the co-influencing relationship of the government upon its citizens, and the consequent influence on the market. You mention governments must prioritise developing a lifestyle upon citizens to help shape their mentalities. Once attitudes are shaped, the citizens can dictate the goods and services demanded in the economy, to which businesses will adapt (both from consumer demand and the members within firms). Do you think the world is ready to respond to the 8th energy crisis? How might the longitudinal insights from your Harvard Grant Study, inform our understanding of individual and societal responses to crises?

Charles: We still have a long way to go, especially in the inequality of accountability burden on the international scale. The 8th energy crisis now challenges emerging economies that do not have infrastructures of their own to sufficiently support themselves on own resources. Let alone in a sustainable way. Developed nations maximise their own advanced green technologies for extracting renewable energy. Meanwhile multinationals are deglobalising. Who is to help the emerging economies? I don't know. I see potential in our studied participants of both unions. The Green Tech participants seek opportunity for innovative technological advancements to maximise sustainably our currently exploited resources. The Regional Collab members impress by their initiatives on mutual support and finding alternatives for local sourcing.

I'd love to see both subgroups recognise each other's values: a collectivist mentality and technological innovation within own regional ecosystems. Once this stage of cooperation happens, maybe we'll be able to reinitiate international partnerships and even a re-globalisation. If communities, regions, and nations aligned their societies to a sustainable reality, they will be capable of international collaboration and helping other nations achieve mutual goals. Only then can emerging economies with significant carbon inequalities be helped by external actors.

Host: You created an insightful projection of what might come, let's see what awaits. Especially if a deglobalised world is to make a return to international cooperation. Thank you, Charles. I wish you the best of luck with the 2nd Generation of the Grant Study. I look forward to your upcoming publications. It was a pleasure.

Charles: Thank you for the invitation and enthralling conversation.

Georges, eco-responsible citizen in 2050

In 2050, France celebrates nine years of carbon neutrality. Follow Georges in his eco-responsible daily life, between green technology and renewed traditions. Discover how bold policies and lifestyle changes have transformed society, making sustainability the norm.

We are in 2050.
France has been carbon-neutral for 9 years.

Georges is an early riser, as usual. He wakes up easily when his alarm goes off: it is 5:00 AM. Since he became a civil servant three years ago, he allows himself to sleep an hour longer than average. A soft voice presents the day's weather before launching a pre-programmed sequence: opening the blinds, starting a coffee, and turning on the necessary electrical appliances for his morning routine.

The hot water Georges uses for his shower comes from a geothermal plant shared with his building, a modest three-story structure partially embedded in a hill to optimize the insulation of this recent complex. It is windy today, and the wind turbines on the roof are running at full capacity, storing energy in batteries located in the building's basement. The wind blew all night, gradually recharging his bike and preserving the battery, thus avoiding any consumption peaks.

The shower is quick, the soap is solid: Georges knows that the greenest energy is the one he doesn't consume. That's what the volunteer trainer said at the last citizen awareness meeting, held annually and mandatory to maintain his rights. These new civic duties seem normal to him: as the son of a farmer, he understands the importance of preserving nature. Successive scandals of energy giants eventually swayed public opinion: it was time to act. Referendums led to the implementation of five strong actions for the climate, including these annual and mandatory awareness sessions on energy issues.

Author

Erwann Bullier, was born and raised in Paris. After completing his scientific baccalaureate, he went on to study economics at Panthéon-Sorbonne University, before taking a work-study Master's degree at BNP Paribas as coordinator of CSR/HR issues, in parallel with his CSR course at GEM.

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5:45 AM. It is already time to leave for work. Georges gets on his electric bike, almost as old as he is and almost as well-maintained. Repairing rather than buying has become the norm, partly thanks to subsidies for second-hand items and spare parts, funded by prohibitive taxes on new products. There were some abuses at the launch, but it was a necessary evil, he thought. As this thought drifts away, he hears a metallic noise in the distance. A sound he hasn't heard in a long time. A combustion engine car. The noise seems to be getting closer, a deep, melodious sound. And here comes the troublemaker, driving his shiny Beta Timeo. The car must be at least 50 years old, a relic from another time. The smell of gasoline reminds him of his father's tractor, which would leave early in the morning to tend to his farm. The driver seemed to be smiling. Indeed, the 95% reduction in greenhouse gas emissions from transport allowed the return of combustion engine cars on the road last year. The practice is highly regulated but allows for leisure driving again. Georges doesn't have far to go. One of the strong actions for the climate was to bring people closer to their workplaces, reducing the need for transportation. The complete paralysis of transportation in January 2038 weighed heavily in the balance. After a decade of focusing on solar energy and a heavy dependence on it, the sunless winter took its toll on public transportation, cutting off much of the urban population's power for several weeks. Vital needs (heating, hospitals) were prioritized, and transportation suffered. As a result, people realized they needed to be able to get to work on their own. The law requiring a maximum of 10 kilometers between home and work was then just a formality.

6:03 AM. Georges arrives at his workplace: a complex of buildings dating back to 2021, which will celebrate their 30th anniversary next year. However, employees were asked to participate in their renovation and insulation with the latest technologies. This is another strong action: the energy efficiency of buildings. For the past 11 years, it has been mandatory to bring the places where we live, work, or store goods up to standard. So, for two months, Georges and his colleagues brought the building housing their department up to code. Supervised by a specialized company, these renovations have become common. The upgrade was validated by a B energy performance certificate, a source of pride for the whole team. This gradually reduced the energy expenses related to buildings, eased the burden on production and distribution entities, and eradicated energy sieves.

6:30 AM: Georges starts his day. He is a civil servant because most large

companies, especially those related to the ecological transition, have been nationalized to ensure that the state's interests in the planet and population take precedence over any financial or power interests. He works at the «cumulonimbus» monitoring office. This term refers to individuals or companies that have not complied with energy-saving regulations, named after the large black cloud sometimes associated with pollution. From 6:30 AM to 8:00 AM, meetings follow one another to track the progress of cases. Then, everyone works independently on their projects. This is the new work organization, flexible according to the time of year. In summer, to avoid enduring the midday heat, rooms in the basement are set up for rest or card games with colleagues. Workdays span a larger range but are generally split in two. The idea is to maximize working hours during daylight when the climate is most conducive. In midsummer, the day runs from 6:00 AM to 11:00 AM, then from 4:00 PM to 7:00 PM, four days a week. The hours shift to a single «old-fashioned» block from 9:00 AM to 3:00 PM, five days a week.

11:30 AM. On this beautiful late spring day, the lunch break is the most enjoyable: sports activities are the norm: inter-department matches, bike rides, or jogging. Then comes mealtime. Here, too, habits have changed. Meat has not disappeared: thanks to technological advances, we can better valorize waste and reduce animals' water consumption. However, meat is limited to once a week. Many people no longer eat it, seeing little benefit. Proteins come from grilled insects or plant-based sources. Taxes on the most polluting foods sped up this change more effectively than awareness campaigns.

2:00 PM. To better handle the long day, napping is customary. It's also good for health. Dedicated spaces are in the basement, where it is most suitable. Activity almost halts during this time, saving energy. Work resumes until the end of the shift.

6:10 PM. It's time for Georges to leave work. But he is excited: tonight is his weekly outing with friends. They frequent a multimodal space: a bar, performance hall, bike repair workshop, and exhibition space. New regulations for public spaces have made these places common, springing up across France. During discussions, Georges and his friends try to recall life before. One claims to have heard of people in the desert making ice to cool their pools when the water was too hot, provoking general laughter. «What next?» Georges exclaimed. «Imagine if they ate tomatoes in winter. Ridiculous!» If only Georges knew…

One advancement of these actions: promoting local and artisanal production over industrial. Taxes have soared as the collective covers most national expenses. This initially sparked public fury. But people soon realized many things were now free, creating a fairer common foundation. Expenses are now mostly for leisure. Less money circulates, with people favoring local and alternative currencies. Some have revived bartering. Strictly regulated, bartering uses a baseline value of 100 for daily products, allowing negotiations. The price of a liter of animal milk? 40 liters of almond milk! Or one pair of vegan leather dress shoes.

9:35 PM. Georges finally returns home after this long day. Tomorrow is another day. «Bike, Work, Sleep!» as his colleagues say. The day's sun has recharged the building's batteries via photovoltaic cells: there will be no power shortage tonight. A short laundry cycle for the communal washing machine, some tidying, a message to his parents, and it is already time to ask his assistant to wrap things up, turn off the lights, and prepare for the next day.

To reduce the consumption of household appliances, sharing washing machines in small co-ops has come back into fashion. Air travel is rationed, private jets banned. Some repetitive administrative tasks are now handled by AIs. Society's efforts have partly corrected the damage humanity caused to nature over the past 150 years. But most importantly, our country has set an example for others. Gradually, countries followed. People were ready to change; they just needed someone to show the way. The journey to a carbon-neutral world is still long. But here and there, some begin to believe. And that is what matters.

Some might think all these changes have hindered humanity's expansion and development. But they have not. The universal and profound consideration of humanity's impact on our planet likely constitutes the greatest advancement in human history.

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