THE LONG WAVES

cM lab

Scenarios

Plotting

Out

the Transition

SCOUT

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BY RAMBOLL GROUP

CNM

President
Jean-Philippe Thiellay

General Director
Romain Laleix

Studies and Prospective Department – Monitoring, Prospective, and Resource Service
Anna Cuomo, Valentine Hassoun, Céline Lugué

Transitions and Innovation Unit
Léopold Foucault, Séverine Morin, Maxime Thibault

Development, Communication, and Partnerships Department – Communication Service
Aurélie Abadie, Anne-Sophie Bach, Lucie Boussouar, Nathalie Leduc, Sarah Xardel

PRODUCTION

Cabinet Ramboll
Sébastien Bruyère, Adeline Cauchy, Mathieu Vinet

GRAPHIC DESIGN

Studio Swindells

ENGLISH TRANSLATION

Stacie Allan

ENGLISH VERSION LAYOUT

Nicolas Roth

CONTACT

CNMlab team : cnmlab@cnm.fr
cnmlab.fr
ramboll.com

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Overview of the study SPOT

This study presents hypothetical scenarios for developing the music sector in line with the target of a carbon neutral economy in France by 2050.

The ecological transition must facilitate the social shift from non-sustainable to sustainable forms of development that do not exceed the nine planetary boundaries.[1] For the whole of society to be able to imagine and move toward this new way of life, it seems essential to offer possible visions of the future. Since 2021, the agency for ecological transition Ademe (Agence de l'environnement et de la maîtrise de l'énergie) has taken this approach in its future planning for the fight against climate change. "Transition(s) 2050" is an ambitious forecasting project for the French economy, which constructs four hypothetical scenarios to reach the target of carbon neutrality by 2050.

Ademe's work, together with information from the SNBC (Stratégie nationale bas carbone) roadmap for lowering carbon emissions, has served as a flexible framework to develop this "long wave" study published by CNMlab. The Ramboll consultancy firm, specialists in future planning, was hired to assess the music sector's current environmental impact, organize the forecasting work and deliver the technical report that makes up the main element of this project.

The study is divided into three parts:

- Overview of the climate and environmental challenges facing the music ecosystem
- Scenarios for adapting the music ecosystem between now and 2050.
- Main issues for the future of the sector.

The study draws on a documentary analysis of economic data, data from existing carbon assessments from the last trimester of 2023, and a series of interviews, which allowed us to draft an initial overview of how exposed the music ecosystem is to climate change and its consequences. This work evaluated the main emission sources and identified the issues relating to the climate and biophysical and non-renewable resources, which may affect supplies, infrastructure, health, working conditions, finances and audiences. These assessments allowed us to establish an overall estimate to quantify the necessary efforts to reach carbon neutrality in each scenario.

To create plausible scenarios, putting together a working group who represented different professions within the ecosystem was essential. This group first met to identify the structuring variables, such as governance and economic models, and more sector-specific variables, such as the question of professions and statuses, and even the link between music and the local area. Following this scoping process, the group created hypotheses for developing these variables within the sector.

These hypotheses were mapped onto the Ademe scenarios and then future projections were developed by taking into account the orders of magnitude for reduction and the effects resulting from each adaptation. The study proposes four model scenarios that offer possibilities for developing the sector.

1. In 2009, an international team of 26 researchers led by Johan Rockström (Stockholm Resilience Centre) and Will Steffen (The Australian National University) identified a set of nine planetary boundaries, which were adopted by France's sustainable development commission, the CGDD (Commissariat général du développement durable): climate change; biosphere integrity; land-system change; freshwater change; biogeochemical flows; ocean acidification; atmospheric aerosol loading; stratospheric ozone depletion; novel entities. For more information, see: https://www.notre-environnement.gouv.fr/themes/societe/article/limites-planetaires.

Hypothetical scenarios 2050: Adapting the music ecosystem to climate and environmental issues

Scenario 1: "À bicyclette" (Yves Montand) – Frugality

Only the first scenario would allow for the sector to make an equitable effort to the overall strategy of reducing greenhouse gas emissions. Frugality is based on significant changes in audience practices and increased state intervention in large-scale decarbonization and adaptation programs alongside the state taking a relative step back from managing cultural policies, which are now confided to local public actors. If implemented, this scenario has the most significant impact on professions within the sector: in real terms, it means an economic contraction of the professional environment, with numerous jobs disappearing.

Scenario 2: "Come Together" (The Beatles) – Restraint and efficiency

The second scenario promotes a form of decentralization that creates a better balance of cultural and music activities across regions. While it avoids an economic contraction of the sector, existing tensions remain unresolved in the provision of biophysical resources to support the roll out of the digital economy of music recording. Its guiding logic is to decentralize and distribute cultural events more evenly across the whole country.

Scenario 3: "Computer Love" (Kraftwerk) – Polarization and efficiency

The third scenario presents the same tensions as the second, but here they are more sharply felt as growth in the sector relies much more on the digital. The gamble on greener technologies brings about dangerous consequences for the sector: it leads to a significant rise in insurance and security costs for live performances. This and other factors contribute to forcing out some professionals in the industry, resulting in the emergence of a tolerated form of counterculture.

Scenario 4: "Harder Better Faster Stronger" (Daft Punk) – Domination

In the fourth and final scenario, the state manages climate crises using technology while public powers disinvest from cultural policies. This absence of state policies results in two different courses of development: actors that continue to grow can support certain artists for their entire careers, and other actors pool their strengths to continue to produce performances. Access to the performing arts becomes a luxury, usually reserved for the elite.

These four scenarios would result in major transformations that would affect both the professions in the industry and the practices of audiences and listeners. Moreover, the final three scenarios would require the music sector to draw more heavily on the efforts of other sectors to offset its carbon footprint. Otherwise, its impact would remain higher than the equitable effort required for all other parts of the French economy.

Key future issues for addressing climate and environmental challenges

This narrative exercise focuses on the major short- and medium-term issues that the music industry must address.

Transforming the music ecosystem and its economic models

The rationale of economic development, along with the simultaneous advance of global warming, reveals the necessity of carrying out work to transform economic models. This study identifies reducing the fragility of infrastructure, predicted changes to professions and skills, and habits of producing and consuming that need to be questioned.

Rethinking the governance of the music ecosystem

Another prominent issue is how this ecosystem should be governed to bring about the transformations that global warming will engender. To address this question, it seems necessary to work on governmental frameworks, all the while redrawing the contours of the landscape and ensuring that this transition is in line with cultural rights.

Working on visualizing these transformations

Finally, to be able to enact these changes, it also seems important to address the issue of how we can visualize these transitions by drawing on experimentation to change practices and uses and on the role of music in changing behaviors.

These scenarios outline possible futures that are on the horizon. Their goal is to allow individuals working in the sector to predict and understand the transformations that could affect the ecosystem in the coming years. They provide a basis from which to open up the debate on the direction that we collectively seek to give to this transition.

Table of Contents

1. Methodological approach: From diagnosis to hypothesis

With the need to think long-term about the climate and environmental issues that are increasingly concrete and observable, this study offers prediction tools that can shed light on decision-making for possible and desired futures. Reflecting on the past informs the choices of the present and prepares for future actions.

This study examines the links between the music ecosystem and climate and environmental change to explore the multiple and uncertain futures up to 2050.

The conducted exercise is thus designed to evaluate what could happen to the French music industry based on an assessment of the principal climate and environmental issues, in particular lowering carbon emissions and adapting to climate risks.

Our methodology is divided into three parts and is summarized in the following figure:

- A first phase of audit and analysis aims to understand the structuring of the music ecosystem and then evaluates in a simplified way the sector's main carbon emissions sources, the main climate issues and those relating to biophysical resources and non-renewable resources. First, we developed the orders of magnitude for a carbon snapshot of the music ecosystem. Inspired by the BEGES (Bilan des émissions de gaz à effet de serre) assessment tool, it followed the same steps: composition, identification of sources and emissions, data collection, assessment calculation and analyses, transition plan and, finally, online publication. Second, we developed the issues relating to adaptation, inspired by approaches for analyzing qualitative climate risks. Three different areas were selected: organizational (key actors identified), operational (through five major issues) and temporal (current climate risks). The details and limitations of the methodology for each step can be found in Annex 1. The audit was largely based on a literature review (see Annex 2) and twelve interviews with key actors representing the main professions in the sector. The list of interviews conducted is available in Annex 3.
- A second phase of creating hypothetical scenarios for the music industry through the prism of these changes in the lead up to 2050 (possible futures). A dedicated working group was set up to carry out this process across three workshops.
- The final phase of identifying the short- (10 years) and medium-term (30 years) issues that, taking into account the exploratory objectives of the study, aims to enrich the CNM's future work in these areas and open up approaches for the music ecosystem to work on in the coming years.

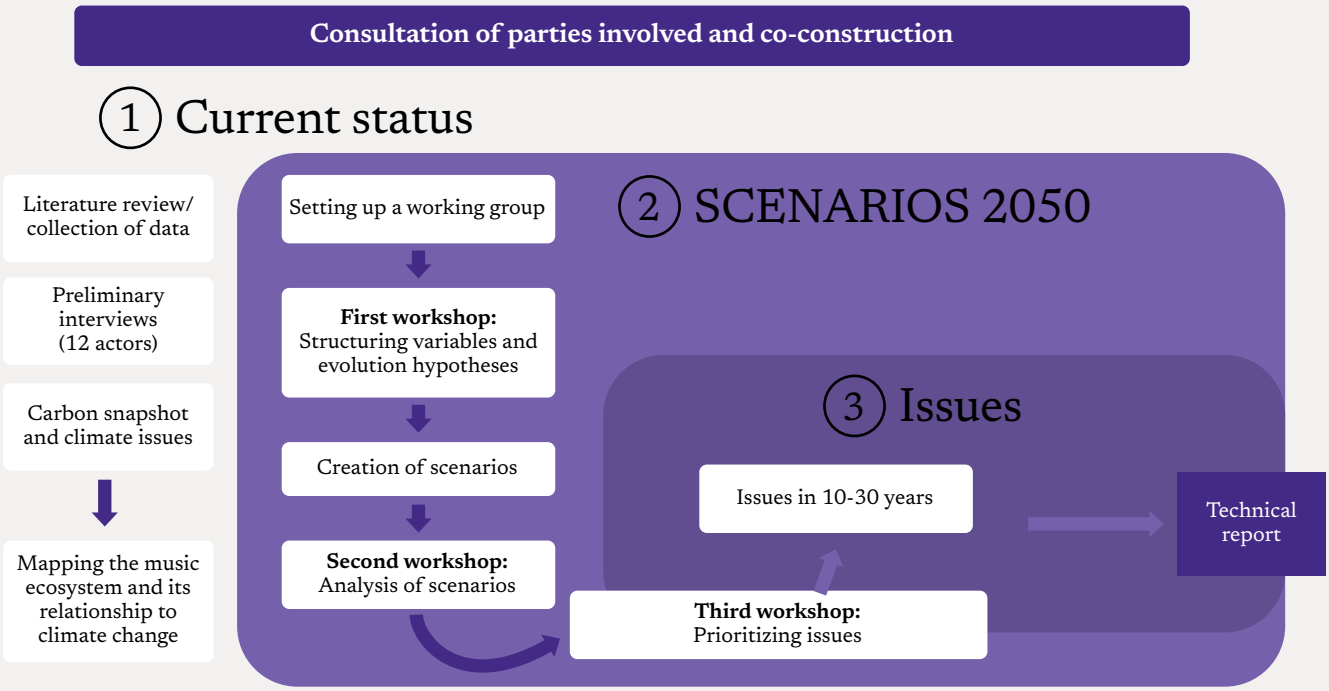


Figure 1: Methodological approach employed in this study

2. Overview of the climate and environmental changes facing the music ecosystem

2.1. A simplified carbon snapshot of the music ecosystem

The music ecosystem is relatively complex and highly fragmented, made up of "several music industries" with some parts that are more industrialized and others more bespoke, and in which the connections between actors and practices are not easily representable or segmented. Nevertheless, a preliminary study allowed us to identify the main value chains within several branches of the music ecosystem.[2] In addition, without aiming to be comprehensive, consultations conducted with representative actors of the ecosystem's main professions allowed for a better documentation of the major issues facing each branch. The list of organizations consulted can be found in Annex 3.

It is important to remember that no carbon assessment of the industry or part of the industry existed when this exercise was carried out, so it was necessary to work with raw heterogeneous data. We voluntarily conducted this exercise in a significantly shorter time frame than usually required (one month compared to six months).

General Aim

The aim of this carbon analysis of the music industry is not to undertake a carbon assessment in line with the usual regulations, notably those of the reference methodology proposed by Ademe.[3] Rather it seeks to evaluate the orders of magnitude of large emission sources within the music industry in a simplified way based on the largest scope and the available data, which is still particularly fragmentary, and then to develop the carbon analysis based on different scenarios created with actors in the music industry. In doing so, it draws out conclusions on orders of magnitude for the necessary reduction effort according to each hypothetical scenario.

It is important to underline that this carbon analysis does not aim to replace other past or present exercises conducted in the music sector, particularly the ongoing REC project,[4] which evaluates the carbon footprint of music production.

Results

A summary of the main sources and rules of extrapolation for each actor is presented on the following page.

2. This study is based on the doctoral work undertaken by Robin Charbonnier, "La régulation à l'épreuve du changement: le cas de la musique", (PhD diss., Institut polytechnique de Paris, 2022).

3. Ademe, "Méthode pour la réalisation des bilans d'émissions de gaz à effet de serre," *Ministère de la Transition écologique et de la Cohésion des territoires*, 2022, https://www. ecologie.gouv.fr/sites/default/files/methodo_BEGES_decli_07.pdf. This carbon assessment uses different methods to measure and track the quantity of greenhouse gases (GHG) that an organization (individual, business, public administration) emits through its activities.

4. SMA, CNM, SNEP, UPFI, Carbone4 et Ekodev, "Lancement de l'étude REC pour construire la feuille de route bas carbone de la musique enregistrée en France," *Syndicat des Musiques actuelles*, 9 May 2023, https://www.sma-syndicat.org/communique- lancement-de-letude-rec-reduisons-notre-empreinte-carbone-pour-construire-la-feuille-de-route-bas-carbone-de-la- musique-enregistree-en-france/. A discussion with the team in charge of this project was organized to compare the results obtained by orders of magnitude.

Details by actors

Venue

- Extrapolated using 5 CA for representative venues and corrected with Carbone4 study
- *Key figure:* No. of spectators/year: 32.3M
- All emissions sources
- Uncertainty: Moderate (reliable CA and correct figures)
- Limitations: Travel potentially underestimated, unrepresentative of the variety of venues

Festival

- Extrapolated using 3 CA for festivals with 125k festival-goes and corrected with Carbone4 study
- *Key figure:* No. of festival-goers/year: 7,39M/year
- All emissions sources
- Uncertainty: Moderate (reliable CA and correct figures)
- Limitations: unrepresentative of the variety of festivals, notably differences between large and small festivals

Composer or artist

- Inspired by the CA of tertiary sector worker + calculated specifically by sources (travel, purchases)
- *Key figure:* 100k performers, 230k composers
- Focus on travel (base calculator: Ensemble Correspondances), does not cover instruments, recording
- Uncertainty: High (no available data on the profession)
- Limitations: Imprecise and difficult to create a general profile of composer or artist
- Possible double counting with festival/venue travel (but foreign artists difficult to separate)

Physical market

- Based on analysis of record manufacturing (Impala CA)
- *Key figure:* 5.4M vinyls, ~18M CD
- Main sources: logistics, manufacturing
- Uncertainty: Moderate (quite reliable figures and limited scope)
- Limitations: Limited to vinyl/CD (no DVD/other formats)

Digital market

- Based on platform and analysis of average listening practices in France
- *Key figure:* 67 % of 16.6 hours weekly
- All emissions sources (ventilation emissions according to CA listening platform)
- Uncertainty: High (relies heavily on hypotheses)
- Limitations: Difficult to study differences in audio/video streams

Audiovisual

- Based on analysis of average listening practices for radio, social media, TV in France
- *Key figure:* 32 % of 16.6 hours weekly
- All emissions sources but no reference CA
- Uncertainty: Very high (no consolidated data)
- Limitations: Very uncertain (carbon intensity of radio listening poorly documented)

Other recording industry actors (publishers, labels)

- Extrapolated using CA for labels
- *Key figure:* €1bn of revenue labels/publisher, 1750 companies
- All sources but without details on profession (recording, merchandising, others)
- Uncertainty: High (extrapolation using revenue highly uncertain, no info on no. of workers)
- Limitations: Not specific enough to the actor

Instrumental manufacturing

- Based on *key data of material/instrument and volumes of professional sales new/second-hand (CSFI)*
- *Key figure:* 1M new instruments/year, 98 % import
- All emissions sources: essentially manufacturing and logistics
- Uncertainty: High (significant assumptions on weight)
- Limitations: Difficult to evaluate part linked to sales/ maintenance service

Limitations

- Different methods according to actors with accompanying uncertainty
- Possible double counting on some sources (physical market, artists travel)
- Sources not currently covered:
  - Instrument manufacturing,
  - Recording (REC study forthcoming),
  - Logistics for artists materials (partial)
  - Certain industry actors (SACEM, others)
- Outside scope:
  - Music practices for leisure

Moderate
High
Very high

Figure 4: Details of the main sources and rules of extrapolation for each actor identified

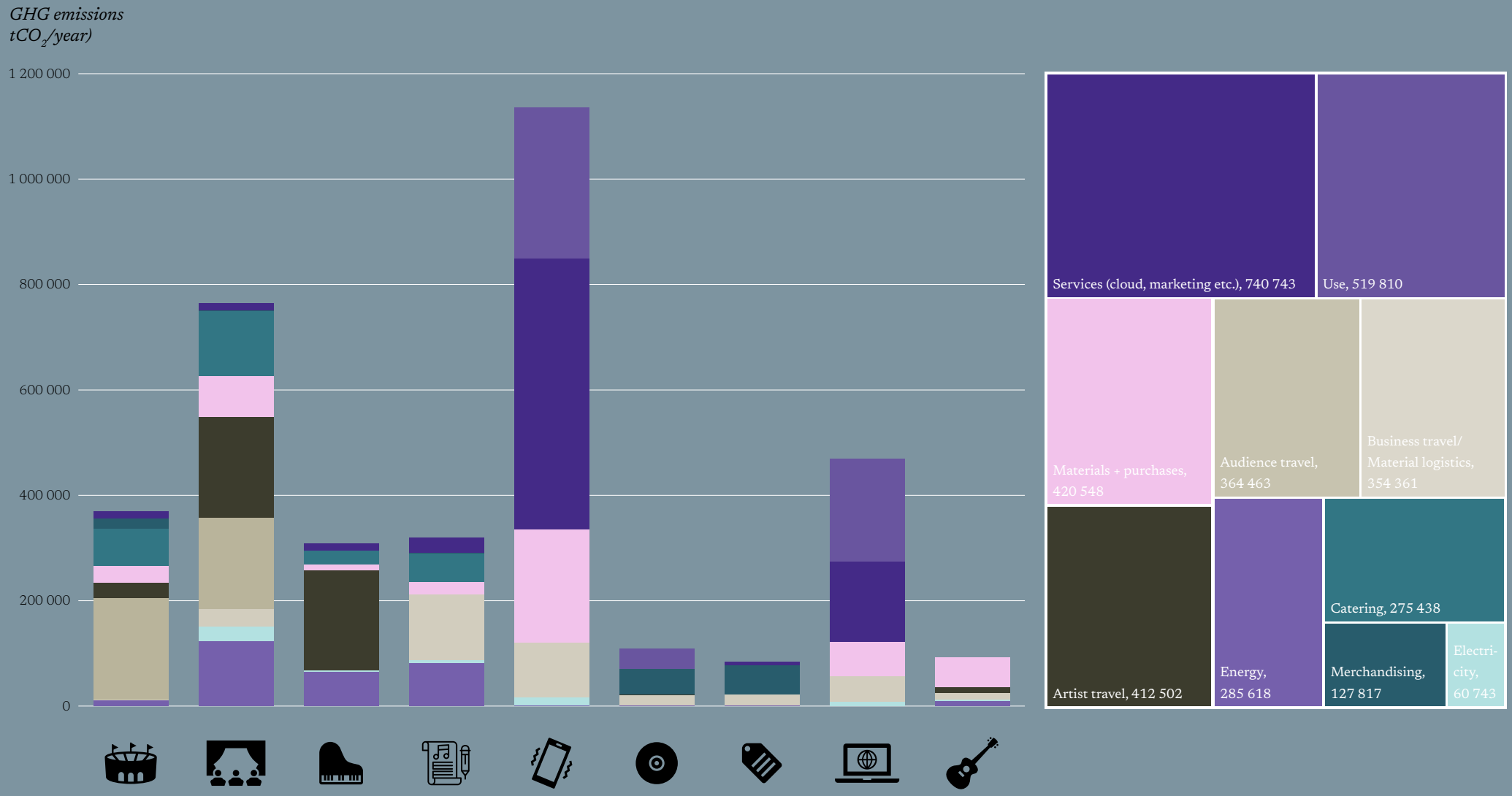


Figure 5: Summary of results of the carbon snapshot by actor and category of GHG emissions (tCO_2e)

Analysis

This carbon snapshot, although indeterminate, highlights several noteworthy facts that were corroborated during the workshops with representatives from different professions across the music industry:

- According to the estimate, the industry's total GHG emissions is equivalent to 3.7 $MtCO_2e$, compared with 385 $MtCO_2e$ for France,[5] around 1 % of national emissions while the GDP of the whole cultural sector accounts for 2 % of the economy.[6] This value may at first seem low compared with other analyses carried out on other sectors.[7] This result is likely linked to using a methodology with a high degree of uncertainty and indicative limitations in scope. Nevertheless, the orders of magnitude allow us to use this analysis for the following forecasting exercise.
- The digital market appears as the area that accounts for the most GHG emissions, essentially due to the energy burden of its infrastructure and its budget for operations (marketing) as well as the emissions linked to the functioning of listening equipment (smartphones, speakers or similar), though these sources are evaluated with a high degree of uncertainty.
- Live performance (venues and festivals) is second in terms of the volume of emissions, with travel undertaken by artists and audiences having a significant impact.
- Artists and conductors are the third most significant actor, largely due to travel and the energy required for their work and music recording.
- Actors in the physical market, instrument manufacturing, and music publishing have a low impact, which is mainly due to the volume of sales or a low number of employees (compared with the rest of the industry).
- The audiovisual also has an impact, but it must be noted that this source remains the most uncertain because of a lack of consolidated data.

This carbon snapshot serves as the starting point for the forecasting exercise.

2.2. Issues of adapting to climate risks and pressures on resources

General Aim

Alongside issues relating to lowering carbon emissions, the main adaptation issues that influence different value chains within the music ecosystem were identified to inform the forecasting exercise (the scenarios)

The information produced and collected on the adaptation issues facing the music industry, on both a French and European scale, is currently very fragmentary, even inexistant in some cases, from a qualitative and quantitative perspective. Our work is therefore based exclusively on:

- Perceptions of climate issues by actors interviewed during the audit phase.
- Publications and bibliographical resources concerning the impact of climate change on the music industry on a global, European and French scale.
- Extrapolating comparable issues using experiences acquired in other sectors or industries.

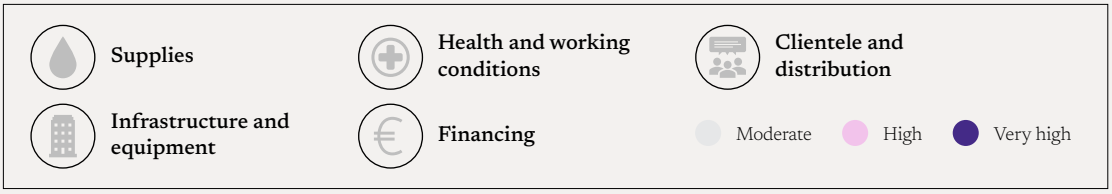


Figure 6: Issues for each value chain considered from the perspective of adaptation

5. "La France réduit encore ses émissions de CO_2 en 2023," *Ministère de la Transition Écologique et de la Cohésion des Territoires*, 20 March 2024 https://www.ecologie.gouv.fr/actualites/france-reduit-encore-ses-emissions-co2-2023#%3A~%3Atext%3DSelon%20les%20premières%20estimations%20du%2Cà%20385%20MtCO2e%20en%202023.

6. "Le poids économique direct de la culture en 2021 [CC-2023-1]," *Ministère de la* culture, 23 June 2023, https://www.culture.gouv.fr/espace-documentation/statistiques-ministerielles-de-la-culture2/publications/collections-de-synthese/culture-chiffres-2007-2024/Le-poids-economique-direct-de-la-culture-en-2021-CC-2023-1#:~:text=En%202021%2C%20le%20poids%20économique,2%2C1%20%25%20en%202020.&text=2021%20est%20une%20année%20de,activité%20pour%20les%20branches%20culturelles.

7. A report estimated that the tourism sector (between 3 and 4% of GDP) produced 118 $MtCO_2e$ in 2018, i.e. 11 % of French territorial emissions. "Le tourisme durable en France : un levier de relance écologique," *ADEME Presse*, 8 June 2021, https://presse.ademe.fr/2021/06/le-tourisme-durable-en-france-un-levier-de-relance-ecologique.html.

Presentation of major issues by branch/value chain

Live performance and production: Venues and festivals

- The increase in water and electricity consumption, notably to ensure the comfort of audiences, risks conflicting with the reduction in available resources (events consume a lot of resources). Numerous regions could be affected by severe restrictions for a large part of the year (for example, the Adour-Garonne Basin).[8]
- Drought risks having an impact on water and electricity supplies, and the production of hydraulic energy is also threatened by the decrease in precipitation levels. Restrictions on electricity use during the summer are therefore predicted for the coming years.[9]
- Travel for technical teams and artists risks being impacted, particularly in certain areas of the South of France (disruption to train and air travel and rerouting during heatwaves).
- The acceleration of climate hazards risks leading to an **increase in festival cancellations and delays, which are already being observed**.
- **For equipment and infrastructure** (scenography, technical materials, venues), bad weather and heat can lead to issues (breakdown, overheating, damage to material).

According to figures from the Centre national de la musique, thirteen festivals were partially cancelled in 2023 due to weather events (11 for storm, 2 for heat) out of around two thousand festivals within the CNM's scope. Actors such as Live Nation indicated that almost a third of dates for certain artists in Europe were cancelled during summer 2023

- On site (festivals and venues), there are numerous **physical and health risks for festivalgoers or audiences at venues** (health risks, heatstroke, vector-borne diseases, direct damage) and for technical teams with noticeably poorer working conditions. The issue of heat raises questions about the seasonality of festivals, holding concerts in badly insulated venues (without air conditioning) during the summer, and holding events at certain times of the day. Poorer working conditions also affects the recruitment of volunteers.
- Setting up: suspending work due to weather events incurs extra costs to relocate materials, enlist **extra technicians or take reactive measures** (intervention of external companies to pump water or remove mud).

Following heavy rainfall in August 2023, the intervention of a construction company to pump water and remove mud cost Cabaret Vert tens of thousands of Euros in addition to the cost of relocating materials.

- **The increases in insurance costs** are liable to continue. There is also a **significant risk of private insurance cover for open air events being invalidated** above a certain temperature threshold[10] in some departments that have already suffered significant damage. Moreover, insurance can be the subject of tension between organizers and host municipalities, in particular concerning administrative decisions, or a lack thereof, to cancel events.

8. "Hydrologie et changements climatiques: quelles tendances observées et à venir sur le bassin Adour-Garonne?" Agence de l'Eau Adour-Garonne, 13 April 2023, https://eau-grandsudouest.fr/medias/etudes/ note-hydrologie-changements-climatiques-quelles-tendances-observees-venir-bassin-adour-garonne.

9. Violaine Lepousez, Cyril Cassagnaud, "Impacts du changement climatique, à quoi faut-il s'attendre en France?" *Carbone4*, June 2019, https://www.carbone4.com/publication-adaptation-changement-climatique.

10. "Impact du changement climatique sur l'assurance à l'horizon 2050," *France Assureurs*, 2021, https://www.franceassureurs.fr/wp-content/uploads/2022/09/vf_france-assureurs_impact-du-changement- climatique-2050.pdf.

For example, Delta Festival estimates 600 000 euros in losses after closing the festival early, at 10pm rather than 2am, on Saturday 26 August 2023 following an extreme weather event. Source: MaMa Music & Convention.

- The practices of live performance and audiences are likely at risk of being disrupted by global temperature increases of 2 °C to 4 °C. Similar to the redirection of tourist flows, we predict that, in time, there will be a **change in festivals' geographic locations** (more towards the North) and their frequency, particularly during the summer period. Audiences will also develop different buying habits.

Music recording

- Drought risks having an impact on water and electricity supplies. **Restrictions on electricity usage during summer** are therefore predicted in the coming years, which could affect sites that have significant energy needs linked to cooling (data centers).
- Telecommunications networks and electric power lines are vulnerable to climate hazards, leading to predictions of **more frequent pressures and cuts** that will impact working conditions, access to digital systems and the durability of economic models relying on B2B.
- In the physical market, **supply chain difficulties for records** (vinyl) have already been observed on occasion, particularly with foreign suppliers (bottlenecks in manufacturing chains, long waiting times between sending files and receiving products, delays for album releases). These issues are liable to increase due to the impact of climate change on globalized logistics chains (impact of low water levels on maritime and river freight).
- More generally, all workers may be subject to physical risks based on location and their physical health:
  - Warehouses stocking materials can be exposed to extreme climate hazards (strong winds, floods).
  - Offices and recording studios in aging buildings (badly insulated) are even more **vulnerable to heatwaves, which are likely to disrupt working conditions.**
  - **Data centers expose platforms to high financial risk**.

An actor from a streaming platform confirmed the vulnerability of workers and imagined back-up solutions: "If tomorrow we no longer had our own data centers because of difficulties with climate events, there is the possibility of transferring everything to a cloud belonging to one of the big actors [Google, Amazon], giving the potentially false impression of still being able to access energy, water and security."

- Increasing phenomenon of **eco-anxiety** for some employees at record labels.
- **Rising costs** of streaming and prices in the physical market.
- Risk of impact on distributors in the physical market owing to issues of supply and resupply of materials and the **drop in sales in the physical market** due to streaming.

Composition

- **Increasingly difficult conditions** for artists and their technical teams (performances in venues and at festivals during heatwaves).
- The phenomenon of **eco-anxiety** and its potential impact on **career development and artistic collaborations** for artists and groups that are highly conscious of these issues, with the paradox of wanting to act ethically (refusing to fly for one-off dates or for certain tours, opposition to clauses for territorial exclusivity) while also needing to develop their career in a highly competitive context. Collective actions like "Pour une écologie de la musique vivante" [For an ecology of live music] (June 2020) by Leila Martial, Pierre Perchaud and Gréroire Letouvet, encourage reflection on professional music practices.[11]

Ensemble Correspondances revealed: "We manage eco-anxiety on a daily basis with politically engaged musicians (who won't fly for less than 3 weeks of touring). When we have an opportunity to tour China, there are many considerations to take into account."

- **High sensitivity of old instruments** compared to modern instruments in outdoor environments (instruments out of tune because of temperature variations particularly in reaction to the cold, varnish cracking).

Ensemble Correspondances added: "During the 2021 heatwave in Normandy, we had to cancel the walkabouts that were due to happen in August. The varnish on the instruments wouldn't have held."

- Difficulties organizing certain tours with rises in **fuel costs which raises questions about dates.**
- Difficulties for some artists/ensembles organizing tours abroad (particularly in the United States) **according to period of the year**, without having to confront extreme climate hazards (for example, hurricanes).
- **Difficult choice of "climate-related" restraint** for artists relying largely on subsidies and whose development and the continuation of their work are contingent on multiple artistic collaborations.
- The climate crisis and the relationship to other living beings are an important source of inspiration for some artists and ecological questions are increasingly becoming integrated into music practices. Since the 1970s, ecomusicology has aimed to study the relationship between ecological questions and musical objects. While popular music genres regularly mention ecological issues in their lyrics in line with the emergence of the climate movement[12] [13], the **increased presence of ecological preoccupations** has also been observed for a number of years now in the titles and accompanying notes for contemporary music composition projects.[14]
- Role of artists in **raising awareness among audiences and distributors** and the creation of collective imaginaries.

11. "Pour une écologie de la musique vivante," *Orchestre National du Jazz*, June 2020, https://www.onj.org/appel-des- musicien%C2%B7ne%C2%B7s-et-des-producteur%C2%B7trice%C2%B7s-de-musique-engage%C2%B7e%C2%B7s- pour-la-transition-ecologique-et-la-sauvegarde-du-vivant/

12. David Ingram, *The Jukebox in the Garden: Ecocriticism and American Popular Music Since 1960* (Leiden: Brill, 2010).

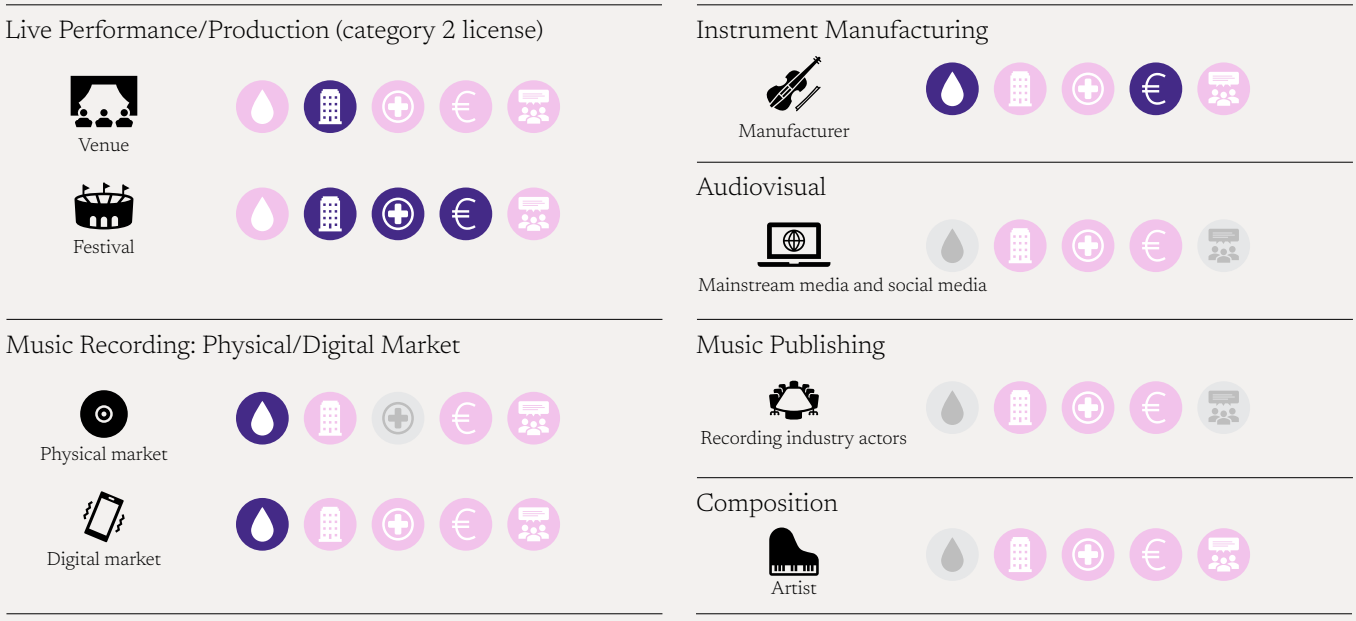
13. Tore Størvold, "Confronting climate change in popular music texts: Nostalgia, apocalypse, utopia," in *The Intellect Handbook of Popular Music Methodologies*, ed. Mike Dines, Gareth Dylan Smith and Shara Rambarran (London: Bristol Intellect, 2022).

14. Alexandra Charvet, "Quand la musique résonne avec l'écologie," *Le Journal de l'UNIGE*, 17 November 2022, https://www.unige.ch/lejournal/analyse/automne-2022/musique-ecologie/.

Instrument manufacturing

- **A wide variety of materials** used for making musical instruments are already, or are at risk of being in future, affected by supply and use issues: wood and other natural materials, animal-based products, metal and mineral products, glues and solvents, and even plastics.
- **The increasing scarcity of some materials** can affect the cost or availability of classic instruments, like brazilwood for bows.
- High sensitivity of antique instruments compared with modern instruments in outdoor environments, notably with increasing temperatures.
- **Vulnerability of manufacturers' economic models** based on a balance between repairs, instrument manufacturing and sales (without distinguishing between the professional and amateur worlds). The variability in the price of instruments and materials risks having an impact on buying practices, notably for amateur practices and repairs (the price of entry level instruments has steadily increased, and it is becoming more cost-effective to have old instruments repaired).
- **Concerns relating to the development of music practices** (80% of music listened to is made electronically).
- **Rise in costs in the instrument market** – risk of impacting the network of distributors.

A visual overview of climate issues and issues linked to resources for the music ecosystem



2.3. Planetary boundaries and pressures on non-renewable resources within the music ecosystem

2.3.1. The nine planetary boundaries

Our work also contextualizes the space for development within the framework of the nine planetary boundaries. This scientific approach developed by the team at the Stockholm Resilience Centre aims to improve the information on the risks of sudden global environmental changes (see figure below) due to human-made pressures that will likely profoundly affect all living beings and our lifestyles.[15] To date, six planetary boundaries have been breached.[16]

In the audit, some climate issues and those linked to non-renewable resources (scarcity of water and biodiversity resources, supply problems) were considered under the prism of adaptation.

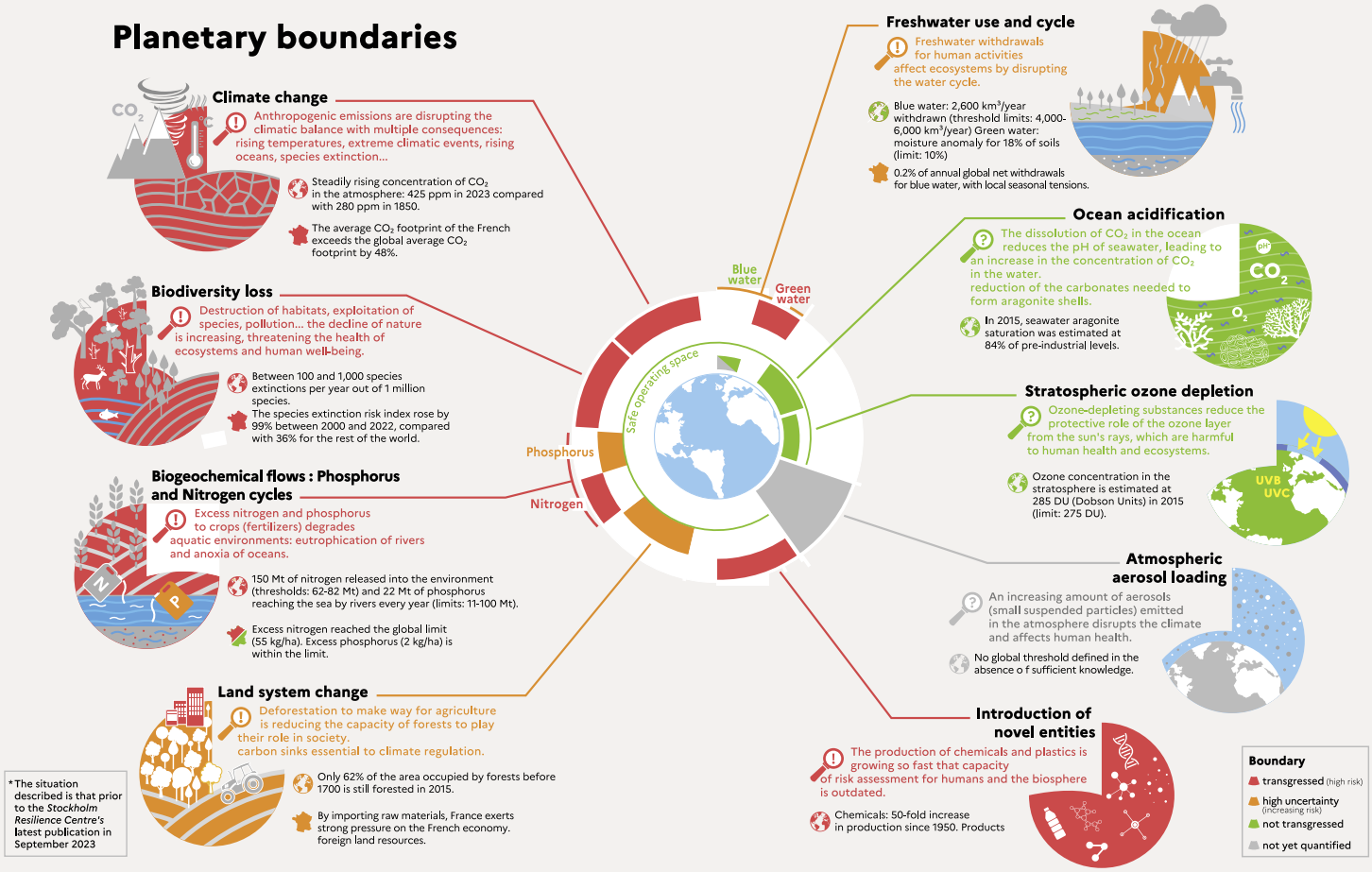


Figure 7: Framework of nine planetary boundaries. Source: Ministry of the Ecological Transition and Territorial Cohesion

15. France and the nine planetary boundaries," *Ministry of the Ecological Transition and Territorial Cohesion*, October 2023, https://www.statistiques.developpement-durable.gouv.fr/edition-numerique/la-france-face-aux-neuf-limites-planetaires/en/synthesis

16. Katherine Richardson et al., "Earth beyond six of nine planetary boundaries," *Science Advances* 9, no. 37 (2023), doi: 10.1126/sciadv.adh2458.

2.3.2. A scarcity of non-renewable resources

The scarcity of resources (fossil fuels, minerals) is not included in the planetary boundaries as it is not considered as a system whose tipping point is likely to threaten human life.

However, this issue is considered within the forecasting exercise for the music sector since manufacturing of instruments and electronic equipment and the phenomenon of digitizing music rely on many metal and mineral materials.

Producing metals draws on a technically delicate process with high energy consumption. Confronted with our societies' rising collective need for metal resources, geotechnical constraints are intensifying, and the energy required for extraction and production remains high. The music sector should reflect on this challenge using the following three starting points.

A sector requiring many fossil and mineral resources

Metals and minerals have always been used in the design of musical instruments. Battery cases, for example, are made from wood or metal, especially steel, brass, bronze, aluminum, copper or titanium. The strings of instruments in the violin family are covered in aluminum, chrome-plated steel, tungsten or silver.

Both physical and digital music have increased the industry's dependence on materials. Speakers offer a case in point: they account for 20% of the use of rare earth magnets.[17] Another example: CDs and vinyl records have often been singled out as a source of plastic pollution, with 90 kilotons of plastic linked to CD sales at their height in 2000.[18]

Intensification of the dependence on rare metals with the digitalization of the industry and the rise of music streaming

While online music has reduced the industry's impact in terms of plastic pollution, digital technologies rely on an increasing number of electronic and connected devices (phones, portable speakers) that require increasingly complex components. A smartphone, for example, is made up of 50 to 70 chemical elements in minuscule quantities, which have very precise usages.[19]

Digital media is often considered "immaterial", yet in reality, it relies on entirely material elements that consume energy and resources, such as network infrastructure and data centers. All this necessitates numerous different metals, requiring increasingly significant amounts of energy for extraction.

Future projections

Between 1980 and 2008, global demand for metals increased by 87%. At the same time, the number of different metals used multiplied by 6.[20]

According to projections, the quantity of metals required by 2050 will represent 3 to 10 times the volume of current production. To meet this demand, it will be necessary to extract more metals over the next 35 years than the cumulative quantity produced since Antiquity.[21] The wide variety of metals to extract poses additional difficulties in terms of production. Most metals are not present in sufficient quantities in the earth's crust to justify mining them in and of themselves. Their production relies on the co-existence of other raw materials in demand (joint products or by-products) that guarantee the economic viability of mining. The mining industry functions on the interdependence of numerous markets for raw materials.

This situation thus poses the question of how the music industry adapts in response to the likely pressures on non-renewable resources and the geopolitical, environmental and social issues that arise in their production. The flow of supply risks becoming unstable, impacting some strategic sectors directly, like energy production, transport or even medicine. While the needs of the music sector remain modest compared to these key strategic sectors, the same difficulties can cause disruption.

17. "Reclaiming rare earth magnets from loudspeakers," *Institute of Materials, Minerals and Mining*, 2 October 2021, https://www.iom3.org/resource/reclaiming-rare-earth-magnets-from-loudspeakers.html.

18. Vincent Lostanlen, "Écologie de la musique numérique," *Musique et Données*, 15 June 2023, https://cnmlab.fr/recueil/musique-et-donnees/chapitre/6/.

19. "Le streaming: une pollution numérique aux multiples visages," *Radio France*, 28 November 2022, https://www.radiofrance.fr/franceinter/podcasts/la-terre-au-carre/la-terre-au-carre-du-lundi-28-novembre-2022-2020690.

20. Luce Engeran, Nathan Barrieu, "Les matières de l'immatériel : existe-t-il des risques d'approvisionnement en matières premières pour les entreprises du numérique?"*Carbone4*, 14 June 2023, https:// www.carbone4.com/analyse-risques-matieres-premieres-numerique.

21. *Ibid.*

3. Hypothetical scenarios 2050: Adapting the music ecosystem to climate and environmental issues

3.1. Presentation of forecasting method

The forecasting exercise drew on the method of creating hypothetical scenarios. This approach is collaborative and required establishing a working group made up of a representative panel from the music ecosystem, its professions and structure to carry out the exercise during three workshops over three days between December 2023 and March 2024.

These workshops targeted several different objectives as the work progressed.

First forecasting workshop

- Sharing of the audit and the climate and environmental issues identified and highlighting potential points that require further attention.
- Identifying the key structuring variables within the music ecosystem for the future of the industry in line with these issues. **Nine variables were identified, namely**:
  - ***Health and safety crises***: The implications of the global health, geopolitical and economic situation for the value chains, music industry actors and the political situation in France.
  - ***Availability of raw materials***: All raw materials and resources that are needed for manufacturing musical instruments, practices, uses, distribution and consumption of music.
  - ***Institutionalization of ecological and societal issues***: The implementation of regulations, legislation and quotas in favor of environmental and societal issues (gender, inclusion).
  - ***Modes of consumption, uses and practices of music***: Types of concerts and performances, types of media and devices for listening to music; who practices it (artists, audiences), how often, when (season, time, at home, at the cinema, in the street) and how.
  - ***Links between music and regions***: The place, role and accessibility of music within regions (cultural rights and integration into the local area).
  - ***Economic models***: Sources of revenue and types of expenses that allow for activities relating to producing/distributing and consuming music to exist.
  - ***Evolution of professions and statuses*** (temporary contracts and status of the profession): Roles within the music industry as defined by job description/labor agreement with initial, continued and informal training implying specialization and versatility of professions.
  - ***Accessibility of music for audiences***: The part of audience's income earmarked for consuming music (buying music or musical experiences, consuming services offering access to music).
  - ***Cultural policy***: Democratizing culture with the aim of social protections for artists and access to culture for all.
  - ***Defining and explaining these variables*** (What are we talking about? What are current trends? What are the signs of weakness?) then constructing possible and differentiated hypotheses for each variable to develop ahead of 2050.

Second forecasting workshop

- Sharing, debating and adjusting the macro-industry scenarios constructed from the first workshop and aligned with Ademe's societal scenarios from "Transition(s) 2050".[22]
- Evaluating the orders of magnitude for reducing GHG emissions (possibilities for reduction) in each category of emissions from the carbon snapshot of the industry; identifying the principal elements that play a role (energy efficiency, changes in travel distances, changes in volume of data for online music, new technologies) and comparing them with the perceptions of the workshop participants.
- Developing each scenario and evaluating what each implies in terms of the climate and environment for the different branches of the music ecosystem (composition, music recording, live performance, music publishing, audiovisual, instrument manufacturing).

22. Ademe, "Prospective - Transitions 2050 – Rapport," *La Librairie*, November 2021, https://librairie.ademe.fr/recherche-et-innovation/5072-prospective-transitions-2050-rapport.html.

Third forecasting workshop

- Sharing, discussions and last adjustments to the final four scenarios.
- Validating the orders of magnitude for the reduction in GHG emissions met for each scenario.
- Identifying the intersecting issues emerging from the audit and creation of the scenarios (retrospectively) and developed in part 4 of this document.

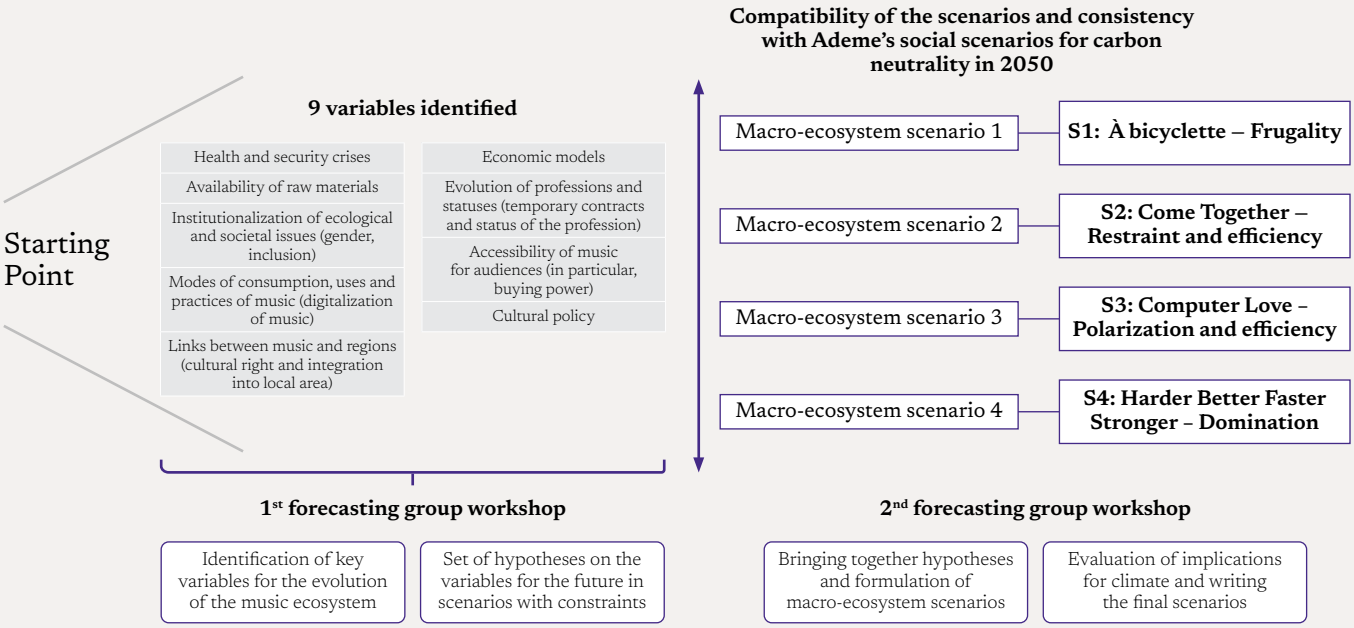


Figure 8: Chronology of creating the hypothetical scenarios for the music ecosystem in 2050 in response to climate and environmental issues

There are several methodological characteristics distinctive to this exploratory exercise to note:

- Working on exploratory scenarios for adapting the music ecosystem in response to climate and environmental issues **implies being realistic within the field of possibilities** (place and role of the state and regional collectivities in the scenarios in terms of cultural policy, cultural rights, modes of consuming music), **and also in restricting the scenarios to** the year 2050 for reaching the objectives of carbon neutrality, a scenario of global warming of +2 °C and the perspective of not exceeding the planetary boundaries and pressures on non-renewable resources. The exercise is thus based on:
  - **The current and projected impact of a scenario of temperatures rising by 2** °C in France by 2050;
  - **The orders of magnitude for the envisaged reduction of carbon emissions within the industry** in line with the SNBC[23] national strategy and Ademe's societal "Transition(s) 2050" strategies (Frugal Generation, Regional Cooperation, Green Technologies and Restoration Gamble);[24]
  - **The projected pressures on biophysical (water, biodiversity) and non-renewable resources.**

The conducted exercise is thus interesting from a methodological perspective and could inform similar forecasting work by others in future.

Carrying out forecasting work on the music industry and, in particular, on the cultural sector requires going beyond the material aspect and taking into account the cultural dimension in the sense of languages, practices, lifestyles and the art. As such, while Ademe's "Transition(s) 2050" scenarios (Frugal Generation, Regional Cooperation, Green Technologies and Restoration Gamble) served to frame the approach and gave more depth and body to the music ecosystem scenarios by integrating societal data, these scenarios were mainly used as inspiration for avenues of reflection and to evaluate the orders of magnitude of certain data (e.g. the ratio of vegetarian diets or the part of fossil energy used for simulating potential reductions of GHG emissions).

The four scenarios are summarized in the following figure and described in detail thereafter.

23. It should be noted that SNBC's scope is not exactly the same as international transportation, for example, would not be considered, but, in this current exercise, these differences in scope are not reflected upon so as not to complicate the reading.

24. "Transition(s) 2050. Decide Now. Act 4 Climate" is a forecasting study carried out by Ademe that depicts four coherent and contrasting scenarios to reach carbon neutrality in France in 2050. It aims to connect the technological and economic dimensions with reflections on the transformations of society that they suppose or provoke.

	S1 À bicyclette	S2 Come Together	S3 Computer Love	S4 Harder Better Faster Stronger
Society	• Search for meaning • Frugality chosen but also obligation • Preference for the local • Nature protected	• Sustainable development of lifestyles • Sharing economy • Preservation of nature written into law	• More new technologies than restraint • "Green" consumerism for wealthy populations, smart society • Optimized services offered by nature	• Lifestyles of mass consumption upheld • Nature is a resource to exploit • AI as the main crisis management tool for dealing with the CC
Governance	• Local decisions, weak international cooperation • Regulation, bans and rationing via quotas	• Shared governance and participative democracy, involving citizens at regional and local levels • Environmental taxation and redistribution	• Minimal regulatory frameworks for private sector actors • State planning • Targeted carbon taxation for companies	• Support for the offering • Significant and targeted international cooperation for some key industries
Regional	• Important role of place-based communities for resources and action • Transfer of services from big cities to small cities and rural zones • Conversion and decentralized establishment of venues • Creation of local production chains • Enriched audience experience, with regional cultural offerings	• Demographic recovery in small cities • Significant cooperation between regions and sectors • Interdependence, pooling and diverse cultural practices • Enriched audience experience, with regional cultural offerings	• Focus on big cities, competing with regions, functional cities • Less events but more planned and organized (big productions) with travel considered for the occasion • Rise in non-declared live performances • Poorer audience experiences in terms of regional cultural offering	• Weak regional dimension, urban sprawl • Significant disparities in audiences' access to concerts and festivals • Audience experiences poorer due to this complete technological takeover
Travel (of artists, audiences, technical teams)	• Significant reduction in travel with more local concerts and pooling resources • Long-term artist residencies or controlled levels of travel • Remote international collaborations or during residencies	• Controlled travel • Optimized touring (train, public transport) • Less buying and transporting materials	• Travel accompanied by the State: working from home, train, biofuels, electric vehicles • Optimized international tours with more train travel	• Significant rise in travel within France and abroad • Travel for wealthy audiences
Cultural policy	• Joint partnerships between communities and civil society to promote local culture • Twinning of events and cultural seasons with other art forms • Interventionist state (financial help, incentives, regulations, attendance limits)	• Increased public intervention in regional cultural policy • More capacity to pressure market actors to implement strict regulations specific to the field of music	• Investments, subventions and tax incentives for projects that include an element of carbon reduction • Cultural policy based on attendance and figures – homogenization of content • Emergence of an organized counterculture	• End of the cultural exception in France • Complete disengagement of the state in financing culture • Conservative and money-making choices • Homogenization of content
Technology (digital, materials)	• Low-tech, reuse and repair • Stable consumption at data centers due to stabilizing flow • Reduction in use of the digital, focus on listening to physical music	• Massive investment (energy efficiency, renewable energy development and infrastructure) • Pooling and developing materials • Streaming continues, eco-streaming, local and optimized servers • Development of alternative/pirate broadcast channels	• Targeting the most competitive technologies for decarbonization • Development of the digital with technical optimization, audiophile format and personalized offers • Return of illegal downloads	• Capturing, stocking or using captured carbon essential • Omnipresent internet of things and artificial intelligence • Significant digitalization of uses (metaverse, VR) • Return of illegal downloads
Professions and status	• Versality on all levels in professions and statuses • Disappearance of specialist professions • Difficulties in maintaining "intermittent" status, becoming and remaining professional becomes a luxury	• Professions and statues upheld • New professions in pooling and developing materials (eco-consultants)	• Growing specialization of professions, difficulties obtaining and maintaining "intermittent du spectacle" status.	• Abandoning of "intermittent" status
Economic models	• Collapse of the music economy partially reduced to amateur practice • Diversifying revenue sources and better spread	• Increased influence of major actors in the sector (major labels, platforms, tech actors and financial backers) and public powers (widespread interventionism)	• Increased influence of major actors (major labels, platforms, promoters and international event organizers) • New actors in streaming and the secondhand market • Precarity for most professionals	• General impoverishing of the sector • Domination of major actors • Differences according to esthetics, reduction in number of artists broadcast, difficulties for new artists to emerge • Explosion of companies providing comprehensive services

Figure 9: Overview of the four prospective scenarios 2050 for the music ecosystem in response to climate and environmental issues

3.2. Scenario 1: "À bicyclette" (Yves Montand) – Frugality

From shock to shift– an accelerated awareness of the deterioration of ecosystems and living conditions

The year 2050 begins with the hope for more peaceful times. The last two decades have been particularly difficult to live through for a large number of our fellow citizens. They were marked by a series of catastrophic events in the south of Europe, which caused unprecedented human and economic losses. The years 2028 to 2033 will remain forever in collective memory. Five years of prolonged drought and an unprecedented lack of rain led to major conflicts in water management, which forced the state to resort to a massive support plan for farmers, prioritizing use to ensure the supply of drinking water for the whole country while only limited aid arrived from neighboring countries. There was a convergence of struggles. Large-scale social and ecological movements were centered around the view of appropriating the resources of the few to benefit a greater number of people, backing the state into a corner and inciting it to act resolutely and more urgently for the rapid transformation of a society facing dwindling resources.

Restraint at the heart of the state's intervention

Traditional democratic institutions play their role and, very quickly, strategies, laws, regulations, and quotas for ecological planning, accompanied by policies of organizing and occupying land on all levels, take effect (updating existing laws, such as Code de l'urbanisme, loi Littoral). The state sets the objectives, but the transition is mainly led by communities who are given new means. The threshold of a +2.7°C rise in temperature across metropolitan France and overseas territories is close to being reached, and all actors in society are striving to put all efforts into attaining carbon neutrality in the short term. Abandoned areas are repopulated and many people left cities to live in rural villages and towns where the urban sprawl is controlled. Promoting the local and sanctifying nature have led to a reduction in the environmental impact and a preference for an economy built on social ties and respect for ecosystems within a context of limiting European and international trade. Quality of life has improved through rewilding developed areas, reducing urban heat islands, a widespread energy efficiency renovation of housing stock, the fall in social inequalities, high quality food based on short supply chains, and the development and promotion of active and less energy intensive ways of travelling.

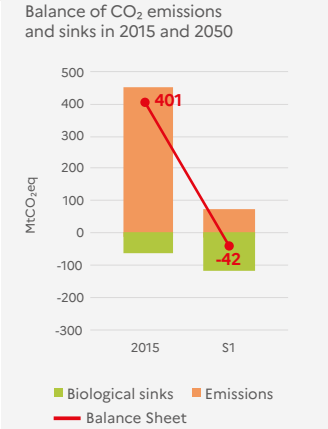


Figure 10: Illustration of carbon issues from the Ademe scenario "Frugal Generation"

A pooling of means

Profound changes have taken place in the ways that people pool needs, live in areas, feed themselves, travel, heat their homes, buy and use equipment. These changes are more in line with the planetary boundaries, favoring restraint and frugality without depending on technologies to collect and store carbon. Natural ecosystems are no longer seen in a utilitarian way, but as forms of life with which we cohabit. We have a certain responsibility towards them: they are a reserve for biodiversity and play a fundamental role in carbon sequestration, regulating temperatures, the water cycle and reducing the impact on natural hazards. Travel is significantly reduced, and half of journeys are now made on foot or by bike while systems of low energy agricultural production are developed by considering questions relating to the environment, health, and animal wellbeing.

The music ecosystem in the age of frugality

The French music ecosystem has little in common with what it was in the 2020s, as it becomes increasingly part of an economy of contact.

The cultural politics of 2050 are responding to the call of the climate emergency through interventionist measures that ensure not only diversity and inclusion, but also the longevity of the musical arts in a framework that respects the environment. Financial aid and incentives are allocated to innovators in the sustainable world: recycling instruments, sets and materials across all genres; production methods with low ecological impact; or creating music education programs for schools and public health facilities to reflect a more egalitarian society. These actions are underpinned by strict environmental standards that affect all aspects of creating and producing music, from manufacturing instruments, producing and distributing recorded music to touring. The new regulations have led to the emergence of a music scene where equity is the norm. Women, individuals from minority groups and artists of all orientations and identities have access to specific funds and support structures that develop their talents and ensure their visibility. Regional music centers are responsible for the balance of sustainable

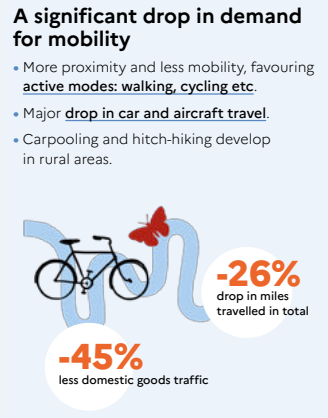


Figure 11: Illustration of social transformation issues in Ademe's scenario "Frugal Generation"

development of different components of the industry by bringing together place-based communities who define the framework for managing restraint and resources. Even if music has no borders, regional differences can still be found in terms of the resources allocated and the cultural offering. Despite a more frugal world and limits on buying power significantly influenced by climate and environmental adaptations, access to music remains a pillar of cultural politics.

In spite of these efforts by public powers, the decrease in material and financial resources available has led to a form of collapse in the music economy partially reduced to amateur practice. Becoming and remaining a professional musician has become a luxury, numerous specialized professions have disappeared, and the surviving professionals now combine several occupations to preserve their status as "intermittents du spectacle" (a state-subsidized regime providing social protections to temporary workers in the entertainment industry between contracts) while respecting the environmental requirements.

A transformation of festival practices

The festivals and concerts that used to consume lots of energy are transformed into gatherings conceived in an environmentally friendly way, with lightweight infrastructure that can be disassembled to minimize the impact on vulnerable land and ecosystems. Smart materials that can insulate against heat have become the norm. Green roofs and walls contribute to a better management of temperatures and rejuvenate biodiversity. Events are powered by 100% renewable energy, and the programing is carefully put together to coincide with favorable weather periods and putting the least strain on biophysical resources, reducing the risk of cancellations and environmental damage. Due to new environmental charters and the explosion of security costs in the last decades, the number of attendees is now limited, and, in a world of less mobility, lotteries are sometimes used for ticket sales. Partnerships are formed with local agricultural producers and the diets of festival goers have become overwhelmingly vegetarian. Forms of twinning between events and cultural seasons have also emerged in places, suggesting a greater intercultural cooperation between music, cinema, theater and other visual arts. Such events have historically been supported by volunteers, yet the changes to live performance have nevertheless led to fewer professional opportunities. In contrast, the festival experience itself is enriched, opening up new audience sociologies.

S1	*Evolution of GHG emissions 2025-2050*	*Volume of GHG emissions avoided ($ktCO_2e$)*	*Main factors*
Fossil fuels	**-95 %**	280	Renewable energy development (90 % mix, i.e. -15 % emissions), electrification = decrease in fossil fuel consumption (-80 %) *(ADEME transition scenarios)*
Electricity	**-20 %**	13	Decrease in consumption (-20 %) *(ADEME transition scenarios)*
Merchandising	**-35 %**	45	Return of physical (+30 % volume), eco-design and biosourced materials (100 % volume, i.e. -50 % emissions) *(workshop hypotheses)*
Catering	**-60 %**	165	Stable volume of sales, vegetarianism (-65 % meat consumption i.e. -45 % emissions), sustainable farming (biofuels) (-25 % emissions) *(work hypotheses and ADEME transition scenarios)*
Travel, Artist	**-80 %**	338	Local concerts (-50 % distance), train/public transport (50% of distances, i.e. -30 % of remaining emissions) *(work hypotheses and ADEME transition scenarios)*
Travel, Audience	**-75 %**	273	Local concerts (-50 % distance), train/public transport (70% of distances, i.e. -50 % of remaining emissions) *(work hypotheses and ADEME transition scenarios)*
Business Travel/ Material Logistics	**-80 %**	262	Local concerts (-50 % distance), train/public transport (50 % of distances, i.e. -30 % of remaining emissions) *(work hypotheses and ADEME transition scenarios)*
Material + Instruments + Purchases	**-70 %**	334	Focus on less electronic instruments, development of repairs industry, biosourced purchases *(workshop hypotheses)*
Services (cloud marketing)	**-80 %**	593	Decrease in listening via streaming (-30 %), sustainable data servers and development of eco-streaming (80 % of listens) (-60 % remaining emissions) *(work hypotheses)*
Use	**-25 %**	130	Decrease in listening via streaming (-30 % listens), increase in listening via physical records (+30 % of emissions of physical use) *(work hypotheses)*
Potential reduction	Approx. 65 % reduction in GHG – compatible with the national reduction effort (approx. 75 %)		

Figure 12: Carbon snapshot of the music ecosystem in this scenario

This scenario demonstrates a significant potential reduction of emissions and is compatible with the national strategy (SNBC) for 2050. Major carbon savings are achieved through a reduction in streaming music alongside the development of sustainable platforms (eco-streaming), a reduction in the volume of materials bought and a reduction in professional practices and travel (reduced distances and minimal use of carbon fuelled transport). This scenario is the most transformative and resilient to resource shortages and climate and environmental issues. Nevertheless, it presents significant economic issues for live performance, composition and parts of music recording due to the fewer professional opportunities in the shrinking music economy and significant investment problems in response to environmental issues in the physical market.

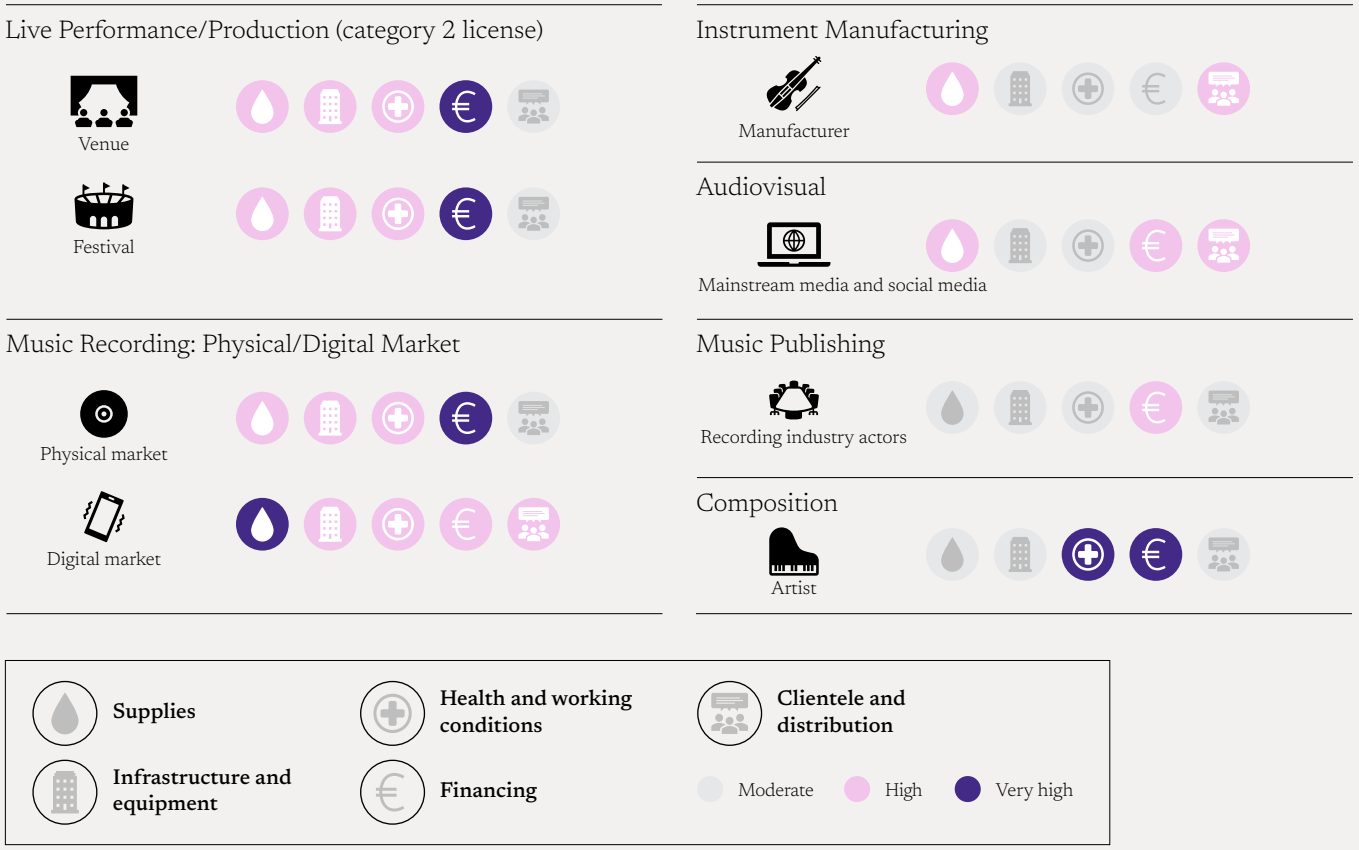


Figure 13: Image of the music ecosystem's resilience in response to climate and environment change in this scenario

Places and artists move and come together

Music venues close to the coasts have had to be moved or protected to resist rising sea levels, with predictions of floods of forty centimeters or more. Concert halls and recording studios are now equipped with independent electricity supply systems and passive cooling solutions in response to more frequent power cuts and temperature increases from May to September. Former live music venues are also being converted or re-established in a decentralized way. Artists take up prolonged residencies in small villages, areas of medium-sized cities or even music cultural institutions (SMAC) which have become truly multi-usage spaces following a change to their remit. Creating local links with audiences has profoundly changed the rhythm of cultural consumption and considerably enriched the cultural experience. These places have responded to the more limited access to some equipment and instruments by offering materials for artists to use. The scarcity of materials has led to a rise in sustainable and local instrument manufacturing. Rare exotic woods have been abandoned in favor of materials that are resistant to the new climate conditions while hiring and the sale of second-hand reconditioned instruments have exploded.

International collaborations are often carried out remotely or during the residencies of foreign artists in France. Artists travel less or use more energy efficient forms of transport. Increasingly, they use sets that are already in place, simpler and adaptable, which they can slightly modify.

Digitalization in the age of frugality

The digitalization of music, inherent to the previous era of consumption, has been reconceptualized to respond to the necessities of energy restraint. Access to recorded music for audiences remains equitable through pricing adapted to income, notably through creating a public streaming platform. Limiting digitalization to reasonable levels and upgrading electronic equipment less frequently mean audiences gather together to listen to music, either in third spaces or in homes, privileging shared experiences. Large cities have been abandoned for medium-sized cities or rural areas where people know each other more.

Actors in the music recording sector have suffered to a greater extent from these changes, leading to industries making huge investments to support the surviving artists following changes to models, reduce energy consumption, limit infrastructure's exposure to climate risks and ensure access to water and energy to cool platform servers.

Limited volumes on production

For the physical market, distributors have reinvented themselves and mainly turned towards lending through music library deposits to reduce the quantity of records produced, thereby encouraging a more conscientious consumption that is less resource intensive. Physical records are increasingly produced on demand. Some chains of production have been able to focus on the local environment, which brings distribution closer to points of sale. Production times remain very variable, and costs are higher due to the sustainable alternatives to traditional materials. For the digital market, with a drop in use, new actors have emerged to propose more sustainable streaming models with different subscriptions according to the quality and quantity of streaming available in response to limits on listening time and hosting content on servers in the local area.

Maïa (45 years, nurse) describes her music practices in this transformed society of 2050:

My daily life is a delicate balance between supporting the health of my patients and my passion for music, which is a big part of who I am and is deeply rooted in the climate reality of our times.
When I cycle to work, I often sing rap music from the 2020s. I was young back then, but I did feel anxious for the future. Today, it is not really obvious, especially at work, but I feel like I have more perspectives.
At the hospital, the fast pace of the corridors contrasts sharply with the melodies coming from patients' rooms where music to reduce stress and support recovery is broadcast. We tested that recently. The music is often created by artists temporarily in residence in the department. They adapt their sound to therapeutic needs. It's quite cool, I think, and there's something for everyone.
After work, I often take part in community music workshops where people of all ages and backgrounds from the commune get together to play. These weekly meetings are held at the local SMAC with instruments hired for the occasion. Sometimes, often even, artists come along. It's a good space to share our love for music, but also to catch up with each other and exchange things. It's crazy how few things I buy nowadays.
At home, I'm always listening to music, but less than before, in fact less alone with my earphones in. But that's really a personal choice. I bought myself a radio. That's quite fun.
On weekends, when the weather isn't great, I spent some time hanging out in music libraries. There is so many people there! But I always discover new artists. Plus, there's information on upcoming concerts, often planned a few days or weeks in advance. I have an annual membership card for the music library. After five or six concerts, it becomes really good value.

3.3. Scenario 2: "Come Together " (The Beatles) – Restraint and efficiency

The decade of cooperation

"The 2050s will be the decade of cooperation: it's now or never", declared the French president in her new year address to the nation. It has been clear since the start of her first mandate in 2042 that the government is striving to carry out her ambitious program for a "social and inclusive, adapted and decarbonized France" and to respond to the social health and environmental crisis that we are witnessing, with the phenomenon of mass migration, the crisis of pollinators and large-scale social movements in agriculture, transport, logistics and the energy sector. These struggles converged some time ago, and, within this difficult context, citizens, non-profits, NGOs, public institutions and social enterprises are mobilized and organized at all regional levels to contribute to a progressive transformation under the banner of democratic renewal. France adopted a new approach of shared governance to fight against climate change and resource shortages by maximizing local cooperation and involving citizens on a regional and inter-community level. The link between the state and communities is strengthen. This governance model has led to new regional strategies that allow for multi-level governance and take into account local specificities.

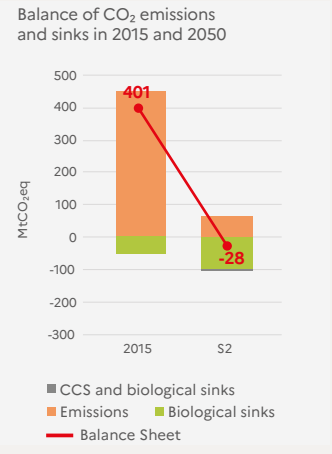


Figure 14: Illustration of carbon issues from the Ademe scenario "Regional Cooperation"

Ecological innovation as social organizer

With the systematic integration of ecosystemic services in urban development, ecological innovation has become central. The intrinsic value of nature is legally recognized with concepts such as ecocide and the rights of nature emerging from decades of environmental education and civic services promoting ecosystems. National investments are focused on adapting to and easing climate change, while regions adjust the policies to their specific contexts and issues (energy efficiency renovation of buildings, circular economy, pooling of equipment for industrial production and low carbon industrial policy, sustainable transport and reducing distances, changing diets).

The consumption of goods is more measured and responsible. The general public is increasingly involved in the gradual transition towards more restrained lifestyles that serve the community, without the effects on society being too harsh.

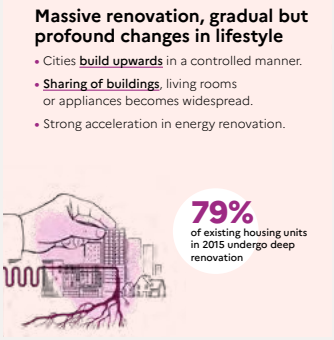


Figure 15: Illustration of social changes in the Ademe scenario "Regional Cooperation"

The search for balance

At the heart of cultural policy, a new model is prospering that involves citizens in decision-making. Regional cultural bodies, made up of elected members, experts, and citizens, are essential for ensuring equitable and adapted initiatives linked to culture. The state, the safeguard of cultural and creative freedoms, offers regions national directives and financial support while the regions implement policies adapted to the diversity of cultural expression, the climate emergency and social inclusion.

The whole ecosystem is compatible with this progressive transition that guarantees access to culture for all and ensures existing professions remain viable with some adjustments. The number of music producers contracts and becomes concentrated around long-standing producers (major and large independent labels). At a significant investment cost, these actors are propped up while being even more directed by the national cultural authorities, which pressure them to reinvent their production and distribution to establish themselves within regional dynamics. Measures aiming to ensure a fairer remuneration of artists and to support emerging artists and less dominant music styles are also implemented.

S2	*Evolution of GHG emissions 2025-2050*	*Volume of GHG emissions avoided ($ktCO_2e$)*	*Main factors*
Fossil fuels	**-95 %**	280	Renewable energy development (90 % mix, i.e. -15 % emissions), electrification = decrease in fossil fuel consumption (-80 %) *(ADEME transition scenarios)*
Electricity	**-10 %**	6	Decrease in consumption (-10 %) *(ADEME transition scenarios)*
Merchandising	**-55 %**	70	Development of personalization (+15 % volume), eco-design and biosourced materials (100% volume, i.e. -60 % emissions) *(workshop hypotheses)*
Catering	**-55 %**	151	Stable volume of sales, vegetarianism (-50 % meat consumption, i.e. -40 % emissions), sustainable farming (biofuels) (-25 % emissions) *(work hypotheses and ADEME transition scenarios)*
Travel, Artist	**-50 %**	211	Local concerts (-30 % distance), train/public transport (50 % des distances, i.e. -30 % of remaining emissions) *(work hypotheses and ADEME transition scenarios)*
Travel, Audience	**-50 %**	182	Local concerts (-30 % distance), train/public transport (60 % des distances, i.e. -30 % of remaining emissions) *(work hypotheses and ADEME transition scenarios)*
Business Travel/ Material Logistics	**-50 %**	164	Local concerts (-30 % distance), train/public transport (50 % des distances, i.e. -30 % of remaining emissions) *(work hypotheses and ADEME transition scenarios)*
Material + Instruments + Purchases	**-60 %**	286	Focus on less electronic instruments, development of repairs/material hiring industry, biosourced purchases *(workshop hypotheses)*
Services (cloud marketing)	**-55 %**	407	Decrease in listening via streaming (-15 %), sustainable data servers and development of eco-streaming (50 % of listens) (-50 % of remaining emissions) *(work hypotheses)*
Use	**-25 %**	130	Decrease in listening via streaming (-15 % listening), improved efficiency of listening devices (-10 % consumption) *(work hypotheses)*
Potential reduction	Approx. 50 % reduction in GHG – necessitates compensating for approx. 25 % of current emissions by reductions in other industries		

Figure 16: Carbon snapshot of the music de ecosystem in this scenario

This scenario presents a potentially significant reduction in emissions, but it is insufficient to follow the national strategy. The equivalent of 25% of current emissions would have to be offset by other industries. The most substantial carbon savings are again linked to reductions in streaming music alongside the development of sustainable platforms (eco-streaming) and travel (reduced distances and minimal use of carbon fuelled transport), followed by reducing use of fossil fuel energy.

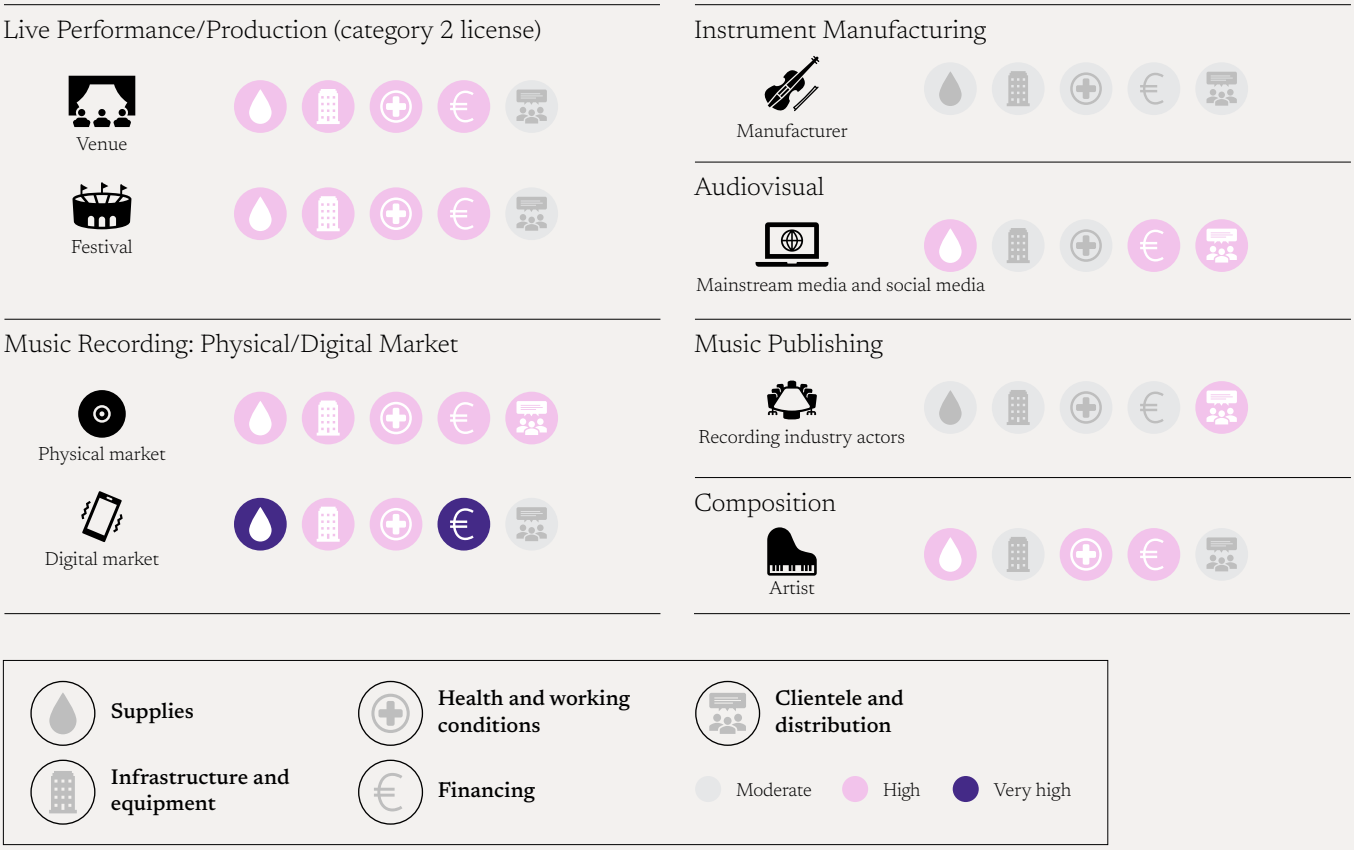


Figure 17: Image of the music ecosystem's resilience in response to climate and environment changes in this scenario

This scenario represents a substantial transition that achieves significant results in terms of resilience against resource shortages and climate and environmental issues. It avoids a significant contraction in the music economy. Serious pressures on music recording remain in terms of the supply of the biophysical resources (water) and minerals that infrastructure and digitalization equipment rely on.

Moderate listening practices

Whilst live performance is still favored, the digital consumption of music continues, with more responsible streaming practices since the RDM (responsible digital music) law passed, reducing the carbon footprint of data through limits on playlists, an optimization and regionalized localization of platform servers and guidance on listening to recorded music. Alternative pirate or free broadcast channels are developed. The production of video content is reduced.

The raw materials required for instruments and set equipment are more scarce, leading to the emergence of new professions focusing on pooling and promoting materials where reuse and recycle become the key words. Networks of craftspeople in instrument manufacturing firmly established in their local areas have benefitted from these policies and have developed while integrating digital technology for better traceability and optimized distribution.

Organizing performing arts within a network

Regions in France developed interregional networks dedicated to the programing, production and promotion of the performing arts. These networks allow for the sharing of resources, co-production of performances and creation of national touring circuits, which optimize the travel itineraries of companies and artists to minimize the environmental impact while also ensuring an extended and balanced circulation of culture. Regions collaborate on a shared cultural calendar to coordinate different music events: festivals, concerts, artist residencies. It also means an end to the overwhelming centralism of Paris combined with a decentralized conversion of former venues, recording studios and head offices of the main music businesses previously based in the Paris region into shared public spaces. This ensures a year-round cultural offering, reduces programming conflicts and improves the visibility of events at a national level. Interregional cultural passes or offers encourage audiences to travel between different regions. These passes offer reduced prices and special advantages for attending different cultural events, thereby supporting local and regional scenes.

The venues and sites of sustained use that host some urban festivals are transformed into multipurpose cultural centers, hosting educational workshops, urban farms, coworking spaces, citizen participation forums, and zones for relaxing with urban gardens. Festivals are integrated into the green fabric of cities, strengthening links with nature and local initiatives in favor of biodiversity. Music events adopt a new seasonal planning to ensure their longevity in response to climate change. Dynamic interactions between the cultural and other sectors multiply: regions and event organizers collaborate closely with transport companies to facilitate access to performances. Offers for combined ticket sales (concert+transport) are proposed to encourage the use of public transport. Train, bus and tram times are adjusted to reflect the start and finish times of events, responding to the needs of spectators.

Festival and concert venues join forces with green energy suppliers to maximize the use of renewable energy (solar, wind, geothermal) to power events, while collaborations with municipalities are stronger. Infrastructure, such as street lighting systems, the construction of green spaces and parking facilities are adapted to support cultural events. Joint efforts are made so that the practical aspects, such as security, health and information, are managed in an efficient and environmentally friendly way.

The cultural experience of music is considerably enriched for audiences.

Maïa (45 years, nurse) describes her music practices in 2050's society of cooperation:

With around 20 years' experience as a nurse and being passionate about music. I can say that we are living in a pivotal era where cooperation and mutual assistance have become the essential drivers of our society. I would never have thought it a few years ago. I feel a lot more valued in my work.

On the tram to work, being in close proximity to other passengers is not always pleasant, so, to block out the world, I listen to some music on Ecosound, a platform that hosts lots of clips, podcasts and live recordings. It also keeps me up to date with events for artists I follow. It's been around for a couple of years now and they are quite serious about their carbon impact via eco-streaming and reducing data consumption.

Tomorrow, I'm off, so I'm going to take the opportunity to go to a citizen participation forum on public health in a place I love. It's a former Parisian concert hall that was converted into a space for democracy and culture in the 2030s. The venue is quite beautiful and there is an outdoor meeting space in the shaded gardens.

Last weekend, I used my culture pass to see a world music concert organized by an artistic collective from the wider region. Since I no longer have a car, the combined concert+transport tickets are such a great idea, especially as those who live in the region benefit from quite cheap prices, though it does mean organizing your day around the times of public transport.

3.4. Scenario 3: "Computer Love " (Kraftwerk) – Polarization and efficiency

A society of green technologies

For twenty years, after having missed the target of reducing greenhouse emissions by 55% by 2030, France engaged in an accelerated trajectory of ecological transition. Believing technological progress was the way to reach the objective of carbon neutrality in 2050 brought about huge investment in certain sectors where technologies were expected to revolutionize energy.

Political decision-makers, pressured by growing demands from citizens to take action on the climate and increasingly alarming global catastrophes, implemented ambitious strategies of decarbonization, modernizing infrastructure and investing in the research and development of clean technologies.

Partnerships between the public and private sectors and strengthened international engagements have led to the financing of ecological engineering and deploying its solutions to conserve biodiversity.

Figure 18: Illustration of the societal transition from Ademe's scenario "Green Technologies".

Green technologies have evolved to respond to climate challenges, though their progress has not always followed the pace required for the ecological emergency. The progressive move away from fossil fuels has left in its place an increased need for compensating technologies, such as the capture and storage of CO2 to reduce residual emissions. These technologies are not only rolled out to reduce the damage of the past, but also to adapt to future climate variations with an emphasis on long-term solutions that integrate resilience and sustainability into national infrastructure and the urban fabric. However, the transition was carried out slower than expected and social tensions remain over how to reconcile economic prosperity and environmental sustainability.

The government adapted its regulatory and fiscal frameworks to encourage innovation and the roll out of these new technologies, concentrating them firstly in densely populated urban areas where they could quickly reach critical mass. At the same time, the state promoted ecosystemic services, introducing market mechanisms to protect nature by quantifying their benefits and attributing them an economic value. Confronted with extreme weather phenomenon and the need to respond to the shortage of natural resources, organization of the national territory was also adapted. Cities and region strengthened their infrastructures to protect against flooding, with the creation of natural buffer zones and the implementation of innovative systems to manage rainwater. Agriculture has been transformed by selecting drought-resistant varieties and favoring efficient irrigation practices that maximize water resources. State-of-the-art weather and climate forecast systems now guide agricultural decisions, while cities integrate green spaces, roofs and walls, which contribute to managing microclimates and increase urban biodiversity.

This approach is mainly led at a national scale, with ecological transition strategies that progress slowly and are often still out of step with non-uniform global practices.

Increasingly specialized professions in the music ecosystem

The French music ecosystem of 2050 reflects the profound transformations brought about by accelerated ecological transition and technological progress. In this ecosystem, cultural policies have played a key role by committing massive investments to support actors and organizations that incorporate green technologies and sustainable practices in their economic and operational models. Subventions and financial incentives are now geared toward projects that include an element of reducing the carbon footprint of the presented project (productions, touring, cultural infrastructures or even data centers). As in other sectors, the introduction of carbon quotas for businesses has led to a greater level of reporting and tracking the emissions that their activities generate.

Since they are able to embrace these new realities, the major actors have shored up their position (major studios, platforms, those who promote and organize events on an international scale), and they are the public power's preferred partners for organizing musical life. In contrast, many professionals in the sector are confronted with a reduction in the overall number of events, professions are becoming more specialized and the criteria for accessing funding are becoming more complex. Obtaining and maintaining the status of "intermittent du spectacle" has become a major challenge despite the possibilities and help offered by artificial intelligence to navigate the administrative labyrinth.

The gap is growing wider between the audiences. Smaller numbers are able to enjoy big live productions, which promotes the most listened to and most financially viable styles, and buy records and other cultural goods. Others, constrained by their limited buying power and the decrease in subventions, turn toward streaming and illegal downloads and toward a vibrant counterculture, offering more understated and low-tech alternatives and defying the growing elitism of attendees at cultural events.

Managing large shows

Live shows must navigate a complex environment between under-pressure economic models, responding to ecological issues and supply problems for certain materials. The seasonal nature of festivals has changed, and events are now planned to minimize the risk of climate phenomenon having an impact, with considerations of safety, health and logistics to manage travel for artists, teams and audiences, notably outside of the Paris region, which remains overwhelmingly central to cultural life. Cities are optimized and expanding. Concert venues, arenas and theaters are now found in the very heart of cities, benefitting from a symbiotic economy and smart automation, regulating the functioning of buildings (water and energy consumption, reacting to extreme temperatures) and the city's systems of flows (giant water misters, automatic management of district cooling and waste network). Confronted with the difficulties of surviving in a highly competitive sector and running counter to mainstream trends and dominant cultural policies, events, sometimes undeclared, spring up in ephemeral and multi-usage spaces on the edges of cities, drawing on an alternative economy of short supply chains and pooling, models of voluntary contribution and membership, and reusing sets and materials.

S3	*Evolution of GHG emissions 2025-2050*	*Volume of GHG emissions avoided ($ktCO_2e$)*	*Main factors*
Fossil fuels	**-90 %**	265	Renewable energy development (85 % mix, i.e. -12 % emissions), electrification = decrease in fossil fuel consumption (-80 %) *(ADEME transition scenarios)*
Electricity	**+15 %**	None (+10)	Increased consumption (+25 %), less intense carbon electricity (-10 %) *(ADEME transition scenarios)*
Merchandising	**-30 %**	38	Moderate development of personalization (equivalent volumes), eco-design and biosourced materials (100 % volume, i.e. -70 % emissions) *(workshop hypotheses)*
Catering	**-50 %**	138	Lower volumes (-15 %) + flexitarianism (-30 % meat consumption, i.e. -35 % emissions), sustainable farming (biofuels) (-25 % emissions) *(work hypotheses and ADEME transition scenarios)*
Travel, Artist	**-35 %**	169	Equivalent distances, train/public transport (30 % of distances) aviation biofuel (30 %, i.e. -35 % of remaining emissions) *(work hypotheses and ADEME transition scenarios)*
Travel, Audience	**-40 %**	128	Equivalent distances to 2025, train/public transport and aviation biofuel (30 %) (40 % of distances, i.e. -40 % of emissions) *(work hypotheses and ADEME transition scenarios)*
Business Travel/ Material Logistics	**-35 %**	98	Equivalent distances, train/public transport (30 % of distances) aviation biofuel (30 %), i.e. -35 % of remaining emissions) *(work hypotheses and ADEME transition scenarios)*
Material + Instruments + Purchases	**-20 %**	167	Development of electronic instruments, volume of instrument purchases stable, biosourced purchases *(workshop hypotheses)*
Services (cloud marketing)	**-10 %**	74	Increase in listening via streaming (+15 %), development audiophile format (+ large storage space), sustainable data servers and development of eco-streaming (30 % of listens) (-20 % of remaining emissions) *(work hypotheses)*
Use	**-20 %**	104	Increase in listening (+15 % listening), improved efficiency of listening devices (-30 % consumption) *(work hypotheses)*
Potential reduction	Approx. 30 % reduction in GHG – necessitates compensating for approx. 45 % of current emissions by reductions in other industries		

Figure 20: Carbon snapshot of the music ecosystem in this scenario

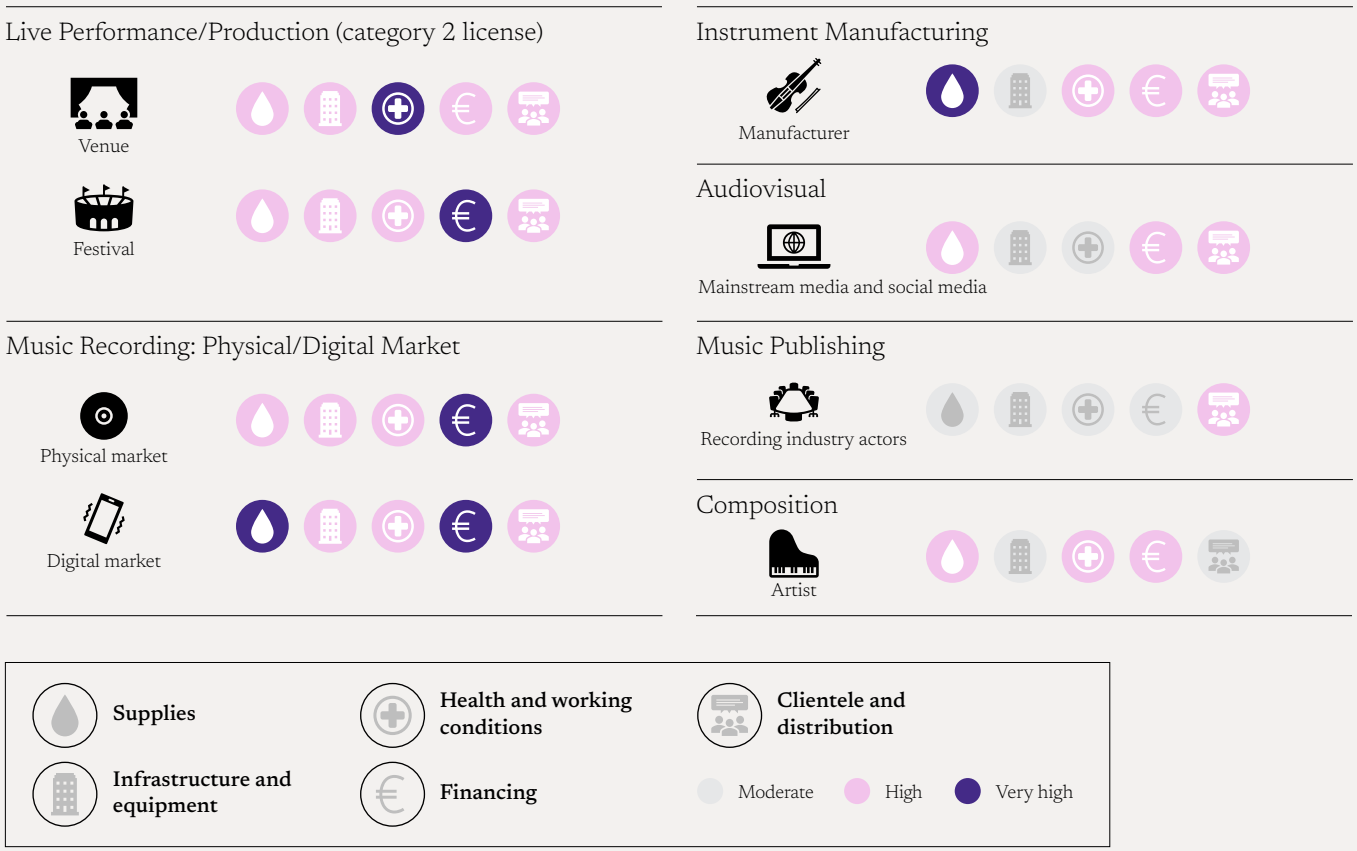


Figure 21: Image of the resilience of the musical ecosystem against climate and environmental changes

This scenario involves firmly believing in technological progress and its capacity to respond to resource shortages and climate and environmental issues. It presents significant financial issues for live performance with higher insurance and security costs and significant health and safety issues for audiences at non-declared countercultural events. There are also significant risks for music recording and instrument manufacturing (supplies, financial viability) in a scenario where the digitalisation of music production and consumption remains high.

More efficient yet expensive listening practices

Music streaming has significantly expanded and remains the preferred mode of music consumption in everyday life. After having shown some signs of being constrained by the mass of data, actors in the industry had to adapt by diversifying their income sources and reducing their carbon footprint and their consumption of water and energy resources by optimizing data centers and offering lower fidelity audio formats. Paid offers have overwhelmingly become the norm while the listening catalogue has been reduced (removal of titles with less than 100 listens per month). Using advanced artificial intelligence, highly personalized experiences are offered, comprising music recommendations based not only on the user's tastes, but also their mood, what they are doing and even their ethical and ecological values.

Platforms integrate new forms of multimedia content, such as video clips, artist interviews and interactive content, enriching the listening experience and creating a more immersive environment. At the same time, alternative platforms have emerged to serve the countercultural segment of the market, offering music that is accessible through micro-transactions or payment models for listening to tracks from independent labels or artists that are not found on the big streaming platforms. These services often promote diversity, inclusion, and support emerging artists. Illegal downloads are also making a comeback.

Searching for materials

The physical music market has felt the full impact of climate change, with economic losses linked to supply problems and conditions of production and logistics being disrupted by the increasing regularity of extreme climate phenomenon. The manufacture and distribution of physical products have become more costly and complicated with carbon quotas, leading to a redefinition of the production chain toward closer proximity, greater sustainability and niche markets. Physical formats are produced using sustainable and ecological materials such as bioplastics or recycled materials and are now sold as experiences in and of themselves. Personalized and extendible, they offer direct access to exclusive content by artists.

Professions within instrument manufacturing have also undergone profound transformations. Despite many actors embracing technology, having historical roots in a local area has benefitted craftspeople who were able to reinvent themselves by positioning their business at the top end of the market for new instruments and within a functionality economy. In the workshops, traditional woods are found alongside eco-designed composite materials, producing acoustic novelties. Exchange networks and second-hand markets have also developed with specialized services for refurbishing and personalizing used instruments, responding to the demands of professional artists and amateurs.

Music in 2050 reflects the different facets of a society that is adapting to ecological challenges and disparate economic realities in a complex and uncertain landscape. The evolution of the music ecosystem sweeps aside an ultra-technological specter reserved for a minority in favor of a vibrant and accessible counterculture, which attests to resilience and human inventiveness in the face of material restrictions and ecological demands.

Maïa (45 years, nurse) describes her music practices in this society of 2050:

I have quite a split view on my own cultural and music practices. On one hand, I have always fought for a true ecological transition since I was a teenager, and we've done it! That's undeniable. On the other, I'm disappointed that the issue of social justice hasn't fully been addressed. You can see this in access to music, for example. I have always been a music lover and play bass with a group of friends on some afternoons. Before we could afford new instruments and materials, but now that's become too difficult. Prices have shot up. We've had to start buying secondhand, but it works well.

Now and then, I take part in open jam sessions in third spaces or urban wastelands. There are quite a lot of events happening there, which operate through membership or voluntary contributions.

Sometimes, I travel across France by train to go to festivals or concerts, but it has become less accessible. It's a shame as, with new technologies, some shows have become quite incredible.

Everything now is so connected, but sometimes, it's a bit oppressive. For example, I've deleted quite a few streaming apps as I felt like they knew everything about me and I was less surprised by new tracks and styles of music that were only a little different from those I normally listen to. My friends have quite eclectic tastes, so I let them advise me on things and then I buy tracks though microtransations to avoid paying for a subscription.

3.5. Scenario 4: "Harder Better Faster Stronger " (Daft Punk) – Domination

Consumer society and restoration gamble

Society remains firmly committed to a model of mass consumption. The repeated appeals for moderation from scientists, NGOs, young people and citizens over the last century have failed to contain the incessant flow of world-wide production. The world of 2050 has taken a path where innovation and technology are the pillars of crisis reduction and management in response to climate change while the harm that results from it (loss of human life, health crises, impoverished biodiversity, lack of water, forced displacement) is seen as inevitable collateral damage.

Worldwide economic growth continues to accelerate, notably thanks to the emergence of a global middle class and the unabated progress of the digital revolution. Rather than reviewing the foundations of this economic model, French society, like that of all rich countries with successive conservative governments, has opted for targeted technological responses (e.g. significant investment in capturing CO_2), producing new unresolved geopolitical issues by increasing financial resources.

Policies relating to food security, health and massive investments to ensure the supply of strategic resources are now orchestrated by national governments within a context of advanced globalization. Infrastructure is protected by strategic reserves and smart homes have become a shared reality, with autonomous systems that use artificial intelligence to regulate buildings. Ecosystemic services, in decline due to overexploitation and deteriorating environments, are progressively replaced by technology-centered innovations. Nature is "repaired" or augmented by technological advances, such as synthetic biology and artificial organisms that carry out vital functions like pollination.

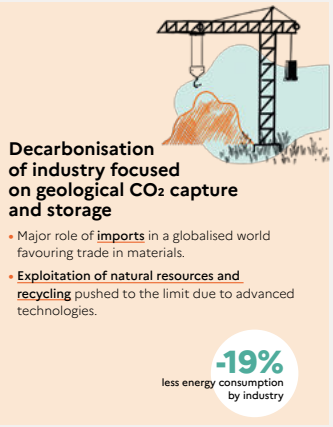


Figure 22: Illustration of the transition issues in the Ademe scenario "Restoration Gamble"

AI as the main crisis management tool in response to climate change

Cities are becoming denser and more modernized in the constant search for a greater level of comfort and security for their inhabitants. Equipped with AI for urban management, its infrastructure can carry out analyses and react dynamically to the challenges posed by the climate. Construction and urban planning techniques are adapted to protect populations at risk of increasing environmental threats, such as extreme heat and flooding.

Despite advanced surveillance and climate modelling, the uncertainty of extreme events has stimulated a market for individual protections. Citizens have their own technological devices to combat the personal consequences of climate change.

To prepare for and react to climate crises, strict preventative measures are in place: buffer zones and the creation of ecosystems, strengthening coastal defenses, reusing treated water, energy efficient desalinization of sea water. Civil defense is strengthened through significant investment, and regular exercises are undertaken to keep populations vigilant. Post-crisis management also benefits from the power of AI to evaluate and quickly rebuilt, making use of learning from previous crises to constantly improve the response to climate events.

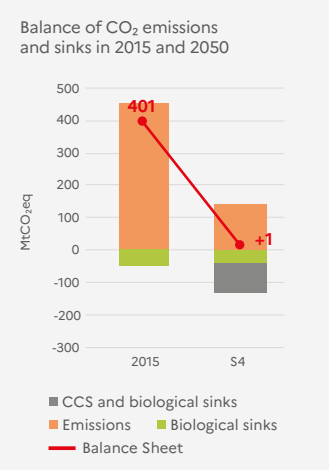


Figure 23: Illustration of carbon issues in the Ademe scenario "Restoration Gamble"

Nevertheless, the choice to not fundamentally change lifestyles has led to increasing dependence on technologies, further pressures on the resources that they require and a rise of social and place-based inequalities. Even with goals such as reducing greenhouse gas emissions and carbon neutrality by 2050, the concessions made to ecologists are viewed as insufficient and coming too late to mitigate financial and environmental costs. The break with past trends is incomplete and despite the hope placed in human ingenuity and global governance, the future suggests that significant challenges will persist.

The end of cultural exception

Mirroring society, the French music ecosystem is in a bad state with the convergence of health and security crises and the radical turn towards digitalization. Having to deal with multiple crises, the state, formerly a vehicle for cultural exception, intervenes less after having changed its political priorities and redirected its attention and resources toward areas deemed more urgent. The frameworks for financing culture are restructured in favor of a more commercial approach that is centered on the private sector pursuing money-making aims rather than cultural ones, which leads to conservative or profitable choices to the detriment of more daring or avant-garde artistic creations.

The weakened French cultural exception has given way to a homogenized cultural landscape, dominated by major actors and the world of celebrity, which amplifies the overall impoverishing of the sector. Based on the model of K-Pop agencies, the number of organizations that cover management, production of shows, and record publishing and production has exploded, eclipsing small production companies and independent artists who have difficulty emerging on the music scene. This transformation of the sector has also reconfigured its professions, ending the status of "intermittent du spectacle". In this major shake-up of the cultural sector, many music professionals fell into precarity, unable to make a living from their work or taking on several different roles. This reform has led to profound repercussions for cultural diversity, the accessibility of culture for audiences and the influence of culture.

Music as a marker of status

Regional inequalities, accentuated by climate change, have changed the link between music and place. Art has become a marker of status, confined to the wealthy with the means to get around. This disparity is more sharply observed for access to concerts and festivals where the presence of high earners contrasts with the growing exclusion of the less well off. To limit financial risks as much as possible, large productions with high capacities are now organized in regions that are the most spared from climate variations or in sheltered or secure places, involving increasingly longer travel distances for artists and audiences. Ticket prices for these events have risen significantly to cover insurance risks and costs linked to carbon offsetting obligations. To make this content available to less wealthy audiences, immersive virtual reality experiences are also offered. Part of the old music infrastructure of the 2020s has been converted.

S4	*Evolution of GHG emissions 2025-2050*	*Volume of GHG emissions avoided ($ktCO_2e$)*	*Main factors*
Fossil fuels	**-80 %**	236	Renewable energy development (70 % mix, i.e. -15 % emissions), electrification = decrease in fossil fuel consumption (-65 %) *(ADEME transition scenarios)*
Electricity	**+65 %**	None (+42)	Electricity efficiency (less intense carbon electricity) (-10 %) and increased consumption (+75 %) *(ADEME transition scenarios)*
Merchandising	**-30 %**	38	Moderate development of personalization (equivalent volumes), eco-design and biosourced materials (100 % volume, i.e. -70 % emissions) *(workshop hypotheses)*
Catering	**-55 %**	151	Lower volumes, fewer in-person events (-30 %) + flexitarianism(-30 % meat consumption, i.e. -35% emissions), sustainable farming (biofuels) (-25 % emissions) *(work hypotheses and ADEME transition scenarios)*
Travel, Artist	**-20 %**	84	Focus on large gatherings (+20 % distance), train/public transport (20 % of distances) + aviation biofuel (50 %, i.e. -30 % of remaining emissions) *(work hypotheses and ADEME transition scenarios)*
Travel, Audience	**-10 %**	73	Increase in distances (indicative rise per relevant spectator)(+30 % distance), train/public transport and aviation biofuel (50 %) (20 % of distances, i.e. -30 % des emissions) *(work hypotheses and ADEME transition scenarios)*
Business Travel/ Material Logistics	**-20 %**	33	Focus on large gatherings (+20 % distance, train/public transport (20 % of distances) + aviation biofuel (50 %), i.e. -30 % of remaining emissions) *(work hypotheses and ADEME transition scenarios)*
Material + Instruments + Purchases	**-20 %**	95	Development of electronic instruments, volume of instrument purchases stable, biosourced purchases *(workshop hypotheses)*
Services (cloud marketing)	**+15 %**	None (+111)	Increase in listening via streaming (+30 %), development audiophile format (+ large storage space), sustainable data servers and development of eco-streaming (15 % of listens) (-10 % of remaining stable emissions) *(work hypotheses)*
Use	**0 %**	0	Increase in listening (+30 % listening), improved efficiency of listening devices (-30 % consumption) *(work hypotheses)*
Compensation effort (sinks and other industries)	Approx. 15 % reduction in GHG – necessitates compensating for approx. 60 % of current emissions by reductions in other industries		

Figure 24: Carbon snapshot of the music ecosystem in this scenario

This scenario presents a potential reduction in emissions that is largely insufficient to follow the trajectory of the national strategy, and the equivalent of 60% of current emissions will need to be compensated for by other industries. The most significant carbon savings are mainly linked to reducing fossil fuels, followed by catering (changing diets). The other categories show less significant reductions and even some potential increases (particularly those linked to streaming with the development of more data-heavy formats despite growing energy efficiency in data centers).

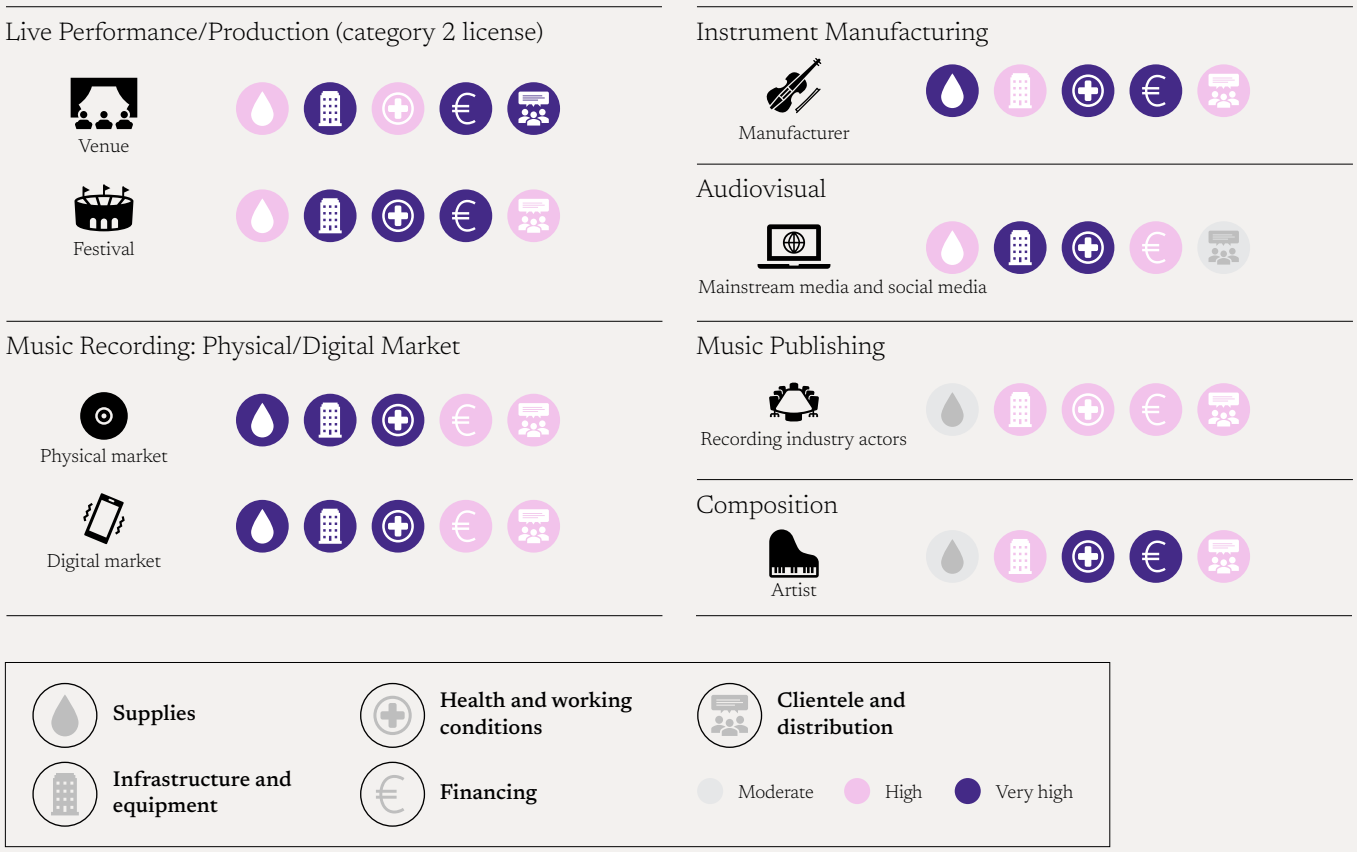


Figure 25: Image of the resilience of the music ecosystem in response to climate and environmental changes

This scenario involves a technological gamble to manage the climate crisis and confront the shortage of resources without transitioning and adapting the music economy. It presents medium to high risks on all levels of the value chains and for the music industry as a whole.

Live performance professionals forced to adapt

Faced with severe economic conditions, some live performance professionals and their colleagues create large collectives to share costs and resources. Economies of scale are formed by pooling technical equipment, coproducing shows and sharing performance spaces in order to reach more local audiences and markets. Some collectives even adopt an itinerant model to reach a wider audience by travelling to isolated communities or those affected by climate instability outside of big metropolitan areas, often with little equipment and simple sets adapted to different environments.

Craftspeople in instrument manufacturing have been severely impacted by the digitalization of music composition, the scarcity of raw materials and the transformation of music teaching. What remains of instrument manufacturing is focused on a niche segment: the “haute couture” of instruments. Acoustic instruments are increasingly considered as collectors’ items or luxuries, with sales reserved for an economic elite and high-level musicians. Preservation movements have emerged to attempt to save threatened forms of knowledge and skills and to support local collectives, but their influence remains limited.

High-definition streaming reigns supreme

Music streaming has been established as the dominant norm of music consumption, mainly because of its convenience and accessibility. Highly sophisticated artificial intelligence algorithms offer an unprecedented level of personalization by analyzing the habits and preferences of users to recommend and create made-to-measure playlists, offering them an unrivalled listening experience. This hyper-personalization allows streaming services to engage listeners in a more efficient way while maximizing the time users spend on their platforms (augmented reality, metaverse). With the consolidation of the market, it is increasingly difficult for emerging or independent artists to gain a place on streaming platforms, unless they are signed to record labels with comprehensive services. A handful of artists therefore dominate public attention and streaming revenue. To respond to climate issues, tech companies have invested heavily in shoring up their water, energy and metal resources to power data centers, and they finance technologies to capture carbon locally.

Although illegal downloads persist, platforms continue to fight against this practice through a combination of legal measures, consumer education and advanced surveillance technologies. They are constantly innovating to offer access modes that turn users away from pirating.

Faced with rising costs due to financing carbon capture, pressures on supplies and investments in synthetic bio-sourced materials from labs, record production has noticeably declined to focus on niche markets. Ownership of physical records serves as an indicator of social status for a privileged clientele who seek exclusive high-quality products. With some audiences moving away from technology and feeling nostalgic for the past, the second-hand market has become more important as consumers and collectors search for old records.

Within a French music ecosystem marked by elitism and crises, music in 2050 is dominated by digital streaming and prestigious physical formats, while a precarious music counterculture is fighting for its existence on the fringes of the established commercial system.

Maïa (45 years, nurse) describes her music practices in this society of 2050:

As a nurse in a large city in France, everyday life is quite taxing, between spending long hours at the hospital and balancing family life. Music has always been a refuge, a way to relax after a trying day.

In the past, I used to go to live concerts regularly, but things have changed a lot. With the end of the "intermittent" status and the extortionate cost of tickets, these experiences are pretty much inaccessible for me. I now make do with automatically generated playlists on my streaming app and sometimes I enjoy watching live concerts in virtual reality. It's affordable but it sadly lacks the soul and human connections of being there in person. Sometimes when I'm on the lookout, I discover local groups and independent artists who play in bars or small community spaces. It is there, in these small pockets of counterculture that I find authenticity and a sense of shared experience. But these artists are few and far between. They're often overwhelmed with multiple different jobs because of financial precarity.

As for records, they've been relegated to souvenirs of the past. I've kept my old collection of vinyl, but I can no longer allow myself to buy any new ones. They've become quite difficult to find. My son has only ever known his augmented and automatically generated playlist. For him, music is background noise coming from his smartphone or a hobby in the metaverse.

I feel torn. I enjoy the comforts of current music technology, but I'm also nostalgic for a time when music was more tangible, more personal. It's a different world now and we need to adapt, but I can't stop myself from thinking about what we've lost along the way.

4. Key issues for addressing climate and environmental problems in the future

These scenarios are tools that structure an exploration of the future and offer the possibility of imagining different visions of that future. They clarify the possible options and the consequences of some transformations in progress.

The scenarios created within this exercise do not represent different paths of evolution or transformation that are favored for the music ecosystem. Instead, they suggest how the industry could implement a given change in the future in line with different combinations of influencing factors. They thus offer the possibility to reflect on elements that will be important to integrate into a long-term vision of the ecosystem and contribute to identifying the questions that policy should address. In this context, several important questions and common issues emerging from this work can be formulated:

4.1. Transforming the music ecosystem and its economic models

4.1.1. The need to understand, track and evaluate public action in a music industry facing climate and environmental changes

This study evidences the need for the music ecosystem to deepen and strengthen its understanding of how it contributes to climate and environmental issues and of the consequences of the climate that it must deal with. In terms of its carbon footprint, the industry lacks reference points, so it must carry out more exercises that evaluate its main levers of decarbonization. The REC (Réduisons l'empreinte carbone de la musique enregistrée) and Déclic[25] studies are good examples of this type of work being pursued in other areas of the music industry. In terms of the industry's contribution to environmental problems, issues relating to organizing and planning live performance events (especially outdoors) should be considered in more depth.

From the perspective of physical risks, the qualitative and quantitative data produced and collected, whether on a national or European scale, is currently very fragmented or inexistant. Over time, it will be important to more accurately evaluate the exposure to future climate hazards for some key sites (SMAC, festivals, data centers, studios, key logistics centers) and the inherent vulnerability of these sites and the people that frequent them (gender, age and profile of audiences, conditions experienced at festivals, security measures and procedures in place). This information would allow for an analysis of the locations of current music infrastructure and their level of preparation for climate hazards and provide the structuring elements to make concerted decisions about the organization of culture at a regional level.

On the ground today...

On the ground, the risk is more accurately characterized and understood, especially in an increasing variety of sectors. The regional environmental agency in Nouvelle-Aquitaine (Agence régionale d'évaluation environnement et climat) evaluates the climate risk for cultural heritage. While this mission aims to preserve landscapes, it also includes the preservation of the built environment in its objectives, and that may apply to certain places used for music practices.

25. See https://declic-musiques.org/.

4.1.2. The need to reduce the vulnerability of music infrastructure and audiences to the climate shocks of today and the future

Confronted with increasingly extreme climate risks, it is apt to measure the economic, health and social repercussions that these issues pose, in particular for live performances, and their complexity (is the event adapted and sustainable? What crisis management procedures are there in the case of climate phenomenon that are difficult to predict?). The current centrality of Paris in terms of venues, recording studios, data centers and head offices of the main businesses in the music industry involves a high concentration of risks in the Paris region that need to be considered.

Beyond understanding these issues and how they can be shared among the biggest number possible, the music ecosystem must question how the efforts to adapt, transform or discontinue some music events and dismantle existing infrastructure should be identified, democratically decided upon and shared between all the actors in the industry (public powers, businesses, audiences, non-profits, trade unions). There is also the question of how complex adapting the industry will be and how much actors will agree to spend if faced with a block on investment that it could involve. Such an undertaking will need to engage all actors and profoundly question current models in the context of a potential reduction in public spending. By its nature, this will be complex and necessitate returning to the very foundations of current practices. This remit goes beyond a national scale and more readily sits at a European level. A significant evolution in the legal and regulatory levers is expected to encourage or force this change.

On the ground today...

Climate hazards are progressively having economic repercussions. Actors are currently facing rising costs of insurance. In 2022, the Eurockéennes festival was marred by cancellations due to weather hazards. Some festival organizers are taking the risk of regular heatwaves as an entry point to start discussions about moving events from summer to autumn to limit their exposure to climate extremes. While these reflections may have seemed excessive some years ago, insurance costs have risen to a sufficient level to raise this possibility, despite the risk of lower attendance outside of vacation periods.

Finally, coherent public action on adapting to climate change necessitates suitable planning, rulings and the coordination of actors on an appropriate national, regional or local scale according to the subject matter, without forgetting the European level, which, even if it is not discussed in this study, remains a major lever to bring about regulatory changes. Collaborations within and outside of the cultural sector will also play a determining role for addressing future questions.

4.1.3. The need to support changes to music professions in response to the new socio-environmental order

All the scenarios predict that professions within the industry will have to profoundly change in the coming years. While the theme of the environment seems fundamental, it is not systematically measured in practice, even though certain roles, similar to the models of eco-consultants and regional adaptation coordinators, could be integrated into the industry in the future. Supporting professions would allow for a standardization and expansion of practices.

On the ground today...

Some trade unions and actors in the industry are developing tools to account for the socio-environmental footprint of different elements of the ecosystem, inspired by what is already practiced in other sectors. For example, the Impala[26] calculator evaluates the carbon footprint of a record; the Seeds d'Arviva[27] calculator is used for events; and other tools integrate dashboards for decision-making in the industry. Professional bodies have already started reflecting on the evolution of professions associated with live performance: on a national level, the CNPS (Conseil national des professions du spectacle) and in numerous regions that are part of the COREPS (Comités régionaux des professions du spectacle).

26. See https://www.impalamusic.org/carbon-calculator/.

27. See https://seeds.arviva.org/.

On the other hand, and following on from this study, it seems judicious to consider observing music professions in light of the changes in progress (what must be supported, what is wanted, what must be created and what must cease if incompatible with the identified issues) by involving particular professional branches of the industry. This reflects the complexity of forecasting exercises like this one, which aims to imagine the phenomena of the transformation without transposing current music professions onto a given future time.

4.1.4. The question of producing, consuming and travelling differently within the music ecosystem considering issues of lower carbon emissions and pressures on resources

Today, it is necessary to regulate what is becoming economically easily achievable, whether in terms of long journeys or volume of consumption. What methods favor solutions with the least carbon impact? What habits promote sustainability? How can this thinking be applied to seemingly decarbonized solutions, but which can be the subject of such questions when their consumption becomes massive, like in the case of streaming? How can we change our relationship with other living beings and inspire a mindset of restraint for consuming resources? The fact that action needs to be taken seems already accepted, but it is difficult to integrate into the music industry as it is with our everyday routines and elsewhere. Beyond the ongoing decision-making, more significant decisions are expected to respond to these new demands (shifting needs, efficiency of transport systems, policies of restraint for water resources, limited attendance numbers).

On the ground today...

Some artists, like Tryo from 2008 onwards[28], have developed their own systems and tools for tracking and measuring their GHG emissions and those of their tours. This information helps artists select one destination over another or make suggestions to tour organizers to lengthen an international tour in support of their values. Venue managers and festival organizers are asking the same question when seeking to measure the impact of artists' travel in terms of staging and where they are coming from. In addition, streaming platforms have already explored formats that consume less data, but this subject is rarely discussed.

4.2. Considering the governance of the music ecosystem and cultural rights

4.2.1. The question of governance frameworks and citizen participation in cultural public action

The scenarios explored only serve to highlight the variety of possible futures. The objectives relating to the level of transformation that seems reasonable to prepare for must be supported by future policies. Their compatibility with the planetary boundaries must be evaluated by going beyond regulation. In particular, it would be wise to increase investment in existing tools, to optimize them on local and national scales, and to draw on collective dialogue through industry agreements and professional advice from the CNM, the CNPS and the COREPS.

The first two scenarios imagine new approaches to shared governance to fight against climate change and resource shortages, involving an increased level of cooperation between the state, regions and/or local communities in terms of cultural policy. This suggests implementing governance mechanisms that involve different levels of administration, promoting a better understanding of local specificities and increasing regional cooperation. Whatever governance frameworks are chosen, the participation of audiences in cultural policy from now to 2050 and more broadly in the debate on the future that is desired and acceptable for the industry emerges as a crucial issue. It is a case of guaranteeing respect for cultural rights for all within this changing context, diversifying cultural expressions and ensuring equitable access to culture.

28. See https://tryo.com/wp2/wp-content/uploads/2015/10/bilan_carbone_tryo_08.pdf

On the ground today...

The question of climate governance already appears in current debates. Even if it only partially responded to the hopes that were placed in it, the Citizens Convention for Climate (Convention citoyenne pour le climat) showed alternative models do exist and can give voice to collectives organized to devise proposals for action plans. This model could be proposed to contribute to legislative design or innovative regulation design, thereby increasing the participation of citizens and members of the profession in creating frameworks.

4.2.2. The need to outline the national/regional/local territory and its relevance for cultural rights and international frameworks

Several questions relating to the organization of music culture on different territorial levels in response to climate and environmental issues reoccur across the scenarios: to encourage less intensive ways for audiences, artists and technical teams to travel, what sustained forms of use or types of conversion can be envisioned for performance venues? How can multi-party collaborations between transport and energy companies, local communities and distribution locations be promoted? How can setting up networks, pooling and reusing resources (places, material and scenery banks) be encouraged within the industry and cultural sector? How can musical cooperation between regions, rather than competition and attractiveness, be cultivated? These questions necessitate political choices that must be made by involving audiences.

For example, inter-regional cultural passes or deals that offer benefits or reduced tariffs can play a role in encouraging audiences to travel and support local and regional music scenes. It therefore seems judicious to question regional frameworks that promote cultural and artistic exchanges to maintain a year-around cultural offering, all the while conforming to the objective of sustainable development and ecological transition. Naturally, this work could adopt a larger scope, notably with European and international dimensions.

On the ground today...

Following Périscope and its partners on the Better Live project, performance venues conscious of this question already somewhat promote regional rooting and have a double impact on the travel of artists and audiences. For example, initiatives are being tested to promote artist residencies lasting several days and offering the possibility of going beyond a single concert date to propose collaborations with the local cultural scene (reading at a library, interview in a cultural space). Moreover, to improve the relationship between artists and audiences, small capacity events taking place across several evenings avoid high attendance numbers which are more difficult to manage and cause significant economic pressures in the case of cancellation.

4.3. Working on visualizing these transformations

4.3.1. The need to change practices and dominant uses through experimentation

Confronted with such significant issues, the transition or transformation of economic models and dominant practices cannot happen overnight. Working on how people visualize these transformations represents a major issue and necessitates highlighting new exemplary models through supporting companies that experiment with fair and sustainable forms of music governance, creation and distribution. Incentives could be offered to actors in the music ecosystem to promote experimentation, measure the impact of these new practices on audience behaviors and evaluate the transition towards sustainable practices.

In particular, continuing to refer to sociological and statistical surveys to support and document the necessary changes to practices will contribute to showcasing the experimentation in progress and demonstrate how these experimentations can be adopted by all actors in the industry.

Leadership training could also become a priority, as well as widespread raising awareness programs for different professions within operations.

On the ground today...

While, for artists, engaging with environmental issues often starts with a desire to produce ethical physical content (particularly organically sourced materials for their records), the concept of eco-production is developing. For example, the label Ecoprod is a key player in audiovisual production, but it also determines the criteria and a methodology to ensure it limits its environmental impact and specifically the carbon footprint of film projects. A similar approach could be replicated in all cultural sectors.

4.3.2. Music's role in changing behaviors

Through their unifying power, music and more broadly culture can play a direct and crucial role in raising awareness of environmental and social problems. It is not a case of controlling music creation, but rather imagining how to get artists and audiences on board with these changes by deconstructing certain ideas of success (events, career paths) and fame that rely on practices that are incompatible with climate and environmental issues.

It also seems important to question spectator experiences in a changing world. Artificial intelligence is currently integrating different purposes. Its impact on artists or how artists will use it remains unknown. Recent experiments demonstrated how music inspired by classical or contemporary music styles could be created with astonishing results. It is still difficult to evaluate how the necessary changes in the industry will be impacted by the arrival of new technologies of this type, whether they will play a beneficial role by limiting the use of resources or a damaging role by contributing to badly managed mass production. There is also the question of preserving music as a heritage of humanity and what should be preserved for a future world under pressure.

The impact of music on these changes and that of these changes on music is a vast subject and, in all cases, will lead to the acceleration of a profound transformation project for the whole industry.

5. Conclusion

This forecasting work highlights issues that open up avenues for further exploration and analysis. By setting up potential imagined futures, the scenarios help understand the issues and inform the decision of which ecosystem we collectively wish to move toward.

On one level, this study encourages extending the assessment of the ecosystem's current impact in terms of greenhouse gas emissions. Such an analysis necessitates a larger dataset collected with specific tools (Seeds and Fairly for the field of live performance), or by drawing on carbon assessments and broader studies. It presents a way forward for the music ecosystem, but it also mirrors a perspective set by the Ministry of Culture in their advisory publication "Guide d'orientation et d'inspiration pour la transition écologique de la culture" [Guide to direct and inspire the ecological transition of culture].[29]

From the perspective of a place-based analysis, exploring each region in turn for issues of adaptation and risks threatening the cultural infrastructure would be an interesting approach to follow up this initial forecasting work. Within this framework, one major issue relates to infrastructure, particularly the more sustainable inclusion of cultural places into the economic fabric and within existing public transport networks.

Extending the analysis of the industry's exposure to climate risks and of the worldwide pressures on resources will be necessary to shed light on the debate within the industry and its future development. Notably, this will involve exploring the links between music and the digital in more detail.

Having voluntarily set aside the European level in the scenarios, a future study of managing the transition from a European perspective would also make sense. This approach would involve including that scale to draw up issues of governance, economic models, and regulations. In doing so, these scenarios would encourage dialogue with other music ecosystems in the European Union with the potential of replicating this methodology in other countries. This presents the opportunity to start a broader dialogue on the vision needed to carry out this transition toward a more sustainable model within the European economic area in the most comfortable way possible.

29. "Guide d'orientation et d'inspiration pour la transition écologique de la culture," *Ministère de la culture*, 7 December 2023, https://www.culture.gouv.fr/Thematiques/transition-ecologique/guide-d-orientation-et-d-inspiration-pour-la-transition-ecologique-de-la-culture.

Annexes

Annex 1: Methodology

Phase 1:
Developing the orders of magnitude for the carbon snapshot of the music ecosystem

The methodology used in this project was inspired by standard carbon accounting exercises, in particular in its definition and consideration of scope while differing from them in the homogeneous treatment of data. The tool, selected from the beginning as one that would allow for a quantitative evaluation of carbon issues, was inspired by the greenhouse gas emissions assessment BEGES (Bilan des émissions de gaz à effet de serre). However, it cannot be considered a BEGES assessment as it was not carried out in line with the usual rules. We use the term "carbon snapshot" in the sense that this exercise has been simplified and carried out with numerous hypothetical dimensions.

Approach comparable to BEGES	Approach not comparable to BEGES
Treatment using BEGES categories Focus on the largest sources of emissions	Treatment of very heterogenous data according to the actors (extrapolation of existing carbon analyses and treatment by calculation hypotheses on key figures according to categories)

Table 1: Differences between BEGES and the methodology of this exercise

Nevertheless, it relies on the established steps of a BEGES exercise.

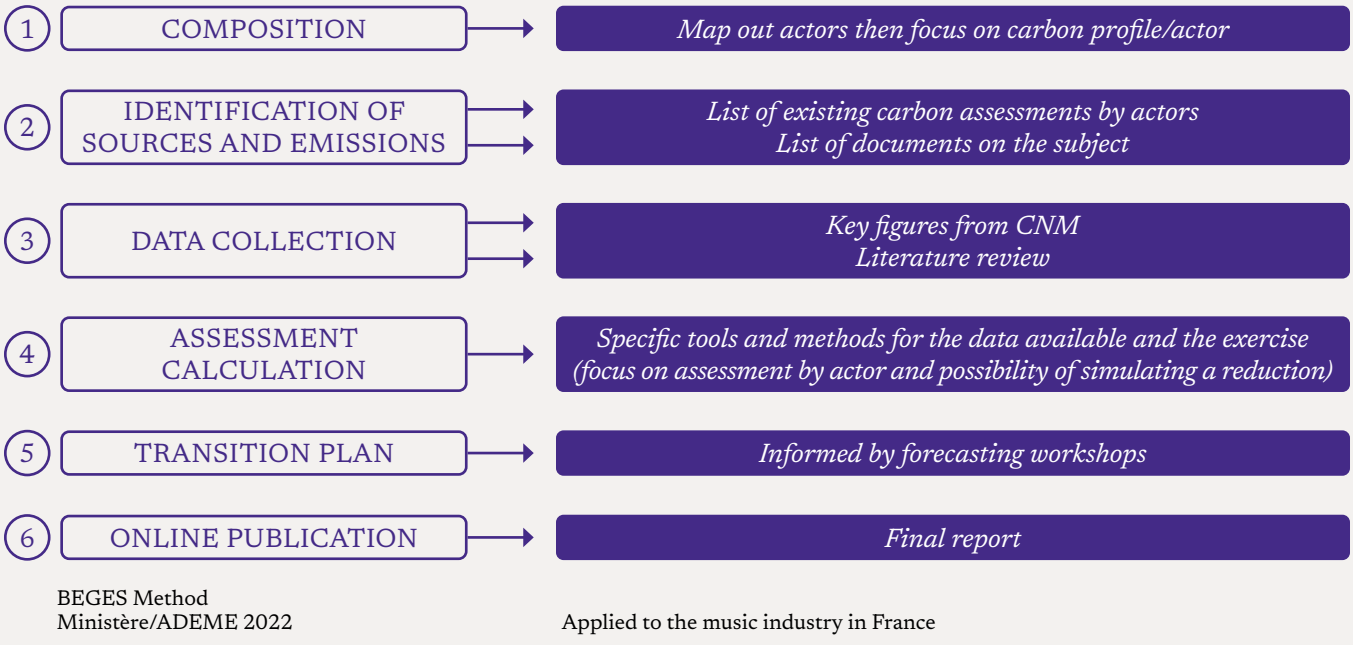


Figure 26: Steps of the BEGES approach applied to the music industry

The first step is **composition (1)**. Taking Robin Charbonnier's mapping of the music industry (see bibliography) as its starting point, a limited selection of music industry actors with similar carbon profiles was made. These profiles also match with the main types of actors usually identified by the CNM. The key figures for these types of actors (e.g. budget, volumes) in particular have been used.

The **parameters** chosen for this exercise are as follows:

- **Temporal** scope: last full year or equivalent in terms of activity (2023);
- **Organizational** scope: music industry in France (including foreign artists coming to France and concerts abroad by French artists), exclusively professional or semi-professional practice (amateur practice excluded from the scope);
- **Operational** scope: all BEGES categories (scopes 1, 2 et 3) in terms of their availability and focus on emission sources considered as having the most impact.

Data collection (2) and (3) was carried out using the following elements:

- Complete or partial carbon assessments of the main actors (festival, artist, digital platform) or main products (record, online listening duration), supplied by the CNM or the interviewed actors, or available online;
- Key figures for the industry (number of festival goers, numbers of records sold, turnover) supplied by the CNM or actors (e.g. CSFI);
- In cases where carbon data was not available, carbon assessments of actors with similar behavior were used (carbon assessment for a consultant used for the carbon assessment of an artist).

The calculation (4) was then made in the following way:

- **Reanalyzing** the available carbon assessments (relevance, rigor and equivalence in BEGES standard categories);
- **Extrapolation** of values on the scale of France by using ratios based on key figures (carbon footprint of festival goers extrapolated using the carbon footprint of a festival considered representative) and correction of the extrapolation using qualitative elements (increased or reduced extrapolation by percentage if the category of emissions is considered to be under- or over-estimated);
- **Synthesis** of values calculated in the carbon assessments by actor;
- **Coherence analysis** of the values calculated through comparison with other available exercises, notably:
  - Comparison of the intensity of festivals with the methodology used by The Shift Project in the study "Décarbonons la culture" [Decarbonize culture],[30]
  - Confirmation and adjustment of the orders of magnitude during the exploratory workshops with a selection of representative actors,
  - Comparison of the orders of magnitude (intensities) between different actors,
  - Comparison between the total volume of emissions and the national volume of emissions and coherence analysis with other values, in particular GDP,
  - Comparison with academic studies and publications in the same sector in France and abroad.

This last step of analysis in particular allows for the elimination of extrapolations judged too incoherent with other orders of magnitude observed in other studies.

30. "Décarbonons la culture," *The Shift Project*, 30 November 2021, https://theshiftproject.org/article/decarboner-culture-rapport-2021/.

Limitations:

While this method allows for working on orders of magnitude relevant for the next part of the project and to achieve some initial results with a very limited database, it is not exempt from the significant limitations listed here:

- A **very high level of uncertainty** must be considered for the results of this analysis. This uncertainty arises from several elements: the lack of mean data, the difficulties of considering a carbon assessment as representative (outside of qualitative considerations), the factors of emissions used in this exercise in connection with the data available. This uncertainty may be behind **the final values, potentially attributing all of them a margin of error of more than 50%**, even more if compared with other similar exercises.
- This **method does not allow for applying the same approach** to the calculations for each actor: some actors are attributed a reference carbon assessment (festival, venue) and others are not. Another method must therefore be used (extrapolation using a carbon assessment produced for the physical market or extrapolation using key data for audiovisual). This makes **the comparison of results much more limited beyond the aim of analyzing the orders of grandeur.**
- **Double counting** is possible for certain sources (for example, artist travel included for festivals, venues and the artists themselves, manufacturing of derived products including records assessed within the carbon evaluations of publishers and the physical market). This is not considered significant for the purposes of this exercise, apart from travel for artists, which is difficult to analyze (festivals consider the travel of foreign and French artists without distinction and the emissions for French artists do not distinguish between concerts abroad or in France).
- Several **emissions sources are currently not distinctly covered** due to a lack of data. None of these sources are considered as having a majority contribution to the total BEGES of the industry yet these sources can be indicative:
  - Recording (partially covered and shared between actors, but treated distinctly and in a more rigorous way by the REC study);
  - Logistics of materials (partially covered).
- As a reminder, only the professional and semi-professional music industry is considered, thereby **excluding amateur practices** and those for leisure which are considered particularly impactful for certain emissions sources, notably instrument manufacturing.

Phase 2:
Method of developing adaptation issues

The methodology used in this project was inspired by qualitative analysis approaches of climate risks aiming to study the value chains from the beginning to the end (without considering their complexity).

The parameters selected for the exercise are as follows:

- **Organizational** scope: eight key "actors" with adaptations identified during the composition phase. Six actors (in purple) were considered as priorities with regard to their activities and were the subject of a detailed presentation for the issues of adaptation:
  - Composition: artists
  - Live performance and production (category 2 license): venues and festivals
  - Music recording: physical market and digital market
  - Instrument manufacturing: manufacturers
  - Music publishing and record publishing
  - Audiovisual: mainstream media and social media

- **Operational** scope: five issues studied in line with common diagnostic approaches for climate risks[31] studying the three parameters (before, in situ, after) of the value chains:
  - *Supplies*: energy, water resources, telecommunications, food, raw materials,
  - *Infrastructure and equipment*: sites of production for shows, of creation and of music recording, offices, warehouses, data centers, pressing plants, all equipment for sets, reception, security, and audience services,
  - *Health and working conditions* of artists, technical teams, industry employees and audiences on site,
  - *Financing*: costs, profitability, insurance,
  - *Clientele* (their uses and practices) and the *distribution* of music products.

- **Temporal** scope: current climate risks (perceptible and weak indications).

Qualification of risk: the level of risk is evaluated qualitatively using feedback from experts according to an evaluation of three categories (Low/Medium/High) which correspond to the presumed exposure to climate risks of value chains as well as the nature and extent of the impact considered.

Limitations:

Our evaluation of the climate issues for the music industry cannot be considered a diagnosis of climate risks, which would necessitate an advanced and cross-referenced analysis of different elements of risks to understand:

- **Climate hazards**: they can relate to trends (rising temperatures, variation in precipitation, rising sea levels) or extremes (heatwaves, violent winds, storms, floods, drought, forest fires);
- **Exposure to these hazards**: the presence of people (audiences, music industry employees), and workforces (SMAC, festivals, data centers, pressing plants, warehouses, offices) in a given place that could be directly or indirectly affected by climate hazards;
- **Vulnerability**: the predisposition of workers to harm due to individual sensitivities (genre, age, inability to cope with or adapt to [being outside fully exposed to the heat without shade or access to cooling devices]).

31. By way of example only, the OCAEA method developed by Carbone4 in partnership with Ademe is one of the references for analyzing the resilience of businesses against the impact of climate change, which studies in depth the elements of risk across three parameters of value chains. For more information, see: https://www.carbone4.com/guide-methodologique-ocara.

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Annex 3: List of interviews conducted

Emily Loizeau	Emily Loizeau	Artist/Producer	Conducted 18/01/2024
Paul Jarret	Paul Jarret	Artist	Conducted 30/11/2023
Fanny Landais	Baco Music	Music publisher	Conducted 22/11/2023
Céline Portes	Ensemble Correspondances	Ensemble/collective	Conducted 13/11/2023
Jean Perrissin	Cabaret Vert	Festival	Conducted 18/11/2023
Alexandra Amana	Believe Digital	Independent label or independent label distributor	Conducted 25/10/2023
Sophie Hautbois	Warner	Major label	Conducted 05/12/2023
Benjamin Guincestre	Deezer	Streaming platform	Conducted 16/11/2023
Aurélie Thuot	Adone Productions	Independent producer, live performance	Conducted 24/10/2023
Mathias Leullier	Live Nation	Producer, live performance	Conducted 23/10/2023
David Demange	La Rodia	Venue	Conducted 15/11/2023
Christophe Chauvin	Green Musicians and ex-CSFI	Instrument manufacturer/supplier	Conducted 09/01/2024

Annex 4: Composition of the working group

Tomas	Legon	EHESS
François	Ribac	LADYSS
Julien	De Lauzun	Nuits Sonores
Solweig	Barbier	Arviva
Maxime	Molé	Collectif des festivals
Aurélie	Berducat	Bi: Pole/Le Bon Air
Lou	Ribeyron	Live Nation
Constance	De Bosredon	Idol
Gaëtan	Grivel	Gérard Drouot Production
Théo	Le Vigoureux	Artist
Haude	Hellio	Morgane Events
Laurence	Ghestem	Culture Demain
Armand	Vache	Baco
Christophe	Chauvin	Green Musicians
Louise	Robert	La P'Art Belle
Emmanuelle	Duthu	Ostinato
Lucie	Boussouar	CNM

	Carbon Assessment Category 2023	BC1 Performance, Festival	BC2 Performance, Venue	BC3 Artist/ Performer	BC4 Composer	BC5 Digital market	BC6 Physical	BC7 Label/ publisher	BC8 Audiovisual	BC9 Instrument manufacturing
Scope 1 Direct GHG emissions	Scope 1 Energy									
	Scope 1 Vehicles									
	Scope 1 Non-energy emissions									
	Scope 1 Fugitive emissions									
	Scope 1 Biomass									
Scope 2 Indirect energy emissions	Scope 2 Electricity									
	Scope 2 Electricity, other									
Scope 3 Indirect transport emissions	Scope 3 Goods, pre									
	Scope 3 Goods, post									
	Scope 3 Commuting									
	Scope 3 Visitors/Audience									
	Scope 3 Visitors/Artists									
	Scope 3 Business travel									
Scope 3 Indirect emissions for purchased goods	Scope 3 Goods purchases/materials									
	Scope 3 Goods purchases/catering									
	Scope 3 Goods purchases/merchandising									
	Scope 3 Fixed assets									
	Scope 3 Waste management									
	Scope 3 Employee leasing, pre									
	Scope 3 Service purchases									
	Scope 3 Service purchases (cloud)									
Scope 3 Indirect emissions for sold products	Scope 3 Use of sold products									
	Scope 3 Employee leasing, post									
	Scope 3 End of life of sold products									
	Scope 3 Investments									

Category of GHG emissions covered by the evaluation with a high level of uncertainty

Category of GHG emissions covered by the evaluation with a moderate level of uncertainty

Category of GHG emissions not covered or not applicable

Category with of double counting (covered by another evaluation)

Mapping of issues of adaptation and non-renewable resources for the music ecosystem Adaptation issues

Adaptation issues

Live Performance/Production (category 2 license)

Venue

Festival

Music Recording: Physical/Digital Market

Physical market

Digital market

Instrument Manufacturing

Manufacturer

Audiovisual

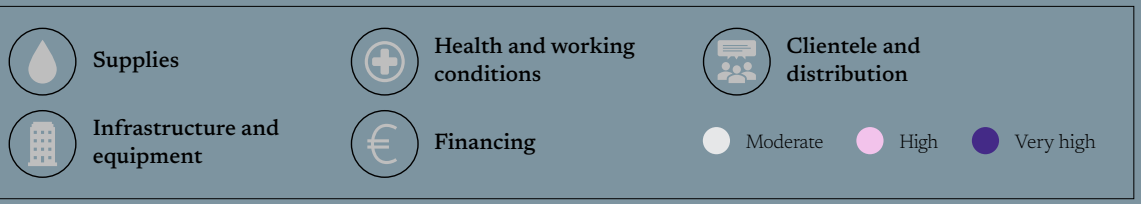
Mainstream media and social media

Music Publishing

Recording industry actors

Composition

Artist



CNMlab

CNMlab is an innovation lab working closely with the academic world to develop a complementary research program to the studies carried out by the CNM.

The CNM created CNMlab in March 2022, alongside its research and forecasting department, to further its aims of observing the economy and data on the whole music sector. Conceived as an innovation lab, CNMlab's role is to develop a program of research and produce publications addressing a variety of subjects (economic models, music practices, diversity, ecological transition, digital economy, health, Europe, heritage, innovation) in connection with the contemporary world and the issues facing the music industry. To build a close relationship with the academic world, the CNMlab brings together each trimester a steering committee of around twenty individuals with different profiles, including sociologists, economists, historians, legal experts, musicologists, and philosophy specialists. This advisory discussion group, with unrivalled expertise in the world of music, contributes to the construction of CNMlab's research program.

Publications

CNMlab regularly disseminates communications and studies using three main formats. The "long wave" format offers in-depth reports resulting from long-term work. "Short wave" is a more concise and dynamic format. In addition, CNMlab publishes an annual "thematic volume" in print and online. Conceived as a collective work, it aims to present different approaches and issues on the same subject.

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