AD NET ZERO
ALL FOR NONE

THE AD NET ZERO GLOBAL MEDIA SUSTAINABILITY FRAMEWORK

A Playbook of voluntary industry standards that address media greenhouse gas emissions.

v1.2

Ad Net Zero Compliance Statement

Ad Net Zero is an international, cross-industry coalition of businesses aimed at decarbonising advertising supply chains and encouraging growth of advertising that drives more sustainable choices and behaviours.

It represents the interests of the advertising industry. It acts as a forum for legitimate contacts between supporters of the advertising industry. It is the policy of ANZ that it will not be used by any company, industry grouping or individuals to further any anti-competitive or collusive conduct, or to engage in other activities that could violate any antitrust or competition law, regulation, rules or directives of any country, or otherwise impair full and fair competition.

Supporters acknowledge that being a supporter of ANZ is subject to the competition law rules and they agree to comply fully with those laws. Supporters agree that they will not use ANZ, directly or indirectly, (a) to reach or attempt to reach agreements or understandings with one or more of their competitors; (b) to obtain or attempt to obtain, or exchange or attempt to exchange, confidential or proprietary information regarding any other company other than in the context of a bona fide business; (c) to further any anti-competitive or collusive conduct; or (d) to engage in other activities that could violate any antitrust or competition law, regulation, rule or directives of any country or otherwise impair full and fair competition.

Publication History

Global Media Sustainability Framework Version 1.0 – June 2024
Global Media Sustainability Framework Version 1.1 – December 2024
Global Media Sustainability Framework Version 1.2 – June 2025

Contents

Executive Summary

Why is this Framework needed?

Ad Net Zero is a global climate action programme working to help the advertising sector and companies that advertise drive better business through education, sustainability-related best practices and more consistent estimation frameworks and sustainable behaviours in the work. Ad Net Zero's Five-Point Action Plan focuses on decarbonising ad operations and supporting every industry to drive better sustainable business results by accurately promoting sustainable products, services, and behaviours. Ad Net Zero is a nonprofit, pro-competitive, member-supported organisation and engages stakeholders across the industry from advertisers to agencies to marketing services and trade organisations.

Action 3 of Ad Net Zero's Five-Point Action Plan helps the industry to reduce emissions from media planning and buying. Related to this is the growing importance of regulatory compliance, with many of Ad Net Zero's supporters citing a key need for a framework to help them more easily provide media and advertising emissions data to relevant authorities.

This Playbook focuses on media, and makes a series of recommendations to establish transparency, consistency, and accuracy so that the industry can consider how to voluntarily pursue reductions at an individual company level. It is important to note that addressing climate impact is just the first step in a long and multi-faceted sustainability journey.

Based on academic estimates of the information and communications technology emissions of 2-4% of total greenhouse gas emissions, the estimated emissions for advertising emissions is in the 2-3% range of total greenhouse gas emissions across all channels. For some advertisers, media represents a small amount of total organisation emissions, however, it can be as much as 35% of total emissions based on data shared with Ad Net Zero. Looking at marketing agency holding companies, media emissions as proportion of total emissions can climb to up to 55%, based on publicly reported data. Therefore, media emissions represent an important area of focus for estimation and for consideration in emissions reductions.

Who is this Framework for?

The Global Media Sustainability Framework (GMSF) is a voluntary and holistic proposal of frameworks built on industry best practices to help advertisers, media agencies, media owners, and media sustainability specialists with their individual approach to data, estimation and reporting challenges. The GMSF is aimed at providing media stakeholders with voluntary and pre-competitive tools to allow for the estimation of emissions more accurately across channels, geographies, and providers. It proposes tools for the media industry to better account for their scope 3 emissions, using media industry and climate-science based standards and best practices. It was created to support and facilitate the work of media directors at advertisers, media investment leads at agencies, media sustainability specialists at media organisations, and sustainability experts at media solutions providers. More information on how specific stakeholders can use the Framework can be found in the Recommendations and Principles section of the Playbook.

In summary, the voluntary GMSF has the objective of fostering enhanced transparency, consistency and accuracy, with the aim of creating pre-competitive conditions for further innovation. Leaders in the industry are encouraged to consider how this voluntary framework and agenda may be relevant to the individual needs and business objectives of their organisation.

What's new in this version of the Playbook?

With each iteration of this Playbook, our methodology and data guidance become stronger, providing a more robust foundation for the industry.

In this version:

- We have developed conceptual formulae for two of the three remaining media channels: Print and Audio, ensuring a more comprehensive approach to emissions estimation. Cinema will follow as soon as possible in the next GMSF version update.
- Crucially, we have introduced data guidance for Digital, the highest-spend channel globally. This means that the digital portion of the Framework is now fully usable, allowing stakeholders to apply standardised methodologies with confidence.

These updates mark a significant step forward in enabling more accurate, consistent, and actionable estimation of media emissions across all major channels.

What are the challenges being addressed?

Background

In 2023, Ad Net Zero's stakeholders expressed a need to develop a voluntary estimation framework based on industry-informed best practices. After our listening tour and research, we determined this work could help alleviate some challenges and offer efficiencies to embrace the opportunities identified in our research.

Common challenges identified from our research

Variability in emissions estimation	We heard from advertisers and national associations who shared the results of their A/B testing, which compared emissions estimates from different providers. These results showed variability ranging from 6x to 20x difference in emissions estimates.
Fragmentation of data requests	We also heard that the marketplace was asking for different datapoints and in an inconsistent way, which inundated media suppliers with multiple contradictory requests that were hard to prioritise.
Impending reporting requirements	The largest organisations will be required to start reporting on emissions data as part of different markets climate disclosure rules. These new legal requirements are mobilising media value chain participants into data collection and reporting that will benefit from guidelines consistent with other sectors. In our most recent 2025 feedback survey, 63% of supporters highlighted regulatory compliance as their key driving factor.

Approach

From these three challenges, we determined that a voluntary industry framework was necessary to **enhance the transparency, consistency, and accuracy in the way advertising industry stakeholders estimate media GHG emissions in support of climate action**, and that the voluntary framework would need to span three main areas:

How it will work alongside existing climate standards	A voluntary industry framework for media should be consistent with the IPCC framework and the Greenhouse Gas Protocol and should propose industry-informed best practices to guide the development of work by and for the media industry, in order to better serve advertisers by aligning with how carbon accounting is conducted by other departments and sectors.
How it will fit across the entire media landscape	A voluntary industry framework for media should be pre-competitive and work across all relevant media channels without bias or prejudice and work towards a fair and replicable framework to ensure that subsectors within media follow a consistent approach.
How it will be global	A voluntary industry framework for media should ideally stretch to all geographies. The goal is to give as many stakeholders as much visibility as possible of the emissions from paid media campaigns globally.

Who was involved?

We embarked on a process to create the Ad Net Zero Global Media Sustainability Framework (GMSF), a process that brought together 53 marketers, 6 media agency holding companies, 31 media owners, 27 industry associations, and 23 media sustainability solutions providers in a pre-competitive space to voluntarily participate in research, working groups, and feedback on recommended approaches. These organisations represent views from 42 markets.

We were inspired by the generous efforts and contributions across all stakeholder groups to produce the voluntary GMSF and recognise that this is the start of an industry-wide journey for the ultimate benefit of the planet and society.

Oversight: How governance incorporates and leverages expertise

In order to validate the scientific integrity of the work and the relevance of the work to industry objectives we established two governing groups:

Steer Team	Responsible for ensuring that our work is relevant to media buyers and sellers and that approaches are developed without the influence of commercial interests and in a pre-competitive manner.
Climate Science Expert Group	Responsible for ensuring that our work is science-based and consistent with GHG accounting practices across other sectors and is developed with scientific grounding and oversight.

Key messages: What do senior leaders need to understand?

Managing vision and purpose in an industry-wide effort and transformation requires clarity, and there are three key messages to share:

This is an evolving journey not the end point	The GMSF framework is strictly voluntary and open to stakeholders in the media industry. It provides the tools to enhance accuracy and consistency in the emissions quantification of media campaigns. The core of this voluntary system – metrics and methodology - will evolve over time as audited, activity-based media product-level data become available and as better techniques (e.g., the use of AI, estimation "hacks") evolve.
Business outcomes, more sustainably	The goal of this work is to develop voluntary, pre-competitive industry frameworks that support efforts to more accurately quantify emissions from media campaigns to enable a more sustainable media industry in compliance with customer and regulatory requirements. The majority of intended users indicated that compliance is their main objective in implementing the GMSF. The goal of media remains consumer reach in order to influence a purchase decision. The ANZ Global Media Sustainability Framework does not challenge the fundamentals of media planning and buying – the GMSF only aims to help in the emissions estimation of it.
Best practices with voluntary freedom in adoption	The voluntary GMSF is a pan-industry pre-competitive collaboration. It has been an amalgam of best practices voluntarily shared and workshopped to create a pre-competitive, industry-informed framework that will be more efficient, saving time and resources for all stakeholders. This guidance respects company freedom – stakeholders will have the liberty to endorse and adapt solutions relevant to their services.

What opportunities can the GMSF encourage?

There are a number of opportunities that could arise from adopting the GMSF

Getting the most accurate data available, in line with best practices	The more granular the data, the lower the level of uncertainty in a company's estimation and reporting. The goal for data is to employ activity-based product level data that is reflective of the media inventory sold to advertisers, with supporting steps, based on actual energy consumption. This won't be delivered immediately by all entities, but we have defined different levels of data, consistent with the IPCC and the GHG Protocol approaches to other sectors, to invite the industry's leaders to start producing data that will eventually reach that level of granularity. In the absence of activity-based, product-level emissions data there will still be levels of approximations made. For each channel, with local cross-industry stakeholders, we will look to define a non-binding recommendation to produce more specific data over time.
A consistent framework to assess message delivery across channels	Adopting a framework to identify energy-consuming activities in a media strategy will facilitate rigorous communication across different stages of delivery. The Channel Emissions Frameworks (CEFs) in this document create a reference point and recommend what should be included for calculation and are a leaping off point for formula development and data collection. These Channel Emissions Frameworks (CEFs) are underpinned by the core phases that a created ad takes in media; Creation, Distribution, and Consumption. (It is important to note that this voluntary framework excludes emissions from the creative production of an ad and starts once the execution is created.)
A pathway to audited data and integration	Given the growing importance of GHG reporting, we recognise that verification of data and formula application is a natural development. As such we've started to engage key auditing bodies on these voluntary frameworks as the starting point for audit on product-level data reporting, use within the media process, and for use in post-campaign reporting into larger sustainability reporting efforts.

Possible ways to leverage GMSF based estimations

The transformation must be taken in stages	In the infographic on the next slide we outline broad buckets for transformation and the stage gates required to signal the transition from one phase to the next. The first and most important step is Benchmarking + Understanding. Data is only gathered at this stage and shouldn't be used for reduction and optimisation unless there are clear areas of waste that parties can identify, such as high-emitting behaviours in MFA media placements.
Flawed comparisons should be avoided	Media-related emissions data should be used to assess company specific progress over time. At this stage we should consider media emissions data to be channel and provider-specific. Stakeholders and partners should encourage continuous improvement and should only consider tactical steps as media emissions databecome more consistent. Use of media emissions data alone to change a media strategy is not advisable, and advertisers should consider the data in combination with business and marketing effectiveness objectives.
Prioritise the elimination of waste	At times, emissions reduction of a channel will be dependent on the supporting structures around it i.e. the electricity grid a channel runs from. Media sustainability leaders may want to consider where and how they can pursue emissions reductions in their value chain – both upstream or downstream – to help reduce their impact. Additionally, there is mounting evidence for unnecessary duplication in digital media that imply waste in the form of too many selling pathways. Media and sustainability leaders will need to reflect on their choice of, and influence on, these wider considerations.

What success looks like and how to manage transformation

Understand + Benchmark + Report

- Establish an understanding of media's carbon impact
- Consider collecting emissions estimation from key markets, key channels, key partners reporting findings to stakeholders
- Consider the development of a future emissions monitoring plan

Reduce + Challenge

- Consider actions from the Ad Net Zero Guide to Sustainable Media
- Review waste-eliminating steps
- Consider encouraging key partners to provide emissions data production and their own reductions

Specify + Optimise

- Consider the specificity of data available and the scale of it (market coverage, total media investment coverage)
- Consider ways to optimise within channels to advance emissions reductions based on individual organisation goals and objectives

The next sections of this Playbook share a set of principles that helped to inspire this work and how we envision its voluntary use, and then steps that media and sustainability leaders should consider as they embark on this journey.

Industry Challenges and Voluntary Tools

A shared vision that helped shape this work

Across the industry, we have gathered input and best practices to build a set of voluntary principles, solutions and pre-competitive standards. This work has included best practices relating to media sustainability. It's important to consider this, as each member reviews this work and determines how they may pursue its implementation.

These are the core elements of thinking that have helped to shape the development of this system of voluntary industry frameworks and tools. Taken together, they are intended to equip the industry with the means of setting the stepping stones to improve the transparency, consistency, and accuracy of media emissions.

1. MEDIA OUTCOMES, MORE SUSTAINABLY

This work was crafted by media experts with input from climate science experts. The goal of this work is to provide support to the objective that core media goals – choosing channels to reach an audience to elicit a purchase decision – are achieved more sustainably.

2. AUDITED ACTIVITY-BASED EMISSIONS DATA IS THE IDEAL DESTINATION

In order to achieve accurate emissions estimation, reductions, optimisations or reporting for emissions accounting we must articulate best practice for data. The best practice for data is to be as close to actual GHG emissions as possible. Further, this best practice focuses on activity-based emissions linked to media inventory or media products that are represented in the media campaigns. Finally, we recognise the need for the audit of media emissions calculations and reporting to drive the principles of accounting into this practice to accurately provide input for advertisers' scope 3 emissions.

3. VOLUNTARY FRAMEWORKS CAN PROMOTE INNOVATION

Voluntary frameworks that are flexible can drive interoperability and allow for plurality in providers and increase competition. The voluntary framework for media sustainability can provide a common foundation on definitions, modules for estimation, and communicating data granularity. These are core to enhancing transparency, which may foster increased competition and innovation.

4. EXPECTATIONS ON SUSTAINABILITY SHOULD SCALE BASED ON MARKET SHARE

Emissions reporting and the granular level of data produced should be cognisant of the size of the media organisation. These are principles in several regulatory and co-regulatory schema. Most notably, we see this represented in the Corporate Sustainability Reporting Directive (CSRD). These same sensibilities can be a useful way for us to consider how media stakeholders produce data. Most importantly, small organisations, unable to produce emissions data based on size should not be penalised, and in instances such as these, alternatives like averages and norms may be applied.

5. VOLUNTARY STANDARDS WILL CREATE A BASELINE THAT IS PRE-COMPETITIVE

In our research and consultations, we've uncovered limitations based on data and formula that have slowed progress and driven some inaccuracies. In order to overcome that, we've identified that voluntary industry standards including frameworks for quantification, formulae, and data, can help create a more transparent and even playing field.

6. INTEROPERABILITY AND TRANSPARENCY ARE NECESSARY FOR GLOBAL OPERATIONS

We endorse the multiplicity of providers and believe that this will ensure marketplace innovation. We also recognise that there are limitations to provider coverage, whether it is geographic or channel in nature, or in their scope of work with a marketer. In order to achieve near global coverage, for end users, we encourage industry stakeholders to consider how the GMSF can provide the means to ensure that outputs from different suppliers can be combined with limited manipulation.

7. VOLUNTARY STANDARDS PRESERVE FREEDOM TO ADAPT AND A MEANS TO DISCLOSE

All of the ANZ Global Media Sustainability Frameworks elements are voluntary and provide a foundational framework for individual organisations to consider when advancing their own goals of accurate, consistent, and rigorous calculation of media emissions. The voluntary nature of the framework elements can be applied thoroughly, partially, or used simply as a means to compare methodologies. We believe in giving industry participants choice in how to use each part of the framework, and that in referencing the framework, industry participants will have transparency at a minimum.

Getting started – some insights and best practice

In the development of the GMSF, we've been fortunate to learn from key media leaders at advertisers and media sustainability specialists at media agencies, solutions providers, and industry associations. In our discussions and interviews we've been able to identify some key insights to share with those starting on their sustainability journeys.

Top Tips

Link media sustainability to the broader business agenda	Media leaders who have embarked on the sustainability agenda have tethered it to the broader organisation sustainability strategy, given that for many organisations media placement is categorised as scope 3 emissions (e.g. indirect emissions from business suppliers). As media emissions may be a smaller part of the overall footprint of an organisation, it's important to consider how media emissions estimation and reduction fits within the overall organisational sustainability strategy. Further, it is essential that advertisers consider executive buy-in from key roles such as the Chief Marketing Officer and the Chief Sustainability Officer.
Understand where marketing and media fit in	Understand where the marketing function fits within your larger enterprise and make sure to understand how media as a key marketing investment plays a role – ranging from contracting with agencies, to purchasing media inventory. This top-down analysis helps to develop an understanding of emissions from the media function and can be an essential cornerstone in the media sustainability journey.
Create a cross-company understanding of your goals	Transparency of media sustainability goals and ambitions is core to managing a partner ecosystem that is diverse, ranging from advertisers and agencies to media sellers to technology and data providers. Media leaders have shared overall objectives and expectations with key media partners as a means of delivering on a range of needs spanning emissions data reporting to understanding media supplier's emissions reduction targets.

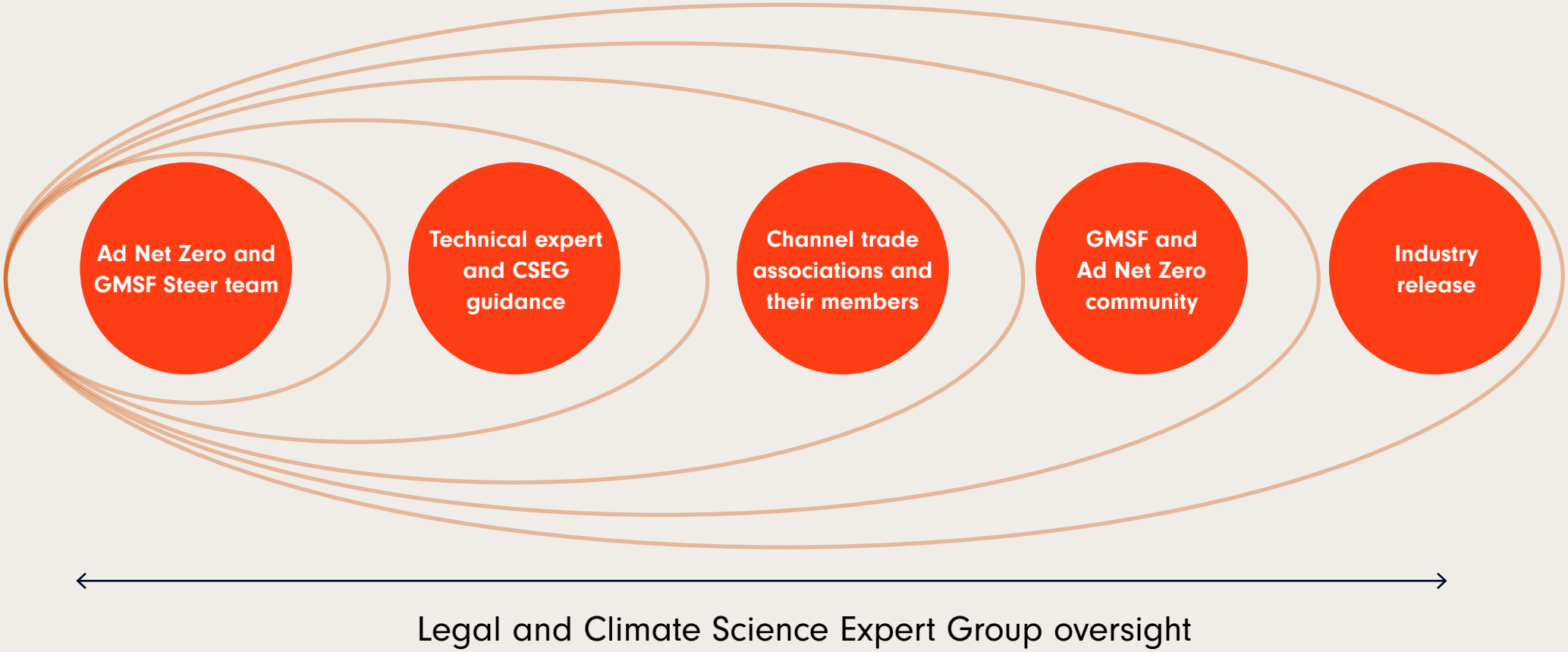
Use data to benchmark your position	Start off the process by developing an initial benchmark to discover what can be estimated and what your emissions currently are. It's important to establish an initial reference point and it's equally important to ensure that the initial read identifies what can be estimated and to what level of accuracy.
Identify 'quick wins' and tactical steps	We've gathered some industry wisdom to help you kickstart your sustainability journey. Click here to access the 2023 ANZ Guide to Sustainable Media Action Guide.
Let materiality in investment and emissions help set priorities	Focusing in on significant areas for investment or emissions in terms of markets, channels, or partners can help establish a disciplined structure of where to focus and what outcomes to pursue. The leading ad buyers at marketers and agencies have used a framework to help determine areas for focused conversation that fit into a series of criteria relative to market, channels, partners, and if known, relative to size of emissions.
Raise long-term ambitions	Share long-term objective with your key partners. This is not dissimilar to the way purchasing or procurement teams function in sharing their organisational objectives on a certain topic and ensuring that their supply partners can help drive transparency or in some cases support that objective, if appropriate. Being able to communicate mutual expectations is a key way for partners to establish transparency.
Challenge key partners	Encourage others to understand their own sustainability work. Internally at an advertiser for instance, this could be a global media lead encouraging their market-level leaders to consider agency and media supplier relationships. Externally at a media agency for instance, this could be engaging with key media suppliers to consider individual organisational sustainability reporting. The common theme of this best practice is having transparent conversations on the media sustainability initiative with key partners and to ask how they can support a shared objective, within reason.
Appropriately manage the media sustainability journey	Media leaders who are sustainability minded, have repeatedly shared that media must still be held to the commercial objective of reaching consumers and driving a sales response, and media sustainability should encourage you to consider the emissions of those activities, not to undermine the goals. Our best practice cohort use this tip as a reminder to avoid any misuse or overuse of the data and the tools at hand to unknowingly undermine media or create uneven or unfair expectations of media supply partners.

GMSF development process

To create our proposals, we implement a process to balance both efficiency and rigour. The different contributors are defined below, as well as the crucial role each plays in the development of the GMSF. By adopting this process, we ensure we build upon any industry leading work that has taken place already, create multiple feedback points for industry stakeholders and apply the latest climate science.

Steer Team Review	To ensure that recommendations help the media planning, buying, and reporting process, and that recommendations are consistent with industry practices.
Climate Science Expert Group Review	To ensure that recommendations leverage sustainability best practices from other sectors, and that recommendations adhere to environmental science expertise.
External Legal Counsel Review	To ensure that the Framework is voluntary and pre-competitive, and recommendations comply with competition law and promote transparency.
Channel Trade Associations	To ensure that media owners and publishers are involved in the creation of channel level proposals and that they reflect current media delivery operations, levels of data availability, and industry best practice.
GMSF and ANZ Community	To ensure that we receive widespread feedback and gain support and understanding across our supporter base for our proposals, before releasing publicly.
Industry Release	To ensure that all proposals are open source so that any company within the advertising industry can voluntarily adopt them as best practice.

GMSF development process visualisation



Component parts and benefits:

Wave 1: Recommendations and resources released in June 2024

The Review Process highlighted the need to build the GMSF in stages. The first wave of recommendations were as follows:

Challenge Observed	Workstream	Benefits of Recommendation	Resources Created
There is a wide range of variability in how media emissions are estimated across various stakeholders	Metric + Methodology	Consistent framework to estimate GHG emissions across 6 media types thereby improving accuracy and rigour	Channel Emissions Frameworks: TV/Video, Digital, Audio, Print, Out-of-Home, and Cinema Channel Emissions Formulae: TV/Video, Digital, Out- of-Home.
There is fragmentation of requests, varied understanding, that impact what and how media emissions data is collected and shared	Data Collection	Efficient mechanism to collect first party emissions data from media sellers and value chain partners	Channel Emissions Data Request Form: Enterprise level
There is a lack of understanding of marketplace solutions and where they fit into the media process	Solutions Transparency	Consistent framework to disclose services, data sources, and scientific oversight of media sustainability service providers	GMSF Solutions Transparency Form

Wave 2: Recommendations and resources released in June 2025

The second wave of recommendations are as follows:

Challenge Observed	Workstream	Benefits of Recommendation	Resources Created
There is a wide range of variability in how media emissions are estimated across various stakeholders	Metrics + Methodology	Consistent framework to estimate GHG emissions across 6 media types thereby improving accuracy and rigour	Channel Emissions Formulae: Audio, Print
There is fragmentation and a lack of priority in how media emissions data is collected and shared	Data Collection	Efficient mechanism to collect first party emissions data from media sellers and value chain partners	Channel Emissions Data Guidance: Digital Includes: A digital data request form, digital data sources and data hacks.

Wave 3: Recommendations and resources

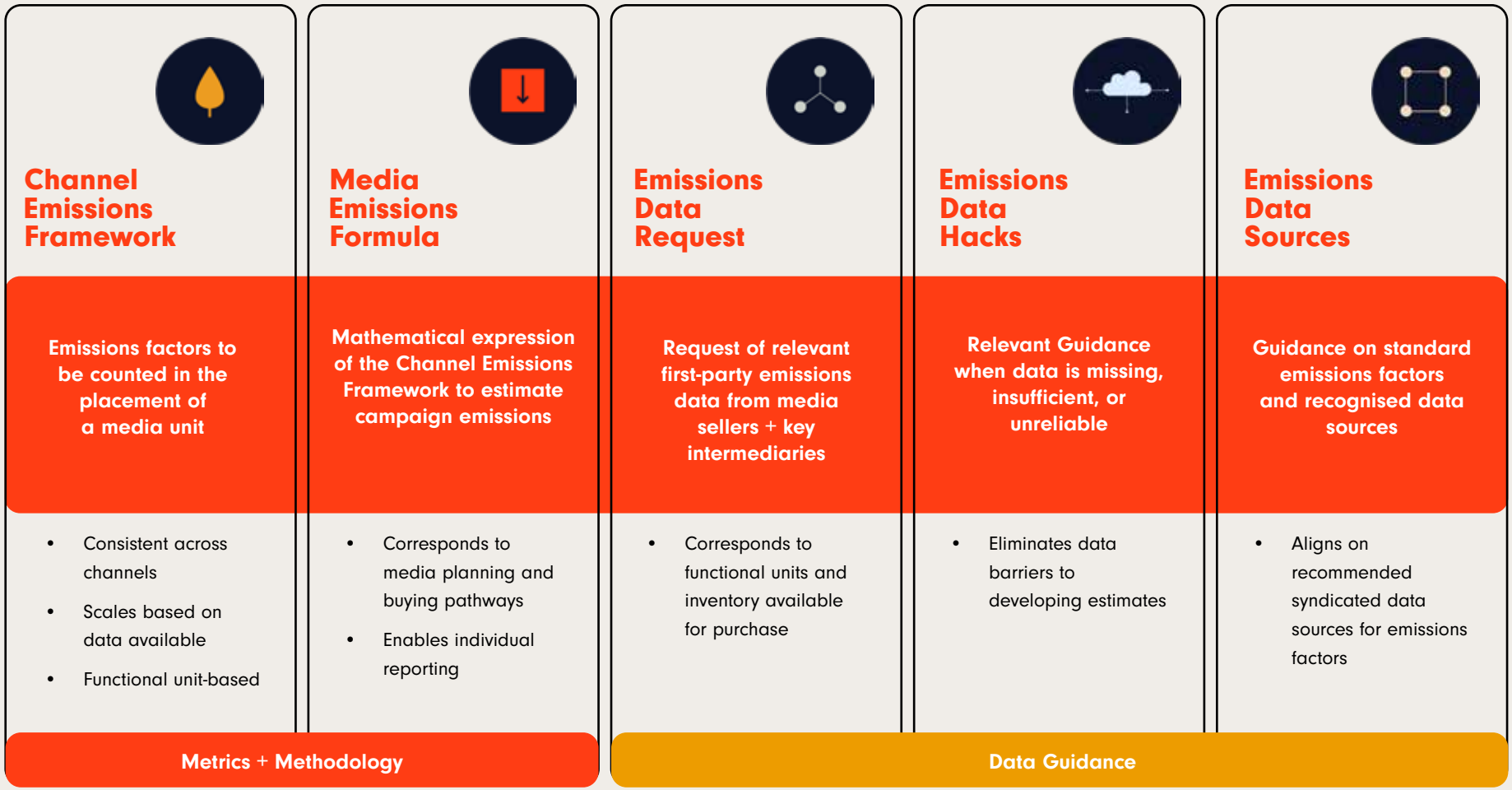
The third wave of recommendations are as follows:

Challenge Observed	Workstream	Benefits of Recommendation	Resources Created
There is a wide range of variability in how media emissions are estimated across various stakeholders	Metrics + Methodology	Consistent framework to estimate GHG emissions across 6 media types thereby improving accuracy and rigour	Channel Emissions Formulae: Cinema
There is fragmentation and a lack of priority in how media emissions data is collected and shared	Data Collection	Efficient mechanism to collect first party emissions data from media sellers and value chain partners	Channel Emissions Data Guidance: TV/Video, Audio, Print, Out-of-Home and Cinema Includes: Channel specific data request forms, data sources and data hacks.
There should be a consistent means of understanding how voluntary industry frameworks are adopted to improve practices	Monitoring	Voluntary tools to map the progress of solutions across industry stakeholders	Media Sustainability Framework Adoption Grid

How do the solutions work together?

The recommendations and resources will work together in order to create transparency, accuracy, and rigour in how media emissions estimation and reporting are managed.

Additionally, each of the Frameworks will have a channel-specific connection which will help drive increased specificity in how the channel is estimated and what data is collected to assist in the estimation of it:



In the subsequent chapters of this Playbook, we go into solution-specific recommendations, who may want to consider using them, and when and how they should consider using them. The Global Media Sustainability Framework is a voluntary set of recommendations built from best practices and Working Group proposals. We encourage members and industry stakeholders to review each of these proposals and determine individually their relevance to their work. We respect individual corporations and their freedom to adopt frameworks, map to frameworks with their current process, or reject them.

Which channel-specific frameworks are ready and what are the future plans?

The channel specific GMSF elements will evolve over time to reflect availability of data and also based on marketplace findings on the materiality of each estimation step.

	Digital	TV/Video	OOH	Print	Audio	Cinema
 Channel Emissions Frameworks	Wave 1	Wave 1	Wave 1	Wave 1	Wave 1	Wave 1
 Channel Emissions Formulae	Wave 1	Wave 1	Wave 1	Wave 2	Wave 2	Wave 3
 Emissions Data Request	Wave 2	Wave 3	Wave 3	Wave 3	Wave 3	Wave 3
 Emissions Data Hacks	Wave 2	Wave 3	Wave 3	Wave 3	Wave 3	Wave 3
 Emissions Data Sources	Wave 2	Wave 3	Wave 3	Wave 3	Wave 3	Wave 3

Recommendations and Principles

Metrics + Methodology : A voluntary consistent framework to estimate GHG emissions across 6 media types thereby improving carbon accounting accuracy and rigour

What is the context and purpose of this recommendation?

Variability in media emissions stems from the boundaries, the formulae used, and the source data. Advertising stakeholders could use a common framework to enhance the comparability and compatibility of data.

What is this recommendation and what questions does it help answer?

The recommendation answers the following key questions:

- What are the boundaries for each media channel?
- What are the key functional unit steps in each phase?
- What is the unit for each functional step?
- What data is required for the calculation?
- What is the mathematical formula?

What is included in the recommendation?

The current recommendation includes the following channel-specific components:

Digital	Channel Emissions Framework Channel Emissions Formulae Channel Emissions Data Guidance
TV/Video	Channel Emissions Framework Channel Emissions Formulae
Out-of-Home	Channel Emissions Framework Channel Emissions Formulae
Print	Channel Emissions Framework Channel Emissions Formulae
Audio	Channel Emissions Framework Channel Emissions Formulae
Cinema	Channel Emissions Framework

What is coming next?

Channel Emissions Formulae for Cinema.

Channel-specific Emissions Data Guidance for: TV / Video, Out-of-Home, Print, Audio and Cinema..

Includes: Channel specific data request forms, data sources and data hacks.

Where does this recommendation fit into the media process?

1. **Pre-or-post campaign emissions reporting and GHG calculation:**
   - The Metrics + Methodology elements can be used for pre-campaign data collection to help ad sellers report on the emissions from established media inventories
   - These elements can also be used for post-campaign emissions reporting, or GHG accounting activities
2. **In-campaign planning or buying:**

   The Metrics + Methodology elements can be used to assist with steps in the media planning (emissions forecasting) or in media buying (placement optimisation) however, these are dependent on provider tools (agency or specialist)

What types of organisations will use the recommendation and how?

- Media sellers may consider using the Framework to provide customers (agencies or advertisers) with post-activity reporting
- Media sustainability providers and media agencies may consider using the Framework to estimate campaigns during the development process
- Media buyers (advertisers or agencies) may consider using the Framework to estimate campaigns after they are completed
- Media sustainability providers may consider using the Framework to provide partners with emissions estimation or accounting services

What considerations should be taken into account?

- The Frameworks will evolve over time as data become more granular
- The Frameworks' accuracy and reliability will improve as their implementation can be audited
- The Frameworks may be modified in their adoption by providers, who based on best practices, may consider disclosing how

Data Collection: An efficient data request mechanism to collect first party emissions data from media sellers and value chain partners

What is the context and purpose of this recommendation?	In order to facilitate the collection of nonconfidential data essential for the media emissions estimation and reporting there must be a common and consistent data request form that corresponds to the Channel Emissions Formulae. This is a voluntary data form that media industry stakeholders may use for emissions reporting and/or emissions data requests.
What is this recommendation and what questions does it help answer?	Efficient mechanism to collect first party emissions data from media sellers and value chain partners. • What first-party emissions data is needed to help estimate the environmental impact of a media placement? • How can we efficiently and consistently collect and share the data that is needed for the Channel Emissions Formulae?
What is included in the recommendation?	A channel-specific voluntary data request and reporting that asks key organisational information that is not commercially sensitive on sustainability efforts.
What is coming next?	Additional voluntary nonconfidential channel-specific data requests based on the Channel Emissions Formulae.
Where does this recommendation fit into the media process?	This voluntary request form may be used during the following steps in the media cycle: 1. On a set regular interval (e.g. end-of-year reporting). 2. On a campaign-specific interval (e.g. pre or post campaign).
What types of organisations will use the recommendation and how?	• Media sellers may use this as a self-reporting template to answer media agency, advertiser, or sustainability solution provider requests (e.g. RFIs). • Media buyers (agencies or advertisers) or sustainability solutions providers may use this form or its questions to request nonconfidential sustainability metrics from media supply partners.
What considerations should be taken into account?	Organisations using this form should not publish company or commercially sensitive information or any other confidential information. Organisations should make sure that they are compliant with their own internal compliance processes to ensure data accuracy and confidentiality policies are adhered to.

Solutions Transparency: A consistent framework to disclose services, data sources, and scientific oversight of media sustainability service providers for greater transparency

What is the context and purpose of this recommendation?	As the landscape of media sustainability solutions evolves, stakeholders will need to understand the coverage and methods they employ; end users may want to understand what functions they fulfil and what standards they use.
What is this recommendation and what questions does it help answer?	The GMSF Solutions Transparency Form is a voluntary disclosure form meant to create a common framework for media sustainability solutions providers to help communicate what and how their services operate and bridge an understanding gap between provider and stakeholders.
What is included in the recommendation?	A voluntary disclosure form that communicates the scope of services solutions providers.
What is coming next?	Additional voluntary nonconfidential channel-specific data requests based on the channel emissions formulae.
Where does this recommendation fit into the media process?	This request form sits outside the media campaign cycle and could be more appropriate in the annual planning and partner selection cycle.
What types of organisations will use the recommendation and how?	• Media sustainability solutions (specialists or agencies) providers may use this form as a way of disclosing service overviews to partners (advertisers, agencies, or publishers) proactively. • Media partners (advertisers, agencies, or publishers) may use this form to request disclosure from media sustainability solutions (specialists or agencies).
What considerations should be taken into account?	Organisations using this form should not publish company or commercially sensitive information or confidential information. Organisations should consult with their own internal compliance processes to ensure data accuracy and confidentiality policies are adhered to.

Monitoring: A framework to estimate the adoption of the GMSF across industry stakeholders

What is the context and purpose of this recommendation?	Marketplace feedback and the degree to which voluntary industry frameworks are relied on, is important to understand whether or not they are helpful and whether they may need updates. This framework creates a company-specific reporting template to understand levels of voluntary adoption of key tools and steps.
What is this recommendation and what questions does it help answer?	• Efficient mechanism to collect first party emissions data from media sellers and value chain partners. • What elements of the voluntary GMSF has the partner chosen to adopt? • What is the relative penetration of each voluntary GMSF recommendation, and which ones are most often adopted?
What is included in the recommendation?	A voluntary monitoring framework that covers key elements of the GMSF and the major steps and solutions considered therein.
What is coming next?	The monitoring framework will be launched as part of Wave 3 of the GMSF along with the Channel Emissions Data Guidance for the remaining channels: TV/Video, Audio, Print, Out-of-Home and Cinema.
Where does this recommendation fit into the media process?	This solution sits outside the media process and is designed to help us learn about the effectiveness of their voluntary industry frameworks.
What types of organisations will use the recommendation and how?	All relevant media stakeholders will be invited to fill out a monitoring template.
What considerations should be taken into account?	Organisations using this form should not publish company or commercially sensitive information or confidential information. Organisations should consult with their own internal compliance processes to ensure data accuracy and confidentiality policies are adhered to.

Strategic Principles: Calculation and Data

1. Phases of media campaigns for quantification

A media campaign will likely involve three major phases:

	In-Scope	Out-of-Scope
Creation	Emissions from physical manipulation of creative assets for media placement Emissions from traffic out of creative	Emissions from the creation of advertising content [covered by production specific GHG estimating tools] Emissions from the creation of programming content
Distribution	Emissions from the steps associated with media selection Emissions from ad placement [inclusive of buy-side and sell-side steps]	
Consumption	Emissions from direct energy consumed to receive ads Embodied emissions from creation and disposal of associated technology [as a proportion of total lifespan]	

These phases are common frameworks across all media channels and allow for industry stakeholders to treat each channel without bias.

2. Channel Specific Steps: Workflows, Emissions Frameworks & Formulae

Based on our third-party blinded survey work via PromoVeritas, we were able to identify core steps for ad messages to consider. We also onboarded input from volunteers in the Metrics + Methodology Working Group, and volunteered frameworks for consideration.

These inputs are distilled into three core components:

Channel Emissions Workflows	Graphical detail of the steps an ad message takes throughout the 3 Phases, specific to buying and transmission methods
Channel Emissions Frameworks	Table detail of the functional units with a clear definition of the emissions, detailing source of emissions data
Channel Emissions Formulae	Mathematical calculation instructions on how to manipulate emissions data inputs to reflect media emissions guidelines

In the subsequent Technical Guide pages we present the outputs. These outputs were developed as recommendations from the Working Group, which were then socialised with relevant channel-level trade bodies and their boards, and then with media sustainability specialist companies. In total we consulted with over 100 companies in distilling recommended best practices.

Technical Principles: Calculation and Data

Calculation Principles

Principles for GHG emissions estimation vary between standards, but are generally underpinned by consistent themes, which should be considered and applied when considering the frameworks and formulae within this Global Media Sustainability Framework. This Global Media Sustainability Framework has been created in order to support several such principles including transparency, completeness and consistency. These principles enable users of the data, produced by following this standard, to have confidence as the data generated is aligned with standards and best practices that are generally followed in GHG accounting.

Users of this information likely rely on similar approaches to estimate the GHG emissions from other business activities, so having consistency across all data sources is important. The below principles are key to both enterprise level accounting (e.g. the GHG Protocol, ISO 14064) which all companies should be already reporting, and GHG lifecycle assessments (e.g. the GHG Protocol Product Life Cycle Accounting and Reporting Standard, ISO 14067), the focus of the Framework.

The GHG Protocol Policy and Action Standard (Chapter 4) lays out the following accounting and reporting principles:

Relevance: Ensure the GHG assessment appropriately reflects the GHG effects of the policy or action and serves the decision-making needs of users and stakeholders—both internal and external to the reporting entity. Users should apply the principle of relevance when selecting the desired level of accuracy and completeness among a range of methodological options.

Completeness: Include all significant GHG effects, sources, and sinks in the GHG assessment boundary. Disclose and justify any specific exclusions.

Consistency: Use consistent accounting approaches, data collection methods, and calculation methods based on established climate standards to allow for meaningful performance tracking over time. Transparently document any changes to the data, GHG assessment boundary, methods, or any other relevant factors in the time series. A key objective of this Framework is to provide an approach that is consistent with how advertisers estimate emissions for all of their other activities so that the emissions based on this Framework can be directly included into advertisers' scope 3 inventories.

Transparency: Provide clear and complete information for internal and external reviewers to assess the credibility and reliability of the results. Disclose all relevant methods, data sources, calculations, assumptions, and uncertainties. Disclose the processes, procedures, and limitations of the GHG assessment in a clear, factual, neutral, and understandable manner through an audit trail with clear documentation. The information should be sufficient to enable a party external to the GHG assessment process to derive the same results if provided with the same source data.

Accuracy: Ensure that the estimated change in GHG emissions and removals is systematically neither over nor under actual values, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users and stakeholders to make appropriate and informed decisions with reasonable confidence as to the integrity of the reported information. Accuracy should be pursued as far as possible, but once uncertainty can no longer be practically reduced, conservative estimates should be used.

Regulatory and Reporting Standards Alignment

In providing feedback during the development of the GMSF, 63% of respondents from across the ad sector indicated that their primary goal in implementing the GMSF is compliance with contractual and/or regulatory requirements to report GHG emissions. Fortunately, the common foundation for all climate accounting standards and emerging regulatory requirements is the Greenhouse Gas Protocol (GHGP) and the GMSF is fully aligned with the GHGP.

A critical objective of the GMSF is to provide GHG emissions estimates for ad campaigns that can be directly incorporated into the current scope 3 subcategory "Purchased goods and services" section of enterprise level GHG inventory reporting particularly for advertisers, in compliance with all GHGP aligned regulations, international climate accounting standards (e.g., the ISO 14064 series), and best practices. Because of significant marketing and advertising spend, many advertisers have reported that the marketing function is a material part of their overall GHG inventory, in some cases it is the largest single line item, making the GMSF particularly relevant. The GMSF can also be valuable to other participants in the advertising value chain in both their enterprise level reporting and in providing reliable, transparent, and consistent estimates to their stakeholders at the ad campaign level.

It is helpful to note that while the GHGP has a strong focus on enterprise level reporting, there are related standards on how to conduct a GHGP compliant Lifecycle Assessment for products and services, which is the essence of the GMSF, by following the Greenhouse Gas Protocol Product Life Cycle Accounting and Reporting Standard (on which the ISO 14067 standard is also based). Terms in the GHGP such as "use of sold products" should not be confused with the term "use phase" (also called "operational emissions") used in LCA approaches like the GMSF which refer to emissions from the operation of the complete infrastructure needed to deliver an ad. These emissions are to be differentiated from the "embodied emissions" which are based on LCAs on the equipment/structures/infrastructure used in delivering content, and cover their manufacturing, transportation, maintenance, end of life emissions. A relatable example is www.cloudcarbonfootprint.org which starts with the simple formula: Total CO2e = operational emissions + embodied emissions.

As the GMSF is aligned with the GHGP, which is the basis for all current and emerging reporting requirements including the CSRD in the EU, the GMSF supports compliance with these requirements. The International Financial Reporting Standards (IFRS) Foundation created the International Sustainability Standards Board (ISSB) that created a climate-related disclosure standard (IFRS S2) that is now being adopted by many national (e.g., Australia, Brazil) and subnational (e.g., California) jurisdictions. A summary of the countries adopting IFRS S2 as of 7 January 2025 can be found here. The GMSF also supports compliance with these reporting requirements.

Data Quality & Data Hacks:

Data Quality:

- In order to estimate emissions in the most accurate way possible, it's important to collect the best available data.
- The preferred type of data should be supplier-specific primary data, followed by secondary data involving estimates where primary data is not available.
- Primary data: data which is collected or directly estimated within the supply chain and can be converted into CO2e emissions through application of emission factors without having to first apply estimates. For example, litres of fuel consumed; kWh of electricity used.
- Secondary data: data which requires the application of assumptions or estimations before conversion into CO2e emissions. This might involve using financial data, or extrapolation using benchmarks from industry data. For example, spend on public transport or estimating energy use from floor area of an office. Secondary data and methods of estimation should be from credible and substantiated sources, and additionally be conservative to avoid understatement.

Uncertainty:

- The use of secondary data reduces the overall accuracy of the subject's footprint and may make reduction efforts difficult to plan and quantify.
- Where secondary data or estimation is used, efforts should be made to increase the provision of primary data over time.
- Material emissions sources and those with high emissions intensity should be prioritised for data collection efforts.
- However, the goal of GHG emission quantification is to identify levers of action to reduce the carbon footprint. It is to keep in mind that there will always be some uncertainty in calculation which will not prevent actors from identifying actions.

Data hacks:

Data hacks are associated with formulae to estimate emissions in the absence of reasonable data/data quality. These can include industry averages, "rules of thumb" and other estimation techniques. They will be completed over time after working with the industry, and examples for each channel will be added in the future to facilitate understanding of concrete application of formula. In this version of the Playbook, we have included the first iteration of digital hacks. Industry work is continuing in order to increase the robustness of these emissions estimates, and updates will be added to future versions of the Playbook.

Emissions Factors

- Best practice and commonly used conversion factors are included within the GMSF and should be used wherever possible.
- Where the referenced conversion factors within the GMSF are not deemed appropriate or aligned to the media channel in question, or a required conversion factor is not available, alternative factors may be applied.
- Emission factors must be from credible sources and relevant to the emissions source, including consideration of geographical reference and date of publication.
- Publicly available and easily accessible conversion factors should be prioritised over those which require a license or are not easily accessible.
- Where proxy conversion factors are required in the absence of a complete match, or there is a choice between multiple conversion factors which are deemed appropriate, the more prudent emissions factor should be used, i.e. the factor which leads to the higher CO2e figure to avoid understatement.

Market-based and location-based methods for electricity use

- There are two methods for reporting of emissions from the use of electricity:
    - **Location-based:** emissions associated with the electricity consumed, according to the average emission intensity of the local electrical grid and the direct use of no/low carbon energy sources.
    - **Market-based:** emissions associated with the electricity that an organisation purchases, according to the contracts it has in place, such as: supplier-specific tariffs and fuel mix, including renewable tariffs; Power Purchase Agreements (PPAs); application of Energy Attribute Certificates (EACs); Renewable Energy Certificates (RECs) and the grid residual mix emissions factor.

Both location-based and market-based methods are useful for organisations to identify emissions reductions opportunities through a combination of operational efficiency and responsible purchasing decisions. When estimating emissions of media channels with respect to electricity, the location-based method must be used. Users may also report results using the market-based method in addition to demonstrate how renewable energy purchased in local markets reduce overall emissions . Market-based method data must be documented to demonstrate it meets the Scope 2 Quality Criteria established within the GHG Protocol Scope 2 Guidance. The location-based method is required as a minimum in order to allow for greater consistency and comparability of results.

Location & market-based emission factors

2 methods for reporting of emissions from the use of electricity

LOCATION-BASED	MARKET-BASED
Emissions associated with the electricity consumed, according to the average emission intensity of the local grid.	**Emissions associated with the electricity that an organisation purchases, according to the contracts it has in place, such as: Power Purchase Agreements (PPAs); application of Energy Attribute Certificates (EACs) or Renewable Energy Certificates (RECs); and the grid residual mix emissions factor.**
• Allow greater consistency and comparability of results. • Method that shall be used when estimating emissions.	• Must be documented to demonstrate it meets the Scope 2 Quality Criteria established within the GHG Protocol Scope 2 Guidance. • Method that can be used additionally to report to demonstrate how renewable energy has been applied to the value chain.

Corporate Emissions Overhead

Allocation of corporate overhead emissions is a universal need across all advertising channels, based on the recognition that there are corporate overhead activities that enable the ultimate delivery of ad content to audiences that are not captured in the unit processes covered by the rest of the GMSF.

Fortunately, this set of emissions is common outside of the advertising sector, so the GMSF approach will follow the established standards and best practices to estimate these emissions in a way that is also practical.

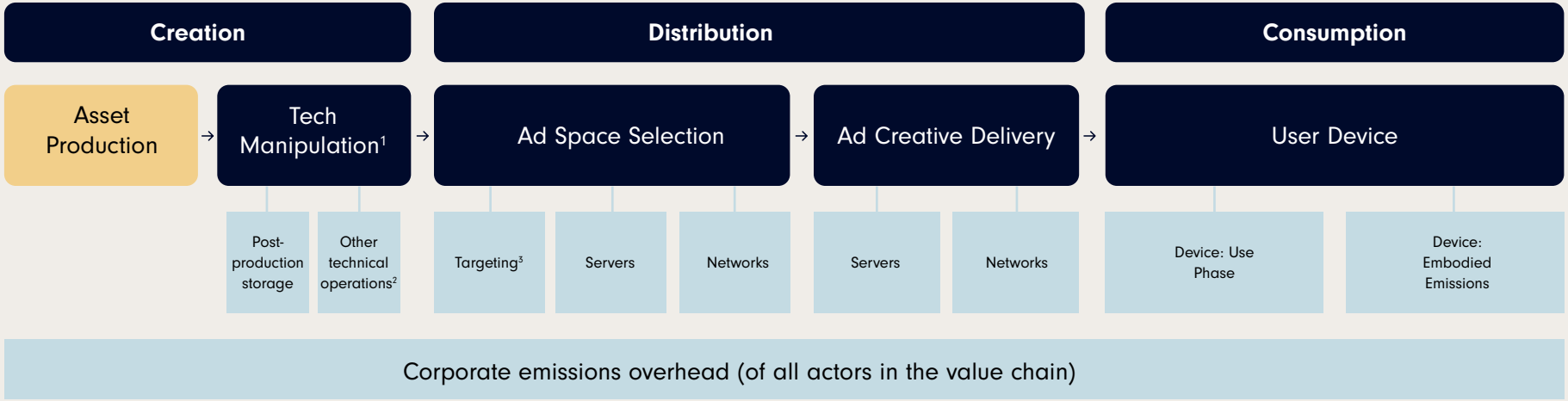
Similar to the data levels that reflect different degrees of uncertainty in the estimates, there will be data levels that reflect uncertainty in the allocation of corporate overhead emissions.

Fortunately, there are other benefits to implementing this methodology, including encouraging every organisation in the ad value chain to have publicly reported, third-party verified GHG inventories which will result in better quality data for the rest of the GMSF methodology and enable these organisations to better support their clients with credible information and support their own reporting needs (e.g., legal compliance, compliance with customer contract requirements).

Digital Workflow, Framework and Formulae

Digital: Channel Emissions Workflow, Channel Emissions Framework, Channel Emissions Formulae

Digital Channel Emissions Workflow



[1]The Tech Manipulation block needed some fine-tuning to become operational and differentiate between tangible short-term elements from expected processes in the future (e.g. AI manipulation), for now this is shown as a placeholder.
[2]Other technical operations is a placeholder whilst the Digital Data Guidance group investigates further.
[3]Targeting is a placeholder for activities relating to targeting and the lifecycle of data, to be confirmed once Data Guidance group investigates further.

Excluded from the system boundaries of this framework.

Included in the system boundaries.

Channel Emissions Framework and Formulae: Digital

Phase	Step & sub-step		Physical processes involved	Expected materiality	Formulae
CREATION	Tech Manipulation (Multivariant creative)	Creative storage	Additional server storage for multiple volumes of assets for the purpose of distribution.	Low	$\sum_{\text{Number of assets}}$ (size of asset (kB)*time stored (yr) * carbon impact of storage (kgCO2e/kB/yr) * allocation factor for the campaign (%))
		Creative transcoding	Server processing for multiple volumes of assets for the purpose of distribution.	-	-
DISTRIBUTION	Ad Space Selection	Creative Selection & Placement	Planning of creative to go on specific inventory within a marketplace	-	-
		Targeting	Digital services used for all targeting activities	-	-
		Direct sale	Exchange of campaign booking between ad buyer and media seller / owner	Low	Same formula as real-time bidding. • If a segment of inventory is set aside exclusively for direct sale: only one activated path to be taken into account • If not: accounted as programmatic (total number of activated path).
	Ad Space Selection	Real-time bidding	Servers processing transmission through automated buying process (SSP/DSP...)	Low to medium	Impressions * Number of potential active paths per impression * Avails ratio * (1 + Requests ratio) * (1 + Responses ratio) * Time of calculation per bid (h) * Compute ratio allocated to bid processing (compute used by SSP/DSP incl. machine-learning) and reporting/analytics (%) * Total relevant infrastructure power incl. PUE (W) * Carbon intensity of electricity (kgCO2e/kWh) * (1 + overhead of other mutualised server resources ratio)
				Low to medium	Impressions * Number of potential active paths per impression * Avails ratio * (1 + Requests ratio) * (1 + Responses ratio) * Time of calculation per bid (h) * Compute ratio allocated to bid processing (compute used by SSP/DSP incl. machine-learning) and reporting/analytics (%) * EF manufacturing and EOL of total relevant infrastructure (kgCO2e) / Average lifetime of equipment (s) * (1 + overhead of other mutualised server resources ratio)

Continued on next page

			Networks transmission through automated buying process (SSP/DSP...)	Low to medium	Impressions * Number of potential active paths per impression * Avails ratio * (1 + Requests ratio) * (1 + Responses ratio) * Data transferred by request type (kB) * Server-to-server networks energy efficiency according to network type and country (kWh/kB) * Carbon intensity of electricity (kgCO2e/kWh)
				Low to medium	Impressions * Number of potential active paths per impression * Avails ratio * (1 + Requests ratio) * (1 + Responses ratio) * Data transferred by request type(kB) * EF manufacturing & EOL amortisation networks according to network type and country10 (kgCO2e/kB)
				Medium to high	Impressions * total server output data per impression (kB) * Σ Number of infrastructures (Breakdown of content delivered by ad servers vs. edge nodes (%) * datacentre or edge nodes energy of efficiency including PUE (kWh/kB output) * carbon intensity of electricity (kgC02e/kWh))
DISTRIBUTION	Ad Creative Delivery	Creative transmission	Ad Servers / CDN edge node processing of ad delivery on display, social, or search	Medium to high	Impressions * total server output data per impression (kB) * Σ Number of infrastructures (Breakdown of content delivered by ad servers vs. edge nodes (%) * datacentre or edge nodes energy of efficiency including PUE (kWh/kB output) * carbon intensity of electricity (kgC02e/kWh))
				Medium to high	Impressions * total server output data per impression (kB) * Σ Number of infrastructures (Breakdown of content delivered by ad servers vs. edge nodes (%) * EF manufacturing and EOL) of total relevant infrastructure (kgCO2e) / infrastructure output bandwidth (kB/s) / average lifetime infrastructure equipment(s)))
			Networks transmission of ad delivery from ad server / CDN edge node to user network as display, social, or search	Medium to high	Impressions * total data transferred on network per impression(kB) * Σ Number of network type (consumption breakdown between types of network (%) * energy efficiency according to network type and country (kWh/kB)) * Σ Number of infrastructures (consumption breakdown between countries of servers/edges nodes and & users(%) * carbon intensity of electricity (kgCO2e/kWh))
					Impressions * total data transferred on network per impression (kB)

Continued on next page

				Medium to high	* ∑ Number of network type	(consumption breakdown between types of network (%) * EF manufacturing & EOL amortisation networks according to network type and country (kgCO2e/kB)))
CONSUMPTION	Device Display	User device load	Download / stream of creative to the user device. Includes embodied emissions of devices.	Low	Impressions *Data transferred per impression(kB) / Broadband speed breakdown by country and by network type (kB/s)	
					* ∑ Devices	(Device mix by type and country (%) * Device power consumption to maintain active connection (W) * time conversion ratio (h/s) * carbon intensity of electricity (kgCO2e/kWh))
				Low	Impressions *Data transferred per impression(kB) / Broadband speed breakdown by country and by network type (kB/s)	
					* ∑ Devices	(Device mix by type and country (%) * EF manufacturing & and EOL amortisation of devices, share of connectivity (kgCO2e/unit) / total active used time over lifetime by device type (s of active use over full lifetime)))
		User device render	Render and display of creative on the user device. Includes embodied emissions of devices.	High	Impressions *Time displayed on device per impression(s)	
					* ∑ Devices	(Device mix by type and country (%) * Device render power consumption (W) * time conversion ratio (h/s) * carbon intensity of electricity (kgCO2e/kWh))
				High	Impressions *Time displayed on device per impression(s)	
					* ∑ Devices	(Device mix by type and country (%) * EF manufacturing & and EOL amortisation of devices, share of render (kgCO2e/unit) / total active used time over lifetime by device type (s of active use over full lifetime))
ALL	Corporate emissions overhead		Allocated organisational emissions attributed to the specific campaign across ALL entities in the campaign value chain.	High	∑ Number of entities	Every organisation in the value chain should be reporting their verified enterprise GHG emissions inventory annually to ensure reasonable data quality at the enterprise level. More guidance will follow on this in the next update of the GMSF.

This channel emissions framework has been designed to be readable within this document. Click here to view an extended version of the channel emissions framework which includes additional detail including; formula type, scaling factors, alternative calculations, data hacks, and further comments.

Key:

- = Not Yet Applicable or To be investigated further

∑ = The mathematical sign for a sum

Digital Data Guidance

What is Data Guidance?

Conceptual emissions formulae require detailed data inputs, but market limitations often result in missing or inconsistent data. Data guidance provides a structured approach to standardising emissions calculations, ensuring consistency, transparency, and practical implementation across the industry.

- **Bridges Theory and Practice** – Translates conceptual formulae into actionable methodologies by addressing data gaps and inconsistencies.
- **Standardises Methodology** – Aligns data collection and assumptions across stakeholders, ensuring consistency and comparability in emissions reporting.
- **Supports Data Availability Constraints** – Establishes a tiered approach, allowing for emissions estimation at different levels of granularity and providing industry-approved defaults when necessary.
- **Enhances Implementation Feasibility** – Creates a practical framework that enables companies to estimate and report emissions accurately, even with incomplete data, while maintaining transparency on uncertainty levels.

By addressing these challenges, data guidance ensures that emissions estimation is both reliable and scalable, enabling broader industry adoption and continuous improvement.

What does data guidance include?

Included	Included	Included
		
Emissions Data Request	**Emissions Data Hacks**	**Emissions Data Sources**
Request of relevant first-party emissions data from media sellers + key intermediaries	**Relevant Guidance when data is missing, insufficient, or unreliable**	**Guidance on standard emissions factors and recognised data sources**
• Corresponds to functional units and inventory available for purchase	• Eliminates data barriers to developing estimates	• Aligns on recommended syndicated data sources for lifecycle assessment
Data Guidance		

How did we construct this data guidance?

IAB Europe's Methodology & Framework Working Group

With the support of Ad Net Zero, IAB Europe created the Methodology & Framework Working Group to help facilitate industry discussion on data guidance. The working group began by analysing the first version of the Global Media Sustainability Framework and identifying areas for improvement - sections where methodological adjustments and additional guidance and/or data were required to meet objectives for the standard. This group compiled the following proposals over the course of several months.

Ad tech, publisher, agency, and sustainability solution vendors developed the updated methodology with assistance from subject matter experts. IAB Europe worked closely with Ad Net Zero throughout this process and presented a first draft of the Working Group's proposals to the GMSF and Ad Net Zero communities. Feedback was collected over a one-month period, during which the Methodology & Framework Working Group split into sub-groups to tackle questions relating to data centres, the programmatic supply chain, ad payloads, and view time in more detail. An anonymised version of the feedback from the GMSF and Ad Net Zero community was reviewed carefully by the Methodology & Framework Working Group, alongside suggestions for data points required to facilitate application of the methodology.

Organisations involved in IAB Europe working group

ProSiebenSat.1 Media SE, Duration Media, impact Plus, Meta, Teads, Cedara, Freewheel, Good-Loop, footsprint, Dk, iab UK, Scope3, Google, XR Extreme Reach, Seen This, DVDW, Dimpact, alliance digitale, PubMatic

What is a Data Request Form?

Emissions Data Request

Request of relevant first-party emissions data from media sellers + key intermediaries

- Corresponds to functional units and inventory available for purchase

Definition:

The request of relevant first-party emissions data from media sellers and key intermediaries.

Purpose:

The data request form is a consistent RFI allowing the industry to implement the GMSF and guide them through the data collection process, identifying the relevant owners/providers of the required data. A singular output that can be shared repeatedly with stakeholders.

Content:

- It specifies the data requested for each data level.
- It recommends data hacks that can be used as defaults and data sources that can be used for calculation.
- It specifies who data should be collected from within the media value chain.

What type of data does the data request form collect?

Every operational formula has 3 different types of data inputs

Required inputs:

- Data that must be provided for a specific campaign, such as number of impressions, media units delivered, or actual energy usage. These inputs are essential for estimating emissions accurately on a case-by-case basis.

Default values:

- Intermediary values needed to power up the formulae, that need to be shared within the market. Those values were defined by channel technical experts during the GMSF process. Examples: default redundancy for cloud, data transferred per active path.

Constants (LCA-based emissions factors):

- Conversion factors derived from well-established data sources as well as Lifecycle Assessment (LCA) studies that quantify emissions for standard activities, materials, or processes. It is important that the emission factors and their sources are clearly communicated.

What type of data does the data request form collect?

Every formula has 3 different types of data inputs, which come to life in operational formula for each unit operation as part of the channel's workflow.

Example Formula:

$$creative\_storage\_impact = total\_masters\_size_a \times allocation\_factor_a \times (copies_{a,hdd} \times storage\_impact_{hdd} + copies_{a,lto} \times storage\_impact_{lto} + copies_{a,cloud}{}^{1} \times storage\_impact_{cloud})$$

Legend:

a: asset of campaign

- required inputs
- default values
- emissions factors

If a required input is unavailable to plug into a formula, a data hack will be applied. More on this in the next sections.

A note on formulae

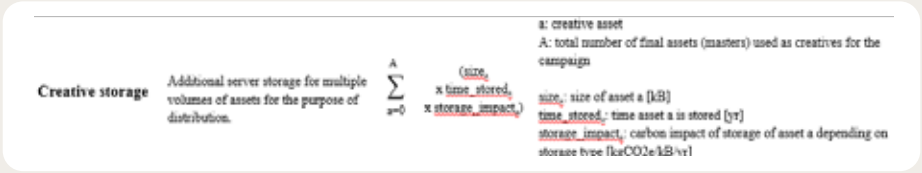
In this document, formulae will be conveyed in 2 different ways: Conceptual vs Operational.

In V1 of the GMSF and other parts of this guidance, conceptual formulae are included in the Channel Emissions Frameworks. The goal of the conceptual formula is to include all the key variables needed to accurately model the different processes in the workflow. These formulae use specific mathematical notation—often referred to as mathematical formalism—to clearly express how each variable influences the system.

In practice, during the transition to operational use, some of these variables were adapted:

- In some cases, the methodology was amended and some variables were either added or removed (e.g. because they were considered insignificant).
- In other cases, multiple variables were combined to make the formulae easier to read and apply. For example, in the formula for digital channel consumption, the effect of digital devices per second is represented by a single value that merges three factors from the original conceptual formula, as agreed upon with channel experts.

The operational formulae are intentionally less technical and more readable, so they can be easily understood and used by a broader audience.



Creative storage	Additional server storage for multiple volumes of assets for the purpose of distribution.	$\sum_{a=0}^{A} (size_a \times time\_stored_a \times storage\_impact_a)$	a: creative asset A: total number of final assets (masters) used as creatives for the campaign $size_a$: size of asset a [kB] $time\_stored_a$: time asset a is stored [yr] $storage\_impact_a$: carbon impact of storage of asset a depending on storage type [kgCO2e/kB/yr]

$$creative\_storage\_impact = total\_masters\_size_a \times allocation\_factor_a \times (copies_{a,hdd} \times storage\_impact_{hdd} + copies_{a,lto} \times storage\_impact_{lto} + copies_{a,cloud}{}^{1} \times storage\_impact_{cloud})$$

Data request form snapshot

This snapshot from the data request form shows how required inputs (in orange), and constants / defaults (in grey) are requested in order to correspond back to the conceptual formula of the unit operation in any specified block of the workflow.

Phase	Step & sub-step		Data type	Parameter of operationalised formula	Expected unit	Comments	Expected data owners	Data level (choose in list)	Value (fill)	Unit (fill)	Data source (fill)
DISTRIBUTION	Ad Space Selection	Real-time bidding	Required input	*Number of active paths per impression*	*Integer / impressions*		*Publishers / Ad tech companies*				
			Required input	*Datacenters emissions per impression*	*kgCO2e / processed impression*		*Publishers / Ad tech companies*				
			Industry default	*Data transferred per active paths*	*MB / active paths*		*N/A - GMSF value - change 'value' match Playbook wording*				
			Emission factor (in GMSF database)	*Network emissions per impression per country*	*kgCO2e / MB*		*N/A - GMSF value - change 'value' match Playbook wording*				
	Ad Creative Delivery	Creative transmission	Required input	*Total payload size per impression*	*MB / impressions*		*Publishers / Ad tech companies*				
			Emission factor (in GMSF database)	*CDN emissions intensity per data transfer per country*	*kgCO2e / MB*		*N/A - GMSF value - change 'value' match Playbook wording*				
			Emission factor (in GMSF database)	*Origin ad server emissions intensity per data transfer per country*	*kgCO2e / MB*		*N/A - GMSF value - change 'value' match Playbook wording*				
			Emission factor (in GMSF database)	*Network emissions per impression per country*	*kgCO2e / MB*		*N/A - GMSF value - change 'value' match Playbook wording*				
CONSUMPTION	Device Display	User device render	Required input	*View time per impression on laptop*	*s*		*Publishers*				
			Required input	*View time per impression on mobile*	*s*		*Publishers*				
			Required input	*View time per impression on tablet*	*s*		*Publishers*				
			Required input	*View time per impression on TV*	*s*		*Publishers*				
			Emission factor (in GMSF database)	*Embodied emissions intensity of laptop*	*kgCO2e / s viewed*		*N/A - GMSF value - change 'value' match Playbook wording*				
			Emission factor (in GMSF database)	*Embodied emissions intensity of mobile*	*kgCO2e / s viewed*		*N/A - GMSF value - change 'value' match Playbook wording*				
			Emission factor (in GMSF database)	*Embodied emissions intensity of tablet*	*kgCO2e / s viewed*		*N/A - GMSF value - change 'value' match Playbook wording*				
			Emission factor (in GMSF database)	*Embodied emissions intensity of TV*	*kgCO2e / s viewed*		*N/A - GMSF value - change 'value' match Playbook wording*				
			Emission factor (in GMSF database)	*Use phase intensity of device per country*	*kgCO2e / s viewed*		*N/A - GMSF value - change 'value' match Playbook wording*				
			Emission factor (in GMSF database)	*Energy intensity of mobile*	*kgCO2e / s viewed*		*N/A - GMSF value - change 'value' match Playbook wording*				
			Emission factor (in GMSF database)	*Energy intensity of tablet*	*kgCO2e / s viewed*		*N/A - GMSF value - change 'value' match Playbook wording*				
			Emission factor (in GMSF database)	*Energy intensity of TV*	*kgCO2e / s viewed*		*N/A - GMSF value - change 'value' match Playbook wording*				

The full data request form can be found HERE.

What is a Data Hack?

Emissions Data Hacks

Relevant guidance when data is missing, insufficient or unreliable

- Eliminates data barriers to developing estimates

Definition:

A Data Hack is a GMSF recognised approach to deal with data shortcomings (e.g. no data, insufficient data, unreliable data). While the intention of a hack is to reduce complexity and eliminate any barrier to estimating emissions, the use of hacks generally means the level of accuracy will decrease. Hacks for less impactful activities will not have a material impact to the final resultant estimate, while hacks for high impact activities need to be called out as increasing the level of uncertainty in the final estimate. The purpose of the data levels classification is to call out which hacks/approximations lead to material uncertainties in the end result.

Use Case:

Hacks make the GMSF implementable in the current data environment, no matter what data barrier is encountered. By tracking the hacks used by data level, the overall result is transparent and consistent. The overall level of uncertainty in emissions estimates will be simply classified as high/red, medium/amber, or low/green based on the cumulative use of hacks/approximations so that the user of the estimate has appropriate context on how to use the emissions estimates following the GMSF.

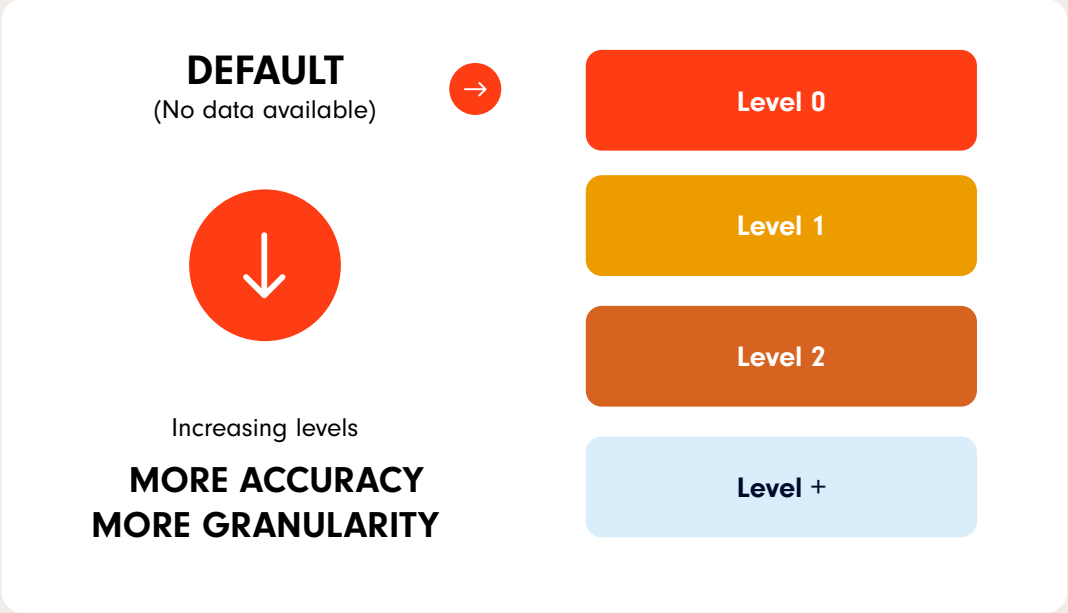
A data hack is defined by levels of granularity or accuracy.

In its simplest form, a data hack at Level "0" will provide a default required input for every formula included in the GMSF.

Each additional level up from level 0 indicates more accurate, granular, or robust required data inputs.

Depending on the unit operation and the relevant workflow and activities captured in that unit operation, the degree to which accuracy and granularity are able to increase will differ.

This data guidance document will serve to showcase how the levels in a unit operation increase and provide the industry with guidance on how to apply any data hacks.



What are Emissions Factors?

Emissions Data Sources

Guidance on standard emissions factors and recognised data sources

- Aligns on recommended syndicated data sources for lifecycle assessment

An Emission Factor (EF) is any coefficient that converts data you have into kgCO2e emissions. There are several basic types of EFs used in the GMSF:

- **Operational Emission Factors** help define how much CO2e is released, that can be based on complex activities such as 'how many kWh of electricity is used in a particular location', or more general asks like 'the approximate average amount of CO2e emitted per $ on advertising spent' (a common, highly simplified approach).
- **Embodied Emission Factors** define how much CO2e is released in the manufacture of physical items used in the advertising process. For example, all of the emissions from producing the paper in a newsprint or billboard ad are estimated via a **Lifecycle Assessment (LCA)**. Less visible examples are all of the ICT (information and communication technology) equipment used across all ad channels. These EFs are generally based on "cradle-to-gate" LCAs that capture all the materials and activities required to make the object.
- **End of Life Emission Factors** define how much CO2e is released in the disposal of the physical items used in the advertising process. For example, the CO2e emissions from disposing (recycling, burning, landfilling) the paper in a newsprint or billboard ad, as well as all the other ICT and other goods used in advertising are estimated through these EFs.

Because the GMSF is a complete, "cradle-to-grave" GHG LCA for ad campaigns, all of these factors are required. **It is critical that the same EFs be used (and transparently documented) by all GMSF practitioners to enable comparability.**

Good News: There are well-established, regularly updated EFs for virtually all common activities across sectors. The GMSF will provide actual EFs or at least the sources of recognised EFs (embodied EFs can be more challenging that operational EFs)

Emission Factors also have varying levels of accuracy

Understanding emission factors (EFs) is critical for ensuring accurate and reliable carbon calculations across the media industry. To support this, we will use these three EF types — ranging from highly reliable official data to industry estimates — to help stakeholders assess the credibility of different data sources. By categorising EFs in this way, we aim to improve transparency and consistency in emissions estimation.

Well researched/updated and widely accepted EFs are available for most common operations (e.g., energy, transportation).

As LCA methods vary and the data providers may have vested interests, this data is more uncertain.

There are "hacks" even for EFs when exact data is hard to obtain, but these EFs can still come from reputable sources like public sector, academic institutes. End-of-life EFs are common examples.

In some cases like energy use and disposal methods, EFs can materially change over geography and time, so the correct EFs should be used.

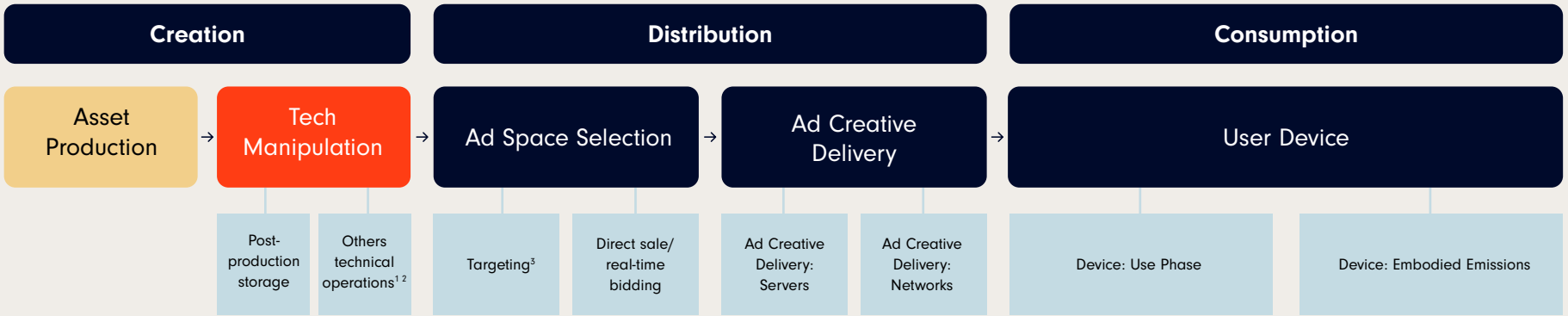
[Click here] to access the recommended EF data sources, which include widely accepted government databases, peer-reviewed studies, and reputable industry sources.

Type 1	Official reports and database from environmental agencies / peer-reviewed scientific studies (e.g. academic LCA)
Type 2	Private studies with scientific advice (e.g. LCA)
Type 3	Industry estimates

Digital Data Guidance: Detailing the Workflow

This section will look at the application of data levels to the version of formula presented in the GMSF. Each unit operation in red will have corresponding tables and data levels.

Operational workflow:



[1]The Tech Manipulation block needed some fine-tuning to become operational and differentiate between tangible short-term elements from expected processes in the future (e.g. AI manipulation), for now this is shown as a placeholder.
[2]Placeholder whilst Digital Data Guidance group investigates further.
[3]Placeholder for activities relating to targeting and the lifecycle of data, to be confirmed once Data Guidance group investigates further.

Excluded from the system boundaries of this framework.

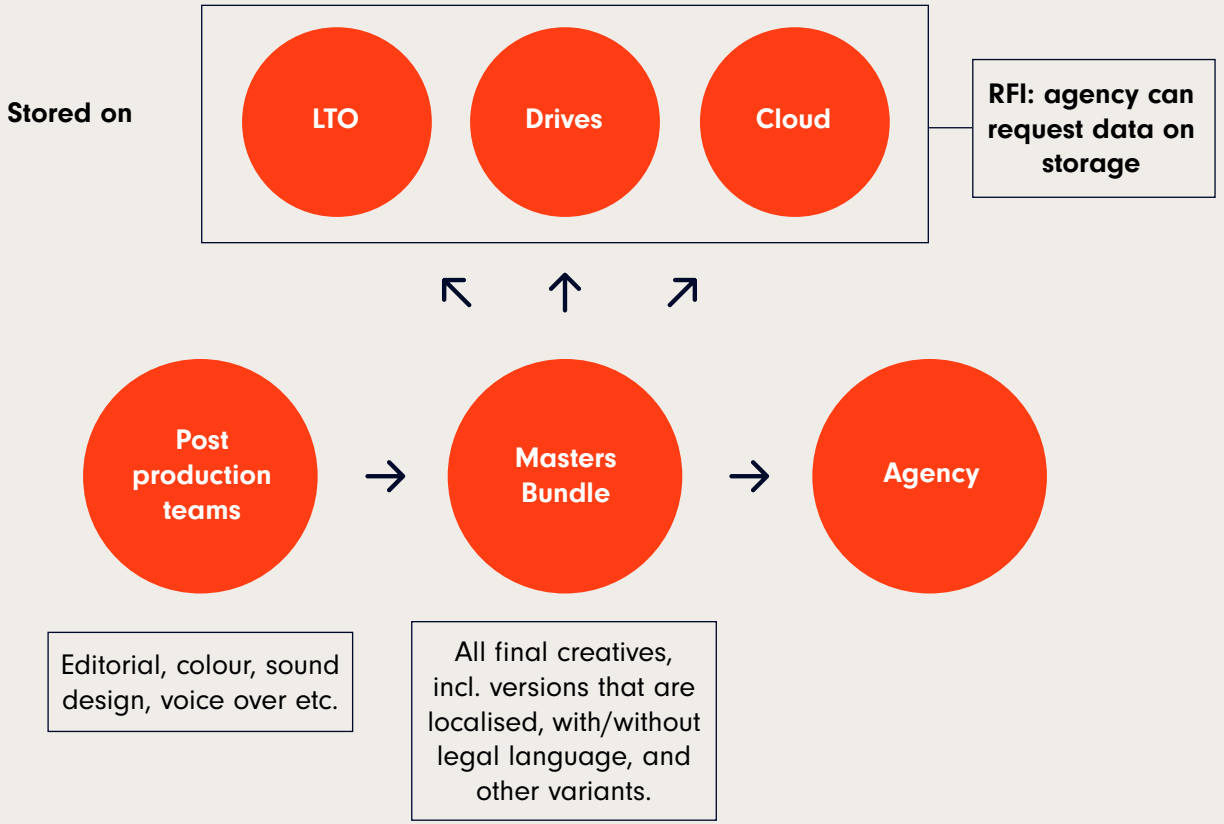
Included in the system boundaries.

CREATION → Tech Manipulation → Post-production storage

CREATION ● Tech Manipulation ● Post-production storage

Technical Context

The post-production storage stage accounts for emissions resulting from the storage of master bundles at the end of the post-production process. The Methodology & Framework Working Group consulted with post-production experts in setting this scope based on the difficulty in tracking asset storage in earlier stages of post-production.



Key:

LTO = Linear Tape Open

CREATION → Tech Manipulation → Post-production storage

Conceptual Formula Reminder

Creative storage

Additional server storage for multiple volumes of assets for the purpose of distribution.

$$\sum_{a=0}^{A} (size_a \times time\_stored_a \times storage\_impact_a)$$

a: creative asset
A: total number of final assets (masters) used as creatives for the campaign

- $size_a$*: size of asset a [kB]*
- $time\_stored_a$*: time asset a is stored [yr]*
- $storage\_impact_a$*: carbon impact of storage of asset a depending on storage type [kgCO2e/kB/yr]*

NB: Allocation factor for storage was removed compared to previously published version

Given the expected low complexity of the topic, only one option is proposed for this sub-step (e.g. identical levels). Taking into account the technical elements presented beforehand, it is suggested to account for storage of master bundles across 3 types of storage.

Time stored is based on assumptions tied to each type of storage unless expiration is otherwise defined by the parties involved.

CREATION → Tech Manipulation → Post-production storage

Operational Formula

The resulting formula would then be:

$$creative\_storage\_impact = total\_masters\_size_a^{1} \times (copies_{a,hdd} \times EF\_storage\_impact_{hdd} + copies_{a,lto} \times EF\_storage\_impact_{ito} + copies_{a,cloud} \times EF\_storage\_impact_{cloud})$$

Legend:

- required inputs
- default values
- emissions factors

[1]The definition of an allocation factor in the case of assets shared between channels has been discarded for this version but may be reconsidered in future releases.

CREATION → Tech Manipulation → Post-production storage

Required inputs and conversion factors

Base Inputs		
Variable	Unit	Source
Total masters size	GB	RFI to post-production company
Copies stored on HDD	Integer	
Copies stored on SSD	Integer	
Copies stored on LTO	Integer	
Copies stored on Cloud	Integer	

Conversion Factors			
Variable	Unit	Value	Source
LTO intensity	kg CO2e per GB	1.14E-03	Fujifilm estimates on LTO-8
HDD intensity	kg CO2e per GB	1.6E-01	Tannu, S., & Nair, P. J. (2023).
SSD intensity	kg CO2e per GB	2E-02	
Cloud intensity	kg CO2e per GB	2.53E-02	ADEME, Base Empreinte (NegaOctet v1.5) 2022 *use-phase based on French grid

Assets are assumed to be stored for 10 years. Use-phase is excluded for local drives as external drives are assumed to be used with infrequent access.

*Please refer to the LINK for latest reference on values and sources.

CREATION → Tech Manipulation → Post-production storage

Calculation example

Example Inputs		
Variable	Unit	Value
Total masters size	GB	50
Copies stored on HDD	Integer	1
Copies stored on SSD	Integer	1
Copies stored on LTO	Integer	2
Copies stored on Cloud	Integer	3

Conversion Factors			
Variable	Unit	Value*	Source – (used for example but sources may be updated)*
LTO intensity	kg CO2e per GB	1.14E-03	Fujifilm estimates on LTO-8
HDD intensity	kg CO2e per GB	1.6E-01	Tannu, S., & Nair, P. J. (2023).
SSD intensity	kg CO2e per GB	2E-02	
Cloud intensity	kg CO2e per GB	2.53E-02	ADEME, Base Empreinte (NegaOctet v1.5) 2022 *use-phase based on French grid

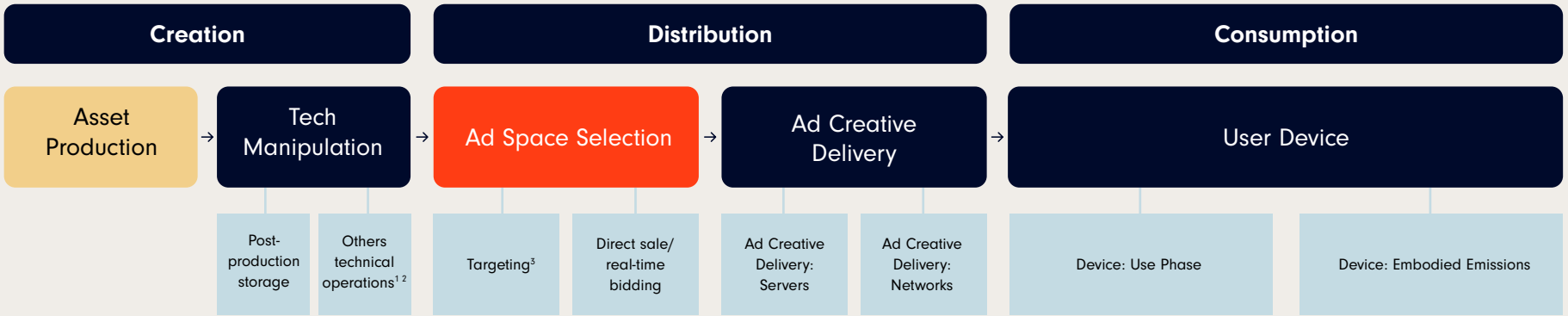
Post_production_storage_emissions =
= Total_masters_size * ((HDD_copies * HDD_intensity) + (SSD_copies * SSD_intensity) + (LTO_copies * LTO_intensity) + (Cloud_copies * Cloud_intensity))
= 50GB * ((1 copy stored on HDD * 0.02 kg CO2e per GB) + (1 copy stored on SSD * 0.16 kg CO2e per GB) + (2 copies stored on LTO * 0.00114 kg CO2e per GB) + (3 copies stored on cloud * 0.0253 kg CO2e per GB))
= **12.909 kg CO2e**

*Please refer to the LINK for latest reference on values and sources. Example above is illustrative only. Specific values in this example may not match the LINK because these values will be periodically updated.

Digital Data Guidance: Detailing the Workflow

This section will look at the application of data levels to the version of formula presented in the GMSF. Each unit operation in red will have corresponding tables and data levels.

Operational workflow:



[1]The Tech Manipulation block needed some fine-tuning to become operational and differentiate between tangible short-term elements from expected processes in the future (e.g. AI manipulation), for now this is shown as a placeholder.
[2]Placeholder whilst Digital Data Guidance group investigates further.
[3]Placeholder for activities relating to targeting and the lifecycle of data, to be confirmed once Data Guidance group investigates further.

Excluded from the system boundaries of this framework.

Included in the system boundaries.

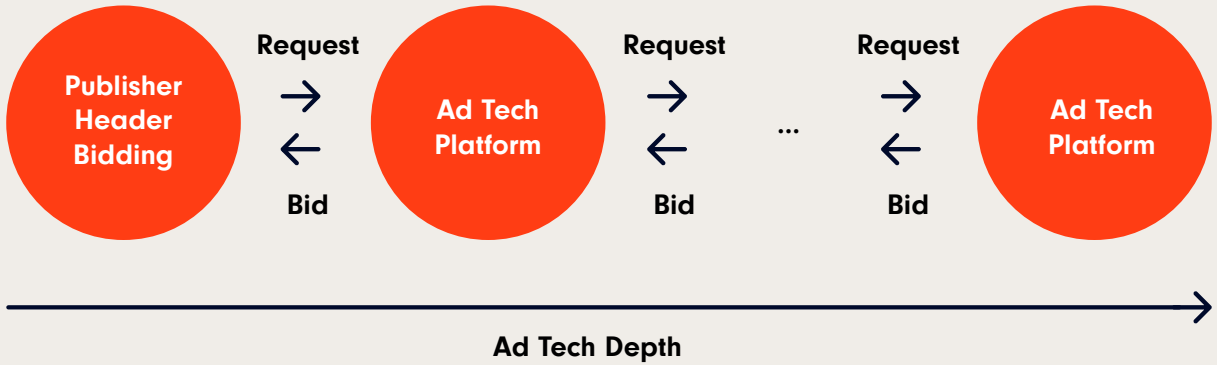
DISTRIBUTION → Ad Space Selection

DISTRIBUTION • Ad Space Selection

Technical Content

The selection stage accounts for the activity required to buy and sell digital ad space, including real-time bidding and direct sale - it is the hardest stage to model in the lifecycle of the digital ad due to limited transparency. The proposed methodology accounts for server processing (compute) and transfer of RTB requests and responses (networking).

Direct sale is modelled as programmatic unless the media owner dedicates a portion of its inventory solely to direct sale and the programmatic supply chain is not activated. Assumptions have been integrated to adapt the methodology for end-to-end platforms (e.g. social) in the absence of information on internal auctioning.



DISTRIBUTION → Ad Space Selection

Conceptual Formulae Reminder

Ad Space Selection	Servers processing transmission through automated buying process (SSP/DSP…)	Use Phase	*Impressions * Number of potential active paths per impression[5] * Avails ratio * (1 + Requests ratio) * (1 + Responses ratio)[6] * Time of calculation per bid (h) * Compute ratio allocated to bid processing (compute used by SSP/DSP incl. machine-learning) and reporting/analytics[7] (%) * Total relevant infrastructure power incl. PUE (W) * Carbon intensity of electricity (kgCO2e/kWh) * (1 + overhead of other mutualized server resources ratio[8])*
		Embodied	*Impressions * Number of potential active paths per impression[5] * Avails ratio * (1 + Requests ratio) * (1 + Responses ratio)[6] * Time of calculation per bid (h) * Compute ratio allocated to bid processing (compute used by SSP/DSP incl. machine-learning) and reporting/analytics[7] (%) * EF manufacturing and EOL of total relevant infrastructure (kgCO2e) / Average lifetime of equipment (s) * (1 + overhead of other mutualized server resources ratio[8])*
	Networks transmission through automated buying process (SSP/DSP…)	Use Phase	*Impressions * Number of potential active paths per impression[5] * Avails ratio * (1 + Requests ratio) * (1 + Responses ratio)[6] * Data transferred by request type[9] (kB) * Server-to-server networks energy efficiency according to network type and country[10] (kWh/kB) * Carbon intensity of electricity (kgCO2e/kWh)*
		Embodied	*Impressions * Number of potential active paths per impression[5] * Avails ratio * (1 + Requests ratio) * (1 + Responses ratio)[6] * Data transferred by request type[9] (kB) * EF manufacturing & EOL amortization networks according to network type and country10 (kgCO2e/kB)*

DISTRIBUTION → Ad Space Selection

Operational Formulae

The resulting formulae would then be:

$$ad\_selection\_impact_{datacenters,\ use\ phase} = number\_impressions \times ads.txt\_lines^{1} \times server\_factor^{1} \times EF\_datacentres\_use\_phase\_intensity \times (share\_servers\_local \times EF\_electricity\_local_{country} + share\_servers\_abroad \times EF\_electricity\_abroad_{country})$$

$$ad\_selection\_impact_{datacenters,\ embodied} = number\_impressions \times ads.txt\_lines^{1} \times server\_factor^{1} \times EF\_datacentres\_embodied\_intensity$$

$$ad\_selection\_impact_{networks,\ use\ phase} = number\_impressions \times ads.txt\_lines^{2} \times call\_factor^{2} \times RTB\_payload\_size\_per\_call \times EF\_network\_use\_phase\_intensity^{3} \times (share\_network\_local \times EF\_electricity\_local_{country} + share\_network\_abroad \times EF\_electricity\_abroad_{country})$$

$$ad\_selection\_impact_{networks,\ embodied} = number\_impressions \times ads.txt\_lines^{2} \times call\_factor^{2} \times RTB\_payload\_size\_per\_call \times EF\_network\_embodied\_intensity^{3}$$

Legend:

- required inputs
- default values
- emissions factors

[1]Those two factors allow to calculate the number of servers involved per impression (incl. estimation of ad tech depth).
[2]Those two factors allow to calculate the number of requests involved per impression (incl. bid rates).
[3]Assuming the use of the simplified network model.

DISTRIBUTION → Ad Space Selection

Required inputs – Data levels

There are two things that need to be estimated in the selection stage: the volume of programmatic activity and the intensity of server operations. Currently, the calculations rely on ads.txt as a proxy and LCA data layered with assumptions respectively. Following this proposal, the Methodology and Framework Working Group will focus on facilitating higher level calculations based on contributed data.

	Programmatic Activity		Datacentres Operations Intensity (per impression)	
Level	Method	Notes	Method	Notes
0	Default value	For cases where no ads.txt is available.	Default value	Based on lifecycle assessment of VMs and assumptions.
1	Ads.txt	Based on ads.txt length as a proxy and standard data on supply chain depth.	Allocation from global data	Based on contributed data on the impact of server operations, allocated to the impression level from global, regional, or data centre level.
2	Contributed data	Based on publishers, SSPs and DSPs sharing aggregate data on volumes of bidding activity for each partner they work with.	Allocation from regional data	
3	Contributed data by geo	Further disaggregated by geo.	Allocation from unit data	
4	Monthly contributed data by geo	Further disaggregated by using monthly data.		
5	Monthly, placement-level contributed data by geo	Further disaggregated leveraging GPID.		

DISTRIBUTION → Ad Space Selection → Active Paths

Required inputs – Default value

For the level 0/1 methodology on active paths, the relevant Methodology & Framework sub-group utilised aggregate data shared by members to develop a simple and practical approach that improves upon previous models of the programmatic supply chain by using more representative assumptions. For example, the size of the average RTB call was reduced by an order of magnitude (where previously a figure representing the average HTTP request was used) and a bid rate was introduced (where previously all bid requests were assumed to return a bid).

Combining aggregated supply chain data on depth (hops) with aggregated ad tech data (throttling, bid rate) yielded the **server factor** and **call factor**, which can be multiplied with the number of ads.txt lines to estimate the **number of activated servers** and **number of RTB calls** (requests/responses) respectively.

For the level 0 method, to be used only in instances where no ads.txt file is present, the sub-group decided to suggest a conservative value of 3000 ads.txt lines. The sub-group noted that in certain regions where ads.txt adoption is less common the level 0/1 methods may be difficult to apply.

The Methodology & Framework Working Group acknowledges that the number of ads.txt lines is an imperfect proxy of programmatic supply chain.

Results		
Format	Server factor	Call factor
Display	1.412	1.464
Video	1.316	1.334

DISTRIBUTION → Ad Space Selection → Active Paths

Required inputs – Assumptions for end-to-end platforms and direct buy

The Methodology & Framework Working Group notes that it is harder to accurately estimate emissions associated with selection on end-to-end platforms (or 'walled gardens') using a bottom-up approach as less information is available. As such, in line with other digital ad emission frameworks and the previous version of the GMSF digital methodology, it proposes a different set of assumptions to adapt the methodology for campaigns run through end-to-end platforms (e.g. social).

Specifically:

- The **number of activated servers** is assumed to be 500.
- The networking emissions are considered to be negligible when operations occur within a single server location. The number of calls is assumed to be 0.

Direct buy should only be accounted for separately in cases where direct deals do not compete with programmatic, and the following assumptions apply:

- Number of activated servers = 2
- Number of calls = 4

DISTRIBUTION → Ad Space Selection

Required Inputs, default values and conversion factors

Base Inputs		
Variable	Unit	Source
Impressions	Integer	Media buy data
Location	Country	
Ads.txt lines	Integer	Media buy data, default available

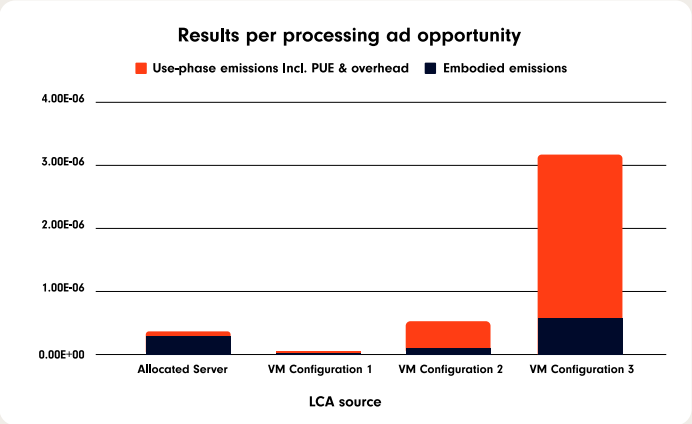
*Please refer to the LINK for latest reference on values and sources. Specific values in this example may not match the LINK because these values will be periodically updated.

Conversion factors and default values			
Variable	Unit	Value	Source
Server lifetime emissions	kg CO2e per supply chain node	Estimated using the methodology on the 'Data Centre Processing ' slide.	
Use-phase network energy consumption	kWh per KB	1.65E-08	Fixed network assumption for RTB calls. Refer to 'Network Emissions Model' slide.
Network embodied emissions	local	2.14E-09	Order of magnitude adjusted.
Number of RTB calls per ads.txt line	Integer	Refer to the methodology on the 'Active Paths level 0/1 slide'. Different figures for display and video ad slots.	
Number of activated servers per ads.txt line	Integer		
Local intensity	kg CO2e per kWh	Refer to the 'Grid Emissions Factors' slide.	
Foreign intensity	kg CO2e per kWh	Refer to the 'Foreign Server Emission Factors' slide.	
Average RTB Payload	KB	3	Chartboost, provided through Ad Net Zero feedback.

DISTRIBUTION → Ad Space Selection → Data centre processing

Required Inputs, default values and conversion factors

For the level 0 default on server processing intensity, the relevant Methodology & Framework sub-group evaluated an approach based on time allocation from LCA data and assumptions around virtualisation, drawing from the Digital Carbon Footprint Framework. The sub-group elected to use figures from a lifecycle assessment of virtual machines for homogeneity (avoiding an additional assumption on VMs per physical machine) and opted for the VM configuration deemed most representative given the set of assumptions and based on feedback from industry experts.



Assumptions				
Variable	Unit	Value	Notes	Source
Electricity consumption of VM.	kWh per year	55.2	VM Configuration 1:1 vCPU, 4 GB dedicated RAM, 5 years lifespan	ADEME, Base Empreinte [French LCA Database] (NegaOctet v1.5)
Embodied emissions of VM.	kg CO2e per year	3.79		
Processing time	Ms	100	Used to allocate server emissions to processing of an ad opportunity.	Clearcode, provided through ANZ feedback.
Overhead factor	(dmensionless)	1.25	Buffer to account for other processing tasks, increase conservativeness.	RTB House, provided through ANZ feedback.
Share of servers in local geo	(dimensionless)	0.5	Share of servers assumed to be in the same country as the user.	Digital Carbon Footprint framework by SRI x Alliance Digitale
Share of servers abroad	(dimensionless)	0.5	Share of servers assumed to be abroad.	
Average PUE	(dimensionless)	1.56	Applied as factor to use-phase.	Uptime Institute
Local grid intensity	kg CO2e per kWh	Refer to the 'Grid Emissions Factors' slide.		
Foreign grid intensity	kg CO2e per kWh	Refer to the 'Foreign Server Emissions Factors' slide.		
Results				
Use-phase server energy incl. PUE & overhead	kWh per ad opportunity	3.41E-07	Based on the assumptions above, to be combined with grid intensities.	
Server embodied emissions	kg CO2e per ad opportunity	1.50E-08	Based on the assumptions above.	

*Please refer to the LINK for latest reference on values and sources.

A Note on End-to-End Platforms

The Methodology & Framework Working Groups notes that it is harder to accurately estimate emissions associated with selection on end-to-end platforms (or 'walled gardens') using a bottom-up approach as less information is available. As such, in line with other digital ad emission frameworks and the previous version of the GMSF digital methodology, it proposes a different set of assumptions to adapt the methodology for campaigns run through end-to-end platforms (e.g. social).

Specifically:

- The **number of activated servers** is assumed to be **500**.
- The networking emissions are considered to be negligible when operations occur within a single server location.

DISTRIBUTION → Ad Space Selection

Calculation Example

Let's assume we want to estimate the impact of ad selection in a display campaign. Our audience is located in Germany, the publisher offering the ad space has 150 ads.txt lines, and we are estimating the impact of 100k ads. We will use the reference German grid EF and the European foreign server grid EF.

Server_usephase_emissions =
= Servers_per_line * Ads_txt_lines * Server_usephase_intensity * (0.5 share of servers in local geo * Local_grid_EF + 0.5 share of servers abroad * Foreign_grid_EF) * Impressions
= 1.412 * 150 ads.txt lines * 0.000000341 kWh per server processing of ad opportunity * (0.5 * 0.344 kg CO2e per kWh + 0.5 * 0.25 kg CO2e per kWh) * 100000 impressions
= **2.145 kg CO2e**

Server_embodied_emissions =
= Servers_per_line * Ads_txt_lines * Server_embodied_intensity * Impressions
= 1.412 * 150 ads.txt lines * 0.000000015 kg CO2e per server processing of ad opportunity * 100000 impressions
= **0.254 kg CO2e**

Network_usephase_emissions =
= Calls_per_line * Ads_txt_lines * Network_usephase_intensity * RTB_payload * (0.5 share of servers in local geo * local_intensity + 0.5 share of servers abroad * foreign_intensity) * Impressions
= 1.464 * 150 ads.txt lines * 0.00000000967 kWh per KB * 3 KB * (0.5 share of servers in local geo * 0.344 kg CO2e per kWh + 0.5 share of servers abroad * 0.25 kg CO2e per kWh) * 100000 impressions
= **0.189 kg CO2e**

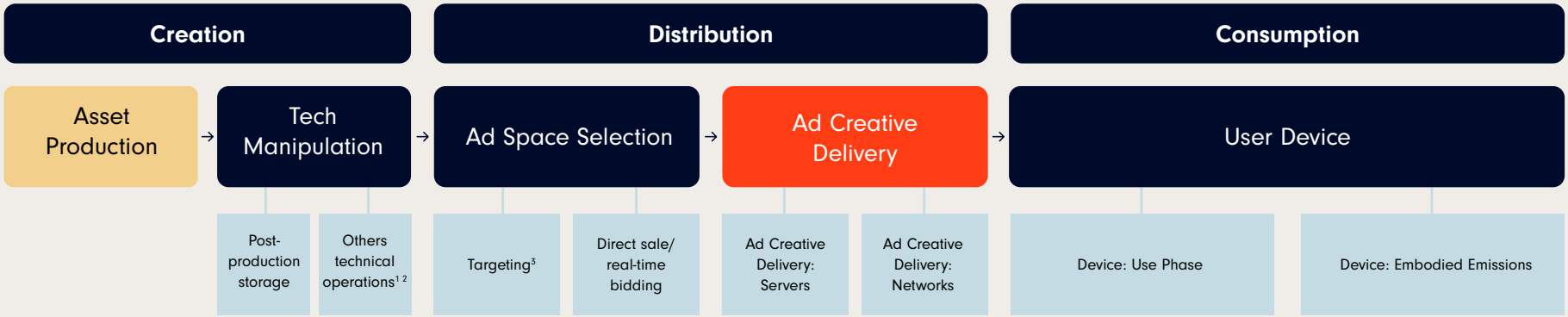
Inputs*		
Variable	Unit	Value
Impressions	Integer	100k
Location	Country	Germany
Ads.txt lines	Integer	150

Network_embodied_emissions =
= Impressions * Calls_per_line * Ads_txt_lines * RTB_payload * Network_embodied_intensity
= 100000 impressions * 1.464 * 150 ads.text lines * 0.003 KB * 0.00000214 kg CO2e per KB
= **0.14 kg CO2e**

*Please refer to the LINK for latest reference on values and sources. Example above is illustrative only. Specific values in this example may not match the LINK because these values will be periodically updated.

Digital Data Guidance: Detailing the Workflow

Operational workflow:



[1]The Tech Manipulation block needed some fine-tuning to become operational and differentiate between tangible short-term elements from expected processes in the future (e.g. AI manipulation), for now this is shown as a placeholder.
[2]Placeholder whilst Digital Data Guidance group investigates further.
[3]Placeholder for activities relating to targeting and the lifecycle of data, to be confirmed once Data Guidance group investigates further.

Excluded from the system boundaries of this framework.

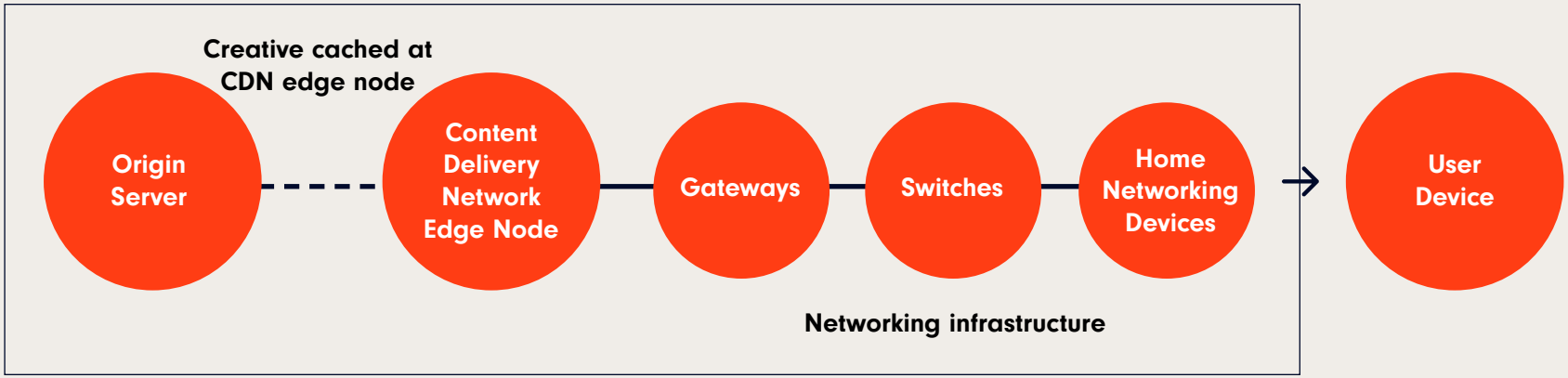
Included in the system boundaries.

DISTRIBUTION → Ad Creative Delivery

Distribution ● Ad Creative Delivery

Technical Context

The delivery section accounts for the emissions resulting from transferring ads to user devices over fixed or mobile connections. The main input is the payload of this transfer. The methodology accounts for content delivery networks and includes an overhead for the origin server. An overhead is applied in certain data levels to account for additional payloads (wrappers, players etc.) - the Methodology & Framework Working Group acknowledges that these are often cached on the user device, but no data was found to integrate a representative assumption. The intensity of network transfer is modelled in accordance with the latest ADEME recommendation based on work with ISPs.



Distribution → Ad Creative Delivery

Conceptual Formulae Reminder

Ad Creative Delivery	Ad Servers / CDN edge node processing of ad delivery on display, social, or search	Use phase	*Impressions* * *total server output data per impression*[11] *(kB)* * $\sum$ Number of infrastructures	*(Breakdown of content delivered by ad servers vs. edge nodes*[12] *(%)* * *datacenter or edge nodes energy of efficiency including PUE (kWh/kB output)* * *carbon intensity of electricity (kgC02e/kWh))*[13]
		Embodied	*Impressions* * *total server output data per impression*[11] *(kB)* * $\sum$ Number of infrastructures	*(Breakdown of content delivered by ad servers vs. edge nodes*[12] *(%)* * *EF manufacturing and EOL) of total relevant infrastructure (kgCO2e)* */ infrastructure output bandwidth (kB/s)* */ average lifetime infrastructure equipment(s))*[13]*)*
	Networks transmission of ad delivery from ad server / CDN edge node to user network as display, social, or search	Use phase	*Impressions* * *total data transferred on network per impression*[11] *(kB)* * $\sum$ Number of network type * $\sum$ Number of infrastructures	*(consumption breakdown between types of network (%)* * *energy efficiency according to network type*[14] *and country (kWh/kB))* *(consumption breakdown between countries of servers/edges nodes*[12] *and & users(%)* * *carbon intensity of electricity (kgCO2e/kWh))*
		Embodied	*Impressions* * *total data transferred on network per impression*[11] *(kB)* * $\sum$ Number of network type	*(consumption breakdown between types of network (%)* * *EF manufacturing & EOL amortization networks according to network type*[14] *and country (kgCO2e/kB)* * *)*[13]*)*

DISTRIBUTION • Ad Creative Delivery

Operational Formulae

The resulting formulae would then be:

$$ad\_creative\_delivery_{datacentres,\ use\ phase} = number\_impressions \times (payload\_size + payload\_overhead) \times (EF\_datacentres\_use\_phase\_intensity \times EF\_electricity\_local_{country})$$

$$ad\_creative\_delivery_{datacentres,\ embodied} = number\_impressions \times (payload\_size + payload\_overhead) \times EF\_datacentres\_embodied\_intensity$$

$$ad\_selection\_impact_{networks,\ use\ phase} = number\_impressions \times (payload\_size + payload\_overhead) \times (EF\_networks\_use\_phase\_intensity^{1} \times EF\_electricity\_local_{country})$$

$$ad\_selection\_impact_{networks,\ use\ phase} = number\_impressions \times (payload\_size + payload\_overhead) \times EF\_networks\_embodied\_intensity^{1}$$

Legend:

a: asset of campaign

- required inputs
- default values
- emissions factors

[1]Assuming the use of the simplified network model.

DISTRIBUTION → Ad Creative Delivery

Required Inputs, default values and conversion factors

Required inputs			
Variable	Unit	Notes	Source
Impressions	Integer		Media buy data
Payload	MB	Refer to 'payload calculation'	
Mobile connection ratio	Ratio	Ratio of users being served ads through fixed (ethernet, wi-fi) and mobile (4G, 5G) connections. Defaults available.	
Fixed connection ratio	Ratio		
Location	Country		

Conversion factors			
Variable	Unit	Value	Source
Electricity consumption of mobile networks	kWh per MB	Please refer to the LINK for latest reference on values and sources.	
Electricity consumption of fixed networks	kWh per MB		
Embodied emissions of mobile networks	kg CO2e per MB		
Embodied emissions of fixed networks	kg CO2e per MB		
Use-phase energy intensity of transferring 1 MB from an edge node	kWh per MB		
Embodied emissions intensity of transferring 1MB from an edge node	kg CO2e per MB		

DISTRIBUTION → Ad Creative Delivery → Payload Calculation

Required inputs – Data Levels

The table below contains information on how to estimate payload depending on the data that is available. The overhead should be added to the payload if using any of the level 0-2 methods. The payload refers to the weight of the assets that are delivered to the user, not those upload to the ad server - transcoding may be applied. Based on aggregate data submitted by members. If granular data is available showing distribution across different transcodes, delivery should be estimated per transcode. If completion rate data is available in quartiles rather than as a mean, calculations should overestimate by using the higher bound of the quartile (e.g. if a given portion of users is reported to have watched between 0 and 3 seconds of a video ad, they are assumed to have watched 3 seconds.)

Payload				
Level	Method	Display default	Video default	Notes
0	Default creative weight	0.25 MB	4 MB, 6 MB instream	Overestimation by design. Instream figure can be used in other environments where heavy ad intervention does not apply (e.g. Safari).
1	100% of creative data assumed to be transferred	N/A		Full creative data assumed to be transferred, overestimation due to lack of data.
2	Completion rate used as proxy for data transferred			E.g. 50% video completion rate ~ 50% of video transferred. Option when actuals on completion rate are available.
3	Actual data transfer			Eliminates need for overhead payload term below. Option when data transfer is available.
Overhead				
Add-on to levels 0-2	Payload beyond creative assets (e.g. players).	0.05 MB	0.35 MB	Overestimation due to caching - actual would require information on network reach, campaign reach, cache lifetimes etc.

DISTRIBUTION → Ad Creative Delivery → Fixed/Mobile

Defaults

These can be used in cases where no data is available on connection type and are based on aggregate data.

Fixed / Mobile Defaults			
Region	Countries Included in Data Sample	Fixed Ratio	Mobile Ratio
Europe	Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom,Switzerland, Iceland, Liechtenstein, Norway	74.31%	25.69%
APAC	Australia, Bangladesh, Brunei, Cambodia, China, Cook Islands, Fiji, India, Indonesia, Japan, Kiribati, Laos, Malaysia, Maldives, Marshall Islands, Micronesia, Mongolia, Myanmar, Nepal, New Caledonia, New Zealand, Niue, North Korea, Pakistan, Palau, Papua New Guinea, Philippines, Singapore, Solomon Islands, South Korea, Sri Lanka, Thailand, Timor Leste, Tonga, Tuvalu, Vietnam	67.68%	32.32%
NA	United States of America, Canada	86.08%	13.92%
LATAM	Mexico, Guatemala, Honduras, Nicaragua, El Salvador, Costa Rica, Panama, Belize, Haiti, Cuba, Dominican Republic, Jamaica, Trinidad & Tobago, Bahamas, Barbados, St. Lucia, Grenada, St. Vincent & Grenadines, Antigua & Barbuda, Dominica, St. Kitts & Nevis, Brazil, Colombia, Argentina, Peru, Venezuela, Chine, Ecuador, Bolivia, Paraguay, Uruguay, Suriname, Guyana	71.45%	28.55%

*Data currently missing for Africa, will be added when available

DISTRIBUTION → Ad Creative Delivery → Network Emissions Model

Inputs, default values and conversion factors

Assumptions			
Variable	Unit	Value	Source
Fixed network bandwidth	GB per h	2.88	Carbon Trust, 2021
Mobile network bandwidth	GB per h	2.19	Greenspector
Fixed network electricity consumption - component a	kWh per MB	5.00E-06	Based on ADEME, Base Empreinte, "Numérique 2.0" dataset, 2025 (based on study on the environmental footprint of French ISPs). Network electricity consumption model has two components based on payload and time respectively. Time is calculated off payload using the bandwidth assumptions.
Fixed network electricity consumption - component b	kWh per user(s)	9.18E-06	
Mobile network electricity consumption - component a	kWh per MB	1.03E-04	
Mobile network electricity consumption - component b	kWh per user(s)	8.50E-06	
Mobile network embodied emissions - component a	kg CO2e per MB	6.20E-06	
Mobile network embodied emissions - component b	kg CO2e per user(s)	1.52E-06	
Fixed network embodied emissions - component a	kg CO2e per MB	9.05E-07	
Fixed network embodied emissions - component b	kg CO2e per user(s)	9.90E-07	

Resulting Conversion Factors		
Variable	Unit	Value
Electricity consumption of mobile networks	kWh per MB	1.17E-04
Electricity consumption of fixed networks	kWh per MB	1.65E-05
Embodied emissions of mobile networks	kg CO2e per MB	8.70E-06
Embodied emissions of fixed networks	kg CO2e per MB	2.14E-06

DISTRIBUTION • Ad Creative Delivery

Calculation Example

Let's assume we want to estimate the impact of ad delivery in a video campaign. We will apply the level 1 method as we know our video asset weighs 2.5 MB but have no data on completion rate or actual data transfer. The level 1 method assumes the entire file is delivered and uses the overhead term. We will estimate the impact for the portion of the audience in Italy and on a fixed connection. The reference grid emission factor is used.

Fixed_delivery_usephase_emissions =
= (Payload + Video_overhead) * (Fixed_network_electricity_consumption + CDN_usephase) * Local_grid_EF * Impressions
= (2.5MB + 0.350 MB) * (0.00000967 kWh per GB + 0.00000043 kg CO2e per KB) * 0.287 kg CO2e per kWh * 100000 impressions
= **0.826 kg CO2e**

Fixed_delivery_embodied_emissions =
= (Payload + Video_overhead) * (Fixed_network_embodied + CDN_embodied) * Impressions
= (2.5MB + 0.350 MB) * (0.00000209 kg CO2e per GB + 0.000000588 kg CO2e per GB) * 100000 impressions
= **0.763 kg CO2e**

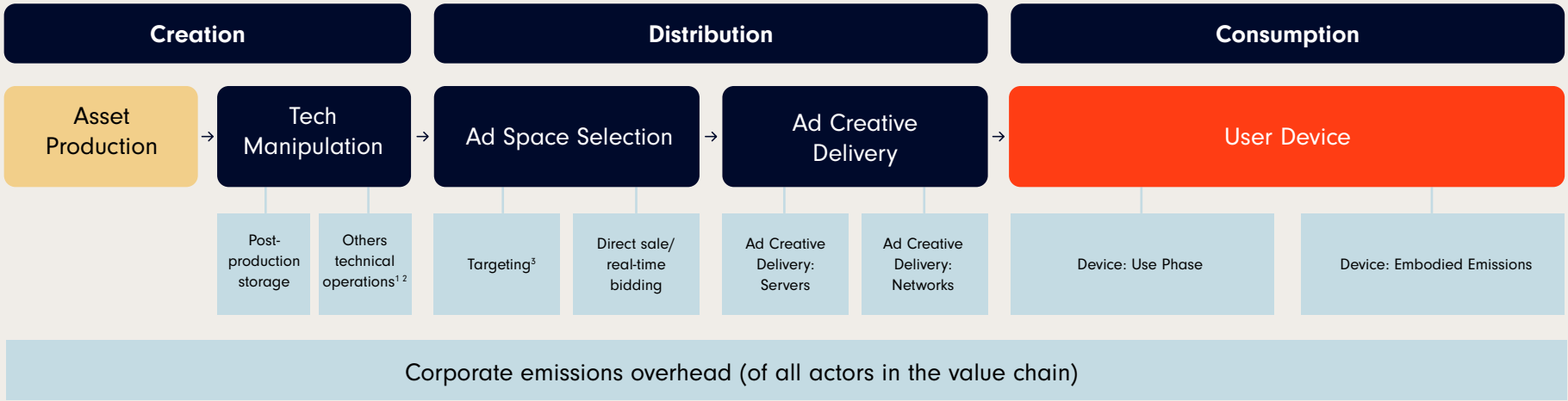
Inputs*		
Variable	Unit	Value
Impressions	Integer	100k
Location	Country	Italy
View Time	Creative weight/MB	2.5

*Please refer to the LINK for latest reference on values and sources. Example above is illustrative only. Specific values in this example may not match the LINK because these values will be periodically updated.

In case the split between fixed and mobile connections is unknown, multiply the total impressions with the ratios on p.76.

Digital Data Guidance: Detailing the Workflow

Operational workflow:



[1]The Tech Manipulation block needed some fine-tuning to become operational and differentiate between tangible short-term elements from expected processes in the future (e.g. AI manipulation), for now this is shown as a placeholder.
[2]Placeholder whilst Digital Data Guidance group investigates further.
[3]Placeholder for activities relating to targeting and the lifecycle of data, to be confirmed once Data Guidance group investigates further.

Excluded from the system boundaries of this framework.

Included in the system boundaries.

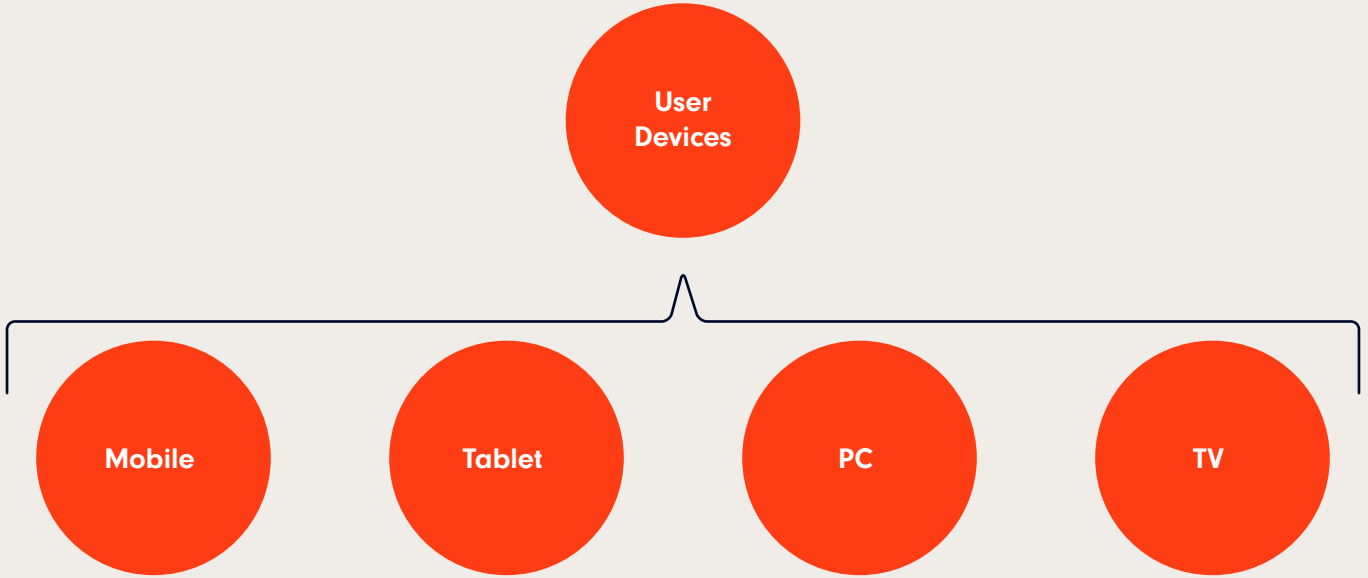
CONSUMPTION → User device

Consumption → User Device

Technical Context

The consumption stage accounts for emissions arising from resource usage on user devices, including both use-phase and embodied emissions across 4 device groups: mobile, tablet, PC, and TV. In the absence of more specific data relating digital ads to hardware usage, two assumptions are included in the proposed methodology. First, the entire device's lifecycle emissions are allocated to each digital ad. Second, view time is used as a proxy to facilitate the time-based allocation.

For the digital channel, the following devices are considered:



Only user render step can be modelised with available data to this date. User device load is therefore neglected.

Consumption ● User Device Render

Conceptual Formulae Reminder

User device render	Render and display of creative on the user device. Includes embodied emissions of devices.	Use phase	*Impressions * Time displayed on device per impression(s)* $* \sum_{\text{Devices}}^{17}$ *(Device mix by type and country (%) * Device render power consumption[16] (W) * time conversion ratio (h/s) * carbon intensity of electricity (kgCO2e/kWh))*
		Embodied	*Impressions * Time displayed on device per impression(s)* $* \sum_{\text{Devices}}^{17}$ *(Device mix by type and country (%) * EF manufacturing & and EOL amortization of devices, share of render[16] (kgCO2e/unit) / total active used time over lifetime by device type (s of active use over full lifetime))*

User render is modelised based on total power of device, therefore discarding the user load phase in the operational formula.

Reference LCA shall be used for each device type within the industry, therefore the remaining parameter requiring guidance is view time.

Consumption ● User Device Render

Operational Formula

The resulting formula would then be:

$$user\_device\_render_{use\ phase} = \sum_{per\ device\ type} \begin{matrix} number\_impressions_{device\ type} \\ \times view\_time_{device\ type}{}^{1} \\ \times EF\_device\_use\_per\_second_{device\ type} \\ \times EF\_electricity\_localcountry \end{matrix}$$

$$user\_device\_render_{embodied} = \sum_{per\ device\ type} \begin{matrix} number\_impressions_{device\ type} \\ \times view\_time_{device\ type}{}^{1} \\ \times EF\_device\_embodied\_per\_second_{device\ type} \end{matrix}$$

Legend:

- required inputs
- default values
- emissions factors

[1]Beyond time allocation, introducing another variable in the equation to further allocate emissions based on screen share will be explored for the next release.

Consumption → User Device Render

Required Inputs, default values and conversion factors

Conversion Factors			
Variable	Unit	Value	Source
Use-phase energy intensity of mobiles	kWh per second	1.3E-06	Based on ADEME, Base Empreinte, "Numérique 2.0" dataset, 2025, Scope3 and Energy Consumption of Consumer Electronics in U.S. Homes in 2020, Urban et. al. Mobile use-phase value is conservative and based on video playback. TV figure represents a smart TV. PC figure based on laptop.
Use-phase energy intensity of tablets	kWh per second	1.4E-06	
Use-phase energy intensity of TVs	kWh per second	3.8E-05	
Use-phase energy intensity of PCs	kWh per second	1.54E-05	
Embodied emissions intensity of mobiles	kg CO2e per second	6.55E-06	Based on ADEME, Base Empreinte, "Numérique 2.0" dataset, 2025, Scope3 and Energy Consumption of Consumer Electronics in U.S. Homes in 2020, Urban et. al. Daily use time from ADEME study on audiovisual services, except for PC. Tablet figure higher due to low daily usage.
Embodied emissions intensity of tablets	kg CO2e per second	2.57E-05	
Embodied emissions intensity of TVs	kg CO2e per second	8.65E-06	
Embodied emissions intensity of PCs	kg CO2e per second	5.45E-06	

Base Inputs		
Variable	Unit	Source
Impressions	Integer	Media buy data
Location	Country	
Device type	Category	Media buy data, default available
Average view time	Seconds	Refer to 'View Time calculation'.

Default Device Split		
Type	Ratio	Source
PC	18%	Aggregate global data contributed by Impact Plus.
Mobile	61%	
Tablet	4%	
TV	17%	

*Please refer to the LINK for latest reference on values and sources. Example above is illustrative only. Specific values in this example may not match the LINK because these values will be periodically updated.

Consumption → User Device Render → View Time

Required inputs

The table below contains information on how to estimate view time depending on the data that is available. The minimum view time should be used if ads that fail to meet viewability specifications are not included in averages used for the level 1 / 2 methods - this ensures that some device usage is still accounted for. If view time data is available in quartiles rather than as a mean, calculations should overestimate by using the higher bound of the quartile (e.g. if a given portion of users is reported to have watched between 0 and 3 seconds of a video ad, they are assumed to have watched 3 seconds).

View Time				
Level	Method	Display default	Video default	Notes
0	Default view time	3 s	30 s	Overestimation by design. For cases where no view time data is available.
1	Average campaign-level view time.	N/A		Average view time for campaign used across device types.
2	Average view time per device type.			Device type-specific view time used in calculations.
Overhead				
Add-on to levels 1-2	Minimum view time	1 s	2 s	Based on MRC standard for viewability - used to account for device usage in cases where view time is not reported for ads that fail to meet viewability specifications.

Consumption → User Device Render → View Time

Calculation Example

Let's assume we want to estimate the impact of consuming ads on mobiles in Austria. We will apply the level 2 methodology as we know the average view time for mobile users to be 3 seconds. Let's also assume that in this average, ads that failed to meet the MRC viewability standard of 1 second are included, so we do not need to use the relevant add-on. The reference grid emission factor will be used.

Mobile_usephase_emissions =
= View_time * Mobile_usephase_energy * Local_grid_EF * Impressions
= 3 seconds * 0.0000013 kWh per second * 0.102 kg CO2e / kWh * 100000 impressions
= **0.03978 kg CO2e**

Mobile_embodied_emissions =
= View_time * Mobile_embodied_intensity * Impressions
= 3 seconds * 0.00000655 kg CO2e per MB * 100000 impressions
= **1.965 kg CO2e**

Inputs		
Variable	Unit	Value
Impressions	Integer	100k
Location	Country	Austria
Device Type		Mobile
Average view time	Seconds	3

*Please refer to the LINK for latest reference on values and sources. Example above is illustrative only. Specific values in this example may not match the LINK because these values will be periodically updated.

Grid Emission Factors

The Methodology and Framework Working Group acknowledges that standard, reference grid emission factors should be provided with the proposed methodology to enable calculations. The Ember dataset is recommended due to its international coverage and free access.

Other sources of grid EFs that are acceptable by accredited verification firms under ISO 14064-3 (e.g. USEPA eGrid, EEA) or equivalent are also acceptable to use for the purposes of the GMSF. These standard sources are provided as links in the GMSF Emissions Factors database via the link provided. The vast majority of these grid emissions factors are annual averages even though the accuracy of the emissions factors generally increases for smaller timespan averages (e.g. monthly averages can reflect material seasonal variations; hourly averages can reflect material diurnal variations). However, given that these more accurate emissions factors are not universally available, may involve significant costs when available, and most importantly it is currently a challenge to be able to match advertising activity with the corresponding time grid emissions factors particularly at the hourly level, it is not expected that the typical user of the GMSF will be in a position to use this more accurate data.

Grid EFs			
Level	Description	Source	Notes
0	Default	Please refer to the LINK for latest reference on values and sources.	
1	Annual		
2	Monthly		
3	Daily		
4	Hourly		

European Reference Grid EFs

Country	kg CO2e / kWh
Austria	1.02E-01
Belgium	1.17E-01
Bosnia Herzegovina	6.37E-01
Bulgaria	2.64E-01
Croatia	1.74E-01
Cyprus	5.12E-01
Czechia	4.14E-01
Denmark	1.44E-01
Estonia	3.42E-01
EU	2.13E-01
Finland	7.23E-02
France	4.42E-02
Germany	3.44E-01

Country	kg CO2e / kWh
Greece	3.20E-01
Hungary	1.83E-01
Ireland	2.80E-01
Italy	2.87E-01
Kosovo	9.35E-01
Latvia	1.37E-01
Lithuania	1.39E-01
Luxembourg	1.35E-01
Malta	4.84E-01
Montenegro	4.14E-01
Netherlands	2.53E-01
North Macedonia	5.65E-01

Country	kg CO2e / kWh
Norway	3.07E-02
Poland	6.16E-01
Portugal	1.12E-01
Romania	2.46E-01
Serbia	6.73E-01
Slovakia	9.65E-02
Slovenia	2.28E-01
Spain	1.46E-01
Sweden	3.58E-02
Switzerland	3.41E-02
Türkiye	4.70E-01
Ukraine	1.62E-01

2024 data from Ember

Continental Server Emission Factors

For the portion of servers assumed to sit abroad in relation to the user being served the ad, the relevant sub-group includes in the proposal grid intensities weighted by known data centre locations by continent. The sub-group notes that these are weighted by number of data centres rather than traffic, that a small number of locations were omitted due to absence of recent emissions data, and that grid intensity values from 2022 and 2023 were used due to broadest coverage.

Foreign Server EFs	
Continent	kg CO2e per kWh
Africa	4.72E-01
Asia	5.93E-01
Europe	2.50E-01
North America	3.78E-01
Oceania	4.78E-01
South America	1.91E-01
Global	3.76E-01
Sources	
Data centre map	Ember EFs

Data Source Links

Data Sources	
Use	Source
Network intensity, device power consumption, device daily usage	ADEME study on audiovisual services (French only) and ADEME study on the environmental footprint of ISP in France
Edge node intensity	ADEME study on audiovisual services (French only)
Cloud storage intensity, virtual machine lifecycle assessment, device embodied emissions over lifetime	ADEME, Base Empreinte [French LCA Database] (NegaOctet v1.5)
Fixed connection bandwidth	Carbon impact of video streaming
PUE	Uptime Institute report
Grid emission factors	Ember
LTO emission factors	Fujifilm estimates on LTO-8
SSD, HDD storage embodied factors	Tannu, S., & Nair, P. J. (2023).

Future work iterations of digital data guidance

As we continue to strengthen and refine our emissions estimation methodologies, Ad Net Zero is actively collaborating with IAB Europe and its members to ensure that industry expertise is integrated into our approach through pre-competitive collaboration.

Key areas of ongoing development include:

- Expanding server emissions modelling based on contributed data (levels 1-3).
- Refining programmatic activity estimation, incorporating input from IAB Europe's technical working groups (levels 2-5).
- Establishing guidance on the inclusion of enterprise-level emissions for a more comprehensive estimation approach.
- Advancing the modelling of DMPs and other intermediary activities to improve accuracy.
- Enhancing detailed modelling of device resource usage due to ads, ensuring realistic energy impact assessments.

A note on notional reductions within digital

Emissions estimates derived using this methodology can vary depending on the input data. Organisations should be mindful that in some cases, changing inputs may yield lower estimated emissions even when real-world greenhouse gas reductions have not occurred.

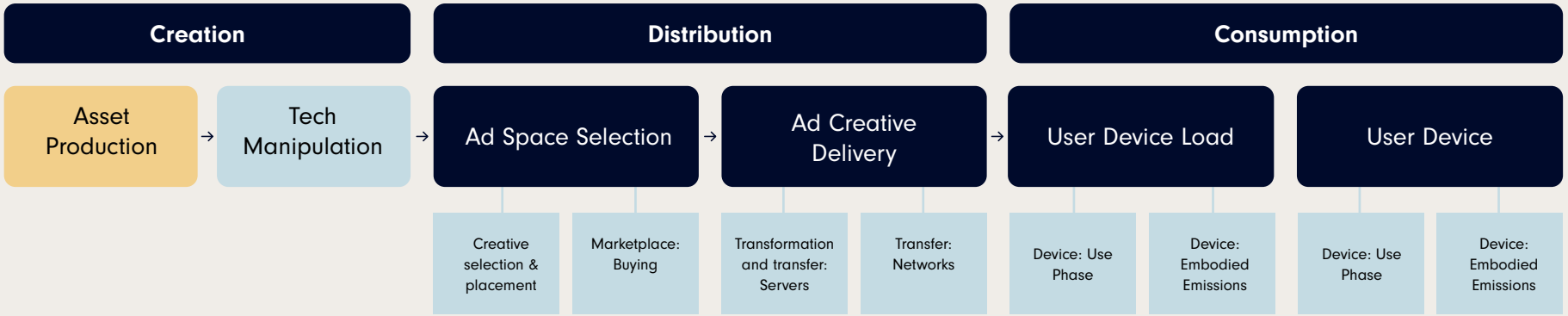
For example, shifting ad targeting from tablets to mobiles may result in a lower estimated energy footprint based on included emission factors. However, this does not inherently change the total electricity consumption of end users, as device usage is independent of ad targeting.

By working closely with IAB Europe and its members, we aim to refine these methodologies further, ensuring that emissions estimates accurately reflect real-world sustainability impacts while maintaining transparency and scientific rigour.

TV/Video Workflow, Framework and Formulae

TV / Video[1]: Channel Emissions Workflow, Channel Emissions Framework, Channel Emissions Formulae

Channel Emissions Workflow: TV / Video



[1]Different delivery types are identified and modelled in the formulae:

- Linear Broadcast (TV/SAT)
- Linear Multicast (IPTV)
- Non-linear (& linear) unicast (OTT/CTV/VOD)

[2]More guidance to follow in future GMSF update regarding Corporate emissions overhead.

Excluded from the system boundaries of this framework.

Included in the system boundaries.

Channel Emissions Framework and Formulae: TV and Video

Phase		Step & sub-step		Physical processes involved	Expected materiality	Formulae V1	
CREATION	Tech Manipulation (Multivariant Creative)	Creative storage		Additional server storage for multiple volumes of assets for the purpose of distribution.	Low	Σ Number of assets	*(size of asset (kB) *time stored (yr) *carbon impact of storage[1] (kgCO2e/kB/yr) *allocation factor for the campaign[2] (%))*
		Creative transcoding		Server processing for multiple volumes of assets for the purpose of distribution.	-	-	
DISTRIBUTION	Ad Space Selection	Creative Selection & Placement		Planning of creative to go on specific inventory within a marketplace	-	-	
		Market-place: Buying	Direct	Proportion of advertiser & media owner's corporate emissions for buying process	-	-	
			Indirect	Proportion of agency/ specialist & media owner's corporate emissions for buying process	-	-	
			Programmatic/ Targeted/ Segmentable/Addressable	Servers processing transmission through SSP/DSP buying process	Import from digital. See footnotes section for more information.		
				Networks transmission through SSP/DSP buying process			
	Ad Creative Delivery	Transformation & Transfer	Linear broadcast (TNT/SAT)	Servers processing of ad delivery (broadcast)	Low to medium		*Number of diffusions * Spot duration (s) * bitrate before transcoding (kB/s) * Number of media outputs[3] / Concurrent transcoding factor[23] * Redundancy factor * Infrastructure efficiency per data transferred including PUE (kWh/kB) * carbon intensity of electricity (kgCO2e/kWh)*
					Low to medium		*Number of diffusions * Spot duration (s) / average lifetime of infrastructure equipment (s) * EF Manufacturing and EOL of infrastructure equipment (kgCO2e)*
				Networks transmission of ad delivery (broadcast)	Low to medium	$*\Sigma$ Number of network type	*Number of diffusions * Spot duration (s) (consumption breakdown between countries of servers / users (%) * network energy intensity according to network type[4] and country (kWh/s) * carbon intensity of electricity (kgCO2e/kWh))*
					Low to medium	$*\Sigma$ Number of network type	*Number of diffusions * Spot duration (s) (consumption breakdown between types of network (%) * EF manufacturing & EOL amortization networks according to network type[4] and country (kgCO2e/kB))*
			Linear multicast (IPTV)	Servers processing and networks transmission of ad (multicast)	Same as linear broadcast (see above).		
			Non-linear (& linear) unicast (CTV/OTT/ VOD..)	Servers processing of ad delivery (unicast)	Medium to high	$*\Sigma$ Number of infrastructures	*Views * total server output data per view[2] (kB) * Number of media outputs[3] / Concurrent transcoding factor[23] (Breakdown of content delivered by ad servers vs. edge nodes[6] (%) * datacenter or edge nodes energy efficiency including PUE (kWh/kB output) * carbon intensity of electricity(kgCO2e/kWh))*
					Medium to high	$*\Sigma$ Number of infrastructures	*Views * total server output data per view[2] (kB) * Number of media outputs[3] / Concurrent transcoding factor[23] (Breakdown of content delivered by ad servers vs. edge nodes[6] (%) * EF manufacturing and EOL of total relevant infrastructure (kgCO2e) / Infrastructure output bandwidth (kB/s) / average lifetime of infrastructure equipment(s))*
				Networks transmission of ad delivery (unicast)	Medium to high	$*\Sigma$ Number of network type $*\Sigma$ Number of infrastructures	*Views * total data transferred on network per view[2] (kB) (consumption breakdown between types of network (%) * energy efficiency according to network type[4] and country (kWh/kB)) (consumption breakdown between countries of servers / edges nodes[6] and users (%) * carbon intensity of electricity (kgCO2e/kWh))*
					Medium to high	$*\Sigma$ Number of network type	*Views * total data transferred on network per view[2] (kB) (consumption breakdown between types of network (%) * EF manufacturing & EOL amortization networks according to network type[4] and country (kgCO2e/kB))*

Continued on next page

Channel Emissions Framework and Formula: TV and Video

						*Impressions * Data transferred per impression[11] (kB) / Broadband speed breakdown by country and by network type (kB/s)*
		User device load	Download / stream of creative to the user device. Includes embodied emissions of devices.	Low	$*\sum_{Devices[13]}$	*(Device mix (%) * Device power consumption to maintain active connection[12] (W)) * time conversion ratio (h/s) * carbon intensity of electricity (kgCO2e/kWh)*
				Low	$*\sum_{Devices[13]}$	*Impressions * Data transferred per impression[11] (kB) / Broadband speed breakdown by country and by network type (kB/s) (Device mix (%) * EF manufacturing and EOL amortization of devices, share of connectivity[12] (kgCO2e/unit) / total active used time over lifetime by device type (s of active use over full lifetime))*
	Device Display	User device render	Render and display of creative on the user device. Includes embodied emissions of devices.	High	$*\sum_{Devices[13]}$	Impressions *Time displayed on device per impression(s) *(Device mix by type and country (%) * Time displayed on device (s) * Device render power consumption[16] (W) * time conversion ratio (h/s) * carbon intensity of electricity (kgCO2e/kWh))*
						Impressions *Time displayed on device per impression(s)
				High	$*\sum_{Devices[13]}$	*(Device mix by type and country (%) * Time displayed on device (s) * EF manufacturing & and EOL amortization of devices, share of render[15] (kgCO2e/unit) / total active used time over lifetime by device type (s of active use over full lifetime))*
ALL	Corporate emissions overhead		$\sum_{Number\ of\ assets}$ *Total relevant annual corporate emissions[7] (kgCO2e) *allocation factor for the campaign[9]*			Every organisation in the value chain should be reporting their verified enterprise GHG emissions inventory annually to ensure reasonable data quality at the enterprise level. More guidance will follow on this in the next update of the GMSF.

This channel emissions framework has been designed to be readable within this document. Click here to view an extended version of the channel emissions framework which includes additional detail including; formula type, scaling factors, alternative calculations, data hacks, and further comments.

Key:

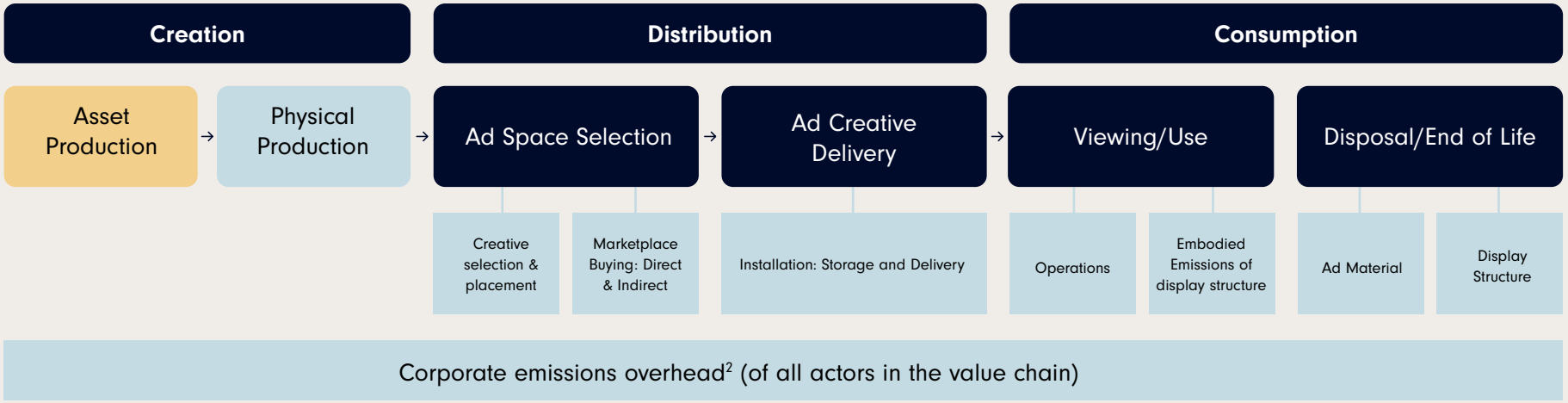
- = Not Yet Applicable or To be investigated further

$\sum$ = The mathematical sign for a sum

Out-of-Home Workflows, Framework and Formulae

Out-of-Home: Channel Emissions Workflows, Channel Emissions Framework, Channel Emissions Formulae

Channel Emissions Workflow: OOH[1]



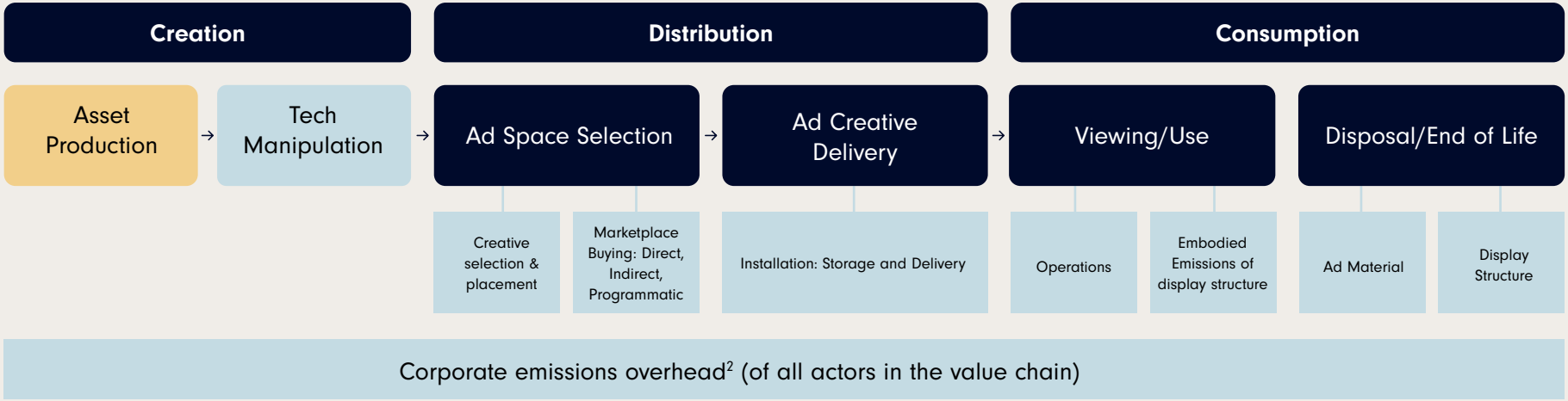
[1]OOH refers to ad formats including; banners/96 sheet/48 sheet/6 sheet/4 sheet/scrollers.

[2]More guidance to follow in future GMSF update regarding Corporate emissions overhead.

Excluded from the system boundaries of this framework.

Included in the system boundaries.

Channel Emissions Workflow: DOOH[1]



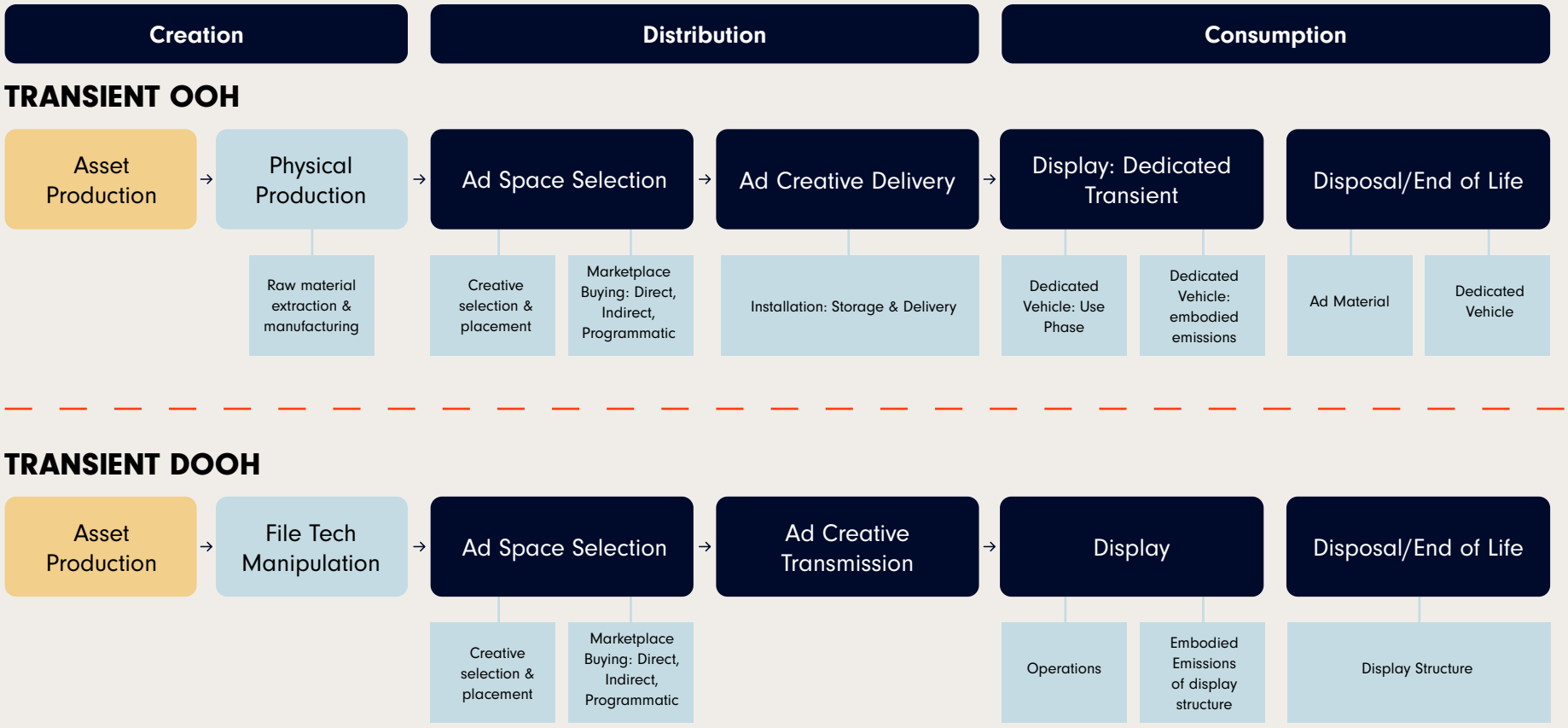
[1]DOOH refers to ad formats including; Large Format Digital (LFD)/D96/D48/D12/D6

[2]More guidance to follow in future GMSF update regarding Corporate emissions overhead.

Excluded from the system boundaries of this framework.

Included in the system boundaries.

Channel Emissions Workflow: Transient[1]



[1]Transient refers to ad formats including; Bus wraps/Bus supersides/Bus t-sides/Taxi wraps/train panels.

[2]More guidance to follow in future GMSF update regarding Corporate emissions overhead.

Excluded from the system boundaries of this framework.

Included in the system boundaries.

Channel Emissions Framework & Formulae: OOH

Phase	Step & sub-step		Physical processes involved	Formula type	Formulae
CREATION	Creative Production		Development of creative	AdGreen methodology	Import kgCO2e from AdGreen calculation
	Physical Production		**Full LCA impact based on material supply chain, transformation, printing, creating finished product**	LCA GHG emission factors	Σ (i = 1ton) (Xi * EFi) i is the format type; Xi is the number of formats produced; EFi is the weighted average emissions factor for format (kg CO2e/format) weighted average EF for format = %recycled material x EF of recycled format + %virgin material x EF of virgin material format
DISTRIBUTION	Demand: selection & Targeting	Creative selection	Process to select creative format	none	none
		Placement volume	Number of sites used for campaign	none	No material emissions from this step; output of this step (Number of sites and format type, number of days live) used in transportation, and operational utilities emissions estimates
		Geographic / Audience selection	Location of sites used for campaign	none	No material emissions from this step. Output of this step (Geographic location of sites) used in transportation emissions estimates
	Marketplace: Buying	Direct	Buying process from advertiser to media owner	ANZ direct formula	To be confirmed within Data Guidance. Potentially to be copied from TV process.
		Indirect	Buying process through agency and/or specialist	ANZ indirect formula	To be confirmed within Data Guidance. Potentially to be copied from TV process.
		Programmatic	Buying process through SSP/DSP	ANZ programmatic formula	insert from programmatic standard
	Installation: Storage & Delivery	Physical - storage	Transportation to storage from production Storage in warehouse	Operational emission factors	Transport: distance travelled km x EF for vehicle type kg CO2e/km x % of vehicle used for ad products Storage: (annual warehouse emissions kg CO2e/area of warehouse sq m) x area used for storage sq m x #days stored/365
		Physical - transportation, installation	Transportation to storage to display locations installation	Operational emission factors	Transport: Σ (i = 1ton) (Di * EFVi) i is the vehicle type; Di dis the total distance(km) travelled to all display sites by the vehicle type; EFVi is the emissions factor for the vehicle type kg CO2e/km installation: Σ (i = 1ton) (Xi * EFIi) i is the format type; Xi is the number of format i; EFIi is the emissions factor for the installation of format i
		Transient - transportation, installation	Transportation of mobile platforms to installation facility installation	Operational emission factors	Transport: Σ (i = 1ton) (Di * EFVi) i is the vehicle type; Di dis the total distance(km) travelled to installation sites by the vehicle type; EFVi is the emissions factor for the vehicle type kg CO2e/km installation: Σ (i = 1ton) (Xi * EFIi) i is the format type; Xi is the number of format i; EFIi is the emissions factor for the installation of format i, including the prorated operational emissions (annual emissions of installation facility * hours for installation per format type/total annual facility operational hours)
		Digital	Digital transmission to display device	none	none

Continued on next page

Channel Emissions Framework & Formula: OOH

CONSUMPTION	Display: Viewing	Transient (not dedicated to advertising)	Assume the advertising does not create any change to mobile platform deployment for other purposes	none	none
		Dedicated Transient--operations	Energy required to move dedicated ad vehicle	transport: Σ (i = 1 to n) (Di * EFVi) i is the vehicle type; Di dis the total distance(km) travelled to installation sites by the vehicle type; EFVi is the emissions factor for the vehicle type kg CO2e/km	-
		Dedicated Transient--embedded	Embedded emissions from dedicated display vehicle	Σ (i = 1 to n) EEVi * (T/LTi) i is the vehicle type; EEVi is the total embedded emissions for the vehicle type kg CO2e; T is hours ad displayed; LTi is hours of total time of depreciation for vehicle type i	-
		Digital--operations	Energy consumed for digital display	kWh used during display time * location based emission factor for grid kg CO2e/kWh	-
		Digital--embedded	Embedded emissions from display structure	Σ (i = 1 to n) EEDi * (T/LTi) i is the display type; EEDi is the total embedded emissions for the display type kg CO2e; T is hours ad displayed; LTi is hours of total time of depreciation for display type i	-
		Physical--operations	Energy consumed for illumination, mechanical movement	kWh used during display time * location based emission factor for grid kg CO2e/kWh	-
		Physical--embedded	Embedded emissions from display structure	Σ (i = 1 to n) EEDSi * (T/LTi) i is the display type; EEDSi is the total embedded emissions for the display structure type kg CO2e; T is hours ad displayed; LTi is hours of total time of depreciation for display structure type i	-
	Disposal & End of Life	Transient (not dedicated) ad material	Disposal/end of life of material removed from mobile platform	Σ (i = 1 to n) (Mi * EFMi) i is the ad material type; Mi is the mass of the ad material kg; EFMi is the weighted average emissions factor for end of life action kg CO2e/km EFMi = % * EFM-recycled + % * ERM-landfill + % * EFM-incineration	-
		Dedicated Transient mobile platform	Disposal/end of life for mobile platforms	Σ (i = 1 to n) DEVi * (T/LTi) i is the vehicle type; DEVi is the total end of life emissions for the vehicle type kg CO2e; T is hours ad displayed; LTi is hours of total time of depreciation for vehicle type i	-
		Physical - ad material	Disposal/end of life of material removed from display structures	Σ (i = 1 to n) (Mi * EFMi) i is the ad material type; Mi is the mass of the ad material kg; EFMi is the weighted average emissions factor for end of life action kg CO2e/km EFMi = % * EFM-recycled + % * EFM-landfill + % * EFM-incineration	-
		Physical - display structure	Disposal/end of life of display structures	Σ (i = 1 to n) DEDi * (T/LTi) i is the display type; DEDi is the total end of life emissions for the display type kg CO2e; T is hours ad displayed; LTi is hours of total time of depreciation for display type i	-
		Digital display structure	Disposal/end of life of display structures	Σ (i = 1 to n) DEDSi * (T/LTi) i is the display type; DEDSi is the total end of life emissions for the display structure type kg CO2e; T is hours ad displayed; LTi is hours of total time of depreciation for display structure type i	-
ALL		Corporate overhead emissions allocation	Allocated organizational emissions attributed to the specific campaign across ALL entities in the campaign value chain	Every organisation in the value chain should be reporting their verified enterprise GHG emissions inventory annually to ensure reasonable data quality at the enterprise level. More guidance will follow on this in the next update of the GMSF.	-

This channel emissions framework has been designed to be readable within this document. Click here to view an extended version of the channel emissions framework which includes additional detail including; formula type, scaling factors, alternative calculations, data hacks, and further comments.

Key:

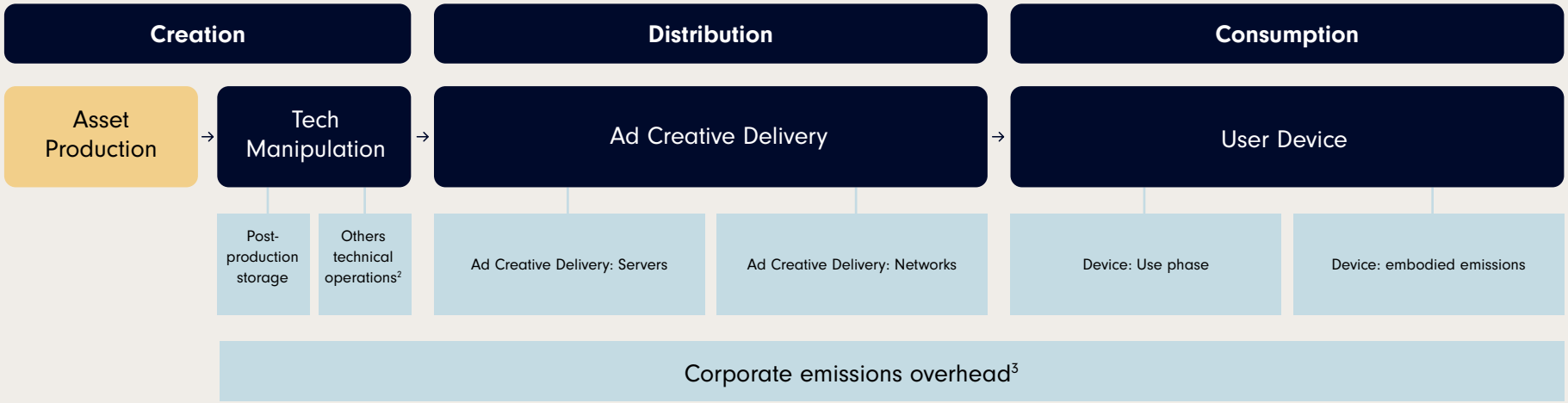
- = Not Yet Applicable or To be investigated further

∑ = The mathematical sign for a sum

Audio Workflows, Frameworks and Formulae

Audio: Channel Emissions Workflows, Channel Emissions Frameworks, Channel Emissions Formulae

Channel Emissions Workflow: Linear Radio (AM/FM/Satellite/ DAB)[1]



[1]Host-read ad formats will be on the agenda of future guidance work.

[2]Placeholder to be imported from Digital channel for now and explored further in Audio data guidance.

[3]More guidance to follow in future GMSF update regarding Corporate emissions overhead.

Excluded from the system boundaries of this framework.

Included in the system boundaries.

Channel Emissions Framework & Formulae: Linear Radio (AM/FM/Satellite/ DAB)[2]

Phase	Step & sub-step			Physical processes	Expected materiality	Formula	
CREATION	Tech Manipulation (Multivariant Creative)	Creative storage[1]		Additional server storage for multiple volumes of assets for the purpose of distribution.	• Low	• $\sum_{a=0}^{A}(size_a \times time\_stored_a \times storage\ impact_a \times allocation\_factor_a)$	a: creative asset A: total number of assets for the campaign • $size_a$: size of asset a [kB] • $time\_stored_a$: time stored [yr] • $storage\_impact_a$: carbon impact of storage of asset a [kgCO2e/kB/yr] • $allocation\_factor_a$: allocation factor for the campaign for asset a [%]
DISTRIBUTION	Ad Space Selection	Direct Programmatic/ Targeted/ Segmentable/Addressable		Servers processing transmission through SSP/DSP buying process Networks transmission through SSP/DSP buying process			
	Ad Creative Delivery	Transformation & Transfer	Linear Radio (AM/FM/Satellite/ DAB)[2]	Data centers processing of ad delivery (broadcast) [1]	• Low to medium	$\sum_{a=0}^{A}(number\_diffusions_a \times spot\_duration_a \times bitrate\_before\_transcoding_a) \times \sum_{i=0}^{I}\sum_{c=0}^{C}(infrastructure\_efficiency_{i,c} \times carbon\_impact\_electricity_c)$	a: creative asset A: total number of assets for the campaign i: servers' infrastructure I: total number of radio servers' infrastructure involved for the campaign c: country of final user C: total number of countries involved for the campaign • $number\_diffusions_a$: number of diffusions of asset a on linear radio/DAB during the campaign • $spot\_duration_a$: time of audio ad relative to asset a [s] • $bitrate\_before\_transcoding_a$: raw bitrate of asset a [kB/s] • $infrastructure\_efficiency_{i,c}$: energy efficiency of radio servers infrastructure i in country c, including PUE (per second of diffusion) [kWh/s] • $carbon\_impact\_electricity_c$: carbon intensity of electricity in country c [kgCO2e/kWh]
					Low to medium	$\sum_{a=0}^{A}(number\_diffusions_a \times spot\_duration_a) \times \sum_{i=0}^{I}\sum_{c=0}^{C}(EF\ embodied\ infrastructure_{i,c})$	a: creative asset A: total number of assets for the campaign i: servers' infrastructure I: total number of radio servers' infrastructure involved for the campaign c: country of final user C: total number of countries involved for the campaign • $number\_diffusions_a$: number of diffusions of asset a on linear radio/DAB during the campaign • $spot\_duration_a$: time of audio ad relative to asset a [s] • $EF\_embodied\_infrastructure_{i,c}$: embodied emission factor of radio servers infrastructure i in country c (amortized relative to lifetime, per second of diffusion) [kgCO2e/s]
				Networks transmission of ad delivery (broadcast)	Low to medium	$\sum_{a=0}^{A}(number\_diffusions_a \times spot\_duration_a) \times \sum_{n=0}^{N}\sum_{c=0}^{C}(network\ efficiency_{n,c} \times carbon\_impact\_electricity_c)$	a: creative asset A: total number of assets for the campaign n: type of network N: total number of networks c: country of final user C: total number of countries involved for the campaign • $number\ diffusions_a$: number of diffusions of asset a on linear radio/DAB during the campaign • $spot\ duration_a$: time of audio ad relative to asset a [s] • $network\ efficiency_{n,c}$: energy efficiency network n, in country c (per second of diffusion) [kWh/s] • $carbon\ impact\ electricity_c$: carbon intensity of electricity in country c [kgCO2e/kWh]
					Low to medium	$\sum_{a=0}^{A}(number\_diffusions_a \times spot\_duration_a) \times \sum_{n=0}^{N}\sum_{c=0}^{C}(EF\ embodied\ network_{n,c})$	a: creative asset A: total number of assets for the campaign n: type of network N: total number of networks c: country of final user C: total number of countries involved for the campaign • $number\_diffusions_a$: number of diffusions of asset a on linear radio/DAB during the campaign • $spot\_duration_a$: time of audio ad relative to asset a [s] • $EF\_embodied\_network_{n,c}$: embodied emissions (manufacturing & end-of-life) of network type n, in country (amortized per kB of data over lifetime of infrastructure) [kgCO2e/kB]

Continued on next page

Channel Emissions Framework and Formulae: Linear Radio (AM/FM/Satellite/DAB)

CONSUMPTION	Device Listening	User device load	Download / stream of creative to the user device. Includes embodied emissions of devices.	Low	/	/
				Low	/	/
		User device play	Play of creative on the user device. Includes embodied emissions of devices.	High	$\sum_{d=0}^{D}\sum_{n=0}^{N}\sum_{c=0}^{C}(number\_plays_d \times time\_per\_play_d \times device\ power\ consumption_{play,d,c} \times time\_conversion\_ratio \times carbon\_impact\_electricity_c)$	*d: device type* *D: total number of device types involved in the campaign* *n: type of network* *N: total number of networks* *c: country of final user* *C: total number of countries involved for the campaign* • $number\_plays_d$: *number of plays (listeners) of asset(s) on device type d* • $time\_per\_play_d$: *time played per play on device type d [s]* • $device\_power\_consumption_{play,d}$: *power consumption of device type d in country c when playing audio content [W]* • $time\_conversion\_ratio$: *seconds to hours* • $carbon\_impact\_electricity_c$: *carbon intensity of electricity in country c [kgCO2e/kWh]*
				High	$\sum_{d=0}^{D}\sum_{n=0}^{N}\sum_{c=0}^{C}(number\_plays_d \times time\_per\_play_d \times EF\ embodied\ device_{play,d,c})$	*d: device type* *D: total number of device types involved in the campaign* *n: type of network* *N: total number of networks* *c: country of final user* *C: total number of countries involved for the campaign* • $number\_plays_d$: *number of plays (listeners) of asset(s) on device type d* • $time\_per\_play_d$: *time played per play on device type d [s]* • $EF\ embodied\ device_{play,d,c}$: *embodied emissions of device type d in country c (amortized per s over lifetime of device), share of play [kgCO2e/s]*
ALL	Corporate emissions overhead		Allocated organizational emissions attributed to the specific campaign across ALL entities in the campaign value chain.	Low	/	Every organisation in the value chain should be reporting their verified enterprise GHG emissions inventory annually to ensure reasonable data quality at the enterprise level. More guidance will follow on this in the next update of the GMSF.

This channel emissions framework has been designed to be readable within this document. Click here to view an extended version of the channel emissions framework which includes additional detail including; formula type, scaling factors, alternative calculations, data hacks, and further comments.

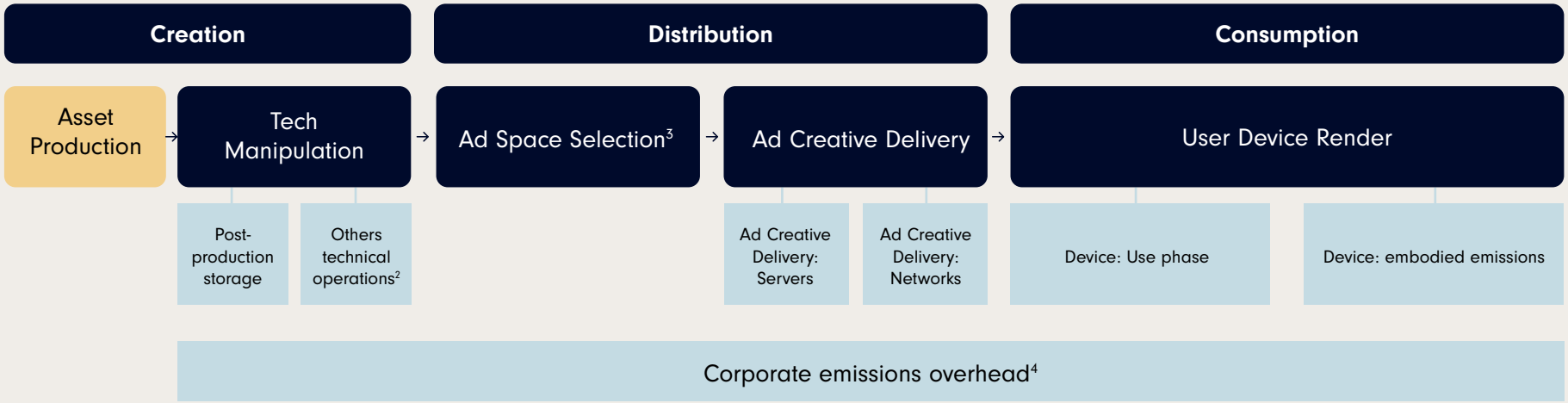
Key:

- = Not Yet Applicable or To be investigated further

$\sum$ = The mathematical sign for a sum

Audio: Channel Emissions Workflows

Channel Emissions Workflow: Audio On Demand[1]



[1]Covers any audio listening via the internet. Podcast host-read ad formats will be on the agenda of future guidance work.

[2]Placeholder imported from Digital channel.

[3]To be adapted from digital, in future guidance work, considering usually more manual intervention and therefore less automated process.

[4]More guidance to follow in future GMSF update regarding Corporate emissions overhead.

Excluded from the system boundaries of this framework.

Included in the system boundaries.

Channel Emissions Framework and Formulae: Audio On Demand

Phase	Step & sub-step		Physical processes involved	Expected materiality	Formulae	
CREATION	Tech Manipulation (Multivariant Creative)	Creative storage[1]	Additional server storage for multiple volumes of assets for the purpose of distribution.	• Low	• $\sum_{a=0}^{A} (size_a \times time\_stored_a \times storage\_impact_a \times allocation\_factor_a)$	a: creative asset A: total number of assets for the campaign • $size_a$: size of asset a [kB] • $time\_stored_a$: time stored [yr] • $storage\_impact_a$: carbon impact of storage of asset a [kgCO2e/kB/yr] • $allocation\_factor_a$: allocation factor for the campaign for asset a [%]
DISTRIBUTION	Ad Space Selection	Direct Programmatic/ Targeted/ Segmentable/Addressable	Servers processing transmission through SSP/DSP buying process Networks transmission through SSP/DSP buying process	/	/	/
	Ad Creative Delivery	Transformation & Transfer / Audio On Demand[2,4]	Data centers processing of ad delivery (unicast) [3]	Medium to high	$\sum_{a=0}^{A} (number\_plays_a \times server\_output\_per\_play_a) \times \sum_{i=0}^{I} \sum_{c=0}^{C} (breakdown\_infrastructure_{i,c} \times infrastructure\_efficiency_{i,c} \times carbon\_impact\_electricity_c)$	a: creative asset A: total number of assets for the campaign i: servers' infrastructure I: total number of radio servers' infrastructure involved for the campaign c: country of final user C: total number of countries involved for the campaign • $number\_plays_a$: number of plays (listeners) for asset a on radio on demand • $server\_output\_per\_play_a$: total server output data per play of asset a [MB] • $breakdown\_infrastructure_{i,c}$: breakdown of total content delivered by infrastructure i in country c (e.g. from cdn servers or edge nodes) [%] • $infrastructure\_efficiency_{i,c}$: energy efficiency of radio servers infrastructure i in country c, including PUE (amortized per kB of data over lifetime of infrastructure) [kWh/kB] • $carbon\_impact\_electricity_c$: carbon intensity of electricity in country c [kgCO2e/kWh]
				• Medium to high	$\sum_{a=0}^{A} (number\_plays_a \times server\_output\_per\_play_a) \times \sum_{i=0}^{I} \sum_{c=0}^{C} (breakdown\_infrastructure_{i,c} \times EF\_embodied\_infrastructure_{i,c})$	a: creative asset A: total number of assets for the campaign i: servers' infrastructure I: total number of radio servers' infrastructure involved for the campaign c: country of final user C: total number of countries involved for the campaign • $number\_plays_a$: number of plays (listeners) for asset a on radio on demand • $server\_output\_per\_play_a$: total server output data per play of asset a [MB] • $breakdown\_infrastructure_{i,c}$: breakdown of total content delivered by infrastructure i in country c (e.g. from cdn servers or edge nodes) [%] • $EF\_embodied\_infrastructure_{i,c}$: embodied emissions of radio servers infrastructure i in country c (amortized per kB of data over lifetime of infrastructure) [kgCO2e/kB]
			Networks transmission of ad delivery (unicast)	Medium to high	$\sum_{a=0}^{A} (number\_plays_a \times network\_transfer\_per\_play_a) \times \sum_{n=0}^{N} \sum_{i=0}^{I} \sum_{c=0}^{C} (breakdown\_network_{n,i} \times network\_efficiency_{n,i} \times carbon\_impact\_electricity_i + breakdown\_network_{n,c} \times network\_efficiency_{n,c} \times carbon\_impact\_electricity_c)$	a: creative asset A: total number of assets for the campaign n: type of network N: total number of networks i: servers' infrastructure I: total number of radio servers' infrastructure involved for the campaign c: country of final user C: total number of countries involved for the campaign • $number\_plays_a$: number of plays (listeners) for asset a on radio on demand • $network\_transfer\_per\_play_a$: total data transferred on network per play of asset a [kB] • $breakdown\_network_{n,i}$: breakdown of total content having transited on network n in country of infrastructure i [%] • $network\_efficiency_{n,i}$: energy efficiency network n, in country of infrastructure i (per kB of data) [kWh/kB] • $carbon\_impact\_electricity_i$: carbon intensity of electricity in country of infrastructure i [kgCO2e/kWh] • $breakdown\_network_{n,c}$: breakdown of total content having transited on network n in country of user c [%] • $network\_efficiency_{n,c}$: energy efficiency network n, in country of user c (per kB of data) [kWh/kB] • $carbon\_impact\_electricity_c$: carbon intensity of electricity in country of user c [kgCO2e/kWh]
				• Medium to high	$\sum_{a=0}^{A} (number\_plays_a \times network\_transfer\_per\_play_a) \times \sum_{n=0}^{N} \sum_{i=0}^{I} \sum_{c=0}^{C} (breakdown\_network_{n,i} \times EF\_embodied\_network_{n,i} + breakdown\_network_{n,c} \times EF\_embodied\_network_{n,c})$	a: creative asset A: total number of assets for the campaign n: type of network N: total number of networks i: servers' infrastructure I: total number of radio servers' infrastructure involved for the campaign c: country of final user C: total number of countries involved for the campaign • $number\_plays_a$: number of plays (listeners) for asset a on radio on demand • $network\_transfer\_per\_play_a$: total data transferred on network per play of asset a [kB] • $breakdown\_network_{n,i}$: breakdown of total content having transited on network n in country of infrastructure i [%] • $EF\_embodied\_network_{n,i}$: embodied emissions (manufacturing & end-of-life) of network type n, in country of infrastructure i (amortized per kB of data) [kgCO2e/kB] • $breakdown\_network_{n,c}$: breakdown of total content having transited on network n in country of user c [%] • $EF\_embodied\_network_{n,c}$: embodied emissions (manufacturing & end-of-life) of network type n, in country of user c (amortized per kB of data over lifetime of infrastructure) [kgCO2e/kB]

Continued on next page

Channel Emissions Framework and Formulae: Audio On Demand

CONSUMPTION	Device Listening[4]	User device load	Download / stream of creative to the user device. Includes embodied emissions of devices.	• Data transferred (incl. file size) • Device type	Low	/	
					Low	/	
		User device play	Play of creative on the user device. Includes embodied emissions of devices.	• Time played • Device type[5]	High	$\sum_{d=0}^{D}\sum_{n=0}^{N}\sum_{c=0}^{C}(number\_plays_d \times time\_per\_play_d \times device\ power\ consumption_{play,d,c} \times time\_conversion\_ratio \times carbon\_impact\_electricity_c)$	*d: device type* *D: total number of device types involved in the campaign* *n: type of network* *N: total number of networks* *c: country of final user* *C: total number of countries involved for the campaign* • $number\_plays_d$*: number of plays (listeners) of asset(s) on device type d* • $time\_per\_play_d$*: time played per play on device type d [s]* • $device\_power\_consumption_{play,d}$*: power consumption of device type d in country c when playing audio content [W]* • $time\_conversion\_ratio$*: seconds to hours* • $carbon\_impact\_electricity_c$*: carbon intensity of electricity in country c [kgCO2e/kWh]*
					High	$\sum_{d=0}^{D}\sum_{n=0}^{N}\sum_{c=0}^{C}(number\ plays_d \times time\ per\ play_d \times EF\ embodied\ device_{play,d,c})$	*d: device type* *D: total number of device types involved in the campaign* *n: type of network* *N: total number of networks* *c: country of final user* *C: total number of countries involved for the campaign* • $number\_plays_d$*: number of plays (listeners) of asset(s) on device type d* • $time\_per\_play_d$*: time played per play on device type d [s]* • $EF\_embodied\_device_{play,d,c}$*: embodied emissions of device type d in country c (amortized per s over lifetime of device), share of play [kgCO2e/s]*
ALL	Corporate emissions overhead		Allocated organizational emissions attributed to the specific campaign across ALL entities in the campaign value chain.	Campaign revenue	High	/	Every organisation in the value chain should be reporting their verified enterprise GHG emissions inventory annually to ensure reasonable data quality at the enterprise level. More guidance will follow on this in the next update of the GMSF.

This channel emissions framework has been designed to be readable within this document. Click here to view an extended version of the channel emissions framework which includes additional detail including; formula type, scaling factors, alternative calculations, data hacks, and further comments.

Key:

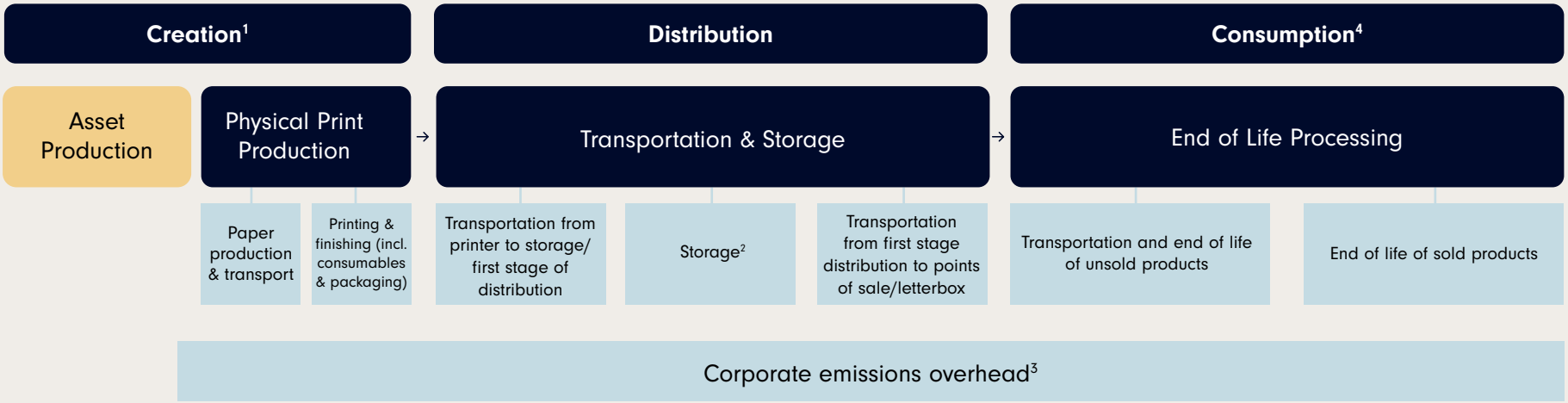
- = Not Yet Applicable or To be investigated further

$\sum$ = The mathematical sign for a sum

Print Workflow, Framework and Formulae

Print: Channel Emissions Workflow, Channel Emissions Framework, Channel Emissions Formulae

Channel Emissions Workflow: Print Publications, Direct Mail & Door Drops (and Digital Publications[5])



[1]Taxonomy Alignment. The top-level taxonomy (Creation, Distribution, and Consumption) has been retained for consistency, while print-specific processes have been mapped within them. Production is encapsulated within Creation, delivery within Distribution, and end-of-life within Consumption, even if the terminology may not be immediately recognisable in a print-specific context.

[2]Storage can exist e.g. for magazines and leaflet campaigns, although likely to be immaterial as generally in ambient warehousing. However transportation can be significant, especially for international titles and mailings, and so this needs further investigation.

Excluded from the system boundaries of this framework.

Included in the system boundaries.

[3]More guidance to follow in future GMSF update regarding Corporate emissions overhead.

[4]The use phase for Publications, direct mail & door drop is likely to be immaterial but needs further investigation and to be modelled to ensure consistency with other channels where the use phase is significant.

[5]The digital publication of printed format (e.g. 'pdf' format, where ad appears) is covered in the Print channel. The steps are imported from Digital channel, excluding Ad Space Selection which is not relevant to this format. However, initial feedbacks suggested this workflow likely had low materiality for print, therefore not worth tracking down the data and addressing through an overhead factor. This topic will be on the agenda for future guidance work and this initial feedback is likely to be challenged.

Channel Emissions Framework and Formulae: Print Publications, Direct Mail & Door Drops

Phase	Step & sub-step		Physical processes	Expected materiality	Formulae	
CREATION	Physical print production		Paper production	High	$\sum_{p=0}^{P} (number\_ad\_format_p \times ad\_format\_share_p \times total\ medium\ weight_p \times EF\ paper\ production_p)$	p: physical print ad format P: total number of physical print ad formats involved in the ad campaign •$number\_ad\_format_p$: total number of physical print ad format of type p distributed in the ad campaign •$ad\_format\_share_p$: percentage of the overall publication that is occupied by the ad format of type p [%]. This % should be a percentage of the overall surface of the entire printed medium (magazine, newspaper, etc.) where the ad appears. For double-sided medium, the percentage shall take into account only the side of the page concerned (e.g. a quarter page ad will account for 1/8th of the surface and weight of the full medium page) •$total\_medium\_weight_p$: weight of the entire printed medium (magazine, newspaper, etc.) where the ad format of type p appears [kg]. •$EF\_paper\_production_p$: emission factor for the specific paper grade/type (coated, uncoated, magazine paper, newspaper...), dependent on the country and energy used (paper mills), in printed medium (magazine, newspaper, etc.) where the ad format of type p appears [kgCO2e/kg of paper]. Varies widely depending on supplier, mill location and type of energy used.[3]
			Transport of paper from papermill to printer, and envelope converter for Direct Mail and Door Drops	Medium	$\sum_{p=0}^{P}\sum_{t=0}^{T} (number\_ad\_format_p \times ad\_format\_share_p \times total\_medium\_weight_p \times distance\ upstream_t \times EF\_transport\_upstream_t)$	p: physical print ad format P: total number of physical print ad formats involved in the ad campaign t: transportation type T: total number of transportation types involved in upstream processes (e.g. sea, air, road...) •$number\_ad\_format_p$; $ad\_format\_share_p$; $total\_medium\_weight_p$: see above descriptions in paper production step •$distance\_upstream_t$: total upstream distances travelled to all print sites with transportation type t [km] •$EF\_transport\_upstream_t$: emissions factor for the transportation type t used upstream [kgCO2e/t.km]
			Printing and finishing (including: prepress, printing, consumables including sourcing of raw materials, printing process including ink[2], glue, packaging, etc.)	Medium	$\sum_{p=0}^{P} (number\_ad\_format_p \times ad\_format\_share_p \times total\ medium\ weight_p \times EF\ printing\ process_p)$	p: physical print ad format P: total number of physical print ad formats involved in the ad campaign •$number\_ad\_format_p$; $ad\_format\_share_p$; $total\_medium\_weight_p$: see above descriptions in paper production step •$EF\_printing\_process_p$: emission factor for the printing process (offset, heliо...) of the printed medium (magazine, newspaper, etc.) where the ad format of type p appears [kgCO2e/kg]. Should include energy used within the process (electricity, natural gas....), as well as an assumed portion of production and delivery of materials (plates, ink, chemicals) except paper. Finishing processes are likely to be included in those figures as printers/finishers may not track it separately. Varies widely depending on supplier, printing facility location, type of printing process and energy used.
DISTRIBUTION	Physical print: Storage & Delivery	Physical – Transportation to storage	Transportation from printer to storage in warehouse e.g. at distributor	Medium	$\sum_{p=0}^{P}\sum_{t=0}^{T} (number\_ad\_format_p \times ad\_format\_share_p \times total\_medium\_weight_p \times distance\ storage_t \times EF\ transport\ storage_t)$	p: physical print ad format P: total number of physical print ad formats involved in the ad campaign t: transportation type T: total number of transportation types involved in transportation to storage processes (e.g. sea, air, road...) •$number\_ad\_format_p$; $ad\_format\_share_p$; $total\_medium\_weight_p$: see above descriptions in paper production step •$distance\_storage_t$: total distances travelled to storage sites with transportation type t [km] •$EF\_transport\_storage_t$: emissions factor for the transportation type t used to storage [kgCO2e/t.km]
		Physical - storage	Storage within the warehouse	Low	/	/
		Physical – Downstream transportation for publications or direct mail[5]	Downstream transportations from storage to where publications are sold (points of sale...) or in the case of direct mail and door drops, to the letterbox	Medium	$\sum_{p=0}^{P}\sum_{t=0}^{T} (number\_ad\_format_p \times ad\_format\_share_p \times total\_medium\_weight_p \times distance\ downstream_t \times EF\_transport\_downstream_t)$	p: physical print ad format P: total number of physical print ad formats involved in the ad campaign t: transportation type T: total number of transportation types involved in downstreai processes (e.g. size of truck) •$number\_ad\_format_p$; $ad\_format\_share_p$; $total\_medium\_weight_p$: see above descriptions in paper production step •$distance\_downstream_t$: total downstream distances travelled to all destinations (points of sale; ...) with vehicle type v [km] •$EF\_transport\_downstream_t$: emissions factor for the transportation type t used downstream [kgCO2e/t.km]

Continued on next page

Channel Emissions Framework and Formulae: Print Publications, Direct Mail & Door Drops

CONSUMPTION	End of life processing	Transportation and end of life of unsold products	Transportation of unsold products and returns back to central warehouse	Medium	$\sum_{p=0}^{P,unsold}\sum_{t=0}^{T}(number\ ad\ format_p \times ad\ format\ share_p \times total\ medium\ weight_p \times distance\ return_t \times EF\_transport\_return_t)$	*p: physical print ad format* *P, unsold: number of physical print ad formats involved in the ad campaign that were unsold* *t: transportation type* *T: total number of transportation types involved in downstream processes (e.g. size of truck)* •$number\ ad\ format_p$; $ad\ format\ share_p$; $total\ medium\ weight_p$: see above descriptions in paper production step •$distance\ returned_t$: total distances for unsold products which are returned with vehicle type v [km] •$EF\ transport\ return_t$: emissions factor for the transportation type t used for return shipments [kgCO2e/t.km]
			Disposal/end of life of print materials for unsold products and returns	Medium	$\sum_{p=0}^{P,unsold}(number\_ad\_format_p \times ad\_format\_share_p \times total\ medium\ weight_p \times EF\ Eol_p)$	*p: physical print ad format* *P, unsold: number of physical print ad formats involved in the ad campaign that were unsold* •$number\_ad\_format_p$; $ad\_format\_share_p$; $total\_medium\_weight_p$: see above descriptions in paper production step •EF_EOL_p: weighted average emissions factor for end-of-life disposal types [kgCO2e/kg]. EF_EOL_p = % * EF-recycled + % * EF-landfill + % * EF-incineration. Unsold products are likely to have a higher recycling ratio.
		End of life of sold products	Disposal/end of life of print materials after use by reader	Medium	$\sum_{p=0}^{P,sold}(number\_ad\_format_p \times ad\_format\_share_p \times total\ medium\ weight_p \times EF\ Eol_p)$	*p: physical print ad format* *P, sold: number of physical print ad formats involved in the ad campaign that were sold* •$number\_ad\_format_p$; $ad\_format\_share_p$; $total\_medium\_weight_p$: see above descriptions in paper production step •EF_EOL_p: weighted average emissions factor for end-of-life disposal types [kgCO2e/kg]. EF_EOL_p = % * EF-recycled + % * EF-landfill + % * EF-incineration.
ALL	Corporate emissions overhead		Allocated organizational emissions attributed to the specific (e.g. business travels, workplace, etc.) across all entities in the campaign value chain.	Low	/	Every organisation in the value chain should be reporting their verified enterprise GHG emissions inventory annually to ensure reasonable data quality at the enterprise level. More guidance will follow on this in the next update of the GMSF.

This channel emissions framework has been designed to be readable within this document. Click here to view an extended version of the channel emissions framework which includes additional detail including; formula type, scaling factors, alternative calculations, data hacks, and further comments.

Key:

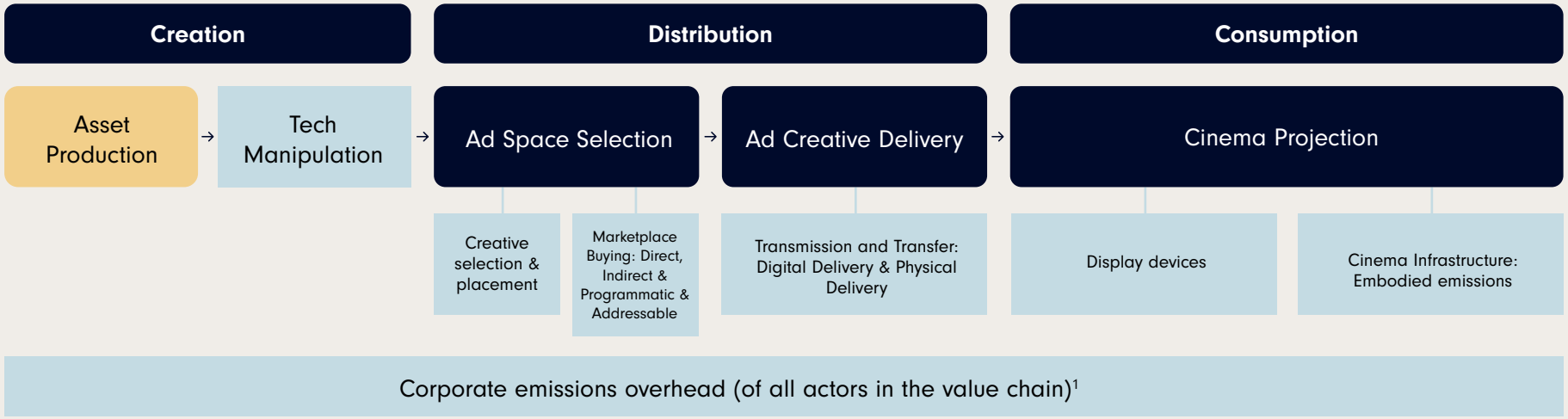
- = Not Yet Applicable or To be investigated further

∑ = The mathematical sign for a sum

Cinema Workflow and Framework

Cinema: Channel Emissions Workflow, Channel Emissions Framework

Channel Emissions Workflow: Cinema



Excluded from the system boundaries of this framework.

Included in the system boundaries.

[1]More guidance to follow in future GMSF update regarding Corporate emissions overhead.

Channel Emissions Framework and Formula: Cinema

PHASE		Step & sub-step		Physical processes involved	Expected materiality	Formulae	
CREATION	Tech Manipulation (Multivariant Creative)	Post-production storage		Additional server storage for multiple volumes of assets for the purpose of distribution.	• Low	$\sum_{a=1}^{A} (asset\_size_a \times time\_stored_a \times storage\_impact_a)$	*a: creative asset used in campaign* *A: total number of final assets (masters) used as creatives for the campaign* • $asset\_size_a$: *total size of ad asset files a (e.g. Digital Cinema Package) [GB]* • $time\_stored_a$: *time asset a is stored [yr]* • $storage\_impact_a$: *carbon impact of storage of asset a depending on storage type (HDD, LTO, Cloud) [kgCO2e/GB/yr]*
		Others technical operations		Server processing for multiple volumes of assets for the purpose of distribution.	/	/	
DISTRIBUTION	Ad Space Selection	Creative Selection & Placement		Planning of creative to go on specific inventory within a marketplace	/	/	
		Market-place: Buying	Direct	Proportion of advertiser & media owner's corporate emissions for buying process	/	/	
			Indirect	Proportion of agency/ specialist & media owner's corporate emissions for buying process	/	/	
			Programmatic/ Targeted/ Segmentable/ Addressable	Servers processing and networks transmission through SSP/DSP buying process	/	/	
	Ad Creative Delivery	Transformation & Transfer	Digital delivery	Servers processing of ad delivery	Low	$\sum_{a=1}^{A}\sum_{c=1}^{C} (asset\_size_a \times number\_cinemas_{a,c} \times EF\_infrastructure\_per\_data\_volume_c)$	*a: creative asset used in campaign* *A: total number of assets for the campaign* *c: country* *C: total number of countries involved for the campaign* • $asset\_size_a$: *total size of ad asset files a (e.g. Digital Cinema Package) [GB]* • $number\_cinemas_{a,c}$: *number of cinemas where ad file a was played, in country c* • $EF\_infrastructure\_per\_data\_volume_c$: *applicable emission factor for efficiency of servers infrastructure in country c (amortized per GB of data over lifetime of infrastructure), including PUE and carbon intensity of electricity in country c for use phase and embodied emissions of infrastructure [kgCO2e/GB]*
				Networks transmission of ad delivery (broadcast)	Low	$\sum_{a=1}^{A}\sum_{c=1}^{C} (asset\_size_a \times number\_cinemas_{a,c} \times EF\_network\_per\_data\_volume_c)$	*a: creative asset used in campaign* *A: total number of assets for the campaign* *c: country* *C: total number of countries involved for the campaign* • $asset\_size_a$: *total size of ad asset files a (e.g. Digital Cinema Package) [GB]* • $number\_cinemas_{a,c}$: *number of cinemas where ad asset a was delivered by digital way, in country c* • $EF\_network\_per\_data\_volume_c$: *applicable emissions factor for carbon efficiency of network, in country c (amortized per GB of data over lifetime of infrastructure), including carbon intensity of electricity in country c for use phase and embodied emissions of infrastructure [kgCO2e/GB]*
			Physical Delivery	Transportation from post-production to storage in warehouse	Low	$\sum_{p=1}^{P}\sum_{t=1}^{T} (total\_package\_weight_p \times distance\_storage_t \times EF\_transport\_storage_t)$	*p: physical package (e.g. hard drive) containing ad files* *P: total number of physical packages involved in the ad campaign* *t: transportation type* *T: total number of transportation types involved in transportation to storage processes (e.g. sea, air, road...)* • $total\_medium\_weight_p$: *weight of the entire package (e.g. hard drive) containing ad files to be delivered [kg].* • $distance\_storage_t$: *total distances travelled to storage sites with transportation type t [km]* • $EF\_transport\_storage_t$: *emissions factor for the transportation type t used to storage [kgCO2e/t.km]*
				Storage within the warehouse	Very low	/	/

Continued on next page

Channel Emissions Framework and Formula: Cinema

				Downstream transportations from storage to cinemas	Low	$\sum_{p=1}^{P}\sum_{t=1}^{T}(total\_package\_weight_p \times distance\_downstream_t \times EF\_transport\_downstream_t)$	*p: physical package (e.g. hard drive) containing ad files* *P: total number of physical packages involved in the ad campaign* *t: transportation type* *T: total number of transportation types involved in downstream transportation to cinemas (e.g. truck type...)* ▪ $total\_medium\_weight_p$: weight of the entire package (e.g. hard drive) containing ad files to be delivered [kg]. ▪ $distance\_downstream_t$: total downstream distances travelled to all cinema with transportation type t [km] ▪ $EF\_transport\_downstream_t$: emissions factor for the transportation type t used downstream [kgCO2e/t.km]
CONSUMPTION	Cinema projection[1]	Display devices		Emissions of technical devices lifecycle involved in the displaying of the campaign projected	Low to medium	$\sum_{a=1}^{A}\sum_{c=1}^{C}(number\_projections_{a,c} \times ad\_duration_a \times time\_scaling\_factor \times power\_projection\_device_c \times EF\_grid_c)$	*a: creative asset used in campaign* *A: total number of assets for the campaign* *c: cinema where the ad was displayed* *C: total number of cinema involved in the campaign* ▪ $number\_projections_{a,c}$: number of times the ad asset a was projected in a cinema c ▪ $ad\_duration_a$: duration of ad a [s] ▪ $time\_scaling\_factor$: time conversion factor [h/s] ▪ $power\_projection\_device_c$: electrical power of the technical devices (e.g. projector, bulb, screen, speakers...) involved in the projection in cinema c [kW] ▪ EF_grid_c: emission factor of electricity grid used by cinema c (e.g. country mix in location-based method) [kgCO2e / kWh]
					Low to medium	$\sum_{a=1}^{A}\sum_{c=1}^{C}(number\_projections_{a,c} \times ad\_duration_a \times EF\_embodied\_projection\_device_c)$	*a: creative asset used in campaign* *A: total number of assets for the campaign* *c: cinema where the ad was displayed* *C: total number of cinema involved in the campaign* ▪ $number\_projections_{a,c}$: number of times the ad asset a was projected in a cinema c ▪ $ad\_duration_a$: duration of ad a [s] ▪ $EF\_embodied\_projection\_device_c$: emission factor related to embodied emissions of the technical devices (e.g. projector, bulb, screen, speakers...) involved in the projection in cinema c, amortized per time used [kgCO2e / s]
ALL	Corporate emissions overhead			Allocated organizational emissions attributed to the specific campaign across ALL entities in the campaign value chain.	High	/	

Key:

- = Not Yet Applicable or To be investigated further

∑ = The mathematical sign for a sum

1 GB = 1 GigaByte = 10^9 Bytes

[1]To ensure consistency with other channels, the scope of this workflow step has been limited to the emissions of the technical devices' lifecycle involved directly in the displaying of the campaign projected (projector, screen...), a scope that will need to be specified more precisely in all cases in future iterations of guidance. Emissions linked to the cinema infrastructure (A/C, lights...) and visitor transportation, are considered as outside the scope. Although the materiality is probably high, it is considered that these are non-advertising specific and tie in with the topic of corporate emissions.

This channel emissions framework has been designed to be readable within this document. Click here to view an extended version of the channel emissions framework which includes additional detail including; formula type, scaling factors, alternative calculations, data hacks, and further comments.

Wave 3 and Future Developments

Future solutions: Metrics + Methodology

We anticipate that frameworks will be updated based on in-market feedback. For instance, as media emissions data continue to become more specific and we determine which aspects of formulae are material, we will evolve key aspects of the frameworks and solutions. As such, Ad Net Zero will continue to publish updates on component parts.

Metrics and Methodology: Cinema

As mentioned, we expect more evolved and specific solutions over time. The next Wave will include the Data Guidance for the following:

Cinema	Channel Emissions Formulae

Once Cinema is completed, all six major media channels will have Channel Emissions Frameworks and Formulae ready to be used. Data Guidance will be provided for each channel in future updates of the GMSF.

Future solutions: Data Collection

Data Collection : Evolving Solutions

As mentioned, we expect more evolved and specific solutions over time. The next Wave will include the Data Guidance for the following:

TV/Video	Channel Emissions Data Request Form Channel Emissions Data Source Guidance Channel Emissions Data Hacks
Audio	Channel Emissions Data Request Form Channel Emissions Data Source Guidance Channel Emissions Data Hacks
Out-of-Home	Channel Emissions Data Request Form Channel Emissions Data Source Guidance Channel Emissions Data Hacks
Cinema	Channel Emissions Data Request Form Channel Emissions Data Source Guidance Channel Emissions Data Hacks
Print	Channel Emissions Data Request Form Channel Emissions Data Source Guidance Channel Emissions Data Hacks

Future solutions: Audit + Verification

Audit + Verification: Establish trust and reliability in the emissions data being provided to the industry

What is the context and purpose of this solution?	This voluntary solution is meant to enable third party auditors to create an industry-supported audit specification that addresses the reliability of sustainability data being used.
What is in consideration in the recommendation under development?	Specifically, audit + verification will ensure that industry-endorsed steps are taken to do the following: a. **Verifying claims:** When companies state they are using the GMSF, they can be audited to ensure this alignment has been accurately implemented. b. **Auditing data:** To ensure that emissions data supplied by the industry to support the GMSF can be trusted as accurate and transparent.
Who is helping to advance the recommendation?	Ad Net Zero will consult external audit groups to focus on the critical sustainability media steps the industry needs validated to increase trust and reliability.
What is coming next?	A proposal of audit specifications, guidelines and a roadmap for implementation.

Future solutions: Data Access

Data Access: Explore potential solutions to expediate access to emissions related data, and potential benefits that could be gained from a central repository

What is the context and purpose of this solution?	This voluntary solution is meant to explore ways that emissions data can be supplied to a trusted, secure central source accessible to media buyers, creating a one-to-many approach for data supply vs a one-to-one solution.
What is in consideration in the recommendation under development?	Specifically, Data Access will look at how other industries use repositories to hold and store information securely to enable one point of access: a. **Viable Solutions:** A landscape analysis to determine what is already in place in other industries, and what the advertising industry is doing to support data collection in other areas. b. **Development and Implementation:** Exploration on how an industry solution can be created and maintained and the functionality required for successful implementation.
Who is helping to advance the recommendation?	Ad Net Zero will establish a working group of volunteers from across the industry, working closely with national trade associations to explore how data can be stored at a country level, as well as at a global level.
What is coming next?	A proposal of potential solutions to explore, and a roadmap of how to apply these to support the GMSF.

Appendix

Frequently Asked Questions

Who is Ad Net Zero?

Ad Net Zero is a global climate action programme working to help the advertising sector and companies that advertise drive better business through education, sustainability-related best practices and more consistent estimation frameworks and sustainable behaviours in the work. Ad Net Zero's Five-Point Action Plan focuses on decarbonising ad operations and supporting every industry to drive better sustainable business results by accurately promoting sustainable products, services, and behaviours. Ad Net Zero is a nonprofit, pro-competitive, member-supported organisation and engages stakeholders across the industry from advertisers to agencies to marketing services and trade organisations.

In March 2023, Ad Net Zero deepened its research on its Action 3, setting up a long-term, cross-industry workstream dedicated to media planning and buying.

What is the Global Media Sustainability Framework and why is it important?

This is Ad Net Zero's cross-industry media workstream. The aim is to provide standardisation for the proliferation of GHG estimation tools and methodology which currently exists in the marketplace.

By creating a set of recommendations based on best practices and validated independent climate science input, we can improve the consistency, accuracy, and rigour for advertisers to better estimate their emissions from media campaigns, regardless of which agency or partner they operate with, in any part of the world. The suite of recommendations also encompasses data request and is expanding to include guidance on audits.

How can industry stakeholders consider using the Global Media Sustainability Framework?

As a voluntary industry framework, the Global Media Sustainability Framework is available without any restrictions. Any stakeholder within the advertising industry can access the resources and consider the relevance to their operations.

Below are some example use cases for Global Media Sustainability Framework to consider:

- Advertisers may request that their partners who estimate GHG emissions from their media activities use the Global Media Sustainability Framework Channel Emissions Formulae, ensuring that regardless of which partners they work with in each market, there will be consistency of estimation.
- Agencies may consider using the Global Media Sustainability Framework Channel Emissions Formulae within their own tools and make GHG emissions a consideration for all media plans, alongside other established media metrics.
- Media owners may supply the requested data to advertisers, agencies and other solutions providers in as much granularity as possible, continually improving the quality of this data over time, adding increased value and transparency to their offerings, and supporting their stakeholders' compliance needs.
- Tool providers can highlight how their tool maps to the Global Media Sustainability Framework Channel Frameworks, enabling them to showcase enhancements or customisation they may offer relative to competitors.

How is this different from other media sustainability frameworks and solutions?

The Global Media Sustainability Framework is based on voluntary work from Working Groups, and voluntary submissions to Ad Net Zero. This is similar to the process Union des Marques ran in France via OneFrame, the French industry standard, for different channels. By inviting organisations into a voluntary process with the wider industry, we have sought to create a single universal framework that can be used across all main channels and markets, with scope to improve over time. This will add much needed consistency across territories and channels and give full transparency to the estimation methodology.

What benefits can stakeholders expect from the Global Media Sustainability Framework?

Advertisers: Advertisers who may work with multiple media agencies, that may each have their own GHG estimation tools, will now have a voluntary framework that can create transparency in how approaches are different or can use the same Framework for GHG media calculations. In addition, by estimating the GHG emissions within their media supply chain, advertisers may voluntarily decide to identify most GHG intensive activities, and may individually decide to take action to reduce these in line with their reduction targets.

Media Agencies: Agencies will have the opportunity to use the Global Media Sustainability Framework to adopt or map their methodologies to the voluntary framework and can use the data request form to more easily get access to first party media seller and supply chain emissions data.

Media Sellers: Media sellers and service providers will have clarity on what data they should provide to GHG estimating tool owners, such as agencies or other estimation providers. This should cut down on the number of requests, and the amount of time it takes to respond to requests for this information. It also provides clarity over how exactly they will be estimated, and how competitors, and other channels will also be estimated when it comes to GHG output. Media Owners can then work to improve the data level of granularity they provide, and ways to reduce the GHG emissions they produce.

Media Sustainability Solutions Providers: Similar to agencies, solutions providers will have the opportunity to use the Global Media Sustainability Framework to adopt or map their methodologies to the voluntary framework and can use the data request form to more easily get access to first party media seller and supply chain emissions data.

Who can help me implement this?

If you're an advertiser, you may consider speaking to your media agency and any estimation partners about adopting the Global Media Sustainability Framework to ensure transparency and consistency of methodology. For agencies, Ad Net Zero will provide the detailed formulae that you can use within your existing estimation tools, or alternatively it can be used by agencies without an existing product to create a new tool. For Media Owners Ad Net Zero will publish the data that will be requested, as well as the preferred granularity, with a pathway to improving the data. ANZ will make all documentation publicly available to help implementation.

How often will the Global Media Sustainability Framework be updated?

We are committed to onboarding feedback from the industry and also continuing to update the work. Our intent is to continue to update the work on an annual cycle at minimum. That said, we will update the Framework as critical updates are available to component parts of the Framework.

What are the biggest and easiest things I can do to reduce my emissions from media planning and buying?

If you are considering tactical emissions reductions alongside or instead of systemic transformation, you may want to consider the principles produced in the Ad Net Zero Guide to Sustainable Media, that was based on best practice tactics currently used by advertisers and agencies.

Glossary of Terms

Term	Definition/Explanation
Sustainability	
Climate Change	Climate change refers to long-term shifts in temperatures and weather patterns. Such shifts can be natural, due to changes in the sun's activity or large volcanic eruptions. But since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil, and gas. Burning fossil fuels generates greenhouse gas emissions that act like a blanket wrapped around the Earth, trapping the sun's heat and raising temperatures.
GHG Protocol	Greenhouse Gas Protocol provides the world's most widely used greenhouse gas accounting standards for companies. GHG Protocol standards and guidance enable companies to estimate, manage and report greenhouse gas emissions from their operations and value chains. The GHG Protocol Product Lifecycle Accounting and Reporting Standard is the foundation of ISO 14067 and highly relevant to this Framework.
Greenhouse Gases (GHG) and CO2e	There are 6 primary greenhouse gases as defined by the Kyoto Protocol. These are Carbon Dioxide, Methane, Nitrous Oxide, Hydrofluorocarbons (HFCs), Perfluorocarbons, and Sulfur Hexafluoride. All of them critically influenced by human behaviour (including the influence of synthetically produced gases like SF6 and HFCs). Since these gases have different impacts, we convert them to a common unit: Carbon Dioxide equivalent or CO2e. The shorthand is "carbon" which is why we talk about decarbonisation.
Intergovernmental Panel on Climate Change (IPCC)	The IPCC is the United Nations' body for assessing the science related to climate change, whose primary responsibility is the preparation of reports assessing the state of knowledge of climate change. These include assessment reports, special reports and methodology reports.
International Organisation for Standardization (ISO)	An independent, non-governmental international organisation that brings global experts together to create internationally-agreed standards in various industries. The ISO 14000 family concerns environmental management. ISO 14064 is the standard that specifies how a company can create its GHG inventory and how that inventory can be verified by an accredited third party. ISO 14067 is the GHG Lifecycle Assessment standard which is most relevant to this Framework.

LCA	Lifecycle assessment (LCA), also known as lifecycle analysis, is a methodology for assessing environmental impacts associated with all the stages of the lifecycle of a commercial product, process, or service. The GMSF is in essence an LCA for the advertising process of the six major media channels.
Science Based Targets initiative (SBTi)	A corporate climate action NGO that develops standards, tools, and guidance which enable companies to set greenhouse gas emissions reductions targets in line with what is needed to keep global heating below catastrophic levels and reach net-zero by 2050 at latest, and have those targets validated. SBTi is spinning out a separate organisation to continue to validate company targets.
Scope 1	Covers all direct GHG emissions from sources that are owned or controlled by the company (e.g. company facilities, company vehicles).
Scope 2	Covers indirect GHG emissions from consumption of energy (e.g., electricity, heat, cooling, steam) generated outside of the organisational boundary of the company.
Scope 3	GHG emissions from the production and extraction of purchased materials, fuels, and goods, as well as all other purchased services (e.g., IT services), transport-related activities (e.g. business travel, commuting) as well as outsourced activities, such as waste disposal – and most media emissions.
Sustainability	In 1987, the UN defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." The 17 UN Sustainable Development Goals in act since 2016 provide detailed descriptions and metrics for each aspect of sustainability. Climate Action, SDG 13, is one of the most relevant to the ad sector (sometimes "sustainability" and "climate" are used interchangeably in the ad sector), and the focus of this Framework. Responsible Consumption and Production, SDG 12, is also very relevant to the ad sector.

Legislation

Corporate Social Responsibility (CSR)	Corporate Social Responsibility is a management concept whereby companies integrate social and environmental concerns in their business operations and interactions with their stakeholders. CSR is generally understood as being the way through which a company achieves a balance of economic, environmental and social imperatives, while at the same time addressing the expectations of shareholders and stakeholders.
Corporate Sustainability Reporting Directive (CSRD)	A directive by the European Union which strengthens the rules concerning the social and environmental information that companies have to report. Large companies will now be required to report on sustainability.
California Climate Reporting Requirements (SB 253 & SB 261)	The US state of California has two requirements similar to CSRD to report GHG emissions, including how they impact financial risk.
International Sustainability Standards Board (ISSB, part of International Financial Reporting Standards)	ISSB is a key driving force for global reporting, aligned with financial reporting, so it is important to understand their structure, processes and what jurisdictions (like Australia, Brazil, Canada) are adopting the S2 standard on climate reporting in whole or adapting them. The S1 standard is the overall sustainability standard that will address topics in addition to climate.
Pre-competitive Collaboration	An industry approach where stakeholders work together to establish common standards and tools without compromising their competitive positions.

Media

Adtech (Advertising Technology)	The software and tools that agencies, brands, publishers, and platforms use to target, deliver, and estimate their digital advertising campaigns.
Avails Ratio	A metric estimating the proportion of available ad opportunities (avails) that result in actual ad impressions after accounting for filtering and optimisation processes.
Demand Side Platform (DSP)	A DSP is an advertising technology platform that allows media buyers to purchase advertising inventory from multiple SSPs and ad- exchanges via one centralised management platform.
Made for Advertising (MFA)	MFA websites are designed for the purpose of arbitrage and to maximise profits for their owners. MFA websites typically use click-bait and/or low-price point advertising to drive users to low quality content featuring excessive ad placements, auto-play video, and pop-up advertising.
Programmatic Advertising	Programmatic advertising uses software, data, and technology to add automation to the media selling and buying process.
Supply Side Platform (SSP)	An SSP is an advertising technology platform that allows publishers to sell their inventory through one single point of contact to the demand side.

Framework

Activity-based Emissions Data	Data collected at the level of individual media activities or ad products, enabling more accurate emissions calculations than aggregated estimates.
Activity-based Product Level Data	Data that directly represents the variables in the formulae (vs using estimates, approximations, proxies, or other types of "hacks").
Ad Creative Delivery	Process of storing a creative on the ad server and then sending it to the user device.
Ad Delivery	Emissions originating from the transmission of the Ad Creative assets from a CDN edge node, over network, but not including end-user device. The Ad Creative assets include all loaded assets required to generate the ad experience: videos, images, javascripts, 3D models, fonts, etc. This includes direct energy consumption by the data centres and the network infrastructure, as well as the hardware's embodied emissions (manufacturing and end-of-life emissions). When transmitting assets from a CDN edge node the calculation can use the user location to determine the carbon intensity of the electricity to apply. When transmitting assets from an Ad Server the calculation can consider both the data centre and the user location to determine the carbon intensity of the electricity to apply.
Ad Space Selection	The process of matching media supply and demand and connecting media owners to media buyers.
Channel Emissions Formula	The set of mathematical expressions applied within the Framework to quantify emissions based on the inputs identified in the workflow.
Channel Emissions Framework	The methodological structure outlining the functional units, data requirements, and boundaries used to calculate emissions for each media channel.
Channel Emissions Workflow	A step by step depiction of the media campaign phases (Creation, Distribution, Consumption) that maps the pathways through which emissions occur.
Data Hacks	Estimation techniques—using industry averages or "rules of thumb"—employed to approximate emissions when granular, primary data is not available.

Data Levels	The GMSF classifies different levels of data with varying granularity, to note when there is a lack of activity-based product level data. This classification along with understanding how much of the data is primary (coming from specific activities) vs estimated (via "hacks" or other rules of thumb) helps users of the overall emissions data understand the level of uncertainty of the data.
Direct Sale	Emissions originating from a direct buying process between ad buyer and media seller. This includes direct power consumption for the processing and transmission, as well as embodied emissions associated with the infrastructure manufacturing and end-of-life. Accounted for as programmatic unless a segment of inventory is set aside exclusively for direct sales.
Embodied Emissions	The greenhouse gas emissions generated during the manufacturing, transportation, installation, maintenance, and disposal of goods, sometimes also referred to as embodied emissions. In the context of the GMSF, embodied emissions have been included and amortised over the life of the device or system involved in media placement or consumption (generally expressed as average life, usage time, end of life). The lifetime depends on lifecycle assessment.
Emissions Factor	Factors based on data and best practices that convert activity and other relevant data into CO2e emissions (e.g. kg CO2e/kWh; kg CO2e/km travelled). Using a common set of emissions factors is a critical part of any carbon accounting framework. There are many emissions factors for common infrastructure services such as electricity, fuels as well as IT services such as data transmission, and some emissions factors are being developed to account for the unique activities that occur in the ad sector.
Functional Operation	Key concept that defines the quantified performance of a studied product/service as a reference unit in a study. The output of the calculation represents the environmental impact of the functional unit. E.g. kg CO2e per 1000 impressions.
Materiality	Materiality is an important concept to guide where to focus the data gathering and calculation efforts and transparently note when emissions were not included. We consider the materiality threshold to be 5% in line with guidance from SBTi and the GHG Protocol.

Post Production Storage	Emissions originating from the storage of ad master bundles across local drives, LTO, and cloud. The masters bundle includes the different files and variants that result from the post-production process and may be used in campaigns. This includes direct energy consumption by the storage infrastructure, as well as the hardware's embodied emissions (manufacturing and end-of-life emissions).
Real-time Bidding	Emissions originating from a real-time bidding (RTB) process. Real-time bidding (RTB) refers to a way of transacting media that allows an individual ad impression to be put up for auction in real-time. This is accomplished through a programmatic on-the-spot auction, similar to how financial markets operate. RTB lets buyers use their own data and targeting options to bid for each ad impression. Advertisers can take factors such as site, placement, price and user data into account when bidding on each impression. The winning bidder's ad is served, which is often customised on the fly to better tailor the message to the audience. This includes direct power consumption for the processing and transmission of requests, as well as embodied emissions associated with the infrastructure manufacturing, and end-of-life.
Scaling Factors	Multipliers applied within the emissions formulae to adjust for variables such as energy intensity or allocation percentages, thereby refining the final emissions calculation.
System Boundaries	Specifies what is included or excluded of the calculations, following LCA principles as structured in the GHG Protocol Product Lifecycle Accounting and Reporting Standard.
Targeting	Emissions originating from any process of data collection for user or context qualification, data analysis and processing to use demographic, interest, behavioral, contextual, or keyword data to deliver ads to a specific audience or within relevant contexts. This process can be done through first-party or third-party data. This placeholder accounts for platforms like DMPs and the lifecycle emissions of data which are yet to be determined.
Tech Manipulation	Creation of multiple asset formats or other modification of the creative product for the purpose of distribution.
Workflow	Graphical detail of the steps an ad message takes throughout the 3 Phases, including buying, transmission and consumption.

Links to referenced documents

Digital – Channel Emissions Framework and Formulae – Extended Version

Print – Channel Emissions Framework and Formulae – Extended Version

TV & Video – Channel Emissions Framework and Formulae – Extended Version

Audio – Channel Emissions Framework and Formulae – Extended Version

Out of Home – Channel Emissions Framework and Formulae – Extended Version

Cinema – Channel Emissions Framework and Formulae – Extended Version

GMSF Digital Data Request Form

GMSF Digital Emissions Factors

GMSF Sustainability Solutions Transparency Form

GMSF Enterprise Data Request Form

FAQs

Acknowledgements

We'd like to recognise all of the industry leaders who have contributed to this work. Without their willingness to voluntarily join meetings – ranging from the Steer Team, the Climate Science Expert Group, the Working Groups or being part of an industry-wide consultation process - the continued development of a GMSF would not be possible. We would also like to thank Ad Net Zero's Global Supporters.

GMSF Steer Team

Climate Science Expert Group

Industry Contributors

Ad Net Zero Global Supporters

AD NET ZERO
ALL FOR NONE

adnetzero.com

support@adnetzero.com

Ad Net Zero Compliance Statement

Ad Net Zero is an international, cross-industry coalition of businesses aimed at decarbonising advertising supply chains and encouraging growth of advertising that drives more sustainable choices and behaviours.

It represents the interests of the advertising industry. It acts as a forum for legitimate contacts between supporters of the advertising industry. It is the policy of ANZ that it will not be used by any company, industry grouping or individuals to further any anti-competitive or collusive conduct, or to engage in other activities that could violate any antitrust or competition law, regulation, rules or directives of any country, or otherwise impair full and fair competition.

Supporters acknowledge that being a supporter of ANZ is subject to the competition law rules and they agree to comply fully with those laws. Supporters agree that they will not use ANZ, directly or indirectly, (a) to reach or attempt to reach agreements or understandings with one or more of their competitors; (b) to obtain or attempt to obtain, or exchange or attempt to exchange, confidential or proprietary information regarding any other company other than in the context of a bona fide business; (c) to further any anti-competitive or collusive conduct; or (d) to engage in other activities that could violate any antitrust or competition law, regulation, rule or directives of any country or otherwise impair full and fair competition.