

# Why your country should create its own carbon database, and how

Identify needs and designate a project owner, set up a steering committee, requisite resources



**Authors:**

Quentin GUIGNARD et Jouairyatou WAGUE, Association Bilan Carbone

**Thanks to other contributors:**

Fanny FLEURIOT, Muriel DESGEORGES, and other ADEME's contributors  
Damien HUET, Association Bilan Carbone

**Icon creation:**

fjstudio

**Page layout:**

Marie Delangue - [www.mariedelangue.com](http://www.mariedelangue.com)

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# Preamble

A database of emission factors  
– also called a carbon database –  
is needed to establish a carbon inventory  
using carbon accounting methods and tools.

To date only a handful of countries have grasped the importance of compiling data that is specific to their national circumstances, in order to get companies and organizations involved and to incite them to calculate their direct and indirect greenhouse gas (GHG) emissions.

Organizations are now ready, and waiting for data and turnkey tools (including emission factors) that they can use rapidly. To enable local organizations to make use of these tools they must have access to readily available emission factors.

Carbon databases meet these multiple objectives, which converge on assessment of the carbon footprints of organizations for the purpose of reducing GHG emissions.

In this document the term «carbon database» refers to:

- a database of GHG emission factors, or any other set of data (most often statistical)

**designed to be used to draw up an inventory of GHG emissions within a given geographic area;**

- **all related activities that go along with the creation of this database, especially coordination and management of user communities and actors involved in carbon accounting in the geographic area.**

This note outlines the basic conditions for successful creation of a carbon database in a general context. These indications are to be adapted to specific community and geographic contexts, taking into account local characteristics such as community structure, actors, skills, etc. The points that require adjustment for local conditions are identified by this icon:



There are a number of reasons for creating an emission factor database. Among the objectives that be pursued, singly or jointly:

- Compile data for carbon accounting by organizations in keeping with international standards, and ensure unified practices across actors and regions;
- Provide incentives to foster carbon accounting at local and national levels;
- Support work to establish and implement local plans for transition to a low carbon economy;
- Provide data for life cycle assessments and build enterprises to be more competitive in conception and design of products with low environmental impact.

Development of a carbon database meets the needs of a number of actors and strengthens carbon

## Note de cadrage

expertise at the national level. A carbon database of appropriate scope and connected to local climate action projects is a platform for the development of public policy to reduce GHG emissions; it will also help drive the emergence of a low carbon transition strategy at the national level.

This preliminary study has been drafted by Association Bilan Carbone at the request of ADEME to present the development of a carbon database to an international audience. The study draws upon the respective experience and expertise of the two organizations and on feedback from projects they have conducted,

separately or together. General notions and terminology are drawn from previous reviews of the literature.



Development of a carbon database meets the needs of a number of actors and strengthens carbon expertise at the national level.

### Association Bilan Carbone

Association Bilan Carbone (ABC) has been actively involved in climate change action since 2011. This work consists in federating and coordinating expertise, raising stakeholder awareness of issues and making appropriate solutions for transition to a low carbon economy available to organizations in France and abroad.

ABC is the developer of a widely recognized carbon accounting tool, Bilan Carbone®. ABC and its partners build and disseminate methods and operational solutions to reduce greenhouse gas emissions and support the transition to a low carbon society.



### ADEME

The Agency for ecological transition (ADEME) is a French public agency under the joint supervision of the Ministry for an Ecological and Solidarity-Based Transition, and the Ministry for Higher Education, Research and Innovation. A key player in the drive to mitigate global warming, ADEME is active in the implementation of public policies regarding the environment, energy and sustainable development. ADEME provides expertise and advisory services to businesses, local authorities, government bodies and the public at large, to enable them to consolidate their environmental action.

ADEME has managed and coordinated the French database of emission factors, Base Carbone®, for the past 15 years. The agency contributes its expertise to work in Europe and around the world.



# Deployment of a carbon database

## **Benefits and opportunities:**

broader competence, a tool for the development of national strategy, creation of a resource centre, a group work method, support for local actors.

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## 1. Focus on the existing ecosystem



The existing ecosystem must be taken into account when creating a carbon database; the main actors must be identified and contacted, and past, current and pending initiatives and projects listed.

A diagram or flow chart of actors and existing activities (e.g., LCA database, energy/climate projects, etc) can be created for the purpose of integrating the carbon database into the existing or emerging work dynamic and to access quantitative and qualitative data that will nourish the database.

Three scales should be considered:

- Supra-national – Determine what international entities and bodies are now solicited at lower levels, and what they furnish (methods, tools, training, expertise, etc). There exist several major international standards for carbon accounting and inventory, among them ISO 14064 for the quantification and reporting of GHG emissions. These standards refer to different perimeters and scopes (organizations, territories, products, etc). Familiarity with existing projects and work will make it easier to establish the carbon database in the ecosystem and obtain recognition by peers and partners.

- National – In addition to this survey of institutional and economic actors and nonprofit stakeholders who show an interest for a carbon database, knowledge of the legislative and regulatory playing fields is an advantage; carbon database objectives can be aligned with these conditions.
- Regional – The database can be designed to include data on a regional scale, in response to specific needs expressed by stakeholders.

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## 2. From needs to governance

### a- Identify needs and designate a project owner



Depending on the scale and the purpose of the carbon inventory, different types of carbon data must be mobilized.

- On a national scale access to data specific to the national context could make it easier to carry out a carbon inventory; public bodies will be better equipped to design GHG emission reduction policies.
- On regional and other territorial scales many actors seek to act on their regulatory or voluntary commitments (e.g., the Convention of Mayors).

- Private-sector organizations are eager to include carbon criteria in their environmental strategy, to become more competitive, enhance their image or obtain labels or certification.
- With solid information drawn from a shared knowledge base the action of all these actors, including individuals, will be more coherent and effective.

Representatives of potential database users should be consulted, to be able to meet their needs as closely as possible. The project to build a carbon database must be a voluntary and joint endeavour of partners who pursue a common objective.

An operational structure must be clearly identified to administer and manage the project. This project owner must be endowed with at least one of the following qualifications:

- Legitimacy to bring together actors on the project scale to focus on emission estimations and the low carbon transition;
- Legitimacy to furnish reference data for future work on energy and climate issues;
- Technical competence on the issues at stake in the low carbon transition;
- Technical competence in the creation of scientific databases;
- Financial resources to fund the project;
- Capacity to manage a project with multiple partners.

If the project owner itself does not possess all these resources, it must be able to mobilize other actors to provide the requisite competencies. The project owner and these outside resources will work together throughout the project and will constitute the core of the steering committee.

### b- Set up a steering committee

The steering committee is made up of the founding partners who will launch and build the database. The committee and its work should be specified in detailed written form as early as possible, and its members selected according to the following criteria:

- use of the database;
- expertise on carbon issues;
- legitimacy (on the basis of research, institutional affiliation, etc);
- financial contribution to database development;
- data contribution to the database.

The steering committee is composed of members who reflect the local context and challenges, and the project owner will suggest names drawn from an exhaustive survey of actors.

A pitfall to be avoided is the risk of lobbying. All the actors with a stake in the database should be asked to participate, but none should have undue influence



within the committee, as the force and reputation of the carbon database are based on its neutrality, making it attractive for a wide range of uses. To limit this risk and keep the committee at a reasonable size, professional federations and representative bodies should be preferred, allowing them to express the views of their branch or sector.

The upstream contribution of participants with different stakes in building and maintaining the database should be obtained as early as possible. This is one of the most important and difficult stages of creating a carbon database. It is called a limiting stage, because it determines the integrity of the project and the longevity of the database.

The contribution of experienced professionals in this domain is highly recommended. «International actors» will help local protagonists gain experience and competence, so that they can themselves manage the database and related activities. The steering committee has the option of giving international actors a formal role or roles at different stages of the database project.

The steering committee will make decisions on content management throughout the life of the database. Practical rules of operation should be drawn up to anticipate the committee's missions and establish adequate decision-making procedures. The project owner will assume responsibility for the final decision if no consensus can be found.

These written rules will frame the commitment and participation of the steering committee members, especially for volunteer members. The structure of the committee and its ability to project a long-term vision for the carbon database will be key to the mission of anticipating change and pursuing relevant action.

## c- Requisite resources



Creation of an emission factor database from the ground up is an ambitious project that calls for a range of financial, material and human resources. These resources must be organized and adapted to specific objectives and allocated at the beginning of the project.

It is not easy to foresee what resources will be needed in the post-creation phase, and the tendency is to underestimate the person hours that will be needed (compared to the initial creation phase). The life of the database will depend on the resources devoted to keeping it relevant and up to date, however. The steering committee should address resource planning as early as possible.

As an example, the French database Base Carbone® is maintained by an employee at 30% of full-time, an annual project assistance contract (80k€/year) and an IT maintenance contract (25k€/year), for total budget on the order of 120k€/year.

Some other questions to guide your reflection:

### • Where will the initial data come from?

To build a database, the first step is to identify the sectors where the need for a carbon database is strongest, for example, energy, transport, industry, etc. The next step is to establish benchmarks on the basis of existing databases and literature and identify emission factors that are valid for a given country or for a «global scope». National surveys and statistics are also a source of useful information. The data used must be consistent with the methodology adopted by the steering committee, with respect to scope, quality, control, procedures, etc. If the data you find do not meet your needs, you may be able to use data from the literature to (re)calculate values according to your criteria. These data should be produced by specialists with the requisite competence.

### • How will the database be accessed, and what are the web development needs?

The answers to these questions will enable the steering committee to set a firm minimum budget. The committee will be responsible for overseeing this budget and adjusting it throughout the life of the







## Framework paper

database. Costs will be estimated on the basis of average costs in the country involved (senior specialist, junior specialist, IT services, etc).

The mode of dissemination is determined so as to make the carbon database readily accessible and easy for users to exploit. Two options can be distinguished: an online version, involving web development, and an offline version that works with spreadsheet software.

A user questionnaire is one way to determine the best solution.

	 Strengths	 Weaknesses
Web version 	<ul style="list-style-type: none"> <li>Easy to update</li> <li>Advanced search options</li> <li>Exportable data</li> <li>Multiple entries</li> <li>Language options</li> <li>Support for the user manual and resource centre</li> <li>Monitoring of database use (number of users, connections, statistics, etc)</li> <li>Attractive design</li> <li>Dynamic content</li> <li>Ergonomics</li> </ul>	<ul style="list-style-type: none"> <li>Development costs</li> <li>Maintenance costs</li> <li>Recourse to outside vendor(s)</li> <li>Need for an internet connection</li> <li>Must be adapted to different devices (computer, tablet, smartphone)</li> <li>Must be accessible via the most common browsers (Mozilla, Chrome)</li> </ul>
Spread-sheet version 	<ul style="list-style-type: none"> <li>Exportable data</li> <li>Readily accessible (no need for internet connection)</li> </ul>	<ul style="list-style-type: none"> <li>Updating takes more time</li> <li>Different versions in circulation</li> <li>Requires minimum familiarity with spreadsheets</li> <li>Must be compatible with open-source software</li> </ul>

The most appropriate oversight will depend on the context. While it is assumed that the steering committee will be at the national level, territorial committees can be set up regionally or locally to gather and transmit useful data and information to the national committee.

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### 3. Carbon database construction methodology and project management

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Methodological approaches to carbon database construction are available in the scientific literature. Feedback from recent projects can also be found. These methodologies outline the standard stages of database construction and propose ways to adapt the methodology to the objectives and purpose of the database to be created.

- Principal data sources are identified in the literature.
- Check how these sources are accessed and used: are they free of charge or fee-based? Are there restrictions on usage?
- Compile new data when specific items are not available in the literature. These emission factors will have to be calculated «from scratch». For this, experts in specific sectors will have to be consulted to fill in the gaps. The database will be composed of both collected data and newly minted data.
- Evaluate the degree of uncertainty for each emission factor to ensure scientific consistency.
- Full documentation of data sources and calculation assumptions must be compiled and made available to users.
- A verification process must be established to ensure the robustness of data.

It may be useful to create multiple entries to the database for different types of users, depending on the desired features (overall emission factors, emission factors broken down by phase or stage, accessibility of detailed information etc).

Among methodological choices, an appropriate and consistent data scope is a fundamental decision. Emission factors for the database must systematically refer to the same scope; the appropriate scope is determined by the needs described in section 2.a and is chosen to ensure that the database will remain useful over time.

When few data are available it may be difficult to demonstrate their reliability. Reliability factors must be

stipulated in the early stages, to ensure homogeneous and harmonized data.

Other issues will arise and will have to be resolved in ways that are consistent with the purpose, objectives and scope of the database. For example, the French Base Carbone® includes both generic emission factors that can be used in a country scope, and more specific factors.

The criterion of carbon emissions is not in itself sufficient to reflect the overall environmental performance of an organization or a product. But it can be a good proxy indicator for environmental footprint in that it reflects fossil energy use and energy consumption levels. A multi-criteria approach can be anticipated when a carbon database is created. If data on other environmental performance factors are available, they can be integrated from the start. If not, the coordinating structure should consider how they can be integrated in the future.

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### 4. Database modalities and moderation

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A carbon database compiles GHG emission factors for various processes, products and services; these emission factors are used to calculate emission inventories and estimate carbon footprints for organizations. The steering committee makes decisions concerning conditions of access to the database: no charge, fees, licensing, registration and information requested, etc.

The format and mode of dissemination must be appropriate to meet the needs of final users and make the database easy to use. In general, the practical aspects of the database platform should be optimized so that «beginners» are encouraged to discover and use the database.

For example, emissions can be estimated:

- in quantity for each GHG: kg of CH<sub>4</sub>, kg N<sub>2</sub>O, kg of CO<sub>2</sub>;
- in quantity of each GHG converted into CO<sub>2</sub> equivalent units according to IPCC equivalencies: (CH<sub>4</sub> in kg CO<sub>2</sub> eq, N<sub>2</sub>O in kg CO<sub>2</sub> eq;
- in cumulative carbon quantity, in kg CO<sub>2</sub> eq.

Emission factors and calculations can be more or less precise: the degree of precision can be an option to be selected by the user.

It is important for the steering committee to think about database modalities, moderation and maintenance early on in the design phase. To coordinate these aspects another entity can be created to work with the project owner, depending on its capacities and competencies. We will call this the «support structure».

The support structure should have the expertise and capacity to ramp up its competence to address the needs of the database users. The survey of actors conducted in the early stages of the project is one way to identify these competencies. A user group and community can be encouraged to stimulate discussion on database issues and will also serve to promote the database.

The steering committee should also anticipate steps to moderate and manage the user community, and provide answers to users' questions, further legitimating the user community. One way to stimulate the user community is to publish, communicate and promote database results, e.g., GHG emission inventories.

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## 5. Managing input and adapting to new uses

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Through user community management the database project can find actors with information that can be contributed to expand the database, especially useful in the early days of a database. The methodology used to build the database will also serve to validate new data and ensure data consistency and compliance with a uniform set of requirements.

The steering committee will have to define a transparent data validation process to ensure impartial treatment of different contributors.

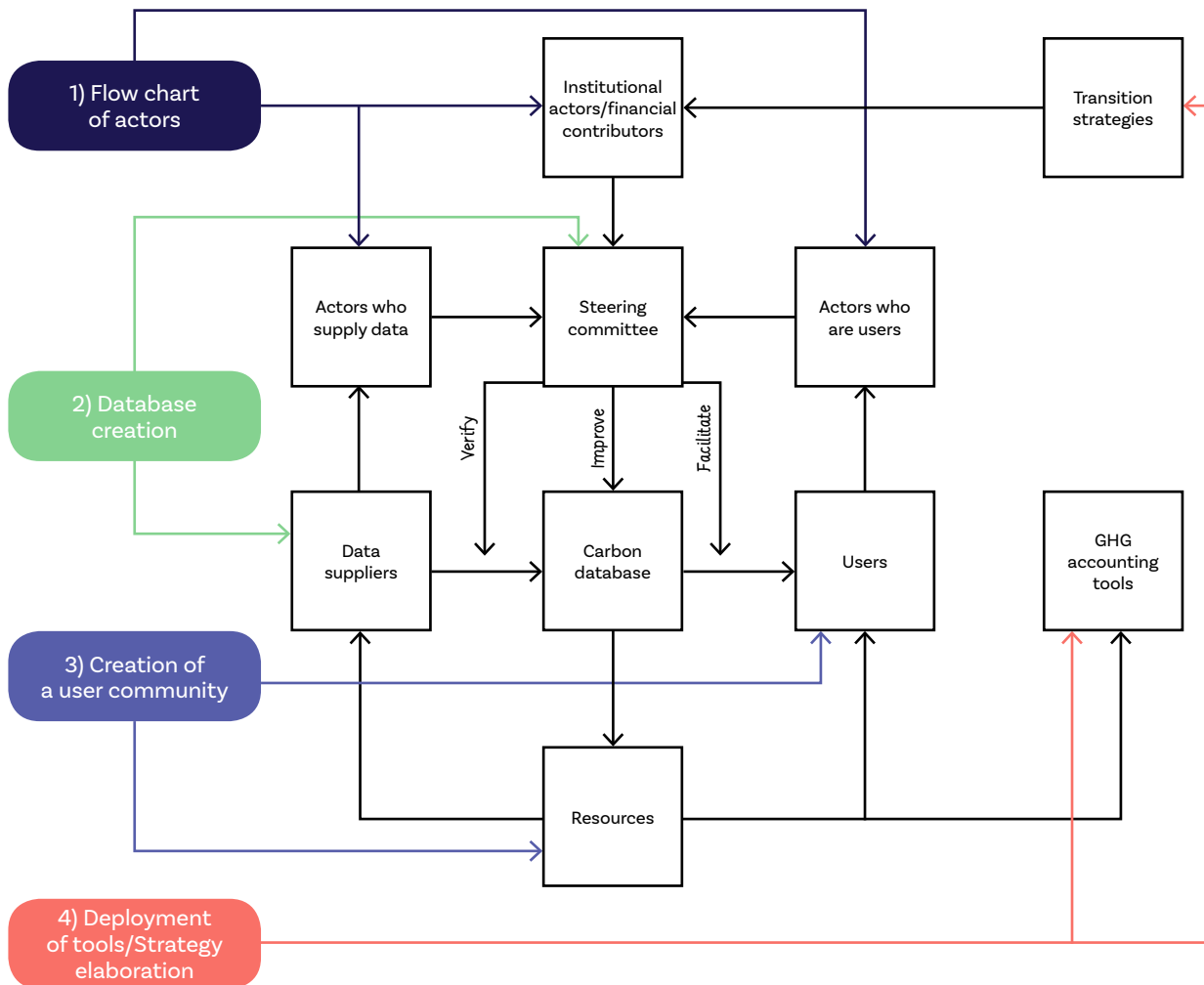
Once the database is launched it can be enriched in various ways, according to the model or models chosen for the database.

- Data supplied by an actor recognized as a contributor and designated as such by the steering committee.
- Data supplied by a group of legitimate actors, identified and solicited by the steering committee. This pathway can be used to obtain specific data for a given sector of activity.
- Data supplied by users of the carbon database. Guidelines for data input should be made available to all users who want to contribute their own data. The steering committee oversees the data input process and reviews proposed data before deciding whether to integrate them or not.
- Unfiltered data input and user evaluation. The carbon database can also be managed as an open public repository in which contributions are published and evaluated by the users themselves, via scoring tools or satisfaction ratings. In this case it is recommended that the steering committee set a minimum level of supporting documentation to be submitted for each proposed emission factor, and that undocumented or insufficiently documented contributions be rejected.

Access to the database also presents many options. User registration, subscription and license agreement are effective ways to track usage and evaluate the usefulness of the database for the community of users. Nowadays, however, many public institutions seek to adhere to principles of «open data». A database that is fully accessible and downloadable online is better aligned with this ethical position and will encourage users to integrate the database into other methods and tools.

## 6. Summary of carbon database modalities and new actors

Figure: Typical creation process and operation of a carbon database



**Stage 1:** Survey of current and future actors and needs

**Stage 2:** Creation of a steering committee, methodological options and establishment of the database with existing and new data

**Stage 3:** Creation of a user community and resource centre

**Stage 4:** Tools and support deployed to accompany users all the way to the elaboration of low carbon transition strategies, including improvements to the database.

**Stage 5:** The energy-climate information ecosystem achieves a continuous loop of input and improvement.

**The firm commitment of the project owner is key to success.** The owner is the entity that initiates the project, typically a national government agency or ministry in charge of energy and climate issues, environment and/or sustainable development.

The project owner, the support structure and other partners must foresee **long-term implication**, at least two to three years to deploy the database. All partners – financial, scientific, institutional etc – will logically be represented on the database steering committee. The project owner and partners must be prepared to cover at least the basic database needs, in financial terms, in human resources, and technical competence and legitimacy.

Third-party stakeholders can be asked to contribute to efforts to create methods and tools, and to raise awareness among actors in the economy. In the section below we list the basic requirements for strategic orientation, awareness and training of users, and technical expertise for the creation and adaptation of tools, etc.

All the participants in the carbon database form an **energy-climate ecosystem** that will ensure the low carbon transition in the geographic area covered by the database.

#### Main principles

- Long-term commitment
- Substantial resources required (human, financial, technical, legitimacy, etc)
- Activities related to database management.



# Activities that are intrinsically linked to database deployment

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## 1. Major international standards of low carbon transition and sources of inspiration

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GHG accounting standards are already in existence. The ISO 14064 standard is the leading internationally recognized standard, and describes options for scope, estimation methods, appropriate assumptions and the form of final reports. Other international bodies have also developed carbon quantification methods. These other methodologies are recognized and disseminated, and are based on the same approach, with some differences.

In France the Bilan Carbone® method was developed by ADEME in 2004, and has been administered by ABC since 2011. This method proposes emission accounting and also the construction of an action plan, vulnerability analysis and prospective studies to build the low carbon world of tomorrow.

The most recent innovation in carbon accounting is the ACT® method co-sponsored by ADEME and the CDP, designed to help organizations assess their strategies in relation to the transition to a low carbon economy.

In our view it is always best to work within the framework of existing standards that are globally shared, because database users will need to refer to this framework and produce information that is compatible with this context.

In addition to methodology, standard rules are defined for the format of information produced and the ways inventories are used. The CDP asks companies to submit information on their climate action and this information guides their inventory approach. For other organizations, for instance city governments, the EU Covenant of Mayors for Climate & Energy asks participants to draw up climate plans that address specific issues to align with the Nationally Determined Contributions (NDCs) of their countries under the Paris Agreement.

The organizations that want to follow the goals of the covenant will have to adapt their action to meet these requirements. To avoid incompatibility of results it is recommended, at a minimum, that organizations develop **a strategic vision and expertise on the stakes of carbon accounting in an international framework.**

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## 2. A resource centre

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The creation of a carbon database provides an occasion to develop in parallel a resource centre, to generate a dynamic movement for the territory as a whole and accelerate the transition. The database itself will be an information source, in that all emission factors are explained and sources documented.

Other resources can also be made available to stakeholders. There is no need to reinvent the wheel – the initial survey of actors can serve to identify information sources and vectors for increasing awareness of issues. If possible, the resource centre

can also distribute the work done by these actors, as long as this work is consistent with the methodological requirements of the database.

The actors in the territory covered by the database can be reached by publication of guidelines, handbooks, self-instruction manuals and simple tools derived from the database. Keep in mind, however, that all these documents represent pages that must be prepared and downloaded, on top of the task of creating the database itself.

Sectoral guides for actors in the economy can be used to attain two objectives at once.

- Raise awareness in a given sector and stimulate discussion by inviting all actors to participate in group meetings and sessions to exchange their views and thoughts.
- Create a legitimate and shared knowledge base, as an initial sectoral platform and forum for questions addressed to the sector as a whole.

The resource centre associated with the carbon database can take the form of a carbon toolbox furnishing a coherent collection of **tools for awareness campaigns, training sessions, footprint calculations and implementation of a carbon strategy, all referring to the carbon database.**

Such a toolbox is an ambitious endeavour in itself, and must be preceded by assessment of the availability of resources and the maturity of partners in the climate domain.

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### 3. Training, certification and labels referring to climate action and transition



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The carbon database can also be an occasion to move towards a more professional approach to climate and transition issues. Training can be designed to strengthen technical expertise in the user community. Such training will enable companies and institutions

to more thoroughly address climate concerns in their respective activities and missions, using the database and developing human expertise to exploit it.

Following on training, certification and labels can be awarded to highlight projects and expertise, as has been done in France. In this way the organizations and territorial entities with the most advanced climate and energy programmes can create and stimulate a community of trained and recognized practitioners with the capacity to design and implement an efficient and targeted transition strategy at all levels.

As stated in Section 2 above, the global context is the fundamental framework. A carbon database aims to develop professional carbon expertise in the local territory it serves, but it must also be legitimate on the international stage.

The steering committee must ensure that the methodological options proposed for use by participating organizations are compatible with international ISO standards that are the reference tools in carbon accounting. The Covenant of Mayors originally covered European countries, and there is now an equivalent framework for Africa, the Covenant of Mayors for Sub-Saharan Africa (COMSSA).

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## 4. General methods and simple tools

When the database is deployed initial users will need simple tools and instructions to introduce them to the use of emission factors. In addition to existing materials, new tools of various sorts can be designed.

- Generic calculator for small organizations: the carbon database can provide a lightweight tool for organizations that do not have the resources needed to conduct a full-scale emission inventory and develop an action plan. This kind of tool provides estimations in orders of magnitude and suggests some recommended measures. Even with a minimum of information it can enable organizations to establish benchmarks and a foundation for future work with more complex tools and techniques.

- Tools for citizens: the carbon database will be a treasure trove of information that national and regional NGOs can use to raise awareness of issues among an even wider audience. Carbon inventory information can be circulated locally to support individual action, support environmental initiatives and present the stakes of the low carbon transition for the region and all of its residents.
- A tool for students: we recommend that students and young professionals be introduced to carbon accounting via a simplified tool for a campus assessment or student project, as a way to accelerate the spread and adoption of this concept. This tool should be easy to use and explained in documentation made available with the carbon database. It should be designed to be included in standard curricula and classroom teaching.
- The Task Force on Climate-Related Financial Disclosures (TCFD) has published its recommendations for assessment of climate change exposure by investment vehicles. Beyond the issues of climate finance, the TCFD proposals underscore the two fundamental points of the low carbon transition. This societal transformation is a necessary response to climate change, and must be recognized as a source of both risks and opportunities.

The transition entails risks because major changes are coming, and some will arrive rapidly, before actors can adapt. There will be opportunities for the actors who anticipate these changes and modify their operations and ways of functioning to fit into a low carbon world. They will be well positioned in new markets.

Simple risk/benefit analysis tools are a good way to guide thinking on the low carbon transition for organizations and territorial entities.

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## 5. Expert, sectoral and local tools and methods

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After a first phase the carbon database may serve as a platform to introduce more specialized tools aimed at assessing a full footprint for organizations, projects, products and territories. Sectoral programmes can be devised to create methods and tools that are designed for a specific type of activity, in compliance with sectoral guidelines. Regional governments can create their own tools for data collection, action plans and communication.

In the long term the carbon database will become the hub of the low carbon transition, from training of students and information disclosure and reporting by organizations, to elaboration of national transition strategies. It will support implication in international schemes such as the Covenant of Mayors and enable all sectors of activity to grasp the stakes of the carbon transition.

The question of multiple criteria must also be addressed. The carbon database aims to compile emission factors and support the development of a technical community focused on carbon accounting. This approach based on a single criterion must be considered alongside other social and environmental concerns. Low carbon transition strategies cannot be implemented if they focus exclusively on greenhouse gases, to the exclusion of other issues.

Action plans that embrace action in several areas, developing synergy and avoiding harmful rebound effects, can be devised using complex tools.

Adaptation to global change is another issue, because the carbon database will focus primarily on mitigation of climate change. For some actors, in particular local and territorial entities, adaptation to more frequent catastrophic climate events and anticipation of future market conditions are subjects of concern. These perspectives call for very specialized tools, according to local climate and needs.



# Conclusion

It is a challenge to create a carbon database in a context of climate knowledge that is not yet mature and a low carbon transition that is just beginning to take shape. A database involves the collaboration of many bodies and organizations, over a long time frame, and the database must be conceived in this framework.

A carbon database represents a cost for the entities involved in its creation. But a carbon database is also a great opportunity, because it will foster a whole ecosystem of tools, training, sectoral development and long-term perspectives.

As the harmful effects of climate change become clearer and clearer for all the countries of the world, a carbon database is the first step to take to address risk, anticipate dangers, integrate constraints and advance towards a low carbon society.

ADEME and ABC possess a broad range of carbon accounting and database experience acquired in France. We are ready to assist all interested parties around the world, so that all regions can build carbon databases to support their strategy and take their place in the low carbon society of tomorrow.



## CONTACT

Association Bilan Carbone  
41 rue Beauregard - 75002 Paris

[contact@associationbilancarbone.fr](mailto:contact@associationbilancarbone.fr)

[www.associationbilancarbone.fr](http://www.associationbilancarbone.fr)



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