SCORE LCA

SCORE LCA SEMINAR

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Ecostatis

ifp Energies nouvelles


SCORE LCA

ETUDE N° 2015-07

RECOMMANDATIONS PRATIQUES POUR L'ACV PROSPECTIVE / REFERENCES ET EXEMPLES DANS LE DOMAINE DE L'ENERGIE

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RAPPORT FINAL

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AGENDA

- Goal of the study and deliverables
- Main results of the study
- User feedbacks
- Questions

GOAL AND DELIVERABLES

Requirement specifications

Aims:

- Provide a state of the art of existing inventories and assess these inventories
- Provide recommendations on how to use these inventories in LCA
- Exemplify with practical examples

3 required sections : 1. literature review ; 2. prospective LCA specificities ; 3. Methodology

Deliverables

- History and state of the art of prospective methods applied to energy and resources studies
- State of the art of prospective LCA (pLCA) ; design of a pLCA typology
- Mapping of actors and institutes in the fields of pLCA and prospective studies
- Survey on practices in pLCA and prospective studies
- Design of a methodology to guide LCA practitioners through prospective LCAs

Objectives

To provide a practical framework allowing guiding LCA practioners in using prospective studies and conduct prospective LCAs

… Not prescribe, along questions and needs, one or several datasets from literature, since the literature is too large to consider an exhaustive mapping of its values or even references.

Here the objective is to **help the practitioner specifying its needs and then understanding, characterising and comparing available data in order to develop a critical analysis and argue its prospective data selection during life cycle inventory.**

Considering the inherent complexity of studying future socio-economic systems (multiple issues, dimensions and scales), their « non-predictability », the increasing large amount of energy and resource scenarios, the diversity of underlying methods and the discrepancy of ensuing results, **reducing the number of bibliographic references by recommanding a small amount of datasets does not make sense.**

Selecting a sample of scenarios can only be done case-by-case, regarding the question, the contexts and the objectives of the LCA. The following methodology therefore constitutes a practical framework aiming at supporting an LCA practitioner during his/her analysis and sorting of the available information.

T1 – STATE OF THE ART ON PROSPECTIVE STUDIES

- After WW2 : modern times of prospective studies :
  - **USA : industrial-military complex, worries linked with resource shortage, nuclear apocalypse and environmmental externalties**
    - (i) : Establishment of an independant and multi-disciplinar think tank composed of mathematicians, physicists, economists, sociologists and psychologists (Research and Development Project – RAND) as soon as 1948.
    - (ii) : Development of formal prospective methods such as the Delphi method or the so-called scenario method.

RAND CORPORATION HI INSTITUTE FOR THE FUTURE

  - **France: centered on long-term national planification issues with a more humanist and utopist vision (normative)**
  - Some kind of rationalisation;

futuribles analyse et prospective

    - (i) : prevalence of technological scenarios:
    - (ii) : design of alternative scenarios in most of the studies
    - (iii) : professionalisation of the field

T1 - STATE OF THE ART ON PROSPECTIVE STUDIES

Temps ancien : réflexion intellectuelle	Prédiction magique, divination, prophétie Utopie
1945-1960 : rationalisation et mise en place des cadres méthodologiques	Prévalence de la prospective technologique aux Etats-Unis Prospective planificatrice et normative en France Construction de scénarios alternatifs de manière systématique Professionnalisation, mise en place d'établissements en France et aux Etats-Unis Diffusion des travaux, écriture d'ouvrages
1970-1980 : structuration internationale et industrialisation de la discipline	Mondialisation des problématiques et de l'activité prospective : environnement, énergie Généralisation de la prospective normative Développement de la prospective stratégique en entreprise et implication marquée des entreprises dans cette activité Perspectives managériales de la prospective
1990-2000 : fragmentation de la discipline et monde unipolaire	Prédominance de la prévision Montée des études critiques Fragmentation en différents champs disciplinaires, diminution de la pluridisciplinarité Marginalisation de la discipline
2000- : réunification dans un monde multipolaire et instable	Retour aux préoccupations des années 1970 : énergie et environnement Mondialisation des contraintes et besoin du politique d'évocation des futurs Prospective stratégique et créativité en entreprises Intégration R&D, stratégie, marketing

Prospective studies structuring

- Prospective: transversal science aiming at defining and studying potential futures in order to help decisions and actions

- Two types of forces contribute to the future of social-economic systems:
  - **Change forces:** « drivers» corresponding to:
    - Technological evolution (new technologies, progress…)
    - Economic evolutions (prices, policies)
    - Social evolutions (lifestyles, behaviours)
  - **Inertia forces** : « restoring » forces linked with:
    - Technology: limited technological progress, high costs
    - Economy
    - Policies
    - Structure; bureaucracy, particular interests

T1 – PROSPECTIVE TYPOLOGIES

Axe 1 : Aim of the project

- **Polarity:** exploratory vs decisionnal scenarios

- **Characteristics:**
  - Subject
  - Client
  - Point of view
  - Scales

T1 – PROSPECTIVE TYPOLOGIES

Axe 2 : Development process

- **Polarity:** intuitive vs formal approach

- **Characteristics:**
  - Type of data (quantitative / qualitative)
  - Type of model and use
  - Organisation and means
  - Orientations / constraints linked with the context of the study

Axe 3 : Scenario content

- **Polarity:** complex vs simple

- **Characteristics:**
  - Time
  - Space
  - Sector
  - Variable nature and limiting conditions
  - Dynamics and deviation level
  - Uncertainties in quantitative models

T1 – PROSPECTIVE TYPOLOGIES

In the field of energy, 12 detailed studies according to the aforementioned typology:

- ADEME visions énergétiques 2030 - 2050
- BP Energy outlook
- Enerdata Global Energy Scenarios to 2040
- World Energy Council Composing Energy Futures for 2050
- Etc.

T2 – PROSPECTIVE LCA TYPOLOGIES

Main topics:

- Energy
- Transport

Two types of studies:

- Photography at time *t*
- Evolution between $t_{initial}$ and t_{final}

T2 – PROSPECTIVE LCA TYPOLOGIES

- 3 objective typologies

(a)
LCA of an existing product or a range of existing products at a future time horizon

(b)
LCA of a product upscaled from laboratoty to commercial deployment

(c)
LCA of a whole sector (eg transportation, energy) associated with prospective scenarios

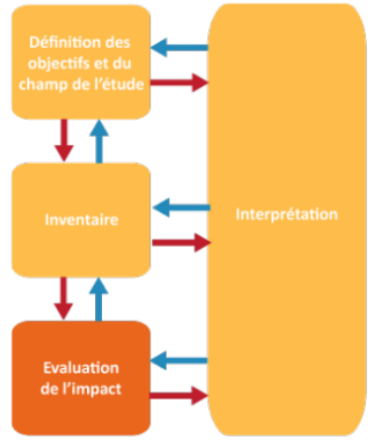
T2 – ONLINE SURVEY

Online survey of LCA practitioners and prospective studies experts. 62 feedbacks.

Main feedbacks:

- Lack of transparence of available data and studies
- Lack of skills to use the models and analyse the available studies
- Confusion between prospective and consequential approaches

T3 - METHODOLOGY



Structure and foundation

3 steps: goal and scope of the study, LCI, interpretation

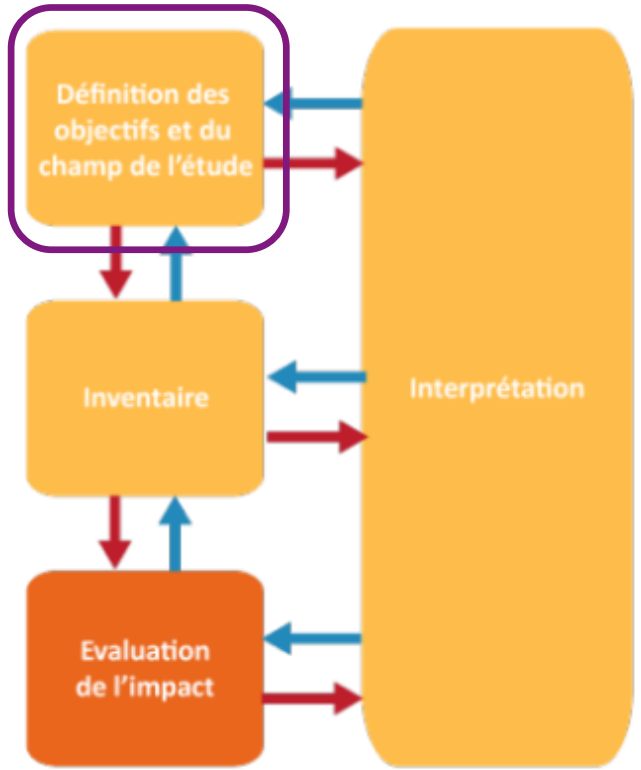
Guidance at every step: serie of questions, decisional tree (LCI) along with examples from the 2 case studies

- Structure: ISO 14040-44 standards
- Questions and recommandations are limited to the specifities of prospective parts of the LCA
- Prospective and pLCA typologies
- Survey of LCA practitionners and prospective studies experts
- Examples for every steps: practical cases from the 2 case studies.
  - LCA of a b-segment electric vehicle sold in France in 2030, business as usual context
  - LCA of the European passenger car fleet in Europe between 2016 and 2050

T3 – METHODOLOGY / STEP 1

1.1 Goal definition

- Which typology (a, b, c) ?
- Context ? Decision-maker = practioner?
- Scenario based on trends or open scenario?
- Ideological biaises?
- Exploring possibilities or ways to reach an objective?

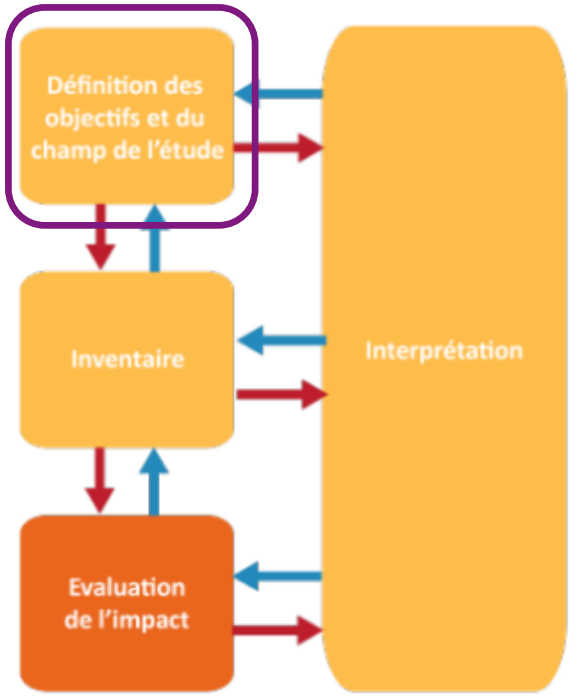


1.2 Types of changes

- Study of a **decision or a change?**

  →**Yes:** is the change internal or does it extend beyond the studied stystem?

  → **Yes:** consequential LCA.



1.3 Time horizon (short / medium / long term)

3 levels defined by the degree of visibility and uncertainty on data relative to the sector rather by an absolute time horizon

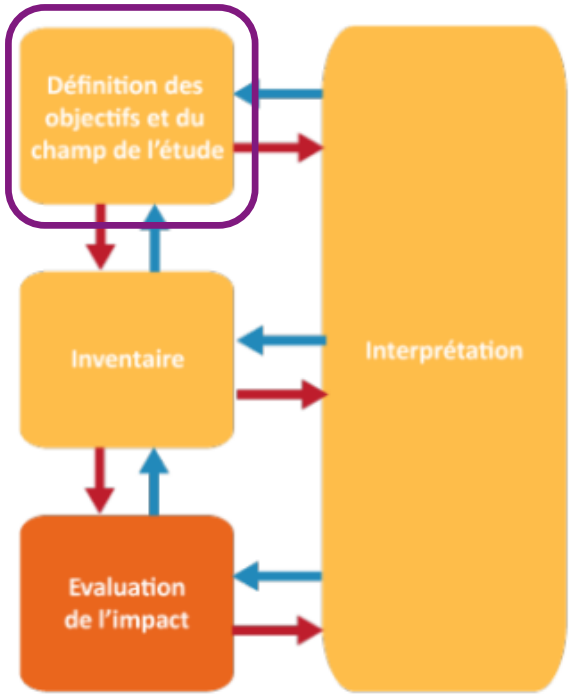
- **Short-term:** extrapolation of existing data and current policies
- **Long-term:** data are very uncertain and extrapolation is not direct. The system might experience technological ruptures or radical changes of behaviours. Future policies (social, economic, industrial, taxes, energies, etc.) are vague or unknown.
- **Medium-term :** between short and long term.

T3 – METHODOLOGY / STEP 1

1.4 Product or system of products

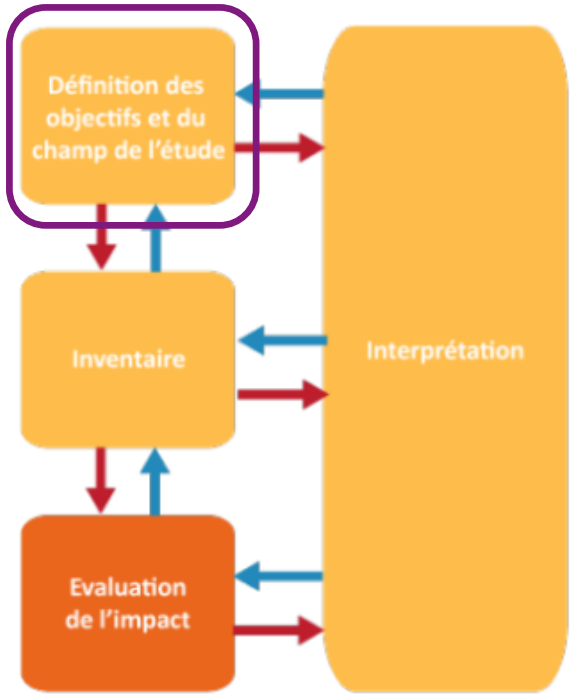
This step allows precising the type and amount of data to collect

- **One product / service:** prospective technical data needed
- **Range of products:** prospective technical data + economic and political data to assess future uses and market shares



1.5 Functional unit (FU)

- **Time-validity** of FU?
- Different FUs for different **scenarios?**
- FU shall specify wether:
  - LCA is a **photography** at a given time horizon
  - LCA is studying the **evolution** between now and a given time horizon (trajectory)



1.6 Perimeter / foreground-background

perimeter allows distinguishing foreground processes (practitioner responsibility) and background processes (external databases)

- Prospective data depending on: time horizon and internal dynamics of the sector, ie: prospective data are required if the sector is dynamic enough in the time horizon considered.
- Prospective data also required if important background system has a faster dynamic than foreground system

1.7 Environmental characterisation: choice of impacts

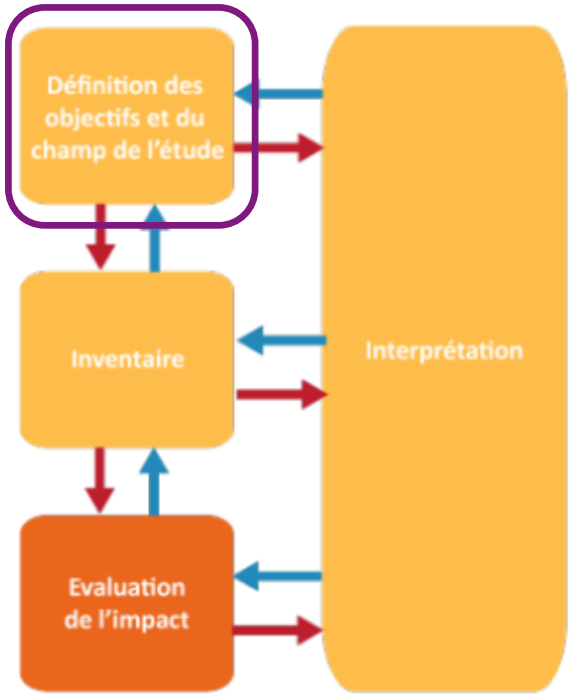
Can be linked with time horizon because relevance can decrease with time horizon, especially for:

- Impacts based on **scarcity**: CML2001 Abiotic Depletion Potential, Water scarcity
- Impacts based on **economic modelling**: ReCiPe resources, externalities
- Impacts based on **damages**: endpoint methods
- Normalised **impacts**: european equivalent.

1.8 Allocation methodologies

methods and allocation values can become obsolete in a prospective context:

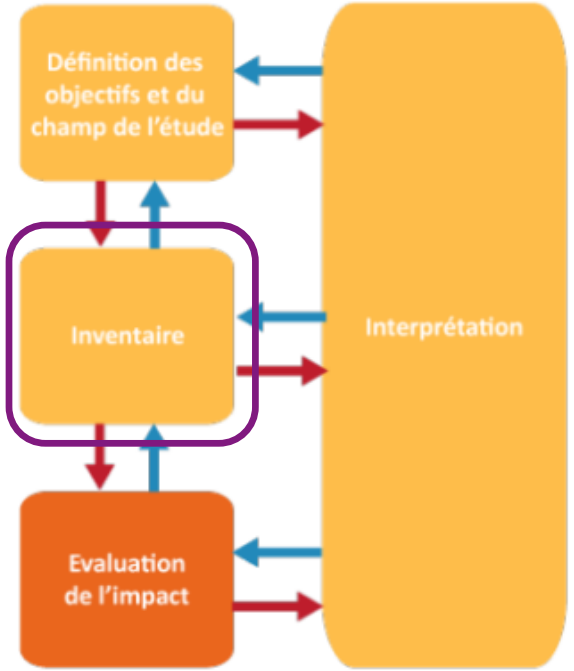
- Coproduct considered as a waste a $t_{initial}$ and having a value at the time horizon considered
- Economic allocations valid at $t_{initial}$ only



T3 – METHODOLOGY / STEP 2

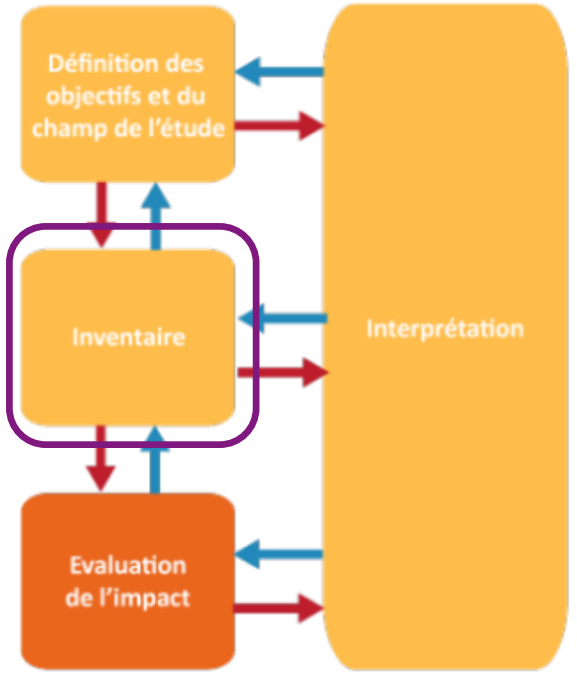
2 steps to collect LCI data

- **Step 1:** 2-step identification of prospective parameters to study
- **Step 2:** Data collection



T3 – METHODOLOGY / STEP 2

2.1 Identification of prospective parameters / values



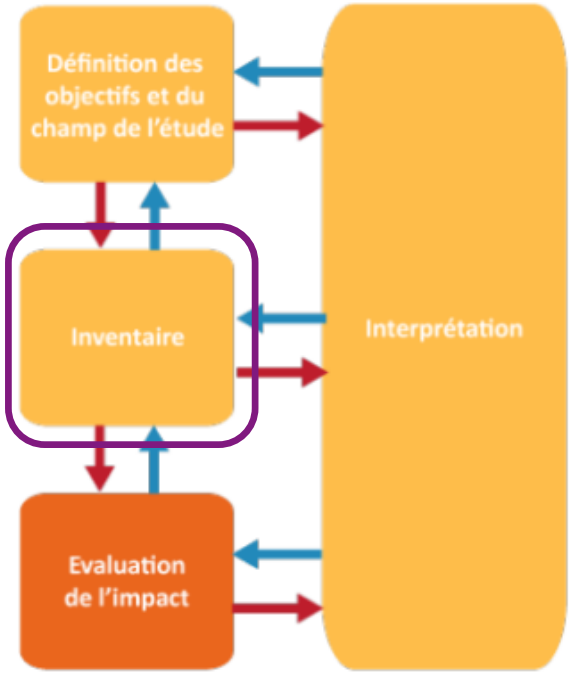
- Conduct a **first attributional LCA a $t_{initial}$** and identify environmental **hotspots**
- If hotspots are **likely to change** at the time horizon considered

  → select these parameters (**group E1**) for prospective data search

- If non business as usual scenarios are retained: identify breakthroughs and potential deviations and widen data search

  → select these parameters (**group E2**) for prospective data search

T3 – METHODOLOGY / STEP 2



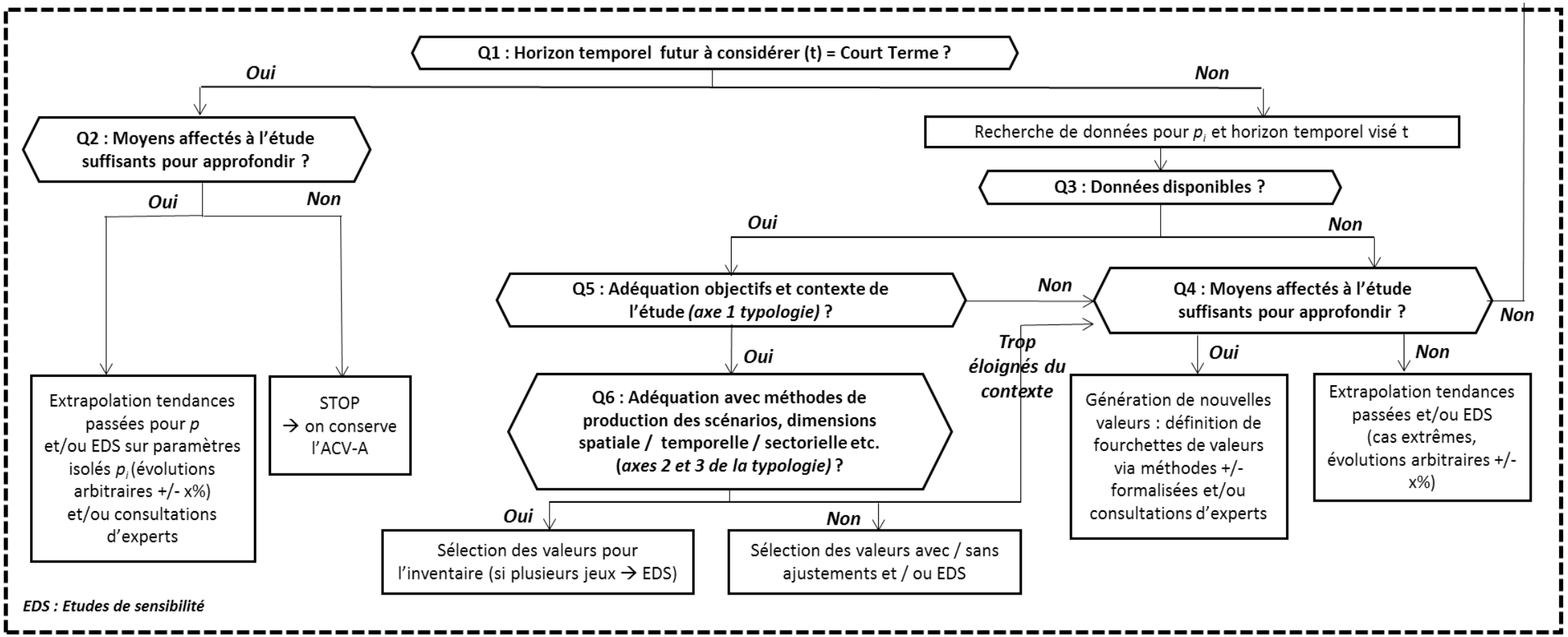
2.2 LCI according to a decision tree

6 questions to help the practiioner, according to:

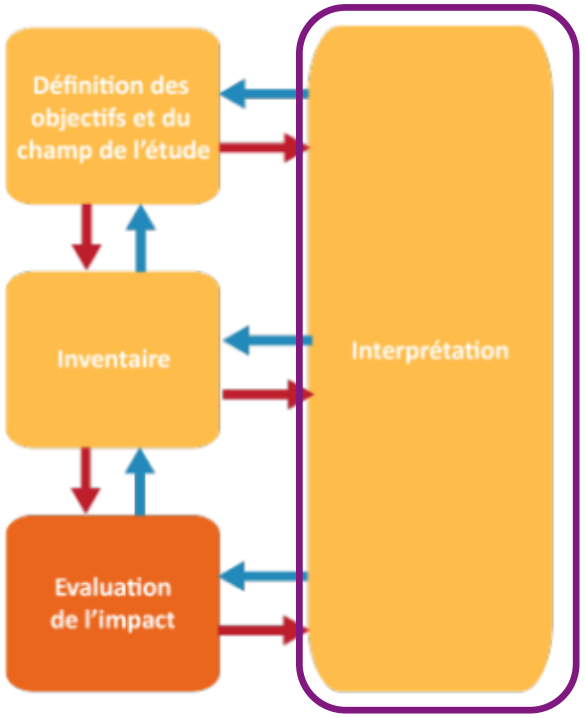
- Time horizon
- Available resources
- Available data
- Adequacy between available data and goal of the study

T3 – METHODOLOGY / STEP 2

Étape 2



EDS : Etudes de sensibilité



Interpretation

- Data grouping and **scenario** construction
- **Critical analysis**, according to:
  - Study limitations, linked with hypotheses
  - Comparaison between $t_{initial}$ and t_{final}
  - Relevance of characterisation factors
  - Use of external data for relevance

DISSEMINATION

Publications

- Working Paper FR → *Les cahiers de l'économie* (T1 2017)
- Publication FR → *Revue de l'énergie* (T1 2017)
- Publication EN → *Energy Policy* (S1 2017)

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