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**TOWARDS A SOCIAL LIFE CYCLE ASSESSMENT
OF THE NATURAL GAS CHAIN**

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1. ABSTRACT

This paper presents the Social Life Cycle Assessment (Social-LCA) of the natural gas chain. Social-LCA is an emergent subject which has grown following the development of standards on social responsibility of companies. The integration of environmental criteria is not anymore a sufficient criteria and a need of social dimensions tends to be more and more reached. The methodology on Social-LCA is going to be developed. A first guide has been published by UNEP-SETAC with “the Guidelines for Social Life Cycle Assessment of Products” but a lot of questions still need answers.

GDF SUEZ has decided to initiate the work about the one specific subject of the Group, the natural gas chain. Thus, in order to prepare the realization of the S-LCA, the scope of the study has been specified. Then, the relevant issues and the main stakeholders have been defined for each steps of the whole life cycle of the natural gas chain. Indeed, it's thanks to the identification of issues and stakeholders than the social impact indicators can be selected and defined. The main difficulties will be now to find and collect the accurate data needed to evaluate the social impacts. Social data are generally aggregated by the whole company and not by specific sites or activities, other kind of data are also given by countries of sector activities or even subjective data as stress, well-being... So the way to match the data to the functional unit will be a real challenge.

Even if methodological development are still needed, social impacts assessment could become a new way of differentiation and a tool for decision support.

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2. CONTEXT AND OBJECTIVES

2.1 Social sustainability of products and services: a growing concern

Sustainability is directly concerned by the way of production and consumption of the whole population. It also relates to the social responsibility of organizations and the objective to improve social and environmental performances along with sustained economic profitability. While the economical and environmental aspects are today well documented, social impacts still need to be considered in the sustainability evaluation of products or activities. This integration of social impacts is facing a lack of indicators and of a theoretical framework about social dimensions.

However, since 2009, several initiatives have shown that social performances tend to be more and more taken into account, from a life cycle perspective, in particular the publication of the UNEP-SETAC "Guidelines for Social Life Cycle Assessment of Products". This new tendency is consistent with the approaches developed in the context of Corporate Social Responsibility, such as the standard ISO 26000 or Global Reporting Initiative (GRI).

UNEP-SETAC guidelines may help organizations and stakeholders to efficiently assess social impacts of their activities :

- Social Life Cycle Assessment (S-LCA), like environmental LCA, may be a comprehensive decision tool (e.g. it avoids the transfer of impacts outside from the organization),
- the relevance of this methodology is increased by the experience from environmental LCA,
- moreover, S-LCA may also point out potential positive impacts.

But there are still some barriers to be overcome:

- from a methodological point of view: lack of databases, and method to characterize the impacts,
- from a practical point of view, as few studies are available that implement those guidelines in real assessments.

2.2. Objectives of the study

Gas sector can sometimes be the target of anti-corporate campaigns raising some issues related to human rights, employee rights, stakeholder rights, environmental protection, community relations, transparency, etc. But the last decade has seen gas companies becoming active players in developing ethical corporate practices and codes of conduct in the work place and engagement with civil society. The involvement of GDF SUEZ in the United Nations' Global Compact, the Global Reporting Initiative (GRI), the Millennium Development Goals, the Dow Jones Sustainability Index, and the World Summits on Sustainable Development in Rio de Janeiro and Johannesburg are some instances.

Followed for several years, the environmental impacts of the natural gas chain are already calculated thanks to the Life Cycle Assessment (LCA) methodology. In order to anticipate stakeholders' expectations and with the sake of innovation, GDF SUEZ has decided to initiate reflections about the integration of social impacts into the assessment of the natural gas chain. Indeed, life cycle of natural gas chain involves material, energy and economic flows but it is also made of stories about production and consumption, positive and negative impacts on the workers, the local communities, the consumers, the society and all value chain actors.

The main objective of this study is thus to identify the social issues and the stakeholders involved in each step of the natural gas life cycle, in order to highlight the most relevant indicators through the whole life cycle of the natural gas chain, from the exploration phase to the consumption by final customers. This is a first step toward a complete Social-LCA of the natural gas chain and a contribution to the application of UNEP-SETAC recommendations.

This study is based on the analysis of different sources:

- Scientific publications in the field of Social Life Cycle Assessment and sustainable indicators
- Corporate Social Responsibility reports published by oil and gas companies
- NGOs reports
- GDF SUEZ's internal data.

3. METHODS

3.1 Definition

Life cycle assessment (LCA) is defined as a compilation of consumptions and emissions of a product over the whole life cycle, from production to end of life (from cradle to grave). Social LCA (LCA-S) would record therefore over the whole life cycle of a product, the flow of labor (jobs created, number of accidents at work), cash flow (salaries) and other immaterial flows, such as respect for local cultures and values, or participation in the increase of well-being sense of employees and surrounding people.

Then, social life cycle assessment has been defined based on ISO's standards 14040: 2006 and 14044: 2006 as "*a social impact (and potential impact) assessment technique that aims to assess the social and socio-economic aspects of products and their potential positive and negative impacts along their life cycle*". A social impact can be defined as the consequence of social relationships or interactions maintained or caused by a given activity (e.g. production, consumption or end of life of product) or by preventive actions taken by stakeholders. In that sense, social impacts may be positive or negative.

3.3 Scope of the case study and choice of the functional unit

For this first case study, the scope has been reduced to the French natural gas chain, as France is one of the historical markets for GDF SUEZ, and thus associated data were more easily available.

As in environmental LCA, a functional unit has to be defined as a reference unit for the study in order to quantify the performance of a product or system. In other words, the function represents the service of the product for consumers. Here, the chosen functional unit is the one used in the environmental LCA of the natural gas chain, i.e.: "1 MJ of natural gas supplied to French consumers (industrial or individuals)".

While the definition of the functional unit is essential to the analysis of the system, one of the difficulties of social LCA is to explicitly link the data and the results to the functional unit, especially when using qualitative data or indicators. But even for the quantitative indicators, case studies of social-LCA demonstrate the difficulty of relating to the functional unit.

The social dimensions of sustainable development are still too rarely or too partially addressed by companies. One explanation probably lies in the fact that the "social" impacts are similar to a "black box" for many economic actors. How to define the social issue? How to deal with the complexity, diversity, the different forms of organization of social issues when referring to intangible items as perceptions of people, their well-being sense and comfort, or the compliance of a project with the values and cultural frames of a given community? While some social impacts can be quantified (such as access to transport infrastructure, or household income), other social impacts appear to be more complex to evaluate than the environmental and economic flows.

Indeed, while emission factors can be directly collected for a given plant in environmental LCA, in S-LCA the data are most often specific to the whole company. It is thus necessary to obtain at least additional data like volumes of natural gas produced or processed by year, or data on the number of employees. This task is even more complex for the data collected from international organizations or NGOs, as these data are presented for the whole country or by industrial sector. Decisions have to be taken on how to report these data to the functional unit: is the proportion achieved depending on the volume of production, the sales of the company or its number of employees ? Finally, concerning the qualitative data, it appears that some indicators cannot be aggregated along the whole chain and expressed for the functional unit, but have to be assessed step by step.

It has to be noted that for this kind of aggregated data (on national level for instance), it could be more difficult to sensitize the company to their social impact which are not strictly linked to their activities.

3.4 The identification of stakeholders and relevant issues

In S-LCA, one of the first step is to identify all the relevant issues and stakeholders of the studied system. Indeed, a listing of the various stakeholders is necessary to determine the impacts assessed.

Stakeholders of a company are defined as all the actors having a relationship with the company. This level of relationship can be specified by degrees of proximity in order to distinguish the primary and

secondary stakeholders. According to theorists working on definition of stakeholders, companies must recognize the important role played by stakeholders if they want to practice their social responsibility: "To be effective, managers need to listen to a wide range of stakeholders (environmental lobbyists, local communities, competitors); managers have obligations to stakeholders that are not limited to shareholders" (in UNEP-SETAC (2009), Guidelines for Social Life Cycle Assessment of Products).

The diagram below describes a vision of the stakeholders that makes a consensus in the literature:

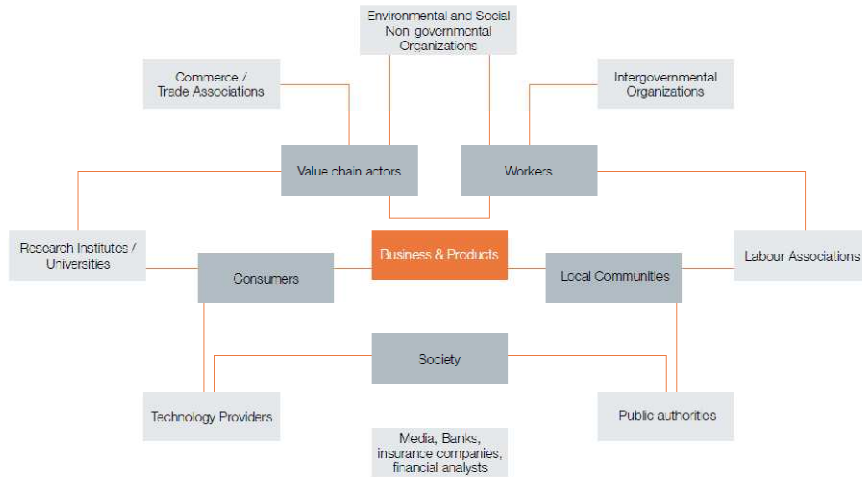


Figure 1 : Diagram of stakeholders (in UNEP-SETAC (2009), *Guidelines for Social Life Cycle Assessment of Products*).

The following categories of agents who have a direct relationship with the company have been identified:

- Employees
- Customers
- Suppliers
- The shareholders of the company
- Habilitators
- Government authorities

Other players maintain indirect relations with the company, such as:

- The families of the employees and the local community
- Workers' associations and unions
- NGOs
- Other companies
- Researchers
- Media.

3.5 Selection of impact indicators

The selection of impact indicators is directly linked to the identification of the stakeholders. Indeed, from the list of stakeholders categories and sub categories are deduced, like government, civil society... For each different category, social critical issue are different and lead the choice of indicators. One of the difficulties of this step is the way to evaluate the impact of "hot spots", i.e. specific social issues which impact only one step or one kind of stakeholders, on the whole life cycle.

3.6 Inventory analysis: data sources

Regulation differs from one region or country to another, so data collection is even more difficult. However, an inventory can be built on existing data, as data from international agencies and associated documents, codes of conduct and industry data like sustainable development reports published by the company and its subsidiaries. A second source of information consists of ad hoc data: workshops with

stakeholders (companies, NGOs, UNEP, Sustainable Development agencies, labor organizations), qualitative interviews (focus groups, directional or semi-directional interviews), questionnaires and surveys.

4. RESULTS

4.1 Social impact assessment

In order to determine the social impacts, a methodology called SIA (social impact assessment) has been defined by the American National Oceanic and Atmospheric Administration. Applied to the present case study, social impact could be defined as the consequences of gas activities on human populations. In fact, the gas industry could have some repercussions on the way people live, work, play, relate to one another, organize to meet their needs and generally cope as members of society. The term also includes cultural impacts involving changes to the standards, values, and beliefs that guide the society.

This methodology, largely used by the American administration during the 70's, uses social indicators to measure and analyze the unintended consequences of a planned intervention like the establishment of a new facility in a particular area (construction of a nuclear power plant, a pipeline, etc.). The aim of this method is to develop decision scenarios that will enable to develop political strategy. First of all, the social impacts assessment needs to determine all stakeholders of the project and the indicators used to measure the consequences. However, it has to be noted that it is not always easy to establish a correlation between social policy within the company and its impacts on stakeholders, because of the time needed to observe changes which are more structural (such as health, access to education) and depending on public policies. Moreover, the decisions of a company that may have a strong impact locally will not appear necessarily in the national indicators of a country as these impacts will be buried in a mass of aggregate indicators.

In addition, social impact assessment is relevant for large groups only if the methodology is replicable and if results can be compared from one country to another and over time. But the local political, economic and social situations can be very different and do not always offer access to a sufficiently detailed and reliable data. The indicators do not have the same value across countries. The social impact assessment can provide useful information to the S-LCA, even though it provides only a snapshot of some phases of the life cycle of the product at some point. Indeed, this methodology can highlight "hot spots" of the product chain, which are socially critical issues. Thus, relevant impact indicators may differ from one step of the life cycle to the other.

4.2 Assessment of social impacts and stakeholders for all the steps of the natural gas chain

In order to initiate this work, a synthetic table, showing the following elements, has been realized:

- Main social themes and potential negative and/or positive impacts of natural gas activity
- Categories of stakeholders involved at each stage of the natural gas chain
- Fields on which a company can take action to fulfill social targets

Social themes	Potential negative social impacts	Potential positive social impacts	Stakeholders
Employment stability			Civil society (employees, trade unions)
Employment practices			
Health and safety			
Capacity development			
Human capital			Civil society (employees, NGOs)
Productive capital			
Community capital			

Social themes	Potential negative social impacts	Potential positive social impacts	Stakeholders
Information provision			Public authorities, civil society, economic actors
Stakeholder influence			
Socio-economic performance			Economic actors, civil society
Socio-environmental performance			

Figure 2: Table showing main social themes, impacts on involved stakeholders and drivers of change that a gas company can activate.

Thus, this table has been completed for each phase of the natural gas life cycle, as it is illustrated in the following figure. They could be used for the social impacts evaluation step.

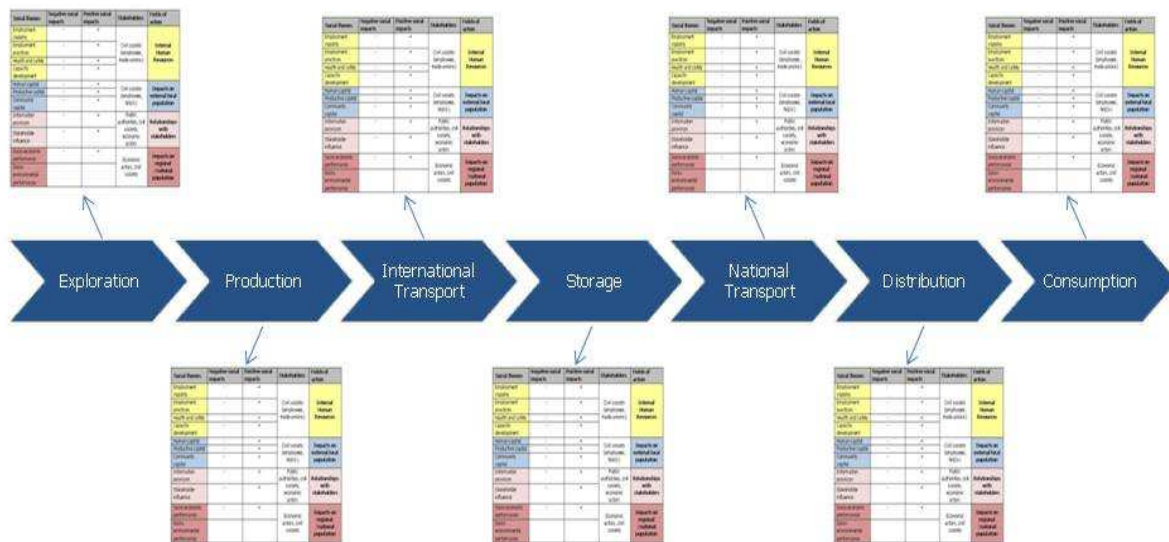


Figure 3: Inventory of life cycle social impacts for each phase of the natural gas life cycle.

4.3 Main issues highlighted

This study has highlighted the following elements for analysis:

- The geographic disparity of the natural gas activity creates significant social issues. Indeed, the steps are located in countries with various living standards, working conditions, codes of conduct and cultural practices. Also some countries concerned by upstream activities of the natural gas chain may face more quickly to ethics, transparency and violence problems, such as corruption or terrorism. For these high issues, key stakeholders are the local NGOs, international organizations, and governments.
- The natural gas activity requires massive industrial infrastructures that occupy large floor areas. Whether the exploration-production with consequent rigs, LNG transport that requires ports to deep draft, or air pipeline networks, there are many social impacts which can be positive and negative.
 - In terms of indicators, these concepts are much more difficult to quantify, particularly regarding negative impacts. Thus, in order to integrate these indicators into a Social LCA, further discussions should be carried to identify the need of data and the way to collect them.
- The establishment of information procedures and / or stakeholders consultation ahead of major projects (construction of natural gas infrastructure), but also throughout the natural gas chain (procedures lift consumer complaints, domestic risk awareness) is essential to promote the social acceptability of natural gas activities and respond to major socio-environmental issues.

- Security is also a major social issue of the natural gas chain, both the safety of employees at their workplace, the safety of local residents and the home safety of users of natural gas. GDF SUEZ is implementing many actions to increase security, both in terms of employees (awareness, training) and neighborhood (awareness campaign exchanges, sites visits...). This has a direct impact on the frequency of accidents, that have been declining since 2007.
 - The number of accidents classified by their severity and frequency is a measure generally followed by industry. In the short term, it will be possible to measure this impact on the whole natural gas chain.
- Finally, fairness is an important issue for both recruitment procedures (parity, inclusion of disabled people...), working conditions (for the natural gas industry specifically, it can be assessed by the inclusion of local people, and living conditions of expatriates ...), access to training for all stakeholders, the outlook for employees.
 - Some data are already collected and monitored by human resources departments. But particular attention should be paid to the contents of the data. For example, the ambiguous definitions of some indicators are a way not to recognize contentious situations (such as working conditions of service providers for example). The interest of the life cycle approach is precisely to highlight the activities of all "external" stakeholders involved in the natural gas chain.

4.4 Data sources

The first source of information about social actions led by GDF SUEZ as well as measured social indicators is the report of activity and sustainable development, which includes for example some social impacts described by the GRI.

These data are most easily available because they already exist across GDF SUEZ and it will be possible to express them in relation to a functional unit after collecting the following additional information:

- Production (or processing or transport) of natural gas in MJ for each site,
- The number of employees at each site.

Ad hoc data could also be used, like :

- Workshops with stakeholders (companies, NGOs, UNEP, Sustainable Development agencies, labor organizations)
- Qualitative interviews (focus groups, interviews or semi-directional)
- Questionnaires and surveys

International organizations are also sources of useful information for situations of countries involved in the study. This data can help to identify hot spots, that is to say, the major social problems of a country or an industry. For example:

- The World Health Organization (WHO) publishes health information that can be identified in some cases as the consequences of poor working conditions or life.
- The International Labour Organisation (ILO) provides reports detailing the organizational characteristics of an industry. The report on the oil and gas industry provides detailed information on the trend of employment in this sector, working conditions and associated industrial relations, management of human resources and corporate social responsibility. This report describes in detail the main issues and provides some figures country by country.
- The International Transparency Agency, which provides indices of corruption in most countries and also details the situation in the industry field.
- Amnesty International provides a detailed assessment of problems of non-compliance with human rights in some countries (death penalty, torture, imprisonment, forced labor, terrorism, corruption ...).

In addition, the University of New Hampshire is currently building a database of "hot spots" in Social LCA by industry and by country, based on the guidelines of the Life Cycle Initiative (LCI). This "social hotspots" database will give information about supply chain products and assess the potential social impacts by integrating data from a wide range of sources. This database is designed to become the best reference for S-LCA. First data are currently appearing on the dedicated web site.

5. CONCLUDING REMARKS

Social-LCA is a recent approach, which do not still have detailed methodological frame. However, this study has allowed to initiate a work on the S-LCA of the natural gas chain by defining main social issues and key stakeholders involved at each stage of the natural gas chain, from exploration to natural gas consumption by a French customer.

The results of the S-LCA will provide guidance on where negative social impacts take place, or on the contrary on the sites where the establishment of production units can produce beneficial effects on local employees and local community. The S-LCA is a method that delivers valuable information about the social conditions of production and consumption.

However, an analysis focused on the social aspects of a product – for instance the natural gas chain - requires further deepening methodological choices. The achievement of concrete case studies is one way to extend both the scientific development and social databases necessary to generalyse this approach. In that way, the S-LCA can become a real tool for decision support, for both companies and end users who can guide their consumption practices in a way which more sustainable and encourage companies to continue their policy of social responsibility.

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