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ROADMAP AND METHODOLOGY REPORT

Method(s) & Roadmap for the Collection of Energy Data from Lebanese Industries

جمعية الصناعيين اللبنانيين
ASSOCIATION OF LEBANESE INDUSTRIALISTS

Editorial

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List of Acronyms

AFD	Agence Française Pour Le Développement
ALI	Association Of Lebanese Industries
CAS	Central Administration Of Statistics
CCIA	Chambers Of Commerce, Industry, And Agriculture
CEDRO	Country Entrepreneurship For Distributed Renewables Opportunities
CHP	Combined Heat And Power
CIP	Cleaning In Place
CO_2	Carbon Dioxide
EC	European Commission
EDCS	Energy Data Collection System
EDL	Electricité Du Liban
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GoL	Government Of Lebanon
HS	Harmonized System
HVAC	Heating, Ventilation, and Air Conditioning
IEA	International Energy Agency
INSEE	National Institute Of Statistics And Economic Studies
IPT	Issa Petrol Trade
I-REC	International Renewable Energy Credits
IRENA	International Renewable Energy Agency
ISO	International Organization For Standardization
IT	Information Technology
LBP	Lebanese Pound
LCA	Lebanon’s Climate Act
LCEC	Lebanese Center For Energy Conservation

LGBC	Lebanon Green Building Council
LPG	Liquefied Petroleum Gas
MISCA	Management Information System On Climate Action
MoE	Ministry Of Environment
MoEW	Ministry Of Energy And Water
MoI	Ministry Of Industry
MoM	Minutes Of Meeting
MOU	Memorandum Of Understanding
NDCs	Nationally Determined Contributions
NEEAP	National Energy Efficiency Action Plan
NREAP	National Renewable Energy Action Plan
NSOs	National Statistical Offices
OAPEC	Organization Of Arab Petroleum Exporting Countries
OMSAR	Office Of The Minister Of State For Administrative Reform
PISS	Permanent Industrial Statistical System
RDF	Refuse-Derived Fuel
RE	Renewable Energy
SMEs	Small-And-Medium Sized Enterprises
SWOT	Strengths, Weaknesses, Opportunities, And Threats
TPES	Total Primary Energy Supply
UNDP	United Nations Development Program
UNESCWA	United Nations Economic and Social Commission for Western Asia
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
UNSD	United Nations Statistics Division
US	United States
USD	United States Dollars

EXECUTIVE SUMMARY

The overall purpose of this study is to determine the most adequate and applicable method and process for the annual systematic collection of energy data from the Lebanese industrial sector.

A methodology and roadmap for the implementation of a comprehensive and integrated Energy Data Collection System (EDCS) for the industrial sector in Lebanon is outlined in this report. The ultimate goal of the proposed data collection system is to build a set of energy use performance indicators, encompassing technical, economic, as well as environmental considerations to be used to:

- Help monitor the energy performance of the industrial sector in the context of an integrated and sustainable industrial development strategy for that sector;

- Provide inputs which could inform the process of setting up energy policies at the national level; and

- Help the country manage better its GHG communication and its nationally determined contributions vis-à-vis the international community through the United Nations Framework Convention on Climate Change (UNFCCC).

The background against which the approach proposed in this document has been developed is based on the findings of an inception report (Annex A), which details the best practices and challenges one has to take into consideration during the implementation of this project. The inception report compiles and analyzes the findings of desk reviews, stakeholder interviews, and industrialist field-survey conducted for the purpose of this study.

The findings of the desk review conducted found that surveying is the preferred method of data collection among international and local experiences in energy data collection, followed by administrative sources. Furthermore, web-based applications were found to be the preferred tool to carry out data collection surveys, followed by paper support questionnaires (Section A2.1 of Annex A).

On the local level, stakeholder meetings showed that there were several attempts to establish an energy data collection system; the most important attempt was the Ministry of Industry's (MoI) initiative in 2014 to establish a permanent statistics system for the industrial sector – this system included an energy section (Section A2.2 of Annex A). Moreover, various performance indicators, which could be built at the aggregated and disaggregated levels across various structural levels of the industrial sector, were identified in the inception report (Section A4 of Annex A).

The findings of the survey conducted for the purpose of the study, which surveyed 197 companies from varying industrial sub-sectors, identified the following main points (Section A5 of Annex A):

- 50% of industrialists are interested in providing energy data;

- Energy management awareness is very low among most industrialists;

- Industrialists need to know what the purpose of the energy data collection project is before providing data;

- Many industrialists lack trust in public administrations;

-Industrialists do not consider energy monitoring as a priority given the country's current crises[1];

- Industrialists cannot allocate limited and valuable funds to install energy meters (only 11% are interested in installing energy meters if the country's current situation does not improve);

- 29% claim that financial incentives are needed to motivate them to install meters;

- Industrialists have a clear preference for a web-based data collection tool (48%); and

- MoI was selected as the most preferred host to operate the data collection system (34%), followed closely by ALI (26%).

The findings of the inception report indicate, mainly, that there is (1) a lack of a comprehensive and detailed database for the industrial sector, (2) an absence of energy use management in most local industries, (3) restricted access to financial resources due to the country's situation at the time of the survey, and (4) difficult operating conditions of the public sector during the country's crisis. These are the four major considerations that have guided the development of the methodology and roadmap presented in this document. Accordingly, there are two fundamental prerequisites and priorities that should be accomplished in order to achieve the goals within an acceptable timeframe and in order to ensure the success of the energy data collection program:

- Secure the necessary funds to finance the different activities described in the roadmap over the first 6 -7 years of project implementation, estimated at around USD 2 million, and

- Carry out a full and all-encompassing survey of the industrial sector which will, among others, contribute to sensibly increasing the number of registered industrial firms at the Ministry of Industry (MoI). Such a survey is a necessary requirement for any integrated and sustainable industrial development policy.

The budgeted amount discussed throughout the report is necessary to close the gaps and overcome the shortcomings stated above, whether at the level of the industrialists or the public sector. The roadmap (Section 2) proposes extensive seminars and workshops that enable the industrialists to buy-into the project and to effectively handle the data collection system. As such, it provides in-kind support to help industrialists install measuring instruments at strategic locations in their facilities. The roadmap projections call for an effective and full-fledged participation of no less than 500 – 600 industrialists, with more than 5 full-time employees, over the first six years of project implementation. As an estimate, if only industrial enterprises with more than five full-time employees are considered, this level of participation could represent a significant proportion of the targeted industrialists' population. A participation of one thousand industrialists may be considered over the long term.

For the purpose of the study, a Terms of Reference detailing the requirement of the proposed energy data collection system was developed, accompanied with three EDCS data entry forms – one for the general industry, one for the cement industry, and one for the dairy industry. The Data Entry forms are presented in Annex D. The templates allow for three levels of data entry depending on the level of knowledge of the respondent firm and its capacity to collect

[1] The survey was undertaken when Lebanon was facing a multitude of crises, including (1) acute shortages of basic amenities, such as fuel, electricity, and medicine, (2) the lack of liquidity due to the banking sector sequestration of depositors' accounts, (3) the devaluation of the Lebanese Pound and the fluctuating exchange rate, (4) the scarcity of foreign currency needed to import raw material, equipment and spare parts, and (5) the reduced demand due to the economic crisis.

the needed data. Furthermore, an energy data collection leadership certification program is devised for industries capable of providing, on a regular basis, energy data down to the disaggregated product level. The long-term goal of the project is to be able to generate energy use performance indicators at the level of the product.

Considering the prevailing instability on the national scene at the time of developing this report, project implementation is challenged by several risks (Section 4). The time at which the data collection system is launched should be carefully considered in order to ensure that this project is established on sustainable tracks.

It would have been preferable to develop the EDCS in the context of an overall national energy strategy, however, the methodology presented in this document takes into consideration all the fundamental components based on which any comprehensive and effective national energy policy is formulated (Section 1).

Furthermore, if implemented, the proposed EDCS will greatly help the Ministry of Industry achieve the objectives set in its vision 2025 for an integrated and sustainable industrial development in Lebanon.

The aforementioned crisis that was facing Lebanon at the time of this project can provide significant opportunities for change; with adequate political backing, a well-planned industrial strategy could allow the industrial sector to stimulate the economy. However, tools to monitor the performance of this strategy are required for effective implementation, given that "you cannot manage what you do not measure".

Moreover, this crisis has made industrialists become more aware of the importance of energy management and its corollary, energy security. Therefore, they will most likely show keener interest in participating in an energy data collection program if the advantages are well- communicated.

The importance of good energy management and related energy data collection activities cannot be overstated enough. This is especially prevalent in Lebanon, where the daily struggles endured during the time of the crisis serve as a constant reminder of the repercussions of energy mismanagement. Consequently, energy use monitoring in the industrial sector could sensibly improve the energy use performance of the industrial sector and thus could have positive implications on the economy of the country.

INTRODUCTION

The lack of an effective and comprehensive energy data collection system for the industrial sector in Lebanon has resulted in the absence of reliable energy data where beneficiary energy policies can be tailored to Lebanese industries. As a result, the national energy bill is one of the major contributing factors to the country's current economic crisis. While developing this report, the country is also facing an alarming energy crisis; mainly fuel shortages and inflation of fuel prices. Energy security is a significant concern to the Lebanese industrial sector.

The CEDRO 5 Project, a partnership between the United Nations Development Program (UNDP), Association of Lebanese Industrialists (ALI), the Lebanon Green Building Council (LGBC), and the International Renewable Energy Certification (I-REC) foundation, co-funded by the European Union (EU), devised a system for energy data collection for the industrial sector that will serve to enhance energy security and provide other benefits to the industrial sector. This system provides various benefits to the industrial sector. It may help industries enhance their energy efficiency, increasing the competitiveness of industries, and reducing greenhouse gas emissions and associated environmental and health-related impacts. Energy efficiency can lead to less reliance on fossil fuels and therefore enhance energy security at the national level. In the long term, this can contribute to sustainable economic development and reduced environmental concerns and air emissions, while in the short term, energy security will enable industries to effectively respond to sudden disruptions in energy supply or prices. Achieving better energy efficiency and improving energy use performance will not only help industries reduce their energy needs and associated costs, but it will also help Lebanon achieve its Nationally Determined Contributions (NDCs) targets. These greenhouse gas (GHG) emission reduction targets are set at 31% (conditional) and 20% (unconditional) compared to a Business-As-Usual scenario (UNFCC, 2020). The program for the collection of energy data from industrialists will help accomplish the above at the industrial and country level. The availability of high-quality and accurate energy data and statistics is essential for industries to evaluate their respective energy efficiency potential. In addition, the establishment of a national energy monitoring and management program that acquires reliable and accurate energy data is essential for ministries, particularly the Ministry of Energy and Water, to devise sound national energy policies. This program may also help the Ministry of Industry formulate a better understanding of the industrial sector, the industrialist needs and challenges, and identify areas in which industrialists require interventions and support. The program will also help the MoI achieve the objectives set in its vision 2025 for an integrated and sustainable industrial development of Lebanon. Overall, the benefits of this program are many for all the concerned stakeholders, including improved energy security, environmental standing, and improved performance of the balance of payments.

The report provides recommendations for the task of building an effective energy data collection system for the industrial sector. The purpose of this document is to establish the roadmap and methodology to build an energy data collection system based on the findings and recommendations of the inception report.

The first section of the report establishes the link between energy policies and the associated required energy information essential to create the implementation performance dashboard for those policies. The main guidelines that could form the basis of an effective and comprehensive energy policy are delineated; the energy use information necessary to establish and manage policy directives devised around each of these guidelines is then identified.

This modular approach allows for the design of an effective, relevant and comprehensive energy data collection system without the need for clear energy policy (whether at the level of the country or the industrial sector). Moreover, it provides the ability to use the data system to devise any energy policy in the future.

Section 2 addresses the roadmap and methodology for establishing the energy data collection system. It details the different activities to be undertaken over the medium term and their respective timeframes and budgets. This information is needed to develop targeted funding campaigns directed towards potential donors. The time of initiating the project will impact the resources needed for its success. Starting the project during turbulent times may require more financial resources and efforts than during times of relative stability. The budgets shown in this document are based on a post-crisis period. Section 3 presents an infographic timeframe for the project extending over the medium term. An assessment of potential risks that may challenge the implementation of the data collection system is outlined in Section 4.

The inception report, which compiles and analyzes the findings of desk reviews, stakeholder interviews, and an industrialist field-survey conducted for the purpose of this study that additionally provides the background against which the approach proposed in this document has been developed, is provided in Annex A. The industrialist survey that was used in the field survey to collect data for the development of the inception report is provided in Annex C and the EDCS data entry forms (for the general industry, the cement industry, and the dairy industry) are provided in Annex D.

01

ENERGY POLICY AND RELATED DATA COLLECTION FROM THE INDUSTRIAL SECTOR

Lebanon imports most of its energy needs; in 2018, these amounted to around 200% of its manufactured and agricultural exports and 30% of its trade deficit. Despite the heavy burden of the energy bill on the economy, Lebanon never adopted a national energy strategy, nor an energy strategy at the level of the industrial sector, to mitigate the high energy security risks the country is subjected to. Consequently, Lebanon is experiencing the current energy supply crisis.

Therefore, effective energy policies are required. Legislation is comprised of a limited number of laws, decrees and strategic roadmaps, which are not fully implemented or enforced. In 2010, the Ministry of Energy and Water (MoEW) released its first Electricity Policy Paper, which was later updated in March 2019, and it was endorsed by the Council of Ministers in April 2019. The policy paper has two main goals: (1) reduce Electricite du Liban's (EDL) financial deficit, and (2) improve power supply.

The first National Energy Efficiency Action Plan 2011-2015 for Lebanon (NEEAP) was prepared in line with the 2010 Electricity Policy Paper. It was approved by the Council of Ministers (of Lebanon) and it included 14 initiatives summarizing all the national objectives, programs, and policies in the energy efficiency and renewable energy sectors.

In March 2016, the second NEEAP for the period 2016-2020 was adopted, with energy efficiency measures being highlighted. In the same year, the National Renewable Energy Action Plan 2016-2020 was also published. Both action plans focused on measures to help achieve the 12% target of primary energy consumption from renewable energy for both power generation and heating purposes, by 2020.

Today, the Lebanese Republic is preparing its third NEEAP, which covers the period 2021-2025. According to Lebanese Center for Energy Conservation (LCEC), this action plan will enhance the roadmap towards the path of sustainability, and it will shape the policy dialogue for all the stakeholders in Lebanon. Although the NEEAP 2021-2025 was scheduled to be released early 2021, it has not been published yet.

Moreover, the Draft Energy Conservation law aims to promote energy efficiency and Renewable Energy (RE) in Lebanon. The draft law provides a legal framework for energy audits, energy efficiency standards and labels, financial incentives for energy efficient appliances, and the institutionalization of the LCEC to provide it with all the required and relevant powers with respect to RE projects and initiatives. However, the draft law has not yet been submitted to the Lebanese Parliament.

Accordingly, this section does not devise a national energy strategy at the level of the country nor at the industrial sector level, but rather, it sets out guiding principles, which can inform the choice of energy data to be collected from industrialists.

Lebanon mostly relies on three hydrocarbon compounds as sources of energy for its economy, namely: heavy fuel, diesel, and gasoline, while Petroleum coke, kerosene, and LPG constitute a small portion of the conventional energy supply (IRENA, 2020) (Figure 1). Renewable energy, in the form of biomass, hydropower, solar, and wind, is also a very small portion of the energy supply (IEA, 2019) (Figure 2).

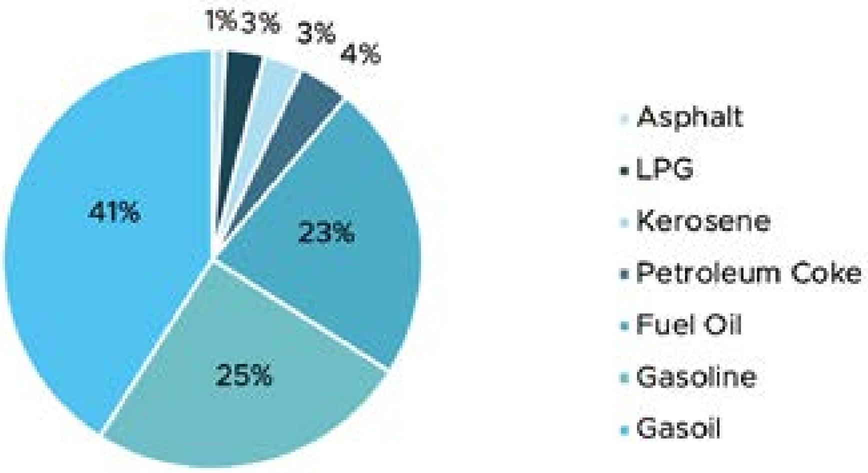

Figure 1. Lebanese primary energy mix in 2018 (%) – Adopted from IRENA, 2020

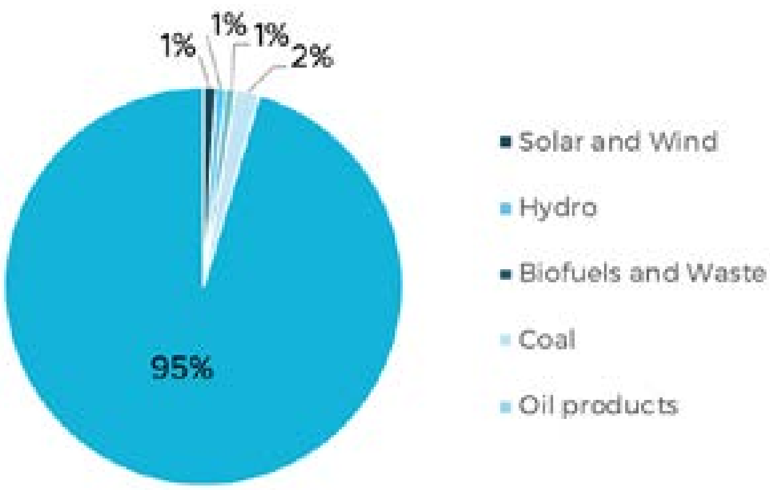

Figure 2. Total Primary Energy Supply by source (%) – Adopted from IEA, 2019

In 2018, the industrial sector share in the national energy demand was around 20%, while its contribution to the economic value added was estimated at around 14%. The industrial sector energy demand mix covers almost the entire spectrum of energy sources available to the country. As a point of comparison, the transportation sector share in energy demand for the same year was around 33%, relying mostly on gasoline, and to a lesser extent, on diesel. The broad energy supply mix of the industrial sector presents a great opportunity for optimization.

A first guiding principle for any energy policy would then be to determine the share of each source of energy in the energy supply mix in the different sectors of the economy (in this case, the industrial sector). This information can help optimize the process of selecting the best national energy mix based on environmental, economic, and social considerations. A corollary to this requirement is to maximize the reliance on renewable energy to mitigate energy security risks pertaining to either sources of supply or reduction of the economic burden. Apart from energy security considerations, the reliance on renewable energy should help the country meet its Nationally Determined Contribution (NDC) commitments to the international community.

Consequently, the devised Energy Data Collection System (EDCS) for the industrial sector should include entries on the type and quantity of each source of energy used (including each type of renewable energy). The share of renewable energy in the energy supply mix is primary information to be collected from industrialists.

Improving the energy use performance of the industrial sector is another guiding principle in any well-developed national energy policy. The aim would be to reduce the energy footprint of the sector in the context of the national economy. Energy use performance is evaluated with respect to three outputs, namely: economic, activity level, and energy conversion services, all three should be covered by the EDCS. These three outputs relate to the monetary value added produced by the industry, to the products, and to the major production services involved (e.g., steam, refrigeration, electricity, compressed air, hot water, etc.), respectively. Heat recovery information is to be included in the set of data needed for production services.

The economic value added (not to be confused with revenues or profits) as well as product outputs and production services are rather sensitive issues. Therefore, the collection of this data requires trust between the industrialist and the party responsible for hosting/managing the EDCS.

The source of energy used for energy conversion services is valuable information required to identify energy use hotspots in industry, down to individual firms. Such information can be used to optimize the energy mix of the sector. The energy conversion services capacity, like steam generation, compressed air production or others, should be included in the information collected.

Considering that electricity blackouts and the high cost of diesel fuel will unlikely be resolved over the short to medium term, particular attention should be given to in-house electricity and energy generation in any energy strategy, both at the national level and at the level of the industrial sector.

For large industries, and for industries with diversified production, the EDCS should facilitate the disaggregation of energy use performance down to the production center or products levels. Again, the purpose is to allow for the capability of detecting hot spots and improving energy use performance. This implies the creation of several EDCS data collection templates tailored to the different targeted classes of industries. This may complicate the data collection process, however, the results that could be achieved would outweigh the additional resources to be committed to the project.

A third guiding principle relates to strategic energy reserves; this principle is at the core of energy security. At the level of the industrial sector, the EDCS should include entries related to the storage capacity of industries for the different energy sources that could be stocked. Such information is important for a properly integrated, sustainable, and comprehensive national energy strategy.

Setting goals and targets to improve the energy security position of the country is the fourth guiding principle in a well-thought-out national energy strategy. Accordingly, the role of the EDCS at the level of the industrial sector is to be a pre-requisite for establishing baselines and subsequently for evaluating distance to targets with respect to established benchmarks. This exercise should involve the three guiding principles discussed above.

The implementation of an EDCS for the industrial sector should help build a wealth of information and experience, which will in turn help prepare a national energy strategy adapted to the needs and specifications of the country.

02

ROADMAP FOR THE IMPLEMENTATION OF AN ENERGY DATA COLLECTION SYSTEM FOR THE INDUSTRIAL SECTOR

2.1. GOALS

The ultimate purpose of the proposed data collection system is to build a set of energy use performance indicators which could be used to:
- Help monitor the energy performance of the industrial sector in the context of an integrated and sustainable industrial development strategy for that sector;
- Provide inputs that could inform the process of setting up energy policies at the national level; and
- Help the country better manage its GHG communication and its nationally determined contributions vis-à-vis the international community through the United Nations Framework Convention on Climate Change (UNFCCC).

2.2. BARRIERS

Four major barriers have been identified that may prohibit an effective energy data collection system. These barriers are:
1. The lack of a comprehensive and detailed database for the industrial sector;
2. The near-total absence of energy use management and energy performance monitoring tools in most local industries;
3. The industries' restricted access to financial resources; and
4. The extremely difficult operating conditions of the public sector in this time of crisis.

In addition, there are other challenges that may also hinder the effective implementation of the proposed energy data collection system. These challenges include:
- Policies to encourage energy efficiency at the industrial level are absent.
- Securing funds may present a challenge as donors may prefer to prioritize funds for other issues, rather than projects related to energy efficiency and performance monitoring.
- Lack of human resources, technical expertise, and financial resources in ministries may hinder their ability to carry out the tasks required by this project.
- Inadequate enforcement of existing laws and regulations.
- As was evident from the stakeholder consultations, there is a lack of coordination between public administrations, which have been previously involved in similar projects, including the Ministry of Environment (MoE), the Ministry of Industries (MoI), and the Central Administration of Statistics (CAS). The results of the industrialist survey also revealed a lack of coordination and communication between the Ministries and the industries, leading to low trust from the industries towards public administrations.
- Awareness and knowledge about energy performance monitoring and energy efficiency is very low among industrialists.
- The current conditions of the country (i.e., the economic crisis, fuel shortages, COVID-19, etc.) may impact the level of responsiveness of the industries in participating in this project since they do not consider energy monitoring as a priority in these difficult times, which is evident from the industrialist survey results.

As a result, a list of activities has been proposed to overcome these barriers.

2.3. ACTIVITIES AND MILESTONES

To achieve the defined goals and overcome the previously listed barriers, the following action items and milestones are proposed, with tentative budgets and time frames. The milestones, which will be discussed in details below, constitute the main parts of the roadmap that represent major progress towards completion and implementation of the proposed EDCS. Most of the milestones selected follow a path of progression, whereby completing one milestone, the following milestone could be attained. Other milestones can start in parallel. For each of the nine milestones discussed, the expected timeframe, budget, key actors, and potential key actors are outlined in the sections below. These milestones represent significant steps along the roadmap that could be measured to track progress toward achieving the full implementation of the EDCS. The sections below also outline the timeline of the tasks/ activities required to achieve each of the nine milestones and monitor overall progress toward the implementation of the EDCS. Currently, the Ministries are experiencing prolonged outages of electricity and a lack of resources (e.g., human, financial, etc.). Given these instabilities prevailing at the national level, the estimates provided are based on a post-crisis period, since initiating the project in the future would require significantly more resources, effort, and time.

2.3.1. Activity 1: Designation of the Project's Focal Point and Secure Funds

The inception report (Annex A) has shown that the MoI is the most plausible candidate to act as the focal point for the project, the operator of the data collection system, and its custodian (here below designated as the focal party). However, considering the adverse effects of the present crisis on the public sector, it is doubtful that the MoI, or any public administration, can presently play this role. Therefore, it is strongly recommended to start the project once the political and economic situation stabilizes, structural reforms are undertaken, and the country resumes some semblance of normalcy – especially if the project is to be implemented with the aim of building energy performance indicators at the level of the national industrial sector. In addition, although Lebanon's Central Administration of Statistic's (CAS) role is presently not well-defined, it may potentially have an important part to play in the various phases of project implementation. Given the challenges ministries are currently facing, CAS could be asked to act as a co-focal party for the project.

Once the focal party is selected by the key stakeholders, project funding over a minimum of six years is to be secured; it is most unlikely that the project will proceed without external funding to ensure its sustainability over the medium term. Irrespective of which key stakeholder is to be designated as the focal party, the project should require a staff of five experienced persons on a full-time basis for the first four years of operation. The specialties required are an IT specialist, a data analyst, an energy expert, and two coordinators. The role of the coordinators is to act as a point of contact with the industries; it is preferable that they have a technical background. The staff should have at least 7 - 15 years of experience in their respective domains. Furthermore, funding will be needed for the industrial sector survey, EDCS implementation, awareness and training campaigns, installation of measuring instruments at industrialists' premises, and other expenses as detailed below.

Key actors: MoI, ALI, UNDP-CEDRO, UNIDO, EU
Potential key actors: CAS, AFD, potential donors
Estimated time frame: 1 year
Estimated budget: N/A

Milestone 1: System Host Selected
Milestone 2: Funds Guaranteed

2.3.2. Activity 2: Comprehensive Survey of the Industrial Sector

Carrying out a full and all-encompassing survey of the industrial sector is a mandatory activity if an integrated and comprehensive EDCS is to be implemented at the level of the industrial sector. The results of the survey will, among others, contribute to sensibly increasing the number of registered industrial firms at the Ministry of Industry (MoI), in addition to being a basic requirement for any integrated and sustainable industrial development policy. Apart from considerations related to the EDCS, the full industrial survey could determine, to a good level of accuracy, the number of operating industrial establishments, especially since many have closed down due to the current economic situation. In addition, this will provide an opportunity to update the MoI's industry database as the information currently available is limited and outdated. The MoI has expressed a keen interest to carry out a full survey of the industrial sector. The United Nations Industrial Development Organization (UNIDO) may assist the MoI in carrying this survey out in 2022.

According to CAS, a well-experienced public administration in the field of statistical surveys, it is not possible to carry out a reliable survey on a certain population if the characteristics of that population are not known. It is recommended that this activity be undertaken in accordance with international standards and guidelines for statistical surveys. This survey is required to have a comprehensive understanding of the present industrial sector and to identify the baseline data, benchmarks, and indicators at the national level.

Key actors: Focal party, MoI, ALI, UNIDO
Potential key actors: CAS, or other survey distribution and data collection companies (as the contractor who will carry out the survey)
Estimated time frame: 2 years
Estimated budget: USD 400,000
(based on MoI estimates)

Note: The focal party is shown in the list of key actors knowing that that any of the key actors or potential key actors could be the focal party. This approach is adopted to make it clear that the choice of the focal party is open.

Milestone 3: Comprehensive Industrial Survey Implemented

2.3.3. Activity 3: EDCS Unit Set Up

Activity 3, which should run in parallel with Activity 2, involves the setting-up of the EDCS unit at the focal party premises. This includes the hiring of the staff, design of the EDCS, establishing protocols and policies, administrative processes, organizing the awareness and capacity building workshops, performing trial runs on the EDCS with the collaboration of a restricted sample of volunteer industrialists (not exceeding 20 companies), as well as other actions needed to make the system fully operational.

During the project development phase, the EDCS unit scope of work is as follows:

- Finalize the EDCS forms based on Annex D of this document and the industrialists' population sampling performed in Activity 2;

- Implement the web-based application based on the Terms of Reference;

- Construct the webpage which should be linked to the focal party official website;

- Execute trial runs with a selected sample of industries to check system readiness;

- Develop the content of the awareness and capacity building seminars;

- Carry out the awareness and capacity building seminars with the help of the focal party staff;

- Supervise the procurement and installation of the measuring instruments at the industrialists' facilities and coordinate with the third-party verification contractor;

- Perform the trial data collection phase and adjust/modify EDCS accordingly; and

- Validate the initial survey results by establishing working groups of industry experts.

During the project operating phase, the EDCS unit scope of work is as follows:

- Maintain the system (e.g., upgrades, web page updates, troubleshooting, debugging, etc.);

- Check that industries are submitting the forms in a timely fashion;

- Data verification and follow up with companies which submit invalid data;

- Follow up with industries who are not responding and report these to higher management;

- Establish baselines and benchmarks for each sector of activity;

- Monitor energy use performance trends across sectors;

- Identify energy champions;

- Issue yearly reports showing statistics regarding data reporting non-response-rate, increase/decrease in population joining the EDCS, trends in most relevant indicators and other energy use information in the industrial sector;

- Modify and upgrade the EDCS based on lessons learned; and

- Establish and operate EDCS help center.

Incentives should be provided to motivate industrialists to join the program. For that purpose, three levels of participation in the energy data collection are devised, as well as an energy data collection leadership certification program (See Annex C). Such incentives could include the following:

- Reduction in formality or membership fees of MoI;

- Recognition certificates for companies which submit complete forms;

- Awards for energy champions that are meeting or exceeding sector benchmarks;

- Free ISO certifications (ISO 9001, ISO 21000, ISO 50001) for members of the Energy Data Collection Leadership Certification Program (grant support needed via MoI, ALI, and/or international community);

- Free consultancy person-days awarded to the energy champion from experts in their sector of activity (grant support needed via MoI, ALI, and/or international community); and

- Free participation in international workshops for industries joining the energy data collection leadership certification program (grant support needed via MoI, ALI, and/or international community).

It is not recommended to introduce penalties for the first five years of the EDCS operation. Therefore, penalties are not discussed in this document.

Key actors: Focal party, MoI, ALI, UNDP-CEDRO, UNIDO
Potential key actors: CAS
Estimated time frame: 15 – 18 months
Estimated budget: USD 300,000 – 350,000 (staff salaries, equipment, consultancy services, office expenses, equipment and resources for the awareness and capacity building seminars, international workshops, ISO certifications, etc.)

Milestone 4: Energy Data Collection System Established

2.3.4. Activity 4: Awareness and Enrollment Campaigns

Once the industrial survey is complete, the characteristics and methods of the sampling process can be identified. Moreover, the sample size and cut-off industry size can be determined, as well as the relative representation of each sector of activity in the sample, and other statistical considerations such as regional representation.

Advertising campaigns, followed by awareness seminars, can start once the sampling procedures are determined, and aim to motivate industrialists to join the EDCS project. The advertising campaign should involve large efforts and span over several media platforms. The campaign should make the industrialist feel obligated to attend the awareness seminars; limiting interaction to sending emails to industrialists will not suffice. The campaign should clearly communicate the objectives of the program, the benefits it could bring to industrialists, to the industrial sector and to the country, the incentive and support packages the program could offer, and the data privacy guarantees. The campaign can capitalize on the energy crisis and its significant effects on the industrial sector.

Awareness seminars should be face-to-face and segregated by sector of activity and region. The awareness seminars play a pivotal role, and the seminars help determine the success of the project. Primarily, awareness seminars should be directed to the industries' higher management; the probability of project success is low without the support and collaboration of higher management. The content of the awareness seminars should be designed with the industrialists' concerns in mind and adapted to each region. It is anticipated that the expectations and mindset of industrialists will vary from one region to the other. Establishing trust between the industrialists and the focal party cannot be stressed enough.

It is estimated that a maximum of 600 – 700 companies can attend the awareness seminars of the first enrollment campaign. Consequently, no less than thirty events should be organized in different Lebanese regions. Venues should be properly equipped and seminars need to be well-organized.

The attendees will be required to fill in an application for enrollment in the EDCS program. The focal party will decide which applications are to be accepted, and the successful applicants should be notified accordingly.

The data privacy guarantee mentioned above is an important aspect to be highlighted in the awareness campaigns to gain the trust of the industries and to encourage them to enroll in the EDCS program. There are several ways to ensure the confidentiality of information that will be shared by the industries participating in this system. Legislative acts and/or regulations that prohibit the disclosure of confidential information have been used in several countries to govern the process of data collection and ensure data privacy (for example, the Statistics Act in Canada). However, this may not be a viable option in Lebanon since (1) the legislative body is currently not completely functional, and (2) the process of passing a law or decree in Lebanon is a prolonged process that often encounters many impediments.

Therefore, relying on a law to establish the EDCS system may significantly delay the implementation of the project. Other ways of ensuring the privacy of collected data include:

- Memorandum of Understanding (MoU) and other types of confidentiality agreements: An MoU is way of ensuring confidentiality of the information that will be shared through the platform. The focal point for the project (e.g., the ministry) will have to sign an MoU with each industry participating in the platform to assure them that the data provided will be kept confidential. This may present some problems at the ministerial level, since MoUs usually require time to be signed, which may delay the process and discourage industries from participating in the data collection process.

- Restricted Access at the level of the data collection tool: Restricted Access is one approach used to limit access to sensitive information through administrative and technological procedures. Restrictions can be added to who can access the dataset and what kind of information they can extract or analyze.

Key actors: Focal party, MoI, ALI, UNDP-CEDRO, UNIDO, regional CCIA
Potential key actors: CAS, advertising agencies, communication specialists
Estimated time frame: 5 - 7 months
Estimated budget: USD 120,000
(EDCS unit expenses, advertising, seminars)

Milestone 5: Participants' Recruited

2.3.5. Activity 5: Capacity Building Campaigns

Successful applicants will be asked to attend a two-day capacity building workshop aimed at providing basic knowledge in energy and instrumentation explaining what data will be collected, where to install measuring instruments, protocols for taking readings, how to fill-in the electronic form, and how the EDCS operates. The workshop should also provide industrialists the basic tools needed for material flow cost accounting, which could help them manage better their activity data. The second day will consist mostly of on-hand simulation training, during which trainees will fill-in the EDCS form, see the related results under the form of indicators, and familiarize themselves with the EDCS.

Considering the nature of the workshops, the delegates should have technical backgrounds, preferably at the level of maintenance managers or senior engineers, depending on the size of the firm. It is estimated that no more than 500 companies will reach this stage during the first enrollment campaign, at best. For the purpose of effectiveness, it is important that these workshops be conducted on a sector of activity basis. It is estimated that no less than 20 events should be organized in various Lebanese regions.

Key actors: Focal party, MoI, ALI, UNDP-CEDRO, UNIDO, regional CCIA
Potential key actors: CAS
Estimated time frame: 3 - 5 months
Estimated budget: USD 50,000
(EDCS unit expenses, seminars)

Milestone 6: Participants Trained

2.3.6. Activity 6: In-situ Measuring Instruments Installations

Applicants that have successfully passed the capacity building workshop will have to install energy measuring instruments. Installation expenses should be carried by the beneficiary; however, any grant availability will be vital in supporting this critical initiative and will ensure its speedy uptake. A third-party quality assurance commissioned by the EDCS focal party will be conducted to ensure that instrumentation has been correctly installed. It is estimated that no less than 500 industries will benefit from this package. The estimated budget amount shown below is based on experience from the MED TES II project, under UNIDO management, where industries in the food sector were asked to install measuring instruments to monitor their energy and water consumption on a daily basis. Based on the results of the inception report, it was necessary to incorporate the cost of the measuring instruments into the budget of the project, since most industries are not capable or willing to invest in any measuring instruments due to the limited available funding. In fact, many industrialists stated their willingness to add meters only if funding is provided.

Key actors: Focal party, MoI, ALI, third party verification contractor
Potential key actors: Measuring instruments suppliers
Estimated time frame: 3 - 5 months
Estimated budget: USD 800,000

Milestone 7: Measuring Instruments Installed

2.3.7. Activity 7: EDCS Trial Phase

Before beginning operation, it is recommended to perform complete test trials, during which industries will be asked to fill in the electronic form based on instrument readings according to a pre-set schedule. The collected data itself will not be representative; however, the exercise will confirm the full operational capacity of the system. Adjustments and modifications could be made at this stage before officially launching the operational phase, especially if the number of companies enrolled may be less than the required sample chosen at the start of Activity 4.

Key actors: Focal party, MoI, ALI, third party verification contractor
Potential key actors: Measuring instruments suppliers
Estimated time frame: 5 - 7 months
Estimated budget: USD 30,000
(EDCS unit expenses)

Milestone 8: EDCS Trial Phase Executed

2.3.8. Activity 8: EDCS Full Operation Buffer Period

The EDCS should be fully operational, and two cycles of data should be collected assuming a yearly collection frequency. This is considered to be a buffer period in case the number of companies that join the project is less than the required number for the project to deliver statistically significant data. The focal party should strive to increase enrollment during the buffer period, especially if industries trust this operation and companies are increasingly appreciating and recognizing the advantages of joining the EDCS. Consequently, additional advertising campaigns, awareness, and capacity building seminars are expected to take place during the buffer period. The number of additional industrialists who could join may well be above 300. The EDCS funding should extend till the end of Activity 8.

After a year of operation, the data collected should be validated by conducting focus group discussions/workshops with the industrialists. It is preferable that the focus groups be conducted for each sub-sector alone (e.g., industrialists from the cement or dairy industry) to attain maximum benefits from the discussions. The focus group should also include experts in the focus group's specific sub-sector of activity to validate the data collected through the EDCS. The focus group discussion will give the industrialists the opportunity to be involved in the evolution and development of the system.

Key actors: Focal party, MoI, ALI
Potential key actors: Advertising media
Estimated time frame: 2 years
Estimated budget: USD 200,000
(EDCS unit expenses, advertising and seminars)

Milestone 9: EDCS Implemented

Overall, the estimated timeframe of the activities of the project should be around 6-7 years. It is doubtful whether a fully operational EDCS effectively covering the industrial sector could be achieved in a timeframe shorter than 6 years. The required budget to achieve such an objective is estimated at around USD 1.7 – 2 million.

EDCS operating expenses beyond Activity 8 are estimated at USD 70,000/year, consisting mostly of staff salaries and office expenses. The incentives provided to industries to motivate them to join could amount to an additional USD 20,000/year.

03

PROJECT TIMELINE OVER THE MEDIUM TERM

Figure 3 presents the project timeline, showing the milestones, key stakeholders involved, budget and duration, while Figure 4 presents the roadmap.

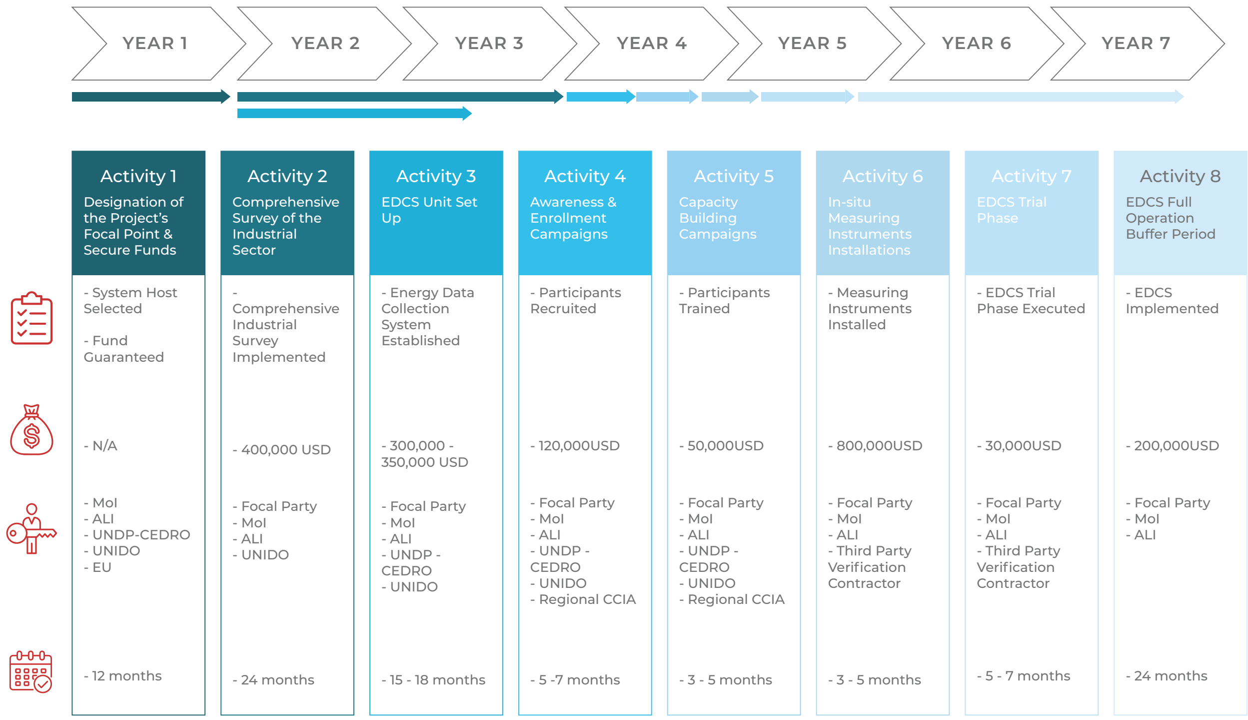

Figure 3. Project Timeline

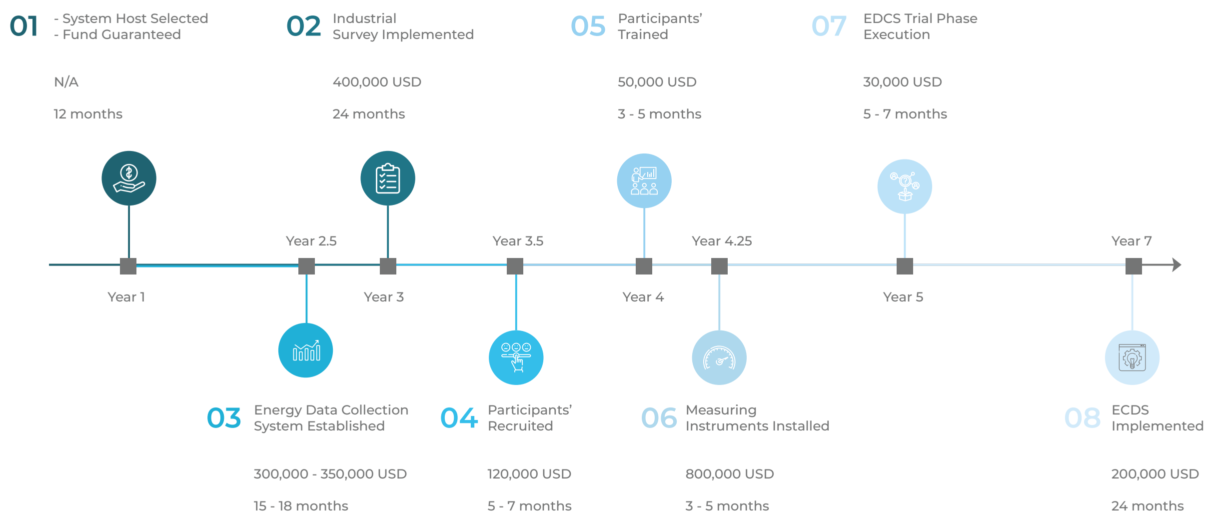

Figure 4: Project Roadmap

04

RISK MANAGEMENT

The project implementation risks that the EDCS may face and the proposed mitigation measures to overcome these risks are presented in the table below.

Table 1. Risks and Recommended Mitigation Measures

Risk	Probability of Risk Occurring	Impact of Risk	Risk Priority (PxI)	Mitigation Measure
Political and Economic Risks				
The crisis in the country does not abate over the next two years and Lebanon plunges deeper into recession. Donor countries may prefer to prioritize aid funds to humanitarian issues rather than technical projects, similarly to what happened with some programs on the onset of the Syrian refugees' crisis.	High	Medium	6	Conduct an extensive mapping of potential donors active in the region. Carry out lobbying campaigns emphasizing the positive impacts of the project, namely: Strengthening the industrial sector, which could contribute to strengthening the energy and food security of the country, as well as revive the economy, and positively impact climate change mitigation. If funds are not available, it is recommended to delay the project until the country is pulled out of its crisis, rather than proceed and risk project failure; if failure occurs, it will be difficult to put back the project on tracks.

Risk	Probability of Risk Occurring	Impact of Risk	Risk Priority (PxI)	Mitigation Measure
Situation improves in the short term, but potential donors are still reluctant to fund this project since they do not consider it a priority at this stage.	Medium	Medium	4	The above actions apply. Furthermore, the EU already has a program related to energy efficiency; the EDCS project could be a part of this program. Reach out to Government of Lebanon (GoL) for possible partial funding of the project.
Economic and Technical Risks				
Due to a persistent economic crisis the response of industrialists to the advertising and awareness campaigns may be limited resulting in a weak participation.	Medium	High	6	Focal party advertising campaigns should stress the benefits of the EDCS, (1) how it may improve the competitiveness of the sector and thus profitability, (2) capitalize on the present fuel crisis to stress the reduced reliance on conventional fuels, and (3) emphasize on the in-kind benefits provided and information privacy. Higher management should be convinced that the project benefits are mutual.
Technical Risks				

Risk	Probability of Risk Occurring	Impact of Risk	Risk Priority (PxI)	Mitigation Measure
Some stakeholders may not seize the importance of carrying out a full survey of the industrial sector before carrying out the EDCS project.	High	Medium	6	MoI is very interested in carrying out a full survey of the industrial sector. MoI could lobby for this action. All key stakeholders should be made aware of the importance of carrying out the full sector survey for the success of the EDCS.
The non-response rate is rather high among the industrialists during the implementation phase.	High	High	9	Focal party should conduct an assessment of the performance of the delegates during the capacity building workshops. The focal party should make sure of the management commitment to the project. If needed, extra manpower should be allocated to the project to support the industries with completing the EDCS forms. Further incentives should be provided to reduce the non-response rate.

** The Probability of Risk Occurring and the Impact of Risk are graded on a scale of 1 to 3: High is denoted as 3; Medium denoted as 2; and Low denoted as 1.*

As seen in Table 1, there are various risks, be it economic or political, that might threaten the implementation of the project, mainly as a result of the country's current conditions at the time of developing this report. But also, technical risks might lead to failure of the project, if mitigation measures are not properly implemented. As such, we recommend that the project is initiated after the country starts engaging in some kind of economic recovery and administrative reforms, in order to ensure the success of the project and its sustainability. Moreover, the project might not be considered as a priority for funding at this time. In addition, initiating this project at a time where industries are in a better mindset (compared to the current survival mode mindset) might also increase participation in the project, thereby ensuring success and reducing low participation and non-response rates that threaten the project's implementation and continuity. Continuity of the project is at the core of every element and every stage of the proposed roadmap to ensure the implementation of a long-lasting data collection system.

A

ANNEX A:

INCEPTION REPORT

A1. Introduction

Due to the multitude of crises facing the country at the time of developing this report, energy security may become the most significant threat to the industrial sector, given that both the country and the industrial sector are unprepared to meet this threat during such difficult circumstances and in the absence of a well-articulated and implemented national energy strategy.

Lebanon should begin establishing effective energy governance. The industrial sector can take the lead in this process of change, considering that it is the primary contributor to the economic revival of the country. Furthermore, this initiative could improve the energy use performance of this sector.

Given that 'one cannot manage what is not measured', a good starting point would be to establish an effective and efficient energy use data collection system for the industrial sector and for related energy statistics. The Ministry of Industry (MoI) attempted to establish this system in 2015; it was unsuccessful due to the lack of resources at the Ministry, In addition to a lack of awareness on energy issues among the industrialists and a near-total absence of energy use monitoring systems on their premises.

The CEDRO 5 Project, devised to implement a system for energy data collection for the industrial sector, aims to address the aforementioned shortcoming. This inception report presents national and international experiences (including lessons learned) in energy data collection in the industrial sector (Section A2). It presents the results of a survey undertaken with a sample of 163 local industrialists – covering most sectors – to explore their readiness to take part in an energy data collection program (Section A5). Furthermore, this document discusses the data required for the energy indicators which could be adopted, and identifies potential barriers to the implementation of the program (Sections A4 and A6).

This inception report will act as a basis for the preparation of a roadmap for the implementation of the data collection program, identification of key parties to be involved in the project, and the layout of a comprehensive data collection template adapted to the local context and the requirements of the program.

Considering the multi-faceted crisis present in Lebanon, the implementation of this project may seem challenging; public administrations are struggling due to the absenteeism of employees and lack of budgets to cover their operating expenses, and many industrialists are fighting for the survival of their industries.

Despite these challenges, the energy data collection program from industrialists should eventually be implemented because Lebanon is in dire need of improving the energy use performance of its economy. Associated benefits are many, including improved energy security and improved performance of the balance of payments for the industrial sector and the overall economy. Moreover, this initiative can help achieve a cleaner economy, by reducing environmental impacts and helping Lebanon meet its emissions pledges to the international community. In the long run, all these factors should contribute to Lebanon's sustainable growth.

This inception report is a guiding document that may contribute to implementing a sustainable program for energy use data collection from the industrial sector, which is the first step of the journey towards devising and executing a sound and integrated energy strategy for Lebanon.

A2. Past and Present Experiences With Energy Data Collection For The Industry

This section studies the energy use data collection activities conducted by countries at the international level, as well as the initiatives pursued at the local level. These experiences can help identify lessons learned and derive best practices for devising an energy data collection program, and provide a guide to proceed with the proposed project. The international experience presents an extensive study based on the International Energy Agency (IEA) website, while the local experience review is based primarily on face-to-face and remote meetings with key stakeholders and complemented with desk reviews.

A2.1. International Level

The 'Energy Efficiency Indicators Statistics - Country Practices' database from the International Energy Agency (IEA) website was studied. This database contains extensive information on practices in data collection for developing energy efficiency indicators in various sectors, including the industrial, residential, services, and transportation sectors in 33 countries. Given the scope of the desk review, the search focused on practices for the industrial sector only. The information was extracted and integrated into a comprehensive excel sheet for further statistical treatment. The information was divided into four categories based on the type of data collection methodology used, namely:

- Surveying: collecting data directly through visits, survey forms, calls, etc.

- Administrative Sources: collecting the needed data from various administrations (e.g., ministries, associations, statistical departments, etc.) involved in data collection in their related sectors of activity.

- Modeling: producing the needed data from primary (raw) data by using formulas and conversion factors.

- Measuring: direct metering at the industrialist's site through automated data acquisition systems, without human intervention in the process.

This exercise enabled the identification of the most common energy data collection methods that are adopted internationally. A summary of the practices used in various countries for the collection of data for the aim of building energy efficiency indicators are presented below.

In total, 58 data collection practices from 33 countries were identified from the IEA database search. Some countries used a combination of methodologies to collect energy-related data. For example, Canada used three types of methodologies: Surveying, modeling, and administrative sources. Other countries, such as Mexico, Sweden, and Switzerland, used both modeling and surveying methodologies. In addition, some countries adopted different surveys to cover different industrial sectors. For example, Switzerland adopted two surveys: One covering the cement industry and another one covering all other manufacturing sectors. The percentage of practices adopting the various data collection methods is presented in Figure 5.

Figure 5 reveals how almost half of the practices solely used the surveying method for data collection, while more than 35% employed a surveying method design in combination with other data collection methods. This suggests that the majority of the countries used a surveying methodology to collect energy-related data. Evidently, surveying is an important tool that has been commonly used for data collection. Surveys are relatively easy to administer and allow for the collection of a broad range of data from a large number of respondents.

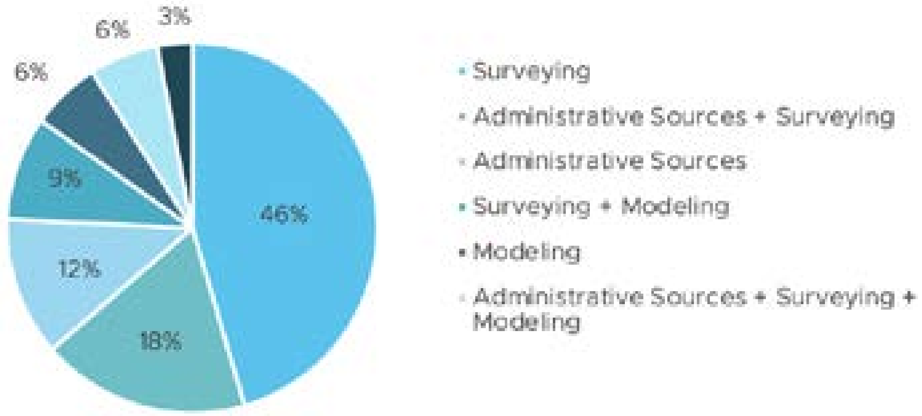

Figure 5. Percentage of Practices Covering the Various Data Collection Methods

Of the 27 countries that used the surveying methodology to collect energy data, 56% were developed countries, 33% were developing countries, and 11% were countries in transition. As for the administrative sources of data collection, 12 countries employed this methodology, of which 58% were developed countries, 33% were developing countries, and 8% were countries in transition. In addition, seven countries used the modeling methodology for energy data collection, of which 86% were developed countries, while the rest (14%) were developing countries[2] (Figure 6 and Figure7).

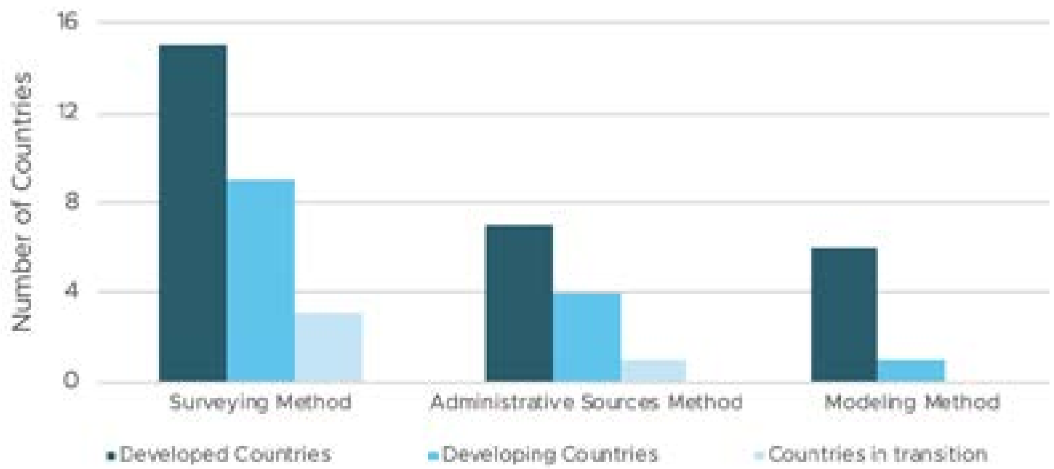

Figure 6. Number of Countries using the Methodologies by Country Classification

[2] *Country classification is based on United Nations 2021 Classification, accessible at the following link: https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/WESP2021_FullReport-optimized.pdf*

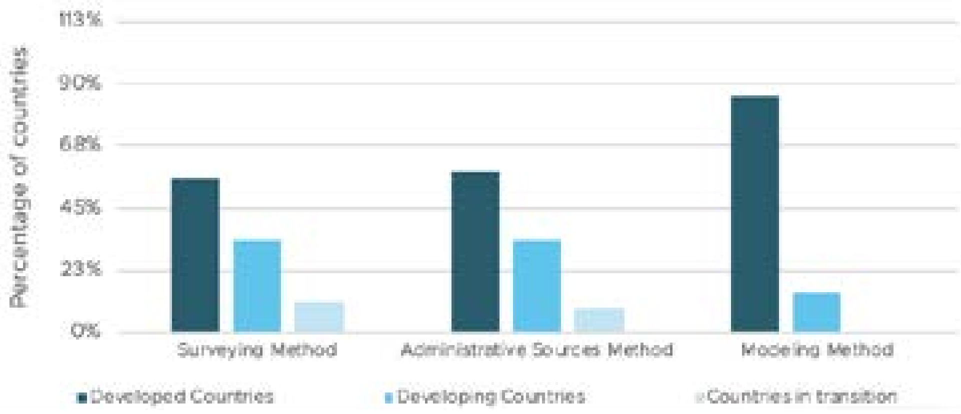

Figure 7. Number of Countries using the Methodologies by Country Classification (%)

Based on the results, economic development is not a guiding variable for the choice of the surveying or administrative sources methodologies; however, it is for modeling. This is most probably because the latter involves more complex approaches for data treatment.

Since surveying was the most common method of data collection among the 33 countries covered by the IEA study, Section A2.1.1 will focus mostly on analyzing the information from the countries that have employed a surveying method design. The analysis will also cover the administrative method in Section A2.1.2, considering that it is the second most common method for energy data collection in the IEA study.

A2.1.1. Survey Method

Out of the 33 countries identified from the database, 27 used the surveying methodology for data collection, either solely or in conjunction with another methodology. The IEA database includes information on 36 survey practices from 27 countries. The list of countries comprises developed and developing countries, including two Arab states, namely, the United Arab Emirates and Morocco. The geographical and development stage diversity of the countries involved makes the IEA study on the surveying methodology most relevant.

The sectors covered by the surveys varied among countries; some surveys covered all manufacturing sectors (16%), others only focused on the pulp and paper sector (16%), cement sector (15%), iron and steel sector (13%), chemicals sector (12%), and aluminum sector (12%). The mining, forestry, and construction sectors were also covered but to a lesser extent (2%).

The most prevalent purpose for data collection was to track energy consumption. The analysis revealed various other data collection purposes cited, including (from most to least common): (1) calculate energy emissions, (2) track industry's physical output over time, (3) complement another data collection initiative, (4) set industry energy efficiency benchmarks, (5) determine process efficiencies within an industry, and (5) evaluate effectiveness of programs and policies. Other data collection purposes cited by only one or two surveys are presented in Table 2.

Table 2. Other Data Collection Purposes in the Survey Method

Data Collection Purpose	Number of Surveys
Determine the different uses of energy consumption	2
Study energy consumption structure	2
Study energy prices	2
Track and report air, water and waste management	2
Understand operational costs within an industry	1
Collect data on the supply and disposition of electricity	1
Collect data for developing energy consumption policies	1
Collect data on fuel-switching capacity	1
Compose Energy Balance Table	1
Derive energy intensity	1
Determine sources of energy	1
Determine the most common equipment and technology found in industries	1
Develop and establish modeling in industry's energy consumption forecast	1
Identify raw materials used	1
Report progress toward Better Planet 2020 Sustainability Goals	1

The most common methods for data collection were electronic formats (Sample size (n)=22), including data reporting systems, internet-based forms sent by email, and web-based data entry. Paper forms sent by mail (n=20) is the second most adopted survey method. Telephone surveys, computer-assisted personal interviews, and on-site interviewing were used as a data collection method, but to a lesser degree. In addition, various survey practices combined more than one method for collecting data (Figure 8). For instance, out of the survey practices that used electronic formats, 10 practices were coupled with paper-based formats to collect energy-related data from industries. Other practices combined paper forms with other data collection methods, such as, on-site interviewing, telephone interviews and/or computer-assisted personal interview.

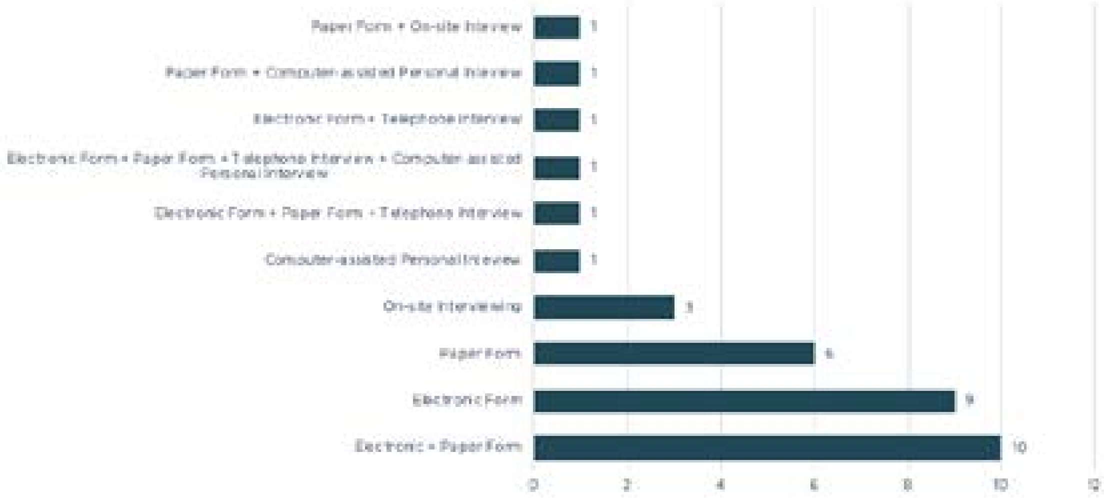

Figure 8. Survey Method Used for Data Collection

The most common study design adopted for sampling was the stratified random sampling technique. Other designs used were census and sampling based on certain pre-established characteristics (Figure 9).

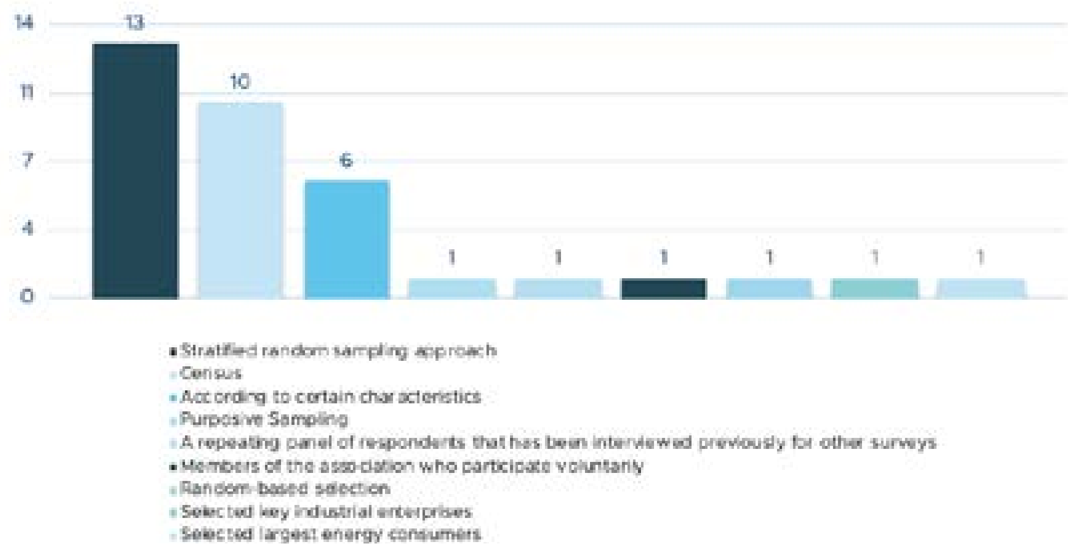

Figure 9. Sampling Design for Surveys

Regarding the sample population, almost half (48%) of surveys covered less than 20% of the total population of industries, 22% sampled between 20% and 40% of the total population, and 13% sampled between 40% and 60%. Interestingly, 17%, the equivalent of four surveys, sampled 100% of the industrial population.

The response rate varied greatly, ranging from 20% to 100%. However, the majority of surveys undertaken (> 70%) had a response rate higher than 80%, 31% between 80% and 89%, 21% between 90% and 99%, and 21% had a 100% response rate (Figure 10). The highest response rates were recorded among those that used the electronic format, ranging between 75% and 100%. When combined with a paper form, the response rate ranged between 28% and 100%.

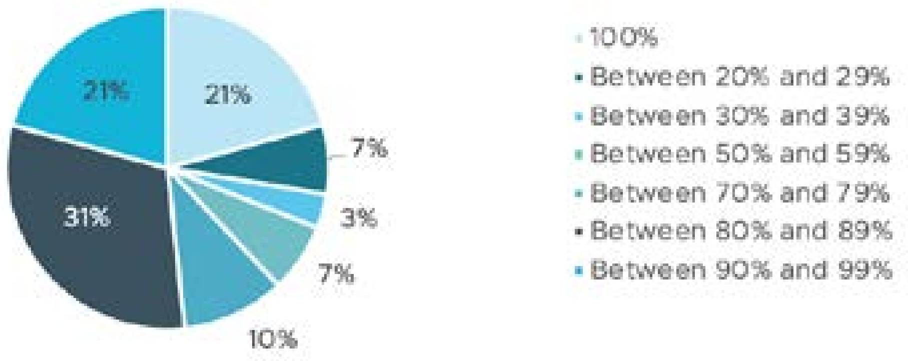

Figure 10. Surveys Response Rate (%)

The time taken to complete the questionnaire varied significantly between the surveys, ranging from 15 minutes to 16 hours. Only 19% required less than 30 minutes to complete the survey, 23% required between 30 minutes and 1 hour, 35% required between 1 hour and 2 hours, while 23% required more than 2 hours to complete.

Information collected from the survey is mainly on energy consumption, sources, and uses, followed by non-energy uses, production by type of product, electricity generation, age of equipment in the facility, and air emissions. Moreover, information on electricity consumption, the amount of power delivered to consumers, adopted energy efficiency measures, and industrial activities was also collected from the surveys.

Twenty of the surveys identified were mandatory, while the remaining 15 were not. In addition, more than half of the surveys were conducted on an annual basis; others were conducted with no regular survey cycle; they were conducted every two, three, or four years, conducted only once, or conducted on a monthly basis (Figure 11).

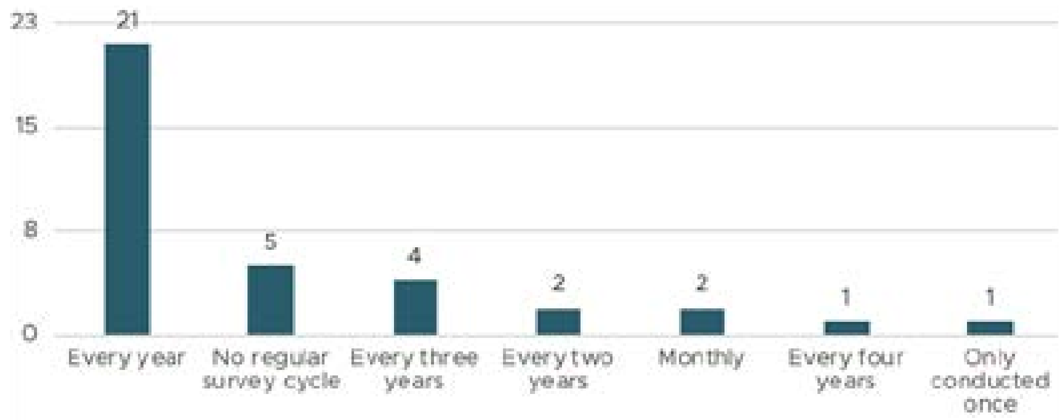

Figure 11. Frequency of Conducting the Surveys

Seventeen surveys did not provide any incentive for respondents to participate in the survey, while the rest provided non-cash incentives (n=3), charged a fine for failure to respond (n=7), or provided respondents with free access to statistics and annual reports (n=1) – which is also a type of in kind incentive (Figure 12).

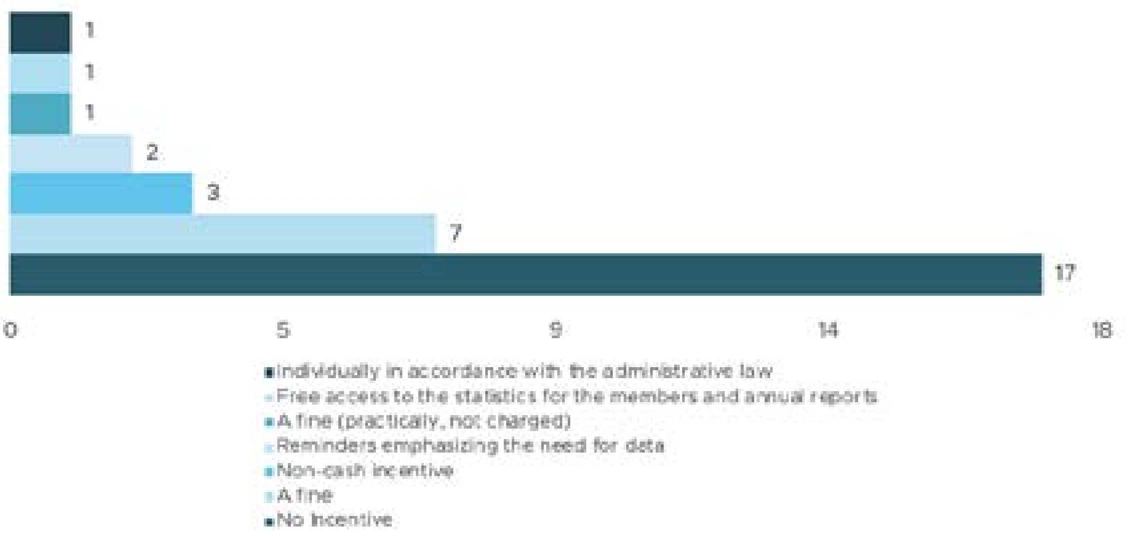

Figure 12. Incentives for Participation in Survey

The main challenges cited by the surveyors in the data collection process were response quality, incomplete surveys, inconsistent responses, and a low response rate (Figure 13). Quality of interviewing staff, reporting within deadlines, and resource availability of respondents were also cited by some surveyors, but to a lesser degree. Incomplete surveys were the most common challenge cited among those who used paper-based form alone as a data collection method, electronic format alone, and a combination of electronic and paper-based formats. Inconsistent responses and response quality were also common challenges cited among those who used paper-based forms, electronic format, and a combination of both.

Figure 13. Challenges Encountered for Data Collection in the Survey Method

Among the countries that employed a surveying methodology, 48% (n=13) cited incomplete surveys as one of the challenges encountered during data collection. As presented in Figure 14 below, 69% of those who cited incomplete surveys as a challenge were from developed countries, 23% were from developing countries, and 8% were countries in transition.

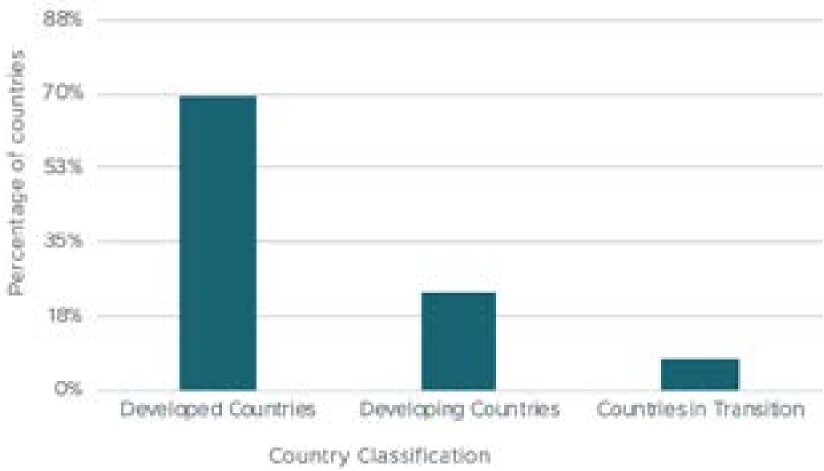

Figure 14. Number of Countries who Cited Incomplete Surveys as a Challenge by Country Classification (%)

Incomplete surveys seem to be a significant issue that should be tackled at the design stage of the data collection programs adopting this methodology. Furthermore, developing countries have seemingly done very well in managing the data collection process using surveys.

A list of recommendations and key best practices that were proposed by the countries identified in the database are presented in Table 3 and Table 4, respectively. These recommendations can guide and inform the development of the tool for energy data collection from the Lebanese industries. The most commonly proposed key best practice was the use of internet-based surveys. Key recommendations include the validation of data reported and increasing sample size.

Table 3. Recommendations to Improve Data Collection Process through Surveys

Recommendations
Data validation
Increasing sample size
Increasing the frequency of the survey
Implementation of a fully automated statistical disclosure avoidance system to protect confidentiality
Working group to discuss ways to improve the survey
Better fund allocation
Carrying out the survey by experienced market research companies
Customized questionnaires for each industry branch
Decrease time period to complete the survey
Detail of “other fuels” question through more targeted field testing

Recommendations
Electronic questionnaire instead of paper
Face-to-face interviews
Fewer revisions of questionnaire
Getting more participants and delivering data faster
Greater emphasis on mandatory authority
Higher level of data cross-checks (validation)
Improved clarity of the questionnaire
Improved communication with respondents
Increasing the time and resources allocated for examining microdata
More efficient follow-up methods
More expertise in energy use evaluation
More frequent direct contact with other industry associations
More resources and expertise in energy use evaluation
Organizing meetings with a working group to improve energy statistics on a regular basis
Reduce redundant information requests or make them on a higher level
Refinement in definitions
Structured content
Use of computer-assisted tools to record the answers directly to the database
Using administrative data to monitor the businesses

Table 4. Key Best Practices for Data Collection Systems in the Survey Method

Key Best Practices
Use of internet-based surveys
Multiple testing of the questionnaire
Additional supervision on the execution of the in-situ surveys
Annual benchmarking and feedback to respondents through online reporting
Carry out the survey annually
Common understanding and definitions through harmonization
Conduct training for data respondents on how to properly fill the survey
Covering the cost of participation can provide an incentive for industries to fill the questionnaire
Data validation

Key Best Practices
Inconsistent and incomplete questionnaires cannot be submitted
Involve all members of the association in the data collection
Involvement of the field staff and related experts
Long-term relationship with energy managers within enterprises of interest
Parallel and immediate data analysis along with data collection help to improve data quality and timeliness
Systematic quality control procedures in all the different data processing stages
The use of a short and simple questionnaire
Using MS Excel to complete the survey
Work with a number of industry associations (for example: use of existing activity-based surveys to validate energy consumption survey)
Working with international experts to improve the national energy statistical system
The use of automated checks in interned based surveys

Case Study: Survey Data Collection Method in Morocco, a Developing Arab Country

In Morocco, the surveying methodology was adopted to collect energy data by the Department of Energy in the Ministry of Energy, Mines, and Sustainable Development. The survey is titled 'Survey of Industry Energy Consumption' and aims to (1) determine the energy consumption by sub-sector and size of enterprise, (2) determine the different uses of these energy consumptions, and (3) determine the energy consumption by process. A stratified random sampling approach was employed; the sample size was 5,000 out of a total population size of 17,081 industrial companies in Morocco. The survey was conducted face-to-face; it was not mandatory; and no incentives were provided for participation. The survey collected data on industry activity, company size, self-production of electricity, industrial process, production, technologies, renewable equipment, and industry energy consumption. It covered the following energy end-uses: 'manufacturing', 'electricity production', 'raw material', and 'other uses'. The survey is not administered on a regular basis. The main challenges cited were the update of the sampling base and the response quality, while the recommendations were mainly to increase the sample size.

It is important to note that the case study of Morocco cannot be applied to any other developing country, such as Lebanon, considering that each country has its specific context (i.e., policy and regulatory environment, challenges, socioeconomic situation, etc.).

A2.1.2. Administrative Sources Method

Besides the surveying methodology, data can be collected from administrative sources which have an already-established database. These databases are hosted by governmental or non-governmental organizations that collect and compile energy data to build energy balances, develop energy efficiency indicators, and for other purposes. Therefore, it is essential to check the available data from these sources before conducting a new data collection process to assess the type of data already available and what is missing in order to avoid duplicating the work. Out of the 33 countries' experiences in the IEA database, 12 are relying on the administrative sources method to collect data for the purpose of building energy indicators.

More than half of the countries utilizing administrative resources are collecting energy data from all the manufacturing facilities (Figure 15 and Figure 16).

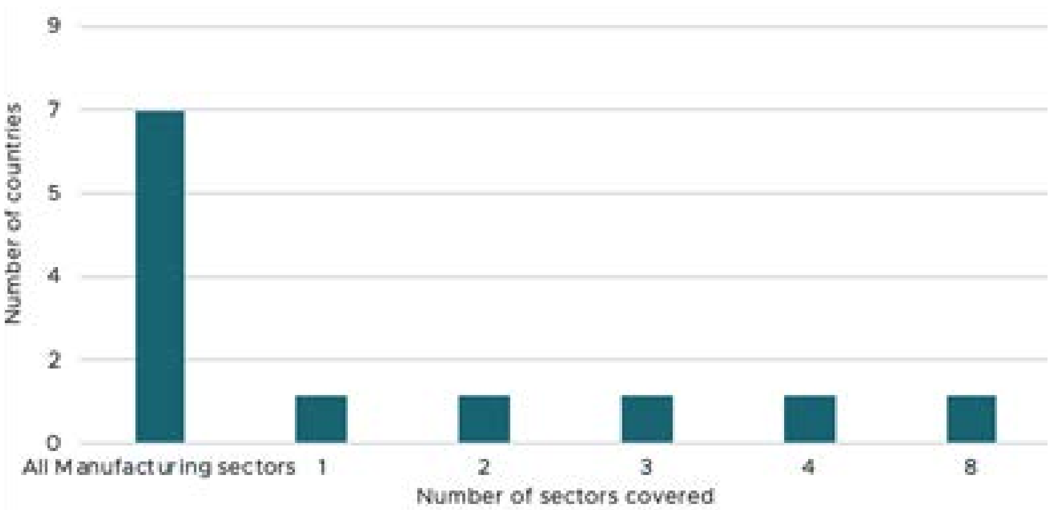

Figure 15. Frequency of Sectors Covered by the Administrative Sources Method

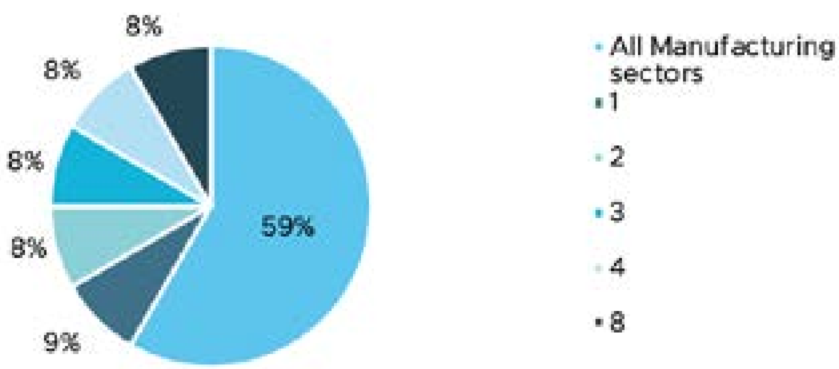

Figure 16. Frequency of Sectors Covered by the Administrative Sources Method (%)

The main purposes for data collection found were:

- Determining end-use energy consumption; and

- Developing national energy balances, which requires a rigorous energy data collection process.

Other reasons for data collection were the development of energy efficiency indicators, calculation of GHG emissions, determining industrial specific energy consumption, and for other reasons listed in Figure 17.

Figure 17. Administrative Sources Method Data Collection Purposes

In order to develop energy efficiency indicators, nearly half of the countries collected data on energy use production activities (Figure 18). These two factors are important in order to develop indicators on specific energy use, which could provide a high level of disaggregation. Specific energy use indicators (e.g., energy consumption per production volume (MJ/kg product)) allow intra-sectorial performance comparisons, within a country or across countries, if proper statistical methodologies are used which take into consideration miscellaneous influencing factors (e.g., weather, production processes, source of energy used, technology, etc.). Other types of data collected included: data on electricity provided by utilities, data on Combined Heat and Power (CHP), process efficiency, and various other data to develop national energy balances.

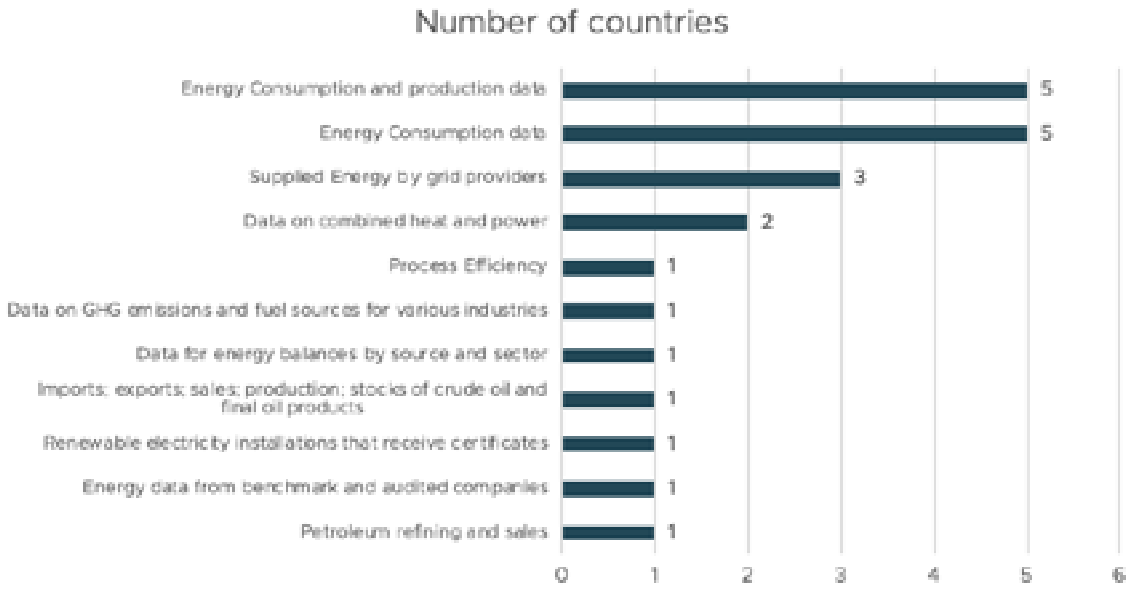

Figure 18. Type of Data Collected from Administrative Sources Method

The administrative sources used for energy data collection varied between countries. Most countries collected data from energy utilities, national statistical offices, governmental organizations, and from the manufacturers themselves – most probably through their associations (Figure 19 and Figure 20).

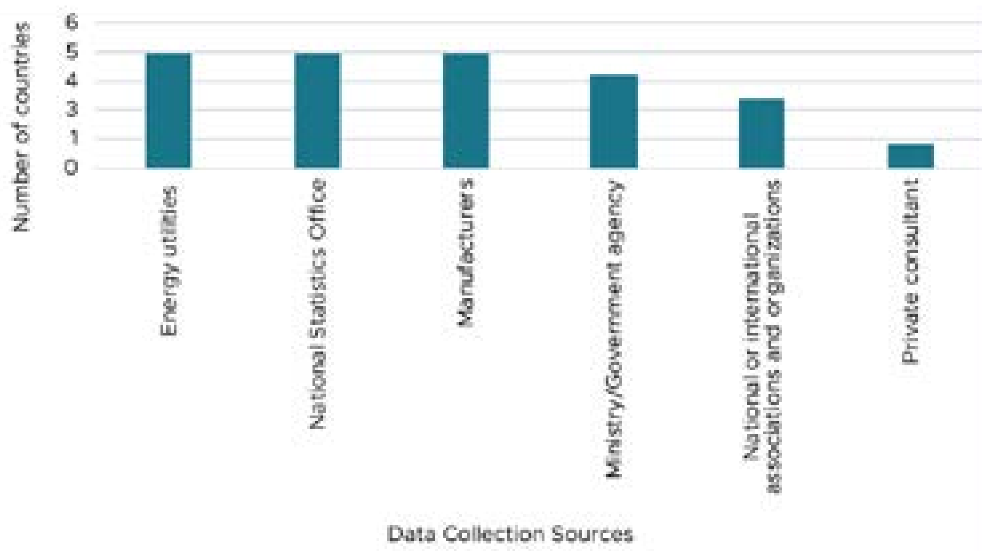

Figure 19. Data Collection Sources in the Administrative Sources Method

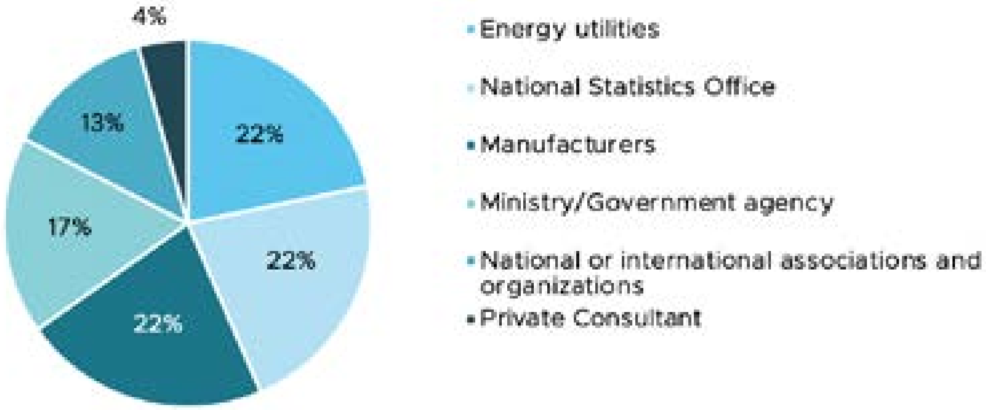

Figure 20. Data Collection Sources in the Administrative Sources Method (%)

The main challenge faced in the process of data collection from administrative sources is the considerable time required to collect the data. Other challenges were: definitions issues within sectors, incompleteness of data, errors, difficulty during data transfer from paper to digital format, and confidentiality issues (Figure 21).

Figure 21. Main Challenges for Data Collection in the Administrative Sources Method

Case Study: Administrative Sources Data Collection Method in Egypt, a Developing Arab Country

Egypt employed an administrative source methodology to collect energy data and aimed to conduct industry statistics. The data was collected from the Ministry of Trade and Industry and the taxes authority. The sources of the data collected were from the factories; the survey where the information was collected was mandatory and industry owners filled them in. The Ministry of Industry administered the survey every six months by email. The main challenges cited was that industries may provide wrong data and they may not cooperate.

A2.2. Local Level

The most relevant and extensive experience in energy data collection in Lebanon is the Ministry of Industry's attempt to establish, among other statistics, a permanent energy data collection system from industrialists. The failure of this attempt characterizes the obstacles any energy data collection program could face in the country and highlights the operating environment in public administrations in Lebanon. This experience has been documented through extensive face-to-face meetings with the concerned individuals at the MoI.

Other relevant experiences are narrated in the following sections, mainly concerning the Ministry of Environment (MoE), the United Nations Development Program (UNDP), the United Nations Statistics Division (UNSD), and the Central Administration of Statistics (CAS), based on face-to-face meetings (MoE/UNDP), remote calls (CAS), and desk reviews (UNSD/United Nations Economic and Social Commission for Western Asia (ESCWA).

A2.2.1. MoI Experience with Energy Data Collection

In 2010, MoI, in cooperation with the Association of Lebanese Industrialists (ALI) and the United Nations Industrial Development Organization (UNIDO), conducted a statistical study on the Lebanese industrial sector. This study was completed in 2007 and covered samples of industries from all industrial sectors and across all Lebanese regions, with the aim of providing quantitative and qualitative data related to the performance of manufacturing facilities, their capacities, as well as their needs and problems. CAS was initially included in the project, but later withdrew; CAS insisted on a full industrial sector survey in order to have a comprehensive baseline on which to build future assessments[3].

When the 2007 'Industrial Sector Statistical Study' became outdated, MoI decided in 2014 to establish a permanent system for information collection from industrialists. As a result, the Permanent Industrial Statistics System (PISS) was created in 2014 and aimed to:

- Accurately quantify the contribution of the industrial sector to the national GDP;

- Determine the number of employment opportunities the industrial sector provides;

- Formulate a better understanding of the hurdles the sector is facing;

- Establish comprehensive and better-targeted policies to ensure the sustainable development of this sector; and

- Guide and inform importers of the addresses of manufacturing facilities and facilitate the export of Lebanese industrial products.

The survey insured the privacy of the individual and private information shared, which is in accordance with the provisions of Legislative Decree No. 155 dating 24/3/1942. The first survey, which was launched in 2015 to cover the year 2013, included a relatively extensive section on energy, requesting information on energy consumption and energy costs per type of energy source used (electricity, fuel oil, diesel oil, natural gas, etc.) and type of end-use consumption (electricity production, boilers, transport, heating, etc.) (Annex B). The survey also included information on the labor force and its distribution by gender, on the cost and volume of raw material purchased, quantity of products in the production phase and in storage, and water consumption.

[3] *Communication with CAS*

MoI included the energy section in its survey mainly at the request of the MoE since the data was necessary to prepare the national communication report for the United Nations Framework Convention on Climate Change (UNFCCC). Nonetheless, the MoE did not follow up on their request and did not collect the data from the MoI – the main reason being that the MoE believed the data lacked accuracy. [4]

To increase the chances of cooperation from the industries in providing the required data, the survey was made to be a prerequisite for obtaining an industrial certificate needed by the industrialists to register their transport vehicles and export their products.

The first edition of the PISS was based on a paper survey form retrieved by the industrialists from the MoI while applying for the industrial certificate. This was manually filled out and submitted back to the MoI. After receiving the filled survey, the MoI transcribed the data into electronic form. Initially, around 70% of the industrialists failed to properly fill the sections related to energy or did not fill them at all. Additionally, a lower portion of industrialists improperly filled the remaining required information. According to the MoI, the main reasons for the aforementioned failure concerning energy data are:

- The industrialists did not know the rating of their electricity subscription with the utility provider (EDL).

- The industrialists lacked sufficient technical know-how in order to understand some of the terminologies in the energy section of the survey, such as kW and KWh.

- They lacked the know-how on how or where to collect the required data, such as their fuel consumption, electricity generation, and consumption. Some industrialists sent pictures of their electricity meters and asked the MoI to find out the subscription rating and electricity consumption accordingly.

- The industrialists aggregated their fuel purchases as one entry in their accounting system. Therefore, it was not possible to get individual purchase data for each type of fuel, let alone the amount of fuel consumed per type. In other words, it was not possible to account for the amount of each fuel type used for electricity generation, steam production, hot water, etc.

- Although electricity consumption from EDL is metered, electricity consumption from the in-house generators is rarely metered.

In the case where forms were submitted back to the MoI incomplete or completely blank, the industrial information department at the MoI had to call back the industrialists and acquire the data over the phone, or the industrialist sent a representative to submit the data. However, in many cases, the representative did not know much about the data required in the survey and therefore provided inaccurate data. As a result, due to these difficulties faced by the industrialists in filling the MoI's first survey for the collection of 2013 data, the industrial information department had a hard time collecting a comprehensive amount of data and analyzing it.

Since most of the surveys lacked any documentation to back up the submitted data,

[4] *Communication with MoE*

such as electricity bills, fuel purchase invoices, or data sheets, the MoI developed an algorithm to validate the accuracy of the data collected. Given the hurdles of the first survey, the year 2013 energy statistics were not published and data collection for the year 2014 was not conducted because the statistics department was overloaded with the collection and analysis of the 2013 data. As a result, the MoI decided to provide the industries with the required certificate even if the company did not fill in the survey form.

To overcome the challenges, the head of the statistical department at the MoI proposed to send the survey ahead of time to give the industrialists some leeway to collect the required data. In turn, the MoI will send an inspector to visit the manufacturing facility to collect and verify the data on-site. This proposal did not materialize because this process required additional human resources, which is not available at the MoI.

Based on the challenges faced and lessons learned from the initial survey, the MoI decided to modify the data required for the year 2015 survey. The year 2013 survey form was the only form to include an entry for energy consumption data because there was no demand for such data, especially since the MoE, which initially requested the information, never inquired about or demanded it. As a result, the statistics department saw no purpose to continue with this process (Annex 2).

For the year 2015 survey, the form was semi-automated; therefore, the industrialists were able to download the form from the Ministry's website and fill it in electronically. However, it had to be printed out and manually submitted to the MoI.

The sections related to employment, production outputs, inputs, and sales were expanded, while the energy section was simplified. As a result, the survey no longer requested data on the amount of energy consumed, but rather, limited the request to fuel and electricity expenditures, knowing that the first survey showed that this information is available in the companies' financial accounts. Furthermore, new information was added concerning the number and capacity (kVA) of Gensets. Data on Gensets was added for two main reasons:

- A program was being proposed to use the available generators in industrial facilities to feed in their excess generating capacity into the utility grid.

- By obtaining information on the generators in an industrial facility, the statistics department could model and verify the diesel consumption for that facility more accurately.

The survey also required data on the availability, type, and capacity of renewable energy at each facility, as well as the percentage share of renewable energy in the total energy consumption of the facility.

Since most of the data collected on energy was based on total fuel and electricity expenditures, rather than the actual amounts consumed, the statistics department used modeling to convert these energy costs into the amount of energy consumed. Although the collection of energy cost data proved to be more effective given that the data was more readily available, the modeling exercise was a tedious task. In specific, the MoI was not able to segregate the fuel consumption for in-house electricity generation and process uses. The MoI believes that it could have been easier and faster to retrieve fuel consumption data from fuel suppliers – who should have such statistics – if the program devised in 2016 for energy subsidies for industrialists was implemented. This is because the suppliers would have been required to keep rigorous accounts of their supplies.

Overall, the year 2015 survey received better results than its predecessor, since confidence was growing with the industrialists. This is because they were becoming more comfortable with the survey and the data collection process, and consequently, they were more willing to cooperate and provide more accurate data. Nonetheless, one of the major issues faced in the year 2015 survey was data reliability. Although the statistics department at the MoI assured the industrialists that the data collected from the survey will only be used for internal purposes to process statistics in the yearly report, many industrialists considerably downsized the amount of energy purchased in fear of taxation by the Ministry of Finance (MoF). Another challenge was that some industrialists performed a dual activity related to both manufacturing and trading, which led to complications in the allocation of the information provided for each of these two activities.

In conclusion, although the year 2015 survey was more reliable and effective than the initial year 2013 survey, albeit less ambitious, it still required a considerable amount of human resources and time to process and model the energy data. For the year 2016, another addition was made to the survey, namely including production activity data. Therefore, non-energy-related data requirements were expanding every year based on the incremental experience obtained, lessons learned, and data gaps. The energy section was practically unchanged, which still focused primarily on collecting energy expenditure data rather than the actual amounts consumed. It is important to note that activity data is an important and necessary step to building effective energy efficiency indicators with a good level of disaggregation, such as calculating energy use per product (quantity, mass, or volume). However, the collection of activity data by the MoI was not intended for energy statistics purposes, but rather, to expand the locally manufactured products database.

In 2017, an expert was brought in from the National Institute of Statistics and Economic Studies (INSEE) – the National Statistics Bureau of France – to help the Lebanese government unify the information and data collection process across the different administrations. Unfortunately, this mission did not succeed due to the lack of cooperation between the MoF and MoI.

In 2018, MoI brought back the INSEE expert to advise on how to improve the PISS. This mission resulted in an improved survey form, which was practically the most advanced considering the general data required, but the energy section remained unchanged. The MoI also met with the Office of the Minister of State for Administrative Reform (OMSAR) to automate the three services offered by the Ministry, namely the industrial registration permit, the industrial certificate, and the PISS. By doing so, the physical presence of industrialists at the Ministry was no longer required to follow up on their formalities. OMSAR promised to automate two of the three services, but the project stopped as a result of the 2019 events.

Due to the economic crisis, COVID-19, and the Beirut Port explosion, the country witnessed a severe shortage in foreign currency required to import raw materials. Consequently, the prevalent concern at the MoI was no longer to obtain data to compute the share of the industrial sector in the national GDP, but rather the sector's import bill and the volume of industrial exports. As a result, the urgency shifted towards collecting data related to the raw material used and imported by industries and the associated nature of production. Furthermore, the lack of resources at the MoI, including a shortage in human resources and burdening office expenses, resulted in a reduced survey format in 2019, which shrank from 12 pages to 4 pages. The survey no longer included any data related to energy – neither consumption nor costs – and focused solely on general information, raw material use, and type of production. In addition, a QR code was added, which when scanned, directs the user automatically to the Ministry's web page where the form could be downloaded.

Currently, the statistics department at the MoI is expanding the Harmonized System (HS) product code. The Lebanese customs HS code is limited to six digits, which does not allow the disaggregation of exports to the product level. Consequently, more than 2,000 items are categorized in the 'other' category in the national custom administration statistics. The MoI is expanding the system to an eight-digit code in order to obtain more accurate information on products manufactured in Lebanon down to the product-level. The current PISS survey is designed for this purpose, and it mainly focuses on products.

The MoI has yet to decide about the future direction for the PISS, which is currently on hold. Apparently, there is an intent to continue with PISS, even in its reduced format.

A2.2.2. MoE Experience

Collection of data related to energy consumption by type, source, and sector is essential for the MoE to estimate the country's GHG emissions accurately and track the progress towards achieving Lebanon's commitment to the Paris Agreement, as mentioned in the Nationally Determined Contributions (NDC). However, the absence of energy data in some categories in official inventories and reports, such as the ones developed by MoE to the UNFCCC, drives the MoI to obtain this data from international organizations, such as the IEA. The IEA mostly estimates or models this data, and the data does not reflect actual figures.

There were various attempts at energy data collection conducted by the MoE that were based on different methodologies and approaches.

First Initiative: Sales Data Collection from IPT:

The first initiative was to estimate energy consumption by collecting yearly fuel sales data (diesel, heavy oil, and LPG) from IPT (network of gas stations). These sales were categorized by consumer type, such as fuel for electricity production, individuals, industries, etc. This data was collected for around three years.

To validate the data collected from IPT on fuel sold to various facilities, a survey was conducted in 2015 to collect energy data from 600 establishments in the commercial and institutional sectors. This data included the amount of heavy fuel oil, diesel oil, and LPG consumed.

Second Initiative: Systematic Questionnaire with the Ministry of Industry:

As mentioned earlier, the MoE requested from the MoI to include data related to energy consumption in the PISS survey that was being developed by the MoI to be filled by industrialists.

The MoE did not follow up on their request for this data because they found it to be lacking in both accuracy and proper verification, which according to the MoE was mainly due to two reasons:

- The individuals filling the questionnaire did not have the required knowledge to provide data on the information requested, and therefore, the data collected was not completely accurate. Sometimes this data was filled in by middle persons who were responsible for acquiring the export permit from the MoI.

- The MoI faced various problems while transferring the data collected from the surveys from their paper format to their digital format.

Third Initiative: Decision 99/1 under Lebanon Climate Act:

In cooperation with Lebanon's Green Mind (NGO), the Central Bank of Lebanon, the Association of Lebanese Industrialists, and the Association of Chambers of Commerce, Industries, and Agriculture, MoE established 'Lebanon's Climate Act' (LCA). LCA comprises a network of companies and institutions engaged in the action against the impacts of climate change and primarily aims at increasing the involvement of the private sector in the fight against climate change.

The Minister of Environment's decision 99/1 on April 2013 provides incentives for the private sector to report their GHG emissions. In exchange for their cooperation, reporting companies are awarded a reporting certificate signed by the Minister of Environment. As mentioned earlier, the MoE utilizes this data to compile and build its national GHG inventory, which is submitted to the UNFCCC. The calculation and validation of GHG emissions from the use of energy require disaggregated data on energy consumption, which is not available in Lebanon. Therefore, Decision 99/1 was considered an attempt to compile this type of disaggregated data.

Under Lebanon's Climate Act, MoE provided a platform that allows industries to showcase their responsibility towards their community. This certification, obtained for participation in this initiative, served as a good incentive for industries that relied on exports, where the certification could serve as a marketing tool.

Prior to the reporting phase, the MoE conducted training for industries and commercial establishments on the reporting methodology, methods to reduce carbon emissions, estimate and mitigate climate-related risks, and develop a climate action plan, which was also considered another incentive for industries to report their emissions. Industries that developed the best climate action plans were given a 'Climate Action Champions' certificate.

The data was mainly collected through excel sheets. Only energy data was required as an input (i.e., energy consumption per fuel and end-use). The associated CO_2 emissions would be automatically generated using built-in formulas. Data was mainly collected on EDL electricity consumption, heavy oil, diesel oil consumption, as well as fuel consumption for transportation. As for the validation process, the MoE required the participating companies to validate their data by certified auditors.

The data collection process from this initiative was effective until the start of the 2019 events (such as the revolution, road closures, political instability, economic turmoil, etc.), where the data collection process stopped due to various reasons, including the following:

- Companies were no longer encouraged to be associated with the Ministry;

- Because of the economic crisis, most of the companies, namely industries, had much more pressing matters than the cumbersome process of collecting data;

- Lack of incentive to collect the required data given that the Ministry also stopped distributing certificates; and

- The crisis was disrupting public administration activities.

Fourth Initiative: Management Information System on Climate Action (MISCA):

The Management Information System on Climate Action (MISCA) is an online platform developed in partnership between MoE and the Ministry of Energy and Water (MoEW), which aims to collect data on different industries and the amount of fuel they import. The data collection process was secured by a Memorandum of Understanding (MoU). The party conducting the data entry and the party validating and publishing the data signed a confidentiality agreement. Only the results of the data were made available online.

The data collection process under MISCA is conducted through three levels:

- Data entry;

- Data validation by the president of the establishment; and

- Approval by the minister and transfer of data to the Ministry of Environment.

Training was also provided for industries and commercial establishments on the methodology of calculating their carbon footprint. A username and password were provided for each industry and were specific for each entry.

However, the main obstacle faced was the change of ministerial cabinet; the MoU was not renewed, and the project was terminated. This raises the issue of continuity and sustainability of these programs when hosted by public administrations.

A2.2.3. CAS Experience

CAS does not collect energy data directly, but rather, it gathers data already compiled by the MoEW and EDL. Nonetheless, CAS does occasionally conduct household surveys, which include data on energy expenditure. CAS faced the following main energy data collection barriers:

- Lack of human resources, technical expertise, and financial resources. Only one person was partly dedicated to energy statistics in the CAS team.

- Reliance on MoEW and EDL to acquire energy data since CAS does not have its own data collection process, and there is a lack of funding to carry out surveys.

- CAS does not have an energy information system; all energy data is stored on excel files. Nonetheless, it seems that CAS is working with the Italian national statistical office (ISTAT) to set up a system.

In 2001, CAS worked on a project with the MoI, in partnership with UNIDO and ALI, which aimed to conduct a census for the Lebanese industries and collect data on a wide range of energy indicators. However, when the government changed, the project was canceled, since the new government did not regard the project as a priority. In 2009, the project was reinitiated, but the MoI took the lead and implemented it on a smaller scale. The outcome of this census did not meet international standards. The MoI asked CAS to be involved in this project; however, CAS refused to take part because they wanted to be involved from the beginning to ensure QA/QC protocols are implemented. Furthermore, CAS insisted that a full census covering all the industrial sectors be undertaken in order to have a solid statistical baseline.

CAS was also previously involved in MEDSTAT, where some energy-related indicators from the EUROSTAT project were requested. However, CAS faced various challenges and difficulties in collecting energy data based on EU and international standards.

Based on their past experiences, CAS highlighted the importance of the following steps for the successful establishment of an energy data collection system:

- A full census of the industrial sector is required as a first step for this project to be able to propose national policies and programs. A phased approach for data collection is not sufficient.

- Online or web-based surveys are not common among Lebanese industries, and therefore, this will present challenges for industrialists in filling the forms.

- The cost of energy monitoring equipment at the industrialists' premises should be included in the budget of the project.

- CAS believes that the timing of the initiative may be convenient in case there is a will to implement structural reforms in the Lebanese government.

- It is crucial to have full consensus on the indicators to be adopted.

A2.2.4. MoF Experience

The MoF interest in energy data is limited to the financial component. Energy expenditures are aggregated in one accounting line, which does not help track energy cost accounting per type of fuel used. Attempts for cooperation between MoI and MoF on energy data collection have been unsuccessful.

A2.2.5. MoEW and EDL[5]

MoEW mainly collects data on electricity and petroleum products. Although the MoEW has the advantage of having an appropriate legal mandate to collect energy data from various administrative sources, it lacks the required human and financial resources.

Conversely, unlike the MoEW and other governmental agencies, EDL has adequate human resources for data collection and aggregation, knowing that data on electricity consumption from the grid is necessary for EDL to conduct a proper billing system. However, EDL does not provide 24 hours of electricity supply, and consequently, its data represents only a portion of electricity demand. This issue is even more relevant nowadays, since black-outs in most regions in Lebanon reach 20 hours, or even more.

As a result, the MoEW and EDL experienced the following identified energy data collection barriers:

- Lack of human resources and proper funding in the MoEW to be able to collect and compile this data. There is no statistical unit in the Ministry; and

- EDL mainly has data on consumers according to the voltage category (Low, Medium, High), and not necessarily according to the class of the consumer (residential, commercial, industrial, etc.).

A2.2.6. UNSD/UNESCWA[5]

Under the scope of the DA10 Program on Statistics and Data and upon the request of the MoEW, UNSD, and the UN Economic and Social Commission for Western Asia (UNESCWA), both UNSD and UNESCWA provided technical assistance by organizing a workshop with key administrative stakeholders (CAS and various government agencies) to assess current practices in national energy data collection and current practices in statistical compilation to build national energy balances. The workshop resulted in proposing an action plan on the measures required to improve the process of building Lebanon's energy balance.

The energy balance should contain information on the end-use consumption of the country (final energy consumption) disaggregated into sectors, i.e., residential, commercial, industrial, transportation, non-energy use, and others. The level of disaggregation of this energy data is not enough to effectively assess the level of energy efficiency achieved by these sectors. For example, no information is given on the type of industry, type of product produced, process used, or technology available in the industrial sector.

The workshop was held at UNESCWA headquarters over a period of five days in July 2019. The main goals of the workshop were to:

- Develop a better understanding of the data required to develop Lebanon's energy balance and the stakeholders responsible for collecting this data;

- Identify gaps in data collection and availability, and measures to mitigate them;

- Improve inter-institutional relationships at a technical level; and

- Better understand how to utilize the energy balance to develop more effective policies for sustainable development.

This technical assistance workshop aimed to optimize the data collection process at the aggregated national and sectorial levels, but the workshop did not target data collection methodologies at a disaggregated level of end-use energy consumption. Nonetheless, the study highlights important opportunities and barriers to energy data collection faced by the main administrative institutions in Lebanon.

The workshop concluded that Lebanon already has a sufficient technical capacity in its administrations to collect and analyze this type of data, there is sufficient access to valuable data sources, and an adequate legal framework is already in place. However, there is a significant deficiency in its institutional arrangements and lack of institutional cooperation when it comes to sharing information.

The UNESCWA, on its own, also collects data related to energy; the data is not collected through surveys rather from:

- Official data sources from National Statistical Office (NSOs), ministries, and UNSD energy statistics questionnaire;

- OAPEC database; and

- IEA database.

[5] *Information sourced from desk review*

UNESCWA data is mainly centered around energy balances, such as energy imports, exports, stock change, transformation sectors, end-use consumption, and non-energy use data. However, they also collect data related to total production volumes by different industrial sectors, including the country's total production of plywood, sugar, wheat, milk, wine, olive oil, etc.

A2.3. Lessons Learned

Many valuable and helpful lessons can be deduced from the national and international experiences in energy data collection from the industry. Below is an analysis of the most prominent issues, both successes and failures, which were identified from the review. Difficulties faced (on behalf of the party responsible for carrying out the survey and the respondents) are categorized in the following sections.

A2.3.1. Incomplete Survey Forms Being Submitted by Respondents

The main reasons behind incomplete survey forms submitted by respondents are the following:

- Absence of a system of 'Bonus-Malus' to incentivize industries to submit a properly completed form:

For example, the MoI delivered activity-renewal or export certificates to industrialists irrespective of how the form was completed (if at all). Conversely, the MoE had a better experience in that regard, where it delivered recognition certificates to companies that adequately reported their energy consumption. Although the contexts of these two experiences are completely different, the effects of the incentives are still valid.

Based on the experience of both these Ministries, incentives may prove vital for the success of this type of data collection. As a result, it is important for the surveys to be mandatory with adequate enforcement, have effective incentives for participants, or both. Therefore, it would have been more effective if the MoI offered an incentive for participants, e.g., a discount on yearly subscription fees for industries successfully filling the survey. Enforcement could be implemented when two or three cycles of the process have been completed, to allow respondents to adapt to the system. In the case of the IEA experience, more than half of the surveys conducted by member countries were mandatory, and only one-third of these mandatory surveys carried penalties. Other methods included multiple reminders and individually pursuing respondents. In some instances, non-cash incentives were provided to respondents, e.g., a promise of a final report including answers from all the respondents.

- Lack of resources and qualified personnel on the part of the respondents and poor understanding of the terminology used in the survey form:

This shortcoming was probably the most important factor that contributed to the failure of the MoI's energy data collection. One prominent example was the experience of the MoI for the year 2013 survey; many industrialists did not know what kW and kWh denoted – most probably because a technical person was never consulted at the time of filling-in the form. Many industrialists lacked sufficient technical knowledge to understand the meaning of the required data, or how to acquire them. Industrialists sent the reports to Ministry clerks, who were not knowledgeable about energy data, to fill in their forms. Furthermore, industrialists did not even know how to take electricity readings from the electricity meters. Instead, they sent pictures of the meters. Very few industries submitted segregated fuel consumption data because most of them do not monitor energy consumption in their plants. The IEA also indicates that it is necessary that staff responsible for filling out the surveys properly understand all the terminology to be able to perform this task with minimal error and to provide the correct documentation.

A comparison between the MoI's and MoE's approach was made to tackle the aforementioned issue, while acknowledging the difference in contexts. The MoE conducted training for industries and commercial establishments on the reporting methodology before launching their energy reporting program. The MoI did not offer this kind of training, and consequently, industrialists were not able to provide accurate information; they did not understand and/or did not know where to find the required information.

- *Complexity of data requirements:*
This issue relates in large part to the previous item. During the year 2013 survey, MoI requirements regarding energy data were very ambitious, and included the quantity of energy consumed per source of energy and per use. This proved to be challenging for industrialists; very few were able to submit this data. Consequently, the MoI has spent considerable effort to try to get this data from industrialists. In the following years, the MoI learned from this experience and as a result, it asked for energy expenses only, since these are more readily available as accounting data.

- *Survey form format (electronic vs. paper form):*
This factor highlights the impact of the lack of resources. In its first survey (for year 2013), the MoI relied solely on a paper format; this has proven to be very tedious and exceeded the statistics department's capacity to process the submitted forms, especially since the respondents had to attend to the Ministry to submit the form.

A2.3.2. Low Response Rate

The issue of a low response rate shares the same root causes mentioned in the previous section, in addition to the following:

- *Ineffective communication between the system host and the respondents:*
The party that is sharing the data needs to clearly know for what purpose the data is being shared and under which conditions. During the field survey conducted for the purpose of this report, many industrialists that participated in the MoI energy data survey were not motivated to enter a new program because they never knew why the MoI asked for the data and what it was used for. This may prove to be a major hindrance for any future data collection program with industrialists. Apparently in 2014, it was not made clear to the industrialists that the energy data collected was used to create the PISS.

- *Energy component share in input of respondents is negligible*:
Many industrialists who were interviewed during the field survey stated that they were not able to respond to the MoI survey because they did not keep record of their energy use; it represented a negligible portion of their expenses.

A2.3.3. Poor Data Quality

The issue of poor data quality can be attributed to the following causes:

- *Lack of good understanding of terminology, energy market and the industry among the staff in charge of the data collection system, and high turnover among the personnel (IEA 2014).*

- *Lack of resources needed to process and report data on the respondent side (IEA 2014):* In the local experience case, the MoI was never able to segregate between fuel use for industrial processes and fuel use for in-house electricity generation, because industrialists rarely allocated the necessary resources to perform this exercise.

- *Lack of resources needed to collect and process data on the system host side:* According to the IEA, many hosts revert to a paper form instead of an online platform due to the lack of resources, despite the fact that handling data in paper format can be a tedious process. Furthermore, the transfer of data from paper to digital format will almost always generate errors. This was the case with the MoI, which was not able to digitalize the energy data collection process due to the lack of resources. Consequently, the MoI was overwhelmed by the magnitude of the data processing requirements, which were amplified by the limited awareness of industrialists. As a result, the MoI had to downscale its ambitions to match its resources.

The IEA also emphasizes the need for proper documentation and evidence to ensure high-quality data. Although setting up an internet platform might increase up-front costs, it may reduce the long-term costs of the surveying process, since errors are detected quicker and data validation is more effective. Data collection internet portals are gaining popularity over paper-based collection knowing that they offer automatic data-checks and they have the advantage of avoiding human-based data entry errors.

Furthermore, the form itself could include additional explanations on terminology and data validation checks.

The IEA indicates that internet-based data collection portals would enhance data flow quality, since the platform can have:

• Built-in error and consistency checks;

• Easier navigation for industrialists;

• Automatic calculations for reference (such as GHG emissions associated with fuel consumption);

• Elimination of data keying errors;

• Reduced human and financial resources required for manual data entry; and

• The possibility of real-time benchmarking with other stakeholders.

Depending on the degree of complexity, the platform could rely on sophisticated customized systems or on spreadsheets with built-in macros.

- *Mistrust between the respondents and the public administrations and data privacy:* The MoI experienced difficulty with validating the energy data because it was under the impression that most industrialists did not disclose correct energy data in fear of taxation by MoF. Although the MoI is actively trying to gain the confidence of industrialists, it remains to be seen if these efforts will be successful, especially in the present crisis. This factor is of particular importance in the context of Lebanon, and it should be particularly addressed in any future data collection project from industrialists. It seems that without administrative reforms, confidence in public administrations may never be attained.

Lastly, the IEA indicates that in many countries industrialists had data privacy and security concerns. The most convenient solution adopted to address this issue was the signing of an MoU between the sharing party and the party hosting the data center. The MoU will have a clear clause ensuring the security and privacy of the information shared. However, this raises the issue of governance continuity; a change at the helm of the Ministry could impede the continuity of the MoU, where the new minister might opt out of signing a new MoU with industrialists (see also below).

A2.3.4. Data Collection System Sustainability

The data collection system sustainability is challenged by various factors, such as:

- *Discontinuity of programs when administrations change:*
For example, the MISCA program at the MoE; the MoU was not renewed after a change of ministerial cabinet, and the project was terminated. Program continuity is another important issue that should be considered when deciding which party will host the data collection program.

- *Resources availability in public administrations:*
This is a key issue considering that most public administrations are operating at less than 50% capacity and cannot financially sustain normal operations. Many programs in the ministries are on hold, including the MoI PISS and the MoE LCA.

- *Data collection program is not based on clear and specific objectives:*
This is the primary factor that led to the non-success of the energy data collection program of the MoI. The MoI did not define specific objectives for the program, which was carried out in the context of a cooperation initiative with (and upon the request of) the MoE. Given that the MoE could not receive the data, the MoI curtailed the project because it was facing many difficulties with data collection. Had the objectives been clearer and more specific, prevailing problems could have been better addressed in order to continue the program.

A3. Scenario Analysis

It is important to conduct a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis (or any other kind of analysis) that includes different future scenarios regarding how the situation may evolve, given the uncertainty associated with the situation in Lebanon. Consequently, three scenarios are briefly presented with their probabilities of occurrence. This scenario analysis is not based on any in-depth study, but rather on casual observation of how the situation in Lebanon has been developing over the past 10 years (Table 5).

Overall, our estimate is that the probability of success for the implementation of the strategy on a large scale will not exceed 20-30%, if conducted within the coming two years. However, if the aim of the project is to retrieve energy data from a limited sample of industries, then the project could start irrespective of the scenario considered. Although it is important to mention that starting the project on a reduced scale with an elite group of industrialists may not help much in the scaling-up process, because two very different populations are being addressed. This is evident from the MoE LCA experience (Section A2.2.2); the project involved the participation of a number of elite companies which submitted their audited energy consumption regularly. Given that it was limited to a closed circle of industries, there was no project scale-up.

Table 5. Scenario Analysis

Scenario	Description	Probability of Occurrence	Probability of Success of the Project	Comment
Worst case scenario	Situation keeps deteriorating slowly for the coming two years, at least, with minimal foreign aid aimed to keep the country in survival-mode and prevent any serious humanitarian crisis	50-70%	Minimal	In such a scenario, many industries will close and most of those that remain, except for exporting firms, will not be able to be involved in such a project. It is expected that the maximum number of firms which could be enrolled will not exceed 50. In such a scenario, public administrations will most probably not be able to sustain this type of project; it will need to be hosted by a private entity – either an NGO or a program – supported by an international organization
Mid-way scenario	Situation will slightly improve over the coming two years but no serious reforms are undertaken. Limited foreign aid for development will be available without being channeled through public entities, and the country's economic output exhibits significant improvements.	20 - 30%	Minimal	In this scenario many industries will fold and many of the remaining ones, except exporting firms, will not be able to get involved in this type of project. It is expected that the maximum number of firms that could be enrolled will range between 50 and 100. In this scenario, public administrations will most probably not be able to sustain this project even if foreign aid is available. The project will most probably need to be hosted by a private entity – whether an NGO or a program – supported by an international organization.
Best case scenario	Situation will improve greatly over the coming two years; Lebanon will settle an agreement with the International Monetary Fund (IMF) and significant reforms are implemented, foreign aid for development and private investments will begin to flow into the country and economic output will exhibit sensible improvements.	20 - 30%	Good	In this scenario, many industries will be revitalized, especially if a serious investment plan is devised to expand the industrial sector. It is expected that the maximum number of firms that could be enrolled may exceed 300 in the first stage and increase to 500 within three years, provided the proper support programs and policies are implemented. In this scenario, the public administrations selected as potential hosts will most probably be able to sustain such this project.

A4. Energy Performance Indicator In Industry

A4.1. Types of Energy Indicators

In order to develop aggregated or disaggregated energy use performance indicators for the industrial sector, three types of data are required:

- Energy use data (expressed in physical units and/or units of energy);

- Activity data (Physical production output and/ or Manufacturing Value Added (MVA); and

- Energy cost data (in monetary terms).

For practical purposes, energy use performance at the level of the sector, sub-sectors, and plant is expressed in terms of final energy, that is, energy available at the service entrance of the facility.

The recommended unit of energy to be adopted is the kWh, further defined into thermal kWh (kWht) or electrical kWh (kWhe). Care should be taken when using these two units to avoid confusion. Moreover, the Megajoule (MJ) is also currently used, especially when absolute quantities of energy are being expressed.

In Lebanon's case, further complications are introduced when it comes to energy accounting due to the blackouts. There are risks of double-counting, since the fuel used to generate in-house electricity has a final energy equivalent to the fuel used in boilers - which generate steam, hot water or high temperature thermal fluid - or in burners, which generate direct process heat.

Moreover, because electricity is either supplied through the utility provider or generated on site, industries may experience difficulties when energy use performance is compared to international benchmarks. If indicators are used at a national level only, then this could reduce the problem. Nevertheless, when computing energy use performance indicators, the energy conversion efficiency of the in-house electricity generating process should be considered whenever electricity is involved. The source of electricity should be traced back clearly, and the in-house electricity generation process should be separated from the production process at the plant.

For the purpose of this project, the industrial energy use performance indicators are divided into six categories, namely:

1. Energy use indicators (absolute quantities of energy expressed in physical or in energy units);

2. Energy productivity indicators (Manufacturing Value Added (MVA) / energy input, physical output / energy input);

3. Energy intensity indicators (energy input / MVA, energy input / physical output or input);

4. Energy efficiency indicators (energy output / energy input) mainly used at the end-use disaggregated level. Energy output could be under different forms such as electricity, steam, hot water, etc.;

5. Energy share indicators (percentage share of energy in total energy supply or demand); and

6. Energy cost in monetary terms.

The aggregation/disaggregation levels of the energy use performance indicators primarily depend on the availability and ability to collect both energy consumption and activity data. Aggregated indicators serve to provide a general idea on the reasons behind trends in energy consumption in a sector. Disaggregated indicators help provide more insight into the key drivers of energy consumption and as a result feed into policy formation. In general, aggregated energy indicators are more accessible. For example, it is usually easier to access data on national energy consumption found in national energy balances, and it is also easier to access activity data in the country's GDP accounts. Not much can be deduced from these indicators with regards to the level of efficiency or required areas of improvement. Therefore, these indicators are rarely used to compare the level of energy use performance between countries or sectors since they are highly dependent on non-energy related factors such as climate, geography, travel distance, industry size, economic structure, population growth, and the economy's level of development.

Although the development of disaggregated energy use performance indicators requires more human and financial resources, they are essential to measuring the actual level of improvement in end-use energy use performance across sectors, sub-sectors, as well as processes and technologies. This high level of disaggregation makes it more effective for cross-country comparison in relation to the degree of efficiency achieved. Unlike the aggregated indicators, disaggregated indicators are not sensitive to changing economic structures, subsidy levels, or price fluctuations. Below is a list of different energy use performance indicators applicable to the project, presented in decreasing levels of aggregation.

Aggregated energy indicators at the industrial sector level include:

- Total energy use expressed in energy units (MWh, MJ, TJ, etc.);

- Total quantities for each type of energy source (electricity, diesel, renewable energy, etc.) expressed in corresponding physical or energy units, as applicable;

- Share of each type of energy source in total energy mix supply (%);

- Overall energy productivity (MVA / energy use, physical output / energy use);

- Overall energy intensity (energy use / MVA, energy use / physical output);

- Total Energy use per end-use (electric motors, steam, direct process heat, electric generators, etc.);

- Share of each end-use in total energy demand (%);

- Share of in-house generated electricity in total electricity demand (%);

- Share of renewable sources in in-house electricity generation (%);

- Overall energy efficiency of in-house conventional electricity generation (%);

- Total cost of energy in monetary terms;

- Total cost of each conventional energy source used;

- Share of each energy source cost in total energy cost (%);

- Share of energy cost in total cost of inputs (%);

- Energy productivity on a cost basis (MVA / cost of energy);

- Energy intensity on a cost basis (cost of energy / MVA); and

- Share of energy cost in total cost of inputs (%).

Aggregated energy indicators at the sub-sector level:

- Same as sector level indicators but applied to specific sub-sectors.

Disaggregated indicators at the sub-sector level:

- Share of each sub-sector in total energy demand in physical and cost terms (%);

- Share of each sub-sector in source of energy demand in physical and cost terms (%);

- Share of each sub-sector in the MVA (%);

- Relative energy intensity performance (item 1 / item 3); and

- Relative energy productivity performance (item 3 / item 1).

Disaggregated indicators at the industrial firm level:

- Energy productivity (MVA / energy input, physical output / energy input);

- Energy intensity (energy input / MVA, energy input / physical output, energy input / physical input);

- Share of each source of energy in energy supply (%);

- Share of each energy end-use in energy demand (%);

- Process end-use or equipment energy efficiency (energy output / energy input);

- Share of in-house generated electricity in total electricity demand (%);

- Energy efficiency of in-house conventional electricity generation (kWhout/kWhin);

- Share of renewable sources in in-house electricity generation (%);

- Energy productivity on a cost basis (MVA / cost of energy);

- Energy intensity on a cost basis (cost of energy / MVA);

- Share of energy cost in total cost of inputs (%);

- Relative energy intensity performance with respect to the sector of activity of the firm; and

- Relative energy productivity performance with respect to the sector of activity of the firm.

Furthermore, other indicators can be derived through modeling from the energy efficiency indicators, such as CO_2 emissions indicators.

CO_2 emissions indicators at the industrial sector level:

- Overall CO_2 emissions resulting from energy use ($kgCO_2$, tCO_2);

- Specific CO_2 emissions for energy use (kg CO_2 / unit energy use);

- Specific CO_2 emissions for economic activity (kg CO_2 / unit MVA);

- Overall CO_2 emissions resulting from each source of energy use ($kgCO_2$, tCO_2); and

- Share of each source of energy in $CO2_2$emissions (%).

CO_2 emission indicators at the industrial sub-sector:

- Overall CO_2 emissions resulting from energy use ($kgCO_2$, tCO_2);

- Specific CO2 emissions for energy use (kg CO2 / unit energy use);

- Specific CO_2 emissions for economic activity (kg CO_2 / unit MVA);

- Overall CO_2 emissions resulting from each source of energy use ($kgCO_2$, tCO_2);

- Share of each source of energy in CO_2 emissions (%); and

- Share of each sub-sector in total CO_2 emissions.

CO_2 emission indicators at the industry level:

- Total CO_2 emissions resulting from energy use, considering electricity utility primary emissions;

- Specific CO_2 emissions for energy use (kg CO_2 / unit energy use);

- Specific CO_2 emissions for process (energy use / unit product output or material input); and

- Specific CO_2 emissions for economic activity (kg CO_2 / MVA).

Industrial energy efficiency indicators could then be disaggregated from sectorial or sub-sectorial levels to process or equipment levels, where possible. The method of expressing process energy efficiency indicators may vary from one sub-sector to the other; as a result, the type of data required to compute such indicators may be specific to each sub-sector.

Figure 22. Level of Aggregation and Disaggregation of Indicators

As the disaggregation level increases, energy indicators become more industry and technology-specific (Figure 22).

A4.2. Energy Indicators and the MoI PISS

As discussed in Section A2.2.1, the MoI attempted to collect industrial energy data as part of its Permanent Industrial Statistics System (PISS), which was created in 2014. The PISS was not part of an integrated strategy devised by the MoI to improve the energy performance of the industrial sector, but rather it was meant to monitor industrial activity. The energy section was included by request from the MoE; the MoE needed the data to develop the energy accounts for the national communication to the UNFCCC. The initial PISS survey for the year 2013 included the following data requests for electricity and fuel types use:

- Electricity cost and consumption from EDL;
- Natural gas cost and consumption for production processes;
- Gasoline used for transportation and its cost;
- Fuel oil used for on-site electricity production and its cost;
- Fuel oil used for production processes and machinery and its cost;
- Fuel oil used for boilers and its cost;
- Diesel fuel used for on-site electricity production and its cost;
- Diesel fuel used for transportation and its cost;
- Diesel fuel used for production processes and machinery and its cost;
- Diesel fuel used for boilers and its cost;
- Diesel fuel used for heating and its cost; and
- Amount and cost of oils used for lubrication.

Activity data requests relating to the production process included:

- Cost of total production volume that has been sold;
- Cost of total raw material bought;
- Monetary value of products in the production phase; and
- Monetary value of finished products.

The data required for energy consumption included both physical and monetary amounts, whereas the activity data on production included only monetary amounts and no physical data. If the MoI was intent on developing energy performance indicators, the collected data, irrespective how accurate it was, could have been used to develop the following disaggregated energy use performance indicators at the sector level:

- Final energy consumption;
- Final energy consumption per fuel type;
- Final energy consumption per end-use type;
- Share of each source of energy in energy supply;
- Share of each energy end-use in energy demand;
- Energy intensity of the sector based on economic output and/or input;
- Energy productivity of the sector based on economic output;
- Share of energy cost in total cost of inputs;
- Share of each energy source cost in total energy cost; and
- Share of in-house generated electricity fuel cost in total energy cost.

The same indicators could have been developed at the sub-sector and for each industry surveyed.

Only a limited number of indicators could have been developed given the absence of production activity data. However, this could have been an excellent start to build an indicator baseline for the industrial sector and its sub-sectors, irrespective of how effective the sampling process was (more than 1,000 companies were involved).

Other environmental indicators, such as CO_2 emissions indicators, could be derived from the collected data through modeling, and are as follows:

- Specific CO_2 emissions for economic activity (kg CO_2 per unit MVA generated);

- Overall CO_2 emissions resulting from each source of energy use; and

- Share of each source of energy in CO_2 emissions.

For the year 2015 PISS survey, the modifications made were contrasting in terms of energy performance indicators development. The MoI limited the energy data requirements to monetary values; however, it required physical output data for volumes of production per product type and the monetary cost of products sold.

A4.3. The First Energy Indicators Report of The Republic of Lebanon

In 2018, the Lebanese Center for Energy Conservation (LCEC), in collaboration with the Ministry of Energy and Water (MoEW), published 'The First Energy Indicators Report of The Republic of Lebanon'. The publication serves as a tool used to monitor Lebanon's progress towards achieving the goals mentioned in the National Energy Efficiency Action Plan (NEEAP) and the National Renewable Energy Action Plan (NREAP). The study also attempts to gather enough data to develop indicators for measuring energy production and consumption, as well as energy efficiency.

The energy data gathered in this study and the indicators developed mainly represent aggregated national and sectorial energy indicators. Furthermore, the energy data presented in the study does not represent all the Lebanese industrial sectors; it is, however, based on a sample of industries audited by the LCEC. The study indicates that in the industrial sector, on-site generators consume the most energy (61%), followed by thermal energy production (23%), and lastly electricity consumption through EDL (16%). At the industrial sector level, these indicators include:

Energy data:

- Electricity consumption by end-use;

- Energy consumption by end-use;

- Energy consumption in industrial buildings;

- Electricity consumption in industrial buildings;

- Thermal energy consumption in industrial buildings; and

Activity data:

- Gross domestic product (GDP); and

- Manufacturing value added.

A4.4. Baselines and Benchmarks

The primary purpose of an energy data collection system in its initial stages is to construct a set of energy use performance indicators, which could act as a baseline against the improvements achieved in future periods that could be evaluated. This initial set of indicators, or baseline, should be representative of the sector being studied. Baseline indicators are evaluated against a set of benchmark indicators pertaining to the sector being considered. This benchmark represents the best available technology (BAT) or best practice. The evaluation of the baseline against benchmark indicators could help establish distance-to-target values and accordingly policies or interventions to close the gap.

For example, in the MED TEST II program (carried out between 2016 and 2018 and managed by UNIDO), which aimed to improve Resource Efficiency and Cleaner Production in 10 food industries in Lebanon; the energy intensity of one dairy plant was measured at 1.2 kWh/kg of milk processed, while the best practice benchmark for the EU region for that type of plant was 0.8 kWh/kg of milk processed. As a result, the distance to target was 0.4 kWh/kg milk processed or a required improvement of 33%. Energy efficiency interventions were carried out, among others, to improve the energy performance of the plant. In the first phase, the energy intensity was reduced to around 1 kWh/kg of milk processed, reducing the distance-to-target to 0.2 kWh/kg of milk processed. This example could be applied at all levels – from national energy statistics down to the process level. The difference is that on a national level an integrated energy policy may be required to address all aspects of energy use, while at the process level, specific energy efficiency interventions may be required.

Baselines and benchmarks could be updated whenever significant changes in technologies or practices occur, whether at the plant or sector level. Errors when selecting suitable benchmarks include overlooking the operating conditions and nature of the processes of the reference benchmark. In many cases, the benchmarks are generated from activities and operating conditions that are similar to the existing baseline construction setup. This is especially critical for energy intensity indicators, which can sometimes be very misleading because they involve many driving factors.

Referring back to the example of the dairy plant located in Lebanon, its production consists of around 50% white cheese, 25% Laban (yogurt), and 25% Labneh (Greek yogurt). The main energy end-users in the plant are milk pasteurization and cold stores. Therefore, it was not suitable to select the best performing dairy that produces powdered milk or yellow cheese in Northern Europe − where climate is polar − as a benchmark. Instead, a high-performance dairy plant located in Southern Europe that produces pasteurized milk and white cheese was chosen, where the climate is much milder.

The same applies when comparing the energy intensity of national economies; one cannot compare at face value that of Lebanon to that of Lithuania, for example, because of differences pertaining to climatic conditions as well as the structure of their GDPs.

A4.5. Data Quality and Error Analysis for Indicators

There are two categories of errors that could affect data quality in any data collection and processing system: Sampling and non-sampling errors.

Sampling errors are the most common source of survey errors and refer to the variability that occurs by chance when a sample, rather than an entire population, was surveyed.

Data retrieved from surveys based on a probability sample can be used to estimate the standard errors of survey estimates. Currently, the standard errors for most estimates can be readily computed using a software that takes into consideration the survey's complex sample design.

Non-sampling errors consist of four types, namely nonresponse error, coverage error, measurement error, and processing error:

- Nonresponse error is a highly visible and well-known source of non-sampling error. It results from an unsuccessful attempt to obtain the desired information from an eligible unit. Nonresponse errors reduce sample sizes, result in increased variance, and introduce a potential for bias in the survey estimates. Nonresponse rates are frequently reported and are often viewed as a proxy for the quality of a survey (complexity and clarity adapted to the sampled population) or the aptitude of respondents. Nonresponse errors were arguably the MoI's biggest challenge when processing the energy section of the PISS survey. Many industrialists left the energy section of the survey blank, or partially completed at best.

- Coverage error is the error associated with the failure to include some population units in the frame used for sample selection (under-coverage), and the error associated with the failure to identify units represented on the frame more than once (over-coverage). The source of coverage error is the sampling frame itself. For example, the MoI PISS survey had a gross coverage error because the non-registered firms were not included in the sampling frame. These firms represent approximately half of the industrial sector population.

- Measurement error is the difference between the observed value of a variable and the true, but unobserved, value of that variable. Measurement error is derived from 4 primary sources in survey data collection: (1) questionnaire, (2) data collection, (3) interviewer (if applicable), and (4) respondent. These sources comprise the entirety of data collection, and each source can introduce an error into the process. For example, the questionnaire may be confusing or may be asking for the wrong information; data collection could be inaccurate because of a faulty instrument or faulty reading; or the respondent may misunderstand the request and provide the wrong data or may write/key-in wrong values. Measurement errors can sometimes be difficult to detect; however, software programs could be included in web-based applications that could detect obvious errors during data entry or could perform data validation through data checks. The MoI PISS suffered from this error because many respondents entered wrong data out of inexperience or voluntarily in fear of data confidentiality concerns. The more variables an indicator involves, the higher the chances of measuring errors occurrence. A typical example are the complex indicators, such as energy intensity or productivity, which involve two or more variables in a ratio relationship. A simple 5% measurement error in both the numerator and denominator in opposite directions will result in a combined error of 10%.

- Processing error occurs after the survey data is collected and during data processing. These errors range from a simple recording error i.e., a transcribing or transmission error, to more complex errors resulting from wrong conversion factors, formulas, or coding. This type of error is a key concern with paper-based surveys because of the high probability of error when transcribing the data into an electronic format.

The classification of error sources in surveys can assist an analyst in developing methods to compensate for shortcomings in their data.

A5. Field Survey

A detailed, cross-sectoral survey involving a sample of registered Lebanese industrial establishments was carried out over a period of six weeks (21 June 2021 – 30 July 2021). The majority of this sample was selected from a list supplied by the MoI on the most responsive industries to the energy section of the first PISS survey conducted by the MoI in 2015. Most of the firms are also members of ALI. This selection was adopted with the assumption that the industrialists who completed (to a significant extent) the PISS survey form in 2015 are expected to have a relatively favorable response to the present survey. The survey may be able to investigate the potential positive responsiveness of industrialists to an energy data collection system, so far as sample selection is concerned. Industrialist surveys were carried out through face-to-face and remote calls interviews (in roughly equal proportions). Remote calls were conducted for the following reasons:

- Previous contact with industries' management made the possibility of conducting the survey remotely possible;

- Some Industries preferred conducting the survey remotely due to COVID-19 restrictions; and

- Long-distance trips could not be made due to gasoline shortages in the country.

The survey (Annex C) introduced the project and collected information pertaining, but not limited, to the following:

- Industry's metadata (name, contact, number of employees, sector of operation, main products, production capacity, production processes);

- Existing installations and processes (what currently exists and how it performs), contemplated expansion, or replacement of production lines;

- Energy consumption profile of the industry (type of energy used and quantity);

- Why the company uses energy the way it does and main drivers of energy demand;

- Renewable energy generation and co-generation capacities;

- Existing energy monitoring systems and extent of the coverage of production processes;

- Willingness of industry to participate in the energy data collection project;

- Factors that may prevent the industry from installing an energy monitoring system and/or join the energy data collection project;

- Time period over which the industry is able to participate in the data collection project;

- The type of support or incentive the industry may require to install an energy data collection system and/or participate in the energy data collection project;

- Suggestions regarding the most suitable energy data collection tool that could be adopted.

Table 6 below provides a summary of the number of industries contacted and the number of surveys completed. The planned sample size (n=182) represents around 4% of registered existing industries. The sectors chosen and the sample size allocation to each sector are based on the sectors' contribution to the MVA of the manufacturing sector in Lebanon. While it is clear that the sample size may not be statistically significant and may present bias, it does allow for a structured diversity.

Out of a total of 564 industries contacted, it was possible to complete 197 surveys (~ 35%), out of which only 163 surveys were filled by decision-makers, such as owners, partners, executive directors, and general managers; that makes a 29% effective response rate. Out of the 367 industries that were contacted and did not schedule a meeting to fill the survey, around 34% promised to call back but never did, and 24% requested an email explaining the project but also never followed up. The rest, as displayed in Figure 22, were either not interested, not operational anymore, did not reply to phone calls and emails, or had incorrect contact information. The main reasons industries cited for not being interested in participating or responding to the survey are: (Figure 23)

- They don't consider this project as a priority in the current situation, and it is not what the industrial sector requires in terms of support;

- They have previous experience in providing cumbersome energy data to ministries, and they did not obtain any benefit from the process;

- Industries are struggling to continue operating, and they do not have time for these types of projects;

- Due to the economic and political crisis in the country, industries are reluctant to work with government agencies because they claimed that they did not receive any incentives or aid from government agencies to develop the industrial sector.

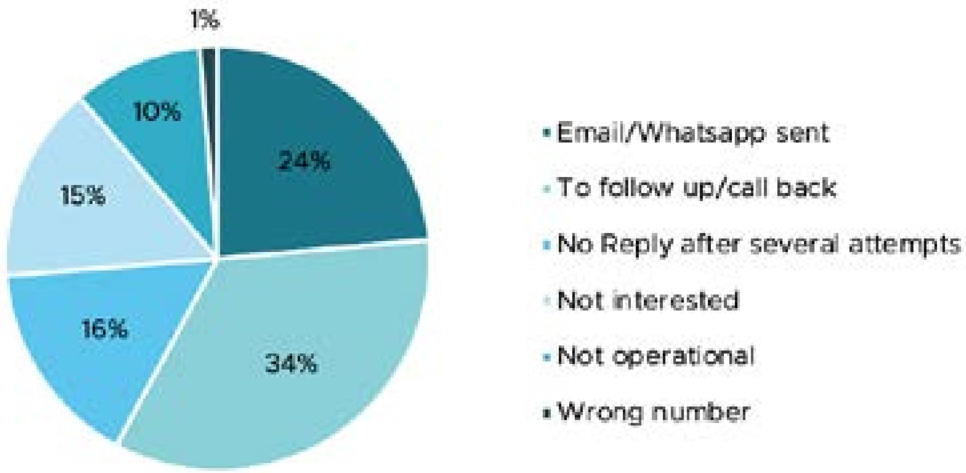

Figure 23. Reasons Why Contacted Industries Did Not Schedule Meeting to Fill the Survey

Given that the most critical questions in the survey – regarding the readiness of industrialists to provide energy data and install meters – required answers from decision makers, only responses received from higher management (n = 163) are considered in the statistical analysis of these questions (see Sections A5.2 and A5.3 below). The statistical analysis for the remaining questions involves the surveys completed by both decision makers and non-decision makers (n = 197), unless otherwise specified.

Based on the above, the survey results presented in this section may feature some sampling error. This error is because the sample is relatively small and may not be statistically significant; therefore, the sample may hold a bias. In addition, the sampled industrialists represent a category of industries (those which responded – to a significant extent − to the PISS energy survey) that are expected to have a relatively favorable response to the present survey thereby having a built-in bias.

Table 6. Summary of Completed Surveys by Sector

Sector		Target	Contacted	Completed by a Decision Maker	Completed by a Non-Decision Maker	Completed by a Decision Maker(%)	Distance to Target
1	Food and Beverage Products	70	152	59	13	84%	16%
2	Other Non-Metallic Mineral Products	35	126	28	5	80%	20%
3	Fabricated Metal Products, Except Machinery and Equipment	15	61	13	3	87%	13%
4	Furniture, Manufacture of Products not Classified Elsewhere	15	44	8	2	53%	47%
5	Materials and Chemical Products	12	48	17	5	142%	0%
6	Rubber and Plastic Products	10	30	11	0	110%	0%
7	Printing, Publishing and Reproduction of Recorded Media	8	40	12	1	150%	0%
8	Clothing, Preparing and Dyeing of Fur	5	28	6	2	120%	0%
9	Machinery and Equipment not Classified Elsewhere	5	14	5	0	100%	0%
10	Paper and Paper Products	4	4	1	2	25%	75%
11	Electrical Machines and Equipment not Classified Elsewhere	3	17	3	1	100%	0%
Total		182	564	163	34	90%	12%

A5.1. General Information about Industries which Responded to the Survey

Apart from the usual administrative information related to energy use, the results presented below highlight the main challenges currently facing the Lebanese industrial sector. These were identified to point out the prospects of success in any future energy data collection program; they also provide background for the recommendations proposed in the next section.

The chart in Figure 24 shows diversity in the industry surveys with regards to their foundation year. The majority of the industries surveyed were established before 1980 (35%) and between 1990 and 2000 (22%).

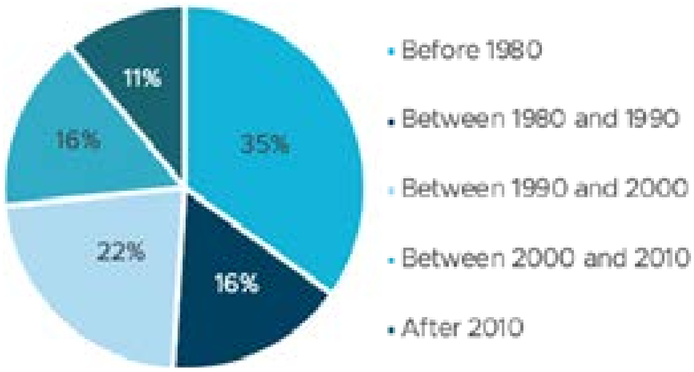

Figure 24. Foundation Year of Industries Surveyed

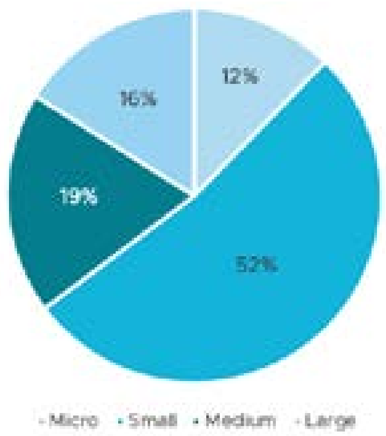

Figure 25. Size of Industries that Completed the Survey

The chart in Figure 25 displays the industries' classification by size based on the following national classification adopted in Lebanon:

- Micro: Less than 10 employees;

- Small: Between 10-50 employees;

- Medium: Between 50-100 employees; and

- Large: More than 100 employees

More than half of the 197 industries that completed the survey were small industries (52%). The Micro industries' share was 12%, while only 19% and 16% were medium and large industries respectively. It is important to note that some of the micro or small industries were recently classified since they lost most of their personnel due to the economic crisis. Figure 22 further illustrates the size distribution of the industries by sector type. Most sectors have a majority of small firms. The Food and Beverage and Other Non-Metallic Mineral Products sectors in particular had the biggest share of micro industries. Large industries were mostly in the Food and Beverage, Materials and Chemical Products, Clothing, Preparing and Dyeing of Fur, and Paper and Paper Products sectors. The shift of the Lebanese industrial sector towards micro and small industries is being accelerated by the economic crisis and crisis associated factors. Industries in the Food and Beverages sector that rely on cold storage suffer the most from the lack of fuel for electricity generation, and as a result, are obliged to curtail production. Many industries have downsized, or have relocated to another country.

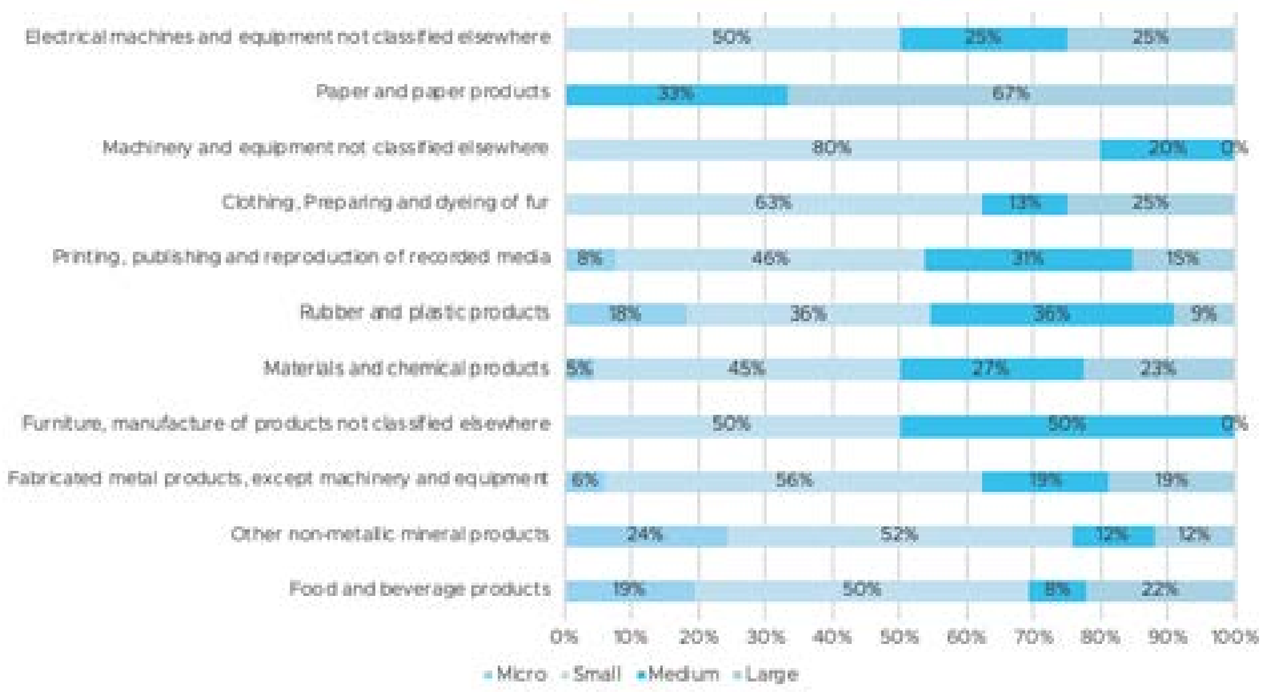

Figure 26. Size of Industries Surveyed by Sector Type

The chart in Figure 27 indicates that 25% of industries surveyed had to cut production between 50-70% in the past two years (2020 and 2021), 34% cut production by less than 50%, and 21% of these industries had to cut production by more than 70%. Only 12% of the industries indicated a stable volume of production, while 8% increased their production (mainly exporting industries).

In the Food and Beverage sector for example, production has decreased significantly due to three main reasons, namely (1) a fall in demand due to the economic crisis, (2) fuel shortages resulting in difficulties in ensuring continuous energy supply, and (3) a decrease in exports to the Gulf Cooperation Council (GCC) countries (mainly KSA) due to both political reasons and KSA's strategy to decrease industrial imports by boosting local manufacturing. The strategy of many GCC countries to support local manufacturing and reduce their imports has impacted industries across various sectors in Lebanon that used to rely heavily on the GCC market for exports. Most of these industries are facing difficulties with finding alternative markets to export their products; the European market, for example, requires a certain level of quality and certifications; these are sometimes too costly to attain for products manufactured in Lebanon.

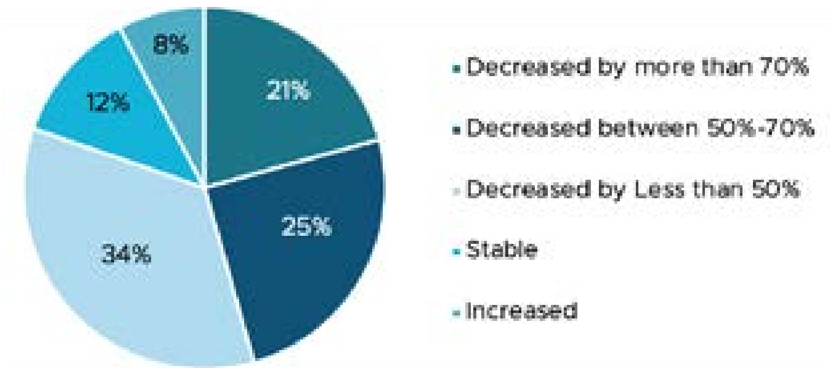

Figure 27. Production Change in the Last 2 Years

Furthermore, many industries have stated that they are facing considerable hurdles with exporting their products. These hurdles include: The long bureaucratic process with ministries and at the port, high costs of shipping from Lebanon, corruption, etc.

Industries have relocated outside of the country because governmental support is more accessible abroad, and it is easier to export. Other industries, such as Printing and Publishing are witnessing a reduction in production, since people are now reading less books and tend to read e-books. As a result, the demand for printed books has declined.

Several industries located in the area of Keserwan, Lebanon, mentioned that they are not able to export their products because they cannot compete with the prices of similar industries in Lebanon. The main reason for this, mentioned by the industrialists, is that industries in the Keserwan area are not benefiting from international incentives and aid that other similar industries, particularly in the areas of Bekaa, North Lebanon, and South Lebanon, are receiving.

The Syrian conflict has resulted in making land transportation of goods more expensive, especially to GCC countries, due to the strict safety and security requirements of the GCC countries. This is a major reason for the reduced competitiveness of Lebanese products. Moreover, although many industrialists have invested into meeting GCC health and industrial standards, other industries do not follow these standards (including legal requirements) and are flooding the market because they are cheaper and can therefore better compete, despite the lower quality of their products.

Forty-six percent of the 197 industries surveyed have previous experience in collecting and submitting energy data; most industries contacted had previously filled the MoI PISS form. Almost all of these industries filled a yearly energy survey form for the PISS, whereas other industries filled energy survey forms less frequently for the private sector for the purpose of conducting energy audits or for renewable energy feasibility studies (Figure 28).

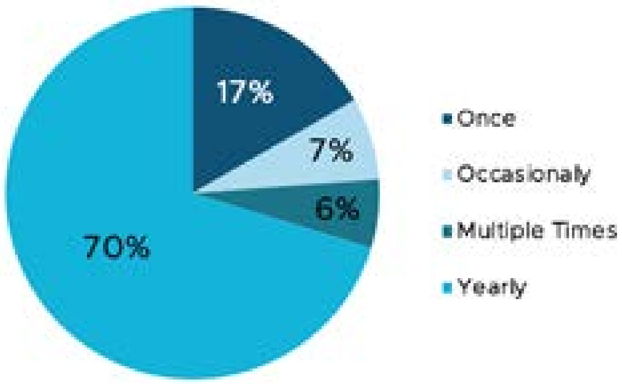

Figure 28. Frequency of Filling Energy Data Survey Forms

The main energy consuming equipment common in all industries were motors, machinery, boilers and refrigeration and cooling, which are displayed in Figure 29. Consequently, any funding or incentive program targeting energy efficiency should ideally focus on these types of equipment in particular. In this regard, more than 60% of the surveyed industries have never implemented an energy efficiency project in their factory, and the 40% that did, mainly focused on changing their old lighting system to more efficient LED light bulbs.

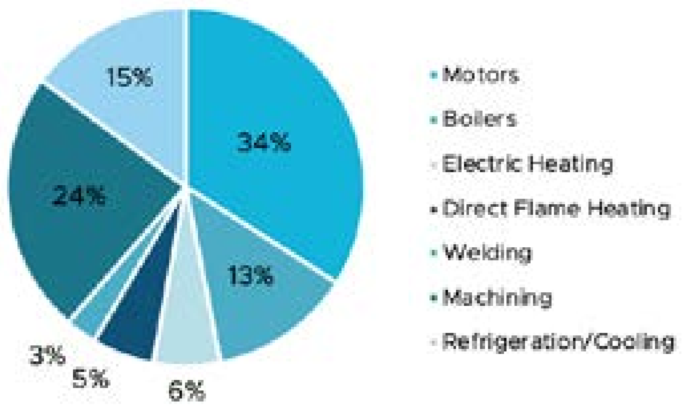

Figure 29. Main Energy Consuming Equipment in Industries Surveyed

The energy sources used in the surveyed industries were mainly electricity from EDL and diesel fuel used for both diesel generators and boilers. Almost all industries are relying on diesel generators to generate their electricity needs due to extensive daily blackouts that are exceeding 20 hours. Only 15% of surveyed industries utilize renewable energy sources, of which 72% used solar PV systems, 21% used solar water heaters, and the remaining industries utilized either biomass or wind energy (Figure 30). Various industries expressed serious interest in investing in renewable energy, namely PV, energy efficiency, and various Resource Efficiency and Cleaner Production (RECP) technologies. Furthermore, due to the increasing reliance on diesel generators – which are operating more than 22 hours per day, particularly in the Food and Beverage sector where refrigeration is required all day – some industries showed interest in installing waste heat recovery systems on their generators to benefit from the wasted heat to cover process heating loads. However, such projects were halted due to financial difficulties.

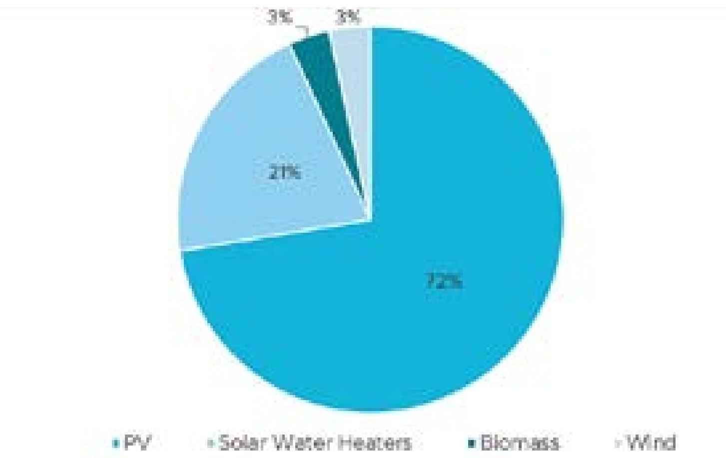

Figure 30. Type of Renewable Energy Utilized

The vast majority of surveyed industries rely on electricity and fuel bills to monitor their consumption and energy costs (Figure 31). This finding indicates the investment and effort needed to establish energy monitoring systems in industries, considering that the majority of the companies that participated in this survey were involved in some kind of energy monitoring activity.

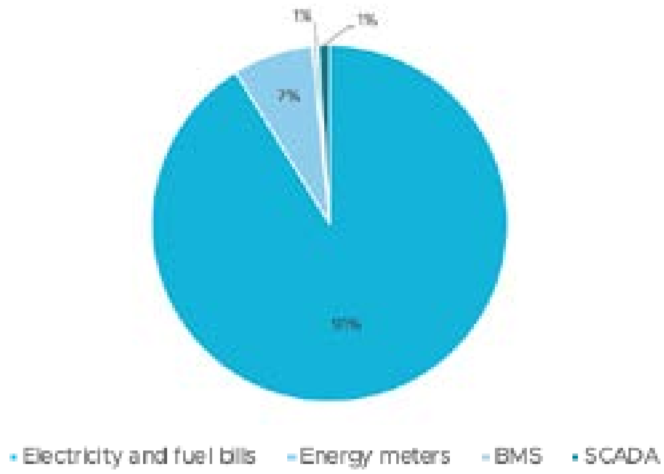

Figure 31. Methods of Monitoring Energy Consumption

A5.2. Challenges Facing Lebanese Industries with Providing Energy Use Data

The main challenges facing Lebanese industries with providing energy use data, as well as the barriers and difficulties that may arise in implementing an energy data collection project, given the country's current situation, are presented in Figure 32. Around 13% of the interviewed decision makers believed that industries should provide energy related data, especially if there is a benefit for them in return. Most of these decision makers did not mind sharing this type of data and did not see a reason why their peers would refrain from doing so. They emphasized that they don't mind sharing this data because they 'have nothing to hide'. The low rate of positive responses suggests mistrust in the system and a lack of awareness among industrialists regarding energy management.

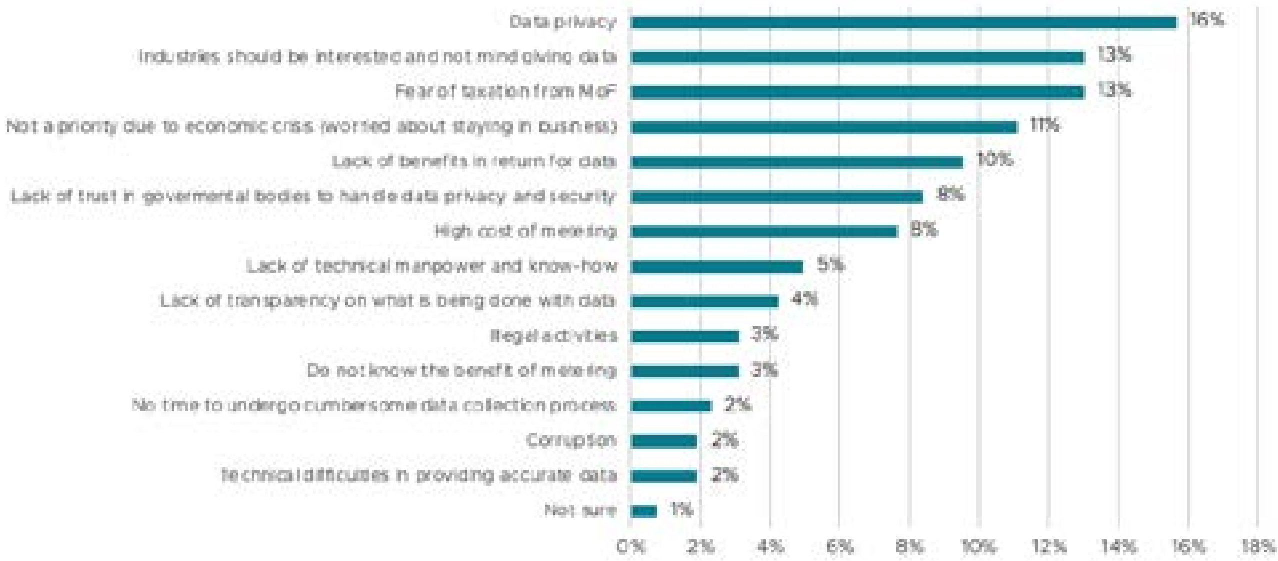

Figure 32. Potential Challenges Facing Lebanese Industries to Provide Energy Use Data

A major concern expressed by industrialists is data privacy, which is mainly due to:

- Fear of taxation from MoF;

- Lack of trust in governmental agencies; industrialists believe that 'sensitive' data provided, particularly data on energy and production, may be disclosed to their competitors. They are concerned that competitors can deduce their level of production from this energy data.

Another common concern for industries that used to provide energy-related data to the MoI and are now reluctant is the lack of transparency in the data collection process and its purpose. From their previous experience in providing energy data to the MoI, these industrialists were not informed of the purpose or outcome of energy data collection and what the benefit was from this process, for both the industries and the Ministry.

Industrialists expressed that collecting this kind of data is a cumbersome process, which requires both time and technical know-how; therefore, if they are not directly involved in the whole process, they are not interested in spending time collecting and providing this data. Consequently, building trust between the party collecting the data and industrialists, and ensuring the security and privacy of their data is critical for the success of this project. There is a common opinion among industrialists that they have frequently provided the MoI with the requested data, but the MoI has not helped them during difficult times, particularly during the current economic crisis. The graph in Figure 33 shows that 29% of industrialists emphasized the importance of funding for implementing energy monitoring systems, while 25% indicated that, in the current situation, they prefer investing in resource efficiency and cleaner production (RECP) or sustainable energy projects, since they reduce energy costs and improve energy security. Finally, 15% believed that installing energy monitoring systems have no benefit to their industry.

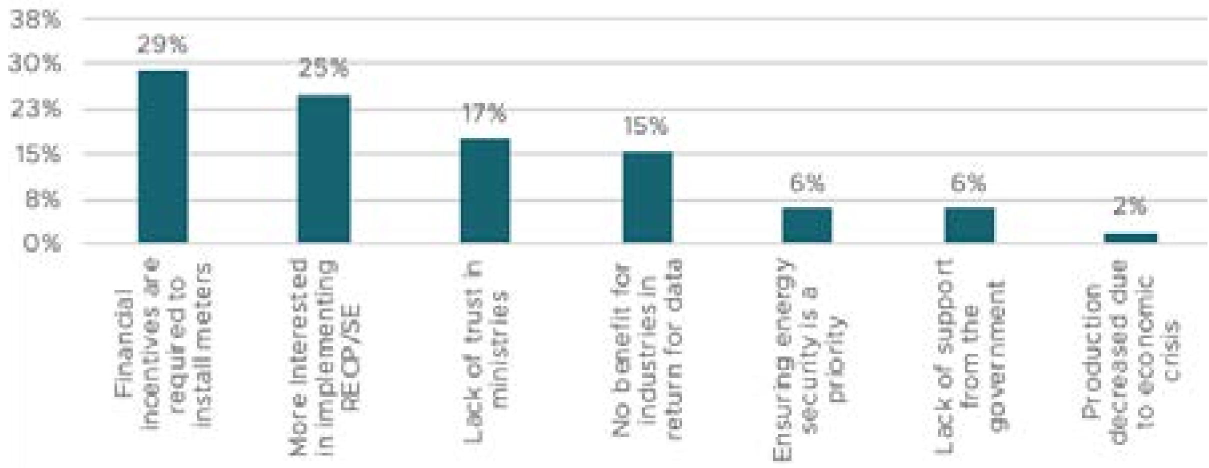

Figure 33. Challenges Facing Industries Surveyed to Participate in this Project

A5.3. Interest in Providing Energy Data

This section, like the previous one, focuses only on the statistical results obtained from surveys filled by decision makers. The analysis will tackle the results for the sample population as a whole and at both the sectorial and industry-size levels. This approach can better guide and inform the design of an energy data collection system. On a scale of 1 to 5 (1 being the lowest interest level), more than 50% of industrialists across all sectors showed interest in providing energy-related data, whereby they submitted a score of 4 or 5. Figure 34 shows that most sectors expressed a clear interest in providing energy data, especially the Materials and Chemicals Products sector and the Machinery sector. These results are expected, given that these two sectors are currently performing well, the former at the local level and the latter when it comes to exports. The least favorable responses are from the Electrical machines sector. Surprisingly, Figure 35 indicates that the micro and medium sized industries showed the greatest interest in providing energy related data. In general, industries' interest in providing energy related data is encouraging, but the sections below suggest that the readiness and ability of industries to install energy monitoring systems and provide process level energy readings depends on the availability of funds at the time of implementation of the project, as well as the availability of financing programs offered for the installation of these systems.

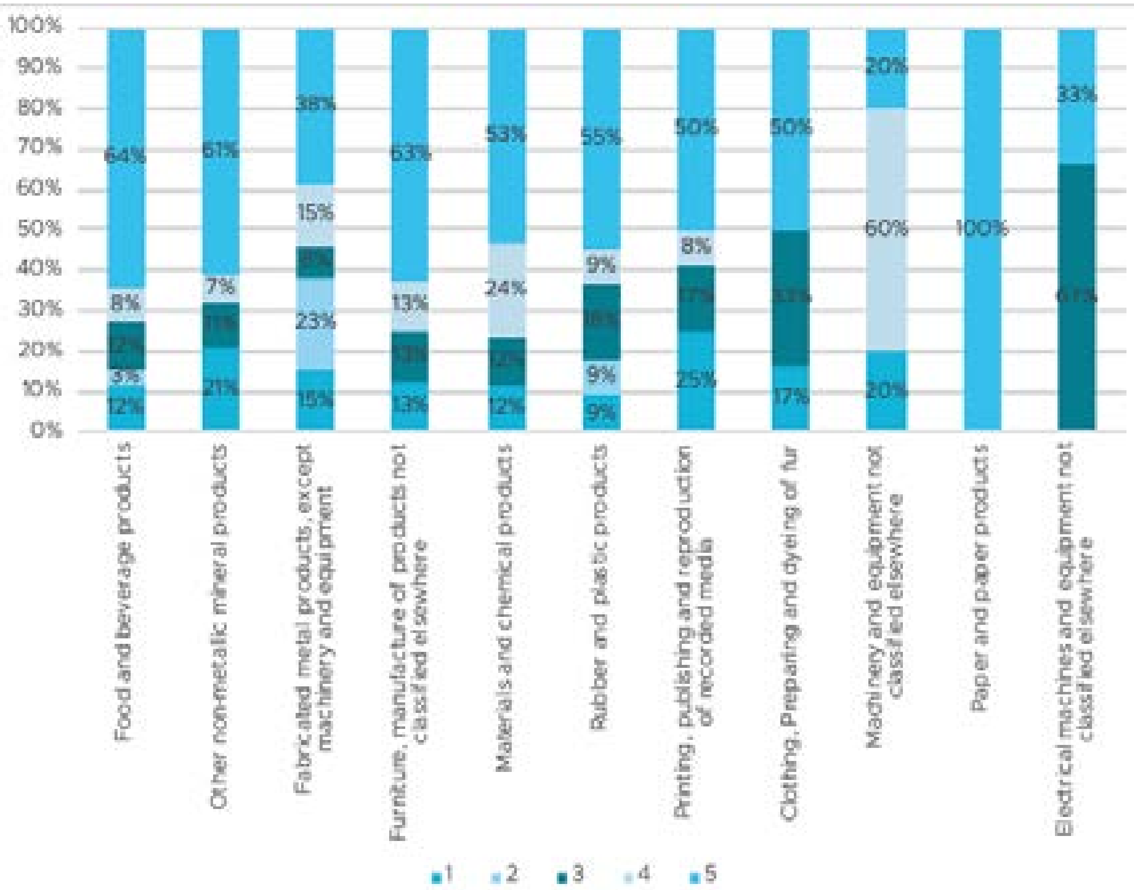

Figure 34. Interest in Providing Energy Data by Sector on a Scale 1-5

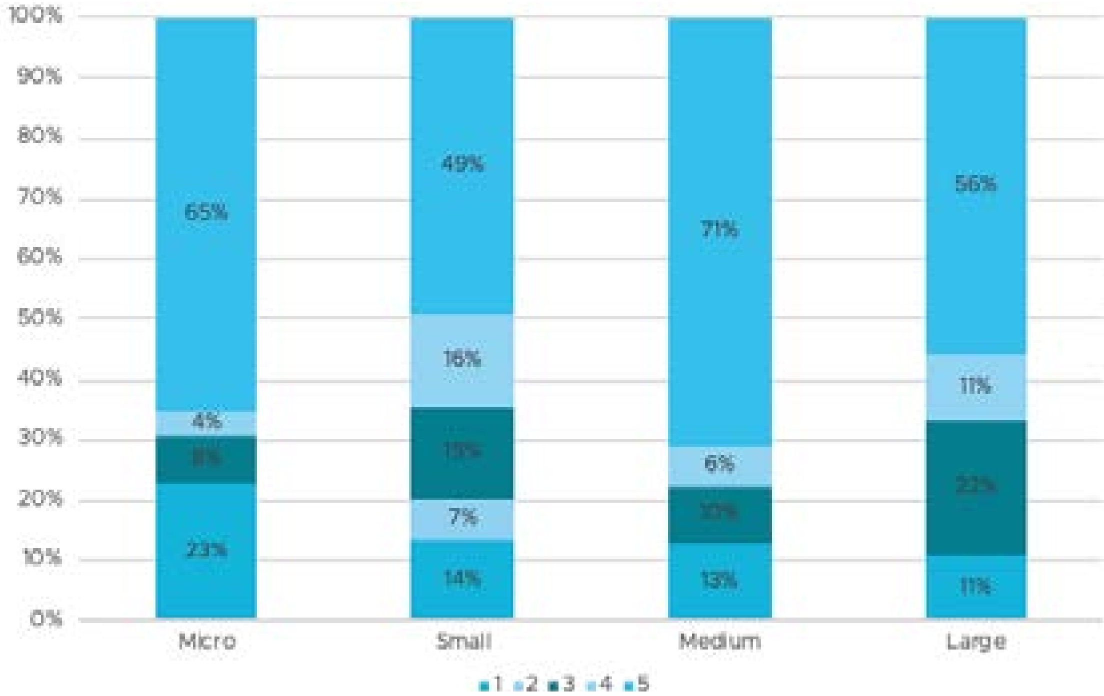

Figure 35. Interest in Providing Energy Data by Enterprise Size on Scale from 1-5

A5.4. Availability of Energy Meters to Monitor Energy

The majority of industries across all sectors (71%) indicated that they have not installed energy metering systems, but rather, they rely on electricity and fuel bills for their energy consumption levels. Figure 36 shows the sectors that had the highest percentage of energy meters installed were the Fabricated Metal Products Except Machinery and Equipment, Other Non-Metallic Mineral Products, and Printing and Publishing and Reproduction of Recorded Media sectors. The Food and Beverage, Paper and Paper Products, Electrical Machines and Equipment, and Clothing sectors had the lowest percentage for the use of energy meters. Industrialists in the Food and Beverage sector believe that they are not energy intensive industries, and therefore, there is no need to install energy meters and monitor energy consumption. Conversely, given that industries in the other three mentioned sectors are struggling to maintain their business, investing in costly energy meters is not a priority for them. Figure 37 illustrates the distribution of the availability of energy meters by industry size. As expected, the large industrial facilities invested the most in energy meters and other energy monitoring systems, while small and micro industries invested the least in these systems. This difference is due to the financial capabilities of large industries (and their ability to make such investment), and that micro and small industries do not always have a good understanding of the benefits of energy meters or the return on investment of this type of equipment.

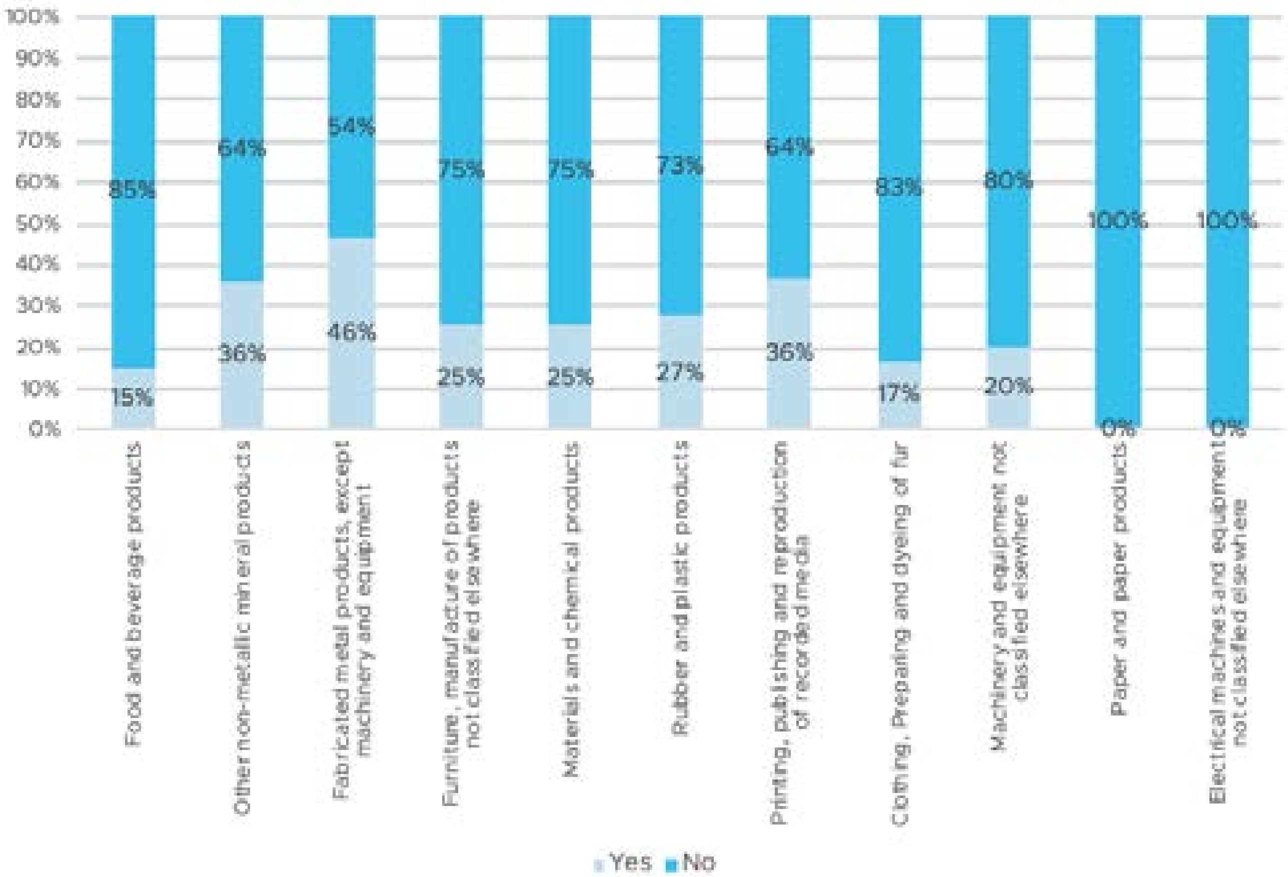

Figure 36. Availability of Energy Meters by Sector

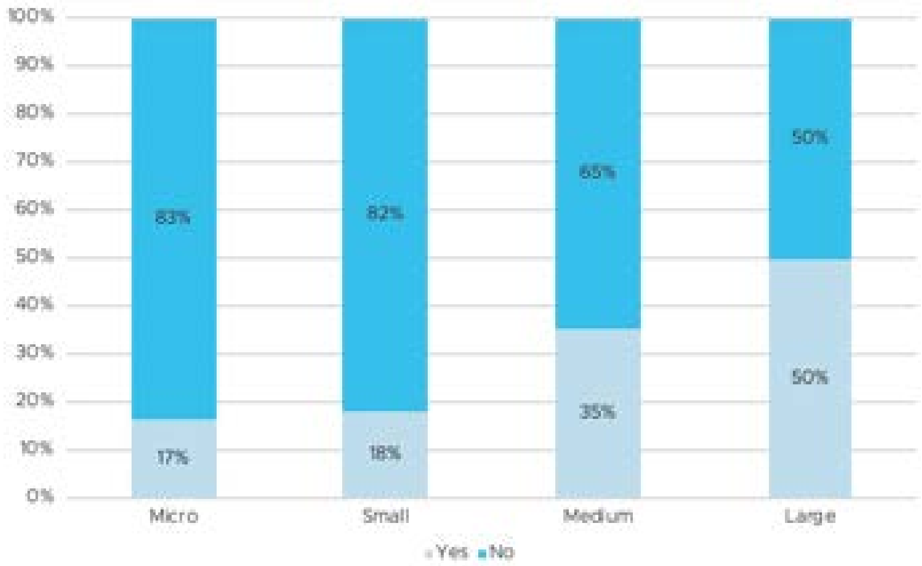

Figure 37. Availability of Energy Meters by Industry Size

A5.5. Interest in Installing Meters

In contrast to the previous section, many industries expressed interest in installing and benefiting from energy meters if the situation in Lebanon improves significantly, and funding for the equipment is available (Figure 38).

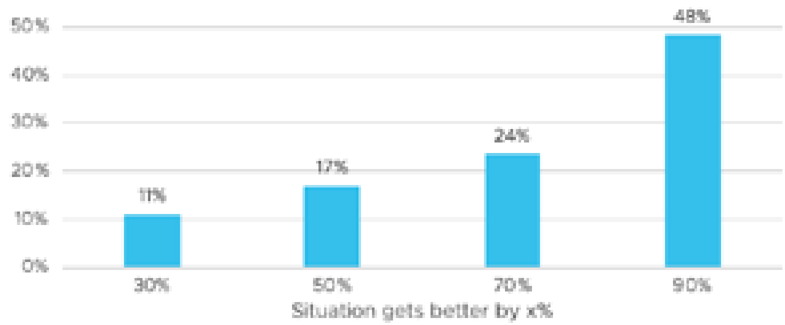

Figure 38. Interest in Installing Energy Meters Across All Sectors

Figure 39 and Figure 40 indicate the level of interest of industries, by sector and by industry size, respectively, in installing energy meters if the situation in Lebanon gets better by 30%, 50%, 70%, and 90%. When briefed on the importance of installing energy meters and monitoring energy consumption, many micro and small sized industries showed interest in installing these systems.

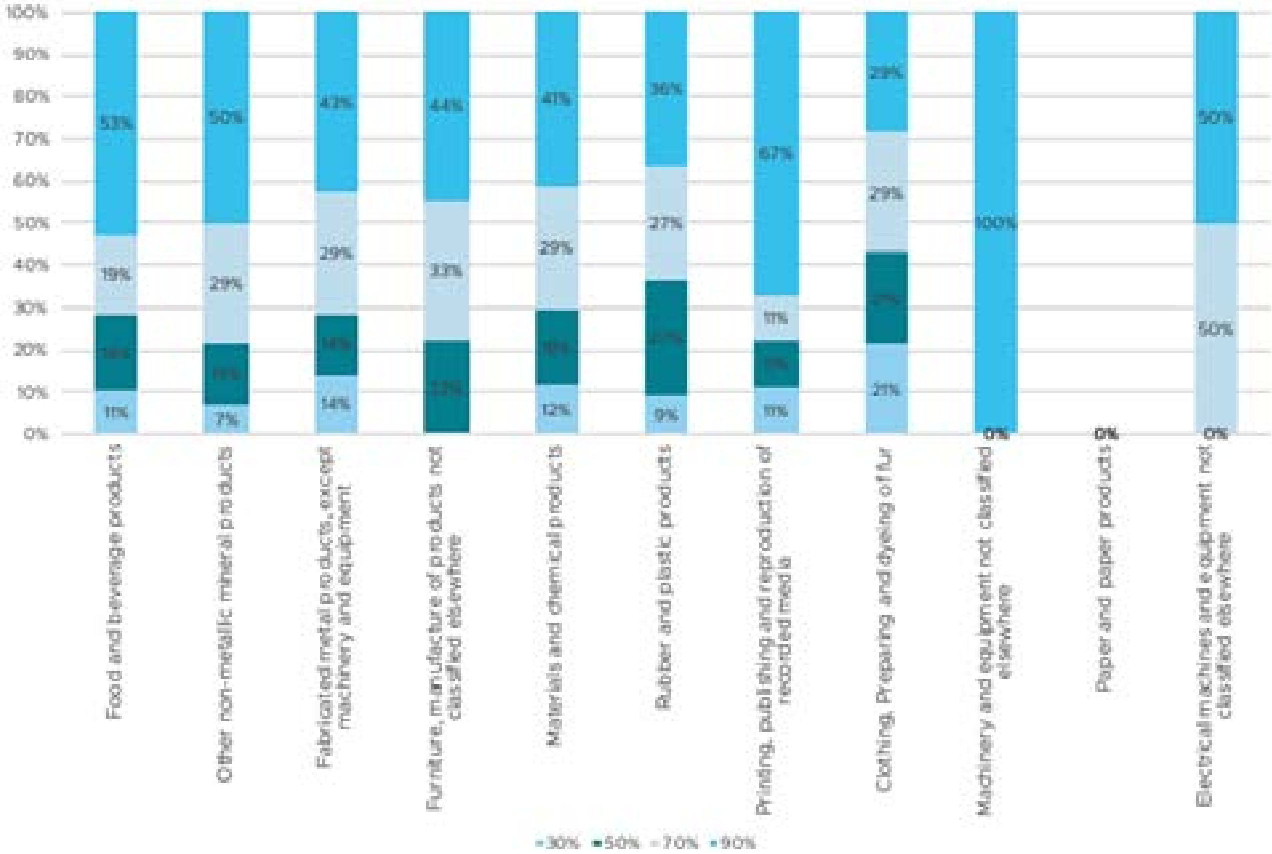

Figure 39. Interest in Installing Energy Meters if Situation Gets Better by X% by Sector

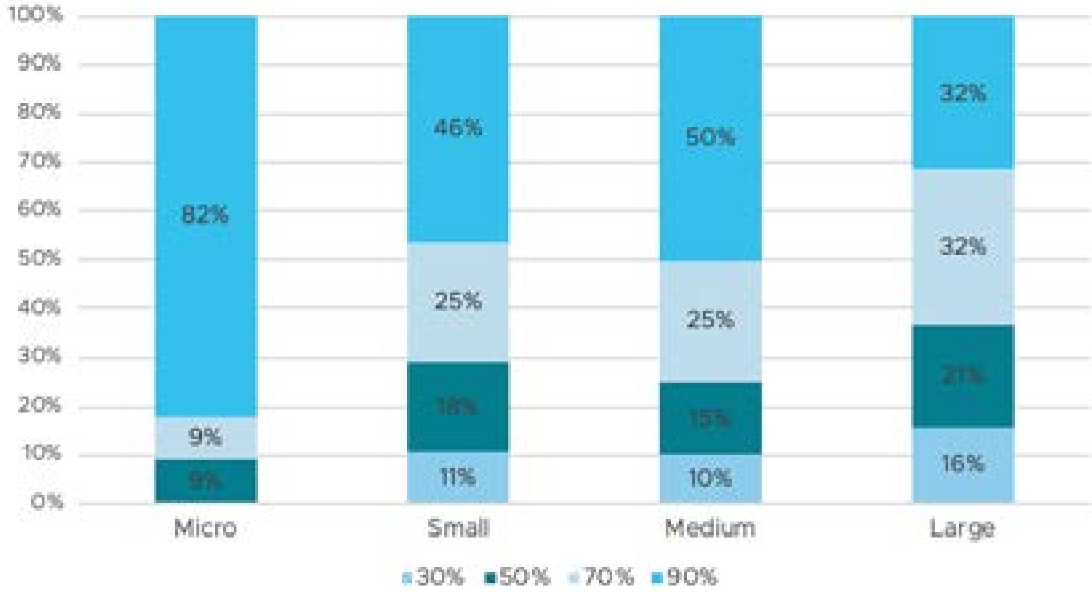

Figure 40. Interest in Installing Energy Meters if Situation Gets Better by X% by Industry Size

A5.6. Reasons Why Energy Is Not Monitored and Major Barriers of Monitoring Energy

This section investigates the reasons behind why energy is not monitored in the sample being studied and the related barriers that prevent industrialists from investing in energy monitoring systems. Figure 41 presents the results across all sectors, while Figure 42 and Figure 43 present the results per sector and industry size, respectively. The most common barriers observed, in order of decreasing importance, were:

- No perceived benefit to install meters or monitor energy consumption in general;

- Financial barriers, investing in monitoring systems is not a priority for their businesses; and

- Installing meters is costly in comparison to the low benefit they would receive in return.

These major barriers were observed across all industry sizes and in most sectors. However, some SMEs did indicate barriers that were not observed with large industries; these included:

- Low energy consumption does not warrant investing in costly energy monitoring systems;

- Monitoring energy consumption through electricity and fuel bills and utility meters is enough for the amount of energy they consume;

- Preference to invest in renewable energy rather than make an investment in energy meters.

Industrialists consider it more important to reduce their bills and maintain energy security, especially given the recent fuel shortages. Investing in meters – whose benefits are not clear to the industrialists – is not a priority for them at the moment.

Financial barriers were cited by almost all sectors and all industry sizes, but more commonly in sectors most affected by the crisis, i.e., the Printing and Electrical Machines sectors. Furthermore, some respondents may not have explicitly referred to the financial barriers and cited other factors in order not to appear in financial distress. Conversely, sectors which are doing relatively well (i.e., the Chemicals sector) did not mention an issue of financial barriers; however, the energy intensity of this sector is relatively low. The industries with the least financial burdens are those that rely heavily on exports.

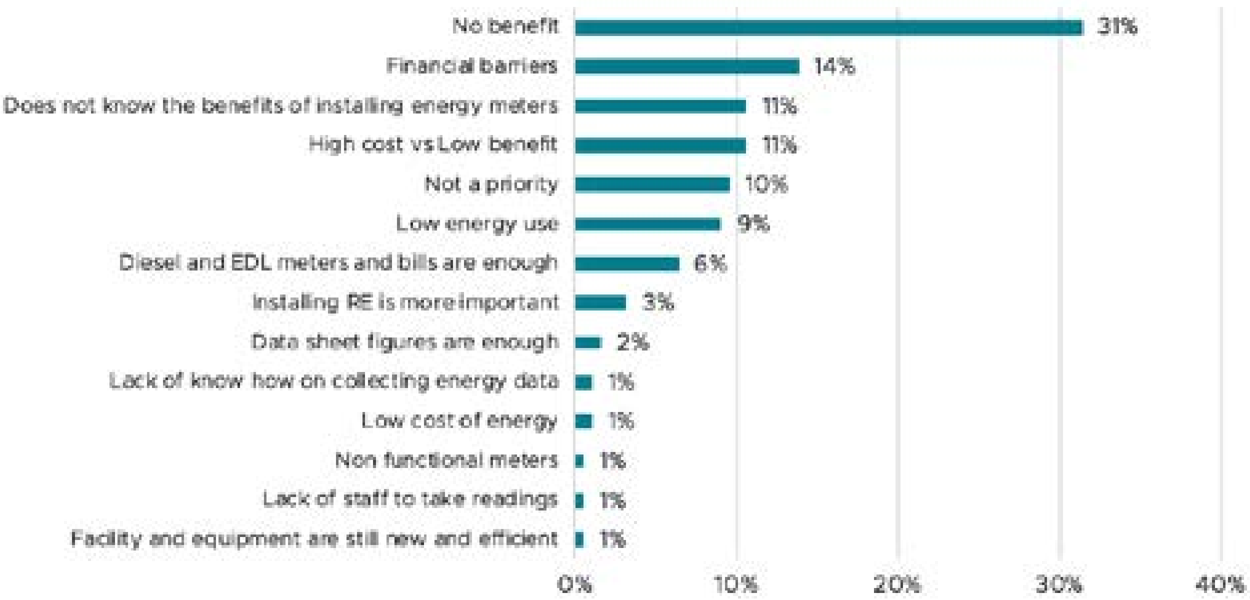

Figure 41. Major Barriers to Energy Monitoring Across Sectors

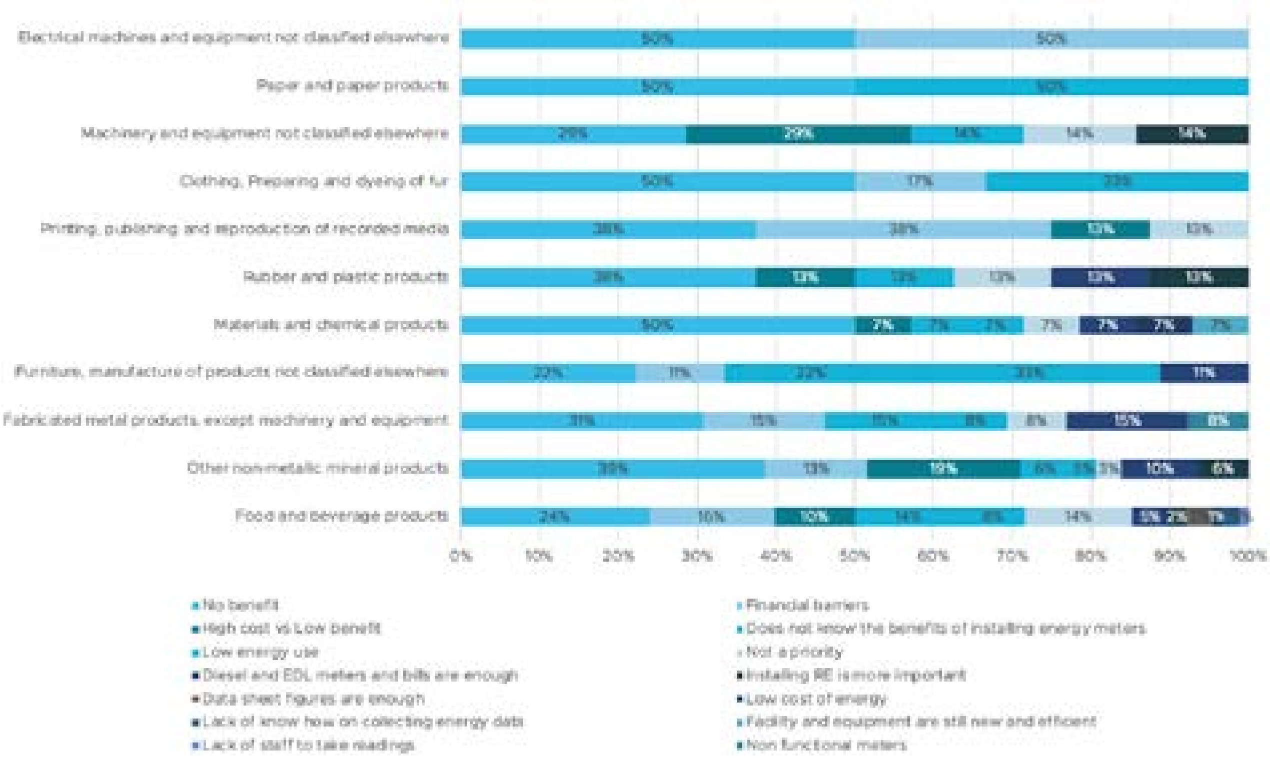

Figure 42. Major Barriers to Energy Monitoring by Sector

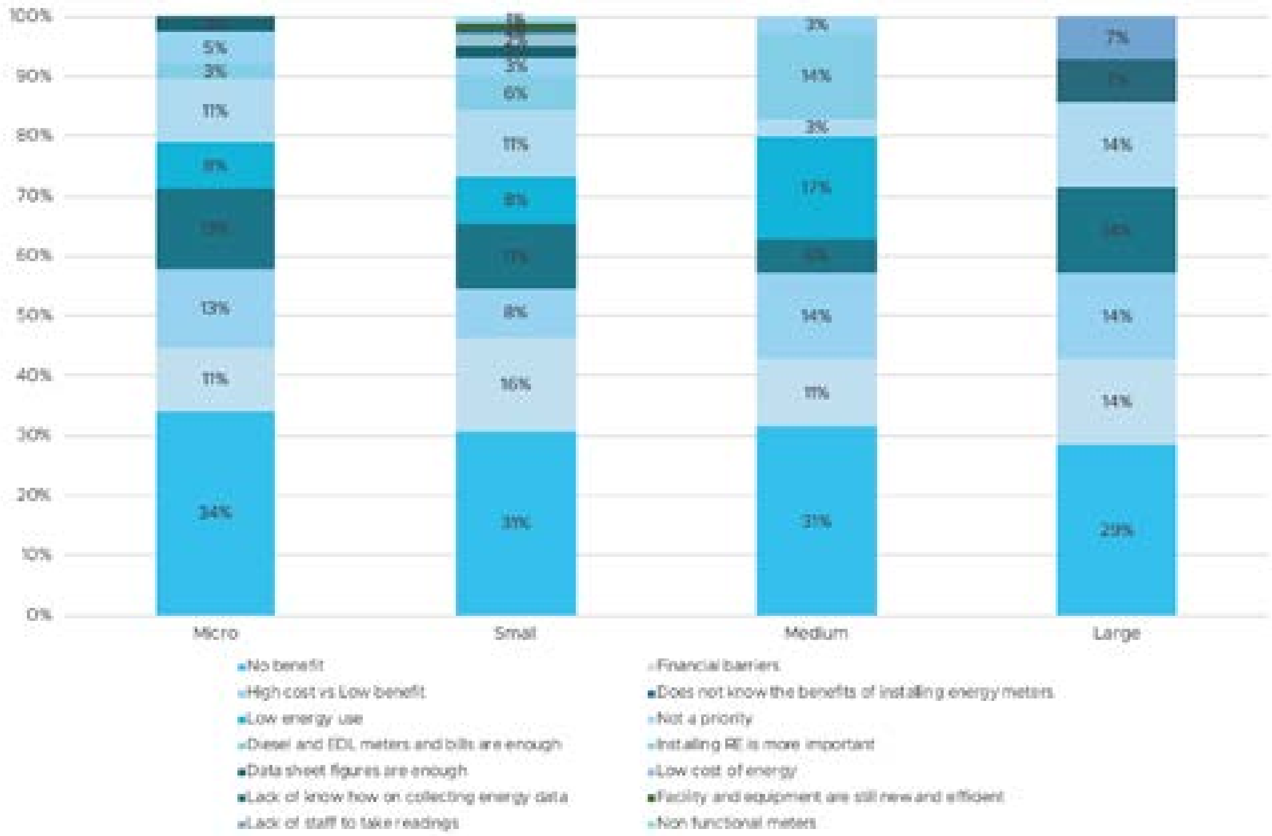

Figure 43. Major Barriers to Energy Monitoring by Industry Size

A5.7. Readiness to Install Process Level Energy Meters

Overall, 38% of respondents expressed readiness to install energy meters at the process level, whereas 62% preferred to limit themselves to electricity and fuel bills. Figure 44 and Figure 45 display these statistics per sector and industry size, respectively. Medium and large industries are more willing to install energy meters and provide energy use data. These statistics will likely increase if funding is available to install metering systems. It should also be noted that the readiness of industrialists to install meters depends on the country's economic situation as well as the availability of capital to implement these projects. All sectors, except for the Paper and Paper Products sector, showed interest in installing meters. However, given the deteriorating economic situation in Lebanon, it is difficult to determine which industries will be able to implement such projects in the near future. The Clothing and Furniture sectors showed high interest in energy metering, despite the fact that these two sectors are particularly hard hit by the crisis; this, however, may be a result of sampling bias in this sector.

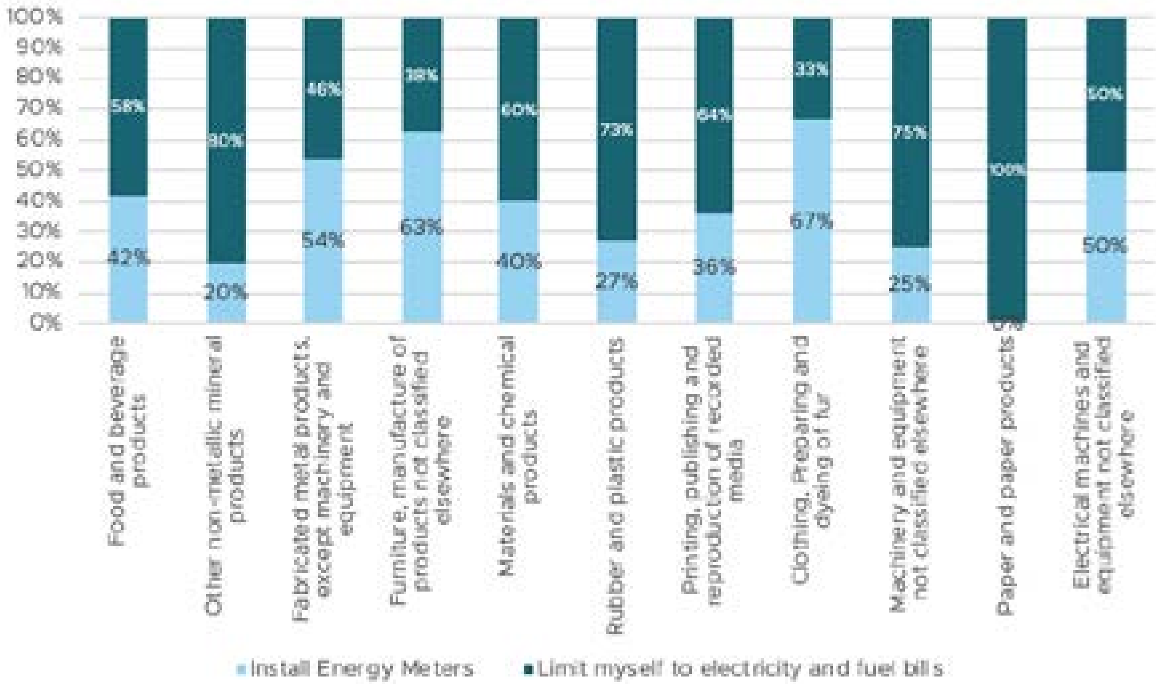

Figure 44. Readiness to Install Process Level Energy Meters by Sector

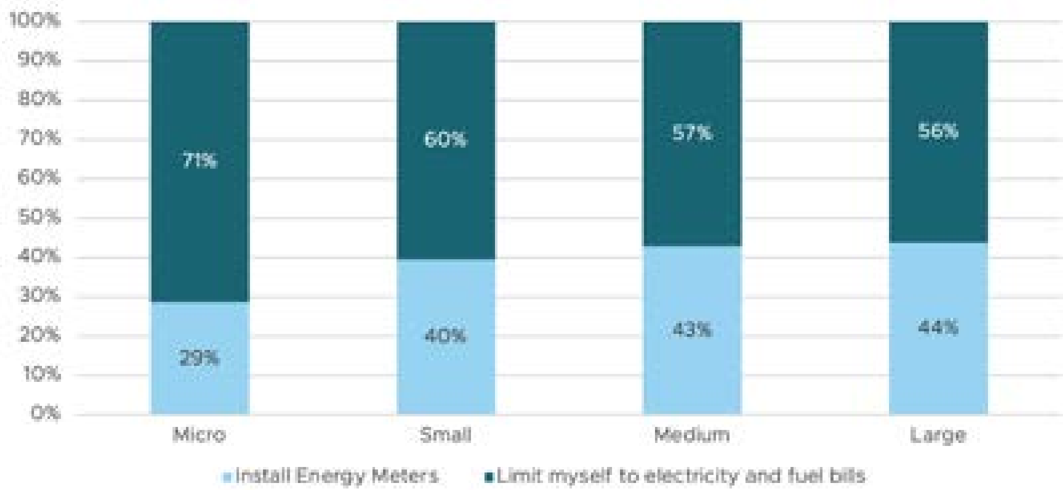

Figure 45. Readiness to Install Process Level Energy Meters by Industry Size

A5.8. Most Suitable Data Collection Method

The most-preferred method for data collection – as chosen by industrialists – is the web-based application survey. Industrialists find this method to be the most convenient, since they can fill the form directly and at their own schedule. Nonetheless, industrialists believe that the web-based tool needs to be well-developed in order not to confuse the participant and to be efficient. The web-based tool would be most effective since it offers the possibility of error checks in real-time, making the data verification process easier and faster. Figure 46 presents the preferences across all sectors.

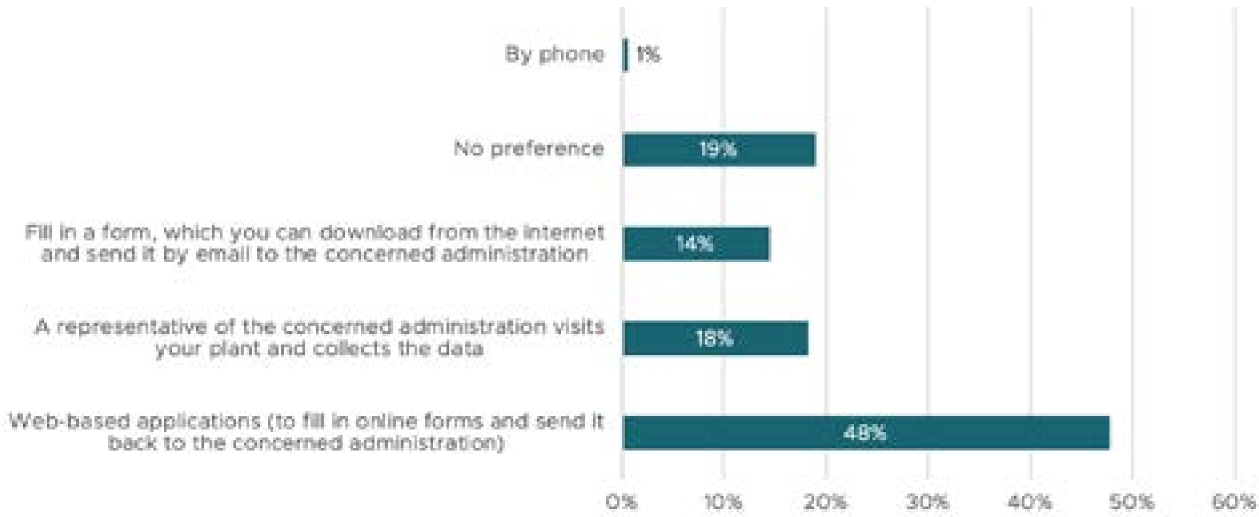

Figure 46. Most Suitable Data Collection Method Across All Sectors

In addition, the second most-preferred method is for a representative of the party responsible for the data collection system to conduct a physical site visit and collect this data. This preference could be because there is more trust associated with providing data in-person, rather than through an online tool.

Figure 47 and Figure 48 provide the same information by sector and industry size, respectively. The site visit method wasmost popular in the follwoing sectors: (1) Rubber and Plastic Products, (2) Electrical Machines and Equipment not Classified Elsewhere, and (3) Materials and Chemical Products sectors. The Paper and Paper Products sector was unanimous in stating no preference for a particular method. Micro enterprises are those that most prefer the web-based application, most likely because it saves time, which is a priority for these resource-limited enterprises.

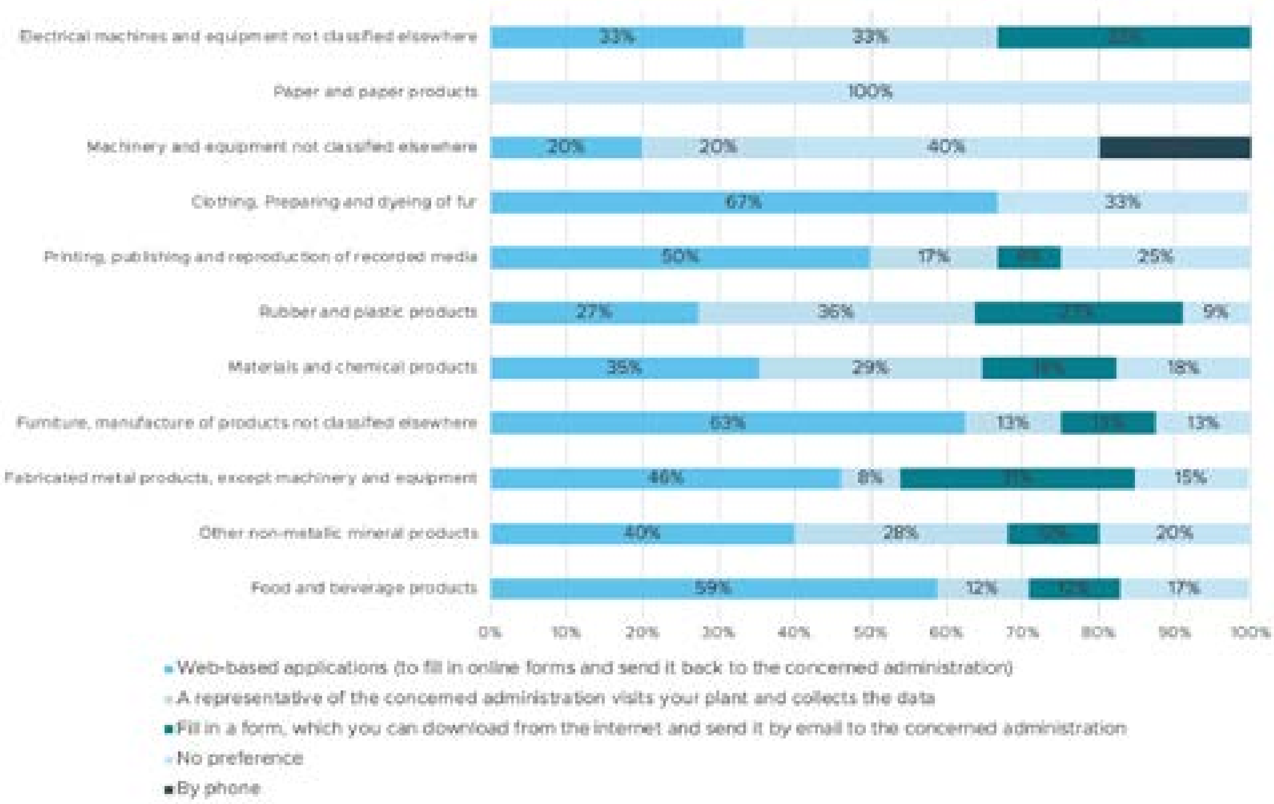

Figure 47. Most Suitable Data Collection Method by Sector

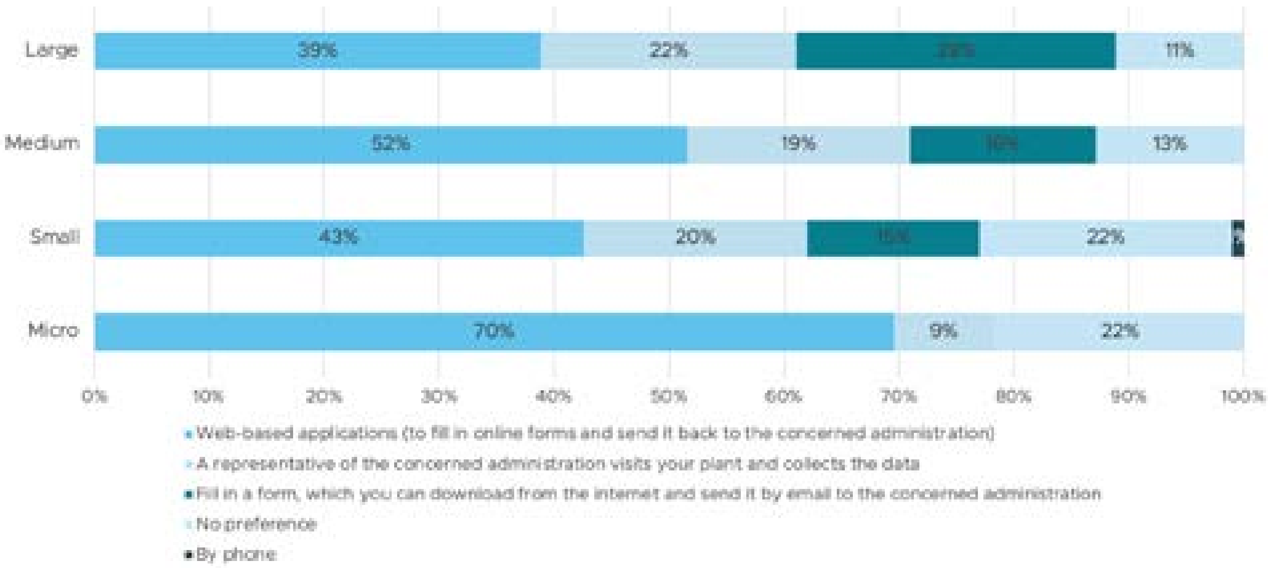

Figure 48. Most Suitable Data Collection Method by Industry Size

A5.9. Most Suitable Party to Handle the Energy Use Data Collection Tool

As expected, the MoI is the most preferred host for the data collection system, followed closely by ALI, while 18% of respondents have no preference towards a particular host party (Figure 49). Additionally, not many industrialists seem to have heard of CAS, which is ranked at the same level as Ministry of Economy: MoE.

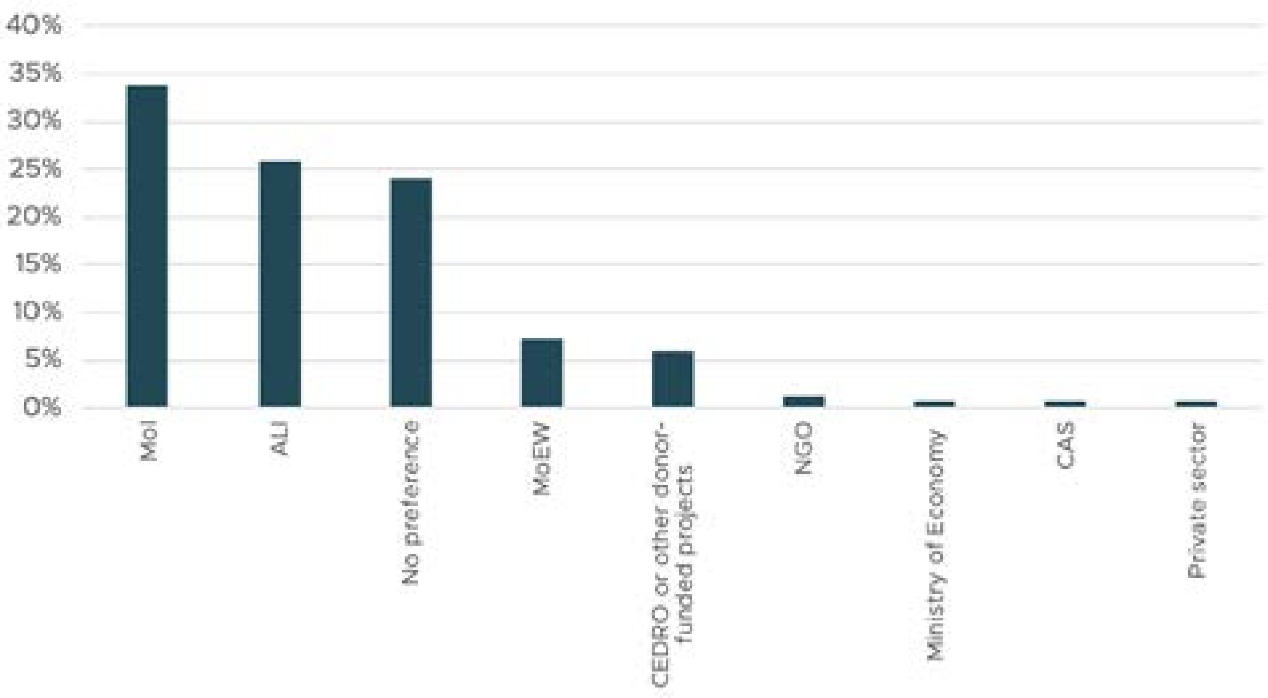

Figure 49. Most Suitable Party to Handle the Energy Use Data Collection Tool Across Sectors

The MoI does not have a preference among the sectors; Figure 50, which displays sectoral preferences, shows that the MoI scored less than ALI in four sectors and scored 0% in two sectors, namely the Machinery sector and the Paper and Paper Products sector. The two sectors where the MoI has a marked preference are the Food and Beverages sector and the Rubber and Plastic Products sector. These statistics indicate a lack of trust in the MoI among industrialists. This is mainly due to:

- Relatively lower trust in MoI with handling sensitive data privately and securely;

- Lack of expected support from the MoI based on past experience, especially during the recent economic crisis, which discouraged industrialists from working with MoI.

Figure 51 indicates that micro industries had a high preference for the MoI and low preference for ALI. This may be because micro industries received less support from ALI than large industries (who indicated more trust in ALI).

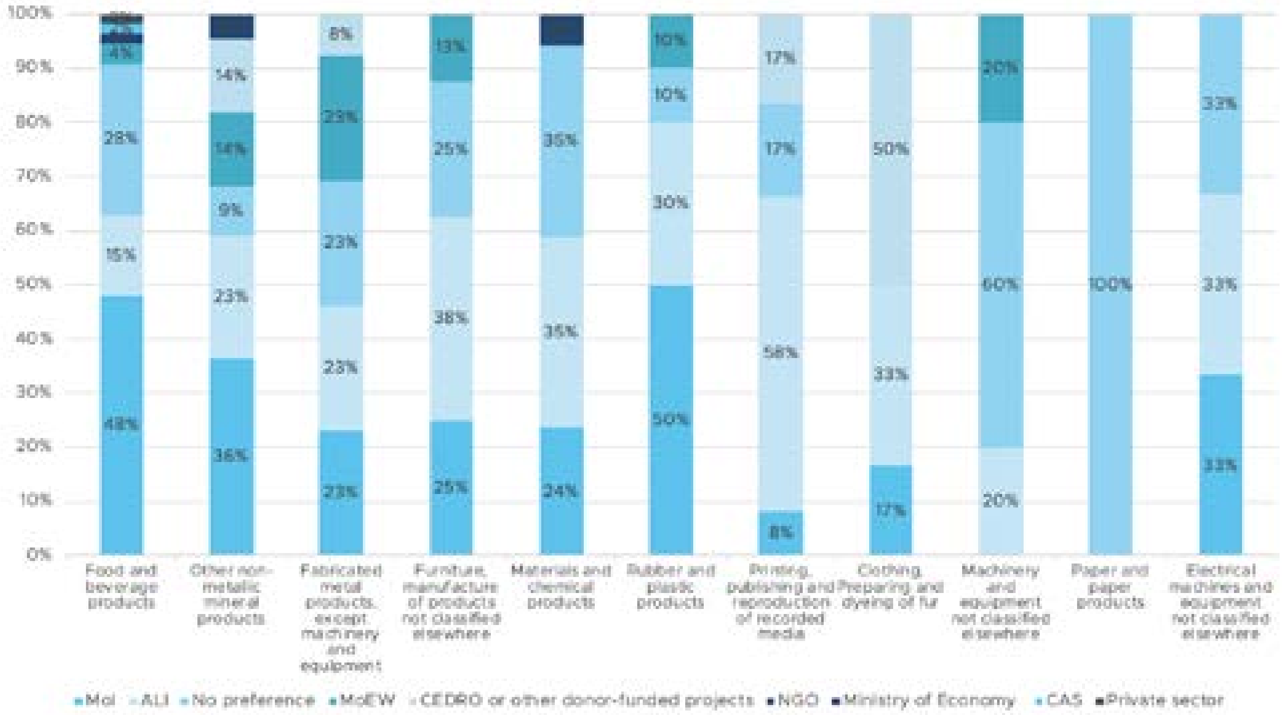

Figure 50. Most Suitable Party to Handle the Energy Use Data Collection Tool by Sector

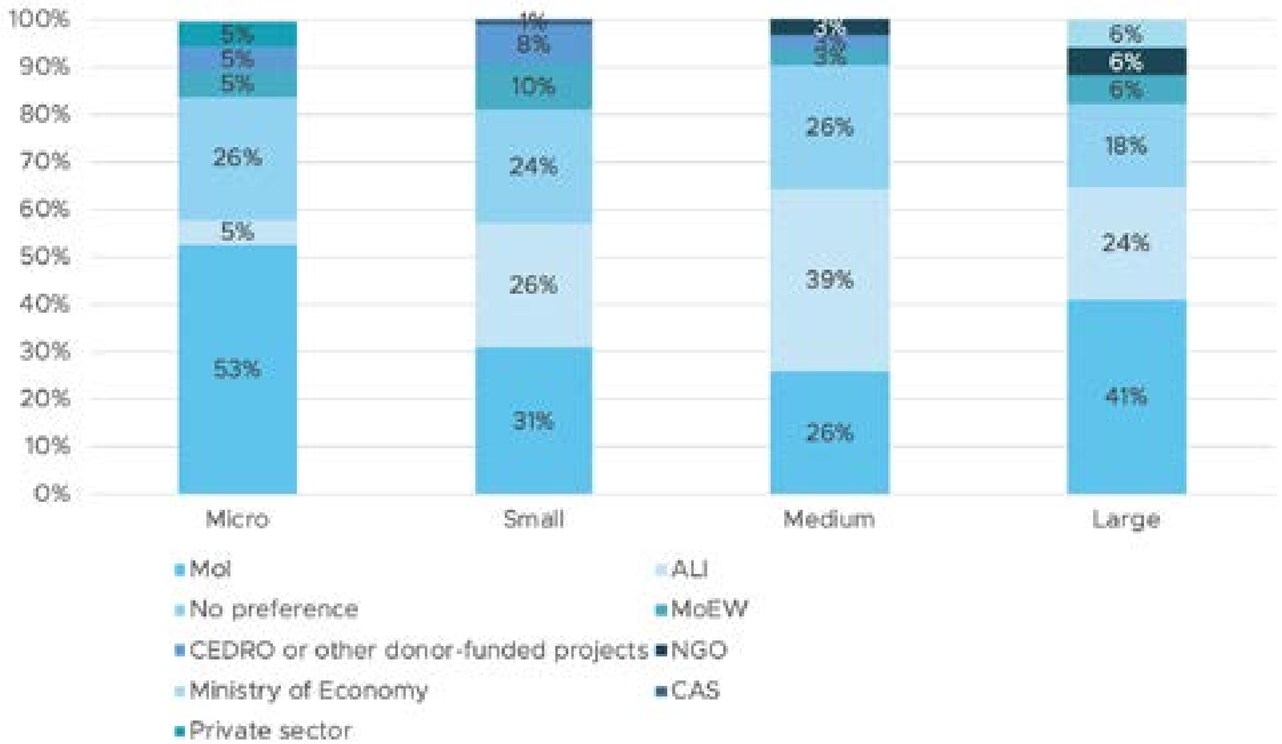

Figure 51. Most Suitable Party to Handle the Energy Use Data Collection Tool by Industry Size

6. Recommendations

Based on an analysis of the information and findings presented in this document, below are a list of recommendations for the most convenient course of action to be adopted for the energy data collection project. These recommendations set a long-term plan for this project, which aims to build energy performance indicators at the level of the industrial sector, rather than short-term implications.

1) As stated by CAS, an extensive industrial sector survey should be executed before the launch of the energy data collection program in order to identify the population structure of the industrial sector. Undertaking a data collection program that aims to build a set of performance indicators at the level of the industrial sector without an extensive industrial sector survey will result in large sampling errors. Therefore, the MoI, in coordination with UNIDO and ALI, must collaborate to conduct an extensive field survey of the industrial sector to include registered and non-registered firms. Incentives could be given to non-registered firms to join the survey. Funding could be discussed with potential donors like EU, AFD, or any other funding party; it is recommended to have UNIDO involved in the project.

2) It is recommended to initiate the project after the country starts engaging in economic recovery and administrative reforms for the following reasons:

- Public administrations are not capable of hosting such a project in the foreseeable future due to lack of resources.

- The survey showed that the industrialists have limited confidence in these administrations. As a result, public administrations need to undergo reforms in order to regain industrialists' trust.

- In the current economic situation in Lebanon, it will be difficult for industries, especially SMEs, to self-finance metering systems, even if they are convinced of their importance. They do not have the financial means to implement these projects. If the project is to start, it is crucial to provide some financing to incentivize industries to install energy meters.

- Starting the project today will result in significant sampling and non-sampling errors. Most data will not be representative because most industries are operating at reduced capacity and energy data will not represent normal operating conditions. Sampling errors will occur because the project cannot have a representative sample of industrialists considering the current sector condition.

- Due to the prevailing situation in the country, many industrialists are currently not in the right mindset to participate in any energy data collection program.

3) The field survey and stakeholder meetings have shown that awareness campaigns related to energy management are a prerequisite to the success of the energy data collection program. Therefore, an energy management awareness program for industrialists needs to be implemented with some incentive package included. The lack of knowledge on the importance of installing energy meters and monitoring energy indicates a need to implement awareness campaigns at all levels of industrial firm sizes and sectors. These campaigns will aim to inform industries on the benefits of metering and energy monitoring, both technically and financially. It is important that the following benefits regarding metering are made clear to industrialists:

- The impacts of meters on energy savings, which should also be translated into financial savings;

- The expected return on this type of investment and its payback period;

- The importance of process and equipment metering;

- The importance of metering for calculating product costs; and

- The impact of metering on equipment maintenance.

4) Devise a communication campaign to involve industrialists in the data collection and surveying process, where the purpose and outcomes of this process are clearly defined and transparently conveyed to the participating stakeholders. Whether the purpose of the data collection surveys is to track industrial energy consumption, production output, or computing GHG emissions, it is essential to assure that this survey will be used. Additionally, whether the purpose is to better target industrial loans and incentives to improve process efficiency, increase the use of cleaner energy sources, and/or better design and formulate programs and policies, it is necessary to share its outcomes with the participating stakeholders. If industrialists are aware of what the benefits are in participating in this data collection process, it will increase their willingness to participate and provide more accurate data.

5) According to stakeholder meetings and the industrialist survey, the MoI seems to be the most suitable choice to host the project, due to its close ties with industrialists and its legal mandate to enforce the provision of data on industries. However, it is important to note that for the success of this project the following measures need to be ensured by MoI:

- Look into the 'trust' concerns with industrialists and work on mitigating these factors;

- Legally ensure the data privacy and security of industries;

- Provide some kind of incentive, such as reductions in subscription fees;

- Transparently involve industrialists in the data collection process and convey a clear understanding about the purpose of the data collection process and its expected outcomes;

- Cooperate with ALI, international non-governmental organizations, and other entities to provide grants to industrialists to install energy monitoring systems.

6) Adopt a web-based survey system for data collection. In addition to the fact that it ensures the highest data-quality, versatility, and ease of information transfer between the host and responders, the results of the field survey have shown that the web-based survey system is the preferred alternative among industrialists.

B

ANNEX B:

SECTIONS OF MOI QUESTIONNAIRE RELATED TO ENERGY

1. MoI Survey 2013

٢ - نفقات وتكاليف المؤسسة على المواد الاولية والطاقة خلال العام ٢٠١٣

٢-١ القيمة الاجمالية للمواد الأولية المشتراة خلال العام ٢٠١٣

	القيمة (بالليرة اللبنانية)
٢-١ القيمة الاجمالية للمواد الأولية المشتراة خلال العام ٢٠١٣	

٢-٢ الكمية المستهلكة من الطاقة الكهربائية، المحروقات والمياه خلال العام ٢٠١٣

كهرباء/غاز/بنزين	وحدة القياس	الكمية المستهلكة	القيمة (بالليرة اللبنانية)
٢-٢-١ الكمية والنفقات المدفوعة على الطاقة الكهربائية المشتراة من كهرباء لبنان	كيلو واط		
٢-٢-٢ الكمية والنفقات المدفوعة على الغاز للإنتاج	ليتر		
٢-٢-٣ الكمية والنفقات المدفوعة على البنزين للنقل الخارجي	ليتر		

الفيول	وحدة القياس	الكمية المستهلكة	القيمة (بالليرة اللبنانية)
٢-٢-٤ الكمية والنفقات المدفوعة على الفيول أويل لإنتاج الطاقة الكهربائية في المصنع (مولد كهرباء)	ليتر		
٢-٢-٥ الكمية والنفقات المدفوعة على الفيول أويل للإنتاج والآليات	ليتر		
٢-٢-٦ كمية الفيول أويل المستهلك للمراجل (Boilers)	ليتر		
٢-٢-٧ المجموع	ليتر		

المازوت	وحدة القياس	الكمية المستهلكة	القيمة (بالليرة اللبنانية)
٢-٢-٨ الكمية والنفقات المدفوعة على المازوت لإنتاج الطاقة الكهربائية في المصنع (مولد كهرباء)	ليتر		
٢-٢-٩ الكمية والنفقات المدفوعة على المازوت للنقل الخارجي	ليتر		
٢-٢-١٠ الكمية والنفقات المدفوعة على المازوت للإنتاج والآليات	ليتر		
٢-٢-١١ الكمية والنفقات المدفوعة على المازوت المستهلك للمراجل (Boilers)	ليتر		
٢-٢-١٢ الكمية والنفقات المدفوعة على المازوت المستهلك للتدفئة	ليتر		
٢-٢-١٣ المجموع	ليتر		

مياه/زيوت /غيره	وحدة القياس	الكمية المستهلكة	القيمـة (بالليرة اللبنانية)
٢-٢-١٤ الكمية والنفقات المدفوعة على المياه المستعملة في العمليات الصناعية	م٣		
٢-٢-١٥ الكمية والنفقات المدفوعة على الزيوت المستهلكة (Lubricants)	ليتر		
٢-٢-١٦ غيره من النفقات المماثلة حدد،			
٢-٢-١٧ المجموع			

٣-مصدر الطاقة الكهربائية خلال العام ٢٠١٥

٣-١- مؤسسة كهرباء لبنان ☐ نعم	☐ كلا
٣-١-١-ساعة كهرباء ☐ نعم اذا نعم، حدد عددها ______	☐ كلا
٣-١-٢-عدد الاميير	٣-١-٣-تعريفة صناعية
|__|__|__|__| ☐ Monophase ☐ Triphase	☐ نعم ☐ كلا
|__|__|__|__| ☐ Monophase ☐ Triphase	☐ نعم ☐ كلا
|__|__|__|__| ☐ Monophase ☐ Triphase	☐ نعم ☐ كلا
٣-١-٤-محطة (Poste) ☐ نعم اذا نعم، حدد عددها ______	☐ كلا
٣-١-٥-قوة المحطة (KVA) محطة ١ |__|__|__|__| محطة ٢ |__|__|__|__|	محطة ٣ |__|__|__|__|

٣-٢- اشتراك مولد كهرباء ☐ نعم	☐ كلا

٣-٣- مولد كهرباء خاص ☐ نعم	☐ كلا	
٣-٣-١-عدد المولدات |__|__|__|		
٣-٣-٢-قوة المولد (KVA) مولد ١ |__|__|__|__|	مولد ٢ |__|__|__|__|	مولد ٣ |__|__|__|__|
مولد ٤ |__|__|__|__|	مولد ٥ |__|__|__|__|	مولد ٦ |__|__|__|__|

٣-٤- هل تستعمل الطاقة المتجددة في المصنع؟	☐ نعم، النسبة المقدرة من مصروف الطاقة |__|__|__|%	☐ كلا
٣-٤-١- نوع الطاقة المتجددة المستعملة ______	القدرة |__|__|__|__|	______
نوع الطاقة المتجددة المستعملة ______	القدرة |__|__|__|__|	______

نفقات وتكاليف المؤسسة خلال العام ٢٠١٥

٤-نفقات وتكاليف المؤسسة على الطاقة الكهربائية خلال العام ٢٠١٥

	القيمة (بالليرة اللبنانية)
٤-١- مؤسسة كهرباء لبنان	|__|__|__| |__|__|__| |__|__|__| |__|__|__| |__|__|__|
٤-٢- اشتراك مولد كهرباء	|__|__|__| |__|__|__| |__|__|__| |__|__|__| |__|__|__|
المجموع (بالليرة اللبنانية)	|__|__|__| |__|__|__| |__|__|__| |__|__|__| |__|__|__|

٥-نفقات وتكاليف المؤسسة على المحروقات خلال العام ٢٠١٥

	القيمة (بالليرة اللبنانية)	الكمية المستهلكة	وحدة القياس
٥-١- المازوت	|__|__|__|__|__|__|__|__|__|__|__|__|		ليتر
٥-٢- البنزين	|__|__|__|__|__|__|__|__|__|__|__|__|		ليتر
٥-٣- الغاز	|__|__|__|__|__|__|__|__|__|__|__|__|		☐ ليتر ☐ كلغ
٥-٤- الفيول اويل	|__|__|__|__|__|__|__|__|__|__|__|__|		ليتر
المجموع (بالليرة اللبنانية)	|__|__|__|__|__|__|__|__|__|__|__|__|		

٥-٥- نسبة المازوت المستعملة لـ:	الانتاج |__|__|__|%	الكهرباء |__|__|__|%	النقل |__|__|__|%

3. MoI Survey 2016

نفقات وتكاليف المصنع خلال العام ٢٠١٦

٤- نفقات وتكاليف المصنع على الطاقة الكهربائية خلال العام ٢٠١٦

٤-١- مصدر الطاقة الكهربائية خلال العام ٢٠١٦

٤-١-١- ☐ مؤسسة كهرباء لبنان ☐ مؤسسة كهرباء زحلة ☐ مؤسسة كهرباء جبيل ☐ مؤسسة كهرباء قاديشا ☐ غير مشترك			
٤-١-١-١- ساعة كهرباء	☐ نعم	اذا نعم، حدد عددها ______	☐ كلا
٤-١-١-٢- عدد الأمبير		٤-١-١-٣- تعريفة صناعية	
|__|__|__|__|	☐ Monophase ☐ Triphase	☐ نعم	☐ كلا
|__|__|__|__|	☐ Monophase ☐ Triphase	☐ نعم	☐ كلا
|__|__|__|__|	☐ Monophase ☐ Triphase	☐ نعم	☐ كلا
٤-١-١-٤- محطة (Poste)	☐ نعم	اذا نعم، حدد عددها ______	☐ كلا
٤-١-١-٥- قوة المحطة (KVA)	محطة ١ |__|__|__|__|	محطة ٢ |__|__|__|__|	محطة ٣ |__|__|__|__|

٤-١-٢-إشتراك مولد كهرباء	☐ نعم	☐ كلا

٤-١-٣-مولد كهرباء خاص	☐ نعم	☐ كلا	
٤-١-٣-١- عدد المولدات	|__|__|__|		
٤-١-٣-٢- قوة المولد (KVA)	مولد ١ |__|__|__|__|	مولد ٢ |__|__|__|__|	مولد ٣ |__|__|__|__|
	مولد ٤ |__|__|__|__|	مولد ٥ |__|__|__|__|	مولد ٦ |__|__|__|__|

٤-١-٤-هل تستعمل الطاقة المتجددة في المصنع؟	☐ نعم، حدد النسبة المقدرة من مصروف الطاقة |__|__|__|%			☐ كلا
٤-١-٤-١-	نوع الطاقة المتجددة المستعملة ______	القدرة	|__|__|__|__|	______
	نوع الطاقة المتجددة المستعملة ______	القدرة	|__|__|__|__|	______

٤-٢- نفقات وتكاليف المصنع على الطاقة الكهربائية خلال العام ٢٠١٦

	القيمة (بالليرة اللبنانية)
٤-٢-١-مؤسسة كهرباء لبنان / زحلة / جبيل / قاديشا	|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|
٤-٢-٢-إشتراك مولد كهرباء	|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|
المجموع (بالليرة اللبنانية)	|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|

٥- نفقات وتكاليف المصنع على المحروقات خلال العام ٢٠١٦

	القيمة (بالليرة اللبنانية)
٥-١- النفقات المدفوعة على البنزين	|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|
٥-٢- النفقات المدفوعة على الغاز	|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|
٥-٣- النفقات المدفوعة على الفيول اويل	|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|
المجموع (بالليرة اللبنانية)	|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|

٥-٤- النفقات المدفوعة على المازوت	|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|	
٥-٤-١- نسبة المازوت المستعملة لـ:	آلات الانتاج |__|__|__| %	مولدات الكهرباء |__|__|__| %
	النقل |__|__|__| %	التدفئة |__|__|__| %

4. MoI Survey 2017 and 2018

نفقات وتكاليف المصنع خلال العام ٢٠١٧

٤- نفقات وتكاليف المصنع على الطاقة الكهربائية خلال العام ٢٠١٧

٤-١- مصدر الطاقة الكهربائية خلال العام ٢٠١٧

٤-١-١-	☐ مؤسسة كهرباء لبنان	☐ مؤسسة كهرباء زحلة	☐ مؤسسة كهرباء جبيل	☐ مؤسسة كهرباء قاديشا	☐ غير مشترك

٤-١-٢-إشتراك مولد كهرباء	☐ نعم	☐ كلا

٤-١-٣-مولد كهرباء خاص	☐ نعم، حدّد	٤-١-٣-١- عدد المولدات	__|__|__|__			☐ كلا
٤-١-٣-٢- قوة المولد (KVA)	مولد ١	__|__|__|__|__	مولد ٢	__|__|__|__|__	مولد ٣	__|__|__|__|__
	مولد ٤	__|__|__|__|__	مولد ٥	__|__|__|__|__	مولد ٦	__|__|__|__|__

٤-١-٤-هل تستعمل الطاقة المتجددة في المصنع؟	☐ نعم، حدّد النسبة المقدرة من مصروف الطاقة	__|__|__|__ %		☐ كلا
٤-١-٤-١-	نوع الطاقة المتجددة المستعملة ____________	القدرة	__|__|__|__	________
	نوع الطاقة المتجددة المستعملة ____________	القدرة	__|__|__|__	________

٤-١-٥- هل يتم استخدام المراجل او الأفران في المصنع؟	☐ نعم، حدّد عددها		☐ كلا
٤-١-٥-١- عدد المراجل	__|__|__	٤-١-٥-٢- عدد الأفران	__|__|__

٤-٢- نفقات وتكاليف المصنع على الطاقة الكهربائية خلال العام ٢٠١٧

	القيمة (بالليرة اللبنانية)
٤-٢-١-مؤسسة كهرباء لبنان / زحلة / جبيل / قاديشا	__|__|__ __|__|__ __|__|__ __|__|__ __|__|__
٤-٢-٢-إشتراك مولد كهرباء	__|__|__ __|__|__ __|__|__ __|__|__ __|__|__
المجموع (بالليرة اللبنانية)	__|__|__ __|__|__ __|__|__ __|__|__ __|__|__

٥-نفقات وتكاليف المصنع على المحروقات خلال العام ٢٠١٧

	القيمة (بالليرة اللبنانية)
٥-١- النفقات المدفوعة على البنزين	__|__|__ __|__|__ __|__|__ __|__|__ __|__|__
٥-٢- النفقات المدفوعة على الغاز	__|__|__ __|__|__ __|__|__ __|__|__ __|__|__
٥-٣- النفقات المدفوعة على الفيول اويل	__|__|__ __|__|__ __|__|__ __|__|__ __|__|__
المجموع (بالليرة اللبنانية)	__|__|__ __|__|__ __|__|__ __|__|__ __|__|__

للاستعلام نرجو الاتصال على الأرقام التالية: بيروت وجبل لبنان: ٠١/٤٢٣٦٤٧ – ٠١/٤٢٣٦٥٢ – البقاع: ٠١/٤٢٣٦٤٣ – الجنوب: ٠٧/٧٥١٠٥٣ – النبطية: ٠٧/٧٦٨١٢٩ – الشمال: ٠١/٤٢٧١٤٥

٢

٥-٤- النفقات المدفوعة على المازوت بالليرة اللبنانية				
٥-٤-١- نسبة المازوت المستعملة لـ:	آلات الانتاج	%	مولدات الكهرباء	%
	النقل	%	التدفئة	%

	القيمة (بالليرة اللبنانية)
٥-٥- النفقات المدفوعة على الفحم الحجري وما شابه	
٥-٦- النفقات المدفوعة على الأوكسجين	

C

ANNEX C:

INDUSTRIALIST SURVEY

Methods and Roadmap for the Collection of Energy Data from Lebanese Industries

The European Commission (EC) is encouraging innovation and entrepreneurship in Lebanon to support a clean energy transition. The overall aim of the EC is to address job creation and growth in support of Lebanon's economy, paving the way for (1) tapping into the potential for green jobs and growth (in particular in the energy sector), (2) alleviating financial and economic burden of the current energy system on the various sectors and sub-sectors of Lebanon, (3) facilitating access to financing, and (4) improving the linkages amongst green entrepreneurship, small-and-medium sized enterprises (SMEs), industries and research/technology centers.
The project being undertaken by ECODIT is a joint effort between the Association of Industrialists (ALI) and CEDRO 5 project under the Single Support Framework for EU Support to Lebanon (2017-2020) program.

The aim of the project is the determination of the most adequate and applicable method and/or process for the annual, systematic collection of energy data from the Lebanese industrial sector, and the subsequent implementation at a later stage of an online portal for that purpose. Energy data information will help monitor and improve energy and economic indicators in the industrial sector.

The scope of this project is to assess past and existing energy data collection projects/initiatives from Lebanese Industries and recommend best practice based on local stakeholders' engagement and international experience and best practices.
Project duration period is five-month to close October 30, 2021.

As a primary activity in this project, ECODIT is currently conducting individual meetings with industrialists as well as with organizations and entities which have been identified as key potential stakeholders in the project. For that purpose, we will be most interested to discuss with you the following.

1. Company Name

___

https://docs.google.com/forms/d/1Qs3uiZTXg3HSfuEyqkHOOkATbsKcxgdlteQslgYgL-Q/edit?ts=60e41755 1/12

2. Contact Person

3. Position of Contact Person

4. Number of Employees

5. Foundation Year

6. Industry Sector

7. Goods Produced

If more than one product is produced please specify the most important four products

8. Level of production capacity utilization

9. Has the production volume per product changed in the last 2 years?

10. Have you every filled a form related to energy data?

Mark only one oval.

- ⬭ Yes
- ⬭ No

https://docs.google.com/forms/d/1Qs3ulZTXg3HSfuEyqkHCOkATbsKcxgdlteQslgYgL-Q/edit?ts=60e41755 3/12

11. If yes, when and what was the frequency?

12. What are your major production processes?

i.e. sterilization, cooking, roasting, baking, plastic extrusion, moldings, raw material mixing, welding, etc.

Check all that apply.

- [ ] Sterilization
- [ ] Cooking
- [ ] Roasting
- [ ] Baking
- [ ] Plastic Extrusion
- [ ] Moldings
- [ ] Raw Material Mixing
- [ ] Welding
- [ ] Refrigeration

Other: [ ] ____________

13. Type of energy used

In the plant and not for transportation

Check all that apply.

- [ ] Electricity
- [ ] Diesel
- [ ] Fuel Oil
- [ ] Renewable Energy
- [ ] Gasoline

Other: [ ] ____________

14. What are approximately the yearly/monthly quantities per type of energy used?

Distinguish between diesel/heavy fuel for generator and diesel/heavy fuel for production

15. Can you distinguish between the quantities of energy used for offices, production and electricity generation?

Mark only one oval.

- ◯ Yes
- ◯ No

16. Share of in-house electricity generation in overall electricity use

17. In case you use renewable energy, what kind of renewable energy?

Check all that apply.

- ☐ Solar water heaters
- ☐ PV
- ☐ Biomass
- ☐ Wind

Other: ☐ __________

18. In case you use renewable energy, what is its share of energy production?

____

19. What are the main energy users in the plant?

Check all that apply.

- [ ] Motors
- [ ] Boilers
- [ ] Electric Heating
- [ ] Direct Flame Heating
- [ ] Welding
- [ ] Machining
- [ ] Refrigeration/cooling

Other: [ ] ______________________

20. Have you implemented any projects that aimed to reduce energy use in the plant?

Mark only one oval.

( ) Yes

( ) No

21. If yes, when?

____

____

____

____

____

22. What is the established procedure in your plant to monitor energy cost (electricity and fuel bills)?

i.e. electricity and fuel bills

23. Have you installed energy use measuring instruments or systems in your plant?

Mark only one oval.

- Yes
- No

24. If no, will you be interested to install meters

Check all that apply.

	Yes	No
If the situation will get better by 30%	☐	☐
If the situation will get better by 50%	☐	☐
If the situation will get better by 70%	☐	☐
If the situation will get better by 90%	☐	☐

25. If you have energy metering instrument, what kind?

Check all that apply.

- [ ] Electricity Meters
- [ ] Thermal Energy Meters
- [ ] Automated Computerized Systems

Other: [ ] ____________________

26. Do you have existing energy readings protocol in your plant to monitor energy cost?

Mark only one oval.

- ( ) Yes
- ( ) No

27. If yes, do you take readings on a regular basis?

Mark only one oval.

- ( ) Yes
- ( ) No

28. If yes, what is the frequency of reading?

Mark only one oval.

- ( ) Daily
- ( ) Weekly
- ( ) Bi-weekly
- ( ) Monthly
- ( ) Yearly
- ( ) Other: ____________________

29. What are the major barriers or reasons why energy is not monitored in your plant?

____

____

____

____

____

30. On a scale of 1 to 5, what is your level of interest to provide energy use data?

Mark only one oval.

	1	2	3	4	5	
Minimum	◯	◯	◯	◯	◯	Maximum

31. Are you ready to install energy meters in your plant for each major process, or would you limit yourself to the electricity and fuel bills?

Mark only one oval.

- ◯ Install Energy Meters
- ◯ Limit myself to electricity and fuel bills

32. In your opinion, what is the most suitable energy use data collection tool that could be adopted?

Your suggestion may help design an energy data collection system better suited to the conditions of the industry and the country

Mark only one oval.

- Fill in a form, which you can download from the internet and send it by email to the concerned administration
- A representative of the concerned administration visits your plant and collects the data
- Web-based applications (to fill in online forms and send it back to the concerned administration)
- Other: ____________________

33. Which of the following entities do you prefer to send the information to?

Mark only one oval.

- Ministry of Industry (MoI)
- Ministry of Environment (MoE)
- Ministry of Energy and Water (MoEW)
- Central Administration of Statistics (CAS)
- Association of Lebanese Industrialists (ALI)
- CEDRO or other donor-funded projects
- Other: ____________________

34. In your opinion, what are the potential challenges facing Lebanese industries to provide energy use data, as well as the barriers and difficulties which may arise in implementing an energy data collection project given the country's current situation?

35. Can you direct us to industrialists who may be interested to get involved in such data collection project?

Mark only one oval.

- Yes
- No

36. If yes, who?

37. Any other related topic you may find interesting to discuss?

D

ANNEX D:

EDCS DATA ENTRY TEMPLATE

1. QUESTIONNAIRE – GENERAL INDUSTRY

Survey year [ ]

Submittal date [ ]

A. Contact details of focal person in charge of filling the questionnaire*

1. Full Name [ ]
2. Position in the Company [ ]
3. Preferred Contact Number [ ]
4. Email [ ]

B. General company information

1. Company Name [ ]
2. Sector of activity [ ]
3. Did you fill the questionnaire in the previous year? ☐ Yes ☐ No
4. Company address [ ]
5. ALI registration number [ ]
6. Ministry of Industry registration number* [ ]
7. Ministry of Finance registration number* [ ]
8. Which level of data entry are you categorized in?* [ ]
9. Do you wish to upgrade your level of data entry for this year?* ☐ Yes ☐ No
10. Are you a member of the energy data collection leadership group?* ☐ Yes ☐ No
11. Number of full time employees as of 01/01/2021* [ ]
12. Number of part time employees as of 01/01/2021* [ ]
13. Main products produced* [ ]
14. Number of operating days per week* [ ]
15. Number of operating hours per day* [ ]
16. Manufacturing Value Added** [ ]

17. Cost of input

(all inputs of the production process including energy and water but excluding labor and capital)***

18. Do you have a valid ISO certification?

- ☐ ISO 50001
- ☐ ISO 9001
- ☐ ISO 14001
- ☐ Other certification(s)

Please indicate other certification(s)

C. GENERAL ENERGY USAGE AND PRODUCTION INFORMATION

1. Sources of energy used*

- ☐ Electricity
- ☐ Fuel Oil
- ☐ Diesel
- ☐ Gasoline
- ☐ Liquified Petroleum Gas (LPG)
- ☐ Biomass
- ☐ Other

2. Level of production utilization

(Average percent of production over the survey year from maximum production capacity) **

Indicate product 1 | Indicate percentage

Overall | Indicate percentage

3. What are the main energy using processes in the plant?*

- ☐ Compressed air
- ☐ Cooking
- ☐ Frying
- ☐ Blanching
- ☐ Sterilization
- ☐ Packaging
- ☐ Pumping
- ☐ Electric Heating
- ☐ Direct Flame Heating
- ☐ Welding
- ☐ Process cooling
- ☐ HVAC (heating ventilation & air conditioning)
- ☐ Refrigeration
- ☐ Lighting
- ☐ Office Appliances
- ☐ Other processes ____________

4. Do you have a dedicated energy management team?* ☐ Yes ☐ No

If yes, please indicate number of staff in the team and their positions

____

5. Have you previously implemented an energy efficiency project?*

If yes, what kind of project(s)?

☐ Yes ☐ No

Please indicate type of energy efficiency project.

____

6. Overall production volume during the survey year***

Product name	Production volume	Unit
Total		

7. Overall energy usage and cost during the survey year*

Energy Source	Amount	Unit	Energy Cost (LBP)

Remarks: Please enter any remarks or comments you have regarding Section C.

D. ELECTRICITY

1. Source of electricity consumption

a. Source of electricity consumption*

☐ Utility
☐ Subscription with generators
☐ On-site private diesel generators
☐ Renewable Energy

b. Facility total electricity demand capacity

Indicate total energy demand + Unit ______

2. Utility subscription*

Utility subscription 1

☐ 1 phase ☐ 3 phases

Enter subscription level in amps ______

Indicate Average Power Factor ______

3. Generator subscription*

☐ 1 phase ☐ 3 phases

Enter subscription level in amps ______

4. Data for on-site generators for the survey year*

Size of generator (kVA)	Fuel type	Amount of fuel used	Unit	Load factor (%)	Yearly hours of operation (hours)	Average power factor	Electricity output (kWh)

a. Do you apply waste heat recovery on your generators? ☐ Yes ☐ No

b. If yes, what is the yearly value of waste heat recovered in absolute value and in percentage of total wasted heat?

Enter value ______

Choose a unit ______

d. What do you use the recovered heat for?

☐ Electricity generation

☐ Steam generation

☐ Hot water generation

☐ Direct process heating

☐ Other

5. Electricity consumption and cost by source (for the survey year)*

	Enter value	Choose unit	Indicate cost in LBP
a. Electricity consumption from utility			
b. Electricity consumption from on-site private generators			
c. Electricity consumption from subscription diesel generators			
d. Electricity consumption from renewable energy sources			
e. Total Electricity Consumption			

6. Electricity consumption by end-use (for the survey year)***

Please indicate the electricity consumption by type of end-use processes in absolute value or in percentage (%) share of total electricity consumption.

Equipment	Capacity	Unit	Electricity Consumption	Unit
Compressed air				
Pumping				
Process Equipment				
Welding				
Packaging				
Electric Heating				
Refrigeration				
HVAC				
Lighting				
Other				

Remarks: Please enter any remarks or comments you have regarding Section D.

E. DIESEL (EXCLUDING TRANSPORTATION)

1. Total diesel consumption (for the survey year)*

a. Diesel is used at your facility for the purpose(s) of:

- ☐ Electricity generation
- ☐ Producing steam
- ☐ Producing hot water
- ☐ Direct Process heating
- ☐ Other ____________

b. Total Diesel Consumption

Enter value ____________

Enter value (LBP) ____________

2. Diesel consumption and cost by source (for the survey year)*

Energy consumption by activity type	Amount	Unit	Energy Cost (LBP)
a. Diesel consumption for electricity generation (on-site diesel generators)			
b. Diesel consumption for steam generation			
c. Diesel consumption for hot water generation			
d. Diesel consumption for direct process heating			
e. Indicate other consumption of diesel			
f. Total Diesel Consumption			

3. Diesel storage*

What period of operation does your diesel storage allow?

Period [ ]

Unit [ ]

4. Steam consumption**

a. What is steam used for? Choose an item [ ]

b. What type of steam system do you use?

☐ Closed Circuit
☐ Open Circuit

c. What percentage of condensate is recovered in your steam system? [ ] %

5. Diesel consumption by end-use (excluding electricity generation) (for the survey year)***

Please indicate the diesel consumption by type of end-use in absolute value or in percentage (%) share of total diesel consumption.

Equipment	Capacity	Unit	Diesel Consumption	Unit
Boiler				
Steam boiler				
Hot water boiler				
Direct process heating				
Oven				
Furnace				
Drying				
Other				

Remarks

Please enter any remarks or comments you have regarding Section E.

[ ]

F. FUEL OIL

1. Total fuel oil consumption (for the survey year)*

a. Fuel Oil is used at your facility for the purpose(s) of:

☐ Electricity generation

☐ Producing steam

☐ Producing hot water

☐ Direct Process heating

☐ Other [ ]

b. Total Fuel Oil Consumption

Enter value [ ]

Enter value (LBP) [ ]

2. Diesel consumption and cost by source (for the survey year)*

Energy consumption by activity type	Amount	Unit	Energy Cost (LBP)
a. Fuel Oil consumption for electricity generation (on-site diesel generators)			
b. Fuel Oil consumption for steam generation			
c. Fuel Oil consumption for hot water generation			
d. Fuel Oil consumption for direct process heating			
e. Indicate other consumption of diesel			
f. Total Fuel Oil Consumption			

3. Fuel Oil storage*

What period of operation does your Fuel Oil storage allow?

Period [ ]

Unit [ ]

4. Steam consumption**

a. What is steam used for? Choose an item [ ]

b. What type of steam system do you use?

☐ Closed Circuit
☐ Open Circuit

c. How much steam is recovered in your process? [ ] %

5. Fuel Oil consumption by end-use (excluding electricity generation) (for the survey year)***

Please indicate the Fuel Oil consumption by type of end-use in absolute value or in percentage (%) share of total diesel consumption.

Equipment	Capacity	Unit	Fuel Oil Consumption	Unit
Boiler				
Steam boiler				
Hot water boiler				
Direct process heating				
Oven				
Furnace				
Drying				
Other				

Remarks: Please enter any remarks or comments you have regarding Section F.

[ ]

G. LIQUIFIED PETROLEUM GAS (LPG)

1. Total Liquified Petroleum Gas (LPG) consumption (for the survey year)*

a. Liquified Petroleum Gas (LPG) is used at your facility for the purpose(s) of:

- ☐ Electricity generation
- ☐ Producing steam
- ☐ Producing hot water
- ☐ Direct Process heating
- ☐ Other ____________

b. Total Liquified Petroleum Gas (LPG) Consumption

Enter value ____________

Enter value (LBP) ____________

2. Liquified Petroleum Gas (LPG) consumption and cost by source (for the survey year)*

Energy consumption by activity type	Amount	Unit	Energy Cost (LBP)
a. Liquified Petroleum Gas (LPG) consumption for electricity generation (on-site diesel generators)			
b. Liquified Petroleum Gas (LPG) consumption for steam generation			
c. Liquified Petroleum Gas (LPG) consumption for hot water generation			
d. Liquified Petroleum Gas (LPG) consumption for direct process heating			
e. Indicate other consumption of Liquified Petroleum Gas (LPG)			
f. Total Liquified Petroleum Gas (LPG) Consumption			

3. LPG storage*

What period of operation does your LPG storage allow?

Period

Unit

4. Steam consumption**

a. What is steam used for? Choose an item

b. What type of steam system do you use?

- ☐ Closed Circuit
- ☐ Open Circuit

c. How much steam is recovered in your process? %

5. Liquified Petroleum Gas (LPG) consumption by end-use (excluding electricity generation) (for the survey year)***

Please indicate the Liquified Petroleum Gas (LPG) consumption by type of end-use in absolute value or in percentage (%) share of total diesel consumption.

Equipment	Capacity	Unit	Fuel Oil Consumption	Unit
Boiler				
Steam boiler				
Hot water boiler				
Direct process heating				
Oven				
Furnace				
Drying				
Other				

Remarks: Please enter any remarks or comments you have regarding Section G.

H. RENEWABLE ENERGY

1. Total energy consumption from renewable energy sources*

a. Types of renewable energy installed on-site

- ☐ Photovoltaic
- ☐ Solar Water Heater
- ☐ Biomass
- ☐ Wind
- ☐ Other RE sources ____________

b. Capacity of renewable energy source installed

Choose RE source ____________

Enter value (kW) ____________

2. Energy Consumption from Renewable Energy Sources (for the survey year)*

Energy consumption from type of renewable energy	Value	Unit
a. Energy consumption from photovoltaics		
b. Energy consumption from solar water heaters		
c. Energy consumption from wind		
d. Energy consumption from biomass		
e. Energy consumption from other RE source		
f. Total Energy Consumption from Renewable Energy		

3. Biomass consumption*

a. Is biomass used to:

☐ Produce steam in a boiler

☐ Produce hot water in a boiler

☐ Produce biogas in an anaerobic digester

☐ Other

b. Biomass boiler

Boiler	Type of biomass	Boiler capacity (kW)	Biomass consumption (tonne)

Remarks: Please enter any remarks or comments you have regarding Section H.

I. TRANSPORTATION***

Energy consumption by type (for the survey year)	Value	Unit	Cost (LBP)
a. Total diesel consumption for transportation			
b. Total gasoline consumption for transportation			
c. Total electricity consumption for transportation (electric vehicles and forklifts)			
d. Total LPG consumption for transportation			
e. Total energy consumption for transportation from alternative sources (biodiesel, methanol, hydrogen, ...)			

Remarks: Please enter any remarks or comments you have regarding Section I.

J. LUBRICANTS***

a. Total amount of lubricants used (for the survey year) [ ]

b. Total cost of lubricants used (for the survey year) [ ] LBP

Remarks: Please enter any remarks or comments you have regarding Section J.

[ ]

K. ENERGY DATA MONITORING SYSTEM*

1. Do you have an operational energy data monitoring system? ☐ Yes ☐ No
2. If yes, please indicate what type [ ]

Remarks: Please enter any remarks or comments you have regarding Section K.

[ ]

L. CONCLUSION

1. How much time did it take to complete this questionnaire (data collection + filling of questionnaire)?

Indicate number of days [ ] Days

Indicate number of hours [ ] Hours

2. Any additional questions or remarks you have regarding this questionnaire?

[ ]

Note:

** Entry level 1 minimum required data entry*

*** Entry level 2 voluntary for the first 3 years of enrollment in the program*

**** Entry level 3 voluntary for the first 5 years of enrollment in the program and minimum entry requirement for joining the energy data collection leadership program*

2. QUESTIONNAIRE – DAIRY INDUSTRY

Survey year

Submittal date

A. Contact details of focal person in charge of filling the questionnaire*

1. Full Name
2. Position in the Company
3. Preferred Contact Number
4. Email

B. General company information

1. Company Name
2. Sector of activity
3. Did you fill the questionnaire in the previous year? ☐ Yes ☐ No
4. Company address
5. ALI registration number
6. Ministry of Industry registration number*
7. Ministry of Finance registration number*
8. Which level of data entry are you categorized in?*
9. Do you wish to upgrade your level of data entry for this year?* ☐ Yes ☐ No
10. Are you a member of the energy data collection leadership group?* ☐ Yes ☐ No
11. Number of full time employees as of 01/01/2021*
12. Number of part time employees as of 01/01/2021*
13. Main products produced*
14. Number of operating days per week*
15. Number of operating hours per day*
16. Manufacturing Value Added**

17. Cost of input [ ]

(all inputs of the production process including energy and water but excluding labor and capital)***

18. Do you have a valid ISO certification?

- ☐ ISO 50001
- ☐ ISO 9001
- ☐ ISO 14001
- ☐ Other certification(s)

Please indicate other certification(s) [ ]

C. GENERAL ENERGY USAGE AND PRODUCTION INFORMATION

1. Sources of energy used*

- ✓ Electricity
- ✓ Fuel Oil
- ✓ Diesel
- ☐ Gasoline
- ☐ Liquified Petroleum Gas (LPG)
- ✓ Biomass
- ✓ Other [ ]

2. Level of production utilization

(Average percent of production over the survey year from maximum production capacity) **

Indicate product 1 [dfdjfnfdjfd] Indicate percentage [ ]

Overall [ ] Indicate percentage [ ]

3. What are the main energy using processes in the plant?*

☐ Compressed air

☐ Processing equipment

☐ Packaging

☐ Pumping

☐ Electric Heating

☐ PDirect Flame Heating

☐ Welding

☐ HVAC (heating ventilation & air conditioning)

☐ Refrigeration

☐ Lighting

☐ Office Appliances

☐ Other processes ____________

4. Do you have a dedicated energy management team?* ☐ Yes ☐ No

If yes, please indicate number of staff in the team and their positions

____

5. Have you previously implemented an energy efficiency project?*

If yes, what kind of project(s)?

☐ Yes ☐ No

Product name ____________

Production volume ____________

Unit ____________

6. Overall production volume during the survey year***

Product name	Production volume	Unit
Total		

7. Material input data***

Required data	Value	Unit
a. Total milk usage for the survey year		
b. Overall whey output quantity for the survey year		

8. Quantity of powdered milk added per product type***

Product type	Quantity of powder milk added	Unit

9. Do you produce any product(s) from the obtained whey?*** ☐ Yes ☐ No

10. If yes, please list these products.***

11. How much milk is added to the whey per product type?***

Product type	Quantity of powder milk added	Unit

12. Overall energy usage and cost for the survey year*

Energy Source	Value	Unit	Energy Cost (LBP)

Remarks: Please enter any remarks or comments you have regarding Section C.

D. ELECTRICITY

1. Source of electricity consumption

a. Source of electricity consumption*

- ☐ Utility
- ☐ Subscription with generators
- ☐ On-site private diesel generators
- ☐ Renewable Energy

b. Facility total electricity demand capacity

Indicate total energy demand + Unit

2. Utility subscription*

Utility subscription 1

☐ 1 phase ☐ 3 phases

Enter subscription level in amps

Indicate Average Power Factor

3. Generator subscription*

☐ 1 phase ☐ 3 phases

Enter subscription level in amps

4. Data for on-site generators*

Size of generator (kVA)	Fuel type	Amount of fuel used	Unit	Load factor (%)	Yearly hours of operation (hours)	Average power factor	Electricity output (kWh)

a. Do you apply waste heat recovery on your generators? ☐ Yes ☐ No

b. If yes, what is the yearly value of waste heat recovered in absolute value and what percentage of total wasted heat?

Enter value

Enter percentage

c. What is the percentage yearly value of waste heat recovered in total heating load demand?

d. What do you use the recovered heat for?

☐ Electricity generation

☐ Steam generation

☐ Hot water generation

☐ Direct process heating

☐ Other

5. Electricity consumption and cost by source (for the survey year)*

	Value	Unit	Cost (LBP)
a. Electricity consumption from utility			
b. Electricity consumption from on-site private generators			
c. Electricity consumption from subscription diesel generators			
d. Electricity consumption from renewable energy sources			
e. Total electricity consumption			

6. Electricity consumption by end-use (for the survey year)***

Please indicate the electricity consumption by type of end-use processes in absolute value or in percentage (%) share of total electricity consumption.

Equipment	Capacity	Unit	Electricity Consumption	Unit
Compressed air				
Pumping				
Pasteurization				
Sterilization				
Cleaning in place (CIP)				
Packaging				
Electric Heating				
Refrigeration				
HVAC				
Lighting				
Other				

Remarks: Please enter any remarks or comments you have regarding Section D.

E. DIESEL (EXCLUDING TRANSPORTATION)

1. Total diesel consumption (for the survey year)*

a. Diesel is used at your facility for the purpose(s) of:

☐ Electricity generation

☐ Producing steam

☐ Producing hot water

☐ Direct Process heating

☐ Other

b. Total Diesel Consumption

Enter value

Enter value (LBP)

2. Diesel consumption and cost by source (for the survey year)*

Energy consumption by activity type	Amount	Unit	Energy Cost (LBP)
a. Diesel consumption for electricity generation (on-site diesel generators)			
b. Diesel consumption for steam generation			
c. Diesel consumption for hot water generation			
d. Diesel consumption for direct process heating			
e. Indicate other consumption of diesel			
f. Total Diesel Consumption			

3. Diesel storage*

What period of operation does your diesel storage allow?

Period

Unit

4. Steam consumption**

a. What is steam used for? Choose an item

b. What type of steam system do you use?

- ☐ Closed Circuit
- ☐ Open Circuit

c. What percentage of condensate is recovered in your steam system? %

5. Diesel consumption by end-use (excluding electricity generation) (for the survey year)***

Please indicate the diesel consumption by type of end-use in absolute value or in percentage (%) share of total diesel consumption.

Equipment	Capacity	Unit	Diesel Consumption	Unit
Boiler				
Steam boiler				
Hot water boiler				
Direct process heating				
Oven				
Furnace				
Drying				
Other				

Remarks

Please enter any remarks or comments you have regarding Section E.

F. FUEL OIL

1. Total fuel oil consumption (for the survey year)*

a. Fuel Oil is used at your facility for the purpose(s) of:

☐ Electricity generation

☐ Producing steam

☐ Producing hot water

☐ Direct Process heating

☐ Other ____________

b. Total Fuel Oil Consumption

Enter value ____________

Enter value (LBP) ____________

2. Diesel consumption and cost by source (for the survey year)*

Energy consumption by activity type	Amount	Unit	Energy Cost (LBP)
a. Fuel Oil consumption for electricity generation (on-site diesel generators)			
b. Fuel Oil consumption for steam generation			
c. Fuel Oil consumption for hot water generation			
d. Fuel Oil consumption for direct process heating			
e. Indicate other consumption of diesel			
f. Total Fuel Oil Consumption			

3. Fuel Oil storage*

What period of operation does your Fuel Oil storage allow?

Period

Unit

4. Steam consumption**

a. What is steam used for? Choose an item

b. What type of steam system do you use?

☐ Closed Circuit

☐ Open Circuit

c. How much steam is recovered in your process? %

5. Fuel Oil consumption by end-use (excluding electricity generation) (for the survey year)***

Please indicate the Fuel Oil consumption by type of end-use in absolute value or in percentage (%) share of total diesel consumption.

Equipment	Capacity	Unit	Fuel Oil Consumption	Unit
Boiler				
Steam boiler				
Hot water boiler				
Direct process heating				
Oven				
Furnace				
Drying				
Other				

Remarks: Please enter any remarks or comments you have regarding Section F.

G. LIQUIFIED PETROLEUM GAS (LPG)

1. Total Liquified Petroleum Gas (LPG) consumption (for the survey year)*

a. Liquified Petroleum Gas (LPG) is used at your facility for the purpose(s) of:

- ☐ Electricity generation
- ☐ Producing steam
- ☐ Producing hot water
- ☐ Direct Process heating
- ☐ Other ______

b. Total Liquified Petroleum Gas (LPG) Consumption

Enter value ______

Enter value (LBP) ______

2. Liquified Petroleum Gas (LPG) consumption and cost by source (for the survey year)*

Energy consumption by activity type	Amount	Unit	Energy Cost (LBP)
a. Liquified Petroleum Gas (LPG) consumption for electricity generation (on-site diesel generators)			
b. Liquified Petroleum Gas (LPG) consumption for steam generation			
c. Liquified Petroleum Gas (LPG) consumption for hot water generation			
d. Liquified Petroleum Gas (LPG) consumption for direct process heating			
e. Indicate other consumption of Liquified Petroleum Gas (LPG)			
f. Total Liquified Petroleum Gas (LPG) Consumption			

3. LPG storage*

What period of operation does your LPG storage allow?

Period

Unit

4. Steam consumption**

a. What is steam used for? Choose an item

b. What type of steam system do you use?

- ☐ Closed Circuit
- ☐ Open Circuit

c. How much steam is recovered in your process? %

5. Liquified Petroleum Gas (LPG) consumption by end-use (excluding electricity generation) (for the survey year)***

Please indicate the Liquified Petroleum Gas (LPG) consumption by type of end-use in absolute value or in percentage (%) share of total diesel consumption.

Equipment	Capacity	Unit	Fuel Oil Consumption	Unit
Boiler				
Steam boiler				
Hot water boiler				
Direct process heating				
Oven				
Furnace				
Drying				
Other				

Remarks: Please enter any remarks or comments you have regarding Section G.

H. RENEWABLE ENERGY

1. Total energy consumption from renewable energy sources*

a. Types of renewable energy installed on-site

☐ Photovoltaic

☐ Solar Water Heater

☐ Biomass

☐ Wind

☐ Other RE sources [ ]

b. Capacity of renewable energy source installed

Choose RE source [ ]

Enter value (kW) [ ]

2. Energy Consumption from Renewable Energy Sources (for the survey year)*

Energy consumption from type of renewable energy	Value	Unit
a. Energy consumption from photovoltaics		
b. Energy consumption from solar water heaters		
c. Energy consumption from wind		
d. Energy consumption from biomass		
e. Energy consumption from other RE source		
f. Total Energy Consumption from Renewable Energy		

3. Biomass consumption*

a. Is biomass used to:

- ☐ Produce steam in a boiler
- ☐ Produce hot water in a boiler
- ☐ Produce biogas in an anaerobic digester
- ☐ Other

b. Biomass boiler

Boiler	Type of biomass	Boiler capacity (kW)	Biomass consumption (tonne)

Remarks: Please enter any remarks or comments you have regarding Section H.

I. TRANSPORTATION***

Energy consumption by type (for the survey year)	Value	Unit	Cost (LBP)
a. Total diesel consumption for transportation			
b. Total gasoline consumption for transportation			
c. Total electricity consumption for transportation (electric vehicles and forklifts)			
d. Total LPG consumption for transportation			
e. Total energy consumption for transportation from alternative sources (biodiesel, methanol, hydrogen, ...)			

Remarks: Please enter any remarks or comments you have regarding Section I.

J. LUBRICANTS***

a. Total amount of lubricants used (for the survey year) [ ]

b. Total cost of lubricants used (for the survey year) [ ] LBP

Remarks: Please enter any remarks or comments you have regarding Section J.

[ ]

K. ENERGY DATA MONITORING SYSTEM*

1. Do you have an operational energy data monitoring system? ☐ Yes ☐ No
2. If yes, please indicate what type [ ]

Remarks: Please enter any remarks or comments you have regarding Section K.

[ ]

L. CONCLUSION

1. How much time did it take to complete this questionnaire (data collection + filling of questionnaire)?

Indicate number of days [ ] Days

Indicate number of hours [ ] Hours

2. Any additional questions or remarks you have regarding this questionnaire?

[ ]

Note:

** Entry level 1 minimum required data entry*

*** Entry level 2 voluntary for the first 3 years of enrollment in the program*

**** Entry level 3 voluntary for the first 5 years of enrollment in the program and minimum entry requirement for joining the energy data collection leadership program*

3. QUESTIONNAIRE – CEMENT INDUSTRY

Survey year

Submittal date

A. Contact details of focal person in charge of filling the questionnaire*

1. Full Name
2. Position in the Company
3. Preferred Contact Number
4. Email

B. General company information

1. Company Name
2. Sector of activity
3. Did you fill the questionnaire in the previous year? ☐ Yes ☐ No
4. Company address
5. ALI registration number
6. Ministry of Industry registration number*
7. Ministry of Finance registration number*
8. Which level of data entry are you categorized in?*
9. Do you wish to upgrade your level of data entry for this year?* ☐ Yes ☐ No
10. Are you a member of the energy data collection leadership group?* ☐ Yes ☐ No
11. Number of full time employees as of 01/01/2021*
12. Number of part time employees as of 01/01/2021*
13. Main products produced*
14. Number of operating days per week*
15. Number of operating hours per day*
16. Manufacturing Value Added**

17. Cost of input [ ]

(all inputs of the production process including energy and water but excluding labor and capital)***

18. Do you have a valid ISO certification?

- ☐ ISO 50001
- ☐ ISO 9001
- ☐ ISO 14001
- ☐ Other certification(s)

Please indicate other certification(s) [ ]

C. GENERAL ENERGY USAGE AND PRODUCTION INFORMATION

1. Sources of energy used*

- ☐ Electricity
- ☐ Coal
- ☐ Petcoke
- ☐ Fuel Oil
- ☐ Diesel
- ☐ Gasoline
- ☐ Liquified Petroleum Gas (LPG)
- ☐ Biomass
- ☐ RDF
- ☐ Other [ ]

2. Level of production utilization

(Average percent of production over the survey year from maximum production capacity) **

Indicate product 1 [ ] Indicate percentage [ ]

Overall [ ] Indicate percentage [ ]

3. Do you have a dedicated energy management team?* ☐ Yes ☐ No

If yes, please indicate number of staff in the team and their positions

[ ]

4. Have you previously implemented an energy efficiency project?*

If yes, what kind of project(s)?

☐ Yes ☐ No

Product name

Production volume

Unit

5. Overall production volume during the survey year***

Product name	Production volume	Unit
Total		

6. Overall energy usage and cost for the survey year*

Energy Source	Amount	Unit	Energy Cost (LBP)

Remarks: Please enter any remarks or comments you have regarding Section C.

D. ELECTRICITY

1. Source of electricity consumption

a. Source of electricity consumption*

☐ Utility
☐ On-site private diesel generators
☐ Renewable Energy

b. Facility total electricity demand capacity

Indicate total energy demand + Unit

2. Utility subscription*

Utility subscription 1

☐ 1 phase ☐ 3 phases

Enter subscription level in amps

Indicate Average Power Factor

3. Data for on-site generators*

Size of generator (kVA)	Fuel type	Amount of fuel used	Unit	Load factor (%)	Yearly hours of operation (hours)	Average power factor	Electricity output (kWh)

a. Do you apply waste heat recovery on your generators? ☐ Yes ☐ No

b. If yes, what is the yearly value of waste heat recovered in absolute value and what percentage of total wasted heat?

Enter value

Enter percentage

c. What is the percentage yearly value of waste heat recovered in total heating load demand?

d. What do you use the recovered heat for?

☐ Electricity generation
☐ Steam generation
☐ Hot water generation
☐ Direct process heating
☐ Other

4. Electricity consumption and cost by source (for the survey year)*

	Value	Unit	Cost (LBP)
a. Electricity consumption from utility			
b. Electricity consumption from on-site private generators			
c. Electricity consumption from subscription diesel generators			
d. Electricity consumption from renewable energy sources			
e. Total electricity consumption			

5. Electricity consumption by end-use (for the survey year)***

Please indicate the electricity consumption by type of end-use processes in absolute value or in percentage (%) share of total electricity consumption.

Equipment	Capacity	Unit	Electricity Consumption	Unit
Compressed air				
Pumping				
Process Equipment				
Conveying				
Packaging				
Electric Heating				
Lighting				
Other				

Remarks: Please enter any remarks or comments you have regarding Section D.

E. ENERGY SOURCES CONSUMED INSIDE KILN*

1. Indicate energy sources consumed inside kiln

Energy Source	Amount	Unit

2. Storage of energy sources used inside kiln*
What period of operation does your energy storage allow?

Energy Type	Period	Unit

Remarks: Please enter any remarks or comments you have regarding Section E.

F. DIESEL (EXCLUDING TRANSPORTATION)

1. Total diesel consumption (for the survey year)*

a. Diesel is used at your facility for the purpose(s) of:

- ☐ Electricity generation
- ☐ Producing steam
- ☐ Producing hot water
- ☐ Direct Process heating
- ☐ Other

b. Total Diesel Consumption

Enter value

Enter value (LBP)

2. Diesel consumption and cost by source (for the survey year)*

Energy consumption by activity type	Amount	Unit	Energy Cost (LBP)
a. Diesel consumption for electricity generation (on-site diesel generators)			
b. Diesel consumption for steam generation			
c. Diesel consumption for hot water generation			
d. Diesel consumption for direct process heating			
e. Indicate other consumption of diesel			
f. Total Diesel Consumption			

3. Diesel storage*

What period of operation does your diesel storage allow?

Period

Unit

4. Steam consumption**

a. What is steam used for? Choose an item

b. What type of steam system do you use?

- ☐ Closed Circuit
- ☐ Open Circuit

c. What percentage of condensate is recovered in your steam system? %

5. Diesel consumption by end-use (excluding electricity generation) (for the survey year)***

Please indicate the diesel consumption by type of end-use in absolute value or in percentage (%) share of total diesel consumption.

Equipment	Capacity	Unit	Diesel Consumption	Unit
Boiler				
Steam boiler				
Hot water boiler				
Direct process heating				
Oven				
Furnace				
Drying				
Other				

Remarks

Please enter any remarks or comments you have regarding Section F.

F. FUEL OIL

1. Total fuel oil consumption (for the survey year)*

a. Fuel Oil is used at your facility for the purpose(s) of:

☐ Electricity generation

☐ Producing steam

☐ Producing hot water

☐ Direct Process heating

☐ Other

b. Total Fuel Oil Consumption

Enter value

Enter value (LBP)

2. Diesel consumption and cost by source (for the survey year)*

Energy consumption by activity type	Amount	Unit	Energy Cost (LBP)
a. Fuel Oil consumption for electricity generation (on-site diesel generators)			
b. Fuel Oil consumption for steam generation			
c. Fuel Oil consumption for hot water generation			
d. Fuel Oil consumption for direct process heating			
e. Indicate other consumption of diesel			
f. Total Fuel Oil Consumption			

3. Fuel Oil storage*

What period of operation does your Fuel Oil storage allow?

Period

Unit

4. Steam consumption**

a. What is steam used for? Choose an item

b. What type of steam system do you use?

- ☐ Closed Circuit
- ☐ Open Circuit

c. How much steam is recovered in your process? %

5. Fuel Oil consumption by end-use (excluding electricity generation) (for the survey year)***

Please indicate the Fuel Oil consumption by type of end-use in absolute value or in percentage (%) share of total diesel consumption.

Equipment	Capacity	Unit	Fuel Oil Consumption	Unit
Steam boiler				
Kiln				
Other				

Remarks: Please enter any remarks or comments you have regarding Section G.

H. RENEWABLE ENERGY

1. Total energy consumption from renewable energy sources*

a. Types of renewable energy installed on-site

- ☐ Photovoltaic
- ☐ Solar Water Heater
- ☐ Biomass
- ☐ Wind
- ☐ RDF
- ☐ Other RE sources

b. Capacity of renewable energy source installed

Choose RE source

Enter value (kW)

2. Energy Consumption from Renewable Energy Sources (for the survey year)*

Energy consumption from type of renewable energy	Value	Unit
a. Energy consumption from photovoltaics		
b. Energy consumption from solar water heaters		
c. Energy consumption from wind		
d. Energy consumption from biomass		
e. Energy consumption from other RE source		
f. Total Energy Consumption from Renewable Energy		

3. Biomass consumption*

a. Is biomass used to:

- ☐ Produce steam in a boiler
- ☐ Produce hot water in a boiler
- ☐ Produce biogas in an anaerobic digester
- ☐ Other

b. Biomass boiler

Boiler	Type of biomass	Boiler capacity (kW)	Biomass consumption (tonne)

4. RDF consumption*

RDF	RDF consumption (tonne)	Calorific Value (MJ/kg)
RDF 1		
RDF 2		

Remarks: Please enter any remarks or comments you have regarding Section H.

I. TRANSPORTATION***

Energy consumption by type (for the survey year)	Value	Unit	Cost (LBP)
a. Total diesel consumption for transportation			
b. Total gasoline consumption for transportation			
c. Total electricity consumption for transportation (electric vehicles and forklifts)			
d. Total LPG consumption for transportation			
e. Total energy consumption for transportation from alternative sources (biodiesel, methanol, hydrogen, ...)			

Remarks: Please enter any remarks or comments you have regarding Section I.

J. LUBRICANTS***

a. Total amount of lubricants used (for the survey year) [ ]

b. Total cost of lubricants used (for the survey year) [ ] LBP

Remarks: Please enter any remarks or comments you have regarding Section J.

[ ]

K. ENERGY DATA MONITORING SYSTEM*

1. Do you have an operational energy data monitoring system? ☐ Yes ☐ No
2. If yes, please indicate what type [ ]

Remarks: Please enter any remarks or comments you have regarding Section K.

[ ]

L. CONCLUSION

1. How much time did it take to complete this questionnaire (data collection + filling of questionnaire)?

Indicate number of days [ ] Days

Indicate number of hours [ ] Hours

2. Any additional questions or remarks you have regarding this questionnaire?

[ ]

Note:

** Entry level 1 minimum required data entry*

*** Entry level 2 voluntary for the first 3 years of enrollment in the program*

**** Entry level 3 voluntary for the first 5 years of enrollment in the program and minimum entry requirement for joining the energy data collection leadership program*

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