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NAMA CHILE
Energías Renovables para Autoconsumo

Ministerio de Energía
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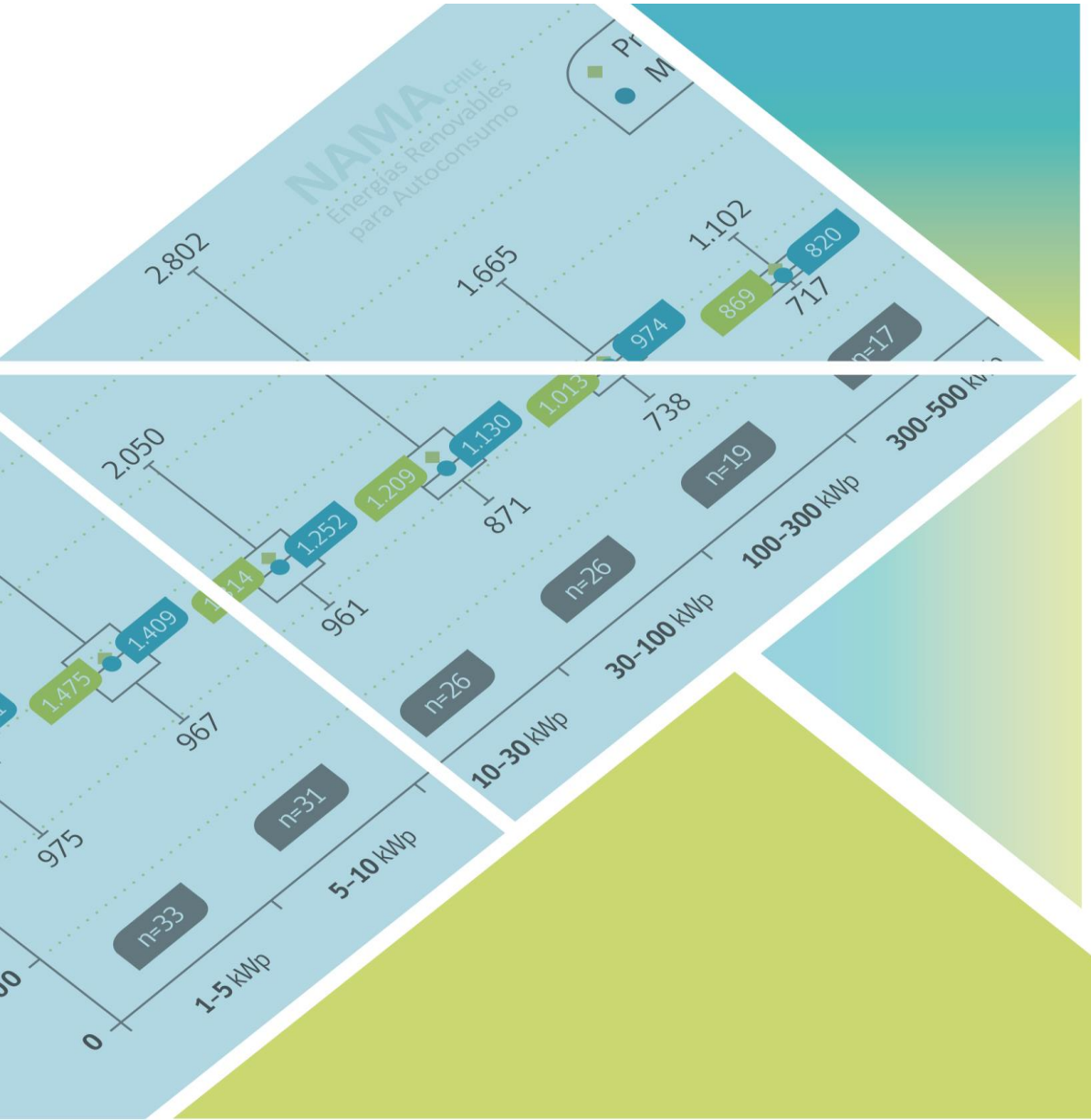


Guidance for the implementation of price indexes

NAMA Facility

Por encargo de:
Ministerio Federal de Medio Ambiente, Protección de la Naturaleza y Seguridad Nuclear de la República Federal de Alemania

Department for Business, Energy & Industrial Strategy

European Commission

CONTENTS

DISCLAIMER

It must be emphasized that all specifications and recommendations proposed in this presentation have been drawn up based on experience in the price indexes that have been implemented to date. It is suggested that all **information presented should be used for support and reference in future studies, but never as fixed conditions that cannot be modified.**

It is recommended that analysis should be conducted prior to each study, covering the market, progress in technology since the previous study, and regulations applicable to the technology, if any changes have occurred. This analysis can be used to determine whether or not is it necessary to perform a new **market study** together with the price index. Additionally, in line with changes in the market and the technology in question, it must be determined whether it would be relevant to modify the power ranges, included components, project formats (such as inclusion of photovoltaic systems that are not connected to the distribution grid), and classes of technologies and/or fuels. However, it should be considered that **any changes to the methodology must be implemented in such a way as to ensure that the results are always comparable with the findings of the previous edition.**

INTRODUCTION

This presentation describes proposals and experiences obtained through the implementation of Renewable Energy Technology Price Indexes, with the principal objective of serving as guidance and reference material for subsequent studies.

The studies used to prepare this document were implemented between 2017 and 2020, in the framework of the Technical Component of the NAMA Support Project, Self-Supply Renewable Energy in Chile. During the first two years the scope was limited to **Photovoltaic Solar Systems (PV)**, while in 2019 one project was included for **Aerothermal and Geothermal Heat Pumps** and one for **Biomass Boilers and Heaters and the fuels used to operate them.**

The presentation starts with a brief description of what price indexes are and what benefits they can provide, together with information on the products that have been generated to date, with links to the original documentation for each. It then describes the implementation process for a Price Index, attaching possible consultancy firms to consider for each technology, implementation costs and timelines, technical specifications used in previous studies, consultant reference material, implementation of surveys and deliverables. Finally, it puts forward some general recommendations and points to take into consideration for future versions of these studies.

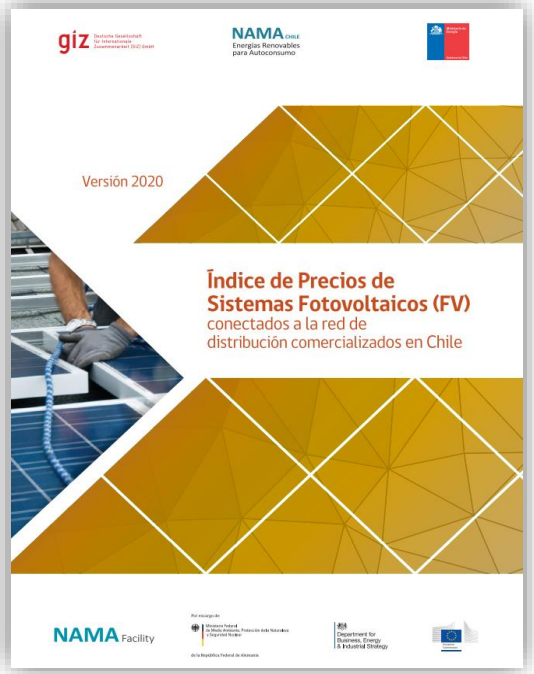
PRICE INDEXES

What is a price index and what are they for?

- A price index is an indicator that shows the price range for a given technology in each time period, and a representative sample of products. Ideally it should be repeated in subsequent years, to analyze pricing trends over the course of time.
- When preparing a price index, a number of components of a renewable energy project may be considered, such as costs associated with design, fitting out, and installation (depending on the specifics of the case), logistics, etc. Price indexes can be combined with studies of markets and value chains, to enhance market analysis for different renewable technologies.
- When no prior price index exists for a given technology, or when it is less standardized that in the case of the photovoltaic market for example, it is advisable to also prepare a market study. This market study should include a **value chain**, which is a tool for analysis of a market, company, product, or service to determine what characteristics define it and generate value or a competitive advantage. This tool can be used to describe the strengths, processes, and stakeholders involved in each stage of the chain that defines a given market or the implementation of a project.
- **Benefits**:
  - The market is rendered transparent, for suppliers as well as for potential clients and the general public.
  - A basis is established for understanding regarding the costs of implementing renewable energy projects for internal consumption, and their distribution by sub-components.
  - An idea is generated regarding the range of prices currently offered in the Chilean market.
  - Information is provided to domestic companies that may wish to offer systems, regarding market prices in international contexts.
  - General description of the market and identification of suppliers of renewable technologies.

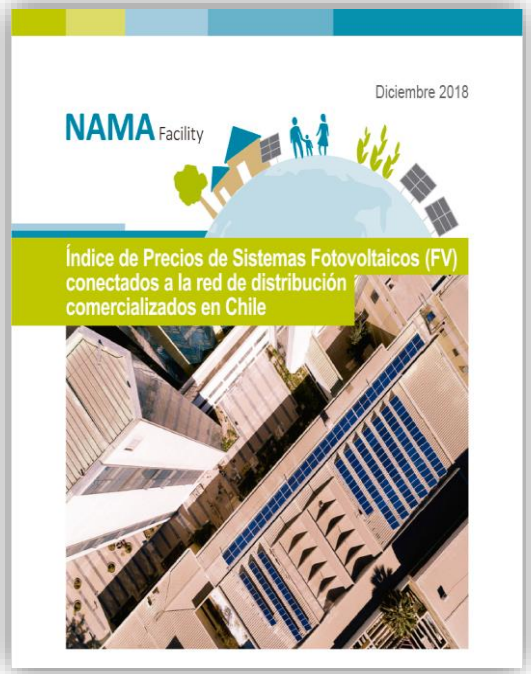
PRODUCTS GENERATED

Photovoltaic Systems (PV)



[Photovoltaic System Price Index 2020]

[Photovoltaic System Price Index 2019]



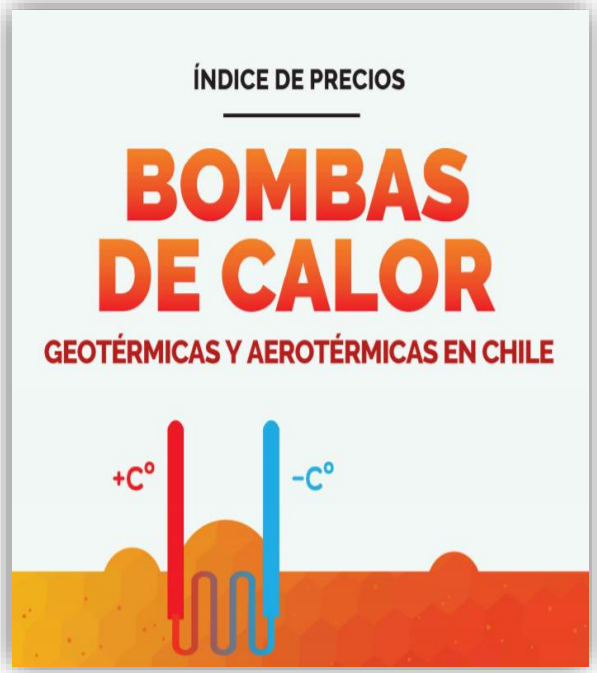
[Photovoltaic System Price Index 2018]

[Photovoltaic System Price Index 2017]

PRODUCTS GENERATED

Geothermal and Aerothermal Heat Pumps

[Heat Pump Market Study 2019, incl. Value Chain]

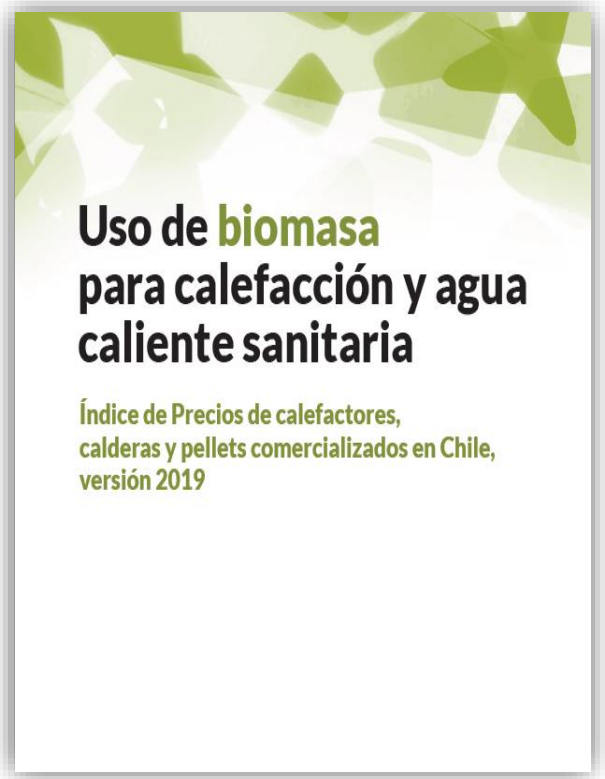


[Heat Pump Price Index 2019]

[Heat Pump Supplier List 2019]

PRODUCTS GENERATED

Biomass Boilers and Heaters and Energy Sources Used for their Operation



Boiler, Heater, and Pellet Price Index 2019

IMPLEMENTATION PROCESS FOR PRICE INDEXES

Definition and Preparation

- Definition of study scope.
- Preparation of ToR.
- Identification of potential consultancy firms.
- Study tender process.
- Technical-economic assessment of offers.
- Kick off meeting with consultancy firm to define the scope of the study and milestone dates for deliverables.

Market Research

- Delivery of the supplier list and specification of the target scope.
- Approval of the survey proposed by the consultancy firm.
- Specification of the platform for implementing the survey.

Implementation

- Delivery of letters of invitation to suppliers (optional)
- Survey implementation.
- Adaptation of target scope (optional).
- Review and validation of deliverables.
- Statistical analysis.
- Submission of final deliverables.

Outreach

- Creation of products for publication.
- Publication of study results.

IMPLEMENTATION PROCESS FOR PRICE INDEXES

Definition and Preparation

1) Definition of study scope. If sufficient information is not available on the market for a given technology, the Terms of Reference should include a prior characterization by means of describing the different equipment items available and specification of the stages in the value chain.
2) Preparation of **Terms of Reference** for the consultancy, including deliverables and schedules.
3) Identification of potential consultancy firms for the study.
4) Study tender process.
5) Technical-economic assessment of offers submitted.
6) Kick off meeting with consultancy firm to define the scope of the study and milestone dates for deliverables.

Market Research

1) The consultancy delivers the supplier list and works with the counterparts to define **the target scope** to be used.
2) Final approval of the survey prepared by the consultancy, having defined the structure and questions to be included.
3) Specification of the platform for implementing the survey (online, phone, and/or in person).

IMPLEMENTATION PROCESS FOR PRICE INDEXES

Implementation

1) Delivery of letters of invitation to suppliers for participation in the study (optional).
2) Implementation of the survey, with monitoring of response rate status.
3) Adaptation of target scope (optional).
4) Review and validation of deliverables by the principal.
5) Statistical analysis of the survey results.
6) Presentation of final deliverables (supplier list, statistical analysis, calculation notes, reports, images, etc.).

Outreach

1) Creation of products for publication (reports, guidance, fact sheets, etc.).
2) Publication of relevant study results (events, webinars, delivery to associations, etc.).

CONTENT ITEMS REQUIRED IN OFFERS FROM CONSULTANCY FIRMS

Consultancy firms' offers should include a technical proposal and an economic proposal. These two proposals will be evaluated by different teams, such that the team reviewing the technical proposal is not aware of the details of the economic proposal, in order to ensure maximum impartiality.

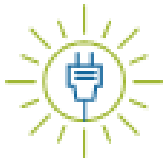
The criteria and weightings used for the evaluation of **technical offers** are specified below:

- **Work proposal (35%)**. Evaluation of the consistency and description of the technical proposal to meet the objectives defined in the ToR. The ToR should specify that preference will be given to offers with innovative proposals to enhance survey response rates.
- **Suitability of proposed concept (20%)**. Evaluation of the strategy for implementing the methodology and the proposed work schedule. Here, valued items include the level of detail, clarity, relevance, and timeliness of delivery milestones for the required products. A week-by-week Gantt Chart is to be included, showing the duration of the consultancy project.
- **Work team background (15%)**, including the CV of each team member.
- **Professional experience of the company (15%)**, including references to projects related to the topics of the study.
- **Backstopping (Team and conception)/Information management (7.5%)**. Consideration is given to the company's capacity in terms of possession of resources, tools, and internal procedures that ensure correct implementation of the project. This can be verified with certifications, software licenses, reference materials, partnerships, etc.
- **Risks/Advantages (7.5%)**. Value is ascribed to points such as flexibility in the event of any changes the principal may require, prior experience in implementation of surveys and price indexes, proposals over and above the requirements specified in the terms of reference, etc.

Meanwhile, the **economic offer** should include proposals covering at least the following points:

- Work hour valuation for each product.
- Total work hours considered (broken down by item or product).

IMPLEMENTATION TIMELINES



Photovoltaic Price Index

Prior studies' implementation times:

- PVPI 2017: Approximately 4 months, between mid-**August** and early **December** 2017.
- PVPI 2018: Approximately 3 months, between early **July** and early **October** 2018.
- PVPI 2019: Approximately 4 months, between early **June** and late **September** 2019.
- PVPI 2020: Approximately 4 months, between late **May** and early **October** 2020.

Suggestions: This study should be conducted once per year, and ideally always during the same period. Prior experience suggests that the study should begin in **May or June**. Thus, assuming an approximate **implementation time of 4 to 5 months**, the final results should be ready for publication by the end of the year. Additionally, it is recommended that **each year** the need to prepare a **market study** should be evaluated in line with technological advances, any changes in applicable regulations, and development in the Chilean market.

IMPLEMENTATION TIMELINES

Aerothermal and Geothermal Heat Pump Study

Prior study implementation time: The contract **start, and end** dates were **April and September** 2019. However, the **end date was extended to the end of October 2019** as the survey implementation period was extended. Therefore, the total duration was **6 months**. The study included preparation of a price index, a market study, and a supplier list.

Suggestions: It is suggested that a price index should be prepared every **two years**. The market study need not be repeated for subsequent studies in the short term; only an update to the price index and supplier list need be conducted. It is recommended that future versions of the price index and supplier list should always start in the same month, ideally **April or May**, with an approximate duration of **5 months. Additionally**, it is recommended that **every two years** the need to prepare another **market study** should be evaluated in line with technological advances, any changes in applicable regulations, and development in the Chilean market.

IMPLEMENTATION TIMELINES

Price Index for Biomass Boilers and Heaters and Energy Sources Used for their Operation

Prior study implementation time: The contract **start, and end** dates were the start of **September to late-November** 2019, equivalent to 12 weeks. However, **the end date was extended by a further 7 weeks**, due to the characteristics of the market. Therefore, the study had a final duration of approximately **19 weeks**. It should be noted that the study included preparation of a price index and a market study.

Suggestions: In view of the characteristics of this market, it is recommended that the price index for pellets should be updated **each year**, and the price index for boilers and heaters **every two years**. It is estimated that the contract should have a duration of **4 to 5 months**. It is also recommended that the study should always start in the same month, ideally **July or August**. Additionally, it is recommended that **every two years** the need to prepare another **market study** should be evaluated in line with technological advances, any changes in applicable regulations, and development in the Chilean market.
Finally, it should be mentioned that the results of this study **do not** cover the concept of 'turnkey' price; they cover the cost of equipment, without installation. This is because installation costs can vary significantly depending on project characteristics.

IMPLEMENTATION TIMELINES

The reason for recommending that the **PV Price Index** should be updated each year is linked to the characteristics of the market and the technology. PV systems are easier to standardize than heat pumps and biomass boilers, mainly because more factors need to be taken into consideration for the latter two technologies, making PV systems more cost efficient. Additionally, the solar PV market is fairly mature, has a large number of stakeholders involved, and has achieved a significant reduction in investment costs during recent years, justifying ongoing annual monitoring of turnkey prices.

Meanwhile, 2019 saw the first price indexes for heat pumps and for biomass boilers and heaters. It is considered advisable to wait two years before repeating the study, and to use these results to analyze how frequently it would be suitable to update the Price Indexes for these two technologies.

Additionally, new regulations are expected to come into force for heat pumps, which may promote development in the market for this technology. Therefore, it may prove useful to update the heat pump Price Index once these new regulations come into force.

CONFIDENTIALITY OF INFORMATION

The consultancy company must be required to maintain absolute confidentiality over the information that it receives from the counterpart in order to conduct the tasks that are commissioned. The company that is hired must agree not to disclose any of this information to third parties, unless the contracting party explicitly permits it to do so. These requirements are to cover the period during which professional services are being provided and remain in force after the contract has been fully executed.

It must be noted that the conclusions and opinions of the authors do not necessarily reflect the position of the Government of Chile or GIZ. Additionally, any references to a company, product, brand, manufacturer, or similar body shall not under any circumstances constitute a recommendation by the Government of Chile or GIZ.

SUPPLIER LIST

- The first task to be performed by the consultancy firm is to define the **universe of suppliers**. The universe of suppliers comprises the list of companies to be used for implementation of the survey. The following matters should be considered when preparing this list:
    - Definition of the **universe of suppliers** should be one of the milestones for deliverables.
        - The companies should be present in the market. Companies that have not implemented projects relating to the study within the past year are not to be included.
        - The universe of suppliers shall comprise those companies that design and/or market projects, equipment, and/or installations (which can include companies that offer turnkey projects and companies that only handle one of the stages).
        - Companies can be selected from the material provided to the consultancy firm before beginning the study, or directly through their own research. This can include online searches for company information, both to define the universe of suppliers and for implementation of the survey.

- The universe of suppliers can be adapted. Once the survey process has begun, suppliers may have gone out of business or may not have worked on renewable power projects within the past year. When duly justified, the universe of suppliers can be reduced. Therefore, **if the universe of suppliers is reduced, there will be a new minimum number of companies to be surveyed in order to attain the predefined confidence level.**

SUPPLIER LIST

Once the **universe of suppliers** has been determined, the sample size necessary to attain a given confidence level in the results should be calculated. By way of reference, the equation used to calculate to sample size in previous studies is provided; this can be modified in line with the characteristics of the universe of suppliers available in future studies. Previous price index studies were requested to attain a minimum confidence level of 90% with an error of 10%.

$$n = \frac{N \cdot Z^2 \cdot p \cdot (1-p)}{(N-1) \cdot e^2 + Z^2 \cdot p \cdot (1-p)}$$

Where:

- **n** is the sample size (number of responses).
- **N** is the size of the universe of suppliers.
- **Z** is the deviation of the mean value to achieve the desired confidence level. Depending on the confidence level, a value will be used as determined based on a Gaussian distribution:
  - Confidence level 90%, Z = 1.64
  - Confidence level 95%, Z = 1.96
- **e** is the estimation error and is 10% for both confidence levels.
- **p** is the probability in favor, with a value of 0.5.

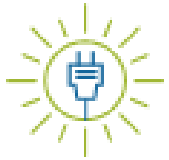
SUPPLIER LIST

Validated supplier lists should include the suite of minimum characteristics shown in the following list. The Annexes also contain the supplier lists from the PV and Heat Pump price index projects, by way of example.

- Company name.
- Indicate whether or not it implements the ESCO model.
- Email address of a contact person.
- Telephone number.
- Regions where the company has performed installations.
- Website.
- Business focus (design, sale of equipment and/or installation, ESCO service, sale of fuel (if applicable, and specifying what type of fuel)).
- Number of branch offices, stating the regions and districts where they are located.
- Identification of a **direct contact within the company:** name, position, email address, telephone number (no generic email addresses or main switchboard telephone numbers will be accepted, except where explicitly justified by the company and verified with an email to that effect).

For the deliverable, a single document should be submitted for the supplier list, in Excel format and should be validated by the corresponding counterparts.

REFERENCE MATERIAL FOR PREPARING THE SUPPLIER LIST



Photovoltaic Systems

- Database of PV suppliers prepared in the most recent version of the PV System Price Index. The principal will provide this database to the consultancy company.
- Database of PV suppliers and installation service providers that have issued TE-4 statements to the SEC. This information is available on the SEC website: http://www.sec.cl/portal/page?_pageid=33,6169736,33_6415703&_dad=portal&_schema=PORTAL
- Acesol and/or Acera database that should be compiled by the selected consultancy company.
- Bibliography.

REFERENCE MATERIAL FOR PREPARING THE SUPPLIER LIST

Heat Pumps

- List of aerothermal and geothermal heat pump suppliers (2019 version), prepared by GIZ and available at: https://www.energia.gob.cl/sites/default/files/lista_de_proveedores.pdf

- Document *¿Quién es quién en el mercado de bombas de calor?* [Who's Who in the Heat Pump Market], prepared as part of the project *"Estado de desarrollo de proyectos de bombas de calor geotérmicas instalados en Chile"* [Development status of geothermal heat pump projects installed in Chile], undertaken by AIGUASOL for CIFES and the Ministry of Energy. Publication year: 2016.

- *Cámara Chilena de Calor y Frío* [Chilean Chamber of Heating and Cooling] database that should be compiled by the selected consultancy company.

- Bibliographic information.

REFERENCE MATERIAL FOR PREPARING THE SUPPLIER LIST

Biomass Boilers and Heaters

- Price Index for biomass boilers and heaters and fuels used to operate them, prepared by GIZ in 2019: https://www.energia.gob.cl/sites/default/files/biomasa_-_indice_de_precios.pdf
- List of pellet and firewood fueled heating systems certified by the SEC, available at: http://www.sec.cl/portal/page?_pageid=33,6069695&_dad=portal&_schema=PORTAL
- Union association Achbiom database that should be compiled by the selected consultancy company.
- Bibliographic information.

SURVEY IMPLEMENTATION

- To implement the survey, it is necessary to establish a suitable methodology for contacting the suppliers and compiling information. The contact methodology should ideally be in the format of an online survey (backed up with contact by email, telephone, or other means, if necessary). In any case, the consultancy company may propose another methodology, which should be validated by the principal before it can be implemented.

- The platform used for the online survey should ensure the protection of data entered, in compliance with Chilean regulations on information security and personal data protection. The consultancy firm should contract the service within its proposal and should be capable of using the tool to implement a simple and precise survey.

- Before the start of implementation, the principal will provide the consultancy firm with a letter of invitation to take part in the survey, signed by representatives of the Ministry of Energy. The consultancy company is to use this letter to issue invitations to supplier companies featured on the lists provided previously.

SURVEY IMPLEMENTATION

- The consultancy firm is expected to take the following matters into account when implementing the survey:

    - Suggesting complementary methods to increase the response rate.
    - The following items should be taken into consideration regarding the letter of invitation sent to suppliers or the presentation of the activity to survey participants:
        - The invitation is to be validated by the principal.
        - Indicate the context, e.g. that the survey has been commissioned for the NAMA Support Project on Renewable Power for Internal Consumption in Chile (only applicable through 2020).
        - Ensure confidentiality of the information submitted by survey participants, that is, it should be made clear from the start that only aggregated results will be published, with no individual data or publication of sensitive information submitted by participants.
        - In order to enhance response rates, suppliers may be offered the chance to add their logo to the publication summarizing the results.
        - Indicate that this study will help promote the market for this technology and will therefore enhance the visibility of participants.

SURVEY IMPLEMENTATION

- The consultancy firm is expected to take the following matters into account when implementing the survey:

    - The consultancy firm is expected to propose a wide range of contact and monitoring methods to ensure a suitable response rate from participating companies. One point to emphasize may be the inclusion of the company's logo on the document that is published at the end of the study, as well as an invitation to take part in any outreach events relating to the price index.
    - When companies express an interest in taking part in the survey and do provide information, they should be asked for photos of projects they have implemented (optional) and a high-resolution file of their logo (compulsory) together with a written authorization (which may be granted by email) to use these images in the publication of the price index.
    - It is suggested that company logos should be requested during the early stages of contact (at the start of implementation).
    - Once the process of gathering information has been completed, an email should be sent to thank the participating companies, also informing them that they will be sent the summary of the study.
    - The consultancy company should provide a copy of the invitations and emails of thanks sent to all companies in an Excel file or a compressed folder.

TECHNICAL SPECIFICATIONS OF PREVIOUS STUDIES

Photovoltaic Systems

- Types of installation included in previous editions:
  - Participating companies had experience in the installation of grid-connected PV systems, as stipulated under Law 21,118, the Distributed Generation Law.
  - Experience in installations between 300 kW and 1.5 MW (1,500 kW). These systems may comprise Small Distributed Generation Facilities (SDGFs) connected to the distribution grid, or non-connected PV systems, as established in Electrical Standard 4/2003.

- Range of power levels used in previous editions:

Distributed generation law	SDGF
1 kW – 5 kW	300 kW – 500 kW
5 kW – 10 kW	500 kW – 1,500 kW
10 kW – 30 kW	
30 kW – 100 kW	
100 kW – 300 kW	

TECHNICAL SPECIFICATIONS OF PREVIOUS STUDIES

Photovoltaic Systems

- The information of prices in the Chilean market compiled during the study were submitted with a breakdown for the following components and for each of the ranges included in the study:
  - Photovoltaic panels
  - Inverters
  - Electrical and assembly materials
  - Installation (including logistics and labor costs)

- In the case of PV systems connected to the grid under the Distributed Generation Law, the official database were provided by the Superintendency of Electricity and Fuels (SEC), such that PV suppliers included in the baseline were those that possess PV projects registered with the SEC.

- The consultancy company also identified suppliers that install PV projects with power levels over 300 kW, that is, outside the range of the Distributed Generation Law, to complement the baseline of PV suppliers. It is also recommended that future editions of the study should include projects that are not connected to the distribution grid and that use storage systems.

TECHNICAL SPECIFICATIONS OF PREVIOUS STUDIES

Heat Pumps

- The consultancy firm should include companies that market equipment that can be used in the residential, commercial, and industrial sector. Here, the following power ranges should be considered: i) low, up to 20 [kWt]; and ii) high, over 20 [kWt]. These ranges arise from the difference between single-phase and three-phase equipment. The information gathering is also to include the 25 indicators defined in the 2019 heat pump price index (10 geothermal price indicators, 12 aerothermal price indicators, and 3 indicators for emitter systems). These indicators include equipment costs for units based on different technologies, heat pump installation, capture system installation, equipment and installation of emitter systems, and maintenance.
  It is suggested that the characteristics of the different supplier markets should be reviewed each year.

- In the field of geothermal heat pumps, at least the following items are to be considered:
  - Open cycle and closed cycle systems.
  - Horizontal collectors and vertical collectors.
  - Electric and gas pumps.

- In the field of aerothermal heat pumps, at least the following items are to be considered:
  - Residential systems: unitary systems (Split), centralized systems (Multisplit), hot water production, and heating via radiators or heated floors.
  - Commercial systems: indirect expansion systems (chillers) and direct expansion systems (VRV).
  - Industrial systems: for water heating and for process heating.

TECHNICAL SPECIFICATIONS OF PREVIOUS STUDIES

Biomass Boilers and Heaters

- The biomass heater and boiler supplier list should include companies that market equipment used in the commercial and industrial sector. It is also to include a list of biofuel suppliers for operating the boilers and heaters (pellets, chips, or briquettes).

- The power range for boilers ran from 10 [kWt] to 1,000 [kWt], and the range for heaters ran from 4 [kWt] to 25 [kWt]. The intermediate boiler power ranges are to be proposed by the consultancy firm, with the following table offered by way of example:

Biomass Boiler power range (kWt)
10 kW – 29 kW
30 kW – 49 kW
50 kW – 99 kW
100 kW – 299 kW
300 kW – 499 kW
500 kW – 1000 kW

Biomass Heater power range (kWt)
4 kW – 5 kW
5.1 kW – 6 kW
6.1 kW – 7 kW
7.1 kW – 8 kW
8.1 kW – 9 kW
9.1 kW – 10 kW
> 10.1 kW

TECHNICAL SPECIFICATIONS OF PREVIOUS STUDIES

Biomass Boilers and Heaters

- Questions for boiler suppliers are also to include issues relating to the fuels used, apart from wood pellets and chips, identifying whether these fuels are traded or whether they are obtained from production processes at the company where the biomass boilers are installed (waste product usage).

- A price comparison is to be obtained for different types of biomass boiler. For example, a biomass boiler of 30 [kWt] fueled with pellets comprises one class, while a boiler of 30 [kWt] that operates with pellets, chips, and other waste products constitutes another class. In order to attain pricing comparability for the classes of biomass boilers, the list of pellet and firewood fueled heating systems certified by the SEC should be taken into account.

- A methodology should be proposed for the fuel price index such as to gather prices for pellets, chips, and briquettes (to be defined by the MEN), from the Metropolitan Region to Aysén Region.
  The principal characteristics of the fuels that are available on the market should also be verified, such as dimensions, density, and moisture content.

DELIVERABLES

- List of suppliers included in the study, in Excel format. The lists should be validated by the counterparts.

- The first progress report is to be delivered in Word format, indicating: i) detailed work schedule, indicating flow of activities and implementation periods for each activity; ii) Gantt Chart, which is to indicate the specific work or activities to be conducted, specifying their durations and sequence; iii) work methodology to be used; and iv) proposal for progress meetings with the technical counterpart.

- The second progress report should include the list of suppliers and the minimum number of responses necessary to attain the confidence level based on the target scope. A work plan for the implementation of the methodology should also be included, in Word format.

  Optional: indicate the confidence level and % error.

- The third progress report is to be delivered in Word format and should include the implementation of the methodology for making contact and gathering information. Technically validated surveys should also be included, with corresponding cost information (Excel file).

DELIVERABLES

- Deliverable 4 is to include a statistical analysis of the data compiled, which will be presented in the final report (Word file) and an Excel file (database of survey results, statistical calculations, graphs, and cost breakdown by components). The information is to be presented in a box graph (legible and easily understood), showing the methodology for specifying the minimum and maximum values, quartiles, median, and atypical values for each power range. For further reference, it is recommended that the results should be presented in the same format that was used in the PV price index:
  http://www.minenergia.cl/archivos_bajar/2020/02/Factsheet_IP_FV_Final.pdf

- Official high-resolution logo of the suppliers that have expressed an interest in being part of the price index publication (factsheet format), with corresponding usage authorization.

- The final delivery comprises a summary or extract of the final report in Word format, which should be brief and written in language accessible to a layperson and should include the principal graphs (use the 2019 PV price index factsheet as guidance for this product).

POSSIBLE PROBLEMS TO BE TAKEN INTO ACCOUNT

- Survey response rate. In many cases, suppliers do not respond to the survey and cannot be contacted by email or telephone, which complicates correct implementation of the price index. The consultancy company is to prioritize correct preparation of the survey, indicating at the kick-off meeting which team members are to handle this task.

- The previous point is directly linked to the universe of suppliers to be considered for statistical analysis of the study. If not all contacts included in the supplier list can be surveyed, the universe should be redefined to include only those that participated in the process.

- Problems with the concept of 'turnkey'. Some technologies show excessing price variations if the definition of 'turnkey' includes either only installation of the equipment (technology changeover) or also installation of all components necessary for it to function (for example, biomass boilers or heat pumps).

- The Terms of Reference must leave no room for ambiguity in the technical specifications to be applied in the study. The language used in the Terms of Reference must be direct and concise, as if phrases such as "it is suggested" or "it is hoped" are used, the consultancy firm may decide to omit important features when implementing the price index.

- There is a temptation to eliminate suppliers from the scope of the study in order to improve statistical indicators. Any elimination of a supplier should be duly justified based on the company's operations, not whether or not it can be contacted.

RECOMMENDATIONS

During implementation:

- Send a personalized email from the official email account to each supplier. Successful tactic in the PV price index.
- Direct calls and emails from the Ministry of Energy. Successful measure that increased response rate in the heat pump price index.
- Visits by the consultancy firm to the companies to conduct the survey (optional).
- In-person participation at industry events for the sector in question, where companies can complete the survey on the spot, for example using tablets and/or computers and/or on paper.
- Collaboration with industry associations to build awareness of the price index study that is being implemented.
- The survey should be complete, concise, and simple, to minimize the time taken in responding.

Regarding the letter of invitation to take part in the survey:

- The letter is to mention how many downloads and/or visits were involved in the previous edition of the price index.
- It should be mentioned that an outreach webinar will be included at the end of the study (so long as the webinar can be offered), presenting the results of the study and the list of participating suppliers.
- Add and emphasize that the results will be published on the website and in publications of the MEN, and to potential clients for the technologies.

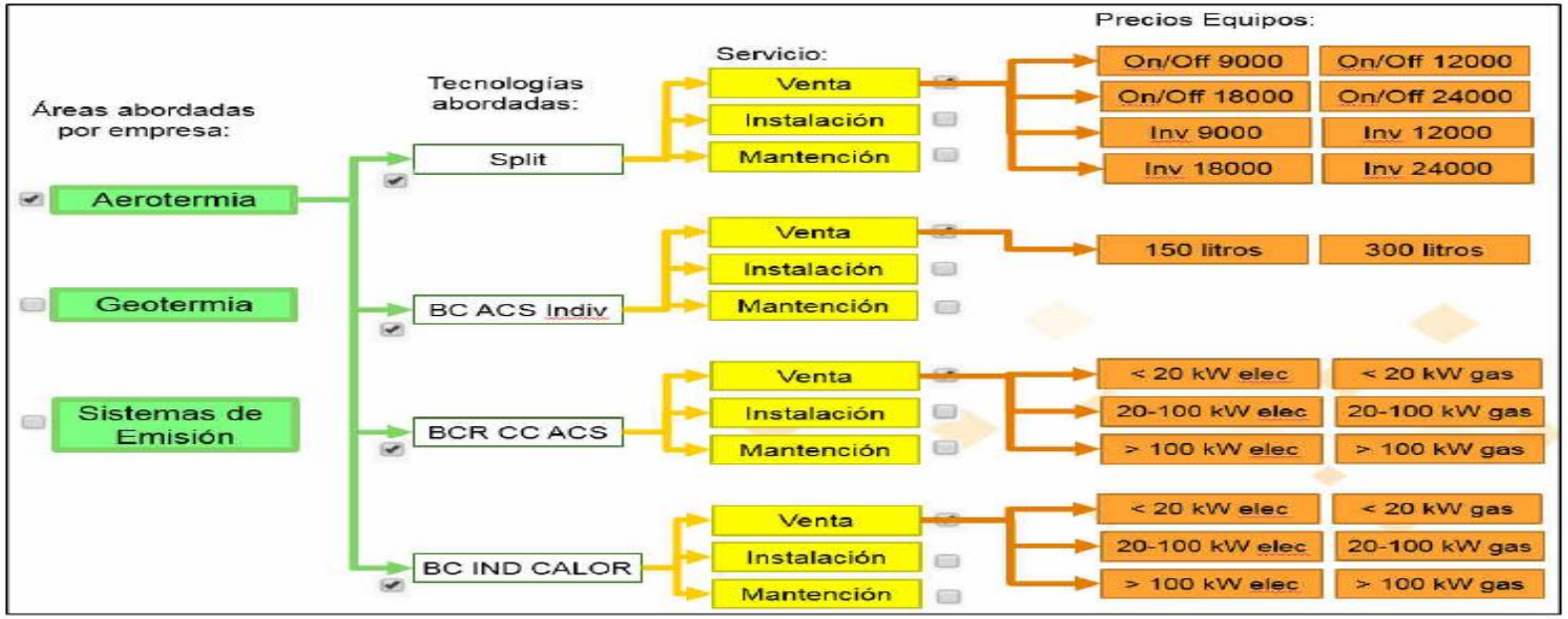
RECOMMENDATIONS

Survey preparation

Usage of platforms such as **Askallo and Surveygizmo** is recommended.

This platform type is recommended because it allows surveys to include **decision trees**, a feature not available in SurveyMonkey or Google Forms, which only allow the creation of lists of questions.

Decision trees allow a single survey to be applied for different technologies and/or specifications, providing an opportunity for respondents to only answer questions that are relevant for their specific situations. These surveys can allow questions to be selected for application with each company, so when a company only addresses a small segment of the full range of technologies, the survey will run to just a few questions, reducing the time taken to fill out the response by up to 50%. The decision tree used in the heat pump study is shown below.



RECOMMENDATIONS

- The evaluation criteria for technical proposals could include proposed methods for attaining a high survey response rate and problem solving in the event of a low response rate.

- Ideally, the consultancy firm should have experience working on renewable power projects, data analysis, and survey implementation, and should have connections with the suppliers.

- Value should be ascribed to the possibility of including a question on maintenance and after-sale service in the surveys.

- For future price indexes, it is recommended that efforts should be made to include the leading industry associations for each technology, either as the main project counterpart or participating jointly with the Ministry of Energy. It is recommended that ACESOL could be approached for the PV price index, ACHIBOM for biomass, and *La Cámara Chilena de Refrigeración y Climatización A.G.* (CChRyC) for heat pumps.

RECOMMENDATIONS

Proposals to enhance survey response rate:

- Before implementing the survey, a publication and/or event may be produced in order to announce and promote the survey and the study and a whole. The format and content items may be proposed by the consultancy firm and validated by the Ministry of Energy.

- Consider holding a launch event for the price index before conducting the survey. This event (on-site or online) could present past results and promote participation in the survey.

- The ToR should specify that preference will be given to offers with innovative proposals to enhance survey response rates.

- Consider holding a webinar at the end of the study and preparing a product like the heat pump supplier list for all price indexes, to provide participating companies with enhanced visibility.

- Before launching the price index campaign, prepare a factsheet with the results of the previous year's index, with a chapter on the companies that took part, arranged from north to south on a map of Chile, showing the name, address, telephone number, email address, website, and headquarters/branch offices.

- Include industry associations for each technology in the outreach and survey implementation monitoring phases, ideally so that they can provide support when surveys are sent out and companies are contacted.