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June 2020

Development of a national roadmap for the use of low-temperature geothermal energy for thermal conditioning in the residential, industrial and commercial services sectors in Uruguay

Product 2

CTCN
CLIMATE TECHNOLOGY CENTRE & NETWORK

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Product 2: Mapping of stakeholders in the use of low-temperature geothermal energy in Uruguay

Deliverable 2.1

Report of the analysis of the
various key actors and stakeholders

1 Introduction

Continuing the technical assistance conducted by DEUMAN for CTCN, the purpose of this document is to present the second product, entitled *"Mapping of stakeholders in the use of low-temperature thermal energy in Uruguay".* It consists of two parts:

The first part consists of an evaluation that identifies and describes relevant stakeholders, while the second part contains the minutes of the virtual meetings, with their respective participant lists and the information agreed between stakeholders and the consulting team.

Stakeholder mapping is of crucial importance because it makes it possible to know and analyse individuals, corporations, private companies, government organizations, non-governmental organisations, and so on, with an interest in the technical assistance and the role they will play within it, as set out in this product.

It should be noted that these stakeholders were previously defined in the Terms of Reference and supplemented in the first product by the consulting team and then extended by a workgroup formed of the National Energy Directorate of the Ministry of Industry, Energy and Mining and the Climate-Change Division of the Environment Ministry. Stakeholders were then classified into five groups: government institutions, independent experts, private entities, academia and associations.

It is important to note that DEUMAN developed a methodology for the process of characterizing stakeholders, to identify which could be affected positively and which negatively, such as power companies, by this initiative. It also identified other actors who control management or decision-making tools relevant to the development of this technology, such as ministries, regional governments and other state regulatory bodies. Those with necessary or useful information or expertise, such as universities and private companies, were also identified.

As noted above, the methodological approach included a new profiling system divided into primary, secondary, tertiary and quaternary stakeholders, where each of these groups is placed according to their experience, capacity and commitment. It is also expected that this second product will provide the consulting team with essential first-hand information on regulatory, technical and financial issues, as well as on those new opportunities and barriers that may arise from the development of low-temperature geothermal energy in Uruguay. This will help to more-clearly define the development of subsequent products, from the identification of barriers and geothermal potential through to the identification of pilot projects and access to Green Climate Fund financing, by means of the development of concept notes.

2 Summary

To develop Product 2 and the fulfilment of its objectives to identify, characterize and classify stakeholders, DEUMAN planned an information-sharing methodology and interviews using guidelines for enquiry. There will now follow a brief description of each process undertaken to produce this report:

Firstly, an evaluation methodology was developed for the accurate characterization of stakeholders. This consists of a series of mutually-complementary steps, followed by the definition of evaluation criteria for the classification matrix given by the ToR (experience, capacity and commitment, plus the criterion of influence or power, which added a broader dimension for the classification). Accordingly, as with any matrix, this classified stakeholders by scoring intervals that placed them into one of four groups: primary, secondary, tertiary and quaternary.

Using the list previously approved by the CTCN, the National Energy Directorate (DNE) and the Department of Climate Change, each actor was invited to a meeting/interview with the DEUMAN technical team, to present to them on the technical assistance and learn about their organizations. We managed to interview only 34 stakeholders from the total number of 66. It should be noted that there were initially 56 approved stakeholders, but as we were interviewing these, we contacted a further 10 institutions with significant experience in the energy sector. These meetings were used to gather important information, not only about each interviewee's current situation or experience, but also about what they saw as future opportunities and barriers for implementation of geothermal technology.

Once the scheduled meetings had been concluded, the significant information from each of them was systematized into minutes. These minutes were used for completing the profile forms that summarize and describe the criteria mentioned for the correct classification of the four criteria (commitment, experience, power or influence, and capacity) into high, medium or low as appropriate and, thus, to obtain the final result from the multiplication of these values.

This yielded 6 primary, 6 secondary, 13 tertiary and 9 quaternary stakeholders, most of whom will help DEUMAN to identify the current situation of Uruguay and current barriers, in products 3 and 4 respectively.

Analysis of this new classification enabled the development of management strategies for joint work between stakeholders and the technical team throughout development of the technical-assistance products. It is also important to note that, despite having received no response from key player National Water Directorate (DINAMA), its participation will be a priority when the consultancy exercise has concluded, as it is the body responsible for regulating the use of water from aquifers, the main source of energy in open low-temperature geothermal systems.

3 Objectives

3.1. General objectives

- Identification and analysis of stakeholders for the development of a roadmap for the use of low-temperature geothermal energy in the residential, industrial and commercial sectors in Uruguay.
- Determination of competencies for each of the identified stakeholders.

3.2. Specific objectives

- Identify the different stakeholders related to or interested in low-temperature geothermal energy.
- Interview each stakeholder and collect the information necessary for correct classification of the stakeholder.
- Record the information in meeting minutes for each meeting held.
- Develop a characterization methodology for the correct analysis of stakeholders.
- Classify stakeholders using the previously-defined methodology and generate strategies for managing stakeholders.

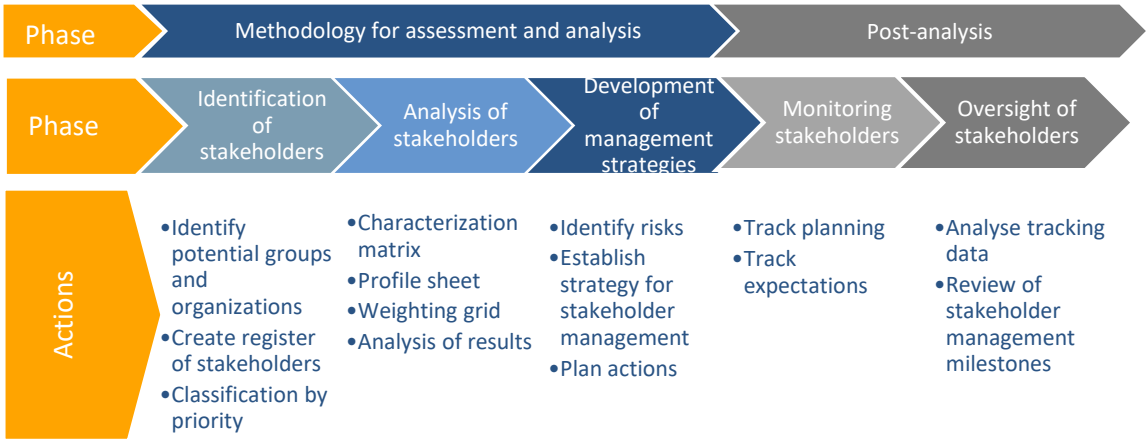
4 Evaluation methodology

For preparation of Product 2: Analysis of stakeholders in the use of low-temperature geothermal energy. DEUMAN has developed a characterization methodology for ascertaining stakeholders' experience, capacity and commitment.

This methodology is divided into two steps: step one involves a preliminary or diagnostic assessment intended to be used to learn stakeholders' experience and capacity; step two, the management step, is intended to sustain the commitment originally found, which will be monitored throughout the technical assistance as part of stakeholder monitoring and oversight.

The assessment comprises the steps of: identification, analysis and development of management strategies, as shown in Figure 1.

Figure 1 Methodology for management of stakeholders



This methodology for stakeholder management will make it possible not only to meet the requirements for Deliverables 2.1 and 2.2 of the Terms of Reference, but also to keep commitments and work in parallel with key stakeholders able to contribute to identifying and addressing any national demand and/or need subsequently reflected in the Roadmap.

The selection and characterization of stakeholders are important as they provide primary-source[1] information on the characteristics of Uruguay, its needs, capacities, interests, perspectives and prospects in the energy sector. Therefore, a holistic vision and approach were the main criteria used for selection, with the objective of reaching out to the largest number of stakeholders.

This first step of the analysis was based on a series of interviews that were conducted throughout the service provision with key stakeholders to outline project ideas, clarify needs, identify opportunities and discuss the correct way to approach barriers to implementation of

[1] Primary sources of information are those that are considered to be unpublished from an intellectual work; witness statements or direct and/or tacit evidence of an event are also considered to be primary sources.

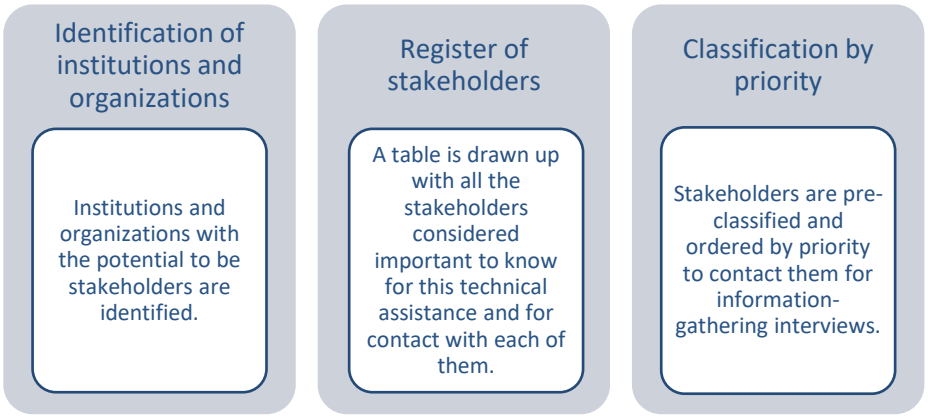
low-temperature geothermal energy in the country. In other words, these early interviews were the beginning of a cycle of joint work.

4.1. Identification of stakeholders

For identification, we used the comments and contributions provided by the Environment Ministry, the Ministry of Industry, Energy and Mining (MIEM) in the first working group, where it was recommended to include certain key stakeholders.

Figure 2 shows the actions conducted during the identification and prioritization of stakeholders to be taken into account:

Figure 2 Identification of stakeholders



4.1.1. Identification of institutions and organizations

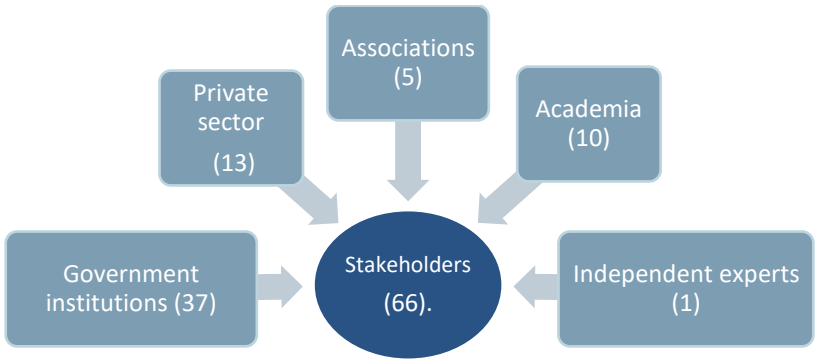
Identification of stakeholders commenced with the list provided in the Terms of Reference for the consultancy. This list included national governmental institutions, such as the National Environment Directorate (DINAMA) and National Water Directorate (DINAGUA) of the Environment Ministry; National Directorate of Land Management (DINOT) of the Ministry of Housing and Land Management; the National Directorate of Mining and Geology (DINAMIGE) and the National Energy Directorate (DNE) of MIEM; the Ministry of Tourism (MINTUR); the National Electricity Generation and Transmission Administration (UTE); the State Water Utilities Company (OSE); the National Fuel, Alcohol and Portland Cement Administration (ANCAP); regional authorities; the Institute of Geological Sciences (ICG); NGOs; and representatives of the private sector and of the Inter-institutional Board of Women in Science, Technology and Innovation.

To this list were added all those government agencies, associations, universities and private entities that were later identified by the consultancy group. Other stakeholders proposed later by the Environment Ministry and MIEM and others identified in the course of this activity were also added to this group.

Thus, a general classification into five groups was used, according to the institutions to which the stakeholders belonged, for the total of 66 stakeholders initially identified. The organizations

or sectors that make up the stakeholders are: government institutions, independent experts, private sector, academia and associations (see Figure 3).

Figure 3 Identification of groups



4.1.2. Register of stakeholders

Following the identification of stakeholders, each was assigned a code. Table 1 shows the 66 suggested stakeholders selected for the first stakeholder assessment interviews.

Table 1 Register of stakeholders

Classification	Code	Bank	Priority
Government institutions	STKH1	National Fuel, Alcohol and Portland Cement Administration (ANCAP)	1
	STKH2	National Electricity Generation and Transmission Administration (UTE)	1
	STKH3	Government of Paysandú	3
	STKH4	Government of Salto	1
	STKH5	Ministry of Industry, Energy and Mining (MIEM) - National Energy Directorate (DNE)	1
	STKH6	Ministry of Industry, Energy and Mining (MIEM) - National Directorate of Mining and Geology (DINAMIGE)	1
	STKH7	Ministry of Tourism (MINTUR)	2
	STKH8	Ministry of the Environment - National Water Directorate (DINAGUA)	1
	STKH9	Ministry of the Environment - National Environment Directorate (DINAMA)	1
	STKH10	Ministry of the Environment - Climate-Change Division	1
	STKH11	Regional Centre for the Management of Groundwater in Latin America and the Caribbean (CeReGAS)	2
	STKH12	National Agricultural Research Institute (INIA)	2
	STKH13	Ministry of Livestock, Agriculture and Fisheries (MGAP) - General Farming Directorate	2
	STKH14	Ministry of Housing and Land Management - National Directorate of Land Management (DINOT)	2
	STKH15	Government of Artigas	3
	STKH16	Government of Canelones	1
	STKH17	Government of Cerro Largo	3
	STKH18	Government of Colonia	3
	STKH19	Government of Durazno	3
	STKH20	Government of Flores	3
	STKH21	Government of Florida	3
	STKH22	Government of Lavalleja	3
	STKH23	Government of Maldonado	1
	STKH24	Government of Montevideo	1

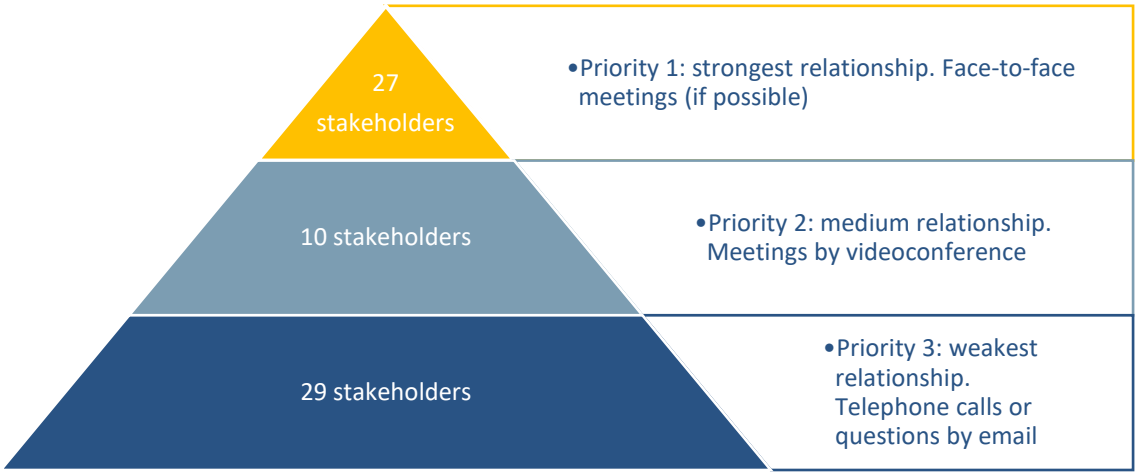
Classification	Code	Bank	Priority
	STKH25	Government of Río Negro	3
	STKH26	Government of Rivera	3
	STKH27	Government of Rocha	3
	STKH28	Government of San José	3
	STKH29	Government of Soriano	3
	STKH30	Government of Tacuarembó	3
	STKH31	Government of Treinta y Tres	3
	STKH32	Inter-institutional Board of Women in Science, Technology and Innovation	3
	STKH33	Energy and Water Services Regulatory Unit (URSEA)	1
	STKH34	National Agency for Research and Innovation (ANII)	3
	STKH35	National Development Agency (ANDE)	3
	STKH36	State Water Utilities Company (OSE)	2
	STKH69	Energy Efficiency Committee - Congress of Regional Governors	2
Independent expert	STKH37	Guillermo Popelka, head geologist at the geothermal project at "Los Pinos" Education Centre	1
Private entities	STKH38	Water Technology Centre	1
	STKH39	Uruguayan Chamber of Industries (CIU)	3
	STKH40	SEG INGENIERIA	1
	STKH41	MCT	1
	STKH42	Estudio Barbot-Rocha	1
	STKH43	Estudio Lagomarsino & cía	1
	STKH57	ASUAN	2
	STKH58	Innovaterra	2
	STKH60	CIR	1
	STKH62	Bidegaray & Asociados	1
	STKH63	Enersys	2
	STKH64	Alternativas sustentables	1
	STKH65	Pressura	1
Higher education institutions	STKH44	ORT University - Faculty of Architecture	1
	STKH45	University of the Republic (UdelaR) - Northern Regional University Centre - Water Department	1
	STKH46	University of the Republic (UdelaR) - Faculty of Sciences (Institute of Geological Sciences)	1
	STKH47	University of the Republic (UdelaR) - Faculty of Engineering (Institute of Mechanical Engineering and Industrial Production)	1
	STKH48	University of the Republic (UdelaR) - Faculty of Engineering (Institute of Fluid Mechanics and Environmental Engineering)	1
	STKH49	University of the Republic (UdelaR) - Faculty of Engineering (Institute of Physics)	3
	STKH50	Technological University of Uruguay - Renewable Energy Engineering	3
	STKH51	University of the Republic (UdelaR) - Faculty of Architecture, Design and Urban Planning (Institute of Construction)	3
	STKH52	University of Labour of Uruguay	3
	STKH61	Pando Technology Pole	3
Authorities	STKH53	Uruguayan Association of Hotels and Restaurants	3
	STKH54	Uruguayan Renewable Energies Association	3
	STKH55	National Rural Development Commission	3
	STKH56	Uruguayan Solar Workgroup	3
	STKH59	Uruguayan Association of private electricity generators	3

4.1.3. Classification by priority

Table 1 also shows the priority assigned to each stakeholder. Three levels of priority were defined, depending on the degree of relationship with the technology, from the point of view of and in the judgement of the consultant, and our preliminary understanding of the roles and/or

activities of each as analysed by the local consultancy. This initial classification will be used to order the mode and schedule of interviews and/or meetings. Figure 4, below, is a graphical explanation of the assignation of priorities, with the number of stakeholders assigned to each priority level.

Figure 4 Stakeholder classification by priority



It should be noted that the mode of work defined had to be modified due to the global situation caused by the pandemic. Face-to-face meetings were held by virtual conferencing or video calls. This turned out to be positive, as it enabled more meetings to be held than planned, due to their being virtual. It also made it possible to unite most of the consulting team, spread over Uruguay, Chile and Peru, to greatly enrich both the presentations and the interviews.

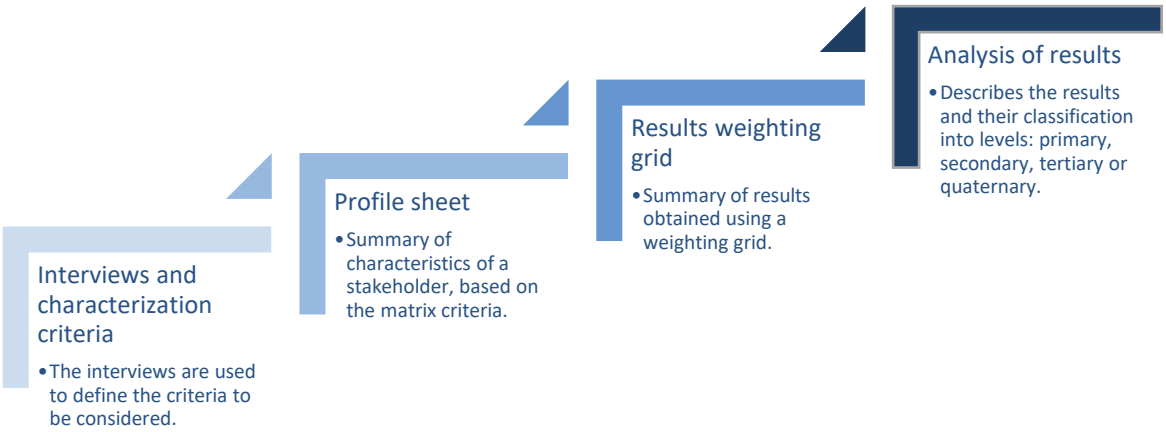
4.2. Stakeholder analysis

This phase is an essential part of the overall analysis. It consists of a description and characterization of stakeholders' experience, capacity and initial commitment as perceived through the meetings and interviews with each of them, as detailed in the Terms of Reference. In this way, it was possible to accurately classify them in accordance with the objectives and characteristics described above.

These meetings were interviews conducted with each stakeholder for an average duration of one hour. In these, the technical assistance was presented and explained, as well as the theoretical and technical principles underlying low-temperature geothermal energy, and interviewees answered a series of questions drawn up by the consulting team, to learn about each organization's current situation and classify them according to the criteria.

Figure 5 below shows the actions that should be carried out for accurate stakeholder analysis.

Figure 5 Stakeholder analysis



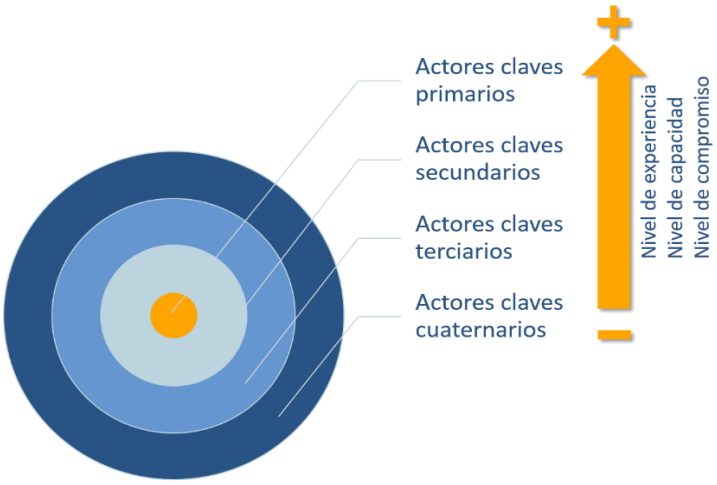
4.2.1. Characterization criteria

This section describes the considerations and criteria analysed for characterization of key stakeholders proposed by the consulting team in order to give a numerical understanding for the degree of influence or power, experience, capacity and initial commitment as characteristics of each stakeholder identified.

It should be noted that this characterization comes later than that made by the consulting team using the priorities described in Section 1.1.4, which priorities were only used to establish in what order to conduct the initial interviews.

The matrix comprises four criteria that help us classify previously-identified stakeholders into four levels: primary, secondary, tertiary and quaternary (see Figure 6). These criteria are described and specified in Box 1.

Figure 6 Classification of stakeholders into levels



BOX 1. CRITERIA FOR THE CHARACTERIZATION OF STAKEHOLDERS

In preparing the matrix, consideration was given to the following criteria proposed by DEUMAN for accurate characterization of the selection of stakeholders. The object of the study is taken to be: exploration of the potential for the development of a roadmap for the use of low-temperature geothermal energy in the industrial, commercial and residential sectors.

a) Influence or power

Classification	Description	Score
High	Has decision-making powers or control over the object of the study and political, regulatory and financial resources. In addition to being bodies that have developed geothermal projects in Uruguay and help to focus new projects for the development of geothermal energy, they act as benchmarks for their peers or other agencies in the use of this technology.	3
Medium	Stakeholders have control over some of the resources mentioned above, such as some public or private companies or associations, but are subject to the decision making of a national entity. They have information or tools that help to develop the object of the study.	2
Low	They have information or tools that help to develop the object of the study. Such as academia (universities and institutions) and associations. Individuals or small independent associations.	1

b) Commitment

Classification	Description	Score
High	The stakeholder shows an interest in the object of the study. The stakeholder provides the information requested. There is a level of commitment demonstrated by a predisposition to share and receive additional information, through the tangible expression of a collaboration model for implementation in the short term. There is an immediate or reasonably-speedy level of response to meetings and/or calls.	3
Medium	The stakeholder shows moderate or partial interest in the object of the study. The stakeholder provides the information requested, but with difficulty, and expresses their willingness to collaborate in the medium term. In other words, important information in recent products: project plans and/or pilots. There is a level of response to meetings and/or calls, albeit with some delay.	2
Low	Indicates effective collaboration in the long term, depending on the results of the technical assistance. Or the stakeholder shows no interest in the object of the study, due to: - Low interest in implementation or adaptation of the matter proposed - Direct or indirect competition - Undervaluing the technology - Does not form part of their scope or planned actions - Other	1

BOX 1. CRITERIA FOR THE CHARACTERIZATION OF STAKEHOLDERS

c) Experience

Classification	Description	Score
High	The stakeholder has experience of implementation or development of projects (pilot or otherwise) involving low-temperature geothermal energy. For government institutions, this will include those that have experience in implementation of regulatory policies to promote energy efficiency, the basis of which is considered to be similar.	3
Medium	The stakeholder has experience in implementing renewable energy and energy-efficiency projects for heating or using heat pumps other than geothermal. Government institutions that promote energy efficiency in the country. Universities and associations that have promoted the development of information highly-relevant to the future development of geothermal energy.	2
Low	The stakeholder has experience of energy-efficiency projects other than those mentioned above or has no experience of such projects, in addition to there being no relationship, or none yet found, between the stakeholder and low-temperature geothermal energy.	1

d) Capacity

Classification	Description	Score
High	The stakeholder has all the capacities described below: - Political capacity: power to make policies (laws, standards, regulations, among others) that contribute to the use of low-temperature geothermal energy. - Regulatory capacity: power to authorize and regulate its use, and power to issue technical reviews of projects. - Technical capacity: in relation to technical knowledge of or research into geothermal energy or related topics: heat pumps, groundwater, drilling, among others. - Financial capacity: related to having or obtaining the money resources to finance the technology.	3
Medium	The stakeholder meets at least two of the following capacities: political, technical, financial, according to the objectives of the technical assistance. Or, indeed, the stakeholder meets at least the financial capacity requirement.	2
Low	The stakeholder meets at least one of the capacities described above.	1

Once all the evaluation criteria are known, the process for proper use of the characterization matrix via the criteria will be described in Box 2.

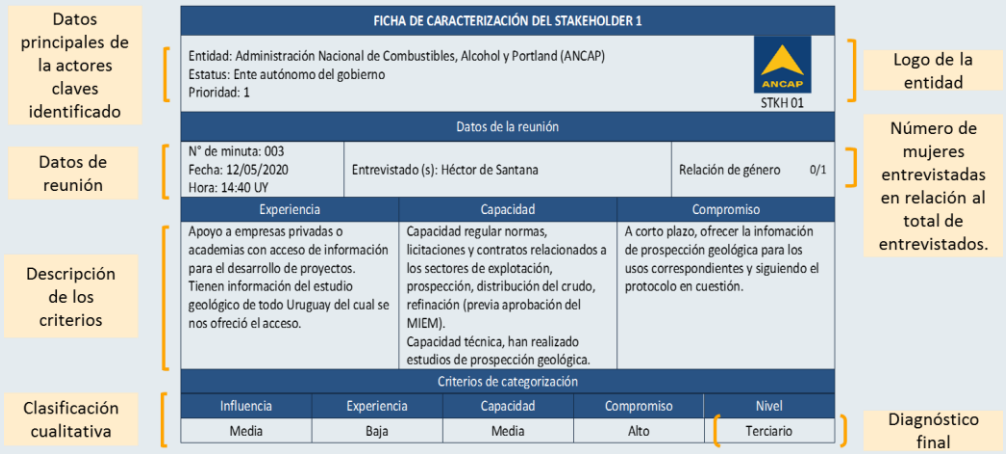
BOX 2. CALCULATION OF RESULTS

The steps for proper use of this matrix are:

In accordance with the following points:

1. A stakeholder profile sheet will be completed for each stakeholder interviewed (see Figure 7) with the description of their experience, capacity and commitment for correct qualitative ranking as high, medium or low for each criterion in an objective manner by the entire consulting team, using the information collected during meetings or interviews.

Figure 7 Stakeholder profile sheet



FICHA DE CARACTERIZACIÓN DEL STAKEHOLDER 1				
Entidad: Administración Nacional de Combustibles, Alcohol y Portland (ANCAP) Estatus: Ente autónomo del gobierno Prioridad: 1			ANCAP STKH 01	
Datos de la reunión				
N° de minuta: 003 Fecha: 12/05/2020 Hora: 14:40 UY	Entrevistado (s): Héctor de Santana		Relación de género	0/1
Experiencia	Capacidad	Compromiso		
Apoyo a empresas privadas o academias con acceso de información para el desarrollo de proyectos. Tienen información del estudio geológico de todo Uruguay del cual se nos ofreció el acceso.	Capacidad regular normas, licitaciones y contratos relacionados a los sectores de explotación, prospección, distribución del crudo, refinación (previa aprobación del MIEM). Capacidad técnica, han realizado estudios de prospección geológica.	A corto plazo, ofrecer la infomación de prospección geológica para los usos correspondientes y siguiendo el protocolo en cuestión.		
Criterios de categorización				
Influencia	Experiencia	Capacidad	Compromiso	Nivel
Media	Baja	Media	Alto	Terciario

2. Similarly, the quantitative score will be given in parallel using the weighting grid whose calculation model is shown in Figure 8 multiplying the values for influence (C4), experience (D4), capacity (E4) and commitment (F4), with the product showing in the results cell (G4).

Figure 8 Calculation example

= Influencia x Experiencia x Capacidad x Compromiso
= C4 x D4 x E4 x F4

	A	B	C	D	E	F	G
1	TABLA DE PONDERACIÓN						
2	N°	Nombre de la entidad	Valoración				
3			Influencia	Experiencia	Capacidad	Compromiso	Resultado
4	1	Nombre 1	3	3	3	3	81
5	2	Nombre 2	1	3	2	3	18
6	3	Nombre 3	3	2	2	3	36
7	4	Nombre 4	2	2	2	2	16
8	5	Nombre 5	2	2	2	1	8
9	6	Nombre 6	1	1	1	1	1

3. Each result of the multiplication of the criteria is then placed into one of four levels, as detailed in Table 2.

BOX 2. CALCULATION OF RESULTS

Table 2 Classification of results

Calculation of results	Score	Level
Influence x Experience x Capacity x Commitment	81 – 54	Primary stakeholder
	24 – 53	Secondary stakeholder
	8 – 23	Tertiary stakeholder
	1 – 7	Quaternary stakeholder

4. Finally, the classification level is recorded on the stakeholder profile sheet.

4.2.2. Stakeholders profile sheet

Stakeholder profile sheets record the results of each meeting and interview with each stakeholder. They summarize the information about the entity interviewed: details about the meeting, such the names of individuals and the proportion of women (for future evaluation); a description of the stakeholder's experience, capacity and commitment and, lastly, the result explaining the reason for their classification for the technical assistance. Figure 7 shows the most important aspects of this record sheet.

Each stakeholder profile sheet will be reproduced below, in preliminary stakeholder code order. Ultimately, 34 stakeholders were characterized. It should be mentioned that the interviews with stakeholders 47 and 48 were conducted at the same meeting, leading to their receiving one shared classification and there being 33 stakeholder profile sheets.

PROFILE SHEET – STAKEHOLDER 1

Entity: National Fuel, Alcohol and Portland Cement Administration (ANCAP)
Status: Government autonomous body
Priority: 1

STKH 01

Meeting record

Minute No.: 003 Date: 12/05/2020 Time: 14:40 UY	Person(s) interviewed: Héctor de Santana	Proportion of women 0/1

Experience	Capacity	Commitment
Support for private companies or higher-education institutions, allowing them access to information for the conduct of projects. They hold geological profile information obtained from exploration wells in various sectors of Uruguay, to which they offered us access.	Regulatory capacity: tenders and contracts related to operation, exploration, distribution of crude, and refining (subject to MIEM approval). Technical capacity: has the tools for conduct of geological survey studies.	In the short term, to offer geological survey information for corresponding uses and according to the relevant protocol.

Categorization levels

Influence	Experience	Capacity	Commitment	Level
Medium	Medium	Medium	High	Secondary

PROFILE SHEET – STAKEHOLDER 2				
Entity: National Electricity Generation and Transmission Administration (UTE) Status: Government autonomous body Priority: 1				STKH 02
Meeting record				
Minute No.: 012 Date: 19/05/2020 Time: 14:00 UY	Person(s) interviewed: Juan Patrone, Eduardo Bergerie, Gastón Hernández		Proportion of women	0/3
Experience	Capacity	Commitment		
Promotes the efficient use of electrical energy through its smart grids. Contributed to the development of thermal solar energy with financial subsidies.	Regulation capacity: generation, transmission and distribution of electricity. Financial capacity: to grant energy subsidies to consumers. Technical capacity: energy efficiency and smart grids.	In the short term, to provide descriptive presentations of the Uruguayan electricity sector and smart grids.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
High	Medium	High	High	Primary

PROFILE SHEET – STAKEHOLDER 3				
Entity: Government of Salto Status: Departmental [i.e. of a departamento] Government Priority: 1				STKH 04
Meeting record				
Minute No.: 016 Date: 26/05/2020 Time: 15:00 UY	Person(s) interviewed: Juan Pablo Zoppi		Proportion of women	0/1
Experience	Capacity	Commitment		
Use of geothermal energy for pool heating. Owns two spa complexes: Daymán and Arapey. Also owns a hot springs borehole in Salto, which it intends to use for an Olympic pool and a hydrotherapy pool. Experience of shared operation of a tomato greenhouse heated using residual hot spring water.	Political capacity: regional-level over its resources. Regulatory capacity: ensures compliance and authorizes hot spring projects. Technical capacity: has knowledge of geothermal heat. Financial capacity: has access to bank and institution funding.	In the short term, made itself immediately available for interview; presented case histories of geothermal works and projects, and committed to future meetings. In addition to a main interest in the reuse of residual hot spring waters. Will share its land-use map and greenhouse data.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Medium	Medium	High	High	Primary

PROFILE SHEET – STAKEHOLDER 4				
Entity: National Energy Directorate (DNE) of the Ministry of Industry, Energy and Mining (MIEM) Status: Government institution Priority: 1				STKH 05
Meeting record				
Minute No.: 013 Date: 22/05/2020 Time: 12:00 UY	Person(s) interviewed: Martin Scarone, Beatriz Olivet, Wilson Sierra, Laura Estrella		Proportion of women	2/4
Experience	Capacity	Commitment		
Advises the executive on definition of the framework for the development of energy efficiency, such as wind and solar power.	Regulatory capacity: has led on processes of legislation for other renewable energy sources (wind, solar). Political capacity: is a ministry. Financial capacity: access to international and national funds.	The presence of the DNE is essential throughout the technical assistance, as it is the contractor for the TA. It will have an important role in the analysis of the national regulatory framework and its comparison with international best practice in geothermal energy.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
High	High	High	High	Primary

PROFILE SHEET – STAKEHOLDER 5				
Entity: National Environment Directorate (DINAMA) of the Ministry of the Environment Status: Government institution Priority: 1				STKH 09
Meeting record				
Minute No.: 042 Date: 24/08/2020 Time: 11:30 UY	Person(s) interviewed: Martín Etcheverry		Proportion of women	0/1
Experience	Capacity	Commitment		
They assess the environmental impacts generated by works and projects. Their participation is appropriate in order to establish whether or not open-loop and water-reinjection systems harm the environment.	Political capacity: is a division of a ministry. Regulatory capacity and technical capacity: to accept or reject open-loop geothermal projects.	DINAMA is crucially important for decision making around the evaluation and acceptance (or not) of the environmental impact assessments (EIAs) for each project planned for the medium term.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
High	Medium	High	High	Primary

PROFILE SHEET – STAKEHOLDER 5				
Entity: Climate-Change Division of the Ministry of the Environment Status: Government institution Priority: 1				STKH 10
Meeting record				
Minute No.: 011 Date: 19/05/2020 Time: 10:00 UY	Person(s) interviewed: Jorge Castro, Carla Zilli		Proportion of women	1/2
Experience	Capacity	Commitment		
Promote climate-change guidelines, assessing the needs of the various sectors to which renewable energy could be applied.	Political capacity: is a division of a ministry. Financial capacity: access to international and funds. Regulatory capacity: in relation to climate-change mitigation plans.	The presence of the Climate Change Division is needed throughout the technical assistance, since it is one of the contractors for the TA and is responsible for overseeing national climate-change mitigation commitments.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
High	Medium	High	High	Primary

PROFILE SHEET – STAKEHOLDER 6				
Entity: Regional Centre for the Management of Groundwater in Latin America and the Caribbean (CeReGAS) Status: UNESCO Category II Centre, funded by the Ministry of the Environment Priority: 2				STKH 11
Meeting record				
Minute No.: 002 Date: 12/05/2020 Time: 10:00 UY	Person(s) interviewed: Alberto Manganelli		Proportion of women	0/1
Experience	Capacity	Commitment		
Holds information on groundwater in Uruguay and a database of boreholes. Also holds a database on the Guaraní Aquifer System Project.	Technical capacity: knowledge and key database on the use of shallow aquifers. Regulatory capacity: through providing DINAGUA and DINAMA with technical advice on the use and protection of groundwater.	In the short term, to offer information collected and research into aquifers and boreholes.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Medium	Medium	Medium	High	Secondary

PROFILE SHEET – STAKEHOLDER 7				
Entity: Government of Canelones Status: Departmental [i.e. of a departamento] Government Priority: 1				STKH 16
Meeting record				
Minute No.: 040 Date: 07/08/2020 Time: 15:00 UY	Person(s) interviewed: Nora Pazos Obregón, Alejandro Tarigo, María Silvana Cabrera.		Proportion of women	2/3
Experience	Capacity	Commitment		
Promotes the use of renewable energy by reducing the amounts payable for land use by each industry/company; land use has been classified by land-use planning throughout the local government territory.	Regulatory and political capacity: is a regional government. Financial capacity: has regional government funds.	In the short term, by implementing schemes to promote the use of geothermal energy by companies, through recognition and benefits, among others.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Medium	Low	High	High	Tertiary

PROFILE SHEET – STAKEHOLDER 8				
Entity: Government of Maldonado Environment Directorate Status: Departmental [i.e. of a departamento] Government Priority: 1				STKH 23
Meeting record				
Minute No.: 009 Date: 15/05/2020 Time: 11:00 UY	Person(s) interviewed: Betty Molina, Virginia Villarino		Proportion of women	2/2
Experience	Capacity	Commitment		
Promotes diversification of the energy matrix, with private-sector wind farms and biogas production as an initiative of its own.	Regulatory and political capacity: is a regional government. Financial capacity: has regional government funds.	In the short term, to contact the League for the Promotion of Punta del Este and the Business Association of Maldonado.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Medium	Low	High	High	Tertiary

PROFILE SHEET – STAKEHOLDER 9				
Entity: Government of Montevideo Status: Departmental [i.e. of a departamento] Government Priority: 1				Intendencia de Montevideo STKH 24
Meeting record				
Minute No.: 035 Date: 17/07/2020 Time: 10:00 UY	Person(s) interviewed: Marianela Elizalde, Pablo Escalante		Proportion of women	1/2
Experience	Capacity	Commitment		
Has developed an Energy-Efficiency Plan, an Energy Plan, a Sustainable-Building Manual, and the SUAMBI Programme. All these have the goal of promoting energy efficiency and the use of renewable energy in the residential sector.	Regulatory and political capacity: is a regional government. Financial capacity: has regional government funds.	In the short term, to establish low-temperature geothermal energy in the public buildings of the regional government territory.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Medium	Low	High	High	Tertiary

PROFILE SHEET – STAKEHOLDER 10				
Entity: Energy and Water Services Regulatory Unit (URSEA) Status: Executive unit of the Presidency of the Republic Priority: 1				STKH 33
Meeting record				
Minute No.: 022 Date: 02/06/2020 Time: 14:00 UY	Person(s) interviewed: Silvana Romero (head), Fernando Bagalciague, Carmen, Andrés Hermida, Eduardo Touya		Proportion of women	2/5
Experience	Capacity	Commitment		
Regulatory agency for energy, distribution of drinking water and sanitation. Authorizes use of the energy-efficiency label on equipment, which geothermal pumps could have. It is not currently within its competency to regulate geothermal energy, unless authorized to do so.	Regulatory capacity: responsible for the efficient use of energy and for the safety of steam generators.	In the long term, its functions depend on authorization by the Executive, which in turn depends on the success of technical assistance.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Medium	Low	Low	Low	Quaternary

PROFILE SHEET – STAKEHOLDER 11				
Entity: National Agency for Research and Innovation (ANII) Status: Government agency Priority: 3				STKH 34
Meeting record				
Minute No.: 023 Date: 03/06/2020 Time: 15:40 UY	Person(s) interviewed: Flavio Caiafa		Proportion of women	0/1
Experience	Capacity	Commitment		
Funds university research projects and companies' and entrepreneurs' innovative pilot projects. Has also funded two geothermal energy projects for greenhouse heating in the "Los Pinos" Education Centre.	Financial capacity: is one of the main sources of public and private funding in Uruguay.	In the medium term, as a source of funding for pilot projects conducted under the Roadmap.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Medium	Medium	Medium	Medium	Tertiary

PROFILE SHEET – STAKEHOLDER 12				
Entity: National Development Agency (ANDE) Status: Government agency Priority: 3				STKH 35
Meeting record				
Minute No.: 024 Date: 03/06/2020 Time: 15:10 UY	Person(s) interviewed: Fernanda Milans, Sebastián Ruiz		Proportion of women	1/2
Experience	Capacity	Commitment		
Provides financial services for private company and entrepreneurs' innovations, with a greater emphasis on MSMEs. Funds project related to the circular economy and, in future, "green" funding.	Financial capacity: is one of the main sources of public funding in Uruguay.	In the medium term, as a source of funding for innovative projects conducted under the Roadmap.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Low	Low	Medium	Medium	Quaternary

PROFILE SHEET – STAKEHOLDER 13				
Entity: Obras Sanitarias del Estado (OSE, State Water Utilities Company) Status: Government agency Priority: 2				STKH 36
Meeting record				
Minute No.: 027 Date: 12/06/2020 Time: 14:30 UY	Person(s) interviewed: Andrés Pérez		Proportion of women	0/1
Experience	Capacity	Commitment		
Borehole drilling. Has an inventory of inactive and active boreholes and their flows. Also has some data on the temperatures of some boreholes.	Technical capacity: borehole drilling and nationwide borehole inventory.	In the long term, to share information on boreholes for future research.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Low	Low	Low	Low	Quaternary

PROFILE SHEET – STAKEHOLDER 14				
Entity: Water Technology Centre (CTA) Status: Private sector Priority: 1				STKH 38
Meeting record				
Minute No.: 010 Date: 15/05/2020 Time: 14:00 UY	Person(s) interviewed: Alejandro Carbajales		Proportion of women	0/1
Experience	Capacity	Commitment		
Centre that brings various industries together and encourages or promotes investment projects related to water management.	Financial capacity: made up of various industries that finance projects.	In the long term, will make contact with companies when information is available on project feasibility.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Medium	Low	Medium	Low	Quaternary

PROFILE SHEET – STAKEHOLDER 15				
Entity: Uruguayan Chamber of Industries (CIU) Status: Private sector Priority: 3				STKH 39
Meeting record				
Minute No.: 020 Date: 29/05/2020 Time: 15:00 UY	Person(s) interviewed: Julio Sosa		Proportion of women	0/1
Experience	Capacity	Commitment		
Body that represents the industrial sector, with powers to issue opinions on public policies related to the sector. Works conjointly with DNE on tendering arrangements to benefit energy efficiencies in industry.	Financial capacity: made up of various industries that finance projects.	In the medium term, will make contact with industries to find out their main hot and cold system needs.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Medium	Low	Medium	Medium	Tertiary

PROFILE SHEET – STAKEHOLDER 16				
Entity: SEG Ingeniería (ESCO) Status: Private sector Priority: 1				STKH 40
Meeting record				
Minute No.: 05 Date: 24/05/2020 Time: 10:00 UY	Person(s) interviewed: Ernesto Elenter		Proportion of women	0/1
Experience	Capacity	Commitment		
Experience in installation of electricity generation, with heat pumps for heating and thermal conditioning in the residential and commercial sector. Also constructs private wind and solar farms.	Technical capacity: air-source heat pumps in residential heating systems. Financial capacity: access to public and private financing for supply of technology.	In the short term, willing to work with new technologies, share information and assess the feasibility of geothermal heat pumps.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Medium	Medium	Medium	High	Secondary

PROFILE SHEET – STAKEHOLDER 17				
Entity: MCT (ESCO) Status: Private sector Priority: 1				STKH 41
Meeting record				
Minute No.: 06 Date: 13/05/2020 Time: 14:00 UY	Person(s) interviewed: Martín Garmendia		Proportion of women	0/1
Experience	Capacity	Commitment		
Experience in using water-water heat pumps at industrial level in heating/cooling systems; also has suppliers of this technology.	Technical capacity: knowledge of installation, repair and efficiency of heat pumps. Financial capacity: access to public and private funding for the sale of energy-efficiency solutions.	In the short term, willing to work with new technologies and share their experience with heat pumps.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Low	Medium	Medium	High	Tertiary

PROFILE SHEET – STAKEHOLDER 18				
Entity: Lagomarsino & cía Status: Private sector Priority: 1				STKH 43
Meeting record				
Minute No.: 007 Date: 14/05/2020 Time: 15:00 UY	Person(s) interviewed: Agustín Bertolotti		Proportion of women	0/1
Experience	Capacity	Commitment		
Implementation of energy efficiency in commercial and residential thermal conditioning; provides LEED certification. Geothermal heat pump projects in Spain.	Technical capacity: thermal conditioning systems. Financial capacity: access to funding.	In the medium term, willing to implement new technologies and synergistic systems.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Medium	High	Medium	High	Secondary

PROFILE SHEET – STAKEHOLDER 19				
Entity: ORT University - Faculty of Architecture Status: Private higher education centre Priority: 1				STKH 44
Meeting record				
Minute No.: 025 Date: 11/06/2020 Time: 15:00 UY	Person(s) interviewed: Andrés Eliceo Cabrera		Proportion of women	0/1
Experience	Capacity	Commitment		
Development of the Uruguayan House (energy-sustainable house) and experience in ground-coupled heat exchangers. The university offers courses on renewable energy and climate architecture, specializing in the design of buildings with complex natural or geothermal thermal conditioning systems.	Technical capacity: providing architects with basic knowledge of low-temperature geothermal energy in buildings. Financial capacity: access to public funding.	In the medium term: to implement a low-temperature geothermal energy pilot in the Uruguayan House.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Low	Medium	Medium	High	Tertiary

PROFILE SHEET – STAKEHOLDER 20				
Entity: Faculty of Science (Institute of Geological Sciences) - UdelaR Priority: 1				STKH 46
Meeting record				
Minute No.: 004 Date: 12/05/2020 Time: 16:30 UY	Person(s) interviewed: Ethel Morales		Proportion of women	1/1
Experience	Capacity	Commitment		
Project to analyse the thermal potential of the stratigraphic column in the city of Salto. 3 student research projects on geothermal energy currently under way. Offered a course in geothermal energy and geothermal evaluation in the past year.	Technical capacity: academic, around the potential for low-temperature geothermal energy in some regions of Uruguay. Financial capacity: access to public funding.	In the short term: willing to conduct pilot research projects and share information requested.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Low	High	Medium	High	Tertiary

PROFILE SHEET – STAKEHOLDER 21				
Entity: Faculty of Engineering (Institute of Mechanical Engineering and Industrial Production, and Institute of Fluid Mechanics and Environmental Engineering, respectively) – UdelaR Status: Public higher education centre Priority: 1				STKH 47 and 48
Meeting record				
Minute No.: 008 Date: 14/05/2020 Time: 17:00 UY	Person(s) interviewed: Pedro Galione, Alfonso Flaquer, Federico González.		Proportion of women	0/3
Experience	Capacity		Commitment	
They have a project on solar heating of groundwater and its subsequent reinjection into the Raigón aquifer. Gave a graduate course on geothermal energy.	Technical capacity: to determine the potential for low-temperature geothermal energy in some regions of Uruguay. Financial capacity: access to public funding.		In the short term: willing to conduct pilot research projects and share information requested.	
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Low	High	Medium	High	Tertiary

PROFILE SHEET – STAKEHOLDER 22				
Entity: Faculty of Engineering (Institute of Physics) – UdelaR Status: Public higher education centre Priority: 1				STKH 49
Meeting record				
Minute No.: 026 Date: 11/06/2020 Time: 18:00 UY	Person(s) interviewed: Italo Bove		Proportion of women	0/1
Experience	Capacity		Commitment	
Experience in thermal solar energy and studies of meteorological variables for their application to solar energy in Uruguay.	Technical capacity: to determine the potential for low-temperature geothermal energy in some regions of Uruguay. Financial capacity: access to public funding.		In the medium term: willing to conduct pilot research projects and share information requested.	
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Low	Low	Medium	Medium	Quaternary

PROFILE SHEET – STAKEHOLDER 23				
Entity: Technology University of Uruguay Renewable Energy Engineering Status: Public higher education centre Priority: 3				STKH 50
Meeting record				
Minute No.: 018 Date: 27/05/2020 Time: 14:00 UY	Person(s) interviewed: Carlos Bello, Vitoria Olave, Marcos Zefferino, Juan Marcelo Aguilar		Proportion of women	1/4
Experience	Capacity		Commitment	
Has offered a course in renewable energy engineering (2016-present). One interviewee has experience of low-temperature geothermal energy projects and their use with heat pumps.	Technical capacity: implementation for the development of research. They have a borehole within the university that could be used for a pilot. Financial capacity: access to funding for objectives.		They are interested in contributing to the research through development of scalable low-temperature geothermal energy pilots.	
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Low	Medium	Medium	High	Tertiary

PROFILE SHEET – STAKEHOLDER 24				
Entity: University of Labour of Uruguay (UTU) Status: Public higher education centre Priority: 3				STKH 52
Meeting record				
Minute No.: 017 Date: 27/05/2020 Time: 10:00 UY	Person(s) interviewed: Daniel Primucci		Proportion of women	0/1
Experience	Capacity		Commitment	
UTU has conducted renewable energy and energy efficiency projects, such as the joint electric vehicles project with UTE.	Technical capacity: implementation for conduct of research. Financial capacity: access to funding for objectives.		In the long term, contributing to implementation of future courses if the Roadmap yields positive results.	
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Low	Low	Medium	Low	Quaternary

PROFILE SHEET – STAKEHOLDER 25				
Entity: Uruguayan Renewable Energies Association (AUDER) Status: Non-profit organization Priority: 3				STKH 54
Meeting record				
Minute No.: 001 Date: 23/04/2020 Time: 16:30 UY	Person(s) interviewed: Jorge Dosil, Anthony Prevett		Proportion of women	0/2
Experience	Capacity	Commitment		
To promote and support renewable energy, energy efficiency and electrical energy storage projects.	Technical capacity: knowledge of other types of renewable energy in Uruguay. They hold conferences in which they could promote the use of geothermal energy.	In the long term, it will depend on the financial and technical feasibility of low-temperature geothermal energy projects.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Low	Medium	Low	Medium	Quaternary

PROFILE SHEET – STAKEHOLDER 26				
Entity: Uruguayan Solar Workgroup Status: Non-profit organization Priority: 3				STKH 56
Meeting record				
Minute No.: 014 Date: 25/05/2020 Time: 15:00 UY	Person(s) interviewed: Pablo Franco Noceto		Proportion of women	0/1
Experience	Capacity	Commitment		
They have promoted regulations for solar thermal energy.	Technical capacity: knowledge of solar thermal energy.	In the long term, to be part of the offer, as designers and implementers of geothermal projects.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Low	Low	Low	Low	Quaternary

PROFILE SHEET – STAKEHOLDER 27				
Entity: ASUAN Status: Private sector Priority: 2				STKH 57
Meeting record				
Minute No.: 021 Date: 01/06/2020 Time: 15:00 UY	Person(s) interviewed: Eduardo Rovira		Proportion of women	0/1
Experience	Capacity	Commitment		
Currently working with air-source heat pumps for heating in the residential sector. Have conducted three geothermal air-conditioning projects. May therefore influence other companies, but to a minor extent.	Technical capacity: knowledge of geothermal technology and heat pumps (performance and installation, suppliers, constraints). Financial capacity: has access to bank and institution funding.	In the long term: developer and knowledgeable of geothermal energy, but believes that there are many barriers to be overcome.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Medium	High	Medium	Low	Tertiary

PROFILE SHEET – STAKEHOLDER 28				
Entity: Bidegaray & Asociados Status: ESCO Priority: 2				STKH 62
Meeting record				
Minute No.: 019 Date: 27/05/2020 Time: 16:00 UY	Person(s) interviewed: Federico Bidegaray		Proportion of women	0/1
Experience	Capacity	Commitment		
Intention to include low-temperature geothermal energy as a cooling system in a plastics firm unsuccessful due to lack of regulations governing reinjection. Provides services in Salto for the utilization of thermal resources; thermal conditioning and energy-efficiency projects in general. Benchmark for their peers in respect of geothermal energy development.	Technical capacity: knowledge for implementation of the technology. Financial capacity: access to private funding and work.	In the short term: presented essential technical information on the technology and commitment to future meetings, in addition to undertaking to contact private companies possibly interested in purchase of geothermal energy projects.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
High	High	Medium	High	Primary

PROFILE SHEET – STAKEHOLDER 29				
Entity: Enersys Status: Private sector Priority: 2				STKH 63
Meeting record				
Minute No.: 015 Date: 26/05/2020 Time: 10:00 UY	Person(s) interviewed: Arturo Correa		Proportion of women	0/1
Experience	Capacity	Commitment		
Works on pool heating with solar energy and heat pumps, as well as heating and cooling systems with different technologies, highlighting geothermal heat pumps, the technology for which is imported from China. They install and provide technical support. Has had ANII funding for the geothermal prototype at the Los Pinos school. Benchmark for their peers in respect of geothermal energy development.	Technical capacity: knowledge of geothermal technology and heat pumps (performance and installation, suppliers). Financial capacity: has access to bank and institution funding.	In the short term: made himself immediately available for interview, presented very useful technical information on the technology and committed to future meetings.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
High	High	Medium	High	Primary

PROFILE SHEET – STAKEHOLDER 30				
Entity: Alternativas Sustentables Status: Private sector Priority: 2				STKH 64
Meeting record				
Minute No.: 029 Date: 06/07/2020 Time: 14:45 UY	Person(s) interviewed: Ricardo Wasersztein		Proportion of women	0/1
Experience	Capacity	Commitment		
Interviewee presented three shallow geothermal energy proposals (association with a drilling company) and has staff specializing in heat pumps. Benchmark for their peers in respect of geothermal energy development.	Technical capacity: knowledge of geothermal technology and heat pumps. Financial capacity: has access to bank and institution funding.	In the medium term: presentation of possible projects to be submitted with a concept note and interest in promoting technology to its customers.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
High	High	Medium	Medium	Secondary

PROFILE SHEET – STAKEHOLDER 31				
Entity: Pressura Status: Private sector Priority: 1				STKH 65
Meeting record				
Minute No.: 030 Date: 07/07/2020 Time: 15:15 UY	Person(s) interviewed: Pablo Vieytes		Proportion of women	0/1
Experience	Capacity	Commitment		
Work with water pumps, air- and ground-source heat pumps for energy-efficiency solutions. Working with a manufacturer from Sweden and China. May influence other companies, but to a minor extent, since its speciality is water pumps.	Technical capacity: knowledge of geothermal technology and heat pumps (performance and installation, suppliers). Financial capacity: access to funding.	In the long term: to provide information as required, assuming the development of the technology is successful together with funding mechanisms that make geothermal heat pump installations financially viable.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Medium	High	Medium	Low	Tertiary

PROFILE SHEET – STAKEHOLDER 28				
Entity: Energy Efficiency Committee – Congress of Regional Governors Status: Public Entity Priority: 2				STKH 69
Meeting record				
Minute No.: 019 Date: 27/05/2020 Time: 16:00 UY	Person(s) interviewed: Federico Bidegaray		Proportion of women	5/5
Experience	Capacity	Commitment		
Is working on general rules for the regulation of energy efficiency in all departamentos, especially in respect of thermal insulation.	Regulatory and political capacity: it brings together all 19 departamentos of the country and proposes energy-efficiency regulations.	In the long term: to collaborate with regard to its roles in the information required. Its collaboration is effective in terms of the technical assistance, in respect of developing thermal efficiency regulations that would directly or indirectly benefit regulation of low-temperature geothermal energy.		
Categorization levels				
Influence	Experience	Capacity	Commitment	Level
Medium	Low	Low	Low	Tertiary

4.2.3 Weighting grid

As part of the second step in the calculation of results, the weighting grid is completed with the qualitative evaluations of the 25 stakeholders interviewed. This now follows as Table 3.

Table 3 Weighting grid

WEIGHTING GRID						
No.	Name of entity	Score				
		Influence	Experience	Capacity	Commitment	Result
1	National Energy Directorate (DNE) of the Ministry of Industry, Energy and Mining (MIEM)	3	3	3	3	81
2	Climate-Change Division, Ministry of the Environment	3	2	3	3	54
3	National Environment Directorate (DINAMA) of the Ministry of the Environment	3	2	3	3	54
4	National Electricity Generation and Transmission Administration (UTE)	3	2	3	3	54
5	Bidegaray & Asociados	3	3	2	3	54
6	Enersys	3	3	2	3	54
7	Alternativas Sustentables	3	3	2	2	36
8	Government of Salto	2	2	3	3	36
9	Estudio Lagomarsino & cía	2	3	2	3	36
10	SEG ENGINEERING	2	2	2	3	24
11	Regional Centre for the Management of Groundwater in Latin America and the Caribbean (CeReGAS)	2	2	2	3	24
12	National Fuel, Alcohol and Portland Cement Administration (ANCAP)	2	2	2	3	24
13	Government of Montevideo	2	1	3	3	18
14	Government of Maldonado	2	1	3	3	18
15	Faculty of Science (Institute of Geological Sciences) - UdelaR	1	3	2	3	18
16	Faculty of Engineering (Institute of Mechanical Engineering and Industrial Production) – UdelaR	1	3	2	3	18
17	Faculty of Engineering (Institute of Fluid Mechanics and Environmental Engineering) – UdelaR	1	3	2	3	18

WEIGHTING GRID						
No.	Name of entity	Score				
		Influence	Experience	Capacity	Commitment	Result
18	National Agency for Research and Innovation (ANII)	2	2	2	2	16
19	Pressura	2	3	2	1	12
20	Government of Canelones	2	1	3	2	12
21	ORT University	1	2	2	3	12
22	MCT	1	2	2	3	12
23	ASUAN	2	3	2	1	12
24	Technological University of the Uruguay - Renewable Energy Engineering	1	2	2	3	12
25	Uruguayan Chamber of Industries (CIU)	2	1	2	2	8
26	Energy Efficiency Committee - Congress of Regional Governors	2	2	1	1	4
27	Faculty of Engineering (Institute of Physics) – UdelaR	1	1	2	2	4
28	Water Technology Centre (CTAgua)	2	1	2	1	4
29	Uruguayan Renewable Energies Association (AUDER)	1	2	1	2	4
30	National Development Agency (ANDE)	1	1	2	2	4
31	Energy and Water Services Regulatory Unit (URSEA)	2	1	1	1	2
32	University of Labour of Uruguay	1	1	2	1	2
33	Obras Sanitarias del Estado (OSE, State Water Utilities Company)	1	1	1	1	1
34	Uruguayan Solar Workgroup	1	1	1	1	1

4.2.4 Analysis of results

With the stakeholders classified into the classification matrix, each group was analysed taking into account that each of them also fulfils, in addition to a level of importance, specific functions that they will carry out during or after preparation of the roadmap. These functions will be specified in the section entitled "Stakeholder Management".

Firstly, we have six primary stakeholders. The DNE, with the highest score, due to its high classification scores on the four criteria, justified by its being a government institution responsible for policies regulating energy in Uruguay and its high degree of commitment to this technical assistance.

The National Environment Directorate (DINAMA), and Climate-Change Division, both under the Environment Ministry, key actors for, respectively, regulating the use of shallow geothermal open-loop systems and promoting renewables for climate-change mitigation.

UTE is an important body in Uruguay, promoting energy-efficiency policies; even so, it has no direct experience with geothermal energy.

There are also two private companies that, on the basis of their experience, have developed low-temperature geothermal energy projects with geothermal heat pumps, coming up against the legal barrier of reinjection of water into aquifers. DEUMAN has established that for fruitful development of the roadmap, it is essential to have drivers of the technology and a market to develop it, in addition to having the influence to be the basis and proof that the technology is applicable in the country.

Secondly, six secondary stakeholders were identified, foremost of which is the Regional Government of Salto, which has hot springs and potential utilization of these as well as research projects and prior experience.

There are also three private companies in this group that develop heat-pump projects and know the Uruguayan market. Similarly, the institutions CeReGAS and ANCAP both have far-reaching technical capacity to deliver opinions to ministries.

Thirdly, a group was formed of 13 tertiary stakeholders. This includes other departamentos whose population density reflects potential for the residential and commercial sectors, suitable for projects to heat buildings using geothermal energy.

The higher-education institutions with the best scores are those that will provide technical support, while those with lower scores will take projects forward but with a high commitment that has placed them in this group.

There is also ANII as a project funder with experience of encouraging innovative projects, something it could do in the future with the universities' pilot projects. Those private-sector organizations with scores of between 8 and 18 have experience in energy efficiency but with a lower degree of commitment or less experience than higher-scoring companies.

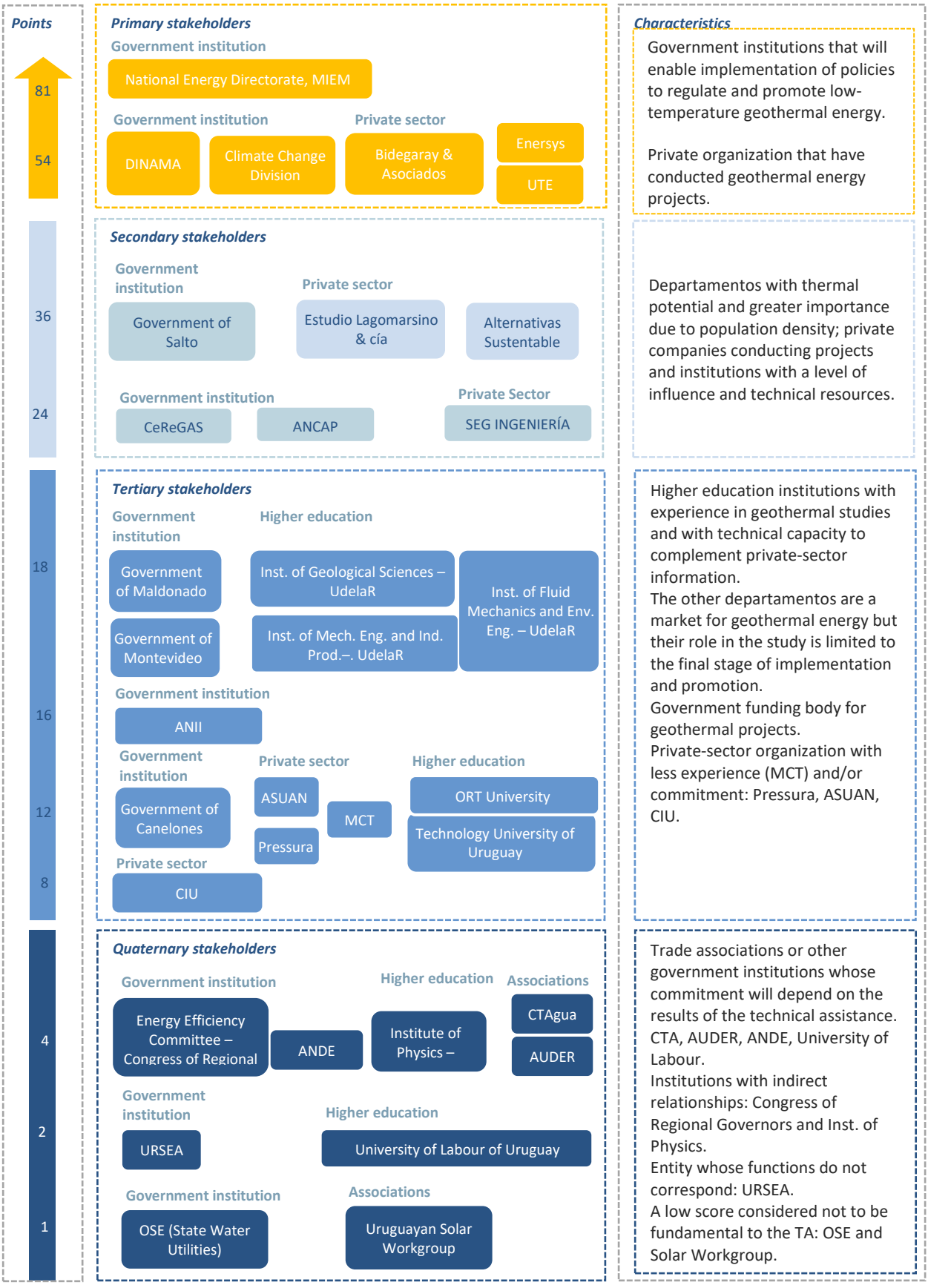
Lastly, in the quaternary group of nine stakeholders, there are those with strong relationships with other types of renewable energy. This group includes higher education institutions and

associations. While the Congress of Regional Governors only has experience in energy efficiency, its participation will be important for the promotion of shallow geothermal energy in due course.

There are also those stakeholders whose interest will reflect the result of technical assistance. These will be considered at a later stage, when the potential of geothermal energy has been demonstrated or when national authorities need it.

There now follows Figure 9, a graphical representation of the characteristics that define the primary, secondary, tertiary and quaternary stakeholders.

Figure 9 Analysis of results



4.3. Management strategies

This third step is composed of the management strategies to be developed to work with stakeholders in accordance with the characterization assigned to each of them from the results obtained in the preceding step.

The goal of these management strategies is to ensure the achievement of the objectives of the technical assistance by involving stakeholders in it. Firstly, the degree of relationship between each stakeholder and the products of this TA was determined, bearing in mind that the TA consists of six products of which we are currently in the second. The second step is to define the appropriate mechanism to continue their participation, defining five modes for this: video interviews, preliminary presentation of product, working groups, workshops and courses.

Table 4 sets out the key aspects of the third, fourth, fifth and sixth products, as detailed in the Terms of Reference, each of which involves the specific participation of and mode of work with certain stakeholders.

Table 4 Stakeholder participation

Product	Key Aspects	Stakes
3. Analysis of the current geothermal energy landscape in Uruguay	a. Compilation of existing studies (potential use) b. Assessment of GHG emissions from exploitation of energy potential and their contributions to national commitments c. National regulatory framework to be analysed with NDE and DNE d. Assess current research, project, etc. capabilities e. Evaluate the value chain and national capacity to produce the technology (market analysis) f. Gender balance analysis and measures to reduce gaps	a. Higher education institutions and private sector b. Climate Change Division c. National Energy Directorate d. Higher education institutions and private sector e. Private sector and UTE f. Meeting with public-sector gender specialists
4. Identification of existing barriers to the use of low-temperature geothermal energy in Uruguay	a. Constraints on the availability of energy resources b. Political and regulatory-framework constraints at national and departmental levels c. Technological barriers d. Financial barriers for bringing products to market e. Environmental constraints f. Social barriers (public acceptance of the technology) g. Propose measures to reduce barriers	a. UTE and ESCOs b. Ministries and regional governments c. Private sector and higher ed. institutions d. Private sector e. Private sector and regional governments f. All interviewees
Products 5 and 6 will be produced on condition that the results of preceding products confirm the feasibility of geothermal-energy use within a reasonable time.		

Product	Key Aspects	Stakes
5. Production of a draft roadmap for low-temperature geothermal energy in Uruguay	a. Allocation of partners to each activity b. Identification of potential projects	a. MIEM and Ministry of the Environment b. Private sector and higher ed. institutions
6. Preparation and writing of a concept note for international climate finance	a. Will include consideration of the possibility of defining a separate project for residential thermal conditioning	a. Private sector

It is expected that stakeholder participation will be fully active and that the agreements reached with each are respected. Every participant has a crucial role for the success of the technical assistance and for that of a portfolio of low-temperature geothermal energy projects.

It is also important to note that as of the preparation of this product, no response has been received from stakeholder "National Water Directorate (DINAGUA)", whose participation is considered to be Priority 1, since it is the body the governs and regulates the use of the country's waters.

It is also important to note that the participation and technical opinion of DINAGUA will be essential for future regulation of low-temperature geothermal energy and of the use of aquifers in open-loop systems. For this reason, the measures to be proposed in Product 4 for reducing gaps in and constraints on the technology will subject to review and approval by DINAGUA.

5 Annex 1: Meeting minutes

Minutes of Meeting: No. 001

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 54 – Uruguayan Renewable Energies Association (AUDER)
1.2. Place: Video conference
1.3. Date: 23 / 04 / 2020
1.4. Time: 14:30 PE – 15:30 CL – 16:30 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy by specialist members of the technical team.
2.2. *Current energy mix in Uruguay:* 97-98% renewable energy (40% wind, 50% hydro and 7-8% biomass), the remaining 2-3% being fossil fuels.
2.3. *Current use of NCRE:* Installed power of 1500 MW with 2100 MW peak. Government support for installation of wind power since 2010.
2.4. *10-year outlook:* Penetration of new NCREs depends on growth in the economy; the economy is currently not growing. There is, however projected growth based on food production (grain and high-quality meat). This would add 400-500 MW by 2026 and 300 MW in wind power.
2.5. *Participation of state-owned enterprises and electricity-sector companies in NCRE:* While ANCAP has a monopoly on fuels, the National Electricity Generation and Transmission Administration (UTE) controls the energy that is generated, transmitted and distributed. We were provided with a contact for direct communication with UTE's Energy-Efficiency Department. They also told us that the monopoly has wells in Río de La Plata, specifically, in Punta del Tigre. It was also stated that private companies are able to generate power for their own use, but not to sell to other companies.
2.6. *Difficulties and barriers:* Wind power is the main source of NCRE. It is very competitive on account of its low prices, whereas the main barriers are technical and financial.
There is national regulation of water which was established in a constitutional reform that controls and monitors it.
2.7. *Opportunities for low-temperature geothermal energy in the residential sector:* This is considered a distant alternative, due to the ingrained culture of using wood, for which there is no regulation prohibiting its use, as there is in other countries, since the high winds in the cities prevents the concentration of fine-particle pollution in the air and helps maintain good air quality. It should also be borne in mind that Uruguay has a mild climate with no extremes of very low or very high temperatures. There is, however, potential in the case of new buildings, where geothermal energy could help achieve the energy-efficiency standards that are now required.
2.8. *Opportunities for low-temperature geothermal energy in the productive sector:* There are potential users, especially in the production and storage of food products (grains and meat). We were recommended to contact executives responsible for the sale of industrial systems.
Another potentially-interested sector was also mentioned, that of marijuana growers, for the thermal conditioning of their greenhouses.
2.9. *Prospects for the use of geothermal energy in Uruguay:* Difficult to know, without the sample of projects from which to assess potential and financial feasibility. Even so, enabling factors were listed, such as compatibility with energy-efficiency standards and with large companies that have their own boreholes.

3. Agreements

3.1. AUDER agreed to meet DEUMAN in future interviews to provide the information required and/or support the performance of the consultancy exercise.

4. Present

No.	Name	Institution
1	Jorge Dosil	AUDER
2	Anthony Prevett	AUDER
3	Jaime Parada	DEUMAN
4	Cristhian Abanto	DEUMAN
5	Mauricio Muñoz	DEUMAN
6	Lucía Samaniego	DEUMAN
7	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 002

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 11 – Regional Centre for the Management of Groundwater in Latin America and the Caribbean (CeReGAS)
1.2. Place: Video conference
1.3. Date: 12 / 05 / 2020
1.4. Time: 08:00 PE – 09:00 CL – 10:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy by specialist members of the technical team.

2.2. *Current status of groundwater:* It began to enter use in the early 1990s due to the arrival of rotary-percussion drilling equipment. The inventory of these has improved in recent years, although there are wells that are not registered with DINAGUA.

2.3. *Regulatory background:* The Water Code of 1978 recorded wells for irrigation, industry and other uses (not for domestic or livestock use). Later, Decree 86 of 2004 established a requirement to obtain a permit prior to drilling and an administrative procedure for the extraction of water. In addition, Decree 214 of 2000 imposed specific conditions for thermal or deep wells in the Guaraní Aquifer.

2.4. *Hydro-geological context:* Most of the land mass is composed of "hard" rocks (basalts to the north and a crystalline basement to the south). There are sedimentary aquifers with good flow rates that enable domestic or localized irrigation uses (watering sports fields, filling swimming pools, washing cars) but not industrial use.
There are two shallow aquifers with significant flow rates; one of these is Raigón, located to the south. There are also about 10 geothermal wells (1000-1200 m) heated by the gradient, since there is no volcanic activity and which have flow rates of 10 to 20 m^3/h.

2.5. *Available Information:* There are some 1:100,000 geological maps of the south, such as Montevideo and Canelones. There are no recharge areas defined or detailed hydrogeological studies. Information on wells is accessible, as is geological information held by public organizations, on condition that it is requested by the Public Information Act. There is detailed literature on aquifers only in certain regions, such as Raigón and Salto.

2.6. *Current regulation of wells:* DINAGUA issues permits for drilling for extraction and use, although the administrative procedure is subject to a high degree of delay. In addition, there is no will to impose methodologies to change old monitoring mechanisms, such as GPS technology on drilling machines. Companies make an annual sworn declaration of wells drilled, but they do not include many domestic wells and drilling companies do not generally declare all the wells they drill.

2.7. *Water reinjection:* Neither DINAGUA nor DINAMA have issued any regulations, generating uncertainty. Injection into shallow aquifers is feasible on condition that what is reinjected has the same characteristics as what was extracted. However, there is no regulation on the quality of groundwater, only on surface waters.

2.8. *Experience of low-temperature geothermal energy:* There is a venture to do with the use of hot water in the north of the country for greenhouses. There are also initiatives that have been proposed but not executed. One company, for example proposed using this type of energy to maintain constant temperature in an industrial process. Sadly, the initiative did not prosper due to lack of support.

2.9. *Drilling equipment:* Drills can reach a maximum of 100-200 m. (The thermal wells were drilled using imported machines). Boreholes cost around USD 100-200 per metre if they are properly constructed (lined, as a rule for the first 10 metres). Prices vary, for example, by time of year. If it is very rainy, for example, prices can go down.

2.10. *Main constraints or difficulties:* A lot of outreach is going to be needed in Uruguay about this technology, as the country has a conservative mindset. And it must be shown that this type of energy is financially viable.

3. Agreements

3.1. CeReGAS agreed to meet DEUMAN in future interviews to provide the information required and/or support the performance of the consultancy exercise. In addition to attending the first preliminary presentation to stakeholders.

4. Present

No.	Name	Institution
1	Alberto Manganelli	CeReGAS
2	Cristhian Abanto	DEUMAN
3	Diego Aravena	DEUMAN
4	Lucía Samaniego	DEUMAN
5	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 003

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 01 – National Fuel, Alcohol and Portland Cement Administration (ANCAP)
1.2. Place: Video conference
1.3. Date: 12 / 05 / 2020
1.4. Time: 12:00 PE – 13:00 CL – 14:40 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy, the experience of CEGA and possible potential in Uruguay by specialist members of the technical team.

2.2. *ANCAP's role and experience:*

Under the Fuels Monopoly Law, ANCAP is responsible for regulations, contracts and tenders related to its roles of operation, prospection, distribution of crude, and refining, with the approval of MIEM and the presidency. It has given private companies flexibilities and approval to carry out import, marketing and distribution procedures.

It has also supported foreign and domestic private companies to gain access / sale of information to develop other products, this being another form of income for ANCAP. Similarly, it has joined university projects providing geological data and has promoted such research working in conjunctions with other entities such as the World Bank.

2.3. *About low-temperature geothermal energy:*

As it sees it, energy issues do not compete with one another, but complement one another. Due to the geological peculiarities of geothermal energy, ANCAP sees a good future and good future results for it.

2.4. *Information required for the technical assistance:*

Geological prospection information is offered for use in geothermal energy applications, in accordance with protocols to allow access to information. This information includes: the inventory of wells in the Cuenca del Norte (North Basin), geophysical and seismic information, information on excavations and maps, among others.

2.5. *Role in the technical assistance:*

Geothermal energy has some particular features in relation to the ANCAP monopoly. There is a possibility that ANCAP could become associated with the exploration and prospection phases, with shared investments, but not in subsequent stages, which should be performed with other private companies or with institutions or associations.

3. Agreements

3.1. Héctor Santana, ANCAP's head of drilling and a geologist by profession, has a resource-oriented viewpoint and suggested that DEUMAN contact the CEO of ANCAP: Alejandro Stepanisich (astepanish@ancap.gob.ur) or speak with the CEO secretariat to strengthen communications, obtain more information and reach important agreements between the two sides.

4. Present

No.	Name	Institution
1	Héctor de Santana	ANCAP
2	Jaime Parada	DEUMAN
3	Joshua Carvacho	DEUMAN
4	Lucía Samaniego	DEUMAN
5	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 004

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 46 – University of the Republic - Faculty of Sciences (Institute of Geological Sciences)
1.2. Place: Video conference
1.3. Date: 12 / 05 / 2020
1.4. Time: 14:30 PE – 15:30 CL – 16:30 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy, the experience of CEGA and possible potential in Uruguay by specialist members of the technical team.

2.2. *Experience and interest:* There is a need identified by the UdelaR Faculty of Sciences to conduct research into geothermal energy, as this is a little-researched area. The Faculty also found characteristics of geothermal energy that were analogous with hydrocarbons exploration (the speciality of the interviewee). With co-workers such as Dr Viramonte and the International Geothermal Energy Observatory of Rio de Janeiro, they analysed the resources of the stratigraphic column (from shallow to deep) in Salto for its thermal potential.

2.3. *About low-temperature geothermal energy:*
Uruguay has many shallow aquifers, such as Raigón, Chuy and those near the River Uruguay, with great geothermal potential. There are also many fissured aquifers, which is where the main dairy producers are located.

2.4. *Scientific research and information on low-temperature geothermal energy:*
There are currently two pieces of degree work and one master's research project on geothermal energy. For this research, information was collected from various organizations, since no excavation was conducted. The organizations include DINAGUA and the state oil company, ANCAP. The information related to deep wells (over 1000 m), stratigraphy, geochemistry, etc. Funding was from public funds such as ANII, CSICA or private funds.
We were also told that there is information on shallow aquifers, theses and books from different parts of the country. There are 1:100,000 and 1:50,000 maps on: Montevideo, Canelones, San José, Salto. Although there are no estimates of geothermal potential, there could be an estimate using existing bibliographic information and data collected in the field.
UdelaR has also invited international experts in geothermal-energy topics to teach.

2.5. *Opportunities for low-temperature geothermal energy:*
Firstly, the hydrogeological work done in Salto could be replicated in many other places. There is also commercial potential in the south and the coastal area, due to having the highest population density.
As for specialists, the training of Uruguayan geologists is considered appropriate since their expertise in hydrogeology could be quickly adapted to geothermal energy.

2.6. *Constraints or difficulties:*
One of the main problems for application (in their assessment) is regulation, because there is no regulation of its use, operation or cost.

3. Agreements

3.1. Ethel Morales agreed to make herself available to provide the information needed for correct preparation of the roadmap and successful conduct of the technical assistance. In addition to attending the first preliminary presentation to all stakeholders.

4. Present

No.	Name	Institution
1	Ethel Morales	Institute of Geological Sciences
2	Cristhian Abanto	DEUMAN
3	Lucía Samaniego	DEUMAN
4	Diego Aravena	DEUMAN
5	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 005

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 50 – SEG Ingeniería (ESCO)
1.2. Place: Video conference
1.3. Date: 24 / 05 / 2020
1.4. Time: 08:00 PE – 09:00 CL – 10:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy by specialist members of the technical team.

2.2. *Experience of SEG Ingeniería:* Company established over 20 years; has implemented a series of projects, electricity generation and industrial process heating, of various types and using various technologies. Has experience working with air-source heat pumps, but not geothermal. Has also worked with 1400 state schools, in the Solís Theatre and with wind and solar farms in Salto. Does not supply equipment and has no preferred technology; willing to work with new technologies.

2.3. *Home heating in Uruguay:*
With an average temperature of 17°C, there is a great need for heating in winter, as winters can be harsh with minimum temperatures of around 6°C, leading to the homeless dying from hypothermia.
Air conditioning, which started to gain in popularity 10 years ago, is now fitted in the homes of 43% of the population, against just 10% in 2008. We were also informed that 37% of families' electricity consumption was on providing domestic hot water, since this is mainly provided using electric water heaters.

1.1. *Opportunities for heating and cooling systems:*
The residential sector able to opt for this technology is that of people with socioeconomic affluence and those keen to take action to combat climate change who choose renewable energy. A luxury homes project by the ASUAN company in Punta del Este was mentioned, where the person in charge is Eduardo Rovira.
In addition, as there is a law that stipulates that a percentage of thermal energy must be solar in new buildings, the same could be suggested for low-temperature geothermal energy use in heating and cooling systems.

2.4. *Opportunities in the industrial sector:* In the agro-industrial field, the cannabis greenhouses were particularly mentioned, as they need thermal conditioning and have high energy demands. Insofar as cooling is concerned, the interviewees highlighted requirements of -20°C y -40°C.
SEG Ingeniería advised us on the basis of their experience to develop projects with payback times no greater than two years, and that the initial investment in a pilot project could be in the region of USD 500,000.

2.5. *Barriers to low-temperature geothermal energy:*
The first barrier is the lack of proven experience to enable organizations to back this technology. Although there is a good prospect of putting teams together in Uruguay, there is no diverse group of established geothermal technology providers.
The second issue is the cultural barrier, which is difficult to overcome even with financial incentives such as subsidies. We were advised to look into the experience of solar thermal subsidies. UTE offered subsidies of USD 800 to encourage customers to install solar thermal collectors and even so, fewer than 2000 customers took the offer up.

3. Agreements

3.1. DEUMAN agreed to share previous low-temperature geothermal energy solutions for SEG Ingeniería to assess the viability of these deals, as well as sharing the presentation.
3.2. SEG Ingeniería has prepared a report on energy and heating indicators in Uruguay, which it is prepared to share.
3.3. DEUMAN agreed to send the CIATEMA company as a contact. CIATEMA manufactures geothermal energy installation equipment in Buenos Aires.

4. Present

No.	Name	Institution
1	Ernesto Elenter	SEG Ingeniería
2	Jaime Parada	DEUMAN
3	Cristhian Abanto	DEUMAN
4	Joshua Carvacho	DEUMAN
5	Mauricio Muñoz	DEUMAN
6	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 006

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 41 – MCT (ESCO)

1.2. Place: Video conference

1.3. Date: 13 / 05 / 2020

1.4. Time: 12:00 PE – 13:00 CL – 14:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy by specialist members of the technical team.

1.2. *MCT's experience of heat pumps:*

The MCT company has been selling energy-efficiency solutions since 1998. It has good experience with water-water heat pumps, having installed 10 projects throughout Uruguay, mainly in the meat-refrigeration industry. Five years ago, it installed an air-source heat pump at the airport, as air-source was more financially-viable than geothermal, and also because there was nowhere to drill boreholes and there were many internal constraints at the airport.

In general, its experience is mainly in the industrial sector, with some in the hotel industry and practically nothing in residential. MCT also told us that its pump supplier, from Finland, also manufactures geothermal energy heat pumps.

1.3. *Experience in the refrigeration industry:*

It works in the dairy and meat refrigeration industries. Its vision is that air-source heat pumps are the best solution for the requirements of this type of industrial refrigeration, because the water used in the meat refrigeration process is more suitable on account of being at 30°C, unlike geothermal pumps where the ground temperature is 18°C.

This is why MCT has concluded that low-temperature geothermal energy is not viable for meat refrigeration systems. The opposite would apply in the dairy industry, which has good potential because it does not use the heating-cooling system all year.

1.4. *Benefits of energy-efficiency projects:*

The fiscal subsidies provided by the government, consisting of investments being reimbursed through tax reliefs, is a good incentive for energy-efficiency projects. Likewise, the use of environmentally-harmful refrigerants is starting to be restricted, under the Montreal Protocol. This is why it is advisable to work with Class A heat pumps, in order to qualify for the state subsidy.

1.5. *Opportunities for the development of low-temperature geothermal energy:*

It could be possible to gain a foothold in tanneries (although their production has fallen) and wool-washing plants, as these need abundant hot water, and the dairy refrigeration industry.

Also, for heating hotels and domestic homes, where many properties have heat pumps due to their winter lasting from March to September.

And although MCT has no experience with greenhouses, it suspects that they would have good potential. We were advised to check with specialists in that area.

1.6. *Summary of recommendations:*

For larger-scale projects, they suggest using a pump motor above 100 kW.

We should also bear in mind that labour is not cheap and that the cost of installation is equally or more expensive than the equipment, and that is why large projects are needed for them to be financially-viable.

3. Agreements

3.1. MCT agreed to pass us the contact details of the Finnish company that supplies their equipment and information on their specific work with heat pumps.

4. Present

No.	Name	Institution
1	Martín Garmendia	MCT
2	Jaime Parada	DEUMAN
3	Joshua Carvacho	DEUMAN
4	Mauricio Muñoz	DEUMAN
5	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 007

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 43 – Lagomarsino & cía
1.2. Place: Video conference
1.3. Date: 14 / 05 / 2020
1.4. Time: 13:00 PE – 14:00 CL – 15:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy by specialist members of the technical team.

2.2. *Experience of Lagomarsino & cía:* Specialists in medium-scale thermal conditioning, mainly in the commercial and residential sector (large buildings). They have also worked with industry and hospitals. They offer sustainable buildings certification under the LEED scheme and for the use of renewable energy.

They have carried out two low-temperature geothermal energy projects with a Spanish company called PGI, using heat pumps. However, they do not have much experience in dimensioning civil works.

2.3. *Context of investments in Uruguay:*

Commercial clients have a culture of assigning greater importance to the initial investment and little importance to operating payback or savings. One example of this is that of solar thermal collectors. These were imposed by the government under the Solar Act, obliging all hotel and buildings constructions to have solar collectors. There is also a law to promote foreign investment, aimed at large-scale energy-efficiency projects, which offers financial credit support and certain tax benefits. It works with a compliance list that awards points.

2.4. *Current situation and experience in air conditioning and heating:*

Uruguay has a temperate climate, but maximum temperatures can reach 35°C and minimums can fall to 0°C. Most homes have heating in the winter, but only half of the population has air conditioning, because air conditioning is more a matter of comfort. They have worked with various office and hotel buildings. They have thermal conditioning projects in hotels and homes in Punta del Este and include LEED certification (ongoing). They told us that most of the investments in Punta del Este are Argentinian.

2.5. *Current situation and experience in the commercial sector:*

They have working in shopping centres, mainly in Montevideo, little in other parts of the country. There are about five major shopping centres in Uruguay and others that are medium or small in size.

In terms of size, the interviewee told us, in shopping centres they have 1,200 tons of refrigeration (1,500 kW thermal), a total surface area of 15,000 to 20,000 m^2 and a thermal load of 15 to 16 m^2/ton refrigeration.

2.6. *Opportunities for low-temperature geothermal energy:*

Although 70% or more of the population is unaware of this, synergies could be sought in the cities between processes that produce heat (such as air conditioning in a shopping centre) and those that require heat (such as a hotel). In other words, if the two buildings are close together, they could enjoy mutual benefits.

This already happens in hospitals. These could be willing to have new technologies that fulfilled their heating and cooling requirements. This complementarity is called "energy recovery" (using residual heat in other processes).

Heating systems are certainly needed in Uruguay, for the reasons mentioned earlier. We were also advised to opt for closed-loop systems, because, said the interviewee, the water returning to the aquifer (if applicable) is not of the same form or quality.

3. Agreements

3.1. Lagomarsino & cía agreed to meet DEUMAN in future interviews to provide the information required and/or support the performance of the consultancy exercise.

4. Present

No.	Name	Institution
1	Agustín Bertolotti	Lagomarsino & cía
2	Cristhian Abanto	DEUMAN
3	Lucia Samaniego	DEUMAN
4	Joshua Carvacho	DEUMAN
5	Mauricio Muñoz	DEUMAN
6	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 008

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 47 and STKH 48 – University of the Republic, Faculty of Engineering (Institute of Mechanical Engineering and Industrial Production; and Institute of Fluid Mechanics and Environmental Engineering, respectively)

1.2. Place: Video conference

1.3. Date: 14 / 05 / 2020

1.4. Time: 15:00 PE – 16:00 CL – 17:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy, the experience of CEGA and possible potential in Uruguay by specialist members of the technical team.

2.2. *Interviewees' experience and research:*

Alfonso (Fluid Mechanics), Pedro and Federico (Mech. Eng.) have been working since January 2018 on a project funded by ANII on heat transport in the Raigón Aquifer. This study began with drilling into the shallow aquifer, using facilities that the Faculty has to teach in a school (4 boreholes). They are also working on geotechnics and the characterization of soils and sediments, with a focus on studying their thermal properties.

The project funded six additional boreholes in addition to the four existing wells, to extract and reinject water, passing it through solar collectors and monitoring wells that were installed nearby. Much of the project consisted of implementation. Due to this, it is now in operation two years later, with controlled flows. They told us that in the summer just gone, they conducted an injection trial which was successful, and so they already have temperature results for the summer and they are planning to measure how much can be recovered in winter. However, they have not yet planned the analysis of its application: how much heat can be recovered with a heat pump.

They are working in parallel on a model to simulate heat and mass transfer in the subsoil; this is ongoing.

2.3. *Information about the reinjection process:*

As the water is not used consumptively, no permit request was made to DINAGUA. The reinjection well has a depth of 23 m and the maximum temperature of reinjected water was 40°C, in accordance with German regulations to avoid changing any properties such as solubility. They also told us that there is no specific regulation for this, because there is no environmental impact analysis.

2.4. *Information on drilling:* Drilling costs USD 150 per metre (including VAT). The process consisted of drilling using drilling mud with direct circulation and rotation. The first meters were clay and dry. Drilling continued for 10 days, with a 6" diameter for both the extraction and reinjection wells, while the monitoring boreholes had a diameter of 2".

2.5. *Teaching about geothermal energy:* They taught a master's course focused on geothermal energy (of the order of 20 contact hours) in the UdelaR Faculty of Engineering. This was warmly received by students and covers electricity-generation, but is more focused on the design of low-enthalpy systems.

3. Agreements

3.1. The interviewees agreed to continue to provide information required for correct preparation of the Roadmap and proper conduct of the technical assistance. In addition to attending with us the first preliminary presentation to all stakeholders.

4. Present

No.	Name	Institution
1	Pedro Galione	Institute of Mechanical Engineering and Industrial Production
2	Alfonso Flaquer	Institute of Fluid Mechanics and Environmental Engineering
3	Federico González	Institute of Mechanical Engineering and Industrial Production
4	Cristhian Abanto	DEUMAN
5	Diego Aravena	DEUMAN
6	Itala Ferrer	DEUMAN
7	Lucía Samaniego	DEUMAN

Minutes of Meeting: No. 009

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 23 – Government of Maldonado: Environment Directorate

1.2. Place: Video conference

1.3. Date: 15 / 05 / 2020

1.4. Time: 09:00 PE – 10:00 CL – 11:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy and its possible application in Uruguay by specialist members of the technical team.

2.2. *Current situation in Maldonado:*

Tourism and construction are predominant. There is a rural area with agriculture, most importantly livestock and dairy production, and there are also vineyards, such as the Garzón and Alto de la Ballena wineries and olive oil producers. These latter two are medium-scale, exporting organizations.

2.3. *Current energy situation in Maldonado and the importance of renewable energy:*

Large amounts of electricity are consumed throughout the departamento, from Punta del Este through to the humblest of homes.

The regional government's Environment Department gives considerable support for the implementation and generation of renewable energy, from private and state-owned wind farms through to biogas production in its landfill site, both of which contribute to the UTE electricity grid.

The landfill site, which has been in operation for 20 years, has been equipped with a biogas plant for 15 years. This produces electricity which is also fed into the grid.

2.4. *Energy use in the productive sectors:*

Each of the major wineries has its own wind generation plant, for its own needs and to feed into the grid. This is in compliance with the Clean Energy Act.

2.5. *Heating systems in Maldonado:*

Due to the winter weather, heating is commonplace. Temperatures rarely go as low as -3 or -4°C with frosts.

Heating is mostly electric, with very little by wood, which is more a cultural matter. Apart from wood-burning stoves or for use with grills, however, electricity remains the most-used option. And burning wood does not present air-quality problems, due to the winds.

2.6. *Experience of low-temperature geothermal energy:*

They have no knowledge of this type of energy, but they are very keen to add it to their energy mix, and especially to look at possibilities for implementing it in some productive sectors, hotels and condominiums.

After the explanation by the technical team, they saw greater interest in the use of low-temperature geothermal energy using horizontal collectors, as this, in the opinion of the interviewee, would not involve excavations to great depths.

3. Agreements

3.1. The Director of Environment agreed to put us in contact with the League for the Promotion of Punta del Este and the Maldonado Business Association, which have a sustainable development committee, to present to them on the technical assistance and consider future projects to develop.

3.2. Similarly, they undertook to support the development of low-temperature energy and join us at the first preliminary presentation to stakeholders.

4. Present

No.	Name	Institution
1	Betty Molina	Government of Maldonado
2	Virginia Villarino	Government of Maldonado
3	Jaime Parada	DEUMAN
4	Lucia Samaniego	DEUMAN
5	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 010

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 38 –Water Technology Centre (CTA)
1.2. Place: Video conference
1.3. Date: 15 / 05 / 2020
1.4. Time: 12:00 PE – 13:00 CL – 14:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introduction of interviewee and explanation of low-temperature geothermal energy and its possible application in Uruguay by specialist members of the technical team.

2.2. *Current situation of the Water Technology Centre:*

The Water Technology Centre arose from a project under the National Agency for Research and Innovation (ANII) to promote and generate solutions from academia into industries related to water management.

It is formed of the regulatory authorities, various companies, such as Coca Cola, BPU (refrigeration), National Milk Institute (INALE), and EFICE, among others; in addition to the most important higher education institutions in Uruguay, which are the bodies providing research solutions to the industries' problems.

It is funded partly by ANII and partly by the enterprises that require the project.

2.3. *Possible interests the companies may have in geothermal energy:*

The interviewees suggested that refrigeration or dairy companies would be the most interested, in addition to the beverages industry, and forestry (UPM) sector, which has a large pulp mill. The pulp mill would have an interest in heating and the other companies in refrigeration and cooling.

We were told that new designs have been developed for the structure of UPM's greenhouses, which are now in the final stage of sale. However, we could contact them to gauge their possible interest in using low-temperature geothermal energy.

2.4. *Recommendations:*

To reach the companies that make up the Centre, there would be a need to present the feasibility of specific projects in relation to each sector and compare its advantages over energy technologies currently used in them.

It would also be important that low-temperature geothermal energy had the support of the state in the form of subsidies or tax incentives.

3. Agreements

3.1. DEUMAN agreed to send further information on the advantages of low-temperature geothermal energy to Alejandro Carbajales, Executive Director, and technical details of possible projects relevant to the companies within the CTA or projects that have already been conducted in other countries, so that Mr Carbajales can inform the others.

3.2. Mr Carbajales will report on the technical assistance to the Executive Committee and will emphasise the companies that may possibly benefit.

3.3. Likewise, they offered to put us in contact with companies that may benefit when project feasibility is available and to join the first preliminary presentation to stakeholders.

4. Present

No.	Name	Institution
1	Alejandro Carbajales	Executive Director, Water Technology Centre
2	Jaime Parada	DEUMAN
3	Lucia Samaniego	DEUMAN
4	Mauricio Muñoz	DEUMAN
5	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 011

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 10 – Ministry of the Environment, Climate-Change Division

1.2. Place: Video conference

1.3. Date: 19 / 05 / 2020

1.4. Time: 08:00 PE – 09:00 CL – 10:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy and its possible application in Uruguay by specialist members of the technical team, and the information gathered from other stakeholders already interviewed.

2.2. *Functions of the Climate Change Division:*

The division has the role of promoting, but not regulating climate-change guidelines, and evaluating the needs of the various sectors to which renewable energy could be applicable.

The division does not have its own budget line, and this is why it seeks financial support from international bodies such as CTCN to secure compliance with climate-change guidelines and meet its objectives.

2.3. *Its role in energy efficiency:*

While the National Energy Directorate (DNE) is the body responsible for energy-efficiency matters, the Climate-Change Division is a member of the jury for national funding competitions in the field of energy-efficiency projects. In addition to the National Policy on Climate Change under the Paris Agreement, it seeks to promote the use of renewable energy and energy efficiency to reduce emissions in Uruguay.

2.4. *Background information on heating and air conditioning in Uruguay:*

Fifteen years ago, no private house had thermal conditioning, but with the diversification of the energy matrix and low electricity prices, such systems are now affordable to most Uruguayans, helping them to be comfortable in their homes and creating a new culture in them.

2.5. *The importance of this project, as seen by the management:*

In the short term, the development of low-temperature geothermal energy would result in an increase in energy efficiency and increased demand for renewable energy. In other words, the use of efficient geothermal pumps would be an innovation in the Uruguayan energy mix without the need to use fossil fuels.

In the long term, the savings in electricity consumption due to these processes will make it possible to introduce electric vehicles in Uruguay, since conventional vehicles are the contributors of carbon to the atmosphere.

In addition, we were recommended to continue working with ESCOs, because they are the ones with the experience of winning and securing energy-efficiency project financing.

3. Agreements

3.1. The Climate-Change Division agreed to help us make contact with the National Environment Directorate (DINAMA) and the National Water Directorate (DINAGUA).

3.2. DEUMAN awaits the approval of the director of the Climate-Change Division for the first preliminary presentation with stakeholders.

4. Present

No.	Name	Institution
1	Jorge Castro	Climate-Change Division
2	Carla Zilli	Climate-Change Division
3	Jaime Parada	DEUMAN
4	Cristhian Abanto	DEUMAN
5	Mauricio Muñoz	DEUMAN
6	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 012

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 02 – National Electricity Generation and Transmission Administration (UTE)

1.2. Place: Video conference

1.3. Date: 19 / 05 / 2020

1.4. Time: 14:00 PE – 15:00 CL – 16:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy and its possible application in Uruguay by specialist members of the technical team.

2.2. *Functions of UTE and electrical energy context:*

UTE is a state-owned enterprise responsible for the generation, transmission and distribution of electricity. While generating and marketing depend on whoever carries out those activities, transmission and distribution are natural monopolies. Electricity is obtained from hydropower, wind and conventional power plants. In addition, other private companies contribute with power from wind or solar farms.

UTE seems to promote the efficient use of electricity in space and water heating, for example, by use of air-source heat pumps. This is why it is developing products to increase electricity demand in this sector. Regarding geothermal heat pumps, we were told that while they are an option, no development work has taken place on them, on account of investment costs.

2.3. *Operation of the electrical system:*

Since 1999, UTE has been responsible for promoting a range of technologies through agreements with the suppliers of these technologies. In these agreements, the partner organization is responsible for providing support and customer installations, while UTE gives consumers energy discounts.

Uruguay has a structural surplus at certain hours of the day and time of year. This will be maintained over time or, in other words, there is excess electricity and a policy of turning demand towards electricity.

2.4. *Demand for electric heating and cooling systems:*

The sectors with the highest demand for such systems are the meat packing plants, seed drying, health, (hospitals and clinics), industry and some hotels. Currently, some hospitals have installed heat-pump systems since they are more efficient than traditional boilers. Some hotels have done the same.

2.5. *Opportunities for low-temperature geothermal energy:*

For UTE, heating sector is a field still unexplored, since the use of woodburning and fossil fuels in some buildings has prevented full-scale electrification. It would also be possible to seek synergies between water and space heating, or other synergies.

If the potential energy-efficiency and cost advantage compared to conventional pumps for air conditioning could be demonstrated, geothermal energy would be used throughout the industry.

2.6. *Smart grid project:* This project is part of electrification in Uruguay. It consists of seeking equipment with thermal inertia to increase the installed power factor and its use.

3. Agreements

3.1. DEUMAN agreed to send typical Coefficient of Performance (COP) figures for geothermal heat pumps to UTE.

3.2. UTE will provide the DEUMAN technical team with presentations describing the electricity sector in the country, with a special focus on smart grids.

4. Present

No.	Name	Institution
1	Juan Patrone	UTE
2	Eduardo Bergerie	UTE
3	Gastón Hernández	UTE
4	Jaime Parada	DEUMAN
5	Lucía Samaniego	DEUMAN
6	Mauricio Muñoz	DEUMAN
7	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 013

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 05 – Ministry of Industry, Energy and Mining (MIEM): National Energy Directorate (DNE)

1.2. Place: Video conference

1.3. Date: 22 / 05 / 2020

1.4. Time: 10:00 PE – 11:00 CL – 12:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy and its possible application in Uruguay by specialist members of the technical team, and the information gathered from other stakeholders already interviewed.

2.2. *Functions of National Energy Directorate:*

The DNE, under the MIEM, is responsible for energy issues, advising the executive on definition of the framework for the development of energy efficiency. It has a defined energy policy with goals for 2015 that have been met and which has not been updated with short-term goals. Statistics for 2018 show a 98% share for renewables in electricity and 63% in the energy supply in general. The goal now is to work on reducing consumption of fossil fuels, of which the transport sector is the largest consumer.

From the viewpoints of the environment and climate change, Uruguay has other goals to accomplish and there is no target at the moment for geothermal development.

2.3. *Opportuneness of the technical assistance, from the DNE viewpoint:*

The main focus is to be able to use "thermal energy storage", which sits well for UTE with the efficient use of smart grids. They call this "postponing to thermal", in that thermal energy storage systems can be used to store heat and increase the flexibility of the electrical system by managing future demand. In other words, the role of low-temperature geothermal energy would be that of helping to improve grid efficiency and seeking economical heating from a renewable source.

2.4. *Comments on the first preliminary presentation to stakeholders:* We were recommended to present the CAPEX, the curve showing reductions in recent years in the cost of heat pumps, a financial comparison with air- and water-source heat pumps, the COP and thermal efficiency, return on investment times and the possibility of using tax benefits, the electricity-consumption profile and demand-management capacity that the technology could provide, and its contribution to emissions reduction compared to fossil fuels.

2.5. *Specific regulation of the low-temperature geothermal energy sector:*

DNE is a regulator and has led on legislative processes for other renewable energy sources (wind, solar). It is respectful of the other institutions and that is why the issue of reinjection should be dealt with by the specific authorities.

Regarding geothermal energy, in the absence of any study, which will be developed with the Roadmap, there are currently no legal considerations for the promotion of low-temperature geothermal energy. This is why the interest of the MIEM is in the identification of barriers, in order to remove them and enable the introduction of geothermal in Uruguay.

3. Agreements

3.1. DEUMAN awaits the approval of the National Energy Directorate for the first preliminary presentation to stakeholders, and for DNE to send its logos.

4. Present

No.	Name	Institution
1	Martin Scarone	National Energy Directorate
2	Beatriz Olivet	National Energy Directorate
3	Wilson Sierra	National Energy Directorate
4	Laura Estrella	National Energy Directorate
5	Jaime Parada	DEUMAN
6	Cristhian Abanto	DEUMAN
7	Joshua Carvacho	DEUMAN
8	Itala Ferrer	DEUMAN
9	Lucía Samaniego	DEUMAN

Minutes of Meeting: No. 014

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 56 – Uruguayan Solar Workgroup
1.2. Place: Video conference
1.3. Date: 25 / 05 / 2020
1.4. Time: 13:00 PE – 14:00 CL – 15:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy and its possible application in Uruguay by specialist members of the technical team.

2.2. *Current situation of Uruguayan Solar Workgroup:*
Has been in operation since 2008 and counts among its members higher education, the private sector and government entities related to solar energy. It was originally financed by UNESCO, the British Embassy in Uruguay and AVINA.
It has a very important role of promoting, through the National Energy Directorate (DNE), enactment of the Thermal Solar Act and the Solar Plan for the use of systems; this latter measure is intended to develop thermal solar energy in the residential sector.

2.3. *The Solar Plan, an incentive for the use of solar energy:*
Individuals acquired a certified solar collector and used the certificate to apply to UTE for a discount on their electricity service for 12 months.
The certificate was issued by an authorized supplier upon the purchase and installation of technology that met technical specifications including the collector's guarantee, specific dimensions and durability.
This subsidy for solar thermal is closely related to a decline in hydroelectric generation on account of reduced rainfall and flow in rivers. This is why UTE was (and continues to be) very interested in options that enable the efficient use of electricity.

2.4. *Background to heating in Uruguay:*
Electric heaters are very common, even more common than gas heaters. Woodburning is also common. There is currently a campaign to persuade wood sellers to sell dry wood, to reduce a proportion of the particulate matter emitted. Using woodburning stoves generates poor air quality and respiratory diseases. Although not to a numerically-significant degree on an annual basis, there are seasons (around 7 months of the year) when woodburning stoves cause atmospheric pollution problems.

2.5. *Main barriers to and expectations of the technical assistance:*
The main barrier, in the opinion of the interviewee, was the drilling, which is expensive. The interviewee was, however, willing and interested in being part of the low-temperature geothermal energy offer as a consultant for project design and implementation, on account of their experience with refrigerants and a contact line for heat pumps.

3. Agreements

3.1. The interviewee agreed to be disposed to supporting the development of low-enthalpy energy and to join the first preliminary presentation to stakeholders.

4. Present

No.	Name	Institution
1	Pablo Franco Noceto	Uruguayan Solar Workgroup
3	Cristhian Abanto	DEUMAN
4	Mauricio Muñoz	DEUMAN
5	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 015

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 63 – Enersys

1.2. Place: Video conference

1.3. Date: 26 / 05 / 2020

1.4. Time: 08:00 PE – 09:00 CL – 10:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy by specialist members of the technical team.

2.2. *Enersys' experience:* It has experience of working with groundwater and drilling, while its experience with heat pumps began in order to use the groundwater. The interviewee told us that groundwater has a temperature of between 18 and 20°C all year round and that ANII gave it funding five years ago to develop a geothermal prototype.

2.3. Differences between air-source and geothermal heat pumps: 98% of the heat pumps in Uruguay are air source and only 2% are geothermal. Geothermal pumps are generally requested by people of European origin who know about geothermal energy. Heat pumps face tough competition in Uruguay, on account of prices, level of complexity and popularity. However, geothermal COP can be 30% more than air-source, which is valued in the industrial and large-scale sector. In small-scale residential applications, however, geothermal cannot compete with air-source.

An important factor that makes geothermal less attractive than air-source is the complexity of installation; capturing groundwater is complex in open-loop geothermal systems. In their opinion, closed-loop systems are not viable as replacement solutions, due to the earthworks involved. The potential is in new-build.

2.4. *Groundwater:* There is abundant groundwater at very shallow depths, but there are environmental restrictions on its use and no regulations defining and allowing its reinjection.

2.5. *The Uruguayan heating market:* There are regional government tenders that are the best sources of income, but what is more typical is dealing direct with residential and commercial customers for heating and pool heating.

There is little experience of geothermal energy: generally private applications for very occasional clients. There are two companies that sell geothermal solutions, although this is not, of course, their main product.

2.6. *Geothermal equipment supply chain:* Enersys uses Japanese brands manufactured in China, and although the compressors (the main part) are good, the electronics are bad. They told us that the equipment is very simple to make, but it is impossible to compete with China on price, just as with Italian and US suppliers that offer better quality but at a very high price.

Enersys looks after technical service, manufacturing fault repair and maintenance. Chinese technology has a service life of around 10 years.

2.7. *Internal associations in Uruguay:* Enersys has experience of strategic trade partnerships for presentations to banks and financial institutions. They have no experience of forming trade associations or of leveraging a new industry on a partnership basis. In their opinion, the ESCO model works very well.

2.8. *Recommendations for implementation of the TA:*

The government should play a major role: firstly, there needs to be a financial stimulus, as there is with solar panels, and tax breaks; they also suggest an ESCO Plan led by UTE for geothermal heat pumps in new installations (construction promotion). Or, through the model of the Committee for Application of the Investment Act (COMAP), which should be adapted for geothermal energy.

Secondly, DINAGUA needs to provide certainty around the use of groundwater. They told us that it is sufficient to use water from the water table and although use of the aquifer is regulated, there should be no change to the physical conditions. Thirdly, there is a need for an environmental impact assessment to regulate reinjection.

3. Agreements

3.1. The interviewee agreed to meet and support future pilot projects for development of the Roadmap, and to attend the first preliminary presentation to stakeholders.

4. Present

No.	Name	Institution
1	Arturo Correa	Enersys
2	Cristhian Abanto	DEUMAN
3	Joshua Carvacho	DEUMAN
4	Mauricio Muñoz	DEUMAN
5	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 016

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 04 – Government of Salto: General Directorate of Works

1.2. Place: Video conference

1.3. Date: 26 / 05 / 2020

1.4. Time: 13:00 PE – 14:00 CL – 15:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy and its possible application in Uruguay by specialist members of the technical team.

2.2. *Economic activities in Salto:*

The main business activities in Salto are tourism and horticulture, these being the pillars of the departamento's economy. There are also livestock, agriculture and industry, but these are not as representative. The interviewee told us that there is a wish to build a marijuana-drying plant, which would use a great deal of electricity and could be an opportunity for low-temperature geothermal energy.

2.3. *Spa complexes:*

Salto has two large spa complexes: Daymán has two 1400-m boreholes supplying water at 48°C and feeding into tourist complexes. Arapey has one borehole that feeds a tourist resort at 40°C. There is another thermal-water borehole in Salto City that was delivered by OSE to the Regional Government of Salto under a loan and restitution arrangement and that is intended to be used to heat swimming pools. They told us that architects wish to develop a smart building.

Daymán has a local population, but Arapey is only tourism.

A project is currently under way for the construction of indoor pools, one Olympic and one hydrotherapy, heated using energy from hot springs.

2.4. *Crop-growing in greenhouses:*

The departamento of Salto is the second-most important in the country for greenhouses. It is hoped to become the centre of horticulture in northern Uruguay. Data are available on the surface area of greenhouses, types of production and other information.

We were told that the project for the use of residual spa water for the tomato greenhouse that had been mentioned earlier had not prospered and that most of the water was returned to the river unused.

2.5. *Opportunities for low-temperature geothermal energy:*

Geothermal energy can be used in two ways: heat pumps and via boreholes. They already have boreholes, and would, therefore, only be seeking to make the most of all the potential of these to benefit more sectors. The first beneficiary they are thinking of is horticulture producers.

The departamento uses air conditioning and electric heating more. This is why there is an opportunity for low-temperature geothermal energy for heating hotels and homes, using residual water from existing spa complexes or wells, because these waters are only currently used to heat swimming pools.

3. Agreements

3.1. The Salto General Directorate of Works will share its land-use map and recorded data on greenhouses.

3.2. It also promised to join us at the first preliminary presentation to stakeholders and to continue to work with us on preparation of the Roadmap.

4. Present

No.	Name	Institution
1	Juan Pablo Zoppi	Government of Salto
2	Jaime Parada	DEUMAN
3	Joshua Carvacho	DEUMAN
4	Lucia Samaniego	DEUMAN
5	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 017

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 52 – University of Labour of Uruguay (UTU)
1.2. Place: Video conference
1.3. Date: 27 / 05 / 2020
1.4. Time: 08:00 PE – 09:00 CL – 10:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy, the experience of CEGA and possible potential in Uruguay by specialist members of the technical team.

2.2. *Experience of the interviewee:*
The interviewee, the Renewable Energy Coordinator at UTU, knows of many examples of geothermal energy in America and has experience of energy-efficiency work. In this particular instance, he considers the technical assistance a new possibility that has many barriers, especially financial and ignorance of the resource.

2.3. *The University's research and dissemination projects:*
UTU has carried out research projects related to renewable energy and energy efficiency, including the implementation of electric cars for a race, financed by UTE. It obtains funding through bids or partnerships with companies.
The university has significant technological potential and carries out technology improvements or simplifications.
It is not currently offering a course in geothermal energy, but if the technical assistance yields positive results the possibility would exist of offering courses to train new specialists in the field.

2.4. *Opportunities for and constraints on low-temperature geothermal energy:*
In his opinion, it will be difficult to enter the residential sector due to the technology being little-known to the community or to future suppliers and the architects who would design the constructions. He does, however, suggest checking the position in respect of agricultural and greenhouse growing.
He recommended that there should be a financial or tax incentive from the authorities for implementation of this new technology, to reduce or completely cover the investment costs, which are higher than those for technologies currently in use.
There is also the possibility of the university conducting projects for the set-up or simplification of geothermal heat pumps. This is something that would have to be discussed with the University.

3. Agreements

3.1. The interviewee accepted our invitation to attend the first preliminary presentation to stakeholders.

4. Present

No.	Name	Institution
1	Daniel Primucci	University of Labour of Uruguay
2	Jaime Parada	DEUMAN
3	Cristhian Abanto	DEUMAN
4	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 018

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 50 – Technology University of Uruguay: Renewable Energy Engineering
1.2. Place: Video conference
1.3. Date: 27 / 05 / 2020
1.4. Time: 12:00 PE – 13:00 CL – 14:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy, the experience of CEGA and possible potential in Uruguay by specialist members of the technical team.

2.2. *Interviewees' experience and research:*
The university has offered a course in Renewable Energy Engineering since 2016 and think that this is a good opportunity for students because it contains units that are very closely related to low-temperature geothermal energy.
In addition, Juan Aguilar has experience working in this type of geothermal energy in other countries and its use with heat pumps.

2.3. *Access to project financing and opportunities:*
Due to being a university, it can access ANII project funding and for this reason it is hoped to carry out a project on the Guaraní Aquifer in the future.

They could also (either on their own initiative or if it is proposed to them) implement a greenhouse project, since one of these is currently under way in a different faculty of the university and they could use the infrastructure for a pilot and look into the potential of geothermal energy for thermal conditioning.
They told us that they have two boreholes in the university itself, but no work has been done on their geothermal potential.
At sectoral level, they believe that the grain-drying industry is a potential beneficiary of this technology.

3. Agreements

3.1. The interviewees agreed to continue to provide information required for correct preparation of the Roadmap and proper conduct of the technical assistance. In addition to attending with us the first preliminary presentation to all stakeholders.

4. Present

No.	Name	Institution
1	Carlos Bello	Technology University of Uruguay
2	Vitoria Olave	Technology University of Uruguay
3	Marcos Zefferino	Technology University of Uruguay
4	Juan Marcelo Aguilar	Technology University of Uruguay
5	Jaime Parada	DEUMAN
6	Cristhian Abanto	DEUMAN
5	Diego Aravena	DEUMAN
6	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 019

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 62 – Bidegaray & Asociados

1.2. Place: Video conference

1.3. Date: 27 / 05 / 2020

1.4. Time: 14:00 PE – 15:00 CL – 16:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introduction of interviewee (guest) and explanation of low-temperature geothermal energy by specialist members of the technical team.

2.2. *Geothermal project experience:*

We were told of their attempt to conduct an open-loop low-temperature geothermal energy project, which did not prosper, in a plastics industry that used a cooling tower and chillers. When it developed faults, it was proposed to install a geothermal system instead, using the boreholes. As there was no clarity over whether the water could be used in a geothermal system, they did not dare continue with the project in order to avoid risk.

The probability of resuming interest would depend on improvements in regulation.

2.3. *Clients using open-loop low-temperature geothermal energy systems:*

They have customers in Salto who use thermal resources: a club and a hotel. The borehole water is too hot for the club to use so it transfers this heat to the river after cooling in ponds. This is why solutions are sought for using it to heat neighbouring homes.

They won an energy-saving project in a hospital in Salto. They are still assessing whether or not to install an air-source heat pump to preheat the steam.

A sustainable cottages project in Maldonado, that could have an interest in geothermal energy. They told us that the client would not bother to be the guinea pig for testing the technology and dealing with regulation.

They have major clients who could be potential pilot projects, once the regulatory part is resolved.

2.4. *Regulatory barrier to the use of groundwater and reinjection:*

Although there is DINAMA for environment issues and DINAGUA as the body issuing drilling permits, there is no regulation covering what to do with water extracted from boreholes and unaltered in quality. It is important to have legislation defining this, with a supporting environmental impact study, based on countries where the use of open-loop low-temperature geothermal energy has been developed.

They also told us that the MIEM Energy Directorate had promoted courses in geothermal energy in the past, with experts to disseminate the associated concepts.

3. Agreements

3.1. Bidegaray & Asociados agreed to work actively on implementation of the Roadmap and to contact potential companies that might agree to implement this technology if regulation is in place to cover its use and reinjection.

3.2. Bidegaray & Asociados agreed to join us at the preliminary presentation to stakeholders.

4. Present

No.	Name	Institution
1	Federico Bidegaray	Bidegaray & Asociados
2	Jaime Parada	DEUMAN
3	Joshua Carvacho	DEUMAN
4	Lucia Samaniego	DEUMAN
5	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 020

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 39 – Uruguayan Chamber of Industries (CIU)
1.2. Place: Video conference
1.3. Date: 29 / 05 / 2020
1.4. Time: 13:00 PE – 14:00 CL – 15:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introduction of interviewee (guest) and explanation of low-temperature geothermal energy and its possible application in Uruguay by specialist members of the technical team.
2.2. *Experience of the Uruguayan Chamber of Industries:*
The Chamber has more than 1000 members, which it represents and reports on the sector's interests, such as the cost of electricity. The CIU is consulted over policy-creation in Uruguay and has worked with the National Energy Directorate to analyse the energy sources that the sector needs and to raise tenders for non-conventional energy sources.
2.3. *Its role in changing the Uruguayan energy mix:*
They told us that development of a new Uruguayan energy matrix consisted not only of changing sources of energy, but also of promoting the development of industry through the acquisition of certificates of origin for its products for export.
2.4. *Opportunities for low-temperature geothermal energy:*
In the opinion of the interviewee, the dairy industry is an important potential beneficiary. Regarding other possibilities, the interviewee would need to meet other members of the Chamber to find out their needs.
He also mentioned that requesting a loan scheme for investment in the technology, as was the case for the use of solar thermal energy, would be a great opportunity.
He added that electricity-generation was expensive in Uruguay and that this should be taken into account when assessing the financial viability of this technology.

3. Agreements

3.1. DEUMAN agreed to send an executive summary of the technical assistance with a description of the opportunities that this technology brings.
3.2. Julio Sosa undertook to meet with the Director of Foreign Trade and the General Management to present the DEUMAN executive summary, with the goal of holding an event or survey to find out about potential low-temperature geothermal energy projects in the industrial sector.
3.3. He also agreed to be disposed to supporting the development of low-enthalpy energy and to join the first preliminary presentation to stakeholders.

4. Present

No.	Name	Institution
1	Julio Sosa	Uruguayan Chamber of Industries
2	Cristhian Abanto	DEUMAN
3	Joshua Carvacho	DEUMAN
4	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 021

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 57 – ASUAN

1.2. Place: Video conference

1.3. Date: 01 / 06 / 2020

1.4. Time: 13:00 PE – 14:00 CL – 15:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy by specialist members of the technical team.

2.2. *ASUAN's experience:*

ASUAN is in Uruguay and Chile, mainly working in heat-recovery equipment in the residential sector and for sports grounds, using air-source heat pumps, since ambient temperatures in Uruguay are not extreme.

They also told us that they work in the range of 16 to 400 kW thermal, installed in the residential sector and a sports ground.

2.3. *Experience in low-temperature geothermal energy:*

They have undertaken three low-temperature geothermal energy projects in the residential sector, although two of these were 10 years ago.

The COP achieved in heat exchange systems was 8.

They have not worked with closed-loop systems because the infrastructure made this impossible, so they opted for open-loop systems. However, they found problems with the quality of the groundwater, leading to corrosion of the pipework and precipitation of sediments.

In the third project, the idea of using the technology arose as a solution for the thermal conditioning of an area of 3000 m^2 using a silent system and that is why they chose to use an open-water lake that the property had, to use its water and exchange heat.

They have also carried out a project on a ship of the Uruguayan Navy School, on which they installed a system using heat from the seawater.

2.4. *Difficulties of low-temperature geothermal energy:*

The investment cost is usually double that of a standard air-source system and, in the opinion of the interviewee, the gains achieved do not make the exercise viable, as the geothermal COP will be greater but marginal for thermal needs and because systems are very complicated and different from other systems. For this reason, they suggest we carry out a more detailed analysis of cost-effectiveness.

2.5. *Opportunities for low-temperature geothermal energy:*

There are no problems with electrical connections in Uruguay, which fosters the use of electricity for thermal conditioning and water heating. In other words, it facilitates the implementation of hot-cold systems using electricity rather than other fuels such as gas or oil. This is why air-source and geothermal heat pumps have a great advantage.

There is a lack of natural gas or easy access to natural gas and that is why they do not work with natural gas systems for heat generation.

3. Agreements

3.1. DEUMAN will send ASUAN an invitation to the first preliminary presentation to stakeholders.

4. Present

No.	Name	Institution
1	Eduardo Rovira	ASUAN
2	Cristhian Abanto	DEUMAN
3	Joshua Carvacho	DEUMAN
4	Mauricio Muñoz	DEUMAN
5	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 022

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 33 – Energy and Water Services Regulatory Unit (URSEA)
1.2. Place: Video conference
1.3. Date: 02 / 06 / 2020
1.4. Time: 12:00 PE – 13:00 CL – 14:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy and its possible application in Uruguay by specialist members of the technical team.

2.2. *Functions of URSEA*

URSEA is the regulatory body for the energy and water distribution and sanitation sectors. It has powers in the field of the efficient use of energy and the safety of steam generators, while also having oversight of quality, safety, consumer rights and subsequent inspection of the three sectors mentioned.

2.3. *Energy-efficiency labelling:*

URSEA is responsible for authorizing the use of the energy-efficiency label on equipment. This labelling includes air conditioners with a cooling capacity up to 10 kW and would also include geothermal pumps.

URSEA does not have powers to approve bonuses or subsidise technologies that meet energy-efficiency standards.

2.4. *Regulation of potable water:*

Water-supply systems are very complex. The comprise surface sources, such as rivers, and underground sources, and the focus is on regulating the quality of the water rather than the detail of designs or volumes of sources.

2.5. *Its role in the technical assistance:*

In its opinion, the technical assistance is challenging and even necessary, but URSEA's functions and powers are delimited, for which reason its role in the TA does not fall within its competency. They currently do not have any ordinance that might regulate the use of geothermal energy, as this falls to the executive.

They also suggested that the ESCOs and National Energy Directorate are very important agents for the development of this project.

3. Agreements

3.1. The Energy and Water Services Regulatory Unit will offer its services as a regulatory body if the executive attributes such powers to it.

4. Present

No.	Name	Institution
1	Silvana Romero	URSEA
2	Fernando Bagalciague	URSEA
3	Carmen	URSEA
4	Andrés Hermida	URSEA
5	Eduardo Touya	URSEA
6	Jaime Parada	DEUMAN
7	Lucía Samaniego	DEUMAN
8	Joshua Carvacho	DEUMAN
9	Diego Aravena	DEUMAN
10	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 023

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 34 – National Agency for Research and Innovation (ANII)
1.2. Place: Video conference
1.3. Date: 03 / 06 / 2020
1.4. Time: 13:40 PE – 14:40 CL – 15:40 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introduction of interviewee (guest) and explanation of low-temperature geothermal energy and its possible application in Uruguay by specialist members of the technical team.

2.2. *Background to ANII:*

ANII is made up of public and private partners that join together to form sectoral funds. The energy sector, UTE and ANCAP are partners, for example. ANII funds university research projects and innovation projects by companies and entrepreneurs, this latter group obtaining funding throughout the year.

For companies, they only fund prototypes capable of being replicated on a large scale; in other words, they cannot have a direct productive use, but must be prototypes used to support research into and the testing of innovative technology.

They also told us that the Orestes Fiandra Fund is the largest, consisting of a loan of up to $1 million.

2.3. *Opportunities for low-temperature geothermal energy:*

In the opinion of the interviewee, thermal conditioning is a demand that is not yet fully covered. Woodburning is common because electricity tariffs are high for consumers.

3. Agreements

3.1. ANII agreed to share information in business innovation instruments and on the types of financial support (grant or loan) they can receive, as well as data on geothermal research projects previously funded by ANII.

3.2. He also agreed to be disposed to supporting the development of low-enthalpy energy and to join the first preliminary presentation to stakeholders.

4. Present

No.	Name	Institution
1	Flavio Caiafa	ANII
2	Jaime Parada	DEUMAN
3	Cristhian Abanto	DEUMAN
4	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 024

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 35 – National Development Agency (ANDE)

1.2. Place: Video conference

1.3. Date: 03 / 06 / 2020

1.4. Time: 15:10 PE – 16:10 CL – 17:10 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy and its possible application in Uruguay by specialist members of the technical team.

2.2. *Background to ANDE:*

ANDE promotes national development on the basis of four strategic pillars: financial services, entrepreneurship, business development and productive linkages. It helps by means of financial funds that may be grants (non-refundable) or second-tier lending (loans).

These include project financing, which they use as a circular-economy strategy. For company pilots sums up to USD 40,000 are available and up to USD 100,000 are available for larger projects.

They hope in future to seek "green" projects to finance, in which they could be helping projects aligned with the technical assistance.

2.3. *Opportunities for low-temperature geothermal energy:*

They think that there is great potential for the use of geothermal energy in the dairy industry, and also in seed drying and industries that use hot-cold systems.

Furthermore, if any company were to seek funding for a pilot project that used low-temperature geothermal energy, it would need a pre-feasibility analysis as a prerequisite.

3. Agreements

3.1. ANDE indicated interest in future funding of low-enthalpy energy projects and to attend the first preliminary presentation to stakeholders.

4. Present

No.	Name	Institution
1	Fernanda Milans	ANDE
2	Sebastián Ruiz	ANDE
3	Cristhian Abanto	DEUMAN
4	Mauricio Muñoz	DEUMAN
5	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 025

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 44 – ORT University – Faculty of Architecture – the Uruguayan House
1.2. Place: Video conference
1.3. Date: 11 / 06 / 2020
1.4. Time: 13:00 PE – 14:00 CL – 15:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy, the experience of CEGA and possible potential in Uruguay by specialist members of the technical team.

2.2. *Experience and interest:*
The interviewee is a specialist in bioclimatic architecture and natural thermal conditioning. He first became interested in geothermal energy eight years ago, in addition to working with Guillermo Popelka.

2.3. *The Uruguayan House:*
This project was undertaken to create an energy-sustainable house. It was financed with bid funds and the university's own funds. From this, sustainable houses are sold at a cost of $60,000.
The first house built has a split air system, which could have an exchange with a geothermal pump to determine the potential of such a system.

2.4. *Geothermal potential in Uruguay:*
In his opinion, the temperature of the subsoil is ideal for the development of shallow geothermal energy, not only in Uruguay but in the whole of Latin America. Geothermal energy should be used in conjunction with energy-efficient building envelopes and infrastructure and this is why he suggests a change of envelopes first.

2.5. *Experience and relationship with the ORT University:*
Renewable energy courses have been taught since 2018, covering the topics of solar, thermal, wind and geothermal energy. The courses take care to explain the operation of geothermal heat pumps. In other words, there already exists a generation of ORT architects that have heard of this technology. What is more, in 2021 there will be a cohort of climate architects specializing in the design of buildings with complex natural and/or geothermal thermal conditioning.

2.6. *Opportunities for projects:*
Eliseo has a "pond loop" project but with no heat pump. He is also planning for the Uruguayan House to have an air handler, with which it would be possible to experiment with geothermal energy.
He is also working as a consultant at a hotel in Minas (in the departamento of Lavalleja), which is wood heated and has proposed a closed-loop coil system for heating, with an electrical transmittance of 0.35 and which could be used for a case study. The water surface is 60 metres from the building and has a surface area of 300 m^2.
The interviewee advised us to contact "Alternativas sustentables" and Pablo Vieytes of "Pressura", as they have worked with heat pumps.

2.7. *Barriers:*
The main barrier is the lack of public awareness; the public is not in the habit of investing in costly but efficient systems. That is why the second barrier is the cost and the construction sector, which would have to adapt to new architectural designs to include low-temperature geothermal energy.

3. Agreements

3.1. Eliseo agreed to provide the information needed for correct preparation of the roadmap and successful conduct of the technical assistance. In addition to continuing to disseminate the technology in the university.

4. Present

No.	Name	Institution
1	Andrés Eliseo Cabrera	ORT University
2	Lucía Samaniego	DEUMAN
3	Diego Aravena	DEUMAN
4	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 026

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 49 – Faculty of Engineering (Institute of Physics) – UdelaR
1.2. Place: Video conference
1.3. Date: 11 / 06 / 2020
1.4. Time: 16:00 PE – 17:00 CL – 18:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introduction of interviewee (guest) and explanation of low-temperature geothermal energy and its possible application in Uruguay by specialist members of the technical team.

2.2. *Experience in low-temperature geothermal energy:*
Works on the use of solar thermal energy, for which reason it could include shallow geothermal energy as a use of solar energy in the first depths of the subsoil.
They are working in UdelaR on experiments with Pedro Galione and also with the Faculty of Engineering on shallow geothermal energy for the supply of domestic hot water.
There is also a thesis that analyses whether geothermal heat pumps are more efficient than solar energy, the results of which indicated that they are indeed slightly more efficient.

2.3. *Domestic hot water:*
There is currently no penalty for heating water with electricity, as is the case in Argentina, because nearly all Uruguayan electricity is from renewables. In addition, electric water heaters are inefficient, with COPs of 1, and the alternatives to them are not economically viable. For example, if the payback time is 2 to 3 years, families will not pay, as happens with solar equipment. Heat pumps for domestic hot water, on the other hand, are competitive at $1200.
They warned us that if these shallow geothermal energy projects are not well designed, they will not be successful.

2.4. *Opportunities and barriers in academia:*
While the university is keen to use research to help overcome the legal barriers that currently exist, there is little research and what there is, is relatively recent (less than 10 years) which takes time since it is an additional activity for university teachers.
The research that they wanted to take forward included one project in Salto City, the Salto Grande hydroelectric dam, for which they could not secure funding and which could not be concluded. If, therefore, the state wishes to promote low-temperature geothermal energy, it needs to go hand in hand with academia.

2.5. *Competition to geothermal heat pumps:*
The main competitor to low-temperature geothermal energy is woodburning, since this is how most homes are heated. As it is quite windy in Uruguay and nearly everyone lives near the coast, there are no atmospheric-pollution problems.
There is also air conditioning, which is easy to operate and easy to move from one home to another, since the public requires quick solutions as not everyone owns their own home.

2.6. *Cultural and commercial barrier:*
There is no market for centralized heat pumps, only for split systems, and there are very few homes with a boiler fired by gas or another fuel.

3. Agreements

3.1. Italo Bove agreed to provide the information needed for correct preparation of the roadmap and successful conduct of the technical assistance.

4. Present

No.	Name	Institution
1	Italo Bove	Faculty of Engineering, UdelaR
2	Jaime Parada	DEUMAN
3	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 027

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 36 –Obras Sanitarias del Estado (OSE, State Water Utilities Company)
1.2. Place: Video conference
1.3. Date: 12 / 06 / 2020
1.4. Time: 12:30 PE – 13:30 CL – 14:30 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy and its possible application in Uruguay by specialist members of the technical team.

2.2. *Current situation of Obras Sanitarias del Estado:*
OSE is responsible for the supply of drinking water in Uruguay and for sanitation in all departamentos except Montevideo. The Groundwater Division works with the hydrogeology section, which is staffed by geologists (4 for research and 2 on infrastructure inspections and maintenance). He also mentioned that the main problem is one of quantity (a lack of water in some places) and quality, which is why they treat water by mixing to change what is distributed.

2.3. *Drilling equipment:*
They are responsible for performing drilling and have their own drilling equipment: 3 No. 6" drills capable of reaching 300 m; 1 medium and 1 small, used for cleaning or for shallower wells. They use tendering to cover demand for other drilling works.
They told us that within OSE the cost of drilling depends on the type of rock, whether it is hard or porous, costing between $150 and $200 per metre drilled, respectively. Both types of drilling use drilling mud and filter and comply with the law on drilling boreholes. When projects are put out to tender, prices vary widely and are even higher in porous rock.

2.4. *Existing wells:* They classify wells into two groups: active and inactive. There are approximately 850 active wells, which supply all parts of the country with water. Some are multiple to cover demand and others have just one borehole to supply a single house or a rural school with a flow rate of 500 L/h or 150 L/h. These are very shallow wells, 20 to 30 metres in depth at most.
There are also around 1500 wells that are inactive for one reason or another, distributed as follows:
- Poor-quality wells that they hold in reserve for future treatment by, for example, reverse osmosis.
- Wells of very poor quality that are sealed, due to there being no possibility of their being treated, or because they have poor flow rates.
- Wells in 5-m^2 plots that they stop using every 5 years in order to sell them.

It should be noted that once a well has had its flow rate and quality assessed, it is passed to the regional authorities, which are responsible for installing the pumps needed for their use.

2.5. *Quality of wells:* We were told that they used to have a probe for profiling wells that measured conductivity and temperature. They also have the variations for wells of more than 100 or 150 m, which were recorded in some cases. Now, however, these probes are broken and out of use. They also mentioned that they recently gave Salto information with laboratory data.

2.6. *Observations on reinjection:*
OSE has no experience of reinjection, because there is no shortage of water. Their only experience was with very shallow wells in the 1990s to remove iron and manganese, with a 30-m test that captured water from a deep well and let it seep into a 15-m deep pool to be aerated. There is information on this and it can be requested.
The interviewee proposed studying reinjection and carrying out the respective environmental assessment.

3. Agreements

3.1. OSE agreed to review its temperature information and provide us with information on its inventories of wells drilled, which DEUMAN can access via the public management system, in addition to the reinjection study mentioned.

4. Present

No.	Name	Institution
1	Andrés Pérez	Groundwater Division
2	Cristhian Abanto	DEUMAN
3	Lucia Samaniego	DEUMAN
4	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 029

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 64 – Alternativas Sustentables

1.2. Place: Video conference

1.3. Date: 06 / 07 / 2020

1.4. Time: 12:45 PE – 13:45 CL – 14:45 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy, the experience of CEGA and possible potential in Uruguay by specialist members of the technical team.

2.2. *Experience of low-temperature geothermal energy:*

It partnered with a drilling company to present three low-temperature geothermal energy proposals; it also has specialists in heat pumps. The last time that it deployed this technology for a residential setting was four years ago, for a German client. Currently, the difficulty is the high investment cost.

2.3. *Opportunities for developing low-temperature geothermal energy:*

Alternativas sustentables is associated with two banks for loans, saying that this is a competitive advantage for initiating shallow geothermal energy projects, because they would be interested in promoting this technology.

3. Agreements

3.1. Ricardo will consult their clients to see if they have any projects that might fit with the use of low-temperature geothermal energy.

3.2. DEUMAN agreed to send the projects teaser for completion with the data requested.

3.3. Ricardo will also provide the information needed for correct preparation of the roadmap and successful conduct of the technical assistance.

4. Present

No.	Name	Institution
1	Ricardo Wasersztein	Alternativas sustentables
2	Joshua Carvacho	DEUMAN
3	Diego Aravena	CEGA // DEUMAN
4	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 030

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 65 – Pressura
1.2. Place: Video conference
1.3. Date: 07 / 07 / 2020
1.4. Time: 13:15 PE – 14:15 CL – 15:15 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introduction of interviewee (guest) and explanation of low-temperature geothermal energy, the experience of CEGA and possible potential in Uruguay by specialist members of the technical team.

2.2. *Experience and interest:*

Pressura was been working mainly with water-pump firms for 18 years. It also imports air-source and geothermal heat pumps and energy-efficiency solutions.
For both of the heat-pump types mentioned, they work with a European pump from Sweden and another produced in China (for smaller-scale projects).

2.3. *Experience of geothermal heat pumps:*

They said that the installation cost of geothermal energy has to be evaluated because it is high, but the technology is more viable in new builds.
It estimates the payback time at around 12 years. It should also be borne in mind that there are sometimes investment capital and funds. Nevertheless, this is not very developed in Uruguay, unlike air-source, which remains the best technology.
They told us that they have a partner who has conducted pilot projects.

2.4. *Opportunities:*

The Uruguayan electricity mix is almost entirely renewable, which makes electricity more efficient. They see opportunities in new lines of infrastructure for hotels and homes, agriculture, and anything that is more efficient when it comes to heating.

3. Agreements

3.1. DEUMAN agreed to send information on reference low-temperature geothermal energy projects.
3.2. Pablo Vieytes agreed to provide the information needed for correct preparation of the roadmap and successful conduct of the technical assistance.

4. Present

No.	Name	Institution
1	Pablo Vieytes	Pressura
2	Jaime Parada	DEUMAN
3	Joshua Carvacho	DEUMAN
4	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 035

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 24 – Government of Montevideo
1.2. Place: Video conference
1.3. Date: 17 / 07 / 2020
1.4. Time: 08:00 PE – 09:00 CL – 10:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy, the experience of CEGA and possible potential in Uruguay by specialist members of the technical team.

2.2. The interviewees are: Marianela Elizalde, coordinator of the energy-efficiency programme, and Pablo Escalante, director of all the city's pumping plant.

2.3. *Government of Montevideo Energy Committee:*
There is an energy committee, formed several years ago, which linked with the MIEM through an agreement to define national energy policy; the Uruguayan State concluded that the regional governments are partners with all these.
The energy committee was changed to energy efficiency and won the Energy-efficiency prize for a project in Solis with a contract with an ESCO to secure the efficiency of the building in question.

2.4. *Energy-efficiency Plan*
Energy efficiency consists of insulating homes and labelling; labelling is new and has only been applied to lighting so far. They are responsible for buildings (300 in total), such as health centres and cultural centres, that are owned by the regional government for public use.

2.5. *Other programmes undertaken:*
There is a climate-change programme, in which incomes goes to priority issues.
The Montevideo Energy Plan, on which they worked with UdelaR.
Buildings sustainability manual, for buildings to be more sustainable. There is one for residential buildings and there is about to be one for services buildings.
They have also worked on own-funding projects or with some form of repayment.

2.6. *Barriers to energy-efficiency projects:*
One of these are the regulatory barriers; the public sector does not have the benefits that are lower for the private sector if it has them (the rates are available on the MIEM website).
They also told us that the regional government is composed of nine departments, each with a policy director, through whom project proposals must be passed for execution. This can make things difficult when it is not given the due importance.
For example, there was a desire to install a photovoltaic plant for water sanitation, but its payback time is 15 years, making it not economically attractive. It was the same with the creation of a wind farm to supply the regional government, but it did not go ahead.
They are currently working with ESCOs that are helping to support the importance of projects and secure the authorities' approval.

2.7. *SUAMBI Programme*
SUAMBI is a manual issued by decree of the departamento of Montevideo which, on the basis of land-use planning, determines and incentivizes the construction of new buildings, creating tax benefits. One of these is an extension of benefits for three further years if the building is sustainable. The manual defines the criteria by which the Committee assesses constructions.

3. Agreements

3.1. Marianela agreed to provide us with information on buildings' levels and consumption, and for the regional government's two plant nurseries and casino. And also the SUAMBI and Energy-Efficiency Plan manuals.

4. Present

No.	Name	Institution
1	Marianela Elizalde	Government of Montevideo
2	Pablo Escalante	Government of Montevideo
3	Cristhian Abanto	DEUMAN
4	Mauricio Muñoz	DEUMAN
5	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 039

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 16 – Energy Efficiency Committee of the Congress of Regional Governors
1.2. Place: Video conference
1.3. Date: 03 / 08 / 2020
1.4. Time: 08:00 PE – 09:00 CL – 10:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy, the experience of CEGA and possible potential in Uruguay by specialist members of the technical team.

2.2. *Congress of Regional Governors:*

This congress is composed of the 19 departamentos of Uruguay and deals with harmonizing legislation where they all have the same legal framework in terms of energy efficiency and land use, such as definitions of land types and building regulations among others. Additionally, all regional governments have the autonomy to set their own internal building policies.

Each regional government has its own land-use plan. In Montevideo, for example, there is a construction office, but if it is a large-scale construction, it is subject to environmental, transit and social analyses by the planning office. There is also a department that regulates how building must be done: the line, height land-occupation factor and other necessary parameters.

2.3. *Opportunities in residential heating:*

- Montevideo has assessments on pollution associated with woodburning.
- Committee working on a general regulation for thermal envelopes.
- MEVIR builds rural homes. It is a publicly-owned organization, groups of 30 to 40 homes. In recent years they have been incorporating energy-efficiency measures such as water heaters.
- Energy-Efficiency Certificates: money is given to the owner according to the savings verified over a period.
- Montevideo spends 40% on efficiency. It has been working on the plan since 2005 and has had thermal efficiency regulation since 2009.
- Inter-Social Housing Law 18,795: private law under which the investor make an investment and the state provides tax benefits in payment. This law has an equation covering the mechanics of payment, and it is applicable to buildings, individual homes and promoted homes.

3. Agreements

3.1. The Energy Efficiency Committee of the Congress of Regional Governors undertook to remain in communication for the development of the technical assistance.

4. Present

No.	Name	Institution
1	Alicia Mimbacas	Congress of Regional Governors
2	Marcia Croci	Congress of Regional Governors
3	Marianela Elizalde	Congress of Regional Governors
4	Nancy Rodríguez	Congress of Regional Governors
5	Isabel Erro	Congress of Regional Governors
6	Cristhian Abanto	DEUMAN
7	Joshua Carvacho	DEUMAN
8	Diego Aravena	DEUMAN
9	Mauricio Muñoz	DEUMAN
10	Itala Ferrer	DEUMAN

Minutes of Meeting: No. 040

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 16 – Government of Canelones
1.2. Place: Video conference
1.3. Date: 07 / 08 / 2020
1.4. Time: 13:00 PE – 14:00 CL – 15:00 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy, the experience of CEGA and possible potential in Uruguay by specialist members of the technical team.

2.2. The interview was with Nora Pazos, of the Department of Climate Change; Silvana Cabrera from the Territorial Planning Department; and Alejandro Tarigo, from the Environmental Management Department.

2.3. *Territorial Planning and renewable energy:*

The Government of Canelones has land-use planning covering the entire departamento and complete land zoning whereby every type of land has an assessment.

They told us that discounts on the amounts payable are available to industries or companies that use renewable energy and energy efficiency for logistics, administration or industrial processes.

They also told us that they are promoting energy-efficiency projects, such as a smart development programme in the transportation sector.

2.4. *Pilot tourism ventures:*

They are currently planning to implement a tourism venture pilot in the hotel sector with renewable energy. This could be an opportunity for the development of low-temperature geothermal energy for heating and thermal conditioning systems and for domestic hot water.

2.5. *Opportunities:*

The regional government is open to the possibility of implementing systems, using recognition, benefits or other incentives, to encourage industry to incorporate low-temperature geothermal energy into its production systems or facilities.

The regional government is a member of the Congress of Regional Governors, an organization for all the regional governments with the goal of unifying regulations without any regional government losing its independence. For this reason, they suggested that we meet with the Congress in order to establish better communications between all the departamentos.

3. Agreements

3.1. The interviewees are willing to meet with us again soon to discuss development of the technical assistance and to encourage its use within the regional government.

4. Present

No.	Name	Institution
1	Nora Pazos Obregón	Government of Canelones
2	Alejandro Tarigo	Government of Canelones
3	Maria Silvana Cabrera	Government of Canelones
4	Cristhian Abanto	DEUMAN
5	Mauricio Muñoz	DEUMAN
6	Lucia Samaniego	DEUMAN

Minutes of Meeting: No. 042

Consultation: Development of a national roadmap for the use of low-temperature geothermal energy

1. Event details

1.1. Event: First interview and meeting with STKH 09 – National Environment Directorate (DINAMA) of the Ministry of Environment
1.2. Place: Video conference
1.3. Date: 24 / 08 / 2020
1.4. Time: 09:30 PE – 10:30 CL – 11:30 UY

2. Items discussed

2.1. Explanation of the technical assistance, introductions of consultants, introductions of interviewees (guests) and explanation of low-temperature geothermal energy, the experience of CEGA and possible potential in Uruguay by specialist members of the technical team.

2.2. *Views on closed- and open-loop systems:*

The National Environment Directorate prefers low-temperature geothermal energy installations to use closed-loop systems since these, unlike open-loop systems cause no perturbance to groundwater or aquifers.
It is important to DINAMA that there be no alteration to the physical or chemical characteristics of this water, for its conservation.
If use of open-loop systems is required, there must be environmental evaluations of the particular case and of corresponding legislation to restrict actions by, for example, establishing quality parameters for groundwater.

2.3. *Environmental Impact Assessments:*

EIAs are required for open-loop systems and any building work. For example, if one wishes to make use of thermal spring water, the corresponding permits must be applied for.
The assessment is carried out by the applicant and DINAMA assesses the project and approves it or not.

2.4. *Comparison of the benefits of open- and closed-loop systems:*

The stakeholder raised the issue of, were there to be no restrictions of any kind on open-loop systems and reinjection, which system would be the more expensive, open or closed? They then clarified that that would depend on the size of the project. For individual homes, for example an open-loop system would not make sense because little capacity is needed, but such a system would be sensible for a greenhouse because of the greater energy efficiency.

3. Agreements

3.1. Martín Etcheverry is willing to meet us to discuss the progress of the technical assistance and to issue comments from his area.

4. Present

No.	Name	Institution
1	Martin Etcheverry	National Environment Directorate
2	Cristhian Abanto	DEUMAN
3	Joshua Carvacho	DEUMAN
4	Mauricio Muñoz	DEUMAN
5	Itala Ferrer	DEUMAN