Technical Cooperation Document

I. Basic Information for the TC

▪ Country/Region:	CHILE
▪ TC Name:	Soluciones para la Descontaminación y Descarbonización en Chile: Aplicaciones de Energía Geotérmica
▪ TC Number:	CH-T1230
▪ Team Leader/Members:	Walter, Martin (INE/CCH) Líder del Equipo; Gischler Blanco, Christiaan (INE/INE) Jefe Alterno del Equipo de Proyecto; Alatorre Frenk, Claudio (CSD/CCS); Bonifaz Urquizu, Jeanette (INE/ENE); Brusa, Federico (CSD/CCS); Cabrera Botero, Maria Margarita (CSD/CCS); Garcia Fernandez, Javier (INE/INE); Marzolf, Natacha (INE/ENE); Mendoza Benavente,Horacio (LEG/SGO); Robles Alzamora, Paola A. (CSC/CCH); Siroit, Gaston (INE/INE); Valdes Florenzano, Claudia Andrea (INO/IEN)
▪ Taxonomy	Apoyo al Cliente
▪ If Operational Support TC, give number and name of Operation Supported by the TC:	n/a
▪ Date of TC Abstract authorization:	18 Dic 2019.
▪ Beneficiary	Republic of Chile
▪ Executing Agency	Inter-American Development Bank
▪ Donors providing funding:	Fondo Fiduciario de Múltiples Donantes NDC Acelera(ACL); Programa Estratégico para el Desarrollo de Infraestructura(INF)
▪ IDB Funding Requested:	NDC Pipeline Accelerator Multidonor Trust Fund (ACL): US$200,000.00 OC Strategic Development Program for Infrastructure (INF): US$200,000.00 Total: US$400,000.00
▪ Local counterpart funding, if any:	US$0
▪ Disbursement period	24 months (includes execution period)
▪ Required start date:	May 2020
▪ Types of consultants	Firms and Individual Consultants
▪ Prepared by Unit:	INE-Infrastructure and Energy Sector
▪ Unit of Disbursement Responsibility:	CSC/CCH-Representación Chile
▪ TC Included in Country Strategy (y/n):	Yes
▪ TC included in CPD (y/n):	Yes
▪ Alignment to the Update to the Institutional Strategy 2010-2020:	Capacidad institucional y estado de derecho; Sostenibilidad ambiental

II. Objectives and Justification of the TC

2.1. The objective of this Technical Cooperation (TC) is to contribute to decontamination and decarbonization efforts in Chile with a focus on potential geothermal energy applications for direct geothermal heating/cooling uses. The project will assess opportunities for the development of low temperature (enthalpy) geothermal projects as an alternative for fossil fuel and biomass heating systems, to both reduce CO_2 emissions, curb air pollution, improve public health in Chilean cities and limit dependence from fossil fuels and impact to their price volatility. Particularly, this TC

will finance: (i) activities related to data gathering, project analysis, technical support for risk mitigation, (ii) the development of pre-feasibility studies and innovative market business models for mainstreaming low enthalpy geothermal energy, and (iii) the design and exploration planning strategy for one district heating/cooling project.

2.2. The Government of Chile (GoCh) actively promotes the development of Non-Conventional Renewable Energy (NCRE) to reduce energy costs and to ensure a more diversified, cleaner and safer energy matrix. The GoCh has prioritized the implementation renewable energy-based District Heating (DH) systems in its national Energy Roadmap 2018-2022 to support the diversification of the national energy matrix and improve energy efficiency. In line with this strategic roadmap, the Ministry of Energy (MINENERGIA) has undertaken several initiatives aimed at exploring opportunities and business models for the deployment of DH solutions with renewable energy, including geothermal resource.

2.3. The deployment of DH with non-conventional renewable energy (NCRE) can bring significant energy and environmental benefits to Chile. The use of firewood and fossil fuels for heating accounts for more than 50% of the national energy matrix and 62% of residential heating[1]. This final use of energy, in addition to entrenching dependence from imported fossil fuels and contributing to high CO2 emissions from the residential sector, is the main source of fine particulate matter, coarse and black carbon pollution, which are the main culprits for low air quality in cities such as Santiago, Rancagua, Talca, Curicó, Chillán, Los Angeles, Temuco, Valdivia, Osorno and Coyhaique [2]. The use of firewood for heating is also a key driver of deforestation of native forests in the Central-South area.

2.4. Chile's Intended Nationally Determined Contribution (INDC) to mitigation is a quantified reduction of the intensity indicator of greenhouse gas (GHG) emissions by 2030. Chile is committed to reduce its CO2 emissions per GDP unit by 25% below their 2016 levels by 2030, considering a future economic growth which allows to implement adequate measures to reach this commitment[3]. Chile hopes to reduce its GHG emissions while decreasing poverty and inequality as well as continue advancing toward sustainable, competitive, inclusive and low-carbon development. To this end, it has introduced incentives to NCRE. Pursuant to Law 20.698, 20% of the energy by 2025 under supply contracts subject to said law will be generated from NCRE. It is a step forward to promote the use of geothermal energy (NCRE in a fix basis) for both electricity generation (high enthalpy) and district heating/cooling (low enthalpy). Additional measures are being implemented to abate GHG emissions and to reduce or prevent forest degradation (e.g. replacing the use of firewood for heating, through a National Policy Framework implemented in 2015).

2.5. Chile has a potential for geothermal energy development estimated between 1,3 GW and 3.8 GW[4]. It is the third country with the highest potential for geothermal energy

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1 http://achbiom.cl/wp-content/uploads/2017/08/polc3adtica-lec3b1a-2016.pdf

2 https://mma.gob.cl/wp-content/uploads/2018/08/Guia-para-Docentes-Sobre-Calidad-del-Aire-003.pdf

3 https://mma.gob.cl/wp-content/uploads/2020/04/NDC_Chile_2020_espan%CC%83ol-1.pdf

4 Final Report from the Chile's Geothermal Worskhop (Mesa Geotérmica)

development in Latin America and the Caribbean (LAC), after Mexico and Costa Rica[5]. District heating/cooling with geothermal resources can contribute to the GoCH efforts to comply with carbon emission commitments by promoting NREC. It is prioritizing the identification of innovative business models with public and private sector initiative that contribute to its overarching policy objectives.

2.6. This TC is aligned with the Second Update to the Institutional Strategy 2020-2023 (AB-3190-2) and is strategically aligned with the development challenge of productivity and innovation, by studying and promoting the implementation of innovative technologies that, amongst other benefits, will improve quality and efficiency of energy provision and therefore positively impact on the country's productivity. The TC is also consistent with the Energy Sector Framework Document (GN-2830-8) as promotion of RE is one of the principles in the energy sector and promoting initiatives to reduce carbon emissions. This operation will contribute to the Corporate Results Framework (CRF) GN-2727-12 by (i) reducing carbon emissions; and (ii) promoting power generation from RE sources. The TC is also aligned with the cross-cutting issues of climate change and environmental sustainability and with the Climate Change Sector Framework (GN-2835-8), by promoting the implementation of geothermal energy sources for district heating/cooling that will displace the use of firewood and fossil fuels, and hence, the reduction of greenhouse gas emissions.

2.7. The TC is also consistent with the Bank's Country Strategy for Chile 2019-2022 (GN-2946) which aims to improve quality of life for a growing middle class and population groups that remain vulnerable, and it is aligned with two of its pillars: (i) stronger investment and enhanced productivity by reducing costs for business and households via new applications for low enthalpy geothermal energy; and (ii) promoting resilience to climate events through improved quality of life for the population via reduction of inhouse decontamination by replacement of firewood and fuels.

2.8. This TC fulfills the eligibility criteria established in the Proposal for the Establishment of the NDC Pipeline Accelerator Multi-Donor Trust Fund document (GN-2890). This TC contributes to decontamination and decarbonization efforts in Chile, it's directly linked to the country's NDC programming, target mobilization of private and/or public capital and make a tangible and measurable contribution to climate change objectives. It is aligned with the results framework of the Strategic Infrastructure Development Program (INF, GN-2819-1) for it supports improvements in public policy design and dissemination of lessons learned in the energy sector, critical for Chile´s socioeconomic development.

III. Description of activities/components

3.1. **Component 1. Data gathering and technical studies (US$125,000.00).** To ensure adequate availability of critical sector information, this component will finance activities related to data gathering aimed at identifying available knowledge, international best practices and technologies, and opportunity areas for geothermal projects in Chile. To this overarching end, the project will support:

[5] https://repositorio.cepal.org/bitstream/handle/11362/40079/1/S1600390_es.pdf

3.2. **Activity 1.1 Technology Benchmark.** Technical costed review and benchmark of available solutions for low enthalpy geothermal introduction, including a detailed analysis of international best practices, and advantages and limitations for introduction of geothermal applications in specific prospective areas in Chile.

3.3. **Activity 1.2. Low enthalpy pre-projects**. This activity will deliver a report on the status of all existing or new low temperature geothermal projects (under prospect, study, development, or construction), including specific review of the following aspects: (i) energy balance, (ii) risk mitigation guidelines for environmental impacts, (iii) best suitable technology (iv) global cost assessment, (v) Financial data, (vi) fix costs, (vii) O&M costs, (viii) revenue streams and (ix) planning.

3.4. **Activity 1.3. Dissemination and Socialization.** This activity will finance workshops, round tables, publications, webinars, videos of successful projects to increase comprehension of the stakeholders such as energy regulators, environmental authorities, local governments, neighboring communities or industries about a low enthalpy geothermal energy potential and benefits.

3.5. **Component 2. Development of pre-feasibility studies, legal framework and innovative market business models (US$200,000.00).** To facilitate the adoption of geothermal based heat solutions at the district level, this component will finance the study of the legal framework, cost analysis, industry price gap and two pre-feasibility studies for the installation of a district heating/cooling using geothermal resources, through:

3.6. **Activity 2.1. Business models and legal framework.** Assessment of existing business models and legal framework to promote public-private investments to finance geothermal applications at the district level. Understanding and Identification of most suited approaches to Chile in specific districts, taking into consideration district heating/cooling requirements for its mainstreaming in social infrastructure and industrial applications.

3.7. **Activity 2.2. Social Infrastructure.** Development of a pre-feasibility study for a selected project focusing on a public infrastructure building (i.e. Housing, hospital, school, library, city hall) or municipal use (to address snow and freezing issues in colder climates, or cooling requirements). This pre-feasibility study will take into consideration the specific location and specificity of the project, the technology chosen and the most cost-effective business model.

3.8. **Activity 2.3. Industry Application.** Development of a pre-feasibility study for an industrial application (e.g. tourism, agroindustry, manufacture, etc.) of low temperature geothermal energy aimed at reducing socioenvironmental impact and optimizing economic sustainability conditions. This pre-feasibility study will take into consideration the specific location and specificity of the project, the technology chosen and selected business model.

3.9. **Component 3. Design an exploration strategy for district heating/cooling projects (US$75,000.00).** This component will finance the design of an exploration strategy to support the implementation of the most promising district heating/cooling projects identified in Component 1 using geothermal and/or other kind of energy-technology source.

3.10. **Activity 3.1. Heat Purchase Agreement (HPA).** The expected result will be a solid, robust and innovative Heat Purchase Agreement (PHA), adaptable to different private or public sponsorship, socioenvironmental conditions, technological opportunities, and

stakeholder arrangements. The HPA shall include a robust legal framework revision that will at least consider but will not be limited to local and national water and geothermal regulations.

3.11. **Activity 3.2. Environmental and Social Preliminary Studies.** This activity will finance the development of environmental and social preliminary studies for the prioritized project according to the local and national legal framework, and all required documents in order to ensure the corresponding environment authorities' approval. The set of documents delivered shall cover complementary exploration works, drilling (if required), development works, construction and operation of the project.

3.12. **Activity 3.3 Technical Contract & Call for tenders (CFT).** This activity will support the preparation of all required documents (i.e. planning, basic engineering, cost estimation) to launch a Call for Tender to select an Engineering Procurement and Construction (EPC) Contractor that will deliver a turnkey contract for a public development project or all tendering documents for a private concession development.

Indicative Budget

Activity/Component/Description	Total Funding	INF	ACL
Component I. Data gathering and its analysis for legal, environmental and technical studies	US$125,000.00	US$125,000.00	US$0.00
Component II. Development of pre-feasibility studies and innovative market business model	US$200,000.00	US$0.00	US$200,000.00
Component III. Design and exploration planning strategy for district heating/cooling	US$75,000.00	US$75,000.00	US$0.00
TOTAL	**US$400,000.00**	US$200,000.00	US$200,000.00

IV. Executing agency and execution structure

4.1. This TC will be executed by the IDB, through the Mining, Geothermal, and Hydrocarbons Cluster within Infrastructure and Energy Sector (INE/INE). Project Monitoring will be carried by means of reporting and periodical technical meetings with relevant counterparts. The Bank will prepare progress reports annually, which will contain at least: the status of the financial progress, the progress and results achieved, report on the activities carried out, lessons learned, and best practices identified, any other information to meet the requirements agreed with ACL. The Bank will execute the project, at the request of the beneficiary, for its technical expertise and knowledge of the challenges associated with geothermal development in the LAC region.

4.2. The execution will be carried out in accordance with the IDB's Operational Guidelines for Technical Cooperation Products – Revised version (GN-2629-1) and its Appendix 10 as a Client Support. The beneficiary's request for the IDB to execute this TC is enclosed (see Annex I). The activities to be executed are included in the Procurement Plan (see Annex IV) and will be contracted in accordance with Bank policies as follows: (a) Hiring of individual consultants, as established in AM-650; (b) Contracting of consulting firms for services of an intellectual nature for Bank-Executed Operational Work as established in policy GN-2765-4 and its associated operational guidelines

OP-1155-4; and (c) Contracting of logistics services and other services other than consultancy, according to the policy GN-2303-28.

V. Major issues

5.1. In view of the high technical level of the proposed TC, the major risk is the implementation management to ensure high quality results. This risk is mitigated by having the TC be executed by the Bank who will provide ongoing monitoring activities and overall evaluation of the program. Peer reviewers to analyze the products produced may also be considered.

5.2. Low enthalpy heating/cooling projects are immersed in a complex social, technical and economical context, mainly due to the lack of information and answers at different levels (communities, financial entities, regulator). Activities presented in this TC, aim to mitigate this lack of knowledge and expertise by allowing the dissemination of Chile's geothermal potential, boosting projects with the minimum requirements and financing innovative and concrete adapted solutions to streamline the completion of a low enthalpy geothermal project in Chile.

VI. Exceptions to Bank policy

6.1. No exceptions to Bank policy are envisioned.

VII. Environmental and Social Strategy

7.1. There are no envisioned environmental or social risk associated with this TC. No potential negative environmental or social impacts were identified and therefore no mitigation strategy is needed and therefore this TC has been classified Category "C" according to the Safeguard Policy Report and Safeguard Screening Form.

Required Annexes:

Solicitud del Cliente_44466.pdf

Matriz de Resultados_24114.pdf

Términos de Referencia_61552.pdf

Plan de Adquisiciones_98982.pdf