

Final Report:

First protected area 100% energy self-sustaining in Chile
Reserva Nacional Coyhaique 100% energéticamente autosustentable



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1. Summary

This project implemented the first protected area in Chile that is 100% energy self-sufficient. The City of Coyhaique, which is the most air-polluted city in South America, faces the urgent need to find alternatives for the polluting, wood-burning stoves in badly or non-insulated houses. The idea for the project originated from discussions with public and private actors, who have a stake in the management of the National Reserve Coyhaique (RNC, Patagonia, Chile). It is in line with the current emphasis of national policies using the booming eco and park-tourism in Chile to develop new forms of park governance that give priority to sustainable tourism and also link it to energy efficiency and the spread of renewable energies. The project is the result of a reconnaissance trip in March 2017 that was coordinated by the former Ambassador of Switzerland Edgar Dörig, Prof. Stephan Rist (Centre for Development and Environment (CDE) and UNESCO Chair on Natural and Cultural Heritage for Sustainable Mountain Development at the University of Bern), Roger Walther (former manager of EBP-Chile) and some other Swiss experts. The Universidad de la Frontera (UFRO) in Temuco became a partner too, contributing with additional expertise in energy efficient buildings, sustainable building materials and sustainable tourism.

The main goals of the project were to: 1) establish a governance board with local stakeholders to guide the other objectives of the project related to; 2) improve energy-efficiency of infrastructure within the park area through energy savings and sustainable infrastructure; 3) establish a program for environmental education with local schools; 4) support the development of sustainable mobility between the park area and the city of Coyhaique; 5) create a homepage for the project to disseminate the experiences; 6) prepare a marketing and communication plan for the project.

These goals resulted in the following achievements: 1) The creation of the Asociación de Amigos de la Reserva Coyhaique, which is very successful in organizing hikes, talks, and concerts, including events for people with special needs. These motivate the local population to benefit from the informational, ecologic, socio-cultural and infrastructural opportunities the project helped providing. 2) The retrofitting of the old Biblioteca with insulation material and energy-efficient windows, which is now used as an exhibition and meeting centre, and a new, energy-efficient building, the “casa muestra”, which is used to showcase interested visitors how they can build energy-efficient houses. 3) A program with the Colegio Baquedano in Coyhaique to take the school children out of the classroom and teach them different subjects from biodiversity to air pollution and energy-efficiency. 4) The elaboration of a plan together with the City of Coyhaique to purchase electric buses, which can be used by schools and by the local population. 5) A vibrant homepage and WhatsApp group for the Asociación de Amigos to inform interested people about their work in and for the park. 6) Marketing and communication of the projects achievements through the collaboration with schools, local tourist guides, local public organizations, and local and national tourism operators.

The goals allowed for establishing a unique model of sustainable park governance that highlights how the inclusion of energy can be linked to sustainable tourism. The implementation of the project was based on the mobilization of human, financial and material resources linked to the management of the RNC and a close collaboration between all involved partners and actors. The project would not have been possible without the great support of various local to national actors in Chile. The local effort was supported by the transfer of scientific, technical and business related expertise from Swiss Universities, park managers (UNESCO world heritage site Swiss Alps Jungfrau-Aletsch (SAJA), the World Nature Forum in Naters (VS) and EBP Switzerland.

Through the project, it was possible to establish key activities that will also go on in the future. These include the new infrastructure, which serves as a role model for other protected areas in the region; the concept for electric mobility, which is now being used by the municipality to apply for funding for purchasing buses; and last but not least, the Asociación with its active participants who carry out different projects.

2. Resumen en español

Este proyecto implementó la primera área protegida en Chile que es 100% autosuficiente en energía. La ciudad de Coyhaique, que es la ciudad más contaminada del aire en Sudamérica, enfrenta la urgente necesidad de encontrar alternativas para la madera contaminante y las estufas de combustión en casas mal aisladas o sin aislamiento. La idea inicial del proyecto se originó a partir de discusiones con actores públicos y privados, quienes mostraron interés en el manejo de los recursos de la Reserva Nacional Coyhaique (RNC, Patagonia, Chile). Este proyecto está en línea con el énfasis actual de las políticas nacionales que utilizan el auge del eco-turismo de parques en Chile para desarrollar nuevas formas de gobierno de parques, las cuales, dan prioridad al turismo sustentable, la eficiencia energética y la expansión de las energías renovables. El proyecto es el resultado de un viaje de reconocimiento en marzo de 2017 que fue coordinado por Edgar Dörig (ex embajador suizo en Chile), el Profesor

Stephan Rist (Centro para el Desarrollo y Medio Ambiente (CDE) y la Cátedra UNESCO sobre Patrimonio Natural y Cultural para Desarrollo de montaña sustentable en la Universidad de Berna), Roger Walther (ex gerente de EBP-Chile) y otros expertos suizos. La Universidad de la Frontera de Temuco también fue un socio en el proyecto también, agregando experiencia adicional en eficiencia energética en la edificación, materiales de edificación sustentables y turismo sustentable.

Los principales objetivos del proyecto fueron: 1) establecer una gestión participativa con los actores locales para guiar los otros objetivos del proyecto; 2) mejorar la eficiencia energética de la infraestructura dentro del área del parque a través del ahorro de energía y la infraestructura sustentable; 3) establecer un programa de educación ambiental con vínculo con escuelas locales; 4) apoyar el desarrollo de movilidad sustentable entre el área del parque y la ciudad de Coyhaique; 5) crear una página de web para el proyecto para difundir las experiencias; 6) Preparar un plan de marketing y comunicación para el proyecto.

Estos objetivos dieron como resultado los siguientes logros: 1) La creación de la Asociación de Amigos de la Reserva Coyhaique, que es muy exitosa en la organización de caminatas, charlas y conciertos al parque para la población local, al tiempo que presta atención a personas con necesidades especiales. 2) La remodelación de la antigua Biblioteca con aislamiento térmico y ventanas de doble vidrio hermético, lo que ha permitido que la biblioteca se utilice como un Centro de Educación Ambiental y reuniones, y un nuevo edificio de eficiencia energética, la casa muestra, que se utiliza para mostrar a los visitantes interesados en técnicas de cómo se puede construir casas energéticamente eficientes. 3) Un piloto de educación ambiental con alumnos de la Escuela Baquedano en Coyhaique para llevar a los niños de la escuela del aula y enseñarles diferentes materias, desde la biodiversidad hasta la contaminación del aire y la eficiencia energética. 4) La elaboración de un plan junto con la ciudad de Coyhaique para, a largo plazo, contar con autobuses eléctricos, que pueden ser utilizados por las escuelas y por la población local. 5) Una página de inicio y un grupo WhatsApp de la Asociación de Amigos para informar a las personas interesadas sobre su trabajo en y para el parque. 6) Marketing y comunicación de los logros de los proyectos a través de la colaboración con escuelas, guías turísticos locales, organizaciones públicas locales y operadores turísticos locales y nacionales.

Los objetivos permitieron establecer un modelo único de gobierno sustentable de parques que resalte cómo la inclusión de la energía puede vincularse con el turismo sustentable. La implementación del proyecto se basó en la movilización de recursos humanos, financieros y materiales vinculados a la gestión de la RNC y en una estrecha colaboración entre todos los socios y actores involucrados. El proyecto no hubiera sido posible sin el gran apoyo de varios actores locales a nacionales en Chile. El esfuerzo local fue apoyado por la transferencia de experiencia científica, técnica y relacionada con los negocios de las universidades suizas, los administradores de parques (sitio de patrimonio mundial de la UNESCO Alpes suizos Jungfrau-Aletsch (SAJA), el Foro Mundial de la Naturaleza en Naters (VS) y EBP Suiza.

A través del proyecto, fue posible establecer algunas actividades claves que también continuarán en el futuro. Estos incluyen la nueva infraestructura, que sirve como un modelo a seguir para otras áreas protegidas en la región; el concepto de movilidad eléctrica, que ahora está siendo presentado por el CONAF y el municipio para solicitar fondos para la compra de autobuses; y por último, pero no menos importante, la Asociación con sus participantes activos que realizan diferentes proyectos.

3. Starting Point

The Chilean government has the objective to increase the ratio of renewable energy to 20% until 2030. The National Plan for Sustainable Development of Tourism also acknowledges this effort and therefore promotes the inclusion of sustainable tourism in protected areas. Until now, there was no specific example how to link sustainable tourism with the national energy strategy. This project made a first step towards filling this gap through establishing the first protected area in Chile that is 100% energy self-sufficient.

The City of Coyhaique in the South of Chile is the most air-polluted city in South America and faces an urgent need to introduce measures for addressing this problem. Furthermore, the city is located in close proximity to the RNC, which is an important protected area for recreation for the local population and well visited by local and national Chilean tourists. The idea of the project resonated well not only with the management of the RNC but also with various local and national actors, who were willing to give their support and carry the project's achievements on beyond the end of the project. The RNC was therefore an ideal place to implement the current project. A reconnaissance trip in March 2017, which was coordinated by Edgar Dörig (former Swiss ambassador in Chile), Prof. Stephan Rist (Centre for Development and Environment (CDE) and UNESCO Chair on Natural and Cultural Heritage for Sustainable Mountain Development at the University of Bern) and Roger Walther (former manager of EBP-Chile), and some other Swiss experts, confirmed this view. These points facilitate a direct dissemination

through information and experience derived from this first 100% energy self-sufficient protected area and indirect dissemination through mass media.

This project idea and its later implementation is part of wider set of REPIC financed projects that are focussing on alternatives for improving the energy efficiency of the Colegio Baquedano and some other public buildings, mainly through technical measures within the city of Coyhaique, carried out by EBP Chile and other local partners.

The strategic alliance between Switzerland and Chile was promising because Switzerland has a solid experience in successfully integrating protected areas, energy, and tourism into regional sustainable development. A well-known example is the UNESCO world heritage “Swiss Alps Jungfrau-Aletsch (SAJA)”, related to the World Nature Forum (WNF). This includes the Goms Energy Region” which is, as a part of the protected area, in the process of becoming 100% energy self-sufficient.

The Centre for Development and Environment (CDE), supported by the UNESCO Chair for Cultural and Natural Heritage and Sustainable Mountain Development of the University of Berne, and the WNF has played a fundamental role in conceptualizing, designing, implementing and monitoring the management plan and monitoring. The main partner of CDE was EBP Chile, which is a company with many years of experience in energy efficiency and solid private, and public partners with whom it collaborates to improve energy efficiency of buildings in three urban municipalities in Chile.

4. Objectives

The project’s overall goal was to transform the RNC into the first Chilean protected area that is 100% self-sufficient in terms of energy. In order to achieve this goal, the project comprised of three main objectives. 1) Improving the existing infrastructure in the park area according to energy-efficient building standards. 2) Creation of ownership among public and private actors in the area who are responsible for investments, policies and environmental education for sustainable development through promoting energy efficiency and the use of renewable energy as well as awareness raising among tourists and the regional population. 3) Establish a replicable model of sustainable park governance that integrates energy self-sufficiency into action plans for sustainable tourism.

To achieve these three objectives, the project planned the following activities:

- 1) A) Improve existing recreation areas with sustainable shelters; B) transform the “library” into an attractive visitor centre with education, history, nature, resting and administrative areas; C) develop a sustainable mobility program between the city and the park.
- 2) A) Development and dissemination of a homepage and APP for informing tourists and the regional population; B) organization of campaigns of environmental education and research in the area; C) communication and marketing of touristic activities.
- 3) A) Establishment of a platform for sustainable governance of the park area, which includes several public and private actors from the area; B) establishment of a network of national reserves within the area.

5. Project Review

5.1 Project Implementation

The approach of the project was based on eight pillars. These include 1) sustainable infrastructure with a new energy-efficient building for demonstration purposes and 2) the retrofitting of an old traditional building as an exhibition centre. 3) Environmental education with a pilot project with a local school and local tourism guides. 4) Sustainable mobility through the elaboration of a project proposal for the purchase of electric buses. 5) Marketing and communication through several channels. 6) A homepage and a visitors’ app. 7) A local governance board to attend the course of project objectives and implementation. 8) Outreach and dissemination. The project team closely collaborated in the different pillars, whereas the lead for the pillars was as shown in Table 1.

Pillars	Organizational lead, collaboration
Sustainable infrastructure (1 and 2)	EBP Chile, UFRO
Environmental education (3)	EBP Chile, CDE, UFRO
Sustainable mobility (4)	EBP Chile
Marketing and communication (5)	EBP Chile, CDE
Local governance board (6)	CDE, Juan Antonio Bijit (president of the Asociación de Amigos de la Reserva Coyhaique)
Homepage and visitors’ app (7)	CDE, Juan Antonio Bijit

Outreach and dissemination (8)	All
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Table 1: Project pillars and organizational lead in each of them.

Main steps in the project included the overall project kick-off meeting in Coyhaique in January 2018, the construction and retrofitting of buildings in the national reserve, the testing of the pilot project in environmental education and the inauguration of the energy-efficient buildings in October 2018, and last but not least the foundation of the Asociación de Amigos de la Reserva Coyhaique in December 2018.

The kick-off meeting in January was used to discuss and start work on the different pillars. Therefore, the project team organized several activities. A first workshop was organized with 26 local stakeholders interested in the local governance board to collect important topics among the population and to discuss possible ways of engagement with them (Annex D). A first workshop was also conducted for the construction of sustainable infrastructure to discuss first designs and the needs of the park authority CONAF together with the municipality and local architects. Furthermore, an initial meeting took place with teachers from the colegio Baquedano, educational employees from CONAF, and the municipality. Initial talks with a local tourism operator took place as well.

After the kick-off meeting, construction work started in a fast pace accompanied by several meetings and close collaboration between EBP Chile, local architects and local stakeholders. In summer 2018, intense discussions started with the teachers of the colegio Baquedano to plan the pilot project in environmental education. In October 2018, we could celebrate the inauguration of the newly constructed demonstration house and the retrofitted now energy-efficient exhibition house, the biblioteca. This inauguration was an important event where not only local stakeholders but also local politicians and decision-makers were present and appreciated the work that had been done. Besides the inauguration, we had a second stakeholder workshop, which was used to concretize the idea of the local governance board. It was decided to establish the Asociación de Amigos de la Reserva Coyhaique and interested people got the opportunity to put down their names for being part of the association. The last important point in October was the implementation of the pilot in environmental education with 2 teachers and 26 students from the colegio Baquedano. The students studied topics such as biodiversity, photosynthesis and air pollution in the national reserve and the event was a big success because many of the students had never been to the reserve before marvelling the natural beauty of the place.

Between October and December, all the preparation work for establishing the Asociación de Amigos de la Reserva Coyhaique was finalized and on 13 December 2018, the association was officially founded. At the beginning of 2019, a webpage (<http://arenacoyh.cl/>) and a logo for the association were established. Furthermore, discussions were held with CONAF for replication of energy-efficiency in other protected areas in Aysen and with the municipality for preparing an application for funding for purchasing electric buses in the city of Coyhaique.

Modifications to the objectives had to be made for pillars 1, 2 and 7. The sustainable shelters around the lakes could not be built and the APP was not elaborated. Instead of the sustainable shelters, the project was able to build an energy-efficient show-house (casa muestra) instead. These adjustments were necessary due to the fact that not all funds applied for in Chile could be generated. The application for FNDR (Fondo Nacional de Desarrollo Regional) failed. This was mainly due to its coincidence with the change of the national government and a reluctance of the new functionaries to approve projects handed in before they took office. Hence, the project had to slightly downscale its objectives, leaving the development of the app aside; this also implied that money for the construction and improvement of the shelters was not available. However, an energy-efficient demonstration house with solar panels for energy-generation was built next to the park entrance, where the population from Coyhaique can go and inform themselves about measures to make their houses more sustainable. The local office of the ministry of environment and CONAF use the infrastructure regularly for internal and public meetings (e.g., for celebrating the international day of the environment in 2019).

5.2 Achievements of Objectives and Results

The project helped to transform the RNC towards 100% energy self-sufficiency, to create the opportunity to generate jobs, additional income and a culture of sustainability among tourists and the local population with a high potential of replication in other protected areas.

Sustainable infrastructure (pillars 1 and 2)

There are two main achievements in the component of sustainable infrastructure: 1) the energetic renovation of the biblioteca (library) and the establishment of this building as a Centre for Environmental Education in accordance with the Management Plan of the Reserva Nacional Coyhaique;

2) the construction of a “Casa Muestra”, a pilot building made on the basis of sustainable timber construction. It uses local natural materials, and showcases efficient construction techniques adjusted to the local conditions, e.g. the protection of the exterior sides of wooden walls by carbonizing the wood based on a traditional Japanese technique. The interventions in infrastructure were planned in accordance with local construction techniques in two design charette sessions, where the team gathered a group of local actors that had participated previously in the first local governance meeting, and experts in local construction such as the manager of the mill that treated the timber for the construction.

The project team launched a public bidding process between local construction companies that showed interest in the project, and two companies presented their bid. The selected company was QW Constructora. Construction began on 17 April 2018 and lasted for five months until 23 October 2018. During this period, the team had to perform a series of tasks to minimize the barriers that the process faced during construction, including separate monthly meetings with the main local institutions CONAF and the Municipality. This was due to the fact that they did not have fluid relations. In order to minimize barriers, the project team had to solve several questions regarding the construction solutions in the Biblioteca; request early meetings with the utility company to present the photovoltaic installation before its request for approval; and define on site the level of treatment that had to be given to the outer facade (shou sugi ban a Japanese technique for long term preservation of timber).

As mentioned in section 5.1, the sustainable shelters in the lake area could not be built due to an incomplete acquisition process with Chilean funding. Instead, the casa muestra was accomplished instead and gives a good overview of options in energy-efficient construction.

General learnings for this component are: 1) the main barrier for implementation is the coordination between the different actors and specifying the role each one has. 2) There is availability of local materials such as timber and thermal insulation but in the case of timber, it has a high content of moist that made the implementation more difficult. 3) The construction proved that there is a need for building capacities among local actors and for establishing processes that provide the resources needed for energy-efficient construction in the region.

Both interventions were successfully inaugurated on 24 October 2018 with the presence of the Swiss Ambassador, representatives from the local Ministries, Municipality and other actors from the tourism sector and representatives from the civil society.

Environmental education (pillar 3)

The main achievement in the component of environmental education was the realisation of a jointly developed pilot module for environmental education with the Colegio Baquedano in Coyhaique. Two morning sessions were held in the RNC with 26 students and two teachers together with four park rangers from CONAF, and the project team from EBP Chile and the University of Bern. The first session was dedicated to the topic of biodiversity in the local woods, its importance for ecosystem services and the necessity to protect it. The second session covered air pollution and decontamination of the city's air. The topics included the causes of air pollution in Coyhaique and its health impacts on the local population, how air pollution can be measured, its impact on climate change, and what each individual can do to reduce it. Two videos were produced to introduce the children to the sessions. These were shown at the beginning of each session in the retrofitted biblioteca in the RNC. Furthermore, the preparation work for this pilot included a manual for both sessions with topics and questions, exercises, and the purchase of additional material such as binoculars, magnifying glasses, Ziploc bags for collecting material in the woods, demonstration pictures of air pollution in the city, tree seedlings to plant trees, and picnic for the students. The materials produced for the two sessions including the video can be found in the Annex C. The students and the teachers appreciated these two sessions for its interactive mode and possibility to experience the curriculum hands on in the fresh air. We therefore think it was a big success. The materials produced were further used by the Asociación de Amigos for some of their events. It remains to be seen if this pilot will be established as a fixed point in the curriculum of the Colegio Baquedano.

A similar manual was produced for tourist guides in Coyhaique and is ready to be tested in case tourists want to visit the reserve. However, this depends a bit on the particular wishes of tourists wanting to visit the place.

Sustainable mobility (pillar 4)

The objective of this component is the establishment of a long-term mobility plan based on electric mobility (powered partially by renewable energy), that connects the city centre with the RNC. The objective is to turn the RNC into the first national protected area that uses a medium size bus

powered by electricity to transport inhabitants, students and tourists, who visit the RNC, thus contributing to the de-contamination initiatives in the city. This plan is in line with a national strategy to push electric mobility in Chile (nowadays Chile has the largest electric bus fleet in Latin America). The sustainable mobility plan needs the agreement and support of several actors such as: Coyhaique Municipality, CONAF, Edelaysen (local utility company), ENELx (utility company that has invested in electric mobility), SEREMIs of Energy, Environment and Transport, and local authorities for tourism. It has been estimated that the total cost for implementation of the electric bus and the charging station (with renewable energy) is approximately 420'000 CHF. The estimate cost for maintenance and operation of the electric bus is at 35'000 CHF per year (Annex G). The plan has been drafted in accordance with the Coyhaique Municipality and CONAF, the next steps are: 1) present the sustainable mobility plan to local government authorities in order to raise awareness and interest. 2) Define a financial mechanism or funding opportunities within the regional government of Aysen region. 3) Define the local actor that will present the funding plan to the regional authorities, and 4) draft the final plan to be presented to the local authorities.

The main identified source of funding is the National Fund for Regional Development (FNDR). The Municipality due to its executive powers is a likely actor to propose to this fund. Other municipalities in Chile such as Las Condes y Vitacura have implemented similar programs and successfully acquired funds for their electric buses.

Marketing and communication (pillar 5)

The marketing and communication plan was submitted with the progress report in September 2018. The inauguration of the project allowed the elaboration of graphic material that displays the benefits of the project's achievements. This material is currently in display in the Biblioteca and the Casa Muestra of the RNC available for visitors (Annex A).

Local hotels have expressed interest in putting this information about the benefits of the sustainable interventions in the RNC on display, and the Municipality has promoted the activities of the project in local radio programs.

Marketing activities have reached regional and local levels so far. At a national level, it has been difficult to achieve marketing and communication outreach.

Local governance board (pillar 6) and homepage (pillar 7)

The objective of this pillar was to create a governing body of local actors who can contribute their perspectives, wishes, and expectations to the management of the RNC. These actors should be actively involved in the implementation of the presented project but also in potential future projects and initiatives.

In order to discuss and decide on how to implement this pillar, we organised two workshops with local actors from the municipality, CONAF, SEREMI energy, citizen associations, indigenous communities, tourist organizations and education. The first workshop took place in January 2018 with the goal to discuss issues and ideas of interest (Annex D). The second workshop was used to inform about the progress of the project and to discuss the preferred structure and form of this body. The result of this second workshop, which took place in October 2018, was the plan to found the Asociación de Amigos de la Reserva Nacional Coyhaique. After the workshop, the local actors arranged everything for the association to be established and concluded the preparations with the official registry at the municipality in December 2018. Since their foundation, the association has been active in organising several events, including a concert of young musicians, a visit for disabled people and several walks in the RNC with members of the association (Annex E). An association of amigos is a special legal form in Chile that allows applying for governmental fund. This form was chosen to being able to initiate own initiatives in the near future.

The local actors appreciated the possibility to be actively involved in the development of RNC-related projects and take part in sustainable regional development of the area they live in. Furthermore, they see these activities as a way for community building. These activities go on also after the conclusion of the presence of the project team. They are carried out through self-organization and resources that numerous members of the Asociación de Amigos de la Reserva Nacional Coyhaique are able to mobilize. This can be evidenced by following the WhatsApp group of which the team members of CDE are part. In addition, a homepage was established for the asociación to communicate their activities and inform about their work.

Outreach and dissemination (pillar 8)

All the team members engaged in dissemination and outreach activities whenever possible. Among them, the project was presented at 3 scientific conferences in Latin America and Europe, in the newsletter of the UNESCO Chair on Natural and Cultural Heritage for Sustainable Mountain Development, and local radio programs in Coyhaique.

5.3 Multiplication / Replication Preparation

All protected areas in Chile are governed by CONAF and we closely collaborated with the person at CONAF responsible for the whole region of Aysen. Therefore, the connection between different park areas is already given through the structure of CONAF. One of the outcomes for replication of this project are the new construction standards in the Aysen region for infrastructure in protected areas (part of activity 3B). The team works closely with CONAF in order to define the requirements for future infrastructure implementations in Patagonia. CONAF has expressed its interest in achieving net zero carbon infrastructure via: 1) an integrative design process that considers all the renewable energy sources available in the territory; 2) a design approach that is “climate driven” to reduce energy demand in the initial schematic design; 3) replication of the envelope and materials specifications from “Casa Muestra” to future building implementations. These standards were incorporated in the terms of reference for six infrastructure projects in protected areas managed by CONAF (Annex F).

Another outcome of the project is the elaboration of a one-day course of techniques for sustainable construction. The course was a request of the municipality of Coyhaique and was partly financed by the municipality and partly by EBP Chile. The first two sessions took place in June 2019 (Annex B). It targets the construction sector, specifically mid-size contractors that are interested in learning about construction techniques with local materials and highly efficient buildings.

5.4 Impact / Sustainability

By the end of the project, we notice a great interest for the project at local, regional and national level. At the local level, the project was a starting point to think about alternatives for building houses that are less polluting and demonstrate how energy-efficient construction can look like. Furthermore, it engaged local actors to think about options for local sustainable development and got a local school involved in environmental education in the RNC.

At the regional level, CONAF plans to implement the same standards in other protected areas of the region as they were applied in the presented project. Furthermore, the project could attract regional decision-makers to the inauguration of the new buildings and these showed great interest in the results of the project.

Coyhaique has expanded its portfolio for projects related to energy efficiency in construction. The lessons derived from the project in the RNC showed a strong interest within the private sector (commercial) to secure investment in energy efficiency and renewable energy. This momentum allowed the Municipality to attract the interest of private actors and jointly acquire a FIE (Energy Investment Fund). Coyhaique was the only municipality at the national level that acquired this fund, and it is becoming a leader in community-based initiatives regarding energy efficiency.

In general, the project greatly helped creating awareness and based on this, showcased how a higher integration of actors (public, private and citizens) can increase synergies between policies and projects normally focussing on individual issues of economic, ecological and social development. People are now convinced that linking energy efficiency, sustainable construction and cultural and educational activities to nature conservation in the park area results in improving the living conditions of humans and nature in the area.

In terms of suggested impact indicators, the project achievements are shown in table 2.

Ecological	Unit	At the REPIC Project's Completion
Installed renewable energy capacity	[kW]	4,5
Renewable energy produced	[kWh]/year	5422
Amount of fossil fuel energy saved	[kWh]/year	118637
Greenhouse gas reduction	[t CO ₂ -eq]/year	29.6
Newly collected and separated waste	[t]	-
Newly recycled waste	[t]	-
Economic		
Energy costs (LCOE)	[Rp/kWh]	
Triggered third-party funding/investments	[CHF]	
Local private income generated	[CHF]	
Social		
Number of beneficiaries	[Number]	100 (direct) / ± 5.000 indirect (visitors)
Number of new jobs	[Number]	-

Number of trained personnel	[Number]	40
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Table 2: Impact indicators in the project.

6. Outlook / Further Actions

6.1 Multiplication / Replication

To promote the project further and encourage replication, the team planned the following steps:

- Present the project in different conferences: The team presented the findings from the project in October 2019 at the Transformations Conference 2019 in Santiago, Chile, and at the Earth System Governance Conference 2019 in Oaxaca, Mexico. The conferences' participants were especially interested in the participatory governance platform and ways how to include local actors into governing protected areas.
- Promote the concept for Net Zero Emission areas for private and public sector: At least one private actor has shown interest in the development of a Climate Positive (CO₂ negative) area in Malalcahuello (Araucania region) with an important conservation component (20 hectares of protected area for conservation).
- Online publications in EBP Chile website (ongoing).
- The high interest for use of local bio-material and wood treatment technologies, which was in charge of the UFRO, led to continued exchange with the University of Bern. The fact that many different biomaterials are available but that their volumes are generally small, led to the project idea of producing biomass for the specific purpose of providing low cost natural insulation materials. Currently, CDE and UFRO explore the possibility to outline a new REPIC project for this purpose.
- Despite the interest in replicating the key aspects of this project in other contexts, we observed that the replication process is slow. This is not due to motivation problems of the mostly local actors such as CONAF or the municipalities but stems from complex decision-making processes and even more complex funding processes for regional and national funding schemes. Making a small team of experts available (e.g. on behalf of the Swiss Embassy) that could support local actors in successfully lobbying at regional and national levels for replication projects would be very beneficial for unlocking blockages in local decision processes.

6.2 Impact / Sustainability

In terms of the sustainability impact of the project, we would like to mention the topic of energy and the social level:

Energy: The project proved that efficient construction can be implemented in Patagonia with the use of local resources and capacities. The Casa Muestra is a building that has an energy demand 86% lower than a regular building in the City of Coyhaique (from 12'960 kWh/year to 1'836 kWh/year). The photovoltaic installation generates 1'859 kWh/year. Total emission reductions in the project is 2 tons CO₂eq/per year. In monetary terms, the savings derived from the project are CLP 4.5 MM (CHF 6'400) per year.

Social level: The project has clear impacts in social aspects especially due to the activities carried out by the "Amigos de la Reserva Nacional Coyhaique". This group has been able to organise cultural (concert in the RNC), and nature activities (trekking with environmental education objectives). The "Amigos de la Reserva Nacional Coyhaique" is currently establishing a legal framework that will allow them to request public funding for the implementation of future projects.

The social dimension of sustainability was also positively influenced by linking students of a public school and other people in the community more directly to outdoor experiences in the RNC. It made relationships between the people stronger through mutual trust and social coherence and raised awareness among them for the importance of a healthy environment around them.

7. Lessons Learned / Conclusions

The findings identified by the project team are the following:

1. **Community and engagement for action and dissemination:** This project is a "call for action" towards a sustainable management in protected areas in Chile. The biggest challenge is to find ways to strengthen the momentum following the activities of the Local Governance component. The presence of a local actor is required from the start to ensure that community-based activities can take place in between the team visits. This was identified early by the team, and Antonio Bijit took leadership of this component and formed the "Amigos de la Reserva Nacional Coyhaique".

2. **Sustainability governance:** this project showcased that a public administration can greatly benefit from interacting with the local population, not only through consulting the people at the beginning of a project but through their participation during the whole implementation process. Such integral participation leads to more democratic social control in policy-making processes. This benefits policy makers and local people likewise. Policy makers are assured that they address real needs in their communities, and local people develop more ownership for supporting public policy goals when they are part of the process.
3. **Technical knowledge for energy efficiency:** In Coyhaique, construction standards are stricter than for many cities in Chile due to problems of poor thermal envelope and particulate matter. Standards need to be transferred correctly to contractors. The team had to invest a significant amount of time in order to do this. The use of timber as a construction material needs to be promoted. There is a misconception that timber construction cannot achieve good energy performance. The team worked closely with the personnel from the RNC and CONAF to demonstrate the added value of quality timber construction.
4. **Replication:** There is a strong interest for replication in the public sector, which is shown in the new standards for infrastructure in protected areas in Patagonia that will be defined according to the results from the infrastructure component of the project. Replication in private protected areas is an aspect that still needs to be explored. The potential for replication in the private sector relies on the benefits of sustainable construction and electric mobility.
5. **Communication:** The project reached a level of visibility that allowed it to be clearly identified at a regional level in Aysén, allowing replication in other protected areas and within the City of Coyhaique. However, replication and communication at the national level still needs to be addressed as a continuous effort such as through academic publications and energy efficiency projects that the team is conducting.

8. References

References list of publications, reports, etc.

9. Annex

When available: Reports, press articles, brochures, test results, etc.

- Annex A: Final report for FIE project with photos of the construction and the inauguration
- Annex B: Course material for the construction course
- Annex C: Educational material of the environmental education pilot including two videos
- Annex D: First workshop report in participatory governance
- Annex E: Photos of activities of the Asociación de Amigos
- Annex F: Document for future replication of energy standards in protected areas in Aysen (CONAF)
- Annex G: Electric Mobility program draft

Please include **photos**, easily comprehensible graphics, etc., with this report.

Please send the complete final report directly to: info@repic.ch

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