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INDUSTRIAL HERITAGE IN "SACRIFICE ZONES". THE POTENTIAL OF BOCAMINA I & II THERMOELECTRIC IN CORONEL, CHILE

Abstract

This work aims to present the recovery potential of the Chilean Sacrifice Zones, urban areas affected by high amounts of pollution caused by industrial activities. It centers in the case of "Bocamina I & II", two Thermoelectric based in the city of Coronel, southern Chile. A settlement historically related to the mining processes. These plants operated for decades supplying the national energy grid and are seen as both symbols of progress and detriment. As part of the government Energy Transition Plan, they were recently closed for more sustainable energy sources and though the decision is seen as a national milestone, not much has been said regarding the buildings themselves. This research contextualizes the case of study, elaborates on how its future use and perception could help mitigate the negative impact on its surroundings and how the case can be extrapolated to similar cases internationally. For this, the work focuses on the plant's infrastructure, their relation to the immediate context of Coronel and importance to Chilean industrial history on two approaches: Analyzing the alternative of their classification as National Monuments by the Chilean National Monuments Council, and by the Adaptive reuse approach, internationally seen as a sustainable strategy for abandoned buildings. Different arguments and examples are presented with the purpose of providing an understanding of the potential of Industrial Heritage reclamation, and how it could change the perception of the Sacrifice Zones through community involvement, urban planning, collaborative design and identity empowerment.

Keywords: sacrifice zones, Bocamina I & II, industrial heritage, community & identity, reclamation, sustainable development.

DZIEDZICTWO PRZEMYSŁOWE W "STREFACH POŚWIĘCENIA". POTENCJAŁ BOCAMINY I I II – TERMOELEKTROWNI W CORONEL, CHILE

Streszczenie

Artykuł ma na celu przedstawienie potencjału odbudowy chilijskich „stref poświęcenia", obszarów miejskich dotkniętych rozległymi przekształceniami i zanieczyszczeniami spowodowanymi działalnością przemysłową. Praca koncentruje się na przypadku dwóch elektrowni węglowych Bocamina I i II, zlokalizowanych w mieście Coronel w południowym Chile, którego bazą ekonomiczną od lat jest górnictwo

i wydobycie. Elektrownie te działały przez dziesięciolecia, zasilając krajową sieć energetyczną i są postrzegane zarówno jako symbol postępu, jak i zniszczenia środowiska. W ramach rządowego planu transformacji energetycznej zostały one niedawno zamknięte. Chociaż decyzja ta jest postrzegana jako kamień milowy w kierunku proekologicznego rozwoju kraju, dotychczas w niewielkim stopniu rozważano skutki społeczno-ekonomiczne i funkcjonalno-przestrzenne zamknięcia obu elektrowni. Niniejsze badanie kontekstualizuje badany przypadek, wyjaśnia, w jaki sposób możliwe jest przyszłe wykorzystanie istniejącego potencjału infrastrukturalnego w kierunku złagodzenia negatywnego ekonomicznego wpływu decyzji zamknięcia elektrowni na ich otoczenie społeczne, a także w jaki sposób przypadek ten można ekstrapolować na podobne przypadki pojawiające się coraz częściej na arenie międzynarodowej w wyniku transformacji energetycznej. W tym celu praca koncentruje się na infrastrukturze elektrowni i zakładów wydobywczych w sąsiedztwie. W kontekście chilijskiej historii przemysłu, aktualne wyzwania miasta Coronel można rozważyć dwojako: jako obiekty kultury przemysłowej postulowane do objęcia ochroną konserwatorską przez Chilijską Radę Zabytków Narodowych lub też zastosować podejście adaptacyjne poprzez ponowne wykorzystanie opuszczonych budynków, postrzegane na arenie międzynarodowej jako zrównoważona strategia rozwoju. Przedstawiono różne argumenty i przykłady w celu zrozumienia potencjału rekultywacji dziedzictwa przemysłowego Coronel oraz tego, w jaki sposób może ona zmienić postrzeganie „stref poświęcenia" poprzez zaangażowanie społeczności, elastyczne planowanie urbanistyczne, wspólne projektowanie i wzmacnianie lokalnej tożsamości.

Słowa kluczowe: strefy poświęcenia, Bocamina I i II, dziedzictwo przemysłowe, społeczność i tożsamość, rekultywacja, rozwój zrównoważony.

Introduction

Sacrifice Zones defines "urban areas exposed to extreme degrees of environmental pollution and degradation caused by the concentration of industrial activities, such as coal mining or electricity generation"[1]. The population of these areas have commonly low economic and educational levels, face several health risks due to soil, water and air pollution[2] and have their basic human rights infringed[3]. As consequence, its inhabitants organized in movements, mostly led by women, to protest these industries and their exploitation of

[1] Castán Broto V., Sanzana Calvet M., *Sacrifice zones and the construction of urban energy landscapes in Concepción, Chile*, "Journal of Political Ecology" 2020, v. 27, p. 280.
[2] Liberona Céspedes F., Ramírez Rueda H., *Antecedentes y reflexiones sobre la zona de sacrificio de Quintero y Puchuncaví*, "Cuadernos Médico Sociales" 2019, v. 59 (1), pp. 21–31.
[3] Honorable Cámara de Diputados, Gobierno de Chile / Honorable Chamber of Deputies, Government of Chile, *Informe comisión especial investigadora sobre causas de Alta contaminación ambiental, especialmente en Concón, Quintero y Puchuncaví, y de responsabilidades en ejecución del plan de descontaminación,* 2019.

natural resources[4], showcasing the importance of their cultural and natural landscapes for their community development, as well as their demands for basic rights.

On the other hand, the coal mining and power plants built in these areas have contributed to the energy matrix of the country since decades; first with hydroelectric and then with thermoelectric plants, which by the 1970s were seen as national symbols of economic and technological progress. This energy strategy led to 28 Coal-based Thermoelectric operating in Chile in 2019. According to the results of the "Report of the Special Inspective Commission on Causes of High Environmental Pollution" by the Chamber of Deputies in 2019, 27 of them are built only in 5 boroughs, as presented in Figure 1(a). The report states that these sites were responsible for 91 percent of Carbon Dioxide and 97 percent of all Sulphur Dioxide emissions, among other substances. This means an increasing damage for ocean ecosystems and the pollution of several species that are harvested and sold by local fishermen and other artisanal extracting crafts[5]. This, plus the growing energy demand of the country and the concern for climate change, led the Chilean Government to move towards the closing of these plants in favor to more sustainable energy sources with the objective to achieve Carbon Neutrality by 2050. Hence, "Chile has been experiencing a remarkable renewable energy transformation over the past few years. The significant potential of several Non-Conventional Renewable Energy sources, a favorable business climate and successful policy reforms by the Chilean government have made Chile one of the most attractive marketplaces for renewable energy developers in the world"[6].

However, this transition has been focused on the renewable energies, leaving the Sacrifice Zones without real long-term transition plan regarding the management of these infrastructures or the habitants of the areas, which will be affectted, as consequences of the transformation process. This article aims to present that the reclamation of these potentially symbolic sites can showcase the resilience of their communities, heal their urban infrastructure and improve their quality of life; strengthening social networks, revaluing abandoned industrial buildings and proving a sustainable development model for the Sacrifice Zones.

As case of study, the article will focus on the recently closed Thermoelectric of Bocamina I & II, located in Coronel, Chile. Understanding its potential. "Not just a metaphor of the episteme and identities characteristics for a certain period,

[4] Bolados García P., Sánchez Cuevas A., *Una ecología política feminista en construcción: El caso de las "Mujeres de zonas de sacrificio en resistencia", Región de Valparaíso, Chile*, "Psicoperspectivas" 2017, v. 16, n. 2, pp. 33–42.
[5] Honorable Cámara de Diputados, Gobierno de Chile, op. cit., p. 64.
[6] Nasirov S., Girard A., Peña C., Salazar F., Simon F., *Expansion of renewable energy in Chile: Analysis of the effects on employment*, "Energy" 2021, v. 226, Article No. 120410.

they are narratives actively co-creating this episteme and identity"[7]. As such, these plants can positively shape the future of its territory and help prevent social crisis after their closing. This can help prevent issues presented in previous conversion plans, such as the remediation for the closing of Lota and Schwager mines on the 1990's[8], leading to the increase of unemployment, loss of cultural identity and abandonment[9]. Thus, "the question how to protect the heritage nowadays sounds how to transform it"[10] and as such, new heritage and cultural identity can emerge from abandoned infrastructure.

1. Sacrifice Zones in Chile

The term Sacrifice Zone is first used as a reference to the nuclear waste disposal areas in the United States by the 1980's "the cleaning of these places implied a scientific-technical challenge difficult to address: because it is waste radioactive, their neutralization was impossible and their danger was practically eternal."[11]. In Chile, the term is coined in the 1990's by the majors of Tocopilla, Huasco, Quintero, Puchuncaví and Coronel boroughs, with the intention of creating awareness to the dire situation, consequence of the several industrial sites emplaced in these districts.

[7] Rewers E., *Visualization of identity: two remarks on the identity, urban planning and architecture / Wizualizacja tożsamości: dwie uwagi o tożsamości, urbanistyce i architekturze*, [in:] A. Jawłowska, *Around the problems of identity/Wokół problemów tożsamości*, Wydawnictwo Uniwersytetu Warszawskiego, Warszawa 2001. Seen on: Dymnicka M., Szczepański J., *Dilemmas of Identity in Contemporary Cities. The City of Gdansk as an Example*, "Procedia Engineering" 2016, Vol 161, pp. 1225-1229.

[8] Gatica F., Guerrero R., *La problemática reconversión de las hulleras, El ejemplo de Lota*, "Tiempo Y Espacio", No. 9-10, pp. 75–90. Retrieved from: https://revistas.ubiobio.cl/index.php/TYE/article/view/1629 [Access: 14/03/2023].

[9] Torrent J., Hernández P., *Reconversión, daño y abandono en la ciudad de Lota*, "Atenea" 2010, no. 504, pp. 147–176.

[10] Dymnicka M., Szczepański J., op. cit., p. 1226.

[11] Folchi M., *Zonas de Sacrificio: Distinto origen, mismo destino, Text based on interview to the expert,* "Los territorios que habita(re)mos: ¿qué futuro existe para las zonas de sacrificio?", "Position Paper", No. 1, 2020, p. 29. [Access: 14/03/2023].

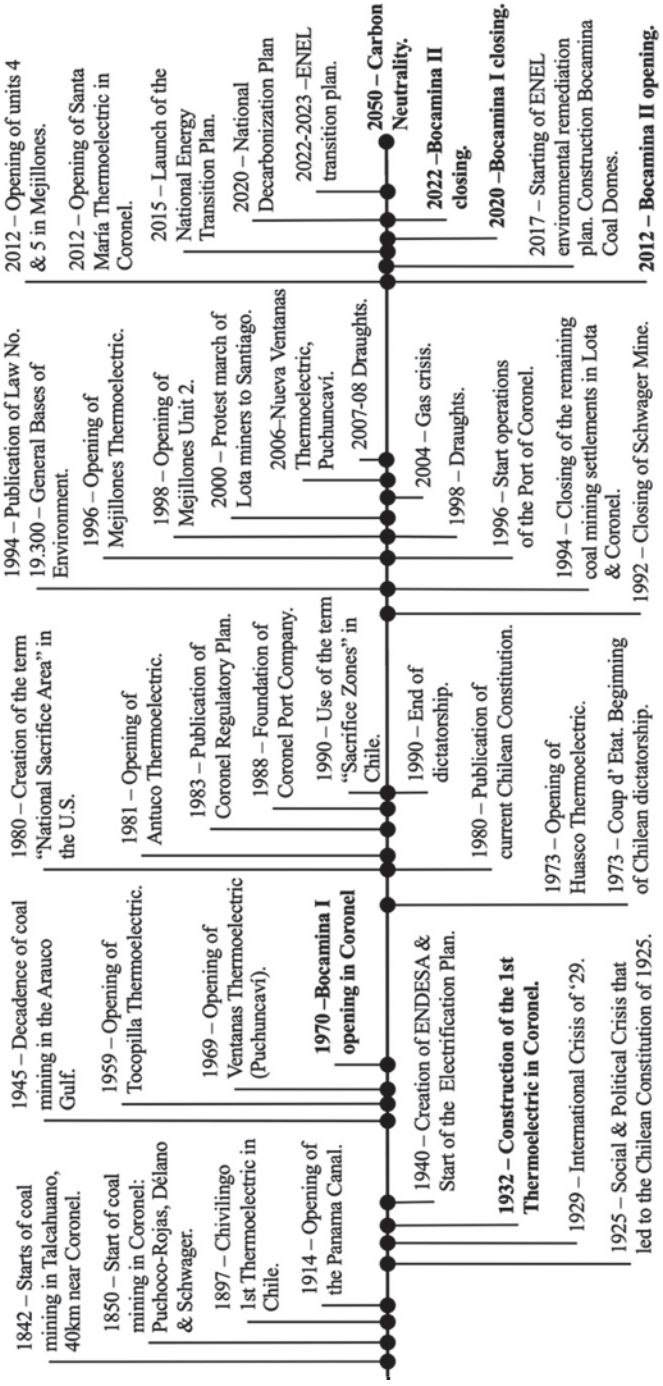
Figure 1. (a) Map of Chile and Sacrifice Zones, (b) Ventana, near Quintero-Puchuncaví, 2011.

Source: (a) Own study, (b) https://www.flickr.com/photos/chicuco/5762397337/in/photostream/ [Access: 14/03/2023].

These zones have different geographical contexts, problematics and origins, but as shown in Figure 1(b), they all share the location of several industries. Since it's not a legal categorization, there is no official definition in Chile for Sacrifice Zone. Thus, it is a social-political characterization of an urban area. The Union of Sacrifice Zones Boroughs defined the term for the Chilean context as "those territories of human settlement environmentally devastated due to industrial development. This devastation has direct implications for the full exercise of people's fundamental rights, such as the right to life, health, education, work, food, and housing, among others. In these territories, environmental damage has meant the situation of vulnerability and impoverishment of the communities"[12].

[12] Instituto Nacional de Derechos Humanos, Definition of Sacrifice Zones by the Unión de Comunas de Zonas de Sacrificio. Retrieved from: https://www.indh.cl/ indh-presenta-mapa-de-conflictos-socioambientales-en-encuentro-sobre-zonas-de-sacrificio/#:~:text=La%20Uni%C3%B3n%20de%20Comunas%20de,por%20causa%20del%20desarrollo%20industrial. [Access: 13/03/2023].

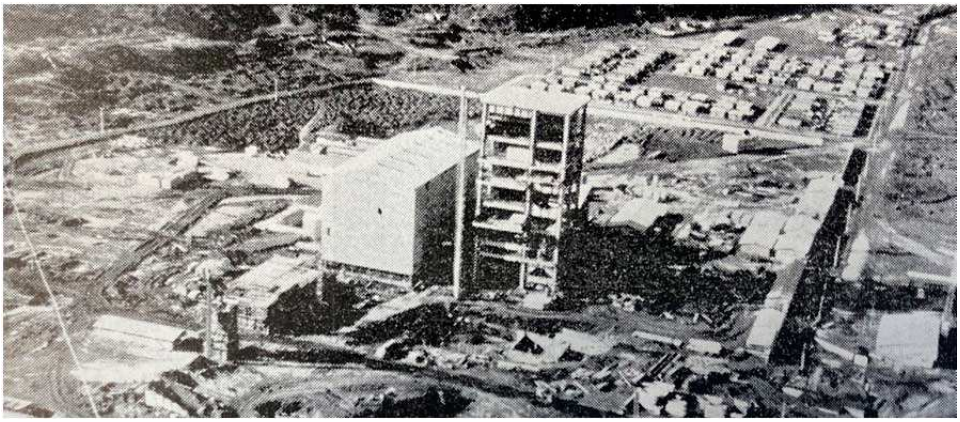
Table 1: Timeline of the coal industry and the closing of Bocamina I & II.



Source: own study.

As shown in Table 1 timeline, the oldest Chilean Sacrifice Zones relate their origins to coal mining and energy production for the increasing national demand. Under the argument of *the needs of the many outweighs the needs of the few*, the progress of the country was historically used as argument for the installation of industrial settlements. In the case of Bocamina I, it was built by ENDESA (National Electricity Company) to relief unemployment in the coal production sector in the Arauco Gulf, due to the rising of petroleum usage in the fuel industry. Opened in 1970, it was portrayed as governmental answer to relief a local situation of poverty and discontent. Figure 2 present an aerial image of the recently build Thermoelectric, as part of its 1971 news bulletin, showing the evident difference of scale of the building in relation to its immediate urban context.

Figure 2. Bocamina I Plant as shown in 1971 ENDESA Bulletin. Chile National Library Archive.



Source: Hevia Toro M., *De Zona de Sacrificio a Paisaje de Remediación: Reconversión y Revalorización Patrimonial de las Termoeléctricas Bocamina en la Bahía de Coronel*, 2021. p. 37.

However, this type of public policy implemented in the beginning and mid XX century took a turn with the dictatorship in 1973, since the economic and energetic strategy shift to the privatization of state companies, leaving these territories in the hands of private enterprises. Because of this, the historically coal-related cities of Lota and Coronel eventually came to a downfall. Since these areas lost ENDESA support and the private investors opted to import cheaper coal from other countries, leaving the generations-long tradition of coal miners and their cities to a prolonged state of decadence. This situation worsens with the closing of the mines in 1997[13]. Years after that, ENDESA was also privatized and due to the government energy policy, which rely heavily on private-investment and coal based thermoelectric, several plants were built in these industrial settlements in the Chilean coast: "Santa María" in 2012, "Nueva Ven-

[13] Folchi M., op. cit., p. 32.

tanas" in 2006, "Campiche" in 2013 and "Bocamina II" in 2012, right next to the original plant, now "Bocamina I".

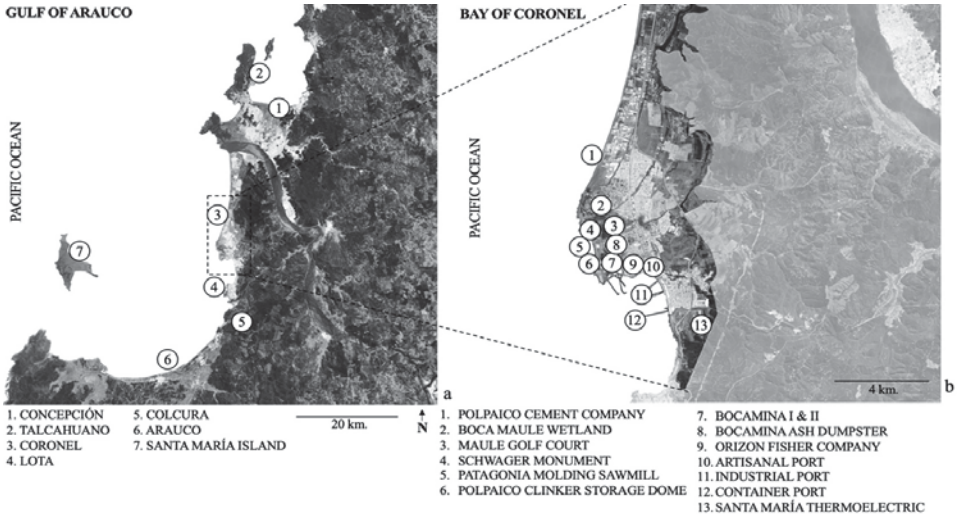
2. Urban Context. The Gulf of Arauco and Bay of Coronel

As shown in figure 3(a), The Gulf of Arauco gathers the cities of Concepción, regional capital, Talcahuano, Coronel, Lota, Arauco and Santa María Island. The Coast of Coronel experienced a mining extraction boom, which by the second half of the XX century had visible consequences. Among them, the installation of secondary industries related to the extracting process, as well as forest and fishing companies. This led to an increase in urbanization, railroads and port infrastructure linked to these activities. Nowadays, Coronel has an area of 279 square kilometers and a population of more than 95.000 inhabitants (2017 Census). As figure 3(b) portrays, this mixture creates a heterogeneous landscape that also includes natural areas such as the Boca Maule Wetland and heritage sites related to mining processes; Shwager and Buen Retiro Mine Shafts and Puchoco-Shwager, declared Typical Zone (TZ) by the National Monuments Council[14]. As for the coast, Figure 4 provides a view of the bay Area and its distribution; Industries, storage and port-related activities, as well as artisanal fishing port, for many inhabitants, their only source of income, next to the industrial port and fishing facilities. Coronel also has 91 wetlands[15], the highest amount nationally, but only 8 of them are recognized by the Communal Regulatory Plan, the official urban tool for city planning of Chilean cities, this leaves the natural territory mostly unprotected and on a second plane, in opposition to the industrial and productive programs.

[14] Consejo de Monumentos Nacionales / National Monuments Council, Chile. Decree No. 220, 2010 attribution of "Typical Zone" to the sector known as Puchoco-Schwager. [Access: 14/03/2023].

[15] EDAFICA Inventario De Humedales Urbanos Y Actualización Catastro Nacional De Humedales, Valdivia, Chile 2020, p. 75.

Figure 3. Gulf of Arauco and Bay of Coronel.

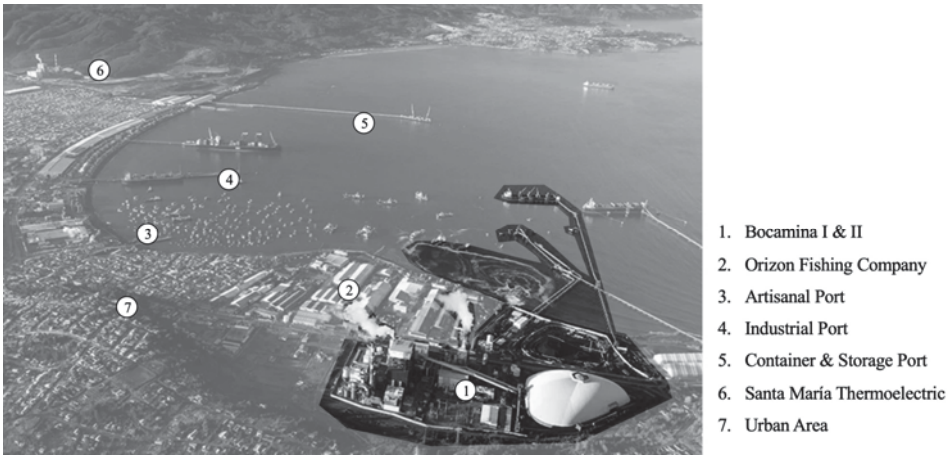


Source: Own study (Based on Google Earth photos) [Access: 15/03/2023].

Economically, the city has two main poles, the industrial sector located at the north side and the Bay and center area. The Bay itself its mostly shaped by industries such as Orizon Fishing Society, Cabo Froward and Polpaico Cement Company, as well as Santa María thermoelectric and Bocamina I & II. This configuration fragments the city creating lack of connectivity between the heritage zones and the center[16], it makes the bay area unavailable to public access or recreational purposes in most of its urban length and gathers the emission of pollution material in a small area.

[16] Hevia Toro M., *De Zona de Sacrificio a Paisaje de Remediación: Reconversión y Revalorización Patrimonial de las Termoeléctricas Bocamina en la Bahía de Coronel*, Thesis for the grade of Architect and Magister in Landscape Architecture, Pontificia Universidad Católica de Chile, Santiago Chile 2021, p. 86.

Figure 4. Bay of Coronel and Bocamina I & II, April 2018.



Source: Original picture by Guy Wenborne. Retrieved from: https://laderasur.com/fotografia/15-fotos-de-chile-desde-el-aire-que-te-dejaran-con-la-boca-abierta/coronel/ [Access: 16/03/2023].
(Edited by author).

3. History of Coronel and Bocamina I & Bocamina II

Since the 1850's, Coronel development was mostly based on coal extraction. "This time of mining roots was the preamble to the birth of the city of Coronel, which like few others did not have a de facto foundation; rather, its gestation is the product of the exploitation of the large coal deposits located in the Puchoco sector and the subsequent settlement of the places surrounding the mining areas, which points to a spontaneous and natural event, without any hint of planning. This fact should be seen as the last link in a long chain of events that began to take shape around the year 1843, in the Talcahuano Bay."[17]. In 1897, Chivilingo, Chile's first Thermoelectric, opened in Lota, but by the 1950's, investors switch from coal extraction to industries and the coal development became stagnant. This was due to the massification of oil use for industrial and energy purposes, as well as the inauguration of the Panama Canal, which reduced the maritime flow in the bay. In 1970, Bocamina I is built to generate employment and make use of coal extracted from the nearby mines, this was planned in 1964 when the Government, requested by the local mining companies, established its construction in the Law of National Budget. In its origins, it was seen as an answer to the social problematic of unemployment of the vast mining community of Lota, Lebu and Coronel, even though the risks and damages linked to coal

[17] Aburto Cristi H., Gutiérrez González M., *Coronel: historia y sociedad carbonífera,* "Revista De Historia" 2000, 1(9-10), p. 113. Retrieved from: https://revistas.udec.cl/index.php/historia/article/view/6871/6484 [Access: 15/03/2023].

thermoelectric were known since 1950[18]. Later, the Thermoelectric helped to surpass the great droughts of 1998-1999 that greatly diminished the energy contribution of hydroelectric plants and forced the country to rely on coal once again. Between 2004 and 2007, Chile was experiencing a gas crisis due to shortages of Argentinian gas imports. This, plus droughts of 2007 and 2008 and the increasing energy demand, forced the nation to rely heavily in Thermo-electric-generated energy, which consequen-tially led to the construction of Bocamina II in 2012, with a potency of 350 MW[19]. Since 2017, both power plants faced modifications to decrease the negative impact on the surrounding environment and urban areas, one of the most visible interventions is the construction of its two iconic domes in 2018. The two structures cover the coal reserves and avoid particulate material to spread with the wind. Years later, ENEL Chile (National entity for Electrical Energy) in charge of the Thermoelectric, signed an agreement to shut both power plants as part of the national energy transition plan. By December 31st of 2020, Bocamina I, was closed and then on September 30th, 2022, Bocamina II. Their closure marked the end of decades of operation and was seen as a milestone in the transition to more clean renewable energy sources and ENEL Chile became the first company to abandon coal as material to produce electricity[20].

4. Thermoelectric Plants & the Industrial Infrastructure of Bocamina I & Bocamina II

A coal-based thermoelectric uses the mineral as heat source for turning water into pressurized steam, which is then used to rotate turbine valves. This charges a generator that creates electrical current by spinning.[21]. According to the National Energy Commission, Bocamina I & II had a combined potency of 478 MW[22] and the main stages of the process can be seen in figure 4: First, the coal arrives through ships and moves through conveyor belts to the domes, then it goes to the Coal Shredder, where is pulverized and later moved to the Furnaces. In here, its combustion heats up purified water that moves through pipes. The water boils and the pressurized steam is conducted to the turbines, where its

[18] Folchi M., op. cit., p. 32.

[19] Comisión Nacional de Energía, Ministerio de Energía, Gobierno de Chile / Natio-nal Energy Commission, Ministry of Energy, Government of Chile, *Anuario Estadí-stico de Energía 2020*. Retrieved from: https://www.cne.cl/wp-content/uploads/2021/12/AnuarioCNE2020.pdf [Access: 14/03/2023].

[20] ENEL Chile, *ENEL es la primera compañía en dejar el carbón para generar electricidad en Chile*, Comunicado de prensa. Retrieved from: https://www.enel.cl/content/dam/enel-cl/prensa/comunicados_de_prensa/2022/20220930-CP-Cierre-Bocamina.pdf [Access: 15/03/2023].

[21] Components of Thermal Power Plant & Working Explanation. Retrieved from: https://www.thermodyneboilers.com/components-working-thermal-power-plant/ [Access: 13/03/2023].

[22] Comisión Nacional de Energía, Ministerio de Energía, Gobierno de Chile/National Energy Commission, Ministry of Energy, Government of Chile, op. cit., p. 10.

pressure rotates valves and starts the generator. This process con-verts kinetic movement into electrical energy, which is later conducted to the High Voltage Yard to increase its voltage and then transmitted to the distribution centers. Parallel, the used steam gets cooled down and return to water in a condenser as part of a "close loop" process, for this, Bocamina uses sea water from the bay. The water is returned to the bay without additional contaminants, but with warmer temperature, which affect the marine ecosystem leading to loss of biodiversity.[23] The solid residues, such as ash, are gathered in silos to be later derived to the ash dumpster or reused as material for the processes of cement and concrete production.

Figure 5: Bocamina I & II Infrastructure.

Source: own study (Based on Google Earth photo) [Access: 15/03/2023].

5. Negative Impact and health risks

Coronel and its Thermoelectric produced 16 percent of the nationwide total of coal-based energy in a radius of 3 kilometers that also contains 10 educational establishments[24]. Its historic Center annually produces 8.800 tons of Nitrogen Dioxide and 8.700 tons of Sulphur Dioxide and is the only urban settlement in the world to have an ash dumpster placed in the City Center, which expanded to 51 times its original size between 2010 and 2018 (Chamber of Deputies Report, 2019) receiving the daily amount of 1.760 tons, for a total sum of 190.000 tons/year [25]. Additionally, various organisms have determined the concentration of Arsenic, Cadmium, Led, Mercury, Chromium and Zinc, as well as the lack of oxygen in the bay due to Liquid Industrial Residue[26].

[23] Centro de Ecología Aplicada, op. cit., p. 24.
[24] Honorable Cámara de Diputados, Gobierno de Chile, op. cit., p. 108.
[25] Ibidem p. 109.
[26] Centro de Ecología Aplicada/Center for Applied Ecology, *Diagnóstico Medio-ambiental y Evaluación Preliminar de Riesgo Ecológico de la Bahía de Coronel*, 2016.

Figure 6. Coronel inhabitants protesting against Bocamina I & II.

a Neighbors protesting by burying themselves in Bocamina I & II ash dumpster.

b Women protesting outside the Thermoelectric.

Source:https://www.biobiochile.cl/noticias/nacional/region-del-bio-bio/2022/09/30/una-decada-de-multas-paros-y-danos-ambientales-el-cierre-de-bocamina-ii-la-gigante-carbonifera.shtml [Access: 16/03/2023].

As expected, with the growing precarious situation and the rise of environmental awareness, the inhabitants of Coronel started demanding social rights. They grouped and formed organizations such as the Guild Association of Artisanal Fishermen of Coronel or Workers United Against Asbestos (TUCA)[27]. Also, many social leaders emerged from communal organizations and have coordinated several demonstrations against Bocamina with actions such as burying themselves in the ash dumpster (Figure 6a) or organizing manifestations at the entrance of the Thermoelectric (Figure 6b). Their objective is to call for the attention of the rest of the country and to showcase the poor living conditions they face related to their physical and psychological health, especially in the younger generations[28]. Hence, the industry that in the 1970's was a symbol of progress and national development is now a banner of pollution, environmental damage, health risks and urban-social displacement.

6. Transition and remediation after the closure of Bocamina I & II

With the closing of Bocamina I & II, ENEL began a "fair transition process that will consider the impacts in the labor, community, environmental and economic scopes of the plants disconnection"[29] (ENEL, 2021) with the objective of empower sustainable progress, relocating families, establishing fundings for

[27] Lincura Matamala O., Díaz Crovetto G., *Reconociendo "riesgos invisibles" en una "zona de sacrificio": el caso de la organización Trabajadores Unidos Contra el Asbesto (TUCA) de la comuna de Coronel, Chile*. "Papeles De Trabajo. Centro De Estudios Interdisciplinarios En Etnolingüística Y Antropología Socio-Cultural" 2021, No. 41, pp. 59–94.

[28] Bartlett S., *Children's experience of the physical environment in poor urban settlements and the implications for policy, planning and practice,* "Environment and Urbanization" 1999, v. 11(2), pp. 63–74.

[29] ENEL, Bocamina, el camino de un proceso inédito. Retrieved from: https://www.enel.cl/es/sostenibilidad/creacion-valor-compartido/bocamina.html [Access: 15/03/2023].

ventures and scholarships and empower artisanal fishing[30]. Since 2019, ENEL and Foresta Nativa, an initiative of University of Concepción, have been developing a plan to turn the circa 10 hectares of the ash dumpster into a native forest inside the urban area of Coronel[31]. Their remediation strategy also considers building communal infrastructure, such as the "Eco Park of the Senses", a 75 square meter building located in Cerro Obligado, near the former power plants. Its construction is based on circular economy principles and has 75 percent recycled/reused materials, the implementation was done with the help of four local women that took part in the building labors and, according to ENEL, this action benefits 6.400 people[32]. Another initiative is the community mural depicted in Figure 7; a 3.500 square meter mural made with the input of 14 community focus groups of Coronel to show their identity. However, these initiatives lack to address what will be the new economic base for inhabitants after the closure of this source of work. Regarding the Power Plants itself, the company started a Phase Out initiative to guarantee a safe dismantling, optimizing the recovery of materials and determine a future use of the site, ruling out the possibilities of installing a new power plant that is not from renewable sources[33] but not much information regarding the site or its buildings has been presented as part of the transition plan.

[30] Ibidem, https://www.enel.cl/es/sostenibilidad/creacion-valor-compartido/bocamina.html [Access: 15/03/2023].

[31] ENEL, Una nueva mirada en Coronel, Retrieved from: https://www.enel.cl/es/historias/a202108-coronel-identidad-emprendimiento-y-circularidad.html [Access: 15/03/2023].

[32] ENEL, Nuevos Espacios Sociales: Eco Parque de Los Sentidos, Retrieved from: https://www.enel.cl/es/sostenibilidad/creacion-valor-compartido/centrales-enel-y-proyectos-comunidades/central-bocamina/parque-de-los-sentidos-de-cerro-obligado.html [Access: 15/03/2023].

[33] ENEL, Transición Justa: Ámbito Económico. Retrieved from: https://www. enel.cl/es/sostenibilidad/creacion-valor-compartido/bocamina.html [Access: 15/03/2023].

Figure 7. Open art to ENEL, community mural.

Source: https://www.enel.cl/es/sostenibilidad/creacion-valor-compartido/centrales-enel-y-proyectos-comunidades/central-bocamina/open-power-to-art-coronel.html [Access: 15/03/2023].

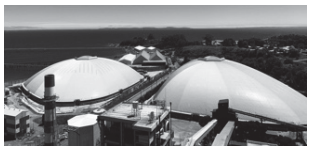
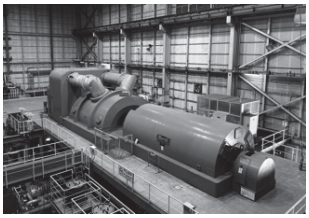
7. Discussion

Though ENEL transition strategy encompasses a broad scope of measurements, it is too soon to determine its effectiveness long-term. In general, they focus on small scale initiatives in different sectors of the affected community but seem to miss an opportunity to address a potential new source of income or the cultural identity of Coronel and its long historic relation to coal extraction and energy production[34]. In this regard, by the definition of the International Committee for the Conservation of the Industrial Heritage (TICCIH) Bocamina I & II can be considered Industrial Heritage, since, as shown in Table 2, they are part of "the remains of industrial culture which are of historical, technological, social, architectural or scientific value. These remains consist of buildings and machinery, workshops, mills and factories, mines and sites for processing and refining, warehouses and stores, places where energy is generated, transmitted and used, transport and all its infrastructure, as well as places used for social activeties related to industry such as housing, religious worship or education"[35]. Based on this, their complete demolition would not be recommended. Since, apart from meaning a big economic endeavor and a loss for national heritage, it would be a missed opportunity for establishing a resilient grieve process for the community, affected by the operational phase of the thermoelectric, and workers, affected by its closure and now forced to face uncertainty regarding relocation or finding new income sources. Therefore, the discussion will focus

[34] Aburto Cristi H., Gutiérrez González M., op. cit, p. 111.
[35] The International Committee for the Conservation of the Industrial Heritage (TICCIH), *Nizhny Tagil Charter for the Industrial Heritage*, 2023. Retrieved from: https://ticcih.org/wp-content/uploads/2013/04/NTagilCharter.pdf [Access: 15/03/2023].

on two alternative ways of keeping Bocamina I & II by seen them as historic landmarks for Coronel.

Table 2. Elements of Bocamina I&II Infrastructure, its functions and possible value/potential.

No.	IMAGE	NAME	PURPOSE	VALUE/POTENTIAL
1.		CONVEYOR BELTS	Distribute coal brought from shipments into the storage domes and then to the shredder.	Historical-Landscape value, since they are structures that goes into the sea they could be used as walkways that grant new perspective on the bay area.
2.	 	COAL DOMES	Structures destined to prevent particulate material pollution.	Iconic landmarks of Coronel and Bocamina, built in 2018 as part of the environmental remediation measurements took to diminish pollution. They showcase great engineering strategies and its vast open-space interior could be repurposed.
3.		FURNACE BUILDING	Building where the combustion of coal turns the water into pressurized vapor.	Industrial architectural value. Its light steel structure could be repurposed.
4.		GENERATOR	Machinery that turns the move-ment of the turbines into electrical energy.	Interesting piece located at the center of the turbine building that could be showcase as historic element.

5.		WATER TOWERS	Structures used for storage the water used involved in the generation of electricity.	As the chimneys, the water towers are part of the industrial aesthetic could be used as bay-viewpoints.
6.		LIME SILOS	Silos used to storage lime used in the production of electricity and waste reduction management.	As the boiler building, the silos have interesting industrial architecture values and could be showcased as historic elements or have its structure repurpose.
7.		CHIMNEYS	Filters of particulate material (solid residue) leftover from the coal combustion.	Iconic structures part of the Thermoelectric Aesthetic, could be used as viewpoints.

Source: own Study.

7.1 Recognition of Bocamina I & II as National Monuments

The importance of the more than 50 years of Bocamina it's already been established; Its contribution to the national energy grid, especially in times of crisis, makes them a fundamental part of Chilean history and establishing them as Industrial Heritage listed in the National Monuments Council might be an attractive alternative that can help reshape the stigma of Sacrifice Zone. Its declaration as National Monument (NM) guarantees the permanency of its buildings and serves as an addition to the cultural heritage of the region and as legal argument against other industry uses for the area since they will be under the protection of Chilean Law No. 17.288 of National Monuments[36]. Examples of these are common in Chile; Chacabuco and María Elena Saltpeter Offices located Antofagasta region, declared NM in 1989[37] and Typical Zone (TZ) in

[36] Gobierno de Chile, Ministerio de las Culturas, las Artes y el Patrimonio, *Ley Nº 17.288 de Monumentos Nacionales y Normas Relacionadas 2019*, Santiago 2019, p. 17. Retrieved from: https://www.monumentos.gob.cl/sites/default/files/ley_ 2019_web.pdf [Access 14/03/2023].

[37] NMC. Dec. No. 1479, 1971, attribution of "Historic Monument" to Chacabuco Saltpeter Office.

2008[38] respectively, or the Buildings of the Industrial Society of Aysén, Coihaique, southern Chile, declared MH in 2009[39]. But perhaps the clearest example of the importance of Industrial Heritage in Chile is Sewell (Figure 8), a mid-twentieths century Saltpeter company-town listed as World Heritage Site in 2006 by UNESCO[40] recognizing the worldwide importance of the "company-town" model.

Figure 8. Sewell UNESCO World Heritage Site.

Source: https://www.monumentos.gob.cl/patrimonio-mundial/lista-actual/sewell [Access: 15/03/2023].

Of the 46 National Monuments and Typical Zones of the Biobío region 10 are related to mining/energy production; 7 are in Lota, near Coronel, the Chivilingo Hydroelectric plant and the "Chiflón del Diablo" Mine, declared NM in 1990[41] and 2009[42] among the most known. Coronel itself has the Puchoco Schwager Sector (TZ in 2010) and the "Cabrías del Pique Arenas Blancas", Historic Monument in 2008[43]. This shows that the Chilean government recognizes and cele-

[38] NMC. Dec. No. 1936, 2008, attribution of "Typical Zone" to María Elena Saltpeter Office.
[39] NMC. Dec. No. 413, 2009 attribution of "Historic Monument" to Buildings of the Industrial Society of Aysén.
[40] UNESCO, World Heritage Site. *Nomination no.1214, Sewell Mining Town,* 2006. Retrieved from: https://whc.unesco.org/en/list/1214/documents/ [Access: 13/03/2023].
[41] NMC. Dec. No. 721, 1990 attribution of "Historic Monument" to Chivilingo Hydroelectric Plant.
[42] NMC. Dec. No. 373, 2009 attribution of "Historic Monument" to Chiflón del Diablo Mine.
[43] NMC. Dec. No. 2218, 2008, attribution of "Historic Monument" to Cabrías del Pique Arenas Blancas.

brates its Industrial Heritage and declaring Bocamina I & II as such could be feasible. However, it is important to have a sensible approach. For the habitants of Coronel, the power plants are still a symbol of pollution, sickness and detriment. As such, declaring them as National Historic Heritage without proper community involvement, could be perceived as another instance of muting the years-long struggle for the recognition the industry issues. To use the heritage declaration as a process that brings psychological and social atonement for the local community, should be done considering their perspective and as such, it must be a coordinated effort that includes the participation of community leaders, representatives of the local government and the private sector. This guarantees a proposal that will be done with the inhabitants of Coronel and therefore securing a positive approach to the buildings themselves, and their incorporation to their identity.

Figure 9. Chambeque, National Historical Monument. Lota, near Coronel.

Source:https://www.monumentos.gob.cl/monumentos/monumentos-historicos/sector-chambeque [Access: 14/03/2023].

Another thing to consider is that the declaration of National Monument under the Law 17.288 relies solely on the owner of the buildings the tasks of keeping them in good condition. It doesn't grant any means of governmental funding perse, and though the owner can apply for other means of funding[44], the Law itself is often seen as undesirable instead of a benefit. Since for all effects of

[44] Ropert R., *La conservacion del patrimonio cultural urbano en el ordenamiento jurídico chileno*, "Revista De Derecho Ambiental" 2015, v. 1, pp. 118–140. Retrieved from: https://revistaderechoambiental.uchile.cl/index.php/RDA/article/view/ 36447 [Access: 13/03/2023].

modification, renewal, repair, addition or destruction the owner must first present documentation to the National Monuments Council and wait for their approval, a process that can take up to several months and has been often criticized. This leads to the abandonment or the detriment of the monuments because of lack of funding to ensure its conservation, as Figure 9 shows with the Historic Monument of Chumbueque in Lota, near Coronel. This scenario means that ENEL will oversee the integrity of the buildings without any additional economic support from the public sector, and idea that might not seem appealing for an international private company. Another negative argument is, even if the declaration itself is awarded, it might be of little help to remediate Coronel state. Retracing to the example of Lota; the declaration of the several historic sites and building were not seen by the community as a help or acknowledgement of their identity. Hence, the social issues persisted as the city was seeing by the rest of the country as "left behind", with their people demanding more governmental help for themselves and not declaration of historical sites, generating a constant friction between inhabitants and monuments.

In this regard, a good example of sustainable heritage/community involvement strategy is the work being conducted nowadays for the "Plan Lota" a governmental initiative to prepare and propose the city as a World Heritage Site based on its mining history, identity and heritage[45]. Unlike the Specific declaration of a particular building or site, their aim since 2019 has been to develop a long-term masterplan approach that links seven governmental institutions, citizen representatives, private investors, organizations and NGOs. It is important to mention that this strategy seems more well-rounded but it also requires a Multidisciplinary Masterplan that considers short and long-term planning, as well as the contribution (and coordinated work) of private investors, public sector, planning policies and an involved community willing to open themselves to address their social traumas and affections.

7.2 Adaptive Reuse and the Symbolic Potential of Bocamina I & II

Another way of approaching this situation could be the adaptive reuse of the power plants without a formal Monument declaration. This scenario seems more appealing in terms of creative/design possibilities, what to do with the infrastructure and how to repurpose it and is often seen by both the public and private sector as great opportunity in terms of media coverage and quantifiable/material solutions. It is also an equilibrium between existing buildings and new uses, supporting heritage as well as new sustainable strategies. Re-

[45] Servicio Nacional de Patrimonio Cultural, Firman convenio para proyectar a Lota como Sitio de Patrimonio Mundial, Retrieved from: https://www.patrimoniocultural.gob.cl/noticias/firman-convenio-para-proyectar-lota-como-sitio-de-patrimonio-mundial [Access: 16/03/2023].

purposing serves against abandonment and deterioration[46] and has economic and environmental benefits, since the well-planned reuse of existing infrastructure means savings in time and demolition processes, as well as building materials and environmental impact of new constructions[47]. The idea of turning the steel frame structures of Bocamina into modern offices or Co-Working spaces, rehabilitating its domes as sport/concerts arenas seems attractive as a statement to renew Coronel condition of Sacrifice Zone, but just as the National Monument approach, it has its pros and cons and should be approached with sensitivity.

Table 3. Barriers of Adaptive Re-use.

Barriers of Adaptive Re-use	Brief Description	Identified Research Study
Physical restrictions	Existing floor layouts, number of columns/walls and structural system layouts	Bruce et al. (2015), Bullen and Love (2011a), Bullen (2007), Cox (2004), Reyers and Mansfield (2001)
Economic considerations	Direct and indirect costs of conservation	Douglas (2006), Bullen (2007), O'Donnell (2004), Reyers and Mansfield (2001), Shipley et al. (2006), Yung and Chan (2012), Wang and Zeng (2010), Cox (2004)
Social considerations	Intangible and non-economic perspectives of maintaining day-to- day lives of people who are attached to the place	Bond (2011), DEH (2004), Yung and Chan (2012)
Building codes and regulations/ legal constraints	Requirement of complying with current building codes, regulations, conservation guidelines, licensing and planning requirements	Bruce et al. (2015), Bullen and Love (2011a), Bullen (2007), Cooper (2001), Douglas (2006), Shipley et al. (2006), Wilkinson et al. (2009)
Non-availability of materials and lack of skilled tradesmen	Incompatibility of new materials with existing materials, as well as the shortage of local workers skilled in conservation work	Cox (2004), Bullen and Love (2011a), Douglas (2006), Remoy and van der Voordt (2007), Reyers and Mansfield (2001)
Limited response to sustainability agenda	Limited support received from building owners and commercial property markets to make buildings sustainable	Ellison and Sayce (2007), O'Donnell (2004), Pivo and McNamara (2005)

[46] Langston C., *The sustainability implications of building adaptive reuse*, 1-10. Paper presented at "The Chinese Research Institute of Construction Management (CRIOCM) International Symposium", Beijing, China 2008.
[47] Foster G., *Circular economy strategies for adaptive reuse of cultural heritage buildings to reduce environmental impacts*, "Resources, Conservation and Recycling" 2020, v. 152, art. No. 104507.

Barriers of Adaptive Re-use	Brief Description	Identified Research Study
Complexity and technical difficulties	Refurbishment techniques, technical installations and innovative solutions required	Ball (1999), Bruce et al. (2015), Bullen and Love (2011a), El Kerdany (2002), Kronenburg (2007), Shipley et al. (2006)
Maintenance issues	High cost of maintenance and repair due to physical deterioration and defects	Bullen and Love (2011a), Bullen (2007), Remoy and van der Voordt (2007), O'Donnell (2004),
Lack of awareness on the adaptive re-use opportunities	Lack of awareness and misconceptions about adaptive re-use	Bullen and Love (2010), Remoy and van der Voordt, (2007), Bullen (2007, 2004), Shipley et al., (2006)
Financial and technical perceptions	Notion that adaptive reuse being expensive, demolition only will provide reasonable profits.	Bruce et al. (2015), Bullen and Love (2011a), Shipley et al. (2006), Yung and Chan (2012)
Commercial risk and uncertainty	Lengthy and difficult renovation or re-use often leading to reduced profits.	Bruce et al. (2015), Bullen and Love (2011a), Shipley et al. (2006),
High remediation costs and construction delays	Contamination caused by hazardous materials in buildings resulting in additional costs and time delays.	Bruce et al. (2015), Bullen and Love (2011a), Bullen (2007), Wilkinson et al. (2009)
Inaccuracy of information and drawings	Lack of accurate information on defects or dimensional and material inconsistencies and drawings of heritage buildings.	Cox (2004), Remoy and van der Voordt (2007), Reyers and Mansfield (2001)
Classification (Zoning) change	Scope and classification changes of buildings requiring building code and zoning compliance.	Bullen and Love (2011a), Cox (2004), Langston et al. (2007), Reyers and Mansfield (2001)
Inertia of production and development criteria	Challenges posed by developmental criteria of cities on urban regeneration or re-development approaches	Bromley et al. (2005), Bullen and Love (2011a)
Creative value compared to re-development	Creative outside appearance and finishing of the building	Bullen (2007, 2004)

Source: De Silva D., Perera K., *Barriers and Challenges of Adaptive Reuse of Buildings,* Conference Paper: Institute of Quantity Surveyors Sri Lanka annual technical sessions 2016 – "Social responsibility of Young Quantity surveyors", 2016.

On one side, the adaptive reuse of existing buildings expands its life span, lowers waste management, reduce energy consumption and improves its standards, while maintaining most of the original structure. It has become an international trend and many countries have Adaptive reuse of Building in their legislation[48]. Since this approach does not consider them as Official National Monument, ENEL would still be able to perform modifications and repairs without requesting any additional governmental documentation but the currently required for any site of similar characteristics. However, this does not come risk-free, since adaptive reuse often needs to deal with Zoning regulations, financial risks, investments uncertainty, building codes & new standards, high re-mediation cost and delays in construction[49] as shown in Table 3. Once again, an additional subject of consideration should be the community and their needs. Since proper involvement in the design and consulting stages of such project might have the benefits of helping define which new uses and programs should the installations have, securing the economic success of the venture, as well as serve as cathartic process for the inhabitants.

Figure 10 a,b. Battersea Power Station as a popularized Industrial Icon & its 2022 renewal.

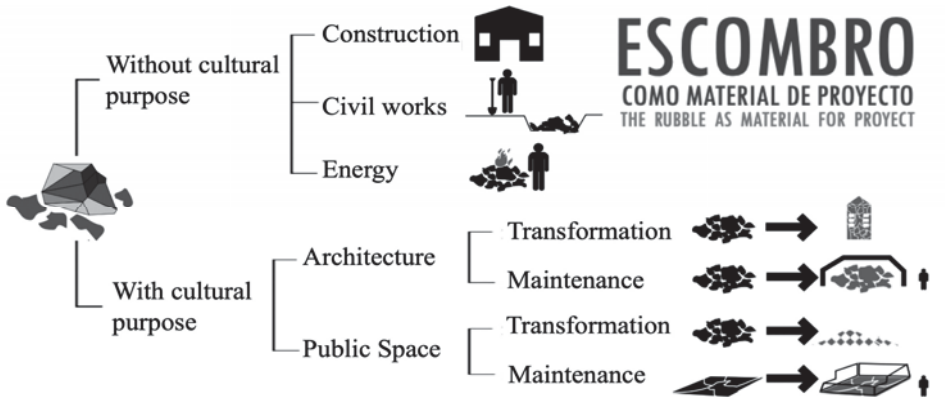
Source a: https://image.ceneostatic.pl/data/products/48049457/i-animals-pink-floyd-winyl.jpg [Access: 17/03/2023].

Source b: https://www.archdaily.com/990615/battersea-power-station-wilkinsoneyre/6349af1852a40846a7575804-battersea-power-station-wilkinsoneyre-photo [Access: 17/03/2023].

[48] De Silva D., Perera K., *Barriers and Challenges of Adaptive Reuse of Buildings.* Conference Paper: Institute of Quantity Surveyors Sri Lanka annual technical sessions 2016 - "Social responsibility of Young Quantity surveyors", 2016. Retrieved from: https://www.researchgate.net/publication/319879628_Barriers_and_Challenges_of_Adaptive_Reuse_of_Buildings#fullTextFileContent [Access: 13/03/2023].
[49] Ibidem, p. 3.

Adaptive reuse of historical buildings as such has several international examples; the Battersea Power Station in London[50] (Figure 10 a & b). An architectural icon from 1941 renewed in 2022, that embodied XX century industrial aesthetic and was internationally popularized as cover of the album Animals by British band Pink Floyd in 1977. The FÆNGSLET Vestsalen Transformation in Horsens, Denmark[51] or the Overschie Church transformation into an apartment complex[52]. Nonetheless, it's important to keep in mind the context of Sacrifice Zone and the struggle of Coronel and their complex historic relation to Bocamina. As such, the understanding of the power plant's infrastructure as a symbol to process grief could be a catalyst for achieving Heritage-sensitive Adaptive use.

Figure 11. Proyecta Memoria Symbolic Rubble Approach – The Rubble as Material.



Source: Basoalto H., & Mora P., / Symbolic Rubble & Public Space, a New Beauty, Santiago 2012, pp. 156-157. Adaptation of scheme by author.

An interesting approach to this topic is the one proposed by "Proyecta Memoria" and their concept of "Symbolic Rubble". As an NGO that arose after the 8.8 magnitude 27F/2010 earthquake that affected most of the Chilean territory, their proposal consists in assigning symbolic value to damaged construction materials, leftovers from natural disasters and their classification and repurpose for architecture and urban infrastructure. This serves as means to simultaneously deal with reconstruction efforts in affected areas, and the affected community itself, aiding in dealing with loss and grieving processes, but also pre-

[50] Archdaily, Battersea Power Station, Retrieved from: https://www.archdaily.com/990615/battersea-power-station-wilkinsoneyre [Access: 17/03/2023].
[51] Archdaily, FÆNGSLET Vestsalen Transformation, Retrieved from: https://www.archdaily.com/979919/faengslet-vestsalen-transformation-cubo-arkitekter [Access: 17/03/2023].
[52] Archdaily, Church to Apartments Transformation, Retrieved from: https://www.archdaily.com/987666/church-to-apartments-transformation-hoyt-architecten [Access: 17/03/2023].

venting heritage loss by reshaping it[53] (Figure 11). A similar case is the Chanco Museum of Reconstruction, in southern Chile. Where the team rebuilds a neo-colonial adobe house affected by the same earthquake, with the agreement between the municipality, the house owners (that didn't have the economical means for reconstruction) and the project team to rebuild the entirety of the house but adapt half of its area as museum that generates consciousness about earthquakes and vernacular architecture, showcasing traditional rammed earth techniques and their symbolic value.

Figure 12. Museo de la Reconstrucción de Chanco / Chanco Reconstruction Museum – Process.

Source: Presentation Museo de la Reconstrucción, reconstrucción y Educación Dentro de una Zona Patrimonial tras el Terremoto del 27f de 2010 en Chile, Gómez-Maestro C. 2018.

As Figure 12 shows, the construction of the museum was based on the "sensitive dismantlement" of the affected areas of the building and the classification and repurpose of damaged construction elements, wooden beams, window frames and others, as symbols for heritage reclamation. They also organized several free workshops for the community to teach about vernacular techniques and crafts, reuse of materials and provided cultural instances to talk about what the earthquake meant for the community and their sense of identity[54]. Nowadays, the Museum is a cultural hub, where the public gathers not only

[53] Basoalto H., Mora P., *Escombro Simbólico y Espacio Público, Una Nueva Belleza / Symbolic Rubble & Public Space, a New Beauty*, Santiago 2012, pp. 75–85, 107–122, 156–157.

[54] Gómez-Maestro C., *Defensa del Patrimonio de la Catástrofe: El Museo de la Reconstrucción de Chanco*, Final Report Diplomado de Gestión e Investigación del Patrimonio Cultural, Universidad Alberto Hurtado, Santiago 2019. Retrieved from: https://museoreconstruccion.wixsite.com/chanco/descargas [Access: 16/03/2023].

related to the earthquake itself, but for cultural expressions such as concerts or communal meetings. Based on these referents, it's possible to extrapolate the concept of "Symbolic heritage" behind these initiatives and their alternative approach to a broader conception of heritage. In the case of Bocamina, it can be translated into public policies and the possible adaptation of its infrastructure. Creating an opportunity to develop an integral approach that encompasses economic growth, investment opportunities and attract new ventures to Coronel, keeping at the same time a conscious approach that empowers the community and generates a profound change in their perception towards the imaginary of the Thermoelectric and the Sacrifice Zone.

8. Conclusion

The presented work ventured to introduce the complexity of Chilean Sacrifice Zones and showcase their potential, using the city of Coronel and the recent closing of its Thermoelectric "Bocamina I & II" as case of study. For this, the research reviewed literature regarding their framework in terms of historical, economic, social, environmental and technological contexts, as well as the possibilities for their future role regarding the city and its immediate territory. The contribution of Bocamina I & II to the progress of the Nation in terms of technological advancements and energy production is non-arguable, but sadly so are they environmental and social negative aspects. In their active history, they shaped the natural, urban and cultural landscape of Coronel and were seeing as symbols both of development and social distress. They helped Chilean development through times of crisis, but at the cost of the surrounding community's welfare in terms of health, economic income, urban quality of life, self-appreciation and cultural identity. As of now, ENEL transition plan does not refer to the infrastructure of the plants themselves and focus on specific, punctual community actions. The question of "What to do with the buildings?" is not yet installled in the public debate. But, if done properly, could present Bocamina as an example on how to reshape endangered communities and industry damaged landscapes. As exposed, this could be achieved in different ways, such as formalizing the site as National Monuments or adapting their infrastructure to future, broader needs; Declaring Bocamina I & II under Chilean law No. 17.288 as National Monuments recognizes the Thermoelectric value as Industrial Heritage and could ensure the permanency of its infrastructure, yet it does not offer economic help nor addresses the social issues created by the industry. Besides, it might pose difficulties for renovations or modifications that could help prevent its deterioration along with open the door for new investment ventures. On the other hand, the possibility of the Adaptive-Reuse approach could offer new uses for the existing infrastructure, introducing new sustainable strategies that support its heritage value, serving against deterioration and abandonment. However, this alternative comes with its own downsides, such as financial and investment uncertainty, high re-mediation costs, changes in zoning or complex technical difficulties that could mean the stagnation or failure of the enterprise.

In any case, for a successful transition from the stigma of Sacrifice Zone it is fundamental to consider the own values of Bocamina and the importance of its infrastructure in terms of national and technological advancement and Industrial Landscape, as well as how it can benefit the community of Coronel, its cultural identity and resilience. Furthermore, the case of Bocamina I & II and their context is specific, but the analysis is replicable to other Chilean Sacrifice Zones or similar sites worldwide, especially in times of global inclination to sustainable energy sources. It is important to mention it's too soon to determine the future of the Thermoelectric and the possible development of the Sacrifice Zones. Hence, further research on the subject is recommended.

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    Dec. No. 373, 2009 attribution of "Historic Monument" to Chiflón del Diablo Mine. [Access: 14/03/2023].

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